GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
Where Project Meets the Environment

CSR CONSULTANTS LTD

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Date: 2022-12-19
Project ID: 189-06G (G21-004-02)

GEOTECHNICAL INVESTIGATION REPORT – PROPOSED SUBDIVISION

2026 MCANDREW CRESCENT, PRINCE GEORGE, BC

PREPARED FOR:
Kidd Group of Companies
#101 - 8191 Hart Highway,
Prince George, BC V2K 3B1

Report Number: G21-004-02-1R1

DISTRIBUTION:
1 Electronic Copy – Kidd Group of Companies
1 Electronic Copy – Scouten Engineering

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1.0 INTRODUCTION

CSR Consultants Ltd. (CSR) was retained by Kidd Group of Companies (the Client) to provide a Geotechnical assessment for the proposed subdivision (the Project) of the property located at 2026 McAndrew Crescent, Prince George, BC (the Site) and an extended assessment of neighbouring site at 1994 McAndrew Crescent. According to drawings provided by Scouten Engineering, the proposed development includes the division of the property into six residential home lots. The 1994 McAndrew Crescent was previously studied, and a report was prepared by CSR Geotechnical dated December 10, 2021.

The main objective of this study is to evaluate the subsurface geology, soil stratigraphy, groundwater condition and slope stability of the Site based on the results of a field investigation and prepare a geotechnical investigation report.

This geotechnical investigation report summarizes the findings of the geological desktop study and geotechnical investigation of the soil and groundwater conditions at the Site. It provides the geotechnical input and design recommendations for the engineering design and construction of buildings foundations, lateral earth pressures and retaining walls.

2.0 SITE DESCRIPTION

The Site is bounded by McAndrew Crescent to west, neighboring properties to the north and south, and undeveloped land to the east. The Site measures approximately 3,040 square metres (m^2) in area. It is located in a Greenbelt Zone (AG) and is currently undeveloped.

According to the City of Prince George's geographic information system (GIS) online mapping database (PG Map, 2022), the Site is relatively flat with a gradual slope from the southeast to the northwest corner. The north end has a steep slope with a grade difference of up to 13 m. There is a grade difference of approximately 1.5 to 2 m between the Site and McAndrew Crescent. The Site is also sloped on the southeast end, with a grade difference of approximately 4 m.

3.0 GEOTECHNICAL INVESTIGATION AND TESTING

A drilling investigation was carried out on June 23, 2022, by CSR and Uniwide Drilling of Prince George. One test hole (TH22-01) was advanced using the solid stem auger drill to a depth of 7.6 m and one test pit (TP22-01) was completed to a depth of 4.0 m below ground surface (bgs). The location of test hole and test pit can be found in the Site plan (Drawings G21-004-02-GS101), following the text of this report. Two Dynamic Cone Penetration Tests (DCPT) were also completed to assist in determining the relative density/consistency of the subsurface soils.

Upon completion, the test holes were backfilled in accordance with Provincial groundwater protection regulations. All fieldwork was carried out under the full-time supervision of our geotechnical engineering staff member, who located the test holes in the field, examined and logged the subsurface conditions encountered, and collected representative soil samples for detailed examination and testing.

Infiltration testing using Guelph Permeameter was completed close to TH22-01, which is located on 1994 McAndrew Crescent, at a depth of approximately 0.3 m and 1.2 m bgs. One infiltration test was completed on Site close to TP22-01 at a depth of 0.3 m bgs.

A detailed description of soils can be found in the test hole logs in Appendix A.

4.0 SUBSURFACE CONDITION

Based on available surficial geology information (Geological Survey of Canada, Map 3-1969), the geology of the Site consists of glaciofluvial deposits including esker gravel and sand, largely of lacustrine origin but deposited against and on ice.

Around 11 to 14 thousand years ago, due to glacial movement, glacial, glaciomarine and glaciofluvial sediments were accumulated. When the glaciers melted, a layer of till, including stone, gravel, sand, and clay was left over the Prince George area. Melt waters resulted in the accumulation of sand and gravel in the valleys between the Nechako and Fraser Rivers. Receding glaciers resulted in flooding of the Prince George Glacial Lake and Vanderhoof area left behind a thick layer of several meters of fine sand over the deposits of sand and gravel[1].

Based on the investigation completed on-Site, the subsurface conditions generally consisted of mainly loose to compact sand with traces of gravel.

4.1 Site Geology

Unit I Sand (Glaciofluvial Sediments)

The site geology mainly consisted of sand throughout the depths of the test holes. It was observed that TH22-02 had a trace of gravel and encountered some gravel between 0.15 to 0.24 m. This soil layer is compact, becoming dense with depth and was characterised as brown and moist to damp. DCPT blow count values range from 5 to 51 blows/0.3 m, increasing significantly at around 6.4 m in TH22-01 and 3.7 m in TH22-02.

4.2 Groundwater Conditions

Based on our Site review, no water seepage is observed at the slope, test hole and test pit locations. In addition, no groundwater seepage was observed at the excavated area at 1994 McAndrew Crescent. Some seasonal perched groundwater is expected due to snowmelt and surficial water infiltration. Based on the elevation of the Site and the nature of the sand, we expect the static groundwater table will be deeper than the proposed building foundation level. The static groundwater table elevation is expected to be deep and well below the construction level.

4.3 Seismic Condition

It is expected that the 2018 British Columbia Building Code (2018 BCBC) will be used for the project, which utilizes design seismic values of the 2015 National Building Code of Canada (2015 NBCC). The National Building Code of Canada seismic hazard values for a 2% probability in 50 years for Site Class C (average shear wave velocity 360 m/s to 760 m/s) were taken from the interactive site provided by Natural Resources Canada. Five percent damped spectral accelerations (Sa(T), where T is the period in seconds), and peak ground acceleration are summarized in Table 1 below.

[1] GEOTOUR GUIDE FOR PRINCE GEORGE, BC - Geological Survey of Canada Open File Report 5559, British Columbia Geological Survey Geofile 2010-10, R.J.W. Turner and G. Nowlan, Geological Survey of Canada; R. Franklin; N. Focht, The Exploration Place

Table 1. Design Spectral Acceleration Values (g) for a 2% Probability of Exceedance in 50 Years

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	PGA
0.114	0.089	0.059	0.040	0.050

4.4 Infiltration Testing

Guelph Permeameter has been utilized to evaluate the infiltration capacity of the soil on this site. Guelph Permeameter Kit follows the ASTM D5126 standard, by measuring the permeability of the soil using falling head method. Three tests were completed on this Site, two were located on native sand and the third one was on native sand that has been compacted due to the excavator load.

The Infiltration test results summarized in Table 2 and detail presented in Appendix B following text of this report. It is recommended that any infiltration system to be design based on a factor of safety of 2.0 applied to the rates obtained from the infiltration test results.

Table 2. Infiltration Test Results

Test	Depth (m)	Approximate Elevation (m)	Soil Type	Permeability (K) (m/sec)		
				Head 50mm	Head 100mm	Average
GPT22-01	0.3	657	Native Sand	8.2E-05	4.8E-05	6.5E-05
GPT22-02	0.3	653	Compacted Sand	1.1E-05	6.4E-06	8.7E-06
GPT22-03	1.2	652.1	Native Sand	8.9E-05	4.6E-05	6.7E-05

5.0 SLOPE STABILITY ASSESSMENT

5.1 Review of Background Information

CSR collected and reviewed available information related to the geotechnical aspects of the Site. The purpose of this review was to enhance our understanding of the subsurface soil and groundwater conditions to assist us to develop the numerical model for slope stability analysis.

Available aerial photographs obtained from the city of Prince George GIS (PGMap) were reviewed through the years from 1993 to 2020. The historical photographs show the Site has been cleared between the years of 1997 and 2003, trees had been removed and a portion of the east slope was excavated and regraded. The slope regrading resulted in the steeper slope at 37 degrees at the toe of the slope. The City of Prince George orthophoto data and our observation on-Site show the slope has been stable since 2003, with no indication of slope failure or instability.

Based on the City of Prince George's surficial geology information (Geological Survey of Canada, Map 3-1969), the geology of the Site consists of Glaciofluvial Deposits, mainly sand, largely of lacustrine origin but deposited against and on ice.

5.2 Visual Slope Condition Review

CSR has reviewed the current condition of the slope on the Site. The east slope at excavated and regraded face was observed to be lightly vegetated with seasonal plants and showed some sign of surficial erosion at this section, resulting in a flatter grade at the toe of slope.

The critical slope was observed to be at 1994 McAndrew Crescent. The slope generally turns to the east away from the lots and the gradient becomes flatter towards the north.

A tree trunk was observed to be bent on the upper slope area which can be sign of slope creep and movement. However, the shape of the bend shows that the movement possibly happened many years ago.

There is tree cleared area above 1994 McAndrew Crescent that based on historic satellite photos may have been cleared to access the top of slope in the past. However, the lack of trees in this area may contribute to erosion and the surficial movement of the upper soil layers of the slope.

5.3 Slope Stability Analysis

The slope stability assessment was undertaken in accordance with the 2018 BCBC. The 2018 BCBC was addressed using the A Guidelines for Legislated Landslide Assessments [2] (the Guideline).

Our analysis is considered the evaluation of the current stability of the Site and the effects of the proposed building construction on the global stability of the slope in both static and seismic conditions. The stability assessment was carried out using the software program SLOPE/W (2021), which employs the Morgenstern-Price limit equilibrium method. A wide range of potential slip surfaces was calculated to determine the lowest factor of safety.

The horizontal earthquake acceleration coefficient is assumed to be equal to the peak spectral response acceleration of 0.05g with a 2% probability of exceedance in 50 years, determined from the National Building Code of Canada (NBCC) seismic hazard calculator for the Site.

Subsurface stratigraphy and soil strength parameters were interpreted based on our site investigation and available geological data, and calibration of the analysis model.

Four sections have been selected from the sections provided in the Site layout drawings prepared by Scouten Engineering for the slope stability assessment to represent different slope geometry in relation to the proposed buildings. Section A was used to evaluate the northern slope. Three Sections of B, C and D were selected to evaluate the eastern slope of Section B located in 1994 McAndrew Crescent while Section C and D represent of Lot 1 and Lot 2 of the proposed subdivision. The summary of slope stability analysis results is presented in Table 3 and a detailed analysis is presented in Appendix C.

According to the Landslide Guideline, based on the results of Section D, slopes along Lot 2, 3 and 4 have been deemed stable. The analysis results meet the guideline that requires a global factor of safety greater or equal to 1.5 and 1.0 for static and seismic conditions, respectively. Lot 1, Lot 5 and 1994 McAndrew Crescent require a retaining wall system in a form of reinforced concrete and/or Mechanically Stabilized Earth (MSE) retaining walls at the edge of the foundations to meet these requirements. Alternatively building foundation walls can be designed as a retaining wall to support the slope.

[2] Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia, Revised May 2010, Engineers and Geoscientists of British Columbia (EGBC)

Table 3: Slope Stability Summary Results for Section A

Section	Factor of Safety					
	Pre-Development		Post-Development			
	Static	Seismic	Static	Seismic	Static Option 1 Retaining Wall	Static Option 2 MSE Wall
A	1.21	1.32	-	1.37	1.50	-
B	1.26	1.15	1.41	1.27	1.50	1.64
C	1.31	1.18	1.43	1.28	1.56	1.56
D	1.82	1.61	1.71	1.52	-	-

Utilizing a reinforced concrete and/or MSE retaining wall will result in a minimum factor of safety of 1.5 in sections A, B and C, both above the required 1.5 factor of safety for static conditions.

Detail recommendations for these retaining walls design presented in Section 7.1.1.

6.0 DISCUSSION

Based on our understanding of the proposed subdivision and the observed subsurface conditions, CSR considers that from a geotechnical perspective the site is generally suitable for the proposed development, provided the recommendations presented in this report are followed as indicated and construction is carried out in general accordance with the intent of our recommendations.

6.1 Building Construction and Foundation Depth

Based on the preliminary information and drawings provided by Scouten Engineering, we expect the construction would be mainly below the existing grade. The Site may require to be excavated for localized deeper excavation for foundations, therefore excavations can be sloped where possible.

Based on the subsurface conditions encountered at the test holes, the subgrade at assumed foundation elevations is expected to be native, dense sand, which will provide satisfactory support by conventional strip and pad foundations for the proposed structure loads. Heavier loads may require to be supported on deeper foundations over till-like soil deposits.

6.2 Seismic Considerations

The subsurface soil below the proposed development is expected to be dense to very dense sand, which is not expected to be prone to liquefication under a 1:2,475-year return period of earthquake events.

7.0 RECOMMENDATIONS

7.1 Slope Stability

7.1.1 Retaining Wall Structures

Based on the slope stability assessment, for 1994 McAndrew Crescent and Lot 1 of 2026 McAndrew Crescent, it is recommended to utilize a MSE retaining wall behind the foundation wall or alternatively design a reinforced concrete retaining wall as the building foundation walls for the lower level of the buildings on the eastern side of the Site.

For Section A at the north slope, it is also recommended to utilize an engineered retaining wall to support the building in a form of a concrete or MSE retaining wall. The retaining wall can be incorporated into the building foundation wall.

All retaining walls proposed at the toe of slope are recommended to be designed for the slope condition. Table 4 summarizes the minimum requirements for the retaining walls, providing options for the design team.

Table 4: Minimum Requirements for Retaining Walls

Lot	Wall	Options	Recommendation				
			Type	Minimum Reinforced Zone/ Foundation Width (m)	Minimum Backfill Behind Wall (m)	Foundation Elevation (m)	Additional Design Load* (kN/m)
1994 Mc Andrew Cres.	Lower Level, East Foundation Wall	1	MSE Wall	3.0	3.5	654.7	-
		2	Concrete Retaining Wall	3.2	2.5	654.5	40
Lot 1	Lower Level, East Foundation Wall	1	MSE Wall	3.0	2.5	654.4	-
		2	Concrete Retaining Wall	3.2	2.5	654.4	40
Lot 5	North Wall	-	Retaining Wall (Concrete/MSE)	3.5	-	646.5	Building Surcharge

* Additional Design Load, lateral line load to be added to the lateral earth pressure defined in Section 7.6, as a load in the mid-height of the wall.

