Ellerslie Road Southwest Expansion at Whitemud Creek Environmental Impact Assessment

Municipal Environmental Impact Assessment

March 2025

Prepared for:
Brookfield Residential (Alberta) LP

Prepared by:
Stantec Consulting Ltd.

Project Number:
1161110185

Limitations and Sign-off

This document entitled Ellerslie Road Southwest Expansion at Whitemud Creek Environmental Impact Assessment was prepared by Stantec Consulting Ltd ("Stantec") for the account of Brookfield Residential (Alberta) LP (the "Client") to support the regulatory review process for its Ellerslie Road South West at Whitemud Creek Expansion Environmental Impact Assessment (the "Application") for the Ellerslie Road Southwest at Whitemud Creek Expansion (the "Project"). In connection therewith, this document may be reviewed and used by the City of Edmonton participating in the review process in the normal course of its duties. Except as set forth in the previous sentence, any reliance on this document by any other party or use of it for any other purpose is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The information and conclusions in the document are based on the conditions existing at the time the document was published and does not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by the Client or others, unless expressly stated otherwise in the document. Any use which another party makes of this document is the responsibility and risk of such party. Such party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other party as a result of decisions made or actions taken based on this document.

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Acronyms / Abbreviations

AACSW	Alberta Arts, Culture and the Status of Women
ARA	Arterial Roadway Assessment
BMP	Best Management Practice
CNWA	*Canadian Navigable Waters Act*
COE	City of Edmonton
COP	Code of Practice
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
EBL	East Bound Lanes
EDGs	Environmental Design Groups
EIA	Environmental Impact Assessment
EPA	Alberta Environment and Protected Areas
ESC	Erosion and Sediment Control
FWIMT	Fish and Wildlife Internet Mapping Tool
GHG	Green House Gas
HRA	Historic Resources Act
LAA	Local Assessment Area
MBCA	Migratory Birds Convention Act
MSE	Mechanically Stabilized Earth
NSR	North Saskatchewan River
NSRVARP	North Saskatchewan River Valley Area Redevelopment Plan
OHWM	Ordinary High-Water Mark
PDA	Project Development Area
QAES	Qualified Aquatic Environmental Specialist
RAP	Restricted Activity Period

ROW	Right of Way
SARA	Species at Risk Act
SESS Tunnel	South Edmonton Sanitary Sewer Line
SUP	Shared Use Pathway
VC	Valued Component
WBL	West Bound Lanes

1 Introduction

Stantec Consulting Ltd. (Stantec) was retained by Brookfield Residential (Alberta) LP to complete an Environmental Impact Assessment (EIA) for the expansion of Ellerslie Road (9 Avenue Southwest [SW], herein referred to as Ellerslie Road) in southern Edmonton (Figure 1-1). This EIA is required by the City of Edmonton to evaluate potential Project-related impacts for the portion of the Project located within the *North Saskatchewan River Valley Area Redevelopment Plan* (NSRVARP) (Bylaw 7188; COE 2018).

The overall Project entails upgrades to Ellerslie Road including the expansion of Ellerslie Road from the current two-lane configuration to a four-lane configuration and a new two-lane bridge crossing over Whitemud Creek (the Project). The Project extends from Ambleside Eco Station access road to approximately 135 Street SW. The Whitemud Creek crossing is located approximately 185 metres (m) west of the intersection with 141 Street SW, which is a major north-south four-lane arterial serving southwestern Edmonton residential communities.

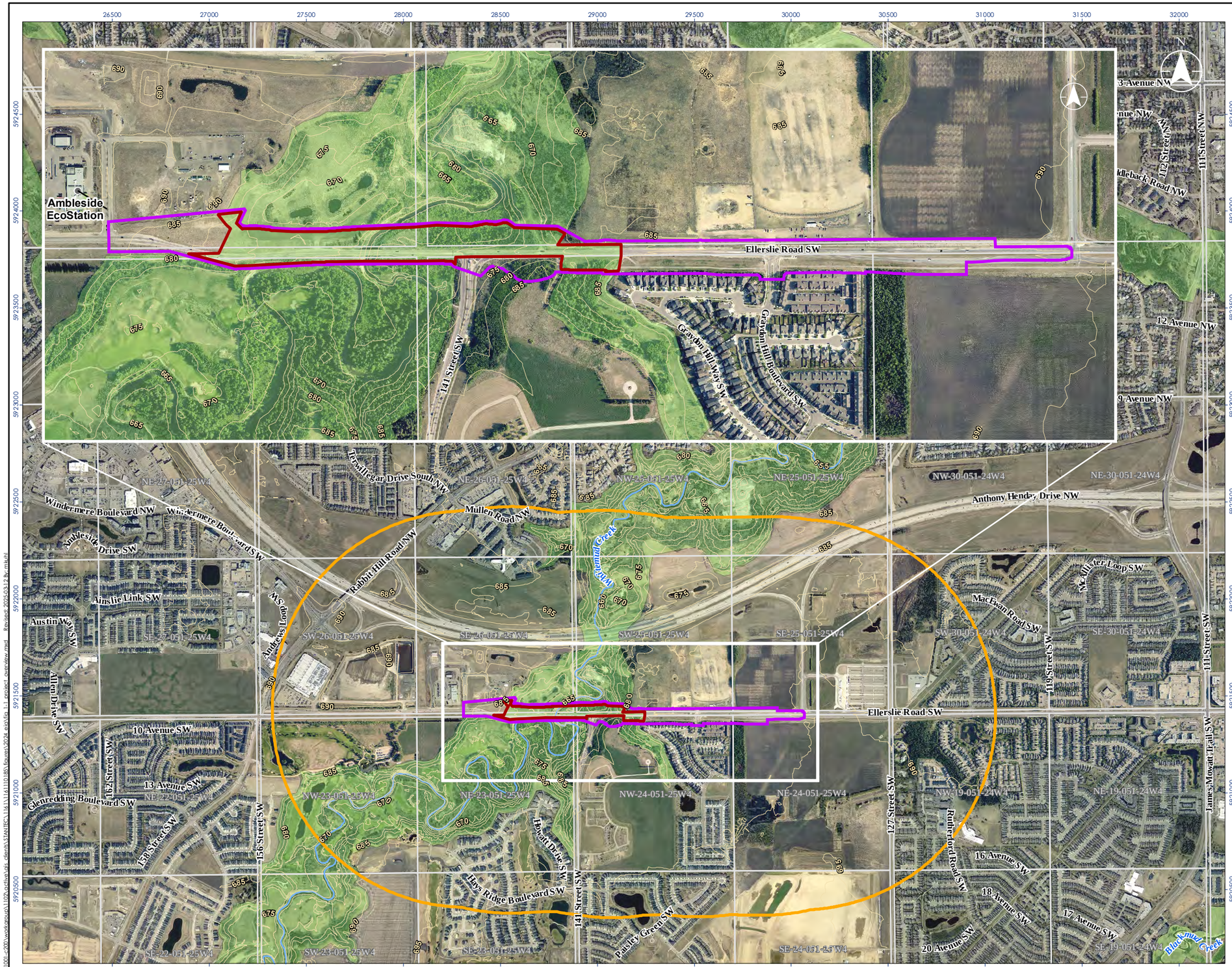
The planned upgrades to Ellerslie Road will be funded by Arterial Roadway Assessment (ARA) funds. ARA funds are collected from developers as condition of subdivision or development permits issued by the City of Edmonton (COE). ARAs are a cost-sharing mechanism for arterial roadway construction, wherein developers and landowners proportionally pay for roadworks that serve their community developments. The COE Bylaw 14380, City Policy and Procedure C507, and the Precedent Servicing Agreement Template govern how the ARA program is administered. Upgrades to Ellerslie Road in proximity to the Whitemud Creek crossing were identified as needed to support further development in the Windermere and Heritage Valley Area Structure Plans (ASPs). The additional lanes will also accommodate increased traffic volume.

The Project includes two additional traffic lanes and a new two-lane bridge over Whitemud Creek.

The major components of the Project include the following:

- Relocate utilities within the existing Right of Way
- Additional two traffic lanes on Ellerslie Road
- Surface water drainage infrastructure
- Ellerslie Road bridge crossing of Whitemud Creek Ravine
- Armouring the banks of Whitemud Creek

Repairs or upgrades to the existing bridge crossing over Whitemud Creek, and the associated existing wildlife passage, are outside the scope of the Project because the existing roadway and bridge, including maintenance activities, are not subject to the ARA program. The existing bridge is anticipated to be replaced near the end of its service life; thirty or forty years in the future.



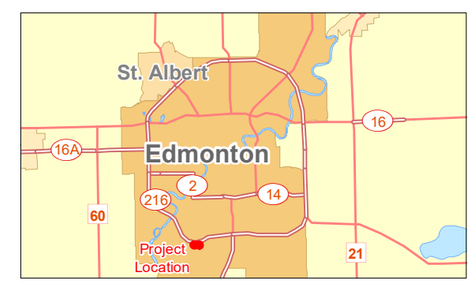
Stantec

- Project Disturbance Area (PDA)
- Ellerslie Road SW Expansion
- Local Assessment Area
- Ground Elevation Contours (m
- Watercourse
- 2019 River Valley ARP (Bylaw 7188
- Quarter Section

0 250 500 metres
1:20,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved. AltaLIS Ltd.
3. Imagery: City of Edmonton, 2023.
4. Contours: City of Edmonton, 2019.
5. m AMSL: metres above mean sea level



Project Location
Portion of 19- and 30-051-24W4 and 23 to 26-051-25W4, Edmonton, Alberta

1161110185
Prepared by MK on 2024-06-21
TR by KF on 2024-11-27
IR by EL on 2024-11-01

Client/Project
Brookfield Residential (Alberta) LP
Municipal Environmental Impact Assessment
Ellerslie Road SW, Eco Station Rd to Graydon Hill Blvd

Figure No.
1-1

Title
Project Overview

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

1.1 Project Setting

The Project crosses the Whitemud Creek Ravine system, which is a tributary to the North Saskatchewan River (NSR) and part of the *North Saskatchewan River Valley Area Redevelopment Plan* (NSRVARP, Bylaw 7188) (COE 2018). The Whitemud Creek Ravine system is also designated as a Biodiversity Core Area (COE 2007). The portions of the overall Project area that are located within the Bylaw 7188 area are the subject of this assessment (Figure 1-1), but the overall Project is described for ease of reading.

1.2 Background

The segment of Ellerslie Road to be upgraded is a two-lane asphalt paved arterial road that is currently a rural cross section road with ditch drainage along the north and south sides. It serves as a major east-west corridor for communities in the southwest part of the City of Edmonton and is subject to high traffic volumes. Generally, east-west roadways are limited in this area of Edmonton, and the closest east-west roads to Ellerslie Road are Anthony Henday Drive and 41 Avenue SW, which are also affected by high traffic volumes.

The Project is situated within a context of existing utility corridors and industrial land-use. Anthony Henday Drive, a major transport utility corridor is located 350 m to the north of the Project. Where Anthony Henday Drive crosses Whitemud Creek, there is a wildlife passage structure that was designed to provide north/south habitat connectivity for large mammals.

There are several utilities that cross the Whitemud Creek Ravine at Ellerslie Road. There are existing ATCO pipelines located immediately north of the existing Ellerslie Road. The alignment of the existing ATCO pipelines is parallel to, and directly under, the proposed Project alignment. ATCO has agreed to the relocation of the pipelines to a new parallel alignment to the north of the proposed Ellerslie Road bridge and roadway. ATCO will complete this relocation in advance of the construction of the new road and bridge under their own scope and permitting requirements. There are also existing overhead powerlines on both sides of the existing Ellerslie Road alignment. EPCOR will remove the overhead line on the existing wood poles on the south side of Ellerslie Road west of 141 St SW, complete some minor modifications to poles infrastructure, and retain the existing lighting infrastructure on the poles. Other utility works are addressed below in Sections 2.1 and 2.2.

EPCOR's South Edmonton Sanitary Sewer Tunnel (SESS Tunnel) is located to the north of the existing crossing at the Whitemud Creek Ravine and includes an existing laydown and construction yard.

To the north of Ellerslie Road there are disturbances associated with historical coal mining as well as more recent borrow pits used for the construction of Anthony Henday Drive (Thurber Engineering Ltd 2019). A review of the Alberta Energy Regulator's Coal Mine Viewer shows a history of both surface and underground coal mines on the north and south sides of Ellerslie Road at its crossing with Whitemud Creek (AER 2024).

On the south side of Ellerslie Road, there is mixed wood forested habitat in the Whitemud Creek Ravine and the Jagare Ridge Golf Course to the west of 141 St SW, and the Graydon Hill Cemetery to the east of 141 St SW. There is also an existing mammal passage structure through a box culvert on the east side of 141 St SW.

1.3 Regulatory Setting

1.3.1 Bylaw 7188

This EIA was completed in accordance with the requirements of the NSRVARP, Bylaw 7188 (COE 2018), and the Guide to Environmental Review Requirements on the North Saskatchewan River Valley and Ravine System (COE 2000). The scope of the EIA is to:

- To identify the potential effects on the physical and biological environment resulting from the Project
- To evaluate the feasibility of mitigating or preventing adverse impacts, and to predict the potential residual effects (if any) associated with the Project after mitigation
- To develop mitigation strategies to avoid or reduce the potential of significant adverse effects to the environment from the construction and operation of the Project

1.3.2 Other Applicable Legislation

Table 1-1 details legislation and policy from all levels of jurisdictions as they apply to the Project. Construction related approvals will be applied for by the developer Proponent, long term approvals, such as the *Public Lands Act* and the *Canadian Navigable Waters Act* will be held under the City of Edmonton.

Table 1-1 Applicable Legislation and Policy Guidance

Legislation or Policy	Requirements or Guidance Provided
Federal	
Species at Risk Act (SARA)	Protects species listed as extirpated, endangered, and threatened on federally regulated land or designated critical habitat. Species regulated under the *Species at Risk Act* may occur within the vicinity of the Project however, no critical habitat or federally regulated lands were identified near the Project.
Migratory Birds Convention Act (*MBCA*), and Migratory Bird Regulations	Protects and conserves migratory bird populations and individuals and their nests and eggs in Canada. The Migratory Bird Regulations were updated in July 2022. The nests of all migratory bird species are protected when they contain a live bird or a viable egg. Some nests are protected when not in use such as great blue heron and pileated woodpeckers. Authorizations to allow construction-related effects on migratory birds and their nests do not exist. Migratory birds have the potential to occur in the Project development area (PDA) or near the Project.
Fisheries Act	The *Fisheries Act* prohibits the Harmful Alteration, Disruption, or Destruction of fish habitat. The Project's activities will include changes to fish habitat and potential effects to fish. The Project will submit a Request for Review (RfR) to the Department of Fisheries and Oceans (DFO) and an application for authorization under the Act.
Canadian Navigable Waters Act (CNWA)	The CNWA authorizes and regulates projects that may impact the public's right to navigate on a given waterbody. The Navigation Protection Program (NPP) is responsible for the administration and enforcement of the CNWA. The Project will submit an application for Approval to the NPP under the Act.

Legislation or Policy	Requirements or Guidance Provided
Provincial	
Environmental Protection and Enhancement Act (*EPEA*)	Existing storm, sanitary and watermains are being moved as part of the Project, along with the addition of stormwater storage tanks that will discharge through the existing outfall on Whitemud Creek and existing stormwater management facilities. EPEA requires notifications for the modification or extension of the existing registered systems.
Public Lands Act	This Act governs activities occurring on public land to ensure they occur in a safe, sustainable, orderly, and environmentally responsible manner. The Project intersects two dispositions under the *Public Lands Act.* Project components, such as bank armouring materials, will be at least partially sited outside the Registered Road Plan allowance and will require a new disposition under *Public Lands Act*.
Soil Conservation Act	In Alberta, the *Soil Conservation Act* requires landowners or occupants to prevent soil loss or deterioration from taking place, and to stop any identified the loss or deterioration from continuing.
Weed Control Act	In Alberta, the *Weed Control Act* requires landowners or occupants to: • Destroy plants listed as *prohibited noxious* upon discovery • Control populations of plants listed as *noxious* to prevent their spread
Water Act	In Alberta, works in and around watercourses are regulated under the *Water Act*. Alberta's *Water Act* requires that an approval, notice or licence be obtained by any person or company planning to undertake an activity that may affect the land or vegetation under or around a water body, or may affect the location, flow or quality of the water or aquatic environment. Project activities will include work on the banks of Whitemud Creek for the bridge installation as well as armouring the banks. A *Water Act* approval application will be submitted as part of the Project. Changes to the discharge at the existing stormwater outfall will need to demonstrate adequate outlet, otherwise an approval under the *Water Act* is required.
Wildlife Act and the Alberta Wildlife Regulation	The *Wildlife Act* protects species listed as endangered or threatened and the Wildlife Regulation provides a list of species considered endangered or threatened. Additionally, the Act prohibits the disturbance or destruction of the house, nest, or den of some wildlife. Endangered or threatened species have the potential to occur within the PDA or near the Project. See Section 4.4 for baseline wildlife conditions within the local assessment area.
Historical Resources Act	Historical resources in Alberta are protected under the *Historical Resources Act* (HRA) and include archaeological, historic and paleontological sites, artifacts, and fossils. Under the Act, no historical resources site can be disturbed without approval of the Minister of Arts, Culture, and Status of Women (AACSW). AACSW determines and issues the requirements for Historical Resources Impact Assessment (HRIA) studies (if deemed required) and for mitigation measures for each archaeological and paleontological resource site. AACSW issues *Historical Resources Act* (HRA) approval for projects to proceed. The Project is situated on lands with potential archaeological and paleontological values. The Project will submit an HRA application because it involves a transportation development. Construction activities will follow HRA approval requirements.

Legislation or Policy	Requirements or Guidance Provided
Municipal	
Arterial Roads for Development Bylaw 14380	Bylaw 14380 allows for an assessment to be collected and used for paying the costs associated with design and construction of Arterial Road Improvements. A consortium of land developers in southwest Edmonton will share the cost of the design and construction of the upgrades to Ellerslie Road associated with the Project.
Community Standards Bylaw (Bylaw C14600)	The COE Community Standards Bylaw regulates the conduct and activities of people on privately owned property and immediately adjacent areas in order to promote the safe, enjoyable and reasonable use of such property for the benefit of all citizens of the City. The bylaw defines the allowable times for construction on private property and Best Management Practices (BMPs) will be followed to comply with these requirements.
Drainage Bylaw (Bylaw 18093)	The installation of surface water drainage infrastructure is one of the Project's activities. The COE Drainage Bylaw regulates the surface drainage on public and private land. Drainage within the Project area during construction will be reviewed and through a drainage assessment and a storm water management plan will be developed and implemented to as part of the Project. Surface water drainage infrastructure will be designed to meet the requirements within this bylaw.
Corporate Tree Management Policy (Policy C456A)	The purpose of the Corporate Tree Management Policy is to ensure that all trees on City owned property are adequately protected from destruction, loss or damage. The Project will impact City owned trees. Tree Protection or Preservation Plans will be prepared as required by the Corporate Tree Management Policy.
Parkland Bylaw (Bylaw 2202)	The purpose of the Parkland Bylaw is to regulate the conduct and activities of people on Parkland in order to promote the safe, enjoyable and reasonable use of the property and to preserve natural ecosystems. The bylaw states '*no person shall: build a structure, whether permanent or temporary';* and '*store or leave construction equipment or related items'.* Permits (e.g., for construction laydowns, access routes, etc.) may be needed.
Public Tree Bylaw 18825	The Public Tree Bylaw mandates to the protection and preservation of City trees. A Tree Permit is required when work is conducted within 5 metres of any Boulevard and Open Space trees, or within 10 metres of Natural Stand. Ground excavation and grading activities within these areas require a Tree Preservation Plan.
Other Guidance	
Erosion and Sediment Control	COE Erosion and Sedimentation Control Guidelines (COE 2005a) COE Erosion and Sedimentation Control Field Manual (COE 2005b)

2 Project Description

The following sections provide a description of the Project components and activities.

2.1 Project Components

The major components of the Project are described below.

2.1.1 Relocate Utilities within Right of Way

Existing utility lines will be re-routed to allow for the expansion of the roadway. The ATCO gas pipeline on the north side of Ellerslie Road and to the west of the Whitemud Creek will undergo re-routing prior to Project construction. The planned ATCO pipeline re-location is not included in the scope of this assessment.

The relocation and burial of the powerlines, other utilities (e.g., fibre optic lines), and service lines to an appropriate alignment will occur as part construction of Ellerslie Road. The Project includes the installation of new primary power cables, abandoning some of the existing cable in place. All primary power will be buried and the overhead poles from 141 Street to the east will be removed (including Telus and streetlighting). The overhead poles from 141 Street to the west (south side only) will remain with streetlight and communication lines.

The location of EPCOR's South Edmonton Sanitary Sewer Line (SESS Tunnel) will be marked off and protected prior to Project-related ground disturbance.

2.1.2 Additional Two Traffic Lanes on Ellerslie Road

Ellerslie Road will ultimately be a six-lane arterial roadway; however this project will build out four lanes with two lanes in each direction (See Appendix A drawings C101-001 to C101-006). Two additional traffic lanes will be added to Ellerslie Road between the Graydon Hill neighborhood and the Ambleside Eco Station. The two new lanes will be located on the north side of the existing lanes for the stretch west of 141 Street and will comprise the West Bound Lanes (WBL). Additional lane expansion will also occur on the south side of the road near the 141 Street SW intersection to provide a turning lane. The existing road and bridge will comprise the East Bound Lanes (EBL) at full build out. East of 141 Street SW the new lanes will be constructed on the south side of the existing lanes and comprise of the EBL.

The Project includes shared use pathways (SUP) on the south side of Ellerslie Road from 141 St SW to Graydon Hill Boulevard, and over the entire extent of Project on the north side of Ellerslie Road. The SUP will be along the north side for the entire stretch west of 141 Street SW but along the south side between 141 Street SW to just beyond Graydon Hill Blvd.

2.1.3 Surface Water Drainage Infrastructure

There is an existing stormwater outfall on Whitemud Creek at the southwest side of the intersection of Ellerslie Road and 141 Street NW. This outfall conveys water from the existing roadways (Ellerslie Road and 141 Street SW) and the stormwater management facilities in the neighbourhoods to the south of Ellerslie Road and discharges water into Whitemud Creek (See Appendix A, Drawing C004-001).

The Project's additional lanes of traffic will create more impermeable surface area in the PDA, and therefore additional surface water management infrastructure was included in the Project's design to maintain appropriate discharge rates to Whitemud Creek (i.e., not exceeding 5 litres/second/ha).

Surface water will be collected and stored in the underground concrete storage tanks (See Appendix A drawings C009-001 to C009-003), and attenuated flows will be released to Whitemud Creek through the existing outfall structure on the south side of Ellerslie Road via the existing storm sewer network. Surface water will also be released to the existing stormwater management facilities located on the north side of Ellerslie Road, west of the crossing of Whitemud Creek. Extensions to the existing storm sewer network are required and will require approvals or notifications under the *Environmental Protection and Enhancement Act.* Surface water quality will be managed through storm sewers, sediment traps, and will comply with requirements under the *Water Act*.

The drainage details for the roadway and bridge will be designed and finalized at the detailed design phase.

2.1.4 Ellerslie Road Bridge Crossing of Whitemud Creek Ravine

The Project includes the construction of a new two-lane bridge over the Whitemud Creek Ravine. The new bridge structure will be located to the north of the existing structure with approximately 5 m of open span between the existing bridge and the new bridge structure (Appendix A – S001-011 and S001-02). The new bridge will include a 4.2 m wide SUP on the north side. The SUP will be protected by traffic barriers between the traffic lanes and the SUP. There will be additional guard rails on the north side of the SUP.

Whitemud Creek Ravine has steep and unstable banks in the vicinity of the crossing; therefore, the Project will require works to improve slope stability under the new east bridge span, the north-east bridge head slope, and north roadway embankment. New bridge construction will include drilled steel piles, piers, and mechanically stabilized earth (MSE) walls at the east bridge abutments to manage slope stability, provide a foundation for the bridge structure over uneven terrain, and reduce the volume of excavation and backfilling required (see Drawings S001-001 to S00-023 in Appendix A).

MSE walls at the east bridge abutments will be constructed to manage slope stability, provide a foundation for the bridge structure over uneven terrain, reduce the volume of excavation and backfilling required, and avoid encroachment on the SESS Tunnel and ATCO Pipeline ROWs (see Drawing S001-S001-014 in Appendix A). An MSE wall will also be constructed above the south opening of the existing box culvert that crosses under Ellerslie Road at the unnamed ravine occurring approximately 350 m east of Whitemud Creek (Appendix A – C102-003).

The design and construction of the new bridge over Whitemud Creek includes provisions for wildlife passage. Below the existing bridge on the east side of Whitemud Creek, wildlife passage is available for all terrestrial Engineering Design Groups (EDGs) at present throughout the year. The Project will create a passage bench beneath the new bridge on the east side of Whitemud Creek that connects with the terrestrial passage below the existing bridge. Terrestrial passage under the existing bridge is presently affected by river scour that has reduced the area available for passage since the wildlife passage assessments were completed in 2014. The wildlife passage bench under the new bridge is designed to accommodate large mammals, with a 3.0 m wide bench and 4.5 m clearance under the bridge girders appropriate for large mammal passage (Clevenger and Huijser 2011). These passage parameters were selected in accordance with COE wildlife passage guidelines for Large Terrestrial (EDGs (COE 2010). This size and type of crossing structure anticipated to be appropriate for use by other EDGs listed in the guidelines.

The existing box culvert (1200 mm x 1800 m) is 80 m long and is used as a passage by wildlife species at baseline. The Project will not directly alter the existing box culvert, which fits the definition of a below-grade wildlife passage structure that is suitable for Medium Terrestrial, Small Terrestrial, and Amphibian EDGs (COE 2010).

2.1.5 Bank Armouring and Slope Restoration of Whitemud Creek

Grading of both banks of Whitemud Creek will occur to facilitate the installation of the new bridge structure within the road right-of-way (See Appendix A drawings S001-020 and S001-021). No change in channel width or gradient will occur. The banks will be graded back to create a 2:1 slope leading down to the channel.

On the west bank, Class II riprap will be installed beneath the new bridge and extend north to tie into the existing bank. The riprap will be installed on top of geotextile fabric that is tied into the existing slope with a geotextile anchor. The riprap will be installed to a thickness of 0.8 m on the slope. A riprap apron 1.6 m long and 0.8 m thick will be installed and buried 0.5 m beneath the thalweg of Whitemud Creek. The riprap will cover an area of 89 m^2 below the ordinary high-water mark (OHWM) and 135 m^2 above the OHWM (See Appendix A drawings S001-020 and S001-021).

On the east bank, Class II riprap will be installed in a similar manner to the west bank, on top of geotextile fabric tied into the wildlife access path with a geotextile anchor and a 1.6 m long 0.8 m deep apron. The riprap will extend north of the new bridge and around the bend in the bank of Whitemud Creek. This riprap will cover an area of 166 m^2 below the OHWM and 207 m^2 above the OHWM. In addition to riprap, this bank will contain nine root wads with 400 mm diameter logs. The logs will be buried 3.0 m into the riprap on the bank and extend 1.0 m from the bank. The root wad will be supported by a woody debris log beneath the streambed. North of the new bridge, on the downstream side, an area of 82 m^2 above the OHWM will have approximately 130 live willow stakes installed. The area of live will staking will also be topped with 150 mm of soil wrapped in a biodegradable erosion and sediment control wrap and seeded (See Appendix A drawings S001-020 and S001-021).

Above the west bank armouring, the area will be restored with 300 mm of topsoil and a grass seed mix (see Appendix A drawing L300-002). Additionally, a mix of shrubs, including willows and green alder, will be planted along the slope. Above the riprap on the east bank, an area of 196 m^2 will be restored with 300 mm of topsoil and a forb mix. Along the MSE wall on the north side of the bridge, the area will be restored with 300 mm of topsoil and a grass seed mix. Shrubs and trees will be planted throughout the seeded grass area along the north edge of the MSE Wall. The total area that will be restored with grass seed and planted is 1,323 m^2 (see Appendix A drawing L300-002).

2.1.6 Removal of Existing Access

Two existing graveled pads that provide access to the north and south sides of Ellerslie Road on the east side of 141 St SW. The north access will be removed as part of the Project (see Appendix A Drawing C100-003). Both access points will be altered by Project activities within the ROW. The north access will be partially covered by the shared use pathway and new WBL and remaining areas within the ROW will be graded and landscaped. The south access will be partially covered by the shared use pathway and EBL but will ultimately remain to provide access to the cemetery lands.

2.2 Project Activities

The Ellerslie Road upgrades are scheduled to commence in April 1, 2025 and is expected to be complete and operational by March 31, 2027. Project activities will be staged to respect the RAP in Whitemud Creek.

2.2.1 Site Preparation and Construction Mobilization

Project activities associated with site preparation and construction mobilization include the following:

- Temporary closure of multi-use trail and signage
- Mobilize equipment to site using public and existing access roads.
- Install temporary fencing and signage for public safety and security
- Install temporary erosion and sediment control measures
- Clear and grub vegetation within the limits of construction
- Strip soils down to clay and store topsoil
- Strip topsoil and store soils following best management practices
- Establish laydown areas within existing disturbance and fueling stations with spill containment mitigation in place
- Traffic control measures to protect workers and the public. Ellerslie Road will remain open as long as possible but closure might be required and if so, appropriate measures and signage will be in place for the construction. Occasional closures may be required but the intent is to minimize closures of this important roadway.

2.2.2 Utility Relocates

Electrical and telecom utility infrastructure will be relocated prior to earthworks. Existing poles will be removed and relocated and then utilities will be re-strung on the poles at their new location. Utility relocation activities will require trucks equipped with buckets and augers. Underground utility relocation works will include excavations and horizontal directional drilling.

2.2.3 Earthworks and Road Construction

Earthworks will shape and prepare the ground for bridge and road construction to achieve Project design specifications and elevations. Project-related activities will include:

- excavation (cuts)
- fills
- grading
- compaction of soil materials
- creation of swales and side slopes as required for appropriate site drainage.

Earthworks will include creating an access path to the valley bottom to accommodate heavy equipment required to construct the abutments, piers, MSE walls, and other Project components. Once the components are in place, earthworks will be required to achieve grading and slope requirements per Project design. Wildlife passage construction will involve creating an earthen bench through grading above the 1:100 year flood level, and wildlife fencing installation when other works are completed.

Work will start with pre-grading (final grade less road core) and then cement stabilization will be required as per geotechnical analysis via pre/proof roll. Following this the gravel will be placed and compacted followed by concrete work and paving. After completion of everything, the pavement markings and street signage will be installed.

2.2.4 MSE Wall Construction

The MSE wall construction in association with the east abutment requires the following Project activities:

- Isolation of work area
- Excavation of banking
- Pile-driving for MSE wall piles, followed by concrete pouring for cast-in-place stabilization piles
- Laying down layers of strapping and layers of granular fill and compacted clay. Bringing in fill to the site, compacting the fill, laying down strapping, until design specifications are met.
- Assembling pre-cast concrete panels, capping the wall, fencing

2.2.5 Bridge Construction

Bridge construction entails the following activities:

- Isolation of work area
- Installation of erosion and sediment controls
- Excavation for abutments and pier foundations
- Pile-drive abutments (steel h-piles) and pier foundations (steel pipe piles: pipes will be infilled with concrete once in place [cast in place]), backfilling and/or grouting (if required)
- Abutment construction
- Pier construction, cast-in-place foundations, assemble/build columns, attach pier caps
- Install bearing and joints, connect abutments and piers
- Place and install girders (steel beams), concrete work
- Build bridge deck, install expansion joints and waterproofing materials
- Earthworks to create wildlife passage bench to design specifications
- Finishing works: complete bridge approaches, install drainage systems and storage tanks, surface paving, shared use pathway, guard rails, fencing, signage

2.2.6 Site Restoration and Revegetation

Site restoration and revegetation entails the following activities:

- Remove temporary fencing
- Place topsoil on graded slopes, finalize grade
- Seed or sod disturbed areas with approved forb or grass seed mix
- Enhancement plantings of native shrubs and trees and boulevard trees

2.2.7 Whitemud Creek Bank Armouring and Revegetation

Whitemud Creek bank restoration activities include:

- Grading
- Geotextile and rip rap installation
- Revegetation plantings such as willow stakes
- Replacing topsoil
- Native shrub plantings
- Grass and forb seeding

2.2.8 Daily Use and Maintenance

Once construction is complete, Ellerslie Road will be used as an arterial roadway during the operations phase of the Project. Project activities include use and maintenance activities on the roadway and bridge, as well as mowing and tree care. Maintenance activities will include periodic inspections of the wildlife passages.

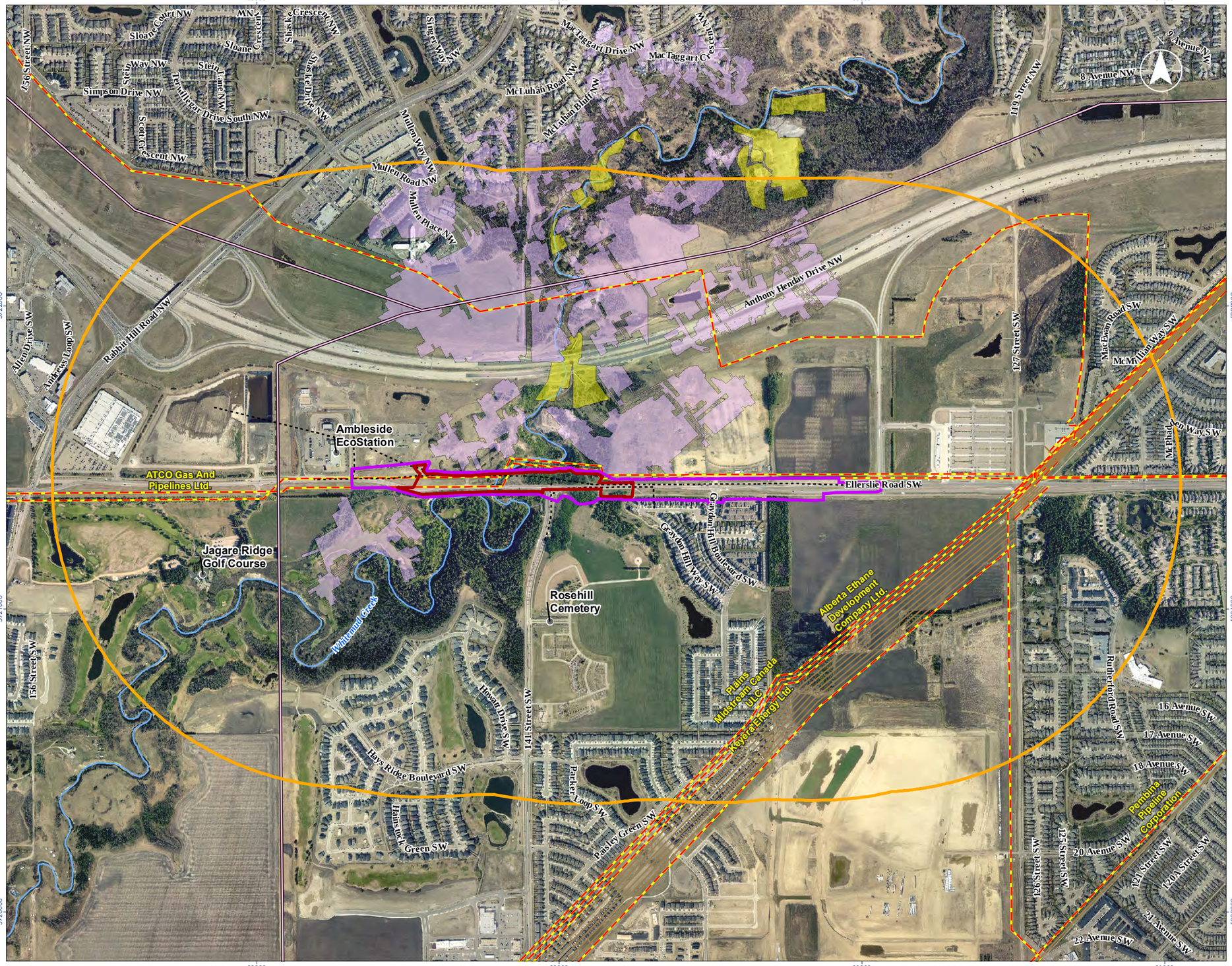
2.3 Project Alternatives

There is considerable complexity associated with the design and construction of a new bridge at the crossing of Whitemud Creek for this location. The steep and unstable banks of Whitemud Creek, combined with spatial boundaries of the SESS Tunnel, ATCO's pipeline right-of-way, existing coal mine shafts and spoil piles, the Jagare Ridge Golf Course, and ecological values associated with the NSRVARP area, present design challenges (Figure 2-1). Multiple design iterations have been considered and modeled with respect to routing as well as retaining wall configurations within the context of the constraints.

In 2019, Stantec circulated a document to the COE which outlined 6 options for a 4-lane roadway spanning from 141 Street SW to the Ambleside Eco Station (Stantec 2019). In 2023, Stantec also circulated a Preliminary Design Report to COE for feedback on potential Project designs. Feedback was received and incorporated into preliminary detailed design.

The detailed design process for the Project has been an iterative process wherein Project designs have been developed by qualified engineers to meet safety standards and cost considerations and scrutinized by experienced environmental planners and qualified professional biologists in the context of potential lasting effects on biophysical components such as fish and fish habitat and terrestrial wildlife passage.

One example of the design iteration involves the MSE wall located east abutment of the bridge which is required to avoid encroachment on the watercourse, the SESS tunnel, and the pipeline ROW, and to allow the backslope to be maintained at a reasonable grade. The original design was reviewed by environmental planners and biologists, and it was determined that the configuration and placement of retaining wall could pose a hazard to large mammals crossing Ellerslie Road at grade due to the 10 m drop-off created by the Project. As a result, the Project design was changed to include a wildlife fence at the on the top of the retaining wall to protect wildlife from a potentially hazardous fall (Appendix A, S001-018).



Stantec

- Project Disturbance Area (PDA)
- Ellerslie Road SW Expansion Area
- Local Assessment Area (LAA)
- Sanitary Line
- Powerline

Pipeline (AER)

- Permitted or Operating
- Discontinued, Abandoned or Removed

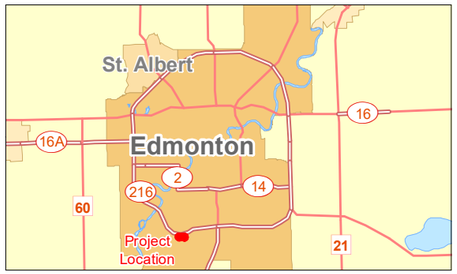
Abandoned Coal Mine

- Surface
- Underground

0 250 500 metres
1:13,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada. All rights reserved. AltaLIS Ltd.
3. Imagery: City of Edmonton, 2017.
4. Coal Mines: Alberta Energy Regulator (AER), Coal Mine Map Viewer (Downloaded 2024-06-24).
5. Pipelines: Alberta Energy Regulator (AER): Wells and Pipelines in Alberta (Downloaded 2021-11-04).
6. Powerlines: AltaLIS (Downloaded 2021-11-03).
7. Sanitary Lines: STANTEC, DWG 1161110195-C004-001-UTILITIES & DRAINAGE.dwg.



Project Location
Portion of 19- and 30-051-24W4 and 23 to 26-051-25W4, Edmonton, Alberta

1161110185
Prepared by MK on 2024-06-21
TR by KF on 2024-11-27
IR by EL on 2024-11-01

Client/Project
Brookfield Residential (Alberta) LP
Municipal Environmental Impact Assessment
Ellerslie Road SW, Eco Station Rd to Graydon Hill Blvd

Figure No.
2-1

Title
Project Constraints

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

3 Environmental Evaluation Approach

This EIA considers the potential effects on Valued Components (VCs) resulting from the construction and operation of the Project. Sections 3.1 through 3.5 outline the methods used to identify, evaluate, and determine the significance of potential environmental effects.

3.1 Scope of the Assessment

VCs are defined as an "environmental element of an ecosystem that is identified as having scientific, social, cultural, economic, historic, archaeological or aesthetic importance. The value of an ecosystem component may be determined on the basis of cultural ideals or scientific concern" (GOA 2010). VCs for the Project were selected with the objective of scoping the effects assessment to Project interactions that are of interest to the COE, the public, and the scientific community. The selection criteria for VCs include consideration of legislative or policy drivers, presence in the Project vicinity, and likelihood of interactions with the Project.

While not all biophysical components were selected as VCs, some aspects of the physical environment may be discussed under other VCs (e.g., noise may occur under sensory disturbance for wildlife). VCs were not carried forward in the effects assessment if Project interactions were considered negligible or if they were not expected to result in a measurable change to the VC with the application of Best Management Practices (BMPs) or standard practices. Items that are not considered VCs are scoped out of the effects assessment and are only discussed in the context of baseline conditions.

3.2 Spatial and Temporal Boundaries

Consideration of potential environmental effects is conceptually bound in space and time, more commonly known as spatial and temporal boundaries of the assessment. The spatial boundaries reflect the geographic area over which the Project's potential environmental effects may occur. The temporal boundaries identify when a potential environmental effect may occur in relation to specific Project components and/or activities. Spatial and temporal boundaries are developed in consideration of:

- timing/scheduling of Project activities
- understanding natural variations of each VC
- the time required for recovery from a potential environmental effect

The spatial boundaries for the Project are defined below with respect to Project components and activities:

<u>The Project Development Area (PDA):</u> The PDA is defined as the area in which Project activities and components may occur, and as such represents the area within which direct physical disturbance may occur as a result of the Project, both temporarily and permanently, and is confined by the Bylaw 7188 area. The PDA of 4.18 hectares (ha) includes the permanent footprint of the road upgrades and the temporary (construction) footprint (i.e., limit of construction and grading limits) (Figure 1-1).

The Ellerslie Road SW Expansion Area (Project area): The Project area is the overall extent of all Project activities and components. The Project area is 9.52 ha in size.

The Local Assessment Area (LAA): The LAA is a one-kilometer (km) buffer surrounding the complete Ellerslie Road SW Expansion Project (including the Project footprint beyond the PDA/bylaw 7188 boundary). The LAA represents the area in which potential environmental effects from Project activities and components can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA is the same for all VCs and covers approximately 677.77 ha (Figure 1-1).

The temporal boundaries for the Project encompass all Project activities. Construction is anticipated to begin in 2025 and is expected to take approximately two years. The Project is anticipated to be operational by 2027.

3.3 Mitigation of Potential Project Effects

Mitigation is the implementation of preventative, corrective or alternative measures to avoid, reduce or control a potential undesirable effect on a VC resulting from Project activities. Mitigation measures may be influenced by industry standard practices, legislative requirements, or corporate practices.

3.4 Evaluation of Potential Residual Effects

Potential residual effects are defined as “an effect that remains after mitigation has been applied” (GOA 2010). Residual effects are described for each potential negative effect on a VC after the implementation of the recommended mitigation measures.

Residual effects are characterized by direction, magnitude, duration, frequency, spatial extent and reversibility. Where possible, these characteristics are described quantitatively for each residual environmental effect. Where these characteristics cannot be expressed quantitatively, at minimum, they are described using qualitative terms that are defined specifically for the VC or effect. Detailed definitions, or characterization, of the effects for each VC included in the evaluation are provided in Table 3-1.

Table 3-1 Characterization of Residual Effects

Characterization	Definition of Qualitative Categories	
Direction	**Positive** – An effect that moves measurable parameters in a direction beneficial to the VC relative to baseline. **Negative** – An effect that moves measurable parameters in a direction detrimental to the VC relative to baseline **Neutral** – No net change in measurable parameters relative to baseline	
Magnitude	**Soils**	**Negligible**—no measurable change in soil quantity or quality, or no change in topography affecting slope stability **Minor**—a measurable change in soil quantity or quality, or a measurable change in topography with no measurable change in slope stability **Moderate**—a measurable change in soil quantity or quality, or a measurable change in topography which is likely to affect slope stability **Major**—a measurable change in soil parameters which results in a change in soil capability, or a measurable change in slope stability which results in slope failure
	Vegetation	**Negligible** – No measurable change to native vegetation communities or rare plants **Minor** – A measurable change to native vegetation communities or rare plants such that distribution and abundance of native plant communities is affected within normal variability of existing conditions **Moderate** – A measurable change to native vegetation communities or rare plants such that distribution and abundance of native plant communities is affected beyond normal variability of existing conditions **Major** – A measurable change to native vegetation communities or rare plants such that distribution and abundance of native plant communities is affected beyond normal variability of existing conditions leading to changes in regional plant diversity
	Wildlife and Wildlife Habitat	**Negligible** – No measurable change to wildlife habitat, wildlife movement, or mortality risk **Minor** – A measurable change to wildlife habitat, wildlife movement, or mortality risk such that species diversity is affected within normal variability of existing conditions and local individuals are affected **Moderate** – A measurable change to wildlife habitat, wildlife movement, or mortality risk such that species diversity is affected beyond normal variability of existing conditions and local populations are affected **Major** – A measurable change to wildlife habitat, wildlife movement, or mortality risk such that regional populations are affected

Characterization	Definition of Qualitative Categories	
Magnitude (cont'd)	**Aquatic Species and Habitat**	**Negligible** – No measurable change in fish mortality, fish habitat, fish passage or potential for release deleterious substances **Minor** – A measurable change in fish mortality, fish habitat, fish passage or potential for release deleterious substances that has the potential to reduce the abundance of aquatic species, quality or abundance of habitat, restrict fish habitat or result in the short-term release of deleterious substances. Effects are limited to the PDA **Moderate** – A measurable change in fish mortality, fish habitat, fish passage or potential for release deleterious substances that has the potential to reduce the abundance of aquatic species, quality or abundance of habitat, restrict fish habitat or result in the short-term release of deleterious substances. Effects may extend beyond the PDA **Major** – A measurable change in fish mortality, fish habitat, fish passage or potential for release deleterious substances that requires authorization under the *Fisheries Act*
	Historical Resources	Site-specific mitigation of project effects on historical resources is provincially regulated. The provincial regulator independently assesses the historical resource value of historic resource sites, determines the need for, and scope of, mitigation measures, and issues project approval under the *HRA*. Since project-specific environmental effects on historical resources are continually mitigated to the standards established by the provincial regulator, after implementation of the required mitigation measures, and Aboriginal consultation (if applicable), there are considered to be no residual environmental effects.
Duration	**Short-term** – Residual effect is restricted to the construction stage. **Medium-term** – Residual effect is measurable for 1-5 years following construction. **Long-term** – Residual effect extends beyond 5 years following construction.	
Frequency	**Single Event** – Occurs once. **Multiple Irregular Event** – Occurs on no set schedule. **Multiple Regular Event** – Occurs at regular intervals. **Continuous** – Occurs continuously.	
Spatial Extent	**PDA**—residual effect is restricted to the PDA **LAA**—residual effect extends into the LAA **Regional**—residual effect extends beyond the LAA into the surrounding region	
Reversibility	**Reversible** – The effect may be reversed after activity completion and reclamation. **Irreversible** – The effect is unlikely to be reversed.	

3.5 Selection of Ecosystem Components

Based on the scoping of potential effects during the construction and operation phases of the Project, six VCs will be carried forward in the assessment of potential environmental effects for the Project. VCs were not carried forward in the effects assessment if Project interactions were considered negligible or if they did not result in a measurable change to the VC with the application of BMPs or standard practices. The VCs that were considered, and a rationale for including or excluding them in the effects assessment are provided in Table 3-2.

Table 3-2 Selection of Valued Ecosystem Components

Valued Component	Potential Project Interaction	Included in Assessment	Rationale for Inclusion/Exclusion
Surface Water	✓	Section 5.1	The Project has the potential to affect the hydrological characteristics of Whitemud Creek within the PDA as a result of the construction of the bridge structure, which includes the placement of rip rap. Surface water and groundwater interactions with construction activities related to earthworks and instream works are likely.
Geology and hydrogeology	-	-	The Project has potential to affect slope stability because the grade of the slopes leading down to Whitemud Creek will be significantly altered. Potential project-related interactions with slope stability have been addressed through geotechnical assessment and design. Therefore, project interactions with geology and hydrogeology are not included as a VC.
Soils	✓	Section 5.2	Soils are included because the Project activities related to earthworks will interact with soil quality and quantity during construction. There is potential for soil loss within the PDA during construction due to excavation, grading and erosion. Cuts and fills required for Project construction will affect local terrain features such as steep banks associated with Whitemud Creek. There is also potential for soil quality to be reduced due to compaction from equipment. Effects to soil quantity will occur until such time as the restoration plan (i.e., seeding and planting) for the PDA is implemented and vegetation has established.
Wetlands	-	-	A wetland assessment was completed for the Project. Wetlands were not identified within the PDA and therefore have not been included in the EIA.
Vegetation	✓	Section 5.3	Project activities require clearing of trees and plant communities within the PDA. Vegetation species and communities has been included because vegetation clearing and ground disturbance will result in the loss of vegetation species and may affect community diversity. Construction and the machinery required has the potential to bring in weed species as well.
Wildlife and Wildlife Habitat	✓	Section 5.5	The Project will result in a change to wildlife habitat during construction and operation. There is potential for the direct mortality of wildlife during construction and operation, as well as change to wildlife movement.

Valued Component	Potential Project Interaction	Included in Assessment	Rationale for Inclusion/Exclusion
Aquatic Species and Habitat	✓	Section 4.6	Aquatic species and habitat are included because instream works are required during Project construction and habitat may be modified through the placement of materials instream.
Air Quality	-	-	Air emissions, including Green House Gas (GHG) emissions, are not evaluated further as the Project will not result in notable increases in air contaminants or GHG emissions. Construction activities will be short term in duration, with relatively few vehicles being required. As a result, with the application of standard mitigation measures, including maintaining vehicles and reducing idling of equipment, limited potential for residual effects is predicted.
Noise	-	-	Project construction activities will occur in accordance with the COE Community Standards Bylaw 14600 which sets noise limits and timing restrictions for construction. The Project is not anticipated to result in a change to baseline conditions following construction. Noise is excluded from this assessment.
Viewscape	-	-	As there are no parks within or adjacent to the PA and the bridge has been designed to align with the overall aesthetics of the existing structure, viewscape will not be included as a VC.
Historical Resources	✓	Section 4.7	Project activities may result in effects on historical resources within the PDA during construction, including effects to unknown resources of cultural, archaeological, historical and/or paleontological significance. As such, Project interactions with historical resources have been included.

4 Baseline Conditions

This section provides the pre-project environmental conditions. The intent of the desktop and field assessments outlined in the sections below is to describe baseline conditions and to set the context for the effects assessment. This information is used to evaluate Project interactions and assess the potential effects based on the identified interactions.

4.1 Surface Water

4.1.1 Methods

The method for describing baseline conditions for surface water was a review of desktop and field studies that were completed to inform preliminary design (Appendix B).

Design discharge is the maximum expected flow of water through a system and provides the basis for bridge design. Stantec calculated design discharge for Whitemud Creek at the Ellerslie Road bridge location to inform design (Appendix B). Methods used to determine design discharge consisted of:

- Review of Alberta Transportation bridge correspondence files for flood history, recent design discharge estimates and historical high- water marks
- Hydraulic analysis of the channel and floodway capacity
- Basin Runoff Potential method
- Hydraulic and frequency analysis of Water Survey of Canada flow data

The methods used to calculate design discharge are in accordance with current Alberta Transportation (AT) hydrotechnical design guidelines (AT 2006) and Transportation Association of Canada (TAC) - Guide to Bridge Hydraulics (TAC 2004).

4.1.2 Results

Results are reiterated from the Preliminary Engineering Design Report document located in Appendix B.

Whitemud Creek is located within the North Saskatchewan River watershed and the Strawberry sub-watershed (North Saskatchewan Watershed Alliance 2019). Whitemud Creek generally flows from the southwest to the northeast, eventually draining into the NSR. South of Ellerslie Road and west of the bridge crossing, Whitemud Creek meanders in an east-west direction for a length of approximately 200 m. There is an unnamed tributary to Whitemud Creek approximately 400 m east of Whitemud Creek, which crosses under Ellerslie Road via a box culvert.

Above the banks of Whitemud Creek, landcover in the LAA includes predominantly natural areas of forested stands and greenspace, however anthropogenic features such as roads, parking lots and other impervious surfaces are present. The presence of impervious surfaces in the LAA affect water quantity within Whitemud Creek at baseline. During rainfall and snowmelt runoff events, surface drainage in the LAA is anticipated to consist of shallow overland flow, shallow concentrated flow directed towards Whitemud Creek, and direct flow from the stormwater outfall.

Whitemud Creek within the PDA is a moderately- sized, permanent watercourse, with a winding, regular meander pattern. This meander pattern is controlled by the shale and sandstone layers in its banks located above the creek's streambed. The ground survey taken of the water level and streambed of the channel, extending upstream and downstream of the stream resulted in an average slope of 0.004 m/m. Based on surveyed site cross-sections the width of the channel at streambed elevation ranged from 8.5 to 10.5 m at an average water depth of 4.2 m for the 1:100- year flood event (Stantec 2023).

Whitemud Creek has a drainage area of 335 km^2 at this site based on Water Survey of Canada (WSC) Gauge 05DF006 information. The gauge is located 2 km upstream from the Project crossing. The largest flood recorded at this Gauge is 114.0 m^3/s on April 23, 1974. The drainage area extends to the south and south-west from this site. Whitemud Creek discharges into the North Saskatchewan River just downstream of the Quesnel Bridge on Whitemud Drive. The estimated maximum discharge rate for Whitemud creek basin is 0.48 $m^3/s/km^2$.

4.2 Geology and Hydrogeology

4.2.1 Methods

Methods for describing baseline conditions for geology and hydrogeology entailed a review of slope stability assessments (Appendix B). The slope stability assessment was informed by geotechnical studies conducted for the Project, as well as desktop review of other investigations completed in the past by other consultants.

Baseline conditions with respect to geology and hydrogeology were investigated through a site visit, geotechnical drilling program, aerial photo review, literature review, and a review of the AER Coal Mine Map Viewer (AER 2024).

4.2.2 Results

The LAA is situated over bedrock formations consisting of deposits of the Upper Cretaceous Period, known as the Horseshoe Canyon Formation. The Horseshoe Canyon Formation consists of deltaic and fluvial deposits of interbedded and interlensed fresh and brackish water sandstone, siltstone and shale. Soft grey, greenish and white weathered bentonitic feldspathic sandstone, brown bentonitic shales, coal seams and beds of carbonaceous shale are typical sediments of this Formation (Thurber Engineering Ltd. 2019). Near surface bedrock within the LAA is composed of deposits of the Edmonton Formation consisting primarily of bentonitic sandstone, siltstone and silty claystone, with coal seams and bentonite beds (Kathol and McPherson 1975, Hoggan Engineering & Testing (1980) Ltd. 2016).

The bedrock at the bridge crossing consists of interbedded clay shale and sandstone with coal inclusions. Bentonite seams were encountered within the bedrock at approximately Elev. 657.9 m and 654.3 m. Bedrock as shallow as 2.7 m below ground surface was encountered (Appendix B, Stantec 2023).

There presently is active erosion occurring on the right creek bank. It extends approximately 50 m downstream from the existing bridge (future EB- Lanes) and is proposed to be protected with rock riprap up to the design high water level (El 663.2). The top of this left bank extends above the proposed roadway grade line and is a steep slope. It has been noted during our site observations, that the toe of the headslope at the existing bridge has been eroded 2 to 3 m across the last few years and the bottom of the pier has been exposed.

Tension cracks were observed along the north side of Ellerslie Road, by the eastern bridge abutment, during a site visit by Stantec in 2019. The tension cracks suggest a marginally stable east slope.

The groundwater level recorded in the piezometers was about 3 m to 4 m below the ground surface on the eastern flood plain and was close to the creek level at approximate Elev. 659 m to 660 m.

4.3 Soils

4.3.1 Methods

Methods for describing baseline conditions for soils entailed a review of slope stability and geotechnical assessments and drawings (Appendix B). The slope stability assessment was informed by geotechnical studies conducted for the Project, as well as desktop review of other investigations completed in the past by other consultants.

4.3.2 Results

Within the PDA, the bedrock is overlain by surficial deposits between 0 m and 12 m thick belonging to the late Tertiary and Quaternary Periods. Glaciolacustrine clays and colluvial soils on the slopes, originating from past surficial slope movements, compose the two major surficial units visible on the surface. The glaciolacustrine deposits are underlain by glacial till and composed of a mixture of clay, silt and sand with some gravel, boulders and larger blocks of bedrock closer to the bedrock surface. The colluvial soils are within the valley slopes and composed of gravitationally moved mixture of clay, silt, and sand (Thurber Engineering Ltd. 2019).

In general, clay till overlying bedrock was encountered on the west side of Whitemud Creek. Top of bedrock was encountered ranging from Elev. 669 m to 666 m on the west side. The east side of Whitemud Creek appears to be part of a flood plain and consisted of clay, sand, and clay till before encountering bedrock. On the east side of Whitemud Creek, the existing ground elevation of the flood plain is at about Elev. 664 m. The bottom of native clay and clay till ranged from approximately 660 m to 661 m and was underlain by bedrock.

Elevations within the PDA range from approximately 660 m to 675 m. The road elevation within the PDA slopes downward towards Whitemud Creek. Whitemud Creek is situated at an elevation of approximately 660 m (Thurber Engineering Ltd., 2019).

A review of the AER Coal Mine Map Viewer identified that the PDA does not intersect with any known coal mines. However, there are several abandoned underground coal mines within the LAA. The abandoned coal mines lie in close proximity to the PDA.

4.4 Vegetation

4.4.1 Methods

Desktop and field assessments were conducted to assess upland plant communities within the LAA and PDA, respectively. The desktop assessment included a search of the Alberta Conservation and Information Management System (ACIMS) for historical occurrences of rare plant and ecological communities within one kilometre of the PDA and review of recent and historical aerial imagery to map upland and wetland plant communities.

A one km radius was selected based in the ecology of species that have the potential to occur within the PDA as well as the surrounding land use. Vegetation and wetland plant communities were classified using a Central Parkland Classification System derived from the following sources:

- A Preliminary Classification of Plant Communities in the Central Parkland Natural Subregion of Alberta (Wheatly and Bentz 2002) for uplands
- Alberta Wetland Classification System (Alberta Environment and Sustainable Resource Development 2015a) for wetlands
- Alberta Vegetation Inventory Standards Manual (Alberta Environmental Protection 1991) for agricultural, industrial and settled lands

Within the PDA, a total of 6 rare plant survey locations were assessed on June 23, 2021 (Figure 4-1. Field assessments included one survey interval of rare plant and rare ecological community surveys. A previous rare plant survey was also completed by Stantec in 2016.

During these surveys information was also gathered on *prohibited noxious* and *noxious* weed occurrences, if observed. See Appendix D for a list of species detected during rare plant surveys.

4.4.2 Results

4.4.2.1 Regional Vegetation

The Project is within the Central Parkland Natural Subregion of the Parkland Natural Region of Alberta (Natural Regions Committee, 2006). The Central Parkland is a large subregion that extends across the central and west central parts of the province and is a transitional zone between the Boreal Forest Natural Region to the north and the Grassland Natural Region to the south. Only a small portion of this subregion remains in a natural condition due to the extent of agricultural activities and development. The Central Parkland is dominated by undulating till plains and hummocky uplands, and the native areas are composed of aspen (*Populus tremuloides*) dominated forest stands on moist sites mixed with prairie vegetation on drier sites. Stands of aspen dominated forest are found throughout the subregion and have understories dominated by saskatoon (*Amelanchier alnifolia*), prickly rose (*Rosa acicularis*), and beaked hazelnut (*Corylus cornuta*). Stands dominated by balsam poplar (*Populus balsamifera*) occur on moist, nutrient rich sites, and often have aspen and white spruce (*Picea glauca*) (Natural Regions Committee, 2006).

4.4.2.2 Local Assessment Area

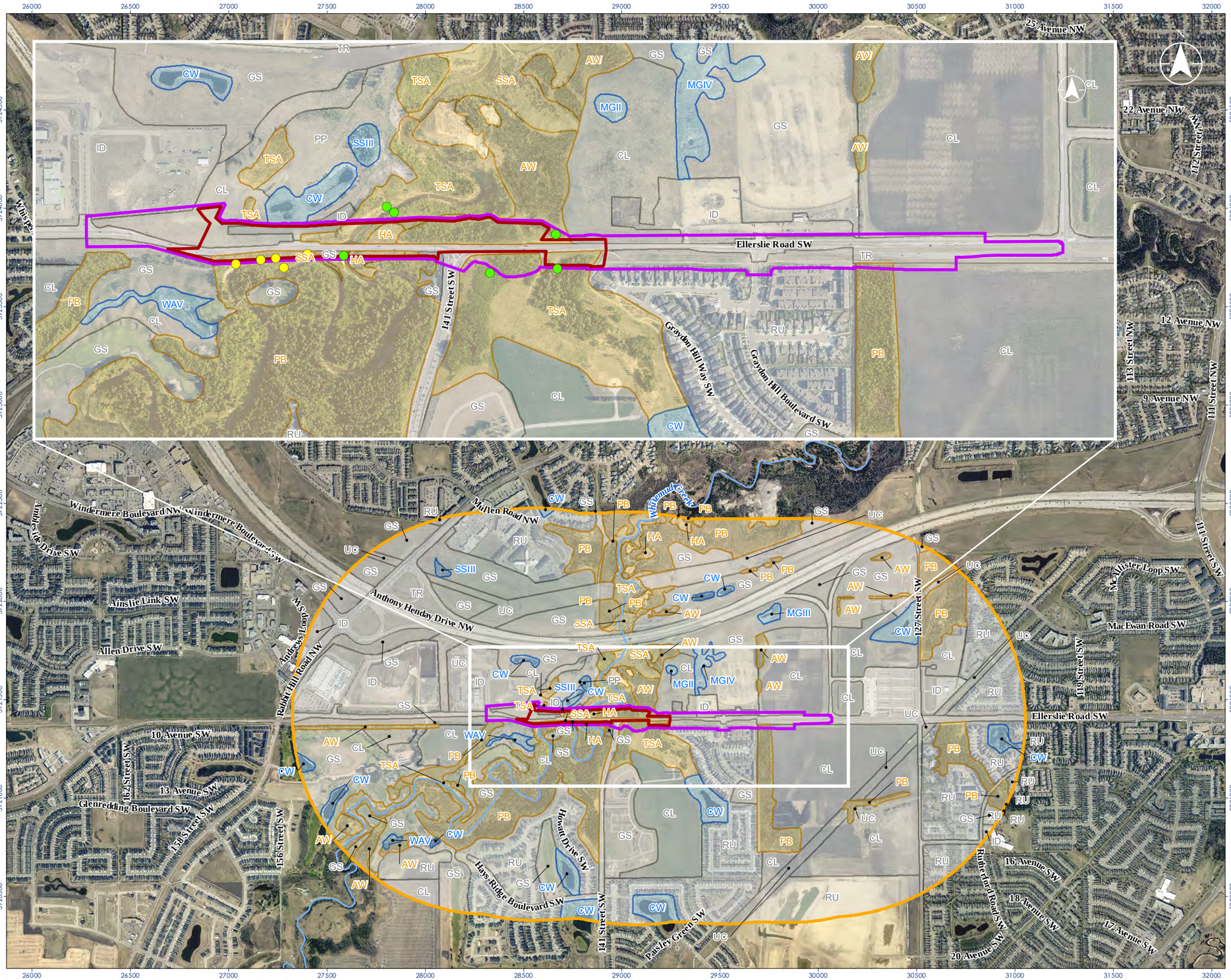
The LAA is characterized by human disturbance, with anthropogenic land units covering approximately 78.9% of the total area. Native upland plant communities occur over approximately 17.9 % of the LAA, and lie mainly within the Whitemud Creek Ravine. Wetlands comprise approximately 3.2% of the total LAA (Table 4-1, Figure 4-1).

Most of the upland native plant community area within the LAA is balsam poplar woodland alliance (12.0%). There are also small amounts of tall shrubland alliance (3.0%) and aspen woodland alliance (1.8%) (Table 4-1; Figure 4-1). The balsam poplar woodland alliance within the LAA is characterized by mature balsam poplar in the canopy with white spruce components.

A general description of plant communities and land units in the LAA is provided in Appendix C.

Table 4-1 Plant Communities and Land Use within the LAA

Plant Community/Land Unit	Area (ha)	Percent of LAA
Anthropogenic	**534.52**	**78.9**
Green space	142.74	21.1
Residential	135.66	20.0
Cultivated land	116.39	17.2
Transportation	64.47	9.5
Industrial development	42.84	6.3
Utility corridor	29.21	4.3
Perennial pasture	3.21	0.5
Upland	**121.25**	**17.9**
Balsam poplar woodland alliance	81.53	12.0
Tall shrubland alliance	20.10	3.0
Aspen woodland alliance	11.99	1.8
Short shrubland alliance	4.06	0.6
Sparse	2.11	0.3
Herbaceous alliance	1.46	0.2
Wetland	**20.50**	**3.2**
Constructed or modified waterbody	17.72	2.6
Temporary graminoid marsh	0.21	0.0
Seasonal graminoid marsh	0.72	0.1
Semi-permanent graminoid marsh	1.57	0.2
Seasonal shrubby swamp	0.71	0.1
Permanent shallow open water	1.06	0.2
Grand Total	**677.77**	**100.0**



Stantec

- Project Disturbance Area (PDA)
- Ellerslie Road SW Expansion Area
- Local Assessment Area
- Rare Plant Survey Location (2016)
- Rare Plant Survey Location (2021)

Wetland Community

- CW - Constructed or modified waterbody
- MGII - Temporary graminoid marsh
- MGIII - Seasonal graminoid marsh
- MGIV - Semi-permanent graminoid marsh
- SSIII - Seasonal shrubby swamp
- WAV - Permanent shallow open water

Upland Community

- AW - Aspen woodland alliance
- HA - Herbaceous Alliance
- PB - Balsam poplar woodland alliance
- SSA - Short Shrubland Alliance
- Sparse
- TSA - Tall Shrubland Alliance

Anthropogenic

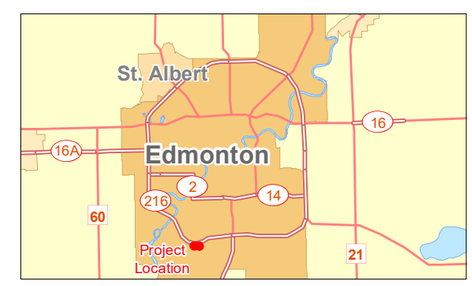
- CL - Cultivated land
- GS - Green space
- ID - Industrial development
- PP - Perennial pasture
- RU - Residential
- TR - Transportation
- UC - Utility corridor

0 250 500 metres

1:20,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved. AltaLIS Ltd.
3. Imagery: City of Edmonton, 2023.
4. ACIMS: Alberta Conservation Information Management System. 2015. Alberta Environment and Parks, Edmonton, AB.



Project Location
Portion of 19- and 30-051-24W4 and 23 to 26-051-25W4, Edmonton, Alberta

1161110185
Prepared by MK on 2024-06-21
TR by KF on 2024-11-27
IR by EL on 2024-11-01

Client/Project
Brookfield Residential (Alberta) LP
Municipal Environmental Impact Assessment
Ellerslie Road SW, Eco Station Rd to Graydon Hill Blvd

Figure No.
4-1

Title
Vegetation Species and Communities

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4.4.2.3 Project Development Area

Plant Communities and Land Use Units

The PDA is characterized by both upland plant communities (52.8%) and anthropogenic land units (47.2 %). Most of the upland native plant community area within the PDA is aspen poplar woodland alliance (25.0%) and tall shrubland alliance (14.8%). There are also small amounts of herbaceous alliance (6.7 %) and balsam poplar woodland alliance (5.7%) (Figure 4-1, Table 4-2). Transportation is the largest anthropogenic land use unit within the PDA at 24.2%, followed by cultivated land (13.0%), and industrial development (7.0%) (Figure 4-1, Table 4-2).

Table 4-2 Plant Communities and Land Use within the PDA

Plant Community/Land Unit	Area (ha)	Percent of PDA
Anthropogenic	**1.98**	**47.2**
Transportation	1.01	24.2
Cultivated land	0.55	13.0
Industrial development	0.29	7.0
Green space	0.09	2.2
Residential	0.04	0.9
Upland Community	**2.21**	**52.8**
Aspen woodland alliance	1.04	25.0
Tall shrubland alliance	0.62	14.8
Herbaceous alliance	0.28	6.7
Balsam poplar woodland alliance	0.24	5.7
Sparse	0.02	0.5
Short shrubland alliance	0.01	0.2
Grand Total	**4.18**	**100.0**

4.4.2.4 Rare Plants

A desktop review of ACIMS was completed for historical occurrences of rare plant and ecological communities within the LAA in advance of rare plant surveys in June 2021, and to inform this EIA on April 30, 2024. The ACIMS searches revealed no historical occurrences of rare plants with in the LAA.

A rare plant survey was completed in June 2021 in accordance with the Alberta Native Plant Council guidelines (Alberta Native Plan Council, 2000) (Figure 4-1). A summer season rare plant survey was completed in 2021. A rare plant survey was also completed in the LAA in 2016 (Figure 4-1).

Three rare plant species were observed during surveys of the LAA in June 2021 (Table 4-3). Observed rare plant species comprised tansy aster (*Machaeranthera tanacetifolia*), green ash (*Fraxinus pennsylvanica*), and common goatsbeard (*Aruncus dioicus*). No rare plant species were observed during the 2016 survey.

Table 4-3 Rare Plants Detected within the LAA

Scientific Name	Common Name	S-Rank[1]	Plot Location	PDA or LAA
Machaeranthera tanacetifolia	tansy aster	S1	ERPJF2102	PDA
			ERPJF2103	LAA
Fraxinus pennsylvanica	green ash	S2	ERPJF2106	LAA
Aruncus dioicus	common goatsbeard	S3	ERPJF2106	LAA

Notes:
[1] Standard Subnational Conservation Ranks (adapted from NatureServe)
S1 Known from five or fewer occurrences or especially vulnerable to extirpation because of other factor(s).
S2 Known from twenty or fewer occurrences or vulnerable to extirpation because of other factors.
S3 Known from 100 or fewer occurrences, or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factors.
S4 Apparently secure.
S5 Secure - taxon is common, widespread, and abundant.

Three plant species designated as *noxious* by the Alberta Weed Control Regulation were observed in the Project area during the 2021 field survey:

- creeping thistle (*Cirsium arvense*)
- perennial sow-thistle (*Sonchus arvensis*)
- common tansy (*Tanacetum vulgare*)

A comprehensive list of species observed during the rare plant survey is provided in Appendix D.

4.5 Wildlife and Wildlife Habitat

4.5.1 Methods

Desktop searches and mapping tools utilized included a review of the COE's various databases and reports, the Fish and Wildlife Internet Mapping System (FWIMS) tool, and results from field assessments (EPA, 2024a). In 2021, a habitat reconnaissance, breeding bird survey and an amphibian survey were completed by Stantec. Breeding bird surveys and amphibian surveys were also completed in 2020 within the LAA. Incidental wildlife observations are listed where relevant. The results of the surveys and the desktop assessments are described below.

4.5.2 Results

The COE lists 232 species that may reside in the NSR valley; the list comprises 178 birds, 47 mammals, and seven herptiles. Approximately 20% of these species are species of conservation concern federally and/or provincially (COE, 2008).

Species of conservation concern are defined as:

- listed federally as endangered, threatened, or special concern under Schedule 1 of the *Species of Risk Act* (GOC [Government of Canada], 2024),
- listed federally as endangered, threatened, or special concern by the Committee on the Status of Endangered Wildlife in Canada (GOC, 2024),
- listed provincially as endangered or threatened under the *Wildlife Act* or special concern by the Endangered Species Conservation Committee (GOA, 2024b),
- listed provincially as at risk, may be at risk, or sensitive according to the General Status of Alberta Wild Species (GOA, 2020).

Wildlife habitat in the LAA occurs mainly within the Whitemud Creek Ravine. About 78.9% of the land cover within the LAA consists of anthropogenically modified land units including green space and cultivated land (Table 4-1; Figure 4-1)

A little less than half of the PDA lies within anthropogenically modified land units (1.98 ha, 47.2%) which is primarily transportation infrastructure (1.01 ha, 24.2%) or cultivated land (0.55 ha, 13.0%) (see Figure 4-1, Table 4-2). The remainder of the PDA lies within aspen woodland alliance (1.04 ha, 25.0%) and tall shrub alliance (0.62 ha, 14.8%), with small areas of herbaceous alliance (0.28 ha, 6.7%) and balsam poplar woodland alliance (0.24 ha, 5.7%). Native upland habitats along Whitemud Creek provide connectivity for wildlife movement within the LAA on either side of Ellerslie Road at baseline. These vegetation communities generally provide habitat values for wildlife species that support life requisites such as breeding, foraging, security, and thermal cover.

Green spaces and cultivated lands within the LAA are likely to have low habitat values for wildlife species within the LAA and PDA.

4.5.2.1 Wildlife Sensitivity Areas and Occurrence Records

The LAA intersects key range areas identified by EPA (2024b), as follows:

- Sharp-tailed Grouse Survey Area
- Sensitive Raptor Range for Bald Eagle

Based on the habitat present, it is unlikely that sharp-tailed grouse use the LAA. Sharp-tailed grouse are generally associated with native grasslands and agricultural settings (Connelly et al., 2020), which are absent in the LAA. Bald eagles could potentially nest in the LAA based on range and habitat availability. There are no known bald eagle nests within the LAA.

4.5.2.2 Terrestrial Mammals

Suitable wildlife habitat occurs on either side of Ellerslie Road within the Project area, including treed, riparian, and open areas. During fieldwork completed for the Project, mammal tracks (white-tailed jackrabbit [*Lepus townsendii*], coyote [*Canis latrans*], deer *spp.*[1]) were observed crossing Ellerslie Road at grade (Stantec, 2019 and 2020, unpublished data). A winter snow-tracking survey in the Project area during February 2014 identified only few deer tracks south of Ellerslie Road, but much more deer activity north of Ellerslie Road, (20 fresh and 44 older tracks). The majority of these deer tracks were near Whitemud Creek, suggesting the forested area adjacent to Whitemud Creek north of Ellerslie Road was being used as winter range by ungulates (Stantec, 2014).

There are two existing wildlife passage structures within the PDA: the Whitemud Creek bridge and a box culvert at the unnamed ravine crossing. Evidence of wildlife use of both structures was observed at both structures during snow track surveys.

4.5.2.3 Breeding Birds

Breeding bird surveys were conducted on June 19, 2021 and June 30, 2021. An additional survey was conducted by Stantec in 2016 for a different version of an Ellerslie Road upgrade that didn't progress to submission. Surveys were conducted following provincial standard protocols outlined in the *Sensitive Species Inventory Guidelines* (GOA, 2013).

Table 4-4 details the species detected during breeding bird surveys conducted in 2021. Thirteen species were detected. Three species of management concern were detected: eastern phoebe (*Sayornis phoebe*) eastern kingbird (*Tyrannus tyrannus*), and bank swallow (*Riparia riparia*). These species are all ranked under the General Status of Alberta Wild Species as *sensitive* (GOA, 2020), and bank swallow is a Schedule 1 Threatened species under SARA. Breeding bird surveys completed in 2016 for another project on Ellerslie Road that didn't move forward indicate the presence of pileated woodpecker (*Dryocopus pileatus*). Pileated woodpecker is included on Schedule 1 of the MBR, 2022, which lists bird species whose nests are known to be reused in subsequent years by migratory birds and are protected year-round (ECCC, 2023).

[1] Deer tracks could have been white-tailed deer (*Odocoileus virginianus*) or mule deer (*Odocoileus hemionus*), but white-tailed deer are the most common local deer species

Table 4-4 Breeding Birds Detected in the Project LAA in 2021

Common Name	Scientific Name	Alberta General Status 2020[1]	COSEWIC[2]	SARA Schedule and Status[2]
Eastern phoebe	*Sayornis phoebe*	Sensitive	-	- -
Eastern kingbird	*Tyrannus tyrannus*	Sensitive	-	- -
American crow	*Corvus brachyrhynchos*	Secure	-	- -
Bank swallow	*Riparia riparia*	Sensitive	Threatened	Schedule 1 Threatened
American robin	*Turdus migratorius*	Secure	-	- -
Cedar waxwing	*Bombycilla cedrorum*	Secure	-	- -
Northern waterthrush	*Parkesia noveboracensis*	Secure	-	- -
Yellow warbler	*Setophaga petechia*	Secure	-	- -
Clay-colored sparrow	*Spizella pallida*	Secure	-	- -
Savannah sparrow	*Passerculus sandwichensis*	Secure	-	- -
Song sparrow	*Melospiza melodia*	Secure	-	- -
White-throated sparrow	*Zonotrichia albicollis*	Secure	-	- -
Red-winged blackbird	*Agelaius phoeniceus*	Secure	-	- -

Notes:
"-"=not assessed
[1] GOA 2020; [2] GOC 2024

4.5.2.4 Amphibians

Amphibian surveys were completed in the LAA and PDA in 2020 and 2021. Survey methods followed provincial standard protocols outlined in the *Sensitive Species Inventory Guidelines* (GOA, 2013) for auditory amphibian surveys.

The 2020 survey was a single visit on May 15, 2020, and resulted in detections of western toad (*Anaxryrus borealis*) and boreal chorus frog (*Pseudacris maculata*). The 2021 survey was completed over two visits (May 10, 2021; June 14, 2021). Boreal chorus frog and wood frog (*Lithobates slyvaticus*) were detected during the 2021 survey period.

4.5.2.5 Species of Management Concern

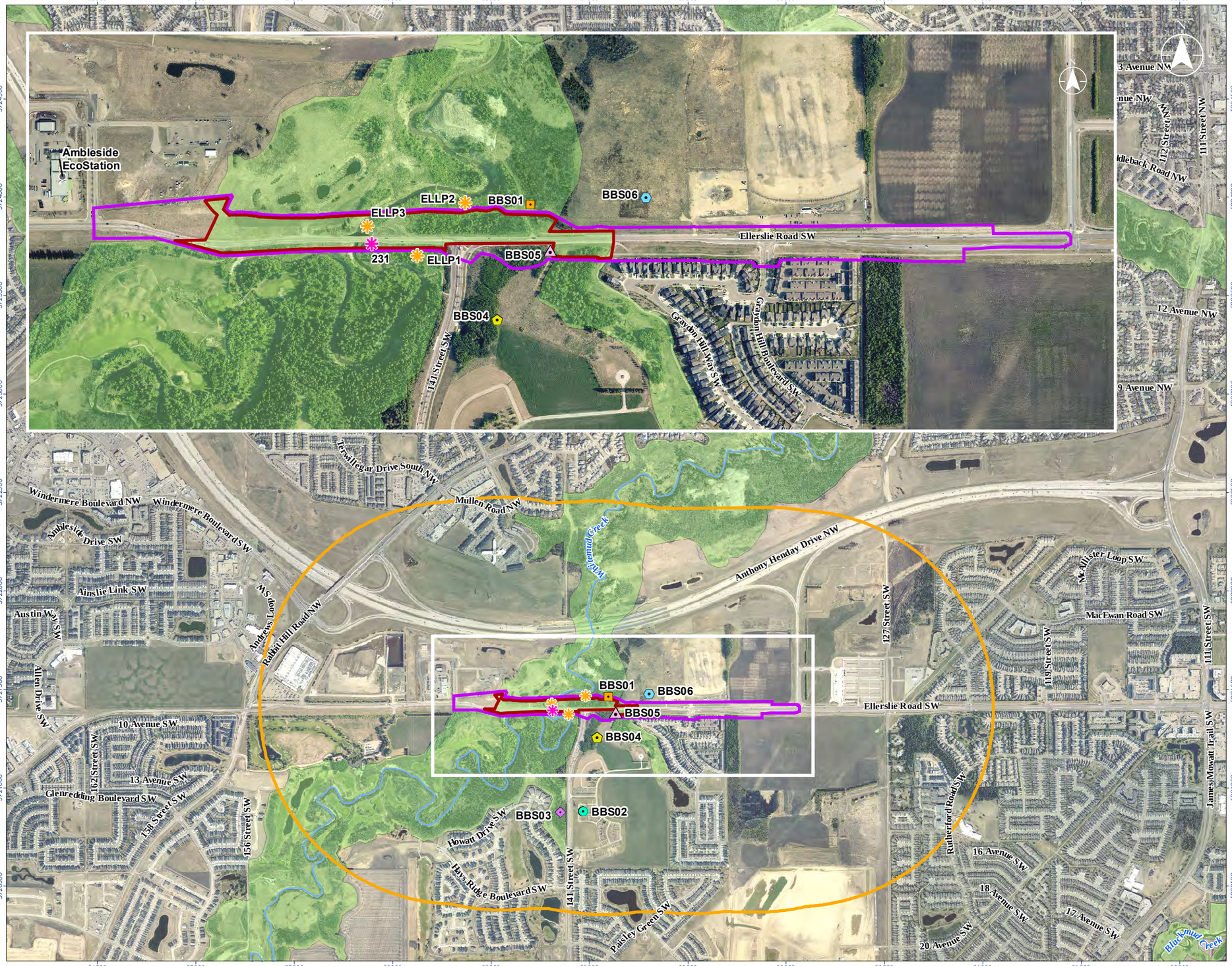
A query of the FWIMT database resulted in four records of species of management concern (Table 4-5) (EPA, 2024a). Bank swallows are insectivore species that have undergone dramatic population declines in recent decades. Bank swallows are colonial nesters, and select nest sites in near vertical banks often in association with rivers and watercourses. Nesting cavities were not observed during 2021 breeding bird surveys. Bank swallow nesting colony sites are typically ephemeral and may change year to year (Garrison and Turner, 2020). Occupied bank swallow nest cavities are considered a residence under Section 33 of SARA, which prohibits damaging or destroying the residence of a listed threatened,

endangered, or extirpated species. The LAA likely provides habitat for garter snakes, which are ranked as Sensitive species in Alberta.

Table 4-5 FWIMT and Field Survey Results for Species of Management Concern Records in the LAA

Common Name	Scientific Name	Alberta General Status 2020[1]	COSEWIC[2]	SARA Schedule and Status[2]
Great blue heron	*Ardea herodias*	Sensitive	-	- -
American kestrel	*Falco sparverius*	Sensitive	-	- -
Peregrine falcon	*Falco peregrinus*	At Risk	-	- -
Bank swallow	*Riparia riparia*	Sensitive	Threatened	Schedule 1 Threatened
Western toad	*Anaxyrus borealis*	Sensitive	Special Concern	Schedule 1 Special Concern

Notes:
"-"=not assessed
[1] GOA 2020; [2] GOC 2024



Stantec

- Project Disturbance Area (PDA)
- Local Assessment Area
- Watercourse
- 2019 River Valley ARP (Bylaw 7188 area)

Breeding Bird Observation

- American Robin, Clay-colored Sparrow, Song Sparrow, White-throated Sparrow, and Yellow Warbler
- American Robin, Bank Swallow, Clay-colored Sparrow, Northern Waterthrush, Red-winged Blackbird, and Yellow Warbler
- American Crow, American Robin, Bank Swallow, Clay-colored Sparrow, Eastern Kingbird, Eastern Phoebe, Red-winged Blackbird, and Yellow Warbler
- Cedar Waxwing and Clay-colored Sparrow
- Clay-colored Sparrow, Song Sparrow, and Yellow Warbler
- Clay-colored Sparrow and Savanna Sparrow

Amphibian Observation

- May 2020
- May 2020, May 2021, and June 2021

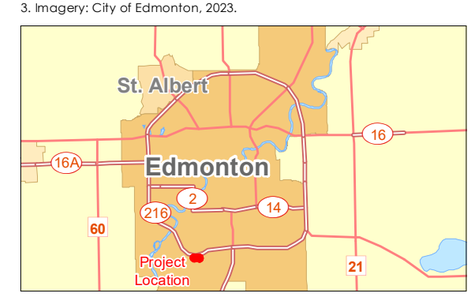
Map extent completely within Central Parkland Natural Sub-Region, Sharp-tailed Grouse Survey Area, Sensitive Raptor Range for Bald Eagle, Ferruginous Hawk, Golden Eagle, Peregrine Falson, Prairie Falcon, and AEP Wildlife Referral Boundary South.

0 250 500 metres

1:20,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved. AltaLIS Ltd.
3. Imagery: City of Edmonton, 2023.



Project Location
Portion of 19- and 30-051-24W4 and 23 to 26-051-25W4, Edmonton, Alberta

1161110185
Prepared by MK on 2025-03-11
TR by KF on 2025-03-xx
IR by EL on 2025-03-1-xx

Client/Project
Brookfield Residential (Alberta) LP
Municipal Environmental Impact Assessment
Ellerslie Road SW, Eco Station Rd to Graydon Hill Blvd

Figure No.
4-2

Title
Wildlife Survey Locations and Species

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4.6 Aquatic Species and Habitat

4.6.1 Methods

A desktop review of historical fish capture data was completed using FWIMT (EPA, 2024a) and DFO's aquatic species at risk and critical habitat map (DFO, 2024). The FWIMT search area included 5 km upstream and 5 km downstream from the Project (the search area) and included layers displaying areas of critical habitat for aquatic species at risk. The resulting historical fish capture data was reviewed for the presence of fish species listed under Schedule 1 of the federal SARA and the *Wildlife Act*. Other species designations and status reports were also considered, including the Committee on the Status of Endangered Wildlife in Canada ([COSEWIC]; Government of Canada [GOC], 2023) and the General Status of Alberta Wild Species (EPA, 2020).

Restricted activity periods (RAPs) have been developed to protect fish species and sensitive fish life stages that may be present in the watercourse. RAPs are based on a watercourse classification system, which utilize region-specific Management Area Maps and are typically used to inform timing of instream construction activities. Watercourse class and RAPs of Whitemud Creek at the bridge crossing location were identified using the Alberta Code of Practice (COP) for Watercourse Crossings (GOA, 2019) and the COP St. Paul Management Area Map (Alberta Environment and Sustainable Resource Development [ESRD], 2012).

A field assessment was conducted by a Stantec QAES on July 19, 2021 at the crossing location, to characterize existing fish habitat conditions and complete a fish assessment. Fish were caught using minnow traps and electrofishing methods to determine species presence within the area. This assessment followed procedures based on standard protocols outlined in Alberta Transportation's Fish Habitat Manual: Guidelines and Procedures for Watercourse Crossings in Alberta (2009) and criteria outlined in the Code of Practice for Watercourse Crossings (GOA, 2019). Around the crossing location, five cross-channel transects were established to document channel characteristics. Transects were established every 100 m from 300 m downstream to 100 m upstream (the assessment area).

The following field information and observations were recorded:

- Date and time
- Photographs
- Habitat type (e.g., pool riffle, run) and area
- Channel characteristics (e.g., channel and wetted widths, depths, gradient)
- Bed material (substrate size distribution)
- Obstructions
- Flood signs
- Stage of stream

Bank materials, bank stability, bank slopes, cover, vegetation and fish habitat were estimated visually. Channel width, wetted width, water depth and bank heights were measured quantitively.

Habitat characteristics were incorporated into a physical habitat classification system, which rates the quality of each macro-habitat type based on physical characteristics (e.g., depth, cover, substrate) with respect to the life history requirements of fish species (e.g., rearing, spawning, migration, overwintering) documented or anticipated to occur in the vicinity of the Project. Fish habitat in Whitemud Creek was rated (i.e., good, moderate, poor, or none) according to its suitability to support migration, spawning, rearing and overwintering by fish species known to be present within the watercourse (Nelson and Paetz, 1992, Scott and Crossman 1998, Joynt and Sullivan, 2003).

4.6.2 Results

A total of twelve fish species have been documented within the desktop search area of Whitemud Creek (EPA, 2024). No sport fish have historically been identified in the assessment area. Whitemud Creek is not identified as critical habitat for aquatic species at risk (DFO, 2024). Table 4-6 outlines the results of the FWIMT search. One species, goldfish, are listed as exotic/alien. No species of management concern were identified within the FWIMT search area.

In the vicinity of the Project, Whitemud Creek is a Class B watercourse, with a RAP extending from April 16 to June 30 (ESRD, 2012).

Table 4-6 Historical Fish Presence in Whitemud Creek in the Search Area

Family	Scientific Name	Common Name	Legislated Protection		Scientific Review or Recommendation	
			SARA[a]	*Wildlife Act*[b]	COSEWIC[a]	General Status[c]
Catostomidae (sucker family)	*Catostomus catostomus*	longnose sucker	No status	Not listed	Not assessed	Secure
	Catostomus commersonii	white sucker	No status	Not listed	Not assessed	Secure
	Catostomus platyrhynchus	mountain sucker	No status	Not listed	Non-active	Secure
Cyprinidae (carp family)	*Carassius auratus*	goldfish	No status	Not listed	Not assessed	Exotic/alien
Gasterosteidae (stickleback family)	*Culaea inconstans*	brook stickleback	No status	Not listed	Not assessed	Secure
Gadidae (cod family)	*Lota lota*	burbot	No status	Not listed	Not assessed	Secure
Leuciscidae (minnow family)	*Pimephales promelas*	fathead minnow	No status	Not listed	Not assessed	Secure
	Chrosomus neogaeus	finescale dace	No status	Not listed	Not assessed	Undetermined
	Couesius plumbeus	lake chub	No status	Not listed	Not assessed	Secure
	Margariscus nachtriebi	northern pearl dace	No status	Not listed	Not assessed	Undetermined
	Rhinichthys cataractae	longnose dace	No status	Not listed	Not assessed	Secure
Percopsidae	*Percopsis omiscomaycus*	trout-perch	No status	Not listed	Not assessed	Secure

Notes:

[a] SARA, and COSEWIC (GOC, 2024); considered a species of management concern if assessed as special concern, threatened or endangered

[b] *Wildlife Act*

[c] General Status of Alberta Wild Species (GOA, 2024); considered a species of management concern if designated as: sensitive, may be at risk or at risk

Two fish species were captured during the fish assessment, including 100 white sucker and four lake chub. Neither species are considered a species of management concern.

Whitemud Creek at the Project location is a permanent watercourse that consists of alternating flat and riffle habitat with some shallow pools present throughout. At the time of assessment, wetted depths ranged from 0.1 m to 0.77 m. Dominate bank materials are fines and organics along the assessed reach, the bank slopes are primarily vertical and unstable. The channel substrate was consistent across all transects and is comprised of approximately 50% cobbles and 50% fines with some small boulders and organics present. Channel width was 8.0 m at the crossing location and at the time of assessment, wetted width was 5.2 m, indicative of a low flow stage. The banks are primarily bare, however areas of grasses and shrubs with few trees exist. One beaver dam was identified approximately 250 m downstream of the proposed bridge.

The habitat for spawning, rearing, overwintering and migration was rated for the species expected to occur in Whitemud Creek. Poor to moderate spawning habitat are present for forage fish and coarse fish species. A variety of substrates provide spawning surfaces for some coarse fish species, although limited surfaces for gravel spawning species was observed.

Moderate rearing habitat was identified for coarse and minnow species as a result of the overhanging vegetation and three small pools (average depth of 0.7 m) were observed downstream of the proposed bridge location. Substrates throughout would provide sufficient habitat for benthic invertebrates.

Overwintering habitat is considered poor, as pools present in the assessment area are less than 1 m in depth and potentially freeze to bottom due to insufficient depths and limited flow.

Migration is moderate for forage fish and poor for coarse fish, as no limited impediments migration were observed (i.e., one beaver dam); however, shallow depths were observed across the assessment area which may limit movement of larger bodied fish.

The upper reaches of Whitemud Creek typically have limited flow outside of spring freshet and heavy rainfall events, which was similar to the low flow conditions observed at the crossing location at the time of assessment. Limited flow, high temperatures and low dissolved oxygen levels present in Whitemud Creek reduce the quality of habitat that may be present for small-bodied fish (i.e., minnow species or juvenile coarse fish) throughout the year. Due to these conditions, the overall habitat quality is rated as poor to moderate. The conditions at the time of assessment are likely to be similar at the time of construction based on the timing (i.e., August 15 to October 31).

4.7 Historical Resources

4.7.1 Methods

A search of the Listing of Historic Resources (Arts, Culture, and Status of Women, 2023) to identify areas where development might affect historic resources, including archaeological and palaeontological sites, Indigenous traditional use sites of a historic nature (i.e., burials, ceremonial sites, etc.), and historic structures was completed.

4.7.2 Desktop Results

Within the PDA, historic resources values of 5 (high potential to contain a historic resource) were identified, with ‘a’ (archaeological) and ‘p’ (palaeontological) historic resource categories of concern.

An HRA clearance application for the PDA was submitted to the Ministry of Arts, Culture, and Status of Women (AACSW) in July of 2024 and clearance has been issued for the Project.

5 Assessment of Potential Effects

5.1 Surface Water

5.1.1 Potential Effects and Interactions

The Project's potential interactions with surface water could result in a change in water quality and quantity.

Potential interactions with surface water between ground disturbance activities and water quality such as sedimentation and erosion are addressed below in Section 5.5 Aquatic Species and Habitat.

Changes in water quantity include potential for the following effects:

- Altered instream flow during construction due to isolation within Whitemud Creek
- Altered runoff flow rates
- Altered hydraulics and morphology of Whitemud Creek

Construction requires the utilization of a dam and pump isolation to allow for dewatering of the workspace in order for work to be completed under dry conditions. Stream isolation can lead to changes in water quality, sediment transport, and habitat availability for aquatic species.

The construction and operation of the Project could cause altered runoff rates (increased peak flows and runoff volumes) due to the increases to the area of impervious areas required for the additional roadway lane and new bridge and reduction of vegetation to promote infiltration. The construction of curbs and gutters on the roadway will alter the pattern of stormwater runoff. Road runoff will be piped to the stormwater outfall on Whitemud Creek, stormwater runoff from the bridge will be directed to storage tanks and then undergo controlled release to the outfall structure.

The presence of the new bridge piers could alter hydraulics and ice flow patterns in Whitemud Creek, including changes to scour patterns and changes to channel morphology.

5.1.2 Mitigation Measures

Standard industry practices and avoidance measures, along with Project-specific mitigation measures will be implemented during construction of the Project to reduce or eliminate potential Project effects on hydrology. See Table 5-1 for proposed mitigation measures for reducing potential effects to hydrology.

Table 5-1 Proposed Mitigation for Reducing Potential Effects to Surface Water

Potential Effect	Effect Pathway	Proposed Mitigation
Altered instream flow during construction	Isolation (construction only)	• Maintain flow around the isolated workspace using a by-pass pump system • If ice is present, flow must be returned under ice downstream of the isolation • Monitor water elevations during pumping • Inspect pumps on a regular basis during use
Altered runoff flow rates	Increased impervious area within LAA (construction and operation)	• Design and install drainage infrastructure to accommodate road and bridge runoff • Construct Project in accordance with Project design drawings • Inspect structures during operation to identify maintenance requirements • Storage tank controlled outflow discharge rate • Stormwater runoff will pass through sediment and grit separators prior to discharge
Altered hydraulics and morphology of Whitemud Creek	Bridge piers alter hydraulics and ice flow patterns, potentially changing channel morphology (operation)	• Design bridge piers and bank protection to reduce potential changes to creek hydraulics (i.e., bridge piers are designed to be above ordinary high water mark) • Construct Project in accordance with Project design drawings • Riprap will be installed to support the banks and reduce erosion

5.1.3 Potential Residual Effects

Project design elements include the bridge structure placement above the OHWM, installation of riprap above and below the OHWM to support the banks and reduce erosion potential, and a surface water storage tank to manage increased flows due to increased impervious area within the LAA as a result of Project presence. During construction, isolation methods will be in place to protect water quality and aquatic life, and instream flows and water elevations will be maintained via a by-pass pump system and water elevations will be monitored.

Changes to water flow and volume are not expected if Project designs are properly implemented during construction. The existing channel parameters are not anticipated to change below the 100- year flood capacity level.

With the implementation of mitigation measures, potential residual effects on surface water are predicted to be neutral in direction, geographic extent is limited to the LAA, minor in magnitude, long-term in duration, are considered predictable in their outcome, reversible and occurring at a multiple, irregular events.

5.2 Soils

5.2.1 Potential Effects and Interactions

The Project's potential interactions with soils include a change in soil quality and quantity during construction resulting from soil loss through wind and water erosion following vegetation removal and soil stripping as well as following soil replacement and prior to vegetation reestablishment. Compaction, rutting or loss of soil structure through vehicle or equipment movement is another potential effect, along with admixing during soil stripping and/or replacement activities. Contamination from fuel or chemical spills could also occur.

Interactions during operation are not anticipated because vegetation will be re-established, and vehicle/equipment activity within the LAA during operation will be limited (other than regular road use).

5.2.2 Mitigation Measures

Standard industry practices and avoidance measures, along with Project-specific mitigations will be implemented during construction of the Project to reduce or eliminate potential Project effects on soil quality and quantity. See Table 5-2 for proposed mitigation measures for reducing potential effects to soils.

Table 5-2 Proposed Mitigation for Reducing Potential Effects to Soils

Potential Effect	Effect Pathway	Proposed Mitigation
Change in soil quality and quantity	Soil loss and changes to soil quality through wind and/or water erosion following vegetation removal and soil stripping	• Develop and implement a storm water management plan for construction activities - install silt fences along areas of the PDA that require soil disturbance to protect Whitemud Creek - provide construction site entrance feature(s) to reduce the transport of sediment on vehicles and equipment - direct runoff through swales, sediment basins, and erosion control berms such that untreated runoff is not discharged from the PDA - install temporary rock check dams, straw swale barriers and/or filter cloth barriers in swales (where appropriate) - stabilize all disturbed areas not subject to construction activities within 30 days, - use geotextiles where appropriate • Develop and implement an ESC plan (COE 2005a) • Monitor ESC measures during construction and rectify deficiencies as soon as possible (COE 2005a) • Limit disturbance to existing vegetation (COE 2005a) • Limit the time exposure of un-vegetated/exposed soils (COE 2005a) • Strip topsoil and subsoil separately, store topsoil and subsoil in separate stockpiles at least one metre apart • Re-vegetate disturbed areas as soon as conditions allow • Topsoil salvage and/or replacement will be avoided during heavy precipitation or extremely windy conditions • Complete inspection and maintenance leading up to and following large precipitation events to ensure ESC function

Potential Effect	Effect Pathway	Proposed Mitigation
	Compaction, rutting or loss of soil structure through vehicle and equipment movement	• In the event of adverse weather that could result in rutting and/or compaction, mitigation measures (i.e., limiting vehicle traffic, utilizing tracked equipment or stripping topsoil) will be considered. If mitigation measures fail, Project activities may be suspended until adverse weather conditions abate • Traffic will be confined to workspace areas, access roads identified and marked by surveyors in order to reduce compaction • Working during and immediately after intense rainfall events or spring thaw when soils are wet will be avoided to the extent practical in order to reduce soil compaction • Installation rig matting (if required)
	Contamination from fuel or chemical spills	• Road vehicles will be refueled and maintained off site • Fueling and equipment maintenance (e.g., greasing, oil changes) will not occur within 100 metres of a waterbody • Construction equipment will be inspected at the beginning and end of each shift, and any leaks noted will be repaired immediately upon detection or equipment will be removed from site • Emergency response materials will be maintained on site and construction equipment will be equipped with a fire extinguisher, spill kits and will be operated by personnel trained in their use

5.2.3 Potential Residual Effects

Project mitigation measures to control water and wind erosion including: supervision of ground disturbance, implementation of an ESC and storm water management plan, and rutting provisions, are expected to prevent measurable changes in soil quality or quantity. BMPs to limit the exposure of fuel or chemicals to the PDA will lower the risk of contamination from fuel or chemical spills. In the event of an unplanned release of fuel or chemicals all impacted areas will be remediated to applicable guidelines (e.g., Alberta Tier 1 Soil Remediation Guidelines, CCME Soil Quality Guidelines for the Protection of Environmental and Human Health).

With the implementation of mitigation measures, potential residual effects on soils will be neutral, limited to the PDA, minor in magnitude, occurring at a single event frequency, short term in duration, and reversible, with the exception of the irreversible residual effect associate with admixing, following post-construction remediation of the workspace.

5.3 Vegetation

5.3.1 Potential Effects and Interactions

The Project will result in the clearing of 2.61 ha existing vegetation, though much of this vegetation has already been approved under separate applications and cleared by other parties to move utilities and pipelines to prepare for the project. As such, project activities are largely focused on areas that are previously disturbed. Effects to native vegetation resulting from tree clearing are limited to a small patch of trees on the east side of Whitemud Creek. Works will primarily occur throughout the road ROW.

Placement of rip rap will occur as part of the Project. Topsoil and seed mix will be placed over the rip rap above the OHWM, and outside of the shadow of the bridge, which is expected to encourage and expedite the naturalization following construction activities. This disturbance may result in the potential introduction or spread of weeds listed in the *Weed Control Act* (i.e., exotic vegetation invasion); several noxious weeds were identified to exist within the PDA.

5.3.2 Mitigation Measures

Standard industry practices and avoidance measures, along with Project-specific mitigation measures will be implemented during construction of the Project to reduce or eliminate potential Project effects on vegetation. See Table 5-3 for proposed mitigation measures for reducing potential effects to vegetation.

Table 5-3 Proposed Mitigation for Reducing Potential Effects to Vegetation

Potential Effect	Effect Pathway	Proposed Mitigation
Change in species and community diversity	• Direct loss or alteration of plant communities and diversity • Introduction or spread of weeds listed in the Alberta *Weed Control Act* (i.e., exotic vegetation invasion)	• Determine the value of City owned trees to be removed from the PDA with the City's Urban Forestry team • Pay financial compensation of offset value of lost trees if their replacement cannot be incorporated into the Project landscape design • Obtain Public Tree Permit and prepare associated Tree Protection or Preservation Plans, as required • Reduce the size of laydown areas where possible • Restrict all equipment to limits within the PDA and designated travel lanes • Limit disturbance to existing vegetation (COE 2005a) • Identify and visibly mark/fence rare plant communities immediately adjacent to the work site. If a site specific buffer cannot be maintained to the satisfaction of a qualified biologist then relocation of the rare plants to a suitable habitat should be undertaken. • Ensure all equipment arrives on-site clean and free of soil or vegetative debris • Minimize disturbance to existing vegetation where possible (COE 2005a, COE 2005b) • Minimize time exposure of un-vegetated/exposed soils (COE 2005a, COE 2005b) • Re-vegetate disturbed areas as soon as conditions allow • Re-vegetate according to the Project Restoration Planting Plan and Boulevard Planting Plans (Appendix A) • Monitor topsoil piles for weed growth during construction and implement corrective measures (i.e., spraying, mowing or hand pulling) to avoid the spread of weeds, as required • Weed control will be conducted in accordance with the Alberta *Weed Control Act* and Regulations • If conducting herbicide weed control application within 100 m of Whitemud Creek, utilize a licensed herbicide applicator and apply herbicides compliant with the EPEA • Develop and implement an ESC plan (COE 2005a) • Monitor ESC measures during construction and rectify deficiencies as soon as possible (COE 2005a)

5.3.3 Potential Residual Effects

Potential residual effects on vegetation species and communities may result from direct loss or alteration of plant communities and diversity, and introduction or spread of weeds listed in the *Weed Control Act*. Where disturbance is occurring outside of the Road ROW, a restoration plan has been developed to re-naturalize the area; however there are constraints on what can be replanted due to the presence of pipeline rights-of-way.

The topsoil and seed mix placed overtop of the riprap, along with the shrubs and trees planted above the riprap, are expected to encourage and expedite the naturalization following construction activities. Over time, a similar level of naturalization after construction is expected to be achieved, as it was prior to construction.

Where tree removals are required, the Project team will consult with the Urban Forestry and Natural Areas team to coordinate an assessment of any trees that may be removed by construction, and any proposed protection strategies. For those City owned trees that require removal, the City Forester will prepare a cost for each tree that will be removed to be applied to the Project. The funds collected as part of any tree removals will be utilized to plant trees in other areas of the City of Edmonton. Tree protection and preservation plans will be prepared to support obtaining a Public Tree Permit, as required.

The project will result in the removal of 2.61 ha of native upland vegetation from the PDA, though much of this vegetation has already been approved under separate applications and removed by third parties to prepare for this project. While replacement of approximately 0.86 ha of the disturbed area with topsoil, grass and forb seed mixes, and native shrubs and trees will occur, there will be approximately 1.75 ha of vegetation lost to the permanent transportation infrastructure (see Appendix A, L300-001 to L300-009). With the implementation of mitigation measures, potential residual effects on vegetation and species communities are predicted to be adverse in direction, local in geographic extent, minor in magnitude, long- term in duration, are predictable in their outcome, reversible and occurring in a single event.

5.4 Wildlife and Wildlife Habitat

5.4.1 Potential Effects and Interactions

The Project’s potential interactions with wildlife and wildlife habitat include change in habitat, change in movement, and change in mortality risk.

Change to the landscape within the PDA as a result of the construction and continued presence of relatively permanent features such as the bridge, MSE wall, bank armouring, and an additional lane of roadway is anticipated to change habitat availability over the life of the Project. The Project will result in the loss of 2.61 ha of native upland vegetation. Sensory disturbance associated with increased human presence and heavy equipment use is anticipated to affect habitat use in proximity to the activities while they are occurring. Sensory disturbance associated with the operations phase is anticipated to result in increased noise and vibration associated with increased traffic volumes over the life of the Project.

Wildlife movements in the LAA are anticipated to be negatively affected during the construction phase due to vegetation clearing and earthworks. Wildlife species may alter movement patterns in relation to increased human presence and sensory disturbance during construction. The inclusion of the wildlife passages is anticipated to maintain wildlife habitat connectivity for terrestrial wildlife post-construction.

During construction, vehicles and other equipment have the potential to result in an increased mortality risk for wildlife in the PDA. Vegetation removal and ground disturbance may result in the physical destruction of key habitat features (e.g., nests, dens, roosts, hibernacula), including those of species of management concern (e.g., eastern phoebe, eastern kingbird, pileated woodpecker). Bank swallows have been observed in the PDA, and their occupied nests are protected under SARA; project-related activities

could potentially interact with bank swallow nest cavities along the banks of Whitemud Creek. Equipment may also result in the direct mortality of small, less mobile species or individuals (e.g., amphibians, juvenile birds), including those of species of management concern (e.g., eastern phoebe, eastern kingbird, western toad). Regular vehicle traffic during construction and operation also poses a mortality risk to local wildlife, with increased risk associated with increased traffic volumes post-construction.

5.4.2 Mitigation Measures

Standard industry practices and avoidance measures along with Project-specific mitigation measures will be implemented during construction of the Project to reduce or eliminate Project-related effects on wildlife habitat, wildlife movements, and mortality risk.

See Table 5-4 for mitigation measures to eliminate or reduce potential effects to wildlife habitat, wildlife movement, and risk of mortality.

Table 5-4 Mitigation Measures to Reduce Potential Project-Related Effects to Wildlife and Wildlife Habitat

Potential Effect	Effect Pathway	Proposed Mitigation
Change in wildlife habitat	• Direct loss or alteration of wildlife habitat due to vegetation removal and ground disturbance • Indirect loss or reduced effectiveness of wildlife habitat through sensory disturbance due to human activity and heavy equipment use	• Restrict all construction activities to the approved Project boundaries and do not clear vegetation beyond Project boundaries • Maintain noise abatement equipment on machinery in good working order to reduce potential sensory disturbance to wildlife • Adhere to all recommended setbacks and timing restrictions for identified wildlife habitat features (e.g., nests, dens), including for species of management concern. • Restore vegetation to approved seed mix as soon as practical

Potential Effect	Effect Pathway	Proposed Mitigation
Change in wildlife movement	• Direct alteration of wildlife corridor due to vegetation removal, ground disturbance, and presence of MSE walls • Indirect loss or reduced effectiveness of wildlife corridor through sensory disturbance due to human activity and vehicle traffic	• Restrict all construction activities to the approved Project boundaries and do not clear vegetation beyond Project boundaries. • Maintain noise abatement equipment on machinery in good working order to reduce potential sensory disturbance to wildlife. • Adhere to all recommended setbacks and timing restrictions for wildlife habitat features (e.g., nests, dens), including for species of management concern. • Construct wildlife passage by creating an earthen bench to allow for the movement of all terrestrial EDGs under Ellerslie Road. • Maintain wildlife passage structures during the post-construction and operations phases. • Where extended lengths of silt fencing may be required, design to include consideration for strategics openings or tiered installation to facilitate wildlife migration through PDA. • Ecological design should include use of biodegradable ESC materials feasible. • Remove ESC materials that are non-biodegradable following remedial activities.
Change in wildlife mortality risk	• Direct mortality from ground disturbance and vegetation removal (e.g., destruction of nests or dens) • Direct mortality from collisions with Project vehicles and equipment	• Schedule the commencement of construction activities outside of the RAP for nesting migratory birds for Nesting Zone B4 (April 10 – August 31; GOC 2024), the general raptor nesting period (March 15 to July 15) (GOA 2021). If avoidance of the RAP is not possible, conduct nest searches and implement appropriate setbacks and/or mitigation measures to reduce the risk of incidental take and implement bird management plans, as required. If nest sweeps are required due to Project timing, results will be documented. This includes species of management concern. • Avoid disturbance activities and earthworks on the banks of Whitemud Creek during the RAP for migratory birds. If the RAP cannot be avoided, complete nest sweeps to determine if bank swallows are using creek banks for nesting cavities. Establish a restricted activity setback around active nesting colony if applicable. • During earthworks avoid storing soils in stockpiles with vertical slopes. Contour soil and aggregate stockpiles to have a slope of less than 70 degrees or cover stockpiles to dissuade use by bank swallows. • If tree removals are scheduled between February 1 and March 15, conduct owl nest searches to reduce potential destruction of wildlife features. • All construction personnel will receive environmental orientation at project start up, including education on avoiding the harassment and feeding of wildlife, mitigations to reduce potential for wildlife mortality, and other key environmental concerns.

Potential Effect	Effect Pathway	Proposed Mitigation
		• Prior to construction at any time of year, surveys for pileated woodpecker nest cavities will be conducted within the PDA and surveys for bald eagle nests will be conducted within 1 km of the PDA. If nests or cavities are identified, a mitigation and management plan will be developed in consultation with a regional EPA biologist. • During construction vehicles and heavy equipment will be limited to established roadways within the approved PDA and low speeds will be maintained • Monitor the construction area for trapped wildlife. Should any wildlife be identified, the Construction Manager will be contacted. In consultation with a professional wildlife biologist and EPA, appropriate corrective actions will be implemented • Keep construction site clear of garbage and food waste on a daily basis to reduce interactions with wildlife

5.4.3 Potential Residual Effects

5.4.3.1 Change in Wildlife Habitat

During construction, vegetation removal and ground disturbance will result in the direct and indirect loss of a small amount of native vegetation (approximately 2.61 ha). Project implementation will result in a change from native woodland habitat that provides foraging, security, and thermal cover for some species to a disturbed site. These changes will reduce the habitat values in the short term for nesting birds and reduce thermal and security cover for some terrestrial mammals, but values will improve over time as the restoration and boulevard plantings get established.

Direct and indirect disturbance to wildlife habitat will be reduced by scheduling construction activities to occur outside of sensitive wildlife periods (e.g., primary nesting periods for migratory birds). Wildlife may avoid areas adjacent to the PDA during construction due to noise, light, human presence, and heavy equipment use associated with construction activities. The extent of potential avoidance outside of the PDA will vary by wildlife species, season, and construction activity.

During construction, potential residual effects on wildlife habitat are predicted to be adverse as there will be direct loss of 2.61 ha of upland wildlife habitat within the construction limits. This habitat will be restored through restoration and boulevard plantings of trees, shrubs, and forbs. The magnitude of the potential effect is predicted to be minor because it is unlikely to have a measurable effect on wildlife abundance in the LAA. Although most changes in habitat will be limited to the PDA, sensory disturbance will extend into portions of the LAA, which may result in temporary local shifts in wildlife distribution. Potential effects on wildlife from direct habitat loss will occur from a single event (i.e., during vegetation removal and construction) and will extend beyond the operations phase. Potential indirect effects from sensory disturbance during construction will be short-term. Overall, the change in habitat is considered reversible because the residual loss or alteration of habitat can be reversed through habitat reclamation. With the implementation of the restoration and boulevard planting plans (See Drawings L-300-001 to L-300-009 in Appendix A).

5.4.3.2 Change in Wildlife Movement

During construction, noise, lights, and human activity, may result in changes to movement associated with the PDA. This reduction in movement through the PDA will persist during the construction period but this adverse effect will be reduced through site restoration and revegetation and by the presence of a wildlife passage structure. Overall, changes to vegetation and land cover will confer a reduction in security cover for some wildlife species moving through the LAA along Whitemud Creek.

Sensory disturbance in adjacent wildlife habitats may result in wildlife temporarily avoiding areas adjacent to the PDA during construction. The extent of potential avoidance outside of the PDA will vary by wildlife species, season, and construction activity. Wildlife are anticipated to habituate to the change in habitat over time and baseline wildlife movements are anticipated to resume during operations as grassed areas become established along the limits of the construction. Large and medium-sized mammals are anticipated to resume use of the corridor within the PDA after wildlife passage construction (as described in Appendix B) and reclamation and revegetation is completed. The planting of trees and shrubs as shown in the landscape plan is likely to facilitate movement for some species such as passerines and small mammals once weed removal activities are completed and plantings are established.

Although most changes in wildlife movement will be limited to the PDA, sensory disturbance will extend into the LAA, which may result in temporary local shifts in wildlife distribution. The effect is anticipated to adverse in direction and minor in magnitude. Potential effects on wildlife will occur from a single event (i.e., construction) and will extend beyond the operations phase. Potential indirect effects from sensory disturbance during construction will be short-term.

5.4.3.3 Change in Mortality Risk

Vegetation removal and site grading, as well as increased human activity (i.e., use of heavy equipment) could result in increased mortality risk to wildlife in the LAA. Wildlife mortality (e.g., for bank or ground nesting birds or amphibians and reptiles) due to ground disturbance and vegetation clearing might occur during site preparation and earthworks. All construction activities will be within the fenced PDA which will limit the potential for adverse effects to wildlife mortality risk for medium and large sized wildlife.

Adherence to migratory bird, owl, and raptor RAPs will reduce mortality risk to birds during construction. Where this is not possible, pre-construction surveys (i.e., nest searches) will be conducted to reduce mortality risk to birds.

The residual effect of construction-related change to mortality risk is considered minor because the Project is unlikely to have a measurable effect on wildlife abundance in the LAA. The increase in mortality is largely limited to the PDA and is short-term (i.e., construction phase only).

5.5 Aquatic Species and Habitat

5.5.1 Potential Effects and Interactions

The potential effects from interactions of Project activities include harmful alteration or destruction of fish habitat through placement of materials instream, including rip rap, and removal of riparian vegetation. Effects may occur through barriers to fish migration during construction due to changes in flow as a result of installation of the isolation to facilitate construction. Death of fish during construction activities may occur through improper use of fish screens, dewatering or failure to complete appropriate fish rescue. Release of deleterious substances may also occur during construction or operation while vegetation is establishing.

5.5.2 Mitigation Measures

Standard industry practices and avoidance measures, along with Project-specific mitigation measures will be implemented during construction of the Project to reduce or eliminate potential Project effects on aquatic species and habitat. See Table 5-5 for proposed mitigation measures for reducing potential effects to aquatic species and habitat.

Table 5-5 Proposed Mitigation for Reducing Potential Effects to Aquatic Species and Habitat

Potential Effect	Effect Pathway	Proposed Mitigation
Modification of fish habitat	• Grading, excavating or dredging within the channel or riparian area • Vegetation clearing or planting instream or within the riparian area • Placement of materials instream (rip rap)	• Removal and salvage of bed and bank materials should be completed in accordance with best practices and Project drawings. • Revegetate disturbed riparian and upland areas following construction works in accordance with best practices and landscape drawings. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring. • Revegetate streambanks and approach slopes in accordance with best practices and landscape drawings. • Design and construct approaches to the watercourse such that they are perpendicular to the watercourse to minimize loss or disturbance to riparian vegetation. • Keep clearing of riparian vegetation to a minimum; use existing trails and roads wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practicable, prune or top the vegetation instead of grubbing/uprooting. • Do not use herbicides for clearing or maintenance of riparian vegetation unless approved by unless otherwise approved and in accordance with applicable provincial and federal laws and regulations. • Store excavated materials above the OHWM. • Backfill with material of the same quality and gradation as the material that was removed.

Potential Effect	Effect Pathway	Proposed Mitigation
		• Restore bed and banks of the watercourse or waterbody to their original contour and gradient; if the original gradient cannot be restored due to instability, a stable gradient that does not obstruct fish passage will be restored • Use clean rock for instream construction associated with the bank restoration. • Complete restoration in accordance with the Project drawings.
Restriction in fish passage	• Installation of temporary isolation	• Fit any water intake pipes with a screen to prevent entrainment. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself. In freshwater, follow these measures for design and installation of intake end-of-pipe fish screens to protect fish where water is extracted from fish-bearing waters: - Adhere to DFO's Interim standard: in-water site isolation (DFO 2023) and Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater (DFO 2020). - Provisions should be made for the removal, inspection and cleaning of screens.
Restriction in fish passage (cont'd)		- Conduct regular maintenance and repair of cleaning apparatus, seals and screens to prevent debris-fouling and impingement of fish. - Pumps should be shut down when fish screens are removed for inspection and cleaning. - Operate the water pumping system continuously, whenever there is water flow, and until the in-water work is completed • Complete a pre-task meeting prior to commencing isolation removal. • Prior to isolation removal, the following steps should be taken: - Pump any residual water from the isolated area into a designated dewatering area - Remove accumulated sediments from the isolated area - Partially reflood the dewatered site in order to re-suspend remaining deposits and pump any residual sediment-laden water from the site - Remove isolation in a controlled manner that allows the water to flow back into the isolated area slowly. - Allow water level to reestablish and any residual sediment to settle before complete removal of the isolation. - Water quality monitoring will be conducted throughout the isolation removal activity in accordance with the Project turbidity monitoring plan.
Death of fish	• Use of industrial equipment • Dewatering or failure to dewater • Improper use or failure to use adequate fish screens	• Schedule isolation and diversion installation outside of the RAP for Whitemud Creek (April 16 to June 30) to protect fish during sensitive time periods (e.g., spawning, migration). • Minimize the duration of instream work and conduct instream work during frozen conditions or periods of low flow where possible to further reduce the risk to fish and their habitat or to allow work in water to be isolated from flows.

Potential Effect	Effect Pathway	Proposed Mitigation
	• Placement or removal of structures instream	• Develop a turbidity monitoring plan that includes specifications for sampling locations and frequency, and detection response procedures, prior to construction. The turbidity monitoring program will be developed to include guidance from the EPA Turbidity Monitoring Guideline (EPA 2022). The turbidity monitoring program will be led by a QAES and reviewed in detail with the contractor prior to commencing instream works. • Before isolation and dewatering works commence, retain a QAES to ensure applicable permits for relocating fish are obtained and to capture any fish trapped within an isolated/enclosed area at the bridge crossing and safely relocate them to an appropriate location. A Fisheries Research Licence should be obtained from EPA prior to commencing construction activities. • A fish rescue will be conducted within the instream isolation prior to dewatering. • A QAES will be consulted throughout the Project should any issues arise that may have the potential to impact the aquatic environment.
Release of deleterious substances	• Mobilization of sediment laden water as a result of construction activities • By-pass pumping system • Instream construction activities, including the installation and removal of the isolation • Failure to stabilize the site between construction and restoration	• Schedule work to avoid wet, windy and rainy periods that may increase erosion and sedimentation. • Machinery should arrive on site in a clean condition, and be maintained free of fluid leaks, invasive species and noxious weeds. • All gear and equipment used to work instream will be disinfected (i.e., rinsed with soapy water, rinsed with Quaternary Ammonium Cation (QUAT) disinfectant, and allowed to air-dry) before arrival on site to prevent the spread of infections, pathogens and invasive species (e.g., whirling disease) • Develop and implement a spill response plan that minimizes risk of accidental spills or releases from entering Whitemud Creek and any other surrounding water bodies during all phases of the Project. • Use a biodegradable hydraulic fluid for equipment when working instream. • Wash, refuel and service machinery, and store fuel and other materials for the machinery, in such a way as to prevent any deleterious substances from entering the water. • Remove all construction materials from the site upon construction completion. • Develop and implement an Erosion and Sediment Control Plan that minimizes the risks of sedimentation into Whitemud Creek and any surrounding water body during all phases of the Project. Maintain erosion and sediment control measures until disturbed ground has been stabilized, suspended sediment has resettled to the bed of the watercourse, and runoff water is clear. The plan will include, but not be limited to, the following practices where applicable: - Minimize instream work - Prohibit instream excavation in non-isolated areas

Potential Effect	Effect Pathway	Proposed Mitigation
		- Temporarily suspend work in the event of weather that could increase the potential for erosion and sedimentation - Install erosion and sediment control measures before starting work to prevent sediment from entering the watercourse - Regularly inspect and maintain erosion and sediment control measures and structures during construction. - Repair erosion and sediment control measures and structures if damage occurs. - Remove non-biodegradable erosion and sediment control materials once the site is stabilized. - Limit disturbance of the banks, and immediately stabilize and reclaim the site to pre-construction conditions where possible. - Place excavated materials and debris above the OHWM and in such a way that they do not enter the watercourse.
Release of deleterious substances (cont'd)		- Develop measures for containing and stabilizing waste material (e.g., dredging spoils, construction waste and materials, commercial logging waste, uprooted or cut aquatic plants, accumulated debris) above the OHWM to prevent re-entry to • Pump sediment-laden water into a vegetated area and prevent sediment and other deleterious substances from entering the creek. • Install a sump pump within excavation area to capture seepage. • Protect pump discharge area(s) with a diffuser to prevent erosion and the release of suspended sediments downstream and remove when the works have been completed. - the watercourse. - Implement subsurface drainage controls, where appropriate, to maintain groundwater and surface water interactions and to maintain the stability of reclaimed land. The type and location of subsurface drainage controls should be determined through onsite investigation with considerations for: subsurface flow potential, erodibility of backfill materials, and degree of slope. • Develop a turbidity monitoring plan that includes specifications for sampling locations and frequency, and detection response procedures, prior to construction. The turbidity monitoring program will be developed to include guidance from the EPA Turbidity Monitoring Guideline (EPA 2022). The turbidity monitoring program will be led by a QAES and reviewed in detail with the contractor prior to commencing instream works.

5.5.3 Potential Residual Effects

The Project has been assessed and mitigation measures have been provided by a QAES to address potential effects to aquatic species and habitat. During construction, a QAES should be consulted to

address any concerns with the mitigation measures identified for the Project activities and to support turbidity monitoring and complete fish rescue activities.

Changes to fish habitat are expected to be limited to the placement of riprap instream.

The channel will be isolated to complete bridge replacement which will temporarily prevent fish movement through the area. The isolation will be completed in compliance with DFO's Interim standard: in-water site isolation. The watercourse will be isolated for the duration of construction and the isolation will be completed outside of the specified RAP. Water flow will be maintained around the temporary isolation during instream works. Upon the completion of construction activities, the temporary isolation will be removed, and fish passage restored.

Instream construction activities will be isolated from Whitemud Creek through the installation of a temporary isolation. Equipment will be washed, refueled and serviced in such a way as to prevent deleterious substances from entering the watercourse. A spill response plan will be developed and adhered to, and monitoring of turbidity will be conducted under the supervision of, or by, a QAES who will be present during the installation and removal of the temporary isolation. Erosion and sediment control measures will be maintained, and the area will be reclaimed following construction activities. It is anticipated that bank restoration activities will improve bank stability and decrease bank erosion.

With the implementation of mitigation measures, potential residual effects on aquatic species and habitat are predicted to be neutral in direction, sub-regional in geographic extent, minor in magnitude, medium-term in duration, predictable in outcome, reversible, and occurring in a single event.

5.6 Historical Resources

5.6.1 Potential Environmental Effects

Because the PDA lies within areas designated with a HRV 5 a and p, archaeological and paleontological resources are believed to be present that could be affected by Project activities that involve surface or subsurface ground disturbance. Project activities have the potential to interact with historical resources which could result in the direct loss or damage to resources of cultural, archaeological, historical and/or paleontological significance.

5.6.2 Mitigation Measures

Standard industry practices and avoidance measures, along with Project-specific mitigation measures prescribed by Alberta Culture and Status of Women (AACSW) will be implemented during construction to reduce or eliminate potential Project-related effects related to the potential loss of historical resources. See Table 5-6 for proposed mitigation measures for reducing potential effects to historical resources.

Table 5-6 Mitigation Measures to Reduce Potential Project-Related Effects to Historical Resources

Potential Effect	Effect Pathway	Proposed Mitigation
Disturbance or destruction of part or all of a historic resource	Removal or disturbance of historical resource through vegetation removal or surface/subsurface disturbance	• HRA requirements for the Project, including the completion of an archaeological HRIA, and a paleontological HRIA • All construction works will comply with any conditions identified in the *Historic Resources Act* authorization • In the event that historical resources are encountered during construction, activities will be halted and AACSW will be notified

5.6.3 Potential Residual Effects

Project-related effects on historical resources are mitigated to the standards set by the regulatory agency (AACSW). The Project will implement the mitigation measures prescribed by AACSW. Residual environmental effects are not anticipated.

6 Monitoring

Monitoring during Project construction will be completed following the development of an ESC plan to determine if proposed mitigation measures outlined in this EIA are followed and are effective. Soil handling and temporary storage during the construction phase of the Project will also be monitored to assess the effectiveness of and adapt mitigation measures to protect soil quality and quantity. Additional construction monitoring will include monitoring for trapped wildlife within the fenced Project construction area.

HRA clearance requirements include the presence of qualified monitors during ground disturbance activities.

Semi-annual inspections will be conducted for the first two years following construction with a focus on identifying bare soil, vegetation establishment, the formation of erosive gullies, isolated pooling and sediment build-up.

7 Summary and Conclusion

The NSR valley is an important biophysical and cultural feature of the COE. Bylaw 7188 requires an environmental assessment for development activities within the *North Saskatchewan River Valley Area Redevelopment Plan* boundaries.

The residual effects (i.e., the effects remaining after the implementation of mitigation measures) of the construction and operation of the Ellerslie Road Upgrades on VCs are summarized in Table 7-1.

Overall, the adverse residual effects associated with the Project are mostly limited to minor magnitude changes to surface water, aquatic species and habitat, and wildlife and wildlife habitat. These effects were reduced by Project design considerations, and will be reduced by the implementation of mitigation measures and standard practices. Site restoration and revegetation will reduce adverse Project-related effects to terrestrial wildlife movements once plantings are established depending on the species and time of year.

Construction activities will require ground disturbance and soil handling which will result in the potential for sedimentation and erosion. Standard practices and the implementation of an ESC plan and stormwater management plan are anticipated to adequately address this effect. Minor magnitude adverse residual effects are anticipated during the construction phase.

