East Porpoise Bay Road Improvements
Project 13004-0001
Geotechnical Design for Retaining Walls

PRESENTED TO

British Columbia Ministry Transportation and Infrastructure

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1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by the British Columbia (BC) Ministry of Transportation and Infrastructure (MoTI) to carry out geotechnical analysis and design for three retaining walls along the west side of the Porpoise Bay Road / Sechelt Inlet Road embankment along a roughly 700 m stretch from Xenichen Avenue and Delta Avenue, in the Sechelt Band Lands. Road upgrades proposed in this location include expansion of the road embankment to the west to accommodate a road realignment and a proposed sidewalk. Several small retaining walls (less than 5 m in height) are proposed along portions of the alignment, where there is insufficient room in the right-of-way (ROW) to accommodate embankment expansion.

The purpose of our assessment was to review the wall designs for conformance with the S6-19 Canadian Highway Bridge Design Code (CHDBC; CSA 2019) and the MoTI (2022) Bridge Standards and Procedures Manual Supplement to the S6-19 CHDBC (referred to herein as the S6-19 Supplement). Design of the road layout, embankments, pavement and drainage are outside of this scope of work; environmental and forestry related aspects of the project are also outside of this scope of work.

This document provides a summary of the project background, subsurface explorations completed to date, inferred soil conditions, and stability analysis results and design recommendations for the retaining walls.

The use of this document is subject to the Limitations on the Use of this Document, attached in Appendix A.

2.0 SITE DESCRIPTION AND BACKGROUND

The project site is located along an approximately 700 m stretch of East Porpoise Bay Road / Sechelt Inlet Road from Xenichen Avenue and Delta Road. The surrounding area outside of the MoTI ROW is part of the Sechelt Band Reserve No. 2.

In the project area, the road generally runs north-south. The topography in the area slopes gently down from east to west, though a noticeable drop-off is present on the west side of the road embankment toward Sechelt Inlet. The topography along the road alignment is gently undulating along the southern 400 m of the proposed improvement corridor, then climbs about 8 m at a grade of about 6.2% to a ridge, which begins to drop off again at the northern end of the project corridor. Land use is variable, consisting primarily of residential and commercial / light industrial, with a small amount of parkland on the west side of the road, south of Schetxwen Road.

The existing road along the improvement corridor consists of two lanes (one in each direction), with relatively narrow paved shoulders, and grass, dirt or parking areas beyond those. There are currently no sidewalks. Two force mains (water and sanitary) run under the existing road.

The proposed road improvements include installation of sidewalks and bike lanes on both sides of the road. These improvements will require the road centerline to shift to the west from its current alignment and will necessitate small retaining walls along several sections. Design drawings prepared by Atkins Réalis / SNC Lavalin Inc. (SNC) showing the proposed improvement, road realignment and retaining wall locations are included in Appendix B. Stations from these drawings will be referenced in this document to describe locations within the improvement corridor.

3.0 SUBSURFACE EXPLORATION

Tetra Tech carried out a subsurface exploration program in May 2022. A total of nine boreholes were drilled using solid stem augers to depths ranging from 1.5 m to 5.3 m. Standard Penetration Tests (SPTs) were carried out in three of the nine boreholes. On completion of drilling, groundwater conditions were recorded in the boreholes, but no groundwater monitoring wells or piezometers were installed in the boreholes. A summary of the boreholes is provided in Table 3-1. The borehole locations are also shown on Figure 1

Table 3-1: Summary of Boreholes Completed

Borehole ID	Approximate UTM Coordinates 10U (1)		Collar Elevation (masl) (2)	Depth (m)	Groundwater Conditions
	Northing	Easting			
BH22-01	5481270.54	445552.63	10.7	1.52	None observed
BH22-02	5481463.26	445585.09	11.6	3.05	None observed
BH22-03	5481572.48	445601.38	17.2	1.52	None observed
BH22-04	5481777.39	445629.87	17.4	4.57	None observed
BH22-05	5481674.40	445613.59	18.7	1.52	None observed
BH22-06	5481366.96	445566.99	9.7	3.05	None observed
BH22-07	5481193.70	445490.17	9.2	3.05	None observed
BH22-08	5481119.43	445431.31	10.0	5.33	None observed
BH22-09	5481776.06	445629.28	17.4	5.33	None observed

Notes:

1) *Approximate coordinates (+/- 5 m) using a hand-held GPS unit.*
2) *Boreholes not surveyed. Elevations estimated based on existing road profiles provided by SNC.*

Grab samples of the subsurface material were collected during the exploration program, and returned to Tetra Tech's laboratory in Nanaimo, BC. Index testing, including moisture content and particle size distribution tests, were carried out on select samples.

Additional details on the subsurface exploration program are provided in Tetra Tech's (2022) Pavement Rehabilitation Assessment Report. Borehole logs are provided in Appendix C for reference. Results from relevant laboratory testing are provided in Appendix D.

4.0 SOIL AND GROUNDWATER CONDITIONS

4.1 Surficial Geology

McCammon (1977) completed surficial geology reconnaissance of the Sunshine Coast in 1974 and 1975 to locate sand and gravel deposits. The project area is located in what is described as the Georgia Lowland. In this area, below an elevation of about 300 m, the ground is "mantled with a variety of unconsolidated materials of glacial, glaciomarine, and fluvial origin".

The project site appears to straddle two main deposits: Capilano fluvial deposits and Salish sediments, which are described in greater detail below.

- "Capilano fluvial deposits are composed of sands and gravels that form fans and deltas left by streams above present sea level up to about the 180-metre contour."

- "Salish sediments are materials now being deposited or that been deposited since sea level became more or less stabilized at its present position. These include silt, sand, and gravel that are found in modern stream channels and deltas; sand and gravel on modern beaches; and bog deposits."

Given that East Porpoise Bay Road is typically about 10 m to 15 m above sea level, on a small plateau-like feature, it is likely that the Capilano fluvial deposits dominate the site.

4.2 Soil Conditions

The soil conditions encountered in the boreholes drilled in May 2022 generally consisted of the following:

- **ROAD BASE / SUBBASE,** consisting of brown sand and gravel, with trace to some silt. The material was described as dry to damp and was compact to dense, with N-values from two to three reliable SPTs in this layer ranging from 21 to 28. This layer ranged in depth from 1.2 m to 2.3 m.
- **SAND (inferred native),** light brown, some gravel to gravelly, with trace silt. The material was described as damp and was loose to dense, with compaction generally improving with depth. N-values from SPTs carried out in this material ranged from 9 to 35. Based on compaction levels, portions of this material are potentially liquefiable, if saturated. Boreholes did not penetrate beyond this material (past 5.3 m).

The nature of the inferred native sand corresponds well with the Capilano fluvial deposits, and we have inferred that the road is founded on these materials. However, given the proximity of the road to the shore and the fact that the ground drops off relatively quickly towards the bay, it is possible that the subsurface west of, and below, the current road alignment is made up of looser Salish sediments. The upper, looser native sand may also represent a (relatively) thin layer of Salish sediment overlying the Capilano fluvial deposits. As such, our geotechnical analyses have allowed for the presence of loose Salish sediments (sand) below the road and overlying the compact Capilano gravelly sand deposits under the road subbase.

4.3 Groundwater Conditions

No groundwater monitoring instrumentation was installed as part of the geotechnical exploration. No groundwater was observed during or following drilling, and recovered soil was typically described as dry or damp.

Given the site's proximity to Porpoise Bay, it is likely that the groundwater elevation is tidally influenced. Review of tidal data since 2020 obtained from the Government of Canada (2023) for the Porpoise Bay station indicates that the average tidal elevation in Porpoise Bay was approximately 1.8 m above sea level (masl), with maximum and minimum elevations of approximately 3 m and 0.1 m, respectively.

4.4 Seismic Considerations

No shear wave velocity testing was completed during the geotechnical exploration. Based on the types of materials encountered in the boreholes and the N_{60} values obtained from SPTs, this site would fall under Site Class D or Site Class E, depending on whether or not soil stiffness substantially increased with depth. We have conservatively assumed Site Class E. There is potential for liquefaction in some of the shallow loose sands if they are below the water table; however, based on the inferred groundwater levels, these are not below the water table.

Table 4-1 outlines the 5% damped spectral accelerations, as well as the peak ground acceleration (PGA), for the design seismic events (as discussed in Section 5.0) for Site Class E at the project location, obtained from the 2020 National Building Code of Canada (NBCC) Seismic Hazard Calculator, operated by Natural Resources Canada (2021).

Table 4-1: Spectral Accelerations and PGA for Project Location and Site Class E (from 2020 NBCC Seismic Hazard Calculator)

Return Period	S_a(0.2)	S_a (0.5)	S_a (1.0)	S_a (2.0)	S_a (5.0)	S_a (10.0)	PGA
475 years	0.602	0.638	0.449	0.240	0.0579	0.0186	0.273

4.5 Engineering Parameters Used

A summary of the engineering parameters for the subsurface are summarized in Table 4-2. These parameters have been assigned based on SPT data collected during the May 2022 exploration program, published correlations and engineering experience with similar materials.

Table 4-2: Summary of Engineering Properties

Soil Unit	Unit Weight (kN/m^3)	Effective Cohesion (kPa)	Effective Friction Angle (º)
Road Base	21	0	38
Road Subbase	20	0	35
Bridge End Fill	20	0	35
Loose Native Sand	18.5	0	34.5 (for $\sigma'_v < 9$ kPa) 30 (for $\sigma'_v > 9$ kPa)
Compact Native Sand	19	0	34.5 (for $\sigma'_v < 9$ kPa) 33 (for $\sigma'_v > 9$ kPa)

It is noted that bilinear failure envelopes were assigned to the loose and compact sand to account for the higher peak friction angle observed for sands of the same relative density at lower effective overburden stresses. The shear strength assigned to the bridge end fill (BEF) is considered conservative. However, if no triaxial or direct shear testing has been completed on the backfill for a mechanically stabilized earth (MSE) retaining wall, the CHBDC S6-19 limits the angle of friction for backfill to 35° for computation of horizontal forces within a reinforced soil mass (as is required for this design). For consistency, an angle of friction of 35° was used throughout the design for BEF.

5.0 SITE CLASSIFICATION FOR DESIGN

East Porpoise Bay Road is not considered a major or lifeline route. As such, the road is classified as “other” for the purpose of design under the CHBDC S6-19 (CSA, 2019). The seismic ground motion return period for a structure less than 6 m high on an “other” road is 1/475 years.

The road consequence is classified as “typical” consequence, based on guidance provided by MoTI representatives.

The level of understanding at the site is considered “typical”, in keeping with the benchmarks outlined in Table 6.2c of the MoTI (2022) Supplement to the Canadian Highway Bridge Design Code (CHDBC; 2019).

The site is considered to be in seismic performance category (SPC) 3, based on the expected ground motions (see Section 4.4) and the requirements outlined in Table 4.10 of the CHBDC S6-19 (CSA, 2019).

6.0 PROPOSED RETAINING WALLS – GEOTECHNICAL DESIGN

Three MSE retaining walls are proposed along the stretch of road upgrades as follows:

- Wall 1: running from stations 101+80 to 102+35, with a maximum height of 3 m (four concrete blocks)
- Wall 2: running from stations 102+90 to 103+50, with a maximum height of 4.5 m (six concrete blocks)
- Wall 3: running from stations 104+80 to 105+10, with a maximum height of 3 m (four concrete blocks)

The design of these walls, including design criteria and analyses, and climate change considerations, is described in the following sections.

6.1 Retaining Wall Design

The retaining walls will be constructed using geogrid with concrete locking block facing. Concrete blocks will be 0.75 m in height and depth, and 1.5 m in length, and will be topped with a pedestrian rail. The walls with have a 10° batter, as shown in the drawings in Appendix B. The concrete blocks will be found on 300 mm levelling pads of well graded base (WGB) fill; for Wall 1 the foundation will be subexcavated 450 mm below the levelling pad and backfilled with compacted BEF, to meet global stability requirements. Geogrid will be cast into the concrete blocks to provide anchored connections in accordance with Clause 6.19.2.1 of the MoTI Supplement to the CHBDC S6-19 (MoTI, 2022). The geogrid will be connected at the mid-height of each concrete block layer, as shown in the drawings in Appendix B.

Exposed geogrid lengths (i.e., measured from the back of the concrete blocks) are 2.4 m for Wall 1 and Wall 3, and 3.15 m for Wall 2, measured from the back of the concrete blocks. The geogrid lengths were selected to meet the criteria outlined below:

- Minimum effective embedment length (Le) of 1.0 m, per Clause 6.19.10.3.2 of the CHBDC S6-19 (CSA, 2019)
- Minimum geogrid length equal to 70% of the wall height, per Clauses 6.19.3.1 and 6.19.3.2 of the CHBDC S6-19 (CSA, 2019)
- Minimum geogrid length of 2.4 m, in keeping with standard practice

The geogrid lengths selected for design were checked against applicable failure mechanisms (limit states) and were found to be satisfactory, as discussed in Section 6.3.

The wall will be backfilled with BEF. The BEF will be extended laterally to the back of the geogrid and to a depth consistent with the base of the levelling pad (or 450 mm below the levelling pad at Wall 1). The limits of the BEF backfill are shown in the drawings in Appendix B. The BEF is expected to be well-draining and will be placed directly against the concrete blocks. A geotextile-wrapped, perforated PVC drain pipe is included at the base of the wall or below, depending on location, as shown in the drawings in Appendix B. It is expected that temporary shoring will be required to protect the existing district of Sechelt force mains located within about 3 m to 5 m of the wall under the road.

In accordance with Clause 6.19.3.3 of the CHBDC S6-19 (CSA, 2019), a minimum embedment of 0.6 m and a minimum horizontal bench of 1 m is provided along the front face of the walls.

6.2 Climate Change Considerations

In accordance with the MoTI (2019a) T-04/19 circular, the impacts of the climate change on the design must be considered, appropriate to the scale of the project. For this project, the impacts of climate change on the geotechnical stability of the proposed retaining walls are generally limited to increases in piezometric levels from sea level rise (which will affect ambient piezometric levels) and from storm/runoff infiltration (which will only impact piezometric levels temporarily), both of which negatively impact stability.

Sea level rise has been assumed to increase groundwater levels by 1.0 m, based on guidance from the BC Ministry of Environment and Climate Change Strategy which indicated that sea levels may rise to this level by the year 2100 (Sunshine Coast Regional District, 2021).

It is estimated that infiltration from a climate change impacted storm event would result in an approximate increase in groundwater levels up to 0.5 m. This is based on the following:

- Information provided by the IDF_CC Tool, Version 6.5 (Simonovic et al., 2015) to the year 2100, which indicates that a 100-year return period storm event, corrected for climate change, would result in 119 mm of rainfall over 24 hours. The IDF_CC Tool does not provide a climate change corrected rainfall value for the 100-year return period storm for a 48-hour period, so we have conservatively doubled the 24-hour rainfall (to 238 mm) and used this value in the design.
- Approximate runoff coefficient of 0.5 (consistent with terrain with variable forest, residential and commercial land use and rolling hills, per the MoTI (2019b) Supplement to TAC Geometric Design Guide) with no evapotranspiration; and
- Approximate soil porosity of 0.25 to 0.60.

The changes to the piezometric levels that we have adopted for evaluation of climate change impact on stability under various loading conditions are summarized in Table 6-1 below.

Table 6-1: Evaluation of Climate Change Impacted Phreatic Surface

Loading	Increase in Phreatic Surface Elevation	Comment
Static	1.5 m	Considers both increase in groundwater table due to sea level rise and a climate change corrected storm event.
Seismic	1.0 m	Considers only increase due to sea level rise, as the likelihood of a 100-year return period storm event occurring concurrently with a with a 475-year return period earthquake is negligible.

Further discussion of climate change impacts on the geotechnical design is provided in Appendix E.

6.3 Internal Retaining Wall Stability

Internal stability of the MSE walls was evaluated using load resistance factored design (LRFD) in accordance with the CHBDC S6-19 (CGS, 2019). Internal stability was checked for serviceability limit state (SLS) and ultimate limit state (ULS) loading conditions. Resistance factors were assigned based on a “typical” consequence structure and “typical” degree of understanding, as discussed in Section 5.0. Load factors and combinations were used as specified in Tables 3.1 to 3.3 of the CHBDC S6-19 (CGS, 2019).

Maximum soil reinforcement loads were evaluated using the simplified method, in accordance with Clause 6.19.10.2.2 of the CHBDC S6-19 (CGS, 2019), using the unit weight and friction angles for BEF outlined in Section 4.5. Additional reinforcement loads included:

- Live load surcharge of 16 kPa, equivalent to a fill height of 0.8 m, in accordance with Clause 6.12.5 of the CHBDC S6-19 (CGS, 2019). Live loading was omitted from seismic loading consideration.
- Horizontal compaction load, corresponding to light compaction, varying from 12 kPa at surface to 0 kPa at 1.7 m (and below), in accordance with Clause 6.12.3 of the CHBDC S6-19 (CGS, 2019).