7.1.2 Slope Protection

Maintain vegetative cover of steep slopes to prevent erosion and unstable slopes. The development shall maintain and/or improve the terrain, vegetation, and drainage courses of the Site. Hydroseeding of the new and previously excavated slopes is also recommended. Tree planting along the east side of the Site can also help prevent surficial erosion and improve the stability of the slope.

Permanent cut slopes, landscaping walls and site grading shall have a gradient of 2H:1V or flatter. All new slopes need to be hydroseeded or planted as recommended above.

7.1.3 Site and Foundation Drainage

Based on infiltration testing, the native sand to silty sand soil on Site has a relatively high infiltration potential, and it is expected that the slopes to naturally drain. However, it is recommended that full drainage be considered for all retaining walls at this Site. The retaining wall drainage shall be connected to the Site drainage system.

7.1.4 Setback Requirement

It is recommended new buildings to have a minimum setback of 5.0 m, from toe of slope, for 1994 McAndrew Crescent and Lot 1, 2 (first 2 southern lots) of 2026 McAndrew Crescent. Retaining walls and landscaping walls shall have a minimum 8.0 m setback from the east property line.

7.2 Site Preparation

Site preparation will include clearing of trees and foliage prior to excavating to the design subgrade elevations. Loose fills and organic soils should be stripped to expose a subgrade of native dense sand for proposed structures.

7.3 Temporary Excavations and Shoring

The soil in the area consists of loose to compact sand with trace of gravel, underlain by fine-grained, dense sand. It is expected most of the excavation can be sloped. All excavations and trenches must conform to the latest Occupational Health and Safety Regulation supplied by the Workers Compensation Board of British Columbia.

The excavations required for foundations construction can be sloped at 1:1 (H: V). Trench excavation can be excavated close to vertical for shallow excavations up to 1.2 m. Deeper excavation for utility and services placement shall be reviewed by the geotechnical engineer and may be supported using Work Safe BC approved shoring cages. The contractor should ensure that shoring cages are maintained in intimate contact with the sidewalls of the excavation. Where the excavation extends larger than the cage, all the gaps shall be backfilled using crushed rock or pea gravel to re-establish confinement against the shoring.

Excavations must be protected from adverse weather conditions, including rainfall, with poly sheeting.

The geotechnical engineer should be contacted to review the excavation and backfill materials and placement.

7.4 Engineered Fill and Grade Reinstatement

Engineered fill should consist of free-draining sand and gravel with fine contents (silt and clay passing 0.075 mm sieve) less than 5% by weight. Engineered fill should be placed in less than 300 mm loose lifts and should be compacted to at least 95% of Modified Proctor Maximum Dry Density (MPMDD).

Any grade reinstatement under the foundations should be completed by Engineered fill.

The existing sand on-site may be re-used as structural fill if above conditions are met. However, any reused soils may not be used under foundations.

7.5 Foundation Design

7.5.1 Foundations Bearing Resistance

We expect the new building foundation to be founded on compact to dense sand using a conventional pad and strip foundations, the subgrade shall be compacted prior to installation of the foundations. For a subgrade of compacted and dense native sand and gravel, foundations may be designed based on a serviceability limit state (SLS) bearing pressure of 150 kPa and a factored ultimate limit state (ULS) bearing pressure of 200 kPa.

For foundations designed as recommended, settlements should be limited to less than 25 mm total and 20 mm over a 10 m horizontal span.

Irrespective of specified bearing pressures, footings should not be less than 450 mm in width for strip footings and not less than 600 mm in width for square or rectangular footings.

Foundation subgrades should be protected from construction disturbance and ground freezing. The exposed subgrade shall be free of pounded water. It is very important that the stripped subgrade of undisturbed dense sand be blinded and protected with lean mixed concrete or clear crushed gravel to preserve its bearing qualities and avoid disturbance prior to pouring the concrete.

7.5.2 Seismic Design of Foundations

The site is generally underlain by dense to very dense soils which are consistent with Site Class E soils, in accordance with Table 4.1.8.4.A. of the 2018 British Columbia Building Code (BCBC).

7.5.3 Frost Penetration

The fine-grained sand is frost susceptible and can form ice during cold weather. Ice lenses below concrete footings and grade-supported slabs can cause the concrete to heave and crack. Based on estimated frost penetration in the Prince George area, we recommend providing at least 1.2 m of soil cover for foundations to protect the bearing soil from freezing.

For unheated structures, protect the footings using rigid board insulation or provide at least 2.4 m of soil cover.

7.6 Lateral Earth Pressure

Earth pressures against the retaining walls are dependent on factors such as lateral restraint along the wall, surcharge loads, backfill materials, compaction of the backfill, and drainage conditions.

The foundation walls or retaining walls are expected to be partially yielding. They will be constructed with a synthetic flat drain mat and/or a 0.3 m wide chinny drain (free-draining, such as 19 mm clear crushed gravel) which are hydraulically connected to drain tile to divert any seepage into the outside of the foundation walls. These drainage layers would satisfactorily lower hydrostatic pressures against the foundation walls. Thus, no hydrostatic pressure is considered in the foundation wall design.

The retaining walls and/or foundation walls can be designed to resist the following lateral earth pressures summarized in Table 5.

Any additional (surcharge) loads not specifically described herein should be added to the earth pressures given. All earth pressures provided are unfactored loads.

Table 5. Recommended Unfactored Lateral Earth Pressure

Condition	Pressure Pattern	Lateral Pressure* (kPa)
Static (Native Soil or Engineered Fill)	Triangular	5.0H
Seismic** 2,475 ground motion	Inverted Triangular	0.5H
Surcharge Load	Rectangular	0.3Q

* H is a height of soil behind the wall in meters
* Q is a magnitude of surcharge pressure (kPa)
** Seismic load and Surcharge shall be added to the static lateral load

7.7 Foundation and Perimeter Drainage

The native sand provides a satisfactory infiltration potential; however, it is still recommended that a perimeter drainage system be installed to prevent water build-up beneath the slab-on-grade and adjacent foundation walls. The perimeter drainage system should discharge into the proposed reinstated municipal storm ditch along McAndrew Cres, or an on-site stormwater management system if decided by the developers. The foundation drainage system should comprise a suitably sized perforated PVC pipe embedded in drain rock. The drain rock should be fully wrapped in non-woven geotextile fabric.

7.8 Stormwater Management

Based on the infiltration testing completed on the Site, the native sand has a high infiltration rate that will reduce the potential runoff. Based on the Civil Drawings it is expected that any excess stormwater runoff from the site, roof and foundation drains will discharge to the proposed reinstated storm ditch along McAndrew Crescent.

8.0 FIELD REVIEWS

In accordance with the BC Building Code and the associated Letters of Assurance program, the Geotechnical Engineer of Record will be recommended the review of certain aspects of the design and construction. These reviews must be carried out to ensure that our intentions have been adequately communicated.

It is the responsibility of the contractors working on-site to review this document before commencing their work and inform CSR a minimum of 24 hours prior to any required field review. Field reviews and consulting services required by the geotechnical engineer are summarized in 6, as follows:

Table 6. Required Review Items

Item	Description
Excavation	Review of temporary slopes and soil conditions
Retaining Wall Installation	Review of wall construction and placement
Foundation	Review of foundation subgrade
Foundation Drainage	Review of foundation drainage system
Backfill	Review of backfill placement alongside foundations and foundation walls

9.0 CLOSURE

This report has been prepared exclusively for our client "Kidd Group of Companies" to provide geotechnical assessment for the proposed subdivision described herein. This report remains the property of CSR Geotechnical Ltd. and unauthorized use of or duplication of this report is prohibited.

We trust the information provided in this report satisfies your requirements at this time. Should you have questions regarding the Project or require assistance, please do not hesitate to contact us. Thank you for the opportunity to be of service.

Yours sincerely,
CSR Consultants Ltd.

Prepared By:

Siman Grewal
Civil Engineering Co-op

Reviewed By:

Farshid Bateni, Ph.D., PEng.
Principal, Geotechnical Engineer
Permit to Practice: 1000195

REFERENCE: CITY OF PRINCE GEORGE OPEN DATA (JULY 2022) AND PGMAP (JULY 2022)

LEGEND:

- APPROXIMATE TEST HOLE LOCATION (TH22- ##)
  APPROXIMATE TEST PIT LOCATION (TP22- ##)
  DYNAMIC CONE PENETRATION TEST (DCPT22- ##)
- GUELPH PERMEABILITY TEST (GPT22- ##)
- SITE BOUNDARY
- 655 CONTOUR LINE (METERS)

GEOTECHNICAL
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PREPARED	FB	CLIENT	KIDD GROUP OF COMPANIES	SHEET 01 OF 01	DATE 2022-07-12
CHECKED	-	DRAWING DESCRIPTION	PROPOSED SUBDEVISION 2026 MCANDREW CRESCENT, PRINCE GEORGE, BC SITE PLAN - TEST HOLE PLAN	SCALE 1:750	
APPROVED	FB			DRAWING No. GS101	REV. -
PROJECT NO.	G21-004-02				

Permit to Practice: 1003423

PRINT ON: 2022-08-02 G21-004-02 \G22-004-02_SitePlan_TestHoles_2022-07-12

APPENDIX A

TEST HOLE LOGS

RECORD OF BOREHOLE: TH22-01

CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

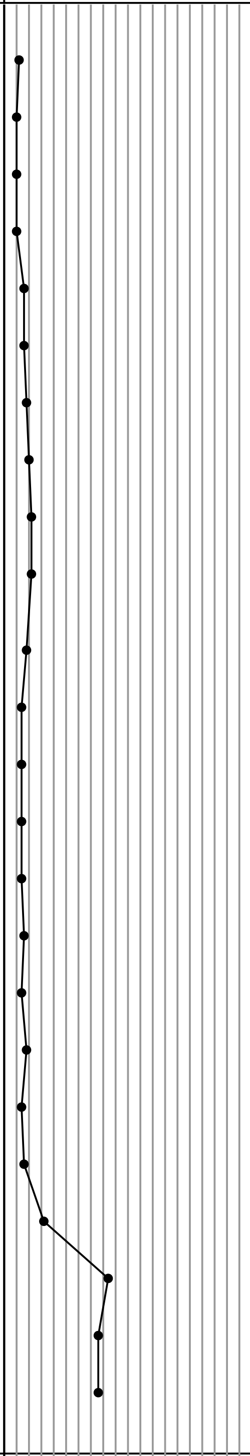
PROJECT NO.: G21-004-02
CLIENT: Kidd Group of Companies
PROJECT: Proposed Subdivision

ADDRESS: 2026 McAndrew Crescent, Prince George, BC
TESTHOLE LOCATION: 1994 McAndrew Cres.

DRILLING DATE: June 23, 2022
DRILLING CONTRACTOR/EQUIPMENT: Uniwide Drilling Co Ltd.

COMMENTS

LOGGED BY SG
CHECKED BY FB

Depth (m bgs)	Depth (ft)	Graphic Log	Material Description	Moisture (%)	Fine Content	Dynamic Cone Penetration Test (DCPT)	Well Diagram	Additional Observations
			TOPSOIL					
0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 5.5, 6, 6.5	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21		(SP) SAND, loose to compact, brown, moist to damp					
7, 7.5	22, 23, 24, 25		@ 6.71 m, Became fine grained, dense, damp					
			End of borehole: 7.62 m					

INCLINATION:-90? - DATUM: GROUND SURFACE
produced by ESlog.ESdat.net on 02 Aug 2022

RECORD OF BOREHOLE: TP22-01

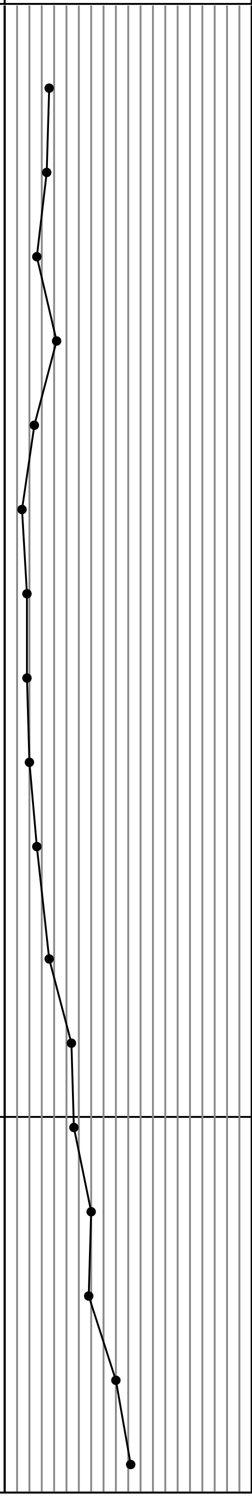
PROJECT NO.: G21-004-02
CLIENT: Kidd Group of Companies
PROJECT: Proposed Subdivision

ADDRESS: 2026 McAndrew Crescent, Prince George, BC
TESTHOLE LOCATION: North End of Property

DRILLING DATE: June 23, 2022
DRILLING CONTRACTOR/EQUIPMENT: Uniwide Drilling Co Ltd.