Table 7-1 Summary of Residual Effects Characterization for Ellerslie Road at Whitemud Creek Expansion

Valued Component	Residual Effects	Effect Pathway	Direction	Magnitude	Duration	Frequency	Spatial Extent	Reversibility
Surface Water	Change in water quantity	Altered instream flow during construction due to isolation	Neutral	Minor	Long-term	Multiple Irregular	LAA	Reversible
		Altered runoff flow rates						
		Altered hydraulics and morphology of Whitemud Creek						
Soils	Change in soil quality and quantity	Soil loss and changes to soil quality through admixing during soil stripping/replacement, wind and/or water erosion following vegetation removal and soil stripping	Neutral	Negligible	Short-term	Continuous	PDA	Irreversible (admixing)
		Compaction, rutting or loss of soil structure through vehicle and equipment movement	Neutral	Negligible	Short-term	Continuous	PDA	Reversible
		Contamination from fuel or chemical spills	Neutral	Negligible	Short-term	Multiple Irregular-	PDA	Reversible
Vegetation	Change in species and community diversity	Direct loss or alteration of plant communities and diversity	Adverse	Minor	Long-term	Continuous	PDA	Reversible
		Introduction or spread of weeds listed in the *Weed Control Act* (i.e., exotic vegetation invasion)	Adverse	Minor	Long-term	Continuous	PDA	Reversible
Wildlife and Wildlife Habitat	Change in habitat	Direct loss or alteration of wildlife habitat due to vegetation removal and ground disturbance Indirect loss or reduced effectiveness of wildlife habitat through sensory disturbance due to human activity and heavy equipment use	Adverse	Minor	Long-term	Single Event	LAA	Reversible

Valued Component	Residual Effects	Effect Pathway	Direction	Magnitude	Duration	Frequency	Spatial Extent	Reversibility
Wildlife and Wildlife Habitat (cont'd)	Change in wildlife movement	Direct loss or alteration of wildlife corridor due to vegetation removal, ground disturbance, and fencing Indirect loss or reduced effectiveness of wildlife corridor through sensory disturbance due to human activity and heavy equipment use	Adverse	Minor	Long-term	Continuous	LAA	Reversible
	Change in wildlife mortality risk	Direct mortality from ground disturbance and vegetation removal (e.g., destruction of nests or dens) Direct mortality from collisions with Project vehicles and equipment	Adverse	Minor	Short-term	Multiple Irregular	PDA	Irreversible
Aquatic Species and Habitat	Modification of fish habitat	Grading, excavating or dredging within the channel or riparian area	Neutral	Minor	Medium-term	Single Event	LAA	Reversible
		Vegetation clearing or planting instream or within the riparian area						
		Placement of materials instream (rip rap)						
	Restriction in fish passage	Installation of temporary isolation	Neutral	Minor	Medium-term	Single Event	LAA	Reversible
	Death of fish	Use of industrial equipment	Neutral	Minor	Medium-term	Single Event	LAA	Irreversible
		Dewatering or failure to dewater						
		Improper use or failure to use adequate fish screens						
		Placement or removal of structures instream						

Valued Component	Residual Effects	Effect Pathway	Direction	Magnitude	Duration	Frequency	Spatial Extent	Reversibility
Aquatic Species and Habitat (cont'd)	Release of deleterious substances	Mobilization of sediment laden water as a result of construction activities	Neutral	Minor	Medium-term	Single Event	LAA	Reversible
		By-pass pumping system						
		Instream construction activities, including the installation and removal of the isolation						
		Failure to stabilize the site between construction and restoration						
Historical Resources	Disturbance of destruction of part or all of a historic resource	Removal or disturbance of historical resource through vegetation removal or surface/subsurface disturbance	Neutral	Negligible	-	-	-	-

8 References

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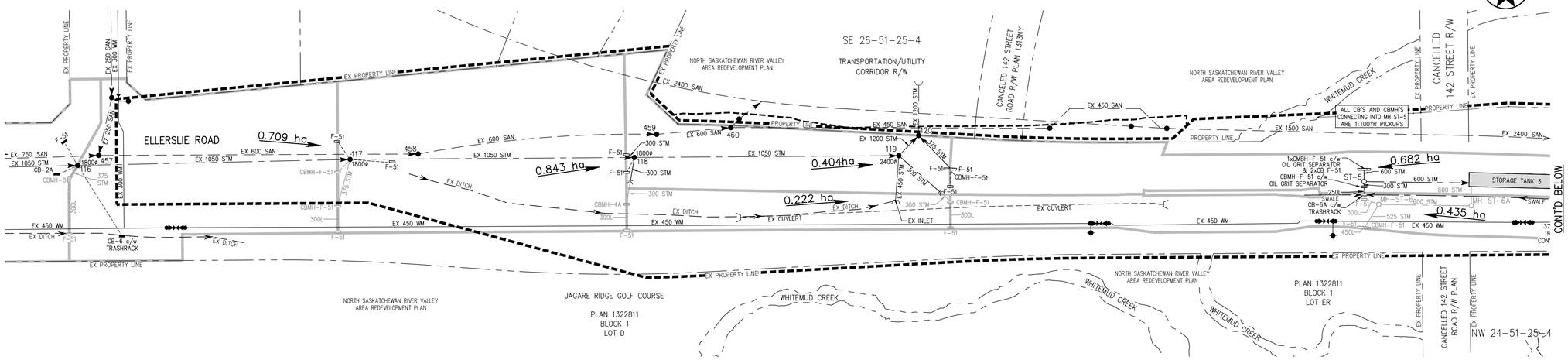
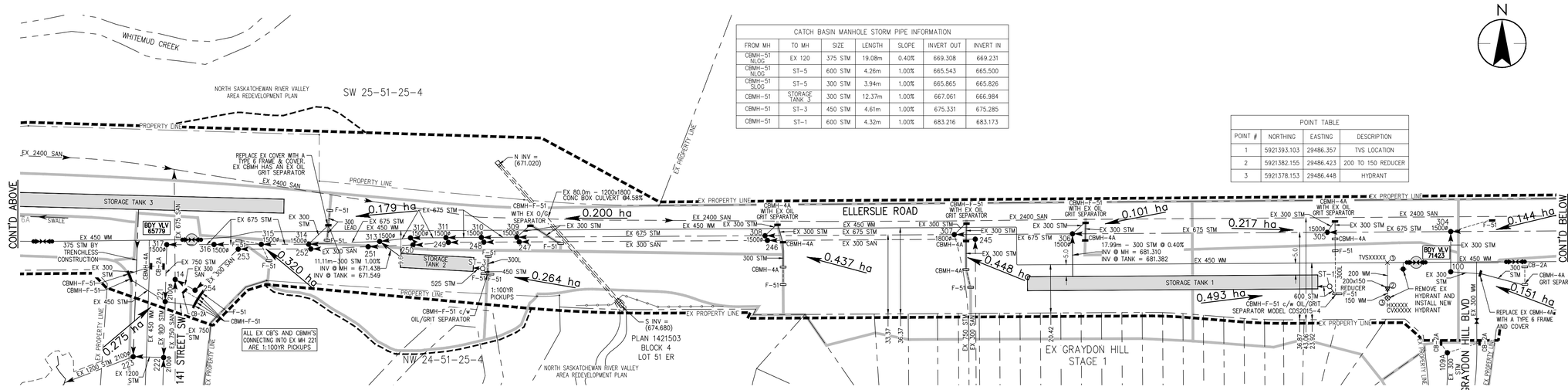
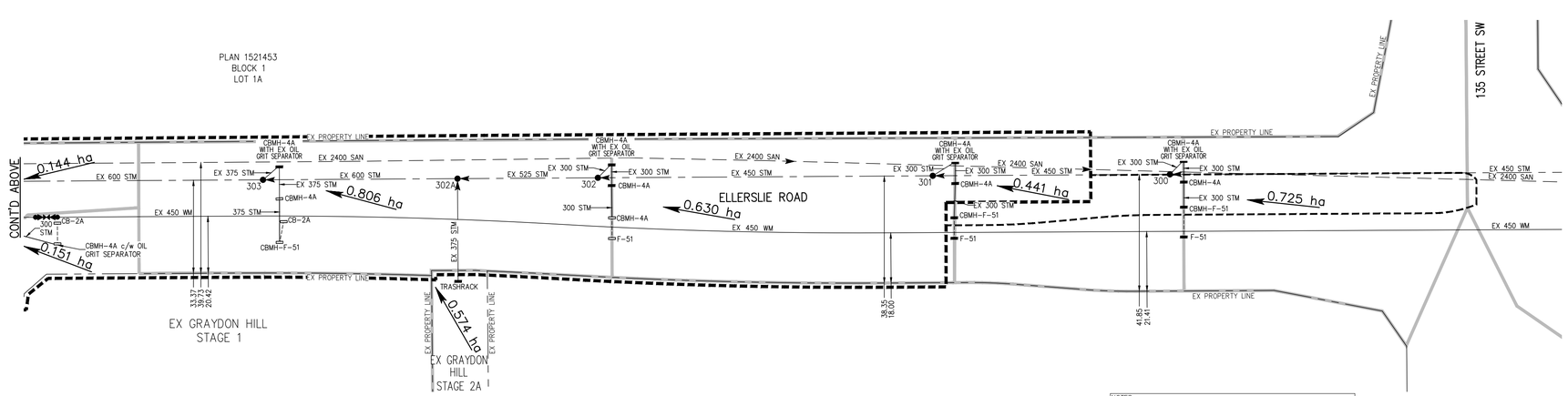
Appendices

Appendix A Design Drawing Package







CATCH BASIN MANHOLE STORM PIPE INFORMATION

FROM MH	TO MH	SIZE	LENGTH	SLOPE	INVERT OUT	INVERT IN
CBMH-51 NLOG	EX 120	375 STM	19.08m	0.40%	669.308	669.231
CBMH-51 NLOG	ST-5	600 STM	4.26m	1.00%	665.543	665.500
CBMH-51 SLOG	ST-5	300 STM	3.94m	1.00%	665.865	665.826
CBMH-51	STORAGE TANK 3	300 STM	12.37m	1.00%	667.061	666.984
CBMH-51	ST-3	450 STM	4.61m	1.00%	675.331	675.285
CBMH-51	ST-1	600 STM	4.32m	1.00%	683.216	683.173

POINT TABLE

POINT #	NORTHING	EASTING	DESCRIPTION
1	5921393.103	29486.357	TVS LOCATION
2	5921382.155	29486.423	200 TO 150 REDUCER
3	5921378.153	29486.448	HYDRANT

NOTES:
1. NO ENCROACHMENT WITHIN RIVER BYLAW AREA UNTIL PERMITS ARE OBTAINED BY OWNER FROM THE CITY OF EDMONTON.
2. NO ENCROACHMENT WITHIN 2.0m'S FROM OUTSIDE OF SESS PIPE WITHOUT AN AGREEMENT FROM EPCOR (TO BE OBTAINED BY CONTRACTOR).
3. NO ENCROACHMENT WITHIN EXISTING ATCO PIPELINES ROW OR FUTURE RELOCATED ATCO ROW.
4. NO CONSTRUCTION TO PROCEED ON BRIDGE OR WEST OF WHITEMUD CREEK UNTIL EXISTING ATCO PIPELINE HAS BEEN RELOCATED AND IS IN OPERATION.

DRAINAGE NOTES:
1. ALL EXISTING CBMH'S ON THE NLOG, CONNECTED TO MH'S 299 TO 314 HAVE AN EXISTING OIL/GRIT SEPARATOR.
2. ADJUST EXISTING MH & CB RIM ELEVATIONS AS NECESSARY TO MATCH PROPOSED ROAD SURFACE.
3. VERIFY EXISTING OVERSIZE MANHOLE TOP OF SLAB ELEVATIONS AND ADJUST CB/CBMH LEADS AS REQUIRED.

WATER NOTES:
1. ALL EXISTING WATER VALVES, CHAMBERS AND ANODE CASINGS ARE TO BE LOCATED AND MARKED TO ENSURE THAT THEY ARE NOT:
   - DAMAGED DURING CONSTRUCTION,
   - FILLED WITH PAVING DEBRIS,
   - PAVED OVER.
2. PRIOR TO REPLACING SIDEWALKS, ALL EXISTING VALVES WITHIN THE SIDEWALKS MUST BE ENCASED IN PVC PIPE.
3. IT IS THE RESPONSIBILITY OF THE PAVING CONTRACTOR TO EXPOSE AND ADJUST ALL VALVE CASINGS THAT ARE PAVED OVER. IF A VALVE CASING EXTENSION IS REQUIRED TO MATCH THE NEW ROAD SURFACE ELEVATIONS, THE MATERIALS USED MUST BE IN ACCORDANCE WITH EWSI'S APPROVED PRODUCT LIST AND DRAWINGS WA-003-001 TO WA-003-005 OF THE CITY OF EDMONTON'S DESIGN AND CONSTRUCTION STANDARDS, VOLUME 4 WATER. VALVE CASING EXTENSIONS ARE AVAILABLE AT NO CHARGE. PLEASE CONTACT EWSI AT 780-412-6823 AT LEAST ONE WEEK IN ADVANCE TO ORDER THE EXTENSIONS.
4. IT IS THE RESPONSIBILITY OF THE CONSULTANT/DEVELOPER TO IDENTIFY ANY WATER FACILITIES (E.G. HYDRANTS) THAT MUST BE RELOCATED AS A RESULT OF THE PROPOSED ROAD IMPROVEMENT PROJECT. ONCE THESE FACILITIES HAVE BEEN IDENTIFIED, PLEASE CONTACT WATER DT INFRASTRUCTURE AT WATERDTINFRASTRUCTURE@EPCOR.COM TO PLAN AND COORDINATE THE RELOCATION. CONTRACT MUST BE SIGN PRIOR TO CONDITIONAL APPROVAL.
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6. EXISTING HYDRANTS TO BE PROTECTED PER STANDARD DETAIL WA-004-004 FIRE HYDRANT HOARDING DETAIL.

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LIMIT OF CONSTRUCTION
DEVELOPMENT BOUNDARY
STORM DRAINAGE BOUNDARY

Permit-Seal for Revision/Plan of Record

Revision/Plan of Record	Dwn.	PM	YY.MM.DD
Development Engineer, Sustainable Development			
Approvals			YY.MM.DD

Permit-Seal for Issued

Issued	Dsgn.	Dwn.	YY.MM
2. SECOND SUBMISSION	TVW	TVW	25.01
1. FIRST SUBMISSION	TVW	TVW	24.02

PROJECT MANAGER: ROY McDIARMID
PROJECT No: 1161-110195

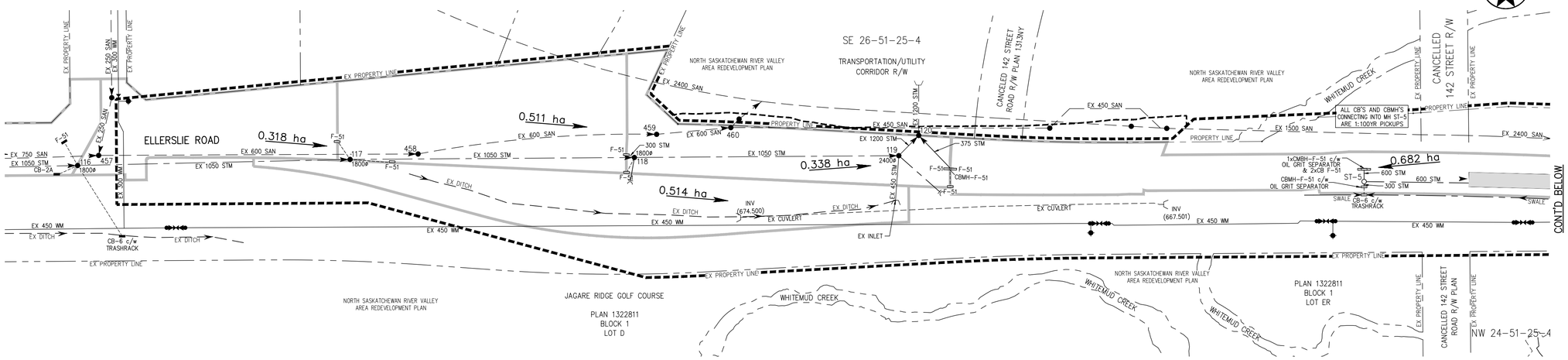
Client/Project
BROOKFIELD RESIDENTIAL (ALBERTA) LP

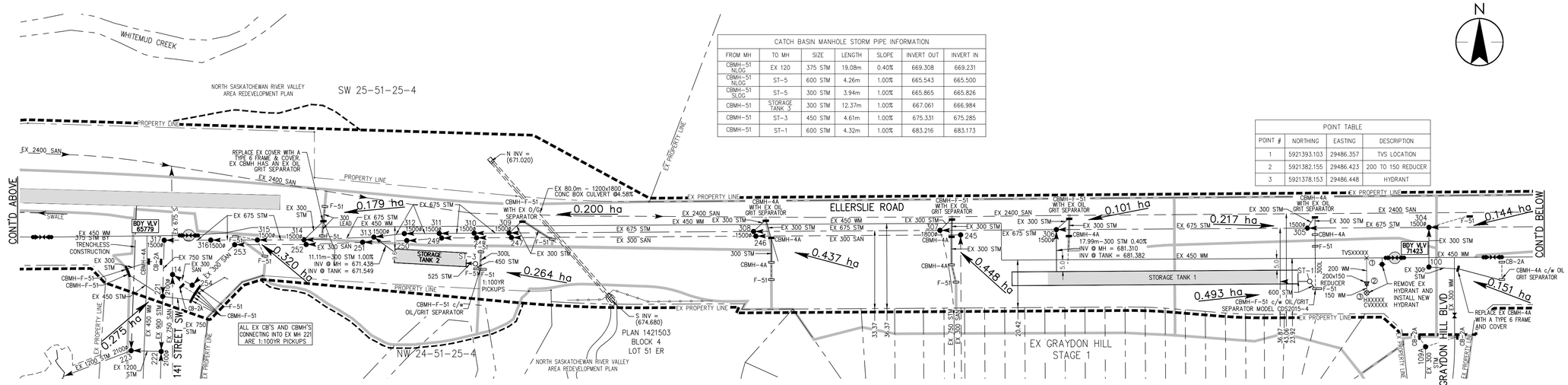
ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
Edmonton, AB

Title
ULTIMATE
SANITARY, STORM
AND WATERMAIN PLAN

Scale 1:1000

Drawing No. C004-001





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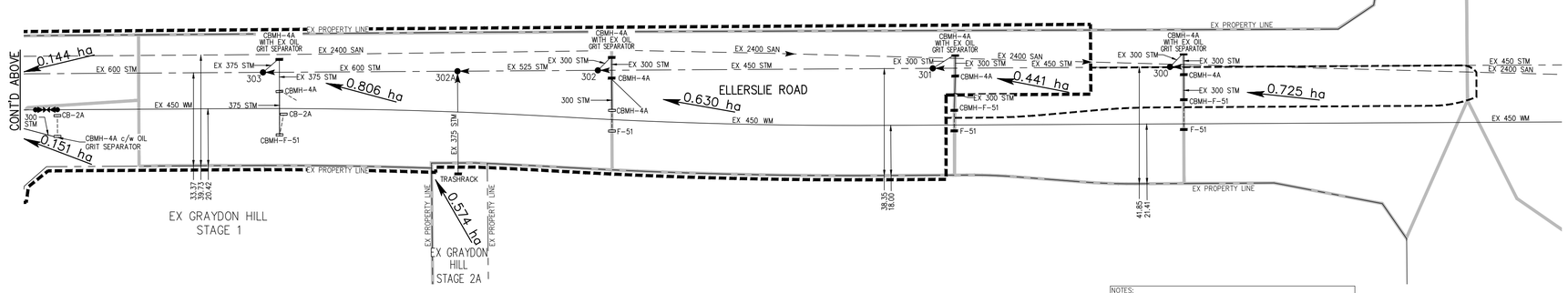

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LIMIT OF CONSTRUCTION
DEVELOPMENT BOUNDARY
STORM DRAINAGE BOUNDARY

Permit-Seal for Revision/Plan of Record

Revision/Plan of Record	Dwn.	PM	YY.MM.DD
Development Engineer, Sustainable Development			
Approvals			YY.MM.DD

Permit-Seal for Issued

Issued	Dsgn.	Dwn.	YY.MM
2. SECOND SUBMISSION	TVW	TVW	25.01
1. FIRST SUBMISSION	TVW	TVW	24.02

PROJECT MANAGER: ROY McDIARMID — PROJECT No: 1161-110195

Client/Project
BROOKFIELD RESIDENTIAL (ALBERTA) LP

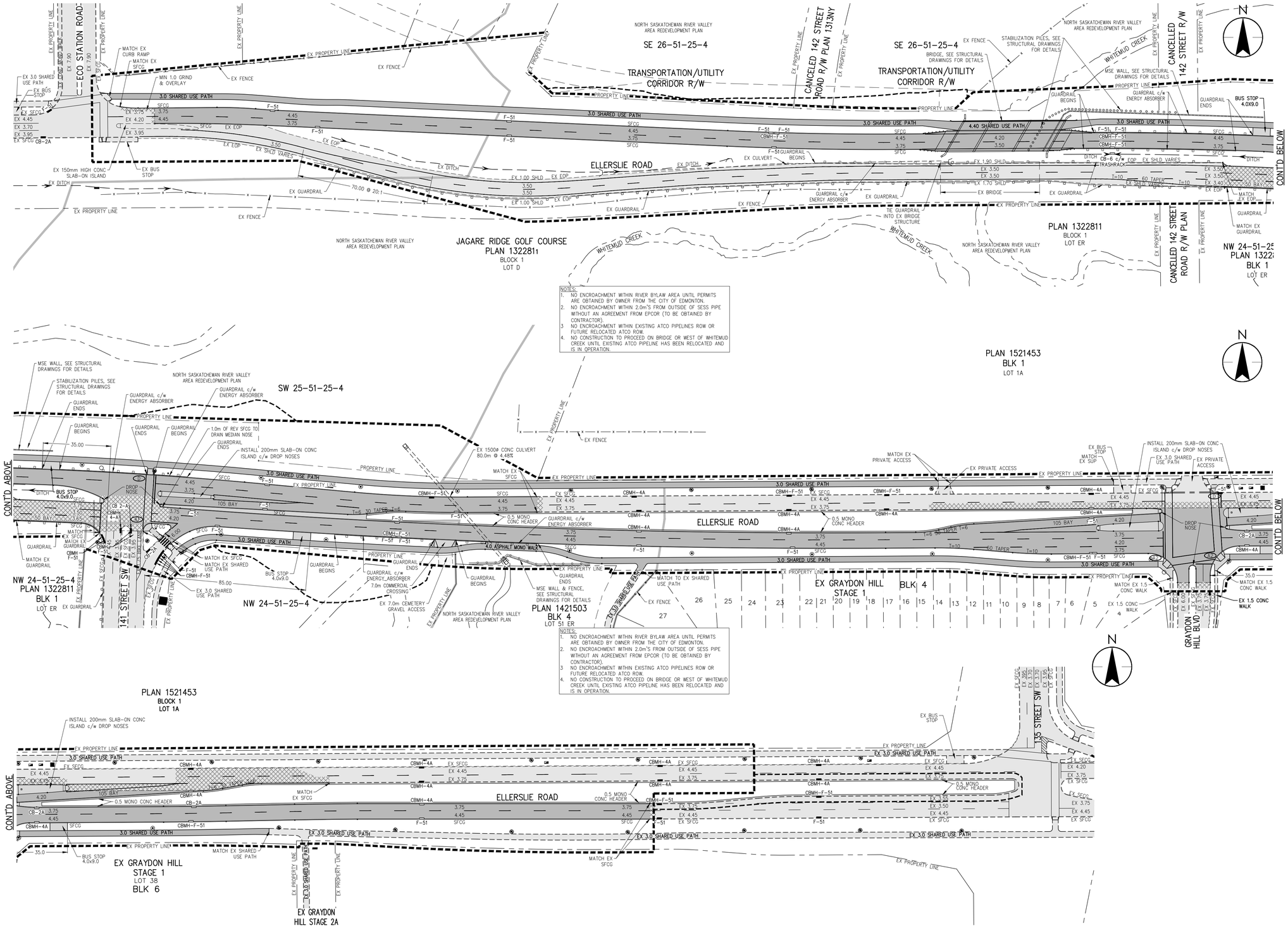
ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
Edmonton, AB

Title
INTERIM
SANITARY, STORM
AND WATERMAIN PLAN

Scale 1:1000 (0 10 20 30 40 50)

Drawing No. C004-002

2025-1-30 10:50am BY: TVANWYK V:\1161\Active\116110195\drawing\02_sheet_files\116110195-C004-002-UTILITIES & DRAINAGE-INTERIM.dwg



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LIMIT OF CONSTRUCTION
DEVELOPMENT BOUNDARY
NORTH SASKATCHEWAN RIVER VALLEY AREA REDEVELOPMENT PLAN
CURB RAMP TYPE
PAVEMENT
EXISTING PAVEMENT
CONCRETE
GRIND AND OVERLAY
GRAVEL
REMOVAL

1. ALL STATIONING, CURVE DATA, LENGTHS AND DIMENSIONS ARE AT GRID LEVEL. COMBINED FACTOR 0.999806.

SEE C100-REMOVALS FOR ROAD REMOVAL INFORMATION

ELLERSLIE ROAD
DESIGN SPEED=70km/h
POSTED SPEED=60km/h

Permit-Seal for Revision/Plan of Record

Revision/Plan of Record	Dwn.	PM	YY.MM.DD
Development Engineer, Sustainable Development			
Approvals			YY.MM.DD

Permit-Seal for Issued

Issued	Dsgn.	Dwn.	YY.MM
2. SECOND SUBMISSION	TVW	TVW	25.01
1. FIRST SUBMISSION	TVW	TVW	24.02

PROJECT MANAGER: ROY McDIARMID
PROJECT No: 1161-110195

Client/Project

BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

Edmonton, AB

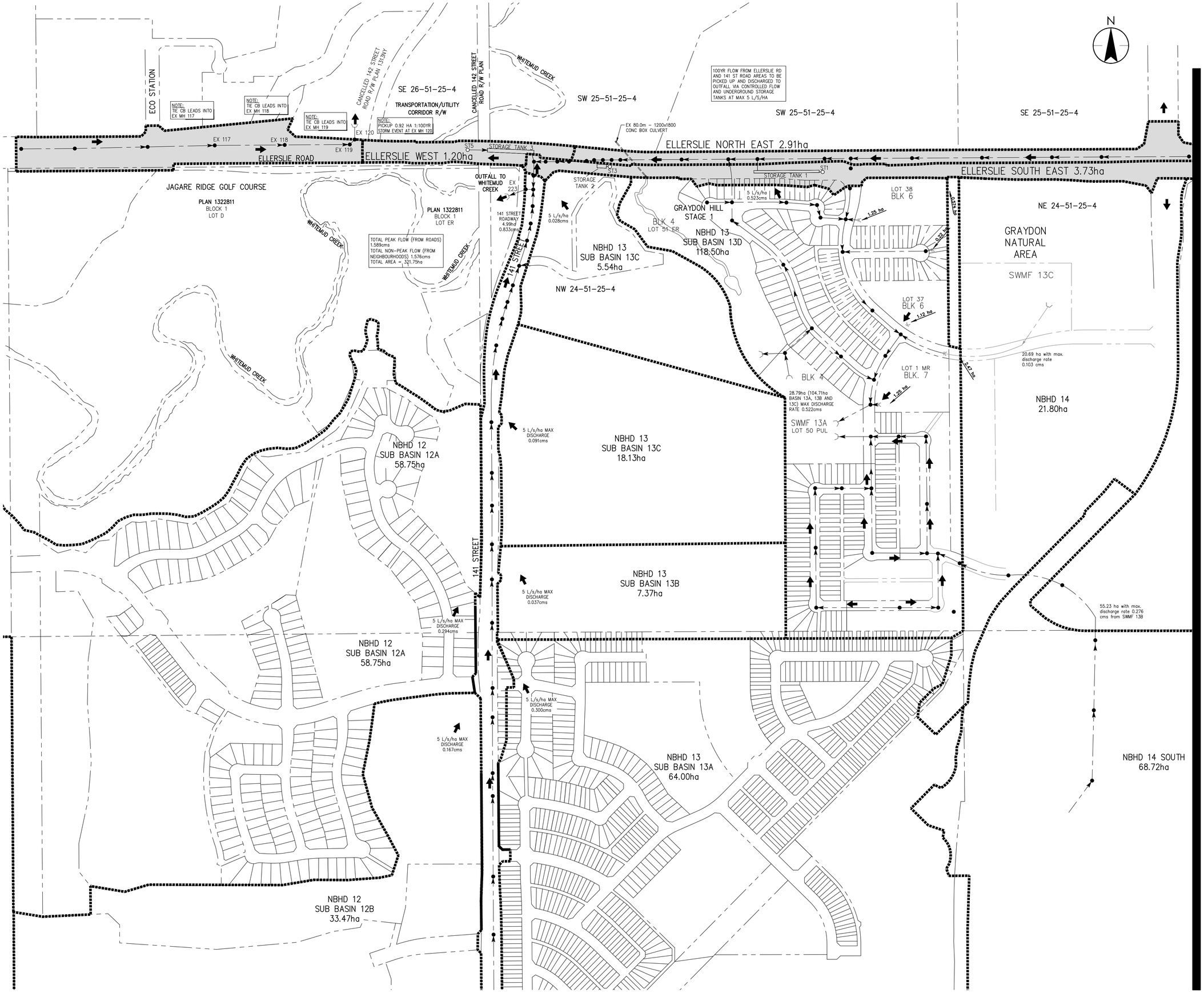
Title

ROAD AND SIDEWALK PLAN

Scale 1:1000

Drawing No. C005-001

2025-1-29 1:26pm BY: TVANWYK V:\1161\Active\116110195\drawing\02_sheet_files\116110195-C005-001-ROAD.dwg



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STORM SEWER AND MANHOLE
EXISTING STORM SEWER AND MANHOLE
FUTURE STORM SEWER AND MANHOLE
MAJOR STORM DRAINAGE BASIN BOUNDARY
DIRECTION OF MAJOR DRAINAGE
ELLERSLIE ROAD SW

Permit-Seal for Revision/Plan of Record

Revision/Plan of Record	Dwn.	PM	YY.MM.DD
Development Engineer, Sustainable Development			
Approvals			YY.MM.DD

Permit-Seal for Issued

Issued	Dsgn.	Dwn.	YY.MM
2. SECOND SUBMISSION	TVW	TVW	25.01
1. FIRST SUBMISSION	TVW	TVW	24.02

PROJECT MANAGER: ROY McDIARMID
PROJECT No: 1161-110195

Client/Project

BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
Edmonton, AB

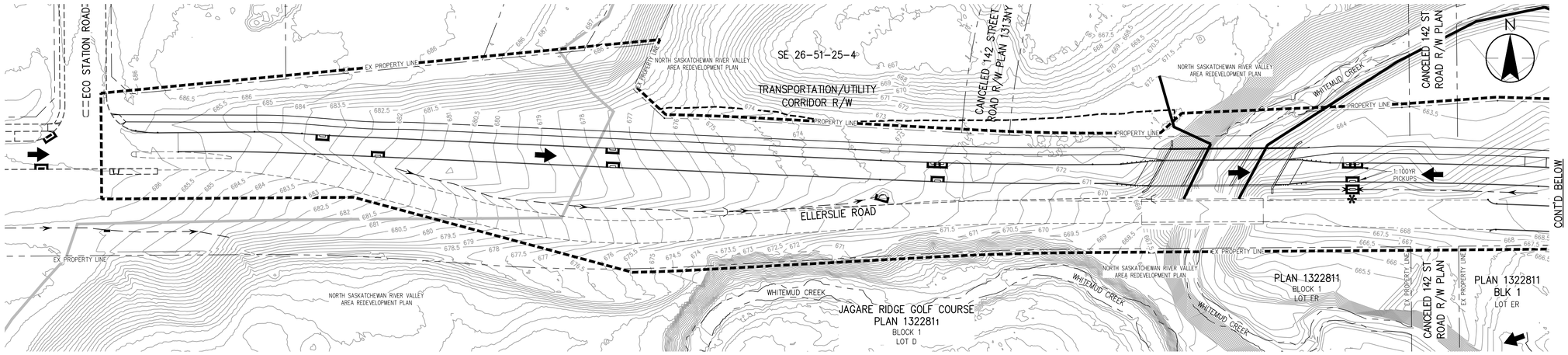
Title

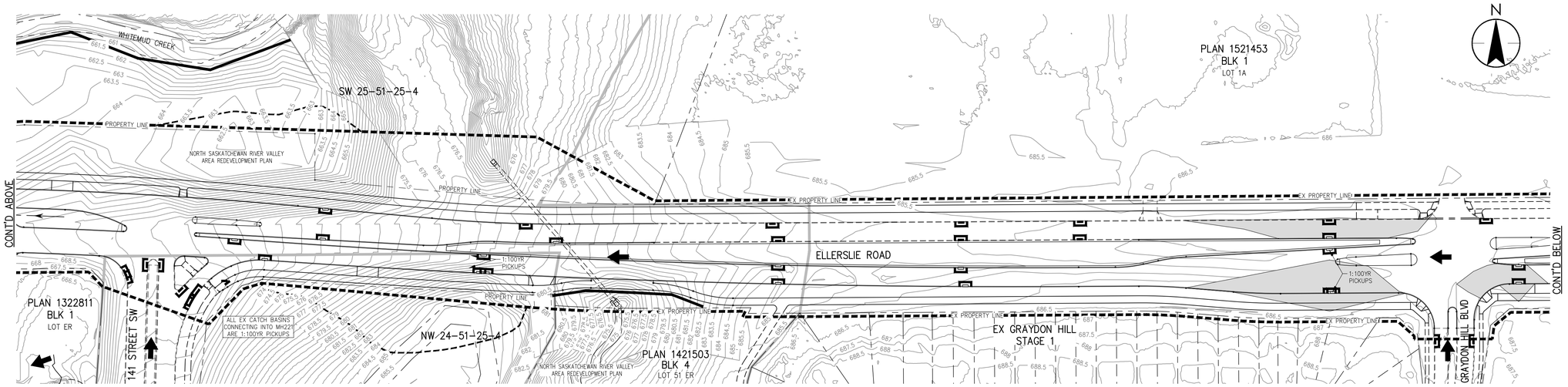
STORM DRAINAGE BASIN SCHEMATIC

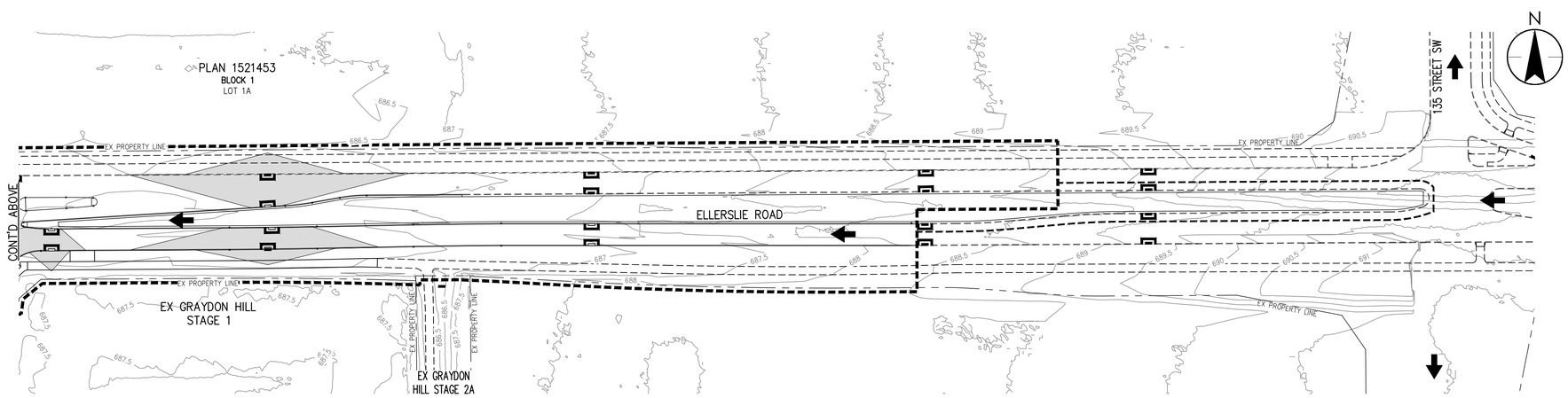
Scale 1:1000 (0 10 20 30 40 50)

Drawing No. C007-001

2025-1-28 9:42am BY: TVANWYK V:\1161\Active\116110195\drawing\02_sheet_files\116110195-C007-001-STM BASIN.dwg







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- OVERLAND FLOW
- GRASS SWALE
- CATCHBASIN WITH SEDIMENT BARRIER
- INTERIM STORM WATER DISCHARGE LOCATION
- SILT FENCE
- DIRECTION OF MAJOR DRAINAGE
- LOCALIZED LOW AREA
- LIMIT OF CONSTRUCTION
- DEVELOPMENT BOUNDARY
- NORTH SASKATCHEWAN RIVER VALLEY AREA REDEVELOPMENT PLAN

Permit-Seal for Revision/Plan of Record

Revision/Plan of Record	Dwn.	PM	YY.MM.DD

Development Engineer, Sustainable Development

Approvals			YY.MM.DD

Permit-Seal for Issued

Issued	Dsgn.	Dwn.	YY.MM
2. SECOND SUBMISSION	TVW	TVW	25.01
1. FIRST SUBMISSION	TVW	TVW	24.02

PROJECT MANAGER: ROY McDIARMID

PROJECT No: 1161-110195

Client/Project

BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

Edmonton, AB

Title

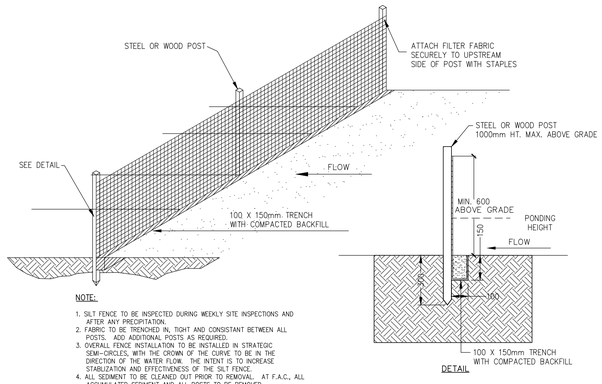
EROSION AND SEDIMENT CONTROL PLAN

Scale

1:1000

Drawing No.

C010-001

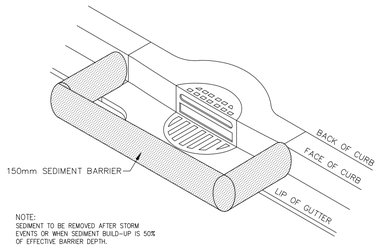


NOTE:

1. SILT FENCE TO BE INSPECTED DURING WEEKLY SITE INSPECTIONS AND AFTER ANY PRECIPITATION.
2. FABRIC TO BE TRENCHED IN, TIGHT AND CONSISTANT BETWEEN ALL POSTS. ADD ADDITIONAL POSTS AS REQUIRED.
3. OVERALL FENCE INSTALLATION TO BE INSTALLED IN STRATEGIC SEMI-CIRCLES, WITH THE CROWN OF THE CURVE TO BE IN THE DIRECTION OF THE WATER FLOW. THE INTENT IS TO INCREASE STABILIZATION AND EFFECTIVENESS OF THE SILT FENCE.
4. ALL SEDIMENT TO BE CLEANED OUT PRIOR TO REMOVAL. AT F.A.C., ALL ACCUMULATED SEDIMENT AND ALL POSTS TO BE REMOVED AND FABRIC TO BE CUT FLUSH WITH GROUND – DO NOT PULL FENCE FABRIC FROM TRENCH.
5. SEDIMENT TO BE REMOVED BEFORE ACCUMULATION REACHES 1/3 OF FENCE HEIGHT.
6. SEDIMENT TO BE REMOVED TO AN OFFSITE LOCATION.

SILT FENCE DETAIL

(Silt Fence)



NOTE:
SEDIMENT TO BE REMOVED AFTER STORM EVENTS OR WHEN SEDIMENT BUILD-UP IS 50% OF EFFECTIVE BARRIER DEPTH.

CATCH BASIN INLET SEDIMENT BARRIER DETAIL

(CB Barrier Detail)

1.0 EROSION AND SEDIMENT CONTROL PLAN WITH CONSTRUCTION SCHEDULE

1.1 PROPOSED SITE CLEARING AND GRADING

- LOW AREAS ARE TO BE PROTECTED FROM SPILL-OVER WITH PROPERLY INSTALLED SILT FENCE OR OTHER APPROPRIATE BMP. SEE ESC PLAN (DRAWING NO. C008-001 AND C008-002) FOR SPILL-OVER LOCATIONS AND DETAILS.
- SURFACE DRAINAGE OR POOLS OF STORM WATER WILL BE PUMPED TO DESIGNATED DISCHARGE LOCATIONS AS PER ESC PLAN C008-001 AND C008-002.
- SHOULD MUD TRACKING OCCUR, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CLEAN THE AFFECTED ROADWAYS. BROOKFIELD RESIDENTIAL (ALBERTA) LP AND JAGARE RIDGE DEVELOPMENTS LTD. WILL HAVE A STREET CLEANING PROGRAM IN EFFECT IN ACCORDANCE WITH SECTION 48 (MATERIAL ON SIDEWALKS AND ROADWAYS) OF THE CITY OF EDMONTON'S TRAFFIC BYLAW #5590.

1.2 UNDERGROUND CONSTRUCTION

- INCLUDES STORM, SANITARY SEWERS, AND WATERMAIN.
- DURING UNDERGROUND INSTALLATION SILTY CLAY WILL BE EXPOSED. IF WET CONDITIONS ARE ENCOUNTERED, WATER IS TO BE PUMPED TO THE DESIGNATED DISCHARGE LOCATIONS PROTECTED WITH SILT FENCE. FILTER FABRIC IS TO BE WRAPPED AROUND THE END OF THE PIPE AT THE END OF EACH DAY.
- THE CONTRACTOR WILL PUMP SURFACE RUNOFF TO DESIGNATED DISCHARGE LOCATIONS AND NOT USE THE STORM SEWER DURING CONSTRUCTION.
- ALL RUNOFF IS MANAGED ON-SITE SIMILAR TO THE ESC FOR PROPOSED SITE CLEARING AND GRADING.
- SHOULD EROSION AND SEDIMENT CONTROL MEASURES IN PLACE BE DAMAGED OR DISRUPTED BY THE CONTRACTOR, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR AND/OR REPLACE THE DAMAGE ON A TIMELY BASIS.
- SHOULD MUD TRACKING OCCUR, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CLEAN THE AFFECTED ROADWAYS. BROOKFIELD RESIDENTIAL (ALBERTA) LP AND JAGARE RIDGE DEVELOPMENTS LTD. WILL HAVE A STREET CLEANING PROGRAM IN EFFECT IN ACCORDANCE WITH SECTION 48 (MATERIAL ON SIDEWALKS AND ROADWAYS) OF THE CITY OF EDMONTON'S TRAFFIC BYLAW #5590.

1.3 ROADWAY CONSTRUCTION

- MANHOLE & CATCH BASIN FRAME AND COVERS WILL BE LOWERED BELOW SUBGRADE TO ALLOW FOR ROADWAY SUBGRADE PREPARATION.
- ALL RUNOFF IS MANAGED ON-SITE SIMILAR TO THE ESC FOR PROPOSED SITE CLEARING AND GRADING.
- TRAPPED WATER WILL BE PUMPED TO THE DESIGNATED DISCHARGE LOCATIONS PROTECTED WITH SILT FENCE.
- THE CONTRACTOR WILL PUMP SURFACE RUNOFF TO DESIGNATED DISCHARGE LOCATIONS AND WILL NOT USE THE STORM OR SANITARY SEWERS OR CATCH BASINS DURING OR AFTER CONSTRUCTION.
- TEMPORARY INLET SEDIMENT CONTROL BARRIERS (SEE DETAIL ON ESC DRAWING) ARE TO BE INSTALLED AT EVERY ON-SITE CATCH BASIN AND THOSE DOWNSTREAM OF THE CONSTRUCTION, AS SHOWN ON DRAWING C008-001 AND C008-002.
- SHOULD EROSION AND SEDIMENT CONTROL MEASURES IN PLACE BE DAMAGED OR DISRUPTED BY THE CONTRACTOR, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR AND/OR REPLACE THE DAMAGE ON A TIMELY BASIS.
- SHOULD MUD TRACKING OCCUR, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CLEAN THE AFFECTED ROADWAYS. BROOKFIELD RESIDENTIAL (ALBERTA) LP AND JAGARE RIDGE DEVELOPMENTS LTD. WILL HAVE A STREET CLEANING PROGRAM IN EFFECT IN ACCORDANCE WITH SECTION 48 (MATERIAL ON SIDEWALKS AND ROADWAYS) OF THE CITY OF EDMONTON'S TRAFFIC BYLAW #5590.

1.4 SHALLOW UTILITIES CONSTRUCTION

- TRAPPED WATER WILL BE PUMPED TO DESIGNATED DISCHARGE LOCATIONS, PROTECTED WITH SILT FENCE.
- THE CONTRACTOR WILL PUMP SURFACE RUNOFF TO DESIGNATED DISCHARGE LOCATIONS AND WILL NOT USE THE STORM OR SANITARY SEWERS OR CATCH BASINS DURING OR AFTER CONSTRUCTION.
- SHOULD EROSION AND SEDIMENT CONTROL MEASURES IN PLACE BE DAMAGED OR DISRUPTED BY THE CONTRACTOR, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR AND/OR REPLACE THE DAMAGE ON A TIMELY BASIS.
- BROOKFIELD RESIDENTIAL (ALBERTA) LP AND JAGARE RIDGE DEVELOPMENTS LTD. WILL HAVE A STREET CLEANING PROGRAM IN EFFECT IN ACCORDANCE WITH SECTION 48 (MATERIAL ON SIDEWALKS AND ROADWAYS) OF THE CITY OF EDMONTON'S TRAFFIC BYLAW #5590.

1.5 LANDSCAPING CONSTRUCTION

- BOULEVARDS AND DISTURBED AREAS ARE TO BE LANDSCAPED ACCORDING TO THE LANDSCAPING DRAWINGS.
- UNTIL LANDSCAPING IS COMPLETE, THE ESC SYSTEM WILL BE MONITORED FOR MAINTENANCE AND RECORD KEEPING AFTER WEATHER EVENTS AND DURING WEEKLY SITE INSPECTIONS, DURING AND AFTER CONSTRUCTION.
- THE CONTRACTOR WILL PUMP SURFACE RUNOFF TO DESIGNATED DISCHARGE LOCATIONS AND WILL NOT USE THE STORM OR SANITARY SEWERS OR CATCH BASINS DURING OR AFTER CONSTRUCTION.
- SHOULD EROSION AND SEDIMENT CONTROL MEASURES IN PLACE BE DAMAGED OR DISRUPTED BY THE CONTRACTOR, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR AND/OR REPLACE THE DAMAGE ON A TIMELY BASIS.
- SHOULD MUD TRACKING OCCUR, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CLEAN THE AFFECTED ROADWAYS. BROOKFIELD RESIDENTIAL (ALBERTA) LP AND JAGARE RIDGE DEVELOPMENTS LTD. WILL HAVE A STREET CLEANING PROGRAM IN EFFECT IN ACCORDANCE WITH SECTION 48 (MATERIAL ON SIDEWALKS AND ROADWAYS) OF THE CITY OF EDMONTON'S TRAFFIC BYLAW #5590.

1.6 SITE MAINTENANCE

- DRAINAGE SERVICES WILL BE NOTIFIED IF ANY MAJOR CHANGES TO THE ESC PLAN ARE TO BE CONTEMPLATED DURING CONSTRUCTION AND PRIOR TO FAC.
- THE CONTRACTOR WILL PUMP SURFACE RUNOFF TO DESIGNATED DISCHARGE LOCATIONS AND WILL NOT USE THE STORM OR SANITARY SEWERS OR CATCH BASINS DURING OR AFTER CONSTRUCTION.
- UNTIL LANDSCAPING IS COMPLETE, THE ESC SYSTEM WILL BE MONITORED FOR MAINTENANCE AND RECORD KEEPING AFTER WEATHER EVENTS AND DURING WEEKLY SITE INSPECTIONS, DURING AND AFTER CONSTRUCTION.
- SHOULD EROSION AND SEDIMENT CONTROL MEASURES IN PLACE BE DAMAGED OR DISRUPTED BY THE CONTRACTOR, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO REPAIR AND/OR REPLACE THE DAMAGE ON A TIMELY BASIS.
- SHOULD MUD TRACKING OCCUR, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO CLEAN THE AFFECTED ROADWAYS. BROOKFIELD RESIDENTIAL (ALBERTA) LP AND JAGARE RIDGE DEVELOPMENTS LTD. WILL HAVE A STREET CLEANING PROGRAM IN EFFECT IN ACCORDANCE WITH SECTION 48 (MATERIAL ON SIDEWALKS AND ROADWAYS) OF THE CITY OF EDMONTON'S TRAFFIC BYLAW #5590.

DRAINAGE SERVICES WILL BE NOTIFIED IF THE SEDIMENT CONTROL PLAN CHANGES. REFER TO THE EROSION AND SEDIMENT CONTROL REPORT FOR ELLERSLIE ROAD – ECO STATION TO GRAYDON HILL BLVD, PREPARED BY STANTEC CONSULTING LTD., DATED JANUARY 15, 2024.

Stantec

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Development Engineer, Sustainable Development

Approvals YY.MM.DD

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2. SECOND SUBMISSION	TVW	TVW	25.01
1. FIRST SUBMISSION	TVW	TVW	24.02

PROJECT MANAGER: ROY McDIARMID

PROJECT No: 1161-110195

Client/Project

BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

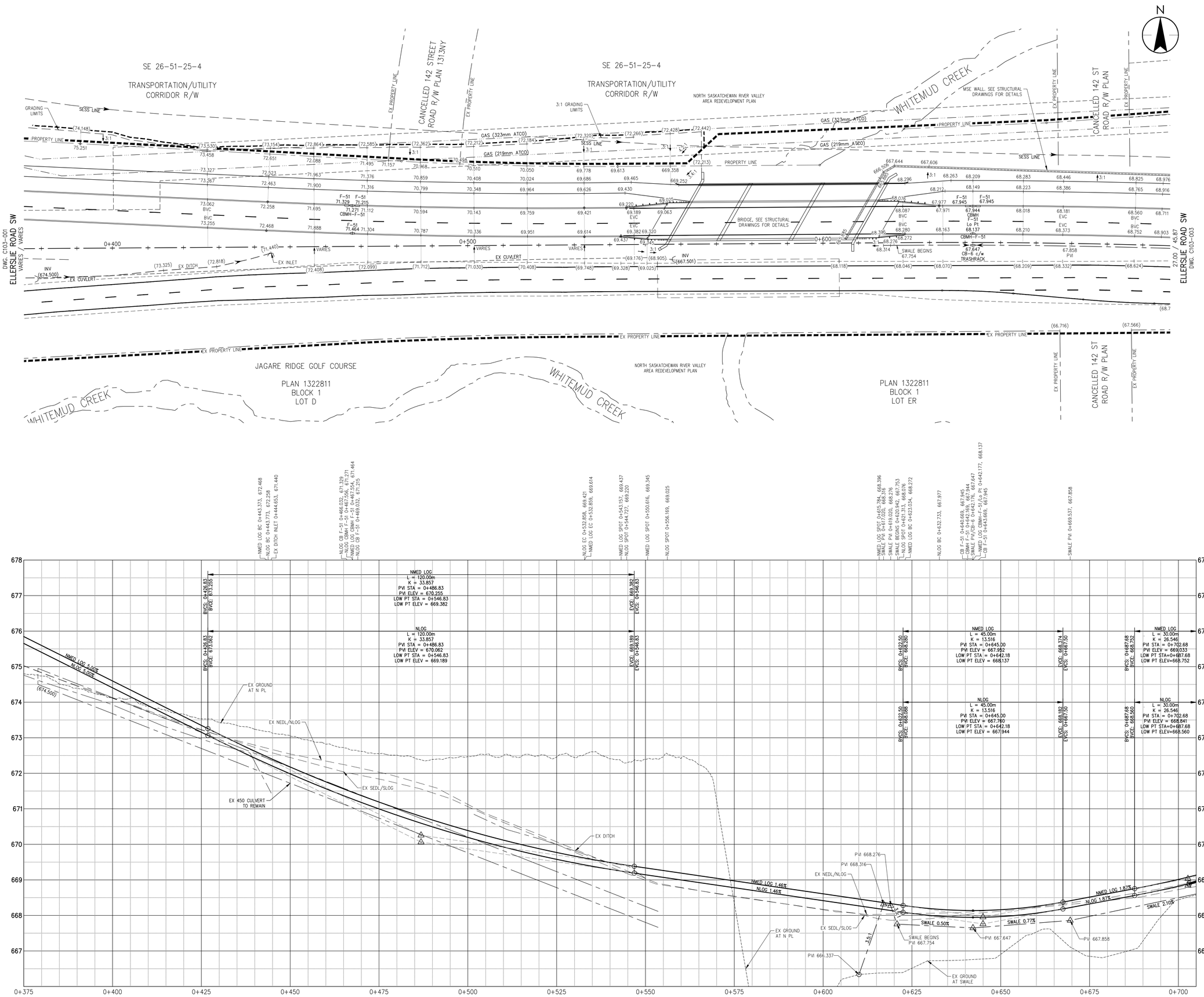
Edmonton, AB

Title

EROSION AND SEDIMENT CONTROL PLAN

Scale 1:1000 (0 10 20 30 40 50)

Drawing No. C010-001



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LIMIT OF CONSTRUCTION
DEVELOPMENT BOUNDARY
NORTH SASKATCHEWAN RIVER VALLEY AREA REDEVELOPMENT PLAN

1. CHAINAGES ARE BASED ON CENTERLINE CONTROL.
2. ELEVATION PREFIX 600.
3. ELEVATIONS ARE TO LIP OF GUTTER GRADES UNLESS OTHERWISE SHOWN.
4. ELEVATIONS ARE TO GEODETIC DATUM.
5. EXISTING ELEVATIONS ARE SHOWN IN BRACKETS (__.___)

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Revision/Plan of Record	Dwn.	PM	YY.MM.DD
Development Engineer, Sustainable Development			
Approvals			YY.MM.DD

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1. FIRST SUBMISSION	TVW	TVW	24.02

PROJECT MANAGER: ROY McDIARMID
PROJECT No: 1161-110195

Client/Project

BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

Edmonton, AB

Title

ELLERSLIE ROAD SW
STA. 0+375 TO STA. 0+700
GRADING PLAN

Scale 1:500

Drawing No. C103-002

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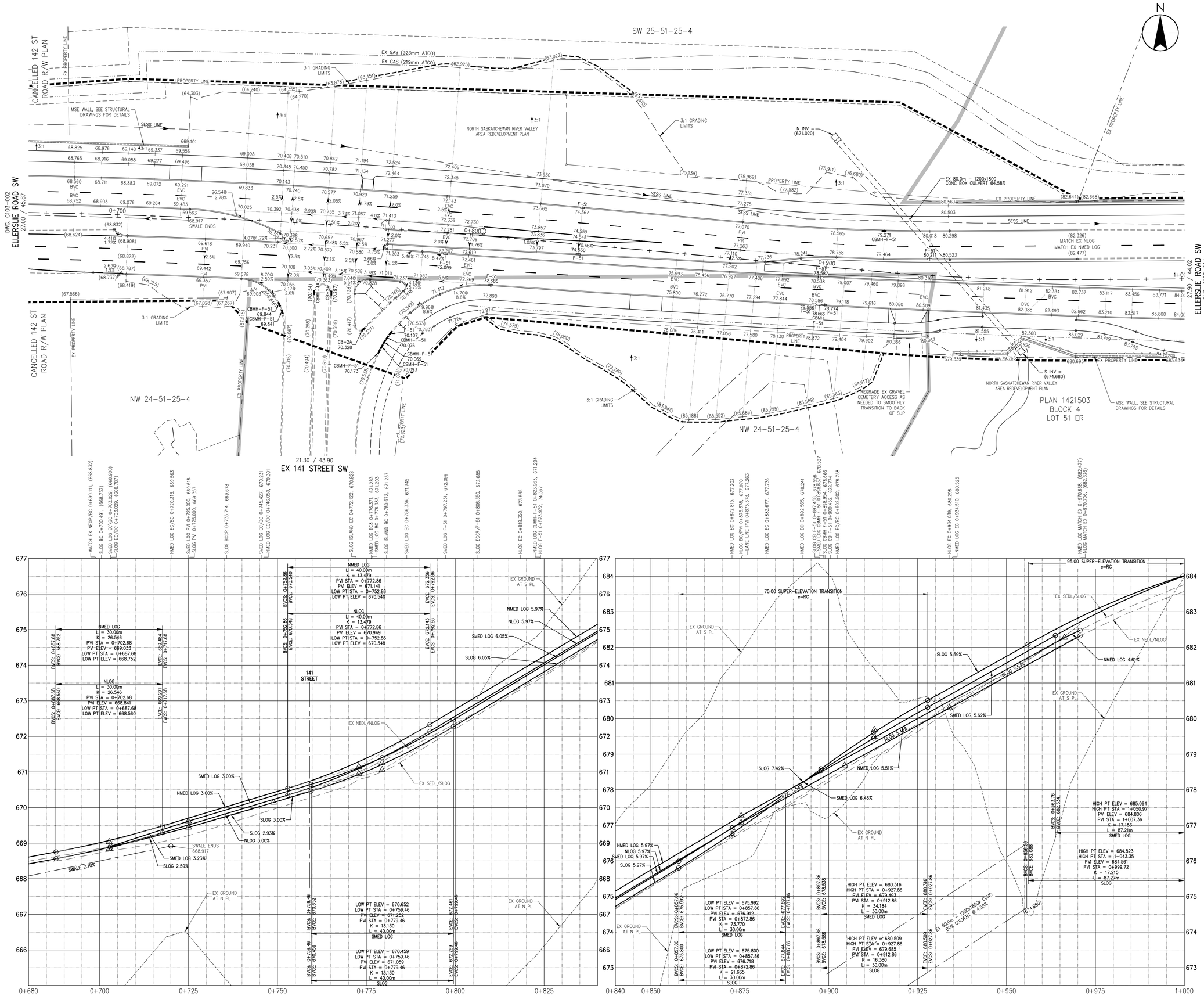

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LIMIT OF CONSTRUCTION
DEVELOPMENT BOUNDARY
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2. ELEVATION PREFIX 600.
3. ELEVATIONS ARE TO LIP OF GUTTER GRADES UNLESS OTHERWISE SHOWN.
4. ELEVATIONS ARE TO GEODETIC DATUM.
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Development Engineer, Sustainable Development			
Approvals			YY.MM.DD

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1. FIRST SUBMISSION	TVW	TVW	24.02

PROJECT MANAGER: ROY McDIARMID
PROJECT No: 1161-110195

Client/Project

BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

Edmonton, AB

Title

ELLERSLIE ROAD SW
STA. 0+675 TO STA. 1+000
GRADING PLAN

Scale 1:500

Drawing No. C103-003

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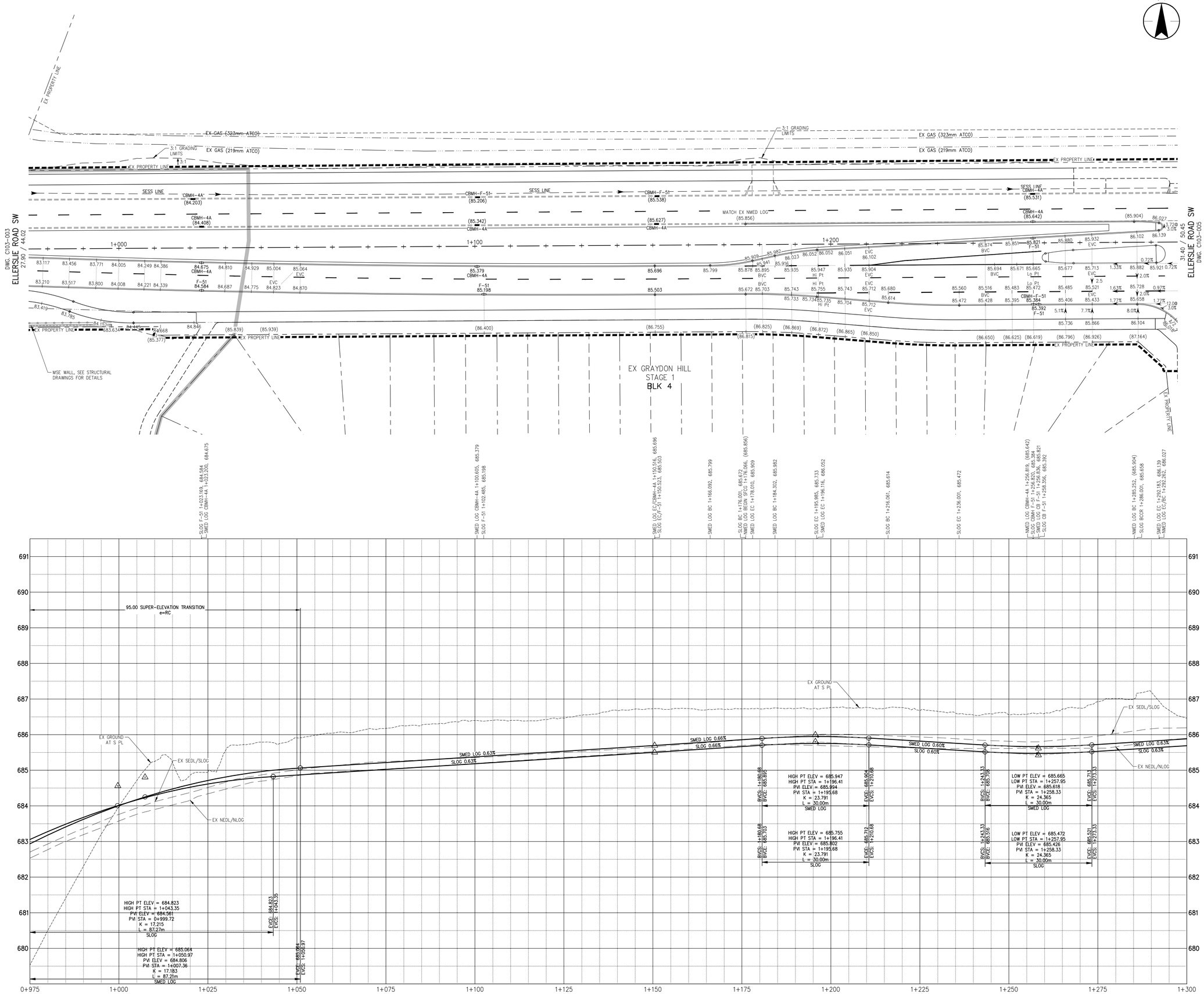

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LIMIT OF CONSTRUCTION
DEVELOPMENT BOUNDARY
NORTH SASKATCHEWAN RIVER VALLEY AREA REDEVELOPMENT PLAN

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2. ELEVATION PREFIX 600.
3. ELEVATIONS ARE TO LIP OF GUTTER GRADES UNLESS OTHERWISE SHOWN.
4. ELEVATIONS ARE TO GEODETIC DATUM.
5. EXISTING ELEVATIONS ARE SHOWN IN BRACKETS (__.___)

Permit-Seal for Revision/Plan of Record

Revision/Plan of Record	Dwn.	PM	YY.MM.DD

Development Engineer, Sustainable Development

Approvals			YY.MM.DD

Permit-Seal for Issued

Issued	Dsgn.	Dwn.	YY.MM
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1. FIRST SUBMISSION	TVW	TVW	24.02

PROJECT MANAGER: ROY McDIARMID

PROJECT No: 1161-110195

Client/Project

BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

Edmonton, AB

Title

ELLERSLIE ROAD SW
STA. 0+975 TO STA. 1+300
GRADING PLAN

Scale 1:500

Drawing No. C103-004

GENERAL CONSTRUCTION NOTES

GENERAL NOTES ARE SUBJECT TO PROJECT SPECIFIC NOTES.

CONTRACTOR IS RESPONSIBLE TO CONFIRM THE LOCATION OF ALL UTILITIES ON SITE PRIOR TO CONSTRUCTION.

CONFIRM ALL CONDITIONS AND DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF WORK.

ALL PLAN VIEW DIMENSIONS ARE IN METRES AND ALL DETAILS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

WRITTEN DIMENSIONS TAKE PRECEDENCE OVER SCALED DIMENSIONS.

THESE NOTES ARE TO BE USED FOR GENERAL REFERENCE IN CONJUNCTION WITH, AND AS A SUPPLEMENT TO THE WRITTEN SPECIFICATIONS, APPROVED ADDENDA, AND CHANGE ORDERS ASSOCIATED WITH THESE LANDSCAPE IMPROVEMENT DOCUMENTS.

NO DESIGN MODIFICATIONS SHALL BE MADE WITHOUT THE OWNER'S AND/OR OWNER'S AUTHORIZED REPRESENTATIVE APPROVAL.

BEFORE COMMENCING WORK ON THE SITE, BECOME THOROUGHLY ACQUAINTED WITH LAYOUT OF ALL UNDERGROUND UTILITIES AND STRUCTURES OVER THE ENTIRE SITE. CONTRACTOR TO ENSURE THE LOCATION OF ALL UNDERGROUND UTILITIES ARE MARKED PRIOR TO WORK COMMENCING. ALL REQUISITE REPAIRS TO DAMAGE CAUSED BY WORK OF THIS SECTION SHALL BE AT THE CONTRACTOR'S EXPENSE.

CONTRACTOR SHALL BE RESPONSIBLE FOR SECURING ALL NECESSARY PERMITS AND SHALL NOTIFY ALL UTILITY COMPANIES WITH UTILITIES ON SITE PRIOR TO THE CONSTRUCTION OF THE PROJECT. CONTRACTOR SHALL ADHERE TO ALL APPLICABLE LOCAL, PROVINCIAL AND/OR FEDERAL LAWS OR REGULATIONS.

CONTRACTOR IS RESPONSIBLE TO ENSURE ALL SETBACKS FROM UTILITIES, APPURTENANCES, STRUCTURES, AND HARDSCAPE MEET GOVERNING MUNICIPALITY'S STANDARDS.

CONTRACTOR SHALL CONFIRM ALL CONDITIONS AND DIMENSIONS ON SITE PRIOR TO COMMENCEMENT OF WORK AND BRING ANY DISCREPANCIES TO THE ATTENTION OF THE OWNER AND/OR LANDSCAPE ARCHITECT IMMEDIATELY.

MEMBER SIZES INDICATED ARE FOR DESIGN INTENT ONLY. CONTRACTOR SHALL ENGINEER FOR STRUCTURAL INTEGRITY AND FIELD VERIFY DIMENSIONS OF ADJACENT AND ADJOINING WORK. REPORT ANY DISCREPANCIES TO OWNER AND LANDSCAPE ARCHITECT.

IN ALL CASES WHERE A CONFLICT MAY OCCUR, SUCH AS BETWEEN ITEMS COVERED IN SPECIFICATIONS AND NOTES ON THE DRAWINGS, OR BETWEEN GENERAL NOTES AND SPECIFIC DETAILS, THE LANDSCAPE ARCHITECT SHALL BE NOTIFIED AND THEY WILL INTERPRET THE INTENT OF THE CONTRACT DOCUMENTS. NO PART OF THE CONTRACT DOCUMENTS ARE INTENDED TO BE IN VIOLATION OF CODES. IF DISCREPANCIES EXIST, NOTIFY LANDSCAPE ARCHITECT AND OWNER IMMEDIATELY.

CONTRACTOR SHALL PROVIDE BARRICADES AND TRAFFIC CONTROL ALONG PUBLIC STREETS IF REQUIRED DURING CONSTRUCTION.

CONTRACTOR SHALL PROVIDE OWNER WITH ALL WARRANTY INFORMATION, INSTRUCTION MANUALS AND ANY OTHER PRODUCT INFORMATION FOR ALL NEW EQUIPMENT OR MACHINERY INSTALLED ON THE SITE WITHIN TWO WEEKS AFTER SUBSTANTIAL COMPLETION.

SHOP DRAWING REVIEWS WILL BE DONE TO ENSURE THAT PRODUCT DATA, MATERIALS, AND SAMPLES MEET OR EXCEED THE ORIGINAL DESIGN INTENT OF THESE DRAWINGS ONLY. STANTEC CONSULTING, LTD., UNDER NO CIRCUMSTANCES ASSUMES RESPONSIBILITY FOR UNFORESEEN CONFLICTS, ENGINEERING, STRUCTURAL CALCULATIONS OR INSTALLATION METHODOLOGIES RESULTING FROM THE PRODUCTION OF ANY SHOP DRAWINGS.

FINAL AESTHETIC GRADING SHALL BE SMOOTH AND CONTINUOUS WITH NO SHARP EDGES, ABRUPT CHANGE IN DIRECTIONS, OR UNSIGHTLY MOUNDS/DEPRESSIONS. TOPSOIL TO BE FREE AND CLEAR OF ANY DEBRIS, ROCKS, OR CLAY.

CONTRACTOR TO ESTABLISH POSITIVE DRAINAGE THROUGHOUT THE ENTIRE PROJECT SITE.

LANDSCAPE CONTRACTOR IS REQUIRED TO OBTAIN ANY REQUIRED PERMITS FOR ALL ON-SITE AND OFFSITE IMPROVEMENTS OUTLINED WITHIN THIS SET OF PLANS AND/OR ANY OTHER ADDITIONAL WORK THEY MAY PERFORM IN THE INTEREST OF THIS PROJECT.

IT SHALL BE THE RESPONSIBILITY OF THE LANDSCAPE CONTRACTOR TO COORDINATE WITH THE OWNER THE FINAL LAYOUT OF ALL HARDSCAPE ITEMS FOR THIS PROJECT. OWNER MAY REQUEST ALL HARDSCAPE ITEMS (HEADERS, SIDEWALKS, FLATWORK, ETC.) BE STAKED AND/OR CHALKED OUT FOR THEIR APPROVAL PRIOR TO INITIAL POUR.

GOOD HOUSEKEEPING PRACTICES

GOOD HOUSE KEEPING PRACTICES, AS OUTLINED IN THE CITY OF EDMONTON WASTEWATER AND DRAINAGE URBAN DEVELOPMENT GUIDELINES FOR EROSION AND SEDIMENT CONTROL, WILL BE IMPLEMENTED DURING CONSTRUCTION AND RESTORATION OF THE SITE.

GOOD HOUSE KEEPING PRACTICES WILL HELP MINIMIZE EROSION AND SEDIMENT CONCERNS. GOOD HOUSE KEEPING PRACTICES THAT WILL BE IMPLEMENTED ON SITE ARE AS FOLLOWS:

STOCKPILES SHOULD BE LOCATED AWAY FROM WATERCOURSES, ENVIRONMENTALLY SENSITIVE AREAS, DRAINAGE COURSES, RAVINES, AND EXISTING ADJACENT DEVELOPMENTS. THE STOCKPILES SHOULD BE STABILIZED AGAINST EROSION IMMEDIATELY FOLLOWING STRIPPING OPERATIONS. STABILIZATION CAN INCLUDE, BUT IS NOT LIMITED TO, ESTABLISHMENT OF A COVER CROP OR A HYDROSEED MATRIX, CONSISTING OF SEED, FIBER BOND, AND TACKIFIER.

ALL CONSTRUCTION VEHICLES SHOULD LEAVE THE SITE AT A DESIGNATED POINT OR POINTS. GRAVELLING OR PAVING (WHERE PRACTICAL) OF FREQUENTLY USED ACCESS ROADS WILL HELP ENSURE THAT MINIMAL MATERIAL SUCH AS MUD IS TRACKED OFF-SITE. THE ACCESS ROAD SHOULD CONSIST OF A BED OF NON-ERODABLE MATERIAL (I.E. GRAVEL) OF SUFFICIENT LENGTH TO ENSURE THAT A MINIMUM OF MATERIAL (MUD) IS TRACKED OFFSITE ONTO ADJACENT MUNICIPAL STREETS. INTERNAL HAUL ROADS AND/OR TRACK PACKS CAN ALSO BE DESIGNATED AND MAINTAINED TO HELP REDUCE OFFSITE TRACKING. IN SITUATIONS WHERE MUD TRACKING BECOMES A MAJOR PROBLEM, A HIGH-PRESSURE PUMP AND HOSE INSTALLATION MAY BE USED TO PROVIDE A WASHDOWN FACILITY FOR TRUCK WHEELS.

WHEN SEWERS HAVE BEEN INSTALLED OR ARE EXISTING, MEASURES SHOULD BE UNDERTAKEN TO ENSURE SEDIMENT AND DEBRIS DOES NOT GET INTO THE MUNICIPAL SEWER SYSTEM. BOTH CATCH BASINS AND MANHOLES SHOULD BE PROTECTED. THIS MAY BE ACCOMPLISHED BY SEALING OPENINGS, SETTING UP SUMPS OR WEIRS INSIDE THE STRUCTURES OR BY PROVIDING APPROPRIATE INLET PROTECTION (FILTER FENCES, SEDIMENT TRAPS, ETC.). A TEMPORARY DRAINAGE SYSTEM SHOULD BE USED WITH APPROPRIATE VELOCITY CONTROLS AND TEMPORARY STORAGE AREAS FOR SEDIMENT CONTROL. THIS WILL ENSURE THAT SEDIMENT AND DEBRIS DO NOT GET INTO THE MUNICIPAL SEWER SYSTEM AND INTO THE DOWNSTREAM WATER WAYS. DILIGENT EFFORTS MUST BE UNDERTAKEN TO ENSURE THAT THE TEMPORARY DRAINAGE SYSTEM DOES NOT FLOOD ADJACENT PROPERTIES.

WHERE ON-SITE OR DOWNSTREAM DETENTION FACILITIES ARE PROVIDED, USE CAN BE MADE OF A QUANTITY CONTROL FACILITY (THROUGH THE PLACING OF TEMPORARY WEIRS OR CHECK DAMS) FOR SEDIMENT CONTROL DURING CONSTRUCTION.

DUST CONTROL MEASURES SHOULD BE IMPLEMENTED TO PREVENT WIND TRANSPORTATION OF DUST FROM DISTURBED SOIL SURFACES. THIS MAY BE ACCOMPLISHED SEVERAL WAYS. VEGETATE, HYDROSEED, OR MULCH AREAS THAT WON'T RECEIVE VEHICLE TRAFFIC. OTHERWISE CONSTRUCT WIND BREAKS OR SCREENS. THE SITE MAY ALSO BE SPRINKLED WITH WATER OR A CHEMICAL DUST SUPPRESSANT TO CONTROL DUST; HOWEVER, CARE MUST BE TAKEN TO PREVENT THE TRACKING OF MUD AS A RESULT. OTHERWISE, ANOTHER EFFECTIVE TOOL IS TO REDUCE VEHICLE SPEEDS TO DECREASE THE AMOUNT OF DUST STIRRED UP.

PROJECT SPECIFIC NOTES

THIS PROJECT IS WITHIN THE JURISDICTION OF THE CITY OF EDMONTON. THE FOLLOWING PROJECT SPECIFIC NOTES SUPERSEDE ALL OTHER NOTES.

THE SUPPLY AND INSTALLATION OF ALL LABOUR AND MATERIALS SHALL CONFORM TO THE DEVELOPMENT AGREEMENT (ELLERSLIE RD SW ECO STATION TO GRAYDON HILL BLVD) AND THE CITY OF EDMONTON LANDSCAPE DESIGN AND CONSTRUCTION STANDARD SPECIFICATIONS, IN THE 2022 EDITION.

PLANT MATERIAL MAINTENANCE:
MAINTAIN PLANT MATERIAL AS OUTLINED IN THE CITY OF EDMONTON'S STANDARD LANDSCAPE DESIGN AND CONSTRUCTION STANDARD SPECIFICATIONS UNTIL THE DATE OF ISSUE OF FINAL ACCEPTANCE CERTIFICATE.

PLANT MATERIAL AT TIME OF FINAL ACCEPTANCE:
ALL MATERIAL MUST BE A HEALTHY, VIGOROUS GROWING CONDITION AS OUTLINED IN THE CITY OF EDMONTON'S STANDARD LANDSCAPE DESIGN AND CONSTRUCTION STANDARD SPECIFICATIONS.

TOPSOIL DEPTH AND TYPE SHALL CONFORM WITH THE CITY OF EDMONTON'S TOPSOIL STANDARD IN THE 2022 EDITION.

WIRE FENCE NOTES

CONTRACTOR TO CALL ALBERTA ONE CALL AT 1-800-242-3447 TO HAVE EXISTING UTILITIES LOCATED PRIOR TO START OF ANY CONSTRUCTION.

ALL FENCE POSTS SHALL BE PRESSURE TREATED PINE OR FIR TIMBER.

THIS DRAWING TO BE READ IN CONJUNCTION WITH THE WRITTEN SPECIFICATIONS, DRAWINGS AND DETAILS FOR THE PROJECT.

ALL LUMBER SHALL BE CLEAN, #1, CONSTRUCTION GRADE PINE, FIR OR SPRUCE MEMBERS, FINISHED AS PER THE DETAILS UNLESS OTHERWISE SPECIFIED.

ALL LUMBER SHALL BE STRAIGHT, SOUND AND FREE OF SPLINTS, WARPS, CRACKS, LARGE KNOTS AND OTHER DEFECTS.

PRESSURE TREATED POSTS TO BE TREATED WITH A SOLUTION OF PENTACHLOROPHENOL AND PETROLEUM TO CSA-080.

ALL CUTS AND BOLT HOLES TO BE TREATED TO MATCH ORIGINAL TREATMENT WHERE POSSIBLE.

POSTS SHALL BE INSTALLED WITH THE LARGE END DOWN.

FENCE TO BE INSTALLED AS CLOSE TO FINISH GRADE AS POSSIBLE. IF REQUIRED, ALLOWABLE MAXIMUM GAP IS 150mm.

BRACE PANELS TO BE A MAXIMUM OF 54.0m APART.

WIRE FABRIC MINIMUM OVERLAP 500mm AND MAXIMUM OVERLAP 1000mm TENSION FABRIC TO PROVIDE UNIFORM PULL FOR EACH RUN OF FABRIC BETWEEN BRACE PANELS

LINE AND STAY WIRES TO BE JOINED THROUGHOUT WITH TIGHT LOCK KNOT CONSTRUCTION.

ENSURE THAT FRONT OF POST IS 1.5 METERS FROM GASLINE.

ALL HARDWARE TO BE GALVANIZED.

ALL FENCES TO BE PLACED 150mm. INSIDE PRIVATE PROPERTY UNLESS OTHERWISE SHOWN.

TREE PRESERVATION NOTES

PRIOR TO CONSTRUCTION, STANTEC IS TO IDENTIFY TREES FOR PRESERVATION AND/OR REMOVAL. NO EXISTING TREE ARE TO BE REMOVED UNTIL DIRECTED BY STANTEC.

ALL EXISTING TREES TO REMAIN ARE TO BE PROTECTED WITH TEMPORARY TREE PROTECTION FENCING CONSISTING OF 1.5m HIGH ORANGE PLASTIC CONSTRUCTION FENCE MOUNTED ON STEEL 'T'-BARS @ 1.5m O.C. DRIVEN INTO GROUND A MINIMUM OF 0.6m. THE TREE PRESERVATION ZONE (TPZ) WILL BE A MINIMUM DISTANCE OF 4m FROM THE TRUNK OF THE TREE OR TO THE DRIPLINE, WHICHEVER IS GREATER. THE CANOPY OF THE TREE SHALL BE PROTECTED TO THE DRIPLINE.

PROTECTIVE BARRIER FENCING WILL REMAIN STANDING AND IN GOOD CONDITION UNTIL CONSTRUCTION COMPLETION.

PROTECTIVE FENCE IS TO BE INSTALLED PRIOR TO DEMOLITION OR OTHER SITE WORK AND MAINTAINED THROUGHOUT CONSTRUCTION UNTIL LANDSCAPE CONSTRUCTION IS FINISHED.

AREAS WITHIN THE DRIPLINE OF THE TREES ARE NOT TO BE USED FOR ANY TYPE OF STORAGE (E.G. STORAGE OF DEBRIS, SURPLUS SOILS). DO NOT PERFORM TRENCHING OR TUNNELING FOR UNDERGROUND SERVICES WITHIN THE DRIPLINE OF TREES DESIGNATED FOR PRESERVATION, UNLESS OTHERWISE SPECIFIED.

TREES SHALL NOT HAVE ANY RIGGING CABLES OR HARDWARE OF ANY KIND ATTACHED OR WRAPPED AROUND THEM, NOR SHALL ANY CONTAMINANTS BE DUMPED WITHIN THE PROTECTIVE AREAS. DO NOT DISPOSE OF CONTAMINANTS WHERE THEY MAY COME INTO CONTACT WITH THE FEEDER ROOTS OF THE TREES.

THE CONTRACTOR SHALL TAKE EVERY PRECAUTION TO PROTECT PLANT AND ROOT SYSTEMS FROM DAMAGE, COMPACTION AND CONTAMINATION RESULTING FROM THE CONSTRUCTION TO THE SATISFACTION OF STANTEC.

IN THE EVENT THAT IT IS NECESSARY TO REMOVE LIMBS OR PORTIONS OF TREES TO ACCOMMODATE CONSTRUCTION, STANTEC IS TO BE INFORMED AND THE REMOVAL IS TO BE EXECUTED CAREFULLY AND IN ACCORDANCE WITH PROPER ARBORICULTURAL TECHNIQUES BY A CERTIFIED ARBORIST. APPROVAL IS REQUIRED PRIOR TO REMOVAL OPERATIONS.

DURING EXCAVATION OPERATIONS IN WHICH ROOTS ARE AFFECTED, THE CONTRACTOR IS TO PRUNE ALL EXPOSED ROOTS CLEANLY. PRUNED ENDS TO POINTED OBLIQUELY DOWNWARDS. DO NOT ALLOW EXPOSED ROOTS TO DRY OUT. THE CONTRACTOR SHALL DISCUSS WATERING OF THE ROOTS WITH THE OWNER AND STANTEC SO THAT OPTIMUM SOIL MOISTURE IS MAINTAINED DURING CONSTRUCTION AND BACK FILLING OPERATIONS, SO AS NOT TO INTERFERE WITH CONSTRUCTION OPERATIONS.

IF GRADES WITHIN THE DRIPLINE OF AN EXISTING TREE ARE TO BE CHANGED REFER TO GRADING NOTES.

TREE PROTECTION ZONES WILL BE IDENTIFIED BY CONTRACTOR AND VERIFIED IN FIELD BY CONSULTANT AND FENCED.

ALL SUPPORTS, BRACING AND PROTECTIVE FENCING WILL BE LOCATED OUTSIDE OF THE TPZ.

ALL SUPPORTS AND BRACING SHALL MINIMIZE DAMAGE TO TREE ROOTS OUTSIDE OF THE TPZ.

NO DISPOSAL OF LIQUIDS SHALL OCCUR WITHIN THE TPZ.

THERE WILL BE NO ACCESS FOR VEHICLES, EQUIPMENT, OR PEDESTRIANS THROUGH THE TPZ UNLESS EXPRESSLY PERMITTED FOR THE MAINTENANCE OF TREES WITHIN THE TPZ.

WEED MANAGEMENT PLAN

PREVENTION:

SEED CERTIFICATES WILL BE PROVIDED FOR REVIEW PRIOR TO PURCHASE OF THE SEED.

ALL CONSTRUCTION VEHICLES SHOULD LEAVE THE SITE AT A DESIGNATED POINT OR POINTS. GRAVELING OR PAVING (WHERE PRACTICAL) OF FREQUENTLY USED ACCESS ROADS WILL HELP ENSURE THAT MINIMAL MATERIAL SUCH AS MUD IS TRACKED OFF-SITE. ALL CONSTRUCTION EQUIPMENT, VEHICLES AND MATERIALS MUST BE CLEAN AND WEED FREE PRIOR TO ENTERING THE SITE. A HIGH-PRESSURE PUMP AND HOSE INSTALLATION MAY BE USED TO PROVIDE A WASHDOWN FACILITY FOR CONSTRUCTION EQUIPMENT AND VEHICLES.

MONITORING:
TO PREVENT WEED INFESTATION FIELD MONITORING WILL BE CONDUCTED ON A BI-WEEKLY BASIS THROUGHOUT THE CONSTRUCTION PERIOD AND ON A MONTHLY BASIS DURING THE ESTABLISHMENT AND MAINTENANCE PERIOD. VEGETATION MANAGEMENT WILL BE CONDUCTED THROUGHOUT THE PROJECT, UNTIL THE MAINTENANCE PERIOD IS COMPLETED, TO CONTROL UNDESIRED VEGETATION. SHOULD ANY NOXIOUS OR PROHIBITED NOXIOUS WEEDS OCCUR WITHIN THE AREA, THEY ARE TO BE REMOVED AS PER THE ALBERTA WEED CONTROL ACT.

CONTROL:
MECHANICAL VEGETATION CONTROL, SUCH AS MOWING OR HAND PULLING, WILL BE USED WHERE POSSIBLE, AND/OR WHEN APPLICATION OF CHEMICAL CONTROLS IS NOT APPROPRIATE.

CHEMICAL CONTROL:
CONTRACTOR TO ENSURE THAT AN APPLICATION FOR A WEED SPRAY PERMIT IS SUBMITTED THROUGH THE CITY OF EDMONTON. CONTRACTOR TO ENSURE TO CONTACT CONSULTANT FOR A SERVICING AGREEMENT NUMBER PRIOR TO APPLICATION FOR A HERBICIDE PERMIT. SPOT APPLICATION OF A NON-SELECTIVE HERBICIDE WILL BE USED, WHERE APPROPRIATE, WITHIN THE SITE. THE USE OF HERBICIDES WILL BE AVOIDED ADJACENT TO WETLANDS AND OTHER WATER BODIES. HERBICIDE WILL BE APPLIED TO INTRODUCED WEED SPECIES USING SPOT APPLICATION SPRAY TECHNIQUES TO MINIMIZE THE DAMAGE TO DESIRED PLANT SPECIES. ALL HERBICIDES WILL BE APPLIED IN ACCORDANCE WITH PROVINCIAL LEGISLATION BY A CERTIFIED PESTICIDE APPLICATOR. NOTICE SIGNS WILL BE POSTED AS PER CITY OF EDMONTON STANDARDS PRIOR TO APPLICATION OF CHEMICAL OR HERBICIDE. ONLY COMPANIES HOLDING A PESTICIDE SERVICE REGISTRATION WILL BE CONTACTED FOR THE APPLICATION OF ANY CHEMICAL CONTROLS.

THRESHOLD:
FOLLOW MUNICIPAL STANDARDS.

UNDISTURBED NATURAL AREAS:

WEEDS ARE TO BE MONITORED AND CONTROLLED IN ALL UNDISTURBED AREAS AS WELL AS NEWLY LANDSCAPED AREAS. UNDISTURBED NATURAL AREAS TO REMAIN.

PLANTING NOTES

CONTRACTOR TO CALL ALBERTA ONE CALL AT 1-800- 242-3447 TO HAVE EXISTING UTILITIES LOCATED PRIOR TO START OF ANY CONSTRUCTION.

CONTRACTOR TO ENSURE THAT ALL NECESSARY ARRANGEMENTS ARE MADE WITH THE PIPELINE COMPANIES CONCERNING THE MOVEMENT OF MATERIALS AND EQUIPMENT NEAR ANY PIPELINE RIGHTS OF WAY.

CONTRACTOR IS RESPONSIBLE FOR THE HOARDING OF ALL TREES WITHIN OR ADJACENT TO CONSTRUCTION AREAS.

CONTRACTOR IS RESPONSIBLE FOR THE ADJUSTMENT OF ALL EXISTING CATCHBASINS, CATCHBASIN MANHOLES, MANHOLES, WATER VALVES, HYDRANTS, ETC. TO MATCH PROPOSED GRADES.

CONTRACTOR IS RESPONSIBLE FOR HAULING OF ALL EXCESS MATERIALS OFF THE SITE.

CONTRACTOR IS RESPONSIBLE FOR GENERAL SITE CLEAN UP.

CONTRACTOR IS RESPONSIBLE FOR ANY DAMAGE TO LANDSCAPED AREAS AND MUST MAKE ALL NECESSARY RESTORATIONS AND REPAIRS.

ALL ANCILLARY WORK NORMALLY ASSOCIATED WITH THIS TYPE OF CONSTRUCTION SHALL BE DEEMED TO BE PART OF THE CONTRACT.

CONTRACTOR TO VERIFY ALL DIMENSIONS AND REPORT ANY DISCREPANCIES TO THE LANDSCAPE ARCHITECT.

LAYOUT TO BE APPROVED BY LANDSCAPE ARCHITECT PRIOR TO CONSTRUCTION STARTING.

CONTRACTOR TO OBTAIN APPROVAL FOR PLANT MATERIAL LAYOUT.

ALL PLANT MATERIAL TO BE NURSERY GROWN STOCK AND SHALL MEET OR EXCEED THE SPECIFICATIONS OF THE CANADIAN NURSERY TRADES ASSOC. FOR SIZE, HEIGHT, SPREAD, GRADING, QUALITY, AND METHOD OF CULTIVATION.

NO SUBSTITUTIONS OF MATERIALS, PRODUCTS, OR QUANTITIES WITHOUT PRIOR CONSENT OF LANDSCAPE ARCHITECT.

ALL TREES TO BE HIGH HEADED AND EXHIBIT A FULL AND UNIFORM CROWN, WITH A SINGLE, DOMINANT, WELL DEVELOPED LEADER; TREES WITH BROKEN OR DAMAGED OR MISSING LEADERS WILL NOT BE ACCEPTED.

ALL PLANT MATERIAL AND WORKMANSHIP TO CONFORM TO THE REQUIREMENTS OF THE CITY OF EDMONTON DESIGN AND CONSTRUCTION STANDARDS IN ITS MOST RECENT EDITION.

CONSULTANT TO CONTACT CITY OF EDMONTON VIA THE INFORMAL INSPECTION REQUEST. THIS REQUEST MUST BE COMPLETED 48 HOURS PRIOR TO CONSTRUCTION OF THE CORED BOULEVARDS.

PLANT SIZE NOTES

DECIDUOUS TREES

60 mm CAL.	OVERALL HEIGHT TO BE 4750-6000mm ON BOULEVARDS MIN. BRANCHING HT. TO BE 1700mm WITH MIN. 15 BRANCHES. WIRE BASKET, BALLED & BURLAPPED, MIN. 900mm ROOT BALL DIA. WITH DEPTH NOT LESS THAN 500mm.
40 mm CAL. #15 CONTAINER.	OVERALL HEIGHT TO BE 2500-3000mm MIN. BRANCHING HT. TO BE 1200mm WITH MIN. 8 BRANCHES. WIRE BASKET, BALLED & BURLAPPED, MIN. 600mm ROOT BALL DIA. WITH DEPTH NOT LESS THAN 300mm.

CONIFEROUS TREES

1500 mm HT. #15 CONTAINER.	WIDTH AT BASE MIN. 40% OF HT. WIRE BASKET, BALLED & BURLAPPED MIN. ROOT BALL DIA. 600mm.

DECIDUOUS SHRUBS

400 mm HT. MIN. #5 CONTAINER	CONTAINER GROWN, OR BALLED & BURLAPPED 4 CANES OR MORE 400mm HT. WITH MIN ROOT SPREAD 250mm.

CONIFEROUS SHRUBS

450 mm SPR. #5 CONTAINER	CONTAINER GROWN, OR BALLED & BURLAPPED WITH A MIN. ROOT BALL DIA. OF 250mm WITH DEPTH NOT LESS THAN 75% OF DIA.

SOD

CERTIFIED CANADA NO.1 CULTIVATED TURF SOD; WITH STRONG FIBROUS ROOT SYSTEM, THICK AND HEALTHY GROWTH DELIVERED 24 HOURS FROM THE TIME OF CUTTING. SOD TO BE FREE OF STONES, BURNS, DRY SPOTS, AND TEARS. SOD TO BE DELIVERED MOIST, CUT IN UNIFORM STRIPS, WIDTH AND THICKNESS, AND OF THE FOLLOWING MIX OR APPROVED EQUAL:

FOR MAINTAINED SOD AREAS:

70-90%	KENTUCKY BLUEGRASS
0-10%	CREEPING RED FESCUE
0-30%	PERENNIAL RYEGRASS

SEED MIXES

CERTIFIED CANADA NO. 1 MIXTURE, MINIMUM GERMINATION OF 75%, MINIMUM PURITY OF 97%. ALL SEED MUST BE FROM A RECOGNIZED SEED FIRM, MEETING THE REQUIREMENTS FOR THE SEEDS ACT FOR CANADA NO. 1 SEED. SEED SHALL BE CERTIFIED NO. 1 GRADE. A GERMINATION TEST MAY BE REQUESTED AND ALL LAWN SEED MUST COMPLY WITH FEDERAL AND PROVINCIAL SEED LAWS.
REFER TO CITY OF EDMONTON DESIGN AND CONSTRUCTION STANDARDS VOLUME 5 (2022 EDITION)

FOR UPLAND AREAS AND STEEP SLOPES: **"CUSTOM GRASS MIX"**

20%	WESTERN WHEATGRASS	10%	TUFTED HAIR GRASS
25%	ROCKY MOUNTAIN FESCUE	10%	AWNED WHEATGRASS
10%	GREEN NEEDLE GRASS	15%	SLENDER WHEATGRASS
10%	JUNE GRASS		

SEED RATE: 35KG PER HECTARE

FOR LOWLAND AND WETLAND AREAS: **"CUSTOM FORBS MIX"**

15%	CANADA MILKVETCH	11%	PHILADELPHIA FLEABANE
15%	BLUE FLAX	10%	TUFTED WHITE PRAIRIE ASTER
12%	CANADA GOLDENROD	10%	PURPLE PRAIRIE CLOVER
12%	SMOOTH ASTER	15%	LOW GOLDENROD

SEED RATE: 5KG PER HECTARE

FOR NON-MAINTAINED AREAS: **"DRY MEADOW MIX"**

20%	JUNEGRASS	10%	GREEN NEEDLEGRASS
20%	ROUGH FESCUE	10%	SHEEPS FESCUE
20%	NORTHERN WHEATGRASS	5%	ANNUAL RYEGRASS
15%	STREAMBANK WHEATGRASS		

SEED RATE: 250KG PER HECTARE

CoE TOPSOIL TYPE REFERENCE

BELOW LISTS THE TOPSOIL TYPE SCENARIOS FOR THIS SPECIFIC PROJECT. REFER TO DRAWING SCHEDULES FOR DEPTH SPECIFICATIONS. FOR A COMPLETE LIST OF THE TOPSOIL TYPE PER APPLICATION, PLEASE REFER TO THE CITY OF EDMONTON DESIGN AND CONSTRUCTION STANDARDS 2022 EDITION.

SOIL APPLICATION	SOIL TYPE
CORED BOULEVARDS	TYPE 1
SOD/SEED	TYPE 1
ORNAMENTAL SHRUB BEDS	TYPE 4
NATIVE SHRUB BEDS	TYPE 1

COMMON ABBREVIATIONS

ABBRV.	DEFINITION
@	AT
ADDTL	ADDITIONAL
AVG	AVERAGE
BUP	BACKFLOW PREVENTION UNIT
BW	BOTTOM OF WALL
CAL	CALIPER
CALCS	CALCULATIONS
CB	CATCH BASIN
CIP	CAST IN PLACE
CL	CENTER LINE
CLR	CLEAR
cm	CENTIMETRE
CMU	CONCRETE MASONRY UNIT
CNTA	CANADIAN NURSERY TRADES ASSOCIATION
CONC	CONCRETE
CONT	CONTINUOUS
CPTED	CRIME PREVENTION THOUGH ENVIRONMENTAL DESIGN
DIA	DIAMETER
EA	EACH
EIA	ENVIRONMENTAL IMPACT ASSESSMENT
ELEV	ELEVATION (EL)
EQ	EQUAL(S)
EX	EXISTING
FAB	FABRICATION/FABRICATOR
FF	FINISH FLOOR
FG	FINISH GRADE
FL	FLOW LINE
FT	FEET
GAL	GALLON
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
HORIZ	HORIZONTAL
HP	HIGH POINT
HT	HEIGHT

ABBRV.	DEFINITION
INFO	INFORMATION
ISA	INTERNATIONAL SOCIETY OF ARBORICULTURE
L.A.	LANDSCAPE ARCHITECT
LF	LINEAR FEET
LM	LINEAR METRES
L/S	LANDSCAPE/LANDSCAPING
NIC	NOT IN CONTRACT
M	METRE
m2	SQUARE METRES
m3	CUBIC METRES
mm	MILLIMETRE
MAX	MAXIMUM
MFG	MANUFACTURED / MANUFACTURING
MIN	MINIMUM
NTS	NOT TO SCALE
OC	ON CENTER
PL	PROPERTY LINE
POC	POINT OF CONNECTION
PUE	PUBLIC UTILITY EASEMENT
PSI	POUNDS PER SQUARE INCH
R, RAD	RADIUS
R/W	RIGHT OF WAY (R.O.W.)
SF	SQUARE FEET
SM	SQUARE METRES
SPD	STANDARD PROCTOR DENSITY
STD	STANDARD
SVT	SIGHT VIEW TRIANGLE
S/W	SIDEWALK(S)
TBD	TO BE DETERMINED
TBS	TO BE SELECTED
TW	TOP OF WALL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
W/	WITH

PLANTING SETBACKS

LANDSCAPE CONTRACTOR TO CALL ALBERTA ONE CALL AT 1-800-242-3447 TO HAVE ALL EXISTING SITE UTILITIES LOCATED PRIOR TO CONSTRUCTION AND PLANT TREES NO CLOSER THAN THE FOLLOWING DIMENSIONS FROM THE UTILITY OR INFRASTRUCTURE. THIS LIST INDICATES SOME OF THE MOST TYPICALLY USED TREE OFFSETS. FOR A COMPLETE LIST (INCLUDING SITE FURNITURE AND SHRUBS) REFER TO THE CITY OF EDMONTON VOLUME 1 TABLE OF MINIMUM OFFSETS.

1.8m/ 3.5m (DEC./CONIFER TREE) FROM WATERMAINS, MANUAL AIR VENTS & SERVICES.
3.5m/7.0m (DEC./CONIFER TREE) FROM FIRE HYDRANTS.
1.8m (DEC. & CONIFER TREE) FROM STORM / SANITARY SERVICES & MANHOLES.
GAS (CONTACT UTILITY).
1.0m FROM STREETLIGHT CABLE & POWER TRENCH.
COMMUNICATION UTILITY (CONTACT UTILITY)
1.65m FROM COLLECTOR RD FOC (>20m ROW)*
2.0m FROM ARTERIAL ROAD CURB FACE.
1.5M FROM COMMERCIAL ACCESS
2.0m FROM ALL OTHER SIGNS.
3.0m FROM STREETLIGHTS & POWER POLES.
1.25m FROM COLLECTOR RD FOC (<20m ROW).*
1.0m FROM LOCAL RD FOC (1.25m PREFERRED).*
15m FROM INTERSECTION.
3.5m FROM YIELD AND STOP SIGNS.
3.5m FROM TRANSIT ZONES.
1.0m / 2.5M FROM PRIVATE PROP. (BLVD WALK/PARK).
1.0M FROM DRIVEWAY, PATH, WALK (1.5M PREFERRED).

*WHERE 1.8M SIDEWALKS APPLY, THE 1.0M OFFSET FROM THE SIDEWALK EDGE WILL GOVERN AND DICTATE THE REMAINING BOULEVARD SPACE AVAILABLE FOR CURB OFFSET. CURB OFFSETS WILL BE REDUCE (FROM THE STANDARD LISTED DISTANCE) AND WILL BECOME THE REMAINING DIFFERENCE.

LANDSCAPE CONTRACTOR IS RESPONSIBLE FOR DAMAGES AND LIABILITIES INCURRED BY DAMAGES TO SITE UTILITIES.

LEGEND

MANHOLE
HYDRANT
LIGHT STANDARD /(W/ PEDESTAL)
PEDESTAL
TRANSFORMER / (EX.)
SWITCHING CUBICLE / (EX.)
COMM. VAULT TYP. A
COMM VAULT TYP. T
(SCALE MAY VARY IN PLAN VIEW)

DEVELOPMENT BOUNDARY
LIMIT OF CONSTRUCTION
WILDLIFE FENCING
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DRAWING LIST

L100-001	SPECIFICATIONS AND NOTES
L100-002	KEY PLAN
L200-001	TREE CLEARING PLAN
L200-002	TREE CLEARING PLAN
L200-003	FENCING PLAN
L300-001	RESTORATION PLANTING PLAN
L300-002	RESTORATION PLANTING PLAN
L300-003	RESTORATION PLANTING PLAN
L300-004	BOULEVARD PLANTING PLAN
L300-005	BOULEVARD PLANTING PLAN
L300-006	BOULEVARD PLANTING PLAN
L300-007	BOULEVARD PLANTING PLAN
L300-008	BOULEVARD PLANTING PLAN
L300-009	BOULEVARD PLANTING PLAN
L400-001	RESTORATION LANDSCAPE DETAILS
L400-002	RESTORATION PLANTING DETAILS
L400-003	RESTORATION PLANTING DETAILS

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2.	SECOND SUBMISSION	CV	JL	25.01
1.	FIRST SUBMISSION	CV	JL	24.02

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Client/Project
BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
SPECIFICATIONS AND NOTES

Permit-Seal

The Alberta Association of Landscape Architects
James Laidlaw

JIM LAIDLAW
AALA, BCSLA, LEED AP®
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200-325 25th Street SE CALGARY, AB T2A 7H8
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PHONE: 403.716.8000

Date____________

Project Number: 1161110195

File Name: 1161110195_notes_key_grub.dwg

CV	KM	CV/JL	24.01.26
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Drawing No. L100-001

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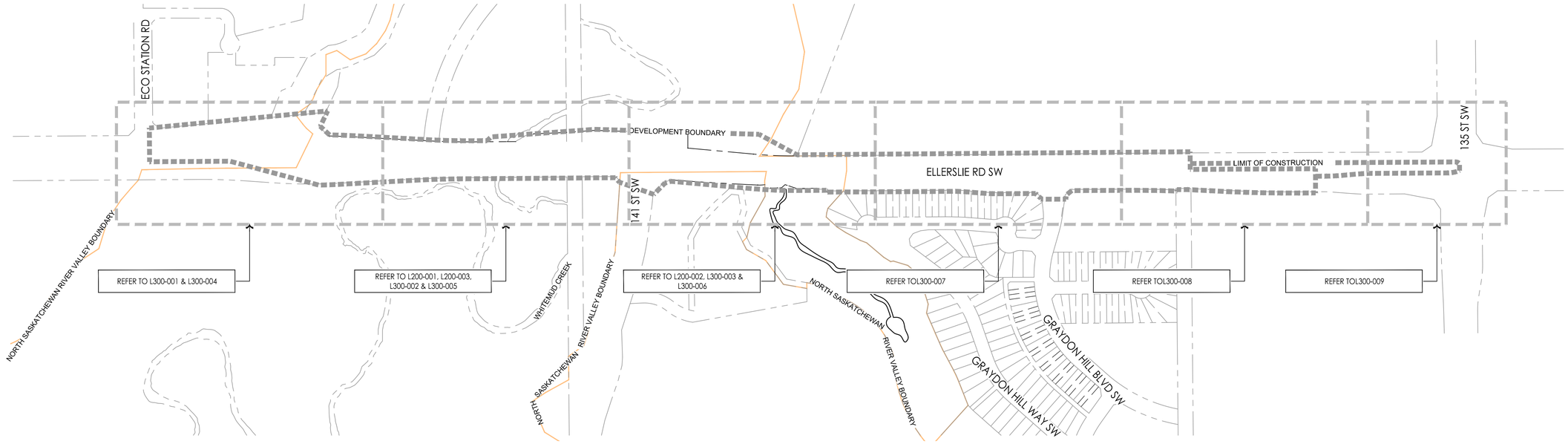

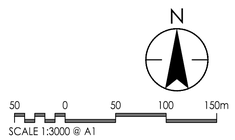

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ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
KEY PLAN

Permit-Seal

The Alberta Association of Landscape Architects

James Laidlaw
Date

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Project Number: 1161110195
File Name: 1161110195_notes_key_grub.dwg

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Revision 0
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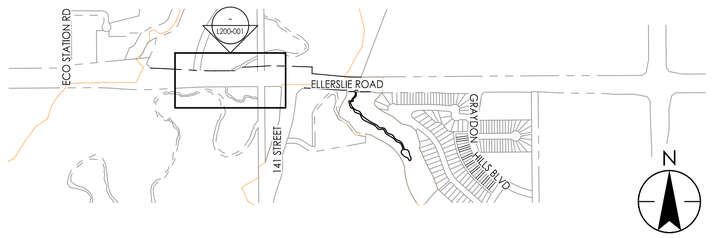


KEYPLAN

SCALE: 1:9000

FENCING SCHEDULE L200-001

SYMBOL	DESCRIPTION	QTY	DETAIL
FN-02	TBAR AND VINYL TREE PROTECTION FENCE -PLACE ALONG EXISTING TREE LINE.	119.8 m	2/L400-001

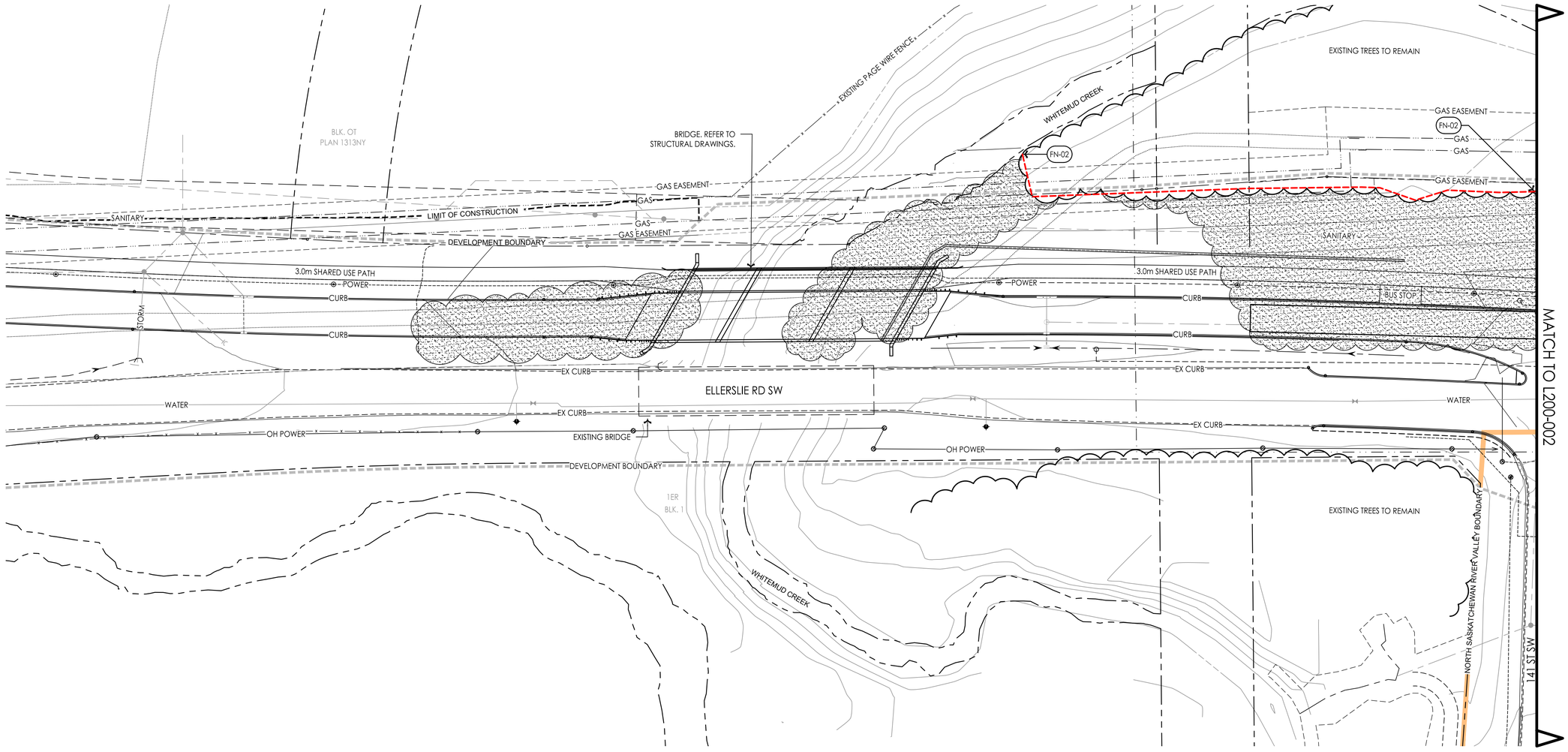
LEGEND

GRUBBING	CLEARING AND GRUBBING REFER TO DETAIL 3/L400-001

NATURAL TREE STAND NOTES

THE IDENTIFIED TREE STAND REQUIRES A NATURAL STAND ASSESSMENT TO BE CONDUCTED BY AN ISA CERTIFIED, CITY OF EDMONTON URBAN FORESTER. CONTACT PARKS AND ROADS SERVICES, NATURAL AREAS FORESTER FOR ASSESSMENT.

NATURAL TREE STAND ASSESSMENTS MUST BE COMPLETED A MINIMUM OF 4 WEEKS PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES. ONCE HAZARDS ARE IDENTIFIED WITHIN THE TREE STAND, HAZARDS MUST BE CORRECTED AND REINSPECTED, PRIOR TO ACCEPTANCE INTO THE CITY INVENTORY.