Active earth pressure coefficients of 0.271 and 0.495 were used for static and seismic analyses, respectively, based on Rankine theory (for static loading) and Mononobe-Okabe method (for seismic loading), as outlined in the Canadian Foundation Engineering Manual (CFEM; CGS, 2006).

Hydrostatic pressure was assumed to be negligible, as the prevailing groundwater table is below the base elevation of the retaining walls, and the wall backfill will be BEF, which is well draining.

Based on the above loading, a maximum factored tensile load of 30.6 kN/m is expected.

Geogrid with an ultimate tensile or juncture strength greater than 150 kN/m should be used. Reduction factors for installation damage, creep and durability should specified by the manufacturer and should not exceed the following:

- Installation damage reduction factor (RFID) – 1.3
- Creep reduction factor (RFCR) – 2.7
- Durability reduction factor (RFD) – 1.3

Geogrid with higher reduction factor(s) recommended by the manufacturer may be used, if discussed and approved with the project's geotechnical engineer. Larger manufacturer recommended reduction factors will increase minimum required tensile or juncture strength.

Concrete block face units should be interlocking, and tension should be applied in the geogrid during construction to prevent bulging. Geogrid should be embedded at least 0.375 m into the concrete blocks.

6.3.1 Geogrid Pullout Resistance

Pullout resistance for the geogrid at each of the sections varies depending on number of geogrid layers and geogrid lengths. Pullout resistance was evaluated using the following formula in accordance with CHBDC S6-19 (CGS, 2019) guidance:

$$P_{ULT} = L_e F^* \alpha \sigma_v C R_C$$

Where:

P_{ULT} = Pullout Resistance

L_e = effective embedment length, based on Figure 6.18 of CHDBC (2019)

F* = 0.67*tanΦ' (where Φ' = effective friction angle of the backfill)

α = scale effect correction factor, equal 0.8 for geogrids (CHDBC, 2019)

σ_v = vertical effective stress

C = surface area geometry factor, equal to 2 for strip or grid reinforcement (CHDBC, 2019)

R_c = reinforcement coverage ratio, equal to 1 where geogrid is continuous along the wall (CHDBC, 2019), which is the assumed configuration for the walls considered herein.

Factored pullout resistance was checked against factored horizontal loading and found to be adequate for the minimum lengths of geogrid specified for each wall (2.4 m for Wall 1 and Wall 3, and 3.15 m for Wall 2). The specified geogrid length also met the minimum L_e requirement of 1.0 m.

6.4 Global Stability

Stability was checked at the locations along the walls where the walls are highest, as well as the locations where the slopes below the walls are steepest; this included the following stations:

- 102+00 (Wall 1)
- 102+30 (Wall 1)
- 103+00 (Wall 2)
- 103+20 (Wall 2)
- 104+80 (Wall 3)
- 104+90 (Wall 3)

Stability was evaluated under static and pseudo-static conditions. The stability analyses were carried out using the commercial 2D modelling software, SLOPE/W (GeoSlope International Ltd., 2021), which uses limit equilibrium analysis to calculate an overall Factor of Safety (FoS) for the slope. For this study, the Morgenstern-Price method of slices was used to compute the FoS, which satisfies both force and moment equilibrium.

6.4.1 Design Criteria

The proposed design criteria for slope stability are based on criteria set out in the S6-19 Supplement (MoTI, 2022), for embankments and geotechnical systems.

Design criteria for slope stability under static loading are summarized in Table 6-2.

Table 6-2: Design Criteria for Slope Stability under Static Loading

Item	Minimum FoS
Overall global stability - static loading	1.54
Stability of slope below wall – static loading	1.54

Notes:

FoS = Factor of Safety

(1) Based on Table 6.2b of MoTI (2022) Supplement for a "typical" understanding and "typical" consequence site.

Seismic stability and displacement criteria were developed based on the S6-19 Supplement (MoTI 2022) requirement, Clause 6.14.2.3, which indicates that for geotechnical systems outside of a bridge influence zone and along roads not considered lifeline or major routes, a minimum of 50% of the travelling lanes must be able to be restored for use within one month following an earthquake with a 475-year return period (i.e., 10% probability of exceedance in 50 years). For these types of systems, the MoTI (2022) S6-19 Supplement indicates that a limit equilibrium pseudo-static analysis of the embankment must be undertaken, using minimum horizontal and vertical seismic coefficient of no less than half the PGA. Where the pseudo-static analyses do not provide a minimum FoS of 1.3, either a simplified displacement-based or a rigorous dynamic analysis must be undertaken; however, no guidance on limits on displacement are provided.

Consistent with previous projects similar to this one completed for the MoTI, an approximate seismic displacement limit of 300 mm following a 1 in 475-year return period earthquake was proposed. This was considered sufficiently low to be able to restore functionality of 50% of the lanes within one month.

6.4.2 Model Geometry

The subsurface geometry used to assess stability was based on regional geology information and the conditions encountered in boreholes BH22-01 to BH22-09, advanced in May 2022 by Tetra Tech . The existing and proposed ground geometry was obtained from cross-section drawings provided by SNC (included in Appendix B), and supplemented with LiDAR BC data, where the existing ground survey provided by SNC did not extend sufficiently far. The subsurface model geometry is shown with the results of the stability analyses in Appendix F.

The S6-19 Supplement (MoTI, 2022) does not provide guidance on the groundwater conditions to be used in stability analyses. As discussed in Section 4.3, groundwater was not encountered during drilling and is assumed to be below the lowest drilling level. We have assumed that current ambient groundwater elevation is at about 3 masl, as previously discussed, and applied climate change corrections to the groundwater elevations as discussed in Section 6.2.

6.4.3 Geotechnical Material Parameters

Soil parameters used in the models are discussed in Section 4.5. All soil materials were modelled using a Mohr-Coulomb or Bilinear failure envelope. Concrete blocks were modelled as high strength material, with a unit weight of 24 kN/m^3.

Geogrid reinforcement was modelled as a geosynthetic with a specified pullout resistance and tensile capacity for different wall heights (3, 4 and 6 block) represented by the critical sections. Pullout resistance and tensile capacity specific to each wall height were calculated based on the loads and resistance factors outlined in Section 6.3. Specified pullout resistance and tensile capacity are included with the results of the stability analyses in the figures in Appendix F.

6.4.4 Stability Analysis Results

The results of the stability analyses for each of the walls are shown on Figures F1 to F23 in Appendix F and summarized in Table 6-3.

Table 6-3: Results of Stability Modelling

Location	Loading	Target FoS	Calculated FoS	
			Global	Lower Slope
Wall 1 – Station 102+00	Static	1.54	1.65	2.32
Wall 1 – Station 102+00	Seismic	1.3	1.30	1.64
Wall 1 – Station 102+30	Static	1.54	1.93	1.62
Wall 1 – Station 102+30	Seismic	1.3	1.43	1.17
Wall 2 – Station 103+00	Static	1.54	1.56	1.68
Wall 2 – Station 103+00	Seismic	1.3	1.29	1.20
Wall 2 – Station 103+20	Static	1.54	1.57	3.01
Wall 2 – Station 103+20	Seismic	1.3	1.30	1.83
Wall 3 – Station 104+80	Static	1.54	1.60	1.54
Wall 3 – Station 104+80	Seismic	1.3	1.22	1.12
Wall 3 – Station 104+90	Static	1.54	2.00	N/A(1)
Wall 3 – Station 104+90	Seismic	1.3	1.57	N/A(1)

Notes:

FoS shown in red indicates locations where target FoS not met.

1) No slope in front of wall; area is flat.

As shown, global stability meets the target FoS under static loading conditions for all locations. However, the target FoS for pseudo-static loading is not met at several locations. As such, a simplified displacement-based approach was used to estimate displacements resulting from the design seismic event at these locations. This is described in the following section.

6.4.5 Seismic Displacement Estimate

Seismic-induced displacements were estimated using the simplified, probabilistic, empirical methods outlined by Bray and Travasarou (2007) for crustal/intraslab earthquakes and Bray et al. (2018) for subduction earthquakes. The methodology involves calculating the estimated seismic displacement using four main input parameters:

- Yield Coefficient (k_y) – which was evaluated for each of the sliding masses using GeoStudio's SLOPE/W (GEOSLOPE International Ltd., 2021).
- Initial Fundamental Period (Ts) of the sliding mass – which is the ratio of four times the estimated height (H) of the sliding mass under yield conditions to the weighted average shear wave velocity (Vs) of the sliding mass, which was estimated for each material type based on SPT N-values.
- Moment Magnitude (Mw) – which was inferred to be 7.0 for crustal/intraslab earthquakes and 9.0 for subduction earthquakes.
- Spectral Acceleration for the degraded period (Sa(1.5Ts)) – which was extrapolated on a semi-log scale from the 5%-damped spectral accelerations obtained from the NBCC 2020 (Natural Resources Canada, 2021), provided in Table 4-3 in Section 4.4.

Seismic-induced displacements were estimated at critical sections where FoS under pseudo-static analyses did not meet the target FoS of 1.3 (see Section 6.4.4). A summary of the input parameters used at each of the sections to calculate displacements, along with the estimated displacement, is provided in Table 6-4.

Table 6-4: Seismic Displacement Estimates and Input Parameters

Parameter	Station 102+30 (Lower Slope)	Station 103+00 (Global)	Station 103+00 (Lower Slope)	Station 104+80 (Global)	Station 104+80 (Lower Slope)
Yield Coefficient (k_y)	0.208g	0.295g	0.225g	0.255g	0.194g
Height of Sliding Mass (H) (1)	0.5 m	4.6 m	0.7 m	3.1 m	0.75 m
Average Shear Wave Velocity of Sliding Mass (V_s)	100 m/s	220 m/s	100 m/s	189 m/s	100 m/s
Initial Fundamental Period (T_s)	0.02 s	0.11 s	0.03 s	0.07 s	0.03 s
Moment Magnitude (M_w) (2)	7.0 / 9.0	7.0 / 9.0	7.0 / 9.0	7.0 / 9.0	7.0 / 9.0
Spectral Acceleration at the Degraded Period ($S_a(1.5T_s)$)	0.53g	0.59g	0.54g	0.565g	0.545g
Estimated Seismic Displacement (2)	62 mm	11 mm	53 mm	18 mm	84 mm

Notes:

(1) Yielded sliding masses shown on Figures F9, F12, F15, F18, F24 and F27

(2) Displacements calculated for both crustal/intraslab earthquakes with M_w=7.0 and subduction earthquakes with M_w=9.0. Only the larger of the two calculated displacements are reported (generated by the crustal/intraslab earthquake for all cases).

6.5 Compound Stability

Compound stability of the wall was checked using the same commercial 2D modelling software (SLOPE/W; GeoSlope International Ltd., 2021), and method (limit equilibrium, Morgenstern-Price method of slices) as was used to check global stability. The same design criteria were applied to compound stability as described in Section 6.4.1. Results of the compound stability assessment found that FoS's were higher than for global stability for all cases. As such, the S6-19 CHBDC (CSA, 2019) requirements for compound stability are considered to be met.

6.6 External Stability

In accordance with the S6-19 CHBDC (CSA, 2019), for a typical degree of understanding, retaining walls must be designed based resistance factors of 0.50 for bearing, 0.50 for overturning, and 0.80 for base sliding. Based on the results of our analysis, these external stability requirements are met for Walls 1 and 3 with a geogrid length of 2.4 m and for Wall 2 with a geogrid length of 3.15 m.

6.7 Additional Considerations and Recommendations

The following additional recommendations are provided, pertaining to the geotechnical design:

- It is recommended that uniaxial geogrid be used for the project, as it is able to achieve greater tensile strengths that biaxial geogrid.
- Concrete blocks should be obtained from a manufacturer with experience in similar projects, where geogrid was cast into concrete blocks.
- BEF should be placed in maximum 300 mm thick loose lifts and compacted to at least 98% modified proctor maximum dry density.
- Only manual construction equipment not exceeding 455 kg (1000 lbs) in weight should be used within 1.2 m of the concrete block wall.
- The full length of geogrid required behind the concrete blocks should be cast into the concrete blocks.
- Trees and large shrubs should not be planted in close proximity to the retaining wall, as their root systems may impact the wall stability and the drainage system.
- Care should be taken to avoid damaging root systems of existing trees near the retaining walls during excavations, as this may damage or kill the tree and cause it to topple. Trees in close proximity to the retaining walls which topple are likely to pull up a significant amount of soil with them which could destabilize the walls.

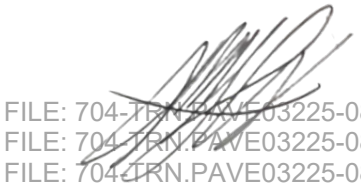
7.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of the British Columbia Ministry of Transportation and Infrastructure and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than the British Columbia Ministry of Transportation and Infrastructure, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

8.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.



2024-01-26

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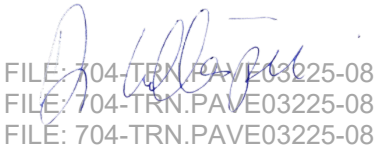

PERMIT TO PRACTICE
TETRA TECH CANADA INC.

PERMIT NUMBER: 1001972

Reviewed by:
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Senior Geotechnical Consultant
Direct Line: 250-653-4722
Donald.Gillespie@tetratech.com

/jmt/sy

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FIGURES

LEGEND

- Borehole Location
- Main Road
- Local Road

NOTES
Base data source:
Imagery from ESRI; Sunshine Coast (2018)

STATUS
ISSUED FOR USE

EAST PORPOISE BAY ROAD & SECHELT INLET ROAD GEOTECHNICAL SERVICES, SECHELT, BC

Borehole Location Plan

PROJECTION	DATUM
UTM Zone 10	NAD83

Scale: 1:4,000
80 40 0 80
Metres

FILE NO.
PAVE03225-08_Fig01_BoreholePlan.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	DS	MRV	KS	0

DATE	PROJECT NO.
January 26,2024	TRN.PAVE03225-08

CLIENT
BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

TETRA TECH

Figure 1

Q:\Vancouver\GIS\TRANSPORTATION\PAVE\PAVE03225-08\Maps\PAVE03225-08_Fig01_BoreholePlan.mxd modified 2022-06-08 by Darren.Schouls

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this document, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, TETRA TECH has not been retained to explore, address or consider and has not explored, addressed or considered any environmental or regulatory issues associated with development on the subject site.

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems, methods and standards employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. TETRA TECH does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

1.9 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historical environment. TETRA TECH does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional exploration and review may be necessary.

1.11 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

Construction activity can impact structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques, and construction sequence are known.

1.14 OBSERVATIONS DURING CONSTRUCTION

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, and the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

1.15 DRAINAGE SYSTEMS

Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function. Where temporary or permanent drainage systems are installed within or around a structure, these systems must protect the structure from loss of ground due to mechanisms such as internal erosion and must be designed so as to assure continued satisfactory performance of the drains. Specific design details regarding the geotechnical aspects of such systems (e.g. bedding material, surrounding soil, soil cover, geotextile type) should be reviewed by the geotechnical engineer to confirm the performance of the system is consistent with the conditions used in the geotechnical design.

1.16 DESIGN PARAMETERS

Bearing capacities for Limit States or Allowable Stress Design, strength/stiffness properties and similar geotechnical design parameters quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition used in this report. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions considered in this report in fact exist at the site.

1.17 SAMPLES

TETRA TECH will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

This document has been prepared based on the applicable codes, standards, guidelines or best practice as identified in the report. Some mandated codes, standards and guidelines (such as ASTM, AASHTO Bridge Design/Construction Codes, Canadian Highway Bridge Design Code, National/Provincial Building Codes) are routinely updated and corrections made. TETRA TECH cannot predict nor be held liable for any such future changes, amendments, errors or omissions in these documents that may have a bearing on the assessment, design or analyses included in this report.