COMMENTS

LOGGED BY SG
CHECKED BY FB

Depth (m bgs)	Depth (ft)	Graphic Log	Material Description	Moisture (%)	Fine Content	Dynamic Cone Penetration Test (DCPT)	Well Diagram	Additional Observations
0.2	1		(SP) SAND, with trace of gravel, compact, brown, moist to damp @0.15 - 0.24 m, Some gravel was encountered					
0.4								
0.6	2							
0.8	3							
1								
1.2	4							
1.4	5							
1.6								
1.8	6							
2	7							
2.2								
2.4	8							
2.6	9							
2.8								
3	10							
3.2	11							
3.4								
3.6	12		@3.66 m, Became dense					
3.8								
4	13		End of borehole: 3.96 m					
4.2	14							
4.4								
4.6	15							
4.8	16							
5								
5.2	17							

APPENDIX B

PERMIABILITY TEST RESULTS

SUMMARY OF PERMIABILITY TEST
(GLUEPH PERMEAMETER - ASTM D5126)

CLIENT	**KIDD GROUP**	PROJECT NO.	G21-004-02
PROJECT	**RESIDENTIAL SUBDEVISION**	TEST DATE	2022-07-22
ADDRESS	2026 McAndrew, Prince George, BC		

TEST NO. GPT22-01
TEST LOCATION: NORTH (CLOSE TO TP22-01)
DEPTH : 0.3 m
SOIL TYPE: FINE SAND TO SILTY SAND

Parameter	Head #1	Head #2
Reservious Type:	Combined	Combined
Enter water Head Height (mm):	50	100
Steady State Rate of Water Level Change (mm/min):	76.8	74.9
Infiltration Rate (m/sec):	8.20E-05	4.76E-05

Average Infiltration Rate	**6.48E-05**

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm²/s), a^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi \left(\frac{H_1}{a^*}\right)}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	$\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)a^* + 2\pi H_1}$

EGBC Permit to Practice 1003423

SUMMARY OF PERMIABILITY TEST
(GLUEPH PERMEAMETER - ASTM D5126)

CLIENT	**KIDD GROUP**	PROJECT NO.	G21-004-02
PROJECT	**RESIDENTIAL SUBDEVISION**	TEST DATE	2022-07-22
ADDRESS	2026 McAndrew, Prince George, BC		

TEST NO. GPT22-02
TEST LOCATION: SOUTH AT 1994 McAndrew Crescent (CLOSE TO TH22-01)
DEPTH : 0.3 m
SOIL TYPE: FINE SAND TO SILTY SAND (Compacted)

Parameter	Head #1	Head #2
Reserviour Type:	Combined	Combined
Enter water Head Height (mm):	50	100
Steady State Rate of Water Level Change (mm/min):	10.3	10
Infiltration Rate (m/sec):	1.10E-05	6.36E-06

Average Infiltration Rate	**8.68E-06**

Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm²/s), α^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \dfrac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi \left(\frac{H_1}{a^*}\right)}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	$\Phi_m = \dfrac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)a^* + 2\pi H_1}$

SUMMARY OF PERMIABILITY TEST
(GLUEPH PERMEAMETER - ASTM D5126)

CLIENT	**KIDD GROUP**	PROJECT NO.	G21-004-02
PROJECT	**RESIDENTIAL SUBDEVISION**		
ADDRESS	2026 McAndrew, Prince George, BC	TEST DATE	2022-07-22

TEST NO. GPT22-03
TEST LOCATION: SOUTH AT 1994 McAndrew Crescent (CLOSE TO TH22-01)
DEPTH : 1.2 m
SOIL TYPE: FINE SAND TO SILTY SAND

Parameter	Head #1	Head #2
Reserviour Type:	Combined	Combined
Enter water Head Height (mm):	50	100
Steady State Rate of Water Level Change (mm/min):	83	72
Infiltration Rate (m/sec):	8.86E-05	4.58E-05

Average Infiltration Rate	**6.72E-05**

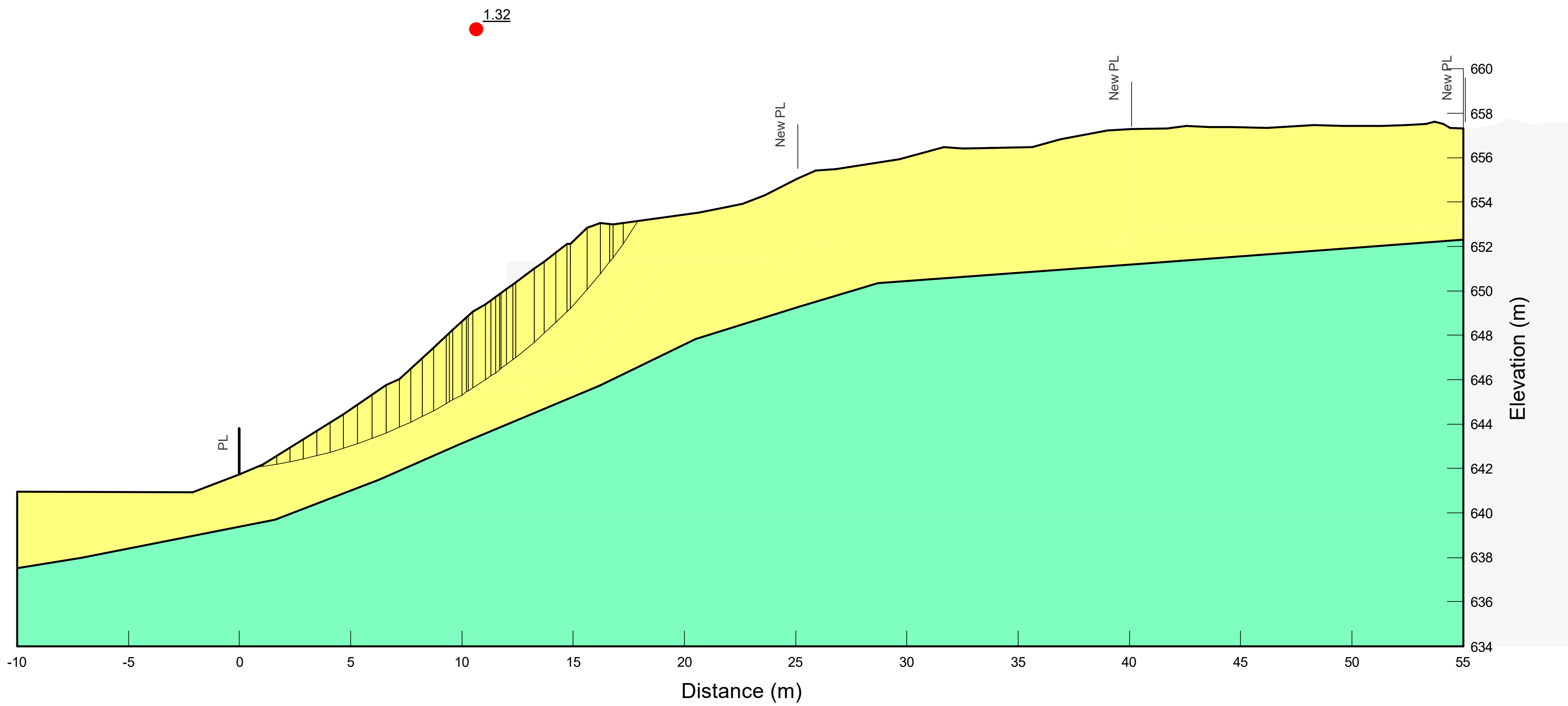
Calculation formulas related to one-head and two-head methods. Where R is steady-state rate of fall of water in reservoir (cm/s), K_{fs} is Soil saturated hydraulic conductivity (cm/s), Φ_m is Soil matric flux potential (cm²/s), a^* is Macroscopic capillary length parameter (from Table 2), a is Borehole radius (cm), H_1 is the first head of water established in borehole (cm) , H_2 is the second head of water established in borehole (cm) and C is Shape factor (from Table 2).

One Head, Combined Reservoir	$Q_1 = \bar{R}_1 \times 35.22$	$K_{fs} = \frac{C_1 \times Q_1}{2\pi H_1^2 + \pi a^2 C_1 + 2\pi \left(\frac{H_1}{a^*}\right)}$ $\Phi_m = \frac{C_1 \times Q_1}{(2\pi H_1^2 + \pi a^2 C_1)a^* + 2\pi H_1}$
One Head, Inner Reservoir	$Q_1 = \bar{R}_1 \times 2.16$	

APPENDIX C

SLOPE STABILITY ANALYSIS

Section A



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:

PWP CONDITION:
(none)

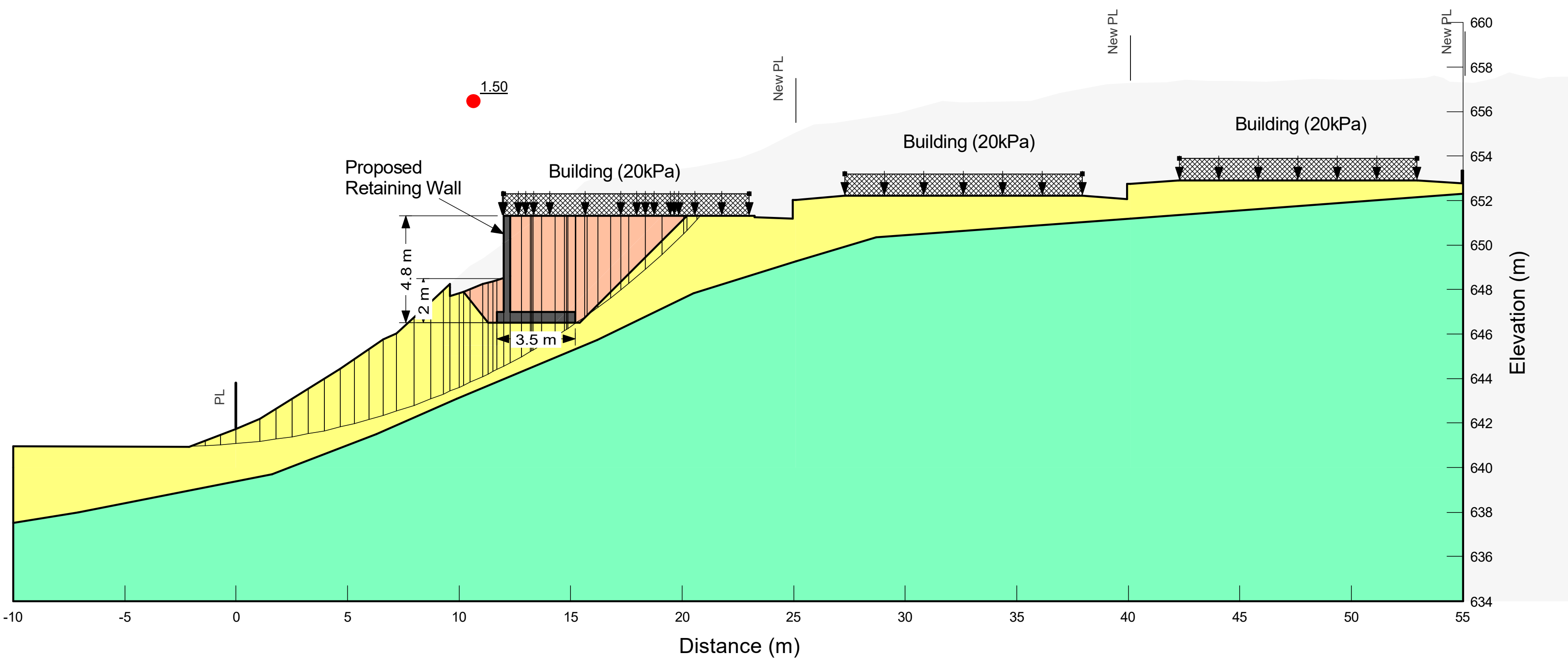
PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Slope Stability_Sec A (N-S)_Pre-Development (Static)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:300

G21-004-02 Sec_A_2022-07-22.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Engineered Fill	Mohr-Coulomb	19	0	38
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:

CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:

PWP CONDITION:
(none)

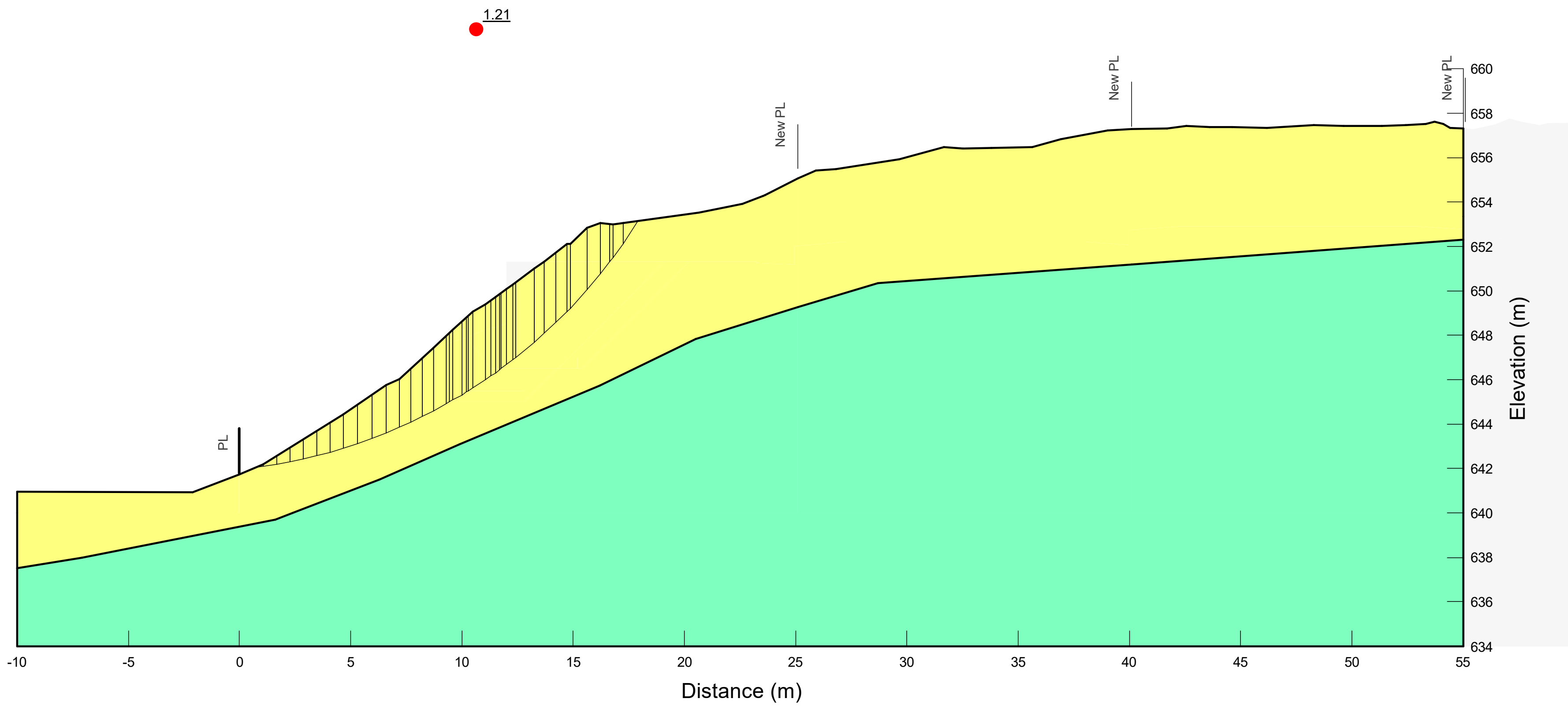
PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Slope Stability_Sec A (N-S)_Post-Development (Static)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:300