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Client/Project
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ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
TREE CLEARING PLAN

Permit-Seal

The Alberta Association of Landscape Architects

James Laidlaw
Date

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Drawing No. L200-001

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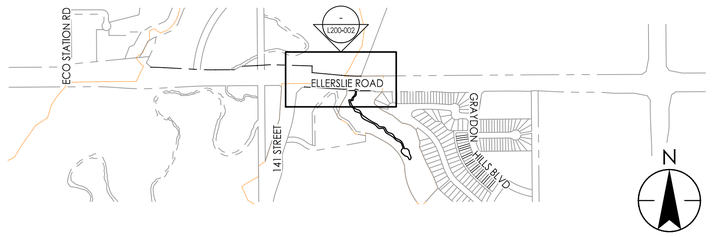

KEYPLAN

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FENCING SCHEDULE L200-002

SYMBOL	DESCRIPTION	QTY	DETAIL
FN-02	TBAR AND VINYL TREE PROTECTION FENCE -PLACE ALONG EXISTING TREE LINE.	354.6 m	2/L400-001

LEGEND

GRUBBING — CLEARING AND GRUBBING REFER TO DETAIL 3/L400-001

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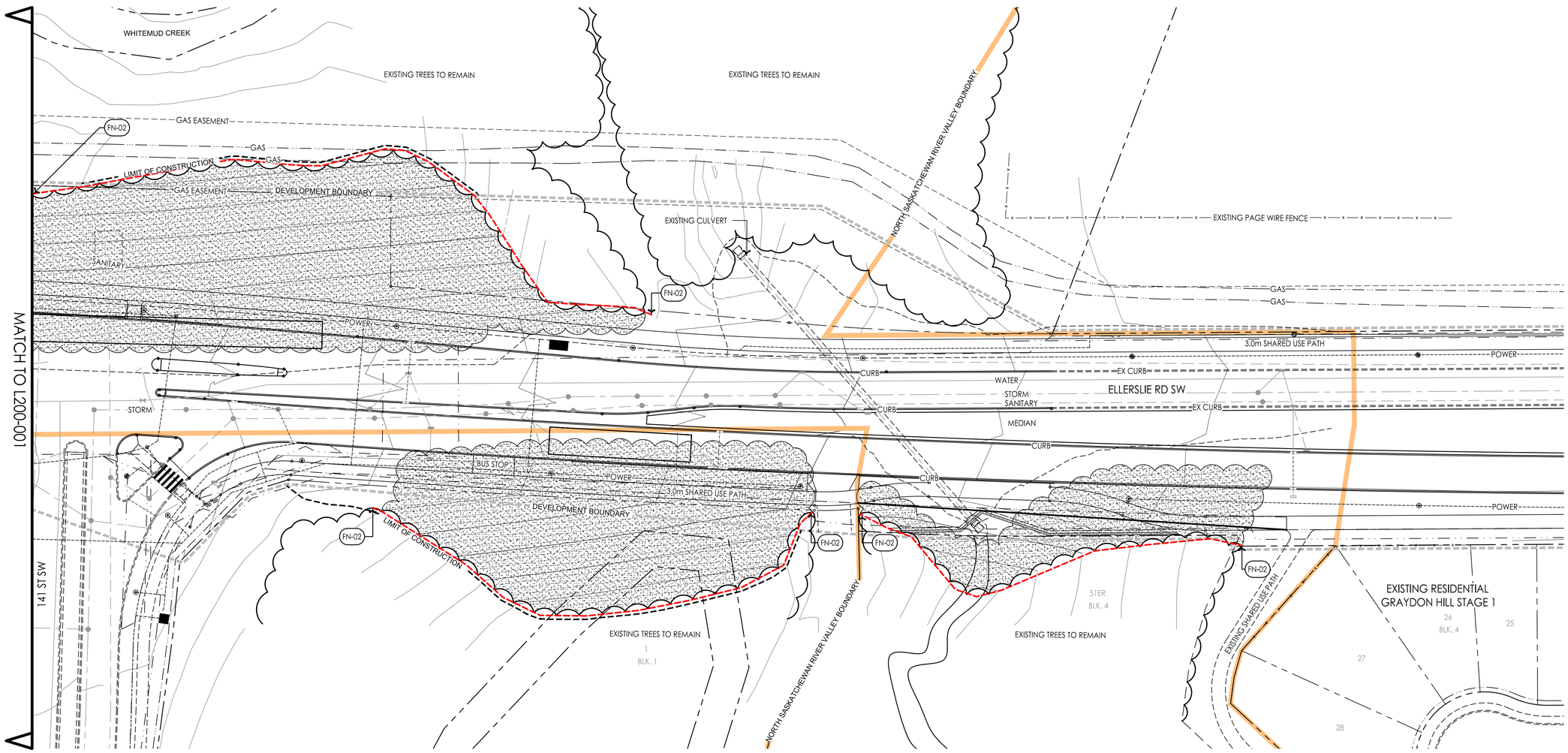

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EDMONTON, AB

Title
TREE CLEARING PLAN

Permit-Seal

The Alberta Association of Landscape Architects

James Laidlaw
Date_____

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Sheet 4 of 17

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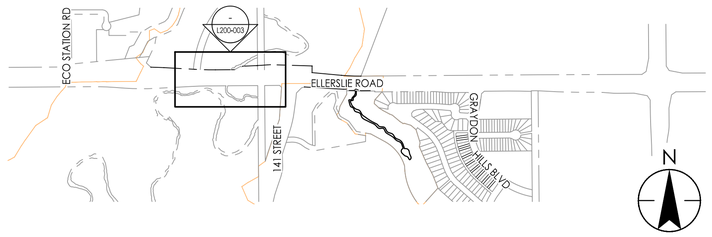
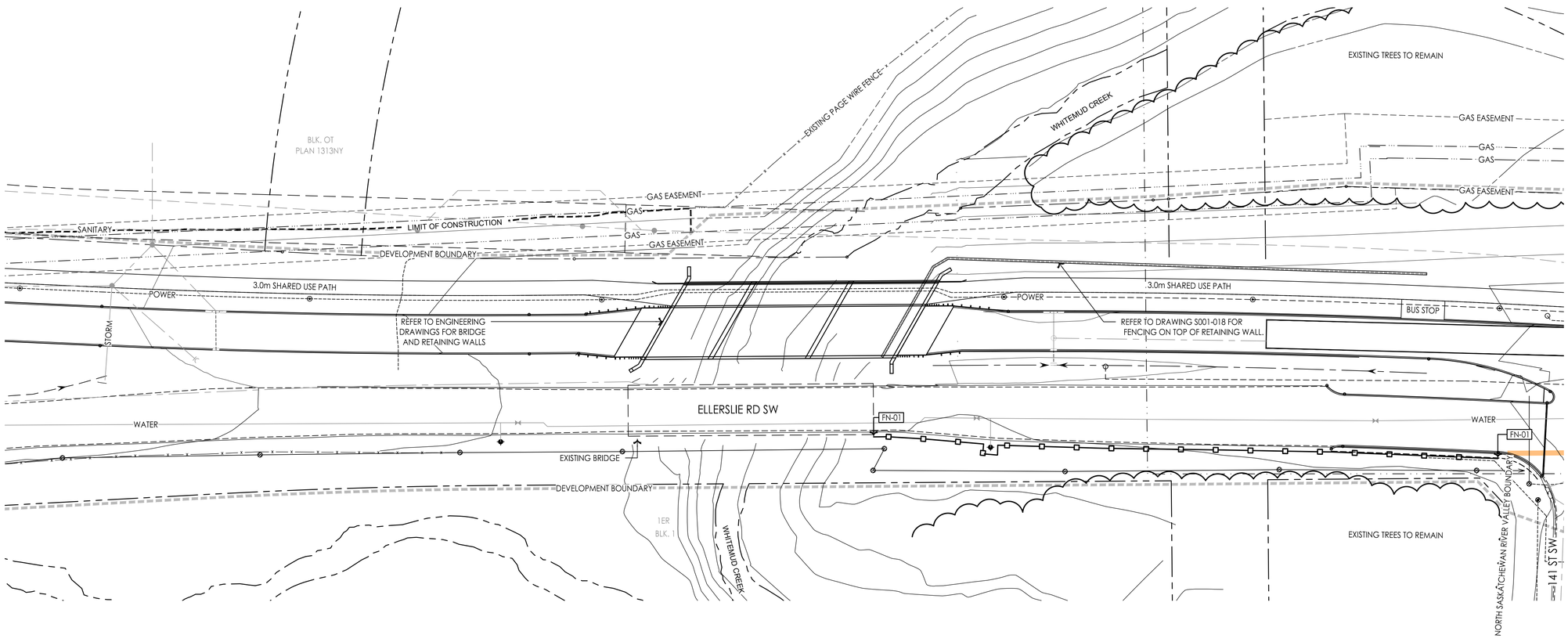


KEYPLAN

SCALE: 1:9000

FENCING SCHEDULE

SYMBOL	FENCING DESCRIPTION	QTY	DETAIL
FN-01	2.4M HT. WILDLIFE FENCE. INSTALL ALONG BACK OF EXISTING/PROPOSED EDGE OF PAVEMENT AND CURB. MAX 1.0M OFFSET.	134.5 m	1/L400-001



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ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
FENCING PLAN

Permit-Seal

The Alberta Association of Landscape Architects

James Laidlaw
Date_____

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Drawing No. L200-003

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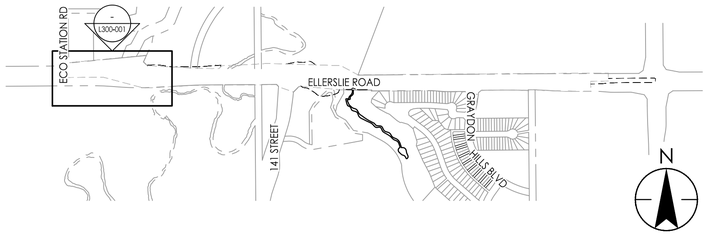

KEYPLAN

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RESTORATION PLANTING REQUIREMENTS

THE RAVINE WILL RECEIVE PLANT MATERIAL AS FOLLOWS:

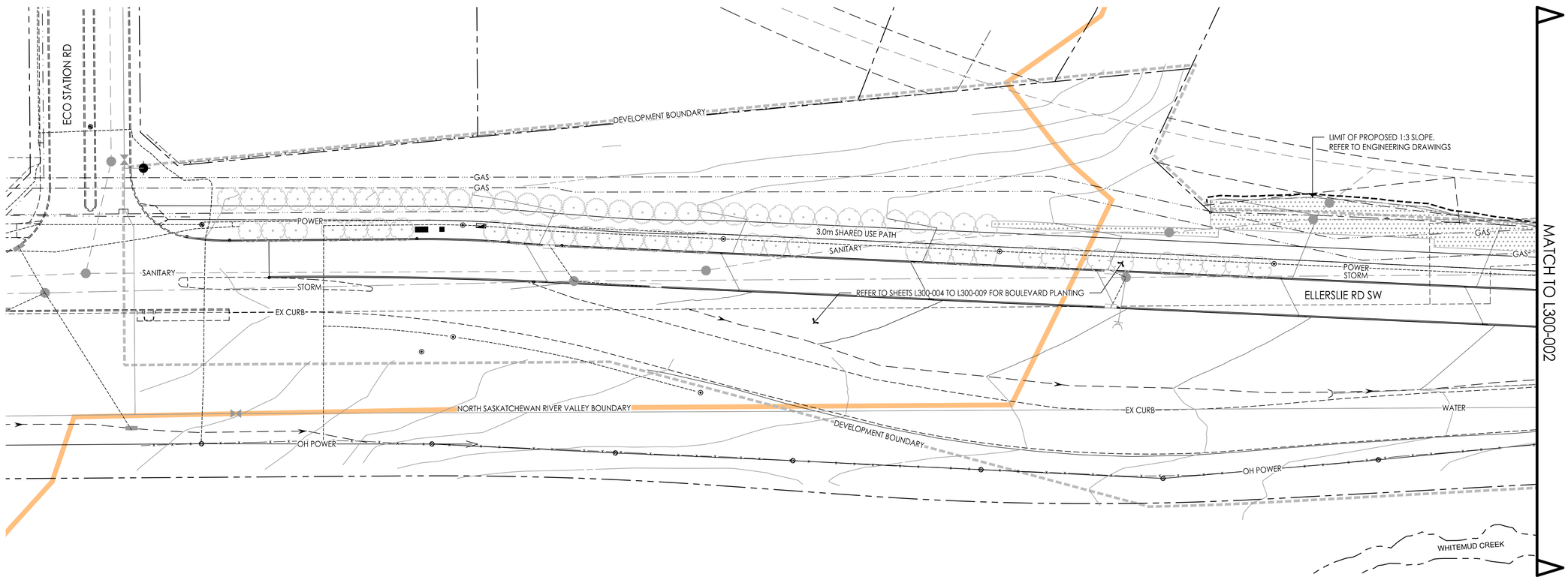
REQUIRED PLANTING:	70 TREES/ha (MAY SUBSTITUTE 7 5 GALLON SHRUBS PER TREE UP TO MAX. 10%)
AREA:	1.10 ha x 70 = 77 TREES W/ MAX. 54 SHRUBS AS SUBSTITUTES.
PROPOSED PLANTING:	77 UNITS OF 50mm CAL./2500mm HT. TREES* 347 UNITS OF 5 GAL. (OR LARGER) POTTED PLANT MATERIAL**

*154 #15 TREES @ 2 #15 POTTED TREES = 1 50mm CAL./2500mm HT. TREE = 77 TREES

**347 ADDITIONAL SHRUBS INCLUDED TO SATISFY BOULEVARD PLANTING REQUIREMENT

PLANT SCHEDULE L300-001

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	DETAIL
GROUND COVERS					
	Grass	576 m²	GRASS MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX. SEED TO BE BRILLION SEEDED.	N/A	N/A



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ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
RESTORATION PLANTING PLAN

Permit-Seal

The Alberta Association of Landscape Architects

James Laidlaw
Date_____

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File Name: 1161110195_planting_creek.dwg

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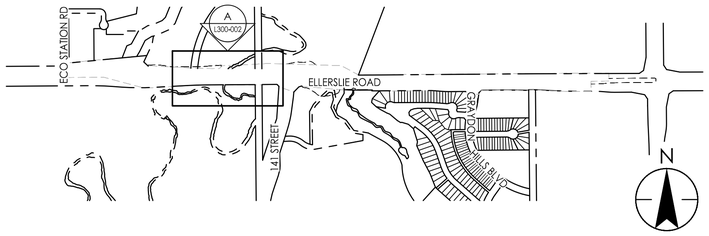


KEYPLAN

SCALE: 1:9000

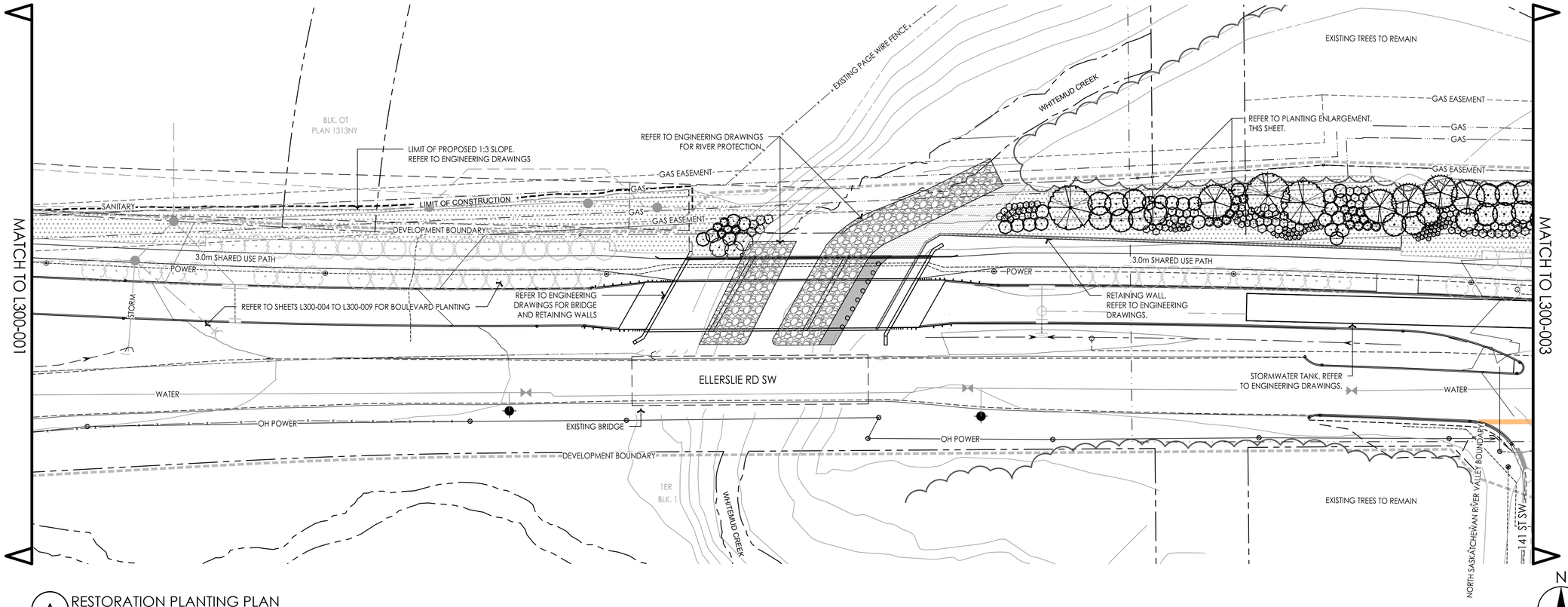
PLANT SCHEDULE L300-002

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CAL/HT	DETAIL
TREES					
	Ac	26	ALNUS CRISPA / GREEN ALDER	40MM CAL./#15 CONT.	1/L400-002
	Pg	5	PICEA GLAUCA / WHITE SPRUCE	1.5M HT./#15 CONT.	1/L400-002
	Pp	3	POPULUS BALSAMIFERA / BALSAM POPLAR	40MM CAL./#15 CONT.	1/L400-002
	Pt	17	POPULUS TREMULOIDES / QUAKING ASPEN	40MM CAL./#15 CONT.	1/L400-002

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	DETAIL
SHRUBS					
	As	22	AMELANCHIER ALNIFOLIA / SASKATOON	400MM HT. / #5 CONT.	2/L400-002
	Cr	45	CORNUS SERICEA / RED TWIG DOGWOOD	400MM HT. / #5 CONT.	2/L400-002
	Cw	20	CORYLUS CORNUTA / WESTERN HAZELNUT	400MM HT. / #5 CONT.	2/L400-002
	Rc	63	ROSA ACICULARIS / PRICKLY ROSE	400MM HT./ #5 CONT.	2/L400-002
	Sbb	5	SALIX BEBBIANA / BEAKED WILLOW	400MM HT. / #5 CONT.	2/L400-002

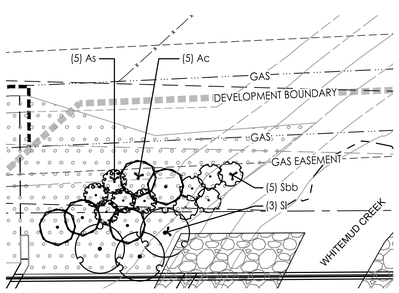
SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	DETAIL
	Sl	3	SALIX LUCIDA / SHINING WILLOW	400MM HT. / #5 CONT.	2/L400-002
	So	34	SYMPHORICARPOS OCCIDENTALIS / WESTERN SNOWBERRY	400MM HT. / #5 CONT.	2/L400-002

GROUND COVERS				
Forb	146 m²	FORBS MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX. SEED TO BE BRILLION SEEDED.	N/A	N/A
Grass	1,347 m²	GRASS MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX. SEED TO BE BRILLION SEEDED.	N/A	N/A
WLC	67.2 m²	WILDLIFE CORRIDOR - W/ 300MM DEPTH NATIVE TOPSOIL SUBSTRATE	N/A	N/A



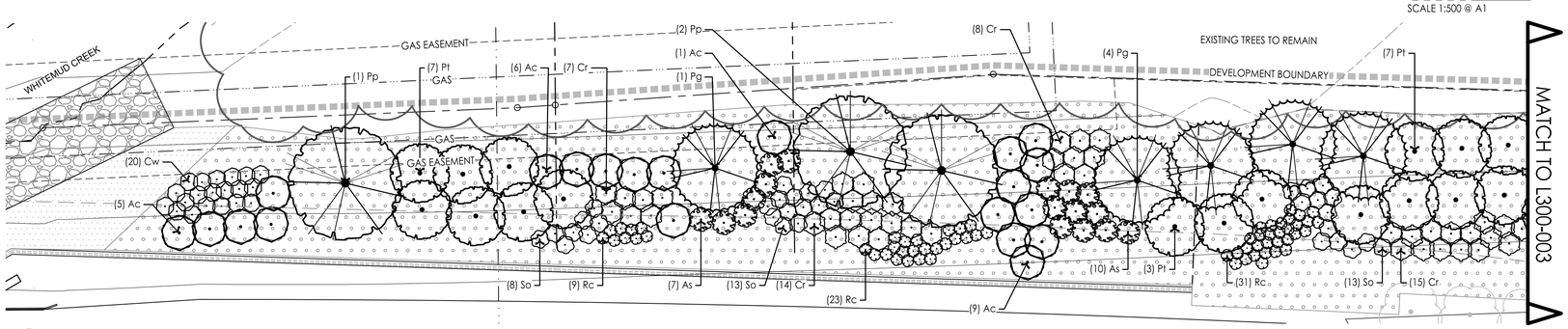
A RESTORATION PLANTING PLAN

SCALE: 1:500



B WEST RAVINE ENLARGEMENT

SCALE: 1:250



C EAST RAVINE ENLARGEMENT

SCALE: 1:250

SCALE 1:500 @ A1

SCALE 1:250 @ A1

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Client/Project
BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
RESTORATION PLANTING PLAN

Permit-Seal

The Alberta Association of Landscape Architects

James Laidlaw
Date

JIM LAIDLAW
AALA, BCSLA, LEED AP
STANTEC CONSULTING LTD.
200-325 25th Street SE CALGARY, AB T2A 7H8
EMAIL: jim.laidlaw@stantec.com
PHONE 403.716.8000

Project Number: 1161110195

File Name: 1161110195_planting_creek.dwg

CV	KM	CV/JL	24.01.26
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. L300-002

Revision 0

Sheet 7 of 17

2025/01/31 8:16 AM By: cvandstine
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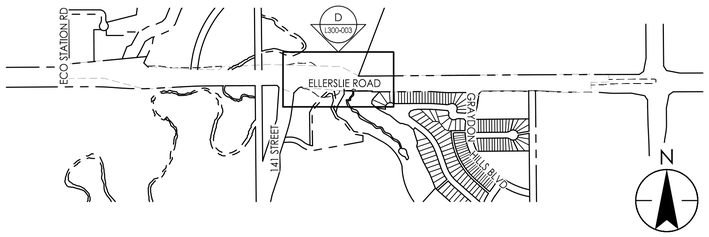
ORIGINAL SHEET - ISO A1

PLANT SCHEDULE L300-003

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CAL/HT	DETAIL
TREES					
	Ac	18	ALNUS CRISPA GREEN ALDER	40MM CAL./#15 CONT.	1/L400-002
	Pg	12	PICEA GLAUCA WHITE SPRUCE	1.5M HT./#15 CONT.	1/L400-002
	Pp	13	POPULUS BALSAMIFERA BALSAM POPLAR	40MM CAL./#15 CONT.	1/L400-002
	Pt	60	POPULUS TREMULOIDES QUAKING ASPEN	40MM CAL./#15 CONT.	1/L400-002

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	DETAIL
SHRUBS					
	As	30	AMELANCHIER ALNIFOLIA SASKATOON	400MM HT. / #5 CONT.	2/L400-002
	Cr	35	CORNUS SERICEA RED TWIG DOGWOOD	400MM HT. / #5 CONT.	2/L400-002
	Cw	29	CORYLUS CORNUTA WESTERN HAZELNUT	400MM HT. / #5 CONT.	2/L400-002
	Rc	42	ROSA ACICULARIS PRICKLY ROSE	400MM HT./ #5 CONT.	2/L400-002
	So	19	SYMPHORICARPOS OCCIDENTALIS WESTERN SNOWBERRY	400MM HT. / #5 CONT.	2/L400-002
GROUND COVERS					
	Forb	372 m²	FORBS MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX. SEED TO BE BRILLION SEEDED.	N/A	N/A
	Grass	6,003 m²	GRASS MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX. SEED TO BE BRILLION SEEDED.	N/A	N/A



KEYPLAN

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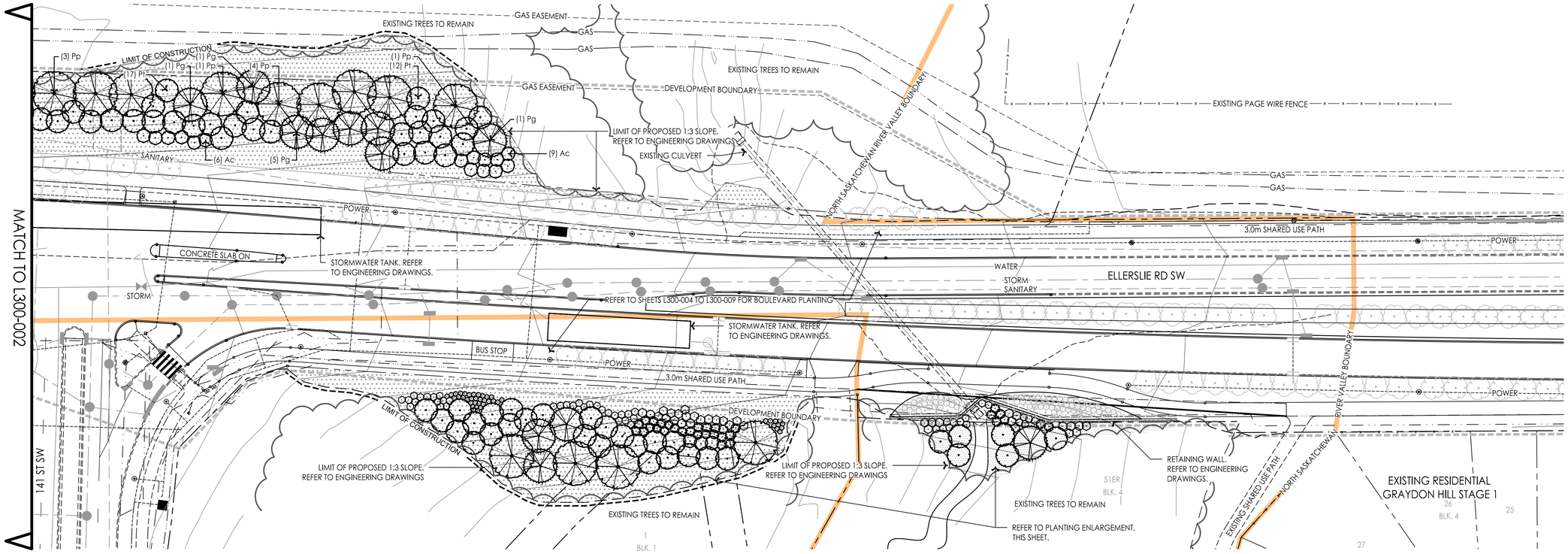

D RESTORATION PLANTING PLAN

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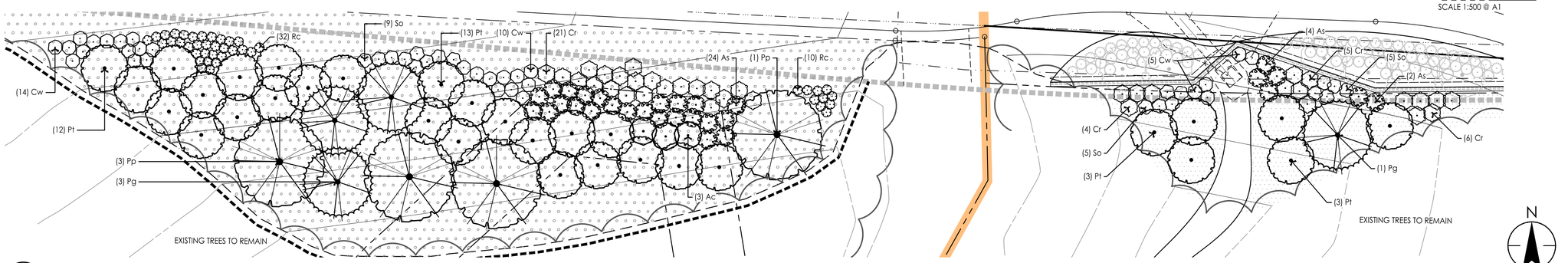

E SOUTH ENLARGEMENT

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Development Engineer: Sustainable Development

Approvals

Issued	By	Appd.	YY.MM.DD
2. SECOND SUBMISSION	CV	JL	25.01
1. FIRST SUBMISSION	CV	JL	24.02

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Drawing No. L300-003

Revision 0

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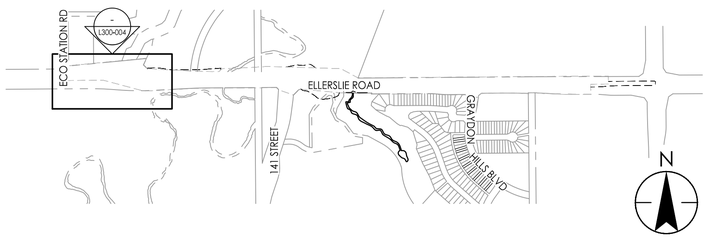


KEYPLAN

SCALE: 1:9000

ARTERIAL ROAD PLANTING REQUIREMENTS

ELLERSLIE ROAD WILL RECEIVE PLANT MATERIAL AS FOLLOWS:

REQUIRED BOULEVARD TREE PLANTING:	1 TREE/10m
BOULEVARD LENGTH :	2034 m (Ultimate only)
REQUIRED BOULEVARD TREES:	203
PROPOSED BOULEVARD TREES:	282 (due to bus stops, utilities, and site lines)
REQUIRED SHRUB PLANTING:	1 SHRUB/1.2m BEHIND WALK ON EA. SIDE OF ULTIMATE RD.
WALK LENGTH:	1687 m (Ultimate only, corner cut to corner cut)
REQUIRED SHRUBS:	1406
PROPOSED SHRUBS:	79 + 980* = 1059**
REQUIRED MEDIAN TREE PLANTING:	1 TREE/10m ON MEDIANS MIN. 4.5m WIDE
MEDIAN LENGTH:	755 m (Ultimate only)
REQUIRED MEDIAN TREES:	76
PROPOSED MEDIAN TREES:	137
DIVERSITY REQUIREMENT:	PROPOSED TREES 419 x 25 % = 105 TREES OF ANY ONE GENUS

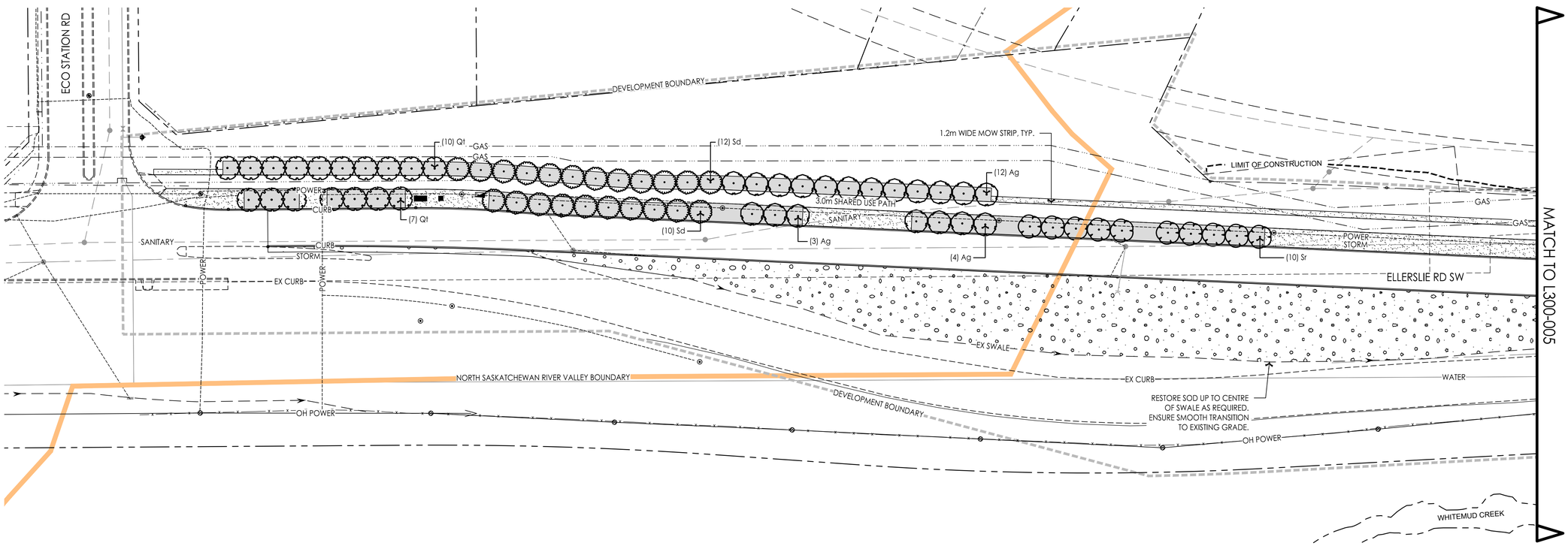
*79 ADDITIONAL BOULEVARD TREES + 61 ADDITIONAL MEDIAN TREES @ 7 SHRUBS/TREE = 980 SHRUBS

**347 ADDITIONAL SHRUBS HAVE BEEN INCLUDED IN NATURAL AREA PLANTING TO SATISFY BOULEVARD PLANTING REQUIREMENT

PLANT SCHEDULE L300-004

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CAL/HT	DETAIL
TREES					
	Ag	19	AESCULUS GLABRA OHIO BUCKEYE	60MM CAL. / B & B	1/L400-003
	Qt	17	QUERCUS MACROCARPA `TOP GUN` TOP GUN BUR OAK	60MM CAL. / B & B	1/L400-003
	Sd	22	SORBUS DECORA SHOWY MOUNTAIN ASH	60MM CAL. / B & B	1/L400-003
	Sr	10	SYRINGA RETICULATA 'IVORY SILK' IVORY SILK JAPANESE TREE LILAC	60MM CAL. / B & B	1/L400-003

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	DETAIL
GROUND COVERS					
	SodC	1191 m²	CORED SOD - W/ 450MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SOD MIX.	N/A	3/L400-003
	Na	2,800 m²	DRY MEADOW NATURALIZATION SEED MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX.	N/A	N/A
	Sod	660 m²	SOD - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SOD MIX.	N/A	4/L400-003



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1.	CV	JL	25.01
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Project Number: 1161110195

File Name: 1161110195_planting_blvd.dwg

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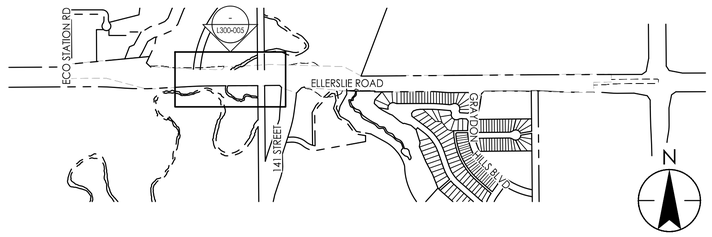
Drawing No. L300-004

Revision 0

Sheet 9 of 17



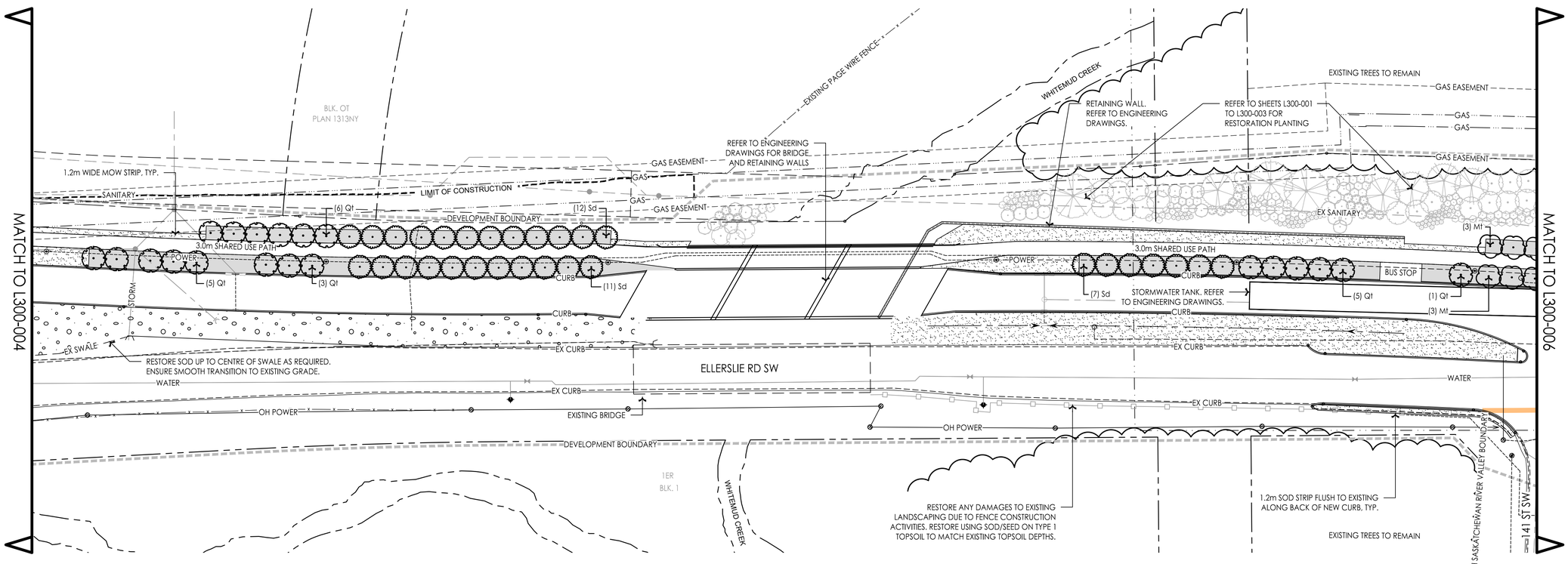
KEYPLAN

SCALE: 1:9000

PLANT SCHEDULE L300-005

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CAL/HT	DETAIL
TREES					
	Mt	6	MALUS X ADSTRINGENS 'THUNDERCHILD' THUNDERCHILD CRABAPPLE	60MM CAL. / B & B	1/L400-003
	Qt	20	QUERCUS MACROCARPA 'TOP GUN' TOP GUN BUR OAK	60MM CAL. / B & B	1/L400-003
	Sd	30	SORBUS DECORA SHOWY MOUNTAIN ASH	60MM CAL. / B & B	1/L400-003

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	DETAIL
GROUND COVERS					
	SodC	1,126 m²	CORED SOD - W/ 450MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SOD MIX.	N/A	3/L400-003
	Na	930 m²	DRY MEADOW NATURALIZATION SEED MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX.	N/A	N/A
	Sod	1,495 m²	SOD - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SOD MIX.	N/A	4/L400-003



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1. FIRST SUBMISSION	CV	JL	24.02
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Drawing No. L300-005

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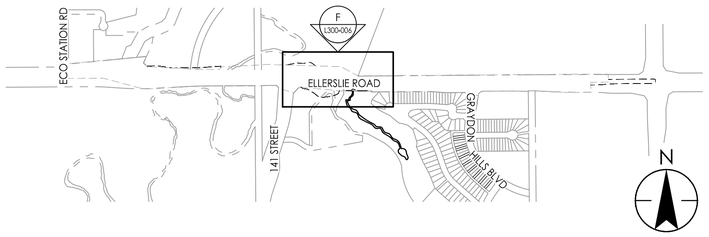


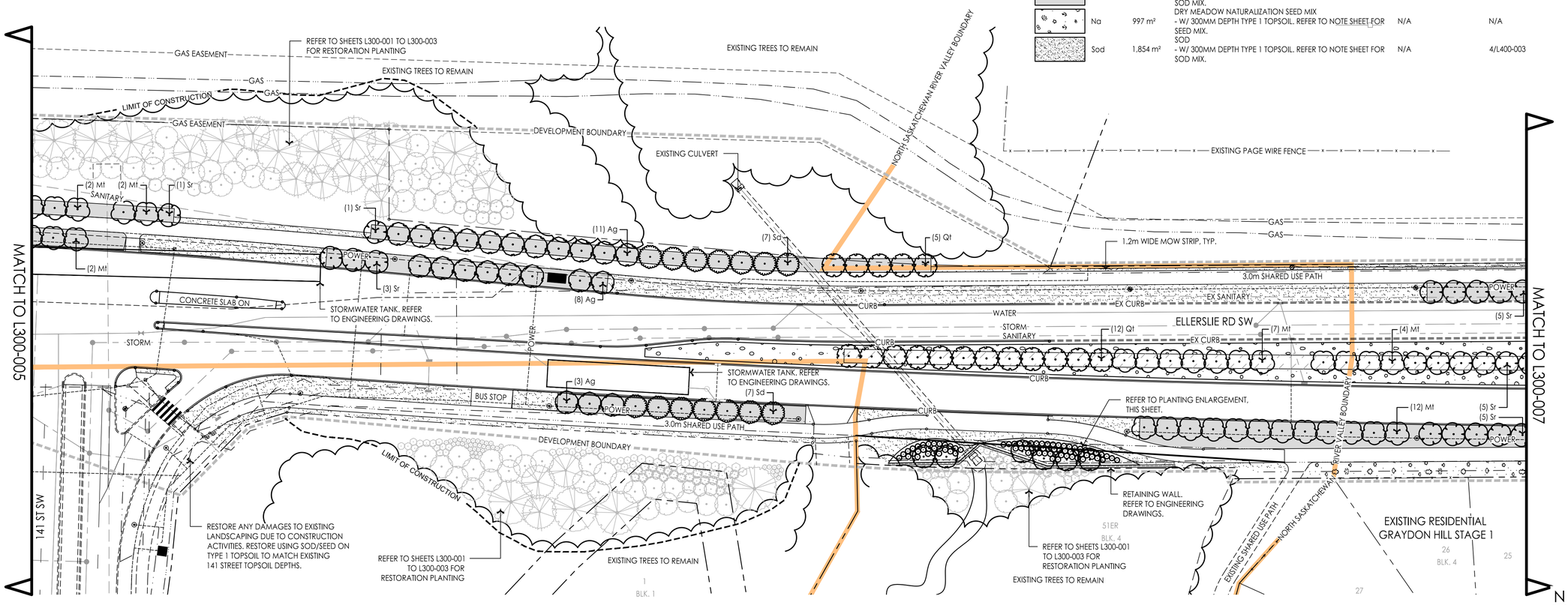
KEYPLAN

SCALE: 1:9000

PLANT SCHEDULE L300-006

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CAL/HT	DETAIL
TREES					
	Ag	28	AESCULUS GLABRA OHIO BUCKEYE	60MM CAL. / B & B	1/L400-003
	Mt	29	MALUS X ADSTRINGENS 'THUNDERCHILD' THUNDERCHILD CRABAPPLE	60MM CAL. / B & B	1/L400-003
	Qt	17	QUERCUS MACROCARPA `TOP GUN` TOP GUN BUR OAK	60MM CAL. / B & B	1/L400-003
	Sd	14	SORBUS DECORA SHOWY MOUNTAIN ASH	60MM CAL. / B & B	1/L400-003
	Sr	20	SYRINGA RETICULATA 'IVORY SILK' IVORY SILK JAPANESE TREE LILAC	60MM CAL. / B & B	1/L400-003

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	DETAIL
SHRUBS					
	Jb	35	JUNIPERUS HORIZONTALIS 'BLUE CHIP' BLUE CHIP CREEPING JUNIPER	450MM SP./#5 CONT.	2/L400-003
	Pd	44	PHYSOCARPUS OPULIFOLIUS 'DONNA MAY' LITTLE DEVIL™ DWARF NINEBARK	400MM HT. / #5 CONT.	2/L400-003
GROUND COVERS					
	MulchC	445 m²	100MM DEPTH SHREDDED CONIFEROUS MULCH CORED MULCH BED- W/ 450MM DEPTH TYPE 1 TOPSOIL.	N/A	3/L400-003
	Mulch	191.6 m²	100MM DEPTH SHREDDED CONIFEROUS MULCH - W/ 450MM DEPTH TYPE 4 TOPSOIL.	N/A	2/L400-003
	SodC	1.546 m²	CORED SOD - W/ 450MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SOD MIX.	N/A	3/L400-003
	Na	997 m²	DRY MEADOW NATURALIZATION SEED MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX.	N/A	N/A
	Sod	1.854 m²	SOD - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SOD MIX.	N/A	4/L400-003



F BOULEVARD PLANTING PLAN

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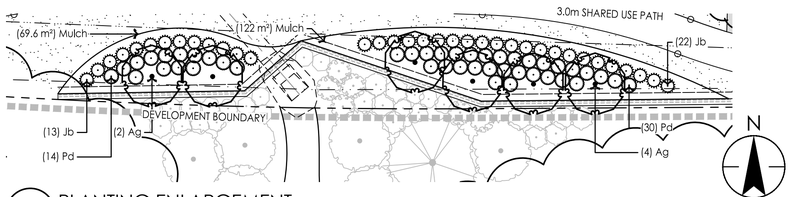

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1. FIRST SUBMISSION	CV	JL	24.02.26
2. SECOND SUBMISSION	CV	JL	25.01.30

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Drawing No. L300-006

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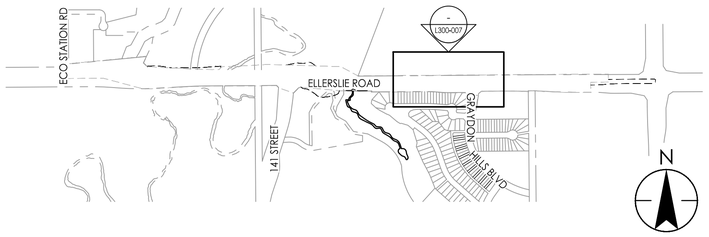

KEYPLAN

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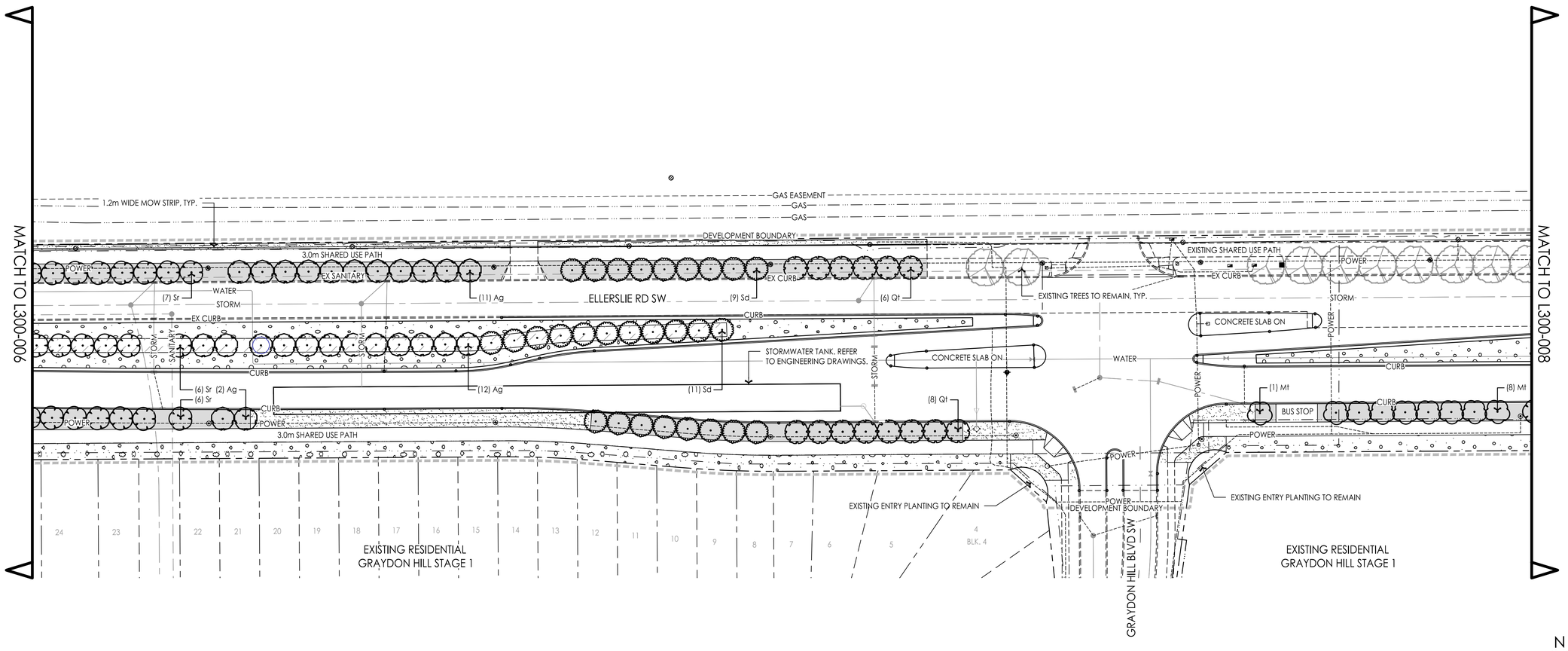
OFFSET LEGEND

- R3500 — HYDRANT OFFSET
- R2700 — DOUBLE LOT SERVICE OFFSET
- R2100 — SINGLE LOT SERVICE OFFSET
- R1800 — WATER MAIN / FIXTURE OFFSET

PLANT SCHEDULE L300-007

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CAL/HT	DETAIL
TREES					
	Ag	25	AESCULUS GLABRA OHIO BUCKEYE	60MM CAL. / B & B	1/L400-003
	Mt	9	MALUS X ADSTRINGENS 'THUNDERCHILD' THUNDERCHILD CRABAPPLE	60MM CAL. / B & B	1/L400-003
	Qt	14	QUERCUS MACROCARPA `TOP GUN` TOP GUN BUR OAK	60MM CAL. / B & B	1/L400-003
	Sd	28	SORBUS DECORA SHOWY MOUNTAIN ASH	60MM CAL. / B & B	1/L400-003
	Sr	19	SYRINGA RETICULATA 'IVORY SILK' IVORY SILK JAPANESE TREE LILAC	60MM CAL. / B & B	1/L400-003

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	DETAIL
GROUND COVERS					
	MulchC	452 m²	100MM DEPTH SHREDDED CONIFEROUS MULCH CORED MULCH BED- W/ 450MM DEPTH TYPE 1 TOPSOIL.	N/A	3/L400-003
	SodC	1,475 m²	CORED SOD - W/ 450MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SOD MIX.	N/A	3/L400-003
	Na	2,207 m²	DRY MEADOW NATURALIZATION SEED MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX.	N/A	N/A
	Sod	716 m²	SOD - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SOD MIX.	N/A	4/L400-003



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1. FIRST SUBMISSION	CV	JL	24.02

Development Engineer, Sustainable Development

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ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
BOULEVARD PLANTING PLAN

Permit-Seal

The Alberta Association of Landscape Architects

James Laidlaw
Date

JIM LAIDLAW
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200-325 25th Street SE CALGARY, AB T2A 7H8
EMAIL: jim.laidlaw@stantec.com
PHONE: 403.716.8000

Project Number: 1161110195

File Name: 1161110195_planting_blvd.dwg

CV	KM	CV/JL	24.01.26
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. L300-007

Revision 0

Sheet 12 of 17

2025/01/31 8:23 AM By: cvandalstine
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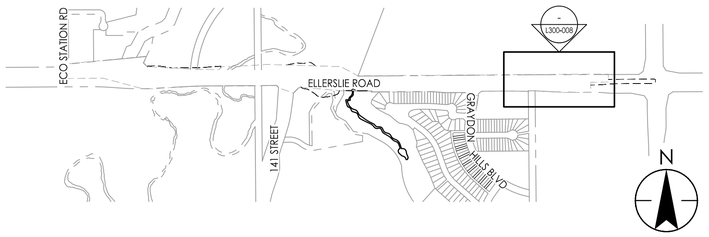
ORIGINAL SHEET - ISO A1



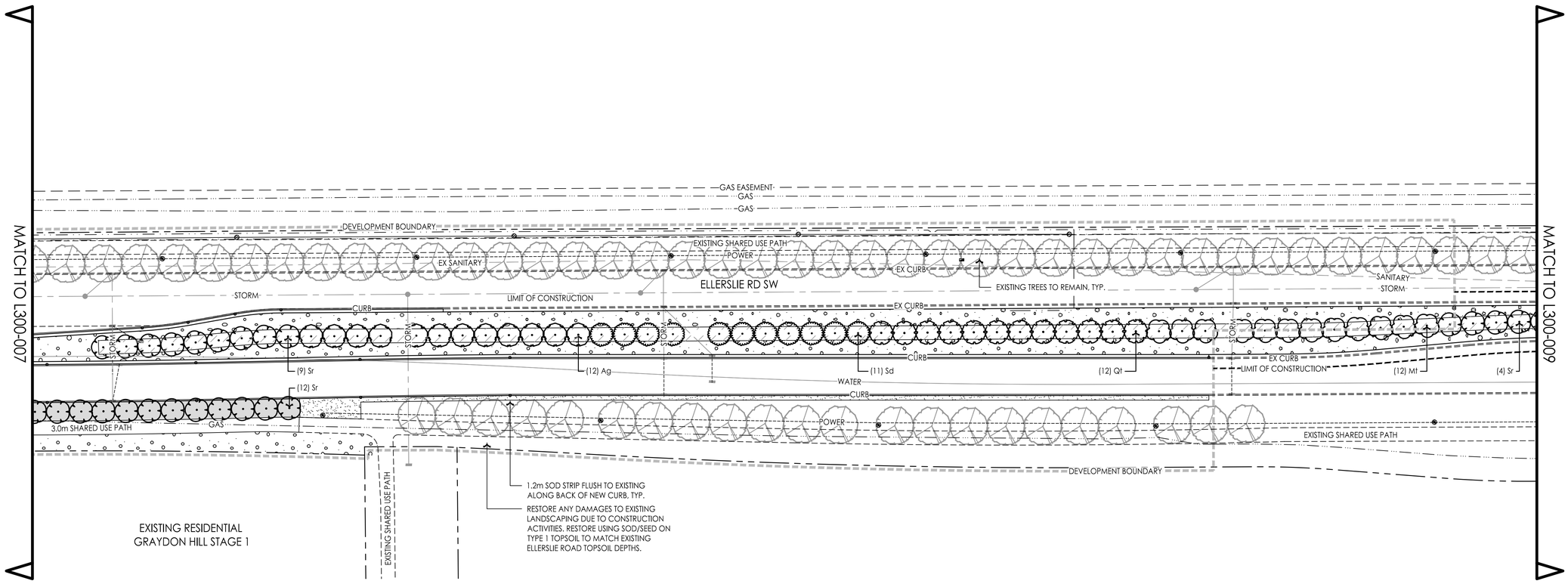
KEYPLAN

SCALE: 1:9000

PLANT SCHEDULE L300-008

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CAL/HT	DETAIL
TREES					
	Ag	12	AESCULUS GLABRA OHIO BUCKEYE	60MM CAL. / B & B	1/L400-003
	Mt	12	MALUS X ADSTRINGENS 'THUNDERCHILD' THUNDERCHILD CRABAPPLE	60MM CAL. / B & B	1/L400-003
	Qt	12	QUERCUS MACROCARPA `TOP GUN` TOP GUN BUR OAK	60MM CAL. / B & B	1/L400-003
	Sd	11	SORBUS DECORA SHOWY MOUNTAIN ASH	60MM CAL. / B & B	1/L400-003
	Sr	25	SYRINGA RETICULATA 'IVORY SILK' IVORY SILK JAPANESE TREE LILAC	60MM CAL. / B & B	1/L400-003

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	DETAIL
GROUND COVERS					
	MulchC	932 m²	100MM DEPTH SHREDDED CONIFEROUS MULCH CORED MULCH BED- W/ 450MM DEPTH TYPE 1 TOPSOIL.	N/A	3/L400-003
	SodC	231 m²	CORED SOD - W/ 450MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SOD MIX.	N/A	3/L400-003
	Na	2,329 m²	DRY MEADOW NATURALIZATION SEED MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX.	N/A	N/A
	Sod	241 m²	SOD - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SOD MIX.	N/A	4/L400-003



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Stantec Consulting Ltd.
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Tel. 780.917.7000
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Revision	By	Appd.	YY.MM.DD
1.			
2.			
3.			
4.			

Issued

	By	Appd.	YY.MM.DD
1. FIRST SUBMISSION	CV	JL	24.02
2. SECOND SUBMISSION	CV	JL	25.01
3.			
4.			

Development Engineer, Sustainable Development

Approvals

ALBERTA ONECALL
ALBERTAONECALL.COM
1-800-242-3447

Client/Project
BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
BOULEVARD PLANTING PLAN

Permit-Seal

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Project Number: 1161110195

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CV	KM	CV/JL	24.01.26
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. L300-008

Revision 0

Sheet 13 of 17

2025/01/31 8:23 AM By: cvandalstine
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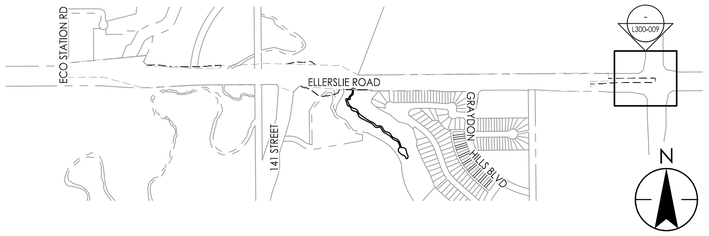


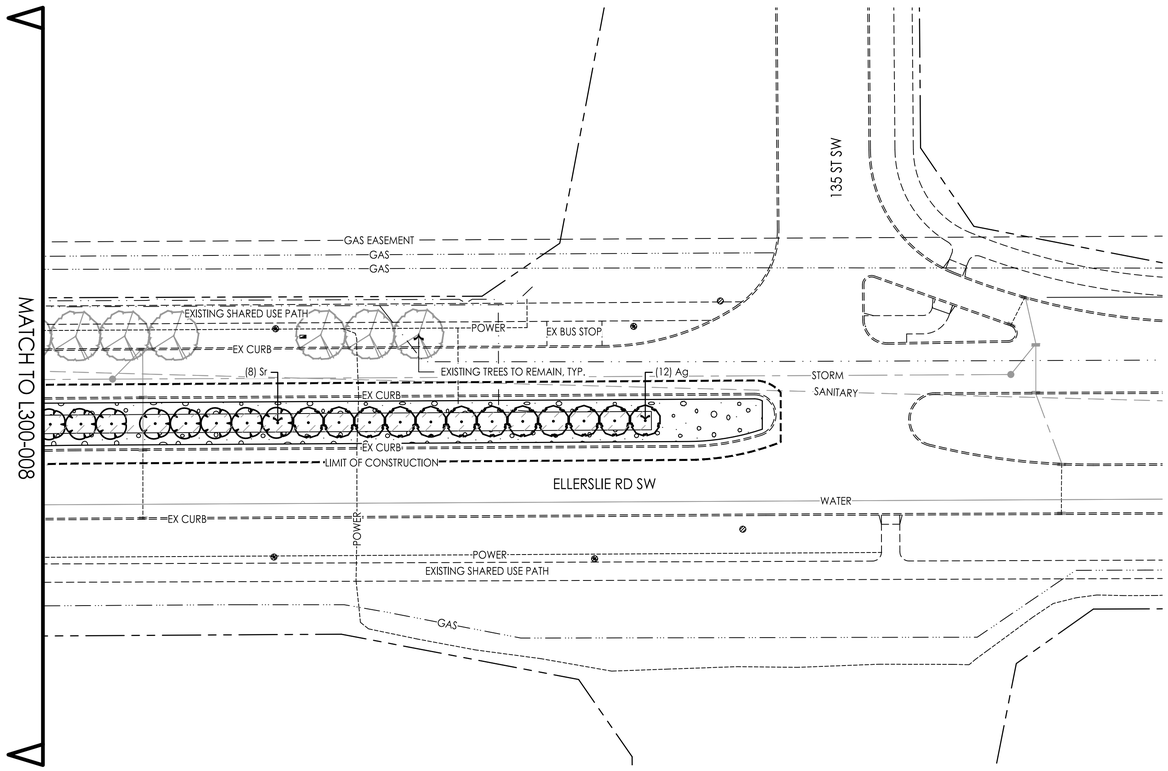
KEYPLAN

SCALE: 1:9000

PLANT SCHEDULE L300-009

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CAL/HT	DETAIL
TREES					
	Ag	12	AESCULUS GLABRA OHIO BUCKEYE	60MM CAL. / B & B	1/L400-003
	Sr	8	SYRINGA RETICULATA 'IVORY SILK' IVORY SILK JAPANESE TREE LILAC	60MM CAL. / B & B	1/L400-003

SYMBOL	CODE	QTY	BOTANICAL / COMMON NAME	CONT	DETAIL
GROUND COVERS					
	MulchC	298 m²	100MM DEPTH SHREDDED CONIFEROUS MULCH CORED MULCH BED- W/ 450MM DEPTH TYPE 1 TOPSOIL.	N/A	3/L400-003
	Na	505 m²	DRY MEADOW NATURALIZATION SEED MIX - W/ 300MM DEPTH TYPE 1 TOPSOIL. REFER TO NOTE SHEET FOR SEED MIX.	N/A	N/A



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SCALE 1:500 @ A1

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1.			

Issued	By	Appd.	YY.MM.DD
2. SECOND SUBMISSION	CV	JL	25.01.24
1. FIRST SUBMISSION	CV	JL	24.02.29

Development Engineer, Sustainable Development

Approvals

ALBERTA ONECALL
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File Name: 1161110195_planting_blvd.dwg

Dwn.	Chkd.	Dsgn.	YY.MM.DD
CV	KM	CV/JL	24.01.26

Drawing No. L300-009

Revision 0

Sheet 14 of 17

2025/01/31 8:23 AM By: cvandstine
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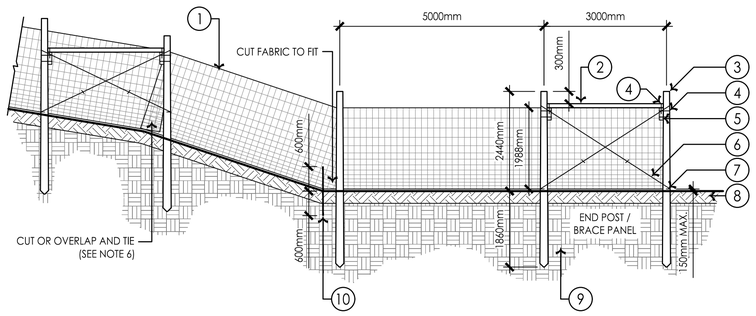
ORIGINAL SHEET - ISO A1



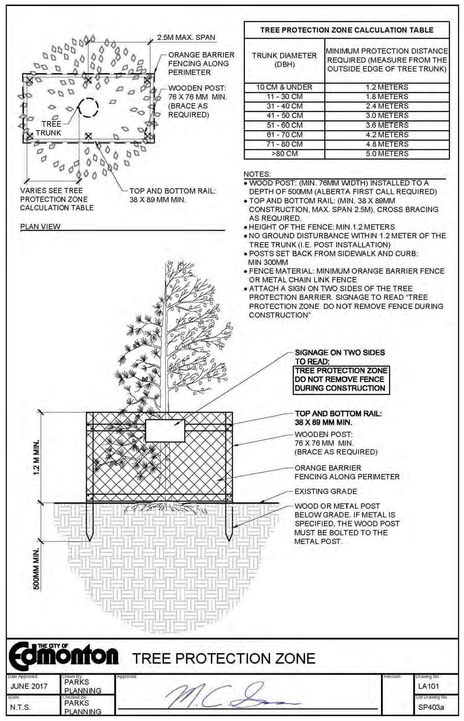
1. 12 1/2 GAUGE HIGH TENSILE WIRE FENCE. HORIZONTAL WIRES TO BE SPACED @ 150mm. VERTICAL WIRES TO TAPER TOWARDS FINISHED GRADE. STAPLE VERTICALLY @ 150mm O.C. USING GALVANIZED, BARBED 3.5mm DIA STAPLES. DRIVE STAPLES 50mm INTO POST.
2. 100 x 100mm PRESSURE TREATED WOOD CROSS BRACE.
3. 4300mm LONG PRESSURE TREATED WOOD POST. MIN TIP DIA. 150mm, MAX BUTT DIA. 200mm.
4. 250mm LONG GALVANIZED SPIKE. PRE-DRILL HOLE.
5. 100 x 100 x 300mm SUPPORT POST UNDER CROSS BRACE.
6. 2 - 9.75 GAUGE GALVANIZED WIRES (TWISTED). TENSION BATTEN TO BE LEFT IN PLACE.
7. 100mm LONG GALVANIZED ARDOX NAIL.
8. TOPSOIL
9. UNDISTURBED NATIVE CLAY.
10. STEEL 'T' POPST C/W GALVANIZED POST CLIPS AT EACH HORIZONTAL FENCE WIRE.

NOTES:

1. CONTRACTOR TO CALL ALBERTA ONE CALL AT 1-800-242-3447 TO HAVE EXISTING UTILITIES LOCATED PRIOR TO START OF ANY CONSTRUCTION.
2. PRESSURE TREATED POSTS TO BE TREATED WITH A SOLUTION OF PENTACHLOROPHENOL AND PETROLEUM TO CSA-080.
3. ALL FENCE POSTS SHALL BE PRESSURE TREATED PINE OR FIR TIMBER.
4. ALL LUMBER SHALL BE CLEAN, #1, CONSTRUCTION GRADE PINE, FIR OR SPRUCE MEMBERS, FINISHED AS PER THE DETAILS UNLESS OTHERWISE SPECIFIED.
5. ALL LUMBER SHALL BE STRAIGHT, SOUND AND FREE OF SPLINTS, WARPS, CRACKS, LARGE KNOTS AND OTHER DEFECTS.
6. CONTRACTOR TO CALL ALBERTA ONE CALL AT 1-800-242-3447 TO HAVE EXISTING UTILITIES LOCATED PRIOR TO START OF ANY CONSTRUCTION.
7. ALL CUTS AND BOLT HOLES TO BE TREATED TO MATCH ORIGINAL TREATMENT WHERE POSSIBLE.
8. POSTS SHALL BE INSTALLED WITH THE LARGE END DOWN.
9. FENCE TO BE INSTALLED AS CLOSE TO FINISH GRADE AS POSSIBLE. IF REQUIRED, ALLOWABLE MAXIMUM GAP IS 150mm.
10. BRACE PANELS TO BE A MAXIMUM OF 54.0m APART.
11. WIRE FABRIC MINIMUM OVERLAP 500mm AND MAXIMUM OVERLAP 1000mm TENSION FABRIC TO PROVIDE UNIFORM PULL FOR EACH RUN OF FABRIC BETWEEN BRACE PANELS
12. LINE AND STAY WIRES TO BE JOINED THROUGHOUT WITH TIGHT LOCK KNOT CONSTRUCTION.
13. ENSURE THAT FRONT OF POST IS 1.5 METERS FROM GASLINE.
14. ALL FENCES TO BE PLACED 150mm INSIDE PRIVATE PROPERTY.
15. ALL HARDWARE TO BE GALVANIZED.
16. DETAIL TO BE READ IN CONJUNCTION WITH THE WRITTEN SPECIFICATIONS AND DRAWINGS FOR THE PROJECT.

1 2440MM HT. WILDLIFE FENCE

SCALE: 1:75



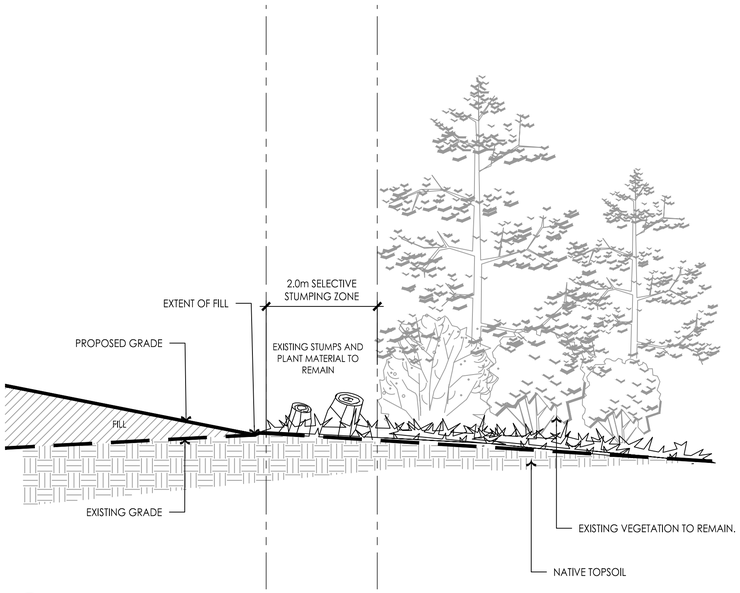
TREE PROTECTION ZONE CALCULATION TABLE	
TRUNK DIAMETER (DBH)	MINIMUM PROTECTION DISTANCE REQUIRED (MEASURE FROM THE OUTSIDE EDGE OF TREE TRUNK)
10 CM & UNDER	1.2 METERS
11 - 30 CM	1.8 METERS
31 - 40 CM	2.4 METERS
41 - 50 CM	3.0 METERS
51 - 60 CM	3.6 METERS
61 - 70 CM	4.2 METERS
71 - 80 CM	4.8 METERS
>80 CM	5.0 METERS

NOTES:

- WOOD POST: (MIN. 76MM WIDTH) INSTALLED TO A DEPTH OF 500MM (ALBERTA FIRST CALL REQUIRED)
- TOP AND BOTTOM RAIL: (MIN. 38 X 89MM CONSTRUCTION, MAX. SPAN 2.5M), CROSS BRACING AS REQUIRED.
- HEIGHT OF THE FENCE: MIN. 1.2 METERS
- NO GROUND DISTURBANCE WITHIN 1.2 METER OF THE TREE TRUNK (I.E. POST INSTALLATION)
- POSTS SET BACK FROM SIDEWALK AND CURB: MIN 300MM
- FENCE MATERIAL: MINIMUM ORANGE BARRIER FENCE OR METAL CHAIN LINK FENCE
- ATTACH A SIGN ON TWO SIDES OF THE TREE PROTECTION BARRIER. SIGNAGE TO READ "TREE PROTECTION ZONE DO NOT REMOVE FENCE DURING CONSTRUCTION"

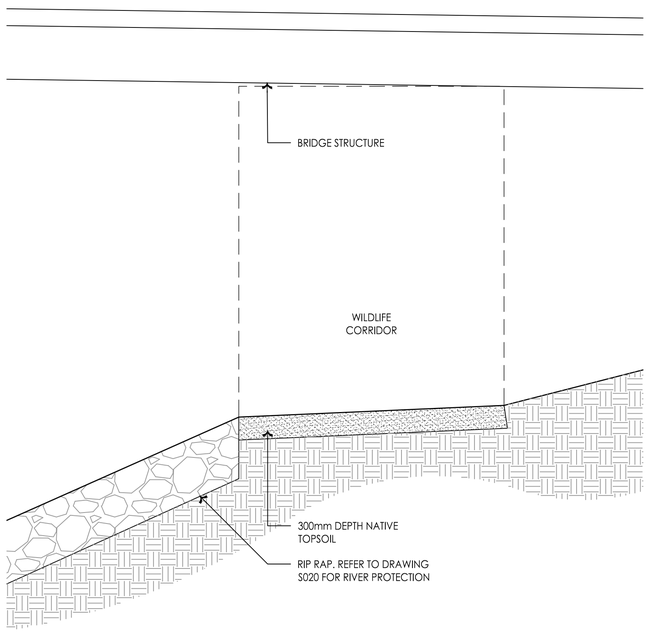
2 TREE PROTECTION - LA101

SCALE: N.T.S.



3 GRUBBING DETAIL

SCALE: 1:40



4 WILDLIFE CORRIDOR

SCALE: 1:40

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2.			
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Issued	By	Appd.	YY.MM.DD
2. SECOND SUBMISSION	CV	JL	25.01
1. FIRST SUBMISSION	CV	JL	24.02

Development Engineer, Sustainable Development

Approvals

4.
3.
2.
1.

Client/Project
BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
LANDSCAPE DETAILS

Permit-Seal

The Alberta Association of Landscape Architects

James Laidlaw
Date

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Project Number: 1161110195

File Name: 1161110195_details.dwg

CV	KM	CV/JL	24.01.26
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. L400-001

Revision 0

Sheet 15 of 17

2025/01/31 8:25 AM By: cvanalstine
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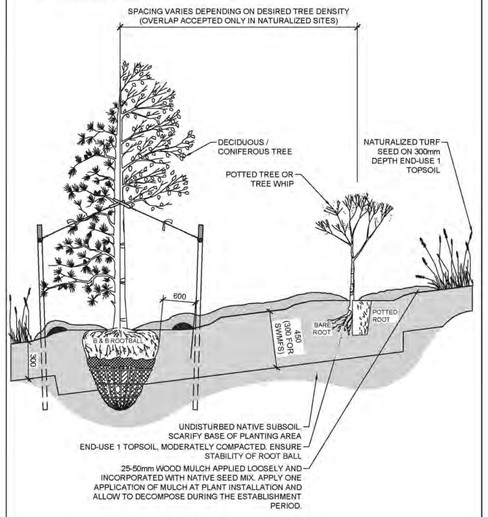
ORIGINAL SHEET - ISO A1

NOTES:
- ALL COMPONENTS AND WORKMANSHIP TO CONFORM TO SPECIFICATION SECTION 02931 NATURALIZATION AS WELL AS THE RELATED SECTIONS.
- PRUNE ONLY DEAD, BROKEN OR DISEASED BRANCHES TO MAINTAIN PROPER SHRUB FORM (DECIDUOUS ONLY).
- ALL TREE STAKES TO MAINTAIN MINIMUM 1.0m CLEARANCE FROM ALL U/G POWER, TELEPHONE AND GAS ALIGNMENTS.
- IF MINIMUM UTILITY SETBACKS PERMIT POSITION TREE STAKES INTO DIRECTION OF PREVAILING WINDS OR IF IN THE BOULEVARD THE STAKES SHOULD BE IN LINE WITH THE DIRECTION OF TRAFFIC.
- DIG ALL ROOT HOLES BY HAND WHEN CLOSER THAN 1.0m TO U/G POWER, TELEPHONE AND GAS ALIGNMENTS (REFER TO SECTION 7.6.2 AND 7.6.3 WHEN CLEARANCE CANNOT BE MAINTAINED FOR ANY EXCAVATIONS).
- ALL DIMENSIONS IN MILLIMETERS.



THE CITY OF Edmonton — TYPICAL TREE NATURALIZATION

Date Approved	Drawn by	Approved	Revision	Drawing No.
FEB 2021	DEDR			LA111
Scale	Checked by			Old Drawing No.
N.T.S.	OPEN SPACE DESIGN			N/A

1 TYP. TREE NATURALIZATION - LA111
SCALE: N.T.S.

NOTES:
- SPECIFICATIONS: ALL COMPONENTS AND WORKMANSHIP CONFORM TO SPECIFICATION SECTION 02931 NATURALIZATION AS WELL AS THE RELATED SECTIONS.
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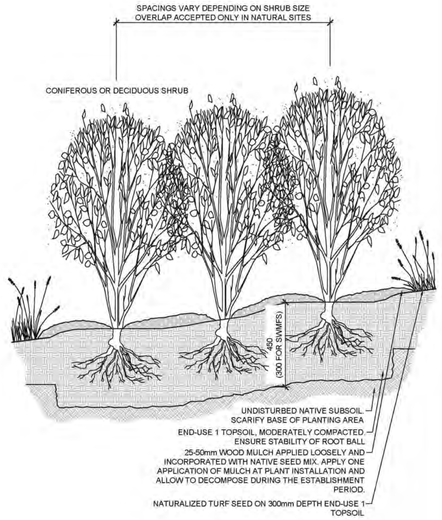
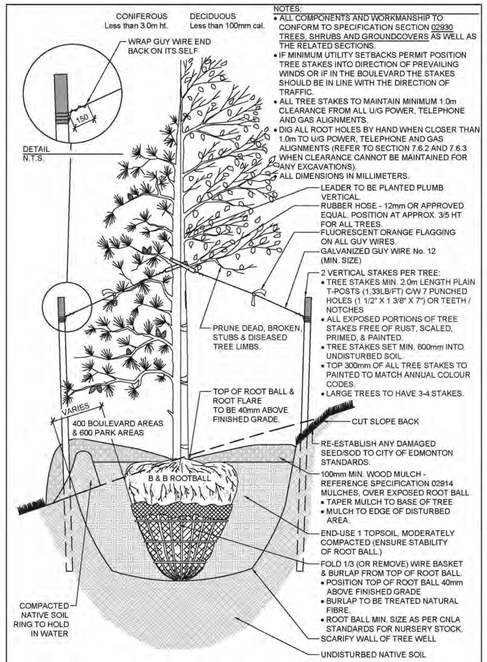
- ALL DIMENSIONS IN MILLIMETERS.



THE CITY OF Edmonton — TYPICAL SHRUB NATURALIZATION

Date Approved	Drawn by	Approved	Revision	Drawing No.
FEB 2021	DEDR			LA110B
Scale	Checked by			Old Drawing No.
N.T.S.	OPEN SPACE DESIGN			LA110

2 TYP. SHRUB NATURALIZATION - LA110B
SCALE: N.T.S.



NOTES:
- ALL COMPONENTS AND WORKMANSHIP TO CONFORM TO SPECIFICATION SECTION 02930 TREES, SHRUBS AND GROUNDCOVERS AS WELL AS THE RELATED SECTIONS.
- IF MINIMUM UTILITY SETBACKS PERMIT POSITION TREE STAKES INTO DIRECTION OF PREVAILING WINDS OR IF IN THE BOULEVARD THE STAKES SHOULD BE IN LINE WITH THE DIRECTION OF TRAFFIC.
- ALL TREE STAKES TO MAINTAIN MINIMUM 1.0m CLEARANCE FROM ALL U/G POWER, TELEPHONE AND GAS ALIGNMENTS.
- DIG ALL ROOT HOLES BY HAND WHEN CLOSER THAN 1.0m TO U/G POWER, TELEPHONE AND GAS ALIGNMENTS (REFER TO SECTION 7.6.2 AND 7.6.3 WHEN CLEARANCE CANNOT BE MAINTAINED FOR ANY EXCAVATIONS).
- ALL DIMENSIONS IN MILLIMETERS.

LEADER TO BE PLANTED PLUMB VERTICAL.
RUBBER HOSE - 12mm OR APPROVED EQUAL. POSITION AT APPROX. 3/5 HT. FOR ALL TREES.
FLUORESCENT ORANGE FLAGGING ON ALL GUY WIRES.
GALVANIZED GUY WIRE No. 12 (MIN. SIZE)
2 VERTICAL STAKES PER TREE:
- TREE STAKES MIN. 2.0m LENGTH PLAIN T-POSTS (1.33LB/FT) CW 7 PUNCHED HOLES (1 1/2" X 1 3/8" X 7') OR TEETH / NOTCHES
- ALL EXPOSED PORTIONS OF TREE STAKES FREE OF RUST, SCALED, PRIMED, & PAINTED.
- TREE STAKES SET MIN. 600mm INTO UNDISTURBED SOIL.
- TOP 300mm OF ALL TREE STAKES TO PAINTED TO MATCH ANNUAL COLOUR CODES.
- LARGE TREES TO HAVE 3-4 STAKES.

RE-ESTABLISH ANY DAMAGED SEED/SOD TO CITY OF EDMONTON STANDARDS.
100mm MIN. WOOD MULCH - REFERENCE SPECIFICATION 02914 MULCHES. OVER EXPOSED ROOT BALL.
- TAPER MULCH TO BASE OF TREE
- MULCH TO EDGE OF DISTURBED AREA.

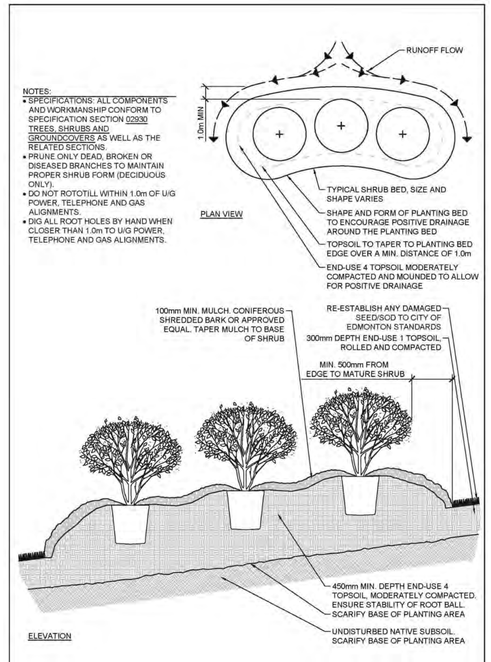
END-USE 1 TOPSOIL, MODERATELY COMPACTED (ENSURE STABILITY OF ROOT BALL.)
FOLD 1/3 (OR REMOVE) WIRE BASKET & BURLAP FROM TOP OF ROOT BALL.
- POSITION TOP OF ROOT BALL 40mm ABOVE FINISHED GRADE
- BURLAP TO BE TREATED NATURAL FIBRE.
- ROOT BALL MIN. SIZE AS PER CNLA STANDARDS FOR NURSERY STOCK.

SCARIFY WALL OF TREE WELL

THE CITY OF Edmonton — TYPICAL TREE PLANTING ON SLOPE

Date Approved	Drawn by	Approved	Revision	Drawing No.
FEB 2021	DEDR			LA107
Scale	Checked by			Old Drawing No.
N.T.S.	OPEN SPACE DESIGN			SP400i

3 TYP. TREE PLANTING ON SLOPE - LA107
SCALE: N.T.S.



NOTES:
- SPECIFICATIONS: ALL COMPONENTS AND WORKMANSHIP CONFORM TO SPECIFICATION SECTION 02930 TREES, SHRUBS AND GROUNDCOVERS AS WELL AS THE RELATED SECTIONS.
- PRUNE ONLY DEAD, BROKEN OR DISEASED BRANCHES TO MAINTAIN PROPER SHRUB FORM (DECIDUOUS ONLY).
- DO NOT ROTOTILL WITHIN 1.0m OF U/G POWER, TELEPHONE AND GAS ALIGNMENTS.
- DIG ALL ROOT HOLES BY HAND WHEN CLOSER THAN 1.0m TO U/G POWER, TELEPHONE AND GAS ALIGNMENTS.

THE CITY OF Edmonton — TYPICAL SHRUB PLANTING BED ON A SLOPE

Date Approved	Drawn by	Approved	Revision	Drawing No.
FEB 2021	DEDR			LA109
Scale	Checked by			Old Drawing No.
N.T.S.	OPEN SPACE DESIGN			SP401b

4 TYP. SHRUB PLANTING BED ON SLOPE - LA109
SCALE: N.T.S.

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Development Engineer: Sustainable Development	By	YY.MM.DD
Approvals		
4.		
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1.		
Revision	By / Appd.	YY.MM
4.		
3.		
2. SECOND SUBMISSION	CV / JL	25.01
1. FIRST SUBMISSION	CV / JL	24.02
Issued	By / Appd.	YY.MM

Client/Project
BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
RESTORATION PLANTING DETAILS

Permit-Seal

Project Number:	1161110195
File Name:	1161110195_details.dwg

CV	KM	CV/JL	24.01.26
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. L400-002
Revision 0
Sheet 16 of 17

2025/01/31 8:25 AM By: cvanatstine
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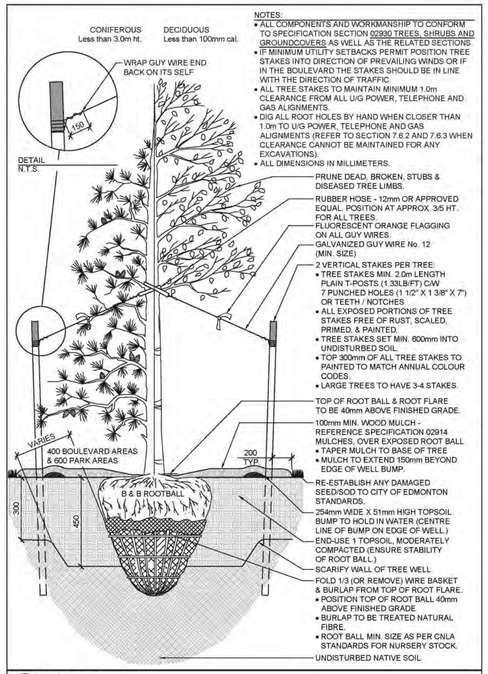
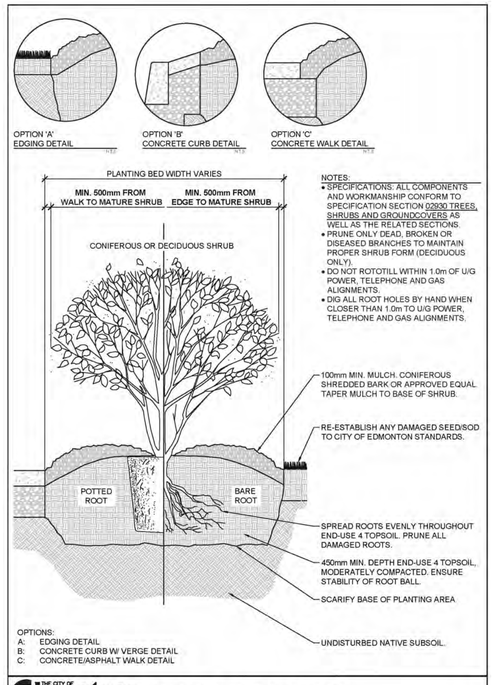


NOTES:
- ALL COMPONENTS AND WORKMANSHIP TO CONFORM TO SPECIFICATION SECTION 02930 TREES, SHRUBS AND GROUNDCOVERS AS WELL AS THE RELATED SECTIONS.
- IF MINIMUM UTILITY SETBACKS PERMIT POSITION TREE STAKES INTO DIRECTION OF PREVAILING WINDS OR IF IN THE BOULEVARD THE STAKES SHOULD BE IN LINE WITH THE DIRECTION OF TRAFFIC.
- ALL TREE STAKES TO MAINTAIN MINIMUM 1.0m CLEARANCE FROM ALL U/G POWER, TELEPHONE AND GAS ALIGNMENTS.
- DIG ALL ROOT HOLES BY HAND WHEN CLOSER THAN 1.0m TO U/G POWER, TELEPHONE AND GAS ALIGNMENTS (REFER TO SECTION 7.6.2 AND 7.6.3 WHEN CLEARANCE CANNOT BE MAINTAINED FOR ANY EXCAVATIONS).
- ALL DIMENSIONS IN MILLIMETERS.

THE CITY OF Edmonton — TYPICAL TREE INSTALLATION

Date Approved	Drawn By	Approved	Revision	Drawing No.
FEB 2021	DEDR	M.C.Stn		LA102
Scale	Checked By			Old Drawing No.
N.T.S.	OPEN SPACE DESIGN			SP400a

1 TYP. TREE INSTALLATION - LA102
SCALE: N.T.S.

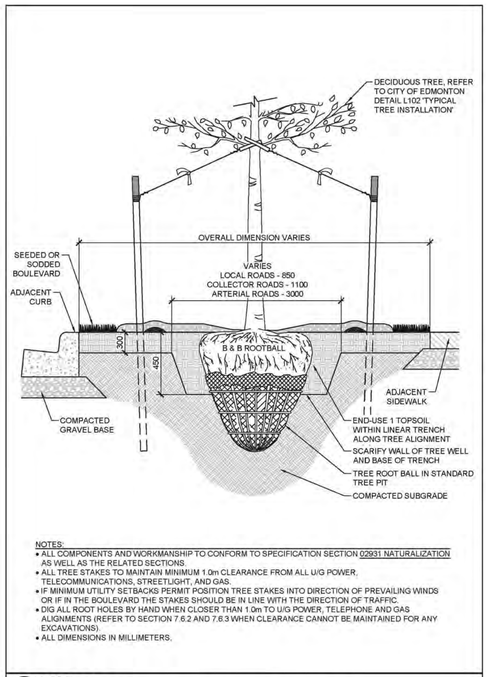


NOTES:
- SPECIFICATIONS: ALL COMPONENTS AND WORKMANSHIP CONFORM TO SPECIFICATION SECTION 02930 TREES, SHRUBS AND GROUNDCOVERS AS WELL AS THE RELATED SECTIONS.
- PRUNE ONLY DEAD, BROKEN OR DISEASED BRANCHES TO MAINTAIN PROPER SHRUB FORM (DECIDUOUS ONLY).
- DO NOT ROTOTILL WITHIN 1.0m OF U/G POWER, TELEPHONE AND GAS ALIGNMENTS.
- DIG ALL ROOT HOLES BY HAND WHEN CLOSER THAN 1.0m TO U/G POWER, TELEPHONE AND GAS ALIGNMENTS.

THE CITY OF Edmonton — TYPICAL SHRUB PLANTING

Date Approved	Drawn By	Approved	Revision	Drawing No.
FEB 2021	DEDR	M.C.Stn		LA108B
Scale	Checked By			Old Drawing No.
N.T.S.	OPEN SPACE DESIGN			LA108

2 TYP. SHRUB PLANTING - LA108B
SCALE: N.T.S.

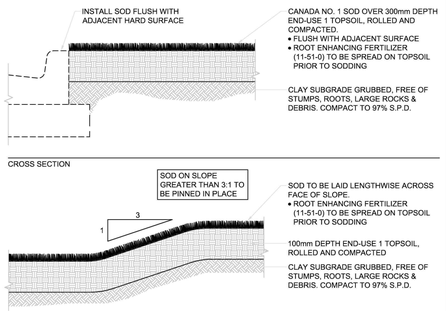


NOTES:
- ALL COMPONENTS AND WORKMANSHIP TO CONFORM TO SPECIFICATION SECTION 02931 NATURALIZATION AS WELL AS THE RELATED SECTIONS.
- ALL TREE STAKES TO MAINTAIN MINIMUM 1.0m CLEARANCE FROM ALL U/G POWER, TELECOMMUNICATIONS, STREETLIGHT, AND GAS.
- IF MINIMUM UTILITY SETBACKS PERMIT POSITION TREE STAKES INTO DIRECTION OF PREVAILING WINDS OR IF IN THE BOULEVARD THE STAKES SHOULD BE IN LINE WITH THE DIRECTION OF TRAFFIC.
- DIG ALL ROOT HOLES BY HAND WHEN CLOSER THAN 1.0m TO U/G POWER, TELEPHONE AND GAS ALIGNMENTS (REFER TO SECTION 7.6.2 AND 7.6.3 WHEN CLEARANCE CANNOT BE MAINTAINED FOR ANY EXCAVATIONS).
- ALL DIMENSIONS IN MILLIMETERS.

THE CITY OF Edmonton — TYPICAL TREE ROOT TRENCH

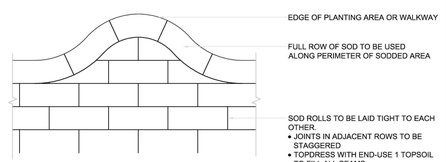
Date Approved	Drawn By	Approved	Revision	Drawing No.
FEB 2021	DEDR	M.C.Stn		LA113
Scale	Checked By			Old Drawing No.
N.T.S.	OPEN SPACE DESIGN			N/A

3 TYP. TREE ROOT TRENCH - LA113
SCALE: N.T.S.



CROSS SECTION

CROSS SECTION THROUGH SLOPE



PLAN VIEW

NOTES:
- SPECIFICATIONS: ALL COMPONENTS AND WORKMANSHIP CONFORM TO SPECIFICATION SECTION 02920 SEED AND SOD AS WELL AS THE RELATED SECTIONS.

THE CITY OF Edmonton — SOD INSTALLATION

Date Approved	Drawn By	Approved	Revision	Drawing No.
FEB 2021	DEDR	M.C.Stn		LA300
Scale	Checked By			Old Drawing No.
N.T.S.	OPEN SPACE DESIGN			SP402

4 SOD INSTALLATION - LA300
SCALE: N.T.S.

ALL DESIGNS, LAYOUTS, DETAILS, AND OTHER INFORMATION SHOWN IN THIS SET OF PLANS SHALL ADHERE TO THE PROJECT NOTES AND APPLICABLE SPECIFICATIONS

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Development Engineer: Sustainable Development

Approvals	By	YY.MM.DD
4.		
3.		
2.		
1.		

Revision	By	Appd.	YY.MM
4.			
3.			
2. SECOND SUBMISSION	CV	JL	25.01
1. FIRST SUBMISSION	CV	JL	24.02

Issued	By	Appd.	YY.MM

Client/Project
BROOKFIELD RESIDENTIAL (ALBERTA) LP

ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
BOULEVARD PLANTING DETAILS

Permit-Seal

Project Number: 1161110195
File Name: 1161110195_details.dwg

CV	KM	CV/JL	24.01.26
Dwn.	Chkd.	Dsgn.	YY.MM.DD

Drawing No. L400-003
Revision 0
Sheet 17 of 17

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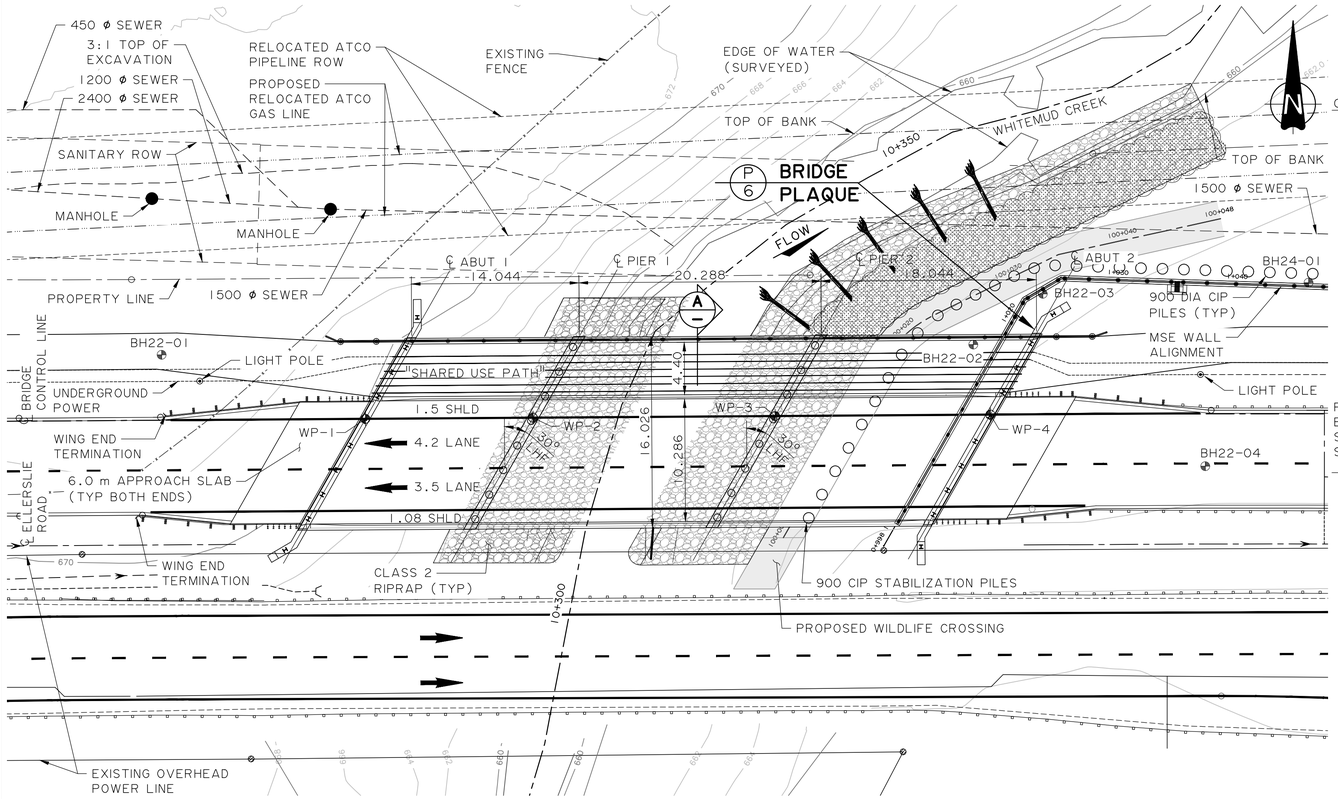
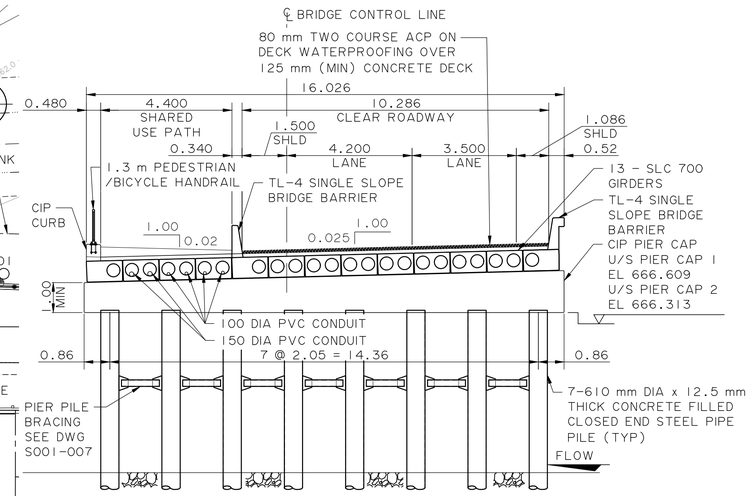


PLAN
1:250

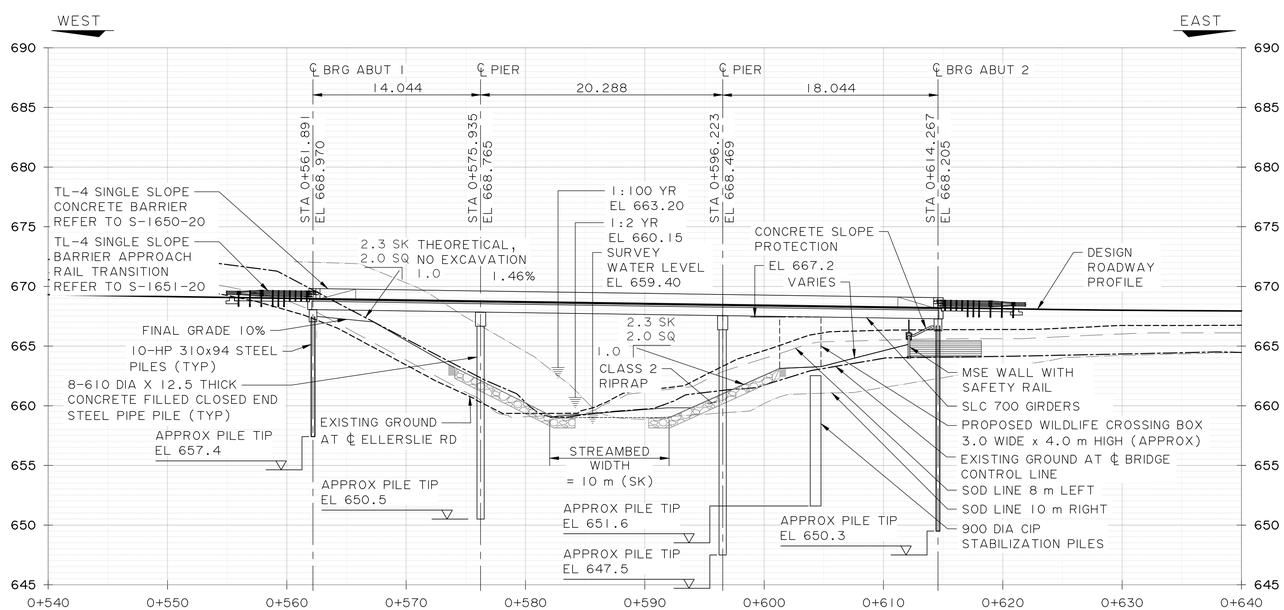


A SECTION
1:100

WORKING POINT (WP) TABLE				
WP	ELEVATION	NORTHING	EASTING	NOTE
1	668.970	5921424.137	28769.991	BRG ABUT 1
2	668.765	5921424.233	28784.035	BRG PIER 1
3	668.469	5921424.371	28804.323	BRG PIER 2
4	668.205	5921424.494	28822.366	BRG ABUT 2

GENERAL NOTES:

- ALL DIMENSIONS SHOWN ON THE GENERAL LAYOUT ARE GIVEN IN METERS UNLESS NOTED OTHERWISE.
- GIRDER LENGTHS SHOWN ARE MEASURED ALONG BOTTOM FLANGE AND ARE CORRECT AT +20°C. ABUTMENT AND PIER STATIONINGS ARE LOCATED SUCH THAT BEARINGS ARE CENTERED AT −5°C. PRECAST SUPPLIERS SHALL MAKE APPRORIATE ALLOWANCE FOR PRESTRESS SHORTENING, SHRINKAGE & CREEP UP TO THE TIME OF GIRDER ERECTION.



ELEVATION
1:250

SHEET	DESCRIPTION	DRAWING
24	CONCRETE STABILIZATION PILE DETAIL	S001-024
23	CONCRETE STABILIZATION PILE PLAN	S001-023
22	RIVER PROTECTION - SHEET 2	S001-022
21	RIVER PROTECTION - SHEET 1	S001-021
20	MSE WALL DRAIN TROUGH	S001-020
19	MSE WALL SAFETY FENCE	S001-019
18	MSE WALL SAFETY RAIL	S001-018
17	MSE WALL DETAILS - SHEET 2	S001-017
16	MSE WALL DETAILS - SHEET 1	S001-016
15	MSE WALL ELEVATION	S001-015
14	MSE WALL PLAN	S001-014
13	HANDRAIL DETAILS	S001-013
12	DECK DETAIL - SHEET 2	S001-012
11	DECK DETAILS - SHEET 1	S001-011
10	GIRDER DETAILS - SHEET 2	S001-010
9	GIRDER DETAILS - SHEET 1	S001-009
8	PIER DETAILS	S001-008
7	ABUTMENT SECTIONS AND DETAILS	S001-007
6	ABUTMENT 2 PLAN AND ELEVATION	S001-006
5	ABUTMENT 1 PLAN AND ELEVATION	S001-005
4	PILE LAYOUT	S001-004
3	SOIL INFORMATION SHEET	S001-003
2	SITE INFORMATION SHEET	S001-002
1	GENERAL LAYOUT	S001-001

INDEX

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Notes

Revision	By	Appd	YYYY.MM.DD
2 2ND SUBMISSION	RC	RM	2025.01.31
1 1ST SUBMISSION	RC	JC	2024.02.02

Issued	By	Appd	YYYY.MM.DD
File Name: 1161110185_GENERAL_LAYOUT	JDC	RC	???
	Dwn.	Dsgn.	Chkd.
			2023.07.22

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Client/Project
BROOKFIELD RESIDENTIAL (ALBERTA) LP
ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
B524 - ELLERSLIE ROAD WESTBOUND BRIDGE OVER WHITEMUD CREEK
GENERAL LAYOUT

Project No. 1161 110185
Scale
Revision 0
Sheet 1 of 24
Drawing No. S001-001

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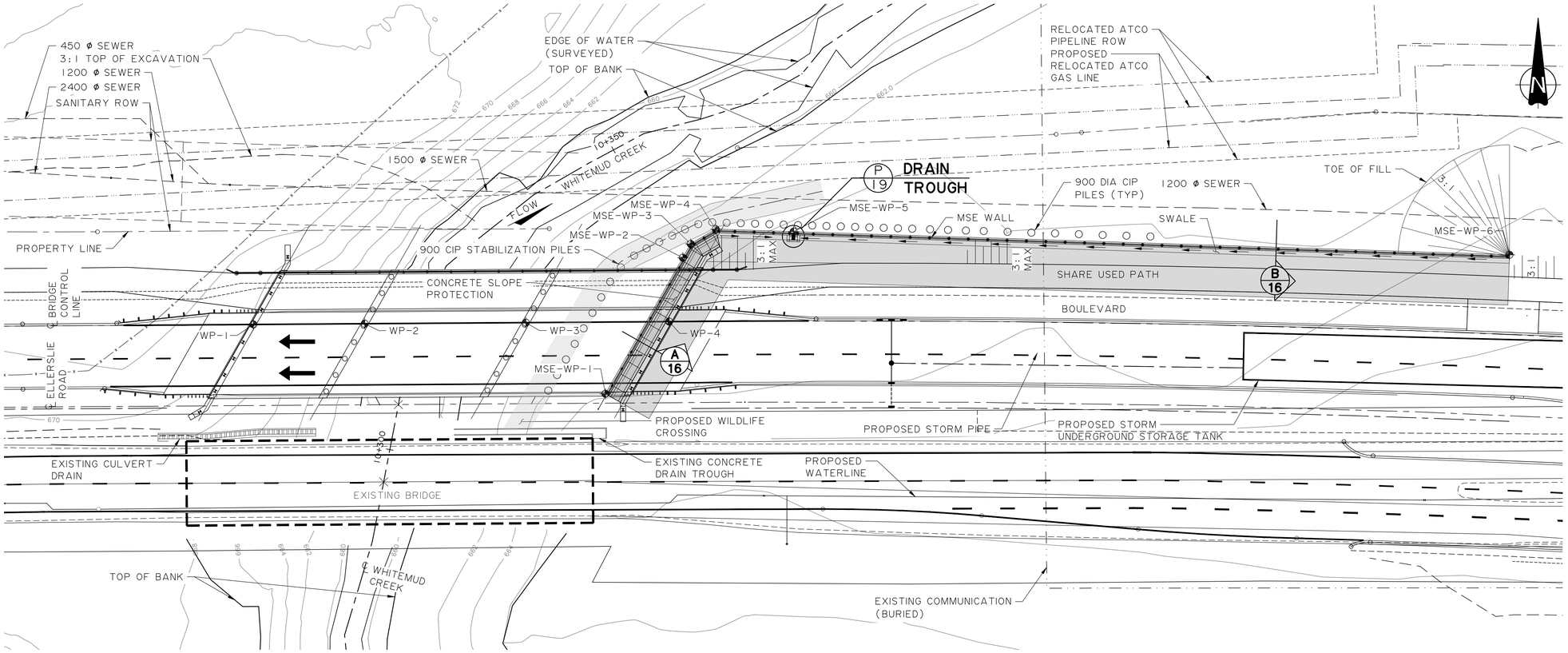


PLAN
1:300

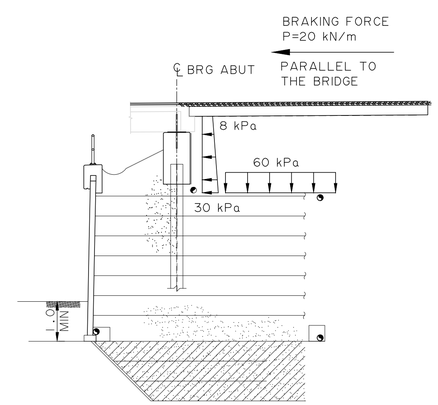
WORKING POINT (WP) TABLE			
WP#	ELEVATION	NORTHING	EASTING
MSE-WP-1	665.885	5921415.413	28814.347
MSE-WP-2	665.885	5921432.540	28824.081
MSE-WP-3	666.506	5921434.280	28825.069
MSE-WP-4	667.644	5921436.139	28828.240
MSE-WP-5	667.606	5921435.822	28838.037
MSE-WP-6	669.101	5921432.904	28928.169

NOTES:

- FOR PILE LAYOUT REFER TO SHEET S001-004
- THE MSE WALL DESIGN AND CONSTRUCTION SHALL FOLLOW THE LATEST VERSION OF "SPECIFICATION FOR BRIDGE CONSTRUCTION" FROM ALBERTA TRANSPORTATION
- MSE WALL SUPPLIER SHALL PROVIDE DETAILED DESIGN/SHOP DRAWINGS WHICH ARE TO SHOW HOW THE MSE WALL INTERFACES WITH THE STRUCTURE AND MEETS THE DESIGN REQUIREMENTS. THESE DRAWINGS SHALL BE SUBJECT TO REVIEW BY THE ENGINEER FOR COMPLIANCE WITH THESE DESIGN REQUIREMENTS
- PRECAST PANEL AND ATTACHMENT DETAIL SHALL BE DESIGNED TO ACCOMMODATE THE RESIDUAL SETTLEMENT OF PANEL AFTER INSTALLATION. REFER TO GEOTECHINCAL REPORT
- REFER TO DRAWING C005-001 FOR ROADWAY CURB & GUTTER AND C006-001 FOR GRADING

ITEM	UNIT	ESTIMATE	AS CONSTR
CAST-IN-PLACE COPING	m^3	34	
MSE WALL AREA	m^2	590	
REINFORCEMENT STEEL (COPING) - CORROSION RESISTANT	kg	2512	
CONCRETE LEVELLING PADS	m^3	6	
BACKFILL - CRUSHED GRANULAR (DES. 2, CL. 20)	m^3	3790	
CONCRETE SLOPE PROTECTION - CLASS C CONCRETE	m^2	41	
REINFORCING STEEL - SLOPE PROTECTION - PLAIN	kg	689	
150 PERFORATED PIPE	m	454	

QUANTITY ESTIMATE



HORIZONTAL LOADS TO MSE WALL FROM ABUTMENT BACKFILL AND SUPERSTRUCTURE

NTS

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2	2ND SUBMISSION	RC	RMcD	2025.01.31
1	1ST SUBMISSION	RC	JC	2024.02.02

Issued	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD
File Name: 1161110185_MSE_PLAN	JDC	RC	???	2023.12.04

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ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
B524 - ELLERSLIE ROAD WESTBOUND BRIDGE OVER WHITEMUD CREEK
MSE WALL PLAN AND CIP PILE

Project No. 1161 110185
Scale
Revision 0
Sheet 14 of 24
Drawing No. **S001-014**

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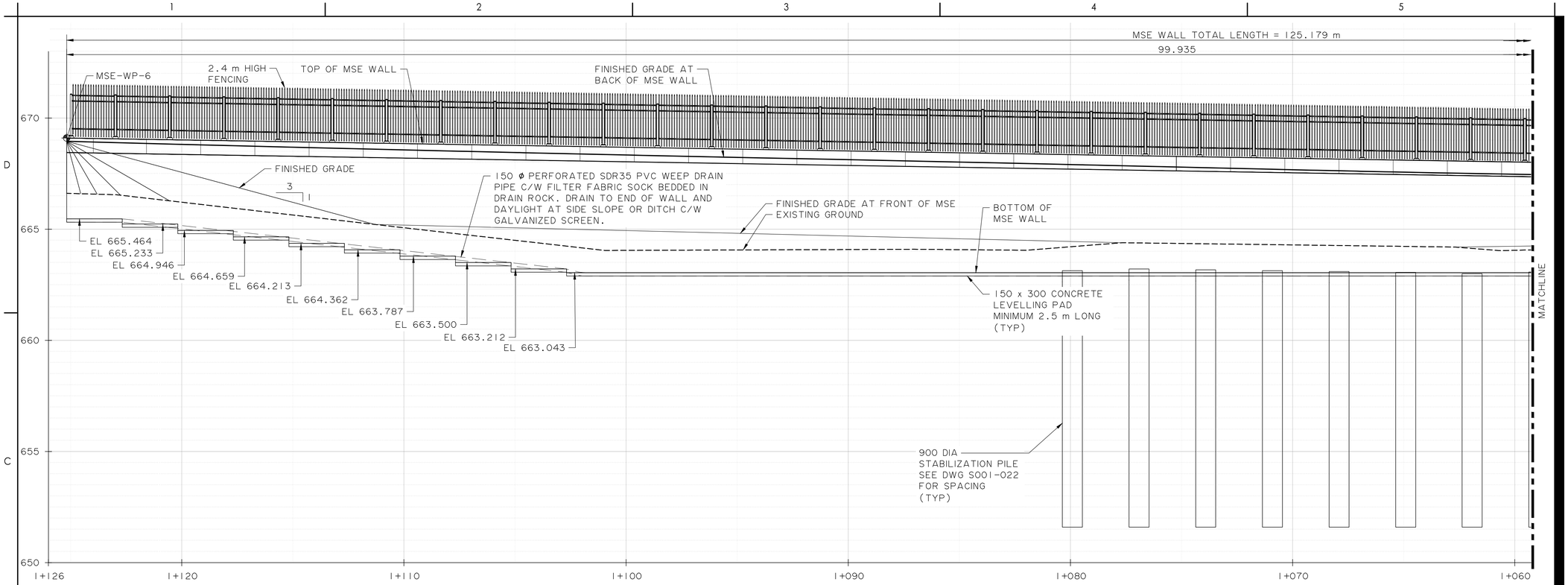

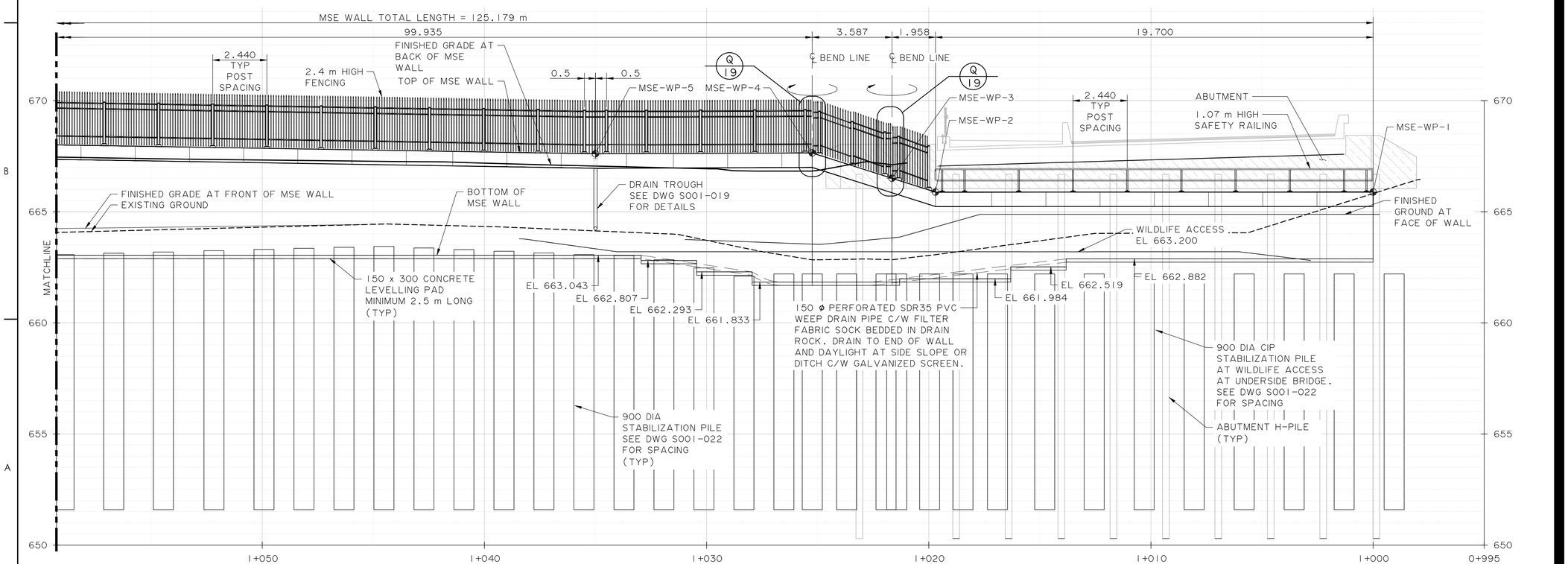

MSE WALL ELEVATION

LOOKING SQUARE TO WALL 1:100

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1 1ST SUBMISSION	RC	JC	2024.02.02

Issued	By	Appd	YYYY.MM.DD
File Name: 1161110185_MSE_PLAN	JDC	RC	SL	2023.12.04
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

EDMONTON, AB

Title

ELLERSLIE ROAD
ECO STATION RD. TO GLENRIDDING
MSE WALL ELEVATION

Project No. 1161 110185

Scale

Revision 0

Sheet 15 of 24

Drawing No. **S001-015**

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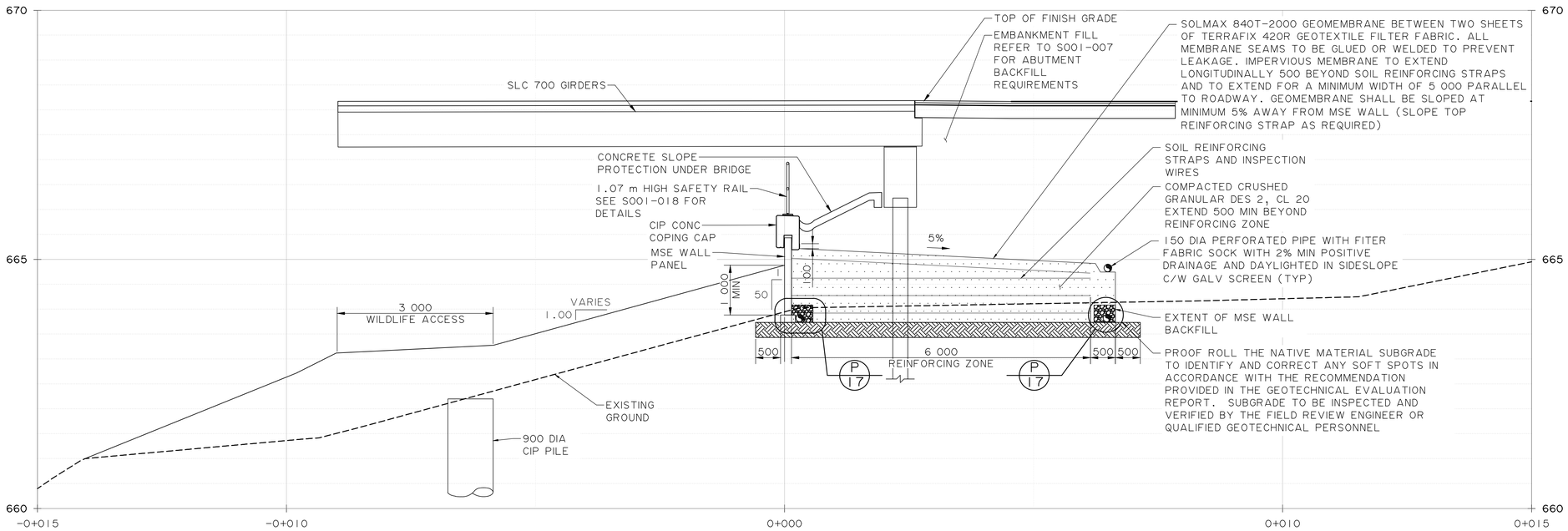

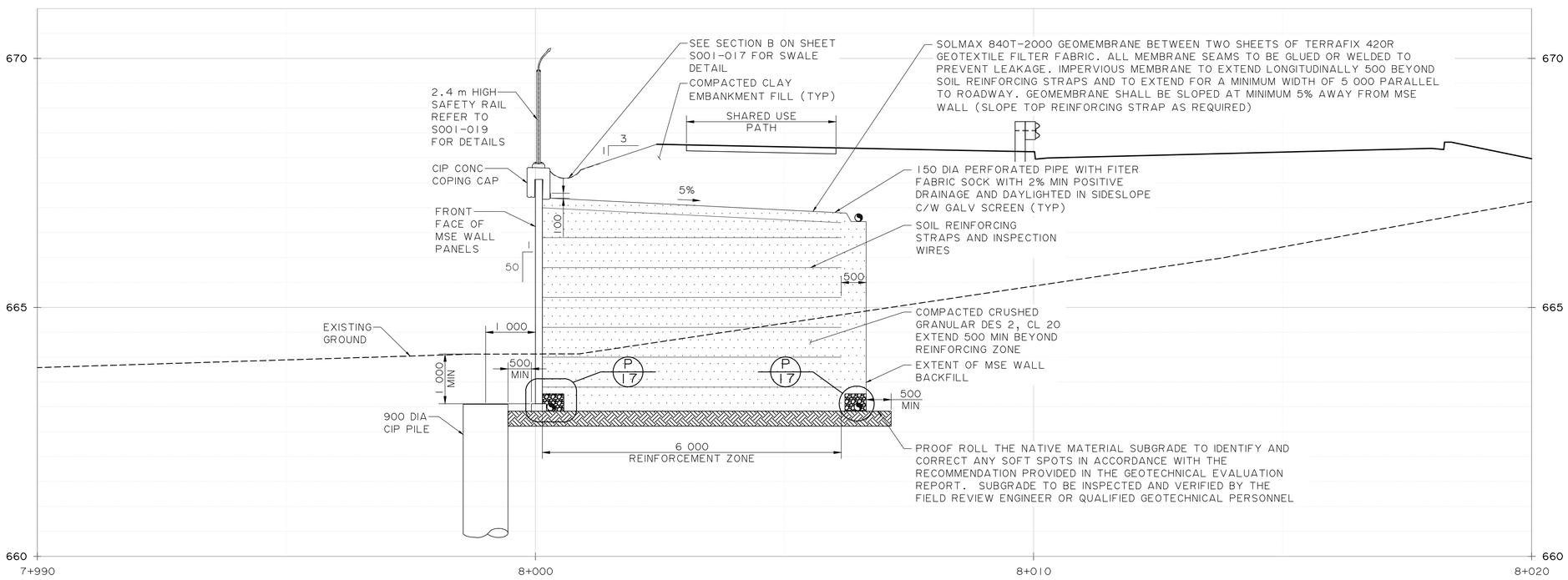

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1 1ST SUBMISSION	RC	JC	2024.02.02

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	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

EDMONTON, AB

Title

ELLERSLIE ROAD
BRIDGE OVER WHITEMUD CREEK
MSE WALL DETAILS - SHEET 1

Project No. 1161 110185

Scale

Revision 0

Sheet 16 of 24

Drawing No. **S001-016**

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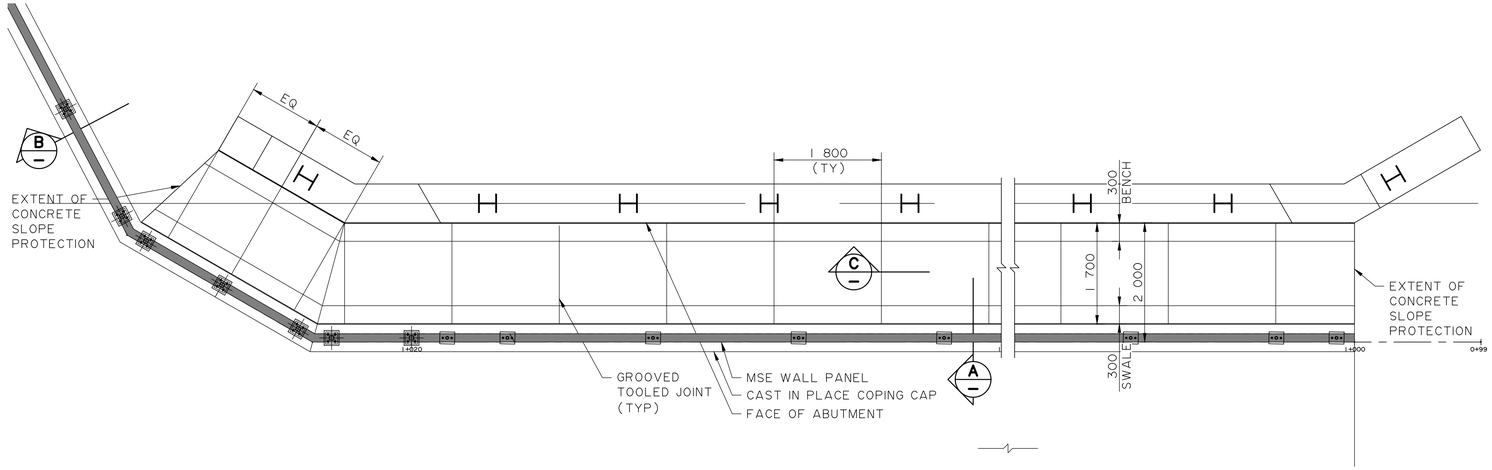
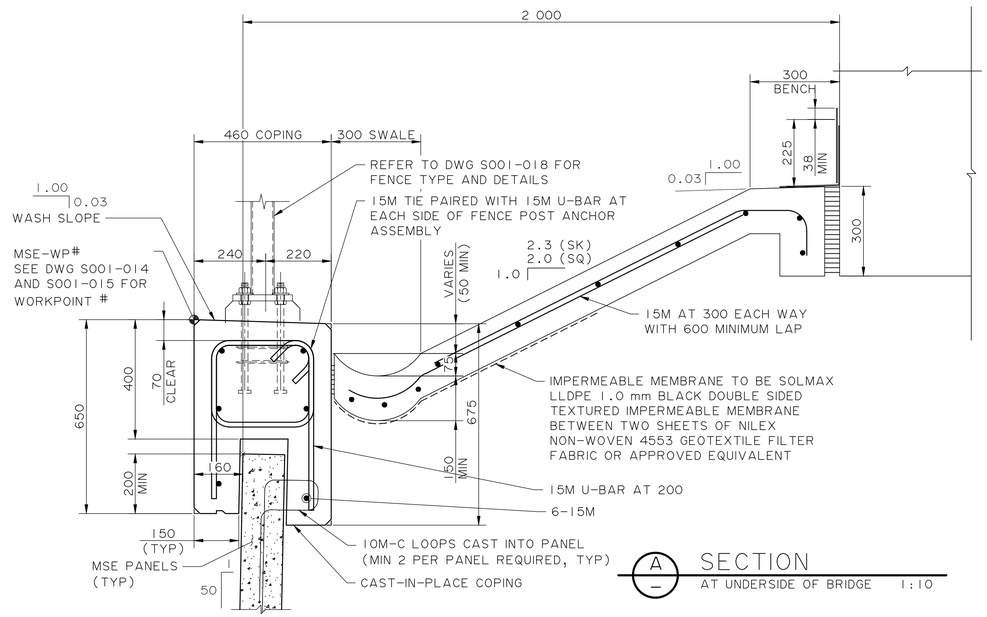


CONCRETE SLOPE PROTECTION PLAN

1:25

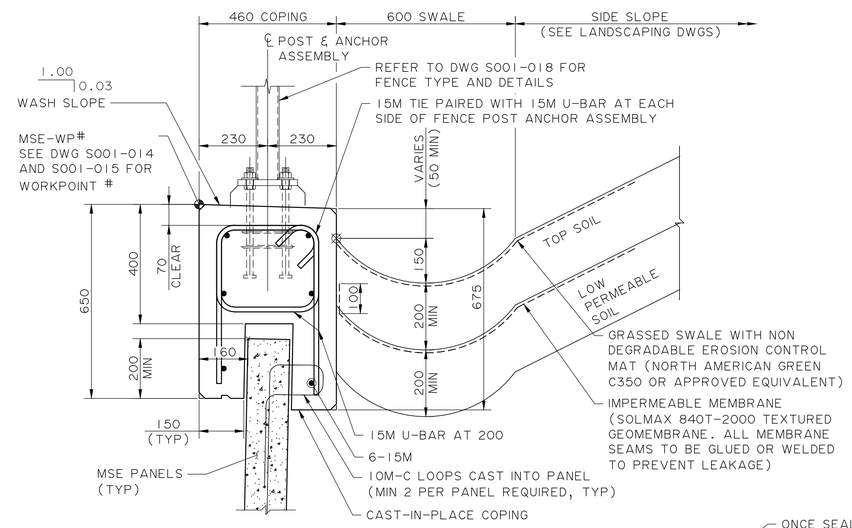
NOTES:

- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE
- ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH SECTION 4 OF THE STANDARD SPECIFICATIONS FOR BRIDGE CONSTRUCTION 2020
- REINFORCING STEEL SHALL BE PLAIN REINFORCEMENT AND BE IN ACCORDANCE WITH SECTION 5 OF THE STANDARD SPECIFICATION FOR BRIDGE CONSTRUCTION 2020
- CONCRETE SHALL BE CLASS C WITH MINIMUM 28 DAY COMPRESSIVE STRENGTH OF $f'c$ = 35 MPa
- ASPHALT IMPREGNATED FIBRE BOARD (AIFB) SHALL MEET THE REQUIREMENTS OF ASTM D1751
- CLOSED CELL FOAM SHALL BE EVAZOTE CROSSED-LINKED ETHYLENE VINYL ACETATE COPOLYMER 30 kg/m^3
- ALL CONCRETE SHALL BE PLACED IN ALTERNATE HORIZONTAL OR VERTICAL COURSES. FIRST COURSE SHALL HAVE CURED A MINIMUM 24 HOURS PRIOR TO PLACING ADJACENT COURSES
- ALL JOINTS SHALL BE FORMED USING A BRONZE SIDEWALK TYPE GROOVING TOOL 100 WIDE AND ROUNDED EDGES TO 6 RADIUS
- CONCRETE SURFACES BETWEEN TOOLED GROOVES SHALL BE GIVEN A CLASS 5 FINISH. BROOM FINISH SHALL BE PARALLEL TO THE ABUTMENT SEAT
- TWO COATS OF A TYPE 2 CURING COMPOUND MEETING THE REQUIREMENTS OF ASTM C309 OR C1315 SHALL BE APPLIED TO CONCRETE SURFACES IN ACCORDANCE WITH SECTION 4 OF THE STANDARD SPECIFICATIONS FOR BRIDGE CONSTRUCTION 2020
- CLEAR COVER IS 60 UNLESS NOTED OTHERWISE. THE CONCRETE COVER TO REINRORCING STEEL SHALL BE WITHIN CONCRETE PLACEMENT TOLERANCES AS SPECIFIED IN THE STANDARD SPECIFICATIONS FOR BRIDGE CONSTRUCTION 2020
- STEEL SHEET FLASHING SHALL CONFORM TO ASTM A653/A653M AND BE GALVANIZED



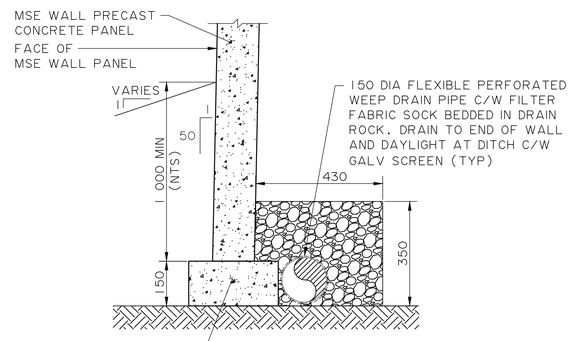
A SECTION

AT UNDERSIDE OF BRIDGE 1:10



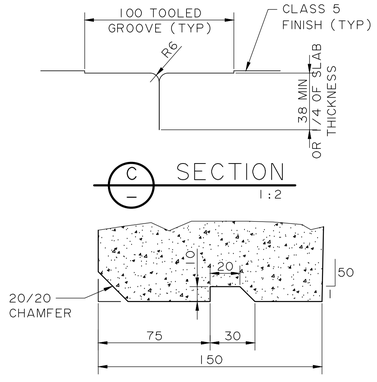
B SECTION

AT SIDESLOPE 1:10



P DETAIL

1:10

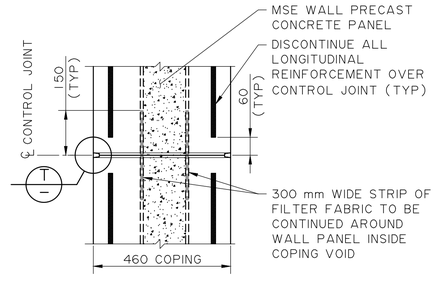


C SECTION

1:2

Q DRIP GROOVE DETAIL

1:2

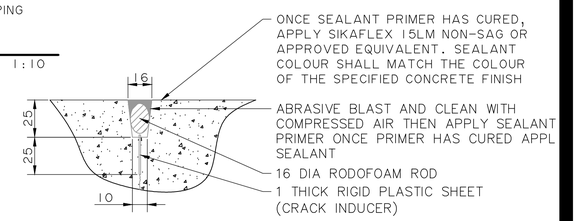


NOTE:

CONTROL JOINTS SHALL BE LOCATED AT THE CENTERLINE OF THE PRECAST CONCRETE FASCIA PANEL JOINTS

COPING DETAIL PLAN

1:10



CONTROL JOINT SECTION

1:2

NOTES:

- CAST-IN-PLACE CONCRETE COPING SHALL BE PLACED CONTINUOUSLY WITH FORMED CONTROL JOINTS AT MAX 2440. LAST SECTION CAN BE LONGER THAN 2440 AT MSE WALL ENDS
- AT CONTROL JOINT, LONGITUDINAL REINFORCEMENT SHALL BE DISCONTINUOUS AND HAVE 60 CLEAR CONCRETE COVER FROM THE CENTERLINE OF THE JOINTS
- CENTER CONTROL JOINTS BETWEEN POSTS OR MINIMUM 300 mm OF FENCE POST CENTER
- CONTROL JOINT SEALANT SHALL BE APPLIED AND CURED

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Revision	By	Appd	YYYY.MM.DD
2 2ND SUBMISSION	RC	RM	2025.01.31
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Issued	By	Appd	YYYY.MM.DD
File Name: 1161110185_MSE_PLAN	JDC	RC	SL	2023.12.04
	Dwn.	Dsgn.	Chkd.	YYYY.MM.DD

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Client/Project
BROOKFIELD RESIDENTIAL (ALBERTA) LP

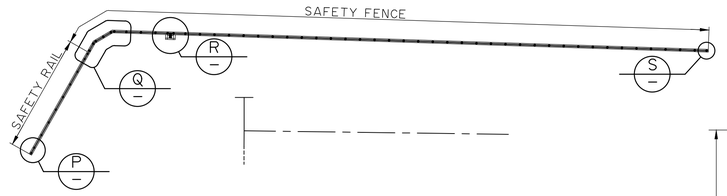
ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

EDMONTON, AB

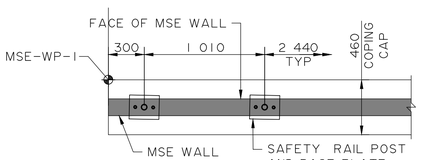
Title
ELLERSLIE ROAD
BRIDGE OVER WHITEMUD CREEK
MSE WALL DETAILS - SHEET 2

Project No. 1161 110185
Scale
Revision 0
Sheet 17 of 24
Drawing No. **S001-017**

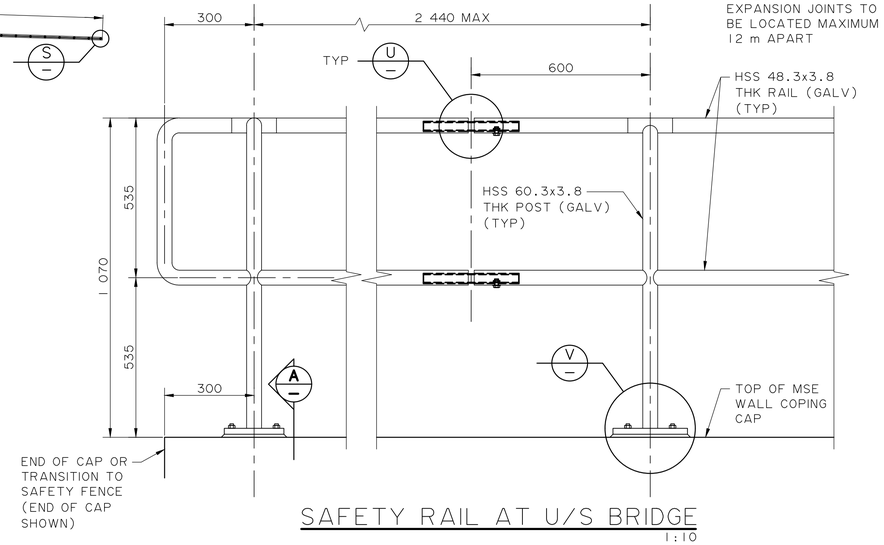
ORIGINAL SHEET - ANSI D



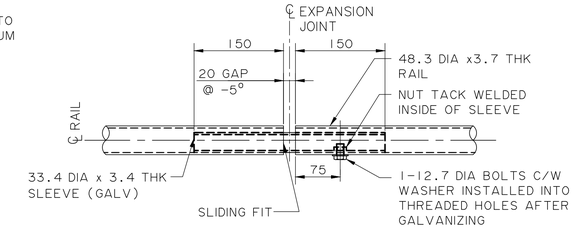
KEY PLAN
SAFETY RAIL AND SAFETY FENCE LOCATION



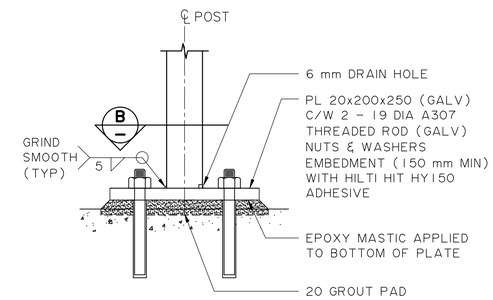
P DETAIL
1:25



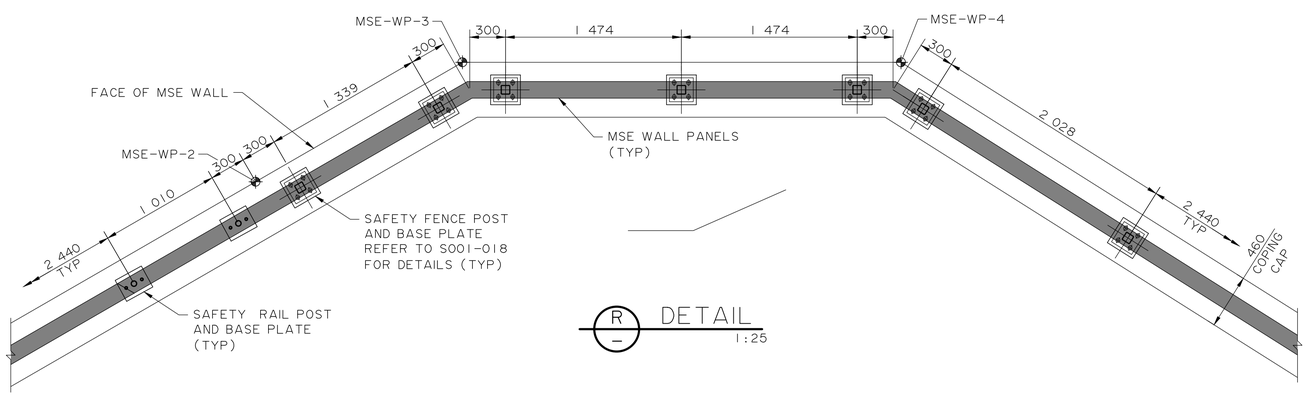
SAFETY RAIL AT U/S BRIDGE
1:10



U DETAIL
1:5



V DETAIL
1:5



R DETAIL
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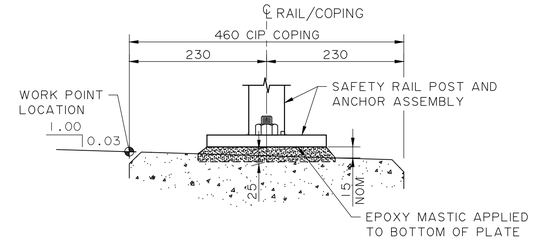

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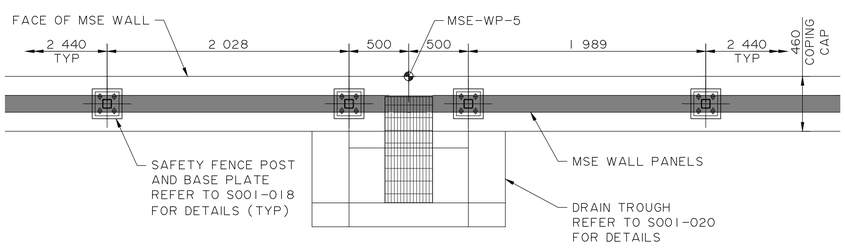

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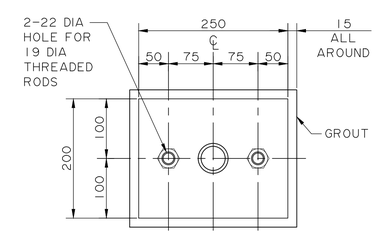

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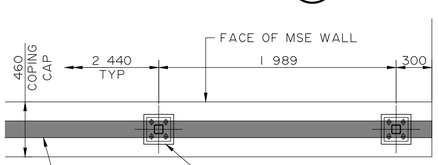

T DETAIL
1:25

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ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
ELLERSLIE ROAD
BRIDGE OVER WHITEMUD CREEK
MSE WALL SAFETY RAIL

Project No. 1161 110185
Scale
Revision 0
Sheet 18 of 24
Drawing No. **S001-018**

\\cd1001-c200\workgroup\1161\active\1161110185\drawing\structures\detail_design\1161110185_mse_plan
2025.01.30 4:13:25 PM
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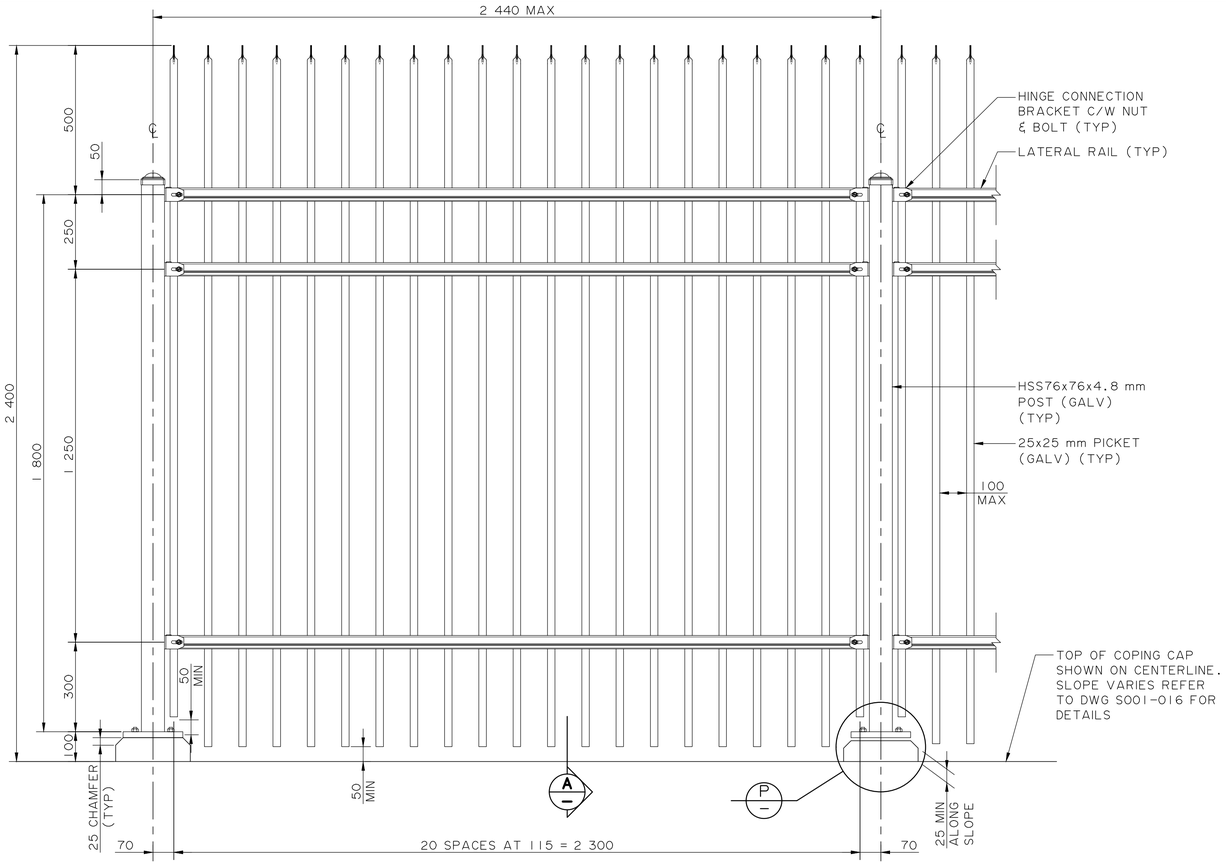
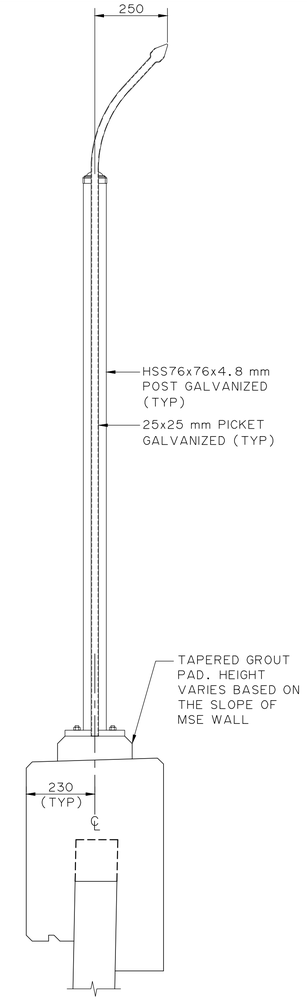


TYPICAL FENCING PANEL
1:10

NOTE:
1. TYPICAL 2440 mm LONG PANELS SHOWN
2. ALL OTHER PANELS SIZES ARE SIMILAR



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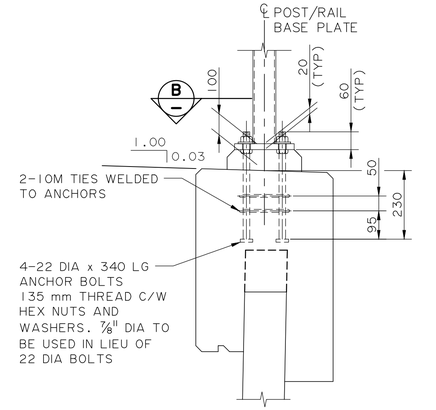
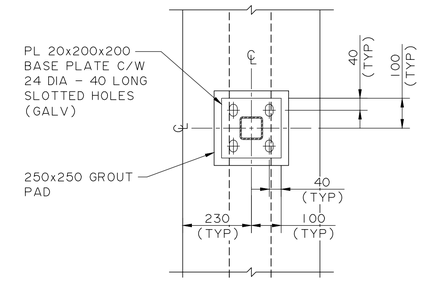