APPENDIX B

SNC LAVALIN INC. DRAWINGS

BRITISH COLUMBIA

Ministry of Transportation & Infrastructure

Lower Mainland District

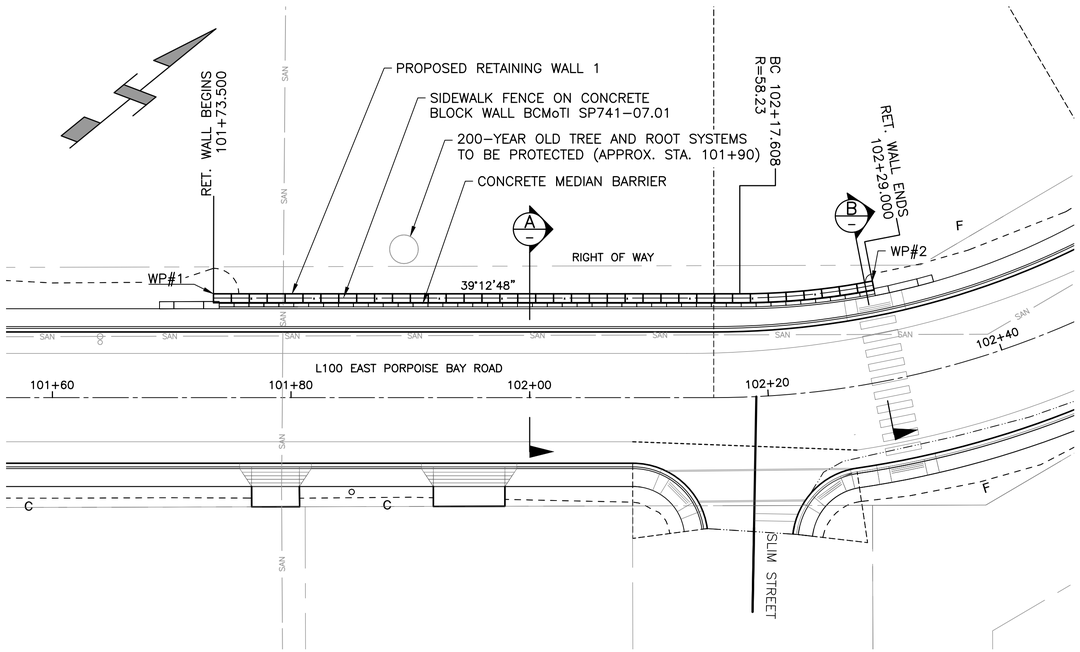
Project No. 13004 - 0001

Retaining Walls No. 10496R / 10497R / 10498R

East Porpoise Bay Road

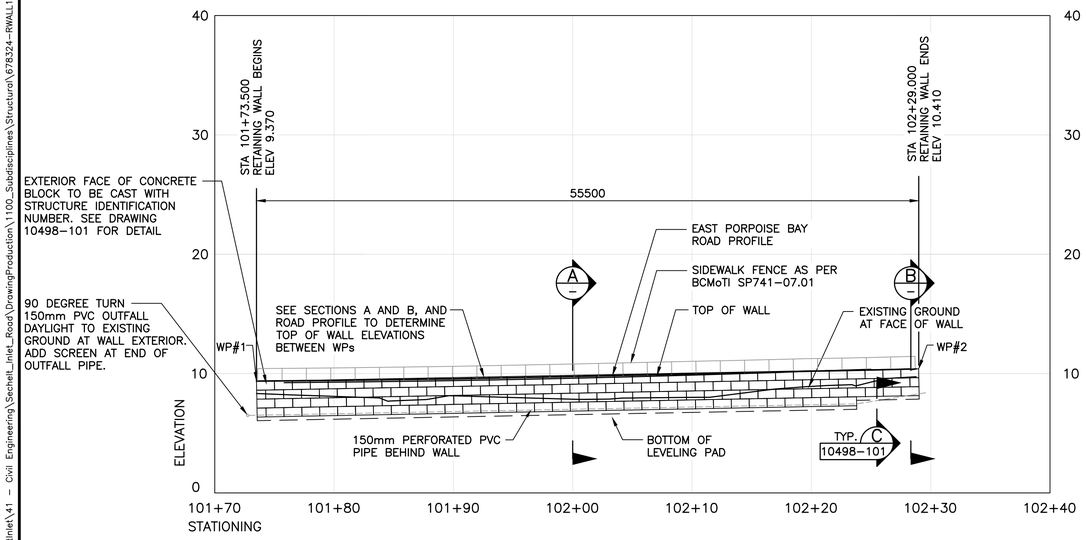
DRAWING No.
10496–000

H–308h–pc(10–03)



RETAINING WALL 1 PLAN

SCALE 1:250



RETAINING WALL 1 ELEVATION

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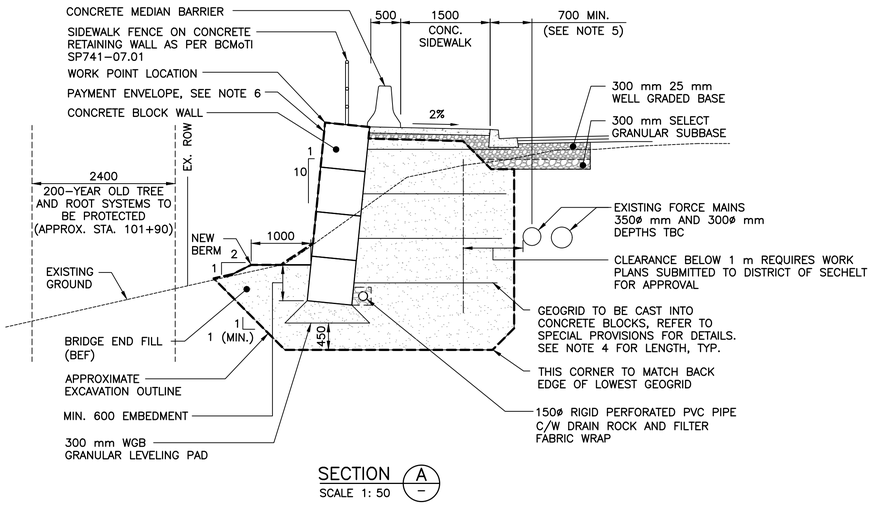

SECTION A

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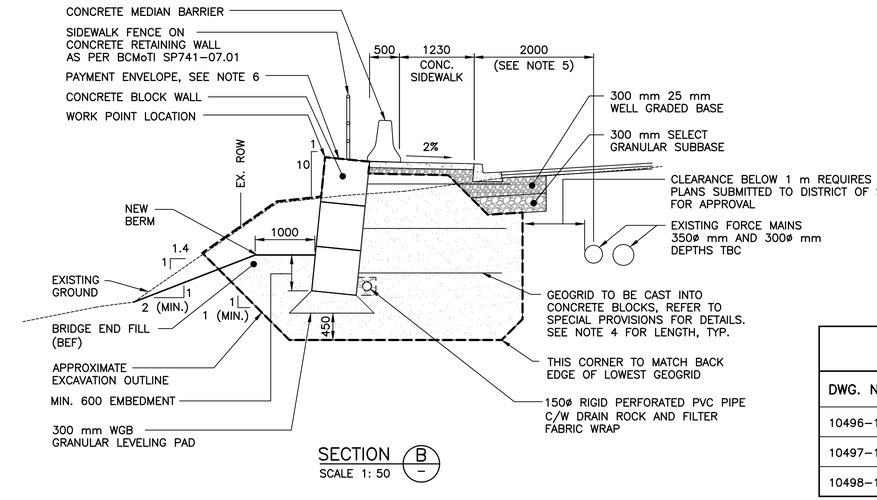
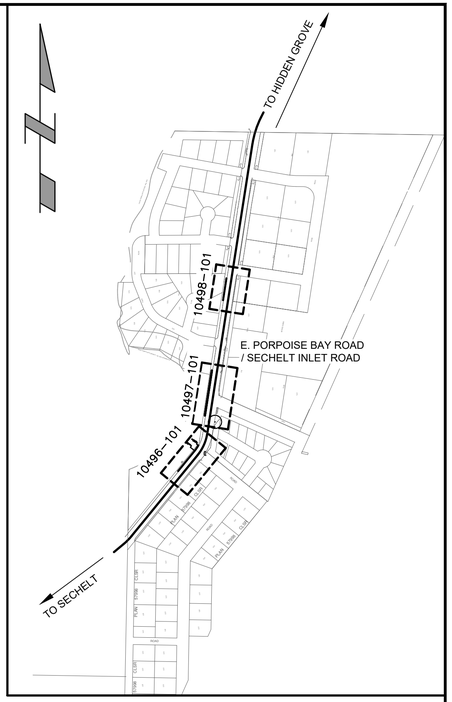


SECTION B

SCALE 1: 50



RETAINING WALL LOCATIONS ARE ALONG THE E. PORPOISE BAY ROAD AND SECHELT INLET ROAD IN THE DISTRICT OF SECHELT.

KEY PLAN

NTS

NOTES:

1. DIMENSIONS ARE IN MILLIMETRES.
2. STATIONING AND ELEVATIONS ARE IN METRES.
3. DESIGN STANDARD: CANADIAN HIGHWAY BRIDGE DESIGN CODE (CHBDC) S6–19
4.

GEOGRID LENGTHS	
GRID POSITION MID–HEIGHT OF BLOCK	MIN. GEOGRID LENGTH (m)
1 (TOP)	2.40
2	2.40
3	2.40
4	2.40

5. THIS DIMENSION LOCATES THE PIPES IN RELATION TO THE DESIGN.
6. PAYMENT ENVELOPE EXCLUDES EXCAVATION, REFER TO SPECIAL PROVISIONS.
7. DESIGN BASE ON GEOTECHNICAL REPORT "EAST PORPOISE BAY ROAD UPGRADES GEOTECHNICAL DESIGN FOR RETAINING WALLS" PREPARED BY TETRA TECH DATED NOVEMBER 15, 2023.

WORK POINTS				
WORK POINT #	NORTHING	EASTING	ELEVATION	STATION
1	481220.688	445504.889	9.370	101+73.500
2	481264.145	445538.969	10.410	102+29.000

LIST OF DRAWING

DWG. No.	TITLE
10496–101	RETAINING WALL No. 10496R – GENERAL ARRANGEMENT
10497–101	RETAINING WALL No. 10497R – GENERAL ARRANGEMENT
10498–101	RETAINING WALL No. 10498R – GENERAL ARRANGEMENT

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Suite 1100 - 745 Thurlow St.
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Certified ISO 9001

Rev	Date	Description	Init

REVISIONS

BRITISH COLUMBIA | Ministry of Transportation & Infrastructure
South Coast Region

LOWER MAINLAND DISTRICT
EAST PORPOISE BAY ROAD
RETAINING WALL No. 10496R GENERAL ARRANGEMENT

PREPARED UNDER THE DIRECTION OF
KAREN CHOI
ENGINEER OF RECORD
DATE

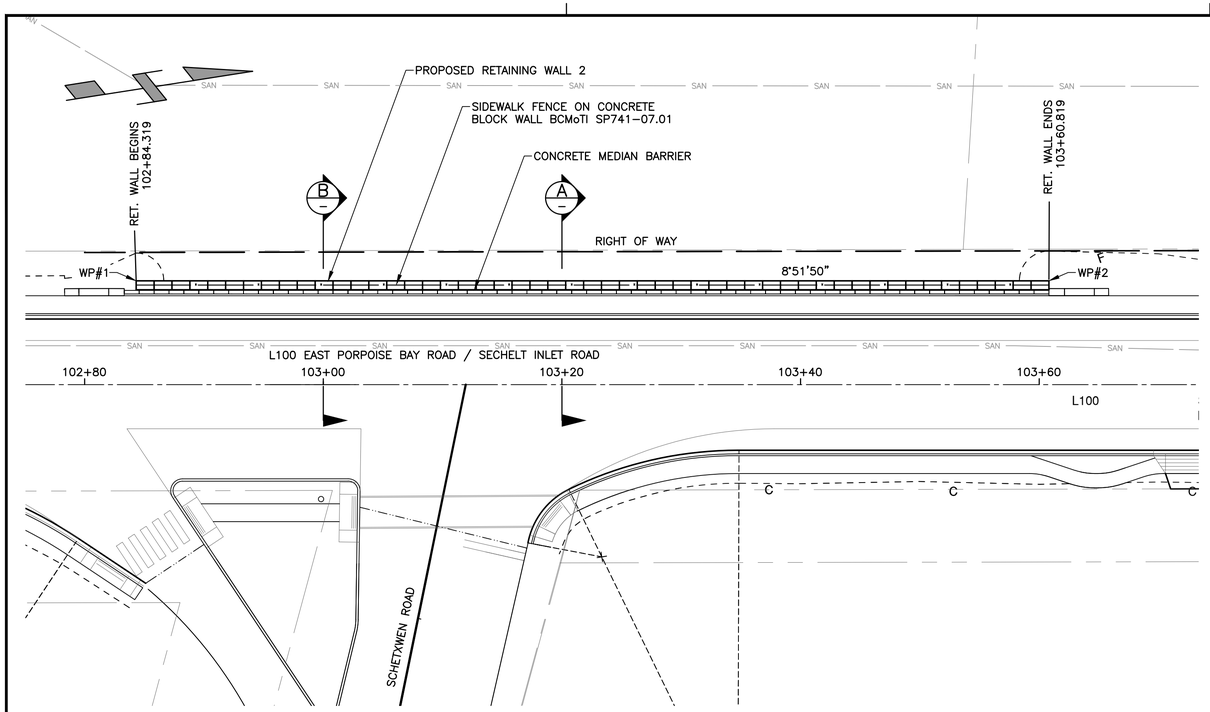
DESIGNED K. CHOI DATE 2023–06–27
CHECKED Z. JIANG DATE 2023–07–05
DRAWN A. CHEUNG DATE 2023–06–27
SCALE AS NOTED
NEGATIVE No.

FILE No.	PROJECT No.	REG.	DRAWING No.
871CS0999	13004–0001	1	10496–101

CANCEL PRINTS BEARING PREVIOUS LETTER

H-308-r1-c(07-08)

mondd H:\DATA\678324–PorpoiseBay&SechelInlet\41 – Civil Engineering\SechelI_Inlet_Road\DrawingProduction\1100_Subdisciplines\Structural\678324–RWALL1–2–3.dwg| Jan.18/2024 – 2:24pm



RETAINING WALL 2 PLAN

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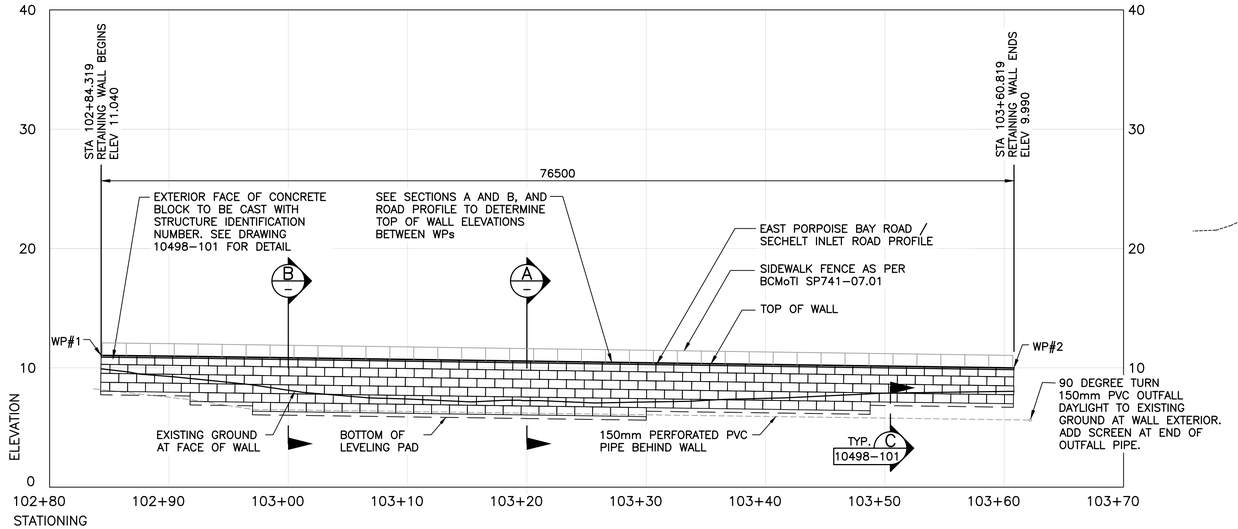
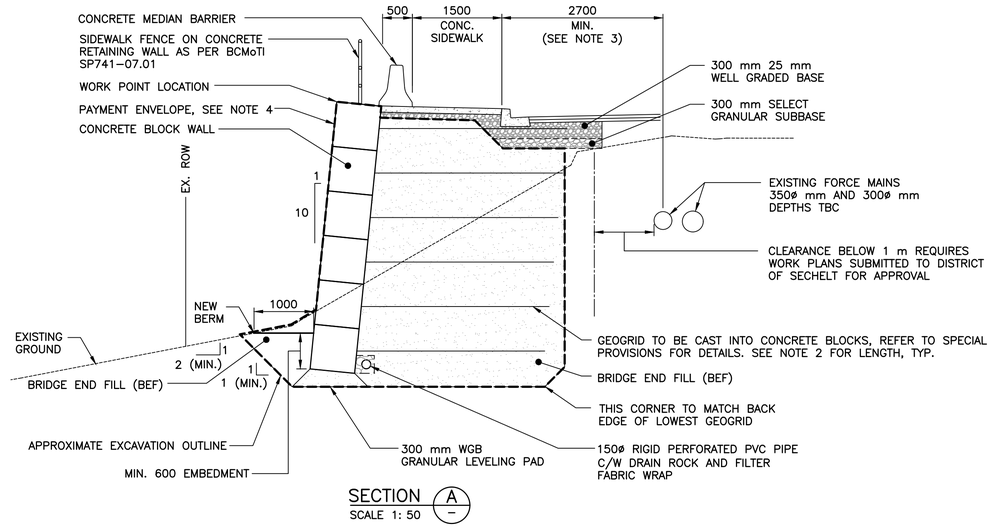