G21-004-02 Sec_A_2022-07-22.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:0.05

PWP CONDITION:
(none)

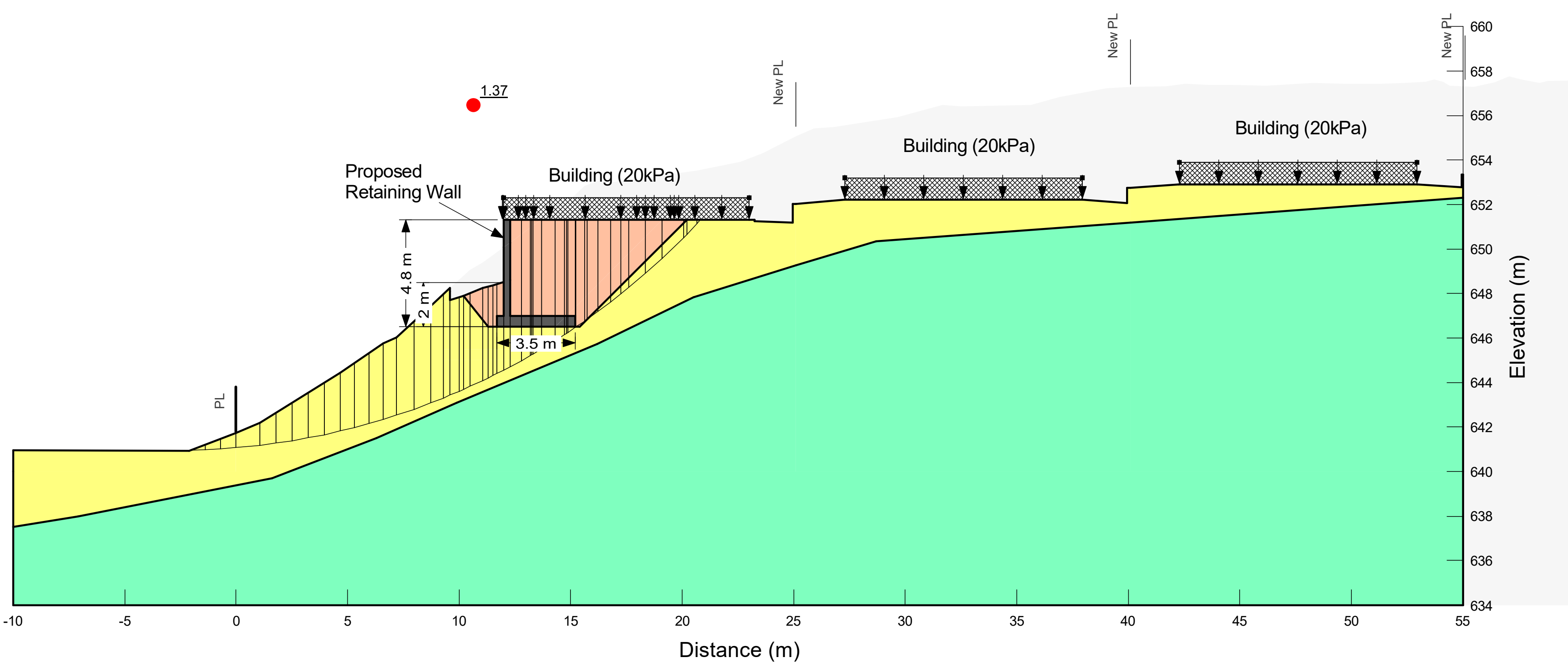
PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Slope Stability_Sec A (N-S)_Pre-Development (Seismic)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:300

G21-004-02 Sec_A_2022-07-22.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Engineered Fill	Mohr-Coulomb	19	0	38
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:0.05

PWP CONDITION:
(none)

PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

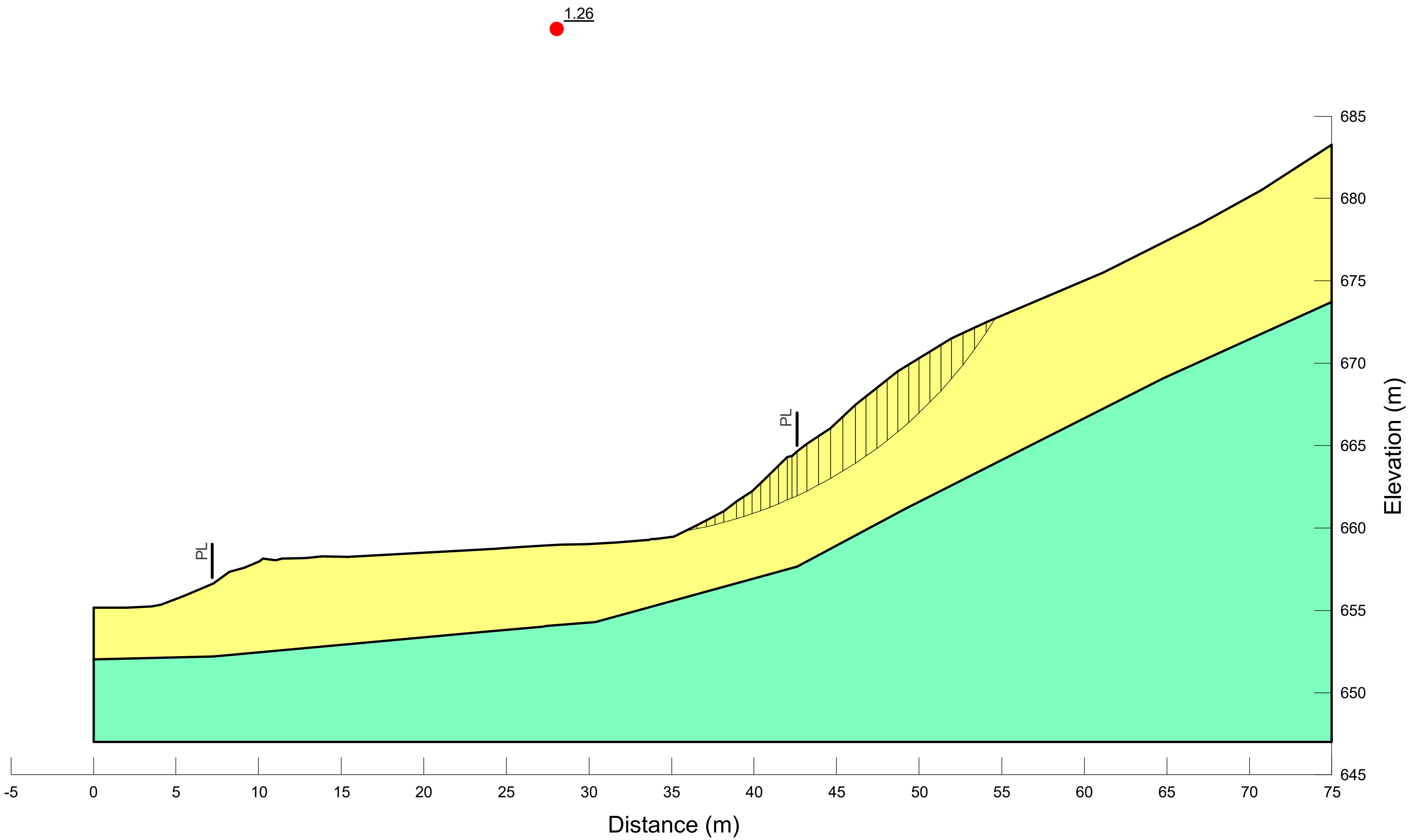
ANALYSIS TITLE:
Slope Stability_Sec A (N-S)_Post-Development (Seismic)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:300

G21-004-02 Sec_A_2022-07-22.gsz

Unit System: International System of Units (SI)

Section B

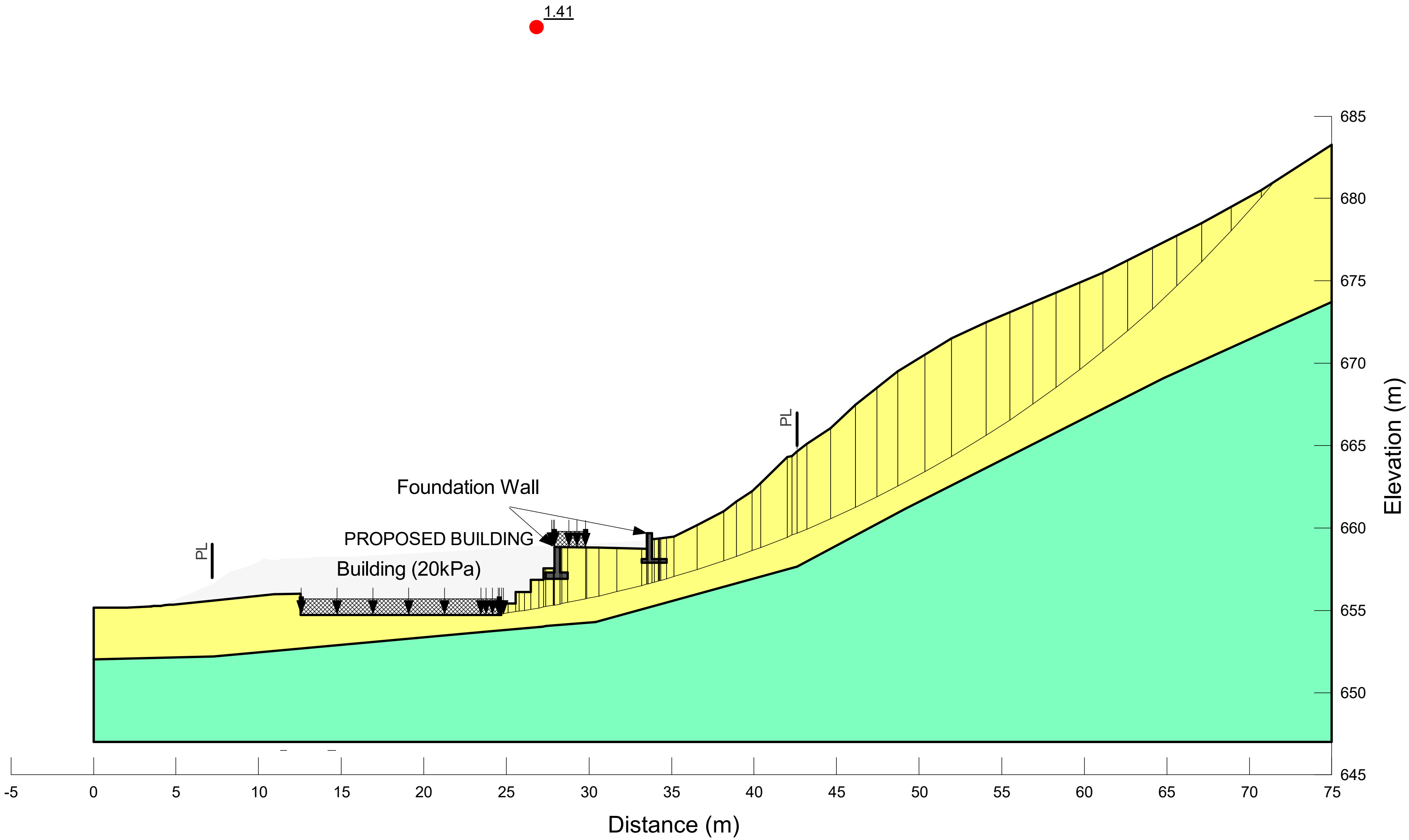


Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT: KIDD GROUP OF COMPANIES	ANALYSIS TYPE: Morgenstern-Price	PROJECT TITLE: **PROPOSED SUBDEVISION** 2026 McAndrew Cresent, Prince George, BC			
CONSLTANT: CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES	HORZ. SEISMIC COEF.: Horz.: PWP CONDITION: (none)	ANALYSIS TITLE: Section B (1994 McAndrew) (E-W)_Pre-Development (Static)			
PROJECT NO. G21-004-02	DATE 2022-07-22	REV. -	ANALYZED BY FB	SCALE 1:350	

G21-004-02 Sec_B_sigma_2022-07-25.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:

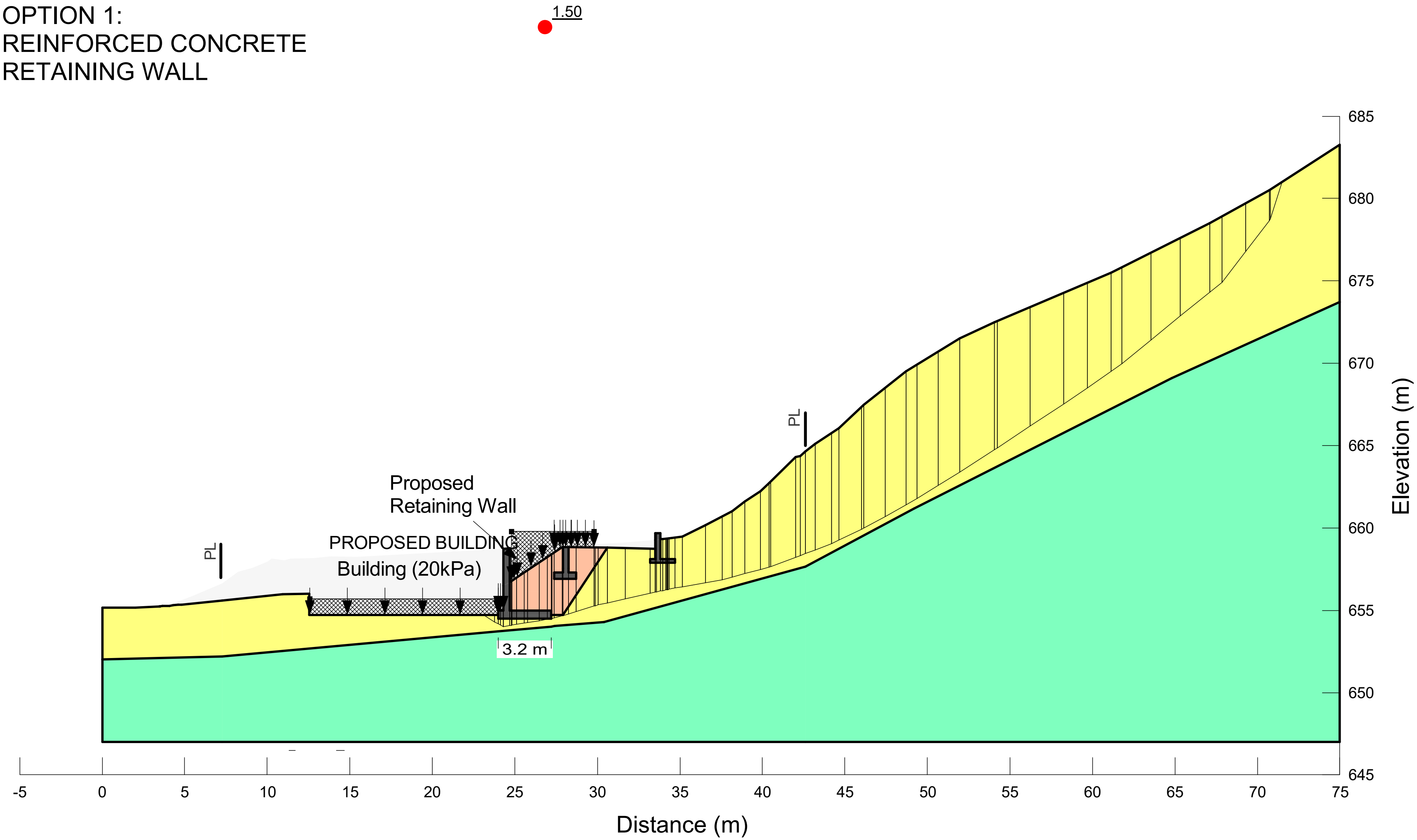
PWP CONDITION:
(none)

PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section B (1994 McAndrew) (E-W)_Post-Development (Static)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

OPTION 1:
REINFORCED CONCRETE
RETAINING WALL



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Engineered Fill	Mohr-Coulomb	19	0	38
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:

PWP CONDITION:
(none)

PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

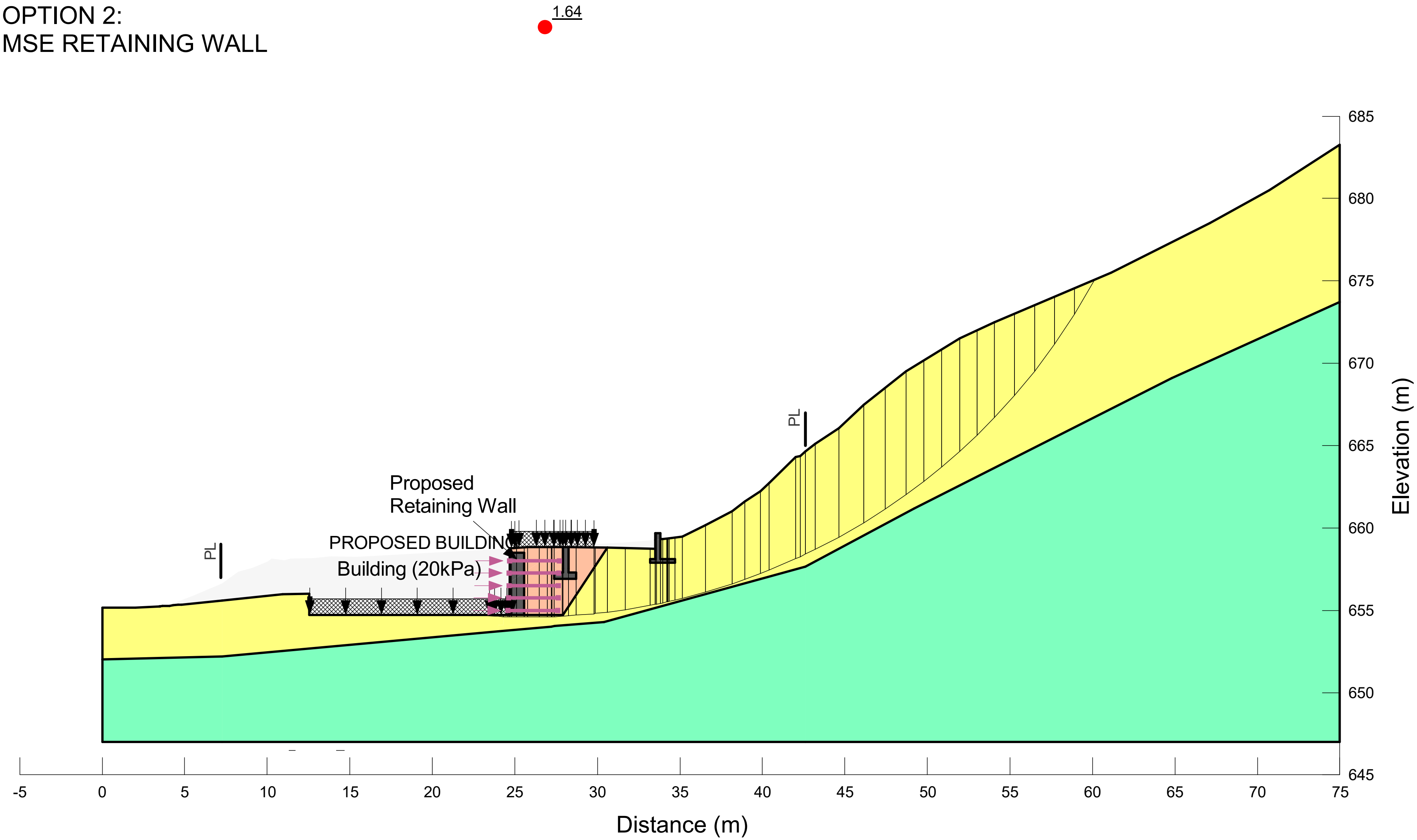
ANALYSIS TITLE:
Section B (1994 McAndrew) (E-W)_Post-Dev. (Static) (Retaining Wall)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_B_sigma_2022-07-25.gsz

Unit System: International System of Units (SI)

OPTION 2:
MSE RETAINING WALL



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Engineered Fill	Mohr-Coulomb	19	0	38
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:

PWP CONDITION:
(none)

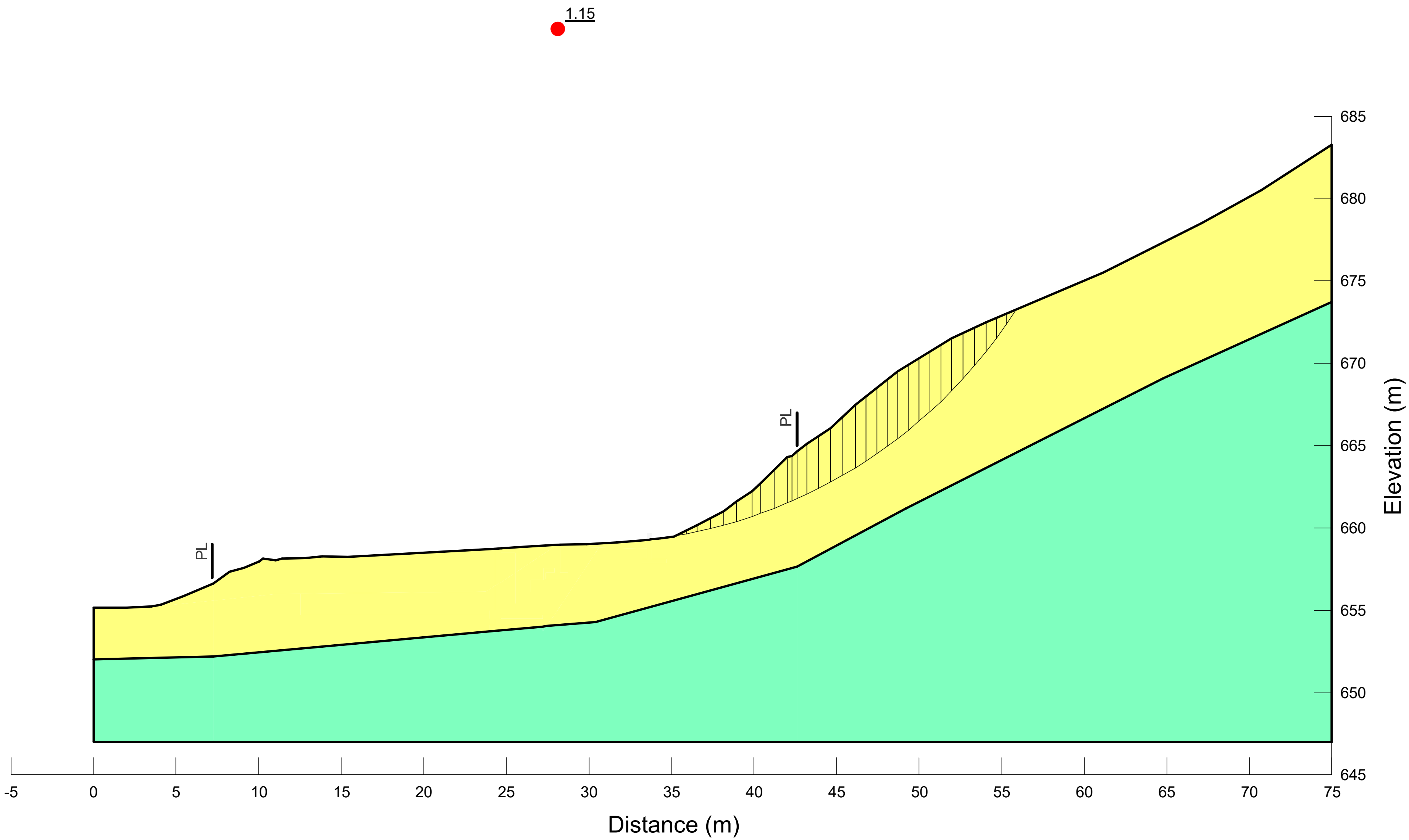
PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section B (1994 McAndrew) (E-W)_Post-Dev. (Static) (MSE Wall)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_B_sigma_2022-07-25.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:0.05

PWP CONDITION:
(none)

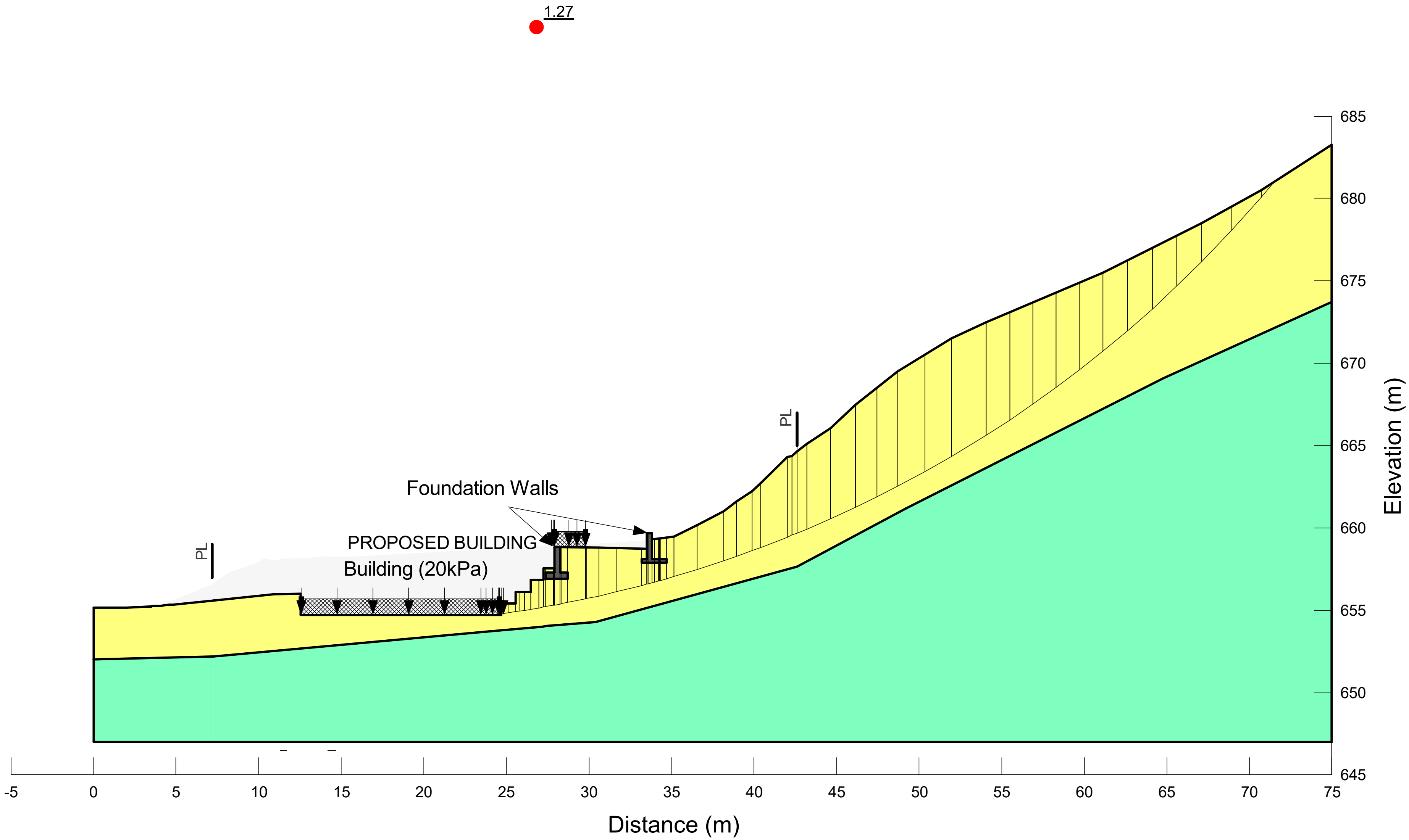
PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section B (1994 McAndrew) (E-W)_Pre-Development (Seismic)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_B_sigma_2022-07-25.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:0.05