P DETAIL
1:10



B SECTION
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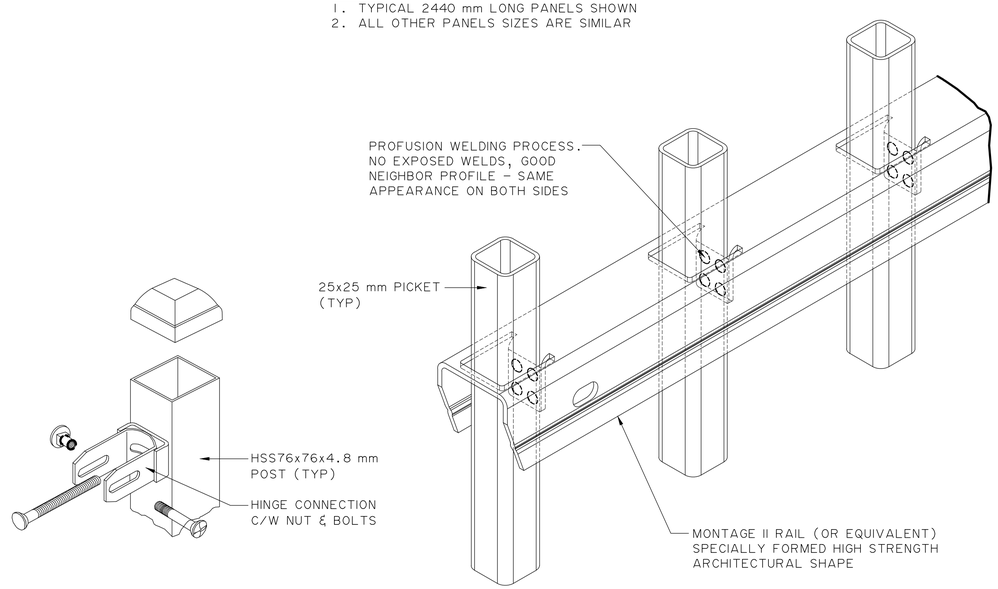
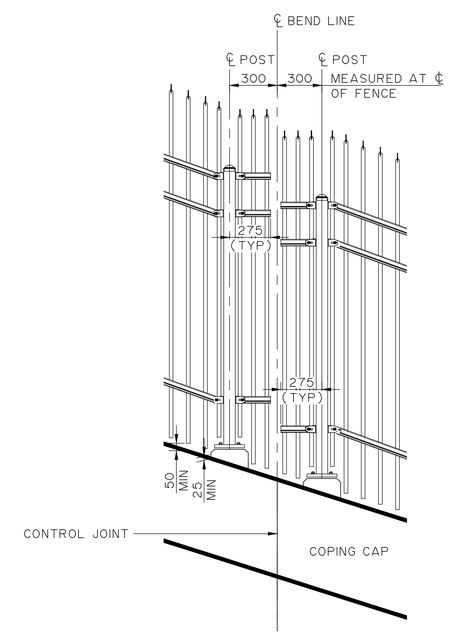


INDUSTRIAL SWIVEL BRACKET
ISOMETRIC VIEW NTS

INDUSTRIAL LATERAL RAIL
ISOMETRIC VIEW NTS



Q DETAIL
1:20

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BROOKFIELD RESIDENTIAL (ALBERTA) LP
ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

Title
ELLERSLIE ROAD
BRIDGE OVER WHITEMUD CREEK
MSE WALL SAFETY FENCE

Project No. 1161 110185
Scale
Revision 0
Sheet 19 of 24
Drawing No. **S001-019**

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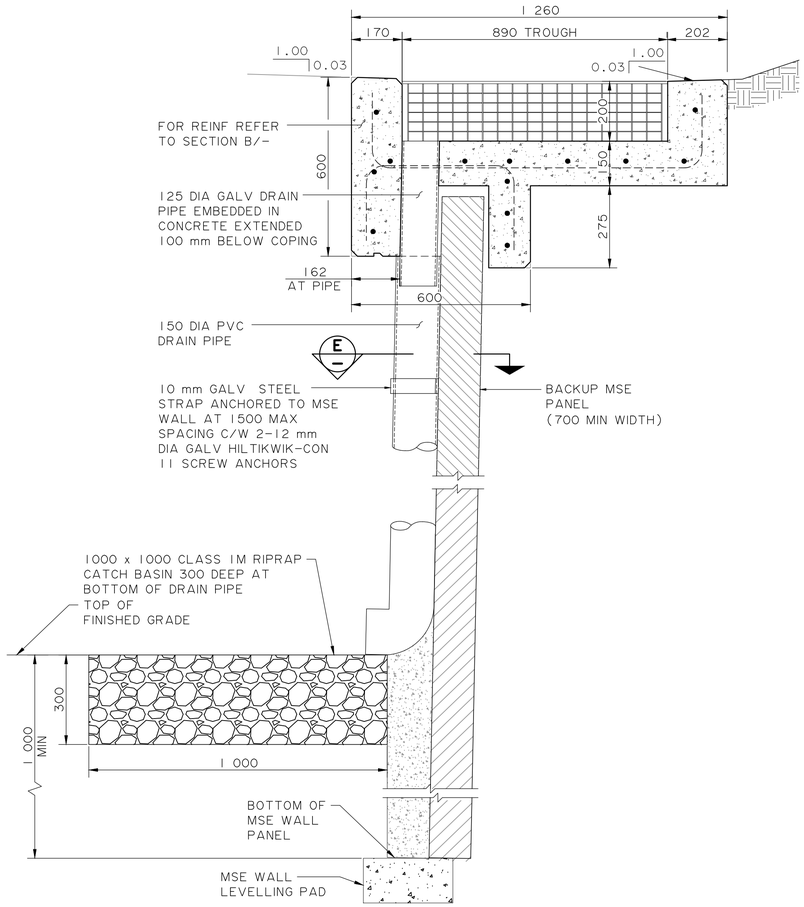
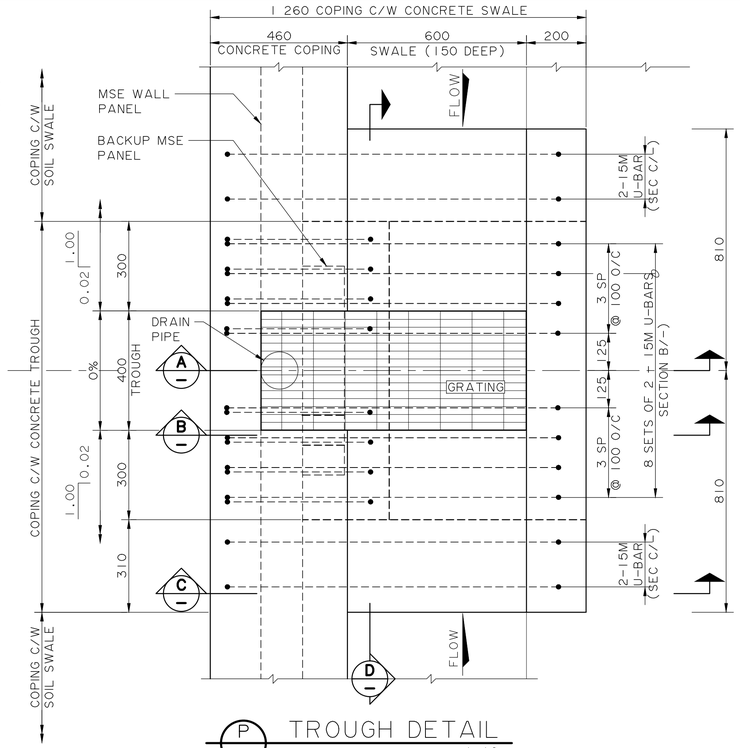


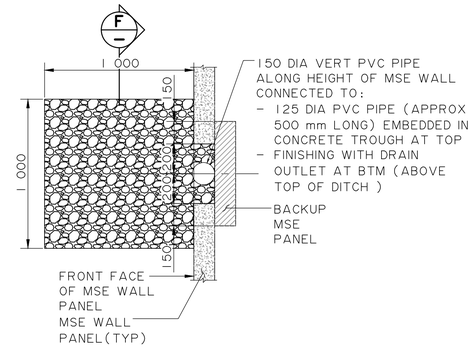
A TROUGH SECTION
AT TROUGH/AT DRAIN PIPE 1:10



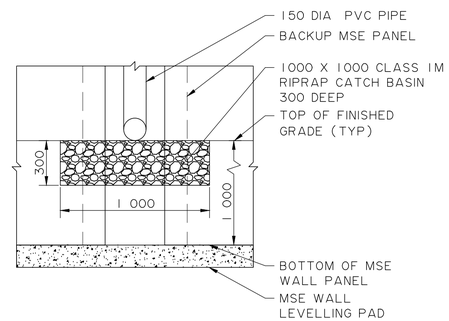
P TROUGH DETAIL
1:10

NOTES:

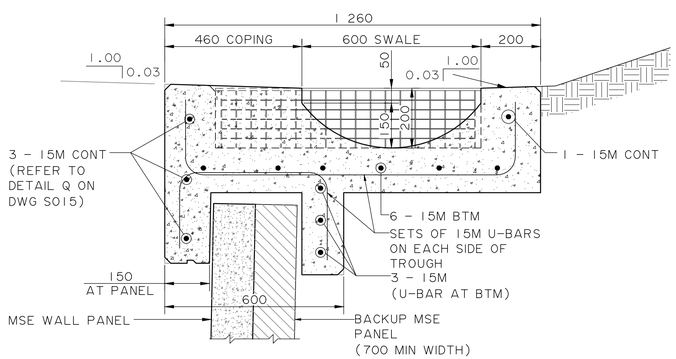
- CONCRETE DRAIN TROUGH IS DESIGNED WITH CONCRETE COPING WITH SOIL SWALE (150 mm DEEP)
- MSE CONCRETE COPING C/W TROUGH SHALL BE CLASS 'HPC' ($f'c$ = 45 MPa)
- ALL STEEL PLATES FOR GRATING SHALL CONFORM TO CSA G40.2 GRADE 300W AND TO BE HOT-DIPPED GALVANIZED AS PER ASTM A123/A123M



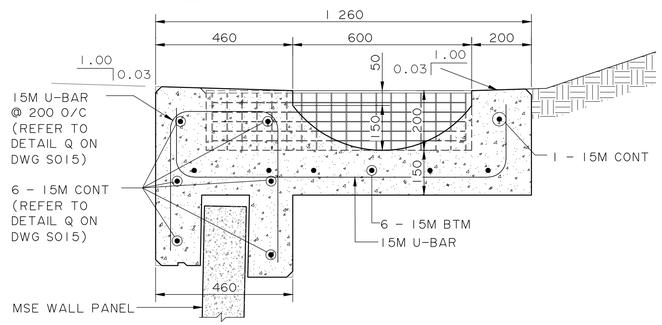
E SECTION
AT PANELS 1:20



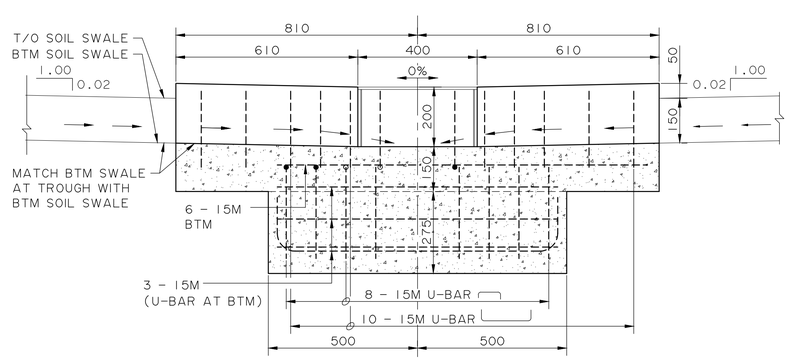
F SECTION
AT PANELS 1:20



B TROUGH SECTION
AT TROUGH 1:10



C TROUGH SECTION
AT TROUGH 1:10



D TROUGH SECTION
AT TROUGH WITH SWALES 1:10

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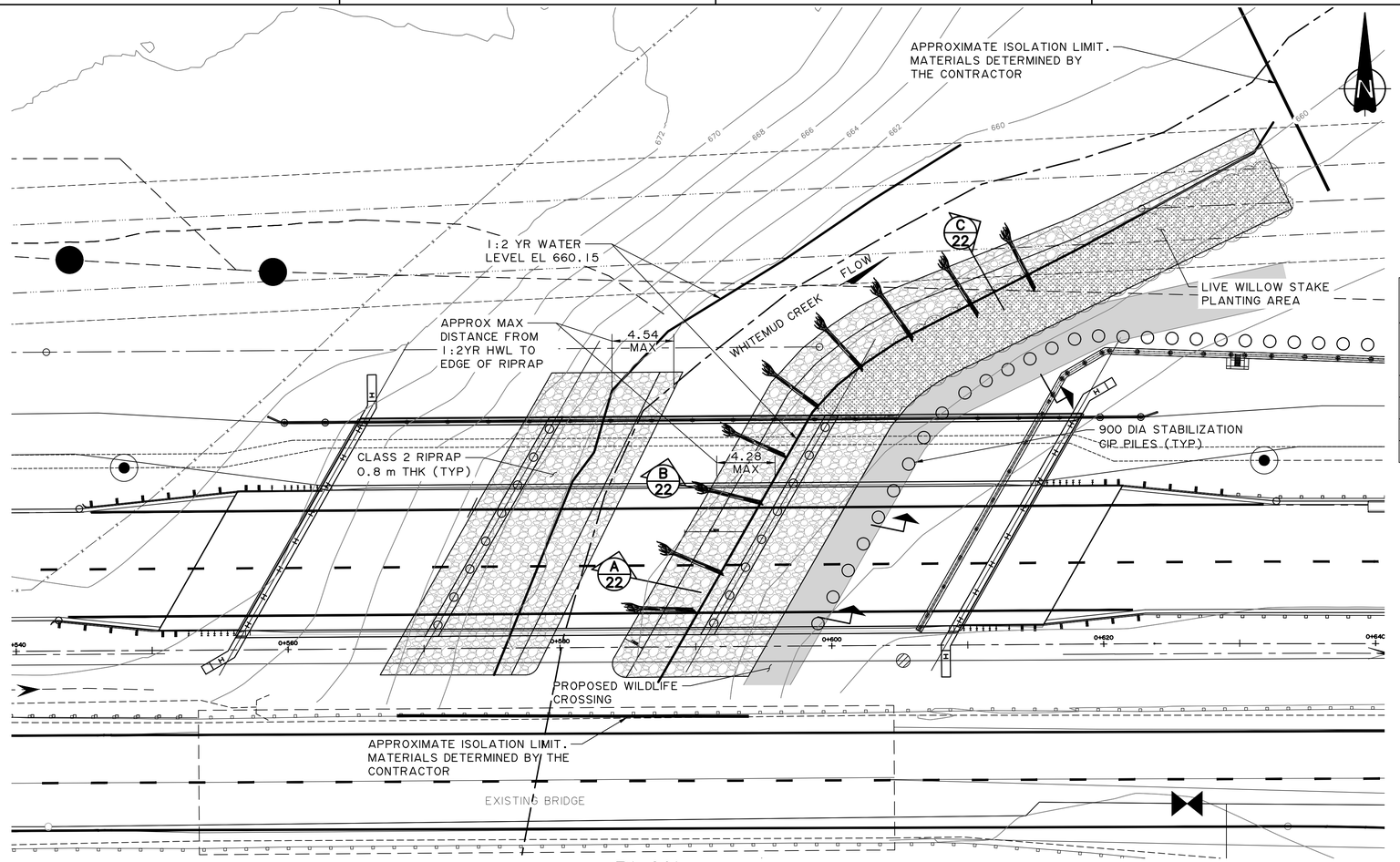
ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.
EDMONTON, AB

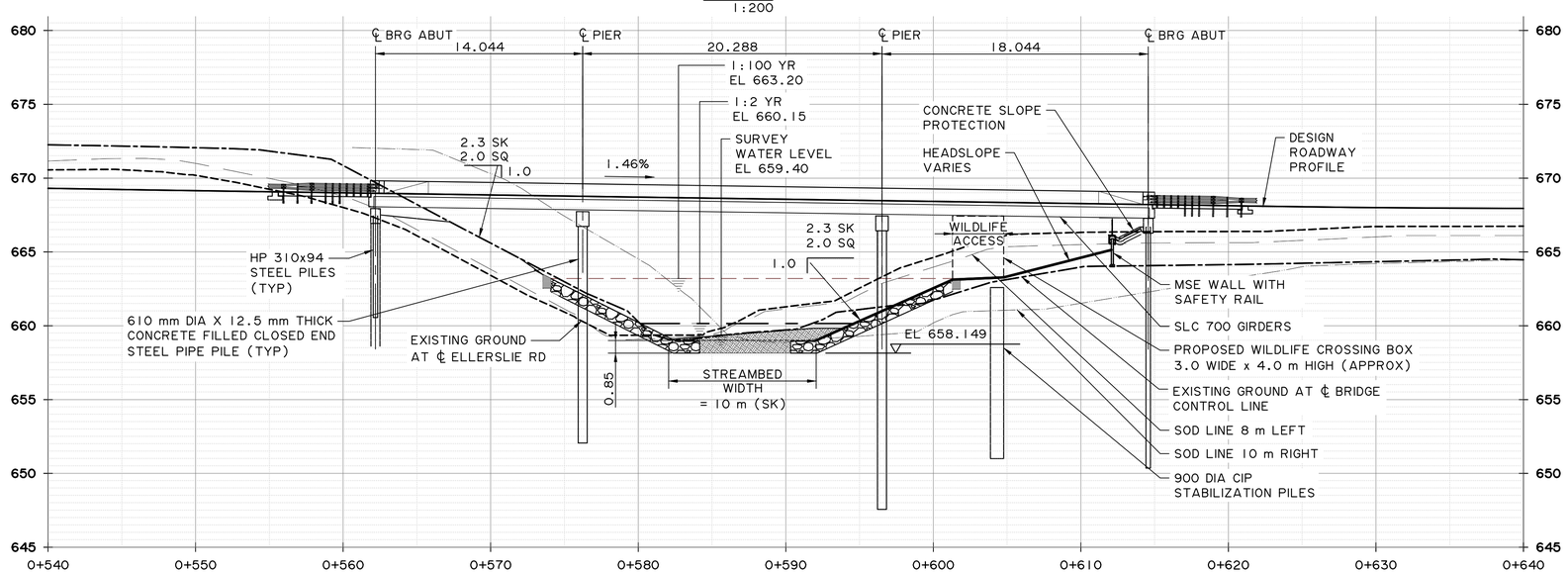
Title
ELLERSLIE ROAD
BRIDGE OVER WHITEMUD CREEK
MSE WALL DRAIN TROUGH DETAIL

Project No. 1161 110185
Scale
Revision 0
Sheet 20 of 24
Drawing No. **S001-020**

ORIGINAL SHEET - ANSI D



PLAN
1:200



ELEVATION
1:200

RIPRAP NOTES:

- CLASS 2 HEAVY ROCK RIPRAP SHALL COVER THE AREA AND SHALL BE PLACED TO THICKNESS SHOWN ON SECTIONS IN THIS DRAWING
- CONSTRUCTION OF RIPRAP SHALL BE IN ACCORDANCE WITH SECTION 10 OF ALBERTA TRANSPORTATION STANDARD SPECIFICATIONS FOR BRIDGE CONSTRUCTION
- PLACE NON-WOVEN GEOTEXTILE FILTER FABRIC UNDER ALL HEAVY ROCK RIPRAP
- GEOTEXTILE FILTER FABRIC SHALL MEET THE REQUIREMENT INDICATED IN PROVIDED TABLE
- PROPOSED RIPRAP TO BE ADJUSTED IN FIELD BY THE ENGINEER AS REQUIRED

NON-WOVEN GEOTEXTILE FILTER FABRIC REQUIREMENTS

REQUIRED PHYSICAL PROPERTIES	TEST METHOD	MINIMUM MARV REQUIRED
		CLASS 2
GRAB STRENGTH	ASTM D4632/D4632M	900 N
ELONGATION (FAILURE)	ASTM D4632/D4632M	50%
STATIC PUNCTURE STRENGTH	ASTM D6241	1925 N
TRAPEZOIDAL TEAR	ASTM D4533/D4533M	350 N

GRADATION REQUIREMENTS

GRADATION		HEAVY ROCK RIPRAP CLASS
REQUIRED PROPERTIES	UNITS	2
NOMINAL MASS	kg	200
NOMINAL DIAMETER	mm	500
NONE GREATER THAN	kg	700
	mm	800
20% TO 50%	kg	300
	mm	600
50% TO 80%	kg	200
	mm	500
100% GREATER THAN	kg	40
	mm	300

QUANTITY ESTIMATE

ITEM	UNIT	ESTIMATE	AS CONSTR
EXCAVATION	m³	1300	
CLASS 2 RIPRAP	m³	862	
LOG WITH ROOTBALL	EA	9	
LIVE STAKES	EA	163	

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Issued	By	Appd	YYYY.MM.DD
File Name: 1161110185_RIVER_PROTECTION	JDC	CT	CJ	2023.11.25
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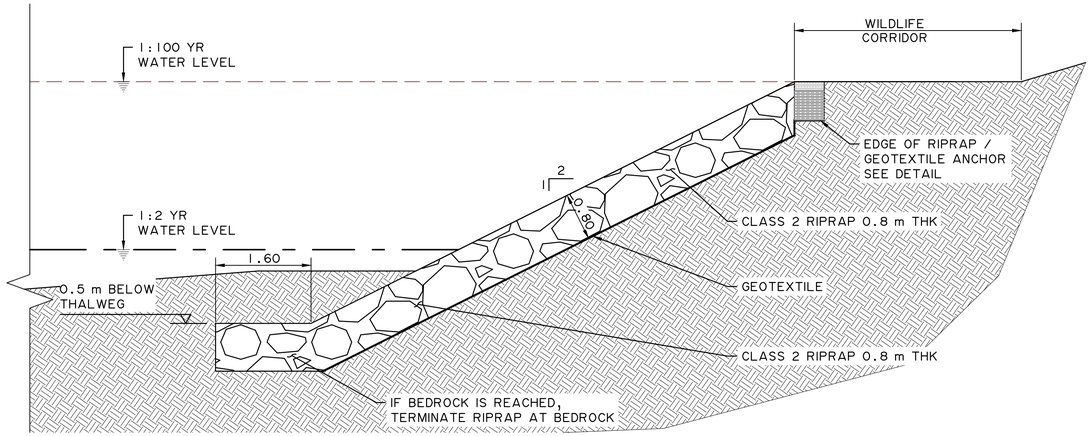
EDMONTON, AB

Title
ELLERSLIE ROAD BRIDGE
OVER WHITEMUD CREEK
RIVER PROTECTION - SHEET 1

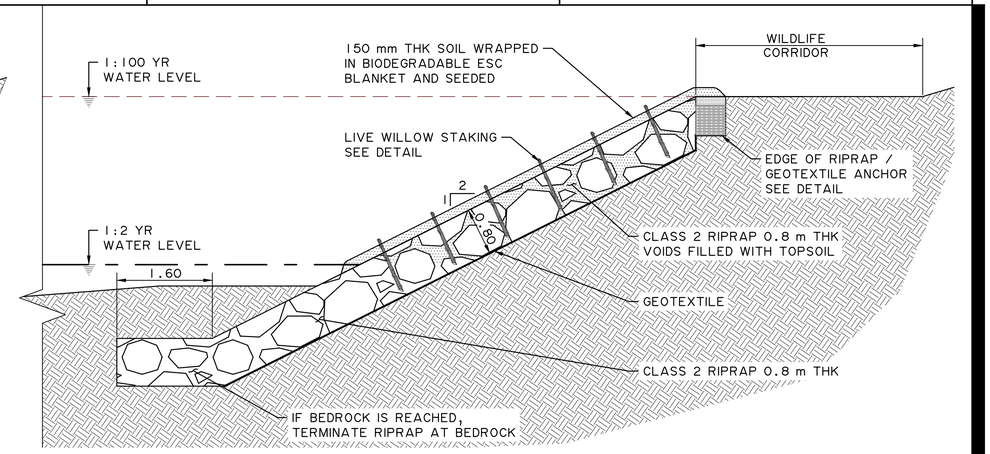
Project No. 1161 110185
Scale
Revision 0
Sheet 21 of 24
Drawing No. **S001-021**

ORIGINAL SHEET - ANSI D



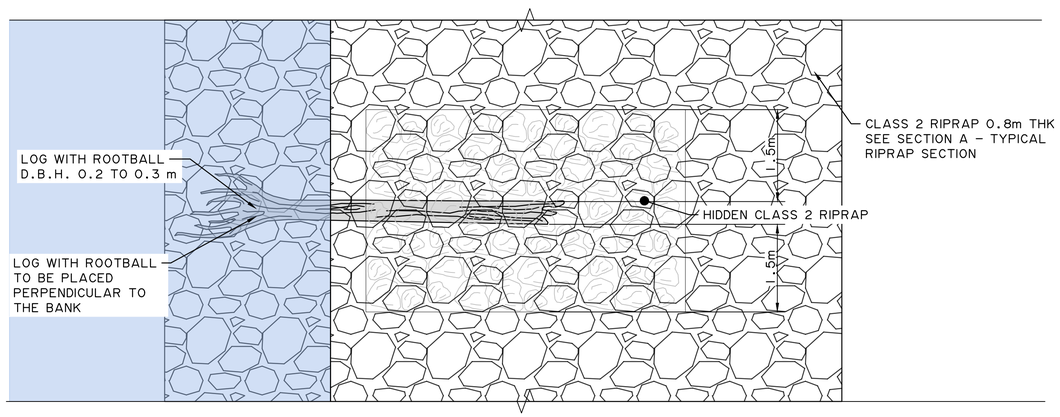
A — TYPICAL RIPRAP SECTION

1:50



C — TYPICAL RIPRAP SECTION

1:50



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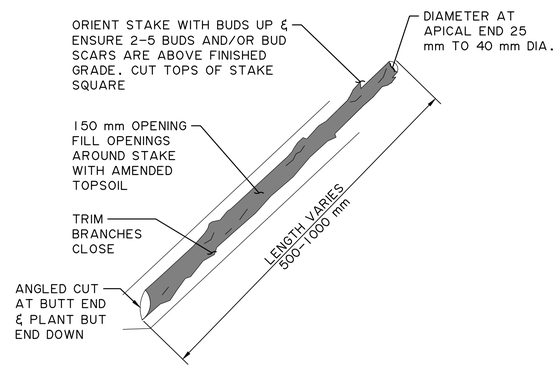
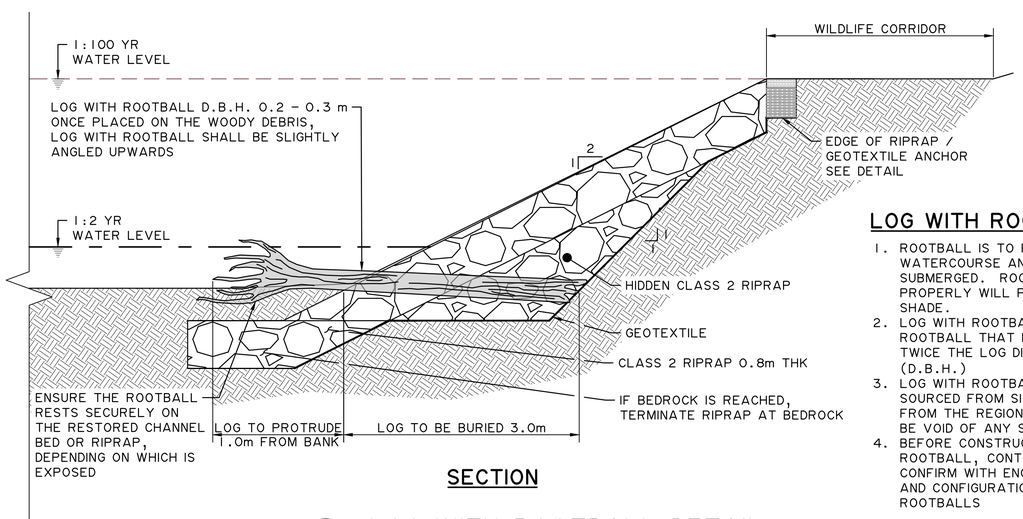


LIVE STAKE DETAIL

1:50

LIVE STAKE DETAIL NOTES:

1. IF STAKES ARE TO BE STORED, HARVEST DURING DORMANT SEASON. WHENEVER POSSIBLE HARVEST AND INSTALL IN AUTUMN, AT THE END OF THE GROWING SEASON AND WHEN STORAGE WILL BE KEPT TO A MINIMUM. SPECIES AND HARVEST LOCATION TO BE CONFIRMED WITH THE CONSULTANT PRIOR TO HARVESTING.
2. LIVE MATERIAL SHOULD BE HARVESTED FROM A SIMILAR ELEVATION, SOIL TYPE AND MOISTURE REGIME AS THE PROJECT SITE.
2. IF APPROPRIATE MATERIAL FOR HARVESTING IS NOT AVAILABLE, NURSERY STOCK MAY BE UTILIZED. CONTRACTOR TO CONFIRM SPECIES WITH PROJECT MANAGER PRIOR TO SECURING PLANTING MATERIAL.
3. USE HEALTHY, STRAIGHT AND LIVE WOOD AT LEAST 1 YEAR OLD
4. MAKE CLEAN CUTS AND DO NOT DAMAGE STAKES OR SPLIT ENDS DURING INSTALLATION
5. SOAK CUTTINGS IN AN APPROVED ROOTING HORMONE FOR MINIMUM 48 HOURS PRIOR TO INSTALLATION
6. PRE-DRILL A PLANTING HOLE FOR STAKES BY UTILIZING A WATER JET STRINGER OR A POST HOLE DRIVER.
7. TO MINIMIZE AIR POCKETS AROUND STAKES BACKFILL WITH AMENDED TOPSOIL COMPLEX.
8. MINIMUM 80% OF THE LIVE STAKE LENGTH TO BE BURIED BELOW FINISHED GRADE
9. MINIMUM 200mm OF LIVE STAKE STAKE TO BE EXPOSED ABOVE GRADE



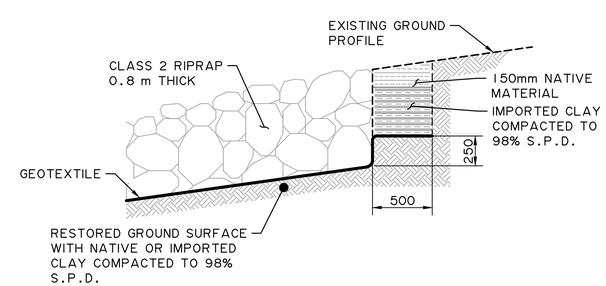
SECTION

B — LOG WITH ROOTBALL DETAIL

1:50

LOG WITH ROOTBALL SPECIFICATIONS:

1. ROOTBALL IS TO PROTRUDE WITHIN THE WATERCOURSE AND BE PARTIALLY OR FULLY SUBMERGED. ROOTBALL WHEN INSTALLED PROPERLY WILL PROVIDE FISH REFUGE AND SHADE.
2. LOG WITH ROOTBALL SHALL HAVE A ROOTBALL THAT IS INTACT AND AT MINIMUM TWICE THE LOG DIAMETER AT BREAST HEIGHT (D.B.H.)
3. LOG WITH ROOTBALL MAY BE LOCALLY SOURCED FROM SITE IF POSSIBLE OR SOURCED FROM THE REGION. WOOD MATERIAL SHALL BE VOID OF ANY SIGN OF DECAY OR ROT.
4. BEFORE CONSTRUCTION OF THE LOG WITH ROOTBALL, CONTRACTOR SHALL REVIEW AND CONFIRM WITH ENGINEER ON THE PLACEMENT AND CONFIGURATION OF THE LOGS WITH ROOTBALLS



EDGE OF RIPRAP / GEOTEXTILE ANCHOR DETAIL

1:20

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ECO STATION ROAD TO GRAYDON HILL BLVD.

EDMONTON, AB

Title

ELLERSLIE ROAD BRIDGE
OVER WHITEMUD CREEK
RIVER PROTECTION - SHEET 2

Project No. 1161 110185

Scale

Revision 0

Sheet 22 of 24

Drawing No. **S001-022**

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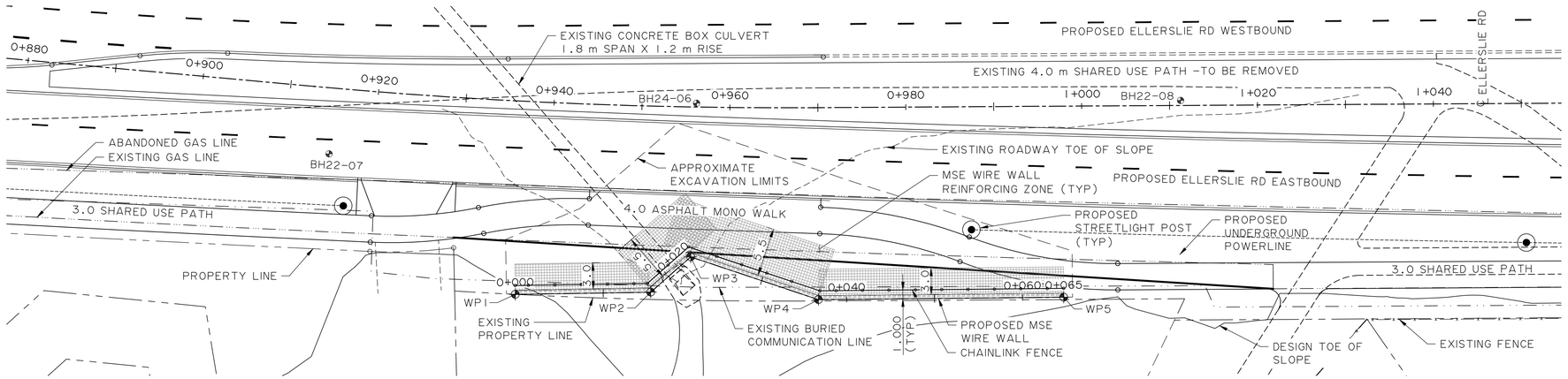
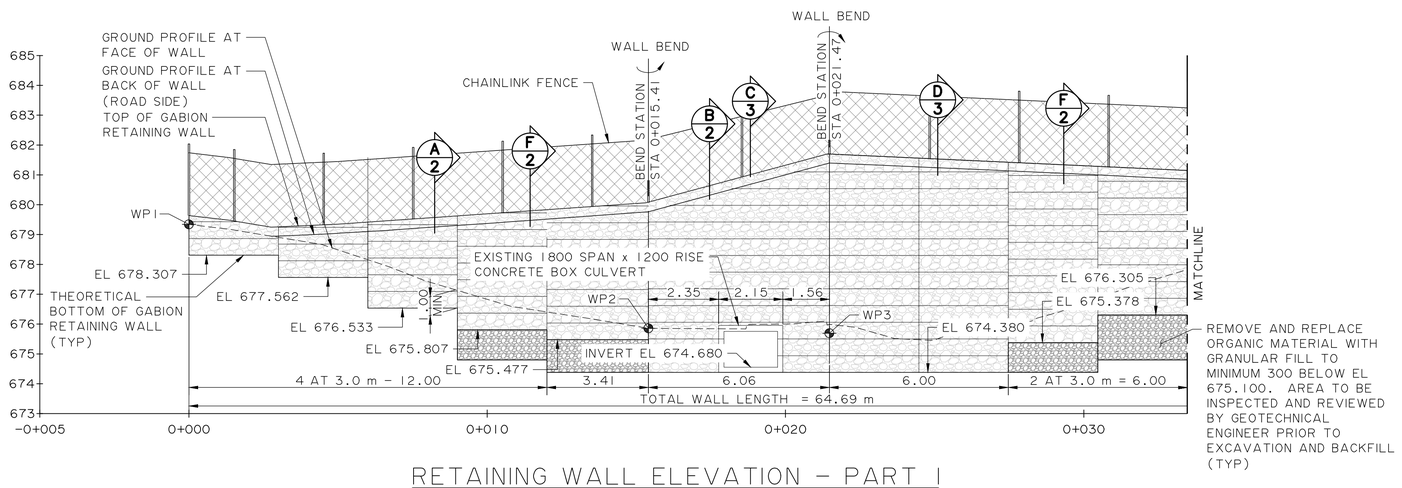


RETAINING WALL PLAN

1:300



RETAINING WALL ELEVATION – PART 1

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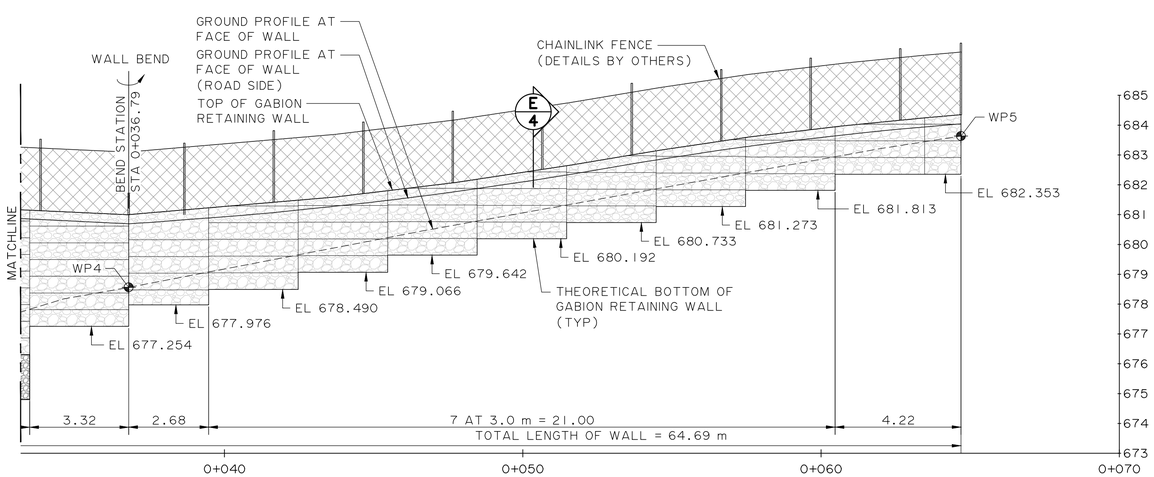
FRONT OF WALL SHOWN

1:100



RETAINING WALL PLAN – PART 2

LOOKING TOWARDS WALL
FRONT OF WALL SHOWN

1:100

GENERAL NOTES

- ALL DIMENSIONS SHOWN ON THE GENERAL LAYOUT AND INFORMATION SHEETS ARE GIVEN IN METRES. ALL OTHER DRAWINGS ARE DIMENSIONED IN MILLIMETRES EXCEPT FOR STATIONS AND ELEVATIONS WHICH ARE EXPRESSED IN METRES
- GEOTECHNICAL INFORMATION PROVIDED FOR THIS PROJECT WAS COMPILED FROM THE REPORT, "ELLERSLIE ROAD – WHITEMUD CREEK BRIDGE CROSSING GEOTECHNICAL INVESTIGATION PREPARED BY STANTEC CONSULTING LTD. DATED JANUARY 31, 2025

SURVEY BY

- CREEK SURVEY INFORMATION PROVIDED BY STANTEC GEOMATICS LTD., COMPLETED JULY 2021 UNDER THE DIRECT SUPERVISION OF JOEL CORCORAN, ALS
- BOUNDARY SURVEY INFORMATION PROVIDED BY STANTEC GEOMATICS LTD., COMPLETED MARCH 2023 UNDER THE DIRECT SUPERVISION OF JOEL CORCORAN, ALS

CONTROL POINTS

- ASCM 181636 N 5921414.621 E 29377.379 EL 685.546T
- THE COORDINATES AND STATIONING ARE BASED ON NAD 83 DATUM USING 3TM GRID PROJECTION, CENTRAL MERIDIAN 114°W. A COMBINED SCALE FACTOR OR 0.999808 HAD BEEN ADOPTED FOR THIS PROJECT

DESIGN NOTES

- DESIGN CODE CAN/CSA-S6-19
- MSE WIRE WALL SHALL BE CONSTRUCTED IN ACCORDANCE WITH SECTION 25 – MECHANICALLY STABILIZED EARTH WALL OF THE ALBERTA TRANSPORTATION STANDARD SPECIFICATIONS FOR BRIDGE CONSTRUCTION 2020
- DESIGN LIFE – 100 YEARS
- COBBLE ROCK TO FILL GABIONS SHALL MEET THE FOLLOWING SPECIFICATIONS

DESIGNATION EMBANKMENT ROCK FILL CLASS 200	
m SIEVE SIZE	mm
200 000	100
150 000	50 – 80
125 500	0

WORKING POINT (WP) TABLE

WP	STATION	ELEVATION	NORTHING	EASTING
WP1	0+000.000	679.339	5921373.992	29143.052
WP2	0+015.410	679.763	5921374.243	29158.457
WP3	0+021.470	675.990	5921378.261	29162.998
WP4	0+036.790	680.693	5921373.394	29177.525
WP5	0+064.690	683.634	5921373.671	29205.422

QUANTITY ESTIMATE

ITEM	UNIT	ESTIMATE	AS CONSTR
MSE WIRE WALL	m^2	235	
BACKFILL (REINFORCE ZONE) CRUSHED GRANULAR (DES 2, CLASS 40)	m^3	765	

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File Name: S002_001-002A	JDC	RC	SL	2023.07.22
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Title
ELLERSLIE ROAD
WELDED WIRE MESH FACE MSE WALL
GENERAL LAYOUT

Project No. 1161 110185
Scale
Revision 0
Sheet 1 of 4
Drawing No. **S002-001**

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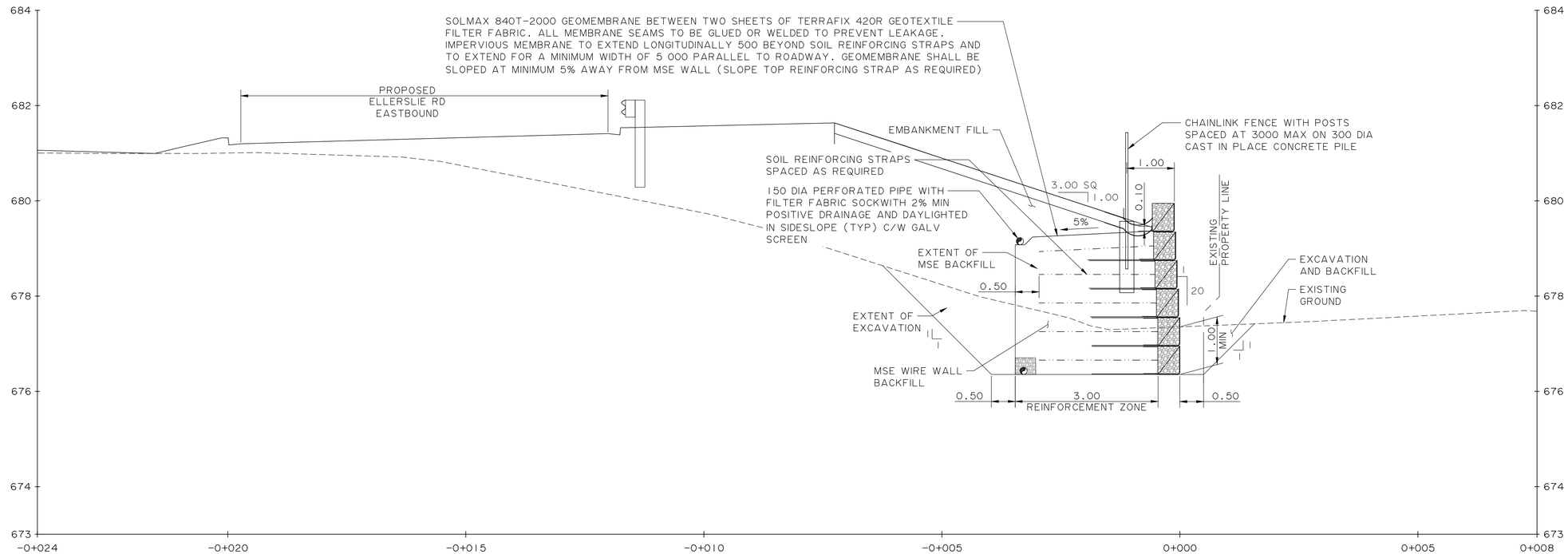

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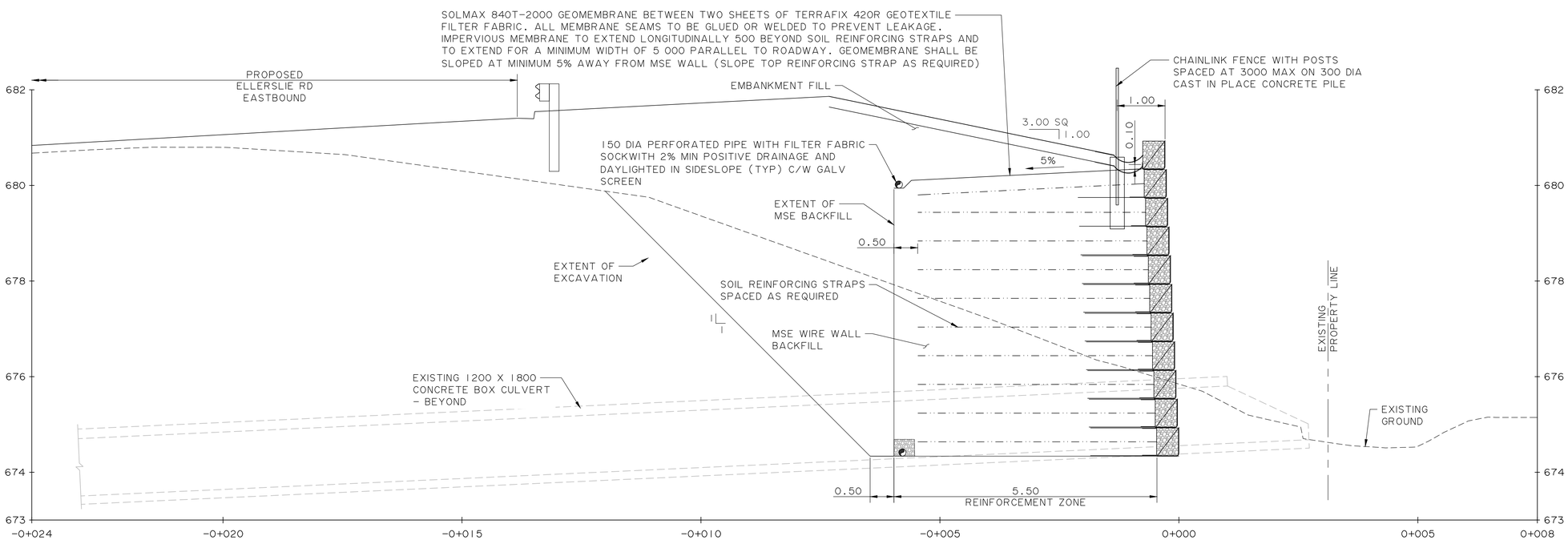

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Title
ELLERSLIE ROAD - CULVERT
WELDED WIRE MESH FACE MSE WALL
SECTIONS - SHEET 1

Project No. 1161 110185
Scale
Revision 0
Sheet 2 of 4
Drawing No. S002-002

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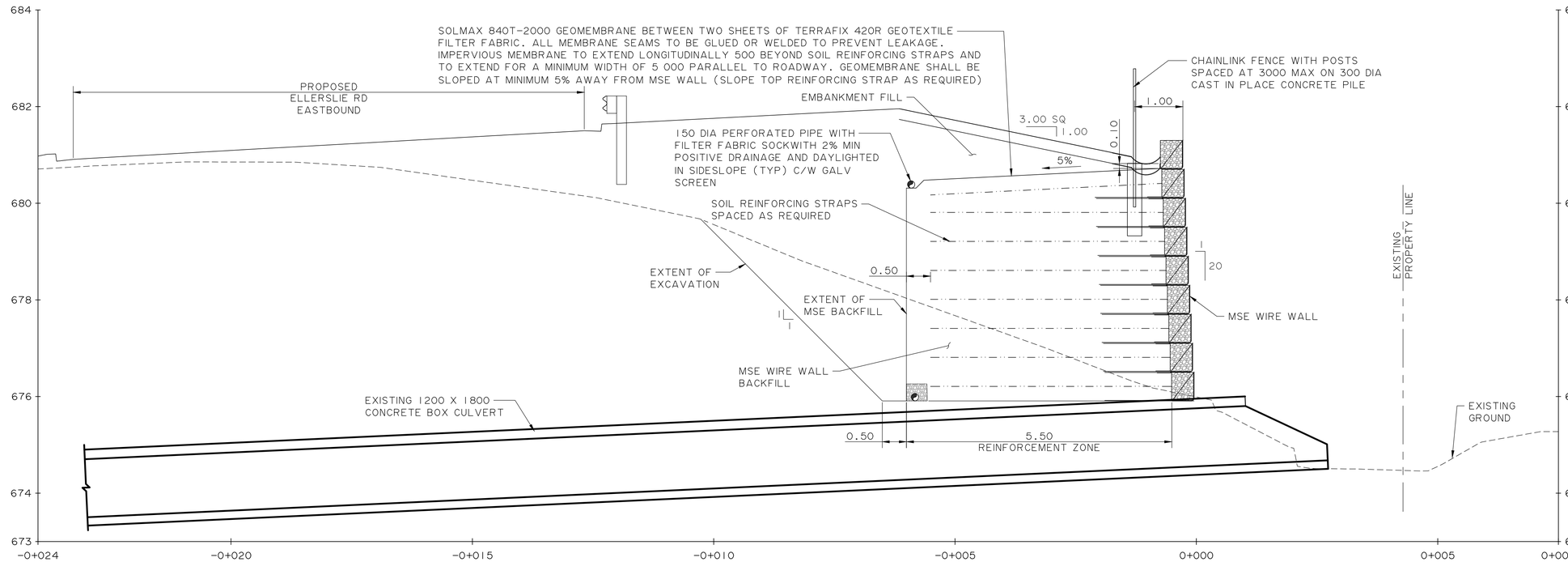

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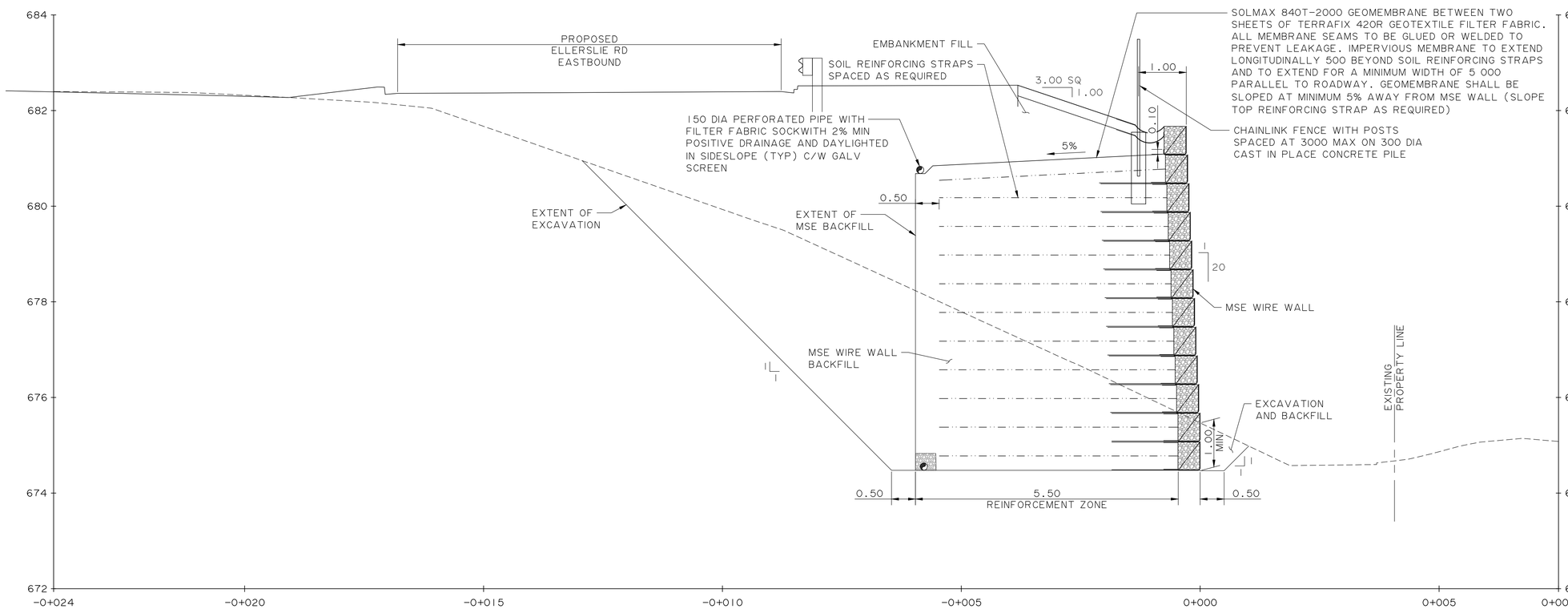

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Title
ELLERSLIE ROAD
CULVERT GABION WIRE WALL
MSE WIRE WALL SECTIONS - SHEET 2

Project No. 1161 110185
Scale
Revision 0
Sheet 3 of 4
Drawing No. **S002-003**

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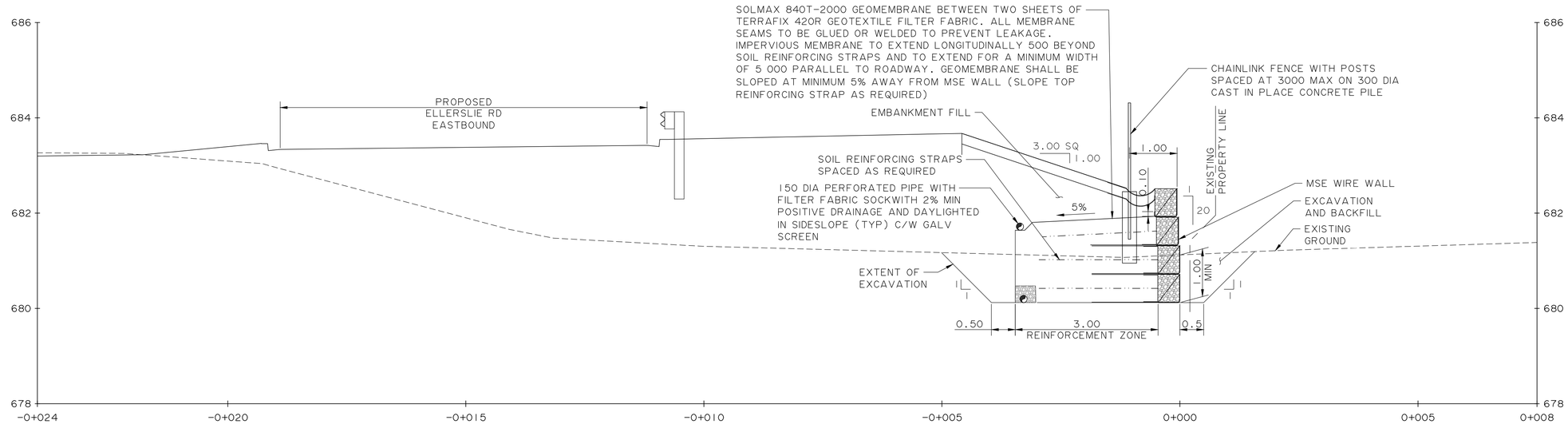

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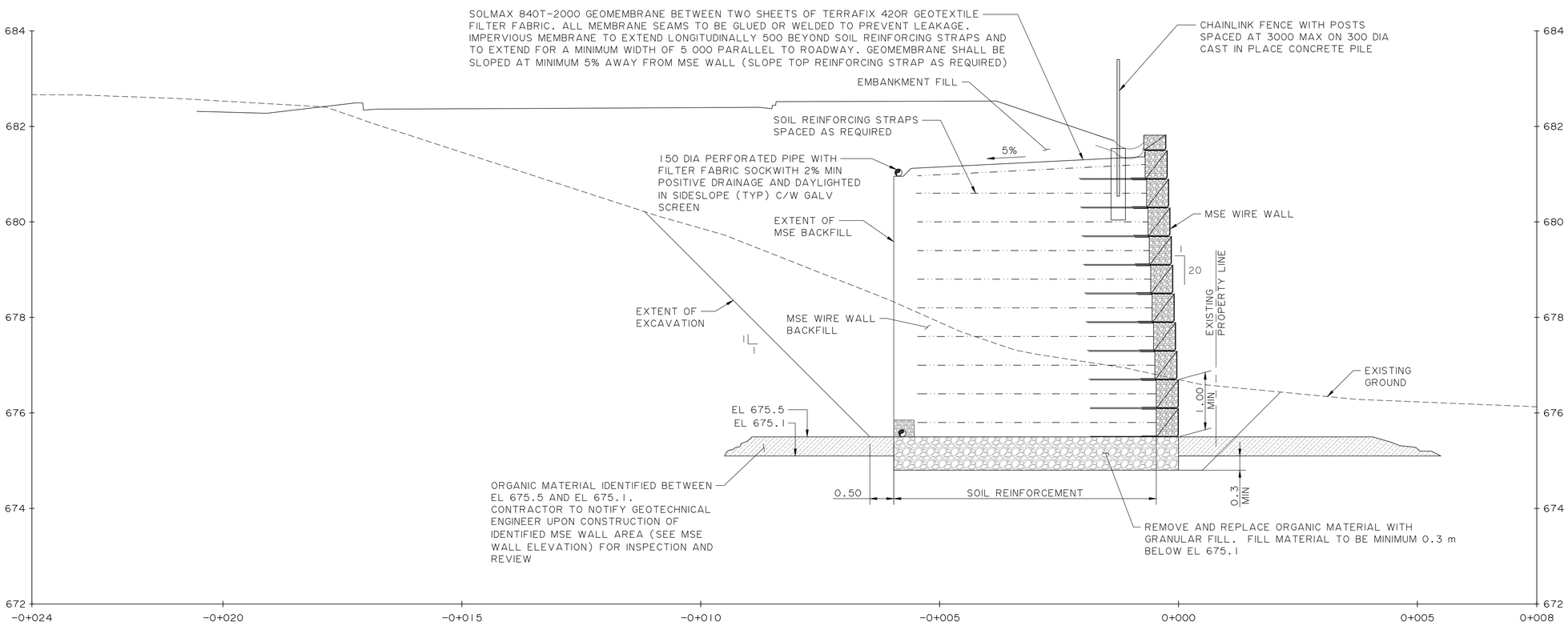

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EDMONTON, AB

Title
ELLERSLIE ROAD
CULVERT GABION WIRE WALL
MSE WIRE WALL SECTIONS - SHEET 3

Project No. 1161 110185
Scale
Revision 0
Sheet 4 of 4
Drawing No. **S002-004**

ORIGINAL SHEET - ANSI D

Appendix B Preliminary Design Report

Ellerslie Road Crossing Over Whitemud Creek, Edmonton, AB

Preliminary Engineering Design Report

Prepared for:
Brookfield Residential (Alberta) LP and Jagare Ridge Developments Ltd.

Prepared by:
Stantec Consulting Ltd.

Project Number: 1161110185

October 19, 2023

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1.0 INTRODUCTION

Stantec Consulting Limited (Stantec) was retained by Brookfield Residential (Alberta) LP and Jagare Ridge Developments Ltd. to complete the preliminary engineering design, detailed design, and preparation of specifications and IFC drawings of the proposed new Ellerslie Road West Bound Lanes (WBLs) including a bridge structure over Whitemud Creek. The existing road and bridge will be retained and become the East Bound Lanes (EBLs), located Immediately south of the proposed WBLs. A location plan is included on the *Ellerslie Road Bridge Over Whitemud Creek – General Layout Drawings* in the preliminary drawing set prepared for this proposed work.

The preliminarily roadway alignment for the proposed WBLs and alterations to the existing road (new EBLs) was completed and finalized by Stantec and accepted by the City of Edmonton (COE) on July 8, 2022. The drawing is included in Appendix A. This Preliminary Engineering Design Draft Report is included with the first submission to the COE and encompasses the site information, road geometrics, environmental constraint information, geotechnical information, drainage considerations, structure options, opinion of probable cost estimates, pros and cons of structure options, and recommendations for detailed design. The MSE or retaining wall located on the east riverbank is required to prevent the bridge head slopes and roadway side slopes from infringing on the creek channel and the ATCO pipeline ROW (as shown on the General Layout Dwg 1). A Wildlife passageway, a minimum 3.0 m width, is proposed to be provided adjacent to the east creek bank at elevation 663.2 (Design 1:100 year flood event), extending a minimum 40 m downstream from the existing bridge to cross-section W-1.

2.0 BACKGROUND

The project scope extends from Graydon Hill Boulevard to Ambleside Eco Station access road and consists of an expansion of the roadway from it's current 2-lane configuration, to a 4 lane configuration, and is required to support further development within the Heritage Valley and Windermere land basins. Various utility lines will be need relocated to accommodate the proposed new alignment. The existing Ellerslie Road alignment is bounded to the north by the Transportation/Utility Corridor (TUC) and Anthony Henday Drive; the constraint requires a transfer of land between the Government of Alberta (GOA) and COE to accommodate the additional lanes and widening of Ellerslie Road. This land transfer is expected to be approved in October of 2023, and fully executed by year-end 2023.

This crossing will not only service traffic on Ellerslie Road over Whitemud Creek but also provide wildlife passage. Consideration of wildlife and environmental impacts (including fisheries) will be required as part of Ellerslie Road construction over Whitemud Creek.

The existing Ellerslie Road bridge is a 3 span (15.24m-16.76m-15.24m) bridge constructed in 1964 with open head slopes. It consists of precast girders, cast-in-place abutments, and steel piles. A 450mm watermain was installed under the bridge in 2013. Based on the city's latest inspection report, the existing bridge is in good condition and will remain in service.

Figure 1: Proposed Site Location

3.0 DESIGN STANDARDS AND CRITERIA

The following design criteria were used for the selection of different structure options for this crossing.

3.1 AESTHETICS

At this particular site, the aesthetics of the profile and underside of the bridge are considered relatively unimportant as the valley generally hides the structure from human view. However, the overall aesthetics must compliment the site and the existing structure. The bridge will not be seen as a single object, but as a system with the existing structure, therefore, consistency and coordination with the existing bridge structure will govern the aesthetics. A uniform, slim, slab-on-girder bridge will be the least visually intrusive structure type. Arch and truss options would not match the exiting 3-span bridge.

3.2 USERS

There are a variety of users at this site,

- Vehicular traffic on Ellerslie Road,
- Whitemud Creek provides a wildlife corridor,
- Pedestrian and bicycle traffic, which are currently not accommodated for at the crossing.
- Users of Whitemud Creek

3.3 ROADWAY DESIGN STANDARDS AND CRITERIA

Within the vicinity of the bridge, Ellerslie Road is currently a two-lane undivided highway with a 9.19m clear bridge deck width. The posted speed limit is 60 km/hr.

The proposed configuration of Ellerslie Road will be a four-lane roadway with two lanes in each direction. A shared use pathway will be included on the new Westbound structure. The design and posted speed for Ellerslie Road will be 70 km/h and 60 km/h, respectively.

3.3.1 Geometric Constraints

The new WBLs are confined by the existing roadway and bridge on the south, and by the TUC to the north.

Whitemud Creek also has steep and unstable banks in the vicinity of the crossing, resulting in the requirement for slope stability under the new east bridge span, the north-east bridge head slope, and north roadway embankment. Realigning Whitemud Creek is not an acceptable alternative, from a fisheries and overall environmental viewpoint.

To provide for the required wildlife passage it is proposed to place it on the down slope side of the retaining wall. This passageway would consist of a 3.0 m bench and would reduce the effective side slopes and reduce any stability issues of this embankment.

3.3.2 Vertical Alignment

The current vertical alignment is a 1.5% grade across the bridge. The proposed structure would follow a similar grade.

Clearance required above the wildlife corridor is 3.0 m.

3.3.3 Horizontal Alignment

The bridge will be on a tangent alignment, directly north of the existing structure. The spacing between the two bridges would be 5m. It is proposed to skew the bridge abutments to align with the banks of Whitemud Creek, which will reduce the overall bridge length required.

3.4 BRIDGE DESIGN STANDARDS AND CRITERIA

Design is based on the latest version of:

- Canadian Highway Bridge Design Code (CHBDC), CAN/CSA-S6-19
- Alberta Transportation Bridge Structures Design Criteria (BSDC), Version 9, 2022
- Alberta Transportation Standard Specifications for Bridge Construction, Edition 17, 2020
- Alberta Transportation Roadside Design Guide, November 2007, Revision 8

- Alberta Transportation Highway Geometric Design Guide
- The bridge shall have a design life of 75 years.

3.4.1 Design Loading

Live loading: CL800 truck loading specified in CHBDC.

3.4.2 Barriers and Railings

TL-4 concrete barriers are required on either side of the traffic lanes. A 1.37 m high pedestrian/bicycle rail is required on the north side of the SUP.

3.4.3 Preliminary Bridge Cross Section

The proposed clear roadway width is a constant 10.277 m on the bridge, which includes one 4.2 m lane, one 3.5 m lane, a 1.7 m shoulder on the north side and a 1.5 m shoulder on the south side. The bridge also includes a 4.2m shared use pedestrian/bike pathway on the north side. 4.2 m SUP to allow 0.6 m shy lines on the bridge at both sides as required in the TAC. Traffic barriers will be installed between the SUP and traffic lanes, 1.37 m high pedestrian/bicycle rail are included on the northside of the SUP.

3.5 DRAINAGE

Major flow will be conveyed overland and minor flow will be conveyed through an underground pipe system along with catch basins. The overland storm drainage will flow east across the bridge to a low point east of the bridge. No ponding will occur on the bridge itself. The drainage details for the roadway and bridge will be designed and finalized at the detailed design phase.

3.6 LIGHTING

There are currently lights on the existing power poles on the south side of the Ellerslie structure. Additional lighting required to support the new lanes of traffic and associated bridge will be determined during detailed design in accordance with the City of Edmonton Design and Construction Standards. Based on the proposed bridge span length, it is expected that lighting will not be required on the bridge structure itself.

4.0 CONSTRAINTS AND CONTROLLING FACTORS

4.1 SITE SPECIFIC CONSIDERATIONS

4.2 UTILITIES

Preliminary studies for a bridge structure on the proposed WBLs over Whitemud creek was carried out considering the various constraints at this crossing. One of the major constraints was the existing ATCO pipelines located immediately north of the existing Ellerslie Road. The alignment of these existing pipelines would run parallel to, and directly under, the proposed road and bridge alignment for the expansion of Ellerslie Road. According to the terms of their franchise agreement, ATCO has agreed to the relocation of the pipelines, at their cost, to a new parallel alignment to the north of the proposed Ellerslie Road bridge and roadway. ATCO will complete this relocation in advance of the construction of the new road and bridge, removing the conflict from the project.

There are existing overhead powerlines within the existing Ellerslie Road R/W. Relocation and burial of the powerlines to an appropriate alignment will occur as part of the proposed design and construction of Ellerslie Road. Determination of the final alignment for these powerlines will occur as part of the detailed design.

4.3 LAND AND RIGHT OF WAY

The road R/W for Ellerslie Road at the crossing of Whitemud Creek is not large enough to accommodate the additional lanes, and additional dedication of land to road R/W will be required. The land to the north of the existing road R/W is currently owned by the Province of Alberta and is incorporated as part of the Transportation/Utility Corridor (TUC) around the City of Edmonton. The City is currently in negotiations with the Province for the acquisition of the required land to incorporate into the Ellerslie Road R/W. The acquisition of land and incorporation into the Ellerslie Road R/W is projected to be completed prior to year-end 2023.

4.4 HYDROTECHNICAL

Whitemud creek, at the proposed crossing, is a moderately- sized, permanent watercourse, with a winding, regular meander pattern. This meander pattern is controlled by the shale and sandstone layers in its banks located above the creek's streambed. There are several tight meander bends that developed because of the erosion resistance provided by the shale and sandstone layers, located upstream of this crossing. The ground survey taken of the water level and streambed of the channel, extending upstream and downstream of the stream resulted in an average slope of 0.004 m/m. Based on surveyed site cross-sections the width of the channel at streambed elevation ranged from 8.5 to 10.5 m. at an average water depth of 4.2 m for the 1:100- year flood event. (See **Appendix** C)

Based on our site reconnaissance the channel bed materials were dominated by a diversity of sand, gravel and cobble substrates. The gravels and cobbles are suitably sized for spawning by fish species known to inhabit this watershed. Habitat cover is poor with limited overhanging vegetation near the proposed and existing bridges. Turbidity at the time of the visit was low based on water clarity and visibility of the substrate. Based on air photography and site observations/assessments of the stream morphology and with the stream's low gradient, little sediment deposition occurs due to its low width to depth ratio, i.e., <12. The stream is slightly entrenched often with one of the adjacent floodplain stream banks being below the 1:100- year flood event.

Our site assessment of creek channel in the vicinity of the crossing is expected to have little if any bed degradation or aggradation. It is recommended that the channel not be reconfigured and that its natural state be retained. Any disturbance to the channel and its bed required by construction should be limited and any restoration and bank protection work, if required, should use bio-engineering methods combined with hard protection material like natural rock riprap to restore and enhance fish habitat. This will assist to reduce scour/erosion occurring at the right channel banks of this reach of the creek.

Methods utilized for determination of a design discharge consisted of:

- Review of Alberta Transportation bridge correspondence files for flood history, recent design discharge estimates and historical high- water marks
- Hydraulic analysis of the channel and floodway capacity
- Basin Runoff Potential method
- Hydraulic and frequency analysis of WSC (Water Survey of Canada) flow data

The methods utilized are in accordance with current Alberta Transportation (AT) hydrotechnical design guidelines & TAC (Transportation Association of Canada) - Guide to Bridge Hydraulics

4.4.1 File Reviews and Historical Discharges

Whitemud Creek has a drainage area of 335 km^2 at this site based on Water Survey of Canada (WSC) Gauge 05DF006 information. The gauge is located 2 km upstream from the project crossing. The largest flood recorded at this Gauge is 114.0 m^3/s on April 23, 1974. The drainage area extends to the south and south-west from this site. Whitemud Creek discharges into the North Saskatchewan River just downstream of the Quesnel Bridge on the Whitemud Freeway. The estimated maximum discharge rate for Whitemud creek basin is 0.48 $m^3/s/km^2$.

Flow and flood information available on existing bridge files was reviewed and considered for this site:

Table 1: Estimated Peak Discharges and Velocities for Whitemud Creek Reaches in Study Area

Bridge File	Road	Stream Location (km)	Structure Type	Year of Construction	DA (km^2)	Slope (m/m)	Flow (m^3/s)	Comments
BF 01588	Ellerslie Road	0	3-span structure with spill through abutments	1964	259	0.004	-	From BIS
BF 85017	Anthony Henday	0.5 km d/s	CIP arch (20m wide)	2004	335	0.003	100	From NHC Report (2000)
BF 00137	41 Avenue	4 km u/s	CIP arch culvert (5300mmx4435mm)	1960	332	-	-	From BIS
BF 01355	Township Road 510	7 km u/s	3-10 m spans bridge with spill through abutments	1994	335	-	-	From BIS
BF 01267	167 Street SW	9 km u/s	3-8.5m spans bridge with spill through abutments	1969 (repl. schedule for 2023)	304	-	-	From BIM Report - a local resident observed the high-water line at or near the underside of the girders

4.4.2 Channel Hydraulics

The flows at the crossing were modeled by utilizing Hydro Chan V 13 software and based on the surveyed cross sections resulted in an average surveyed streambed slope of 0.004 m/m. An average Manning's "n" of 0.045 was selected for the main channel and its banks. Rating curves based on surveyed cross sections were analyzed hydraulically to determine a floodway discharge range and associated flood stage. Based on these analyses the average floodway capacity of the natural channel flows results in discharges of:

Table 2: Natural Channel and Proposed Re-aligned channel (with 4 m streambed with 1H:1V sideslopes and with 1m average depth of channel) Hydraulics

Return Period	Annual Exceedance Probability (%)	Depth/Elevation (m)	Average Velocity V (m/s)	Flow Q (m^3/s)
1:2 Year	50	1.15/660.15	1.15	10
1:25 Year	4	3.1/662.1	1.97	78
1:50 Year	2	3.60/662.6	2.20	114
1:100 Year (Q_{design})	1	4.2/663.2	2.46	165
1:200 Year (Q_{Check1})	0.5	4.8/663.8	2.70	227

See **Appendix** C for results of natural channel hydraulics.

Estimated scour depth below streambed is 2.5 m. i.e., to elevation 656.5 m. Minimum freeboard is elevation 664.7, which is 1.5 m above the 1:100-year flood event. Wildlife Passageway designed for minimum 3.0 m width at the design high-water level (DHWL) elevation of 663.2.

4.4.3 Basin Runoff Potential Analysis Method

The Basin Runoff Potential method is a hydrotechnical tool developed by AT to help determine the supply of water from a drainage basin. The formula provided by AT to determine the basin runoff potential flow is as follows.

$$Q = q \times DA$$

Where

- Q = basin runoff potential flow (m^3/s)
- q = unit flow ($m^3/s/km^2$), this parameter is based on AT's Basin Runoff Potential map, experience in the area and engineering judgment.
- q_1 = 0.55 $m^3/s/km^2$, based on AT's Basin Runoff Potential Map for this area
- DA = drainage area (km^2) = 335 km^2, this is the drainage area contributing flows to the proposed crossing.

Results from this analysis provided a basin runoff potential flow of 184 m^3/s. The basin runoff potential analysis method does not normally apply for drainage areas greater than 100 km^2. It does not apply directly to this site but provides a comparison to other methods used.

4.4.4 Fish Passage Design Flow

The existing channel parameters are not changing, below the 100- year flood capacity. We do not anticipate any significant impact to fish passage.

4.4.5 Recommended Hydrotechnical Design Parameters

The governing design for this site is the channel hydraulics. The hydraulic design for the proposed new WBLs bridge is for the 1:100- year flood event and corresponding Q, flow depth, estimated scour depth and average velocity. The recommended design parameters are:

- Discharge: Q = 165 m^3/s
- Average Design Velocity: V = 2.46 m/s
- High Water Elevation =664.2 m (approximately 4.2 m flow depth
- Average channel slope = 0.004m/m (0.4%)
- Bed width = 10.0 m at water level approximately 0.5 m above streambed
- Mean velocity for fish flow = 1.15 m/s based on 1:2- year flood event
- Water depth for fish flow = 1.16 m based on 1:2- year flood event
- Fish flow = 10 m3/s based on 1:2 year– flood event
- The ice forces on the piers will be determined at the detailed design stage

4.4.6 Bridge Hydraulics

Both single span bridge and three span bridge options have been considered, however, the hydrotechnical analysis is similar for both options. Since the bridge is controlled by the roadway grade, channel hydraulics do not impact the bridge soffit elevation or span lengths. A three-span structure would require 2 piers within the high-water cross-section but are outside of normal flow (1:5-year flows), not expected to cause any barriers for debris, ice flows etc.

A two- span option would require a pier near the centre of the creek channel which would impact the hydraulics and be susceptible to scouring and damage from floating debris and flowing ice. A two-span structure is not recommended for these reasons.

5.4.7 Erosion Protection of Creek Banks

There presently is active erosion occurring on the right creek bank. It extends approximately 50 m downstream from the existing bridge (future EB- Lanes) and is proposed to be protected with rock riprap up to the design high water level (El 663.2). This right bank protection work will consider and incorporate mediation measures for fisheries and fish habitat. The need for protection of the left creek bank will be assessed during the detailed design phase. The top of this left bank extends above the proposed roadway grade line and due to its steep slope and layers of shale bank protection may not be required.

The scope of this project does not include consideration of the state of creek banks at the existing bridge. It has been noted during our site observations that the toe of the headslope at the existing bridge has been eroded 2 to 3 m across the last few years and the bottom of the pier has been exposed. This has been communicated to the COE Transportation group, and our understanding is that the City will undertake maintenance work to address this erosion. If construction scheduling allows for it, it would be advantageous to coordinate any maintenance activities for the existing bridge with the construction activities for the new bridge.

4.5 ENVIRONMENTAL

4.5.1 City of Edmonton Wildlife Passage

Whitemud Creek is a tributary of the North Saskatchewan River and the Whitemud Creek Ravine System is designated as a Biodiversity Core Area (City of Edmonton 2007) and provides habitat and a movement corridor for numerous wildlife species within Edmonton.

During fieldwork completed for the Project, mammal tracks (white-tailed jackrabbit [Lepus townsendii], coyote [Canis latrans], deer spp.) were observed crossing Ellerslie Road at grade (Stantec 2019 and 2020, unpublished data). A winter snow-tracking survey in the Project area on February 7, 2014, identified only few deer tracks south of Ellerslie Road but much more deer activity north of Ellerslie Road. The majority of these deer tracks were near Whitemud Creek, suggesting the forested area adjacent to Whitemud Creek north of Ellerslie Road was being used as winter range (Stantec 2014).

There are two existing wildlife passage structures within the Project area: the existing Whitemud Creek bridge and a box culvert at the unnamed ravine crossing to the east of the existing Whitemud Creek bridge. Evidence of wildlife use of both structures has been observed at both structures during snow track surveys.

Based on an evaluation of the wildlife present, habitat features and constraints, recommendations for wildlife passage have been made by Stantec. For the bridge structure, this includes a minimum opening of 3.0 m high and 3.0 m wide based on Clevenger and Huijser (2011). Height measurement refers to height from expected movement path for terrestrial wildlife. Additional recommendations are outlined within the Wildlife Passage Design Recommendations report prepared by Stantec (2023).

4.5.2 City of Edmonton Bylaw 7188

The North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188) requires an environmental impact assessment (EIA) to be submitted for any infrastructure construction planned to occur in the Bylaw 7188 area. EIAs provide the environmental context of the Project, identify potential adverse environmental effects, and provide mitigation and monitoring techniques to limit adverse environmental impacts.

Stantec is preparing an EIA report for the Project incorporating the baseline data collected during the field programs (i.e., wildlife, rare plant and fisheries). The assessment will include review of design drawings and other information on proposed construction areas including staging and laydown areas. The EIA will be submitted to various City of Edmonton departments for review, circulation and sign off. Approval by City Council is also required.

4.5.3 Water Act

Within the Project, Whitemud Creek is considered a Class B watercourse and has a restricted activity period of April 16 to June 30 (Alberta Environment and Sustainable Resource Development 2012).

Due to the required instream works for the Project, approval under the *Water Act* will be required. The submission for approval will be supported by the results of the fish and fish habitat assessment, which will be summarized in a Qualified Aquatic Environmental Specialist Report (QAES Report). The QAES Report will also evaluate the effects of the Project to fish and fish habitat and will make recommendations for mitigative measures to implement during construction activities.

4.5.4 Public Lands Act

The *Public Lands Act*, administered by Alberta Environment and Protected Areas (AEPA), requires that infrastructure within public lands acquire a formal disposition. The Ellerslie Road bridge crossing at Whitemud Creek will require the completion and submission of a license of occupation disposition (DLO). In addition, bank protection works, such as armoring will also require a separate DLO. The DLO applications will be submitted as part of the detailed design phase of the Project.

4.5.5 Historical Resources Act

In Alberta, historical resources are protected under the Alberta *Historical Resources Act* (*HRA*) and are defined as precontact, historic, and paleontological sites and their contents. Cultural landscapes and traditional use sites may also be associated with historical resources. Within the Project, there are Historic Resource Values (HRVs) of "4a" and "5 a, p" (Alberta Culture 2022), indicating that a significant archaeological site has been recorded within this area and that there is a perceived high potential to encounter significant paleontological resources.

Stantec will submit an *HRA* Application for the entire Project footprint, during the detailed design phase. Alberta Culture will review the Project relative to potential for impacts to historical resources and will issue either approval or requirements for a Historical Resources Impact Assessment (HRIA) relative to archaeological and/or paleontological resources, which may consist of pre-impact assessment or monitoring during construction.

4.5.6 Canadian Navigable Waters Act

The *Canadian Navigable Waters Act* (CNWA) protects the public right to navigate and regulates works constructed within navigable waters. Generally, navigable waters include waterbodies that are capable of being navigated by any type of floating vessel for transportation, recreation, or commerce and where the public has a right to navigate the water as a highway. Whitemud Creek is considered a navigable waterway under the CNWA and there

is precedence of the watercourse having been considered navigable under previous navigable waters legislation. The Project has considered impacts to navigation as part of the preliminary design and was a consideration for not including a center pier as part of the design. The construction of a bridge is classified as a major work under the CNWA and an application for approval is required to be submitted to Transport Canada via Navigation and Protection Program online portal. This application will be submitted by Stantec as part of the detailed design phase of the Project.

4.5.7 Fisheries Act

Stantec completed a fish and fish habitat assessment for this Project on July 19, 2021. Two fish species were captured as part of this assessment, white sucker (*Catostomus commersonii*) and lake chub (***Couesius plumbeus***), however an additional 13 species have been documented within Whitemud Creek (AEPA 2023). The data collected from this assessment will be utilized to prepare the Project QAES report. The QAES Report will evaluate the effects of the Project to fish and fish habitat and will make recommendations for mitigative measures to implement during construction activities. The QAES report and Project design will be submitted to the Department of Fisheries and Oceans Canada (DFO) for review (i.e., Request for Project Review). From this review DFO will either issue a letter of advice or determine that an Authorization under the *Fisheries Act* is required as a result of the Project causing Harmful Alteration, Disruption and Destruction (HADD) of fish habitat. If a HADD is anticipated to occur, the Project will require an offsetting plan, which includes measures to offset lost or altered fish habitat and a subsequent monitoring plan.

4.6 SUMMARY OF GEOTECHNICAL RECOMMENDATIONS

Stantec completed a geotechnical investigation to determine design parameters for the proposed Ellerslie Road crossing over Whitemud Creek in Edmonton, Alberta. The investigation included advancing four boreholes ranging in depth from 15.5 m to 30.8 m for the proposed bridge crossing.

Foundation recommendations and slope stability analyses are included in the preliminary geotechnical memorandums included in **Appendix E**, respectively. The two memoranda provide general information about the soil conditions encountered during the investigation program and the preliminary engineering concepts to address the geotechnical concerns regarding the bridge crossing. Further details will be included in the final geotechnical report.

4.6.1 Historical Instabilities

Two small scale historical landslides along the Whitemud Creek were noted in previous geotechnical reports (Thurber 2015a, 2015b, 2019, Hoggan 2016).

Hoggan (2016) noted a landslide occurred in 1983 due to "inadequate backfill" induced tension cracks and excessive rain on the south side of the existing Ellerslie Road. Stantec surmises this landslide location is approximately 400 m west of the existing bridge.

Thurber (2019) noted a historical landslide to the southwest of the existing Ellerslie Road bridge which occurred prior to 1962 possibly triggered by the original construction activities of Ellerslie Road. It is believed that the landslide may have forced Whitemud Creek to meander southward. A slope inclinometer (SI) was installed on the southwest corner of the slope near the western bridge abutment. The SI did not show any distinct zones of movement when measured between March and June 2019. Thurber conducted a comparison of the crest of the creek valley in the area from 1962 through 2017 indicating little change suggesting no significant slope regression since 1962.

Stantec installed two slope inclinometers (SI) during the current field investigation. These SI did not register any slope movement nine months after installation. However, slope instabilities are very common along the rivers and creeks in the Edmonton area and are triggered by a combination of toe erosion, bedrock softening, rise of ground water level, and development on top of the crest. Therefore, slope instability could be triggered by the new bridge construction, especially due to thick fill placement on the east flood plain. If triggered, two potential planes were identified in the bed rock where deep-seated translational landslide could occur. These land slide surfaces are identified at elevations 657.9 and 659 on the east side of the existing bridge. Use of cast in place (CIP) concrete stabilization piles and a retaining wall is considered to provide slope stability and to retain the embankment fill along the slip planes on the east side of the bridge. Two options are considered for this purpose.

- CIP stabilization piles for the two sliding surfaces with concrete retaining wall for embankment slope stability
- CIP stabilization piles for the two sliding surfaces with a Mechanically Stabilized Earth (MSE) wall for embankment slope stability, in front of the stabilization piles

Further discussion related to slope stability with the two options is provided in the following sections.

4.6.2 Subsurface Conditions

In general, clay till overlying bedrock was encountered on the west side of Whitemud Creek. Top of bedrock was encountered ranging from Elev. 669 m to 666 m on the west side.

The east side of Whitemud Creek appears to be part of a flood plain and consisted of clay, sand, and clay till before encountering bedrock. On the east side of Whitemud Creek, the existing ground elevation of the flood plain is at about Elev. 664 m. The bottom of native clay and clay till ranged from approximately 660 m to 661 m and was underlain by bedrock.

The bedrock at the bridge crossing belongs to the Cretaceous Horseshoe Canyon Formation consisting of interbedded clay shale and sandstone with coal inclusions. Bentonite seams were encountered within the bedrock at approximately Elev. 657.9 m and 654.3 m.

The groundwater level recorded in the piezometers was about 3 m to 4 m below the ground surface on the eastern flood plain and was close to the creek level at approximately Elev. 659 m to 660 m.

The bridge approach on the west side requires cuts of approximately up to 1 m to match the grade alignment of the existing Ellerslie Road bridge. On the east side, an approximately 4.5 m to 5.0 m approach embankment would be required to match the existing grade. Stantec carried out geotechnical investigation for determination of any potential slope instability or movement issue on the east side.
Two slope inclinometers were installed in boreholes BH22-02 and 03 during the current field investigation. These slope inclinometers did not register any slope movement nine months after installation.

4.6.3 Engineering and Construction Challenges

Conclusively, the following challenges were identified during the geotechnical investigation and preliminary design:

- Bedrock as shallow as 2.7 m below ground surface was encountered and could result in difficult driving conditions. Pre-drilling for driven steel piles should be considered to achieve adequate embedment depth.
- Historical slope instabilities were documented by others near the existing bridge suggesting marginally stable creek slopes at the site.
- Tension cracks were observed along the north side of Ellerslie Road, by the eastern bridge abutment, during a site visit by Stantec in 2019. The tension cracks suggest a marginally stable east slope. Slope stabilization measures should be considered in design of the bridge crossing.
- Potential weak planes were identified in the bedrock (bentonite seams) where deep-seated translational landslide could occur. Slope stabilization measures should consider a potential failure mechanism along these weak planes.

4.6.3.1 Retaining Walls

Stantec completed preliminary slope stability analysis for the eastern embankment of the proposed bridge. Slope stability analyses were carried out using the 2- dimensional limit equilibrium computer software. The computer model examines many potential failure surfaces and identifies the “critical” failure surface which produces the minimum Factor of safety (FoS)against sliding. Seven sections (A0, A41.A4, W2, W3, W6 and W10) were adopted to represent the embankment slope from the east bridge abutment towards the eastern gully. (Appendices D1 & D2).
Slope stability analyses were undertaken to assess the global stability for two retaining wall options:

- Option 1 – Concrete wall
- Option 2 – MSE wall

Target factors of safety (FoS) for the short-term case and long-term case was 1.3 and 1.5 respectively. The analysis considered anticipated subsurface conditions at the site and the proposed geometry of the bridge crossing for each retaining wall option. For each option and at each cross section, the following scenarios were completed for the embankment slope stability analysis:

- Long-term stability without stabilization piles.
- Long-term stability with stabilization piles.
- Short-term (End of Construction) stability with stabilization piles.

The long-term stability of the bridge head slope was also assessed for select sections where a concern was identified due to proximity of the retaining structure to the creek or fill placement along the creek bank.

For both options, cast-in-place (CIP) piles were required for slope stabilization. CIP piles were placed directly beneath the concrete abutment wall and 1 m in front of the MSE wall. From Sections A1 to A4, slope stabilization piles would also be required along the lower head slope in addition to those along the concrete abutment wall and MSE wall to achieve adequate FoS against head slope instability. Alternatively, due to the flexibility in the layout of stabilization piles for MSE wall option, stabilization piles could be placed near the west edge of the wildlife crossing to remove the need for a second row of piles along the lower slope. Alternatively, soil nails may also be a suitable option but will require additional analyses and refinement during detailed design.

4.6.3.2 Foundations

Due to relatively high loads to be carried by the pier foundations, it will be necessary to carry the loads on deep foundations. Two bridge foundation options are being evaluated by Stantec's bridge engineer based on whether a MSE wall or a concrete abutment wall will be used to retain the head slope.

For the MSE wall option, the bridge structure will be supported by driven piles for both the abutments and piers. The abutment foundations will consist of H-Piles while the pier foundations will consist of pipe piles filled with concrete. Driven steel piles may require pre-drilling to reach design embedment depth.

For the concrete wall option, the west abutment foundation will consist of steel H-piles. For east abutment foundation, the CIP stabilization piles may also be used to support the abutment loads. The pier foundations will consist of pipe piles filled with concrete, as for the MSE option. Potential sand layers may exist within the overburden. In addition, groundwater levels are approximately at creek level and may ingress into the pile hole. Temporary casing should be available to protect the pile hole from sloughing or caving in, as well as groundwater ingress.

4.6.3.3 Whitemud Creek Erosion Control

Erosion was observed along the creek bank during Stantec's site visit. The proposed bridge crossing should consider erosion protection to prevent loss of soil along the creek bank. Details for erosion protection will be finalized during detailed design.

4.6.3.4 Constructability Constraints

It is expected that normal construction methods will be used for this project.

Due to the steep slopes on the east and west bank of the ravine, difficult access and very limited working area is available for heavy equipment. A suitable site access road will be designed and constructed to provide construction access to this site.

Construction activities will also be constrained by the presence of the ATCO Pipelines along the north boundary of the proposed road widening and at the proposed bridge location. Relocation of the existing pipelines at their crossing of Whitemud Creek must be completed by ATCO prior to bridge construction activities beginning. In addition, the proposed ATCO pipeline relocation may introduce constraints on the design alignment and construction methods of the retaining walls and piles associated with the bridge design. Conversations have been initiated with ATCO on these potential constraints and will be finalized during the detailed design phase.

The proximity to the TUC may also introduce construction constraints. In the event that additional working space is needed outside the boundaries of what is being acquired by the City of Edmonton for inclusion in the future Ellerslie Road right-of-way, an application to Alberta Infrastructure for a Right of Entry for Construction may be required to obtain approval of that additional working space within the TUC lands.

4.6.4 Traffic Accommodation

Ellerslie Road is a major east-west corridor and will remain open throughout construction. All traffic will remain on the existing bridge until the new bridge is operational. Occasional full closures may be required (for example during girder erection), which can be complete on off peak hours.

Regular traffic control measures will be required for access to and from site.

5.0 BRIDGE STRUCTURE ALTERNATIVES

Slab-on-girder bridges are considered the most economical and feasible structure options for the given spans, both single span and three span options have been considered further. A two-span option is not considered further as a centre pier would be directly in the centre of Whitemud Creek, impeding the navigability of the waterway and be susceptible to scouring.

A large concrete or corrugated structural steel arch was considered, however, preliminary analysis showed that an arch structure is not suitable for this crossing due to environmental concerns as it would impact the creek and the wildlife passageway, in addition, construction would be difficult for an arch structure in close proximity to the existing bridge and it is not economical to replace.

Ultimately a one span and a three-span bridge are being considered for the WBLs. These structure options are:

1) Three Span (14.0-20.3-18.0m) Bridge with Retaining Wall
2) Three Span (14.0-20.3-18.0m) Bridge with MSE Wall
3) Single Span (52m) Bridge

A shared used path has been included for each option on the north side of the bridge. Details of the considered options are summarized in the following sections.

5.1 THREE SPAN (14.0-20.3-18.0M) BRIDGE WITH RETAINING WALL

A Three span bridge option was investigated to assess its feasibility (See Sketches given in **Appendix** Error! Reference source not found.). From an environmental perspective, a bridge would accommodate wildlife of all sizes and accommodate a wildlife passage corridor. Based on the features of the ravine, a three span (14.0-20.-18.0m) bridge structure of approximately 52 m out to out of fills (at a skew of 30 degrees LHF) in length would be required.

Standard precast concrete girders (SLC-700) can be utilized for a three span option. This is a common construction method in the local market and typically cost effective due to the use of side by side placed precast girders.

As discussed in the preceding sections, to resolve the slope stability/land sliding issue cast in place concrete (CIP) stabilization piles are recommended along the two aforementioned land sliding surfaces. For this option, the stabilization CIP piles are considered to be used to support the abutment loads on the east side, serving both for carrying the bridge loads and as stabilization piles for slope stability.

Cast in place reinforced concrete deck will be constructed as per Alberta Transportation (AT) standard drawings.

5.2 THREE SPAN (14.0-20.3-18.0M) BRIDGE WITH MSE WALL

This option is similar to the above with the same bridge configuration, except with an MSE wall instead of a retaining wall. To resolve the slope stability issue, CIP stabilization piles will be used as discussed in the preceding sections.

The MSE wall has been used for many bridges on Anthony Henday Drive. Stantec recently designed an 18m high MSE wall on the Aurum Road project including a concrete arch culvert over a creek within the City. All MSE walls have been installed and are functioning as intended.

5.3 SINGLE SPAN BRIDGE (52M)

A single span structure of this length would be NU girder or steel girders. The benefits of a single span structure, such as aesthetics and a larger opening for wildlife are hindered due to the close proximity of the three span bridge directly beside the structure.

A single span structure would have the same requirement for a slope stability solution (retaining wall or MSE wall with cast-in-place stabilization piles).

5.4 DESIGN LOADS.

For preliminary design, all the design loads considered are as specified by Canadian Highway Bridge Design Code except for Live Load. The Live Load used for preliminary analysis was a CL-800 standard design truck as specified by Alberta Bridge Design Manual Seismic Load requirement.

The Site is in a relatively low seismic activity zone. However, Stantec will check the design of the proposed structure to resist the minimum earthquake force as per Canadian Highway Bridge Design Code (CHBDC) according to the specified performance level.

6.0 EVALUATION

6.1 OPINION OF PROBABLE COST

The following table summarizes the opinion of probable cost for the structure options including 10% for contingencies. The standard ARA 15% for engineering and testing is not included in the OPC below.

Other project costs such as utility relocation, additional Right of Way etc. are not included in the total project cost and are assumed to be similar for all options discussed. This methodology is consistent with providing the owner with comparative costs to identify preferable options. All figures have been rounded up to the nearest $10-thousand value.

Traffic accommodation will be covered under the roadway cost estimate.

Table 3: Opinion of Probable Cost

Structure Options	Description	Opinion of Probable Cost Estimate*
1	Three Span (14.0-20.3-18.0m) Bridge with Retaining Wall	$7,866,000.00
2	Three Span (14.0-20.3-18.0m) Bridge with MSE Wall	$7,577,000.00
3	Single Span Bridge (52m)	$9,041,000.00

Stantec Consulting Ltd./Inc. does not guarantee the accuracy of this Estimated Cost. The actual final cost of the project will be determined through the bidding and construction process.

Details of opinion of probable cost estimates are given in Error! Reference source not found.**E.**

6.2 COMPARISON

The following are Pros and Cons of three structure options based on feedback we received from contractor and our own assessment;

Table 4: Pros and Cons of Structure Options

Assessed Item	Three Span Bridge with Retaining Wall	Three Span Bridge with MSE Wall	Single Span Bridge
Aesthetics	Would match overall aesthetics of existing structure.	Would match overall aesthetics of existing structure. MSE walls are available in a variety of pigments and form patterns.	Deep girder height. Sleek with no piers. Doesn't match existing structure.
Roadway impacts	None	None	Deep superstructure and abutment will require excavation at west abutment which may impact the existing bridge and roadway.
Utilities	ATCO line needs to be relocated.	ATCO line needs to be relocated.	ATCO line needs to be relocated.

Assessed Item	Three Span Bridge with Retaining Wall	Three Span Bridge with MSE Wall	Single Span Bridge
	EPCOR SESS impacted	EPCOR SESS impacted	EPCOR SESS impacted
Right-Of-Way	No impact	No impact	No impact
Hydrotechnical	Piers are located outside of the normal water mark, but within the highwater mark. Negligible impact on hydrotechnical capacity.	Piers are located outside of the normal water mark, but within the highwater mark. Negligible impact on hydrotechnical capacity.	No impact to hydrotechnical capacity.
Environmental Impact	Instream work will be required.	Instream work will be required.	Instream work will be required for slope protection and stability measures.
Wildlife			
Constructability	Use of precast standard SLC girders involves comparatively less construction efforts . CIP retaining wall requires formwork, increasing the construction efforts..	Use of precast standard SLC girders involves comparatively less construction efforts. A comparatively large quantity of selected granular fill is required to provide support to MSE wall.	Both NU girder and Steel girder would require field splicing. NU girder may require post tensioning for that much long span. CIP deck slab would require formwork. The only advantage is the elimination of piers. construction.
Design Time	Standard bridge, comparatively short design time	Same as for the first option except that design of MSE	Detailed design of superstructure

Assessed Item	Three Span Bridge with Retaining Wall	Three Span Bridge with MSE Wall	Single Span Bridge
	as the AT standard girders and piles to be used	wall may take additional design time	and foundation required
Construction Time	Cast-in-place wall require longer construction, need form works and cast in place concrete pour.	Precast MSE panel will shorten the construction schedule	Longer fabrication time for girders, no pier construction
Slope Stability/Walls	Need additional row of stability pile in front of wall	Less stability pile	Same as option 1
Geotechnical	Stability piles required	Less stability piles required	Stability piles required
Design Life	75 years	75 years	75 years
Estimated class B Cost	**$7,866,000.00**	$7,577,000.00	$9,041,000.00
Compatibility with existing bridge	Compatible with the existing bridge	Same as option 1	Not compatible with existing bridge, as piers are eliminated
Recommended order of preference	2	1	3

7.0 RECOMMENDATION

We recommend proceeding with detailed design for the 3-span standard SLC girder with MSE wall option.

8.0 CLOSING

We would be pleased to discuss the recommendations provided in this report with the City if required.

Prepared By: Shuxuan Li M.Sc., EIT

Reviewed By: Ren Cheng, M.Eng,. P.Eng.,

Jason Cunha, P.Eng.

9.0 REFERENCES

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Thurber Engineering Ltd. (2015b). South Edmonton Sanitary Sewer (SESS) SW4-SW5 Tunnel Geotechnical Investigation Addendum Report No 1. File No. 14-31-367.

Thurber Engineering Ltd. (2019). Ellerslie Road West of 141 Street Geotechnical Slope Stability Assessment and Preliminary Remedial Options. File No. 24722.

Appendix A – ROADWAY DESIGN

Development Services
URBAN PLANNING AND ECONOMY

City of Edmonton
8th Floor, Edmonton Tower
10111 104 Avenue NW
Edmonton, AB T5J 0J4
edmonton.ca

June 28, 2022 File: Ellerslie Road SW

Stantec Consulting Ltd.
10220 103 Ave NW
Edmonton, AB T5J 0K4

Attention: **Bart Krawczynski, P. Eng**

Subject: **Preliminary Plan: Ellerslie Road (Eco Station Rd - Graydon Hill Blvd) Approval**

We have received the electronic design files for the above listed location and are returning the signed and approved Preliminary Plan.

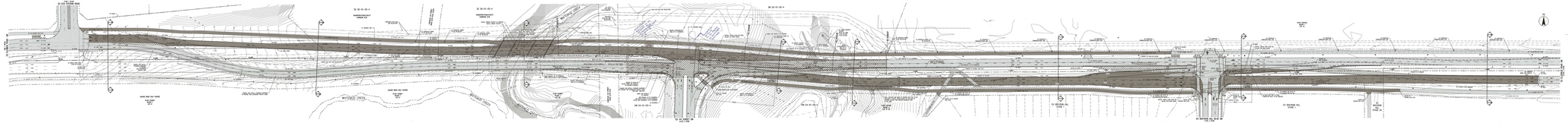
Should you require any additional information regarding this matter, please contact me at laura.grynas@edmonton.ca

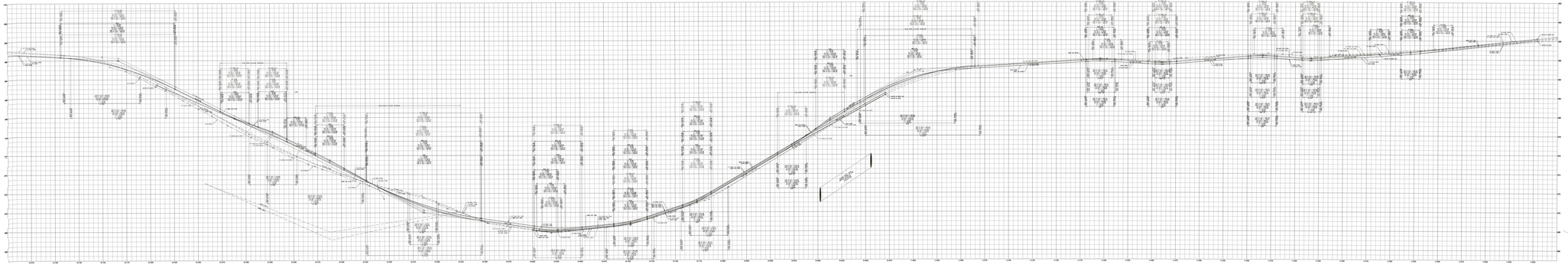
Yours truly,

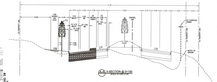
DocuSigned by:
Laura Grynas
4F90B34E6AB549A...

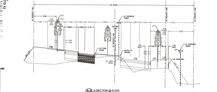
Laura Grynas, P.Eng.
Senior Engineer – Development Engineering and Drawing Review
Development Services Branch
LG/el

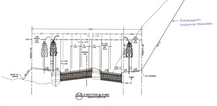
Enclosure

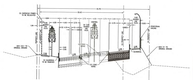


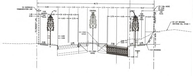


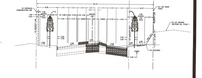


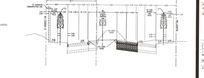












Stantec

STANTEC CONSULTING LTD.
1-11120 - 178 STREET NW
EDMONTON, ALBERTA T5S 1P2
Consulting Engineers

ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE SPECIFIED. DO NOT SCALE DRAWINGS. REPORT ALL DISCREPANCIES TO THE ENGINEER.

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- EXISTING CONTOURS
- PROPOSED EDGE OF TRAVEL
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- PROPOSED EDGE OF SHOULDER
- EXISTING EDGE OF SHOULDER
- PROPOSED CURB
- EXISTING CURB

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PRELIMINARY DESIGN

THIS DRAWING WAS PREPARED FOR THE PRELIMINARY DESIGN PHASE AND MAY NOT BE SUITABLE FOR OTHER PURPOSES.

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Revision/Date of Issued	Dwn.	Ver.	Chk'd

PROFESSIONAL ENGINEER STAMP/SEAL

PERMIT TO PRACTICE
STANTEC CONSULTING LTD.
PERMIT NUMBER: P 5279
APPROVED BY: EGBC
EXPIRY DATE: DECEMBER 31, 2012

DESIGNED	K. W.	Y.R.	2009
PREPARED	K. W.	Y.R.	2009
REVIEWED	K. W.	Y.R.	2009

DATE CHORD_LENGTHS PREPARED: OCT 2009

SUBMITTED BY:

SUBMITTED TO:
BROOKFIELD RESIDENTIAL
EDMONTON

ELLERSLIE ROAD SW
ECO DIVISION ROAD TO GRAYDON HILL BLVD.

Alternative 1A

ELLERSLIE ROAD SW
ECO DIVISION ROAD TO GRAYDON HILL BLVD.
PRELIMINARY ROADWAY PLAN

Scale: 1:500 (H) 1:50 (V)

Drawing No.:
P1

Appendix B - SITE PHOTOS

Stantec	Project File:	**1161110185- Ellerslie Road Bridge Over Whitemud Creek, City of Edmonton**	
	Bridge File Number:	**B093**	
Year Built:	**Existing bridge, 1965**	By:	**Ren Cheng**
Date:	**20220419, 20220617, 20191117**	Page:	**1 / 15**

Photo 1
Photo labels and locations

Photo 2- IMG3764

Existing bridge general view looking from Northwest (Photo taken on June17, 2022)

Stantec	Project File:	**1161110185- Ellerslie Road Bridge Over Whitemud Creek, City of Edmonton**	
	Bridge File Number:	**B093**	
Year Built:	**Existing bridge, 1965**	By:	**Ren Cheng**
Date:	**20220419, 20220617, 20191117**	Page:	**2 / 15**

Photo 3 _IMG3774
Scour at downstream east bank, (Photo taken on June17, 2022)

Photo 4- IMG_3765

Northeast headslope and sideslope of the existing bridge (Photo taken on June17, 2022)

Photo 5- IMG_3776

Slope inclinometers at west (Photo taken on June17, 2022)

Photo 6- IMG_1958
Slope inclinometers at east (Photo taken on April 19, 2022)

Photo 7- IMG_1088
Northeast headslope and sideslope of the existing bridge, creek at the north (Photo taken on November 17, 2019)

Photo 8- IMG_1092
East headslope (Photo taken on November 17, 2019)

Photo 9- IMG_3780
Whitemud Creek looking downstream at the north of existing bridge(Photo taken on June17, 2022)
.

Photo 10- IMG_3799
Half CSP drainpipe at Northwest
(Photo taken on June17, 2022)

Photo 11- IMG_3801
Ellerslie Road looking east (Photo taken on June17, 2022)

Photo 12- IMG_3777
Underside of the existing bridge showing peri column (Photo taken on June17, 2022)

Stantec	Project File:	**1161110185- Ellerslie Road Bridge Over Whitemud Creek, City of Edmonton**	
	Bridge File Number:	**B093**	
Year Built:	**Existing bridge, 1965**	By:	**Ren Cheng**
Date:	**20220419, 20220617, 20191117**	Page:	**7 / 15**

Photo 13- IMG_3779
Scour at the east pier (Photo taken on June17, 2022)

Photo 14- IMG_3792
Upstream looking form the bridge (Photo taken on June17, 2022)

Photo 15- IMG_1962
Elevation view of the existing bridge and watermain, looking south (Photo taken on April 19, 2022)

Photo 16- IMG_1974

Bank at the Northwest, looking west (Photo taken on April 19, 2022)

Stantec	Project File:	**1161110185- Ellerslie Road Bridge Over Whitemud Creek, City of Edmonton**	
	Bridge File Number:	**B093**	
Year Built:	**Existing bridge, 1965**	By:	**Ren Cheng**
Date:	**20220419, 20220617, 20191117**	Page:	**9 / 15**

Photo 17- IMG_1960
Elevation view looking from Northeast (Photo taken on April 19, 2022)

Photo 18- IMG_1994
.
Erosion at the east pier (Photo taken on April 19, 2022)

Stantec	Project File:	**1161110185- Ellerslie Road Bridge Over Whitemud Creek, City of Edmonton**	
	Bridge File Number:	**B093**	
Year Built:	**Existing bridge, 1965**	By:	**Ren Cheng**
Date:	**20220419, 20220617, 20191117**	Page:	**10 / 15**

Photo 19- IMG_1098

Watermain at the east abutment (Photo taken on November 17, 2019)
.

Photo 20- IMG_1972
East pier looking west
(Photo taken on April 19, 2022)

Photo 21- IMG_1966
Elevation view looking north (Photo taken on April 19, 2022)

Photo 22- IMG_1969
Underside of the existing bridge at east span
(Photo taken on April 19, 2022)

Photo 23- IMG_1998
West span (Photo taken on April 19, 2022)

Photo 24- IMG_1996
West River ban at upstream
(Photo taken on April 19, 2022)

Stantec	Project File:	**1161110185- Ellerslie Road Bridge Over Whitemud Creek, City of Edmonton**	
	Bridge File Number:	**B093**	
Year Built:	**Existing bridge, 1965**	By:	**Ren Cheng**
Date:	**20220419, 20220617, 20191117**	Page:	**133 / 15**

Photo 25- IMG_2003
Scour at the upstream bank
(Photo taken on April 19, 2022)

Photo 26- IMG_3799
.
(Photo taken on April 19, 2022)

Stantec	Project File:	**1161110185- Ellerslie Road Bridge Over Whitemud Creek, City of Edmonton**	
	Bridge File Number:	**B093**	
Year Built:	**Existing bridge, 1965**	By:	**Ren Cheng**
Date:	**20220419, 20220617, 20191117**	Page:	**144 /15**

Photo 27- IMG_1959
West bank at the downstream (Photo taken on April 19, 2022)

Photo 28- IMG_1985
West bank at the downstream, bed rock exposed.
(Photo taken on April 19, 2022)

Stantec	Project File:	**1161110185- Ellerslie Road Bridge Over Whitemud Creek, City of Edmonton**	
	Bridge File Number:	**B093**	
Year Built:	**Existing bridge, 1965**	By:	**Ren Cheng**
Date:	**20220419, 20220617, 20191117**	Page:	**155 / 15**

Photo 29 IMG_3769
Northeast bank
(Photo taken on June17, 2022)

Photo 30- IMG_3787
Steep slope at the west bank, downstream
(Photo taken on June17, 2022)

Appendix C – HYDRAULIC ANALYSIS

Frequency Analysis Results	
Return Period	**Q (cms)**
2	**9.35**
5	**25.02**
10	**43.34**
25	**78.49**
50	**115.54**
100	**164.08**
200	**226.86**

HydroChan Rating Curve								
	n=0.035				**n=0.05**			
	Elevation (m)	A (m2)	V (m/s)	Q (m3/s)	Elevation (m)	A (m2)	V (m/s)	Q (m3/s)
1:2 years	660.1	7.81	1.24	9.72	660.26	9.55	0.96	9.15
1:5 years	660.7	14.80	1.67	24.64	661.04	19.32	1.29	24.92
1:10 years	661.3	23.36	1.87	43.63	661.76	32.23	1.39	44.88
1:25 years	662	37.46	2.13	79.87	662.42	47.17	1.65	78.00
1:50 years	662.5	49.10	2.40	118.03	663.02	62.26	1.86	115.88
1:100 years	663	61.73	2.65	163.57	663.68	80.50	2.07	166.44
1:200 years	663.6	78.20	2.92	228.29	664.34	100.49	2.26	226.75

	Left Overbank			Main Channel			Right Overbank			Total	
Elevation	A	V	Q	A	V	Q	A	V	Q	Q	
(m)	(m^2)	(m/s)	(m^3/s)	(m^2)	(m/s)	(m^3/s)	(m^2)	(m/s)	(m^3/s)	(m^3/s)	
659.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
659.05	0.00	0.00	0.00	0.02	0.12	0.00	0.00	0.00	0.00	0.00	
659.10	0.00	0.00	0.00	0.08	0.19	0.02	0.00	0.00	0.00	0.02	
659.15	0.00	0.00	0.00	0.19	0.25	0.05	0.00	0.00	0.00	0.05	
659.20	0.00	0.00	0.00	0.34	0.30	0.10	0.00	0.00	0.00	0.10	
659.25	0.00	0.00	0.00	0.53	0.35	0.18	0.00	0.00	0.00	0.18	
659.30	0.00	0.00	0.00	0.76	0.39	0.30	0.00	0.00	0.00	0.30	
659.35	0.00	0.00	0.00	1.03	0.43	0.45	0.00	0.00	0.00	0.45	
659.40	0.00	0.00	0.00	1.35	0.48	0.64	0.00	0.00	0.00	0.64	
659.45	0.00	0.00	0.00	1.71	0.51	0.88	0.00	0.00	0.00	0.88	
659.50	0.00	0.00	0.00	2.11	0.55	1.16	0.00	0.00	0.00	1.16	
659.55	0.00	0.00	0.00	2.54	0.61	1.56	0.00	0.00	0.00	1.56	
659.60	0.00	0.00	0.00	2.97	0.67	2.00	0.00	0.00	0.00	2.00	
659.65	0.00	0.00	0.00	3.42	0.73	2.48	0.00	0.00	0.00	2.48	
659.70	0.00	0.00	0.00	3.87	0.78	3.01	0.00	0.00	0.00	3.01	
659.75	0.00	0.00	0.00	4.33	0.83	3.58	0.00	0.00	0.00	3.58	
659.80	0.00	0.00	0.00	4.80	0.87	4.19	0.00	0.00	0.00	4.19	
659.85	0.00	0.00	0.00	5.28	0.92	4.85	0.00	0.00	0.00	4.85	
659.90	0.00	0.00	0.00	5.77	0.96	5.54	0.00	0.00	0.00	5.54	
659.95	0.00	0.00	0.00	6.27	1.00	6.28	0.00	0.00	0.00	6.28	
660.00	0.00	0.00	0.00	6.77	1.04	7.06	0.00	0.00	0.00	7.06	
660.05	0.00	0.00	0.00	7.29	1.08	7.87	0.00	0.00	0.00	7.87	
660.10	0.00	0.00	0.00	7.81	1.12	8.73	0.00	0.00	0.00	8.73	
660.15	0.00	0.00	0.00	8.35	1.15	9.62	0.00	0.00	0.00	9.62	1:2 years
660.20	0.00	0.00	0.00	8.89	1.19	10.56	0.00	0.00	0.00	10.56	
660.25	0.00	0.00	0.00	9.44	1.22	11.54	0.00	0.00	0.00	11.54	
660.30	0.00	0.00	0.00	10.00	1.26	12.55	0.00	0.00	0.00	12.55	
660.35	0.00	0.00	0.00	10.57	1.29	13.61	0.00	0.00	0.00	13.61	
660.40	0.00	0.00	0.00	11.14	1.32	14.71	0.00	0.00	0.00	14.71	
660.45	0.00	0.00	0.00	11.73	1.35	15.84	0.00	0.00	0.00	15.84	
660.50	0.00	0.00	0.00	12.33	1.38	17.02	0.00	0.00	0.00	17.02	
660.55	0.00	0.00	0.00	12.93	1.41	18.24	0.00	0.00	0.00	18.24	
660.60	0.00	0.00	0.00	13.54	1.44	19.49	0.00	0.00	0.00	19.49	
660.65	0.00	0.00	0.00	14.16	1.47	20.79	0.00	0.00	0.00	20.79	
660.70	0.00	0.00	0.00	14.80	1.50	22.13	0.00	0.00	0.00	22.13	
660.75	0.00	0.00	0.00	15.43	1.52	23.51	0.00	0.00	0.00	23.51	
660.80	0.00	0.00	0.00	16.08	1.55	24.94	0.00	0.00	0.00	24.94	1:5 years
660.85	0.00	0.00	0.00	16.74	1.58	26.40	0.00	0.00	0.00	26.40	
660.90	0.00	0.00	0.00	17.41	1.60	27.90	0.00	0.00	0.00	27.90	
660.95	0.00	0.00	0.00	18.08	1.63	29.45	0.00	0.00	0.00	29.45	
661.00	0.00	0.00	0.00	18.76	1.65	31.04	0.00	0.00	0.00	31.04	
661.05	0.00	0.00	0.00	19.47	1.66	32.22	0.00	0.00	0.00	32.22	
661.10	0.00	0.00	0.00	20.19	1.66	33.47	0.00	0.00	0.00	33.47	
661.15	0.00	0.00	0.00	20.95	1.66	34.79	0.00	0.00	0.00	34.79	
661.20	0.00	0.00	0.00	21.73	1.67	36.18	0.00	0.00	0.00	36.18	
661.25	0.00	0.00	0.00	22.53	1.67	37.65	0.00	0.00	0.00	37.65	
661.30	0.00	0.00	0.00	23.36	1.68	39.19	0.00	0.00	0.00	39.19	
661.35	0.00	0.00	0.00	24.22	1.68	40.80	0.00	0.00	0.00	40.80	
661.40	0.00	0.00	0.00	25.11	1.69	42.49	0.00	0.00	0.00	42.49	
661.45	0.00	0.00	0.00	26.02	1.70	44.26	0.00	0.00	0.00	44.26	1:10 years
661.50	0.00	0.00	0.00	26.95	1.71	46.10	0.00	0.00	0.00	46.10	
661.55	0.00	0.00	0.00	27.92	1.72	48.03	0.00	0.00	0.00	48.03	
661.60	0.00	0.00	0.00	28.91	1.73	50.03	0.00	0.00	0.00	50.03	
661.65	0.00	0.00	0.00	29.92	1.74	52.11	0.00	0.00	0.00	52.11	
661.70	0.00	0.00	0.00	30.96	1.75	54.27	0.00	0.00	0.00	54.27	
661.75	0.00	0.00	0.00	32.02	1.78	57.02	0.00	0.00	0.00	57.02	
661.80	0.00	0.00	0.00	33.09	1.81	59.83	0.00	0.00	0.00	59.83	
661.85	0.00	0.00	0.00	34.17	1.84	62.71	0.00	0.00	0.00	62.71	
661.90	0.00	0.00	0.00	35.26	1.86	65.65	0.00	0.00	0.00	65.65	
661.95	0.00	0.00	0.00	36.36	1.89	68.66	0.00	0.00	0.00	68.66	
662.00	0.00	0.00	0.00	37.46	1.91	71.73	0.00	0.00	0.00	71.73	
662.05	0.00	0.00	0.00	38.58	1.94	74.86	0.00	0.00	0.00	74.86	

662.10	0.00	0.00	0.00	39.71	1.97	78.06	0.00	0.00	0.00	78.06	1:25 years
662.15	0.00	0.00	0.00	40.85	1.99	81.33	0.00	0.00	0.00	81.33	
662.20	0.00	0.00	0.00	42.00	2.02	84.65	0.00	0.00	0.00	84.65	
662.25	0.00	0.00	0.00	43.16	2.04	88.05	0.00	0.00	0.00	88.05	
662.30	0.00	0.00	0.00	44.33	2.06	91.51	0.00	0.00	0.00	91.51	
662.35	0.00	0.00	0.00	45.51	2.09	95.03	0.00	0.00	0.00	95.03	
662.40	0.00	0.00	0.00	46.69	2.11	98.62	0.00	0.00	0.00	98.62	
662.45	0.00	0.00	0.00	47.89	2.14	102.28	0.00	0.00	0.00	102.28	
662.50	0.00	0.00	0.00	49.10	2.16	106.00	0.00	0.00	0.00	106.00	
662.55	0.00	0.00	0.00	50.32	2.18	109.79	0.00	0.00	0.00	109.79	
662.60	0.00	0.00	0.00	51.55	2.20	113.64	0.00	0.00	0.00	113.64	1:50 years
662.65	0.00	0.00	0.00	52.78	2.23	117.57	0.00	0.00	0.00	117.57	
662.70	0.00	0.00	0.00	54.03	2.25	121.55	0.00	0.00	0.00	121.55	
662.75	0.00	0.00	0.00	55.29	2.27	125.61	0.00	0.00	0.00	125.61	
662.80	0.00	0.00	0.00	56.56	2.29	129.73	0.00	0.00	0.00	129.73	
662.85	0.00	0.00	0.00	57.84	2.32	133.92	0.00	0.00	0.00	133.92	
662.90	0.00	0.00	0.00	59.12	2.34	138.18	0.00	0.00	0.00	138.18	
662.95	0.00	0.00	0.00	60.42	2.36	142.51	0.00	0.00	0.00	142.51	
663.00	0.00	0.00	0.00	61.73	2.38	146.90	0.00	0.00	0.00	146.90	
663.05	0.00	0.00	0.00	63.05	2.40	151.36	0.00	0.00	0.00	151.36	
663.10	0.00	0.00	0.00	64.38	2.42	155.89	0.00	0.00	0.00	155.89	
663.15	0.00	0.00	0.00	65.71	2.44	160.49	0.00	0.00	0.00	160.49	
663.20	0.00	0.00	0.00	67.06	2.46	165.16	0.00	0.00	0.00	165.16	1:100 years
663.25	0.00	0.00	0.00	68.42	2.48	169.90	0.00	0.00	0.00	169.90	
663.30	0.00	0.00	0.00	69.79	2.50	174.71	0.00	0.00	0.00	174.71	
663.35	0.00	0.00	0.00	71.16	2.52	179.59	0.00	0.00	0.00	179.59	
663.40	0.00	0.00	0.00	72.55	2.54	184.53	0.00	0.00	0.00	184.53	
663.45	0.00	0.00	0.00	73.95	2.56	189.55	0.00	0.00	0.00	189.55	
663.50	0.00	0.00	0.00	75.36	2.58	194.64	0.00	0.00	0.00	194.64	
663.55	0.00	0.00	0.00	76.77	2.60	199.80	0.00	0.00	0.00	199.80	
663.60	0.00	0.00	0.00	78.20	2.62	205.03	0.00	0.00	0.00	205.03	
663.65	0.00	0.00	0.00	79.64	2.64	210.33	0.00	0.00	0.00	210.33	
663.70	0.00	0.00	0.00	81.08	2.66	215.71	0.00	0.00	0.00	215.71	
663.75	0.00	0.00	0.00	82.54	2.68	221.15	0.00	0.00	0.00	221.15	
663.80	0.00	0.00	0.00	84.01	2.70	226.67	0.00	0.00	0.00	226.67	1:200 years
663.85	0.00	0.00	0.00	85.48	2.72	232.26	0.00	0.00	0.00	232.26	
663.90	0.00	0.00	0.00	86.97	2.74	237.92	0.00	0.00	0.00	237.92	
663.95	0.00	0.00	0.00	88.47	2.75	243.65	0.00	0.00	0.00	243.65	
664.00	0.00	0.00	0.00	89.98	2.77	249.46	0.00	0.00	0.00	249.46	

Rating Curve Data: n=0.035

	Left Overbank			Main Channel			Right Overbank			Total	
Elevation	A	V	Q	A	V	Q	A	V	Q	Q	
(m)	(m^2)	(m/s)	(m^3/s)	(m^2)	(m/s)	(m^3/s)	(m^2)	(m/s)	(m^3/s)	(m^3/s)	
659.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
659.10	0.00	0.00	0.00	0.08	0.21	0.02	0.00	0.00	0.00	0.02	
659.20	0.00	0.00	0.00	0.34	0.33	0.11	0.00	0.00	0.00	0.11	
659.30	0.00	0.00	0.00	0.76	0.44	0.33	0.00	0.00	0.00	0.33	
659.40	0.00	0.00	0.00	1.35	0.53	0.71	0.00	0.00	0.00	0.71	
659.50	0.00	0.00	0.00	2.11	0.61	1.30	0.00	0.00	0.00	1.30	
659.60	0.00	0.00	0.00	2.97	0.75	2.22	0.00	0.00	0.00	2.22	
659.70	0.00	0.00	0.00	3.87	0.87	3.35	0.00	0.00	0.00	3.35	
659.80	0.00	0.00	0.00	4.80	0.97	4.67	0.00	0.00	0.00	4.67	
659.90	0.00	0.00	0.00	5.77	1.07	6.17	0.00	0.00	0.00	6.17	
660.00	0.00	0.00	0.00	6.77	1.16	7.86	0.00	0.00	0.00	7.86	
660.10	0.00	0.00	0.00	7.81	1.24	9.72	0.00	0.00	0.00	9.72	
660.20	0.00	0.00	0.00	8.89	1.32	11.76	0.00	0.00	0.00	11.76	
660.30	0.00	0.00	0.00	10.00	1.40	13.98	0.00	0.00	0.00	13.98	
660.40	0.00	0.00	0.00	11.14	1.47	16.38	0.00	0.00	0.00	16.38	
660.50	0.00	0.00	0.00	12.33	1.54	18.95	0.00	0.00	0.00	18.95	
660.60	0.00	0.00	0.00	13.54	1.60	21.71	0.00	0.00	0.00	21.71	
660.70	0.00	0.00	0.00	14.80	1.67	24.64	0.00	0.00	0.00	24.64	1:5 years
660.80	0.00	0.00	0.00	16.08	1.73	27.77	0.00	0.00	0.00	27.77	
660.90	0.00	0.00	0.00	17.41	1.79	31.07	0.00	0.00	0.00	31.07	
661.00	0.00	0.00	0.00	18.76	1.84	34.56	0.00	0.00	0.00	34.56	
661.10	0.00	0.00	0.00	20.19	1.85	37.26	0.00	0.00	0.00	37.26	
661.20	0.00	0.00	0.00	21.73	1.85	40.28	0.00	0.00	0.00	40.28	
661.30	0.00	0.00	0.00	23.36	1.87	43.63	0.00	0.00	0.00	43.63	1:10 years
661.40	0.00	0.00	0.00	25.11	1.88	47.31	0.00	0.00	0.00	47.31	
661.50	0.00	0.00	0.00	26.95	1.90	51.33	0.00	0.00	0.00	51.33	
661.60	0.00	0.00	0.00	28.91	1.93	55.70	0.00	0.00	0.00	55.70	
661.70	0.00	0.00	0.00	30.96	1.95	60.43	0.00	0.00	0.00	60.43	
661.80	0.00	0.00	0.00	33.09	2.01	66.62	0.00	0.00	0.00	66.62	
661.90	0.00	0.00	0.00	35.26	2.07	73.10	0.00	0.00	0.00	73.10	
662.00	0.00	0.00	0.00	37.46	2.13	79.87	0.00	0.00	0.00	79.87	1:25 years
662.10	0.00	0.00	0.00	39.71	2.19	86.92	0.00	0.00	0.00	86.92	
662.20	0.00	0.00	0.00	42.00	2.24	94.26	0.00	0.00	0.00	94.26	
662.30	0.00	0.00	0.00	44.33	2.30	101.89	0.00	0.00	0.00	101.89	
662.40	0.00	0.00	0.00	46.69	2.35	109.81	0.00	0.00	0.00	109.81	
662.50	0.00	0.00	0.00	49.10	2.40	118.03	0.00	0.00	0.00	118.03	1:50 years
662.60	0.00	0.00	0.00	51.55	2.45	126.54	0.00	0.00	0.00	126.54	
662.70	0.00	0.00	0.00	54.03	2.50	135.35	0.00	0.00	0.00	135.35	
662.80	0.00	0.00	0.00	56.56	2.55	144.45	0.00	0.00	0.00	144.45	
662.90	0.00	0.00	0.00	59.12	2.60	153.86	0.00	0.00	0.00	153.86	
663.00	0.00	0.00	0.00	61.73	2.65	163.57	0.00	0.00	0.00	163.57	1:100 years
663.10	0.00	0.00	0.00	64.38	2.70	173.58	0.00	0.00	0.00	173.58	
663.20	0.00	0.00	0.00	67.06	2.74	183.90	0.00	0.00	0.00	183.90	
663.30	0.00	0.00	0.00	69.79	2.79	194.53	0.00	0.00	0.00	194.53	
663.40	0.00	0.00	0.00	72.55	2.83	205.47	0.00	0.00	0.00	205.47	
663.50	0.00	0.00	0.00	75.36	2.88	216.72	0.00	0.00	0.00	216.72	
663.60	0.00	0.00	0.00	78.20	2.92	228.29	0.00	0.00	0.00	228.29	1:200 years
663.70	0.00	0.00	0.00	81.08	2.96	240.18	0.00	0.00	0.00	240.18	
663.80	0.00	0.00	0.00	84.01	3.00	252.39	0.00	0.00	0.00	252.39	
663.90	0.00	0.00	0.00	86.97	3.05	264.91	0.00	0.00	0.00	264.91	
664.00	0.00	0.00	0.00	89.98	3.09	277.77	0.00	0.00	0.00	277.77	
664.10	0.00	0.00	0.00	93.02	3.13	290.95	0.00	0.00	0.00	290.95	
664.20	0.00	0.00	0.00	96.10	3.17	304.46	0.00	0.00	0.00	304.46	
664.30	0.00	0.00	0.00	99.22	3.21	318.30	0.00	0.00	0.00	318.30	
664.40	0.00	0.00	0.00	102.39	3.25	332.47	0.00	0.00	0.00	332.47	
664.50	0.00	0.00	0.00	105.59	3.29	346.98	0.00	0.00	0.00	346.98	
664.60	0.00	0.00	0.00	108.83	3.32	361.83	0.00	0.00	0.00	361.83	
664.70	0.00	0.00	0.00	112.11	3.36	377.02	0.00	0.00	0.00	377.02	
664.80	0.00	0.00	0.00	115.44	3.40	392.55	0.00	0.00	0.00	392.55	
664.90	0.00	0.00	0.00	118.81	3.43	407.44	0.00	0.00	0.00	407.44	
665.00	0.00	0.00	0.00	122.23	3.46	422.72	0.00	0.00	0.00	422.72	

Rating Curve Data: n=0.05

	Left Overbank			Main Channel			Right Overbank			Total	
Elevation	A	V	Q	A	V	Q	A	V	Q	Q	
(m)	(m^2)	(m/s)	(m^3/s)	(m^2)	(m/s)	(m^3/s)	(m^2)	(m/s)	(m^3/s)	(m^3/s)	
659.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
659.06	0.00	0.00	0.00	0.03	0.10	0.00	0.00	0.00	0.00	0.00	
659.12	0.00	0.00	0.00	0.12	0.17	0.02	0.00	0.00	0.00	0.02	
659.18	0.00	0.00	0.00	0.27	0.22	0.06	0.00	0.00	0.00	0.06	
659.24	0.00	0.00	0.00	0.49	0.26	0.13	0.00	0.00	0.00	0.13	
659.30	0.00	0.00	0.00	0.76	0.31	0.23	0.00	0.00	0.00	0.23	
659.36	0.00	0.00	0.00	1.09	0.35	0.38	0.00	0.00	0.00	0.38	
659.42	0.00	0.00	0.00	1.49	0.38	0.57	0.00	0.00	0.00	0.57	
659.48	0.00	0.00	0.00	1.94	0.42	0.81	0.00	0.00	0.00	0.81	
659.54	0.00	0.00	0.00	2.45	0.47	1.15	0.00	0.00	0.00	1.15	
659.60	0.00	0.00	0.00	2.97	0.52	1.56	0.00	0.00	0.00	1.56	
659.66	0.00	0.00	0.00	3.51	0.57	2.01	0.00	0.00	0.00	2.01	
659.72	0.00	0.00	0.00	4.05	0.62	2.52	0.00	0.00	0.00	2.52	
659.78	0.00	0.00	0.00	4.61	0.67	3.07	0.00	0.00	0.00	3.07	
659.84	0.00	0.00	0.00	5.19	0.71	3.67	0.00	0.00	0.00	3.67	
659.90	0.00	0.00	0.00	5.77	0.75	4.32	0.00	0.00	0.00	4.32	
659.96	0.00	0.00	0.00	6.37	0.79	5.01	0.00	0.00	0.00	5.01	
660.02	0.00	0.00	0.00	6.98	0.82	5.75	0.00	0.00	0.00	5.75	
660.08	0.00	0.00	0.00	7.60	0.86	6.53	0.00	0.00	0.00	6.53	
660.14	0.00	0.00	0.00	8.24	0.89	7.36	0.00	0.00	0.00	7.36	
660.20	0.00	0.00	0.00	8.89	0.93	8.23	0.00	0.00	0.00	8.23	
660.26	0.00	0.00	0.00	9.55	0.96	9.15	0.00	0.00	0.00	9.15	1:2 years
660.32	0.00	0.00	0.00	10.23	0.99	10.11	0.00	0.00	0.00	10.11	
660.38	0.00	0.00	0.00	10.91	1.02	11.12	0.00	0.00	0.00	11.12	
660.44	0.00	0.00	0.00	11.61	1.05	12.17	0.00	0.00	0.00	12.17	
660.50	0.00	0.00	0.00	12.33	1.08	13.27	0.00	0.00	0.00	13.27	
660.56	0.00	0.00	0.00	13.05	1.10	14.41	0.00	0.00	0.00	14.41	
660.62	0.00	0.00	0.00	13.79	1.13	15.60	0.00	0.00	0.00	15.60	
660.68	0.00	0.00	0.00	14.54	1.16	16.83	0.00	0.00	0.00	16.83	
660.74	0.00	0.00	0.00	15.31	1.18	18.11	0.00	0.00	0.00	18.11	
660.80	0.00	0.00	0.00	16.08	1.21	19.44	0.00	0.00	0.00	19.44	
660.86	0.00	0.00	0.00	16.87	1.23	20.81	0.00	0.00	0.00	20.81	
660.92	0.00	0.00	0.00	17.67	1.26	22.23	0.00	0.00	0.00	22.23	
660.98	0.00	0.00	0.00	18.49	1.28	23.69	0.00	0.00	0.00	23.69	
661.04	0.00	0.00	0.00	19.32	1.29	24.92	0.00	0.00	0.00	24.92	1:5 years
661.10	0.00	0.00	0.00	20.19	1.29	26.08	0.00	0.00	0.00	26.08	
661.16	0.00	0.00	0.00	21.10	1.29	27.33	0.00	0.00	0.00	27.33	
661.22	0.00	0.00	0.00	22.05	1.30	28.65	0.00	0.00	0.00	28.65	
661.28	0.00	0.00	0.00	23.03	1.31	30.06	0.00	0.00	0.00	30.06	
661.34	0.00	0.00	0.00	24.05	1.31	31.55	0.00	0.00	0.00	31.55	
661.40	0.00	0.00	0.00	25.11	1.32	33.12	0.00	0.00	0.00	33.12	
661.46	0.00	0.00	0.00	26.20	1.33	34.78	0.00	0.00	0.00	34.78	
661.52	0.00	0.00	0.00	27.34	1.34	36.53	0.00	0.00	0.00	36.53	
661.58	0.00	0.00	0.00	28.51	1.35	38.36	0.00	0.00	0.00	38.36	
661.64	0.00	0.00	0.00	29.72	1.36	40.29	0.00	0.00	0.00	40.29	
661.70	0.00	0.00	0.00	30.96	1.37	42.30	0.00	0.00	0.00	42.30	
661.76	0.00	0.00	0.00	32.23	1.39	44.88	0.00	0.00	0.00	44.88	1:10 years
661.82	0.00	0.00	0.00	33.52	1.42	47.53	0.00	0.00	0.00	47.53	
661.88	0.00	0.00	0.00	34.82	1.44	50.25	0.00	0.00	0.00	50.25	
661.94	0.00	0.00	0.00	36.14	1.47	53.04	0.00	0.00	0.00	53.04	
662.00	0.00	0.00	0.00	37.46	1.49	55.91	0.00	0.00	0.00	55.91	
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Rating Curve Data: n=0.05

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663.38	0.00	0.00	0.00	71.99	1.98	142.28	0.00	0.00	0.00	142.28	
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663.98	0.00	0.00	0.00	89.37	2.16	192.62	0.00	0.00	0.00	192.62	
664.04	0.00	0.00	0.00	91.19	2.17	198.10	0.00	0.00	0.00	198.10	
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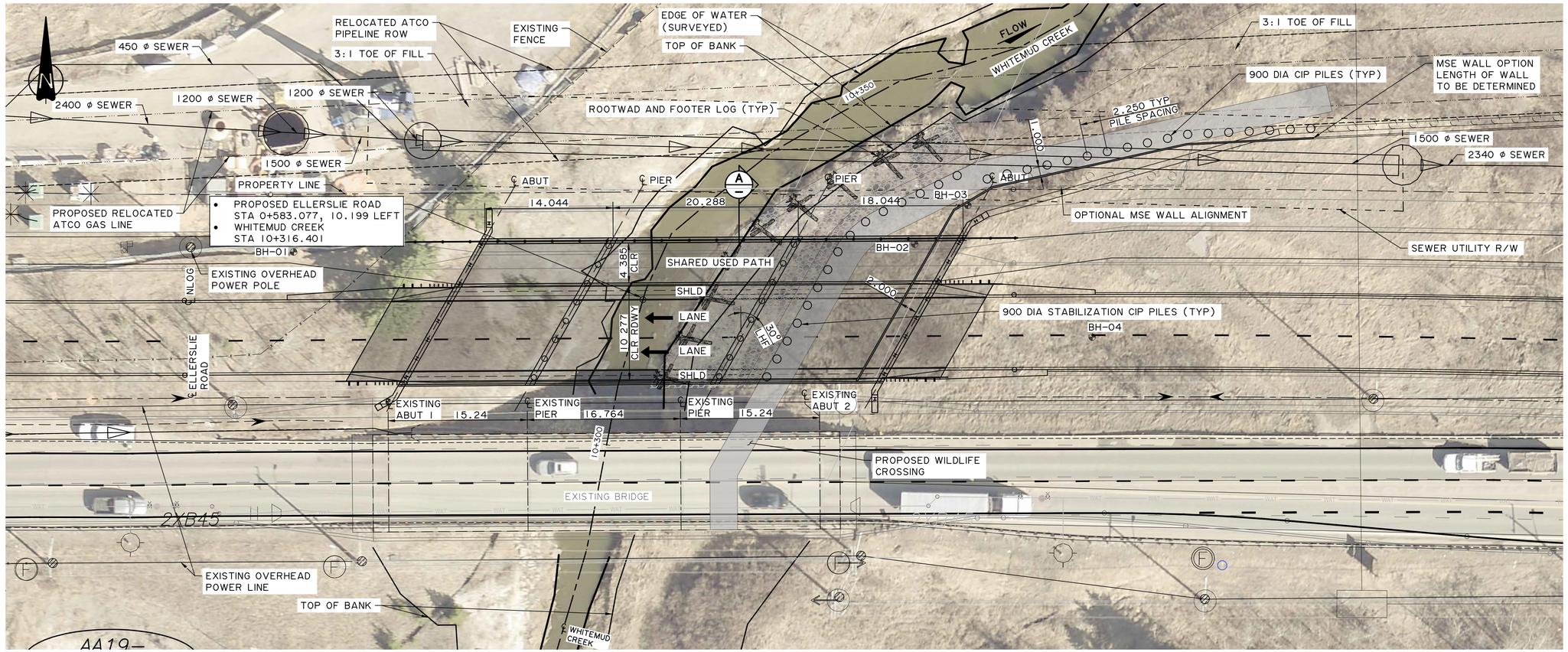
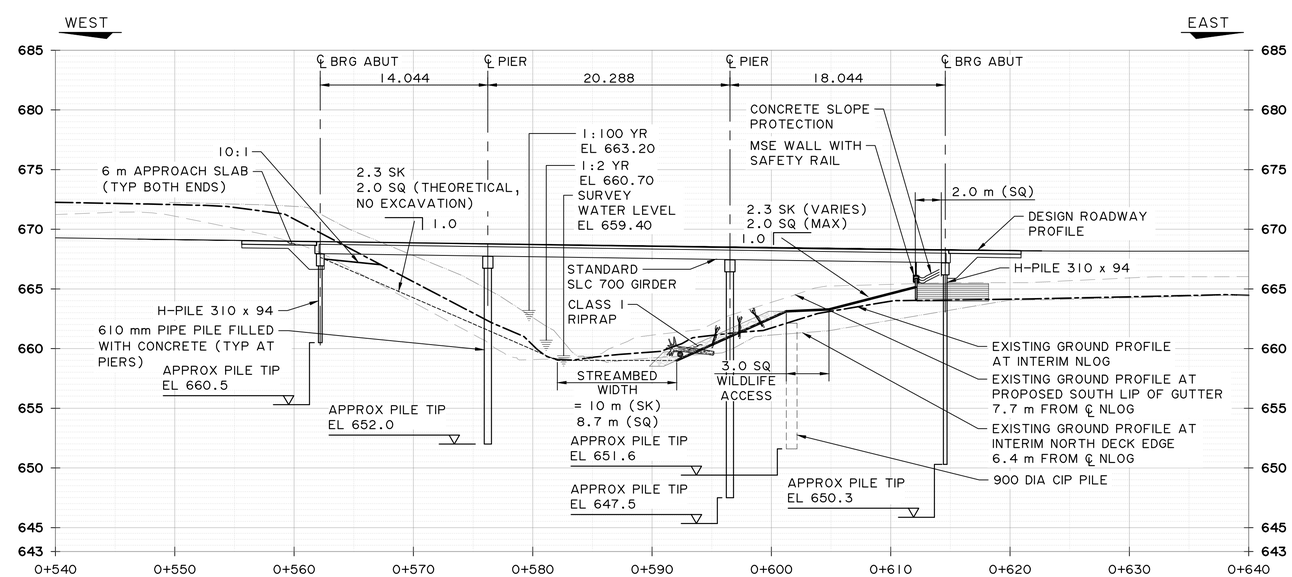
664.94	0.00	0.00	0.00	120.17	2.41	289.45	0.00	0.00	0.00	289.45	
665.00	0.00	0.00	0.00	122.23	2.42	295.90	0.00	0.00	0.00	295.90	

Appendix D – SKETCHES



MSE WALL OPTION – PLAN

1:250



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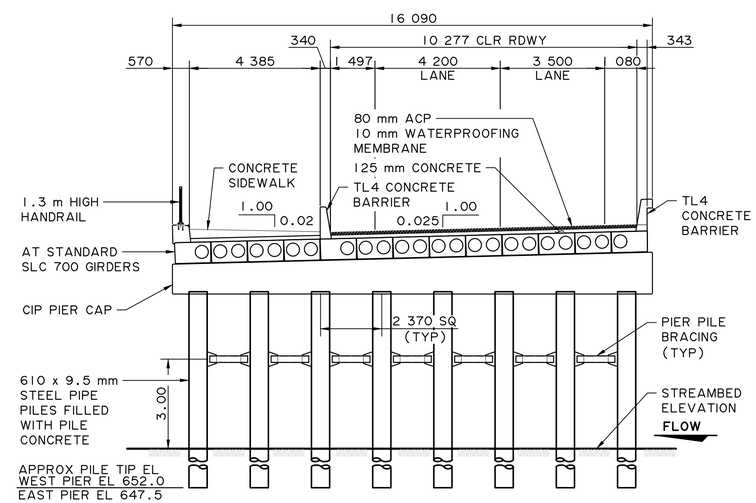
1:250



SECTION A

1:100

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ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

EDMONTON, AB

Title

ELLERSLIE ROAD BRIDGE
OVER WHITEMUD CREEK
GENERAL LAYOUT - MSE WALL OPTION

Project No. 1161 110185

Scale

Revision RC

Sheet 1 of 3

Drawing No.