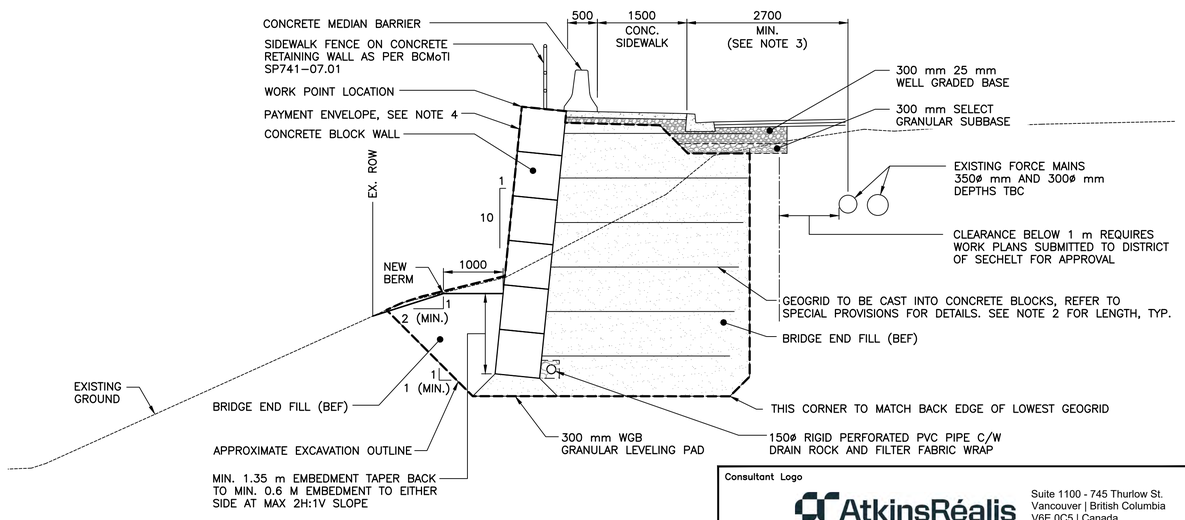
RETAINING WALL 2 ELEVATION

SCALE: 1:250



SECTION A

SCALE 1: 50



SECTION B

SCALE 1: 50

NOTE:

1. REFER TO NOTES ON DRAWING 10496–101
2.

GEOGRID LENGTHS	
GRID POSITION MID–HEIGHT OF BLOCK	MIN. GEOGRID LENGTH (m)
1 (TOP)	3.15
2	3.15
3	3.15
4	3.15
5	3.15
6	3.15

3. THIS DIMENSION LOCATES THE PIPES IN RELATION TO THE DESIGN.
4. PAYMENT ENVELOPE EXCLUDES EXCAVATION, REFER TO SPECIAL PROVISIONS.
5. DESIGN BASE ON GEOTECHNICAL REPORT "EAST PORPOISE BAY ROAD UPGRADES GEOTECHNICAL DESIGN FOR RETAINING WALLS" PREPARED BY TETRA TECH DATED NOVEMBER 15, 2023.

WORK POINTS				
WORK POINT #	NORTHING	EASTING	ELEVATION	STATION
1	481313.690	445550.028	11.040	102+84.319
2	481389.277	445561.816	9.990	103+60.819

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Vancouver | British Columbia
V6E 0C5 | Canada
Certified ISO 9001

Rev	Date	Description	Init

REVISIONS

BRITISH COLUMBIA | Ministry of Transportation & Infrastructure
South Coast Region

LOWER MAINLAND DISTRICT
EAST PORPOISE BAY ROAD

RETAINING WALL No. 10497R
GENERAL ARRANGEMENT

PREPARED UNDER THE DIRECTION OF
KAREN CHOI
ENGINEER OF RECORD
DATE

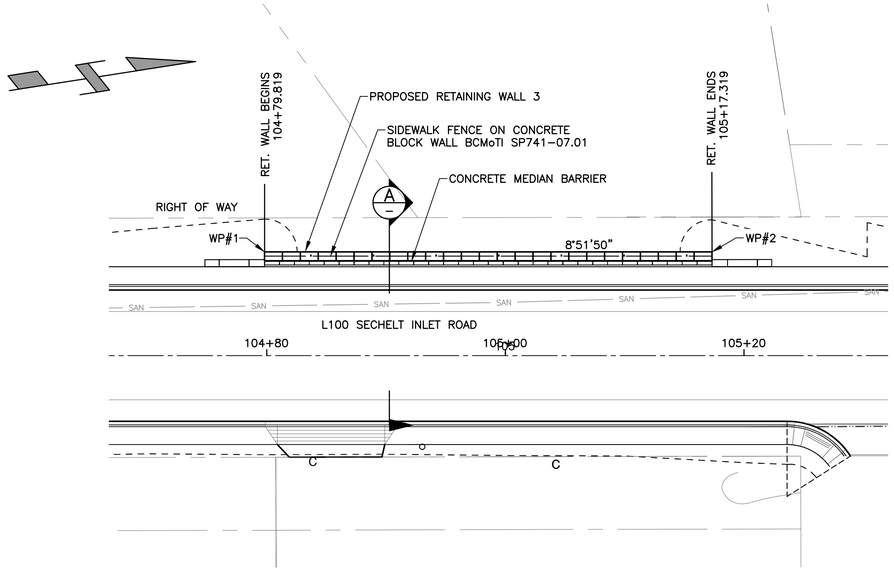
DESIGNED K. CHOI DATE 2023–06–23
CHECKED Z. JIANG DATE 2023–07–05
DRAWN A. CHEUNG DATE 2023–06–23
SCALE AS NOTED
NEGATIVE No.

FILE No. 871CS0999
PROJECT No. 13004–0001
REG. 1
DRAWING No. 10497–101

CANCEL PRINTS BEARING PREVIOUS LETTER

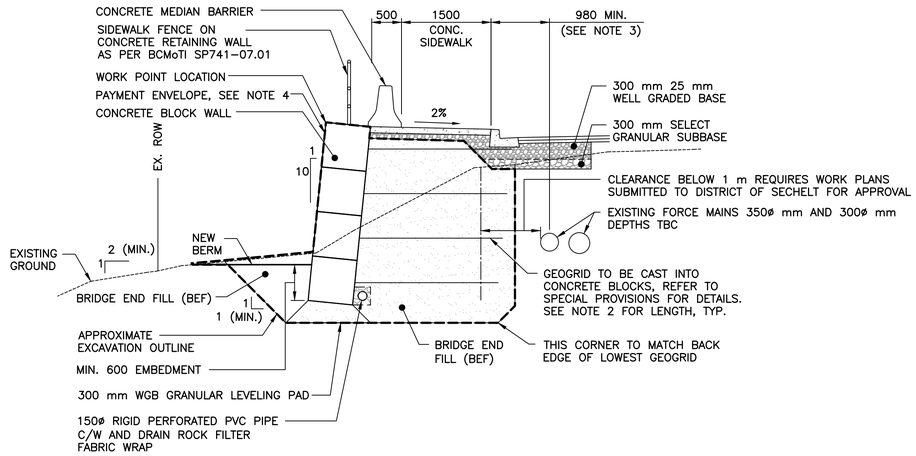
PLOT DATE: 2023/06/23 H:\DATA\678324-PorpoiseBay&SechelttInlet\42 - Structural Engineering\42DK - Sketches-Drawings\678324-S1-960-XXX.dwg

H–308–1–c(07–08)



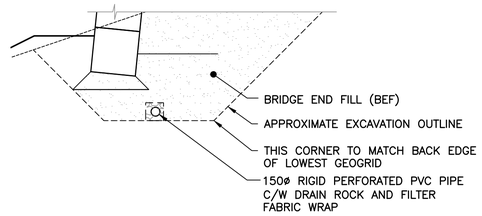
RETAINING WALL 3 PLAN

SCALE: 1:250



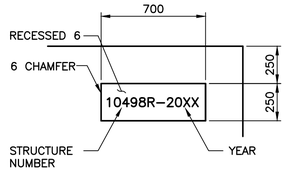
SECTION A

SCALE 1: 50



TYPICAL SECTION (PVC PIPE BELOW WALL)

SCALE 1: 50

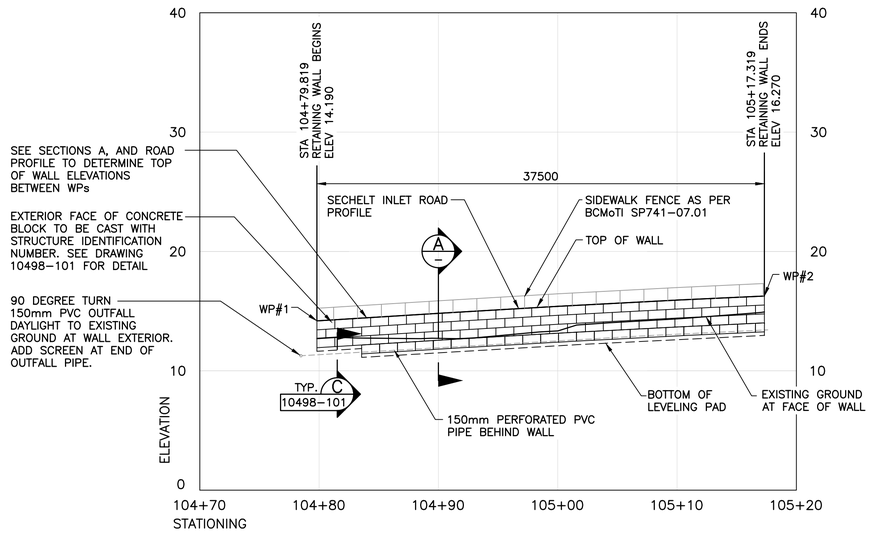


RETAINING WALL NUMBER =
RETAINING WALL 1 NUMBER = 10496R
RETAINING WALL 2 NUMBER = 10497R
RETAINING WALL 3 NUMBER = 10498R

STRUCTURE NUMBER AND YEAR OF CONSTRUCTION
CAST IN 117 HIGH NUMERALS AS SHOWN. NUMERAL
FORMS LOANED BY THE MINISTRY OF TRANSPORTATION

STRUCTURE NUMBER DETAIL

SCALE 1:20



RETAINING WALL 3 ELEVATION

SCALE: 1:250

NOTE:

1. REFER TO NOTES ON DRAWING 10496–101
2.

GEOGRID LENGTHS	
GRID POSITION MID–HEIGHT OF BLOCK	MIN. GEOGRID LENGTH (m)
1 (TOP)	2.40
2	2.40
3	2.40
4	2.40

3. THIS DIMENSION LOCATES THE PIPES IN RELATION TO THE DESIGN.
4. PAYMENT ENVELOPE EXCLUDES EXCAVATION, REFER TO SPECIAL PROVISIONS.
5. DESIGN BASE ON GEOTECHNICAL REPORT "EAST PORPOISE BAY ROAD UPGRADES GEOTECHNICAL DESIGN FOR RETAINING WALLS" PREPARED BY TETRA TECH DATED NOVEMBER 15, 2023.

WORK POINTS				
WORK POINT #	NORTHING	EASTING	ELEVATION	STATION
1	481506.853	445580.152	14.190	104+79.819
2	481543.905	445585.930	16.270	105+17.319

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Rev	Date	Description	Init

REVISIONS

BRITISH COLUMBIA | Ministry of Transportation & Infrastructure
South Coast Region

LOWER MAINLAND DISTRICT
EAST PORPOISE BAY ROAD

RETAINING WALL No. 10498R
GENERAL ARRANGEMENT

PREPARED UNDER THE DIRECTION OF

KAREN CHOI
ENGINEER OF RECORD

DATE

DESIGNED K. CHOI DATE 2023–06–26
CHECKED Z. JIANG DATE 2023–07–05
DRAWN A. CHEUNG DATE 2023–06–26
SCALE AS NOTED
NEGATIVE No.

FILE No.	PROJECT No.	REG.	DRAWING No.
871CS0999	13004–0001	1	10498–101

CANCEL PRINTS BEARING PREVIOUS LETTER

PLOT DATE: 2023/06/23 H:\DATA\678324-PorpoiseBay&SecheltInlet\42 - Structural Engineering\42DK - Sketches-Drawings\678324-S1-980-XXX.dwg

H–308–r1–c(07–08)

BRITISH COLUMBIA

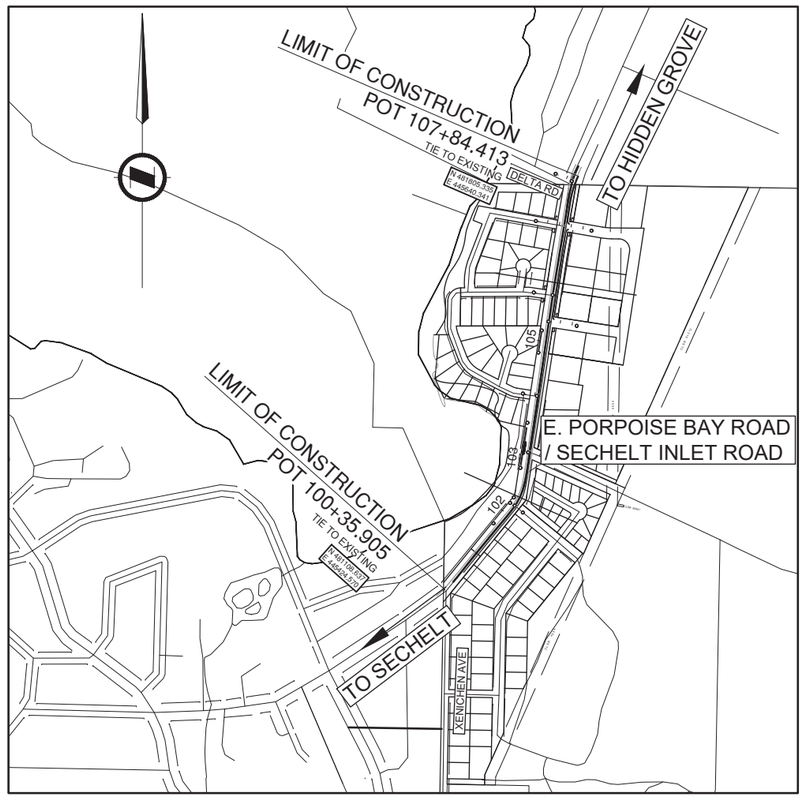
Ministry of Transportation and Infrastructure

PROJECT NO. 13004 - 0001

EAST PORPOISE BAY ROAD IMPROVEMENTS

DRAWING NUMBER	REV
R1-980-000	--

LOCATION MAP
N.T.S.



KEY PLAN
SCALE 1:5000

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

DRAWING INDEX	
R1-980-000	COVER PAGE
R1-980-001	LOCATION MAP, KEY PLAN AND DRAWING INDEX
R1-980-002	LEGEND AND CONTROL POINT TABLE
R1-980-101 TO 103	PLAN
R1-980-201 TO 202	PROFILE
R1-980-301 TO 302	TYPICAL SECTIONS
R1-980-353	DETAILS
R1-980-401 TO 403	GEOMETRICS, LANING, SIGNAGE AND PAVEMENT MARKINGS
R1-980-501 TO 503	SPOT ELEVATION
R1-980-701 TO 703	DRAINAGE DESIGN AND UTILITY RELOCATION - PLAN AND PROFILE
R1-980-704	SANITARY DESIGN - PLAN AND PROFILE
R1-980-721	DRAINAGE DETAILS
R1-980-1101	RE-VEGETATION PLAN
10496-000	COVER PAGE
10496-101	RETAINING WALL No. 10496R GENERAL ARRANGEMENT
10497-101	RETAINING WALL No. 10497R GENERAL ARRANGEMENT
10498-101	RETAINING WALL No. 10498R GENERAL ARRANGEMENT

PROJECT No. 13004 - 0001

EAST PORPOISE BAY ROAD IMPROVEMENTS

XENICHEN AVENUE TO DELTA ROAD

STA. 100+35.905 TO 107+84.413
STB. 0.749 km

LANDMARK KILOMETRE INVENTORY
SEGMENT - NA

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

LOCATION MAP, KEY PLAN AND DRAWING INDEX

EAST PORPOISE BAY ROAD IMPROVEMENTS

REFER TO TENDER DRAWING PACKAGE APPROVAL FORM	REFER TO TENDER DRAWING PACKAGE APPROVAL FORM
DIRECTOR, ENGINEERING	EXECUTIVE DIRECTOR, SOUTH COAST REGION
DATE 2022-06-03	DATE 2022-06-03

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-001	--

PLOT DATE: 2024/01/16 \\sli\0262\TxProject\DATA\678324-PorpoiseBay&SechelInlet41 - Civil Engineering\SechelI_Inlet_Road\DrawingProduction\000_CoverKeyPlanLegendR1-980-001.dwg

EXISTING LINE TYPES

- SHOULDER LEFT OR RIGHT
- GRAVEL
- EDGE OF PAVEMENT
- WHITE LINE
- BROKEN WHITE LINE RURAL
- BROKEN WHITE LINE URBAN
- YELLOW LINE
- DOUBLE YELLOW LINE
- CENTERLINE
- CURB & GUTTER
- DRIVEWAY
- BREAK IN GROUND
- BOTTOM OF SLOPE
- BUILDING
- CONCRETE MEDIAN BARRIER
- POWER LINE
- BUSHES, HEDGES, TREE LINE
- TOP OF BANK
- DITCH EDGE
- CULVERT
- FENCE
- RETAINING WALL
- HEAD WALL
- SITE MISCELLANEOUS