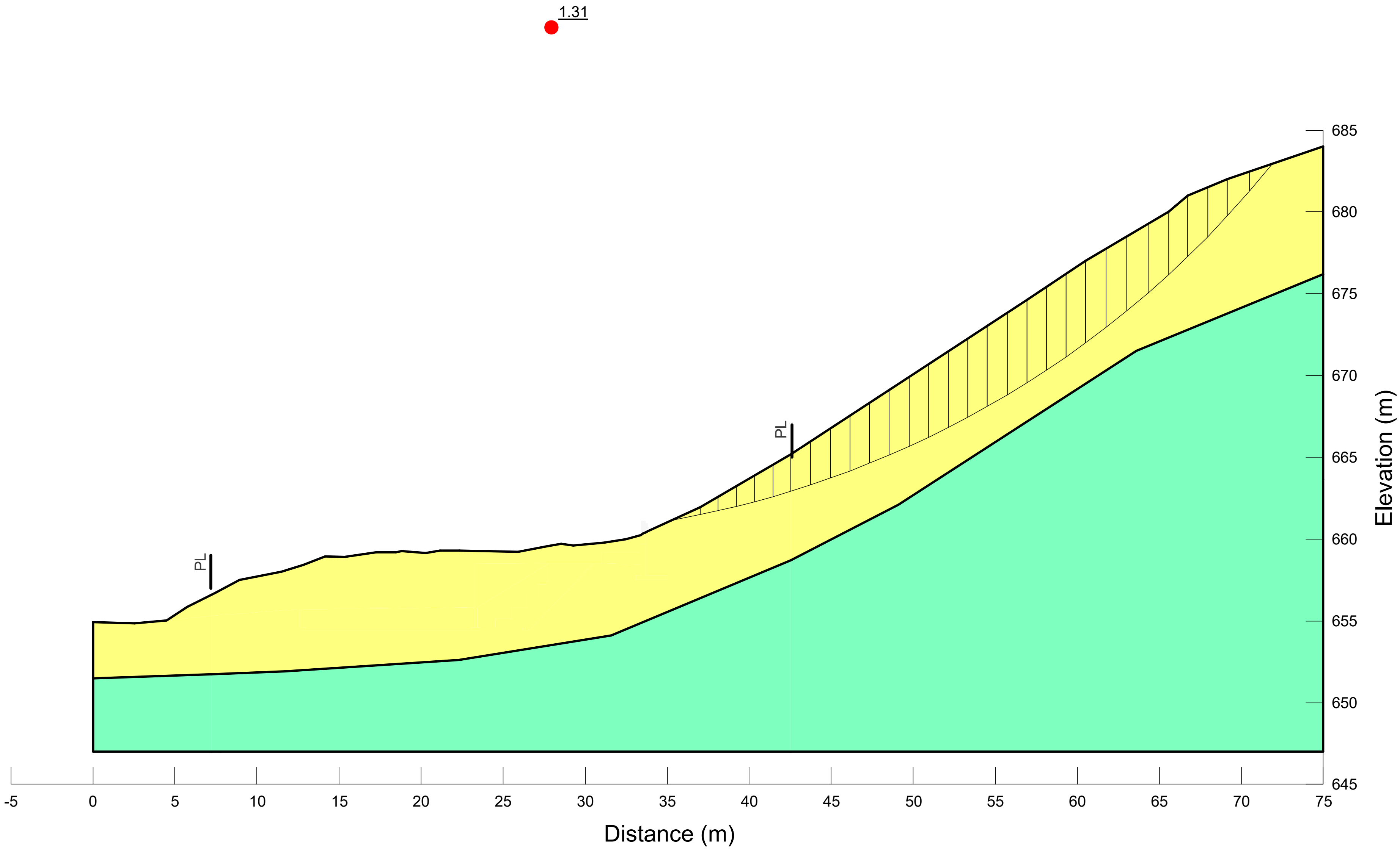
PWP CONDITION:
(none)

PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section B (1994 McAndrew) (E-W)_Post-Development (Seismic)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

Section C



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:

PWP CONDITION:
(none)

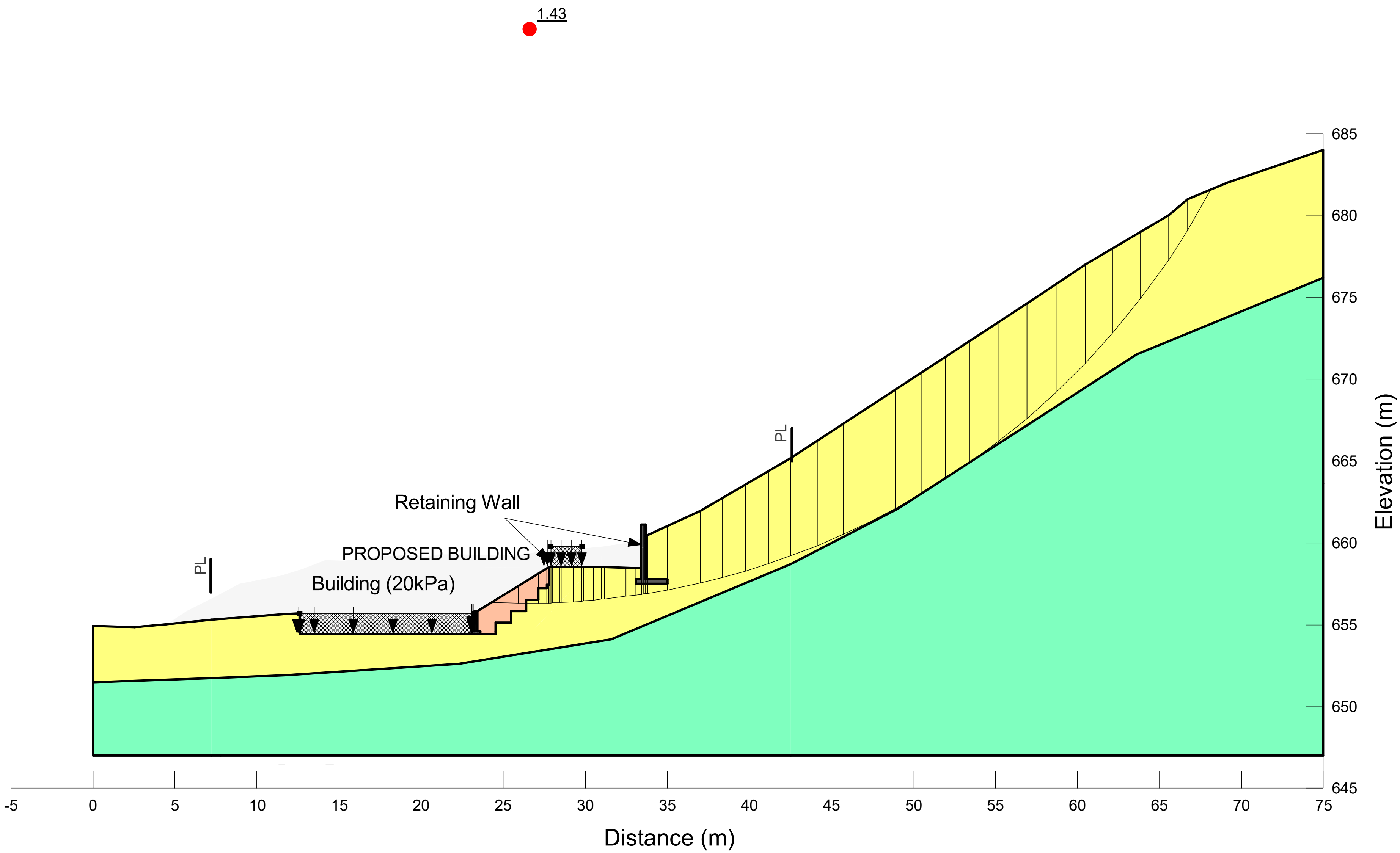
PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section C (E-W)_Pre-Development (Static)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_C_2022-07-25.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Engineered Fill	Mohr-Coulomb	19	0	38
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:

PWP CONDITION:
(none)

PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

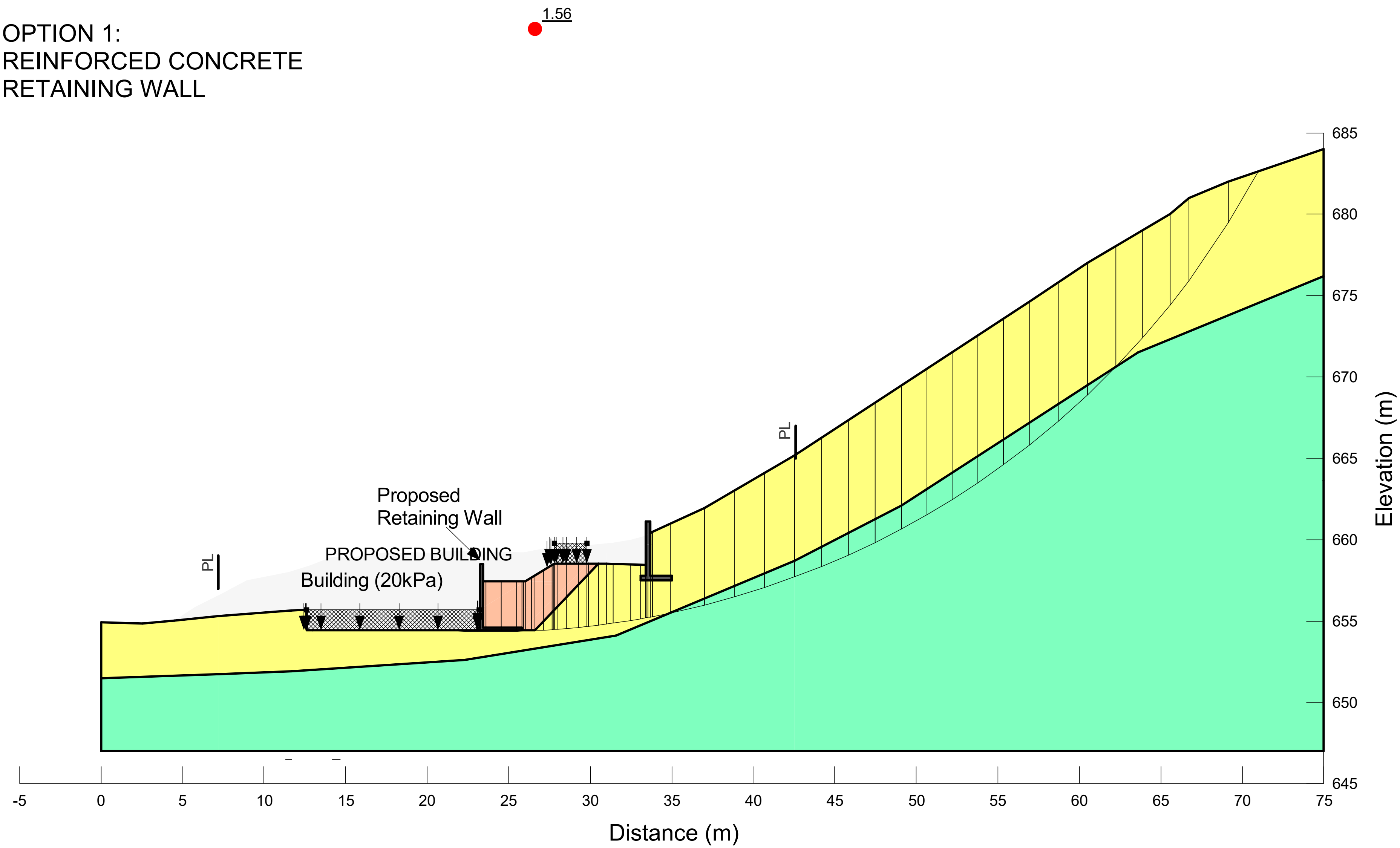
ANALYSIS TITLE:
Section C (E-W)_Post-Development (Static)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_C_2022-07-25.gsz

Unit System: International System of Units (SI)

OPTION 1:
REINFORCED CONCRETE
RETAINING WALL



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Engineered Fill	Mohr-Coulomb	19	0	38
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:

PWP CONDITION:
(none)

PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

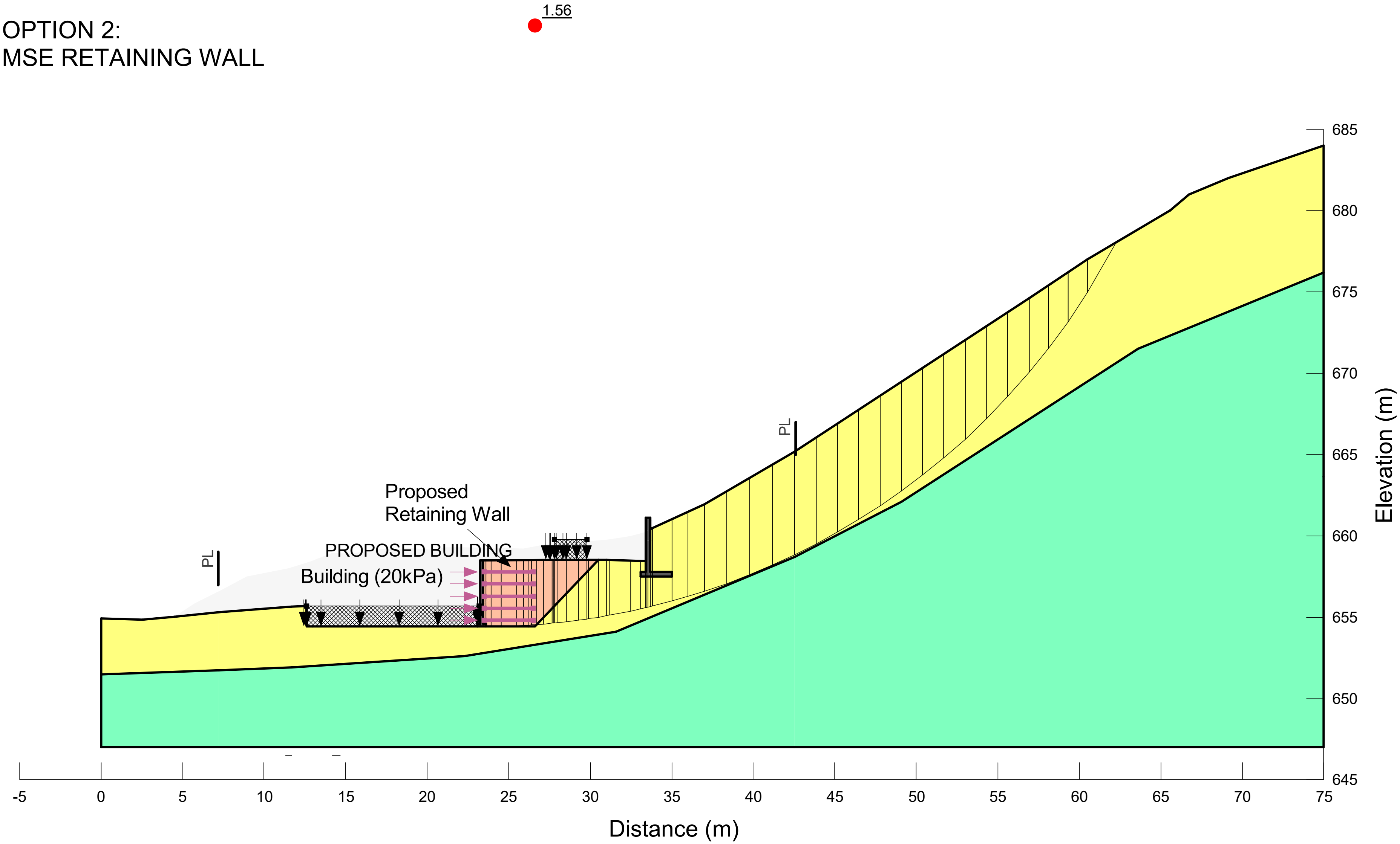
ANALYSIS TITLE:
Section C (E-W)_Post-Dev. (Static) (Retaining Wall)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_C_2022-07-25.gsz

Unit System: International System of Units (SI)

OPTION 2:
MSE RETAINING WALL



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Engineered Fill	Mohr-Coulomb	19	0	38
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price
HORZ. SEISMIC COEF.:
Horz.:
PWP CONDITION:
(none)

PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section C (E-W)_Post-Dev. (Static) (MSE Wall)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
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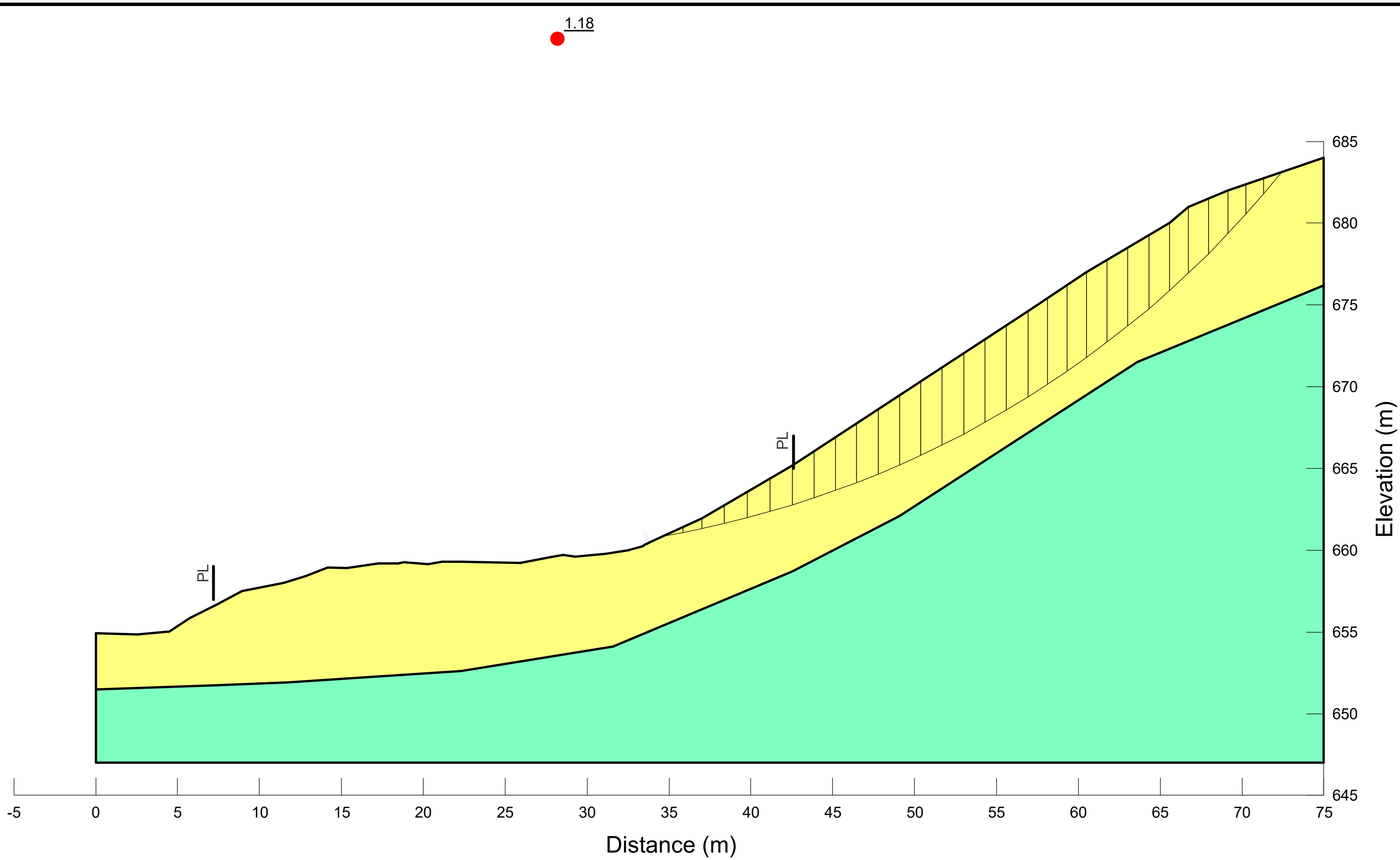
G21-004-02 Sec_C_2022-07-25.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:0.05

PWP CONDITION:
(none)

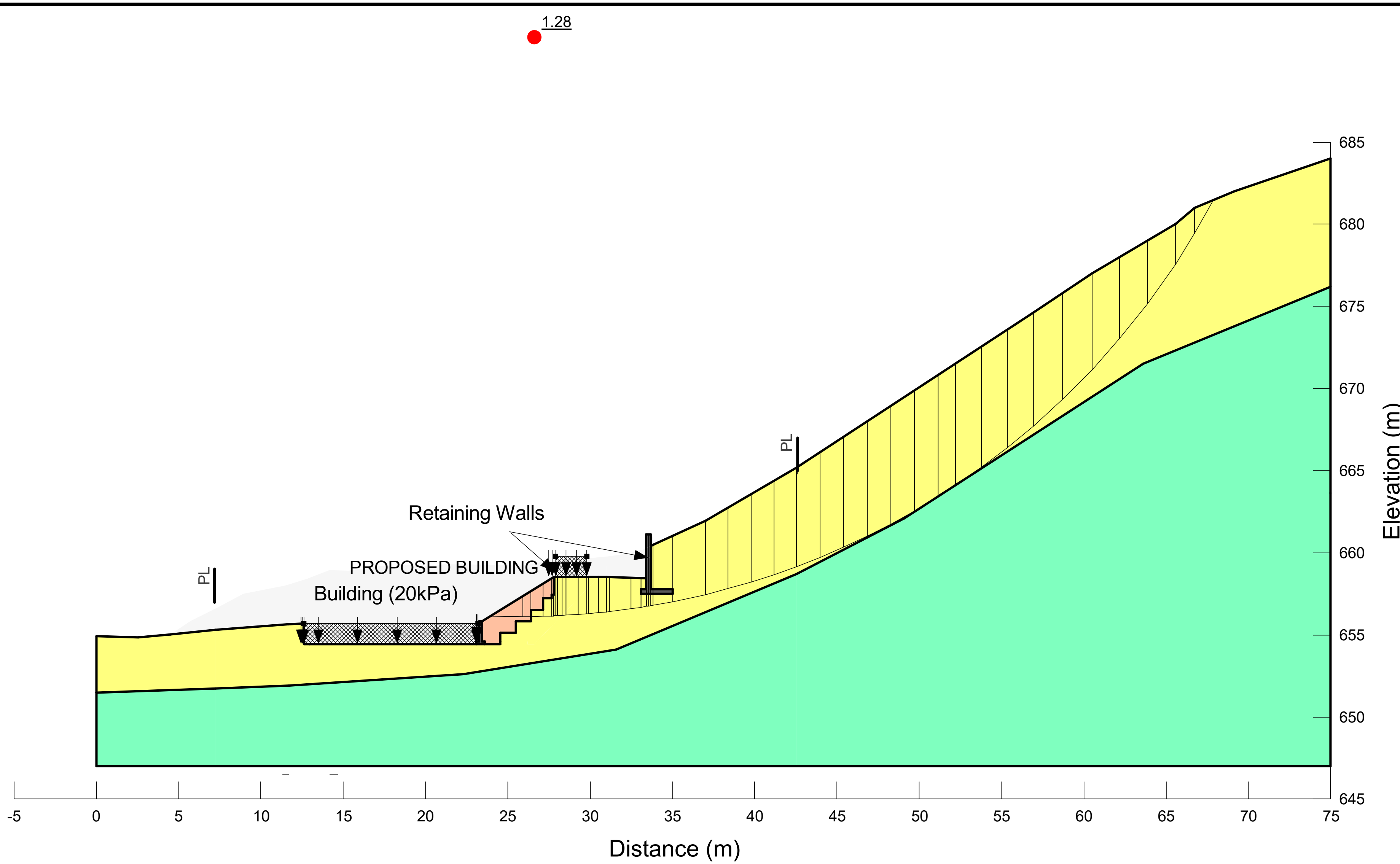
PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section C (E-W)_Pre-Development (Seismic)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_C_2022-07-25.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Engineered Fill	Mohr-Coulomb	19	0	38
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:0.05

PWP CONDITION:
(none)

PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

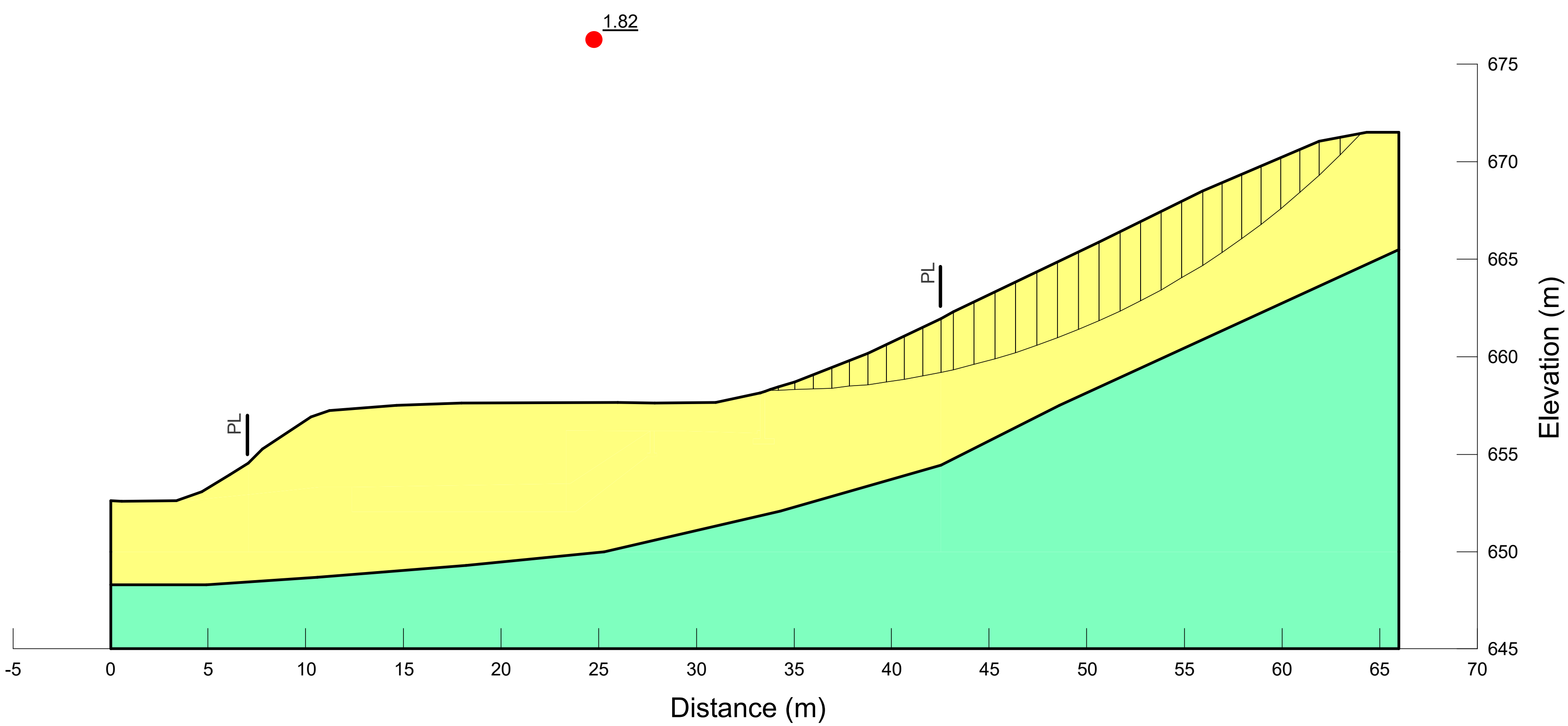
ANALYSIS TITLE:
Section C (E-W)_Post-Development (Seismic)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_C_2022-07-25.gsz