\\ca1001-c20\workgroup\1161\active\1161110185\drawing\structures\new pattern copy_1\sep2023\1161110185_S_001_prelims
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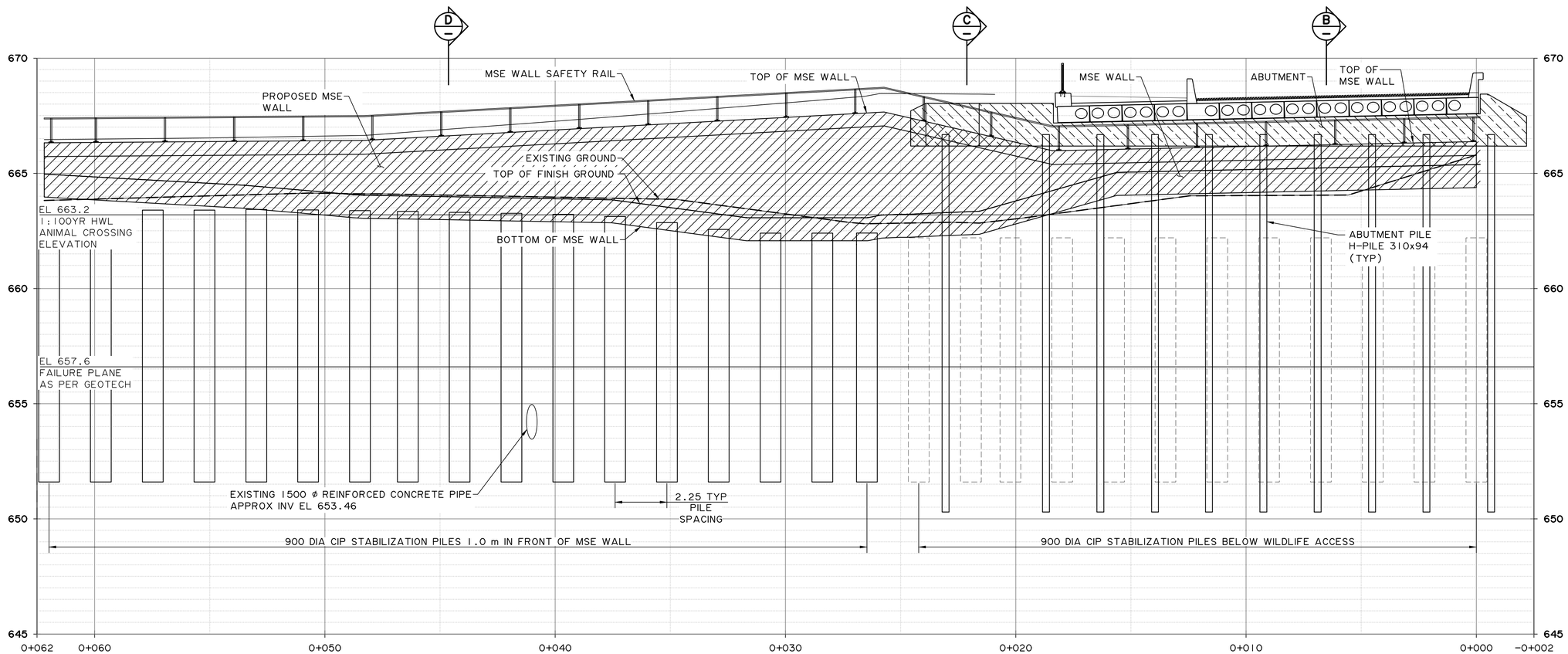

MSE WALL OPTION – ELEVATION

LOOKING EAST 1:100

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EDMONTON, AB

Title

ELLERSLIE ROAD BRIDGE
OVER WHITEMUD CREEK
MSE WALL ELEVATION

Project No. 1161 110185

Scale

Revision 0

Sheet 2 of 3

Drawing No.

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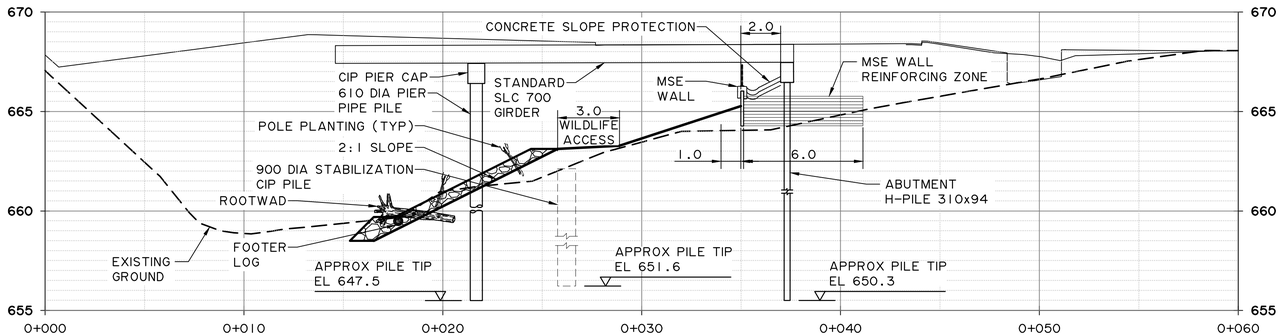

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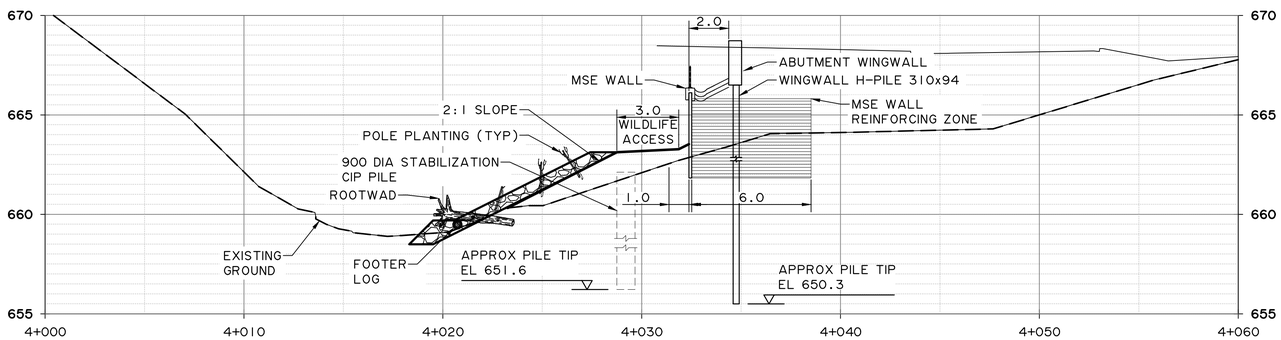

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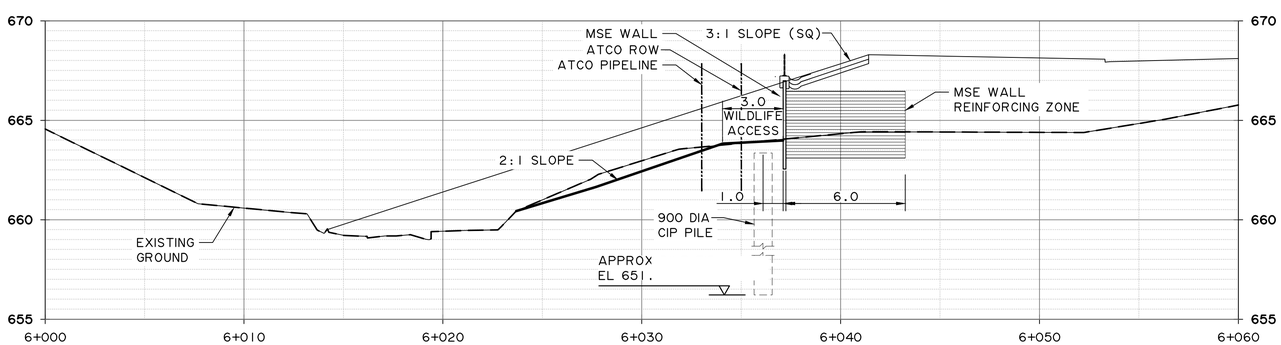

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ELLERSLIE ROAD BRIDGE OVER WHITEMUD CREEK SECTIONS - MSE

Project No. 1161 110185
Scale
Revision 0
Sheet 3 of 3
Drawing No.

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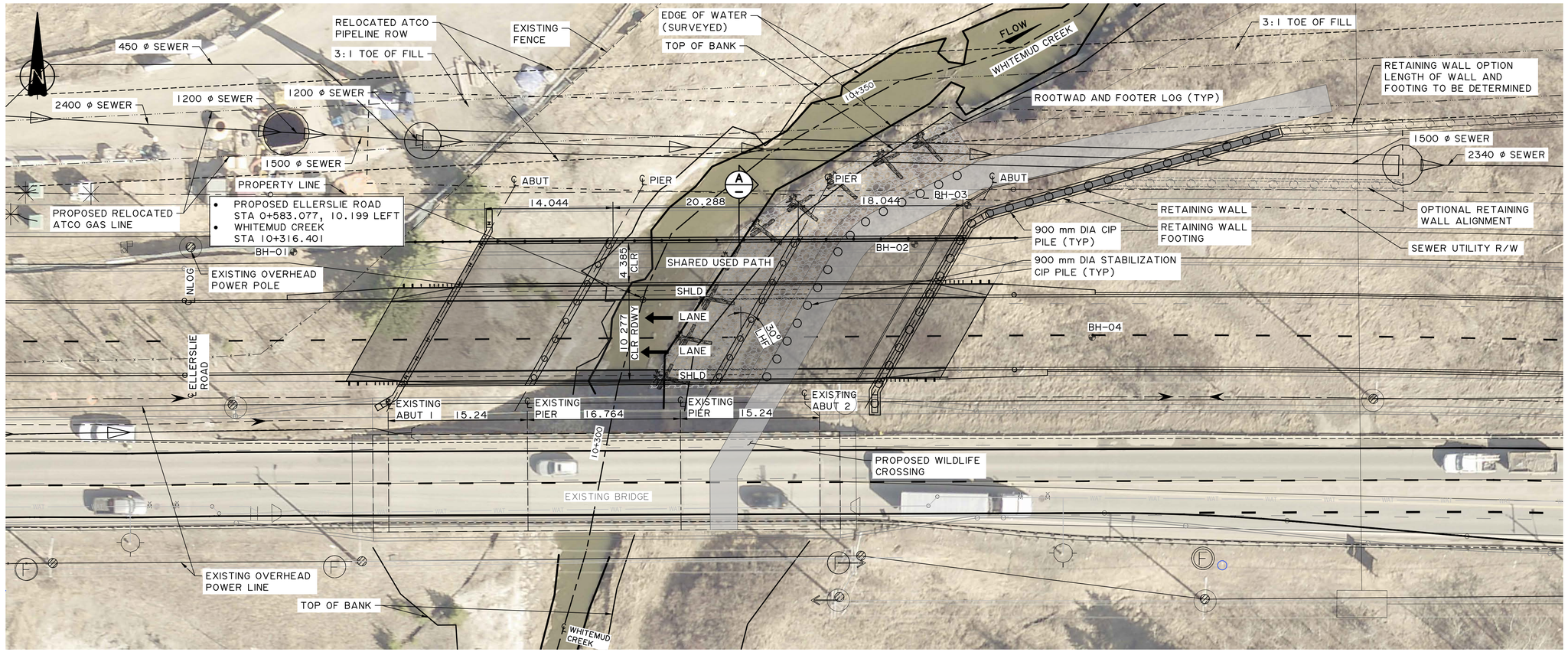
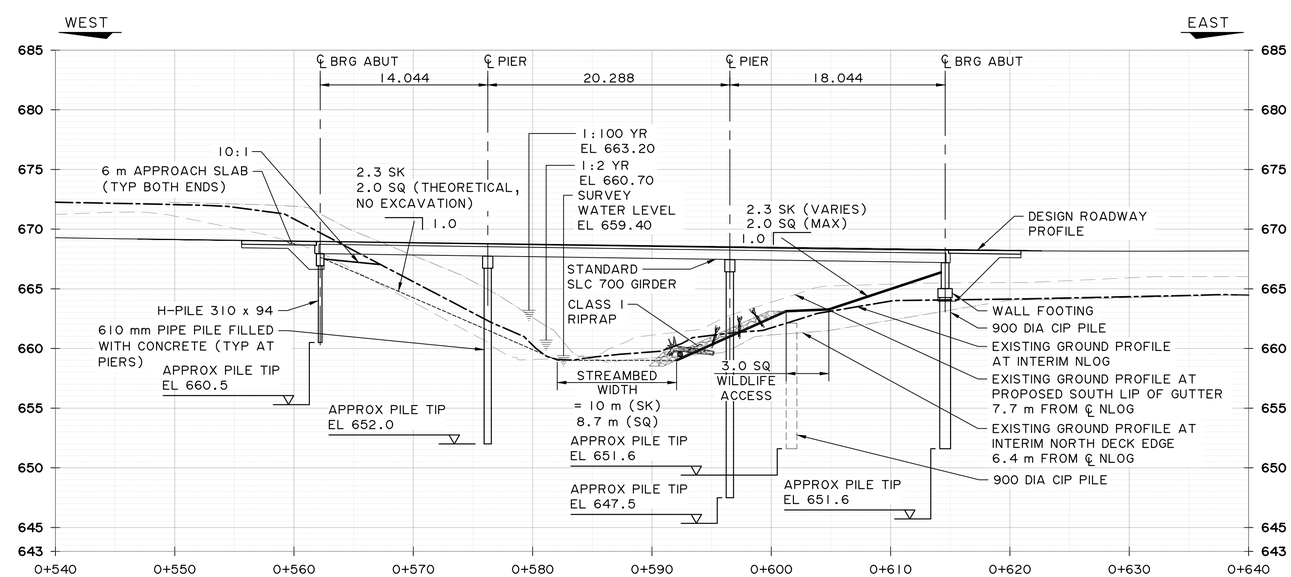


RETAINING WALL OPTION – PLAN

1:250



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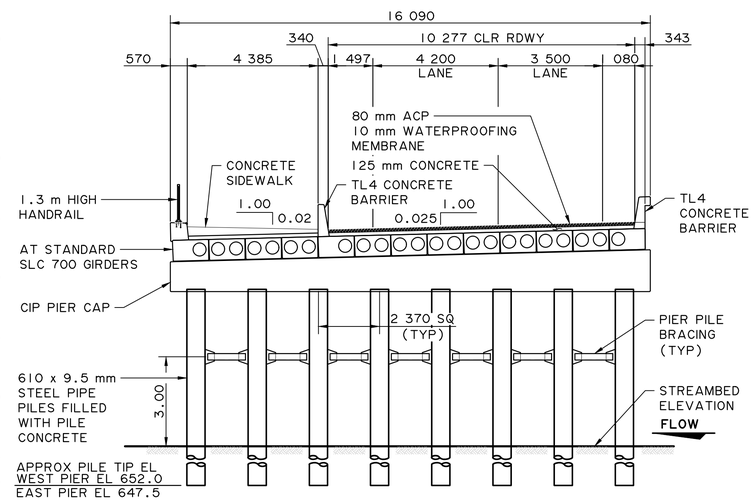

A SECTION

1:100

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EDMONTON, AB

Title

ELLERSLIE ROAD BRIDGE
OVER WHITEMUD CREEK
GENERAL LAYOUT - RETAINING WALL

Project No. 1161 110185

Scale

Revision 0

Sheet 1 of 3

Drawing No.

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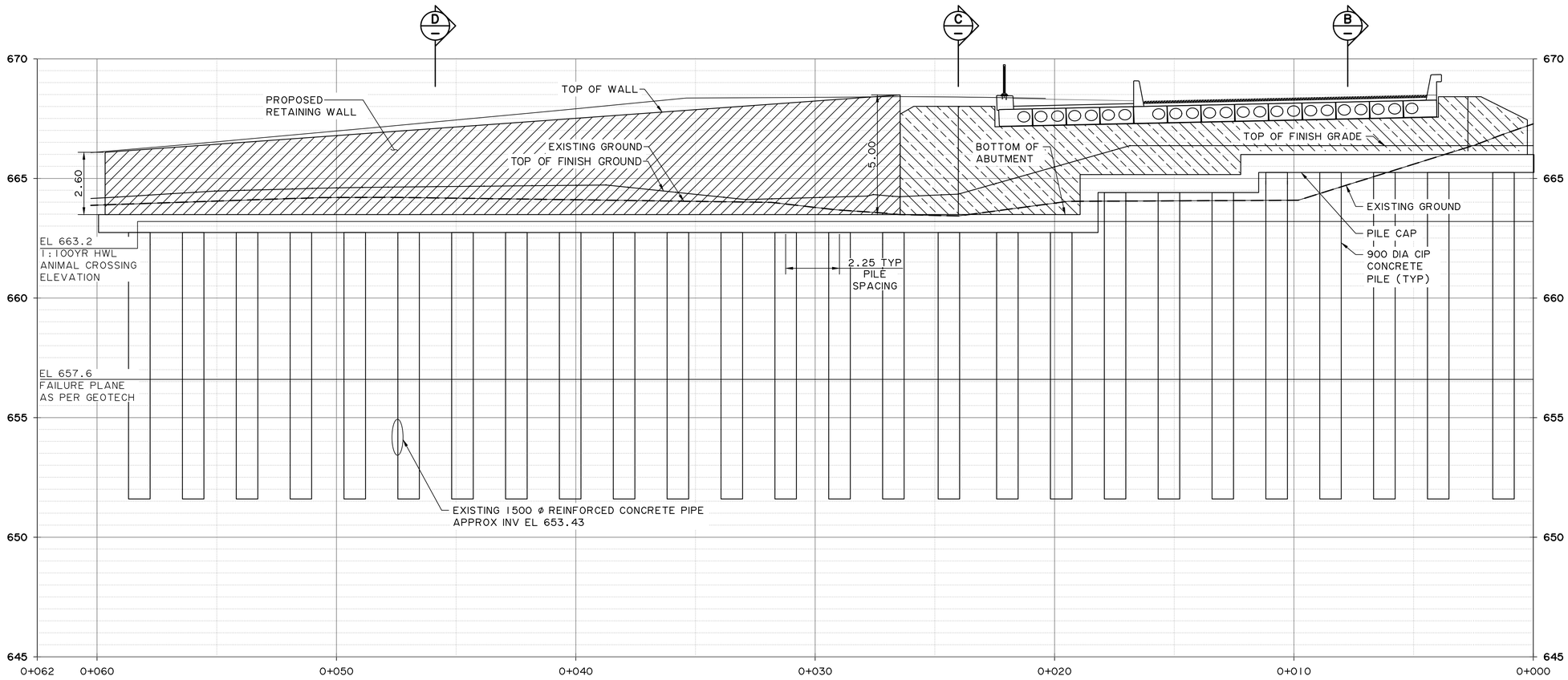

RETAINING WALL OPTION – ELEVATION

LOOKING EAST 1:100

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EDMONTON, AB

Title

ELLERSLIE ROAD BRIDGE
OVER WHITEMUD CREEK
RETAINING WALL ELEVATION

Project No. 1161 110185

Scale

Revision 0

Sheet 2 of 3

Drawing No.

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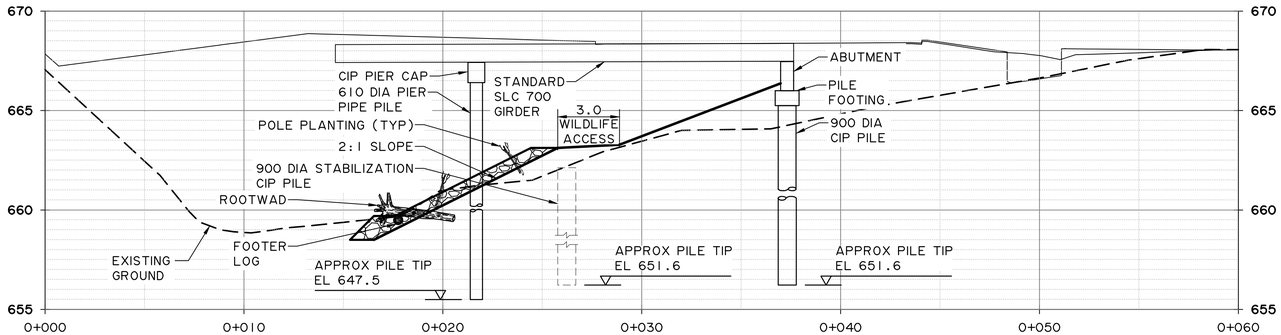

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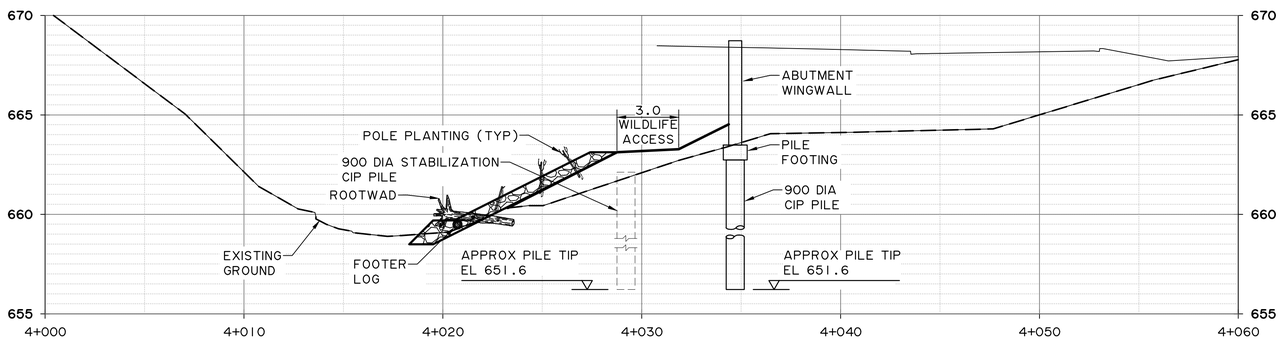

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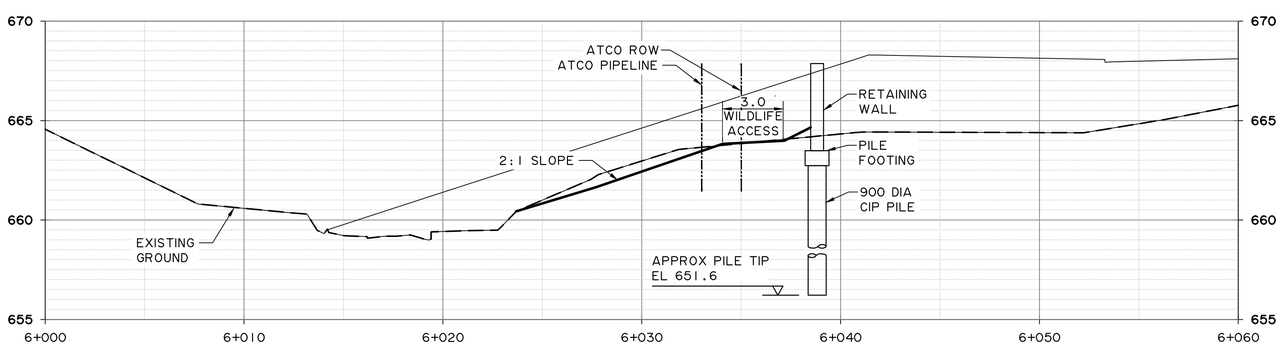

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EDMONTON, AB

Title
ELLERSLIE ROAD BRIDGE OVER WHITEMUD CREEK SECTIONS - RETAINING WALL

Project No. 1161 110185
Scale
Revision 0
Sheet 3 of 3
Drawing No.

ORIGINAL SHEET - ANSI D

Appendix E - GEOTECHNICAL MEMOS

Stantec

To:	Ren Cheng	From:	Leslie Cho
	BC 1136		BC 1233
Project/File:	1161110185	Date:	January 13, 2023

Reference: Ellerslie Road - Whitemud Creek Widening Preliminary Foundation Recommendations

Stantec completed a geotechnical investigation for the above referenced project. To support Stantec's preliminary drawing submission, preliminary foundation recommendations are provided herein. This report should be read in conjunction with the attached Statement of General Conditions in **Appendix A**.

1 Generalized Subsurface Stratigraphy

The borehole locations are plotted on Figure 1 in **Appendix B** which includes boreholes from Stantec's recent investigation as well as relevant boreholes by others[1]. In general, clay till overlying bedrock was encountered at the proposed west bridge abutment location, whereas the proposed east bridge abutment is located within the Whitemud Creek flood plain and consisted of clay, sand, and clay till before encountering bedrock. The elevation of various soil layers represents a generalized model of the conditions within each area. Variability in depth and thickness of each soil unit should be anticipated.

Detailed borehole records along with the Borehole Symbols & Terms are provided in **Appendix C**.

2 Foundation Recommendations

Two bridge foundation options are being evaluated by Stantec's bridge engineer based on whether a Mechanically Stabilized Earth (MSE) wall or a concrete abutment wall will be used to retain the headslope. For the MSE wall option, it is understood that the bridge structure will be supported by driven piles for both the abutments and piers. The abutment foundations will consist of H-Piles (HP310 x 94) and the pier foundations will consist of 610 mm x 12.5 mm pipe pile infilled with concrete. For the concrete pile wall option, 900 mm diameter cast-in-place (CIP) piles are being considered to support the abutment.

2.1 Geotechnical Resistance Factors

In accordance with the Canadian Highway Bridge Design Code (CHBDC)[2], the factored axial resistance at ultimate limit states (ULS) can be calculated using resistance factors of 0.4 for compression loading and 0.3 for tension or uplift loading. The "Degree of Understanding" has been taken as "Typical." If

[1] Thurber Engineering Ltd. (2021). Preliminary Geotechnical Assessment Golden Spike Transmission Whitemud Creek – Edmonton, AB. File No. 30225.
[2] CSA Group (2019). Canadian Highway Bridge Design Code CSA-S6:19.

dynamic load tests are conducted on a sufficient number of piles, the geotechnical resistance factors for compression loading can be increased to 0.5.

2.2 Driven Steel Piles

For driven steel piles the resistance of the piles against axial compressive loads is derived from a combination of shaft friction and end bearing. The recommended unfactored unit shaft friction and end bearing are provided in **Table 2-1.**

Table 2-1 Pile Design Parameters for Driven Steel Piles

Location	Soil Type	Approximate Depth (m)	Elevation (m)	Unfactored Shaft Friction (kPa) (1)	Unfactored End Bearing (kPa)
West Abutment	Clay/Clay Till	0 – 3.4	672.5 – 669.1	35	N/A
	Weathered Bedrock	3.4 – 5.5	669.1 – 667.0	75	1,350
	Competent Bedrock	5.5 – 30.0	667.0 – 642.5	150	4,000
West Pier	Competent Bedrock	0 – 20.0	662.5 – 642.5	150	4,000
East Pier	Clay/Sand/Clay Till	0 – 1.2	661.5 – 660.3	30	N/A
	Weathered Bedrock	1.2 – 2.3	660.3 – 658.0	70	1,200
	Competent Bedrock	2.3 – 24.7	658.0 – 633.3	150	4,000
East Abutment and MSE Wall (1)	Clay/Sand/Clay Till	0 – 3.2	663.5 – 660.3	30	N/A
	Weathered Bedrock	3.2 – 5.5	660.3 – 658.0	70	1,200
	Competent Bedrock	5.5 – 30.2	658.0 – 633.3	150	4,000

Notes:
(1) Shaft resistance to be ignored in the upper 2 m or the entire fill depth whichever is greater.

The unfactored shaft resistance is obtained by multiplying the unfactored unit shaft friction by the surface area of the pile in contact with the surrounding soils. For pipe piles, only the exterior surface area in contact with the soil should be used for frictional resistance. For driven H-piles, the surface of a rectangle enclosed by the H-piles, which includes the surface area of the exterior sides of the two flanges plus twice the depth of the web may be used. The end bearing resistance should be applied to the gross area at the pile tip. For driven H-piles, the end bearing resistance may be taken as the cross-sectional area of the rectangle bounded by the flanges for the H-piles.

For piles driven to bedrock, a minimum of two pile diameters (2D) or 1 m into the bedrock, whichever is greater, is required to develop the full toe resistance. Pile driving refusal is expected within the upper

few meters of the bedrock. In this case, the total geotechnical pile resistance can be taken as $0.6*A*f_y$, where A is the cross-sectional area of the pile (steel portion only), and f_y is the yield stress of the steel.

Driven steel piles should be installed with a minimum centre-to-centre spacing of three pile diameters (or flange depths).

Potential cobbles or boulders may be present within the clay till based on local experience. If encountered, these large particles can lead to early refusal or damage to the piles. Piles with heavier section are recommended to improve drivability, reduce the likelihood of pile damage, and compensate for long-term corrosion. Pile tips can also be reinforced with driving shoes to reduce pile toe damage. Driving shoes should be securely welded to the bottom of the piles and should not protrude beyond the exterior perimeter of the pile cross-section.

Bedrock as shallow as 2.7 m bgs was encountered at the site and may result in difficult pile driving conditions. The drivability of steel piles depends on many factors such as pile size, sectional area, yield strength, hammer size, and ground conditions. Therefore, it is recommended that pile drivability be further evaluated through field trials using Pile Driving Analyzer (PDA) and Case Pile Wave Analysis Program (CAPWAP) analyses. It was noted from Stantec's historical data review that the existing Ellerslie Road bridge piers were pre-drilled and then driven until the required capacity was reached.[3] As such, pre-drilling for the new bridge should be considered to achieve the minimum embedment depth, which is typically governed by uplift or lateral loads. For pipe piles, the pre-drilled pilot hole should be no greater than 95% of the pipe size. For H-piles, the pre-drilled hole should be filled with fillcrete after piling to achieve full soil-pile contact.

It is further recommended that PDA tests and CAPWAP analysis of the test data be carried out at each abutment and pier location during construction. The purpose of this test and analysis is to confirm the pile capacities and to assess if any pile damage occurred during driving. As per the Bridge Structures Design Criteria[4], if a minimum 10% of the piles and one at each substructure element are PDA tested, the resistance factors can be increased to 0.5 for compression loading condition.

2.2.1 DRIVEN STEEL PILE INSTALLATION

Monitoring of pile installations by qualified personnel is required to confirm that the piles are installed in accordance with design assumptions and that driving criteria are satisfied. For each pile, a complete driving record in terms of the number of blows per 250 mm of penetration should be recorded by monitoring personnel and reviewed frequently during pile installation by a qualified geotechnical engineer.

Piles should be driven with adequately sized hammer. For single acting diesel hammers, the hammer energy should be in the range of 450 to 600 Joules per square centimeter of steel in the pile cross section. If hydraulic hammer is used, the above recommended hammer energy can be reduced by 10% to 20% due to its higher efficiency.

In advance of driving production piles, the ability of a pile driving hammer to drive the proposed piles to the required capacity should be confirmed using WEAP analysis once the contractor provides details

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[3] Government of the Province of Alberta. Whitemud Creek Bridge West of Ellerslie General Layout. Drawing No. 3700-C. File No. 1588.
[4] Alberta Transportation (2018). Bridge Structures Design Criteria Version 8.1.

regarding the proposed hammer energies and configurations. Once the hammers have been selected, the pile driving termination criteria should be determined using wave equation analyses for the various loads, for each pile size and for a range of embedment depths.

It is recommended that piles within a group be driven from the center of the group outwards. Where end bearing has been included in the design, or where the piles are driven using a termination criterion, the elevation of the tops of piles previously installed should be monitored as adjacent piles are driven to determine if heaving of the previously installed piles has occurred. Piles that have heaved must be re-driven to at least their initial embedment depths.

2.3 Cast-in-Place Piles

Conventional CIP concrete piles are considered feasible for bridge foundations. The unfactored geotechnical resistance against compression loads can be determined using the shaft resistance and end bearing presented in **Table 2-2** below.

Table 2-2 Pile Design Parameters for CIP Piles

Location	Soil Type	Approximate Depth (m)	Elevation (m)	Unfactored Shaft Friction (kPa) (1)	Unfactored End Bearing (kPa)
West Abutment	Clay/Clay Till	0 – 3.4	672.5 – 669.1	35	N/A
	Weathered Bedrock	3.4 – 5.5	669.1 – 667.0	90	1,350
	Competent Bedrock	5.5 – 30.0	667.0 – 642.5	160	3,300
West Pier	Competent Bedrock	0 – 20.0	662.5 – 642.5	160	3,300
East Pier	Clay/Sand/Clay Till	0 – 1.2	661.5 – 660.3	30	N/A
	Weathered Bedrock	1.2 – 2.3	660.3 – 658.0	80	1,000
	Competent Bedrock	2.3 – 24.7	658.0 – 633.3	160	3,300
East Abutment (1)	Clay/Sand/Clay Till	0 – 3.2	663.5 – 660.3	30	N/A
	Weathered Bedrock	3.2 – 5.5	660.3 – 658.0	80	1,000
	Competent Bedrock	5.5 – 30.2	658.0 – 633.3	160	3,300

Notes:
(1) Shaft resistance to be ignored in the upper 2 m or the entire fill depth whichever is greater.

CIP piles should have a minimum diameter of 400 mm. The minimum centre-to-centre spacing of CIP piles should also be no less than 2.5 times the pile diameter.

End bearing for CIP piles can only be relied on if the pile toe is thoroughly cleaned and inspected. To engage the full end bearing resistance, the toe of CIP piles should be embedded a minimum of two pile diameters or 1 m, whichever is greater, below the soil stratum.

Resistance to uplift loads can be calculated using the recommended unfactored shaft resistance presented in **Table 2-2** and geotechnical resistance factor of 0.3 for tension or uplift loading.

2.3.1 CIP PILE INSTALLATION

Despite sloughing not recorded in the boreholes, the potential for sand layers exists within the overburden. In addition, the groundwater levels are approximately at creek level and may ingress into the pile hole. As such, temporary casing should be available to protect the pile hole from sloughing or caving in, as well as groundwater ingress. Where temporary casing is left in place, the unfactored skin friction from **Table 2-2** should be reduced by 50% to 70% within the cased zone. Furthermore, obstructions, such as cobbles and boulders, may be encountered in the clay till during pile hole formation.

Pile excavation should proceed without interruption to the final depth specified in the design approved by the Engineer. Where end bearing is relied upon, base cleaning will be required.

The above recommendations cover the basic requirements for construction of the drilled shaft. Additional recommendations include:

- The top of the temporary casing should be kept higher than the actual working platform to improve safety of the workers and allow for safe inspections.
- The contractor shall have enough casing on site to cover at least 1 m into bedrock.
- The excavation of adjacent piles within 5 m should be deferred until the concrete in the constructed pile has set (a minimum of 24 hours following placement).

Water accumulated at the bottom of the pile hole should be pumped or otherwise cleaned out to provide a hole free of standing water prior to concrete placement. If groundwater seepage cannot be effectively managed, tremie concrete placement methods will be required.

2.4 Settlement of Pile Foundations

Piles are likely to be founded in the bedrock. The settlement for both the abutment and pier piles are estimated to be less than 15 mm plus elastic shortening on the pile.

2.5 Negative Skin Friction of Piles

Settlement of the ground relative to the piles can cause downdrag load on pile foundations due to negative skin friction. Piles installed in or through compressible clays (e.g., native clay and new embankment fill) could be subjected to downdrag load. Piles should be designed such that no structural failure of the pile occurs due to downdrag. The geotechnical design or geotechnical capacity of the piles will not be affected by the downdrag load. The structural design should satisfy the following condition:

Structural capacity of the pile > Dead Load + Downdrag Load.

The downdrag load can be estimated using the unfactored skin friction from **Table 2-1** and **Table 2-2** for clay, clay till, and sand. Where the piles are in direct contact with the new embankment fills, a downdrag

load of 40 kPa can be adopted for new embankment fills. A load factor of 1.25 should be used for downdrag load design.

2.6 Lateral Pile Resistance

Vertical piles resist lateral loads and moments by deflecting until the necessary reaction in the ground is mobilized to resist the lateral loads. The design of piles subjected to lateral loads should consider such factors as the relative rigidity of the pile to the surrounding soil, the fixity conditions at the head of the pile (pile cap level), the structural capacity of the pile to withstand bending moments, the soil resistance that can be mobilized, the tolerable lateral deflection at the head of the pile, the applied vertical load, and pile group effects. For longer, more flexible piles, the maximum yield moment of the pile may be reached prior to mobilization of the lateral geotechnical resistance. For design purposes, both structural and geotechnical resistances should be evaluated to establish the governing case.

The lateral pile deflection is dependent on the soil types and properties in the upper portion of the pile shaft, typically in the upper 5 to 10 pile diameters. Lateral load response of single pile can be determined structurally by modelling the soil as a series of horizontal springs as illustrated on Figure 2 in **Appendix B**. The soil spring over unit loading area is typically referred to as horizontal subgrade reaction modulus (k), which is not a fundamental soil property and is dependent on the loaded area. In discussion with the bridge designer, lateral pile response is only required for the east abutment for CIP piles. The modulus of horizontal subgrade reaction (k) for the east abutment is provided in **Table 2-3**. The lateral spring constant, expressed in (MN/m) can be obtained by multiplying the modulus of horizontal subgrade reaction by the pile diameter and contributing length of each spring along the pile shaft.

Table 2-3: Horizontal Subgrade Reaction for East Abutment

Location	Soil Type	Elevation (m)	Approximate Depth (m)	k (MN/m^3)		Limiting Deflection y_o (mm)
				Downhill	Uphill	
East Abutment	Clay/Sand/ Clay Till	663.5 – 661.5	0 – 2.0	3	5	12
		661.5 – 660.3	2.0 – 3.2	4	7	12
	Weathered Bedrock	660.3 – 659.0	3.2 – 4.5	12		10
		659.0 – 658.0	4.5 – 5.5	18		9
	Competent Bedrock	658.0 – 657.0	5.5– 6.5	60		8
		657.0 – 656.0	6.5– 7.5	100		7
		656.0 – 655.0	7.5– 8.5	150		7
		Below 656	Below 7.5	220		7

Notes:
(1) k values based on 900 mm CIP piles.

(2) Depth based on available design drawings for anticipated elevations of piles after site grading has been completed. Confirm the recommended pile design parameters based on provided elevation ranges based on the nearest borehole.

When installed as a group, interaction between piles occurs such that the lateral pile deformations are increased. For designs using horizontal subgrade reaction or p-y curves, it is advised that pile group load response be reduced as a function of center-to-center pile spacing.

Recommended p-multipliers or multipliers to coefficient of horizontal subgrade reaction[5], which account for reduced resistance due to pile-soil-pile interaction are detailed in **Table 2-4**.

Table 2-4: Normalized Pile Row Spacing and p-Multipliers

Pile Row	Pile Row Spacing			
	3d	**4d**	**5d**	**6d**
Lead	0.8	0.85	0.9	1.0
Second	0.6	0.7	0.8	0.9
Third	0.4	0.6	0.7	0.8

2.7 Lateral Earth Pressure

Where earth pressure is to be accounted for, i.e., for pile wall design, the earth pressure parameters presented in **Table 2-5** can be used. No passive resistance should be allowed within the frost zone.

Table 2-5: Lateral Earth Pressure Coefficients

Soil Type	Unit Weight, γ (kN/m^3)	Buoyant Unit Weight, γ' (kN/m^3)	Effective Friction Angle, φ' (degrees)	At Rest Earth Pressure Coefficient, K_o	Active Earth Pressure Coefficient, Ka	Passive Earth Pressure Coefficient, Kp
Embankment Fill	20	10	26	0.55	0.40	2.5
Alluvial Deposits (Clays and Sands)	18	8	24	0.60	0.42	2.2
Granular Fill	21	11	35	0.45	0.30	3.5

Notes:

- Buoyant unit weights should be used when below the water table. Water pressure should also be added to the lateral earth pressure.
- A surcharge load of 12 kPa should be included for areas adjacent to Ellerslie Road.
- Refer to the nearest borehole location for the anticipated soil conditions for the respective cross section.

[5] Rollins, K.M., et. al. (2006). Pile Spacing Effects on Lateral Pile Group Behavior: Analysis. Journal of Geotechnical and Geoenvironmental Engineering, Vol. 132, No. 10, pp. 1262-1271.

2.8 Frost Considerations

The Canadian Foundation Engineering Manual[6] provides guidelines on the estimation of frost penetration depth. Based on climate data and the soil conditions encountered, the frost penetration depth is estimated to be about 2.2 m for a 10-year return period and 2.7 m for a 50-year return period.

Driven steel and CIP piles will be subjected to adfreezing force (frost jacking) acting along the pile shafts within the depth of frost penetration. Resistance to adfreezing force will be provided by the shaft friction below the depth of frost penetration, sustained compressive loads, and the weight of the pile. The minimum embedment length against frost action can be rationally determined using an unfactored adfreeze pressure of 65 kPa for concrete pile and 100 kPa for steel pile over the frost penetration depth. A load factor of $\alpha = 1.2$, should be adopted for frost uplift. To determine the factored uplift resistance against frost jacking in terms of ULS, a resistance factor, $\varphi = 0.8$ should be applied to the unfactored shaft friction values. In cases where the piles are subject to live loads as well as frost jacking forces, the live loads should be added to the frost jacking forces.

2.9 Seismic Site Class

The Site is in a relatively low seismic activity zone; however, the proposed structures should be designed to resist the minimum earthquake force as per the CHBDC. For seismic design, the bridge structure could be classified as a “Major Route Bridge.” Performance levels of the structure are as defined in the CHBDC.

The subsurface condition consists primarily of soft rock with about 3.4 m of overburden soils. As such, Seismic Site Class C is representative of the Site as per Table 4.1 of the CHBDC.

[6] Canadian Geotechnical Society (2006). Canadian Foundation Engineering Manual. 4th Edition.

3 Closing

We trust this report meets your current requirements. If you have any questions, please do not hesitate to contact the undersigned.

Respectfully,

Stantec Consulting Ltd.

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Attachment: Appendix A – Statement of General Conditions
Appendix B – Figures
Appendix C – Borehole Symbols & Terms and Borehole Records

PERMIT TO PRACTICE
STANTEC CONSULTING LTD.
Signature ID 78675
Date 13 Jan. 2023
PERMIT NUMBER: P 0258
The Association of Professional Engineers and Geoscientists of Alberta

Appendix A Statement of General Conditions

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

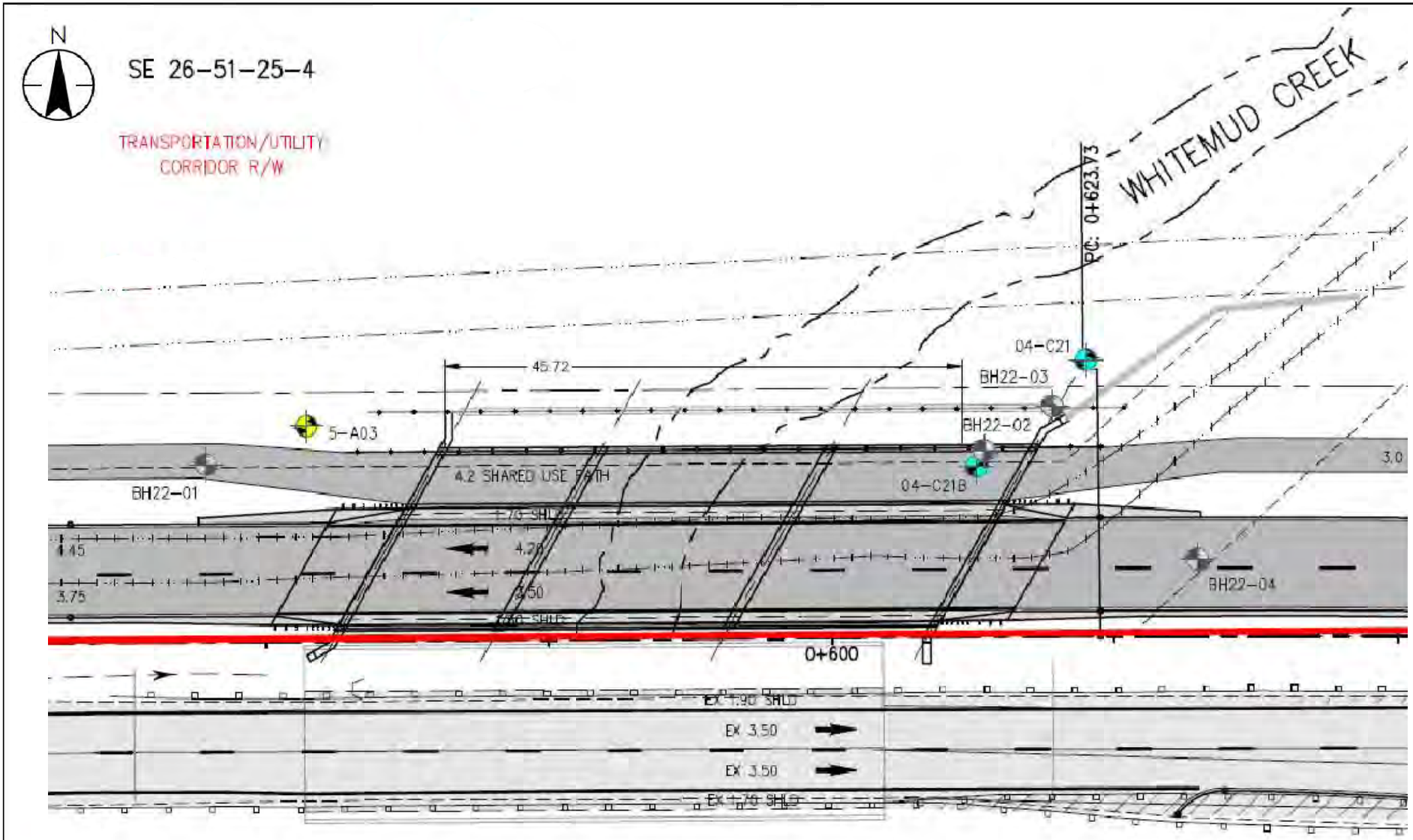
STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behaviour. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

Appendix B Figures



Stantec

BOREHOLE (STANTEC 2022)

HISTORIC BOREHOLE (AMEC 2005)*

HISTORIC BOREHOLE (AMEC 2004)*

*Borehole Records available through Thurber Engineering Ltd. (2021).

Project No.:	1161110185
Scale:	---
Date:	October 3, 2022
Prepared by:	CU
Checked by:	LC

Title

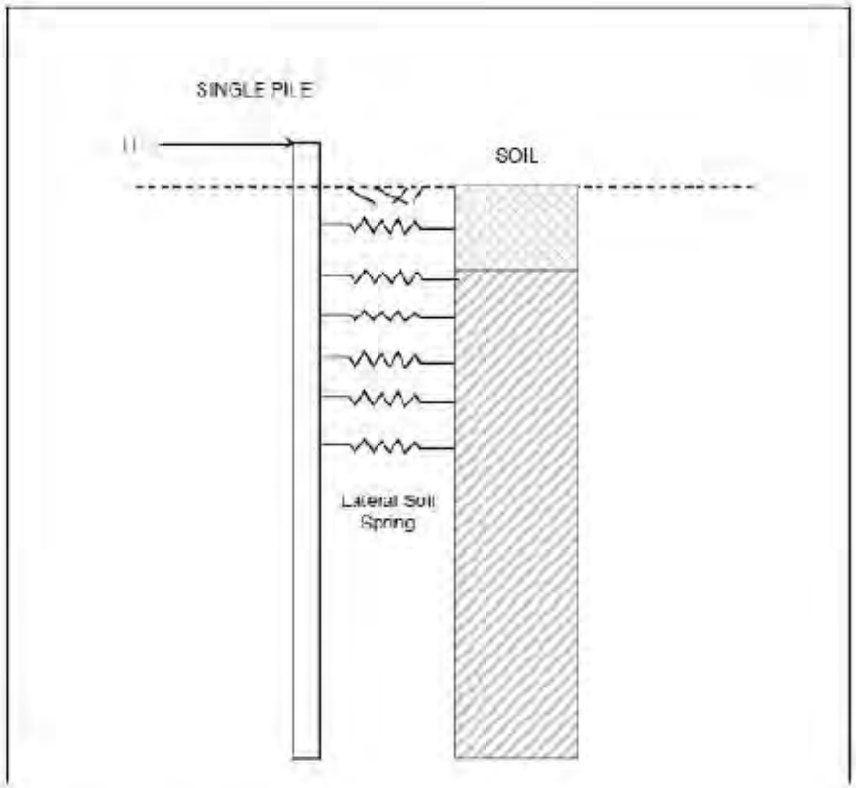
Borehole Location Plan

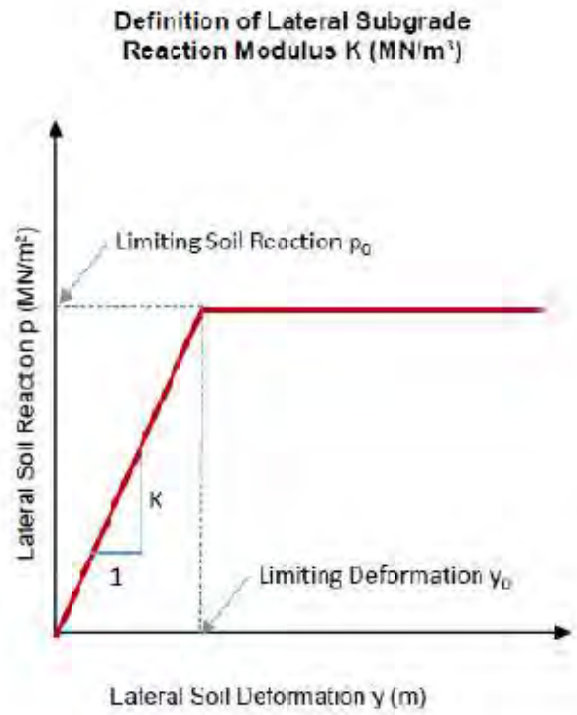
Client/Project

Ellerslie Bridge – Whitemud Creek Crossing

Figure No.

1





Note:
Lateral subrade reaction modulus K (MN/m³) should be multiplied by the contributing area of each soil spring to obtain the spring constant in MN/m.

Lateral soil reaction increases linearly with soil deformation (i.e. constant K) if the soil deformation is less than the limiting deformation y_0, beyond limit deformation y_0, the soil reaction reaches its maximum value and no longer increase with soil deformation.

Stantec

Project No.: 1161110185	Client/Project :
Scale: ---	
Date: Ocotber 4, 2022	Ellerslie Bridge Whitemud Creek Bridge Crossing
Prepared by: CU	
Checked by: LC	

Title
Definition of Lateral Subgrade Reaction Modulus

Figure No.
2

Appendix C Borehole Symbols & Terms and Borehole Records

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	mixture of soil and humus capable of supporting vegetative growth
Peat	mixture of visible and invisible fragments of decayed organic matter
Till	unstratified glacial deposit which may range from clay to boulders
Fill	material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure

Desiccated	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of regular alternating layers of silt and clay
Stratified	composed of alternating successions of different soil types, e.g. silt and sand
Layer	> 75 mm in thickness
Seam	2 mm to 75 mm in thickness
Parting	< 2 mm in thickness

Terminology describing soil types

The classification of soil types are made on the basis of grain size and plasticity is in accordance with the Prairie Farm Rehabilitation Association (PFRA) Modified version of the Unified Soil Classification System (USCS) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. See page 4 for definitions and other details.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris)

Terminology describing materials outside of the PFRA Modified version of the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils

The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on Page 2. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

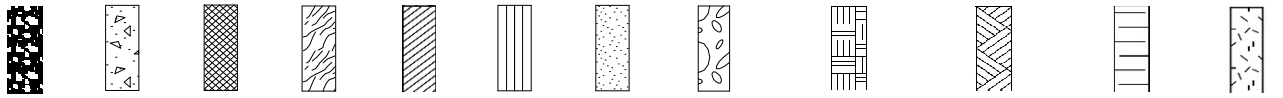
Terminology describing consistency of cohesive soils

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kg/cm^2 or kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



Asphalt | Concrete | Fill | Organics | Clay | Silt | Sand | Gravel Cobbles Boulders | Undifferentiated Bedrock | Sedimentary Bedrock | Metamorphic Bedrock | Igneous Bedrock

SAMPLE TYPE

AS, BS, GS	Auger sample; bulk sample; grab sample
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
SO	Sonic tube
SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby Tube or thin wall tube
SV	Shear vane
RC *HQ, NQ, BQ, etc.*	Rock Core; samples obtained with the use of standard size diamond coring bits.

WATER LEVEL

Measured: in standpipe, piezometer, or well

Inferred: seepage noted, or; measured during or at completion of drilling

RECOVERY FOR SOIL SAMPLES

The recovery is recorded as the length of the soil sample recovered in the direct push, split spoon sampler, Shelby Tube, or sonic tube.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test (SPT): the number of blows of a 140-pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) outside diameter (O.D.) split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50 for 75 mm or 50/75 mm). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60-degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Total Core Recovery (TCR) denotes the sum of all measurable rock core recovered in one drill run. The value is noted as a percentage of recovered rock core based on the total length of the drill run.

Solid Core Recovery (SCR) is defined as total length of solid core divided by the total drilled length, presented as a percentage. Solid core is defined as core with one full diameter.

Rock Quality Designation (RQD) is a modified core recovery that incorporates only pieces of solid core that are equal to or greater than 10 cm (4") along the core axis. It is calculated as the total cumulative length of solid core (> 10 cm) as measured along the centerline of the core divided by the total length of borehole drilled for each drill run or geotechnical interval, presented as a percentage. RQD is determined in accordance with ASTM D6032.

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock quality

Rock Mass Quality	Rock Quality Designation Number (RQD)	Alternate (Colloquial) Rock Mass Quality	
Very Poor Quality	0-25	*Very Severely Fractured*	*Crushed*
Poor Quality	25-50	*Severely Fractured*	*Shattered or Very Blocky*
Fair Quality	50-75	*Fractured*	*Blocky*
Good Quality	75-90	*Moderately Jointed*	*Sound*
Excellent Quality	90-100	*Intact*	*Very Sound*

Terminology describing rock strength

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

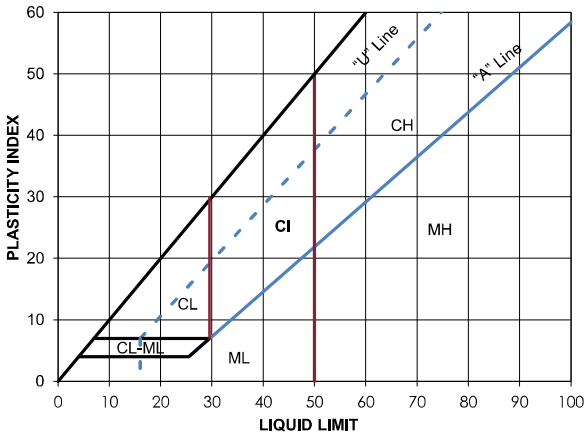
Terminology describing rock with respect to discontinuity and bedding spacing

Spacing (mm)	Discontinuities Spacing	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

Major division			Group symbol	Typical description	Laboratory classification criteria	
Coarse grained soils	Gravels (more than half coarse grains larger than 4.75 mm)	Clean gravels (little or no fines)	GW	Well-graded gravels, little or no fines	$C_u = \frac{D_{60}}{D_{10}} > 4;\ C_c = \frac{(D_{30})^2}{D_{10}\ x\ D_{60}} = 1\ to\ 3$	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	Not meeting above requirements	
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures	Content of fines exceeds 12%	Atterberg limits below 'A' line or PI less than 4
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above 'A' line or PI more than 7
	Sands (more than half coarse grains smaller than 4.75 mm)	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}} > 6;\ C_c = \frac{(D_{30})^2}{D_{10}\ x\ D_{60}} = 1\ to\ 3$	
			SP	Poorly graded sands, little or no fines	Not meeting above requirements	
		Sands with fines	SM	Silty sands, sand-silt mixtures	Content of fines exceeds 12%	Atterberg limits below 'A' line or PI less than 4
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above 'A' line or PI more than 7
Fine grained soils	Silts (below 'A' line negligible organic content)	$W_L < 50$	ML	Inorganic silts and very fine sands, rock flour, silty sands of slight plasticity	Classification is based upon plasticity chart (see below)	
		$W_L > 50$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils		
	Clays (above 'A' line negligible organic content)	$W_L < 30$	CL	Inorganic clays of low plasticity gravelly, sandy, or silty clays, lean clays		
		$30 < W_L < 50$	CI	Inorganic clays of medium plasticity, silty clays		
		$W_L > 50$	CH	Inorganic clays of high plasticity, fat clays	**Note:** Whenever the nature of the fine content has not been determined, it is designated by the letter 'F'	
	Organic silts & clays (below 'A' line)	$W_L < 50$	OL	Organic silts and organic silty clays of low plasticity	Example: SF is a mixture of sand with silt or clay	
		$W_L > 50$	OH	Organic clays of high plasticity		
Highly organic soils			Pt	Peat and other highly organic soils	Strong colour or odor, and often fibrous texture	

Note: Boundary classification possessing characteristics of two groups are given group symbols, e.g. GW-GC is a well graded gravel mixture with clay binder between 5% and 12%.



Note: plasticity chart is for soils passing 425 µm sieve

Soil components by particle size distribution

Fraction		Sieve size (mm)		Defining ranges of percentage by weight of minor components	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	75	19	50 – 35	And
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	35 - 20	____y/ey
	Medium	2	0.425		
	Fine	0.425	0.075	20 - 10	Some
Silt (non-plastic) Or Clay (plastic)		0.075		10 – 1	Trace
Oversize materials					
Rounded or sub-rounded cobbles 75 mm to 200 mm Boulders > 200 mm		Angular rock fragments Rocks > 0.75 m^3 in volume			

Note: All sieve sizes are referenced to U.S. standard ASTM E.11 – Alternate equivalent metric sieve sizes in accordance with CGSB Spec. 8-GP-2M to apply when prescribed

BOREHOLE RECORD

BH22-01

Stantec

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 14, 2022 to February 16, 2022**

BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
WATER LEVEL: **11.0 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	672.5							
	672.2	CLAY FILL - dark brown, silty, trace sand, trace organics, trace oxides, medium plastic, moist		BS	1			
		CLAY TILL (CI) - stiff, brown, silty, sandy, trace coal, trace organics, trace oxides, medium plastic, moist						
1				SS	2	400		SPT N-value not recorded since it was completed in frozen ground.
		- frozen to 1.5 m		BS	3			Sieve/Hydro at 1.6 m G 0% S 33% M 40% C 27%
2		- frequent coal fragments from 2.2 m to 2.3 m		ST	4	450		
3				SS	5	400	10	
	669.1	CLAY SHALE - extremely weak, grey, slightly weathered, silty, frequent oxides, high plastic, moist		BS	6			
4		- fresh and platy structure below 3.8 m		SS	7	450	56	
		- excellent below 4.2 m		RC	8	100	100	Switch to bedrock coring at 4.2 m. Prior to switching: - borehole dry - borehole open
5				SS	8A	400		
6								UCS at 5.6 m: Qu = 293 kPa Atterberg Limit at 5.6 m: PL=29%, LL=94%

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

16/36/50 for 140 mm >>

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 672, 671, 670, 669, 668, 667

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m

Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-01

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 14, 2022 to February 16, 2022**

BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
WATER LEVEL: **11.0 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa): LABORATORY TEST ▲ FIELD VANE TEST ◆ POCKET PEN. ★ POCKET SHEAR VANE ◘ — 50 kPa, 100 kPa, 150 kPa, 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count: 10, 20, 30, 40, 50, 60, 70, 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
6		CLAY SHALE continued - multiple fractures at 6.5 m - 50 degree, undulating, and rough joint at 6.5 m - grey and brown below 6.6 m - siltstone fragments at 6.9 m		RC	9	100	94			666
				SS	9A	400			19/21/50 for 130 mm >>	
7	665.4	SANDSTONE - excellent, grey, fresh, extremely weak, fine, occasional interbedded clay shale, trace coal, moist - 80 degree, curved, and smooth joint at 7.4 m		RC	10	91	91	UCS at 7.2 m: Qu = 998 kPa		665
8	664.5	CLAY SHALE - fair, grey, fresh, extremely weak, silty, trace coal inclusions, blocky structure, high plastic, bentonitic, moist - 100 mm thick siltstone layer at 8.4 m - frequent fractures from 8.5 m to 8.6 m		SS	10A	230			39/50 for 80 mm >>	664
	663.8	SANDSTONE - excellent, grey, fresh, extremely weak, fine, occasional interbedded clay shale, occasional siltstone fragments, trace coal inclusions, moist		RC	11	93	80	UCS at 9.2 m: Qu = 259 kPa		
9		- 70 mm thick calcareous zone at 9.5 m - 100 mm thick siltstone layer at 9.8 m - frequent coal fragments at 9.9 m - calcareous from 10.1 m to 10.5 m								663
10	662.0	CLAY SHALE - excellent, brown and grey, fresh, extremely weak, silty, trace coal inclusions, blocky structure, high plastic, moist		RC	12	94	94	UCS at 10.9 m: Qu = 319 kPa Atterberg Limit at 10.9 m: PL=22%, LL=111%		662
11		- 50 mm siltstone clast at 11.1 m - brown from 11.1 m to 11.9 m - carbonaceous from 11.5 m to 11.8 m - greenish grey from 11.8 m to 12.5 m						UCS at 11.6 m: Qu = 398 kPa		661
12				RC	13	100	100			

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m
Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-01

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 14, 2022 to February 16, 2022**

BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
WATER LEVEL: **11.0 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
12		CLAY SHALE continued								
		- 90 degree, planar, and rough joint at 12.4 m								660
13		- carbonaceous from 13.0 m to 13.4 m - brown below 13.0 m - extremely weak to very weak below 13.1 m		RC	14	100	97	UCS at 13.1 m: Qu = 1721 kPa Atterberg Limit at 13.1 m: PL=27%, LL=91%		
		- bentonitic sandstone and trace siltstone clasts from 13.5 m to 13.8 m						UCS at 13.5 m: Qu = 873 kPa		659
14		- carbonaceous from 13.8 m to 13.9 m - 60 degree, stepped, and rough joint at 13.8 m - 30 mm thick fractured zone below 13.8 m - 60 degree, undulating, and rough joint at 13.9 m - fair below 14.2 m								658
		- frequent coal fragments at 14.7 m		RC	15	100	67			
15		- fractured zone from 15.2 m to 15.7 m - 70 degree, undulating, and rough joint at 15.2 m - 50 degree, irregular, and smooth joint at 15.4 m								657
		- excellent below 15.7 m								
16		- 80 degree, undulating, and smooth joint at 15.9 m								
		- greenish grey at 16.3 m - 70 degree, undulating, and smooth joint at 16.4 m		RC	16	100	94			656
		- 60 degree, curved, and smooth joint at 16.6 m						UCS at 16.6 m: Qu = 1644 kPa		
17		- 60 degree, curved, and smooth joint at 16.9 m								
		- siltstone clasts at 17.3 m - 50 degree, irregular, and rough joint at 17.4 m								655
		- brown below 17.7 m								
18	654.5									

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m

Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-01

Stantec

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 14, 2022 to February 16, 2022**

BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**
WATER LEVEL: **11.0 m on May 17, 2022**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
18		SANDSTONE - excellent, grey, fresh, very weak, fine, bentonitic, silty, occasional to frequent interbedded clay shale up to 30 mm thick, trace coal inclusions, moist		RC	17	94	94			654
19				RC	18	100	100	UCS at 19.3 m: Qu = 1789 kPa		653
		- calcareous from 19.7 m to 20.0 m								
20										
		- medium, occasional siltstone fragments, and calcareous below 20.3 m								652
	651.9	CLAY SHALE - excellent, grey, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist - interbedded sandstone from 20.6 m to 21.0 m - 70 degree, undulating, and smooth joint at 20.8 m - 30 mm thick siltstone seam at 21.1 m - brown below 21.1 m		RC	19	100	100			651
21										
22		- 45 degree, undulating, and smooth joint at 22.0 m		RC	20	100	100			650
23		- trace coal fragments at 23.1 m								
		- good below 23.3 m - occasional interbedded sandstone from 23.3 m to 23.5 m - fractured zone from 23.5 m to 24.3 m								649
24										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m
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BOREHOLE RECORD

BH22-01

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BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
WATER LEVEL: **11.0 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
24		CLAY SHALE continued - excellent below 24.3 m - 60 degree, undulating, and smooth joint at 24.8 m - occasional interbedded sandstone from 24.8 m to 25.2 m and below 25.7 m		RC	21	100	83			648
25				RC	22	100	100			647
26		- 60 degree, undulating, and rough joint at 26.1 m - 70 mm thick carbonaceous seam and coal fragments at 26.2 m - 50 mm thick bentonitic seam at 26.3 m - fair below 26.4 m - fractured and slickensided from 26.5 m to 26.7 m								646
27		- fractured from 27.1 m to 27.4 m - 4 mm thick coal seam at 27.6 m		RC	23	100	63			645
28		- 200 mm thick sandstone layer at 27.9 m - brown from 28.1 m to 28.4 m - 60 degree, undulating, and rough joint at 28.7 m		RC	24	100	97	UCS at 28.1 m: Qu = 1021 kPa		644
	643.7	SANDSTONE - excellent, grey, fresh, extremely weak to very weak, fine, occasional interbedded clay shale, moist								
29		- frequent interbedded clay shale below 29.4 m		RC	25	100	100			643
30										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m

Logged By: CU
Reviewed By: LC

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Stantec

BOREHOLE RECORD

BH22-01

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 14, 2022 to February 16, 2022**

BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**
WATER LEVEL: **11.0 m on May 17, 2022**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
30		SANDSTONE continued - 280 mm thick clay shale layer at 30.2 m								
	642.0	Borehole end at 30.5 m Upon completion: - vibrating wire piezometer (S/N 1700248) installed at 13.8 m - 1" PVC standpipe piezometer installed with slotted section from 1.8 m to 3.6 m (in same borehole) - backfilled with sand, bentonite, and cuttings Water level on March 7, 2022: 3.6 m (standpipe piezometer) 10.3 m (vibrating wire piezometer) Water level on May 17, 2022: 3.7 m (standpipe piezometer) 11.0 m (vibrating wire piezometer)								642
31										641
32										640
33										639
34										638
35										637
36										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m
Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-02

Stantec

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**
WATER LEVEL: **3.1 m on May 17, 2022**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	663.6							
	663.5	ROOTMAT: 100 mm						
		CLAY (CI) - stiff, brown, silty, sandy, trace oxides, trace organics, medium plastic, moist		BS	1			
		- frozen to 0.7 m		SS	2	400	9	
	662.1							
		SAND (SM) - brown, fine, poorly graded, silty, some clay, moist		ST	3	600		Atterberg Limit on ST3: Non-plastic Sieve/Hydro at 1.5 m G S M C 0% 50% 30% 20%
2	661.5							
		CLAY (CI) - soft to firm, brown, silty, sandy, trace oxides, trace organics, medium plastic, moist - 80 mm thick sand layer at 2.3 m		SS	4	400	4	
	660.8							
3		CLAY TILL (CI) - stiff, brown, silty, sandy, some gravel, trace coal, trace oxides, medium plastic, moist						
	660.2			SS	5	350	13	
		SANDSTONE - extremely weak, slightly weathered, grey, fine, bentonitic, trace coal, moist - seepage inferred at 4.0 m		BS	6			
4	659.6							
		CLAY SHALE - extremely weak, fresh, grey, silty, trace coal inclusions, blocky structure, high plastic, moist		SS	7	400	35	
		- good and brown below 4.4 m		RC	8	0	0	Switch to bedrock coring at 4.4 m. Prior to switching: - borehole dry - borehole open No core recovery from 4.4 m to 4.8 m due to plugged drill bit. Good quality inferred from 4.4 m to 4.8 m.
5		- multiple 90 degree, planar, and rough joints from 4.9 m to 5.1 m - 45 degree, rough, and planar joint at 5.3 m and 5.4 m		RC	9	86	86	
		- frequent coal fragments at 5.4 m and 5.5 m - excellent below 5.5 m - extremely weak to very weak below 5.9 m		RC	10	100	100	
6								

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 663, 662, 661, 660, 659, 658

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m
Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-02

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
WATER LEVEL: **3.1 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS	ELEVATION (m)
6		CLAY SHALE continued							
		- 45 degree, smooth, and planar joint at 6.4 m - good below 6.4 m						Plugged drill bit caused core sample to be partially washed away resulting in reduced diameter core sample from 6.4 m to 6.8 m.	657
		- siltstone fragments from 6.8 m to 7.1 m							
7				RC	11	92	89		
		- very weak below 7.3 m						UCS at 7.3 m: Qu = 1143 kPa	656
8		- excellent below 7.9 m							
		- 20 mm fractured zone at 8.6 m - 170 mm sandstone layer at 8.6 m		RC	12	100	99		655
9	654.1								
		SANDSTONE - excellent, grey, fresh, very weak, fine, occasional interbedded clay shale, occasional coal inclusions, moist - 30 mm thick clay shale seam at 9.6 m - siltstone fragments at 9.7 m and 10.7 m - frequent interbedded clay shale from 10.1 m to 10.3 m							654
10				RC	13	100	100		653
		- 90 degree, smooth, and planar joint at 10.7 m							
11		- fine to medium below 11.0 m							
				RC	14	100	100	UCS at 11.5 m: Qu = 1119 kPa	652
12									

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m

Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:26 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-02

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
WATER LEVEL: **3.1 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	ELEVATION (m)
12		SANDSTONE continued - multiple fractured zones up to 40 mm thick and containing siltstone fragments from 12.8 m to 13.1 m							651
	650.7	CLAY SHALE - poor, brown, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist - excellent below 13.2 m		RC	15	100	94		
13		- grey below 13.6 m						UCS at 13.6 m: Qu 1483 kPa	650
14		- occasional interbedded sandstone below 14.0 m - 45 degree, curved, and smooth joint at 14.1 m - 40 degree closed joint at 14.3 m - carbonaceous from 14.5 m to 14.7 m		RC	16	100	100		649
15		- 45 degree, curved, and smooth joint at 15.1 m - 190 mm thick sandstone layer at 15.1 m - silstone fragments at 15.3 m							648
16		- 90 degree, planar, and rough joint and silstone fragments at 15.9 m - carbonaceous from 16.0 m to 16.5 m - 100 mm thick sandstone layer at 16.5 m - 70 degree, planar, and rough joint at 16.5 m - thin siltstone interbedds below 16.6 m		RC	17	91	91		647
17		- multiple joints, fractured/rubbled zones, and fair from 17.1 m to 18.6 m		RC	18	100	60		646
18									

BACKFILL/ MONITOR WELL/ PIEZOMETER

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m

Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:26 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-02

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
WATER LEVEL: **3.1 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
18		CLAY SHALE continued						
		- good below 18.6 m						
19				RC	19	100	90	
		- fractured with infilled clay at 19.4 and 19.5 m - extremely weak below 19.5 m - grey and bentonitic from 19.5 m to 19.9 m						
20								
		- excellent below 20.1 m - 90 degree, planar, and rough joint at 20.3 m						
		- fractured at 20.7 m - carbonaceous from 20.8 m to 21.4 m - very weak below 20.9 m		RC	20	100	100	
21	642.2							
		SANDSTONE - excellent, grey, fresh, very weak, fine, bentonitic, occasional interbedded clay shale, moist						UCS at 21.6 m: Qu = 1668 kPa
22	641.5							
		CLAY SHALE - fair, brown, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist - carbonaceous below 22.2 m - multiple 20 to 30 degree, planar, and smooth joints from 22.1 m to 22.3 m		RC	21	100	23	
	641.0							
		COAL - very poor quality, highly fractured, blocky						
23								
	639.7							
24		CLAY SHALE		RC	22	100	63	

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 645, 644, 643, 642, 641, 640

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m

Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:26 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-02

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**
WATER LEVEL: **3.1 m on May 17, 2022**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
24		CLAY SHALE - excellent, brown, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist								639
25		- occasional interbedded sandstone below 25.5 m		RC	23	100	100			638
26	637.3	- 45 degree, planar, and smooth joint at 26.0 m								
		SANDSTONE - excellent, grey, fresh, very weak, fine, occasional interbedded clay shale, moist								637
27	635.9	- frequent interbedded clay shale from 26.7 m to 27.2 m		RC	24	100	100			636
28		CLAY SHALE - excellent, grey, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist - slightly carbonaceous from 28.0 m to 28.2 m and from 28.5 m to 28.8 m		RC	25	100	100			635
29		- grey from 28.8 m to 29.6 m - dark grey below 29.7 m								634
30										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m
Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:27 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-02

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
WATER LEVEL: **3.1 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
30		CLAY SHALE continued		RC	26	100	100			
		- 20 mm fractured zone with siltstone fragments at 30.6 m								633
	632.8	Borehole end at 30.8 m Upon completion: - vibrating wire piezometer (S/N 1700249) installed at 22.2 m - 2.75" slope inclinometer casing installed to 30.8 m: - A+ Direction: 308 degrees magnetic north - stickup: 80 cm - backfilled grout and sand Water level on March 7, 2022: 2.6 m Water level on May 17, 2022: 3.1 m								
31										632
32										
33										631
34										630
35										629
36										628

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m
Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-03

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 4, 2022 to February 6, 2022**

BH COORDINATES [UTM 12U] 5922638.0N 329487.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **663.4m**
DATUM: **Geodetic**
WATER LEVEL: **4.1 m on May 17, 2022**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	663.4						
	663.3	ROOTMAT: 100 mm					
		SAND (SC-CL) - loose, brown, silty, clayey, fine, trace organics, trace coal, moist	BS	1			
		- frozen to 0.6 m					
1			SS	2	150	5	
		- trace to some clay from 1.8 m to 2.3 m					
2			BS	3			
			ST	4	400		Sieve/Hydro at 2.3 m G 0% S 50% M 27% C 23%
	660.7						
		CLAY TILL (CI) - stiff, brown, silty, sandy, medium plastic, moist	SS	5	300	14	
3	660.4	SANDSTONE - extremely weak, slightly weathered, grey, fine, bentonitic, interbedded clay shale, moist					
		- seepage inferred at 3.8 m	BS	6			
	659.6	CLAY SHALE - extremely weak, fresh, grey and brown, silty, platy structure, trace coal inclusions, high plastic, moist	SS	7	400	21	
4		- 50 mm bentonitic seam at 3.9 m - good and blocky structure below 4.2 m	RC	8	80	80	Switch to bedrock coring at 4.2 m. Prior to switching: - borehole dry - borehole open
		- frequent coal fragments from 4.8 m to 4.9 m					
5		- 30 degree, curved, and rough joint at 5.0 m - excellent and very weak below 5.2 m - 45 degree, curved, and rough joint at 5.5 m					
	657.9	BENTONITE - bluish grey, extremely weak, high plastic, moist	RC	9	100	100	
	657.6	- 85 degree, planar, and rough joint at 5.7 m					
6							

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 663, 662, 661, 660, 659, 658

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 15.5 m
Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:32 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-03

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 4, 2022 to February 6, 2022**

BH COORDINATES [UTM 12U] 5922638.0N 329487.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **663.4m**
DATUM: **Geodetic**
WATER LEVEL: **4.1 m on May 17, 2022**

UNDRAINED SHEAR STRENGTH, Cu (kPa): LABORATORY TEST ▲ FIELD VANE TEST ◆ POCKET PEN. ★ POCKET SHEAR VANE ◘ — 50 kPa, 100 kPa, 150 kPa, 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count: 10, 20, 30, 40, 50, 60, 70, 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
6		CLAY SHALE - excellent, very weak, fresh, grey and brown, silty, blocky structure, trace coal inclusions, high plastic, moist - 30 degree, curved, and rough joint at 5.9 m - occasional interbedded sandstone below 6.5 m		RC	10	100	100			657
	656.7	SANDSTONE - excellent, grey, fresh, very weak, fine, bentonitic, occasional interbedded clay shale, moist						Atterberg Limit at 7.1 m: PL=21%, LL=103%		
7	656.0	CLAY SHALE - excellent, brown, fresh, very weak, silty, occasional interbedded sandstone, trace coal inclusions, blocky structure, high plastic, moist - 40 mm fractured zone at 7.9 m - 50 degree, curved, and rough joint at 8.0 m		RC	11	100	100			656
8	654.8	SANDSTONE - excellent, grey, fresh, very weak, medium to fine, bentonitic, occasional siltstone inclusions, moist - 250 mm thick clay shale layer at 9.0 m - 40 mm zone of bentonite laminations at 9.1 m - occasional interbedded clay shale from 9.2 m to 11.3 m - 70 degree, undulating, and smooth joint at 5.5 m		RC	12	100	100			655
9										654
10		- 30 mm thick weak and cemented/calcareous seams at 10.5 m and 10.6 m		RC	13	100	100			653
11		- weak and cemented/calcareous from 11.3 m to 11.5 m								652
12										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 15.5 m
Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:32 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-03

Stantec

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 4, 2022 to February 6, 2022**

BH COORDINATES [UTM 12U] 5922638.0N 329487.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **663.4m**
DATUM: **Geodetic**
WATER LEVEL: **4.1 m on May 17, 2022**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
12	651.2	SANDSTONE continued		RC	14	95	95			
		CLAY SHALE - excellent, brown and grey, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist - 90 mm fractured zone at 12.6 m - slightly carbonaceous and occasional siltstone inclusions from 12.8 m to 14.3 m		RC	15	100	100			651
13										650
14		- 50 degree, planar, and rough joint at 13.9 m - interbedded sandstone and siltstone inclusions from 14.3 m to 15.9 m		RC	16	100	100			649
15	647.9	- weak below 15.1 m								648
16		Borehole end at 15.5 m Upon completion: - vibrating wire piezometer (S/N 1603865) installed at 6.3 m - 2.75" slope inclinometer casing installed to 14.0 m: - A+ Direction: 311 degrees magnetic north - stickup: 62 cm - backfilled grout and sand Water level on March 7, 2022: 4.1 m Water level on May 17, 2022: 4.1 m								647
17										646
18										

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 15.5 m
Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:33 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-04

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 6, 2022 to February 7, 2022**

BH COORDINATES [UTM 12U] 5922623.0N 329500.0E
WATER LEVEL: **4.5 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **664.5m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	664.5						
	664.4	ROOTMAT: 100 mm					
		SAND (SC) - compact, brown, silty, clayey, fine, trace organics, moist	BS	1			Sieve/Hydro at 0.2 m G S M C 0% 55% 25% 20%
		- frozen to 0.7 m					
1			SS	2	400	15	
	663.3						
		CLAY AND SAND TILL (CI) - stiff, brown, silty, trace coal, trace oxides, medium, moist					
			BS	3			Additional shelby tube (ST4B) collected in borehole 1 m west of BH22-04 at 1.5 m depth. Sieve/Hydro at 1.5 m G S M C 0% 43% 34% 23%
2		- trace gravel below 2.1 m					
			ST	4	600		
3			SS	5	400	13	
	661.3						
		CLAY SHALE - extremely weak, slightly weathered, grey, silty, high plastic, moist - frequent oxides and discolouration from 3.6 m to 3.8 m					
	660.7						
4		SANDSTONE - extremely weak, fresh, grey, fine, bentonitic, trace coal inclusions, trace oxides, moist	SS	6	450	41	
		- excellent below 4.2 m					Switch to bedrock coring at 4.2 m. Prior to switching: - borehole dry - borehole open
			RC	7	100	100	
5		- frequent interbedded clay shale and thin coal interbedds from 4.9 m to 5.0 m					
			SS	7A	430		12/22/50 for 130 mm
	658.8						
		CLAY SHALE - carbonaceous from 5.9 m to 6.4 m					
6							

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 664, 663, 662, 661, 660, 659

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 16 m

Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:36 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-04

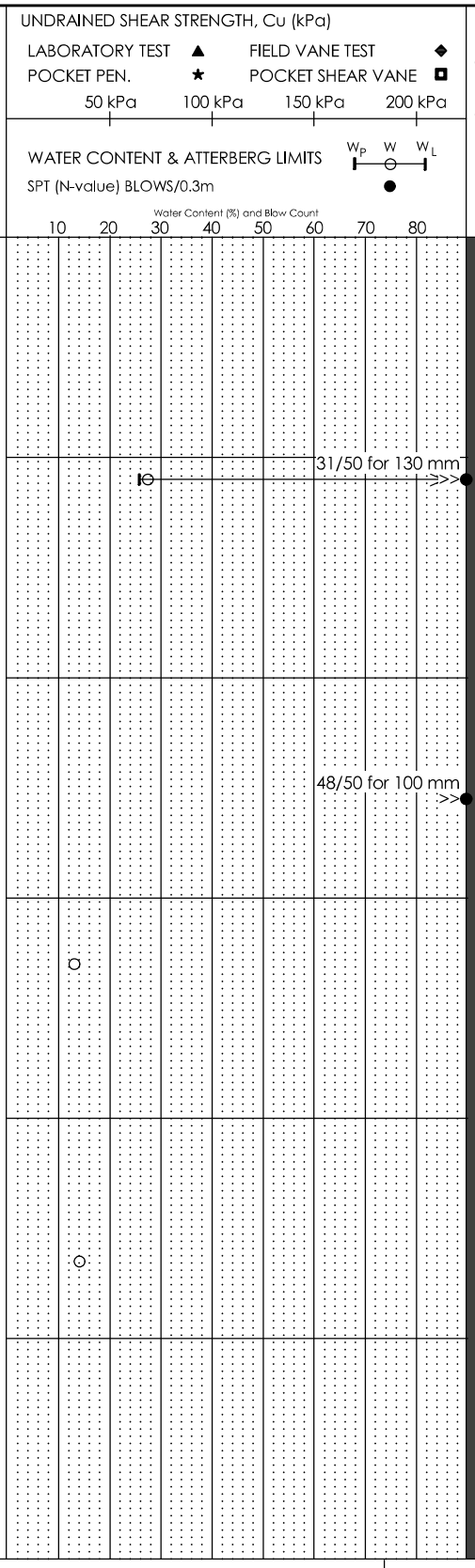
Stantec

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 6, 2022 to February 7, 2022**

BH COORDINATES [UTM 12U] 5922623.0N 329500.0E
WATER LEVEL: **4.5 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **664.5m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
6		CLAY SHALE - excellent, brown and grey, fresh, extremely weak, silty, trace coal inclusions, blocky structure, high plastic, moist - grey from 6.4 m to 6.6 m		RC	8	100	100	UCS at 6.1 m: Qu = 270 kPa
7		- 180 mm thick bentonitic layer at 6.9 m - light brown from 7.2 m to 7.4 m		SS	8A	60		Atterberg Limit at 7.1 m: PL=26%, LL=143%
	657.1	SANDSTONE - excellent, grey, fresh, extremely weak, fine, occasional interbedded clay shale, trace coal, moist						
	656.8	CLAY SHALE - excellent, brown, fresh, extremely weak to very weak, silty, blocky structure, high plastic, moist		RC	9	100	100	
8				SS	9A	0		
	655.7	SANDSTONE - excellent, grey, fresh, very weak, fine, moist - extremely weak from 9.4 m to 9.6 m - occasional interbedded clay shale below 9.9 m		RC	10	100	100	
9	654.5	CLAY SHALE - excellent, grey, fresh, extremely weak, silty, blocky structure, high plastic, moist - 40 mm siltstone clast at 10.1 m - slightly carbonaceous from 10.3 m to 10.9 m		RC	11	100	100	UCS at 10.1 m: Qu = 766 kPa
10	653.3	SANDSTONE - excellent, grey, fresh, extremely weak, fine, moist						
11								
12								



BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 658, 657, 656, 655, 654, 653

Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 16 m

Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:36 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-04

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 6, 2022 to February 7, 2022**

BH COORDINATES [UTM 12U] 5922623.0N 329500.0E
WATER LEVEL: **4.5 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **664.5m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
12		SANDSTONE continued		RC	12	100	100	
13		- occasional thin coal interbedds below 13.0 m		RC	13	100	100	
14	650.4	- weak and cemented/calcareous from 13.9 m to 14.3 m						
		CLAY SHALE - excellent, brown, fresh, very weak, silty, occasional siltstone fragments, blocky structure, high plastic, moist - 20 mm siltstone seam at 14.4 m - 30 mm fractured zone at 14.7 m - extremely weak to very weak below 14.7 m		RC	14	100	100	
15								
16	648.5	Borehole end at 16.0 m Upon completion: - vibrating wire piezometer (S/N 1700067) installed at 14.7 m - 1" PVC standpipe piezometer installed with slotted section from 0.8 m to 3.8 m in borehole 0.5 m west - backfilled with sand and bentonite Water level on March 7, 2022: Dry (standpipe piezometer) 4.4 m (vibrating wire piezometer) Water level on May 17, 2022: Dry (standpipe piezometer) 4.5 m (vibrating wire piezometer)						
17								
18								

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 652, 651, 650, 649, 648, 647

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 16 m

Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:37 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

City of Edmonton	South Edmonton Sanitary Sewer	BOREHOLE NO: **04-C21**
DRILLER: Garrity & Baker	Ellerslie Road	PROJECT NO: EG09167
DRILL/METHOD: Mayhew 1000 - Wet Rotary / Coring (Tra[illegible])	SW3	ELEVATION: 663.2 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

STANDARD PEN (N) 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	PNEUMATIC PIEZOMETER	OTHER TESTS COMMENTS	ELEVATION (m)
0	CLAY, very silty, very sandy, low to medium plastic, brown, coal pieces						663
1							662
2							661
3	SANDSTONE, silty, bentonitic, fine grained, grey						660
4	SANDSTONE, silty, bentonitic, fine grained, moderately cemented, light grey, massive, very weak (R1) ... from 3.5m to 3.6m, moist, bentonitic, medium plastic SILTSTONE, silty, bentonitic, grey, fractured, weak (R2) CLAY SHALE, silty, medium plastic, green to grey, carbonaceous debris, very weak (R1), isolated fractures at 60º to 65º		C1				659
5	CLAY SHALE, silty, medium plastic, dark grey, very weak (R1), carbonaceous debris, occasional coal debris up to 2 cm thick CLAY SHALE, silty, highly plastic, dark grey, very weak (R1), trace carbonaceous debris, rare fractures at 60º						658
6	... at 5.95m, 4 cm thick coal bed ... from 6.0m to 6.2m, lost core, most likely carbonaceous clay shale SANDSTONE and CLAY SHALE, intermixed, very silty, clayey, very fine grained bentonitic sandstone, silty clay bedded at 0º to 5º, very weak (R1)						657
7	SANDSTONE, silty, moderately cemented, fine grained, very weak (R1), occasional carbonaceous laminae at 0º to 6º, (easily fractured horizontally) CLAY SHALE, silty, high plastic, green to grey, very weak (R1), rare sub vertical fractures, trace carbonaceous debris ... from 7.7m to 7.85m, moderately fractured with some soft clay		C2				656
8	SANDSTONE, very silty, bentonitic, moderately cemented, fine grained, green to grey, very weak (R1), occasional carbonaceous laminae at 0º to 5º CLAY SHALE, very silty, some very fine sand, medium plastic, brown to grey, very weak (R1), trace carbonaceous debris						655
9	... from 9.2m to 9.3m, abundant horizontal fractures, some soft sticky brown medium plastic clay SANDSTONE, silty, bentonitic, moderately cemented, fine to medium grained, very weak (R1), occasional brown						654
10							

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Edmonton, Alberta

LOGGED BY: DD
REVIEWED BY: APL/CRT

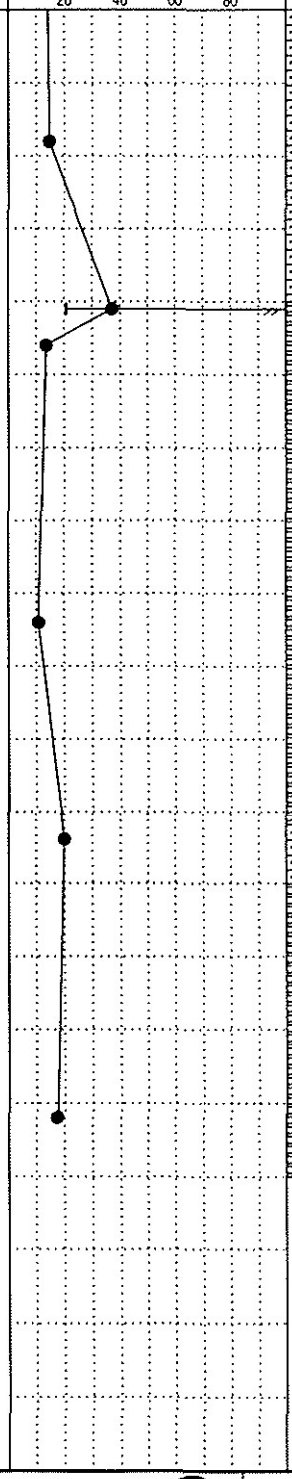
COMPLETION DEPTH: 18.00 m
COMPLETION DATE: 16/11/04

EG09167.GPJ 04/12/24 10:44 AM (BOREHOLE LOG)

City of Edmonton	South Edmonton Sanitary Sewer	BOREHOLE NO: **04-C21**
DRILLER: Garrity & Baker	Ellerslie Road	PROJECT NO: EG09167
DRILL/METHOD: Mayhew 1000 - Wet Rotary / Coring (Tra[illegible])	SW3	ELEVATION: 663.2 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand



Depth (m)	SOIL DESCRIPTION	SAMPLE NO	OTHER TESTS COMMENTS	ELEVATION (m)
10	carbonaceous and grey clay laminae at 0º to 15º, trace silt nodules ... from 9.3m to 9.6m, occasional horizontal fractures ... from 9.7m to 9.8m, brown clay shale layer at 0º to 3º	C3		653
11			q_u=1215.17 kPa at 4.99% Strain w=12.7%	652
12	... from 11.8m to 12.0m, abundant dark brown to black carbonaceous laminae at 8º CLAY SHALE, silty, hard, medium to high plastic, green to grey, very weak (R1) ... from 12.0m to 12.45m, highly plastic clay with trace silt, grey ... from 12.45m to 12.55m, pockets of very fine silty sand ... from 12.55m to 12.9m, silty, carbonaceous debris, brown to grey		w_p =20.7, w_L = 112.2	651
13				650
14	... from 14.04m to 14.5m, sandstone layer at 5º to 15º, bentonitic with thin coal laminae at base of layer, very weak (R1) ... from 14.05m to 14.4m, silty, sandy, brown ... at 14.8m, fractured at 22º	C4	q_u=1821.8 kPa at 3.51% Strain w=11.1%	649
15	... from 15.0m to 15.6m, several fractures at 0º to 15º			648
16	SANDSTONE and CLAY SHALE, intermixed, silty, very fine grained bentonitic sandstone intermixed with brown to grey highly plastic clay shale, occasional carbonaceous laminae, moderately cemented, very weak (R1) CLAY SHALE, silty, highly plastic, grey to brown, very weak (R1), frequent light brown hard siltstone nodules up to 6 cm thick ... at 16.6m, fractured at 12º	C5		647
17	... at 16.9m, slickensided at 40º (C3, G1, B2, R3, S2) CLAY SHALE, silty, very hard, highly plastic, very weak (R1), trace carbonaceous debris, numerous slickensides (Slb, C2, C3, G1, G6, O4, B1, R1, S1-S2) at 0º to 90º			646
18	CLAY SHALE, silty, very hard, high plastic, very weak (R1), carbonaceous debris, numerous slickensides (Slb, C3, G1, O4, B2, R1-R6, S2-S3) at 0º to 90º End of Hole at 18.0 m. Upon Completion: Piezometer (SR# 029567) installed to 12.3 m.			645
19				644
20				

amec	AMEC Earth & Environmental Edmonton, Alberta	LOGGED BY: DD REVIEWED BY: APL/CRT	COMPLETION DEPTH: 18.00 m COMPLETION DATE: 16/11/04

EG09167.GPJ 04/12/24 10:44 AM (BOREHOLE LOG)

City of Edmonton	South Edmonton Sanitary Sewer	BOREHOLE NO: **04-C21B**
DRILLER: Garrity & Baker	Ellerslie Road	PROJECT NO: EG09167
DRILL/METHOD: Mayhew 1000 - Wet Rotary / Coring (TR208)		ELEVATION: 663.45 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

STANDARD PEN (N) 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	OTHER TESTS COMMENTS	ELEVATION (m)
0	CLAY, silty, very sandy, trace gravel, medium plastic, brown, coal pieces					663
1						662
2						661
	... from 2.5m to 3.5m, rock pieces, sandstone pieces, coal pieces, rough drilling					
3	... from 3.2m to 4.6m, lost core, sandstone based on cuttings					660
	SANDSTONE, silty, bentonitic, fine grained, grey		C1			
4	... from 4.3m to 4.5m, some water loss, rough drilling					659
	SANDSTONE, silty, bentonitic, very fine grained, extremely weak (R0), some weak (R2) siltstone fragments					
5	CLAY SHALE, silty, very hard, high plastic, grey to brown, very weak (R1), some carbonaceous debris		C2			658
	... at 5.2m, fractured at 50º					
	... from 5.55m to 5.65m, highly fractured core					
	...at 5.6m, sandy lense, 3 cm thick					
6	... from 6.1m to 6.25m, green to grey, highly plastic					657
	... from 6.[illegible]m to 6.65m, silty, dark brown, carbonaceous, medium plastic, very weak (R1)					
	...[illegible]om 6.65m to 8.[illegible] occasional sub vertical fracture					
7	... from 6.95m to 7.1m, pockets of very fine grained bentonitic sand		C3			656
	... at 7.65m, slickensided, C3, G1, B3, R1, S3, at 55º					
	... from 7.7m to 7.8m, silty, green to grey					
8	End of Hole at 8.0 m. Bentonite chips to surface.					655
9						654
10						

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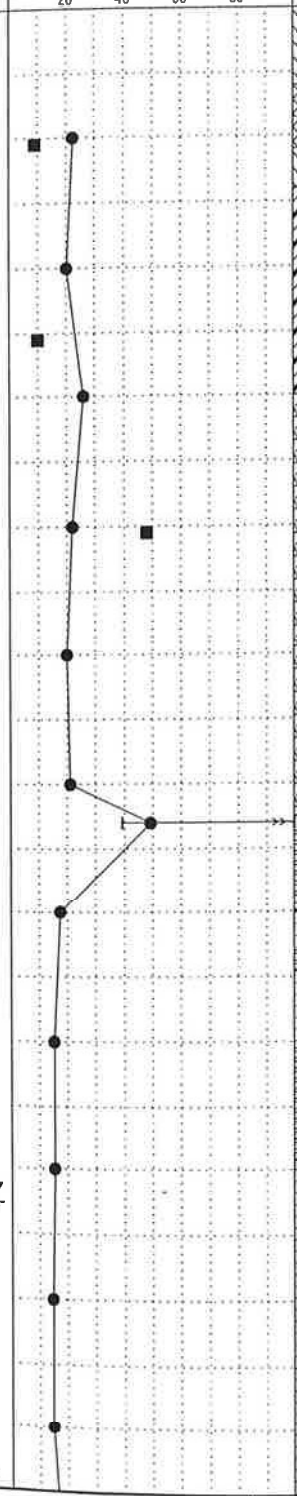
LOGGED BY: DD	COMPLETION DEPTH: 8.00 m
REVIEWED BY: APL/CRT	COMPLETION DATE: 17/11/04

EG09167.GPJ 04/12/24 10:44 AM (BOREHOLE LOG)

City of Edmonton	South Edmonton Sanitary Sewer	BOREHOLE NO: **05-A03**
	Ellerslie Road (SW3)	PROJECT NO: EG09167
DRILL/METHOD: M 10/Solid Augers	NAD 83-3TM-GRID: N 5921434 E 28763	ELEVATION: 672.2 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand



Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	OTHER TESTS COMMENTS	ELEVATION (m)
0	TOPSOIL, silty. sandy, medium plastic, black				BH05-A03 was drilled with solid auger from surface to 12.2 m; with wet rotary - from 12.2 m to 20.9m, and located 1.8 m from auger hole	672
1	CLAY FILL, silty, sandy, rootlets, sandstone and clayshale fragments, coal chips		D1	9		671
	... rootlets, brown					
	TOPSOIL, silty. sandy, medium plastic, decayed wood, brown					
	CLAY, medium plastic, stiff, silty, sandy, coal chips, sand pockets, rust stain, brown					
2						670
			D2	10		
3	CLAYSHALE, medium to high plastic, hard, silty, sandy, brown, weathered					669
4	... hard, blue-grey		D3	48		668
			C1			
5			C2			667
			C3			
6						666
	CLAY, bentonitic, high plastic, hard, white		C4			
	CLAYSHALE, medium to high plastic, hard, silty, fragments of well cemented white calcium deposit, grey					
	... free water trace					
7	SANDSTONE, Bedrock, silty, fine grained, very dense, blue-grey		C5			665
	CLAYSHALE, high plastic, hard, silty, fragments of well cemented white calcium deposit, grey					
	SANDSTONE, Bedrock, silty, fine grained, very dense, blue-grey					
8			C6			664
	CLAYSHALE, high to medium plastic, hard, silty, grey					
	... carbonaceous, coal fragment, dark brown					
			C7			
9	SANDSTONE, silty, fine grained, very dense, occasionally coal fragments, blue-grey					663
			C8			
10			C9			662
11			C10			661
11.5						

EG09167SW3.GPJ 06/03/02 02:46 PM (BOREHOLE LOG)

amec	AMEC Earth & Environmental Edmonton, Alberta	LOGGED BY: CRA	COMPLETION DEPTH: 15.30 m
		REVIEWED BY:	COMPLETION DATE: 6/4/05

City of Edmonton	South Edmonton Sanitary Sewer	BOREHOLE NO: **05-A03**
	Ellerslie Road (SW3)	PROJECT NO: EG09167
DRILL/METHOD: M 10/Solid Augers	NAD 83-3TM-GRID: N 5921434 E 28763	ELEVATION: 672.2 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	SLOTTED PIEZOMETER	OTHER TESTS COMMENTS	ELEVATION (m)
11.5	.. well cemented		C11				
12	... moderate cemented						
	SANDSTONE, silty, fine grained, blue-grey, very weak (R1)					From 12.2m to 14.9m: REC = 100% RQD = 100%	660
	CLAYSHALE, silty, sandy, medium plastic, carbonaceous, brown, very weak (R1)		C12				
13	... fracture at 40°, soft brown clay on surface						659
	... fracture at 3°		C13				
	SANDSTONE, silty, fine grained, moderately cemented, blue-grey, very weak (R1)		C1a				
	... thin carbonaceous beds at 10°					APPROX. TUNNEL ZONE	
14	CLAYSHALE, silty, high to medium plastic, brown-grey, very weak (R1)		C14				658
	... to 14.2m numerous slickensides (Slc), through going, semi-Undulating, intersecting, hard force to brake, striated, shiny, glossy at 45°						
	... from 13.9 m to 14.2 m high plastic, bentonitic, greenish grey		C15				
15	... from 14.2m to 16.1m medium to high plastic, hard, slightly carbonaceous, coal fragments, brown					From 14.9m to 18.0m: REC = 100% RQD = 71%	657
	... to 18.2 fractured at 40° to 50°						
	... slickensides, planer, through going, hard force, striated, pock marked, shiny, glossy at 45°						
16	... to 14.9m numerous slickensides (Slc), through going, semi-Curved, intersecting, hard force, striated, moderately shiny at 25° to 70°						656
	... high plastic, hard, grey to light brown		C2a				
17	... slickenside at 42° through going, planer, falls apart, striated, dull						655
18	SANDSTONE, silty, clayey, fine grained, bentonitic, clay laminas, carbonaceous fragments from 0 -25°, of blue-grey to brown, very weak (R1)					From 18.0m to 20.9m: REC = 100% RQD = 100%	654
19	... medium grained, non-plastic, moderately cemented, trace of coal, laminated		C3a			q_u = 1694 kPa at 6.24% Strain	653
20						q_u = 1354 kPa at 6.63% Strain	652
	... from 20.6m to 20.9m siltstone nodules up to 50 mm, moderately cemented, light brown						
21	End of Hole at 20.9 m No Water upon completion 1" PVC Standpipe installed to 10.0 m - slotted from 10 m to 6.9 m, 0.8 m stickup Backfilled with drill cuttings and grout						651
22							650
23							

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LOGGED BY: CRA
REVIEWED BY:

COMPLETION DEPTH: 15.30 m
COMPLETION DATE: 6/4/05

EG09167SW3.GPJ 06/03/02 02:46 PM (BOREHOLE LOG)

Stantec

To:	Ren Cheng	From:	Leslie Cho and Ellen Huang
	BC 1136		BC 1233
Project/File:	1161110185	Date:	February 3, 2023

Reference: Ellerslie Road - Whitemud Creek Widening Preliminary Slope Stability Assessment

Stantec completed a slope stability assessment for the above referenced project to support Stantec's preliminary bridge design submission. This technical memorandum presents the slope stability analysis results and should be read in conjunction with the attached Statement of General Conditions in **Appendix A**.

1 Project Understanding

As shown on Figure 1 in **Appendix B**, a new 3-span bridge will be constructed parallel to the existing Ellerslie Road bridge as part of the proposed Ellerslie Road Whitemud Creek Widening project. The bridge measures about 52.4 m long and 14.7 m wide and will be founded on driven steel piles, similar to the existing bridge. A preliminary foundation design memo was submitted on January 13, 2023, under a separate cover (Stantec 2023).

The western bridge approach will consist of cuts up to 1 m to approximately match the grade alignment of the existing Ellerslie Road bridge. The eastern bridge approach will require constructing an approximately 4.5 m to 5.0 m high approach embankment. The embankment side slope will require a retaining wall to avoid encroachment into Whitemud Creek and utility (ATCO) right-of-way (ROW) as shown on Drawing S001, **Appendix B**. It is understood that two retaining wall options are being evaluated by Stantec's bridge engineers including Mechanically Stabilized Earth (MSE) wall and concrete wall supported on piles. The new embankment will extend from the proposed east bridge abutment towards the eastern gully that ties into Whitemud Creek further downstream. The embankment will gradually decrease in height towards the east until a 3H:1V embankment slope can be achieved.

2 Subsurface Conditions

The borehole locations are plotted on Figure 1 in **Appendix B** which includes boreholes from Stantec's recent investigation as well as relevant boreholes by others (Thurber 2021).

In general, clay till overlying bedrock was encountered on the west side of Whitemud Creek. Top of bedrock was encountered ranging from Elev. 669 m to 666 m on the west side.

The east side of Whitemud Creek appears to be part of a flood plain and consisted of clay, sand, and clay till before encountering bedrock. On the east side of Whitemud Creek, the existing ground elevation of the flood plain is at about Elev. 664 m. The bottom of native clay and clay till ranged from approximately 660 m to 661 m and was underlain by bedrock.

The bedrock at the bridge crossing belongs to the Cretaceous Horseshoe Canyon Formation consisting of interbedded clay shale and sandstone with coal inclusions. Bentonite seams were encountered within the bedrock at approximately Elev. 657.9 m and 654.3 m.

The groundwater level recorded in the piezometers was about 3 m to 4 m below the ground surface on the eastern flood plain and was close to the creek level at approximately Elev. 659 m to 660 m.

The elevation of various soil layers represents a generalized model of the conditions within each area. Variability in depth and thickness of each soil unit should be anticipated.

Detailed borehole records along with the Borehole Symbols & Terms are provided in **Appendix C**.

3 HISTORICAL SLOPE INSTABILITIES AND LANDSLIDE MECHANISM

Two small scale historical landslides along the Whitemud Creek were noted in previous geotechnical reports (Thurber 2015a, 2015b, 2019, Hoggan 2016).

Hoggan (2016) noted a landslide occurred in 1983 due to “inadequate backfill” induced tension cracks and excessive rain on the south side of the existing Ellerslie Road. Stantec surmises this landslide location is approximately 400 m west of the existing bridge.

Thurber (2019) noted a historical landslide to the southwest of the existing Ellerslie Road bridge which occurred prior to 1962 possibly triggered by the original construction activities of Ellerslie Road. It is believed that the landslide may have forced Whitemud Creek to meander southward. A slope inclinometer (SI) was installed on the southwest corner of the slope near the western bridge abutment. The SI did not show any distinct zones of movement when measured between March and June 2019. Thurber conducted a comparison of the crest of the creek valley in the area from 1962 through 2017 indicating little change suggesting no significant slope regression since 1962.

Tension cracks were observed along the north side of Ellerslie Road, by the eastern bridge abutment, during a Stantec site visit in Q4 2019. Undercutting and erosion of the bedrock along the western bank, immediately downstream of the existing bridge was also observed.

Two slope inclinometers were installed in boreholes BH22-02 and 03 during the current field investigation. These slope inclinometers did not register any slope movement nine months after installation as shown in **Appendix E**. However, slope instabilities are very common along the rivers and creeks in the Edmonton area and are triggered by a combination of toe erosion, bedrock softening, rise of groundwater level, and developments on top of the crest (Soe Moe et al. 2009). Therefore, slope instability could be triggered by the new bridge construction, especially due to thick fill placement on the east flood plain.

If triggered, the landslide is expected to follow a near horizontal weak plane in the bedrock such as bentonite seam, bentonitic shale, or shale of high plasticity. Two potential weak planes were identified in the bedrock where deep-seated translational landslide could occur:

- The bentonite seam at Elev. 657.9 m; and,
- The bentonitic shale of very high plasticity at Elev. 659 m.

4 Preliminary Slope Stability Assessment

4.1 Slope Stability Analysis

Stantec's geotechnical group completed preliminary slope stability analyses for the eastern embankment of the proposed bridge. Slope stability analyses were carried out using the commercially available 2-Dimensional limit equilibrium computer software SLOPE/W (GeoStudio 2021) utilizing the Morgenstern–Price method. The computer model examines many potential failure surfaces and identifies the "critical" failure surface which produces the minimum Factor of Safety (FoS) against sliding.

The FoS is a unitless fraction generalized as a ratio of the resisting forces divided by the driving forces. A FoS of unity (1.0) indicates a marginally stable slope whereas less than unity indicates that the slope has failed or is unstable.

Seven sections (A0, A1, A4, W2, W3, W6 and W10) illustrated on Drawing S001 (**Appendix B**) were adopted to represent the embankment slope from the east bridge abutment towards the eastern gully. For Section W10, it was assumed that a 1.5 m buffer from ATCO right-of-way would be required during construction. The soil stratigraphy was generalized based on the field investigations conducted by Stantec and others. The groundwater level was selected based on the measured water levels during field investigation. A surcharge load of 12 kPa was applied to the top of the slope to account for traffic load.

Soil parameters used for slope stability are presented in **Table 4-1**. The values were estimated based on the borehole data collected at the site. The soil parameters were generally in agreement with that encountered in the Edmonton area.

Table 4-1 Soil Parameters Used for Slope Stability Analysis

Soil/Rock	Unit weight γ (kN/m^3)	Cohesion c' (kPa)	Friction angle φ' (°)	Excess Pore Pressure, B-Bar
Alluvial Clay	18	2	24	0.3
Bentonitic Shale/Bentonite Seam(1)	19	0	8	0
Bedrock	21	50	22	0.2
Embankment Fill	20	2	26	0
Note: (1) Bentonitic shale at Elev. 659 m and bentonite seam at Elev.657.9 m.				

In the analyses, residual strength parameters (φ' = 8°, c = 0 kPa) were used for the bentonitic shale and bentonite seam since these layers may have been pre-sheared due to historical slope movement or valley rebound.

In discussion with the bridge designers, two options are being considered for retaining the embankment side slope:

- Option 1 consists of extending the concrete abutment wall along the embankment toe.
- Option 2 consists of constructing a MSE wall in front of the proposed bridge abutment and following a similar alignment as Option 1.

For each option and at each cross section, the following scenarios were completed for the embankment slope stability analysis:

- Long-term stability without stabilization piles.
- Long-term stability with stabilization piles.
- Short-term (End of Construction) stability with stabilization piles.

The long-term stability of the bridge head slope was also assessed for select cases (A0, A1, A4, and W2) where a concern was identified due to proximity of the retaining structure to the creek or fill placement along the creek bank.

For the short-term case, a FoS of 1.3 was targeted while a FoS of 1.5 was targeted for the long-term case. Based on the slope stability analyses, construction of the proposed embankment will require slope stabilizing measures along the full length of embankment to achieve a FoS of 1.5 for long-term stability

For both options, cast-in-place (CIP) piles were assumed for slope stabilization. CIP piles were placed directly beneath the concrete abutment wall and 1 m in front of the MSE wall. From Sections A1 to A4, slope stabilization piles would also be required along the lower head slope in addition to those along the concrete abutment wall and MSE wall to achieve adequate FoS against head slope instability. Alternatively, due to the flexibility in the layout of stabilization piles for MSE wall option, stabilization piles could be placed near the west edge of the wildlife crossing to remove the need for a second row of piles along the lower slope.

To determine the resultant lateral force required to stabilize the slope, a lateral force (kilonewton per meter of wall length) was applied until an overall long-term FoS of 1.5 was achieved. The location of the resultant lateral force can be assumed to be located at about 1/3 the height above the failure plane.

As an alternative to a second row of stabilization piles, a conceptual option to use soil nails to stabilize the lower slope was analyzed using Section A1. A FoS > 1.5 was achieved based on 4 rows of soil nails 7 m long and installed at an inclination of 20 degrees with assumed bond strength of 50 kPa. Further details and refinement can be provided during detailed design should soil nails be selected for use.

Table 4-2 below summarizes the slope stability results and the required lateral forces that must be resisted by the slope stabilization piles to stabilize the overall slope for both options. For all analyses, the critical slip surface was found to be generally along the bentonite seam or the bentonitic shale. For MSE wall, a potential slip surface along the wall base was also evaluated.

Table 4-2 Summary of Slope Stability Analysis Results

Section	Sub-Case		Factor of Safety		Required Lateral Force (kN/m)	Reference Figure (Appendix D)
			Estimated	Meet the Requirement		
A0	Option 1-Concrete Abutment Wall	No Stabilization Piles - Long Term	1.12	No	-	D1
		With Stabilization Piles - Short Term	1.43	Yes	260	D2
		With Stabilization Piles - Long Term	1.51	Yes	260	D3

		Head Slope Failure – No Piles	1.34	No	-	D4
		Head Slope Failure with Piles	1.55	Yes	30	D5
	Option 2- MSE Wall	No Stabilization Piles - Long Term (Global Failure)	1.07	No	-	D6
		No Stabilization Piles - Long Term (MSE Wall Base Failure)	1.86	Yes	-	D7
		With Stabilization Piles - Short Term	1.41	Yes	190	D8
		With Stabilization Piles - Long Term	1.51	Yes	190	D9
		Head Slope Failure – No Piles	1.49	Yes	-	D10
A1	Option 1- Concrete Abutment Wall	No Stabilization Piles - Long Term	1.11	No	-	D11
		With Stabilization Piles - Short Term	1.41	Yes	280	D12
		With Stabilization Piles - Long Term	1.50	Yes	280	D13
		Head Slope Failure – No Piles	1.14	No		D14
		Head Slope Failure with Piles	1.51	Yes	70	D15
		Soil Nails – Long-Term	1.53	Yes	-	D16
	Option 2- MSE Wall	No Stabilization Piles - Long Term (Global Failure)	0.98	No	-	D17
		No Stabilization Piles - Long Term (MSE Wall Base Failure)	2.17	Yes	-	D18
		With Stabilization Piles - Short Term	1.41	Yes	240	D19
		With Stabilization Piles - Long Term	1.53	Yes	240	D20
		Head Slope Failure – No Piles	1.18	No	-	D21
		Head Slope Failure with Piles	1.51	Yes	45	D22
A4	Option 1- Concrete	No Stabilization Piles - Long Term	0.81	No	-	D23

	Abutment Wall	With Stabilization Piles - Short Term	1.38	Yes	340	D24
		With Stabilization Piles - Long Term	1.52	Yes	340	D25
		Head Slope Failure – No Piles	1.37	Yes	-	D26
		Head Slope Failure with Piles	1.54	Yes	10	D27
	Option 2- MSE Wall	No Stabilization Piles - Long Term (Global Failure)	0.84	No	-	D28
		No Stabilization Piles - Long Term (MSE Wall Base Failure)	1.71	Yes	-	D29
		With Stabilization Piles - Short Term	1.30	Yes	280	D30
		With Stabilization Piles - Long Term	1.54	Yes	280	D31
		Head Slope Failure – No Piles	1.37	No	-	D32
		Head Slope Failure With Piles	1.54	Yes	-	D33
		Head Slope Failure With Piles at Wildlife Crossing	1.46	No	-	D34
W2	Option 1- Concrete Abutment Wall	No Stabilization Piles - Long Term	0.79	No	-	D35
		With Stabilization Piles - Short Term	1.34	Yes	320	D36
		With Stabilization Piles - Long Term	1.50	Yes	320	D37
		Head Slope Failure – No Piles	1.55	Yes	-	D38
	Option 2- MSE Wall	No Stabilization Piles - Long Term (Global Failure)	0.91	No	-	D39
		No Stabilization Piles - Long Term (MSE Wall Base Failure)	1.69	Yes	-	D40
		With Stabilization Piles - Short Term	1.30	Yes	265	D41
		With Stabilization Piles - Long Term	1.51	Yes	265	D42
		Head Slope Failure – No Piles	1.56	No	-	D43

W3	Option 1- Concrete Abutment Wall	No Stabilization Piles - Long Term	0.88	No	-	D44
		With Stabilization Piles - Short Term	1.42	Yes	270	D45
		With Stabilization Piles - Long Term	1.51	Yes	270	D46
	Option 2- MSE Wall	No Stabilization Piles - Long Term (Global Failure)	0.96	No	-	D47
		No Stabilization Piles - Long Term (MSE Wall Base Failure)	1.86	Yes	-	D48
		With Stabilization Piles - Short Term	1.35	Yes	230	D49
		With Stabilization Piles - Long Term	1.51	Yes	230	D50
W6	Option 1- Concrete Abutment Wall	No Stabilization Piles - Long Term	1.22	No	-	D51
		With Stabilization Piles - Short Term	1.45	Yes	160	D52
		With Stabilization Piles - Long Term	1.52	Yes	160	D53
	Option 2- MSE Wall	No Stabilization Piles - Long Term (Global Failure)	1.22	No	-	D54
		No Stabilization Piles - Long Term (MSE Wall Base Failure)	1.58	Yes	-	D55
		With Stabilization Piles - Short Term	1.46	Yes	160	D56
		With Stabilization Piles - Long Term	1.52	Yes	160	D57
W10	Option 1- Concrete Abutment Wall	No Stabilization Piles - Long Term	1.30	No	-	D58
		With Stabilization Piles - Short Term	1.42	Yes	140	D59
		With Stabilization Piles - Long Term	1.50	Yes	140	D60
	Option 2- MSE Wall	No Stabilization Piles - Long Term (Global Failure)	1.30	No	-	D61
		No Stabilization Piles - Long Term (MSE Wall Base Failure)	1.55	Yes	-	D62

		With Stabilization Piles - Short Term	1.43	Yes	130	D63
		With Stabilization Piles - Long Term	1.50	Yes	130	D64

For the concrete abutment wall option, a loading case with active lateral earth pressure should also be structurally assessed in addition to the assessment using the resultant lateral load.