PROPOSED LINE TYPES

- MAIN ALIGNMENT (L100C1 101)
- SECONDARY ALIGNMENT (L200C1 201)
- CONCRETE CURB
- DRIVEWAY
- GRAVEL SHOULDER
- GUTTER
- LANE EDGE
- BROKEN WHITE LINE RURAL
- DECELERATION / ACCELERATION LANE
- LANE EDGE
- MEDIAN
- BROKEN WHITE LINE URBAN
- WHITE LINE
- YELLOW LINE
- EDGE OF PAVEMENT
- RAISED ISLAND / MEDIAN
- RAISED ISLAND / MEDIAN LETDOWNS
- SHOULDER GRAVEL
- CLEARING & GRUBBING BOUNDARY

EXISTING SYMBOLS

- CONTROL MONUMENT
- DETAIL HUB
- OLD IRON PIN (OP)
- POWER POLE
- LAMP STANDARD (LS)
- SERVICE METER (SV)
- GUY WIRE
- GAS VALVE (GV)
- WATER VALVE (WV)
- TELEPHONE MANHOLE (MH Tel)
- SIGN ONE POST
- DELINEATOR POST (DP)
- MANHOLE
- CATCH BASIN LAWN (CB Lawn)
- STORM MANHOLE (MH Storm)
- CATCH BASIN
- PILING (Piling)
- TESTHOLE
- TREE

CONTROL POINTS TABLE

Date: Nov.10, 2017 | **Origin:** GCM 08H2536

Project: Sechelt Inlet Road Improvements | **Tack Point:** POPEYE | **ACSF:** 0.999636

Horizontal Datum: UTM Z10 NAD 83 CSRS | **Vertical Datum:** CGVD28 HT2.0

Point ID	Local Northing	Local Easting	Elevation	UTM Northing	UTM Easting	Ellip. Ht	Combined scale	Survey Method	Comment
TACKPT	481563.918	445610.408		5481563.918	445610.408	0.000	-	-	-
POPEYE	481563.918	445610.408	17.706	5481563.918	445610.408	0.293	0.999636	STATIC	DESTROYED
08H2536	481916.062	445899.604	28.227	5481915.934	445899.499	10.833	0.999634	SUPPLIED	BRASS CAP
09H2562	480920.694	445103.036	6.478	5480920.928	445103.221	-10.967	0.999639	SUPPLIED	BRASS CAP
CHAWLIN	481727.633	445630.813	18.389	5481727.573	445630.806	0.984	0.999636	STATIC	REBAR
SLIM	481263.783	445557.081	10.543	5481263.892	445557.100	-6.886	0.999637	STATIC	REBAR
XEN	481108.705	445432.478	10.157	5481108.871	445432.543	-7.280	0.999638	TS	NAIL
XENA	481141.747	445459.276	10.376	5481141.901	445459.331	-7.060	0.999638	TS	SPIKE
XENB	481192.537	445500.731	9.132	5481192.672	445500.771	-8.301	0.999638	TS	SPIKE
BAYVIEW	481592.367	445607.837	17.598	5481592.357	445607.838			TS	REBAR
TSULICH	481422.448	445571.039	9.599	5481422.499	445571.053			TS	NAIL

All local coordinates are derived by first scaling from the Tack Point and then removing the millionth digit from the Northing

To calculate local coordintes manually, or with software that is unable to use a tack point, or if a match to adjacent projects is required, the applied Northing and Easting shifts must be recorded here.

Northing Shift -5001996.016 — Local Northing = (UTM Northing/ACSF)+Northing Shift

Easting Shift -162.261 — Local Easting = (UTM Easting/ACSF)+Easting Shift

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SCALE 0 5 1:500 25m

CAD FILENAME R1-980-002

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 1/16/2024

DESIGNED Z. JIANG DATE 2021-03-31
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R.WONG/S.S DEEPAK DATE 2023-06-03
DRAWN Z. JIANG DATE 2022-06-02

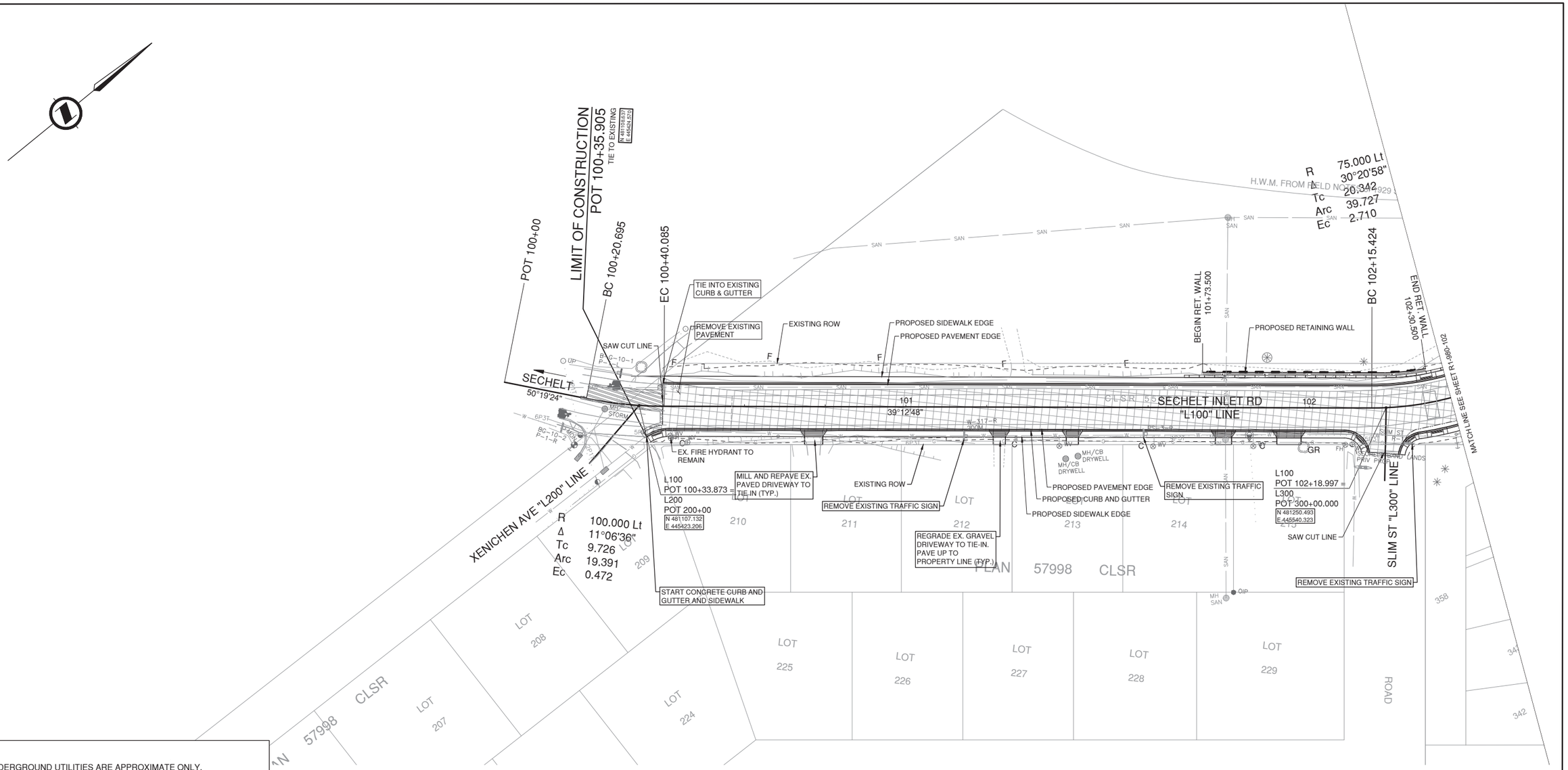
LEGEND AND CONTROL POINTS TABLE

EAST PORPOISE BAY ROAD IMPROVEMENTS

--

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-002	--

PLOT DATE: 2024/01/16 \\sll02621\xProject\DATA\678324-PorpoiseBay&SecheltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\000_CoverKeyPlanLegend\R1-980-002.dwg



NOTES:

1. ALL UNDERGROUND UTILITIES ARE APPROXIMATE ONLY.
2. ALL UTILITY POLES TO BE RELOCATED BY OTHERS UNLESS OTHERWISE NOTED. SEE DRAINAGE AND UTILITIES DWGS FOR DETAILS

FOR PROFILES SEE DWG R1-980-201 TO 202

FOR TYPICAL SECTIONS SEE DWG R1-980-301 TO 302

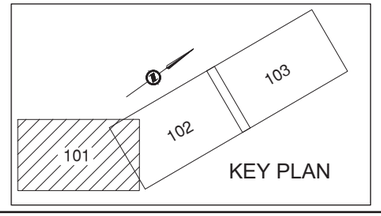
FOR GEOMETRICS AND LANING SEE DWG R1-980-401 TO 403

FOR DRAINAGE AND UTILITIES SEE DWG R1-980-701 TO 704

LEGEND:

- REMOVE EXISTING PAVEMENT
- MILLING

GR TOTAL THIS SHEET
0 ha



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SCALE 0 5 1:500 25m

CAD FILENAME R1-980-101 TO 103

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 1/16/2024

DESIGNED	Z. JIANG	DATE	2021-03-31
QUALITY CONTROL	B. POMPHREY	DATE	2022-06-03
QUALITY ASSURANCE	R.WONG/S.S.DEPW	DATE	2022-06-03
DRAWN	Z. JIANG	DATE	2022-06-02

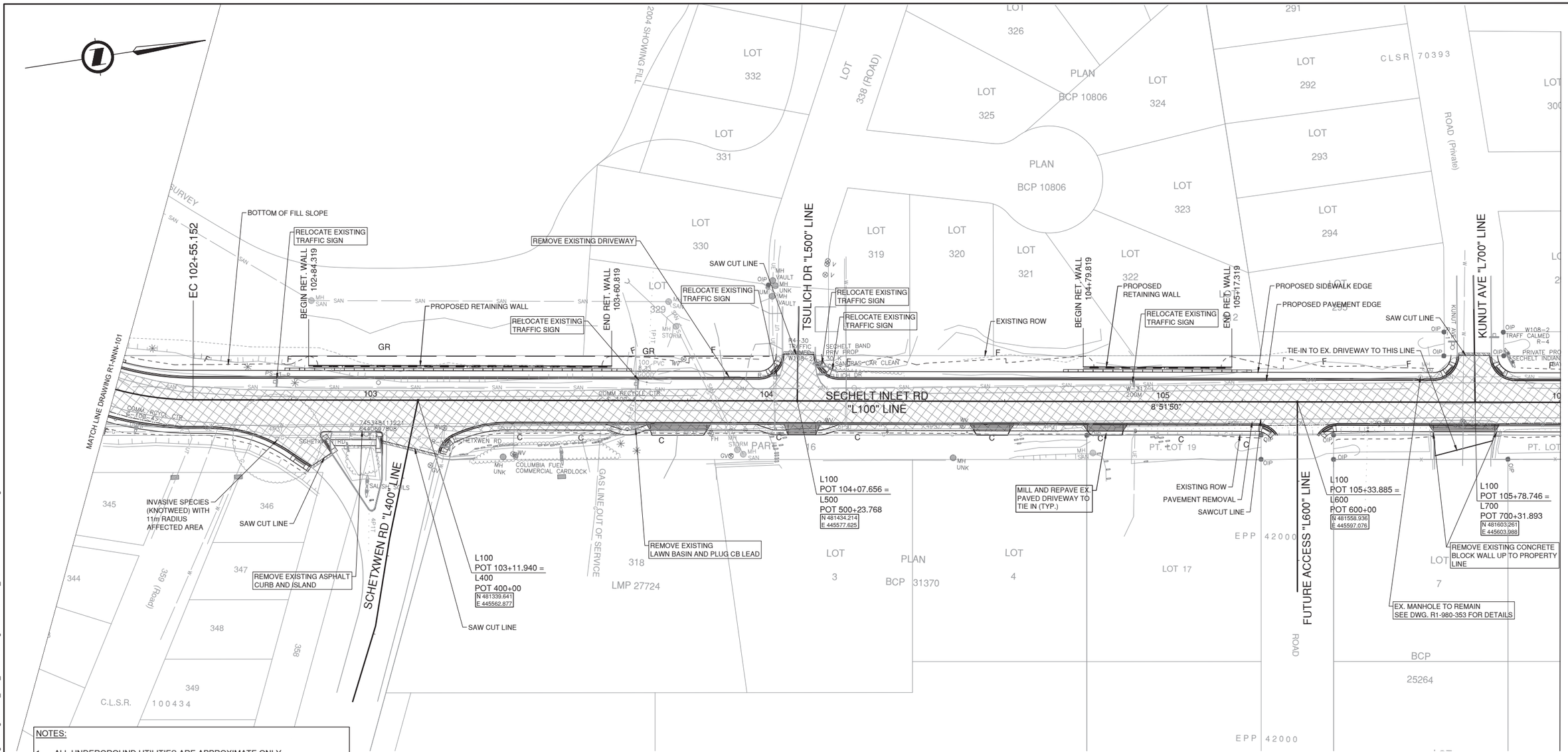
PLAN

EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 100+18.000 TO 102+35.000

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-101	--

PLOT DATE: 2024/01/16 \\sli02621\xProject\DATA\678324-PorpoiseBay&SecheltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\100_Plans\R1-980-101 to 103.dwg



NOTES:

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FOR PROFILES SEE DWG R1-980-201 TO 202

FOR TYPICAL SECTIONS SEE DWG R1-980-301 TO 302

FOR GEOMETRICS AND LANING SEE DWG R1-980-401 TO 403

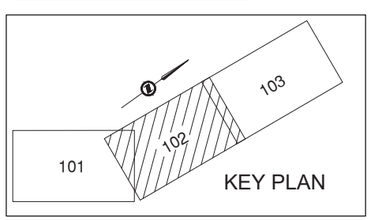
FOR DRAINAGE AND UTILITIES SEE DWG R1-980-701 TO 704

LEGEND:

REMOVE EXISTING PAVEMENT

MILLING

GR TOTAL THIS SHEET
0.1033 ha



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SCALE 0 5 1:500 25m

CAD FILENAME R1-980-101 TO 103

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER
DATE 1/16/2024

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QUALITY ASSURANCE R. WONG DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

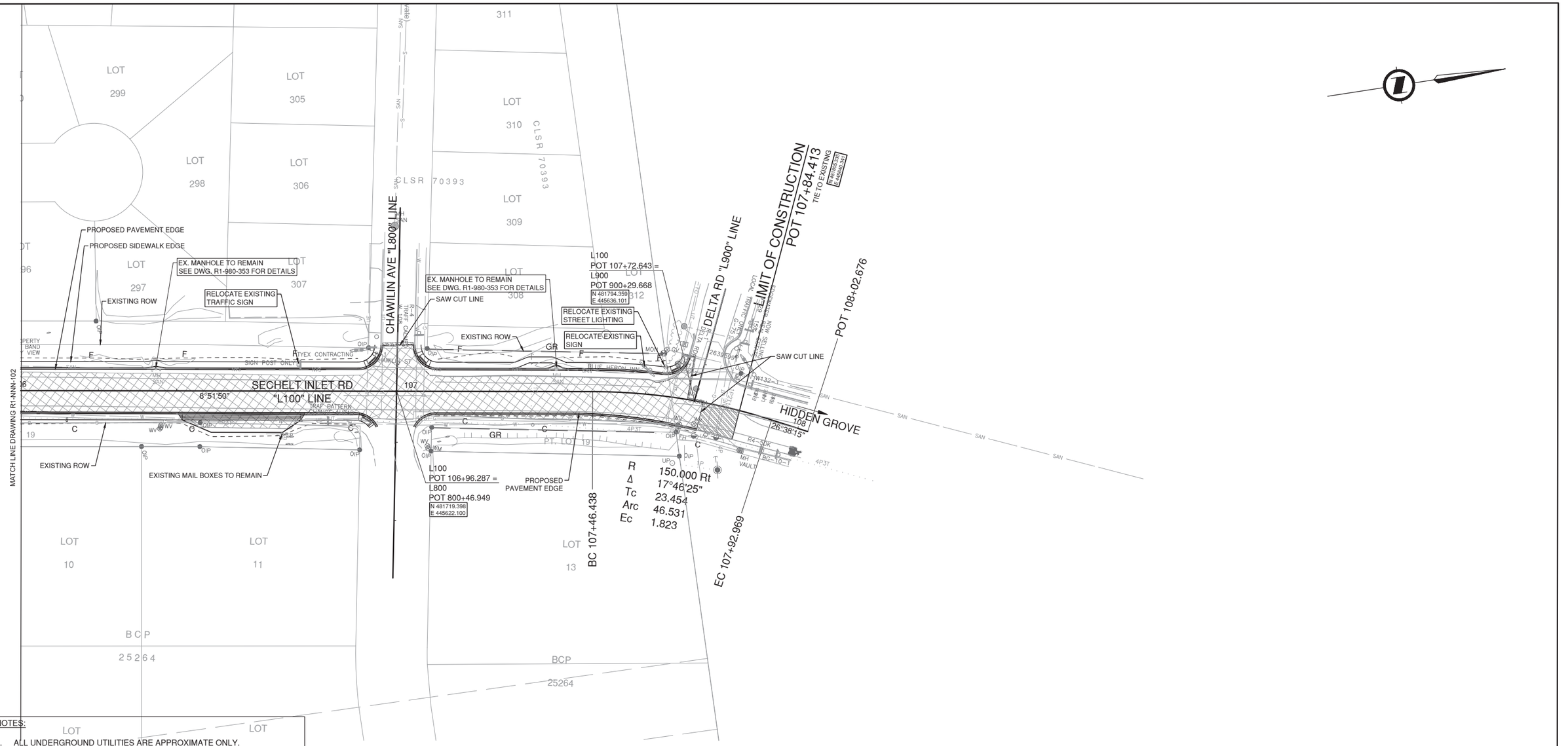
PLAN

EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 102+35.000 TO 106+00.000

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-102	--

PLOT DATE: 2024/01/16 \\sll02621\xProject\DATA\678324-PorpoiseBay&SechelttInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\100_Plans\R1-980-101 to 103.dwg