Unit System: International System of Units (SI)

Section D



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:

PWP CONDITION:
(none)

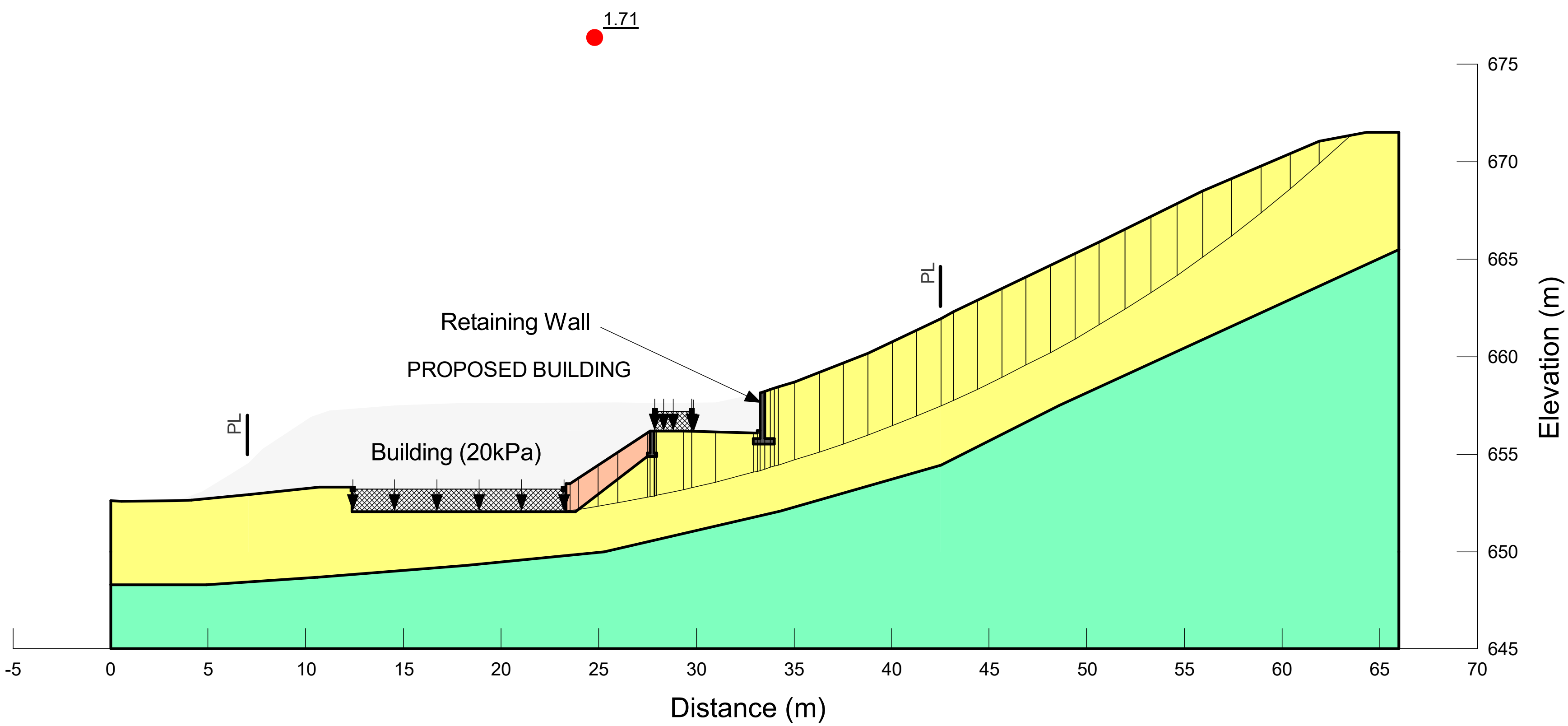
PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section D (E-W)_Pre-Development (Static)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_D_2022-07-25.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Engineered Fill	Mohr-Coulomb	19	0	38
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:

PWP CONDITION:
(none)

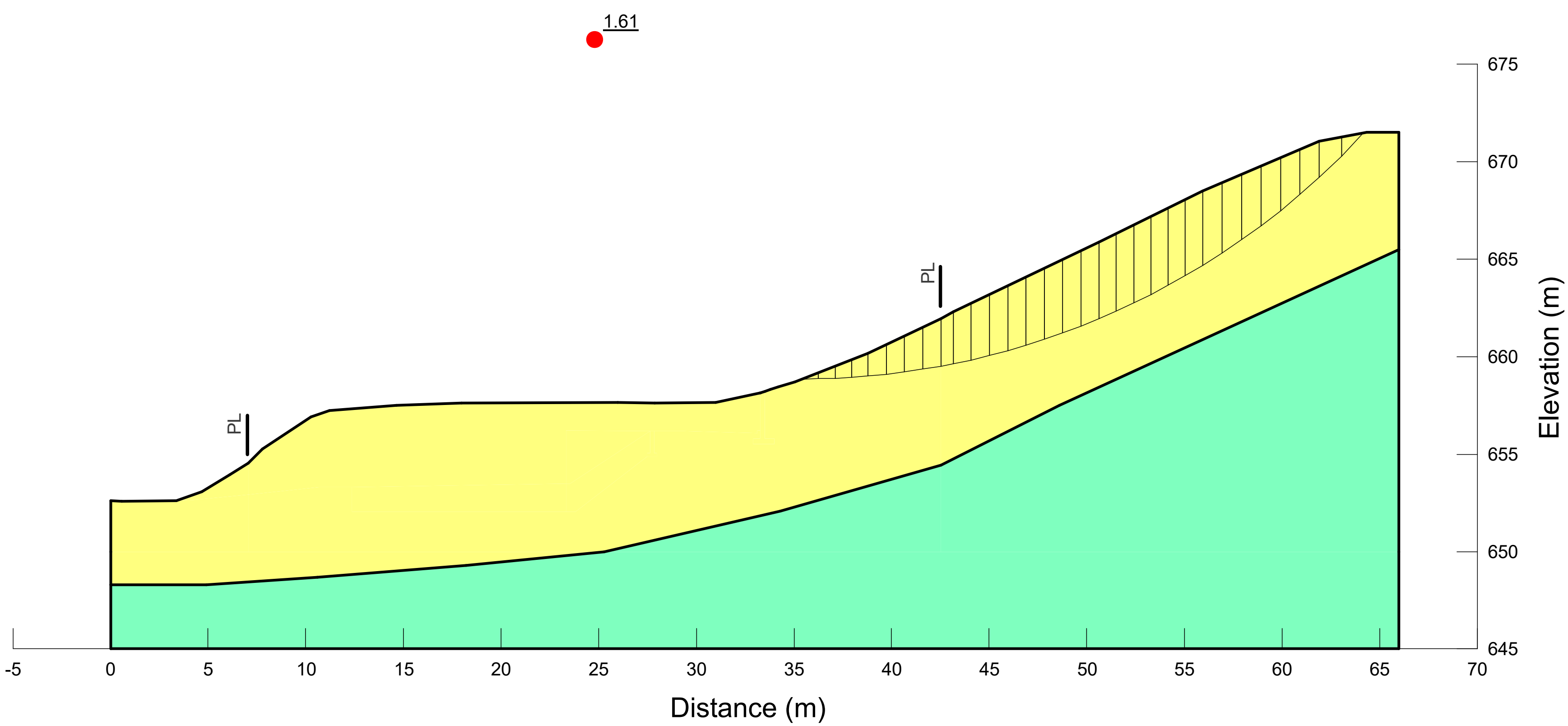
PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section D (E-W)_Post-Development (Static)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_D_2022-07-25.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE:
Morgenstern-Price

HORZ. SEISMIC COEF.:
Horz.:0.05

PWP CONDITION:
(none)

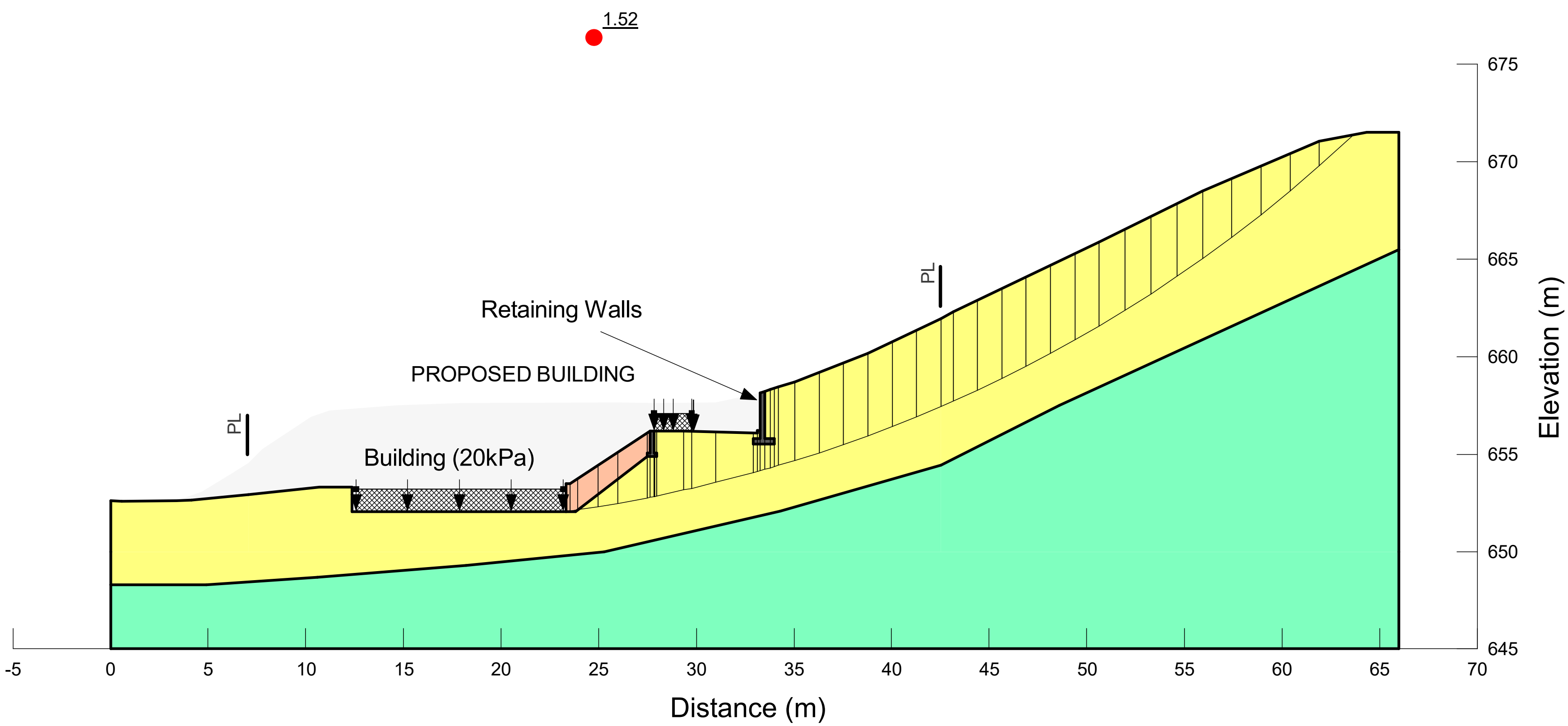
PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section D (E-W)_Pre-Development (Seismic)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350

G21-004-02 Sec_D_2022-07-25.gsz

Unit System: International System of Units (SI)



Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)
	Concrete/Retaining Wall	High Strength	24		
	Engineered Fill	Mohr-Coulomb	19	0	38
	Silty Sand (Lower)	Mohr-Coulomb	18	5	36
	Silty Sand (Upper)	Mohr-Coulomb	18	5	33

CLIENT:
KIDD GROUP OF COMPANIES

CONSLTANT:
CSR GEOTECHNICAL ENVIRONMENTAL WATER RESOURCES

ANALYSIS TYPE: **Morgenstern-Price**

HORZ. SEISMIC COEF.: **Horz.:0.05**

PWP CONDITION: **(none)**

PROJECT TITLE:
PROPOSED SUBDEVISION
2026 McAndrew Cresent, Prince George, BC

ANALYSIS TITLE:
Section D (E-W)_Post-Development (Seismic)

PROJECT NO.	DATE	REV.	ANALYZED BY	SCALE
G21-004-02	2022-07-22	-	FB	1:350