4.2 Pile Wall Design Parameters

4.2.1 PILE SIZE AND SPACING

For preliminary design, a minimum pile diameter of 900 mm can be assumed. The centre-to-centre spacing for CIP piles to stabilize the slope can be assumed to range from 2 to 4 pile diameters. If CIP piles are used to support both the bridge structure and stabilize the slope (i.e., Option 1), the center-to-centre spacing of the abutment CIP piles should not be less than 2.5 pile diameters. The pile length should extend a minimum of 6 m below the anticipated slip surfaces shown on **Appendix D**.

The final arrangement of piles will be assessed during the detail design stage to ensure soil arching occurs (i.e., the soil does not flow between piles) and provide an estimate of the deformation.

4.2.2 LATERAL RESISTANCE FOR CIP PILE WALL

The underlying bedrock will be required to anchor the CIP piles which are used to stabilize the slope. From the various scenarios assessed, sliding failure through the bentonite layers within the clay shale bedrock is the critical case. The lateral load response of the piles embedded within the bedrock can be determined structurally by modelling the bedrock as a series of horizontal springs. The soil spring over unit loading area is typically referred to as horizontal subgrade reaction modulus, k, in MN/m3 which is not a fundamental soil property and is dependent on the loaded area. Stantec (2023) previously provided the modulus of horizontal subgrade reaction (k) for 900 mm diameter foundation piles.

4.2.3 LATERAL EARTH PRESSURE

The retaining structures supporting the vertical face of the embankment will be required to resist the lateral loads caused by the embankment fill. The lateral pressure can be assumed to be a triangular distribution where the unit weight is multiple by the depth and the respective earth pressure coefficient. A surcharge loading of 12 kPa multiplied by the respective earth pressure coefficient should also be applied when adjacent to Ellerslie Road. **Table 4-3** provides a summary of the lateral earth pressure design parameters.

Table 4-3 Earth Pressure Parameters

Soil Type	Unit Weight, γ (kN/m^3)	Buoyant Unit Weight, γ' (kN/m^3)	Effective Friction Angle, φ' (degrees)	At Rest Earth Pressure Coefficient, K_o	Active Earth Pressure Coefficient, K_a	Passive Earth Pressure Coefficient, K_p
Embankment Fill	20	10	26	0.55	0.40	2.5

Alluvial Deposits (Clays and Sands)	18	8	24	0.60	0.42	2.2
Granular Fill	21	11	35	0.45	0.30	3.5

Notes:

- Buoyant unit weights should be used when below the water table. Water pressure should also be added to the lateral earth pressure.
- A surcharge load of 12 kPa should be included for areas adjacent to Ellerslie Road.
- Refer to the nearest borehole location for the anticipated soil conditions for the respective cross section.

4.3 Recommended Further Work

From a slope stability perspective, the shear strength of bentonitic bedrock and bentonite seams within the bedrock is a governing factor in the global stability assessment. At the time of the field investigation, constraints such as site access, utility conflicts, and presence of trees prohibited a more detailed investigation east of Section W3. As such, the available field information is limited east of Section W3 and critical design assumptions were made. Additional field investigation and laboratory testing are recommended to further confirm the presence and properties of bentonitic bedrock and bentonite seams within the bedrock. The slope stability analysis should then be updated based on the additional field investigation and laboratory testing. Additional slope inclinometer readings should also be obtained during the additional field investigation to confirm slope movements, if any.

Finite Element Method (FEM) stress-deformation analysis should be carried out to model the soil-pile interaction to support the detailed pile wall design. FEM analysis can provide more accurate estimate of the magnitude and distribution of the shear resistance along a pile which is critical for pile design.

5 Closing

We trust this report meets your current requirements. If you have any questions, please do not hesitate to contact the undersigned.

Respectfully,

Stantec Consulting Ltd.

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Huang, Ellen Digitally signed by Huang, Ellen Date: 2023.02.03 12:43:14 -07'00'

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Signature ID 78675
Date 3 Feb. 2023
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Attachment:
- Appendix A – Statement of General Conditions
- Appendix B – Figures and Drawings
- Appendix C – Borehole Symbols & Terms and Borehole Records
- Appendix D – Slope Stability Analysis Results
- Appendix E – Slope Inclinometer Plots for BH22-02 and BH22-03

6 References

Hoggan Engineering & Testing (1990) Ltd. (2016). First Submission – Geotechnical Investigation Slope Stability Analysis Whitemud Creek & Ellerslie Road SW Between 141 Street SW & Ambleside ECO Station. File No. 6004-41.

Soe Moe, K.W., Cruden, D.M., Martin, C.D., Lewycky, D., Lach, P.R. (2009) Mechanisms and Kinematics of River Valley Landslides in Edmonton, GeoHalifax 2009, pp 390-397.

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Thurber Engineering Ltd. (2021). Preliminary Geotechnical Assessment Golden Spike Transmission Whitemud Creek – Edmonton, AB. File No. 30225.

Appendix A Statement of General Conditions

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

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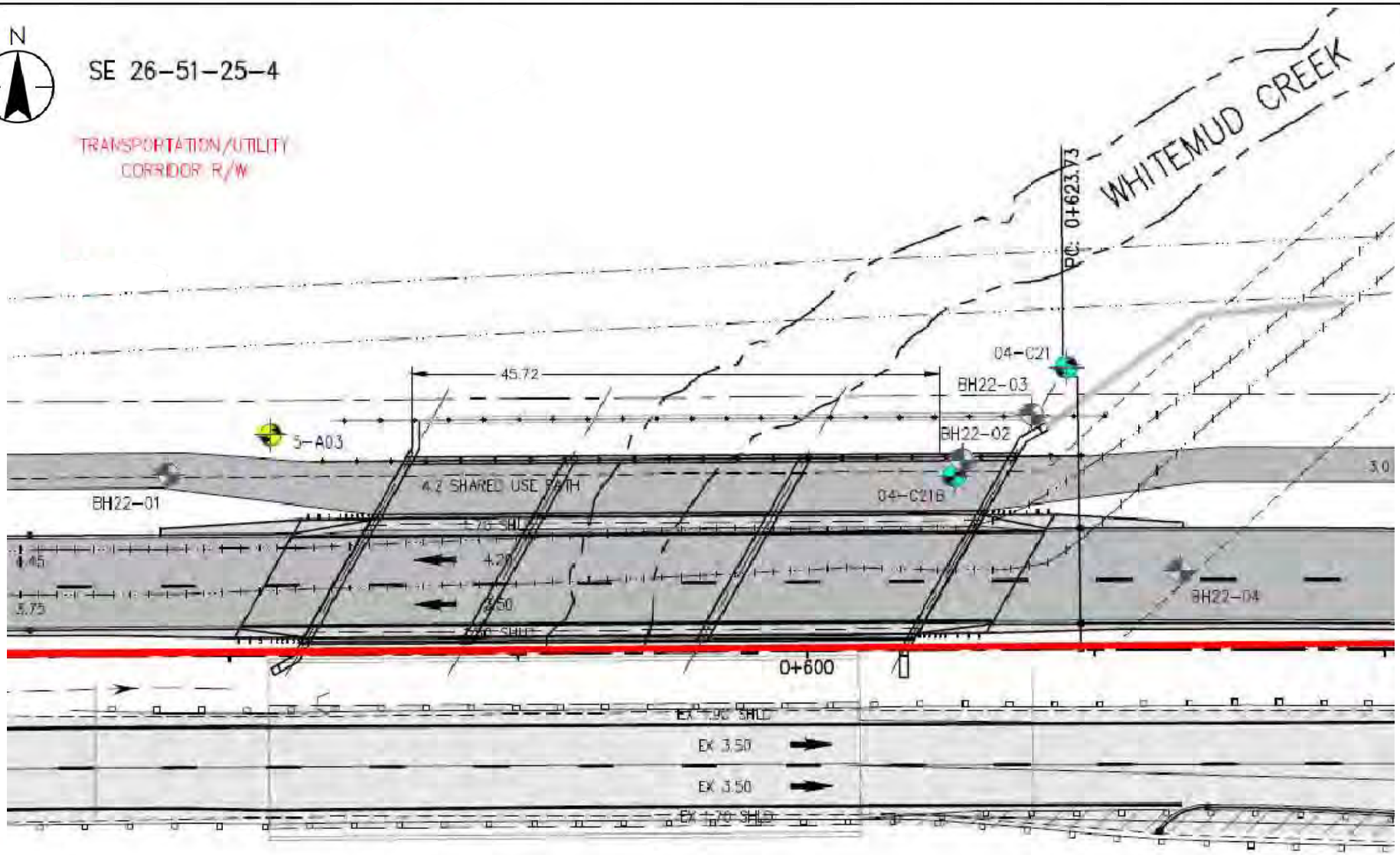
INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behaviour. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

Appendix B Figure



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BOREHOLE (STANTEC 2022)

HISTORIC BOREHOLE (AMEC 2005)*

HISTORIC BOREHOLE (AMEC 2004)*

*Borehole Records available through Thurber Engineering Ltd. (2021).

Project No.:	1161110185
Scale:	---
Date:	October 3, 2022
Prepared by:	CU
Checked by:	LC

Client/Project

Ellerslie Bridge – Whitemud Creek Crossing

Title

Borehole Location Plan

Figure No.

1

MSE WALL OPTION – PLAN

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Notes

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ELLERSLIE ROAD SW
ECO STATION ROAD TO GRAYDON HILL BLVD.

EDMONTON, AB

Title
ELLERSLIE ROAD
ECO STATION RD. TO GLENRIDDING
GENERAL LAYOUT - MSE WALL

Project No. 1161.110185

Scale

Revision 0

Sheet of XX

Drawing No. **S001**

ORIGINAL SHEET - ANSI D

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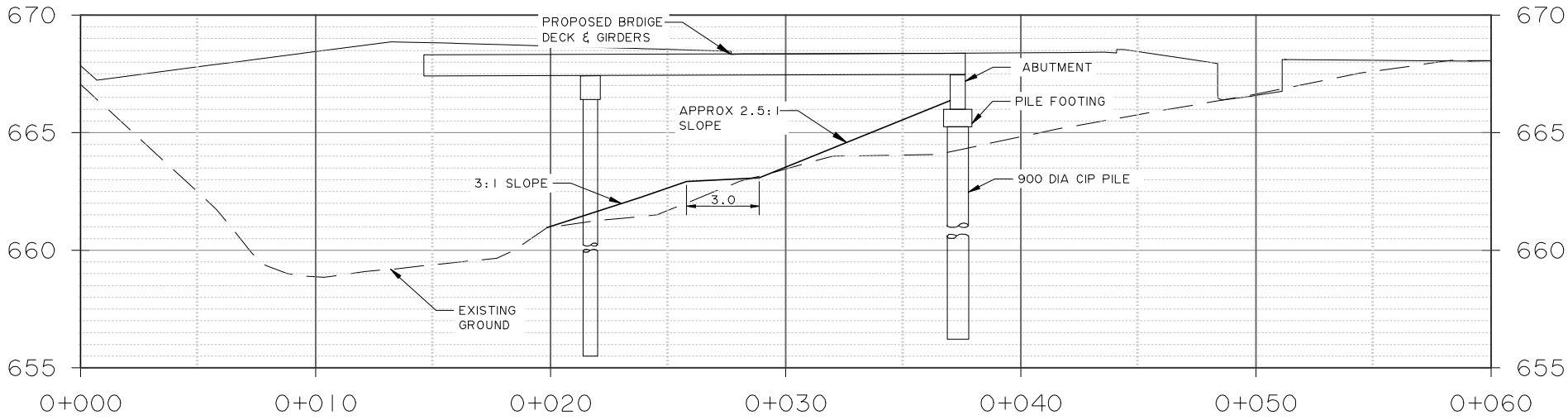

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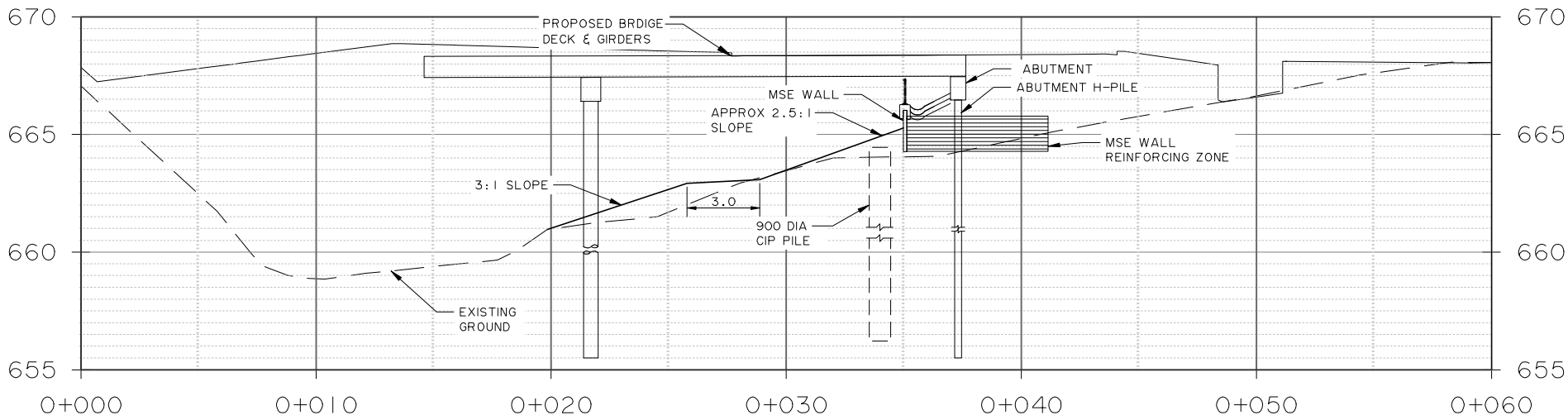

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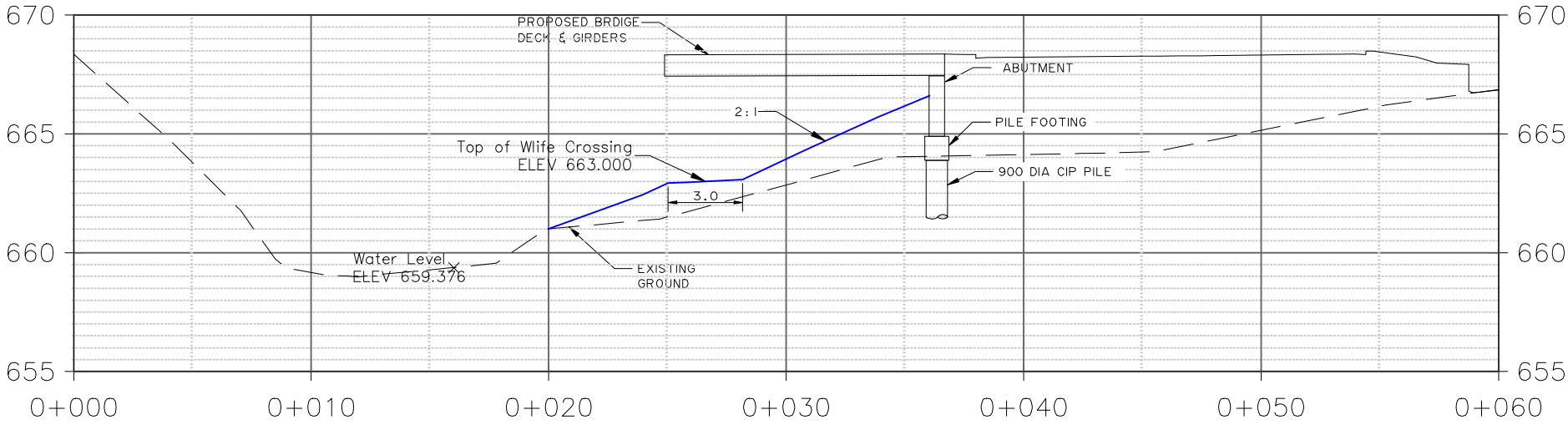

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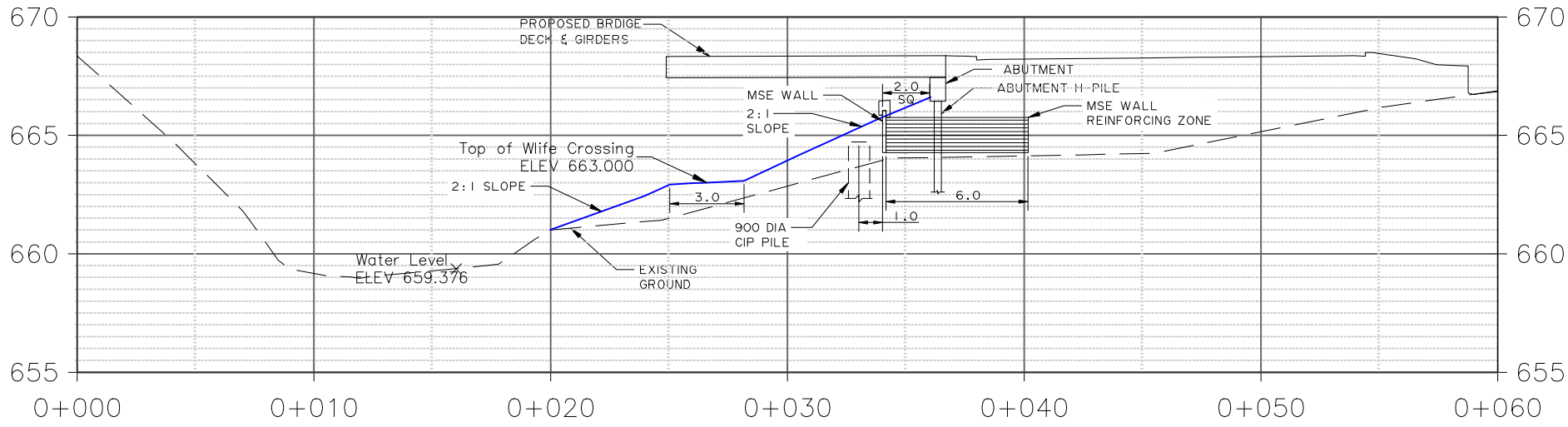

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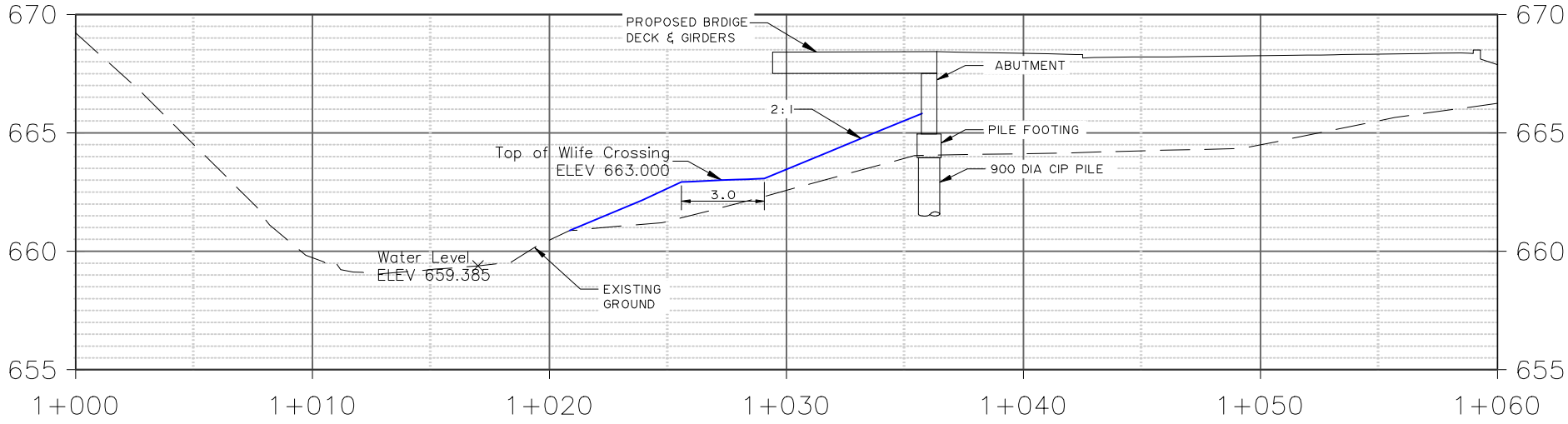

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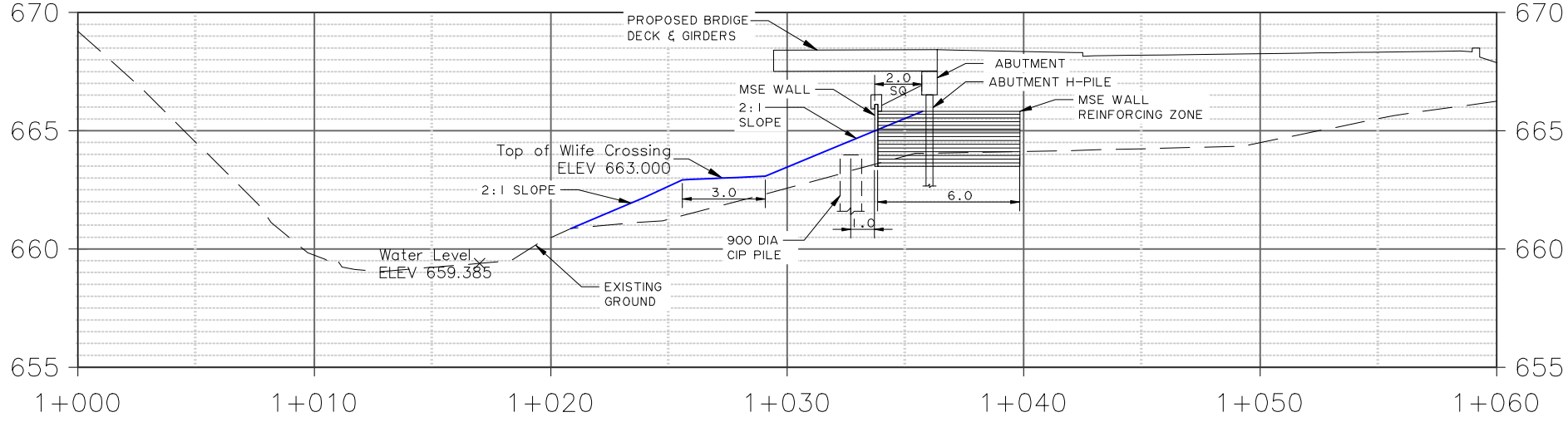

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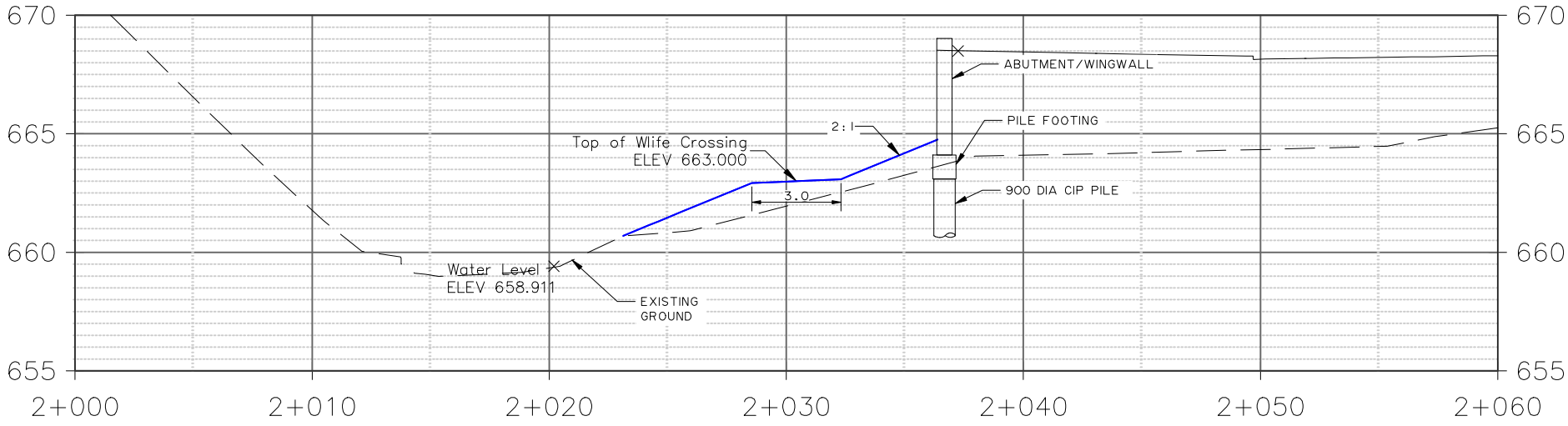

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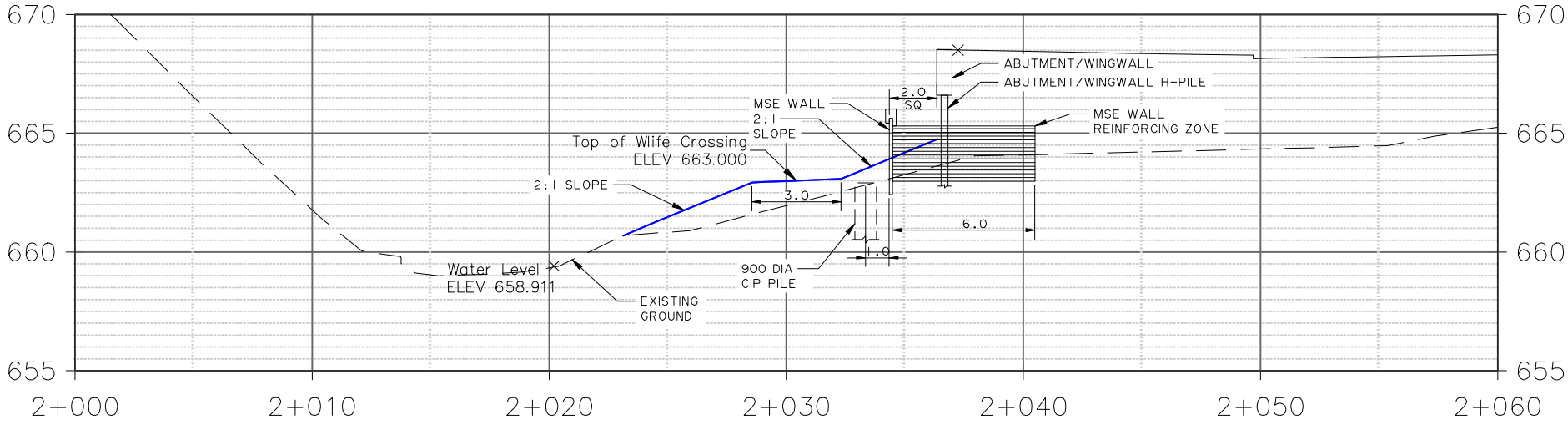

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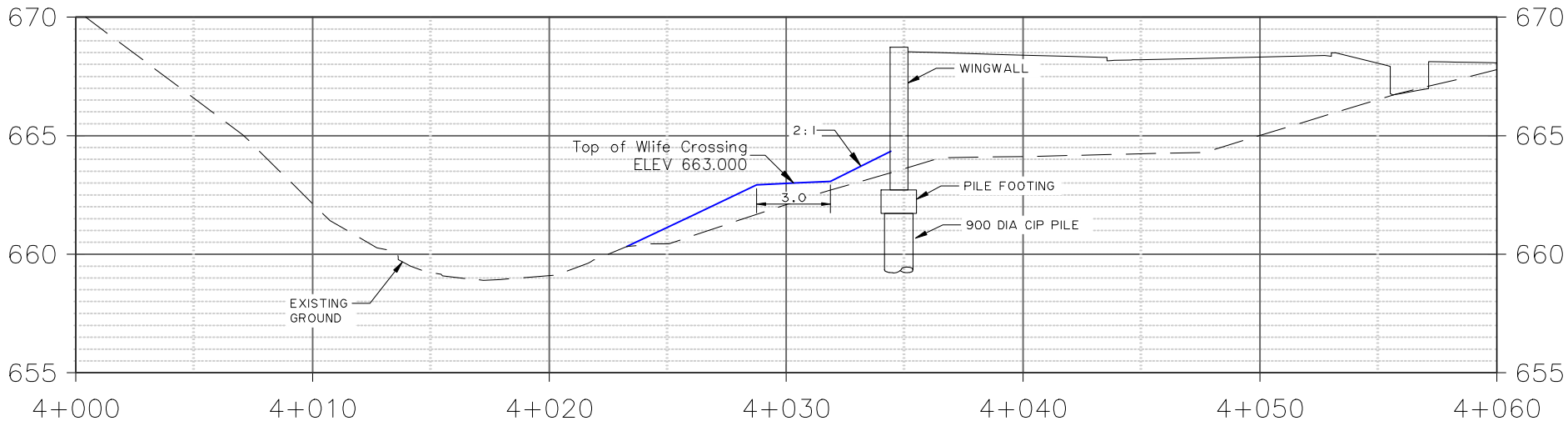

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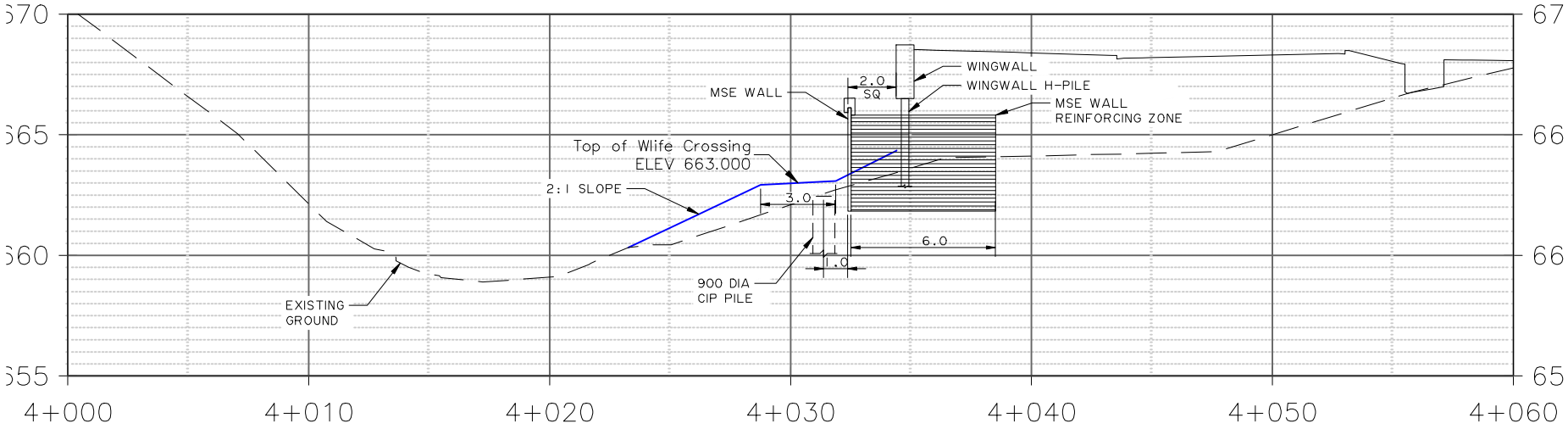

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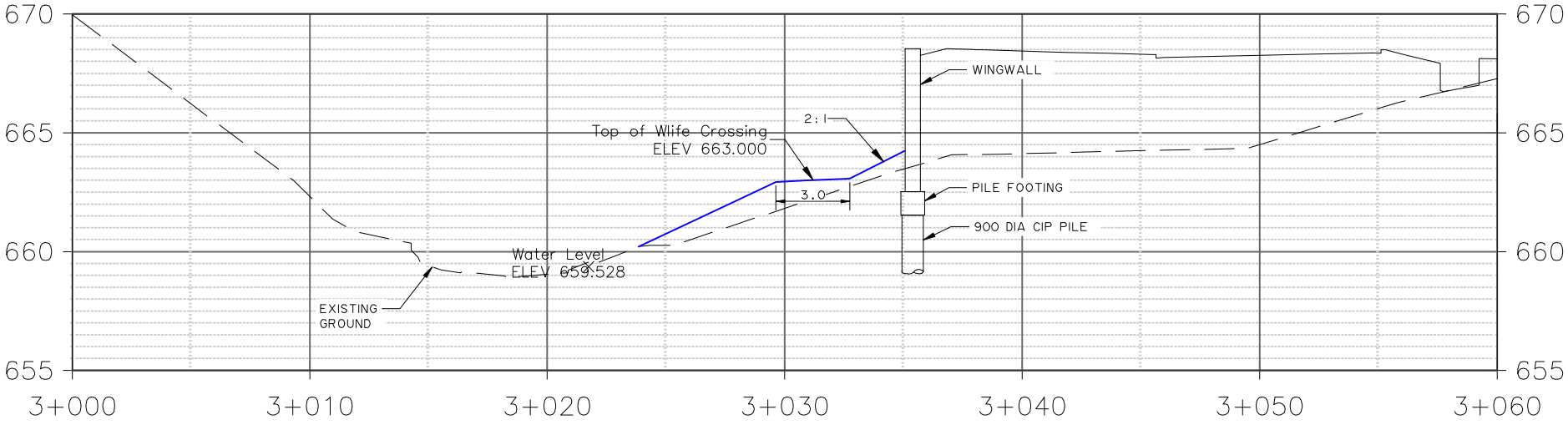

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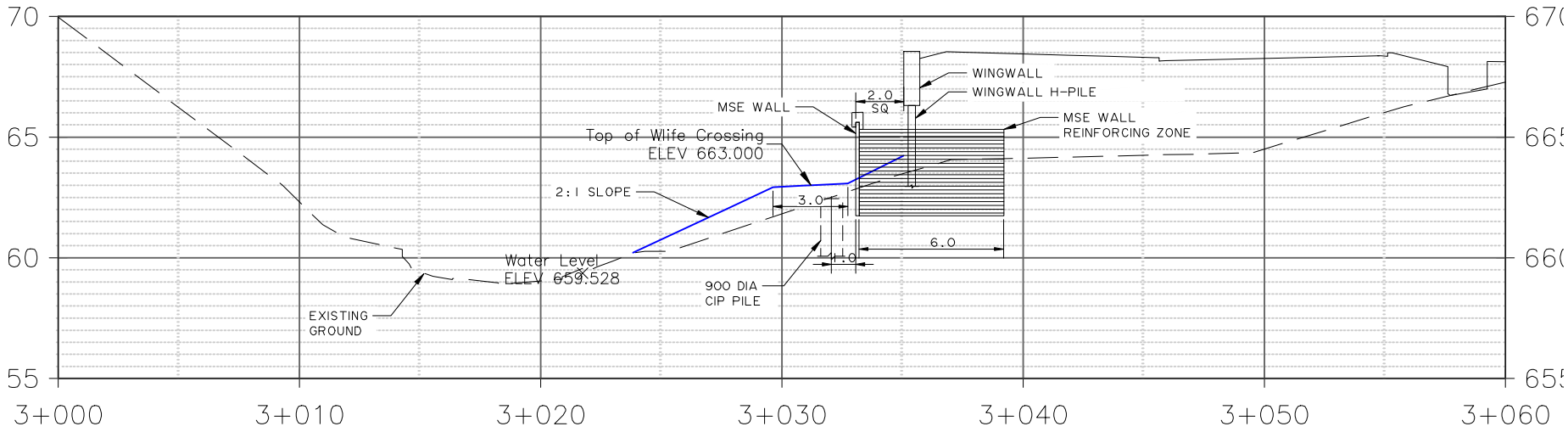

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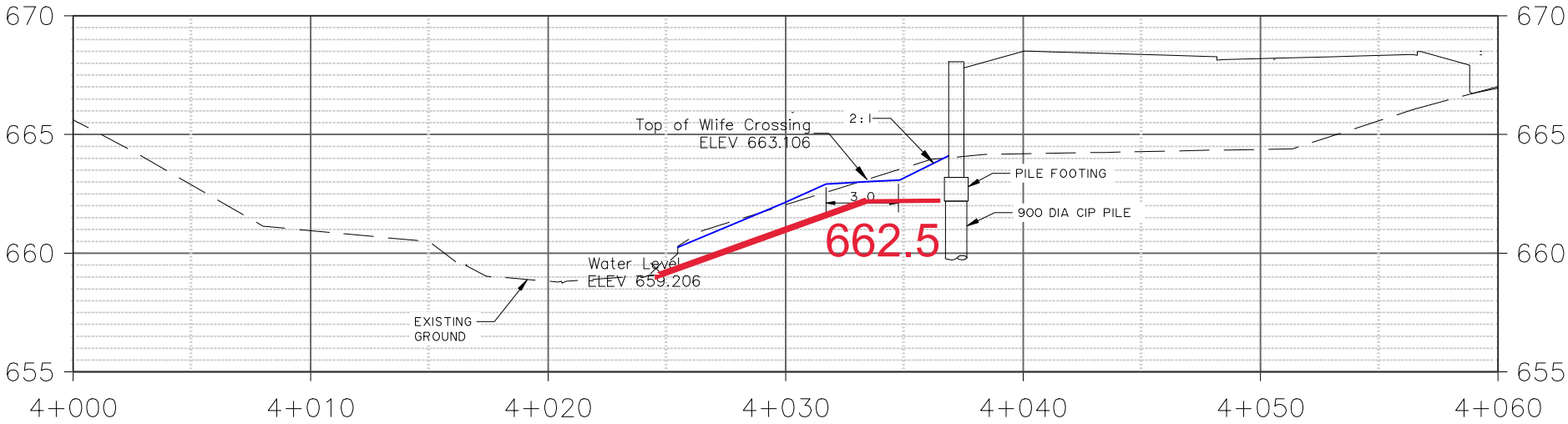

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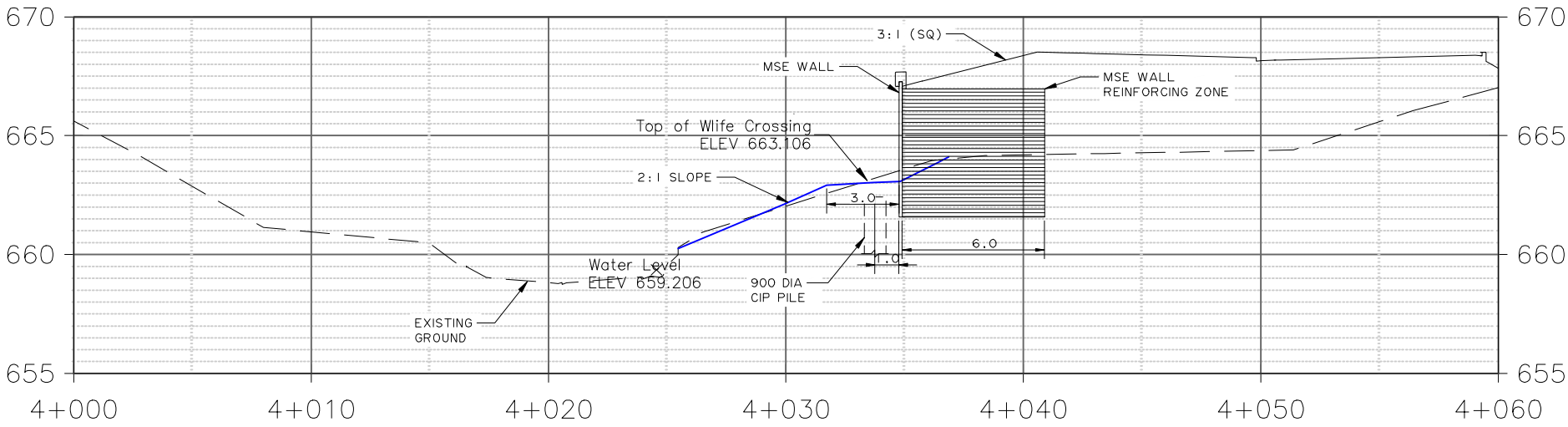

MSE WALL OPTION

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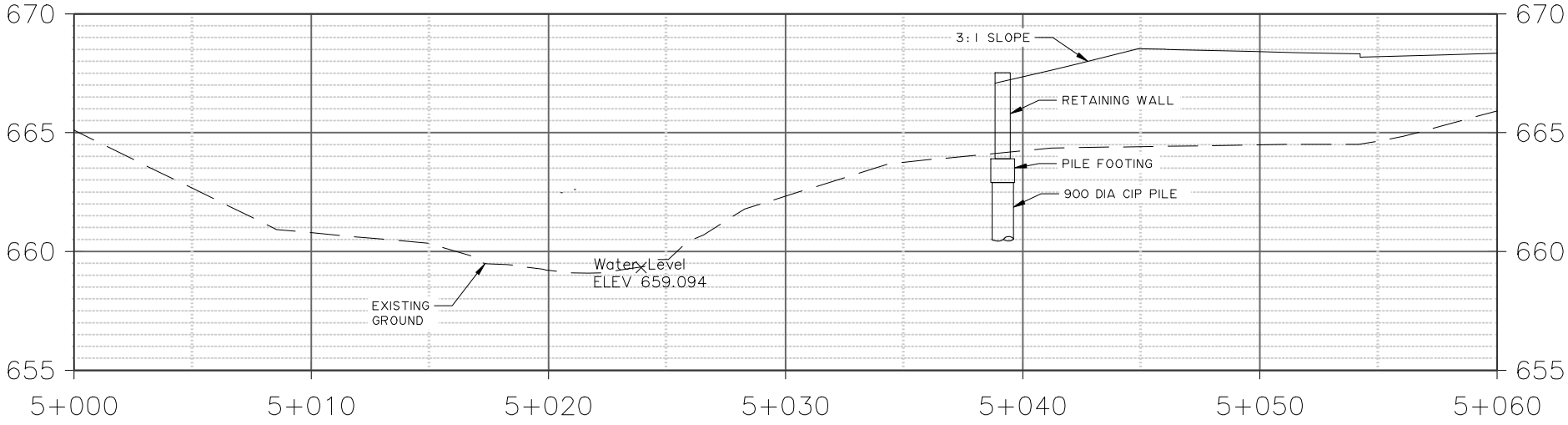
W3



RETAINING WALL OPTION

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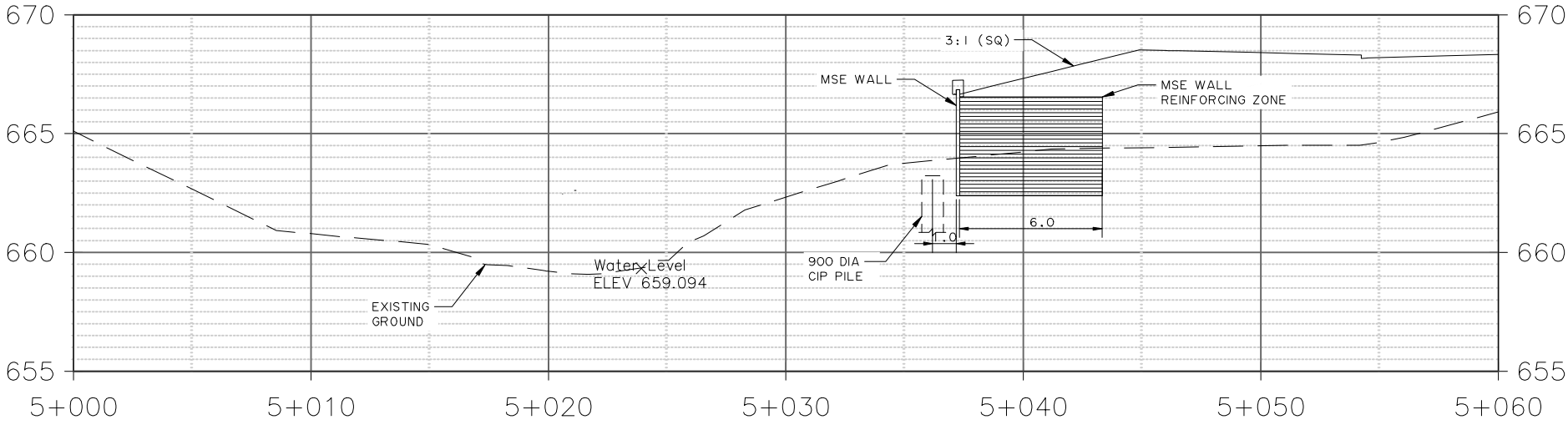
W3



MSE WALL OPTION

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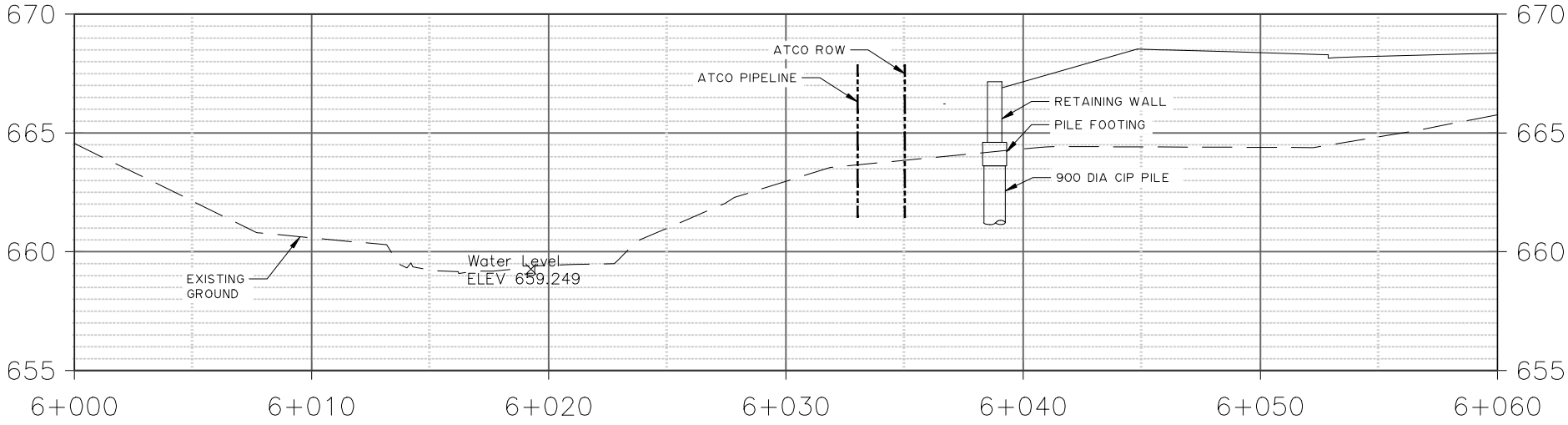
W4



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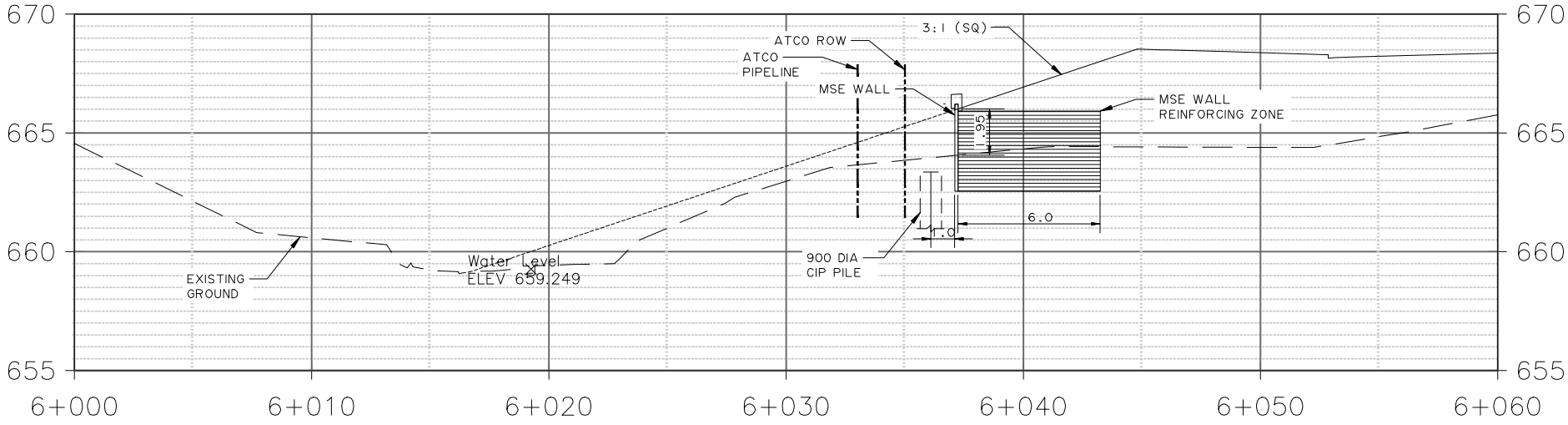
W4



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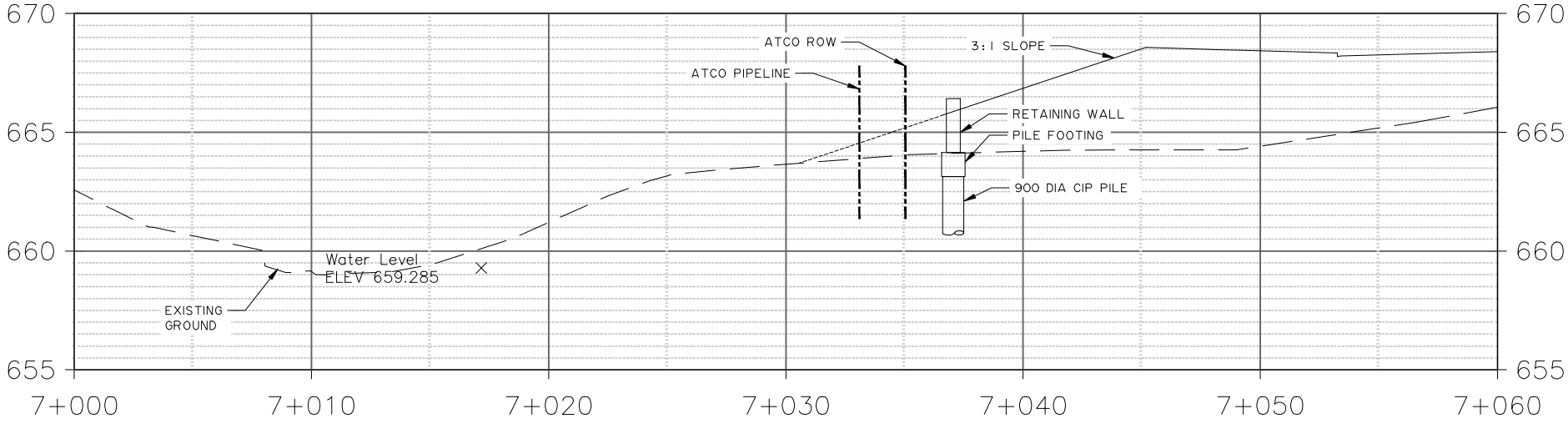
W5



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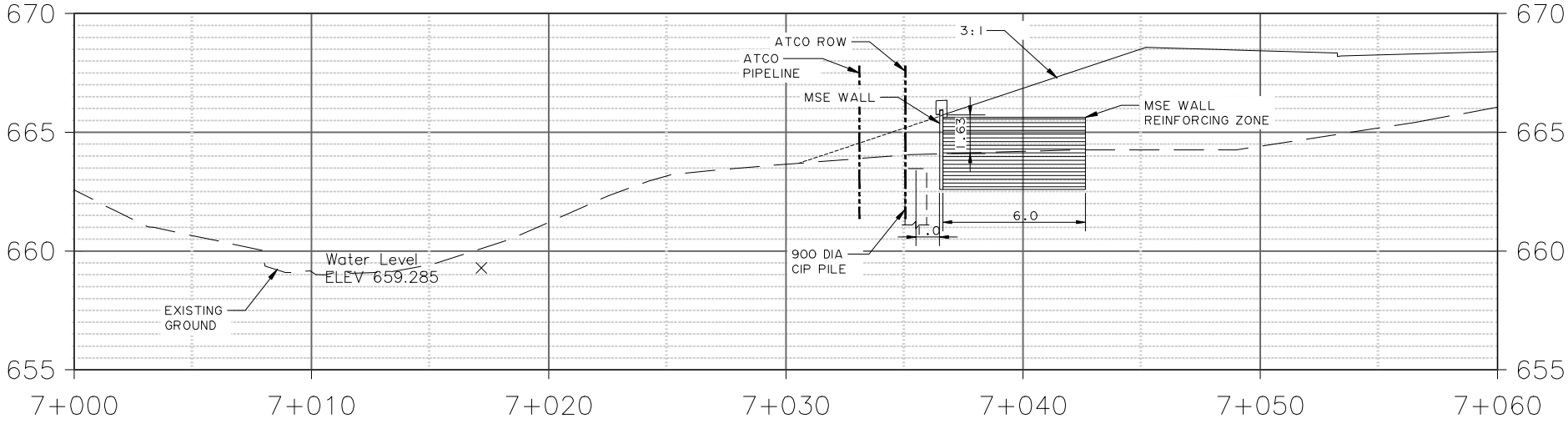
W5



MSE WALL OPTION

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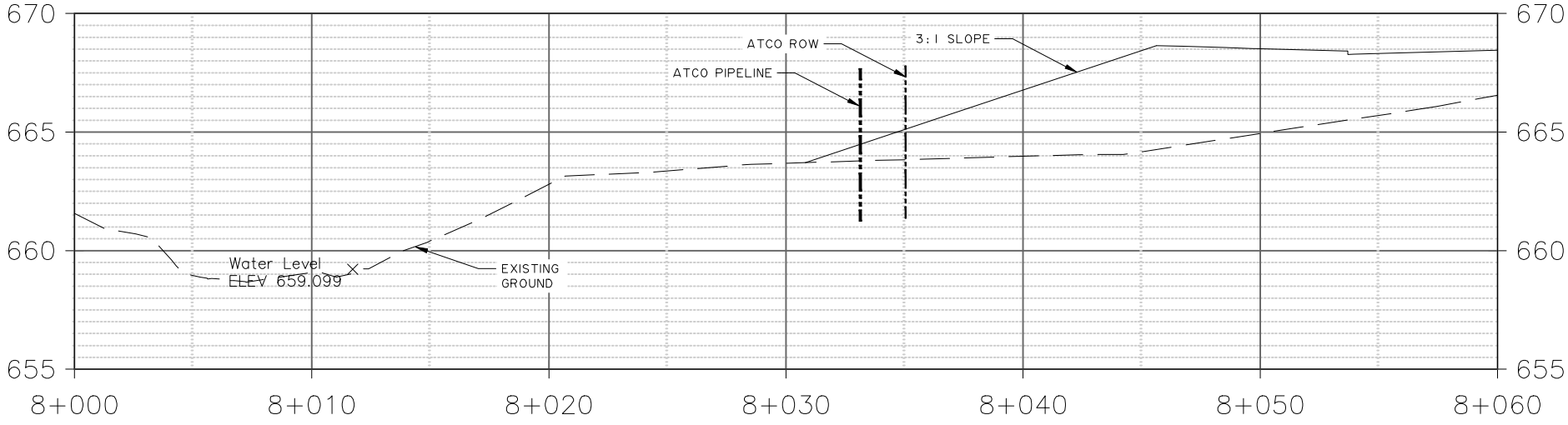
W6



RETAINING WALL OPTION

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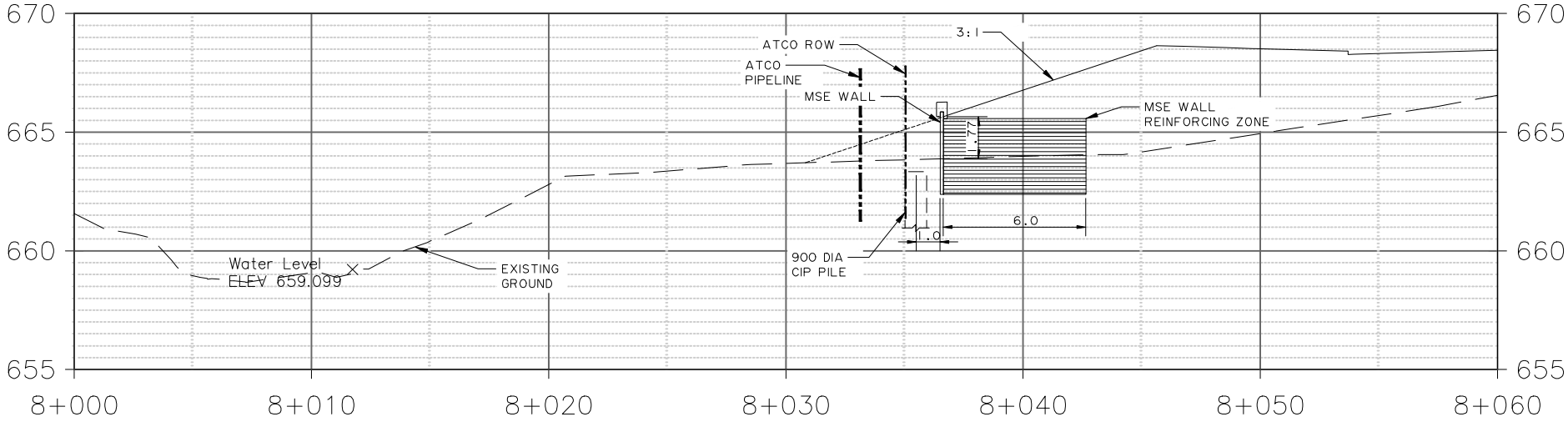
W6



MSE WALL OPTION

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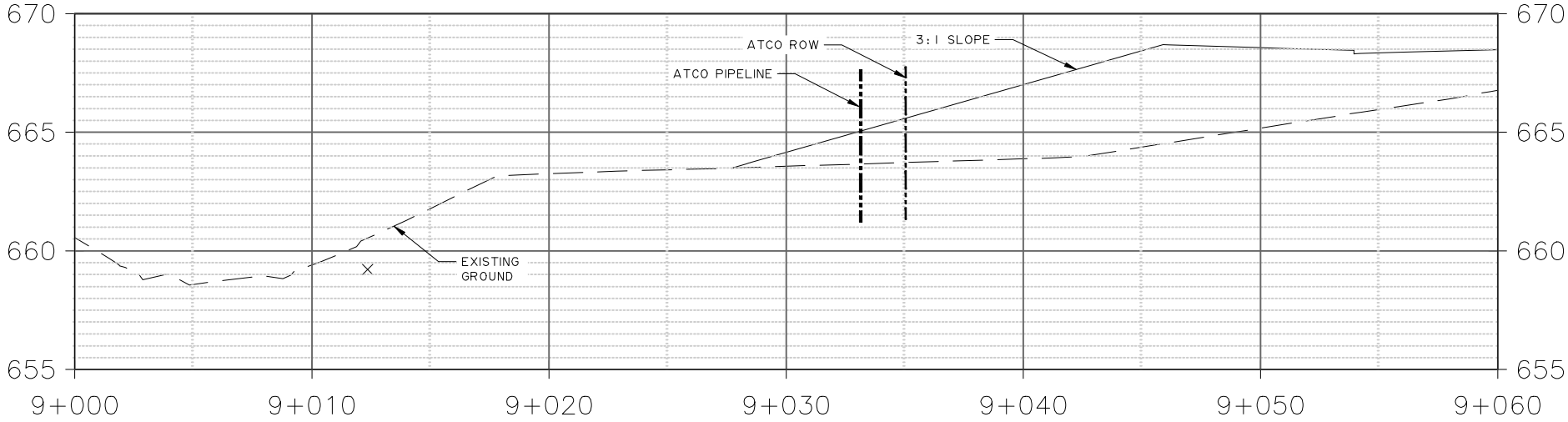
W7



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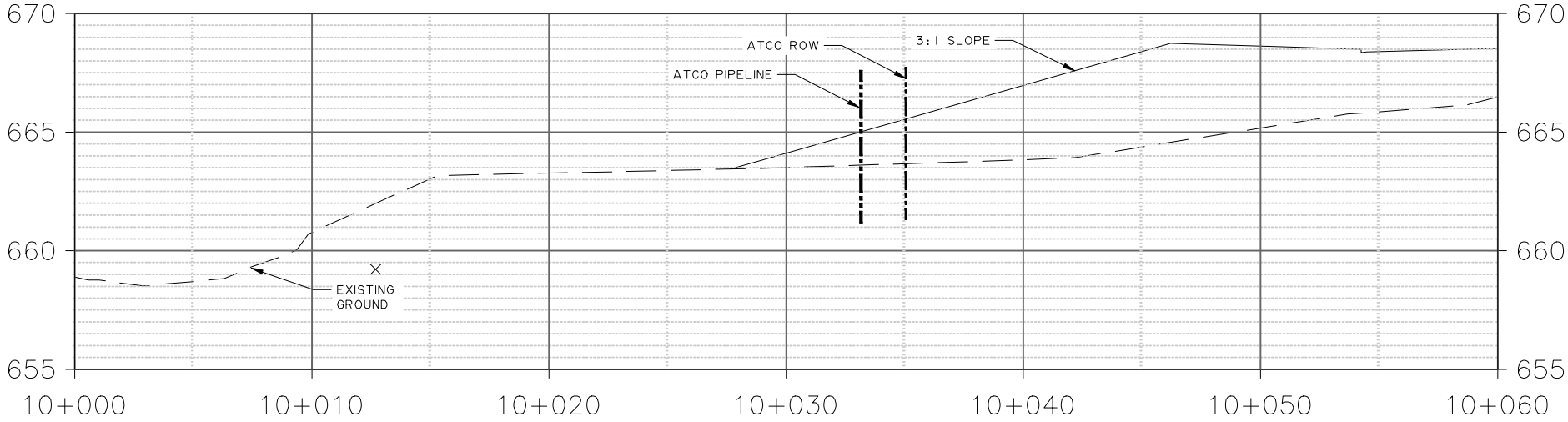
W8



SECTION
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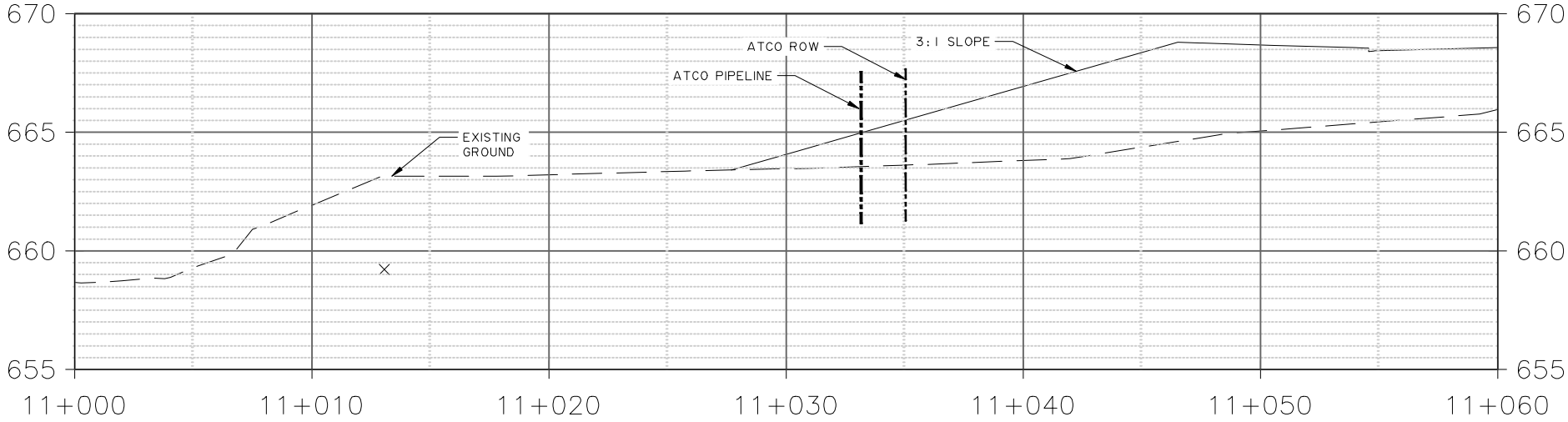

SECTION
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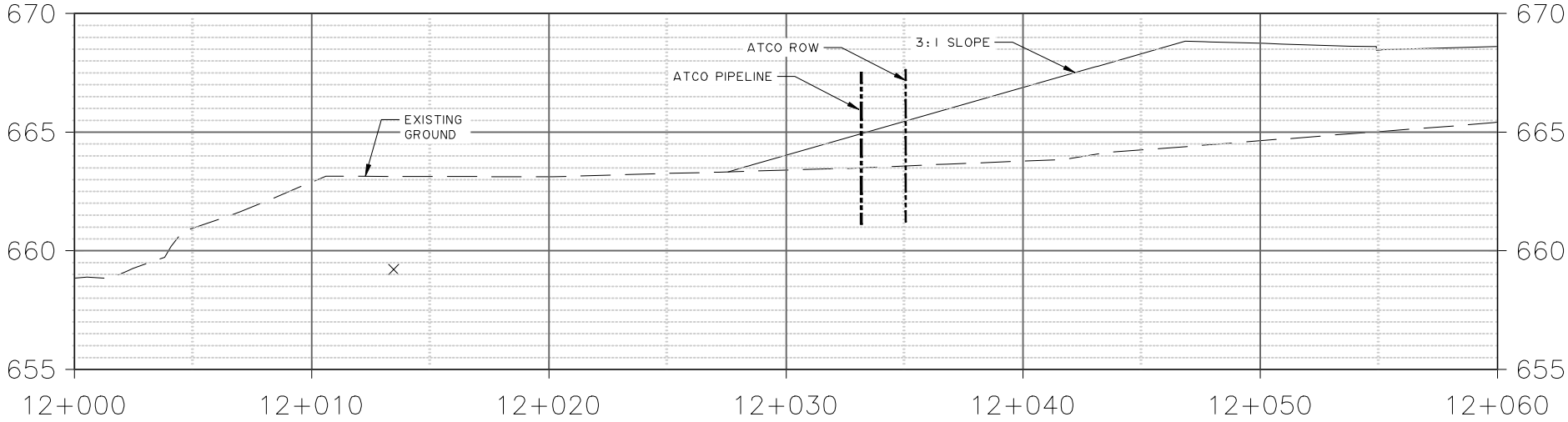

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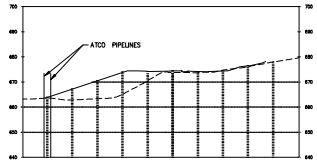

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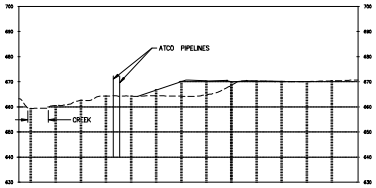

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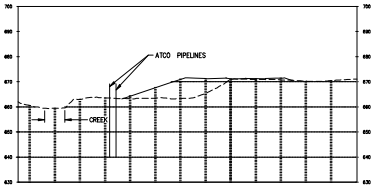

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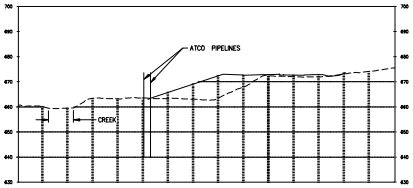

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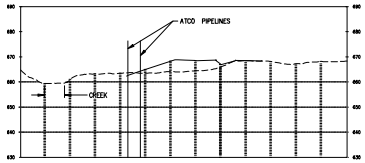

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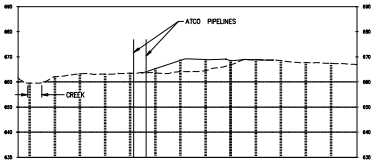

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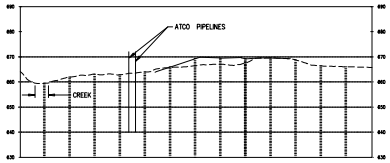


Appendix C Borehole Symbols & Terms and Borehole Records

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	mixture of soil and humus capable of supporting vegetative growth
Peat	mixture of visible and invisible fragments of decayed organic matter
Till	unstratified glacial deposit which may range from clay to boulders
Fill	material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure

Desiccated	having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	having cracks, and hence a blocky structure
Varved	composed of regular alternating layers of silt and clay
Stratified	composed of alternating successions of different soil types, e.g. silt and sand
Layer	> 75 mm in thickness
Seam	2 mm to 75 mm in thickness
Parting	< 2 mm in thickness

Terminology describing soil types

The classification of soil types are made on the basis of grain size and plasticity is in accordance with the Prairie Farm Rehabilitation Association (PFRA) Modified version of the Unified Soil Classification System (USCS) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. See page 4 for definitions and other details.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris)

Terminology describing materials outside of the PFRA Modified version of the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils

The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on Page 2. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

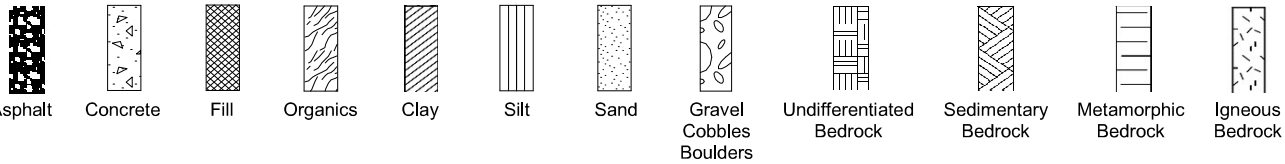
Terminology describing consistency of cohesive soils

The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kg/cm^2 or kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.



SAMPLE TYPE

AS, BS, GS	Auger sample; bulk sample; grab sample
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
SO	Sonic tube
SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby Tube or thin wall tube
SV	Shear vane
RC *HQ, NQ, BQ, etc.*	Rock Core; samples obtained with the use of standard size diamond coring bits.

WATER LEVEL

Measured: in standpipe, piezometer, or well

Inferred: seepage noted, or; measured during or at completion of drilling

RECOVERY FOR SOIL SAMPLES

The recovery is recorded as the length of the soil sample recovered in the direct push, split spoon sampler, Shelby Tube, or sonic tube.

N-VALUE

Numbers in this column are the field results of the Standard Penetration Test (SPT): the number of blows of a 140-pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) outside diameter (O.D.) split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50 for 75 mm or 50/75 mm). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60-degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Total Core Recovery (TCR) denotes the sum of all measurable rock core recovered in one drill run. The value is noted as a percentage of recovered rock core based on the total length of the drill run.

Solid Core Recovery (SCR) is defined as total length of solid core divided by the total drilled length, presented as a percentage. Solid core is defined as core with one full diameter.

Rock Quality Designation (RQD) is a modified core recovery that incorporates only pieces of solid core that are equal to or greater than 10 cm (4") along the core axis. It is calculated as the total cumulative length of solid core (> 10 cm) as measured along the centerline of the core divided by the total length of borehole drilled for each drill run or geotechnical interval, presented as a percentage. RQD is determined in accordance with ASTM D6032.

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock quality

Rock Mass Quality	Rock Quality Designation Number (RQD)	Alternate (Colloquial) Rock Mass Quality	
Very Poor Quality	0-25	*Very Severely Fractured*	*Crushed*
Poor Quality	25-50	*Severely Fractured*	*Shattered or Very Blocky*
Fair Quality	50-75	*Fractured*	*Blocky*
Good Quality	75-90	*Moderately Jointed*	*Sound*
Excellent Quality	90-100	*Intact*	*Very Sound*

Terminology describing rock strength

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

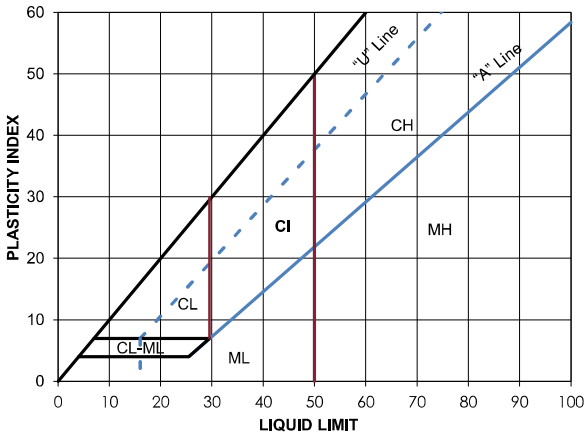
Terminology describing rock with respect to discontinuity and bedding spacing

Spacing (mm)	Discontinuities Spacing	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

Major division			Group symbol	Typical description	Laboratory classification criteria	
Coarse grained soils	Gravels (more than half coarse grains larger than 4.75 mm)	Clean gravels (little or no fines)	GW	Well-graded gravels, little or no fines	$C_u = \frac{D_{60}}{D_{10}} > 4;\ C_c = \frac{(D_{30})^2}{D_{10}\ x\ D_{60}} = 1\ to\ 3$	
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	Not meeting above requirements	
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures	Content of fines exceeds 12%	Atterberg limits below 'A' line or PI less than 4
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above 'A' line or PI more than 7
	Sands (more than half coarse grains smaller than 4.75 mm)	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}} > 6;\ C_c = \frac{(D_{30})^2}{D_{10}\ x\ D_{60}} = 1\ to\ 3$	
			SP	Poorly graded sands, little or no fines	Not meeting above requirements	
		Sands with fines	SM	Silty sands, sand-silt mixtures	Content of fines exceeds 12%	Atterberg limits below 'A' line or PI less than 4
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above 'A' line or PI more than 7
Fine grained soils	Silts (below 'A' line negligible organic content)	$W_L < 50$	ML	Inorganic silts and very fine sands, rock flour, silty sands of slight plasticity	Classification is based upon plasticity chart (see below)	
		$W_L > 50$	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils		
	Clays (above 'A' line negligible organic content)	$W_L < 30$	CL	Inorganic clays of low plasticity gravelly, sandy, or silty clays, lean clays		
		$30 < W_L < 50$	CI	Inorganic clays of medium plasticity, silty clays		
		$W_L > 50$	CH	Inorganic clays of high plasticity, fat clays	**Note:** Whenever the nature of the fine content has not been determined, it is designated by the letter 'F'	
	Organic silts & clays (below 'A' line)	$W_L < 50$	OL	Organic silts and organic silty clays of low plasticity	Example: SF is a mixture of sand with silt or clay	
		$W_L > 50$	OH	Organic clays of high plasticity		
Highly organic soils			Pt	Peat and other highly organic soils	Strong colour or odor, and often fibrous texture	

Note: Boundary classification possessing characteristics of two groups are given group symbols, e.g. GW-GC is a well graded gravel mixture with clay binder between 5% and 12%.



Note: plasticity chart is for soils passing 425 µm sieve

Soil components by particle size distribution

Fraction		Sieve size (mm)		Defining ranges of percentage by weight of minor components	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	75	19	50 – 35	And
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	35 - 20	____y/ey
	Medium	2	0.425		
	Fine	0.425	0.075	20 - 10	Some
Silt (non-plastic) Or Clay (plastic)		0.075		10 – 1	Trace
Oversize materials					
Rounded or sub-rounded cobbles 75 mm to 200 mm Boulders > 200 mm		Angular rock fragments Rocks > 0.75 m^3 in volume			

Note: All sieve sizes are referenced to U.S. standard ASTM E.11 – Alternate equivalent metric sieve sizes in accordance with CGSB Spec. 8-GP-2M to apply when prescribed

BOREHOLE RECORD

BH22-01

Stantec

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 14, 2022 to February 16, 2022**

BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
WATER LEVEL: **11.0 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	672.5							
	672.2	CLAY FILL - dark brown, silty, trace sand, trace organics, trace oxides, medium plastic, moist		BS	1			
		CLAY TILL (CI) - stiff, brown, silty, sandy, trace coal, trace organics, trace oxides, medium plastic, moist						
1				SS	2	400		SPT N-value not recorded since it was completed in frozen ground.
		- frozen to 1.5 m		BS	3			Sieve/Hydro at 1.6 m G 0% S 33% M 40% C 27%
2		- frequent coal fragments from 2.2 m to 2.3 m		ST	4	450		
3				SS	5	400	10	
	669.1	CLAY SHALE - extremely weak, grey, slightly weathered, silty, frequent oxides, high plastic, moist		BS	6			
4		- fresh and platy structure below 3.8 m		SS	7	450	56	
		- excellent below 4.2 m		RC	8	100	100	Switch to bedrock coring at 4.2 m. Prior to switching: - borehole dry - borehole open
5				SS	8A	400		
6								UCS at 5.6 m: Qu = 293 kPa Atterberg Limit at 5.6 m: PL=29%, LL=94%

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

16/36/50 for 140 mm >>

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 672, 671, 670, 669, 668, 667

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m

Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:20 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-01

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WATER LEVEL: **11.0 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa): LABORATORY TEST ▲ FIELD VANE TEST ◆ POCKET PEN. ★ POCKET SHEAR VANE ◘ (50 kPa, 100 kPa, 150 kPa, 200 kPa)
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count (10, 20, 30, 40, 50, 60, 70, 80)

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
6		CLAY SHALE continued - multiple fractures at 6.5 m - 50 degree, undulating, and rough joint at 6.5 m - grey and brown below 6.6 m - siltstone fragments at 6.9 m		RC	9	100	94			666
				SS	9A	400			19/21/50 for 130 mm >>	
7	665.4	SANDSTONE - excellent, grey, fresh, extremely weak, fine, occasional interbedded clay shale, trace coal, moist - 80 degree, curved, and smooth joint at 7.4 m		RC	10	91	91	UCS at 7.2 m: Qu = 998 kPa		665
8	664.5	CLAY SHALE - fair, grey, fresh, extremely weak, silty, trace coal inclusions, blocky structure, high plastic, bentonitic, moist - 100 mm thick siltstone layer at 8.4 m - frequent fractures from 8.5 m to 8.6 m		SS	10A	230			39/50 for 80 mm >>	664
	663.8	SANDSTONE - excellent, grey, fresh, extremely weak, fine, occasional interbedded clay shale, occasional siltstone fragments, trace coal inclusions, moist		RC	11	93	80	UCS at 9.2 m: Qu = 259 kPa		
9		- 70 mm thick calcareous zone at 9.5 m - 100 mm thick siltstone layer at 9.8 m - frequent coal fragments at 9.9 m								663
10		- calcareous from 10.1 m to 10.5 m		RC	12	94	94			
	662.0	CLAY SHALE - excellent, brown and grey, fresh, extremely weak, silty, trace coal inclusions, blocky structure, high plastic, moist						UCS at 10.9 m: Qu = 319 kPa Atterberg Limit at 10.9 m: PL=22%, LL=111%		662
11		- 50 mm siltstone clast at 11.1 m - brown from 11.1 m to 11.9 m								
		- carbonaceous from 11.5 m to 11.8 m						UCS at 11.6 m: Qu = 398 kPa		661
12		- greenish grey from 11.8 m to 12.5 m		RC	13	100	100			

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m
Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-01

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 14, 2022 to February 16, 2022**

BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
WATER LEVEL: **11.0 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
12		CLAY SHALE continued								
		- 90 degree, planar, and rough joint at 12.4 m								660
13		- carbonaceous from 13.0 m to 13.4 m - brown below 13.0 m - extremely weak to very weak below 13.1 m		RC	14	100	97	UCS at 13.1 m: Qu = 1721 kPa Atterberg Limit at 13.1 m: PL=27%, LL=91%		
		- bentonitic sandstone and trace siltstone clasts from 13.5 m to 13.8 m						UCS at 13.5 m: Qu = 873 kPa		659
14		- carbonaceous from 13.8 m to 13.9 m - 60 degree, stepped, and rough joint at 13.8 m - 30 mm thick fractured zone below 13.8 m - 60 degree, undulating, and rough joint at 13.9 m - fair below 14.2 m								658
		- frequent coal fragments at 14.7 m		RC	15	100	67			
15		- fractured zone from 15.2 m to 15.7 m - 70 degree, undulating, and rough joint at 15.2 m - 50 degree, irregular, and smooth joint at 15.4 m								657
		- excellent below 15.7 m								
16		- 80 degree, undulating, and smooth joint at 15.9 m								
		- greenish grey at 16.3 m - 70 degree, undulating, and smooth joint at 16.4 m		RC	16	100	94			656
		- 60 degree, curved, and smooth joint at 16.6 m						UCS at 16.6 m: Qu = 1644 kPa		
17		- 60 degree, curved, and smooth joint at 16.9 m								
		- siltstone clasts at 17.3 m - 50 degree, irregular, and rough joint at 17.4 m								655
		- brown below 17.7 m								
18	654.5									

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m
Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-01

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 14, 2022 to February 16, 2022**

BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
WATER LEVEL: **11.0 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
18		SANDSTONE - excellent, grey, fresh, very weak, fine, bentonitic, silty, occasional to frequent interbedded clay shale up to 30 mm thick, trace coal inclusions, moist		RC	17	94	94			654
19				RC	18	100	100	UCS at 19.3 m: Qu = 1789 kPa		653
		- calcareous from 19.7 m to 20.0 m								
20										
		- medium, occasional siltstone fragments, and calcareous below 20.3 m								652
	651.9	CLAY SHALE - excellent, grey, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist - interbedded sandstone from 20.6 m to 21.0 m - 70 degree, undulating, and smooth joint at 20.8 m - 30 mm thick siltstone seam at 21.1 m - brown below 21.1 m		RC	19	100	100			651
21										
22		- 45 degree, undulating, and smooth joint at 22.0 m		RC	20	100	100			650
23		- trace coal fragments at 23.1 m								
		- good below 23.3 m - occasional interbedded sandstone from 23.3 m to 23.5 m - fractured zone from 23.5 m to 24.3 m								649
24										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m

Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-01

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 14, 2022 to February 16, 2022**

BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**
WATER LEVEL: **11.0 m on May 17, 2022**

UNDRAINED SHEAR STRENGTH, Cu (kPa): LABORATORY TEST ▲ FIELD VANE TEST ◆ POCKET PEN. ★ POCKET SHEAR VANE ◘ — 50 kPa, 100 kPa, 150 kPa, 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count: 10, 20, 30, 40, 50, 60, 70, 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
24		CLAY SHALE continued - excellent below 24.3 m - 60 degree, undulating, and smooth joint at 24.8 m - occasional interbedded sandstone from 24.8 m to 25.2 m and below 25.7 m		RC	21	100	83			648
25				RC	22	100	100			647
26		- 60 degree, undulating, and rough joint at 26.1 m - 70 mm thick carbonaceous seam and coal fragments at 26.2 m - 50 mm thick bentonitic seam at 26.3 m - fair below 26.4 m - fractured and slickensided from 26.5 m to 26.7 m								646
27		- fractured from 27.1 m to 27.4 m - 4 mm thick coal seam at 27.6 m		RC	23	100	63			645
28		- 200 mm thick sandstone layer at 27.9 m - brown from 28.1 m to 28.4 m - 60 degree, undulating, and rough joint at 28.7 m		RC	24	100	97	UCS at 28.1 m: Qu = 1021 kPa		644
	643.7	SANDSTONE - excellent, grey, fresh, extremely weak to very weak, fine, occasional interbedded clay shale, moist								
29		- frequent interbedded clay shale below 29.4 m		RC	25	100	100			643
30										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m
Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:21 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

Stantec

BOREHOLE RECORD

BH22-01

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 14, 2022 to February 16, 2022**

BH COORDINATES [UTM 12U] 5922636.0N 329413.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **672.5m**
DATUM: **Geodetic**
WATER LEVEL: **11.0 m on May 17, 2022**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
30		SANDSTONE continued - 280 mm thick clay shale layer at 30.2 m								
	642.0	Borehole end at 30.5 m Upon completion: - vibrating wire piezometer (S/N 1700248) installed at 13.8 m - 1" PVC standpipe piezometer installed with slotted section from 1.8 m to 3.6 m (in same borehole) - backfilled with sand, bentonite, and cuttings Water level on March 7, 2022: 3.6 m (standpipe piezometer) 10.3 m (vibrating wire piezometer) Water level on May 17, 2022: 3.7 m (standpipe piezometer) 11.0 m (vibrating wire piezometer)								642
31										641
32										640
33										639
34										638
35										637
36										

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.5 m
Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-02

Stantec

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**
WATER LEVEL: **3.1 m on May 17, 2022**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	663.6							
	663.5	ROOTMAT: 100 mm						
		CLAY (CI) - stiff, brown, silty, sandy, trace oxides, trace organics, medium plastic, moist		BS	1			
		- frozen to 0.7 m		SS	2	400	9	
	662.1							
		SAND (SM) - brown, fine, poorly graded, silty, some clay, moist		ST	3	600		Atterberg Limit on ST3: Non-plastic Sieve/Hydro at 1.5 m G S M C 0% 50% 30% 20%
2	661.5							
		CLAY (CI) - soft to firm, brown, silty, sandy, trace oxides, trace organics, medium plastic, moist - 80 mm thick sand layer at 2.3 m		SS	4	400	4	
	660.8							
3		CLAY TILL (CI) - stiff, brown, silty, sandy, some gravel, trace coal, trace oxides, medium plastic, moist		SS	5	350	13	
	660.2							
		SANDSTONE - extremely weak, slightly weathered, grey, fine, bentonitic, trace coal, moist - seepage inferred at 4.0 m		BS	6			
4	659.6							
		CLAY SHALE - extremely weak, fresh, grey, silty, trace coal inclusions, blocky structure, high plastic, moist		SS	7	400	35	
		- good and brown below 4.4 m		RC	8	0	0	Switch to bedrock coring at 4.4 m. Prior to switching: - borehole dry - borehole open No core recovery from 4.4 m to 4.8 m due to plugged drill bit. Good quality inferred from 4.4 m to 4.8 m.
5		- multiple 90 degree, planar, and rough joints from 4.9 m to 5.1 m		RC	9	86	86	
		- 45 degree, rough, and planar joint at 5.3 m and 5.4 m - frequent coal fragments at 5.4 m and 5.5 m - excellent below 5.5 m - extremely weak to very weak below 5.9 m		RC	10	100	100	
6								

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 663, 662, 661, 660, 659, 658

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m
Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:26 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-02

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
WATER LEVEL: **3.1 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	ELEVATION (m)
6		CLAY SHALE continued							
		- 45 degree, smooth, and planar joint at 6.4 m - good below 6.4 m						Plugged drill bit caused core sample to be partially washed away resulting in reduced diameter core sample from 6.4 m to 6.8 m.	657
		- siltstone fragments from 6.8 m to 7.1 m							
7				RC	11	92	89		
		- very weak below 7.3 m						UCS at 7.3 m: Qu = 1143 kPa	656
8		- excellent below 7.9 m							
		- 20 mm fractured zone at 8.6 m - 170 mm sandstone layer at 8.6 m		RC	12	100	99		655
9	654.1								
		SANDSTONE - excellent, grey, fresh, very weak, fine, occasional interbedded clay shale, occasional coal inclusions, moist - 30 mm thick clay shale seam at 9.6 m - siltstone fragments at 9.7 m and 10.7 m - frequent interbedded clay shale from 10.1 m to 10.3 m							654
10				RC	13	100	100		
		- 90 degree, smooth, and planar joint at 10.7 m							653
11		- fine to medium below 11.0 m							
								UCS at 11.5 m: Qu = 1119 kPa	652
12				RC	14	100	100		

BACKFILL/ MONITOR WELL/ PIEZOMETER

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m

Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-02

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
WATER LEVEL: **3.1 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
12		SANDSTONE continued								
		- multiple fractured zones up to 40 mm thick and containing siltstone fragments from 12.8 m to 13.1 m								651
	650.7	CLAY SHALE - poor, brown, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist - excellent below 13.2 m		RC	15	100	94			
13		- grey below 13.6 m						UCS at 13.6 m: Qu 1483 kPa		650
14		- occasional interbedded sandstone below 14.0 m - 45 degree, curved, and smooth joint at 14.1 m - 40 degree closed joint at 14.3 m								649
		- carbonaceous from 14.5 m to 14.7 m		RC	16	100	100			
15		- 45 degree, curved, and smooth joint at 15.1 m - 190 mm thick sandstone layer at 15.1 m - silstone fragments at 15.3 m								648
16		- 90 degree, planar, and rough joint and silstone fragments at 15.9 m - carbonaceous from 16.0 m to 16.5 m - 100 mm thick sandstone layer at 16.5 m		RC	17	91	91			
		- 70 degree, planar, and rough joint at 16.5 m - thin siltstone interbedds below 16.6 m								647
17		- multiple joints, fractured/rubbled zones, and fair from 17.1 m to 18.6 m								646
18				RC	18	100	60			

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m
Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-02

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
WATER LEVEL: **3.1 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
18		CLAY SHALE continued								
		- good below 18.6 m								645
19				RC	19	100	90			
		- fractured with infilled clay at 19.4 and 19.5 m - extremely weak below 19.5 m - grey and bentonitic from 19.5 m to 19.9 m								644
20		- excellent below 20.1 m - 90 degree, planar, and rough joint at 20.3 m								643
		- fractured at 20.7 m - carbonaceous from 20.8 m to 21.4 m - very weak below 20.9 m		RC	20	100	100			
21	642.2	SANDSTONE - excellent, grey, fresh, very weak, fine, bentonitic, occasional interbedded clay shale, moist						UCS at 21.6 m: Qu = 1668 kPa		642
22	641.5	CLAY SHALE - fair, brown, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist - carbonaceous below 22.2 m - multiple 20 to 30 degree, planar, and smooth joints from 22.1 m to 22.3 m		RC	21	100	23			
	641.0	COAL - very poor quality, highly fractured, blocky								641
23										640
	639.7	CLAY SHALE		RC	22	100	63			
24										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m

Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-02

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**
WATER LEVEL: **3.1 m on May 17, 2022**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
24		CLAY SHALE - excellent, brown, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist								639
25		- occasional interbedded sandstone below 25.5 m		RC	23	100	100			638
26	637.3	- 45 degree, planar, and smooth joint at 26.0 m								
		SANDSTONE - excellent, grey, fresh, very weak, fine, occasional interbedded clay shale, moist								637
27	635.9	- frequent interbedded clay shale from 26.7 m to 27.2 m		RC	24	100	100			636
28		CLAY SHALE - excellent, grey, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist - slightly carbonaceous from 28.0 m to 28.2 m and from 28.5 m to 28.8 m		RC	25	100	100			635
29		- grey from 28.8 m to 29.6 m - dark grey below 29.7 m								634
30										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m
Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-02

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 10, 2022 to February 14, 2022**

BH COORDINATES [UTM 12U] 5922634.0N 329481.0E
WATER LEVEL: **3.1 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **663.6m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
30		CLAY SHALE continued		RC	26	100	100			
		- 20 mm fractured zone with siltstone fragments at 30.6 m								633
	632.8	Borehole end at 30.8 m Upon completion: - vibrating wire piezometer (S/N 1700249) installed at 22.2 m - 2.75" slope inclinometer casing installed to 30.8 m: - A+ Direction: 308 degrees magnetic north - stickup: 80 cm - backfilled grout and sand Water level on March 7, 2022: 2.6 m Water level on May 17, 2022: 3.1 m								
31										632
32										
										631
33										
										630
34										
										629
35										
										628
36										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 30.8 m

Logged By: CU
Reviewed By: LC

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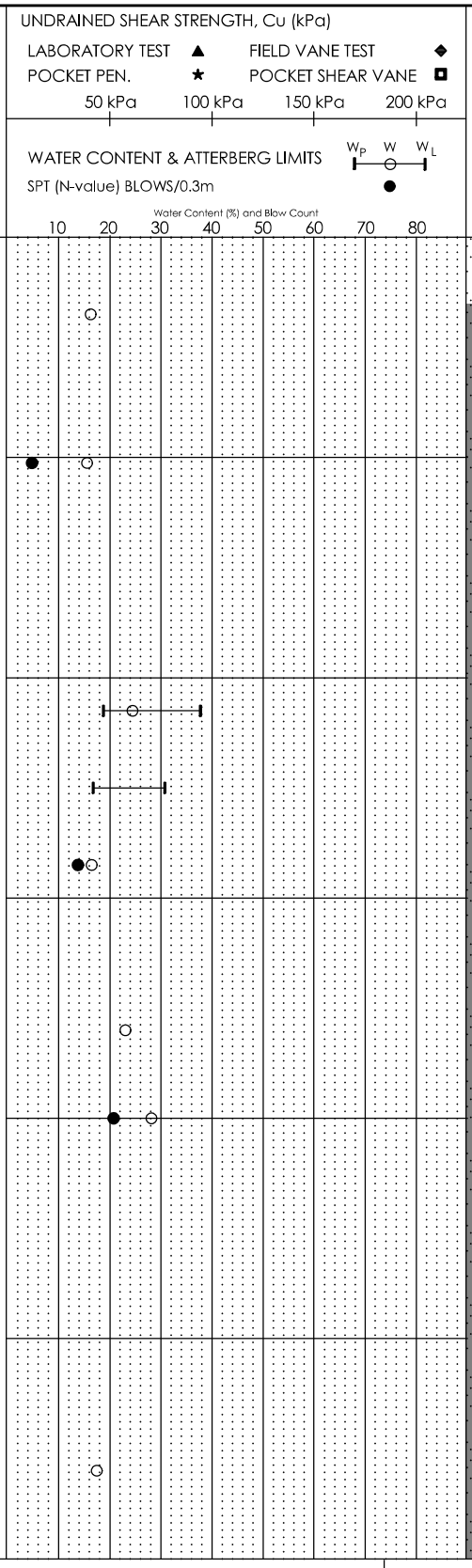
BOREHOLE RECORD

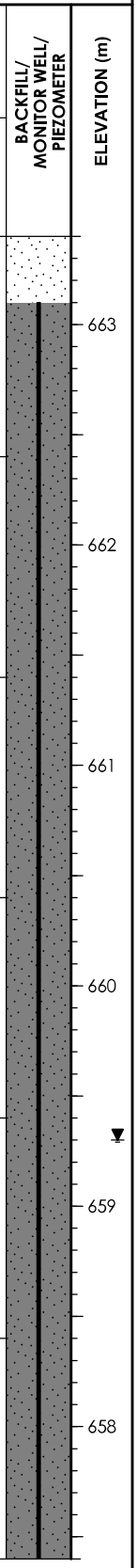
BH22-03

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 4, 2022 to February 6, 2022**

BH COORDINATES [UTM 12U] 5922638.0N 329487.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **663.4m**
DATUM: **Geodetic**
WATER LEVEL: **4.1 m on May 17, 2022**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	SAMPLE TYPE	SAMPLE NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	663.4						
	663.3	ROOTMAT: 100 mm					
		SAND (SC-CL) - loose, brown, silty, clayey, fine, trace organics, trace coal, moist	BS	1			
		- frozen to 0.6 m	SS	2	150	5	
		- trace to some clay from 1.8 m to 2.3 m	BS	3			
			ST	4	400		Sieve/Hydro at 2.3 m G 0% S 50% M 27% C 23%
	660.7						
		CLAY TILL (CI) - stiff, brown, silty, sandy, medium plastic, moist	SS	5	300	14	
	660.4						
		SANDSTONE - extremely weak, slightly weathered, grey, fine, bentonitic, interbedded clay shale, moist					
		- seepage inferred at 3.8 m	BS	6			
	659.6						
		CLAY SHALE - extremely weak, fresh, grey and brown, silty, platy structure, trace coal inclusions, high plastic, moist - 50 mm bentonitic seam at 3.9 m - good and blocky structure below 4.2 m	SS	7	400	21	
			RC	8	80	80	Switch to bedrock coring at 4.2 m. Prior to switching: - borehole dry - borehole open
		- frequent coal fragments from 4.8 m to 4.9 m - 30 degree, curved, and rough joint at 5.0 m - excellent and very weak below 5.2 m - 45 degree, curved, and rough joint at 5.5 m					
	657.9						
		BENTONITE - bluish grey, extremely weak, high plastic, moist - 85 degree, planar, and rough joint at 5.7 m	RC	9	100	100	
	657.6						
6							





▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 15.5 m

Logged By: CU
Reviewed By: LC

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BOREHOLE RECORD

BH22-03

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 4, 2022 to February 6, 2022**

BH COORDINATES [UTM 12U] 5922638.0N 329487.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **663.4m**
DATUM: **Geodetic**
WATER LEVEL: **4.1 m on May 17, 2022**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY (mm) or TCR %	SAMPLES N-VALUE or RQD %	OTHER TESTS / REMARKS
6		CLAY SHALE - excellent, very weak, fresh, grey and brown, silty, blocky structure, trace coal inclusions, high plastic, moist - 30 degree, curved, and rough joint at 5.9 m - occasional interbedded sandstone below 6.5 m		RC	10	100	100	
	656.7	SANDSTONE - excellent, grey, fresh, very weak, fine, bentonitic, occasional interbedded clay shale, moist						
7								Atterberg Limit at 7.1 m: PL=21%, LL=103%
	656.0	CLAY SHALE - excellent, brown, fresh, very weak, silty, occasional interbedded sandstone, trace coal inclusions, blocky structure, high plastic, moist - 40 mm fractured zone at 7.9 m - 50 degree, curved, and rough joint at 8.0 m		RC	11	100	100	
8								
	654.8	SANDSTONE - excellent, grey, fresh, very weak, medium to fine, bentonitic, occasional siltstone inclusions, moist - 250 mm thick clay shale layer at 9.0 m - 40 mm zone of bentonite laminations at 9.1 m - occasional interbedded clay shale from 9.2 m to 11.3 m - 70 degree, undulating, and smooth joint at 5.5 m		RC	12	100	100	
9								
10								
		- 30 mm thick weak and cemented/calcareous seams at 10.5 m and 10.6 m		RC	13	100	100	
11								
		- weak and cemented/calcareous from 11.3 m to 11.5 m						
12								

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 657, 656, 655, 654, 653, 652

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 15.5 m
Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:32 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-03

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 4, 2022 to February 6, 2022**

BH COORDINATES [UTM 12U] 5922638.0N 329487.0E
PROJECT NO. : **1161110185**
BH ELEVATION: **663.4m**
DATUM: **Geodetic**
WATER LEVEL: **4.1 m on May 17, 2022**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	BACKFILL/ MONITOR WELL/ PIEZOMETER	ELEVATION (m)
12		SANDSTONE continued		RC	14	95	95			
	651.2	CLAY SHALE - excellent, brown and grey, fresh, very weak, silty, trace coal inclusions, blocky structure, high plastic, moist - 90 mm fractured zone at 12.6 m - slightly carbonaceous and occasional siltstone inclusions from 12.8 m to 14.3 m								651
13				RC	15	100	100			650
14		- 50 degree, planar, and rough joint at 13.9 m - interbedded sandstone and siltstone inclusions from 14.3 m to 15.9 m								649
15				RC	16	100	100			
	647.9	- weak below 15.1 m								648
16		Borehole end at 15.5 m Upon completion: - vibrating wire piezometer (S/N 1603865) installed at 6.3 m - 2.75" slope inclinometer casing installed to 14.0 m: - A+ Direction: 311 degrees magnetic north - stickup: 62 cm - backfilled grout and sand Water level on March 7, 2022: 4.1 m Water level on May 17, 2022: 4.1 m								647
17										646
18										

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 15.5 m
Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:33 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-04

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 6, 2022 to February 7, 2022**

BH COORDINATES [UTM 12U] 5922623.0N 329500.0E
WATER LEVEL: **4.5 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **664.5m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
0	664.5							
	664.4	ROOTMAT: 100 mm						
		SAND (SC) - compact, brown, silty, clayey, fine, trace organics, moist		BS	1			Sieve/Hydro at 0.2 m G S M C 0% 55% 25% 20%
		- frozen to 0.7 m						
1				SS	2	400	15	
	663.3							
		CLAY AND SAND TILL (CI) - stiff, brown, silty, trace coal, trace oxides, medium, moist						Additional shelby tube (ST4B) collected in borehole 1 m west of BH22-04 at 1.5 m depth.
				BS	3			Sieve/Hydro at 1.5 m G S M C 0% 43% 34% 23%
2		- trace gravel below 2.1 m						
				ST	4	600		
3				SS	5	400	13	
	661.3							
		CLAY SHALE - extremely weak, slightly weathered, grey, silty, high plastic, moist - frequent oxides and discolouration from 3.6 m to 3.8 m						
	660.7							
4		SANDSTONE - extremely weak, fresh, grey, fine, bentonitic, trace coal inclusions, trace oxides, moist		SS	6	450	41	
		- excellent below 4.2 m						Switch to bedrock coring at 4.2 m. Prior to switching: - borehole dry - borehole open
				RC	7	100	100	
5		- frequent interbedded clay shale and thin coal interbedds from 4.9 m to 5.0 m						
				SS	7A	430		12/22/50 for 130 mm >>
	658.8							
		CLAY SHALE - carbonaceous from 5.9 m to 6.4 m						
6								

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 664, 663, 662, 661, 660, 659

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 16 m

Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:36 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-04

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 6, 2022 to February 7, 2022**

BH COORDINATES [UTM 12U] 5922623.0N 329500.0E
WATER LEVEL: **4.5 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **664.5m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS	ELEVATION (m)
6		CLAY SHALE - excellent, brown and grey, fresh, extremely weak, silty, trace coal inclusions, blocky structure, high plastic, moist - grey from 6.4 m to 6.6 m		RC	8	100	100	UCS at 6.1 m: Qu = 270 kPa	658
7		- 180 mm thick bentonitic layer at 6.9 m - light brown from 7.2 m to 7.4 m		SS	8A	60		Atterberg Limit at 7.1 m: PL=26%, LL=143% 31/50 for 130 mm	
	657.1	SANDSTONE - excellent, grey, fresh, extremely weak, fine, occasional interbedded clay shale, trace coal, moist							657
	656.8	CLAY SHALE - excellent, brown, fresh, extremely weak to very weak, silty, blocky structure, high plastic, moist		RC	9	100	100		
8				SS	9A	0		48/50 for 100 mm	656
	655.7	SANDSTONE - excellent, grey, fresh, very weak, fine, moist - extremely weak from 9.4 m to 9.6 m - occasional interbedded clay shale below 9.9 m		RC	10	100	100		655
9	654.5	CLAY SHALE - excellent, grey, fresh, extremely weak, silty, blocky structure, high plastic, moist - 40 mm siltstone clast at 10.1 m - slightly carbonaceous from 10.3 m to 10.9 m		RC	11	100	100	UCS at 10.1 m: Qu = 766 kPa	654
10	653.3	SANDSTONE - excellent, grey, fresh, extremely weak, fine, moist							653
11									
12									

BACKFILL/ MONITOR WELL/ PIEZOMETER

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 16 m

Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:36 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

BOREHOLE RECORD

BH22-04

CLIENT: **Brookfield Residential (Alberta) LP**
PROJECT: **Ellerslie Road - Whitemud Creek Bridge Crossing**
LOCATION: **Edmonton, Alberta**
DATE BORED: **February 6, 2022 to February 7, 2022**

BH COORDINATES [UTM 12U] 5922623.0N 329500.0E
WATER LEVEL: **4.5 m on May 17, 2022**

PROJECT NO. : **1161110185**
BH ELEVATION: **664.5m**
DATUM: **Geodetic**

UNDRAINED SHEAR STRENGTH, Cu (kPa)
LABORATORY TEST ▲ FIELD VANE TEST ◆
POCKET PEN. ★ POCKET SHEAR VANE ◘
50 kPa 100 kPa 150 kPa 200 kPa
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N-value) BLOWS/0.3m ●
Water Content (%) and Blow Count
10 20 30 40 50 60 70 80

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION (MUSCS)	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm) or TCR %	N-VALUE or RQD %	OTHER TESTS / REMARKS
12		SANDSTONE continued		RC	12	100	100	
13		- occasional thin coal interbedds below 13.0 m		RC	13	100	100	
		- weak and cemented/calcareous from 13.9 m to 14.3 m						
14	650.4	CLAY SHALE - excellent, brown, fresh, very weak, silty, occasional siltstone fragments, blocky structure, high plastic, moist - 20 mm siltstone seam at 14.4 m						
15		- 30 mm fractured zone at 14.7 m - extremely weak to very weak below 14.7 m		RC	14	100	100	
16	648.5	Borehole end at 16.0 m Upon completion: - vibrating wire piezometer (S/N 1700067) installed at 14.7 m - 1" PVC standpipe piezometer installed with slotted section from 0.8 m to 3.8 m in borehole 0.5 m west - backfilled with sand and bentonite Water level on March 7, 2022: Dry (standpipe piezometer) 4.4 m (vibrating wire piezometer) Water level on May 17, 2022: Dry (standpipe piezometer) 4.5 m (vibrating wire piezometer)						
17								
18								

BACKFILL/ MONITOR WELL/ PIEZOMETER

ELEVATION (m): 652, 651, 650, 649, 648, 647

▼ Water Level Measured On Date Indicated

BACKFILL SYMBOL: ASPHALT, GROUT, CONCRETE, BENTONITE, DRILL CUTTINGS, SAND, SLOUGH

Drilling Contractor: All Service Drilling
Drilling Method: Solid Stem, HQ Coring
Completion Depth: 16 m

Logged By: CU
Reviewed By: LC

Printed May 24 2022 8:50:37 STANTEC GEO 2016 BH_LOGS_1161110185_FNL.GPJ MASTER1.GDT 5/24/22

City of Edmonton	South Edmonton Sanitary Sewer	BOREHOLE NO: **04-C21**
DRILLER: Garrity & Baker	Ellerslie Road	PROJECT NO: EG09167
DRILL/METHOD: Mayhew 1000 - Wet Rotary / Coring (Tra[illegible])	SW3	ELEVATION: 663.2 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

STANDARD PEN (N) 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	PNEUMATIC PIEZOMETER	OTHER TESTS COMMENTS	ELEVATION (m)
0	CLAY, very silty, very sandy, low to medium plastic, brown, coal pieces						663
1							662
2							661
3	SANDSTONE, silty, bentonitic, fine grained, grey						660
4	SANDSTONE, silty, bentonitic, fine grained, moderately cemented, light grey, massive, very weak (R1) ... from 3.5m to 3.6m, moist, bentonitic, medium plastic SILTSTONE, silty, bentonitic, grey, fractured, weak (R2) CLAY SHALE, silty, medium plastic, green to grey, carbonaceous debris, very weak (R1), isolated fractures at 60º to 65º		C1				659
5	CLAY SHALE, silty, medium plastic, dark grey, very weak (R1), carbonaceous debris, occasional coal debris up to 2 cm thick CLAY SHALE, silty, highly plastic, dark grey, very weak (R1), trace carbonaceous debris, rare fractures at 60º						658
6	... at 5.95m, 4 cm thick coal bed ... from 6.0m to 6.2m, lost core, most likely carbonaceous clay shale SANDSTONE and CLAY SHALE, intermixed, very silty, clayey, very fine grained bentonitic sandstone, silty clay bedded at 0º to 5º, very weak (R1)						657
7	SANDSTONE, silty, moderately cemented, fine grained, very weak (R1), occasional carbonaceous laminae at 0º to 6º, (easily fractured horizontally) CLAY SHALE, silty, high plastic, green to grey, very weak (R1), rare sub vertical fractures, trace carbonaceous debris ... from 7.7m to 7.85m, moderately fractured with some soft clay		C2				656
8	SANDSTONE, very silty, bentonitic, moderately cemented, fine grained, green to grey, very weak (R1), occasional carbonaceous laminae at 0º to 5º CLAY SHALE, very silty, some very fine sand, medium plastic, brown to grey, very weak (R1), trace carbonaceous debris						655
9	... from 9.2m to 9.3m, abundant horizontal fractures, some soft sticky brown medium plastic clay SANDSTONE, silty, bentonitic, moderately cemented, fine to medium grained, very weak (R1), occasional brown						654
10							

amec

AMEC Earth & Environmental
Edmonton, Alberta

LOGGED BY: DD
REVIEWED BY: APL/CRT

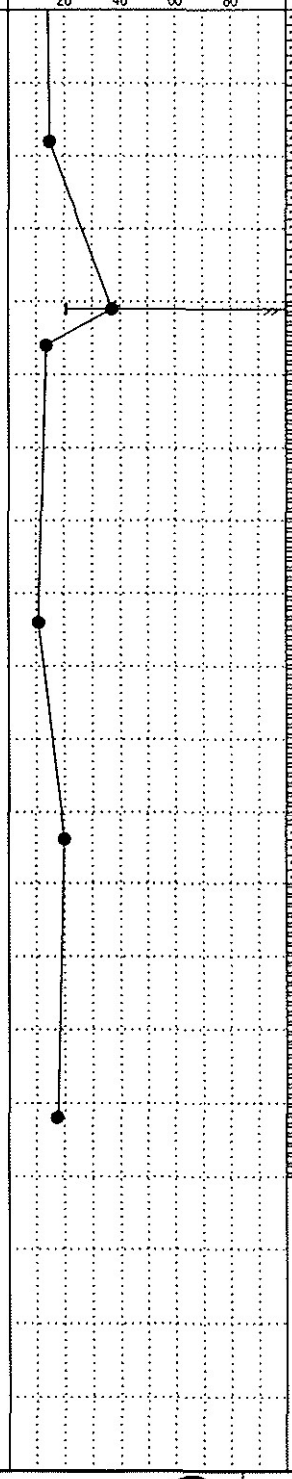
COMPLETION DEPTH: 18.00 m
COMPLETION DATE: 16/11/04

EG09167.GPJ 04/12/24 10:44 AM (BOREHOLE LOG)

City of Edmonton	South Edmonton Sanitary Sewer	BOREHOLE NO: **04-C21**
DRILLER: Garrity & Baker	Ellerslie Road	PROJECT NO: EG09167
DRILL/METHOD: Mayhew 1000 - Wet Rotary / Coring (Tra[illegible])	SW3	ELEVATION: 663.2 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand



Depth (m)	SOIL DESCRIPTION	SAMPLE NO	OTHER TESTS COMMENTS	ELEVATION (m)
10	carbonaceous and grey clay laminae at 0º to 15º, trace silt nodules ... from 9.3m to 9.6m, occasional horizontal fractures ... from 9.7m to 9.8m, brown clay shale layer at 0º to 3º	C3		653
11			q_u=1215.17 kPa at 4.99% Strain w=12.7%	652
12	... from 11.8m to 12.0m, abundant dark brown to black carbonaceous laminae at 8º CLAY SHALE, silty, hard, medium to high plastic, green to grey, very weak (R1) ... from 12.0m to 12.45m, highly plastic clay with trace silt, grey ... from 12.45m to 12.55m, pockets of very fine silty sand ... from 12.55m to 12.9m, silty, carbonaceous debris, brown to grey		w_p =20.7, w_L = 112.2	651
13				650
14	... from 14.04m to 14.5m, sandstone layer at 5º to 15º, bentonitic with thin coal laminae at base of layer, very weak (R1) ... from 14.05m to 14.4m, silty, sandy, brown ... at 14.8m, fractured at 22º	C4	q_u=1821.8 kPa at 3.51% Strain w=11.1%	649
15	... from 15.0m to 15.6m, several fractures at 0º to 15º			648
16	SANDSTONE and CLAY SHALE, intermixed, silty, very fine grained bentonitic sandstone intermixed with brown to grey highly plastic clay shale, occasional carbonaceous laminae, moderately cemented, very weak (R1) CLAY SHALE, silty, highly plastic, grey to brown, very weak (R1), frequent light brown hard siltstone nodules up to 6 cm thick ... at 16.6m, fractured at 12º	C5		647
17	... at 16.9m, slickensided at 40º (C3, G1, B2, R3, S2) CLAY SHALE, silty, very hard, highly plastic, very weak (R1), trace carbonaceous debris, numerous slickensides (Slb, C2, C3, G1, G6, O4, B1, R1, S1-S2) at 0º to 90º			646
18	CLAY SHALE, silty, very hard, high plastic, very weak (R1), carbonaceous debris, numerous slickensides (Slb, C3, G1, O4, B2, R1-R6, S2-S3) at 0º to 90º End of Hole at 18.0 m. Upon Completion: Piezometer (SR# 029567) installed to 12.3 m.			645
19				644
20				

amec	AMEC Earth & Environmental Edmonton, Alberta	LOGGED BY: DD REVIEWED BY: APL/CRT	COMPLETION DEPTH: 18.00 m COMPLETION DATE: 16/11/04

EG09167.GPJ 04/12/24 10:44 AM (BOREHOLE LOG)

City of Edmonton	South Edmonton Sanitary Sewer	BOREHOLE NO: **04-C21B**
DRILLER: Garrity & Baker	Ellerslie Road	PROJECT NO: EG09167
DRILL/METHOD: Mayhew 1000 - Wet Rotary / Coring (TR208)		ELEVATION: 663.45 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

STANDARD PEN (N) 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE NO	SPT (N)	OTHER TESTS COMMENTS	ELEVATION (m)
0	CLAY, silty, very sandy, trace gravel, medium plastic, brown, coal pieces					663
1						662
2						661
	... from 2.5m to 3.5m, rock pieces, sandstone pieces, coal pieces, rough drilling					
3	... from 3.2m to 4.6m, lost core, sandstone based on cuttings					660
	SANDSTONE, silty, bentonitic, fine grained, grey		C1			
4	... from 4.3m to 4.5m, some water loss, rough drilling					659
	SANDSTONE, silty, bentonitic, very fine grained, extremely weak (R0), some weak (R2) siltstone fragments					
5	CLAY SHALE, silty, very hard, high plastic, grey to brown, very weak (R1), some carbonaceous debris		C2			658
	... at 5.2m, fractured at 50º					
	... from 5.55m to 5.65m, highly fractured core					
	...at 5.6m, sandy lense, 3 cm thick					
6	... from 6.1m to 6.25m, green to grey, highly plastic					657
	... from 6.[illegible]m to 6.65m, silty, dark brown, carbonaceous, medium plastic, very weak (R1)					
	...[illegible]om 6.65m to 8.[illegible] occasional sub vertical fracture					
7	... from 6.95m to 7.1m, pockets of very fine grained bentonitic sand		C3			656
	... at 7.65m, slickensided, C3, G1, B3, R1, S3, at 55º					
	... from 7.7m to 7.8m, silty, green to grey					
8	End of Hole at 8.0 m. Bentonite chips to surface.					655
9						654
10						

amec

AMEC Earth & Environmental
Edmonton, Alberta

LOGGED BY: DD	COMPLETION DEPTH: 8.00 m
REVIEWED BY: APL/CRT	COMPLETION DATE: 17/11/04

EG09167.GPJ 04/12/24 10:44 AM (BOREHOLE LOG)

City of Edmonton	South Edmonton Sanitary Sewer	BOREHOLE NO: **05-A03**
	Ellerslie Road (SW3)	PROJECT NO: EG09167
DRILL/METHOD: M 10/Solid Augers	NAD 83-3TM-GRID: N 5921434 E 28763	ELEVATION: 672.2 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand

STANDARD PEN (N) 20 40 60 80

PLASTIC M.C. LIQUID 20 40 60 80

Depth (m)	SOIL DESCRIPTION	SAMPLE NO	SPT (N)	OTHER TESTS COMMENTS	ELEVATION (m)
0	TOPSOIL, silty. sandy, medium plastic, black			BH05-A03 was drilled with solid auger from surface to 12.2 m; with wet rotary - from 12.2 m to 20.9m, and located 1.8 m from auger hole	672
1	CLAY FILL, silty, sandy, rootlets, sandstone and clayshale fragments, coal chips	D1	9		671
	... rootlets, brown				
	TOPSOIL, silty. sandy, medium plastic, decayed wood, brown				
2	CLAY, medium plastic, stiff, silty, sandy, coal chips, sand pockets, rust stain, brown	D2	10		670
3	CLAYSHALE, medium to high plastic, hard, silty, sandy, brown, weathered				669
4	... hard, blue-grey	D3 C1	48		668
5		C2			667
		C3			
6	CLAY, bentonitic, high plastic, hard, white	C4			666
	CLAYSHALE, medium to high plastic, hard, silty, fragments of well cemented white calcium deposit, grey				
	... free water trace				
7	SANDSTONE, Bedrock, silty, fine grained, very dense, blue-grey	C5			665
	CLAYSHALE, high plastic, hard, silty, fragments of well cemented white calcium deposit, grey				
	SANDSTONE, Bedrock, silty, fine grained, very dense, blue-grey				
8	CLAYSHALE, high to medium plastic, hard, silty, grey	C6			664
	... carbonaceous, coal fragment, dark brown	C7			
9	SANDSTONE, silty, fine grained, very dense, occasionally coal fragments, blue-grey	C8			663
10		C9			662
11		C10			661
11.5					

EG09167SW3.GPJ 06/03/02 02:46 PM (BOREHOLE LOG)

amec

AMEC Earth & Environmental
Edmonton, Alberta

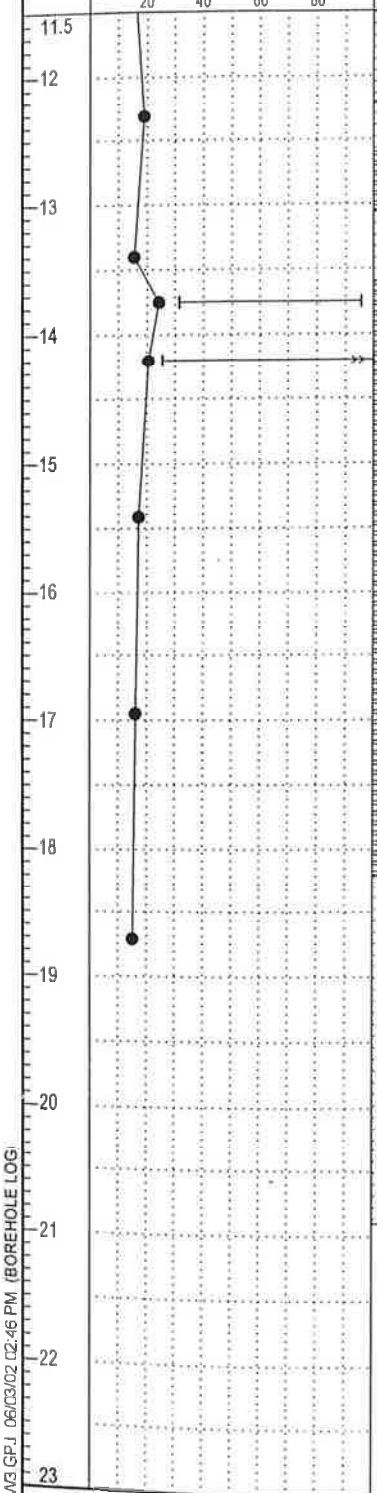
LOGGED BY: CRA
REVIEWED BY:

COMPLETION DEPTH: 15.30 m
COMPLETION DATE: 6/4/05

City of Edmonton	South Edmonton Sanitary Sewer	BOREHOLE NO: **05-A03**
	Ellerslie Road (SW3)	PROJECT NO: EG09167
DRILL/METHOD: M 10/Solid Augers	NAD 83-3TM-GRID: N 5921434 E 28763	ELEVATION: 672.2 m

SAMPLE TYPE: Shelby Tube | No Recovery | SPT Test (N) | Grab Sample | Split-Pen | Core

BACKFILL TYPE: Bentonite | Pea Gravel | Slough | Grout | Drill Cuttings | Sand



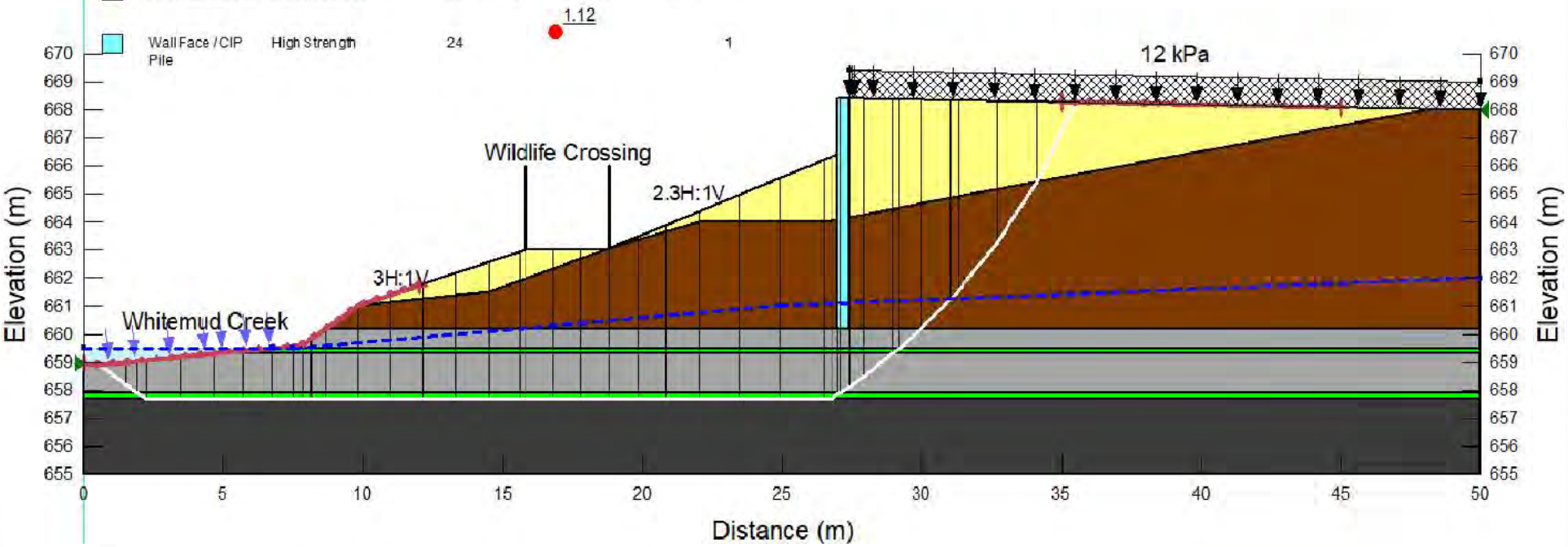
Depth (m)	SOIL DESCRIPTION	SAMPLE NO	SPT (N)	OTHER TESTS COMMENTS	ELEVATION (m)
	.. well cemented ... moderate cemented	C11			
	SANDSTONE, silty, fine grained, blue-grey, very weak (R1)			From 12.2m to 14.9m: REC = 100% RQD = 100%	660
	CLAYSHALE, silty, sandy, medium plastic, carbonaceous, brown, very weak (R1) ... fracture at 40°, soft brown clay on surface ... fracture at 3°	C12			659
	SANDSTONE, silty, fine grained, moderately cemented, blue-grey, very weak (R1) ... thin carbonaceous beds at 10°	C13 C1a			
	CLAYSHALE, silty, high to medium plastic, brown-grey, very weak (R1) ... to 14.2m numerous slickensides (Slc), through going, semi-Undulating, intersecting, hard force to brake, striated, shiny, glossy at 45° ... from 13.9 m to 14.2 m high plastic, bentonitic, greenish grey ... from 14.2m to 16.1m medium to high plastic, hard, slightly carbonaceous, coal fragments, brown ... to 18.2 fractured at 40° to 50° ... slickensides, planer, through going, hard force, striated, pock marked, shiny, glossy at 45° ... to 14.9m numerous slickensides (Slc), through going, semi-Curved, intersecting, hard force, striated, moderately shiny at 25° to 70° ... high plastic, hard, grey to light brown ... slickenside at 42° through going, planer, falls apart, striated, dull	C14 C15 C2a		APPROX. TUNNEL ZONE From 14.9m to 18.0m: REC = 100% RQD = 71%	658 657 656
	SANDSTONE, silty, clayey, fine grained, bentonitic, clay laminas, carbonaceous fragments from 0 -25°, of blue-grey to brown, very weak (R1)			From 18.0m to 20.9m: REC = 100% RQD = 100%	654
	... medium grained, non-plastic, moderately cemented, trace of coal, laminated	C3a		q_u = 1694 kPa at 6.24% Strain	653
	... from 20.6m to 20.9m siltstone nodules up to 50 mm, moderately cemented, light brown			q_u = 1354 kPa at 6.63% Strain	652
	End of Hole at 20.9 m No Water upon completion 1" PVC Standpipe installed to 10.0 m - slotted from 10 m to 6.9 m, 0.8 m stickup Backfilled with drill cuttings and grout				651 650

amec	AMEC Earth & Environmental Edmonton, Alberta	LOGGED BY: CRA REVIEWED BY:	COMPLETION DEPTH: 15.30 m COMPLETION DATE: 6/4/05

EG09167SW3.GPJ 06/03/02 02:46 PM (BOREHOLE LOG)

Appendix D Slope Stability Analysis Results

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



Stantec

Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A0
Checked by:	XL	

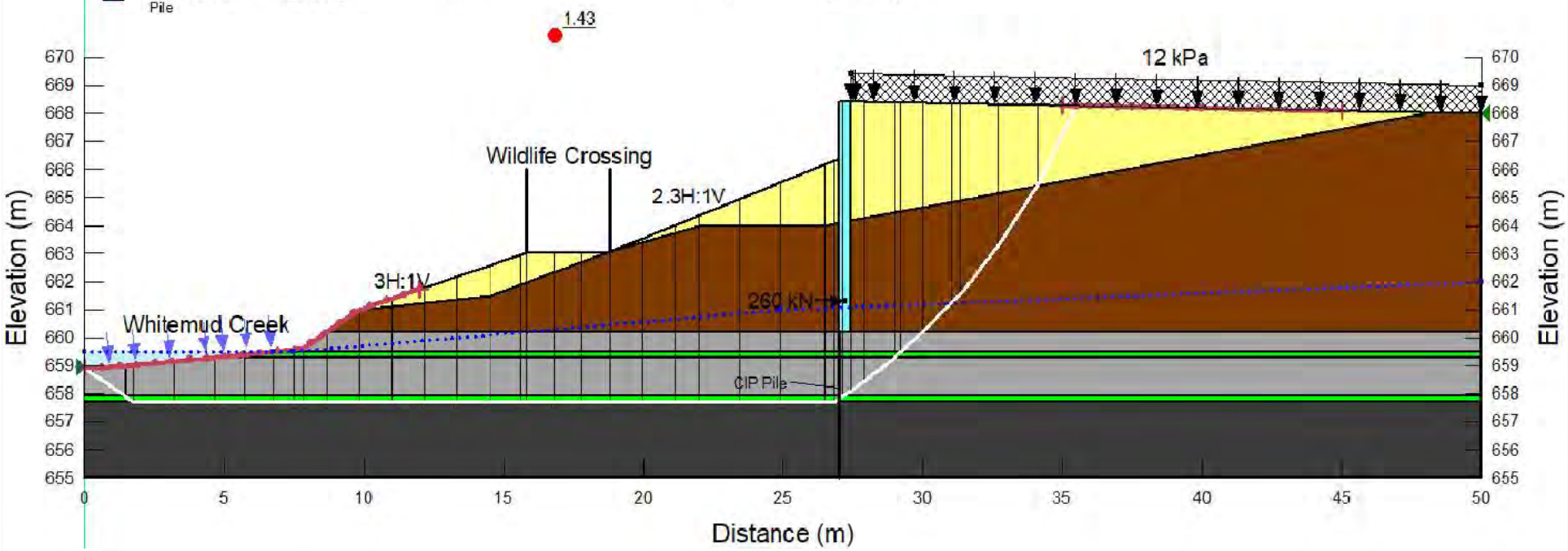
Title

Option 1: Concrete Abutment Wall
No Stabilization Piles, Long Term

Figure No.