NOTES:

1. ALL UNDERGROUND UTILITIES ARE APPROXIMATE ONLY.
2. ALL UTILITY POLES TO BE RELOCATED BY OTHERS UNLESS OTHERWISE NOTED. SEE DRAINAGE AND UTILITIES DWGS FOR DETAILS

FOR PROFILES SEE DWG R1-980-201 TO 202

FOR TYPICAL SECTIONS SEE DWG R1-980-301 TO 302

FOR GEOMETRICS AND LANING SEE DWG R1-980-401 TO 403

FOR DRAINAGE AND UTILITIES SEE DWG R1-980-701 TO 704

LEGEND:

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MILLING

GR TOTAL THIS SHEET
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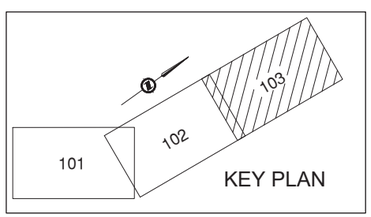

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SCALE 0 5 1:500 25m

CAD FILENAME R1-980-101 TO 103

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

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QUALITY CONTROL	B. POMPHREY	DATE	2022-06-03
QUALITY ASSURANCE	R. WONG	DATE	2022-06-03
DRAWN	Z. JIANG	DATE	2022-06-02

PLAN

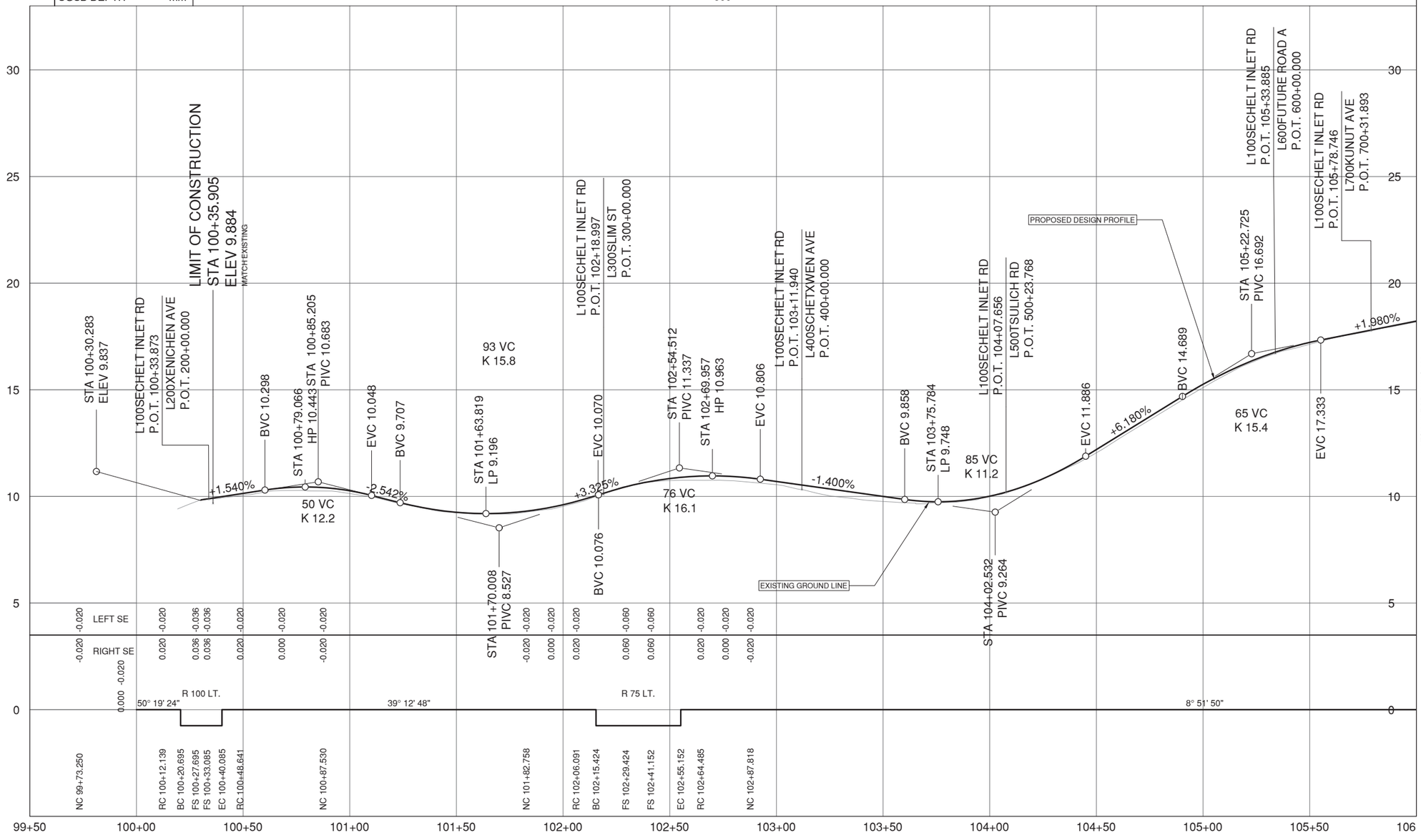
EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 106+00.000 TO 107+84.000

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-103	--

PLOT DATE: 2024/01/16 \\sil\0262\TxProject\DATA\678324-PorpoiseBay&SechelltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\100_Plans\R1-980-101 to 103.dwg

EXCAVATION	m³	2109
EMBANKMENT	m³	1096
STRIPPING	m³	768
25mm WGB DEPTH	mm	300
SGSB DEPTH	mm	300



DESIGN SPEED 50 km/h

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SCALE 0 10 H 1:1000 50m / 0 1 V 1:100 5m

CAD FILENAME R1-980-201 TO 202

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

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QUALITY ASSURANCE R.WONG/S.S.DEEPAK DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

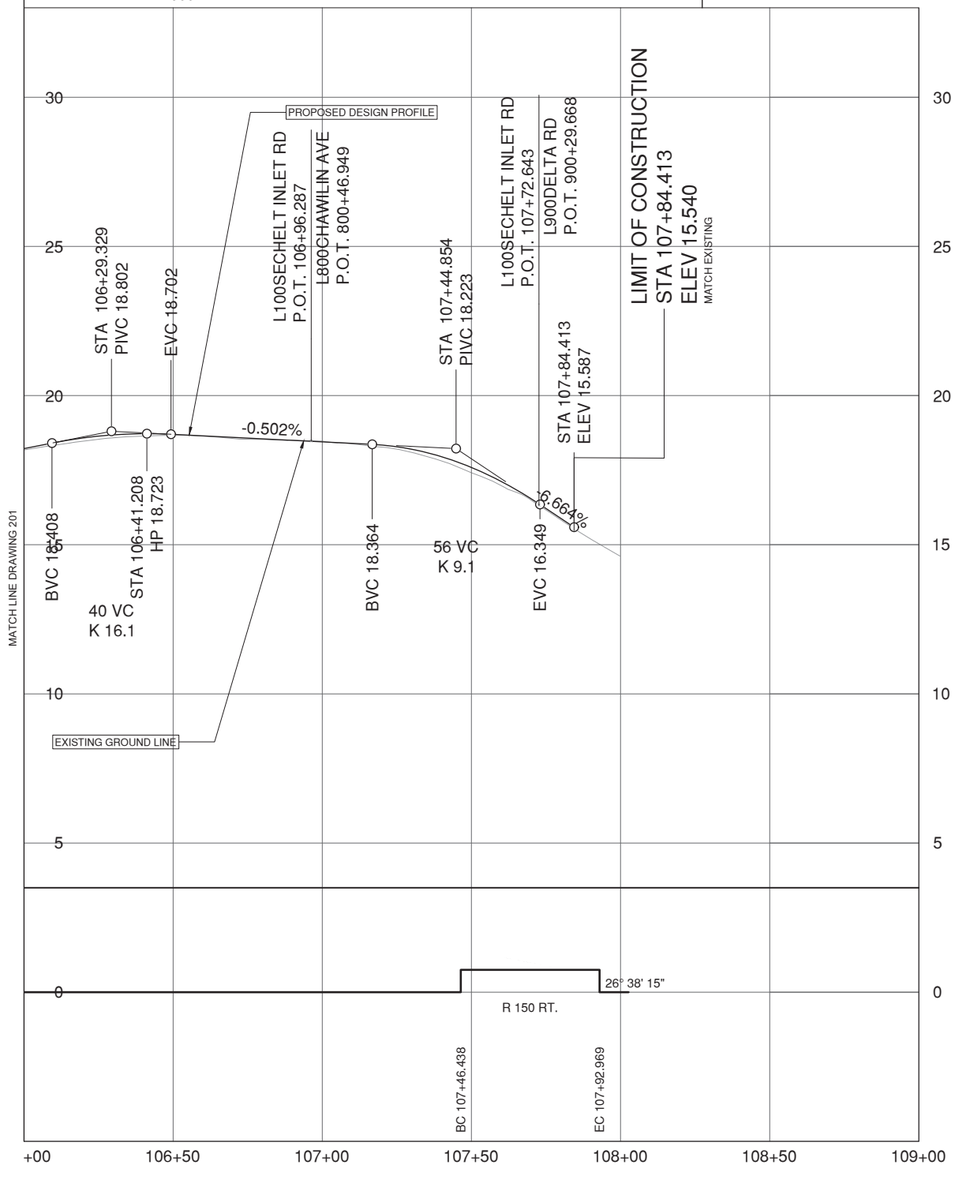
PROFILE

EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 100+18 TO 105+50

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-201	--

	TOTAL
996	3107
51	1147
250	1018
300	
300	



DESIGN SPEED 50 km/h

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SCALE 0 10 H 1:1000 50m / 0 1 V 1:100 5m

CAD FILENAME R1-980-201 TO 202

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

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DRAWN Z. JIANG DATE 2022-06-02

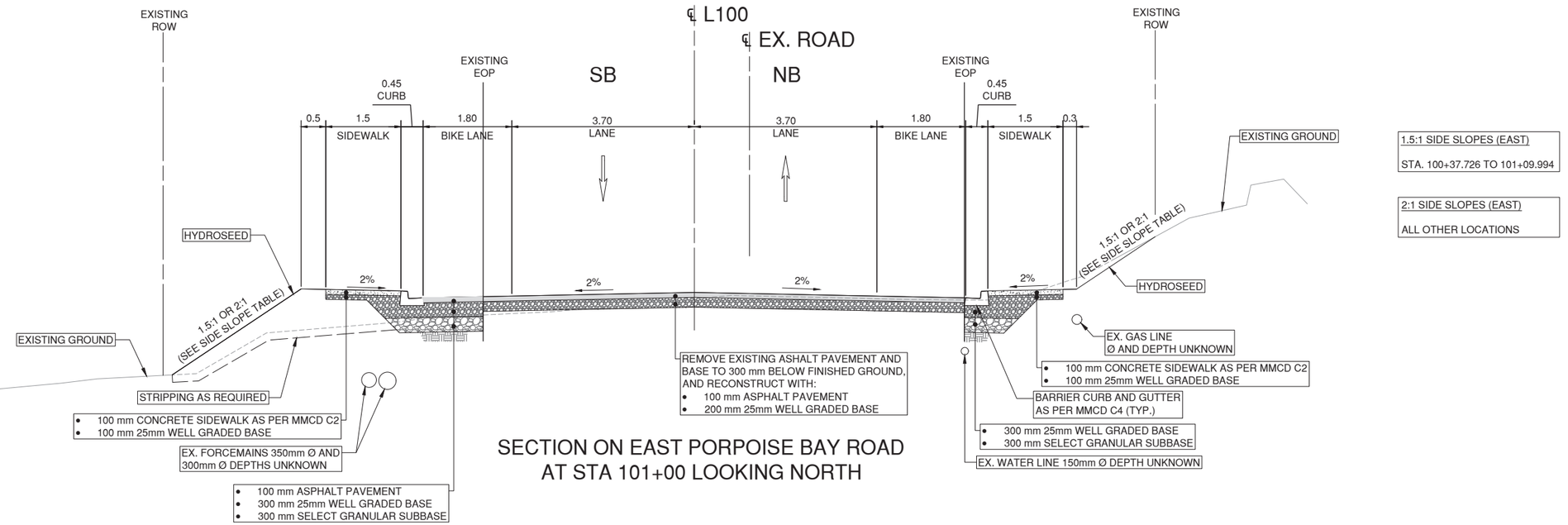
PROFILES

EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 105+50 TO 107+84

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-202	--

PLOT DATE: 2024/01/16 \\sli0262\TxProject\DATA\678324-PorpoiseBay&SecheltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\200_Profiles\R1-980-201 to 202.dwg



1.5:1 SIDE SLOPES (WEST)

STA. 100+49.994 TO 101+73.500
STA. 102+30.500 TO 102+84.319
STA. 103+60.819 TO 103+80.543
STA. 104+60.311 TO 104+79.811
STA. 105+17.319 TO 105+30.320

2:1 SIDE SLOPES (WEST)

ALL OTHER LOCATIONS

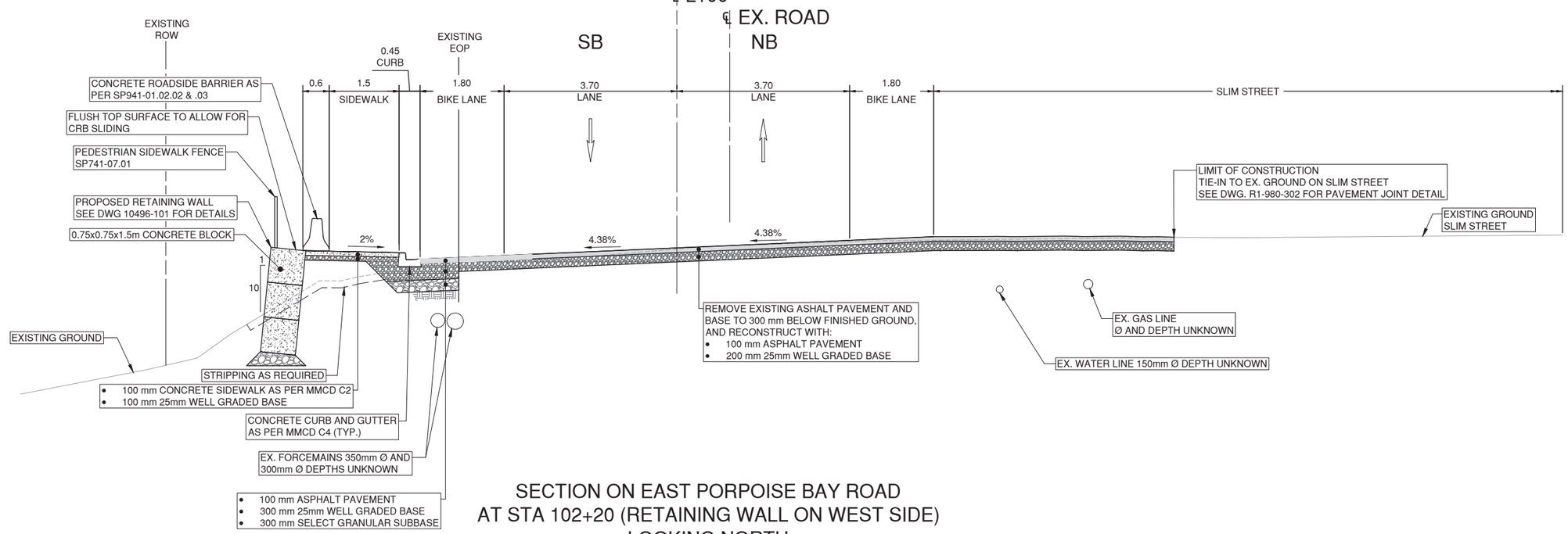
1.5:1 SIDE SLOPES (EAST)