D1

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	0	1	0.2	No
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	0	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1	0	Yes
	Wall Face / CIP Pile	High Strength	24				1	0	Yes



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A0
Checked by:	XL	

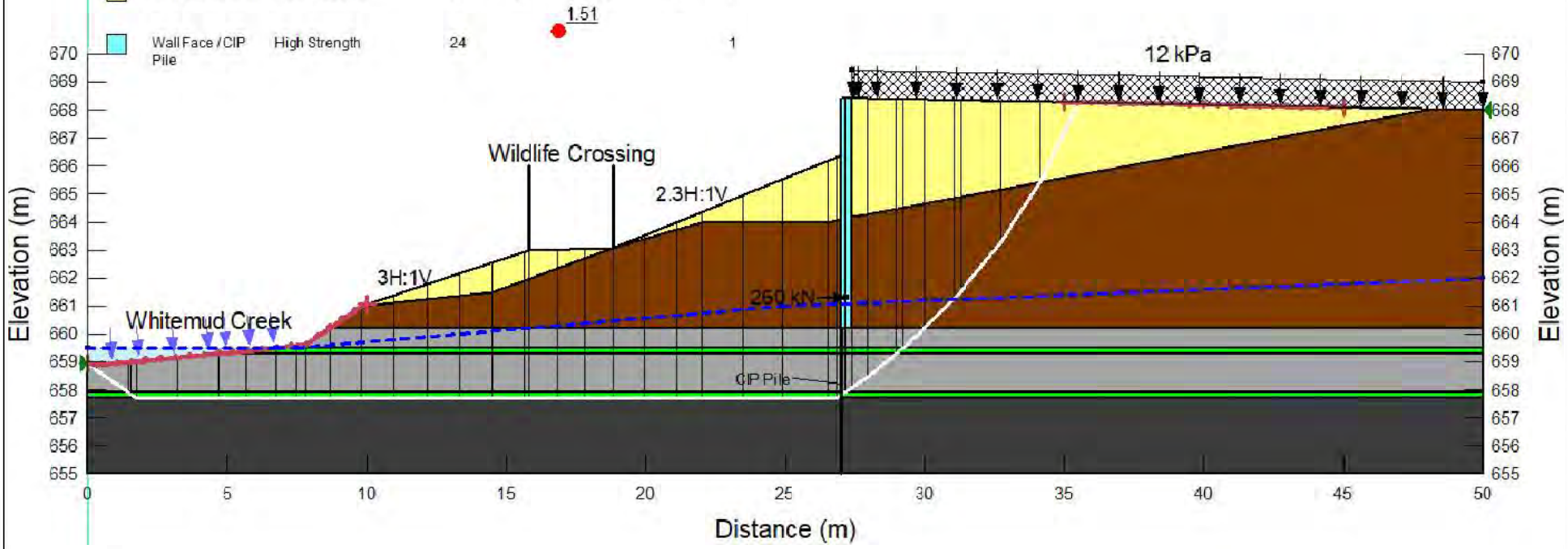
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Short Term

Figure No.

D2

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



Stantec

Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A0
Checked by:	XL	

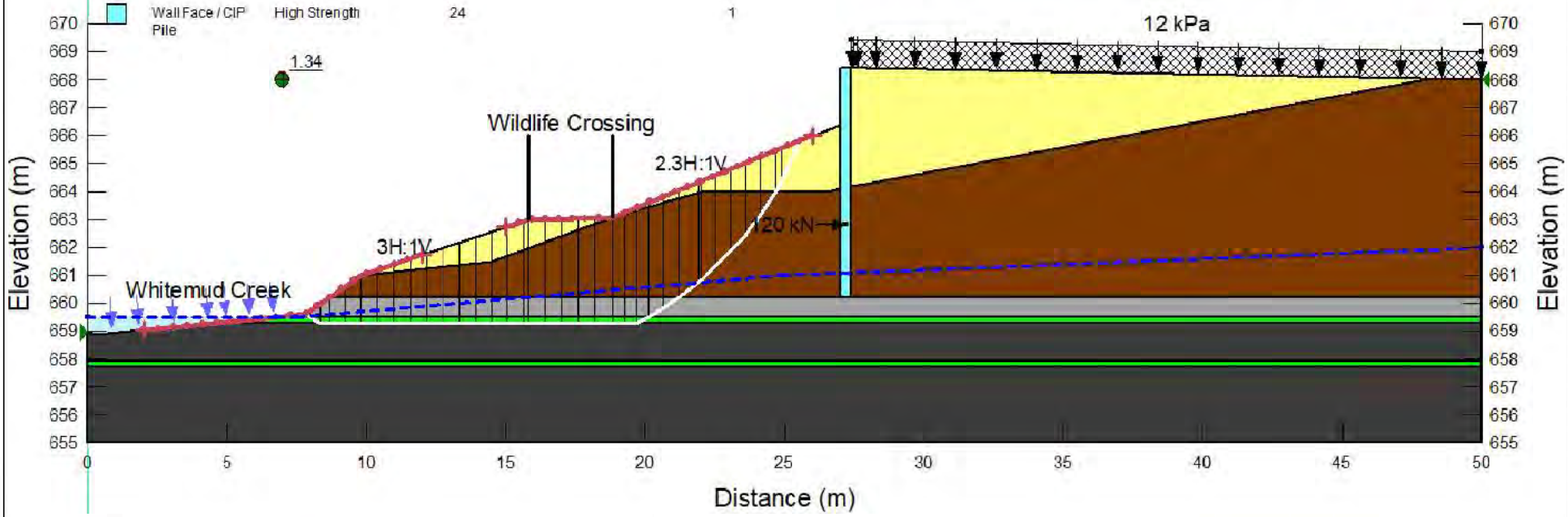
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Long Term

Figure No.

D3

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



Stantec

Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A0
Checked by:	XL	

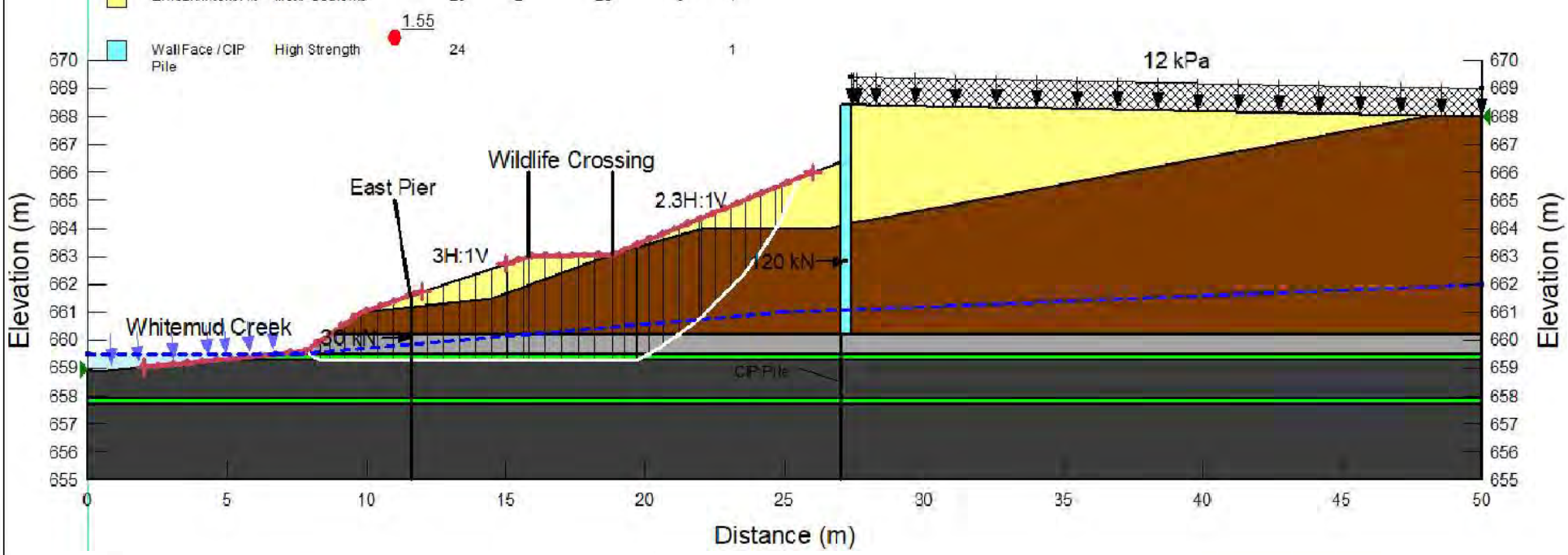
Title

Option 1: Concrete Abutment Wall
Head Slope Failure, No Piles

Figure No.

D4

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



Stantec

Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A0
Checked by:	XL	

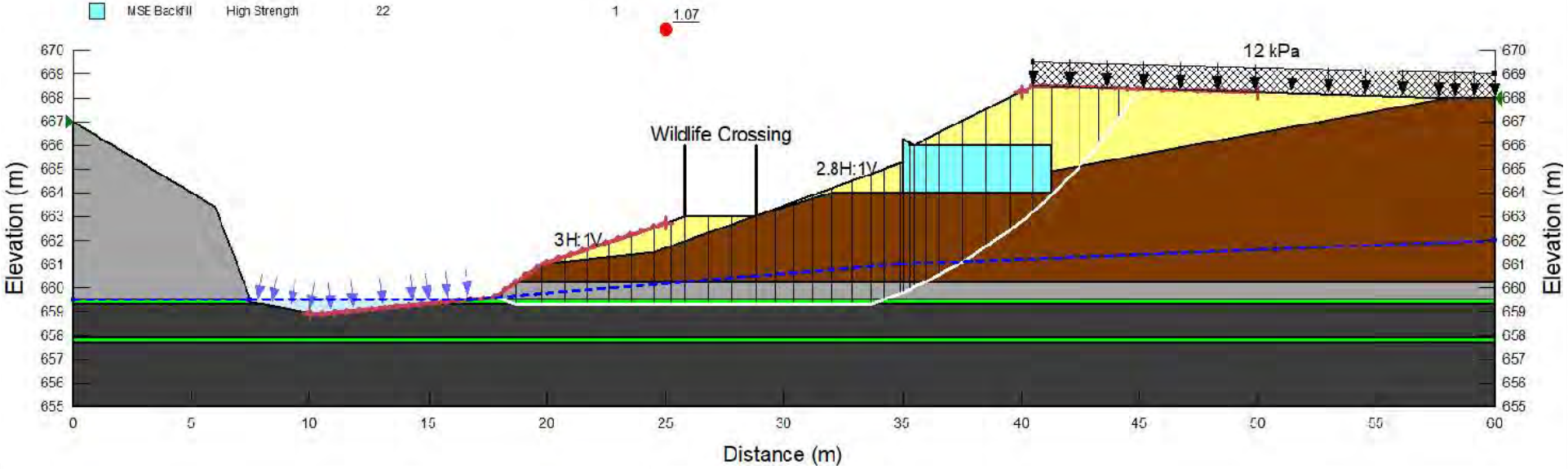
Title

Option 1: Concrete Abutment Wall
Head Slope Failure, with Piles

Figure No.

D5

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr Coulomb	20	2	26	0	1
	MSE Backfill	High Strength	22				1



Stantec

Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A0

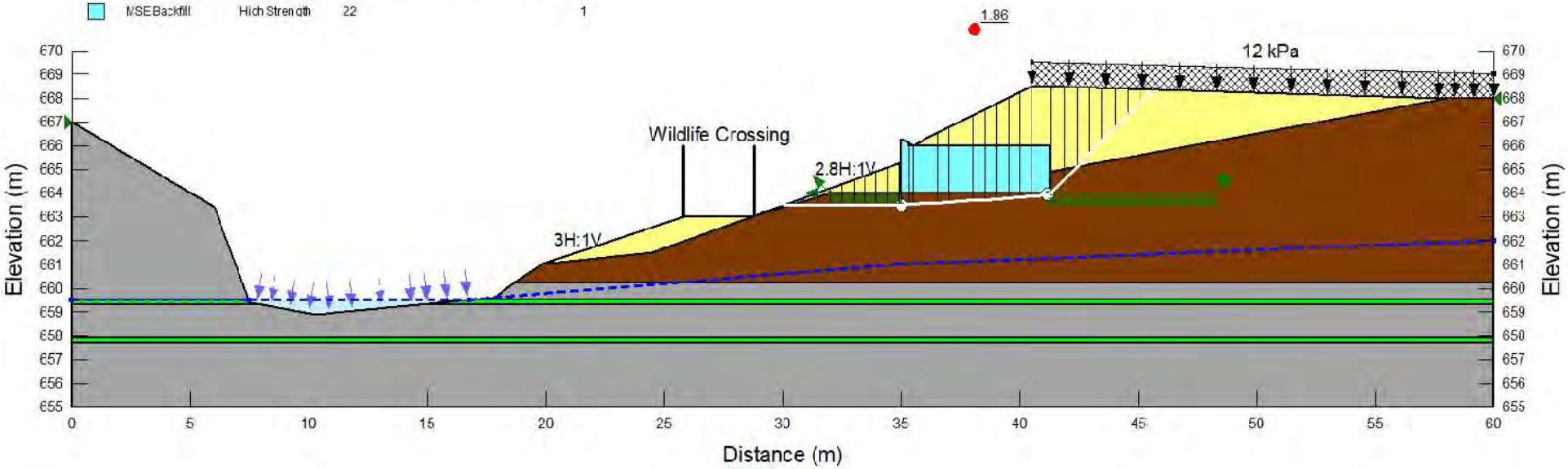
Title

Option 2: MSE Wall
No Stabilization Piles, Long Term

Figure No.

D6

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	20	0	1
	MSE Backfill	High Strength	22				1



Stantec

Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A0
Checked by:	XL	

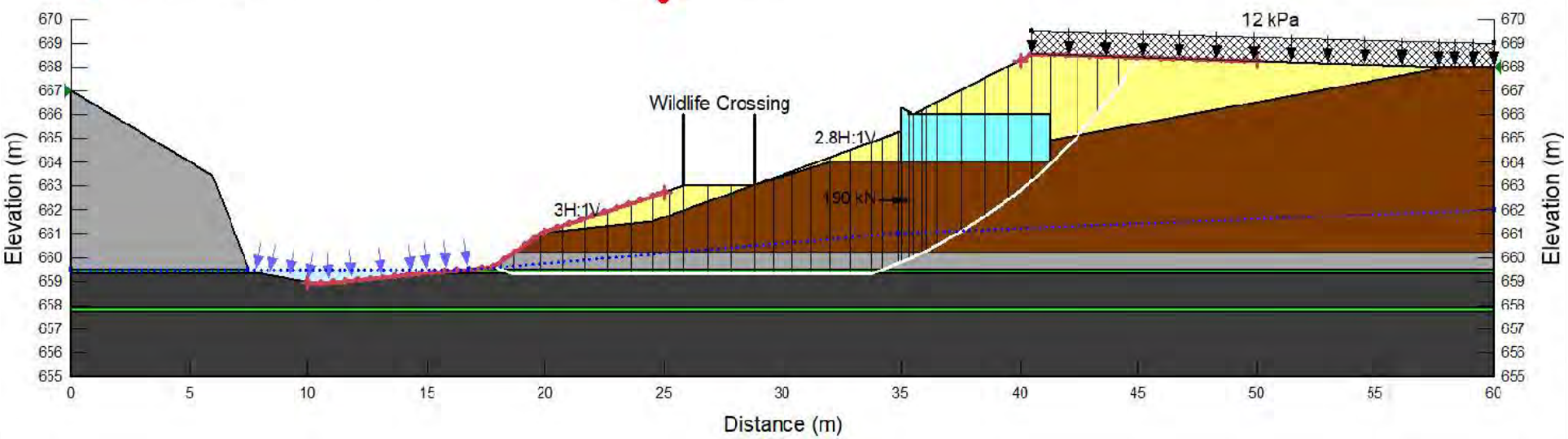
Title

Option 2: MSE Wall
No Stabilization Piles, Sliding Failure, Long-Term

Figure No.

D7

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	0	1	0.2	No
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	0	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1	0	Yes
	MSE Backfill	High Strength	22				1	1.41[0]	Yes



Stantec

Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A0

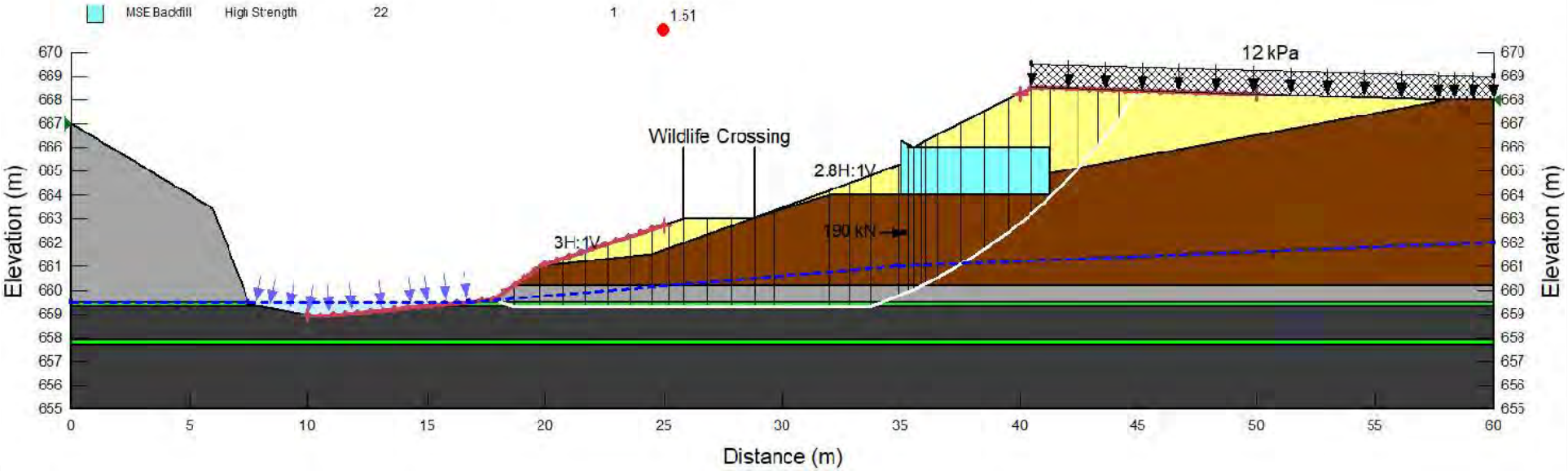
Title

Option 2: MSE Wall
With Stabilization Piles, Short Term

Figure No.

D8

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill	High Strength	22				1



Stantec

Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek
Bridge Crossing - Section A0

Title

Option 2: MSE Wall
With Stabilization Piles, Long Term

Figure No.

D9

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill	High Strength	22				1

Stantec

Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A0

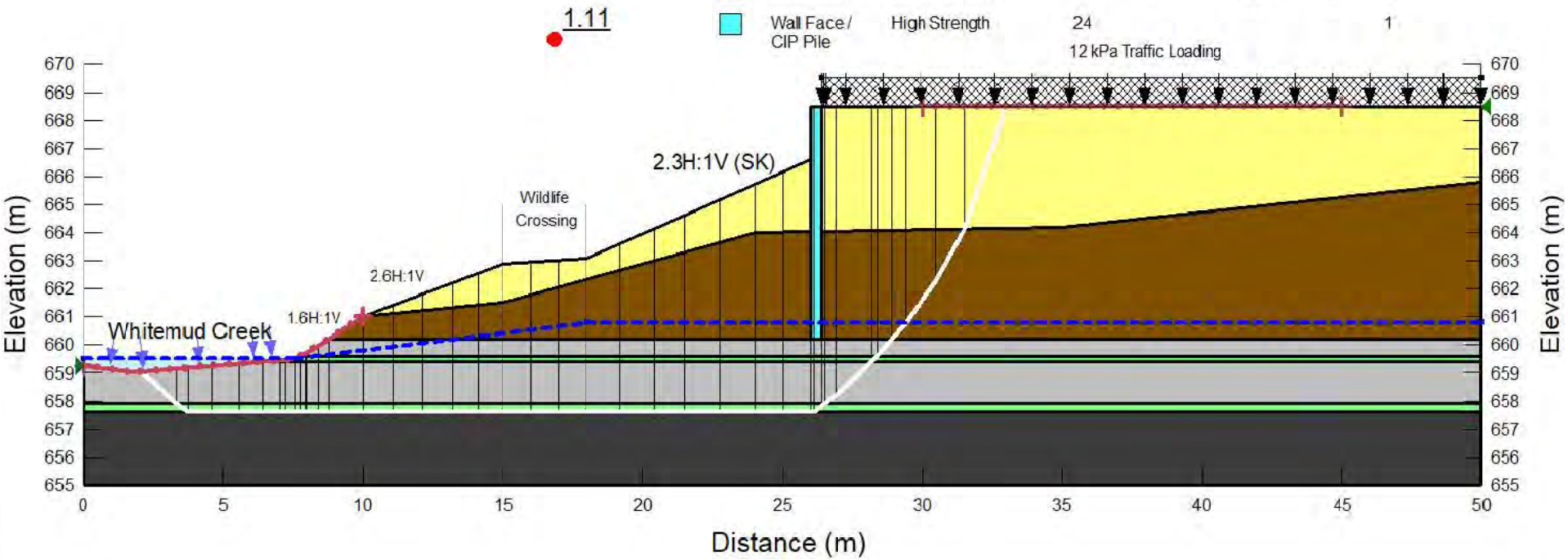
Title

Option 2: MSE Wall
Head Slope Failure, with Piles

Figure No.

D10

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment	Mohr-Coulomb	20	2	28	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A1
Checked by:	XL	

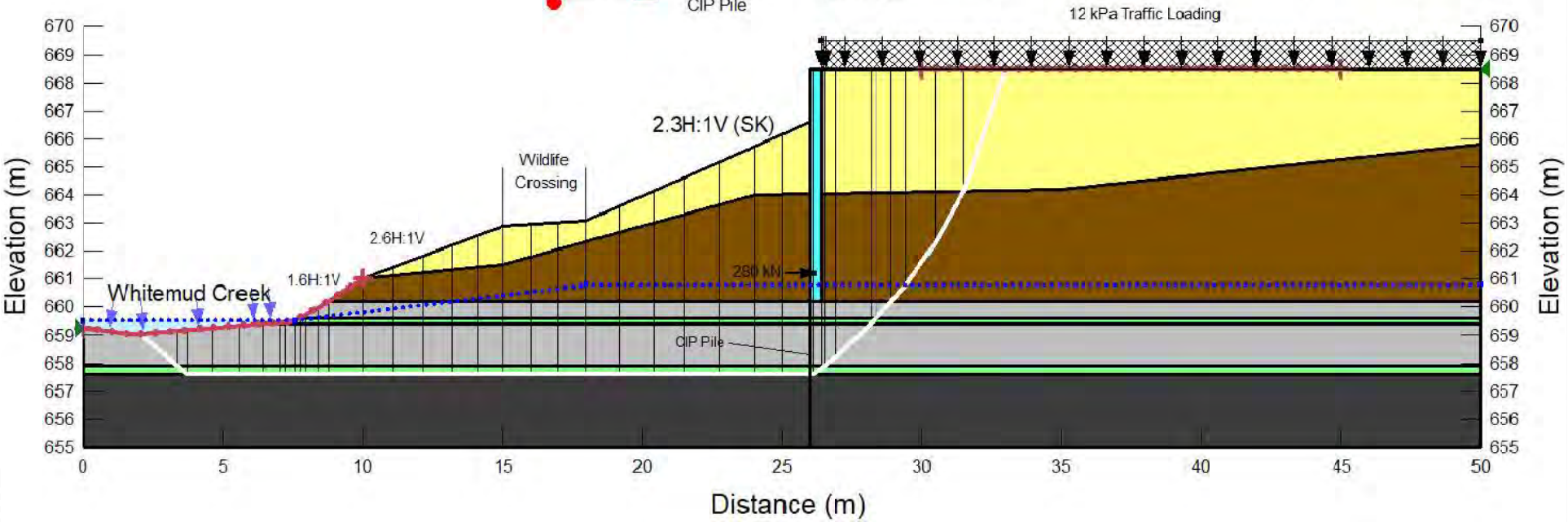
Title

Option 1: Concrete Abutment Wall
No Stabilization Piles, Long Term

Figure No.

D11

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	0	1	0.2	No
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	0	1	0	No
	Embankment	Mohr-Coulomb	20	2	28	0	1	0	Yes
	Wall Face / CIP Pile	High Strength	24				1	0	Yes



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Project No.:	1161110185
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Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A1

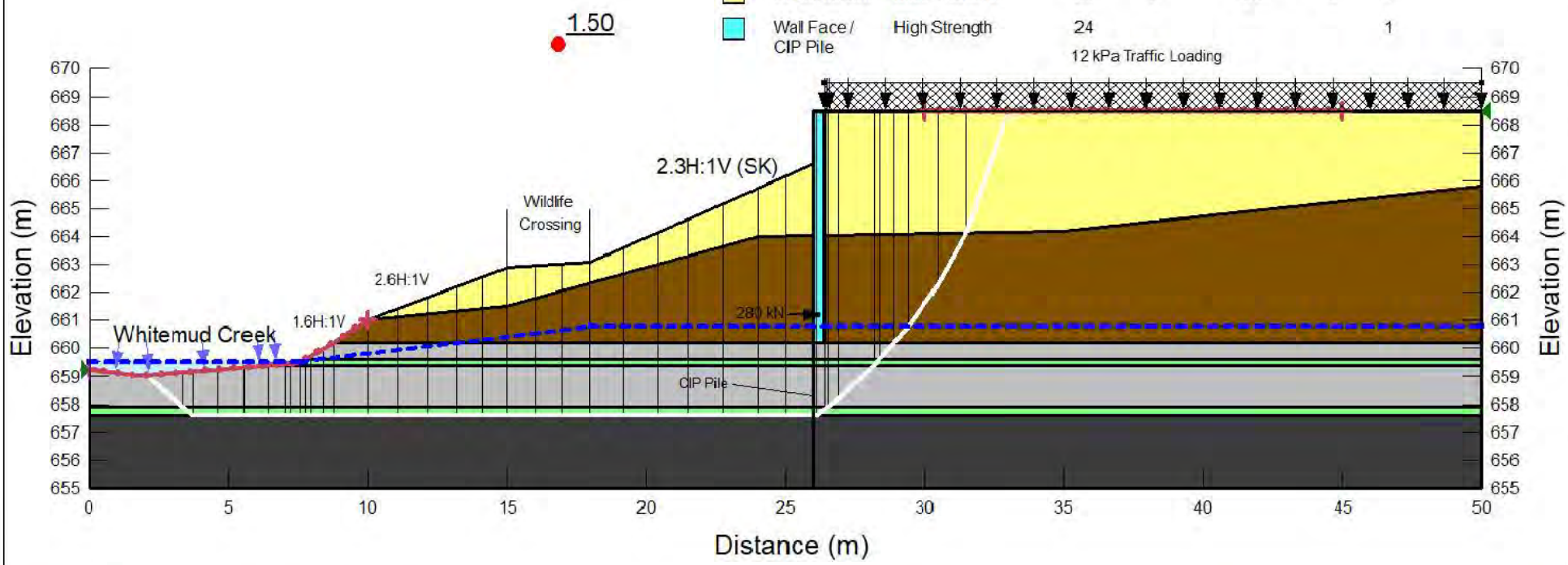
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Short Term

Figure No.

D12

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment	Mohr-Coulomb	20	2	28	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
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Checked by:	XL	

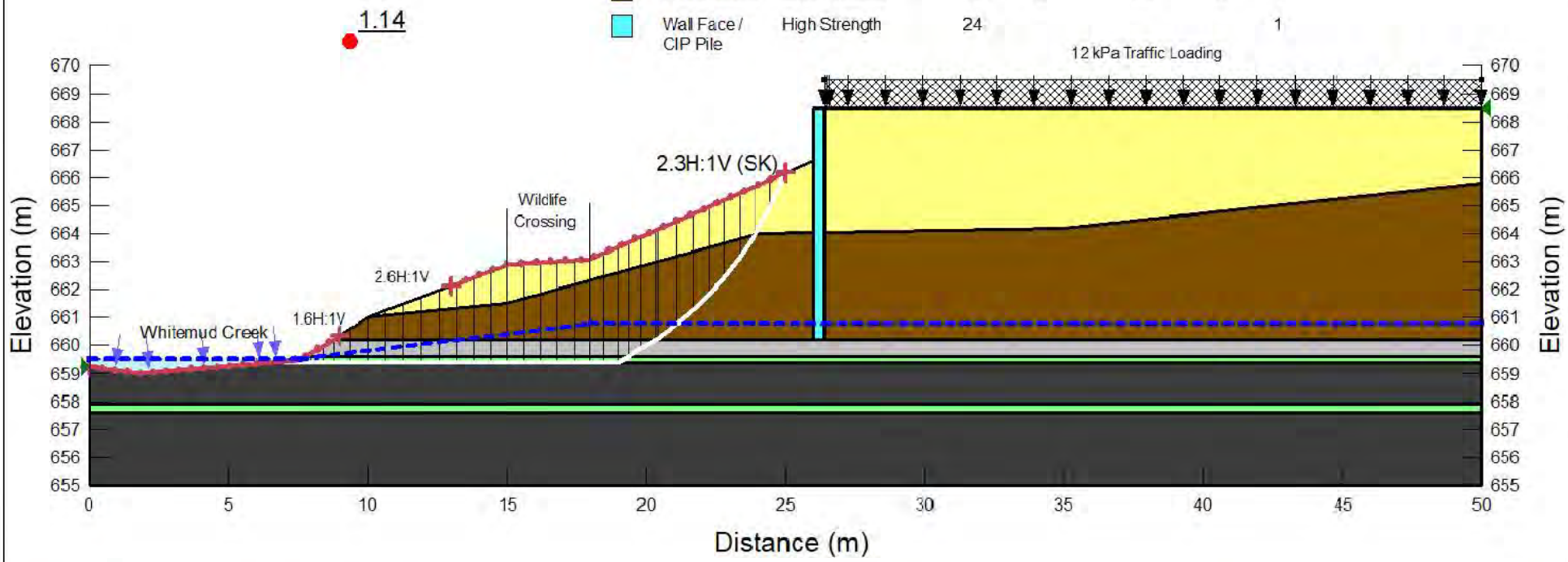
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Long Term

Figure No.

D13

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment	Mohr-Coulomb	20	2	28	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Checked by:	XL	

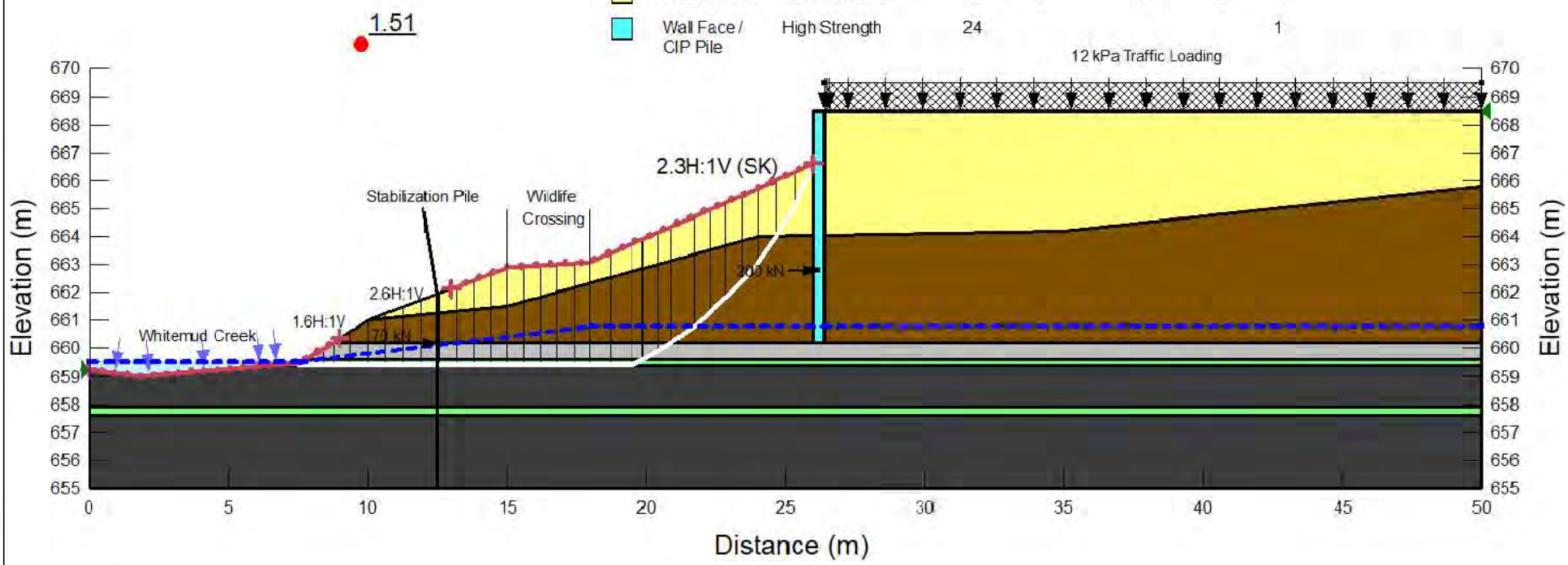
Title

Option 1: Concrete Abutment Wall
Head Slope Failure, No Piles

Figure No.

D14

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment	Mohr-Coulomb	20	2	28	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A1

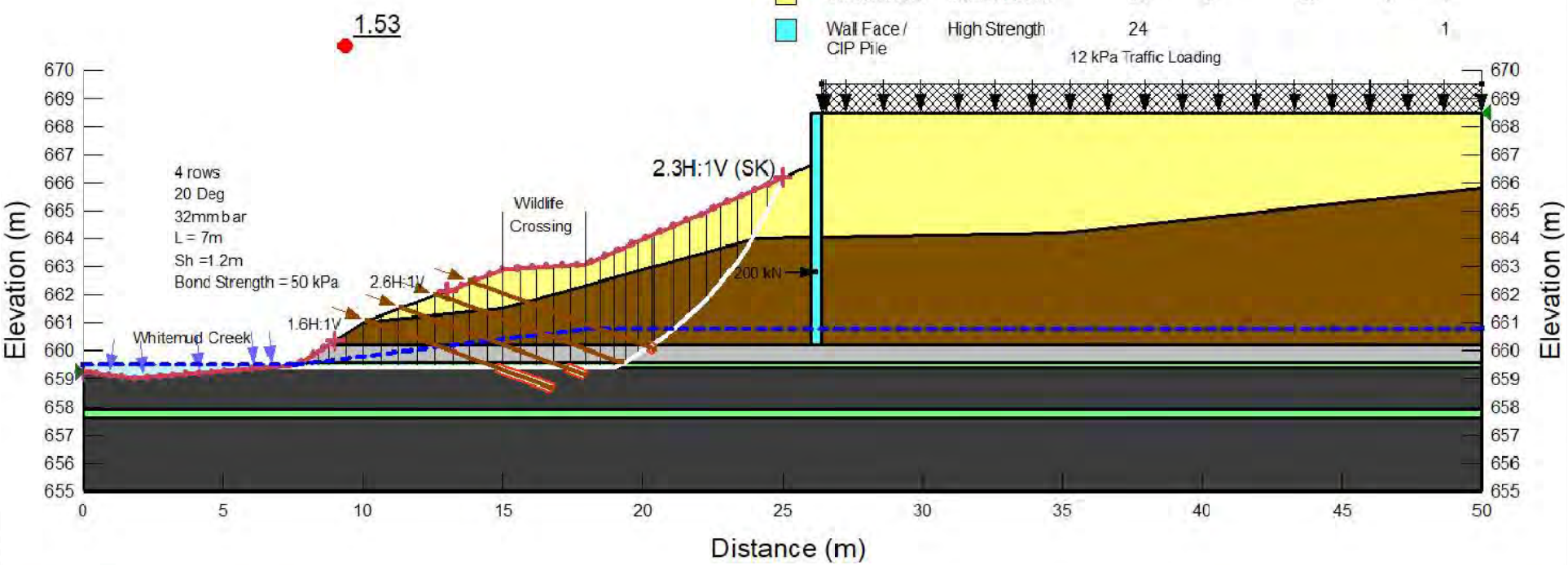
Title

Option 1: Concrete Abutment Wall
Head Slope Failure, with Piles

Figure No.

D15

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment	Mohr-Coulomb	20	2	28	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Date:	Jan 30, 2023
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Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A1

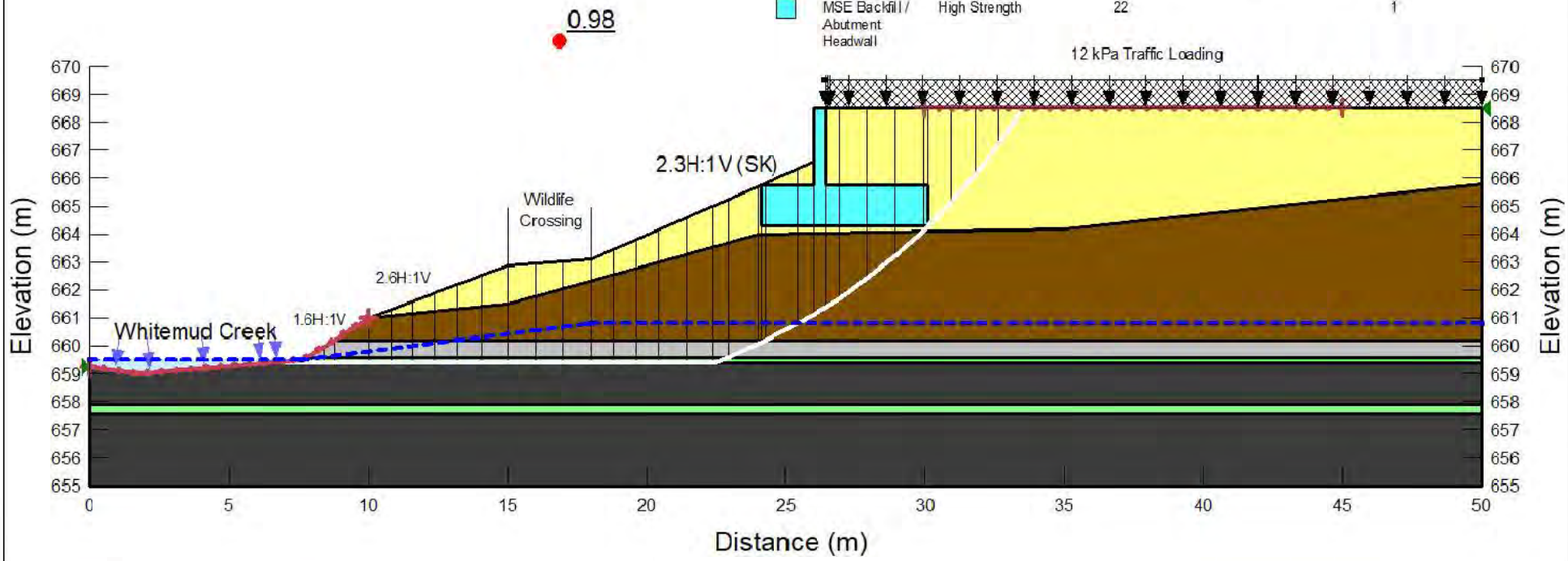
Title

Option 1: Concrete Abutment Wall Head Slope Failure, with Soil Nails

Figure No.

D16

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment	Mohr-Coulomb	20	2	28	0	1
	MSE Backfill / Abutment Headwall	High Strength	22				1



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Project No.:	1161110185
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Date:	Jan 30, 2023
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Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A1

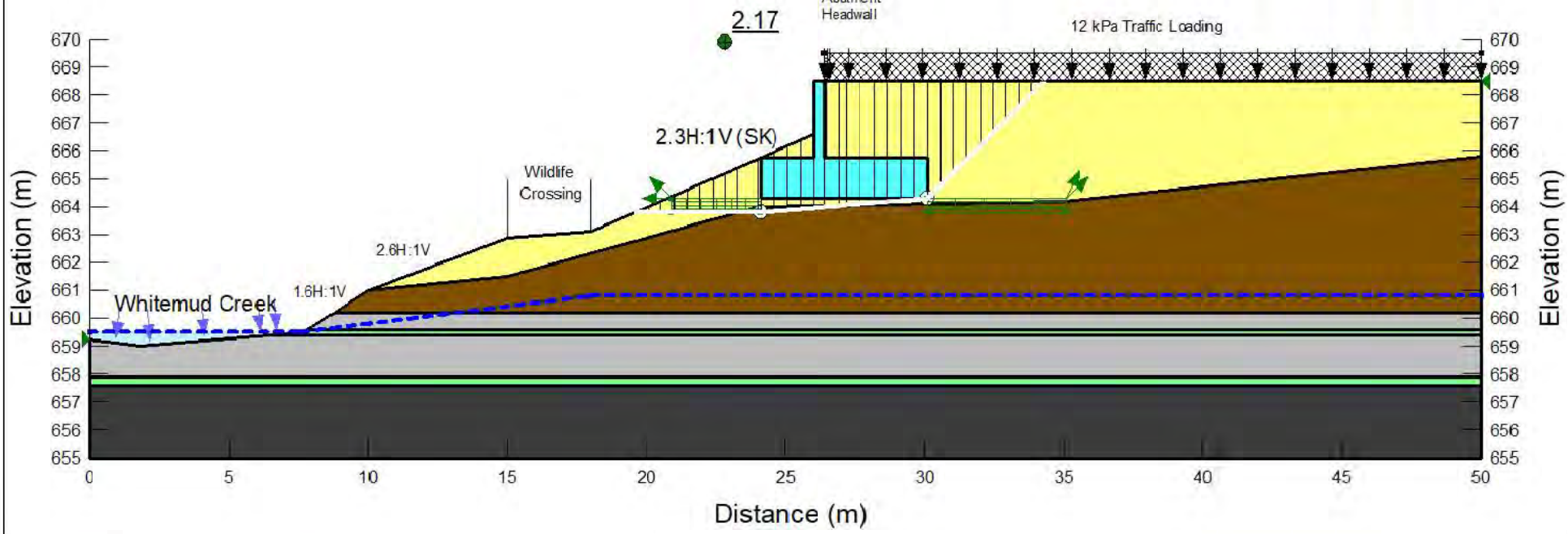
Title

Option 2: MSE Wall
No Stabilization Piles, Long Term

Figure No.

D17

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment	Mohr-Coulomb	20	2	28	0	1
	MSE Backfill / Abutment Headwall	High Strength	22				1



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Checked by:	XL	

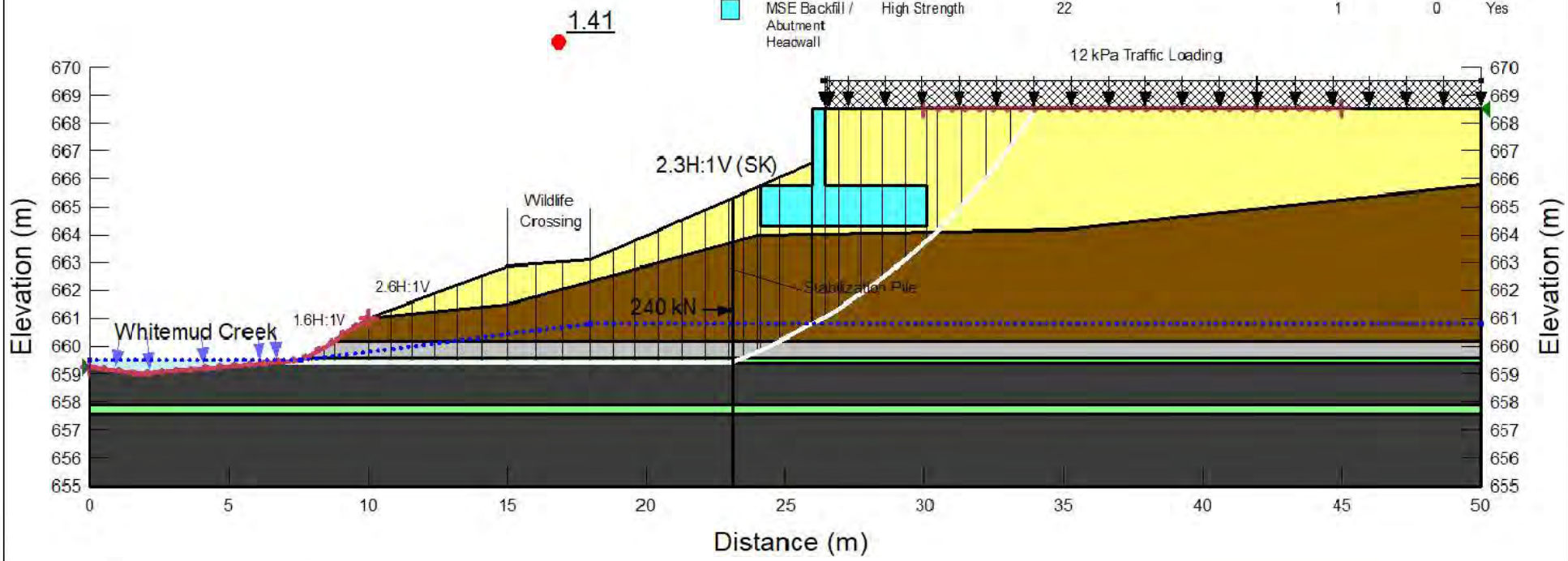
Title

Option 2: MSE Wall
No Stabilization Piles, Sliding Failure, Long-Term

Figure No.

D18

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	0	1	0.2	No
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	0	1	0	No
	Embankment	Mohr-Coulomb	20	2	28	0	1	0	Yes
	MSE Backfill / Abutment Headwall	High Strength	22				1	0	Yes



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Checked by: XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A1

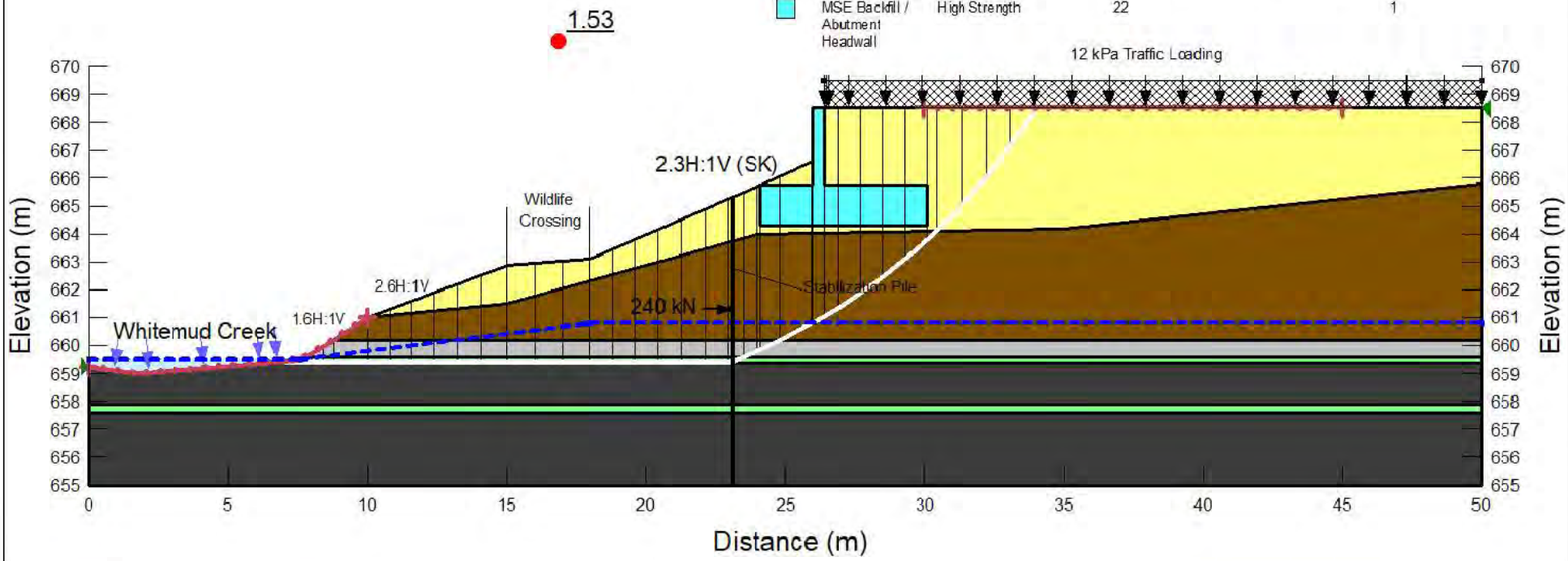
Title

Option 2: MSE Wall
With Stabilization Piles, Short Term

Figure No.

D19

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment	Mohr-Coulomb	20	2	28	0	1
	MSE Backfill / Abutment Headwall	High Strength	22				1



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Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A1

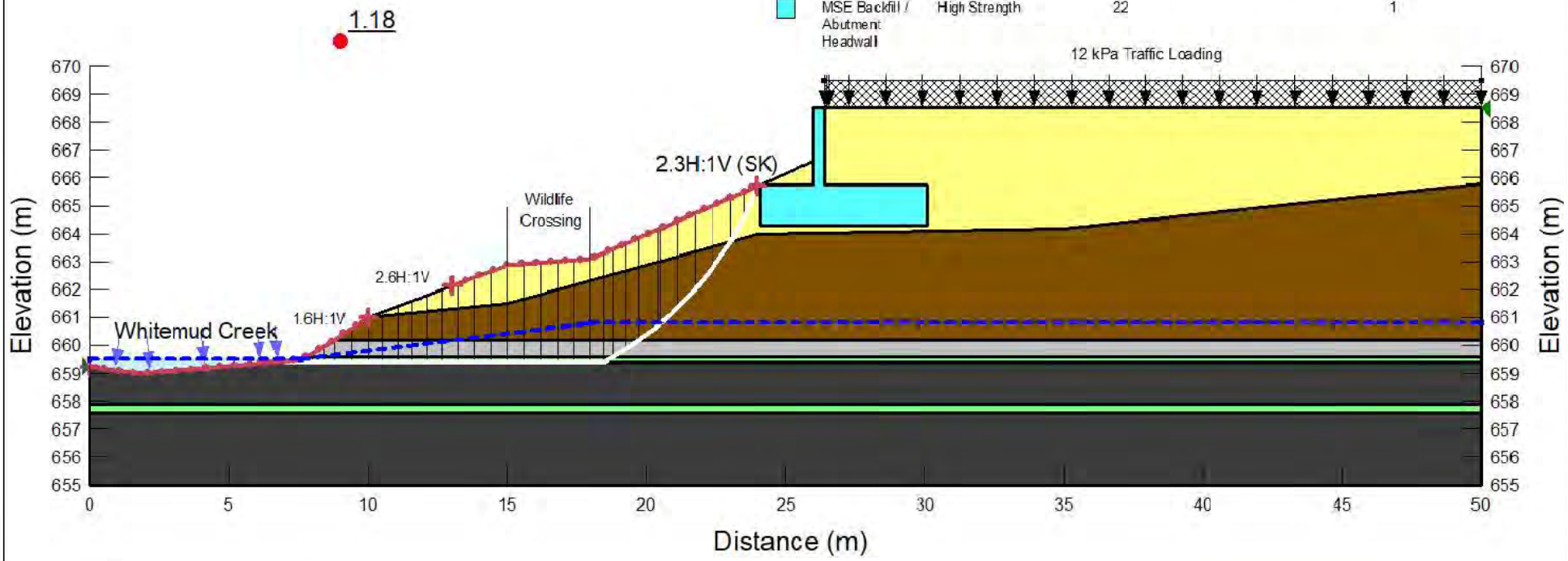
Title

Option 2: MSE Wall
With Stabilization Piles, Long Term

Figure No.

D20

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment	Mohr-Coulomb	20	2	28	0	1
	MSE Backfill / Abutment Headwall	High Strength	22				1



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Scale: ---
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Prepared by: LC
Checked by: XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A1

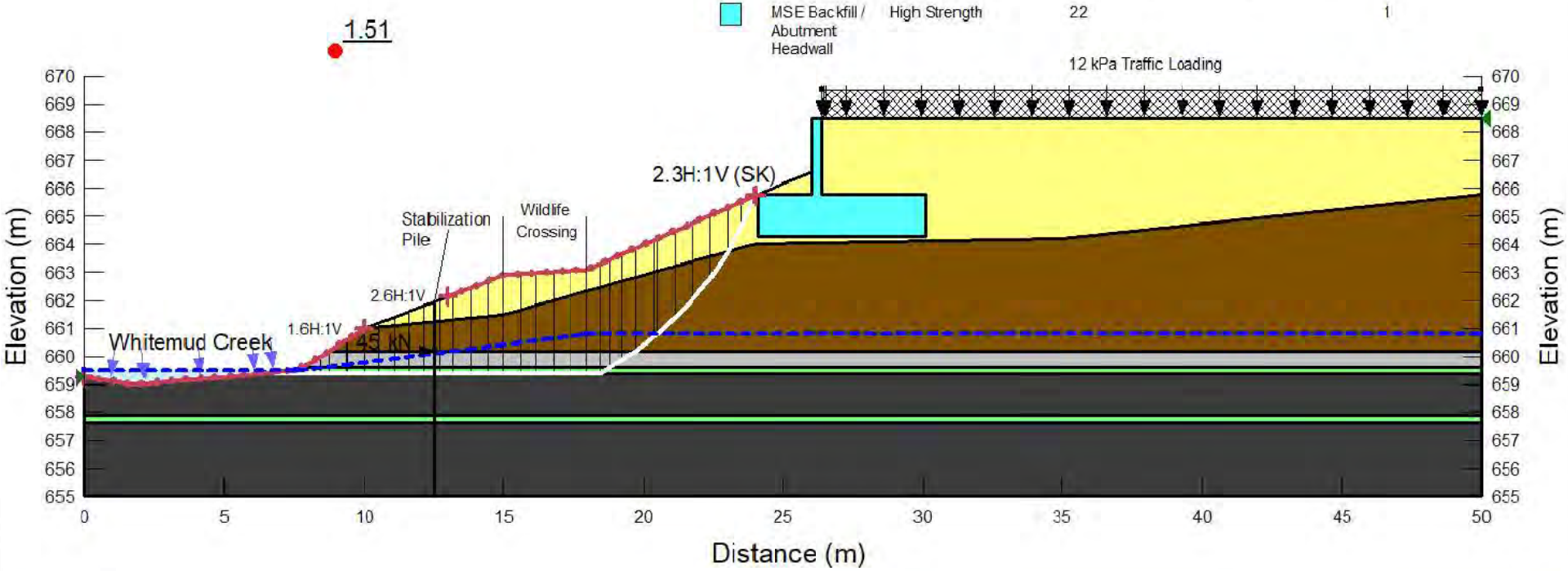
Title

Option 2: MSE Wall
Head Slope Failure, No Piles

Figure No.

D21

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment	Mohr-Coulomb	20	2	28	0	1
	MSE Backfill / Abutment Headwall	High Strength	22				1



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Project No.: 1161110185
Scale: ---
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Prepared by: LC
Checked by: XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A1

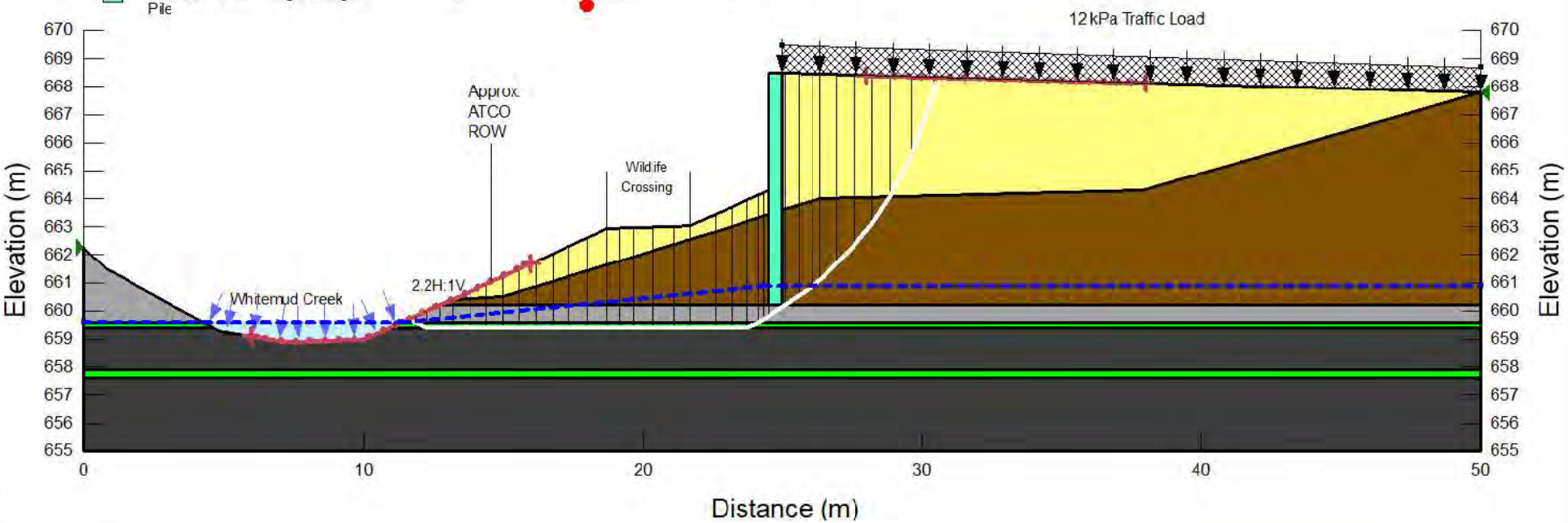
Title

Option 2: MSE Wall
Head Slope Failure, with Piles

Figure No.

D22

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A4
Checked by:	XL	

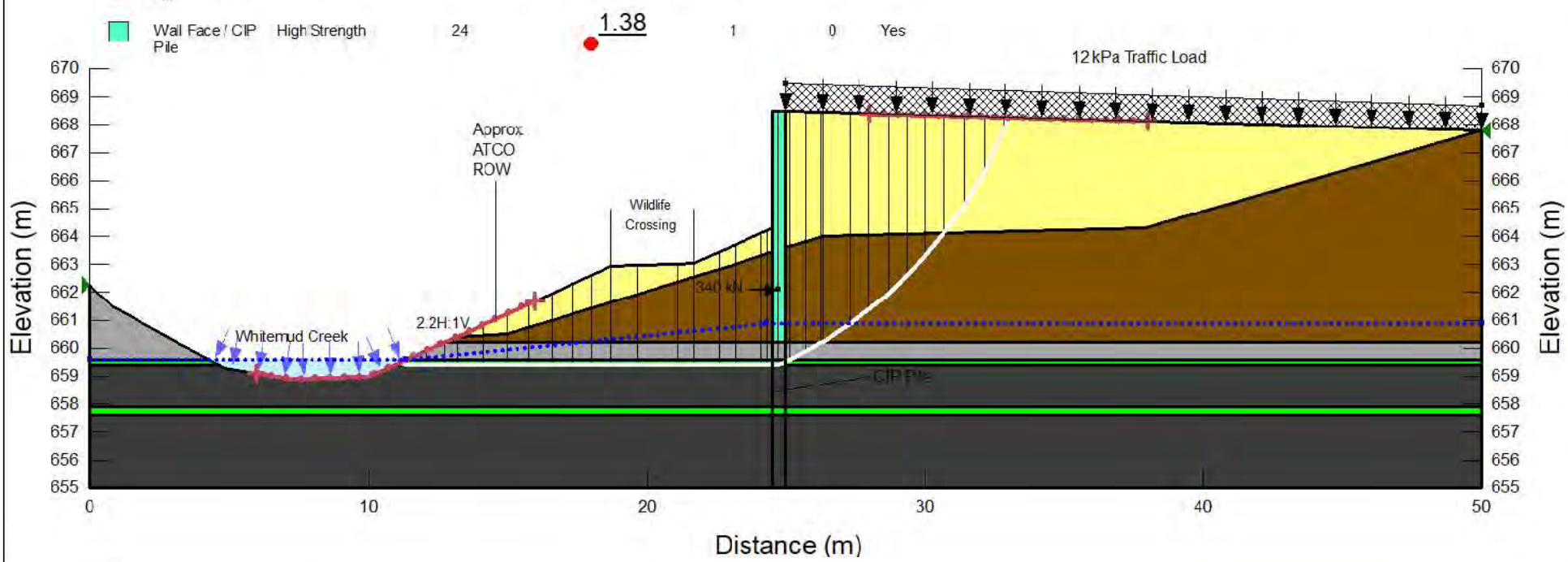
Title

Option 1: Concrete Abutment Wall
No Stabilization Piles, Long Term

Figure No.

D23

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	0	1	0.2	No
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	0	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1	0	Yes
	Wall Face / CIP Pile	High Strength	24				1	0	Yes



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Project No.:	1161110185	Client/Project
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Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A4
Checked by:	XL	

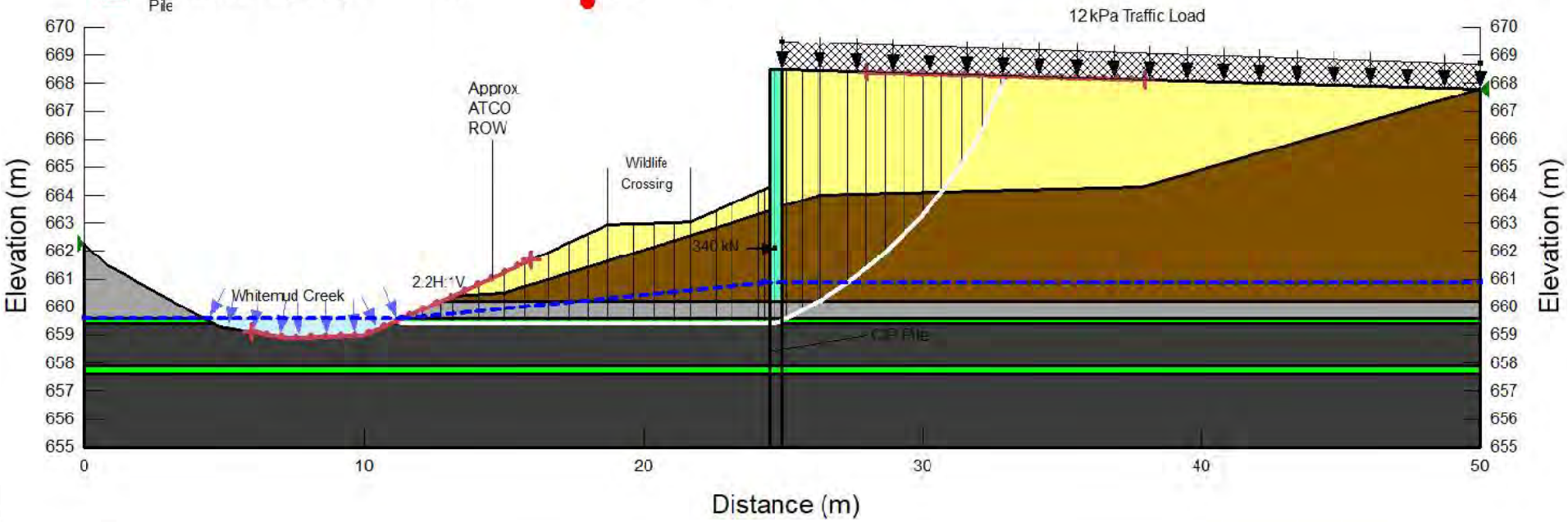
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Short Term

Figure No.

D24

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



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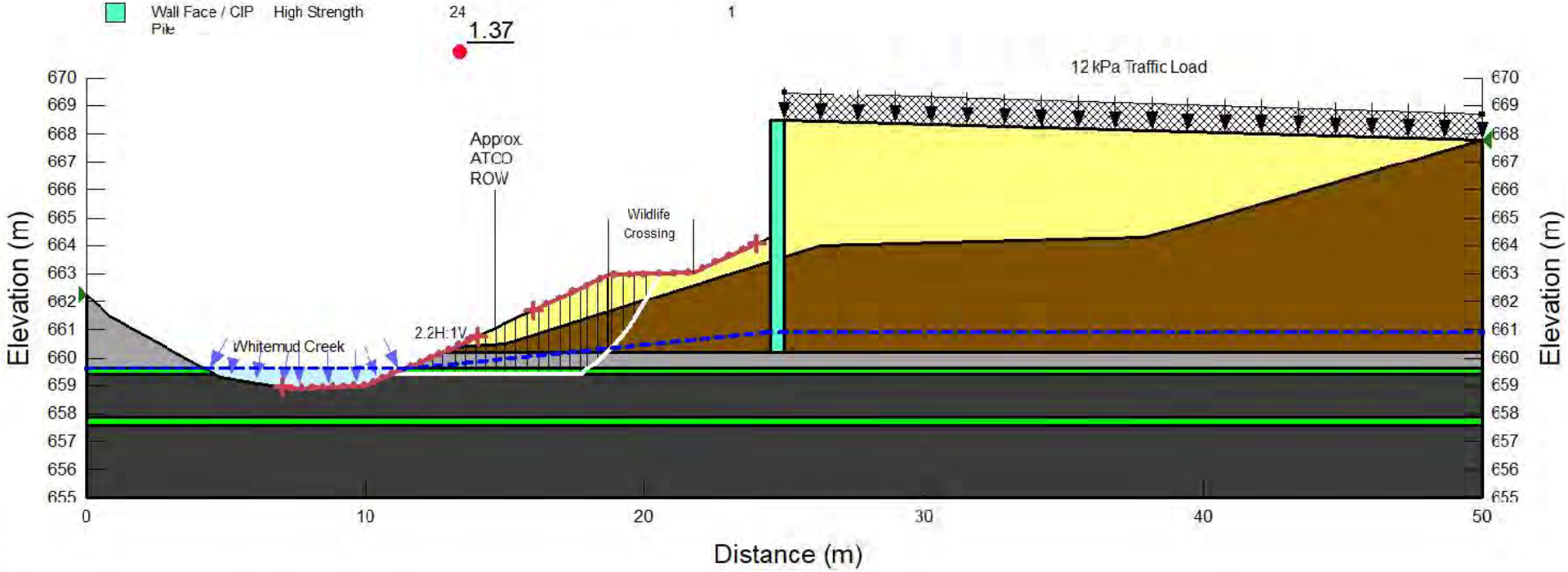
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Long Term

Figure No.

D25

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Project No.:	1161110185	Client/Project
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Prepared by:	LC	Bridge Crossing - Section A4
Checked by:	XL	

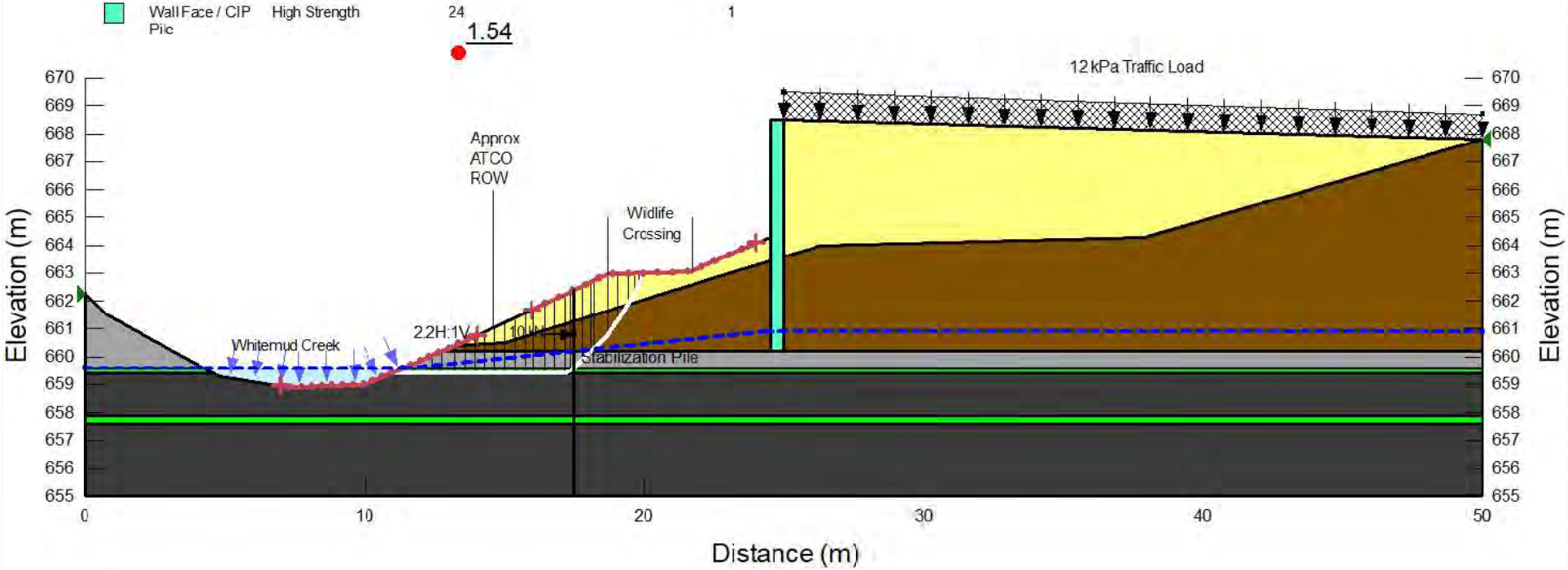
Title

Option 1: Concrete Abutment Wall
Head Slope Failure, No Piles

Figure No.

D26

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fil	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Project No.:	1161110185	Client/Project
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Prepared by:	LC	Bridge Crossing - Section A4
Checked by:	XL	

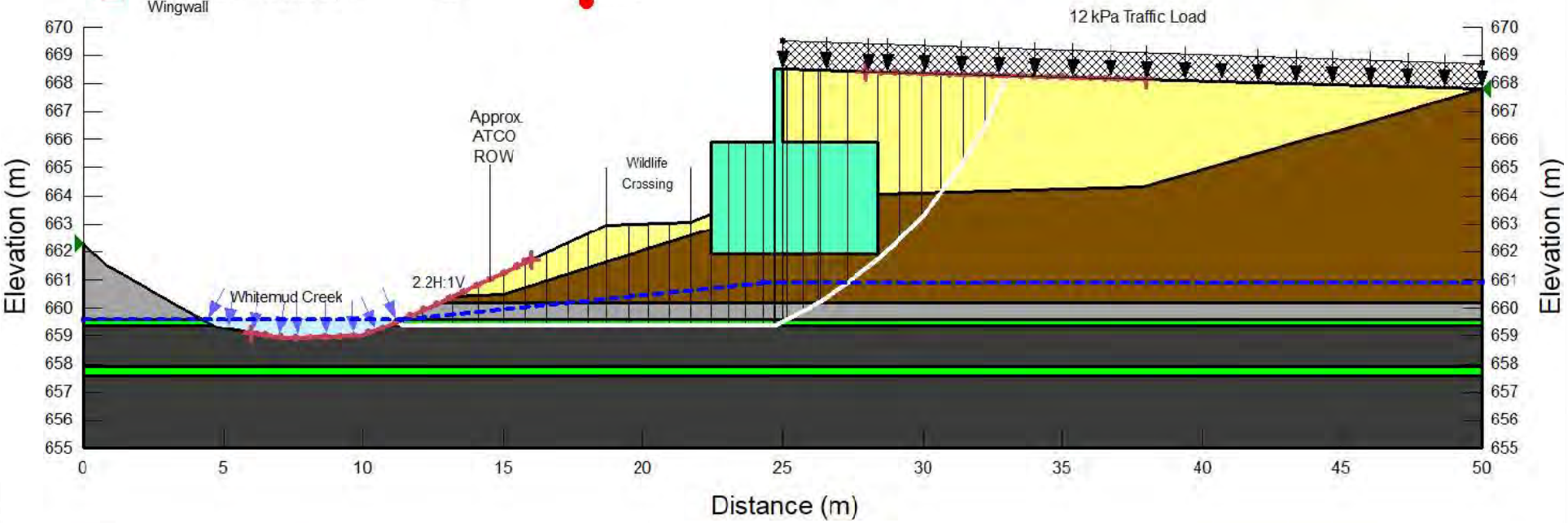
Title

Option 1: Concrete Abutment Wall
Head Slope Failure, with Piles

Figure No.

D27

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill / Wingwall	High Strength	22				1



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Date:	Jan 30, 2023
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Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A4

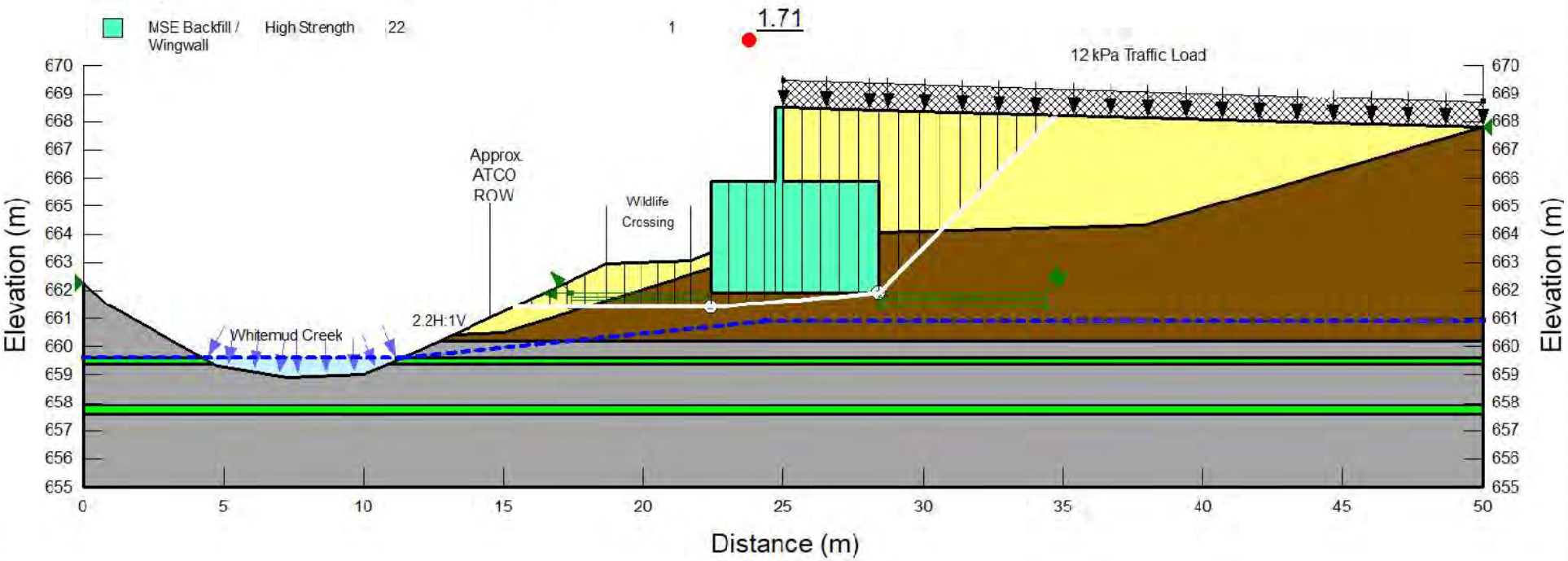
Title

Option 2: MSE Wall
No Stabilization Piles, Long Term

Figure No.

D28

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill / Wingwall	High Strength	22				1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A4
Checked by:	XL	

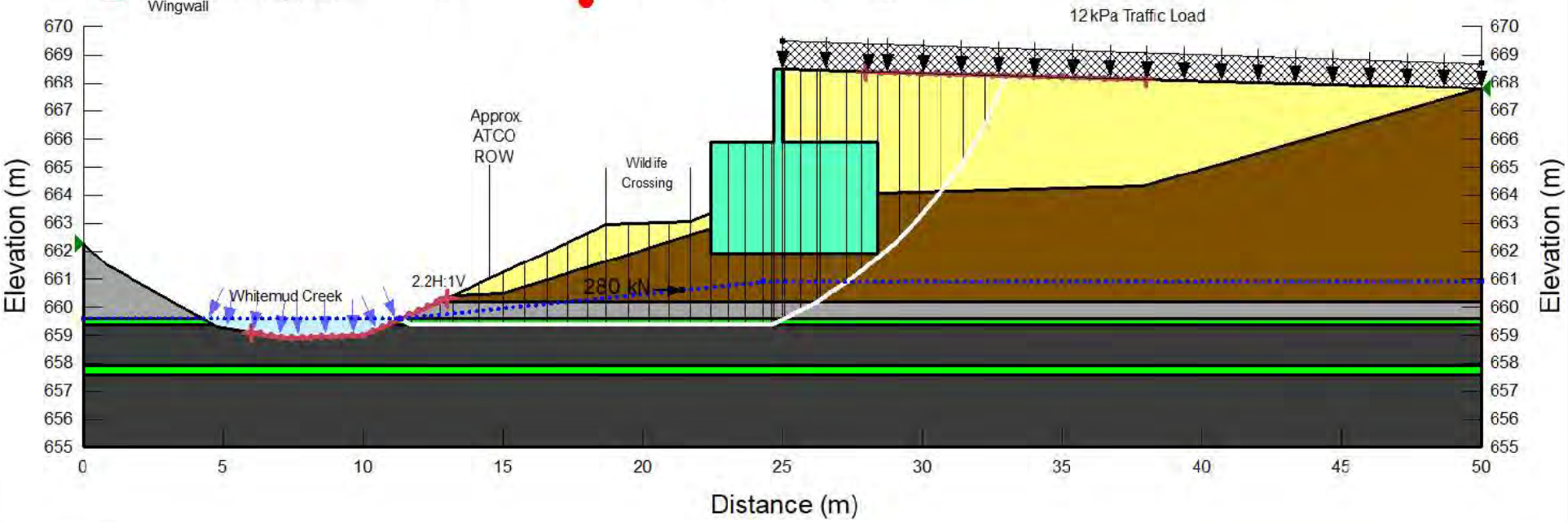
Title

Option 2: MSE Wall
No Stabilization Piles, Sliding Failure, Long-Term

Figure No.

D29

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	0	1	0.2	No
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	0	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1	0	Yes
	MSE Backfill / Wingwall	High Strength	22				1	0	Yes



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Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A4

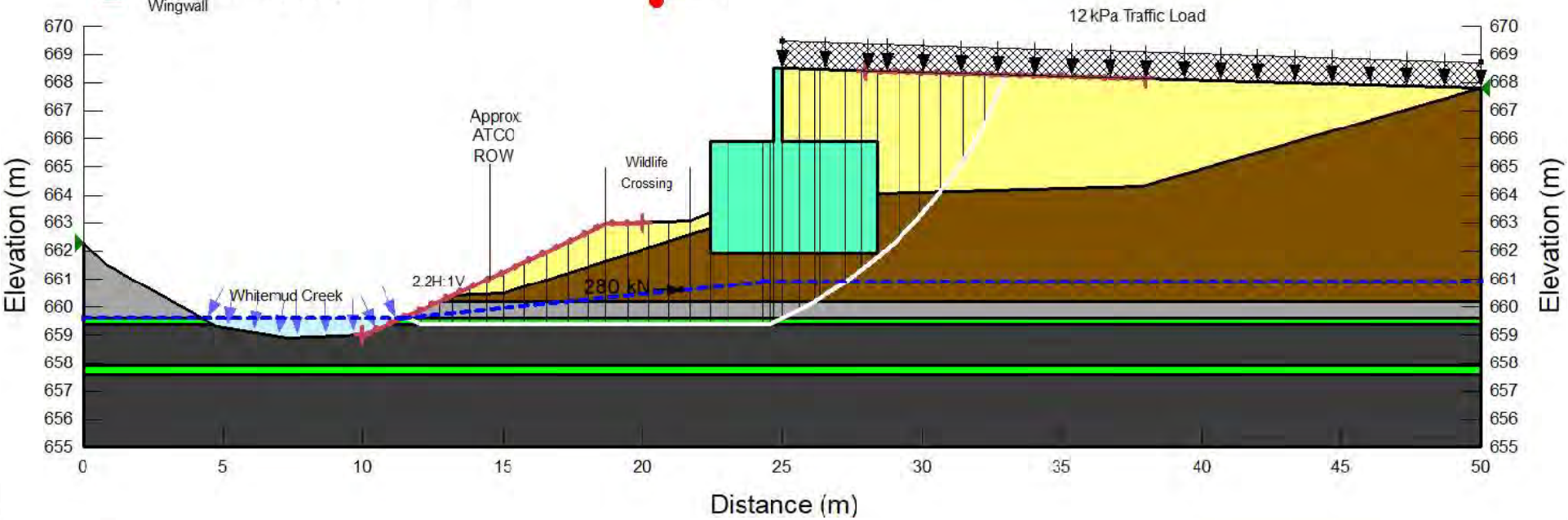
Title

Option 2: MSE Wall
With Stabilization Piles, Short Term

Figure No.

D30

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill / Wingwall	High Strength	22				1



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Project No.:	1161110185
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Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A4

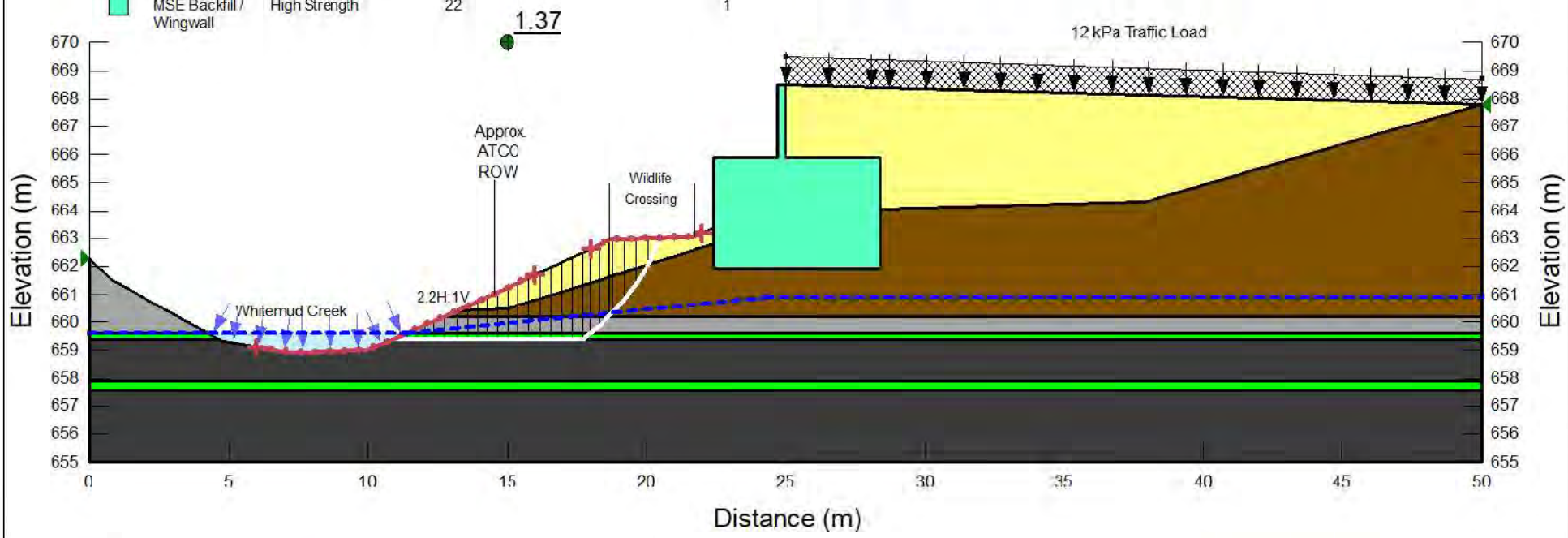
Title

Option 2: MSE Wall
With Stabilization Piles, Long Term

Figure No.

D31

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill / Wingwall	High Strength	22				1



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Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A4

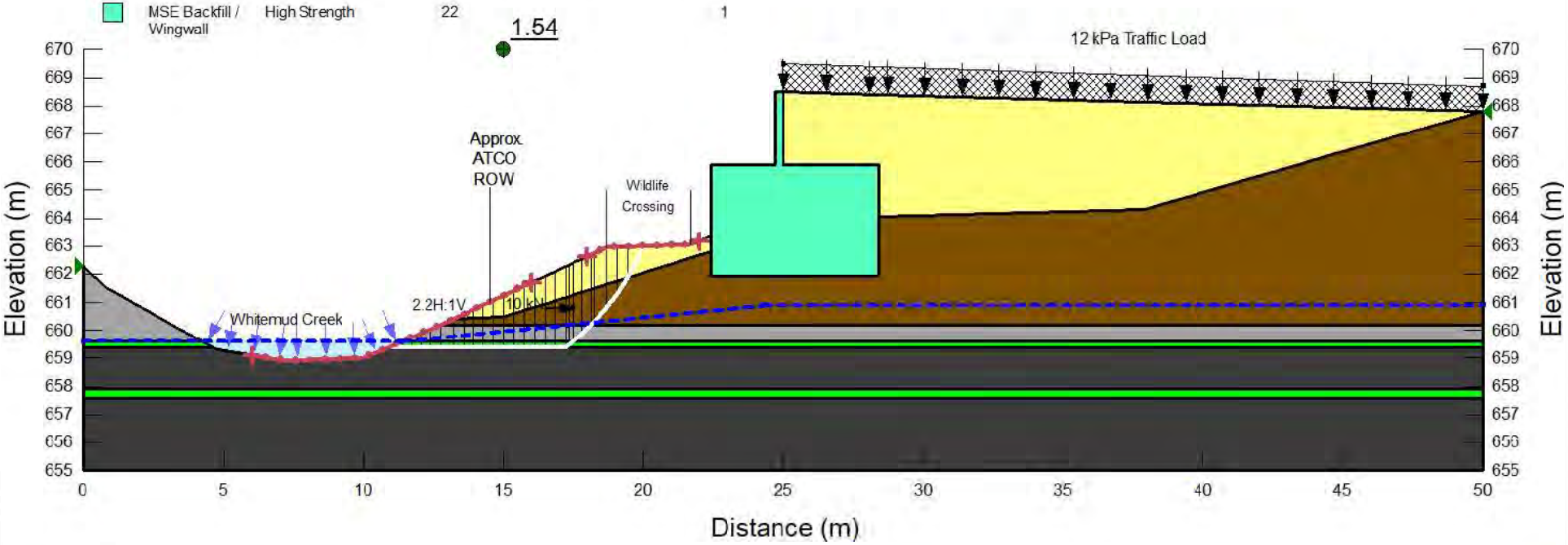
Title

Option 2: MSE Wall
Head Slope Failure, No Piles

Figure No.

D32

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill / Wingwall	High Strength	22				1



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Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section A4

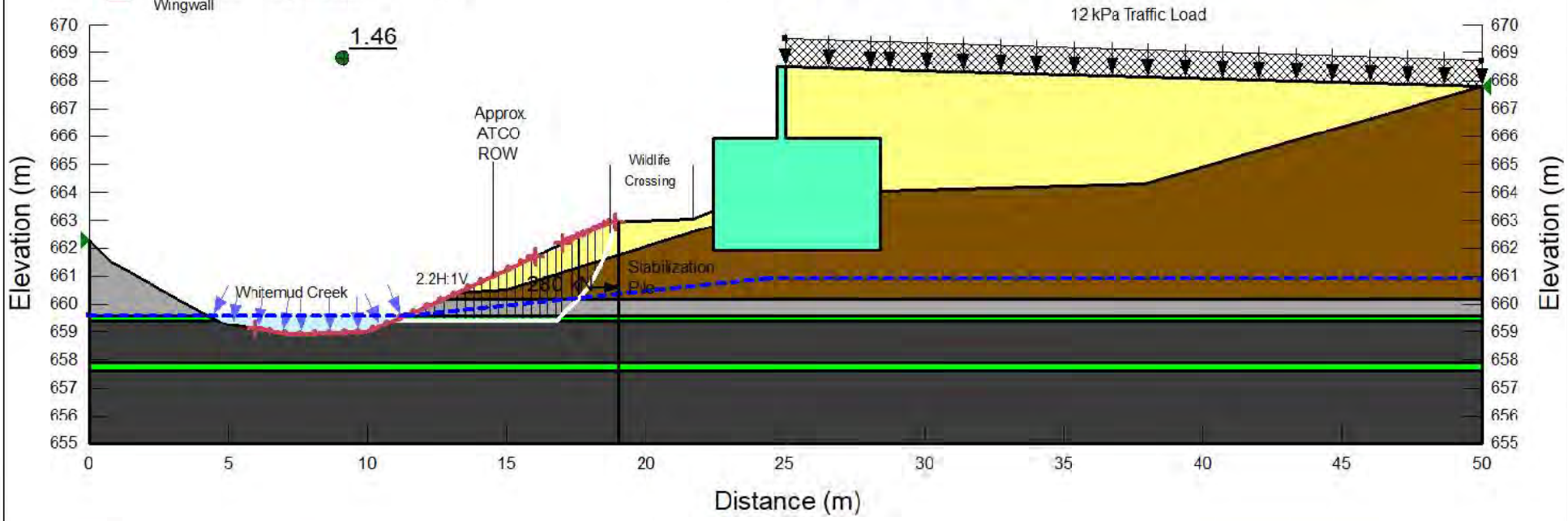
Title

Option 2: MSE Wall
Head Slope Failure, with Piles

Figure No.

D33

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill / Wingwall	High Strength	22				1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section A4
Checked by:	XL	

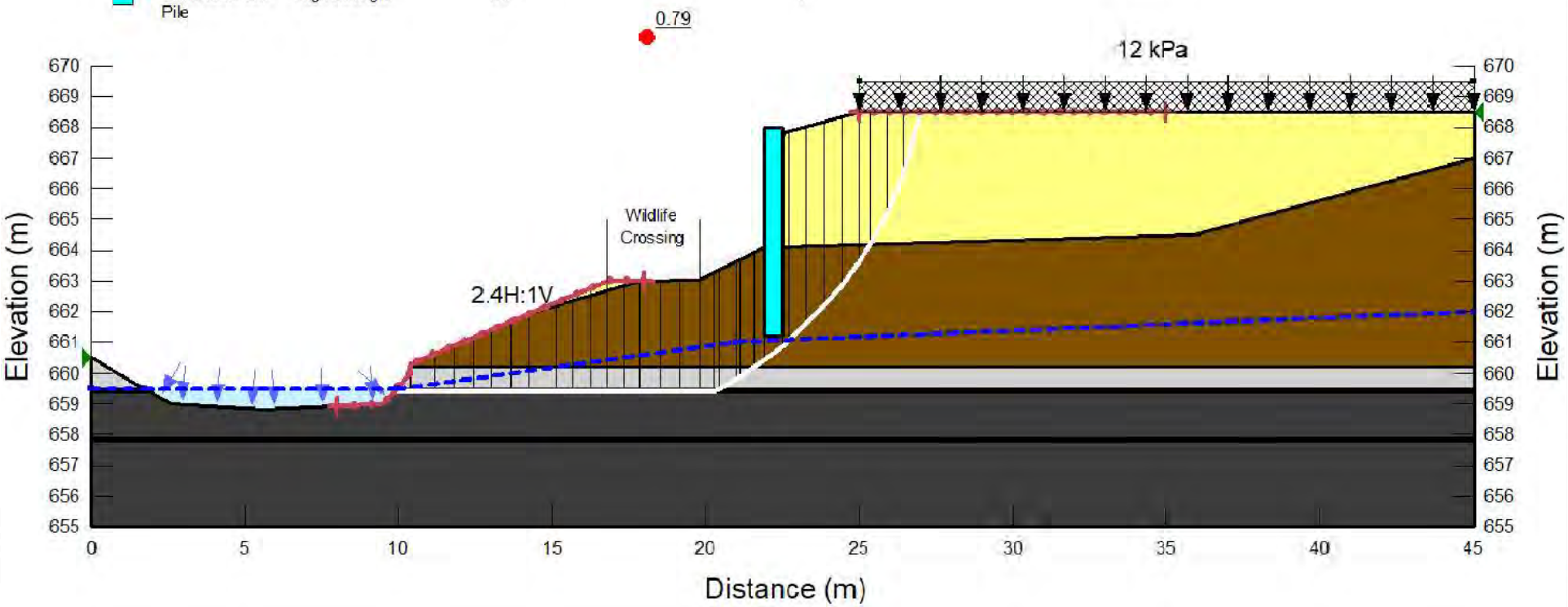
Title

Option 2: MSE Wall
Head Slope Failure, with Piles at Wildlife Crossing

Figure No.

D34

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section W2
Checked by:	XL	

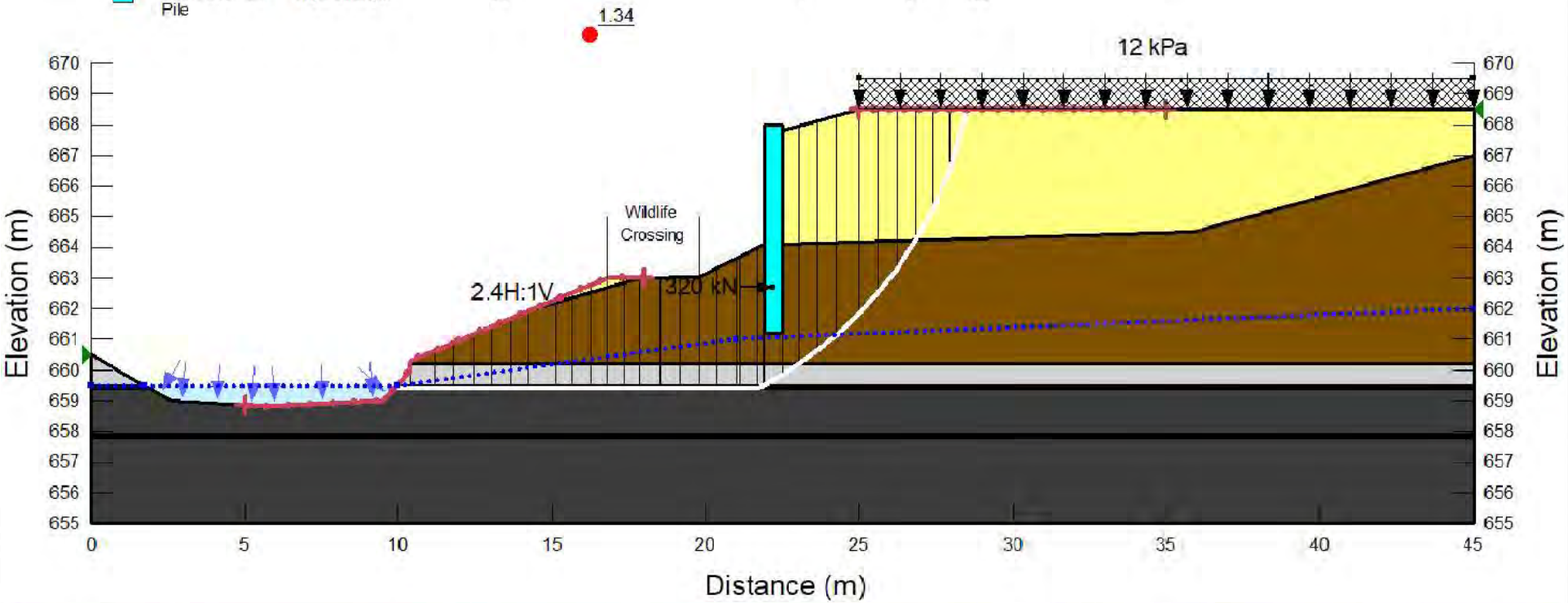
Title

Option 1: Concrete Abutment Wall
No Stabilization Piles, Long Term

Figure No.

D35

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	0	1	0.2	No
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	0	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1	0	Yes
	Wall Face / CIP Pile	High Strength	24				1	0	Yes



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Project No.:	1161110185	Client/Project
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Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section W2
Checked by:	XL	

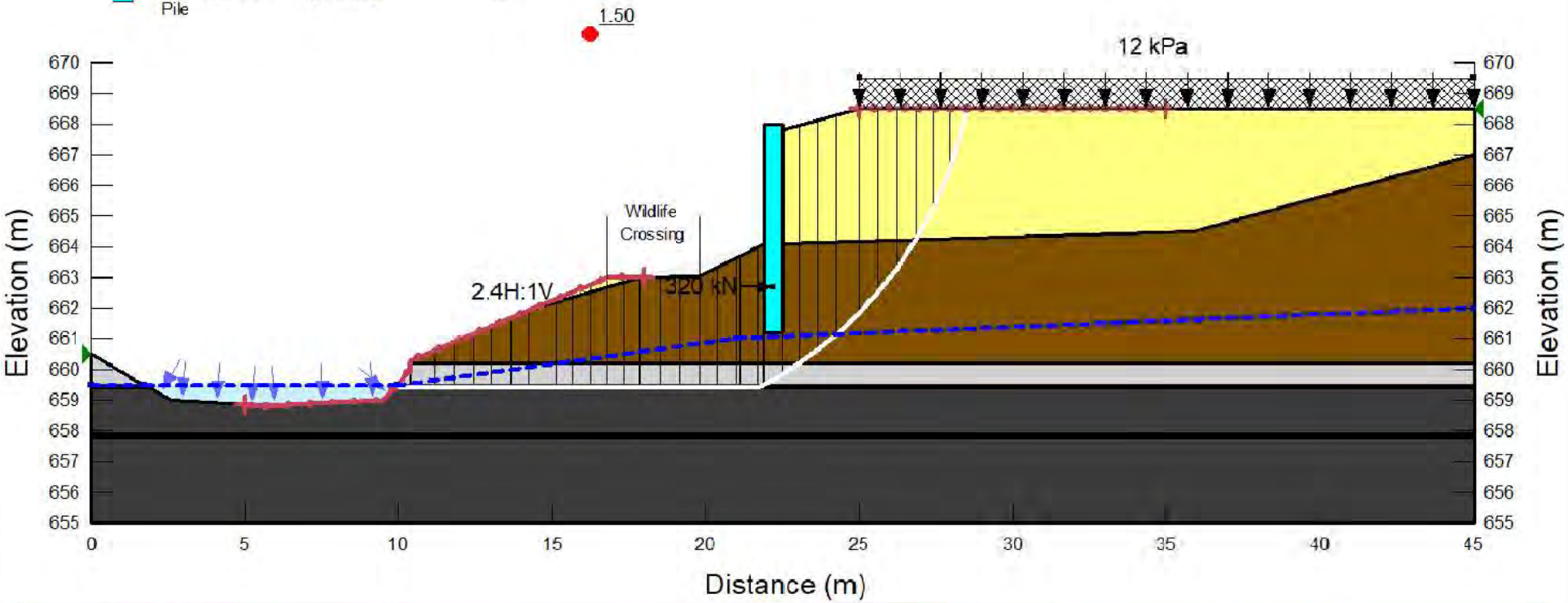
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Short Term

Figure No.

D36

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section W2
Checked by:	XL	

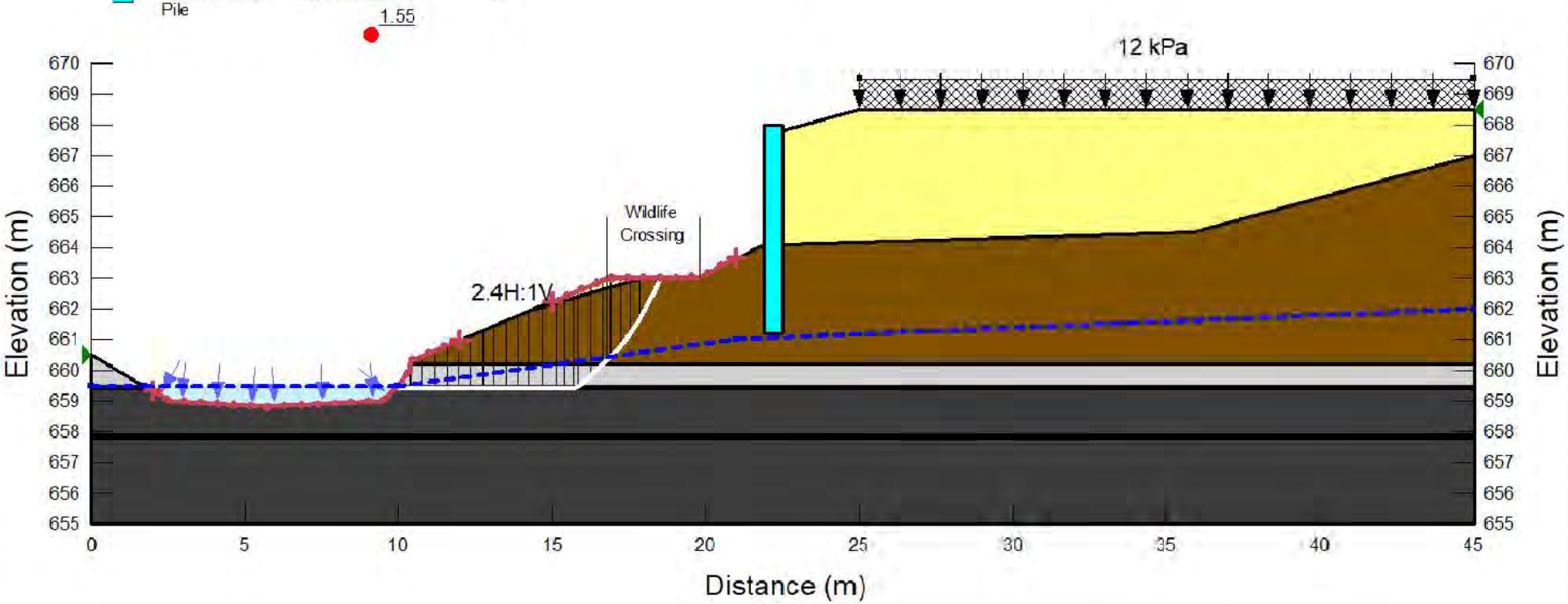
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Long Term

Figure No.

D37

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
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Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section W2

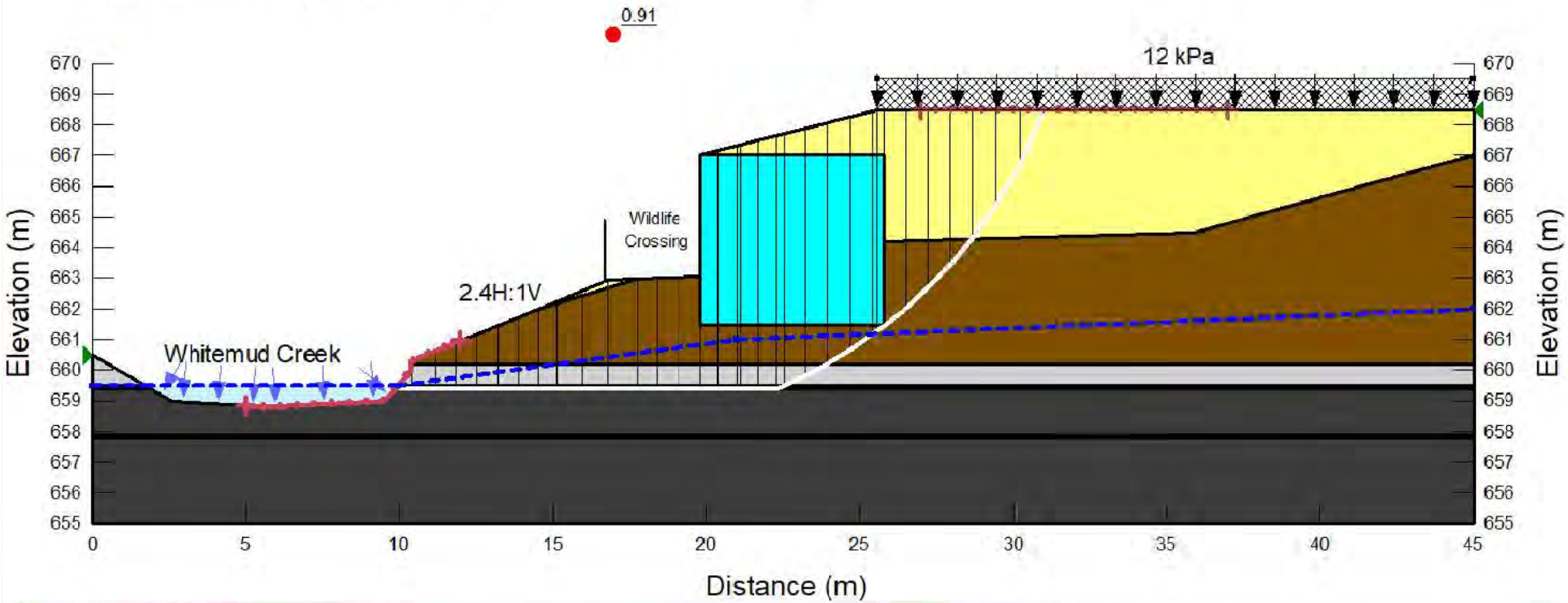
Title

Option 1: Concrete Abutment Wall
Head Slope Failure, No Piles

Figure No.

D38

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill	High Strength	24				1



Stantec

Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section W2

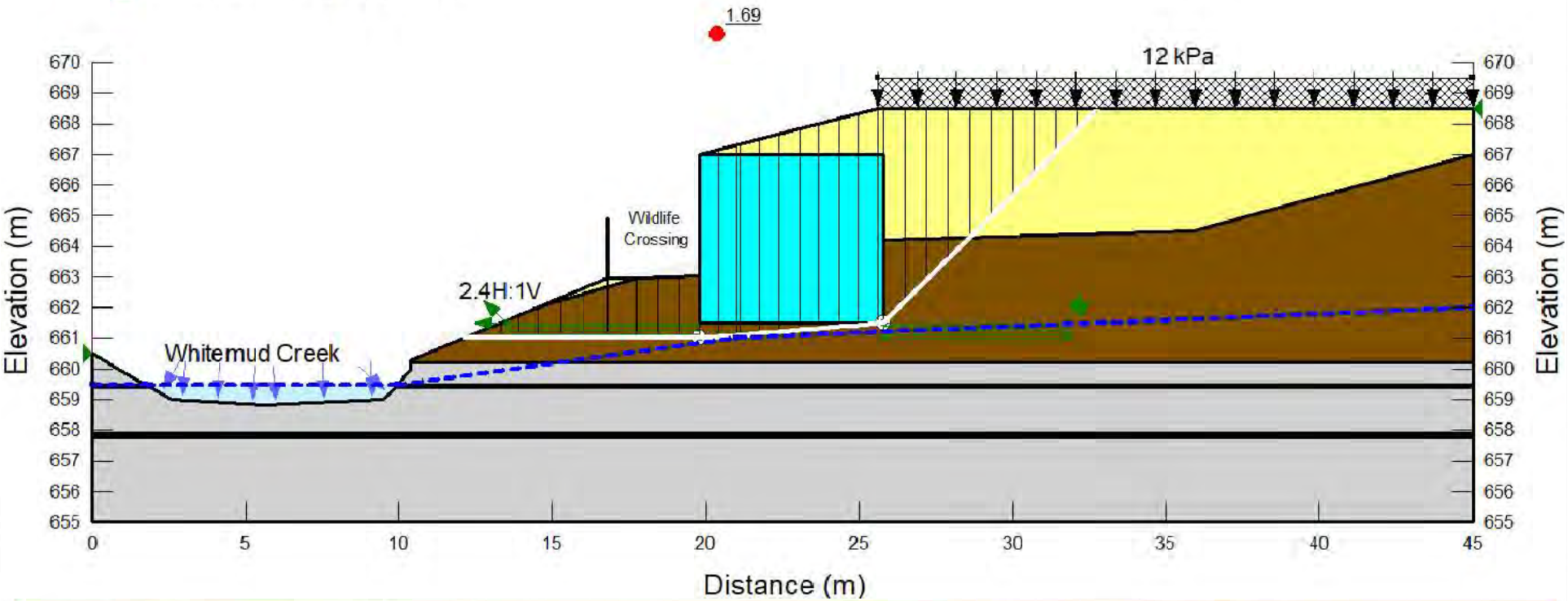
Title

Option 2: MSE Wall
No Stabilization Piles, Long Term

Figure No.

D39

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill	High Strength	24				1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section W2
Checked by:	XL	

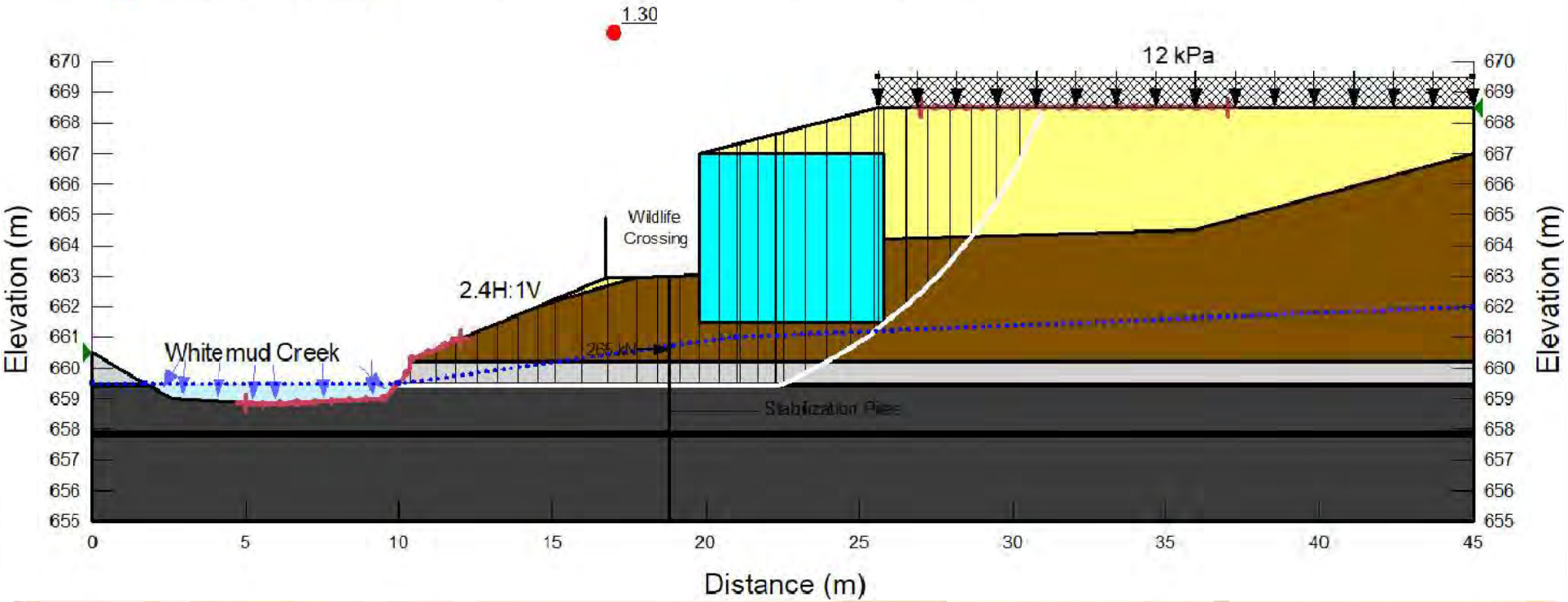
Title

Option 2: MSE Wall
No Stabilization Piles, Sliding Failure, Long-Term

Figure No.

D40

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	0	1	0.2	No
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	0	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1	0	Yes
	MSE Backfill	High Strength	24				1	0	Yes



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Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section W2

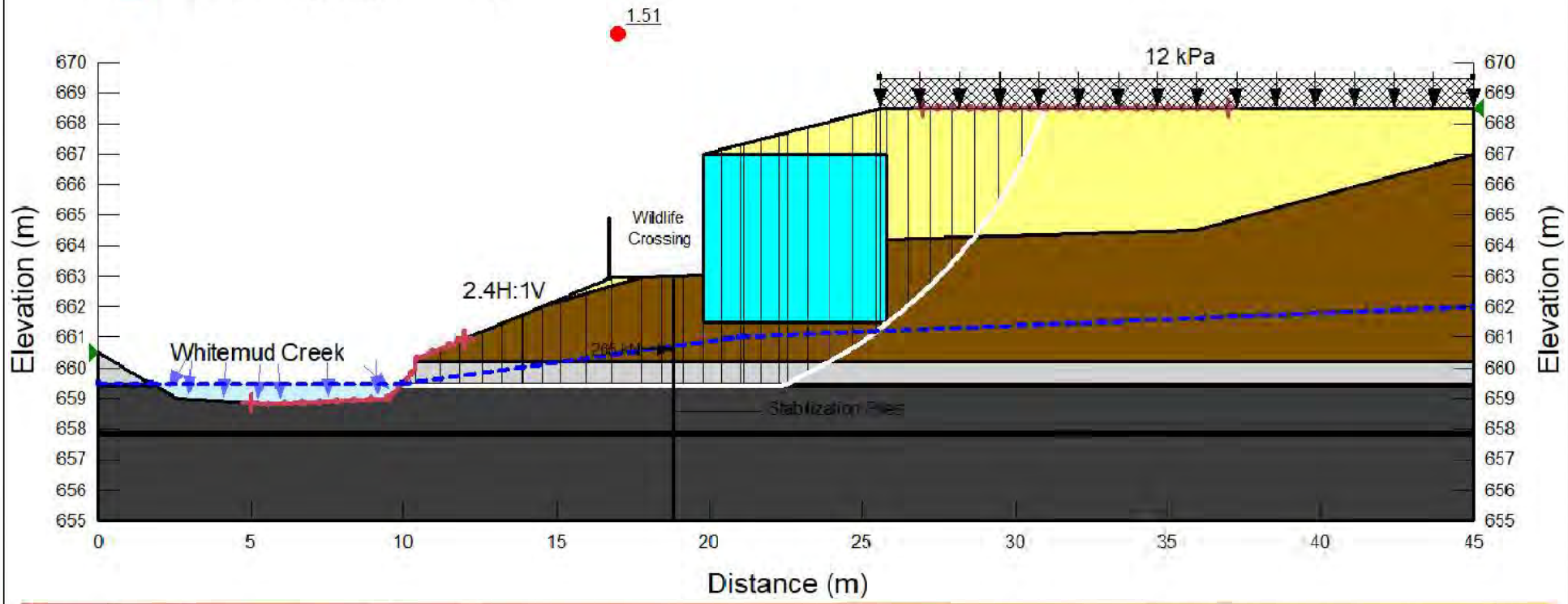
Title

Option 2: MSE Wall
With Stabilization Piles, Short Term

Figure No.

D41

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill	High Strength	24				1



Stantec

Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
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Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section W2

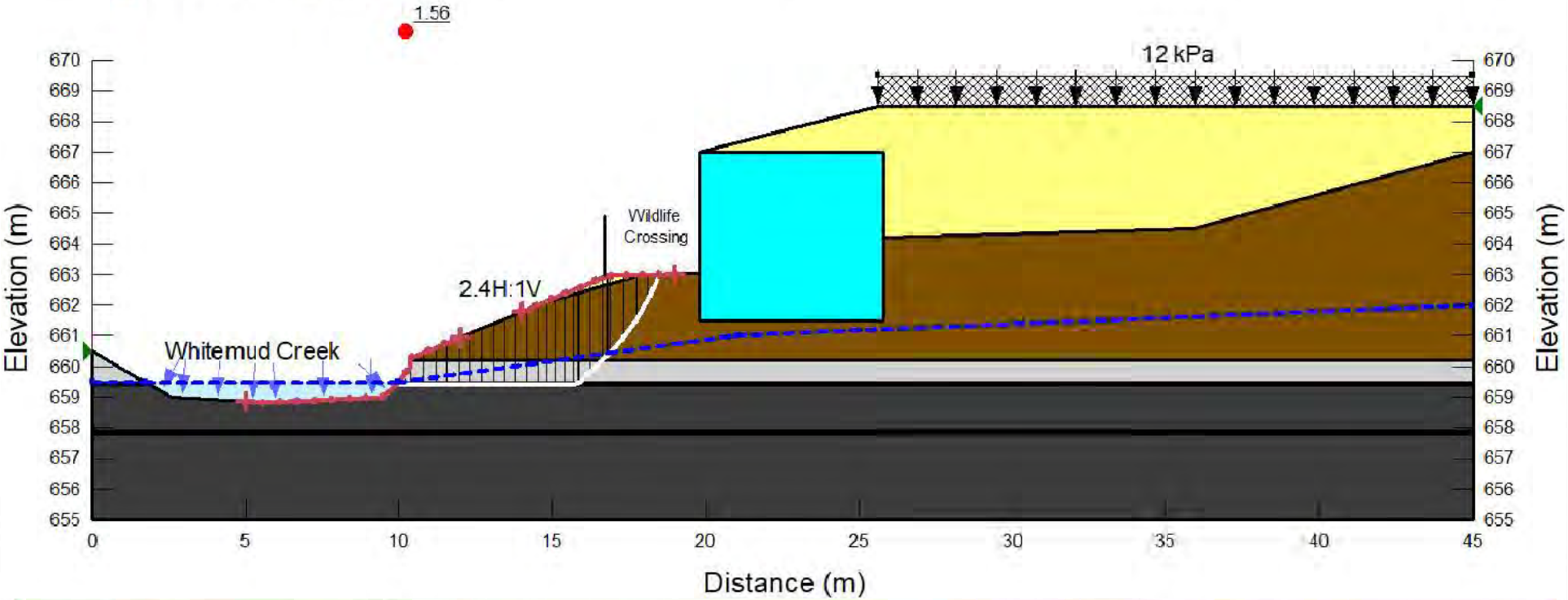
Title

Option 2: MSE Wall
With Stabilization Piles, Long Term

Figure No.

D42

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill	High Strength	24				1



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Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section W2

Title

Option 2: MSE Wall
Head Slope Failure, No Piles

Figure No.

D43

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1

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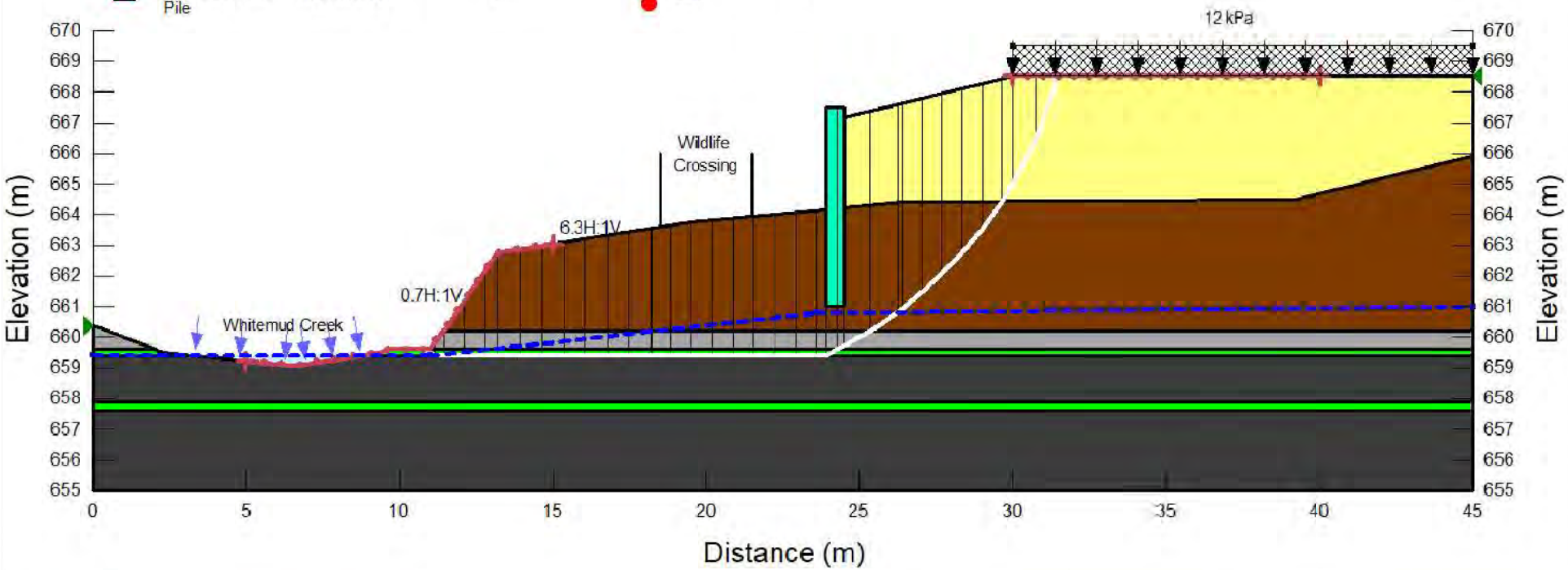

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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section W3
Checked by:	XL	

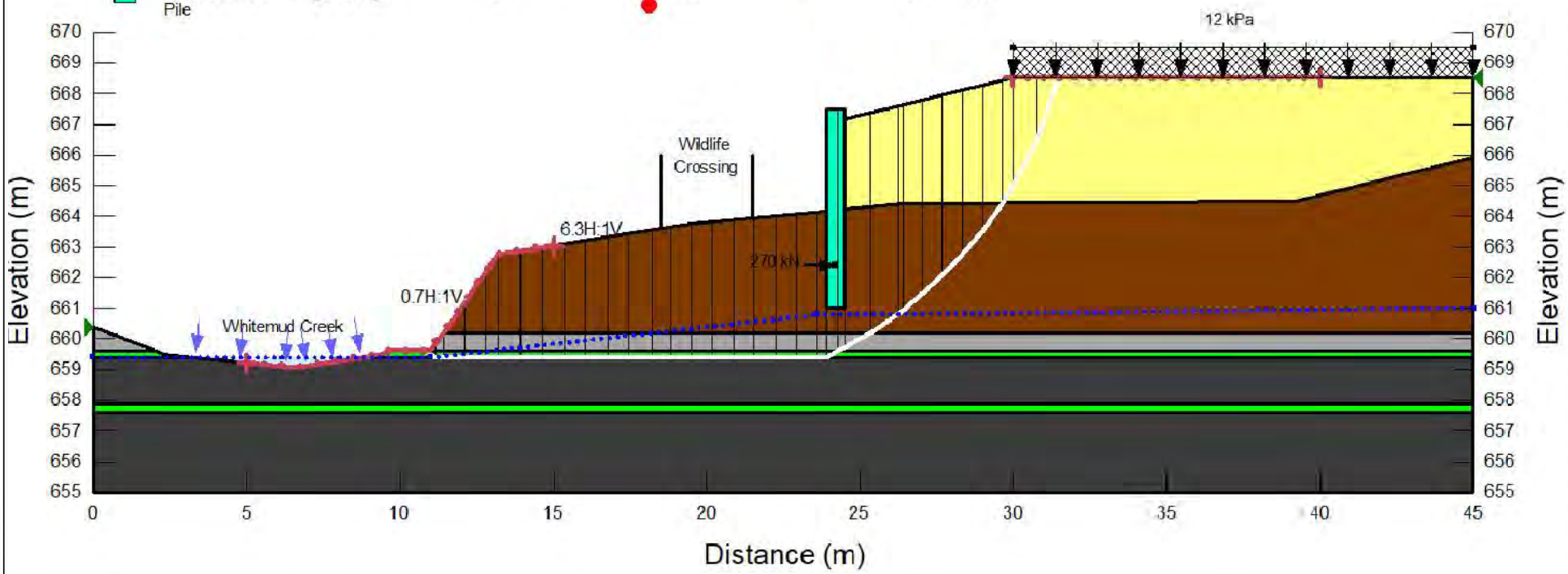
Title

Option 1: Concrete Abutment Wall
No Stabilization Piles, Long Term

Figure No.

D44

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	0	1	0.2	No
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	0	1	0	No
	Embankment Fil	Mohr-Coulomb	20	2	26	0	1	0	Yes
	Wall Face / CIP Pile	High Strength	24				1	0	Yes



Stantec

Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section W3
Checked by:	XL	

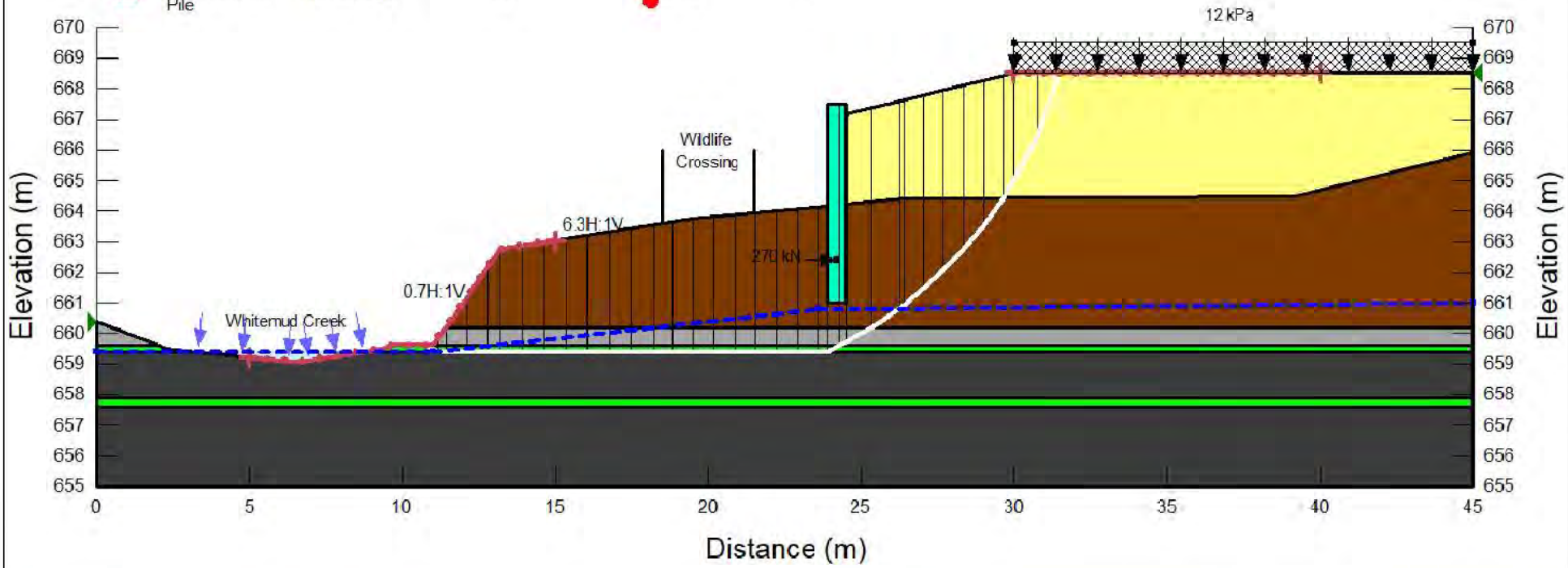
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Short Term

Figure No.