STA. 100+37.726 TO 101+09.994

2:1 SIDE SLOPES (EAST)

ALL OTHER LOCATIONS

SECTION ON EAST PORPOISE BAY ROAD AT STA 101+00 LOOKING NORTH



RETAINING WALLS

STA. 101+73.500 TO 102+30.500
STA. 102+84.319 TO 103+60.819
STA. 104+79.819 TO 105+17.319

SECTION ON EAST PORPOISE BAY ROAD AT STA 102+20 (RETAINING WALL ON WEST SIDE) LOOKING NORTH

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SCALE 0 0.5 1:50 2.5m

CAD FILENAME R1-980-301 TO 302
PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

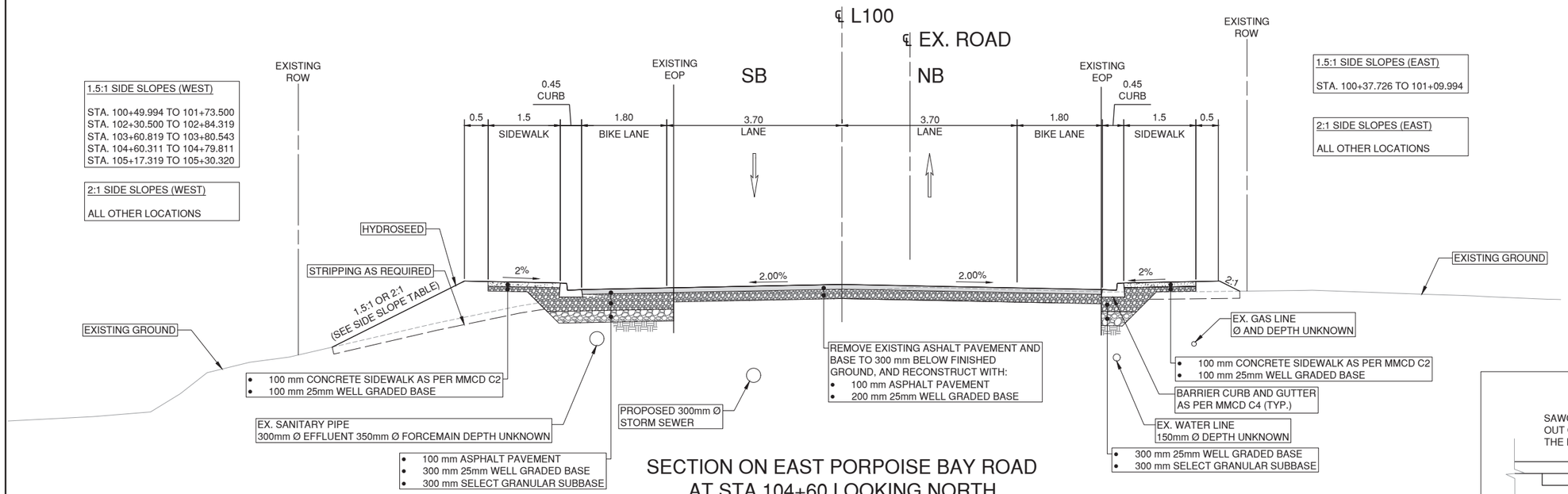
SENIOR DESIGNER
DATE 1/16/2024

DESIGNED Z. JIANG DATE 2021-03-31
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R.WONG/S.S.DEEPAK DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

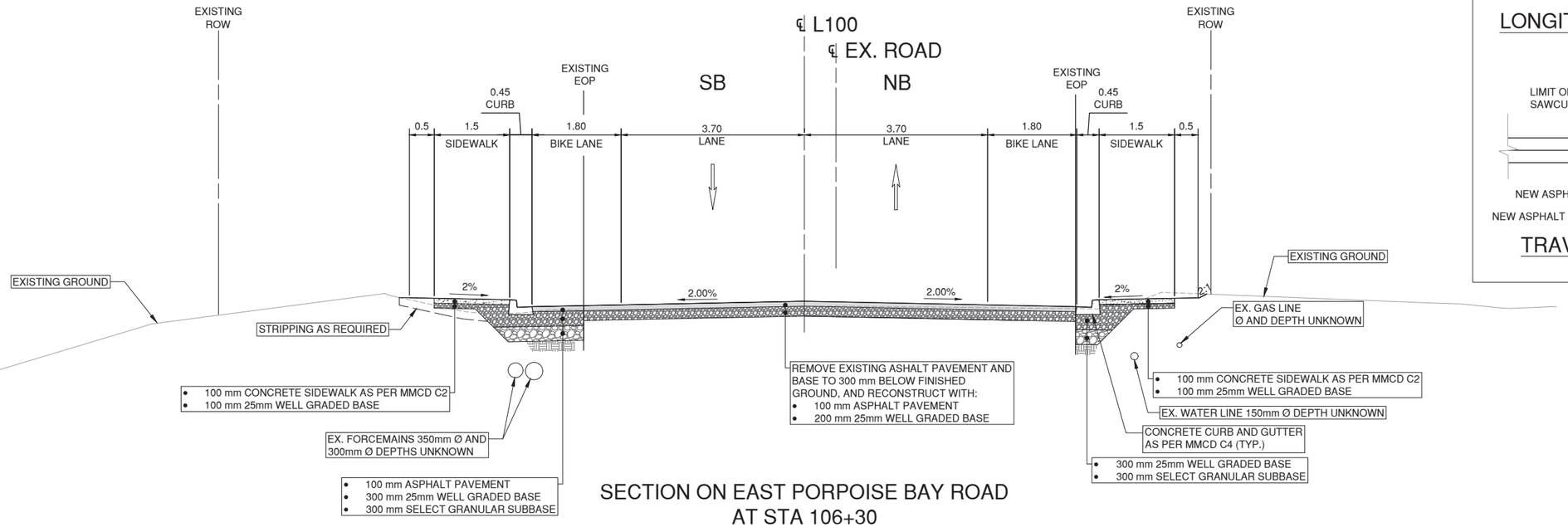
TYPICAL SECTIONS

AT STA. 101+00 AND 102+20
EAST PORPOISE BAY ROAD IMPROVEMENTS

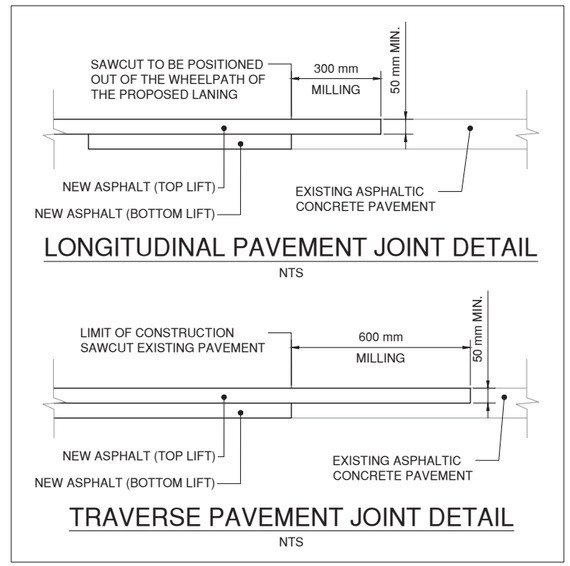
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-301	--



SECTION ON EAST PORPOISE BAY ROAD
AT STA 104+60 LOOKING NORTH



SECTION ON EAST PORPOISE BAY ROAD
AT STA 106+30
LOOKING NORTH



LONGITUDINAL PAVEMENT JOINT DETAIL
NTS

TRAVERSE PAVEMENT JOINT DETAIL
NTS

AtkinsRéalis
Suite 1100 - 745 Thurlow St.
Vancouver | British Columbia
V6E 0C5 | Canada

SCALE 0 0.5 1:50 2.5m

CAD FILENAME R1-980-301 TO 302
PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

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DATE 1/16/2024

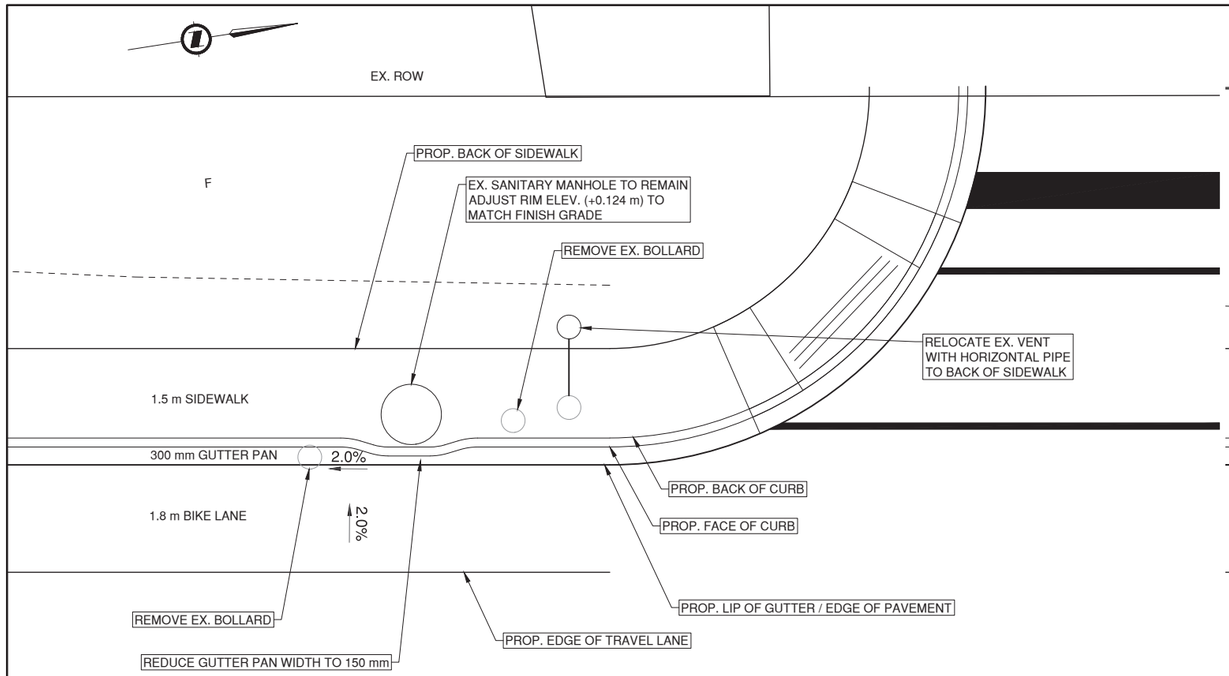
DESIGNED Z. JIANG DATE 2021-03-31
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R.WONG/S.S.DEEPAK DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

TYPICAL SECTIONS

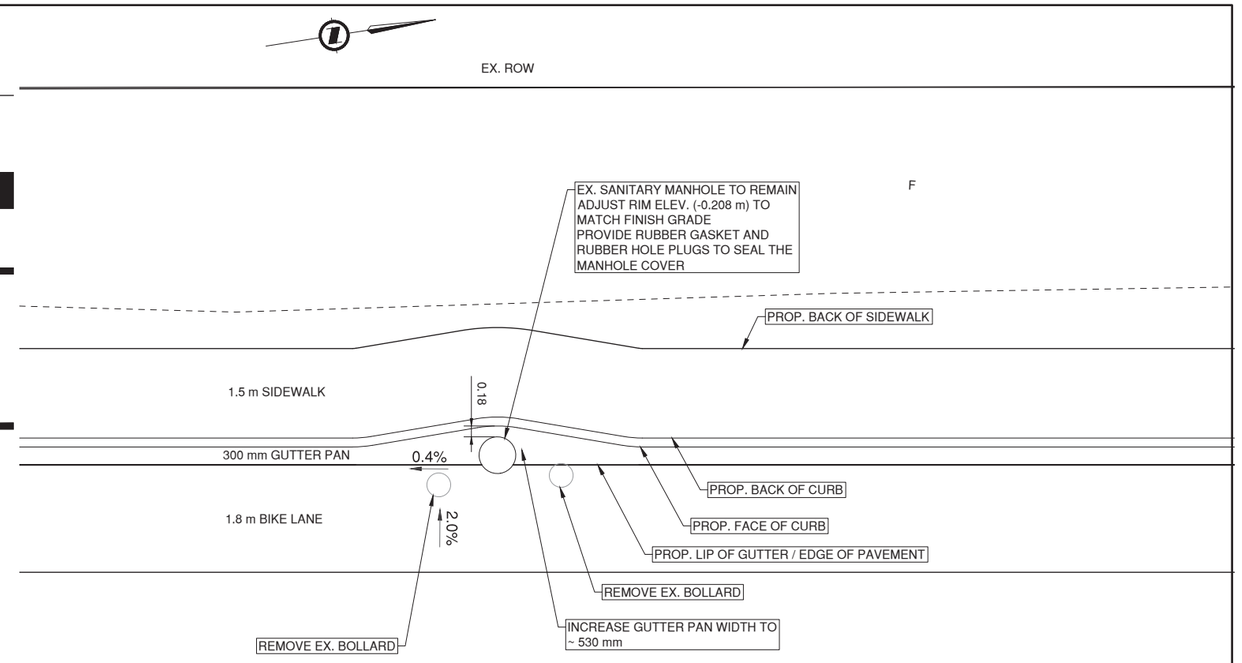
AT STA. 103+00 AND 106+30
EAST PORPOISE BAY ROAD IMPROVEMENTS

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-302	--

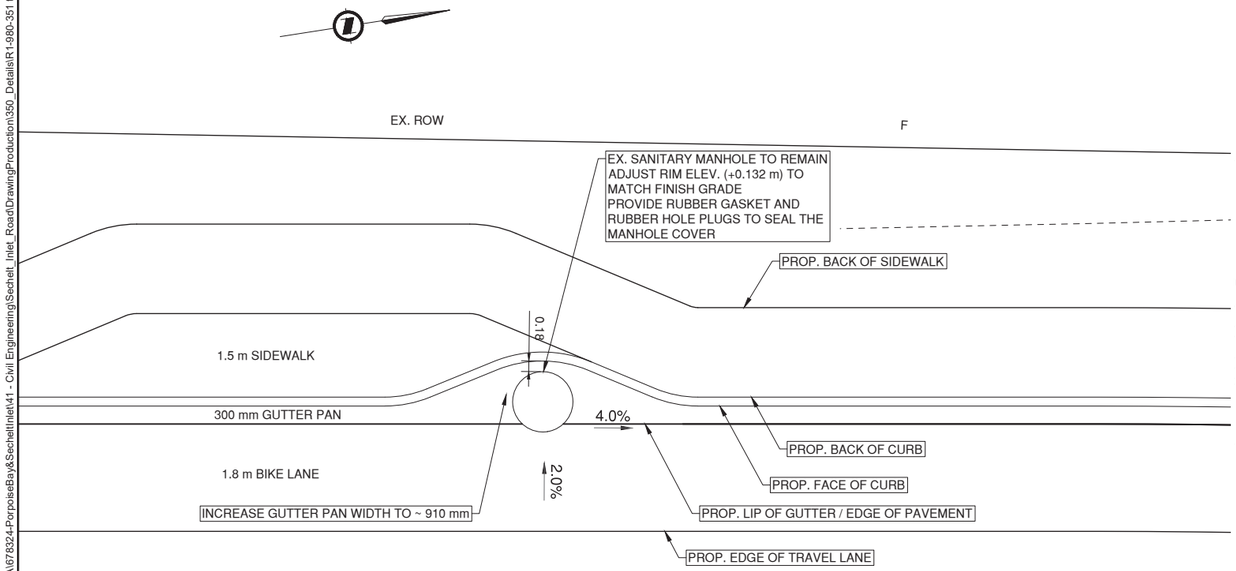
PLOT DATE: 2024/01/16 \\sli0282\TxProject\DATA\878324-PorpoiseBay&SechelltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\300_TypicalSections\R1-980-301 to 302.dwg