D45

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	Wall Face / CIP Pile	High Strength	24				1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section W3
Checked by:	XL	

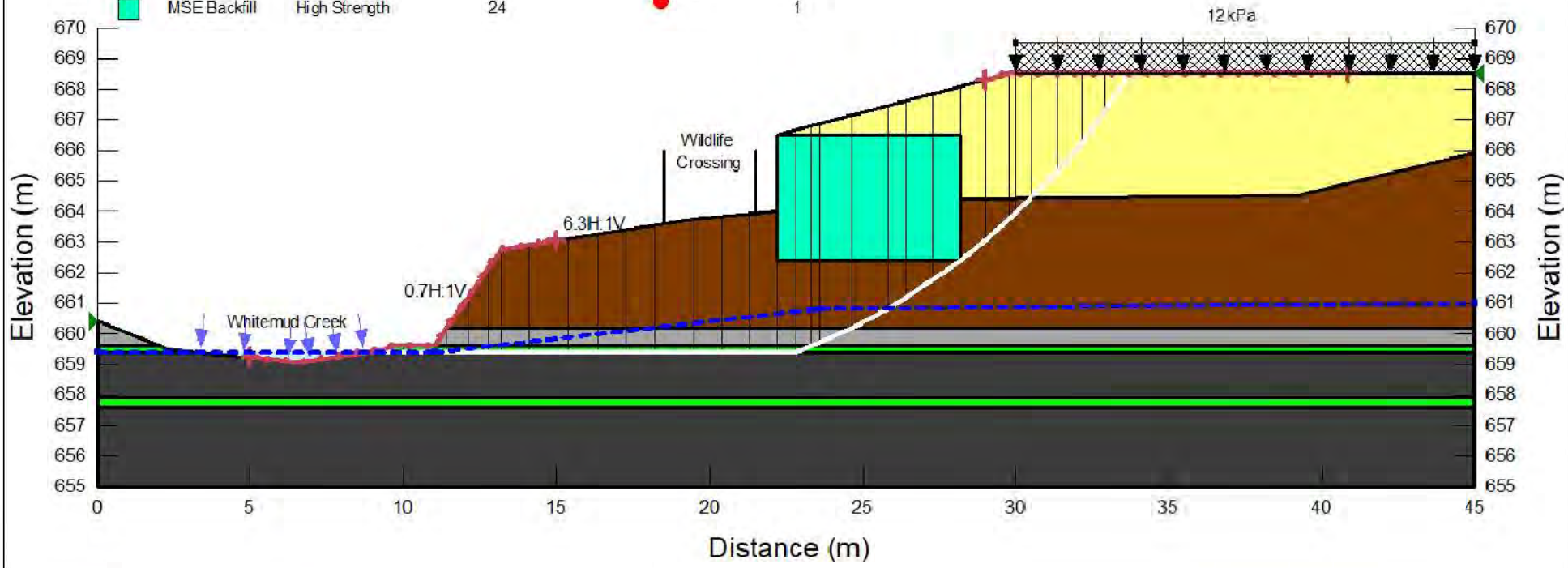
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Long Term

Figure No.

D46

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill	High Strength	24				1



Stantec

Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section W3

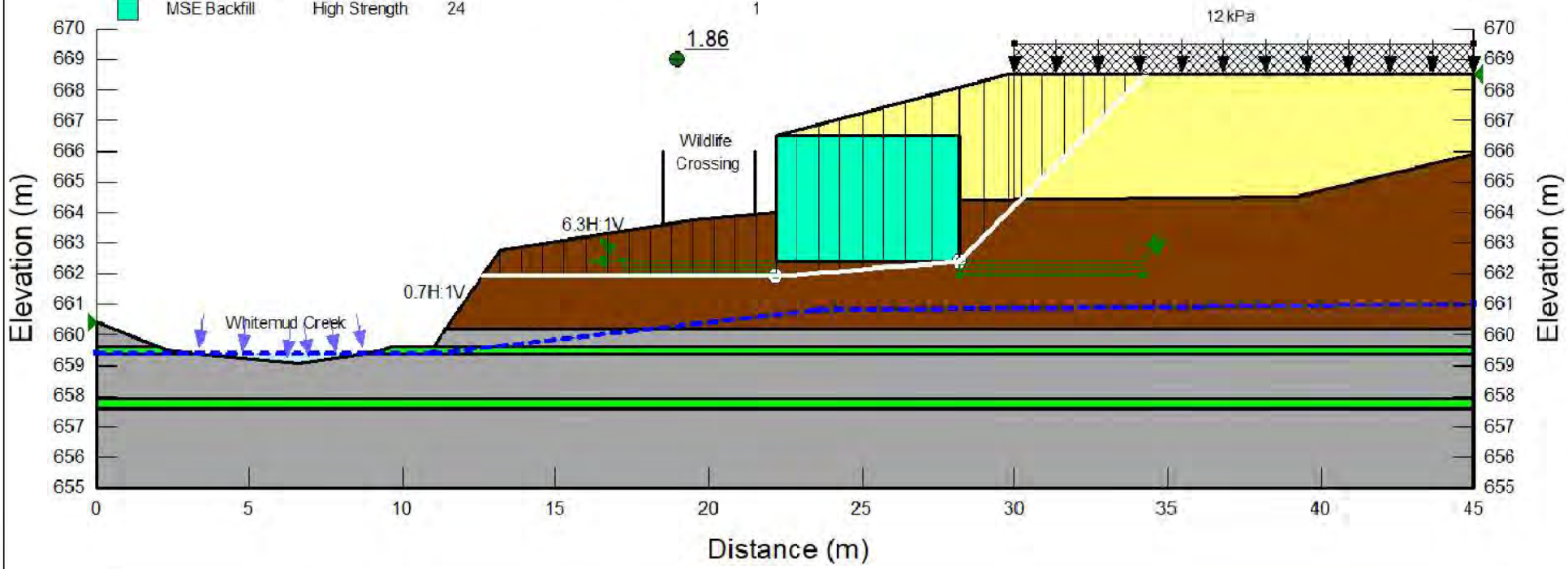
Title

Option 2: MSE Wall
No Stabilization Piles, Long Term

Figure No.

D47

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill	High Strength	24				1



Stantec

Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Jan 30, 2023	Ellerslie Road – Whitemud Creek
Prepared by:	LC	Bridge Crossing - Section W3
Checked by:	XL	

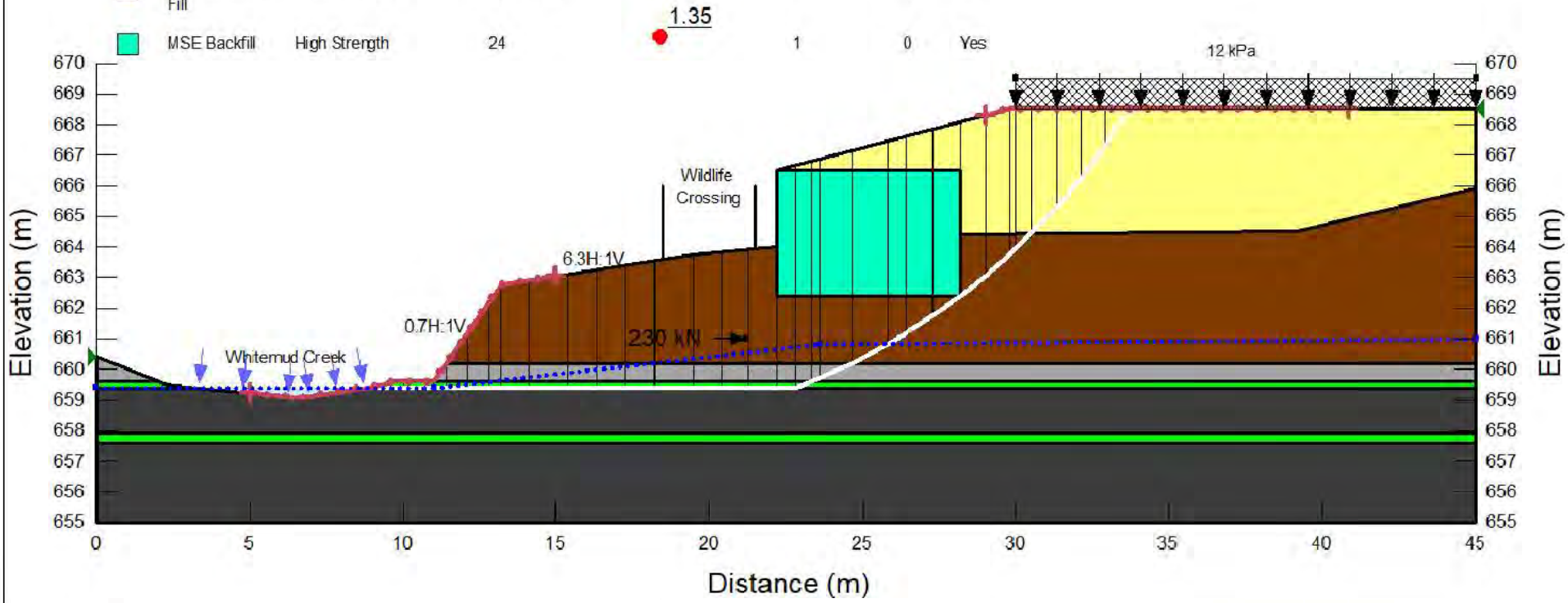
Title

Option 2: MSE Wall
No Stabilization Piles, Sliding Failure, Long-Term

Figure No.

D48

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	0	1	0.2	No
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	0	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1	0	Yes
	MSE Backfill	High Strength	24				1	0	Yes



Stantec

Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section W3

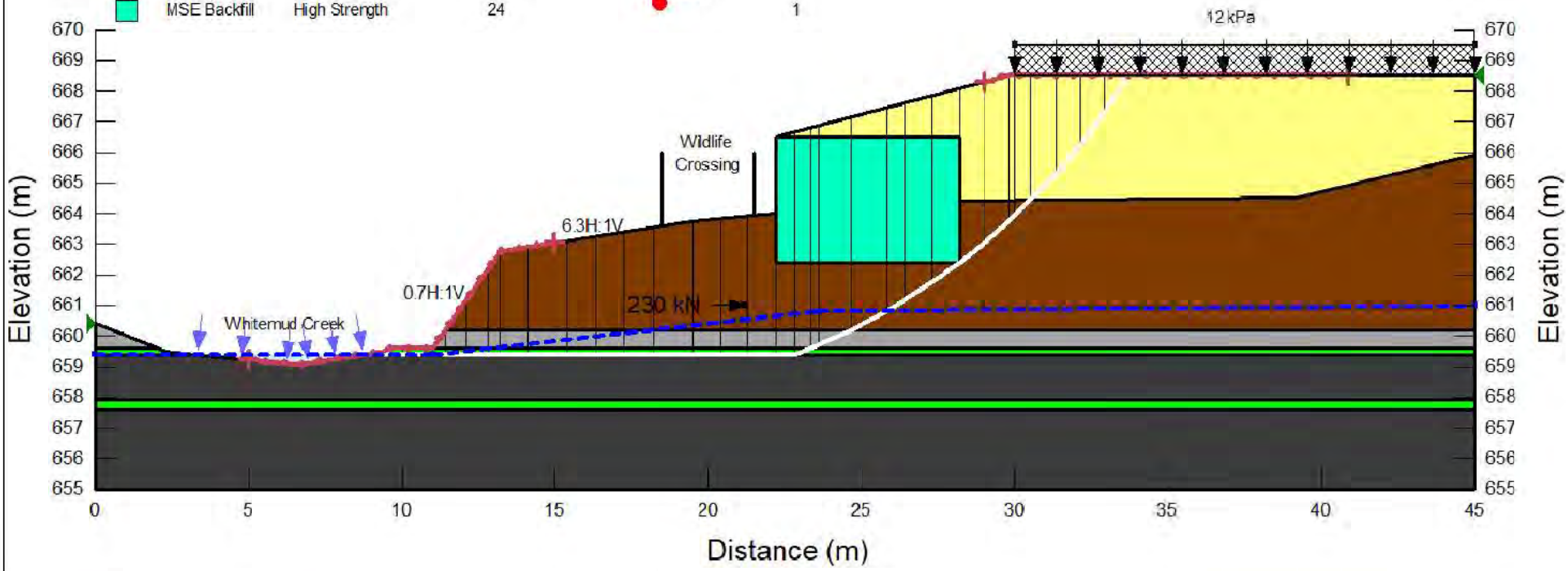
Title

Option 2: MSE Wall
With Stabilization Piles, Short Term

Figure No.

D49

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	0	1
	Bedrock	Mohr-Coulomb	21	50	22	0	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)					1
	Bentonite	Mohr-Coulomb	19	0	8	0	1
	Embankment Fill	Mohr-Coulomb	20	2	26	0	1
	MSE Backfill	High Strength	24				1



Stantec

Project No.:	1161110185
Scale:	---
Date:	Jan 30, 2023
Prepared by:	LC
Checked by:	XL

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek
Bridge Crossing - Section W3

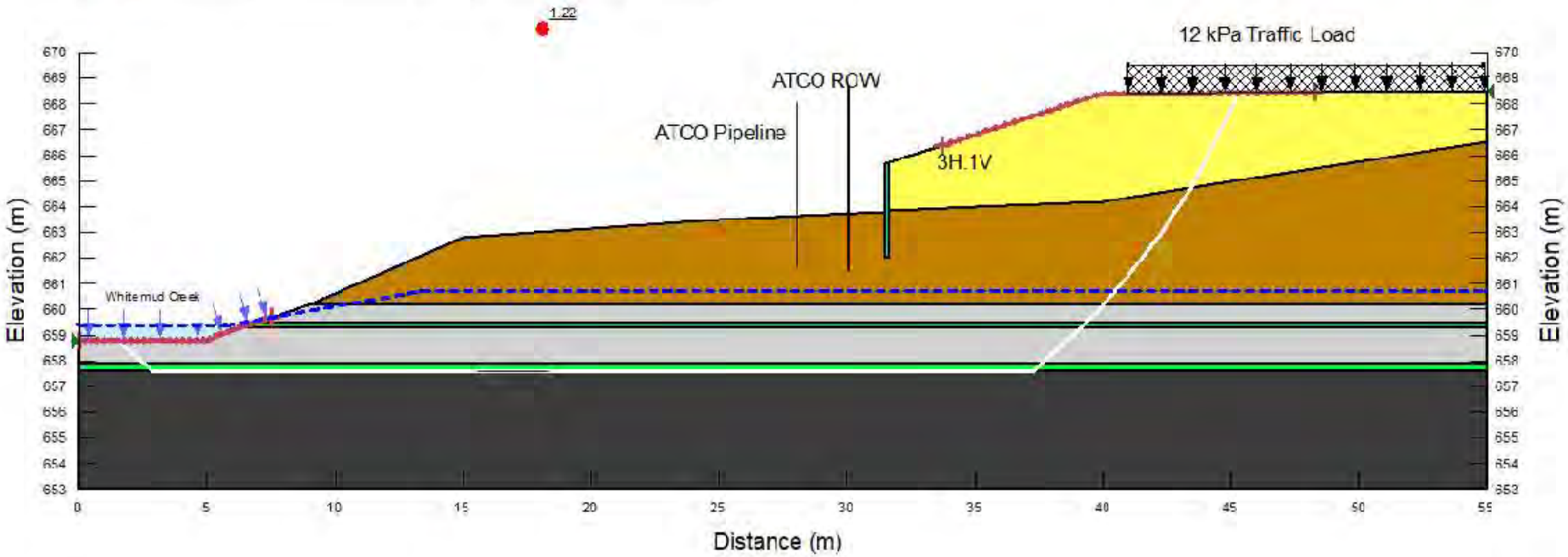
Title

Option 2: MSE Wall
With Stabilization Piles, Long Term

Figure No.

D50

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	19	2	24	1
	Bedrock	Mohr-Coulomb	21	50	22	1
	Bedrock (impenetrable)	Bedrock (Impenetrable)				1
	Bentonite	Mohr-Coulomb	19	0	8	1
	Embankment Fill	Mohr-Coulomb	20	7	28	1
	Wall Face / CIP Pile	High Strength	24			1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Oct.2022	Ellerslie Road – Whitemud Creek
Prepared by:	EH	Bridge Crossing - Section W6
Checked by:	LC	

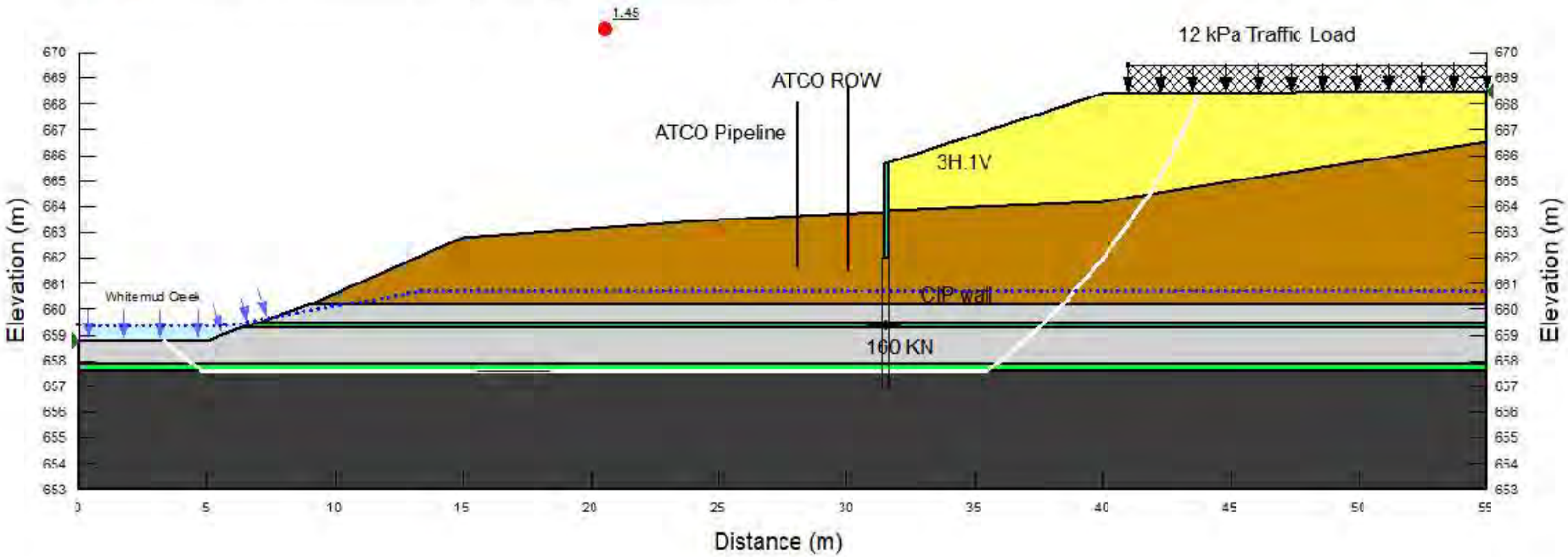
Title

Option 1: Concrete Abutment Wall
No Stabilization Piles, Long Term

Figure No.

D51

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line	Rbar	Add Weight
	Alluvial Clay	Mohr-Coulomb	19	2	24	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	1	0.2	No
	Bedrock (impenetrable)	Bedrock (Impenetrable)				1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	26	1	0	Yes
	Wall Face / CIP Pile	High Strength	24			1	0	No



Stantec

Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Oct.2022	Ellerslie Road – Whitemud Creek
Prepared by:	EH	Bridge Crossing - Section W6
Checked by:	LC	

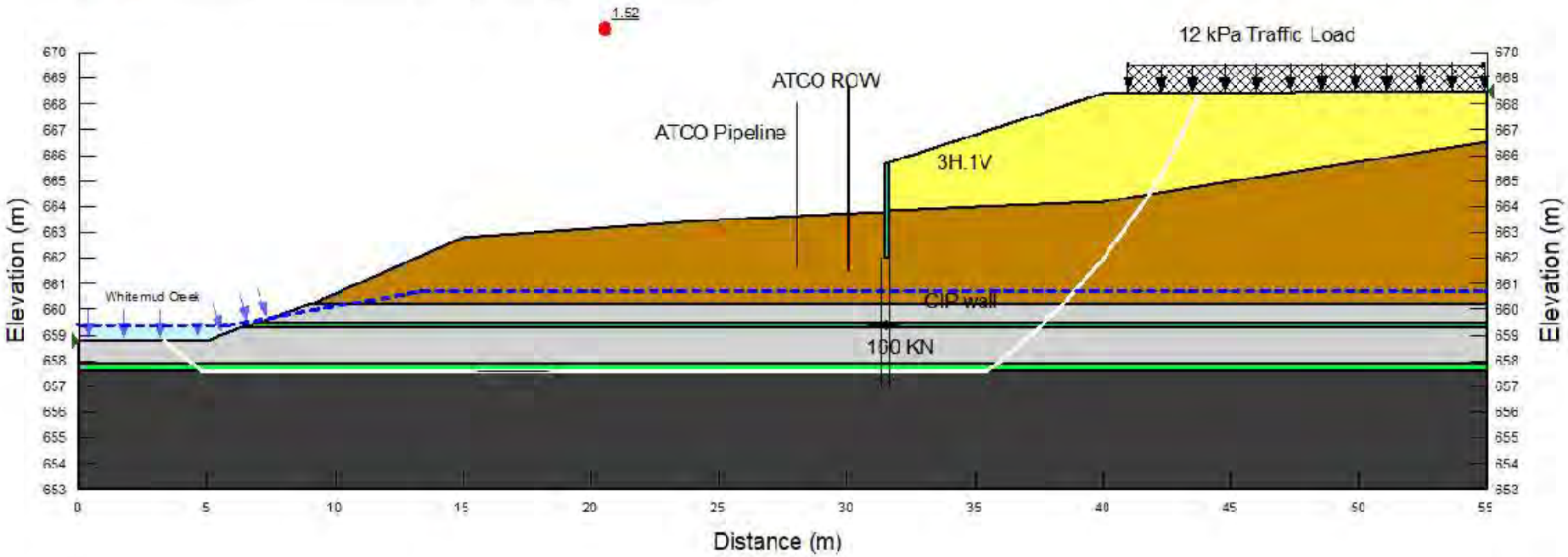
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Short Term

Figure No.

D52

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	19	2	24	1
	Bedrock	Mohr-Coulomb	21	50	22	1
	Bedrock (impenetrable)	Bedrock (Impenetrable)				1
	Bentonite	Mohr-Coulomb	19	0	8	1
	Embankment Fill	Mohr-Coulomb	20	7	28	1
	Wall Face / CIP Pile	High Strength	24			1



Stantec

Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Oct.2022	Ellerslie Road – Whitemud Creek
Prepared by:	EH	Bridge Crossing - Section W6
Checked by:	LC	

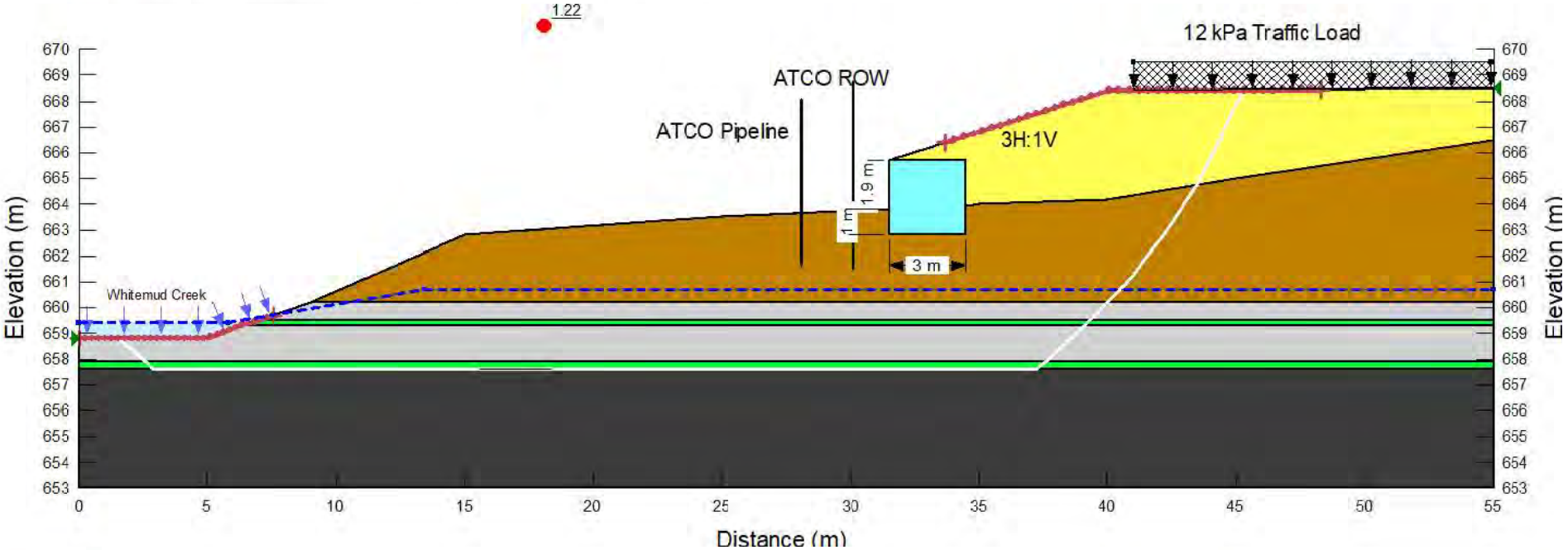
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Long Term

Figure No.

D53

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	1
	Bedrock	Mohr-Coulomb	21	50	22	1
	Bedrock (impenetrable)	Bedrock (Impenetrable)				1
	Bentonite	Mohr-Coulomb	19	0	8	1
	Embankment Fill	Mohr-Coulomb	20	2	26	1
	MSE Backfill	High Strength	22			1



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Project No.:	1161110185
Scale:	---
Date:	Oct.2022
Prepared by:	EH
Checked by:	LC

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek Bridge Crossing - Section W6

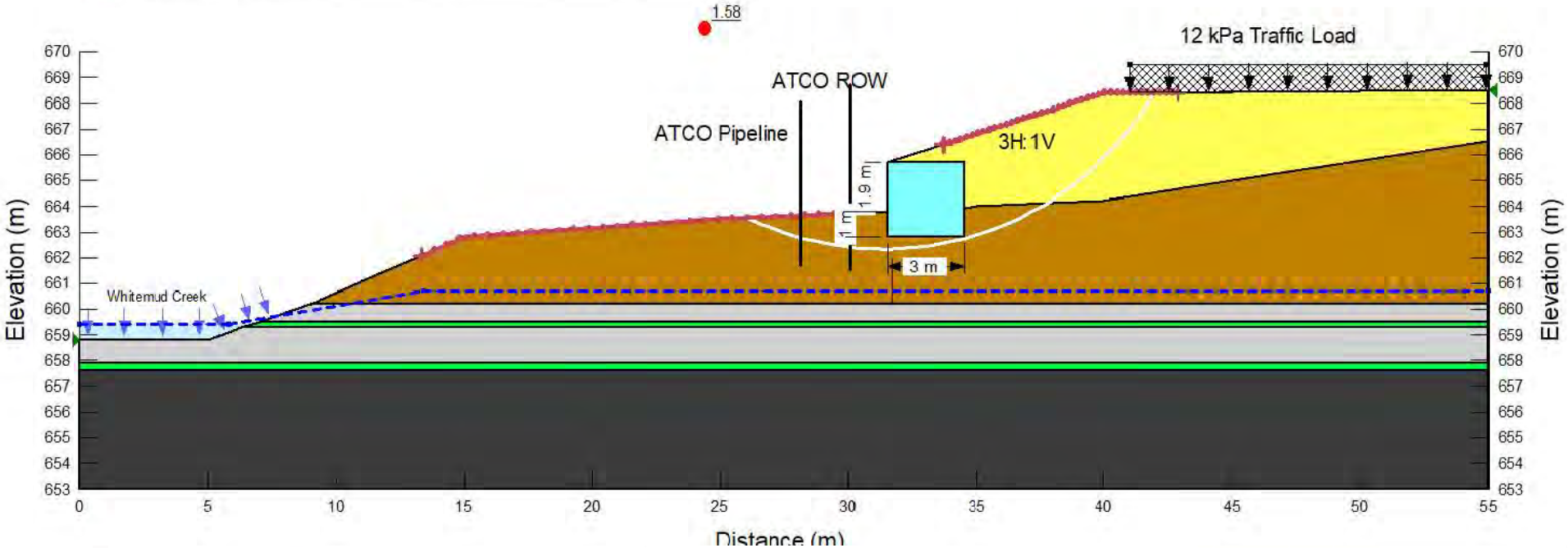
Title

Option 2: MSE Wall
No Stabilization Piles, Long Term

Figure No.

D54

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	1
	Bedrock	Mohr-Coulomb	21	50	22	1
	Bedrock (impenetrable)	Bedrock (Impenetrable)				1
	Bentonite	Mohr-Coulomb	19	0	8	1
	Embankment Fill	Mohr-Coulomb	20	2	26	1
	MSE Backfill	High Strength	22			1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Oct.2022	Ellerslie Road – Whitemud Creek
Prepared by:	EH	Bridge Crossing - Section W6
Checked by:	LC	

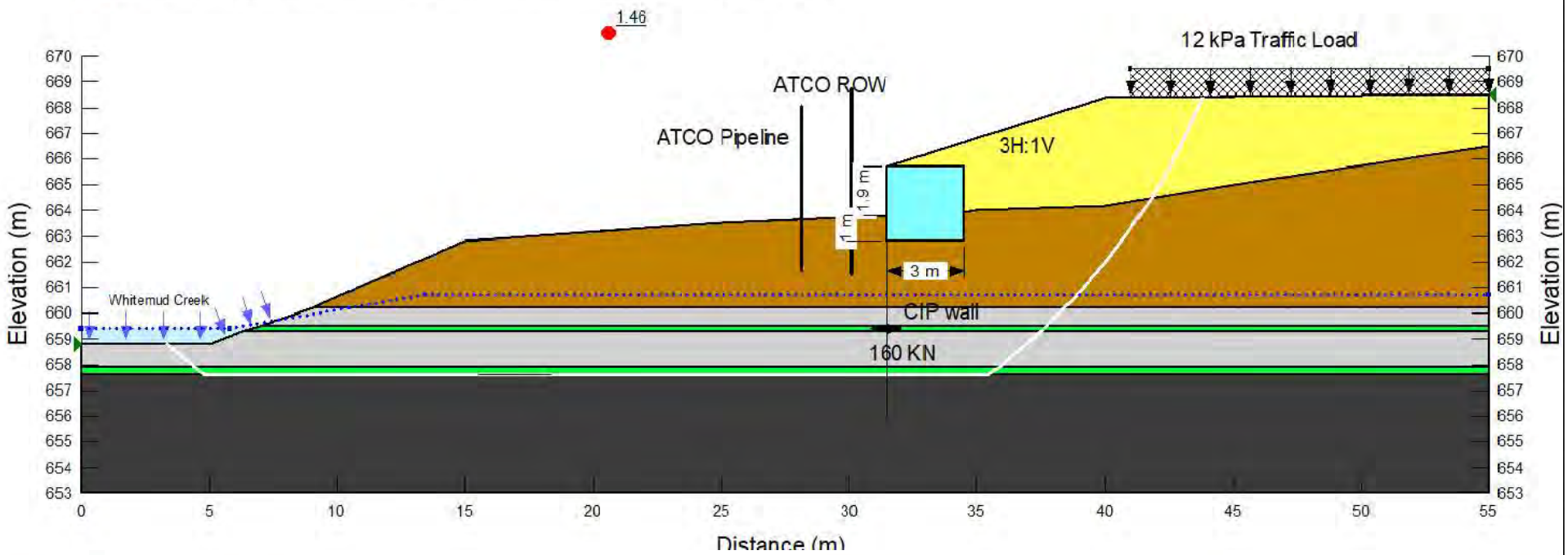
Title

Option 2: MSE Wall
No Stabilization Piles, Sliding Failure, Long Term

Figure No.

D55

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	1	0.2	No
	Bedrock (impenetrable)	Bedrock (Impenetrable)				1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	26	1	0	Yes
	MSE Backfill	High Strength	22			1	0	No



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Project No.:	1161110185
Scale:	---
Date:	Oct.2022
Prepared by:	EH
Checked by:	LC

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek
Bridge Crossing - Section W6

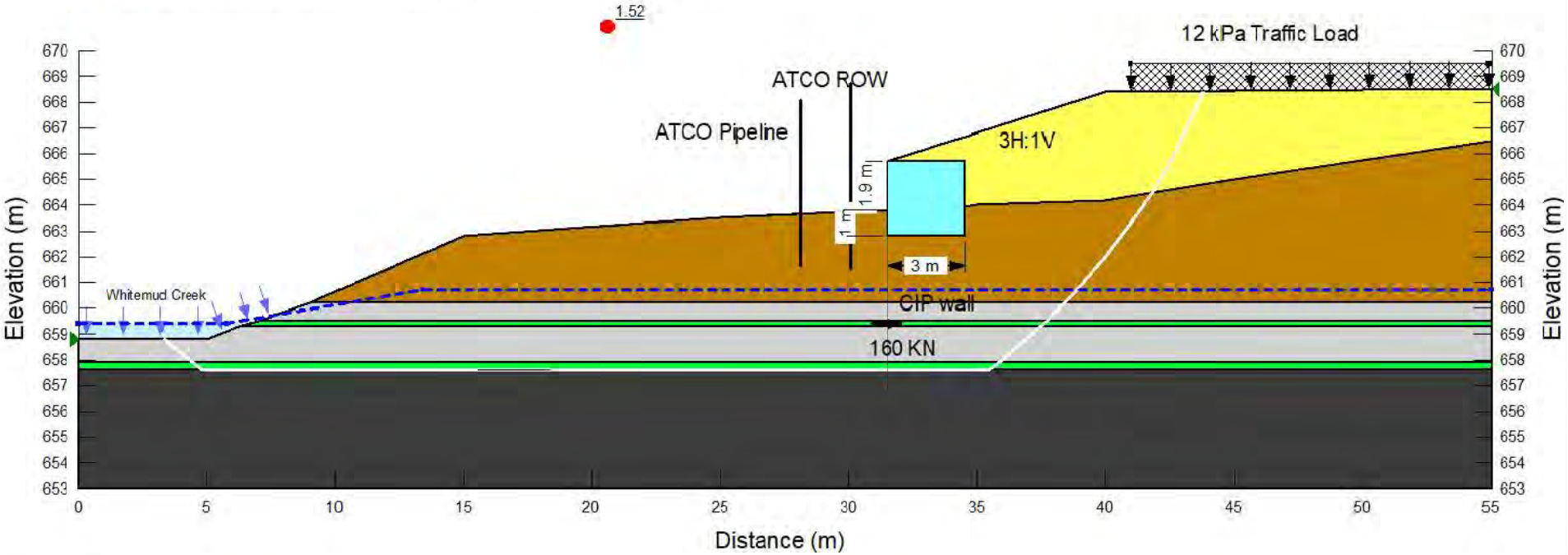
Title

Option 2: MSE Wall
With Stabilization Piles, Short Term

Figure No.

D56

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	1
	Bedrock	Mohr-Coulomb	21	50	22	1
	Bedrock (impenetrable)	Bedrock (Impenetrable)				1
	Bentonite	Mohr-Coulomb	19	0	8	1
	Embankment Fill	Mohr-Coulomb	20	2	26	1
	MSE Backfill	High Strength	22			1



Stantec

Project No.:	1161110185
Scale:	---
Date:	Oct.2022
Prepared by:	EH
Checked by:	LC

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek
Bridge Crossing - Section W6

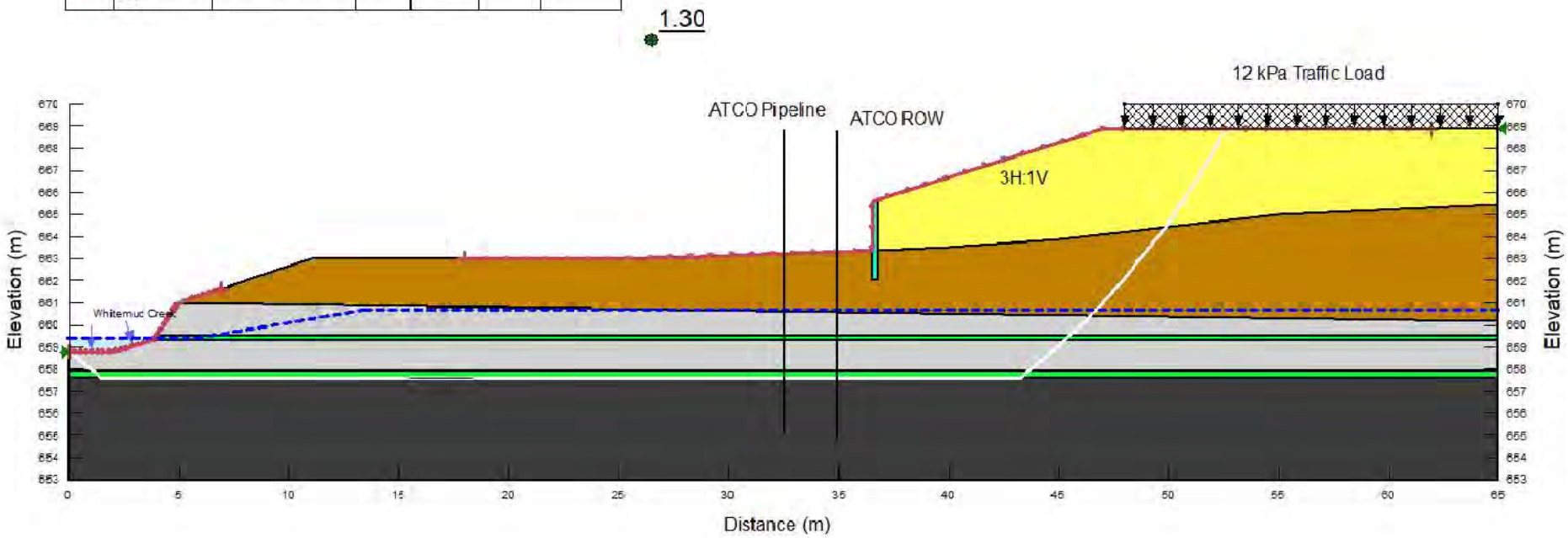
Title

Option 2: MSE Wall
With Stabilization Piles, Long Term

Figure No.

D57

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	1
	Bedrock	Mohr-Coulomb	21	50	22	1
	Bedrock (Impenetrable)	Bedrock (Impenetrable)				1
	Bentonite	Mohr-Coulomb	19	0	8	1
	Embankment Fill	Mohr-Coulomb	20	2	26	1
	Wall Face / CIP Pile	High Strength	24			1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Oct.2022	Ellerslie Road – Whitemud Creek
Prepared by:	EH	Bridge Crossing - Section W10
Checked by:	LC	

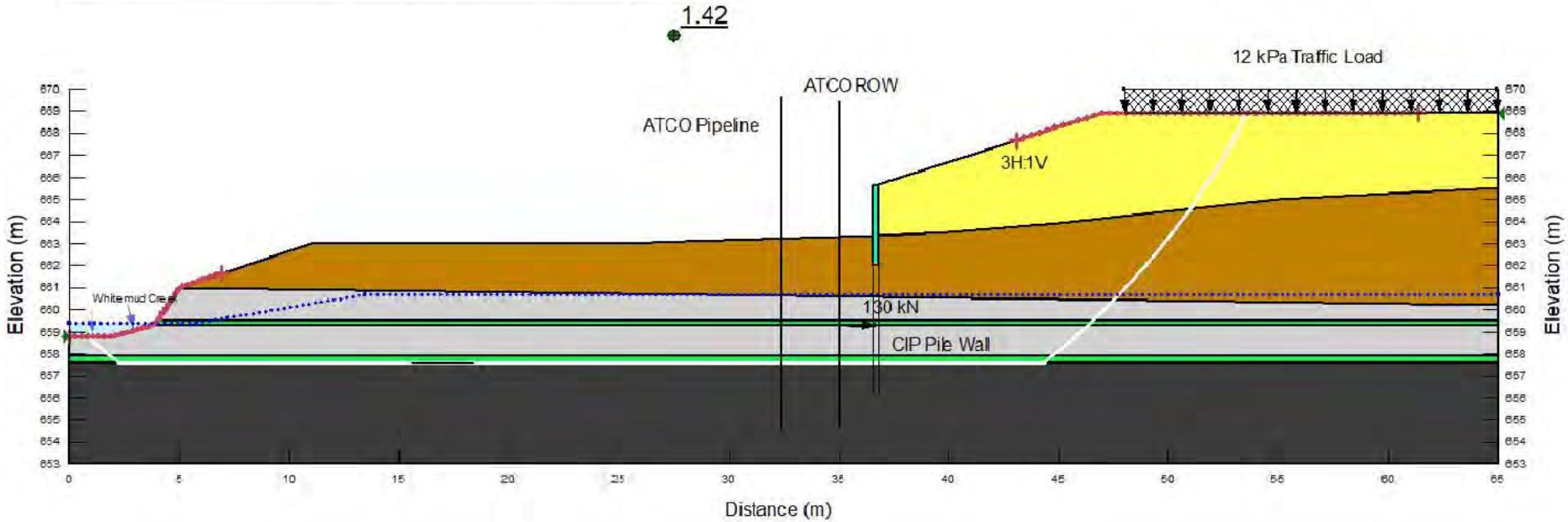
Title

Option 1: Concrete Abutment Wall
No Stabilization Piles, Long Term

Figure No.

D58

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line	Rbar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	1	0.2	No
	Bedrock (impenetrable)	Bedrock (Impenetrable)				1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	28	1	0	Yes
	Wall Face / CIP Pile	High Strength	24			1	0	No



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Oct.2022	Ellerslie Road – Whitemud Creek
Prepared by:	EH	Bridge Crossing - Section W10
Checked by:	LC	

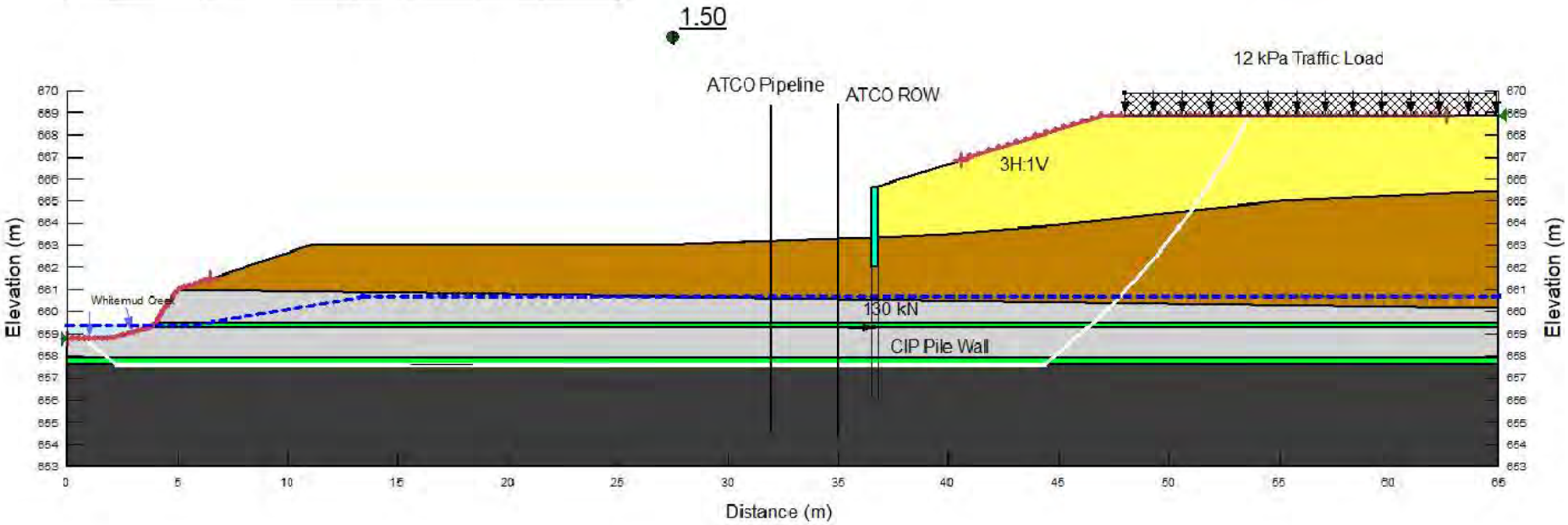
Title

Option 1: Concrete Abutment Wall
With Stabilization Piles, Short Term

Figure No.

D59

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	1
	Bedrock	Mohr-Coulomb	21	50	22	1
	Bedrock (impenetrable)	Bedrock (Impenetrable)				1
	Bentonite	Mohr-Coulomb	19	0	8	1
	Embankment Fill	Mohr-Coulomb	20	2	26	1
	Wall Face / CIP Pile	High Strength	24			1



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Project No.:	1161110185	Client/Project
Scale:	---	Brookfield Residential (Alberta) LP
Date:	Oct.2022	Ellerslie Road – Whitemud Creek
Prepared by:	EH	Bridge Crossing - Section W10
Checked by:	LC	

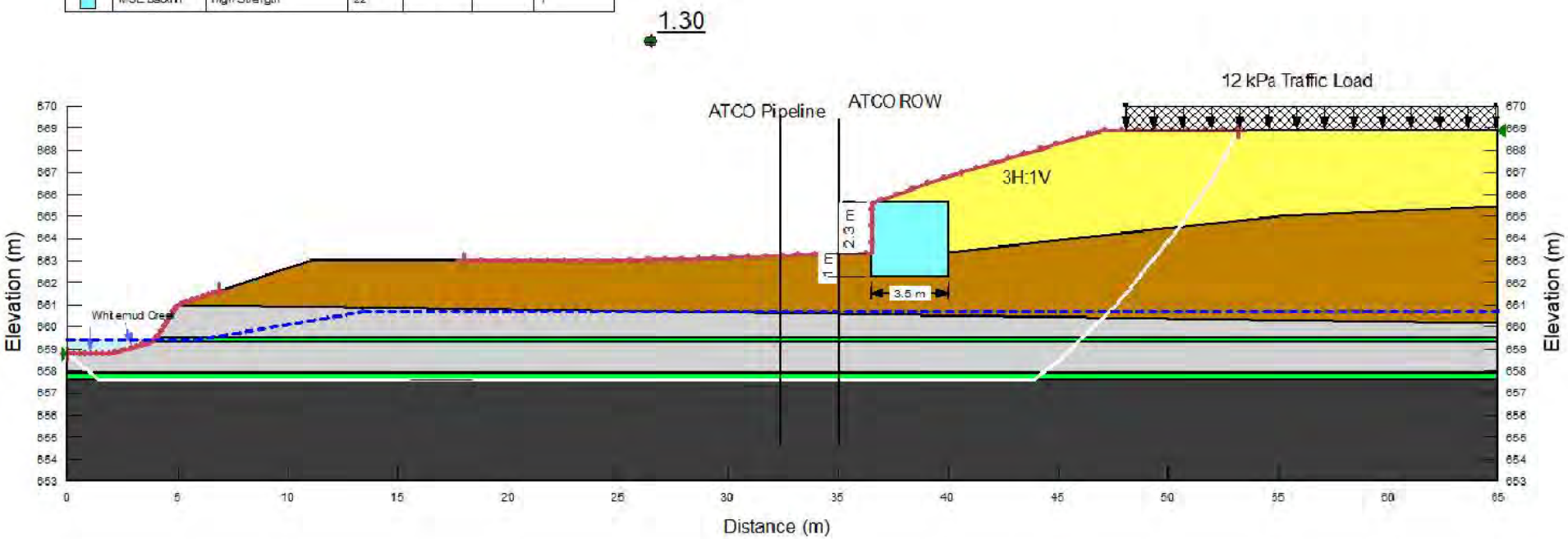
Title

Option 1: Concrete Abutment Wall With Stabilization Piles, Long Term

Figure No.

D60

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	1
	Bedrock	Mohr-Coulomb	21	50	22	1
	Bedrock (Impenetrable)	Bedrock(Impenetrable)				1
	Bentonite	Mohr-Coulomb	19	0	8	1
	Embankment Fill	Mohr-Coulomb	20	2	28	1
	MSE Backfill	High Strength	22			1



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Project No.:	1161110185
Scale:	---
Date:	Oct.2022
Prepared by:	EH
Checked by:	LC

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek
Bridge Crossing - Section W10

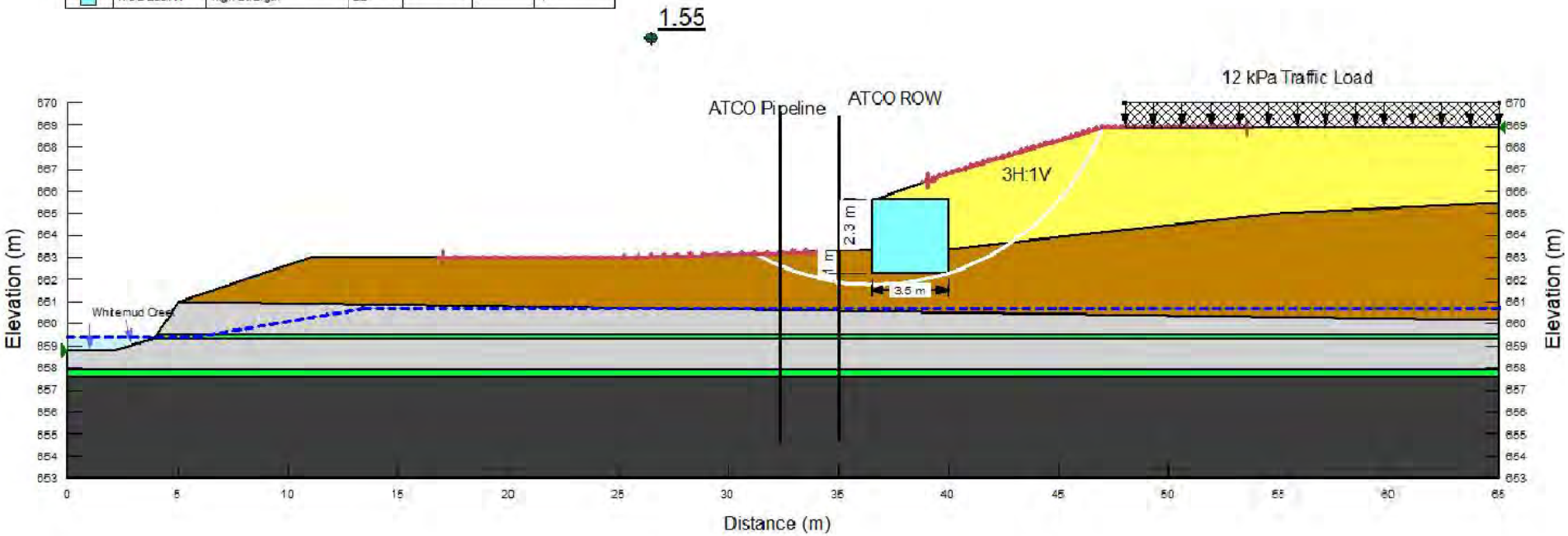
Title

Option 2: MSE Wall
No Stabilization Piles, Long Term

Figure No.

D61

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	1
	Bedrock	Mohr-Coulomb	21	50	22	1
	Bedrock (Impenetrable)	Bedrock(Impenetrable)				1
	Bentonite	Mohr-Coulomb	19	0	8	1
	Embankment Fill	Mohr-Coulomb	20	2	26	1
	MSE Backfill	High Strength	22			1



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Project No.: 1161110185
Scale: ---
Date: Oct.2022
Prepared by: EH
Checked by: LC

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek
Bridge Crossing - Section W10

Title

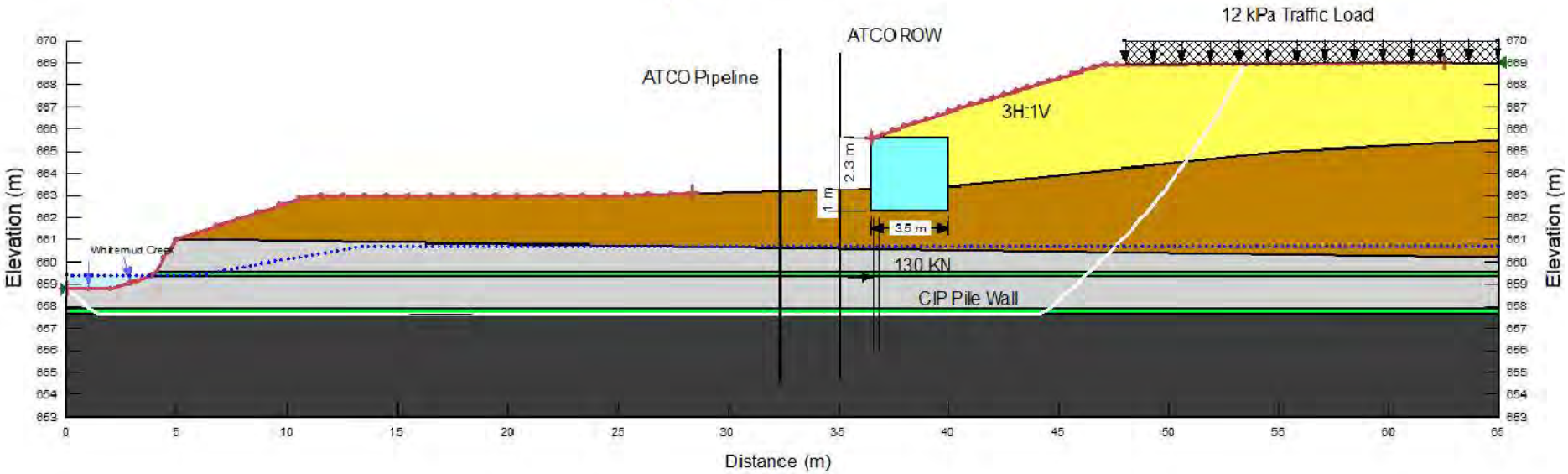
Option 2: MSE Wall
No Stabilization Piles, Sliding Failure, Long Term

Figure No.

D62

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line	B-bar	Add Weight
	Alluvial Clay	Mohr-Coulomb	18	2	24	1	0.3	No
	Bedrock	Mohr-Coulomb	21	50	22	1	0.2	No
	Bedrock (impenetrable)	Bedrock(Impenetrable)				1	0	No
	Bentonite	Mohr-Coulomb	19	0	8	1	0	No
	Embankment Fill	Mohr-Coulomb	20	2	28	1	0	Yes
	MSE Backfill	High Strength	22			1	0	No

1.43



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Project No.: 1161110185
Scale: ---
Date: Oct.2022
Prepared by: EH
Checked by: LC

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek
Bridge Crossing - Section W10

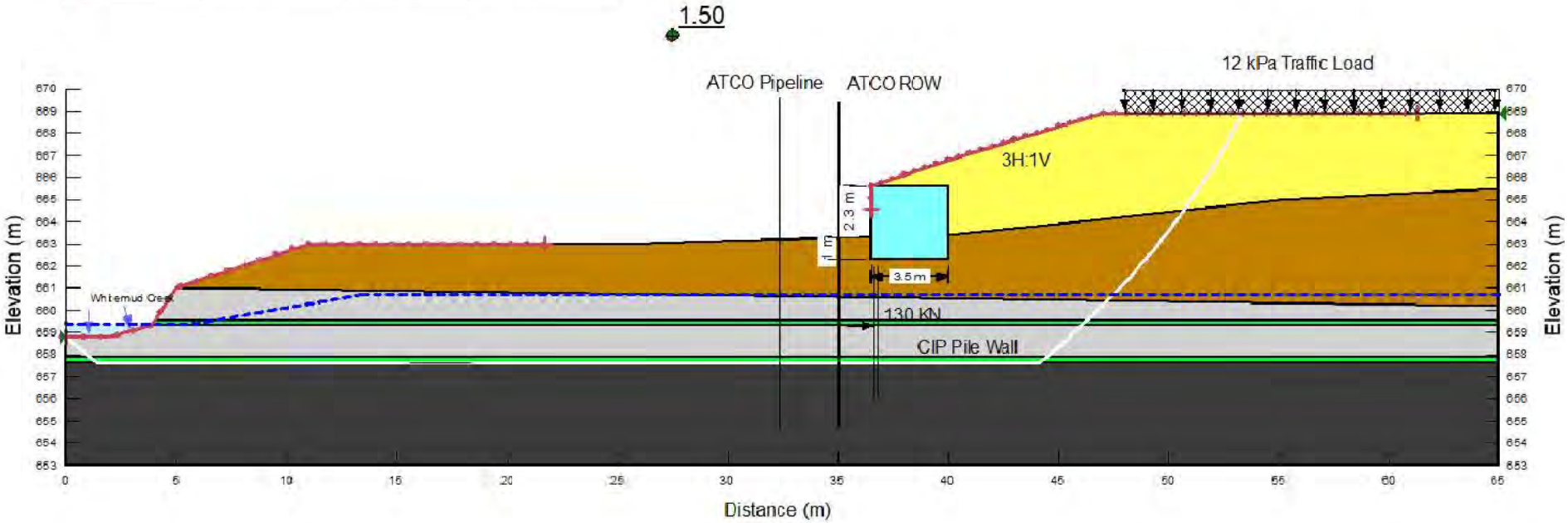
Title

Option 2: MSE Wall
With Stabilization Piles, Short Term

Figure No.

D63

Color	Name	Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Alluvial Clay	Mohr-Coulomb	18	2	24	1
	Bedrock	Mohr-Coulomb	21	50	22	1
	Bedrock (impenetrable)	Bedrock (Impenetrable)				1
	Bentonite	Mohr-Coulomb	19	0	8	1
	Embankment Fill	Mohr-Coulomb	20	2	26	1
	MSE Backfill	High Strength	22			1



Stantec

Project No.:	1161110185
Scale:	---
Date:	Oct.2022
Prepared by:	EH
Checked by:	LC

Client/Project

Brookfield Residential (Alberta) LP
Ellerslie Road – Whitemud Creek
Bridge Crossing -Section W10

Title

Option 2: MSE Wall
With Stabilization Piles, Long Term

Figure No.

D64

Appendix E Slope Inclinometer Plots for BH22-02 and BH22-03

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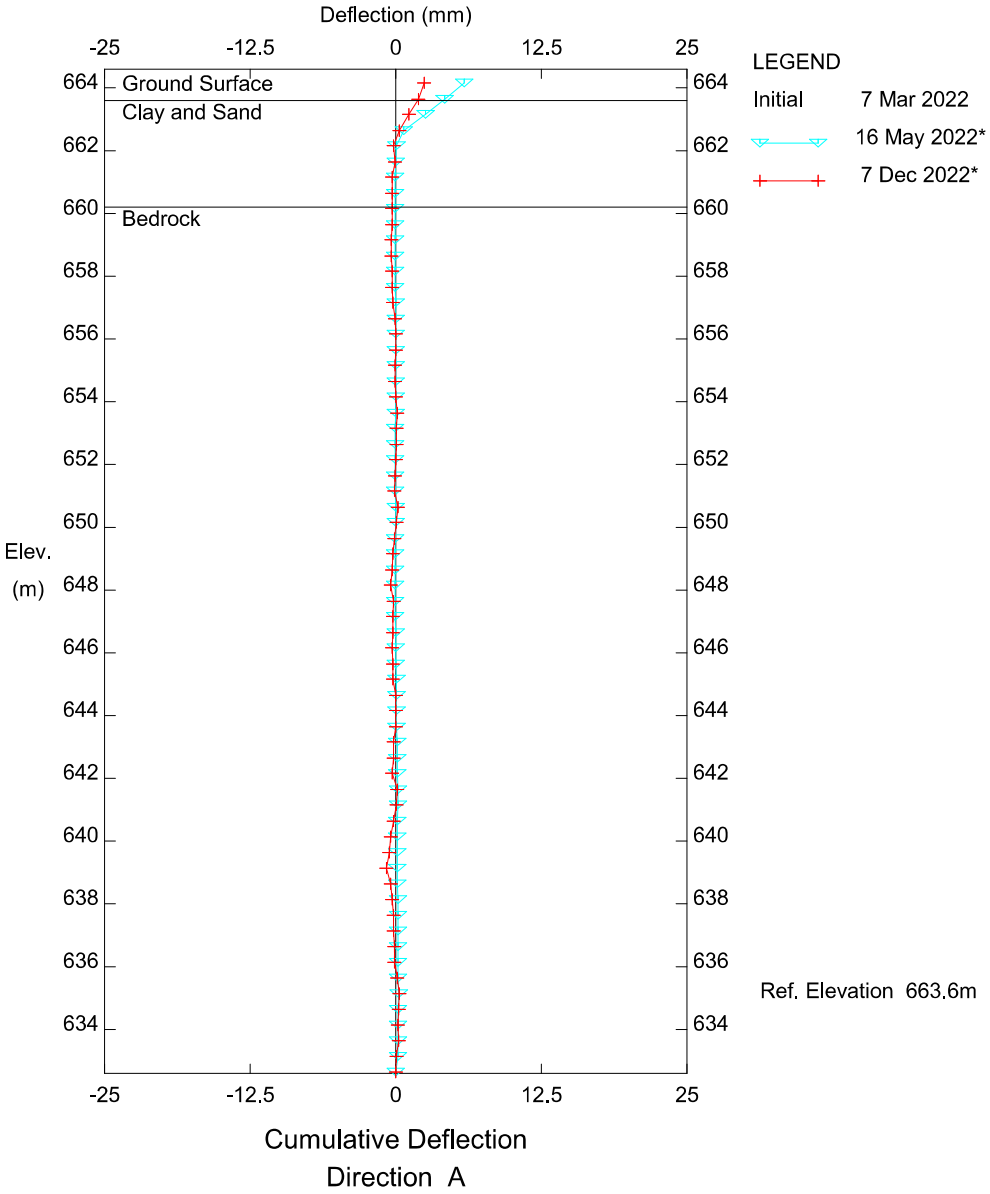

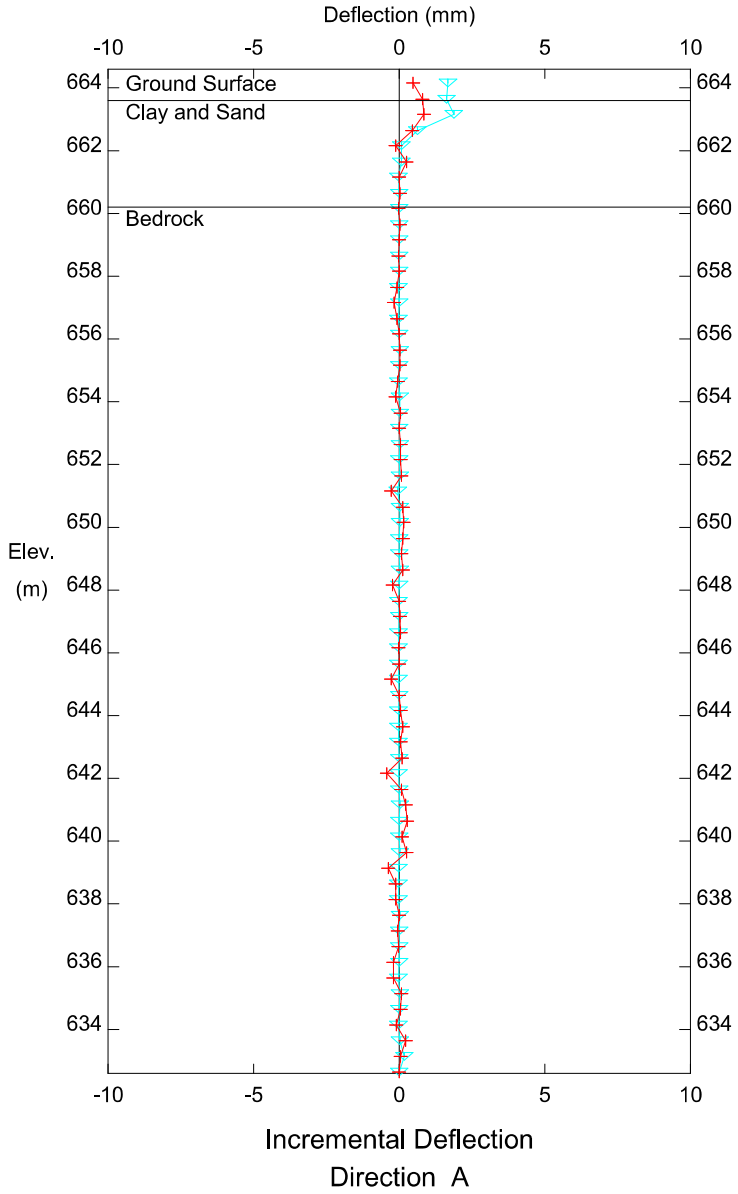

Ellerslie Road - Whitemud Creek Bridge, Inclinometer BH22-02

Brookfield Residential (Alberta) LP

Sets marked * include zero shift and/or rotation corrections.

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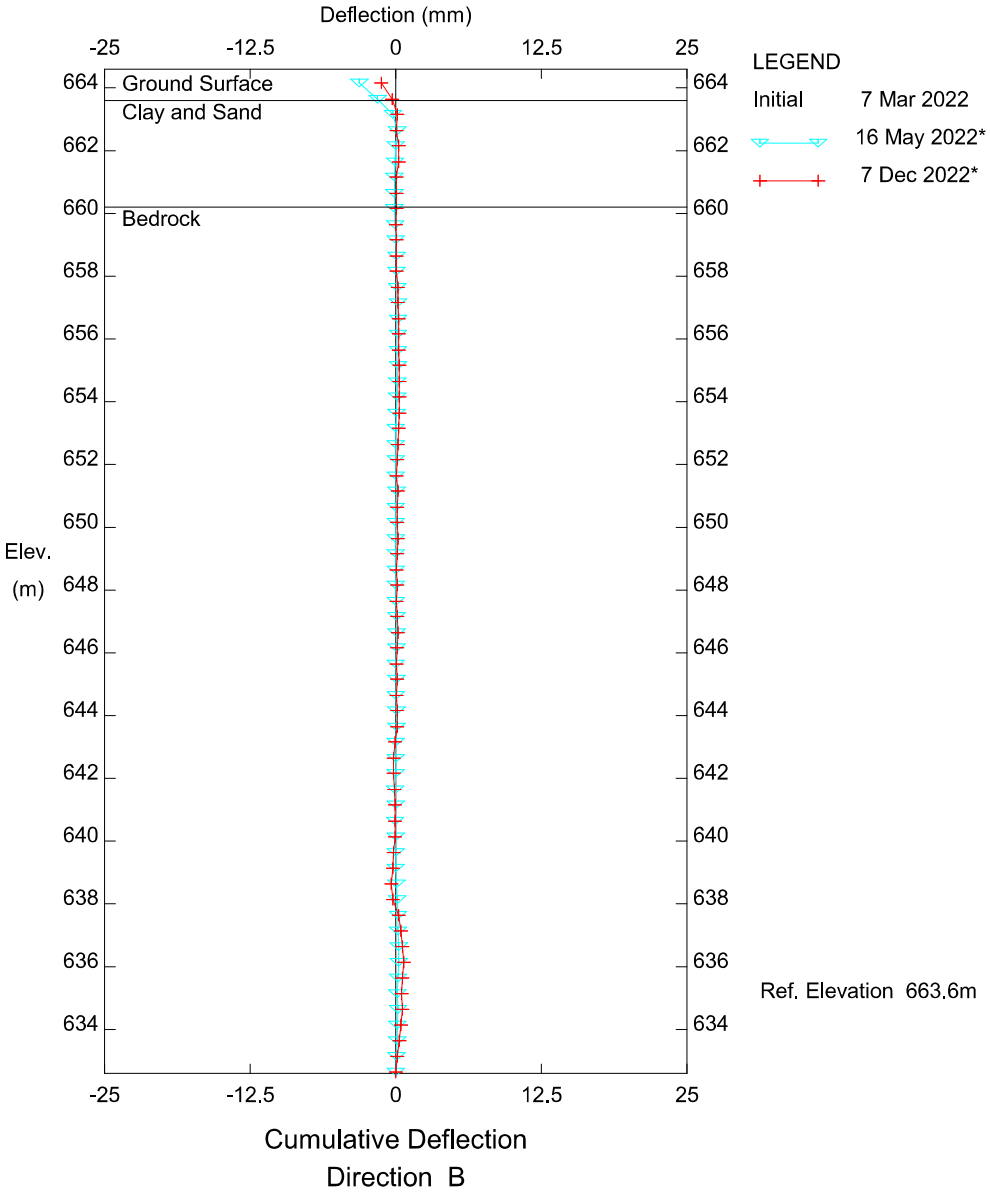
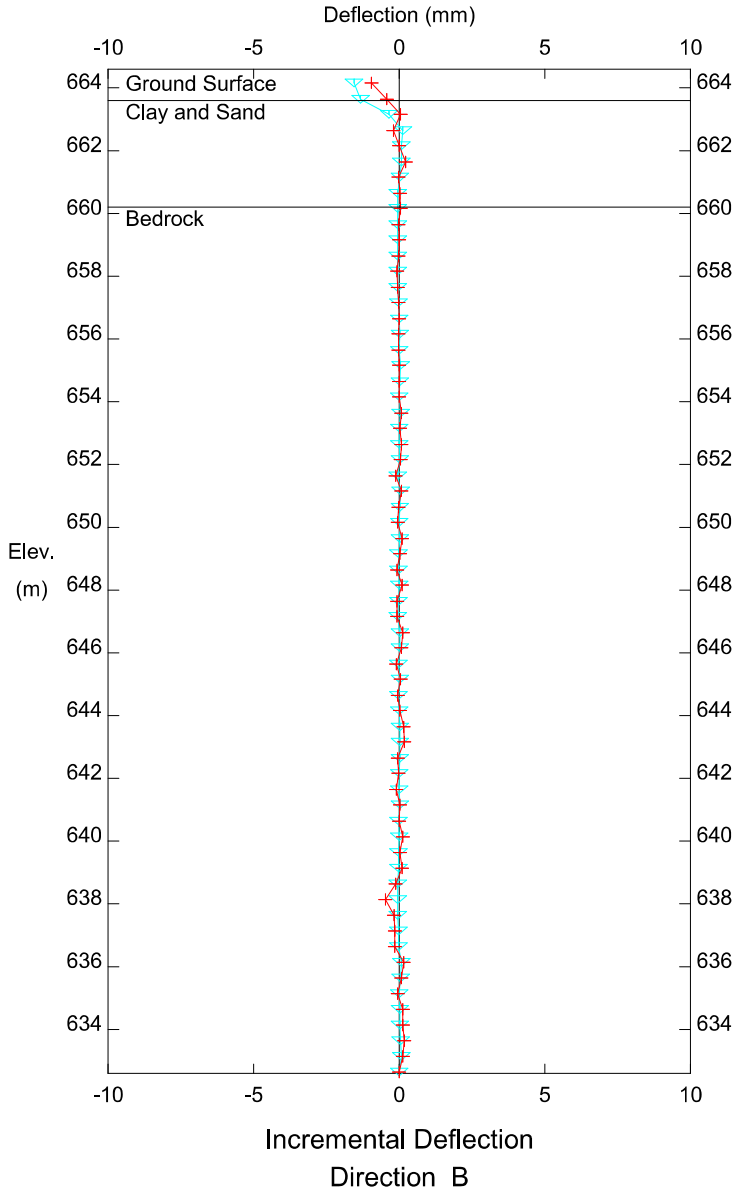
Stantec Consulting Ltd - Edmonton





Ellerslie Road - Whitemud Creek Bridge, Inclinometer BH22-02

Brookfield Residential (Alberta) LP

Sets marked * include zero shift and/or rotation corrections.

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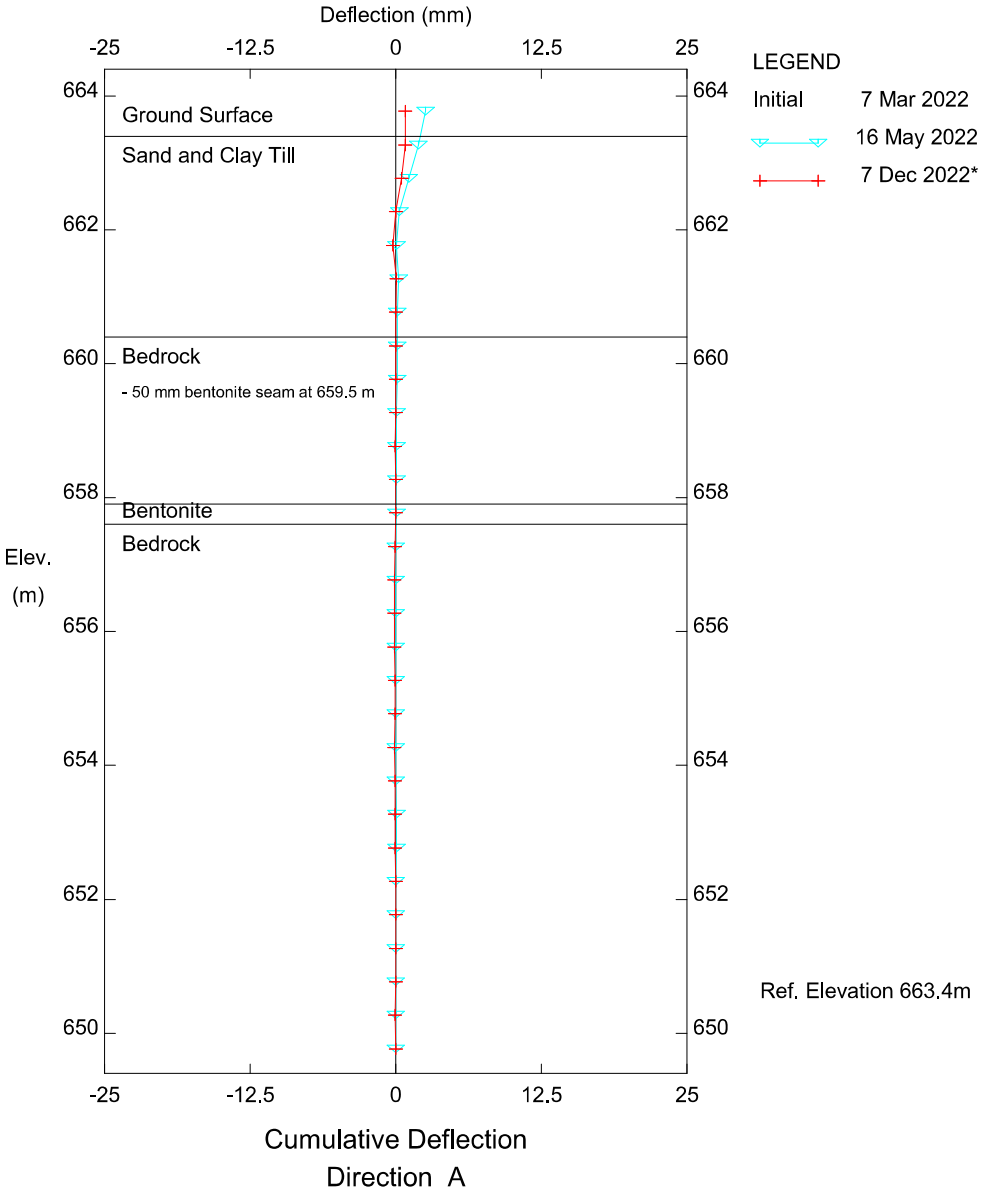
Stantec Consulting Ltd - Edmonton



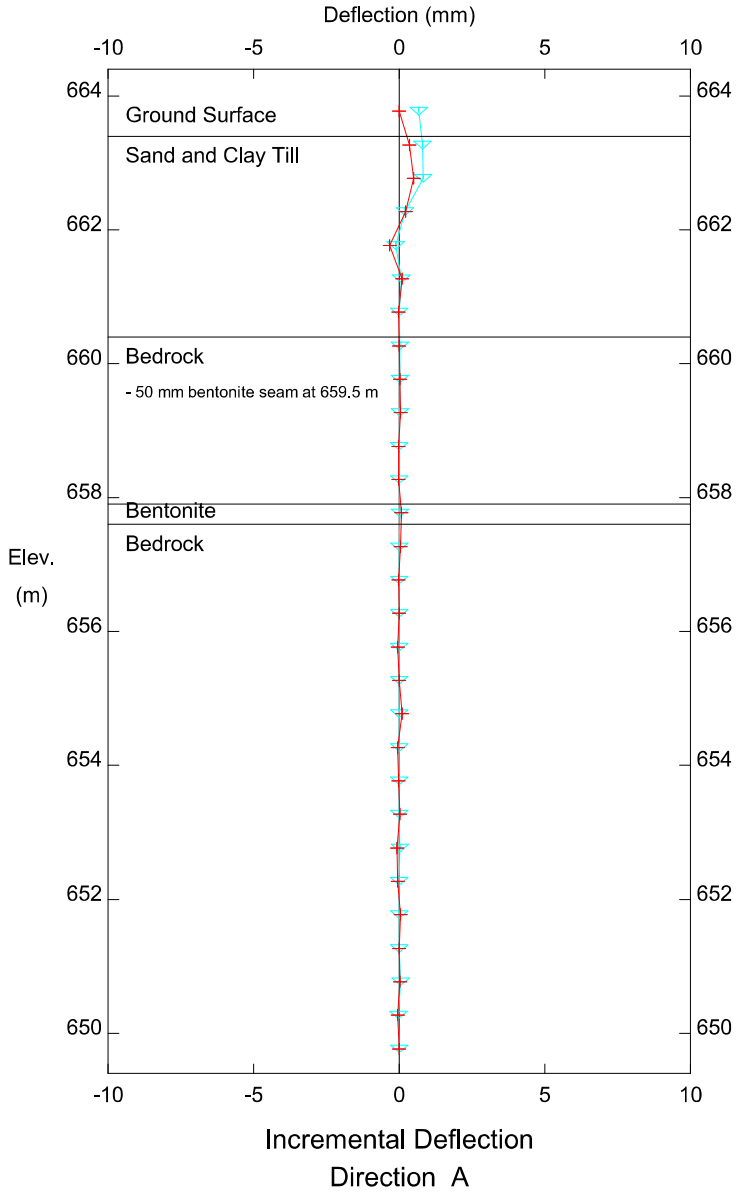
LEGEND

Initial 7 Mar 2022

16 May 2022

7 Dec 2022*

Ref. Elevation 663.4m



Ellerslie Road - Whitemud Creek Bridge, Inclinometer BH22-03

Brookfield Residential (Alberta) LP

Sets marked * include zero shift and/or rotation corrections.

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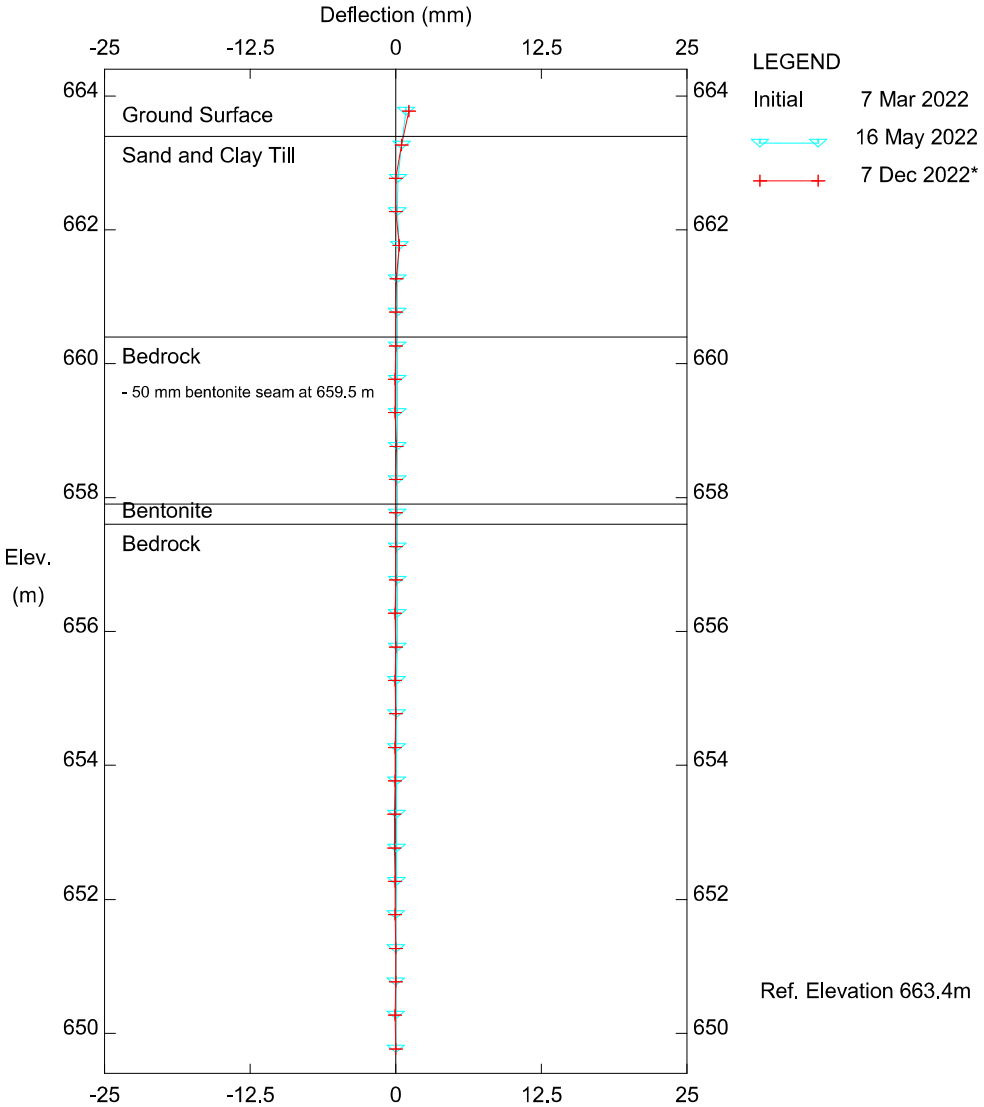
Stantec Consulting Ltd - Edmonton



Cumulative Deflection
Direction B

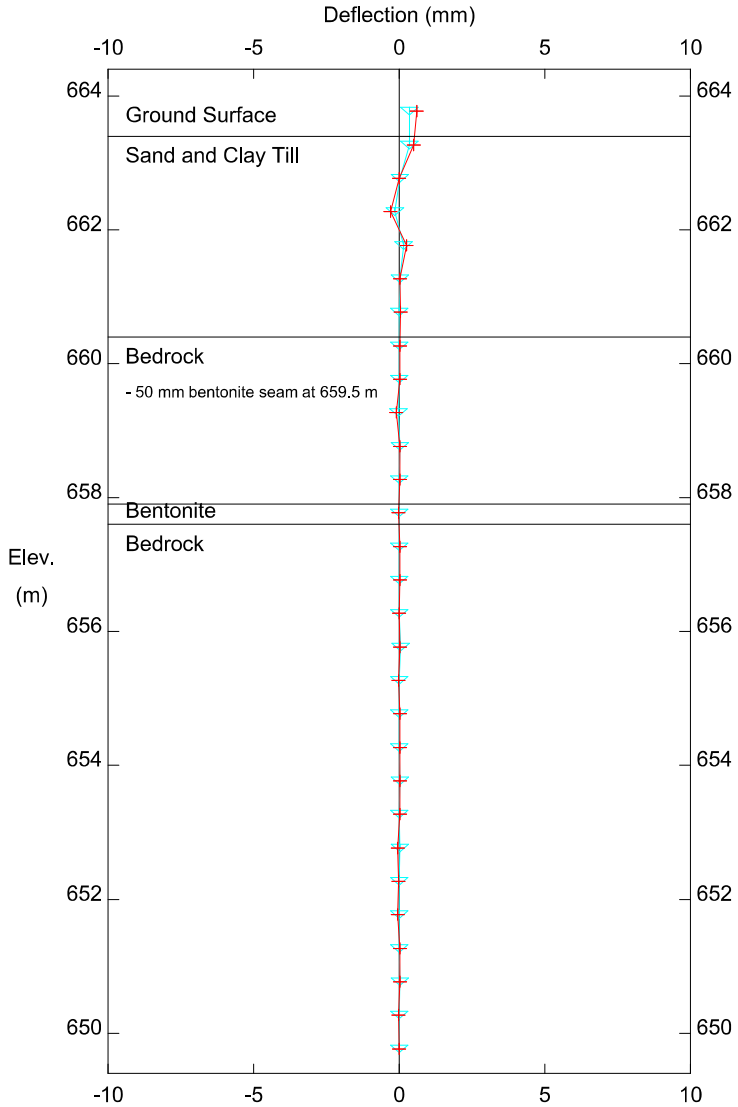
LEGEND

Initial 7 Mar 2022

16 May 2022

7 Dec 2022*

Ref. Elevation 663.4m



Incremental Deflection
Direction B

Ellerslie Road - Whitemud Creek Bridge, Inclinometer BH22-03

Brookfield Residential (Alberta) LP

Sets marked * include zero shift and/or rotation corrections.

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Appendix F – OPINIONS OF PROBABLE COST

Ellerslie Road Bridge over White Mud Creek
Type "B" Cost Estimate
Span 14-20-18m SLC-700, Retaining Wall Option

Print date ***2023-10-10***

Item No.	Bid Item Description	Unit	Estimated Quantities	Estimated Unit Price	Estimated Cost
1	Mobilization (1.2.13)	lump sum	1	$1.00	$621,781.35
2	Traffic Accommodation for Bridge Structure	lump sum	1	$100,000.00	$100,000.00
3	Care of Water	lump sum	1	$200,000.00	$200,000.00
4	Structural Excavation	lump sum	1	$20,000.00	$20,000.00
5	Backfill-Granular	cubic meters	1,100	$120.00	$132,000.00
6	Backfill-Non Granular	cubic meters	200	$50.00	$10,000.00
7	Supply of Piling - H-Pile 310X79 (Plain)	meters	69	$400.00	$27,600.00
8	Pile Set-up (H-Pile 310x79)	piles	10	$6,000.00	$60,000.00
9	Pile Driving (H-Pile 310x79)	meters	69	$50.00	$3,450.00
10	Supply of Piling - Galvanized Pipe-Pile 610mm Dia for Pier	meter	106	$1,200.00	$126,720.00
11	Supply of Piling - Plain Pipe-Pile 610mm Dia for Pier	meters	168	$800.00	$134,400.00
12	Pile Set-up (Pipe-Pile 610mm Dia)	piles	16	$7,000.00	$112,000.00
13	Pile Driving (Pipe-Pile 610mm Dia)	meters	184	$100.00	$18,400.00
14	Drill Rig Set-up	piles	57	$8,000.00	$456,000.00
15	Pile Installation	meters	511	$700.00	$357,980.00
16	PDA test	piles	6	$3,000.00	$18,000.00
17	Concrete - Class Pile	cubic meters	416	$700.00	$290,886.09
18	Concrete - Class HPC	cubic meters	253	$2,600.00	$657,878.13
19	Concrete - Class C	cubic meters	262	$1,700.00	$445,773.30
20	Supply of Reinforcing Steel - Stainless Steel	kilogram	23,200	$12.00	$278,400.00
21	Supply of Reinforcing Steel - Plain	kilogram	116,800	$3.00	$350,400.00
22	Place - Reinforcing Steel	kilogram	140,000	$2.00	$280,000.00
23	Supply of Girders - 14m Type SLC-700 Curb Girder	girders	1	$53,990.00	$53,990.00
24	Supply of Girders - 14m Type SLC-700 -Girder with TL4 Barrier Rebar	girders	2	$31,665.00	$63,330.00
25	Supply of Girders - 14m Type SLC-700 - Interior	girders	10	$22,326.00	$223,260.00
26	Supply of Girders - 20m Type SLC-700 Curb Girder	girders	1	$77,115.00	$77,115.00
27	Supply of Girders - 20m Type SLC-700-Girder with TL4 Barrier Rebar	girders	2	$45,238.00	$90,476.00
28	Supply of Girders - 20m Type SLC-700 - Interior	girders	10	$31,894.00	$318,940.00
29	Supply of Girders - 18m Type SLC-700 Curb Girder	girders	1	$69,420.00	$69,420.00
30	Supply of Girders - 18m Type SLC-700 -Girder with TL4 Barrier Rebar	girders	2	$40,710.00	$81,420.00
31	Supply of Girders - 18m Type SLC-700 - Interior	girders	10	$28,705.00	$287,050.00
32	Delivery of Girders	lump sum	1	$78,000.00	$78,000.00
33	Erection of Girders	lump sum	1	$100,000.00	$100,000.00
34	Strong Post Guardrail -Supply & Install(beyond approach rail transition)	meters	200	$150.00	$30,000.00
35	Guardrail End Treatment	Each	4	$6,000.00	$24,000.00
36	Approach Rail Transition	Each	4	$5,500.00	$22,000.00
37	Pedestrian Handrail	meters	62	$1,000.00	$62,000.00
38	Miscellaneous Iron (pile bracing, girder anchors, steel plates etc.)	lump sum	1	$20,000.00	$20,000.00
39	Conduits	lump sum	1	$2,000.00	$2,000.00
40	Deck Waterproofing	square meter	967	$75.00	$72,525.00
41	Asphalt Concrete Pavement - Mix Type Mix Type H2 using PG 58-28 Asphalt Cement Grade	tonne	180	$120.00	$21,600.00
42	Safety Railing on Retaining wall	meters	92	$300.00	$27,600.00
43	Erosion Control Barrier (Silt Fence)	meters	200	$16.00	$3,200.00
44	River Protection Work	lump sum	1	$410,000.00	$410,000.00
				TOTAL (Round to $1000)	**$6,840,000.00**
				Contingencies 15% (Round to $1000)	**$1,026,000.00**
				Total Construction Cost (Round to $1000)	**$7,866,000.00**

Ellerslie Road Bridge over White Mud Creek
Type "B" Cost Estimate
Span 14-20-18m SLC 700, MSE Wall Option

Print date ***2023-10-10***

Item No.	Bid Item Description	Unit	Estimated Quantities	Estimated Unit Price	Estimated Cost
1	Mobilization (1.2.13)	lump sum	1	$1.00	$598,986.51
2	Traffic Accommodation for Bridge Structure	lump sum	1	$100,000.00	$100,000.00
3	Care of Water	lump sum	1	$200,000.00	$200,000.00
4	Structural Excavation	lump sum	1	$20,000.00	$20,000.00
5	Backfill-Granular	cubic meters	650	$120.00	$78,000.00
6	Backfill-Non Granular	cubic meters	200	$50.00	$10,000.00
7	Supply of Piling - H-Pile 310X79 (Plain)	meters	231	$400.00	$92,400.00
8	Pile Set-up (H-Pile 310x79)	piles	20	$6,000.00	$120,000.00
9	Pile Driving (H-Pile 310x79)	meters	231	$50.00	$11,550.00
10	Supply of Piling - Galvanized Pipe-Pile 610mm Dia for Pier	meter	106	$1,200.00	$126,720.00
11	Supply of Piling - Plain Pipe-Pile 610mm Dia for Pier	meters	168	$800.00	$134,400.00
12	Pile Set-up (Pipe-Pile 610mm Dia)	piles	16	$7,000.00	$112,000.00
13	Pile Driving (Pipe-Pile 610mm Dia)	meters	184	$100.00	$18,400.00
14	Drill Rig Set-up	piles	49	$8,000.00	$392,000.00
15	Pile Installation	meters	403	$700.00	$282,240.00
16	PDA test	piles	8	$3,000.00	$24,000.00
17	Concrete - Class Pile	cubic meters	345	$700.00	$241,185.23
18	Concrete - Class HPC	cubic meters	253	$2,600.00	$657,878.13
19	Concrete - Class C	cubic meters	68	$1,700.00	$116,115.73
20	Supply of Reinforcing Steel -Stainless Steel	kilogram	23,200	$12.00	$278,400.00
21	Supply of Reinforcing Steel - Plain	kilogram	77,600	$3.00	$232,800.00
22	Place - Reinforcing Steel	kilogram	100,800	$2.00	$201,600.00
23	Supply of Girders - 14m Type SLC-700 Curb Girder	girders	1	$53,990.00	$53,990.00
24	Supply of Girders - 14m Type SLC-700 -Girder with TL4 Barrier Rebar	girders	2	$31,665.00	$63,330.00
25	Supply of Girders - 14m Type SLC-700 - Interior	girders	10	$22,326.00	$223,260.00
26	Supply of Girders - 20m Type SLC-700 Curb Girder	girders	1	$77,115.00	$77,115.00
27	Supply of Girders - 20m Type SLC-700-Girder with TL4 Barrier Rebar	girders	2	$45,238.00	$90,476.00
28	Supply of Girders - 20m Type SLC-700 - Interior	girders	10	$31,894.00	$318,940.00
29	Supply of Girders - 18m Type SLC-700 Curb Girder	girders	1	$69,420.00	$69,420.00
30	Supply of Girders - 18m Type SLC-700 -Girder with TL4 Barrier Rebar	girders	2	$40,710.00	$81,420.00
31	Supply of Girders - 18m Type SLC-700 - Interior	girders	10	$28,705.00	$287,050.00
32	Delivery of Girders	lump sum	1	$78,000.00	$78,000.00
33	Erection of Girders	lump sum	1	$100,000.00	$100,000.00
34	Strong Post Guardrail -Supply & Install(beyond approach rail transition)	meters	200	$150.00	$30,000.00
35	Guardrail End Treatment	Each	4	$6,000.00	$24,000.00
36	Approach Rail Transition	Each	4	$5,500.00	$22,000.00
37	Pedestrian Handrail	meters	62	$1,000.00	$62,000.00
38	Miscellaneous Iron (pile bracing, girder anchors, steel plates etc.)	lump sum	1	$20,000.00	$20,000.00
39	Conduits	lump sum	1	$2,000.00	$2,000.00
40	Deck Waterproofing	square meter	967	$75.00	$72,525.00
41	Asphalt Concrete Pavement - Mix Type Mix Type H2 using PG 58-28 Asphalt Cement Grade	tonne	180	$120.00	$21,600.00
42	Safety Railing on Retaining wall	meters	92	$300.00	$27,600.00
43	MSE wall granular Backfill	Cubic meters	1,300	$120.00	$156,000.00
44	Erosion Control Barrier (Silt Fence)	meters	200	$16.00	$3,200.00
45	MSE (Mechanically Stabilized Earth) Wall	square meter	246	$1,000.00	$246,250.00
46	River Protection Work	Lump sum	1	$410,000.00	$410,000.00
	TOTAL (Round to $1000)				**$6,589,000.00**
	Contingencies 15% (Round to $1000)				**$988,000.00**
	Total Construction Cost (Round to $1000)				**$7,577,000.00**

Ellerslie Road Bridge over White Mud Creek
Type "B" Cost Estimate
Single Span 52m, Retaining Wall Option

Print date ***2023-10-10***

Item No.	Bid Item Description	Unit	Estimated Quantities	Estimated Unit Price	Estimated Cost
1	Mobilization (1.2.13)	lump sum	1	$1.00	$714,738.75
2	Traffic Accommodation for Bridge Structure	lump sum	1	$100,000.00	$100,000.00
3	Care of Water	lump sum	1	$200,000.00	$200,000.00
4	Structural Excavation	lump sum	1	$30,000.00	$30,000.00
5	Backfill-Granular	cubic meters	1,100	$120.00	$132,000.00
6	Backfill-Non Granular	cubic meters	200	$50.00	$10,000.00
7	Supply of Piling - H-Pile 310X79 (Plain)	meters	284	$400.00	$113,680.00
8	Pile Set-up (H-Pile 310x79)	piles	18	$6,000.00	$108,000.00
9	Pile Driving (H-Pile 310x79)	meters	284	$50.00	$14,200.00
14	Drill Rig Set-up	piles	61	$8,000.00	$488,000.00
15	Pile Installation	meters	687	$700.00	$481,180.00
16	PDA test	piles	6	$3,000.00	$18,000.00
17	Concrete - Class Pile	cubic meters	451	$700.00	$315,752.03
18	Concrete - Class HPC	cubic meters	316	$2,600.00	$822,640.46
19	Concrete - Class C	cubic meters	422	$1,700.00	$717,910.00
20	Supply of Reinforcing Steel - Stainless Steel	kilogram	41,600	$12.00	$499,200.00
21	Supply of Reinforcing Steel - Plain	kilogram	116,000	$3.00	$348,000.00
22	Place - Reinforcing Steel	kilogram	157,600	$2.00	$315,200.00
23	Supply of Girders - Steel 1900mm	tonne	290	$4,530.00	$1,313,700.00
24	Delivery of Girders	Lump sum	1	$115,000.00	$115,000.00
25	Erection of Girders	Lump sum	1	$250,000.00	$250,000.00
26	Bearings	each	12	$5,000.00	$60,000.00
27	Strong Post Guardrail -Supply & Install(beyond approach rail transition)	meters	200	$150.00	$30,000.00
28	Guardrail End Treatment	Each	4	$6,000.00	$24,000.00
29	Approach Rail Transition	Each	4	$5,500.00	$22,000.00
30	Pedestrian Handrail	meters	62	$1,000.00	$62,000.00
31	Miscellaneous Iron (pile bracing, girder anchors, steel plates etc.)	lump sum	1	$20,000.00	$20,000.00
32	Conduits	lump sum	1	$2,000.00	$2,000.00
33	Deck Waterproofing	square meter	967	$75.00	$72,525.00
34	Asphalt Concrete Pavement - Mix Type Mix Type H2 using PG 58-28 Asphalt Cement Grade	tonne	180	$120.00	$21,600.00
35	Safety Railing on Retaining wall	meters	92	$300.00	$27,600.00
36	Retaining wall granular Backfill	Cubic meters	-	$120.00	$0.00
37	Erosion Control Barrier (Silt Fence)	meters	200	$16.00	$3,200.00
38	River Protection Work	lump sum	1	$410,000.00	$410,000.00
				TOTAL (Round to $1000)	**$7,862,000.00**
				Contingencies 15% (Round to $1000)	**$1,179,000.00**
				Total Construction Cost (Round to $1000)	**$9,041,000.00**

Appendix G – WILDLIFE PASSAGE DESIGN RECOMMENDATIONS

Ellerslie Road Ecostation to Graydon Hill Project Wildlife Passage Design Recommendations

October 19, 2023

Prepared for:
Transportation Group, Stantec Consulting Ltd.

Prepared by:
Environmental Services, Stantec Consulting Ltd.

Project Number:
116110875

Limitations and Sign-off

This document entitled Wildlife Passage Design Recommendations was prepared by Environmental Services, Stantec Consulting Ltd. (“Stantec”) for the account of Transportation Group, Stantec Consulting Ltd. (the “Client”). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec’s professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

Prepared by: _____
Signature

Sheila McKeage, B.Sc., P.Biol., R.P. Bio.
Senior Wildlife Biologist
Printed Name and Title

Reviewed by: _____
Signature

Bill Harper, B.Sc., M.Sc., R.P.Bio.
Senior Wildlife Biologist
Printed Name and Title

Approved by: _____
Signature

Kurtis Fouquette, B.Sc., P.Biol.
Senior Associate,
Senior Environmental Scientist
Printed Name and Title

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Photo 1. View of existing Ellerslie Road bridge structure over Whitemud Creek, looking north. A.2
Photo 2. View of existing box culvert at Ellerslie Road and unnamed ravine crossing showing wildlife usage, looking south. A.2

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Appendix A Photos

1.0 Introduction

Ellerslie Road (9 Avenue SW) will be upgraded from a rural cross section to an urban curb and gutter road and widened to accommodate expanding residential development in southern Edmonton. Part of the Ellerslie Road upgrade, the Ellerslie Road EcoStation to Graydon Hill Project (the Project), intersects the Whitemud Creek ravine system. This ravine system is designated as a Biodiversity Core Area (City of Edmonton 2007) and provides habitat and a movement corridor for numerous wildlife species within Edmonton. The Project includes two additional traffic lanes and a second two-lane bridge over Whitemud Creek, with eventual replacement of the existing bridge, approximately 185 metres (m) west of the intersection with 141 Street SW. Without the implementation of mitigation measures including wildlife passage structures, the widening of Ellerslie Road, and projected increases in traffic volume and vehicle speed, is expected to increase the adverse impacts of the road on wildlife at this location. Roads affect wildlife and biodiversity primarily through habitat change including habitat fragmentation and genetic isolation, sensory disturbance, change in movements, and direct mortality though wildlife-vehicle collisions.

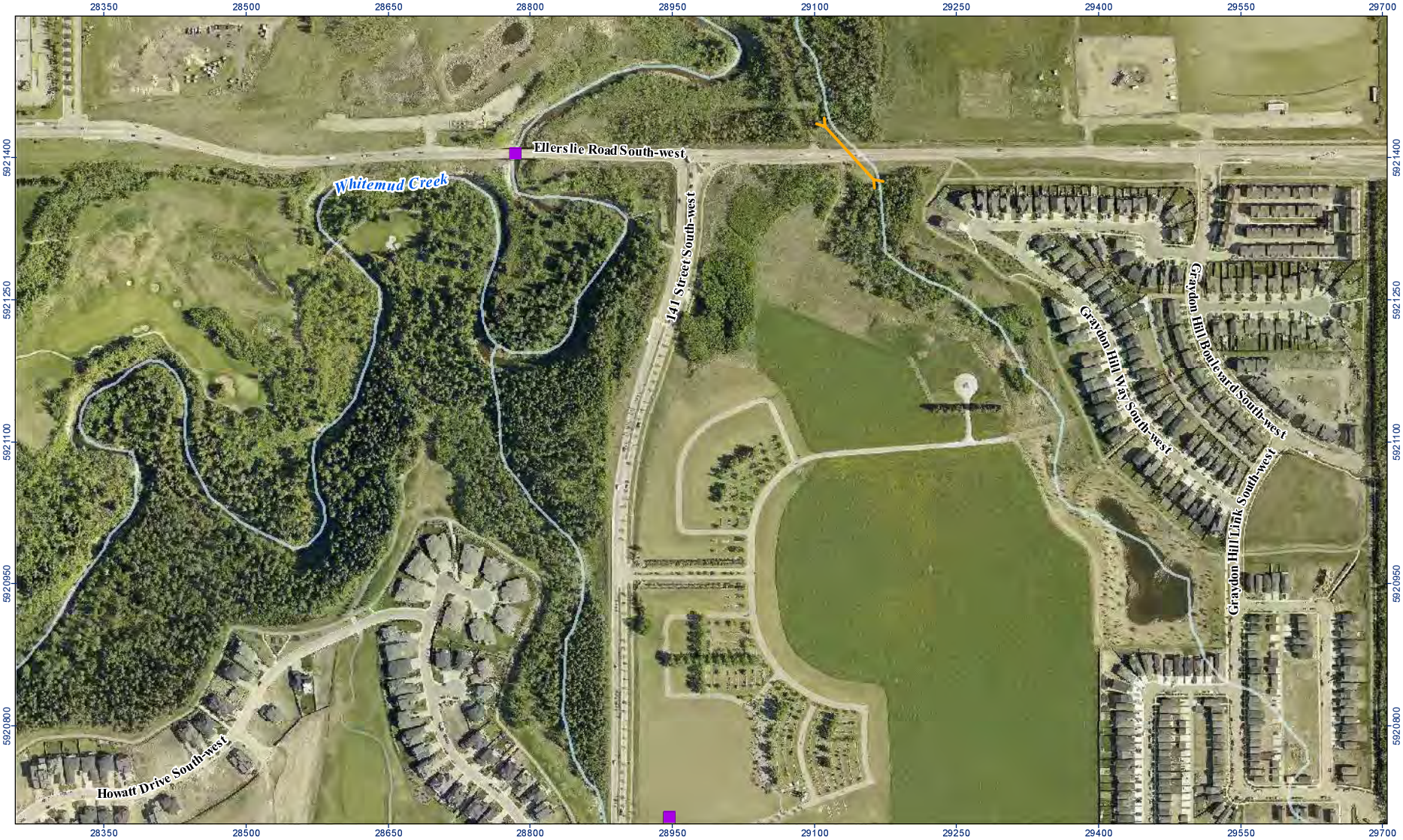
The primary mitigation to reduce the impacts of roads on wildlife and biodiversity is to provide safe passage opportunities and to direct wildlife movements away from heavily trafficked roads via exclusion fencing. Wildlife passage structures are required as part of the road design for the Project to maintain permeability for wildlife movements and to improve motorist safety by reducing the potential for wildlife-vehicle collisions.

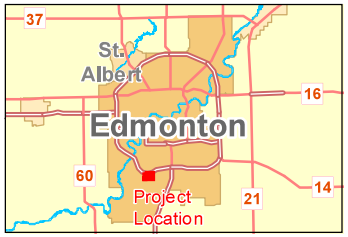
The City of Edmonton commissioned the *Wildlife Passage Engineering Design Guidelines* (WPEDG) (City of Edmonton 2010) to guide the incorporation of measures to reduce the impacts of roads on wildlife into the development of transportation infrastructure. The objective of these guidelines is to reduce human-wildlife conflict through improved awareness, safety, and collision reduction while also aiding in the maintenance of habitat connectivity and reducing genetic isolation.

The objective of this report is to provide preliminary design recommendations for Project infrastructure based on guidance in the WPEDG for the Ellerslie Road Ecostation to Graydon Hill Project.

2.0 Project Area and Baseline Wildlife Movement Patterns

The Project area includes Ellerslie Road from Ellerslie Road EcoStation to Graydon Hill. The Project area includes an intersection with 141 St SW and bisects Whitemud Creek ravine and a small unnamed tributary ravine approximately 400 m east of Whitemud Creek (Figure 1).





Whitemud Creek Bridge

Box culvert at unnamed ravine

Watercourse

N

0 50 100 metres
(At original document size of 8.5x11)
1:6,000

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Data Sources: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, 2020.

Stantec

Project Location
Within NW 24-51-25 W4M
Edmonton, Alberta

Prepared by MKuhl on 2022-05-31
TR by ABcd on 2021-XX-XX
IR by ABcd on 2021-XX-XX

1161110185

Client/Project
Graydon Hill Developments Ltd.
Environmental Screening Report
for Graydon Hill Road Widening

Figure No.
1

Title
Project Overview

Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

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Suitable wildlife habitat occurs on either side of Ellerslie Road within the Project area, including treed, riparian, and open areas. During fieldwork completed for the Project, mammal tracks (white-tailed jackrabbit [*Lepus townsendii*], coyote [*Canis latrans*], deer *spp.*[1]) were observed crossing Ellerslie Road at grade (Stantec 2019 and 2020, unpublished data). A winter snow-tracking survey in the Project area on February 7, 2014 identified only few deer tracks south of Ellerslie Road, but much more deer activity north of Ellerslie Road, (20 fresh and 44 older tracks). The majority of these deer tracks were near Whitemud Creek, suggesting the forested area adjacent to Whitemud Creek north of Ellerslie Road was being used as winter range (Stantec 2014). Bird and bat species present in the Whitemud Creek ravine system likely fly across Ellerslie Road throughout the Project area while moving between habitat patches.

There are two existing wildlife passage structures within the Project area: the Whitemud Creek bridge and a box culvert at the unnamed ravine crossing (Figure 1). Evidence of wildlife use of both structures has been observed at both structures during snow track surveys.

Both wildlife passage structures will be retained and upgraded as part of the Project.

2.1 Whitemud Creek Bridge

The existing bridge over Whitemud Creek is approximately 50 m long and 10 m wide (Appendix A, Photo 1). The bridge piles are protected by a rip-rap apron and are situated above Whitemud Creek's wetted area at typical water flows but may lie below 1:100-year flood elevations. There is an existing bench, approximately 2 to 3 m wide, under the bridge on the east side of the creek. Evidence of coyote and deer crossing under the bridge has been observed on the bench and on the frozen creek during the winter (Stantec 2020, unpublished data).

The Project will add a second bridge on the north side of the existing structure. Conceptually, the existing path on the east side of Whitemud Creek would extend under the new bridge structure. Preliminary concepts for the new bridge would include a distance of approximately 2 m of open span between the existing bridge and the new bridge structure. The addition of the second bridge, and the berm required to support its eastern abutment, will extend the distance for wildlife to pass through the crossing structures and may affect its use by some species. The approximate length of the wildlife passage with the addition of the second bridge will be slightly less than 40 m, inclusive of the 2 m of open span.

2.2 Box Culvert at Unnamed Ravine

Ellerslie Road bisects an unnamed ravine approximately 400 m east of Whitemud Creek where a box culvert is in place to allow for ephemeral water flows and acts as a wildlife passage structure. South of Ellerslie Road, this unnamed ravine is proposed as an Environmental Reserve as part of the Graydon Hill Neighborhood Structure Plan. The ravine includes a non-fish bearing seasonal tributary to Whitemud Creek, which drains under Ellerslie Road via an existing 1,000 millimetre (mm) box culvert (Figure 1). The proposed Environmental Reserve was identified in the surrounding Heritage Valley 13 Neighbourhood

[1] Deer tracks could have been white-tailed deer (*Odocoileus virginianus*) or mule deer (*Odocoileus hemionus*), but white-tailed deer are the most common local deer species

Structure Plan (Stantec 2012) as having a high to moderate interconnectivity to the Whitemud Creek Ravine System.

The existing 1,000 mm box culvert (1 m x 1 m) is 44.4 m long and is used as a passage by wildlife (Appendix A, Photo 2; Stantec 2020, unpublished data). The Project includes the extension of the existing box culvert by 8.5 m to accommodate the widened road. The total length of the extended 1,000 mm box culvert will be approximately 53 m. The extended box culvert fits the definition of a below-grade wildlife passage structure that is suitable for Medium Terrestrial, Small Terrestrial, and Amphibian EDGs (City of Edmonton 2010).

3.0 Target Wildlife Ecological Design Groups

The WPEDG provides wildlife species categories, called Ecological Design Groups (EDG), based on characteristics relevant to wildlife passage planning and design, including the size, mobility and habitat use of the target EDGs. Based on the species observed within the Project area (Clark Ecoscience 2013; Stantec 2014; Stantec 2019 and 2020, unpublished data) and through discussion with City of Edmonton staff, wildlife passage design should consider the following EDGs: Large Terrestrial, Medium Terrestrial, Small Terrestrial, Amphibian, Aquatic, Aerial Mammal, Scavenger Birds, Birds of Prey, Water Birds, Ground Dwelling Birds, and Other Birds.

4.0 Wildlife Passage Design Recommendations

Based on the WPEDG and the EDGs identified for the Project area, below-grade crossings are required to accommodate Large Terrestrial, Medium Terrestrial, Small Terrestrial, Amphibian and Aquatic EDGs. The recommended wildlife passage design for Ellerslie Road includes maintaining below-grade crossing for terrestrial and aquatic EDGs at current locations with design features incorporated into the upgraded infrastructure to facilitate wildlife movement. Because this Project is at the preliminary design stage, specific recommendations pertaining to wildlife passage measures and other general mitigation measures are provided below but may need to be refined at the detailed design stage.

4.1 Whitemud Creek Bridge

The existing Whitemud Creek Bridge is considered a suitable passage structure for the Large Terrestrial EDG and other terrestrial EDGs (e.g., Medium Terrestrial, Small Terrestrial, and Amphibian). A second two-lane bridge over Whitemud Creek that parallels this existing bridge structure is proposed for this Project. These two parallel Whitemud Creek bridges are expected to be the primary means of Large Terrestrial EDG passage through the Whitemud Creek ravine below Ellerslie Road. By designing a suitable passage for the Large Terrestrial EDG, the second two-lane bridge structure is expected to be suitable for other terrestrial EDGs.

The largest species expected to use this wildlife passage is moose (*Alces alces*). The US Federal Highway Administration's *Wildlife Crossing Structure Handbook, Design and Evaluation in North America* (Clevenger and Huijser 2011) recommends a minimum opening of 4 m high and 7 m wide for large mammal underpasses. However, because moose prefer large, open structures with good visibility and vertical clearance, these minimum dimensions may not be sufficient to ensure regular use. Stantec recommends a passage with a minimum opening of 4.5 m high and 12.0 m wide based on Clevenger and Huijser (2011). Height measurement refers to height from expected movement path for terrestrial wildlife.

Other design recommendations for the proposed second Whitemud Creek bridge are as follows:

- Include dry ground adjacent to the creek. A bench to accommodate wildlife passage should be provided on the east side of Whitemud Creek. The wildlife passage bench width should be a minimum of 2 m (preferably 3 m) (Huijser et al. 2008; Alberta Transportation 2020), with minimum clearance between the bench and the ceiling of the underpass at 3 m (Huijser et al. 2008), but as above, Stantec recommends a 4.5 m clearance.
- Reduce the length of the passage by incorporating retaining wing-walls (e.g., mechanically stabilized earth [MSE] walls) at both entrances.
- Maintain the natural substrate below the crossing or reclaim with natural substrate (e.g., soil and vegetation).
- Avoid the use of rip rap for bank armoring if possible. If it must be used, review options to naturalize the rip rap.

- Maintain natural side slopes beneath the bridge to the extent possible and avoid sharp vertical walls that impede wildlife movement (Jackson and Griffin 2000). It may be necessary to tie the wildlife passage bench into gentle sloping fill (3:1 to 4:1) north of Ellerslie Road to avoid construction of vertical retaining walls that might be necessary to extend the wildlife passage bench north of the bridge.
- Provide natural light and clear lines of sight. Given that the proposed structure is a two-lane bridge (with potential to expand to another lane in the future) adequate openness and lines of site are expected to be accomplished through the bridge structure alone. The berm supporting the road and bridge on the north side should be kept as far back from Whitemud Creek as possible.
- Incorporate micro-habitat complexity using salvage materials (logs, root wads, rock piles etc.) within the crossing structure to provide Small Terrestrial EDGs security cover and protection from predators (e.g., incorporation of logs, rocks, stumps).
- Limit the construction footprint to the extent practical to retain native vegetation.
- Maintain the natural streambed for Aquatic EDGs to the extent possible.
- Locate bridge piles outside of creek bed.
- Consider designing the bridge underside to accommodate roosting for bats. Typically, this consists of vertical crevices 0.25 to 3 centimetres (cm) wide and 30 cm deep, located at least 3 m above the ground (Keeley and Tuttle 1999)
- Consider installing taller streetlights on the bridge to encourage bat foraging for insects near streetlights to occur higher than the vehicles.

4.2 Box Culvert at Unnamed Ravine Crossing

The dimensions of the planned extended box culvert wildlife passage structure are suitable for all terrestrial EDGs except Large Terrestrial (City of Edmonton 2010). Other design features that may be incorporated which may increase the structure suitability for wildlife passage include:

- The extended box- culvert wildlife passage structure should be designed for the largest terrestrial EDG likely to currently use this structure, in this case Medium Terrestrial. By designing for this group, the majority of the other EDG's should be able to use the crossing.
- The current condition of the existing box culvert should be confirmed by camera inspection to determine if any blockages or constrictions are present.
- Natural substrate and native vegetation should be present at the approach to the wildlife passage. These may assist in creating a natural feel for the structure and, for smaller EDGs, provide security cover from predators. Rip-rap used at the inlet and outlets should be the smallest possible to prevent erosion. Debris grates should not be installed.
- Incorporate micro-habitat complexity using salvage materials (logs, root wads, rock piles etc.) within the wildlife passage structure to provide Small Terrestrial EDGs security cover and protection from predators (e.g., incorporation of logs, rocks, stumps).

- Approximately 200 m of small mammal/amphibian diversion fencing (100 m on either side of Ellerslie Road) should be installed to force small animals to use the below-grade wildlife passage structure rather than cross over the road.

4.3 Other Wildlife Passage Design Recommendations

Wildlife exclusion fencing designed for large terrestrial animals (i.e., deer and moose) along Ellerslie Road is not currently recommended due to the potential for ungulates to enter the fenced area at the intersection with 141 Street SW and become trapped on the roadway. Huijser et al. (2015) point out that short sections of fence tend to be less effective at reducing wildlife-vehicle collisions than longer sections of fence due to end runs of the fencing system and intrusions by wildlife into the fenced road corridor at the fence ends. The steep slopes of the bridge berm and Whitemud Creek may direct wildlife to the crossing structures without the use of fencing. As well, fences are not used at the crossing of 23 Avenue and Whitemud Creek, a structure similar to that proposed for the Project. However, the City of Edmonton may require some form of wildlife exclusion fencing for the Project. Escape features for trapped wildlife (e.g., one-way gates, jump outs) and appropriate fence end treatments should be incorporated into a wildlife exclusion fence design should one be required.

McGuire et al. (2020) refer to design parameters and construction techniques that can reduce or avoid costs, while maintaining or improving the overall efficacy of wildlife crossing structures. To maintain the long-term functionality of wildlife crossing structures, it is important conserve and manage the lands on both sides of these structures in a way that facilitates wildlife movement and population connectivity (McGuire et al. 2020).

The following mitigation measures are recommended to reduce the risk of collisions between vehicles and the Aerial Mammals, Scavenger Birds, Birds of Prey, Water Birds and Other Birds EDGs as they fly over Ellerslie Road.

- Use natural vegetation and tree plantings to direct the flight path of birds and bats higher over the road so that these species can cross the road more safely away from traffic (Tremblay 2006). This will also help minimize the gap in habitat created by the road right-of-way and maintain the aesthetics of the area. To accomplish this measure, clearing of mature trees and vegetation should be reduced to the extent possible along Ellerslie Road and any tree plantings should be taller than the highest vehicles using the road.
- Install wildlife-friendly streetlights that reduce spill and glare for areas adjacent to the Whitemud Creek Ravine

5.0 Summary

The Project presents opportunities to address the impacts of roads on wildlife at Whitemud Creek. This report provides preliminary design recommendations for the Project based on the WPEDG, peer-reviewed, and gray literature. These recommendations will likely need to be refined and revised as more detailed design progresses.

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Appendix A Photos

Photo 1. View of existing Ellerslie Road bridge structure over Whitemud Creek, looking north.

Photo 2. View of existing box culvert at Ellerslie Road and unnamed ravine crossing showing wildlife usage, looking south.

Appendix C Plant Community and Land Unit Descriptions

Table C-1 Plant Community / Land Unit Descriptions

Plant Community/ Land Unit	Map Code	Description
Upland Plant Community		
Aspen Poplar Woodland Alliance	AP	This alliance also has a deciduous-dominated canopy, but is typically mixed with both aspen and balsam poplar (*Populus balsamifera*) species. Occasionally paper birch (*Betula papyrifera*) may be dominant or co-dominant in some stands. Minor components of spruce (*Picea* sp.) may also occur in the canopy. This plant community is characteristically found in lower slope positions along streams and riverbanks or lake margins, or in wet, depressional areas on moderately to imperfectly drained soils.
Aspen Woodland Alliance	AW	The canopy of this woodland alliance is composed primarily of aspen (*Populus tremuloides)*, but may have minor components of coniferous species (often spruce). This plant community is characteristic of a wide variety of sites from steep slopes to gradual to moderate (level) areas to depressions and low-lying areas, but these sites are typically are not very wet, occupying well to moderately well drained soils.
Balsam Poplar Woodland Alliance	PB	The canopy of this woodland alliance is composed primarily of balsam poplar, but can also have inclusions of aspen, paper birch and sometimes minor spruce components. Willow species (*Salix* sp.) can also form a major component of the shrub layer, as seen through openings in the forest crown, or even make up canopy level structure in some stands. These communities commonly occur on level areas adjacent to wetlands, lakes, rivers or in low-lying areas (link in between sand dunes) or wet and nutrient rich substrates. These sites are typically found on moderately well to imperfectly drained soils, and can be derived from a fluctuating water table or continuous water source (soil is wet for a longer portion of the growing season).
Mixed Deciduous and Evergreen Woodland Alliance	MX	This upland woodland alliance has a mixed forest canopy of both deciduous and coniferous species. The deciduous component is often dominated by aspen, balsam poplar, and paper birch, while the coniferous component is typically dominated by white spruce (*Picea glauca*). This alliance is typically found on well to moderately well drained upland soils with submesic to subhygric moisture conditions. However, some sites can be found in more low-lying areas or near water courses where they can receive nutrient rich seepage or flood waters for a portion of the growing season. As a result, slope and aspect are variable on these sites.
White Spruce Woodland Alliance	SW	This woodland alliance is dominated by white spruce, although minor components of balsam fir (*Abies balsamea*), aspen, balsam poplar, paper birch or even black spruce (*Picea mariana*) can occur in some stands. In this area, communities of this alliance are found in more middle to lower slope positions or in depressions where additional moisture and cooler temperatures prevail. It can sometimes be classified as a white spruce swamp but is still generally considered to be an upland community. This woodland alliance is perhaps more common further north into the Boreal Forest Natural Area, but in the Parkland Natural Region it is perhaps less common and, at times, can be considered locally rare.

Plant Community/ Land Unit	Map Code	Description
Tall Shrubland Alliance	TSA	This upland shrubby alliance typically includes aspen, choke cherry (*Prunus virginiana*), prickly rose (*Rosa acicularis*), wild red raspberry (*Rubus idaeus*) or willow. These communities are typically between 1.5 to 5 m in height and can represent younger, shrub-level successional stages of other upland woodland alliance communities, usually from some form of disturbance (either natural or anthropogenic). Some communities form when beavers, pathogens or insect outbreaks remove large portions of the forest canopy allowing the shrub layer to develop. These sites can be found in a variety of locations, from dry, steep, south facing slopes with rapid soil drainage to well to moderately well drained upland clearings and open (level) woodlands.
Short Shrubland Alliance	SS	This shrubby community type is similar to the Tall Shrubland Alliance described above; however, the shrub layer is typically shorter than 1.5 m in height. It often includes groves of snowberry (*Symphoricarpos albus*) or buckbrush (*Symphoricarpos occidentalis*) in addition to aspen, choke cherry, prickly rose, wild red raspberry and/or willow.
Water Land Unit		
Open Water	OW	This land unit is considered open water greater than 2 m deep, including ponds, lakes, rivers and flooded areas, which are not part of any natural ephemeral to semi-permanent wetland or anthropogenic dugout or reservoir.
Agricultural Land Unit		
Cultivated Land	CL	This unit includes all cultivated lands used for agronomic, annual crops, such as barley, wheat or oats, and hayfields used for bailing or silage in the fall. Narrow features such as windrows, roads and ditches may also be included within this agricultural land unit.
Green Space	GS	This unit includes areas created or maintained by man, currently used as green space. Some areas in this map unit include the following: parks, campgrounds, cemeteries, golf courses, ribbon development and recreational areas.
Industrial Development	IL	This unit includes all general industrial and/or oil & gas development, including plant sites, mine sites, well sites and other geophysical activities. It may or may not contain vegetated lands.
Perennial Pasture	PP	Perennial pasture includes land that is, or was, used for grazing livestock. It can include reclaimed lands or farmland planted with cultivated grasses and/or legumes that may be harvested at least once a year; however, these areas are typically rarely cultivated.
Residential	RR	This unit includes all settled areas. It also includes new subdivisions where land clearing has occurred (future residences).
Transportation	TR	This unit includes all roads, trails, highways, rail lines and rail yards that may or may not be vegetated. Areas cleared and/or maintained in association with transportation rights-of-way are also included.

Appendix D Vegetation List

Table D-1 Vegetation List

Scientific Name	Common Name	S-Rank [1]	G-Rank [2]	Native or Exotic	ACIMS Track List
Acer negundo	Manitoba maple	SU	G5	Native	Do not track
Achillea millefolium	common yarrow	SNA	G5	Exotic	Do not track
Actaea rubra	red and white baneberry	S5	G5	Native	Do not track
Agropyron cristatum	crested wheatgrass	SNA	G5	Exotic	Do not track
Alnus incana	grey alder	S5	G5	Native	Do not track
Amelanchier alnifolia	saskatoon	S5	G5	Native	Do not track
Anemonastrum canadense	Canada anemone	S5	G5	Native	Do not track
Anemone cylindrica	long-fruited anemone	S5	G5	Native	Do not track
Aruncus dioicus	common goatsbeard	S1	G5	Native	Do not track
Betula papyrifera	white birch	S5?	G5	Native	Do not track
Bromus inermis	smooth brome	SNA	G5T5	Exotic	Do not track
Caragana arborescens	common caragana	SNA	GNR	Exotic	Do not track
Carex spp.	-	-	-	-	-
Carex deweyana	Dewey's sedge	S4	G5	Native	Do not track
Cirsium arvense	creeping thistle	SNA	G5	Exotic	Do not track
Cornus sericea	red-osier dogwood	S5	G5	Native	Do not track
Corylus cornuta	beaked hazelnut	S5	G5	Native	Do not track
Elaeagnus commutata	silverberry	S5	G5	Native	Do not track
Eleocharis palustris	creeping spike-rush	S5	G5	Native	Do not track
Elymus trachycaulus	slender wildrye	S5	G5	Native	Do not track
Equisetum arvense	common horsetail	S5	G5	Native	Do not track
Equisetum pratense	meadow horsetail	S5	G5	Native	Do not track
Fraxinus pennsylvanica	green ash	S2	G4	Native	Track selected extant EOs (i.e., partial tracking)
Galium boreale	northern bedstraw	S5	G5	Native	Do not track
Galium triflorum	sweet-scented bedstraw	S5	G5	Native	Do not track
Geum macrophyllum	large-leaved yellow avens	S5	G5	Native	Do not track
Geum rivale	purple avens	S5	G5	Native	Do not track
Heracleum maximum	cow parsnip	S5	G5	Native	Do not track
Lathyrus spp.	-	-	-	-	-

Scientific Name	Common Name	S-Rank [1]	G-Rank [2]	Native or Exotic	ACIMS Track List
Lonicera involucrata	bracted honeysuckle	S5	G5	Native	Do not track
Machaeranthera tanacetifolia	tansy aster	S1	G5	Native	Track all extant and selected historical EOs
Maianthemum canadense	wild lily-of-the-valley	S5	G5	Native	Do not track
Maianthemum stellatum	star-flowered Solomon's-seal	S5	G5	Native	Do not track
Medicago sativa	alfalfa	SNA	GNR	Exotic	Do not track
Mertensia paniculata	tall lungwort	S5	G5	Native	Do not track
Muhlenbergia spp.	-	-	-	-	-
Picea glauca	white spruce	S5	G5	Native	Do not track
Poa palustris	fowl bluegrass	S5	G5	Native	Do not track
Poa pratensis	Kentucky bluegrass	S5	G5	Native	Track selected extant EOs (i.e., partial tracking)
Populus balsamifera	balsam poplar	S5	G5	Native	Do not track
Populus tremuloides	aspen	S5	G5	Native	Do not track
Prunus virginiana	choke cherry	S5	G5	Native	Do not track
Ribes americanum	wild black currant	S4	G5	Native	Do not track
Ribes oxyacanthoides	northern gooseberry	S5	G5	Native	Do not track
Ribes triste	wild red currant	S5	G5	Native	Do not track
Rosa acicularis	prickly rose	S5	G5	Native	Do not track
Rubus idaeus	wild red raspberry	S5	G5	Native	Do not track
Sanicula marilandica	snakeroot	S4S5	G5	Native	Do not track
Scirpus spp.	-	-	-	-	-
Scirpus microcarpus	small-fruited bulrush	S5	G5	Native	Do not track
Solidago altissima	tall goldenrod	S5	G5	Native	Do not track
Solidago altissima	tall goldenrod	S5	G5	Native	Do not track
Sonchus arvensis	perennial sow-thistle	SNA	GNR	Exotic	Do not track
Symphoricarpos occidentalis	buckbrush	S5	G5	Native	Do not track
Symphyotrichum puniceum	purple-stemmed aster	S4	G5	Native	Do not track
Symphyotrichum puniceum var. puniceum	purple-stemmed aster	S4	G5T5	Native	Do not track
Tanacetum vulgare	common tansy	SNA	GNR	Exotic	Do not track
Taraxacum officinale	common dandelion	SNA	G5T5	Exotic	Do not track

Scientific Name	Common Name	S-Rank [1]	G-Rank [2]	Native or Exotic	ACIMS Track List
Thalictrum spp.	-	-	-	-	-
Thalictrum venulosum	veiny meadow rue	S5	G5	Native	Do not track
Viburnum edule	low-bush cranberry	S5	G5	Native	Do not track
Vicia americana	wild vetch	S5	G5	Native	Do not track
Viola canadensis	western Canada violet	S5	G5	Native	Do not track

Notes:

[1] **Standard Subnational Conservation Ranks:**

SX Taxon is believed to be extirpated from the province.

SH Known from only historical records but still some hope of rediscovery.

S1 Known from five or fewer occurrences or especially vulnerable to extirpation because of other factor(s).

S2 Known from twenty or fewer occurrences or vulnerable to extirpation because of other factors.

S3 Known from 100 or fewer occurrences, or somewhat vulnerable due to other factors, such as restricted range, relatively small population sizes, or other factors.

S4 Apparently secure.

S5 Secure - taxon is common, widespread, and abundant.

SNA Not applicable- A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities. Example - introduced species

[2] **Global Conservation Status Ranks:**

G5 Secure-At very low risk for extinction or elimination due to a very extensive range, abundant populations or occurrences, and little or no concern from declines or threats

G4 Apparently Secure — At fairly low risk of extinction or elimination due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors

T# Infraspecific Taxon (trinomial) - The status of infraspecific taxa (subspecies or varieties) are indicated by a "T-rank" following the species' global rank.

GNR Unranked-Global rank not yet assessed