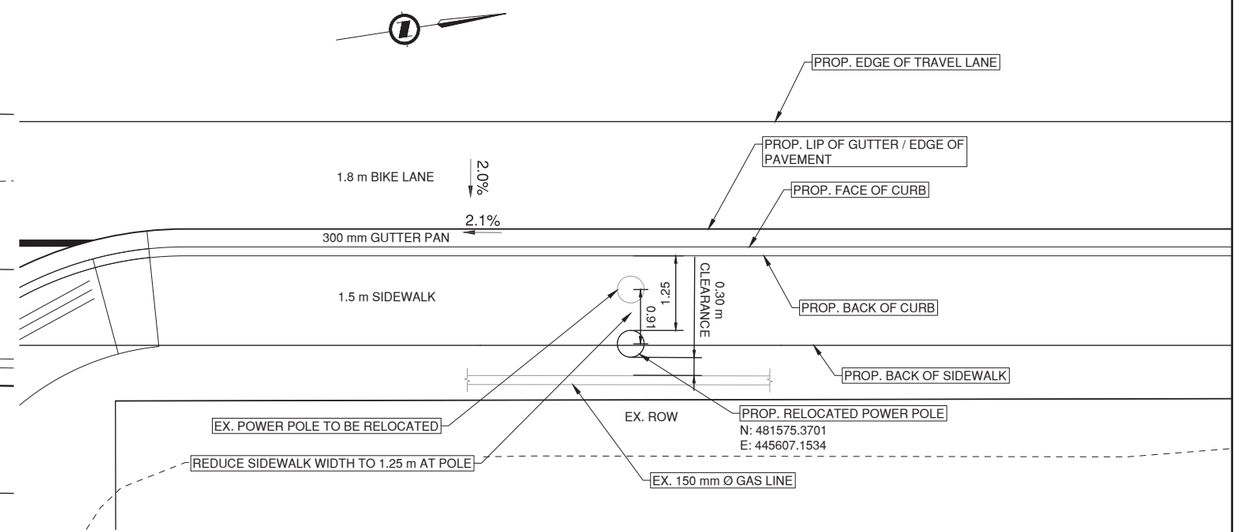
CURB AND SIDEWALK DETAIL AT 105+65



CURB AND SIDEWALK DETAIL AT 106+35



CURB AND SIDEWALK DETAIL AT 107+37



CURB AND SIDEWALK DETAIL AT 105+52

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V6E 0C5 | Canada

SCALE 0 0.5 1:50 2.5m

CAD FILENAME R1-980-351 TO 353
PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER
DATE 2022-05-13

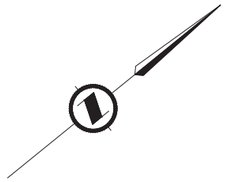
DESIGNED Z. JIANG DATE 2022-03-31
QUALITY CONTROL B. POMPHREY DATE 2022-03-31
QUALITY ASSURANCE R.WONG/S.S.DEPW DATE 2022-03-31
DRAWN Z. JIANG DATE 2022-03-31

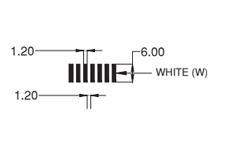
DETAILS

CURB AND SIDEWALK
EAST PORPOISE BAY ROAD - IMPROVEMENTS
--

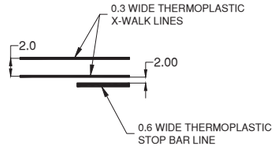
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-353	--

PLOT DATE: 2024/01/16 \\sli\i026\2\Txp\Project\DATA\678324-PorpoiseBay&Sechelt\Inlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\350_Details\R1-980-351 to 353.dwg





TYPICAL CROSS WALK (ZEBRA) DETAIL



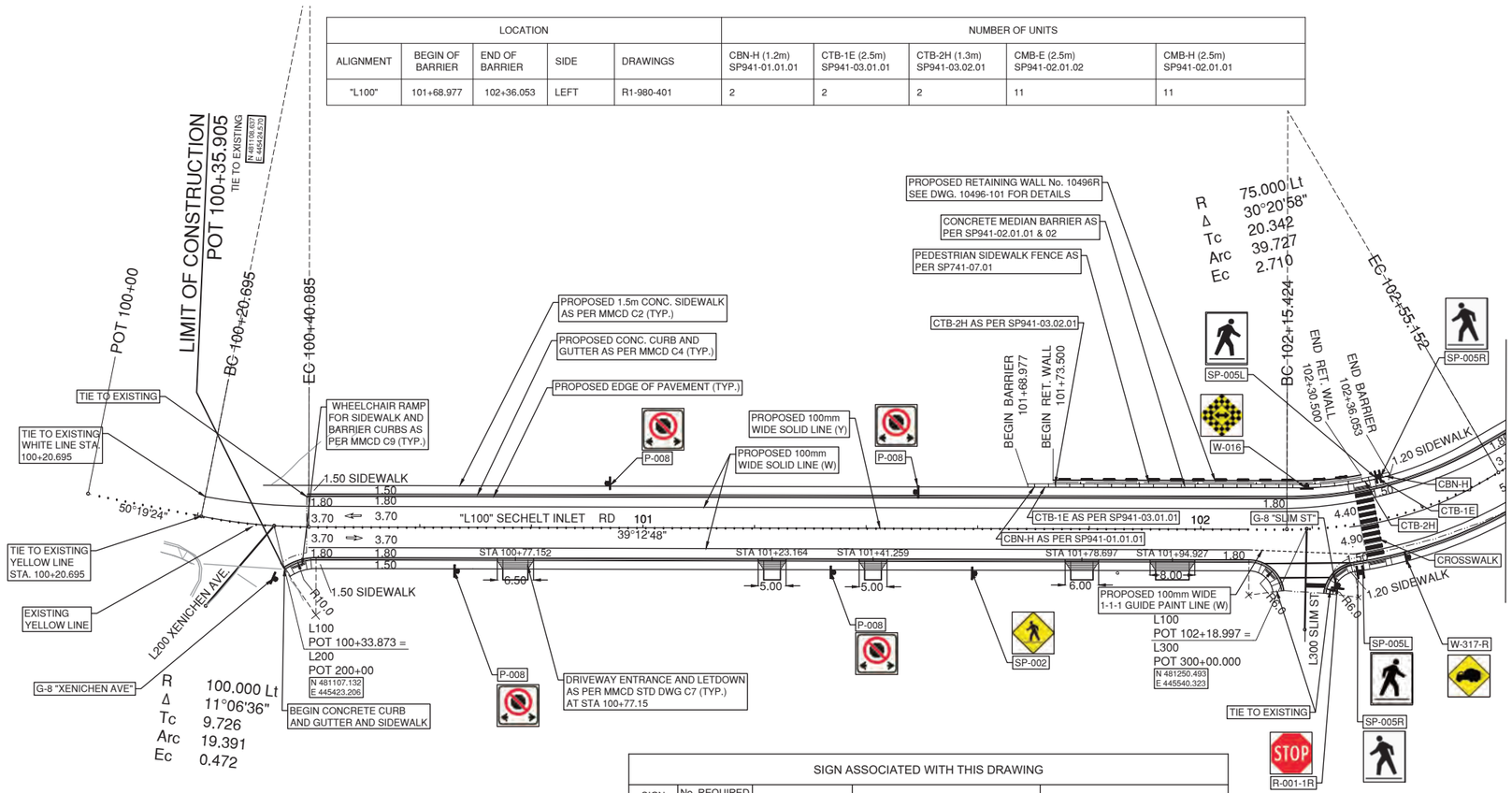
TYPICAL STOP BAR AND CROSS WALK DETAIL

PAVEMENT MARKINGS LEGEND

- 100mm – LANE EDGE & DIRECTIONAL DIVIDING PAINT LINES
- 100mm – GUIDE PAINT LINES (WHITE)
- 100mm – CONTINUITY PAINT LINES (WHITE)
- 100mm – URBAN LANE PAINT LINES (WHITE)
- 100mm – RURAL LANE PAINT LINES (WHITE)

ALL PAVEMENT MARKINGS TO BE WHITE UNLESS OTHERWISE NOTED
(Y) DENOTES YELLOW

LOCATION					NUMBER OF UNITS				
ALIGNMENT	BEGIN OF BARRIER	END OF BARRIER	SIDE	DRAWINGS	CBN-H (1.2m) SP941-01.01.01	CTB-1E (2.5m) SP941-03.01.01	CTB-2H (1.3m) SP941-03.02.01	CMB-E (2.5m) SP941-02.01.02	CMB-H (2.5m) SP941-02.01.01
"L100"	101+68.977	102+36.053	LEFT	R1-980-401	2	2	2	11	11



SIGN ASSOCIATED WITH THIS DRAWING					
SIGN TYPE	No. REQUIRED SIGNS	No. REQUIRED POSTS	LOCATION	DESCRIPTION	COMMENTS
G-8	1	1	STA 100+33.87 RT	STREET NAME: XENICHEN AVE	INSTALL NEW
P-008	1	1	STA 100+66.35 RT	NO STOPPING	INSTALL NEW
P-008	1	1	STA 100+94.05 LT	NO STOPPING	INSTALL NEW
P-008	1	1	STA 101+33.68 RT	NO STOPPING	INSTALL NEW
P-008	1	1	STA 101+49.20 LT	NO STOPPING	INSTALL NEW
SP-002	1	1	STA 101+59.08 RT	PEDESTRIAN CROSSING AHEAD	INSTALL NEW
W-016	1	1	STA 102+19.15 LT	CHECKERBOARD SIGN	INSTALL NEW MOUNTED ON CRB
R-001-1R	1	1	STA 102+22.54 RT	STOP	INSTALL NEW
G-8	1	-	STA 102+22.54 RT	STREET NAME: SLIM ST	INSTALL NEW
SP-005R	1	1	STA 102+27.09 RT	PEDESTRIAN CROSSING	INSTALL NEW
SP-005L	1	-	STA. 102+27.09 RT	PEDESTRIAN CROSSING	INSTALL NEW MOUNTED ON CRB
SP-005L	1	1	STA 102+33.98 LT	PEDESTRIAN CROSSING	INSTALL NEW MOUNTED ON CRB
SP-005R	1	-	STA 102+33.98 LT	PEDESTRIAN CROSSING	INSTALL NEW
W-317-R	1	1	STA 102+35.00 RT	TRUCK CROSSING/TURNING AHEAD	INSTALL NEW

NOTE:

1. HOLLOW ARROWS SHOW TRAVEL LANE DIRECTION, SOLID ARROWS SHOW PAVEMENT MARKINGS

DESIGN VEHICLE
WB-20: "L100" THROUGH MOVEMENT
HSU: SIDE ROADS

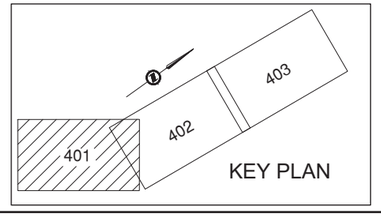
DESIGN SPEED 50 km/h "L100"

FOR PLAN SEE DWG R1-980-101 TO 103

FOR PROFILES SEE DWG R1-980-201 TO 202

FOR TYPICAL SECTIONS SEE DWG R1-980-301 TO 302

FOR DRAINAGE AND UTILITIES SEE DWG R1-980-701 TO 704



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Vancouver | British Columbia
V6E 0C5 | Canada

SCALE 0 5 1:500 25m

CAD FILENAME R1-980-401 TO 403

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 2024-01-16

DESIGNED Z. JIANG DATE 2021-03-31
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R. WONG DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

GEOMETRICS, LANING, SIGNAGE AND PAVEMENT MARKINGS

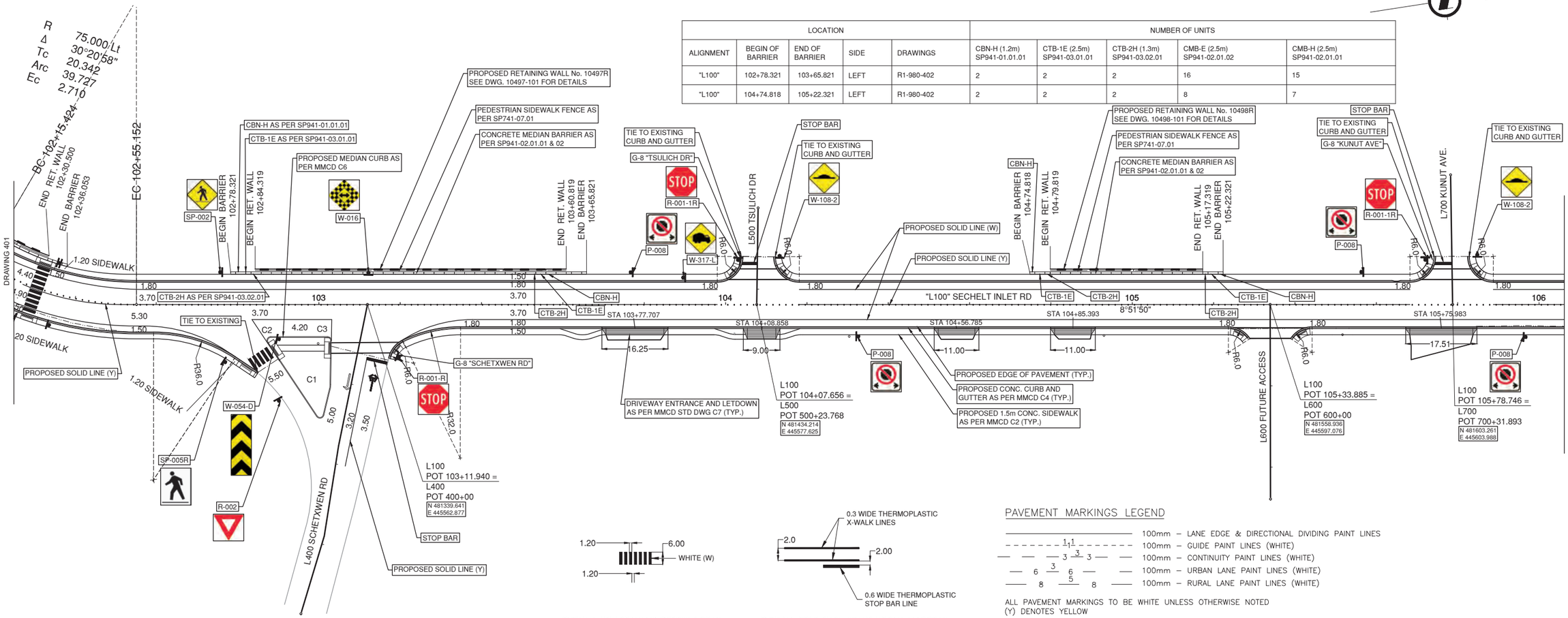
EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 100+35.905 TO 107+84.413

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-401	--

DRAWING 402

PLOT DATE: 2024/01/16 \\sli\02621TxProject\DATA\678324-PorpoiseBay&Sechelt\Inlet\41 - Civil Engineering\SechelI_Inlet_Road\DrawingProduction\400_GeometricsLaning\R1-980-401 to 403.dwg



LOCATION					NUMBER OF UNITS				
ALIGNMENT	BEGIN OF BARRIER	END OF BARRIER	SIDE	DRAWINGS	CBN-H (1.2m) SP941-01.01.01	CTB-1E (2.5m) SP941-03.01.01	CTB-2H (1.3m) SP941-03.02.01	CMB-E (2.5m) SP941-02.01.02	CMB-H (2.5m) SP941-02.01.01
"L100"	102+78.321	103+65.821	LEFT	R1-980-402	2	2	2	16	15
"L100"	104+74.818	105+22.321	LEFT	R1-980-402	2	2	2	8	7

TYPICAL CROSS WALK (ZEBRA) DETAIL

TYPICAL STOP BAR AND CROSS WALK DETAIL

PAVEMENT MARKINGS LEGEND

- 100mm – LANE EDGE & DIRECTIONAL DIVIDING PAINT LINES
- 100mm – GUIDE PAINT LINES (WHITE)
- 100mm – CONTINUITY PAINT LINES (WHITE)
- 100mm – URBAN LANE PAINT LINES (WHITE)
- 100mm – RURAL LANE PAINT LINES (WHITE)

ALL PAVEMENT MARKINGS TO BE WHITE UNLESS OTHERWISE NOTED
(Y) DENOTES YELLOW

ISLAND CURVE DATA							
TAG	RADIUS	Δ	Tc	ARC LENGTH	Ec	P.I.	STATIONS
C1	5.000	012°41'06"	0.556	1.107	0.031	P.I. STA. 7+039.401 P.I. N. 481327.611 P.I. E. 445581.466	B.C. 7+038.845 E.C. 7+039.952
C2	1.000	123°39'26"	1.867	2.158	1.118	P.I. STA. 7+012.330 P.I. N. 481313.132 P.I. E. 445566.733	B.C. 7+010.463 E.C. 7+012.621
C3	1.000	090°52'12"	1.015	1.586	0.425	P.I. STA. 7+027.514 P.I. N. 481329.692 P.I. E. 445569.311	B.C. 7+026.499 E.C. 7+028.084

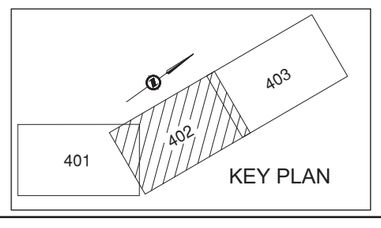
SIGN ASSOCIATED WITH THIS DRAWING					
SIGN TYPE	No. REQUIRED SIGNS	No. REQUIRED POSTS	LOCATION	DESCRIPTION	COMMENTS
SP-002	1	1	STA 102+76.18 LT	PEDESTRIAN CROSSING AHEAD	INSTALL NEW
SP-005R	1	-	STA 102+76.57 RT	PEDESTRIAN CROSSING	INSTALL NEW
W-054-D	1	1	STA 102+87.73 RT	DOUBLE OBJECT MARKER	INSTALL NEW
R-002	1	1	STA 102+99.73 RT	YIELD	INSTALL NEW
W-016	1	1	STA 103+12.14 LT	CHECKERBOARD SIGN	INSTALL NEW MOUNTED ON CRB
R-001-1R	-	1	STA 103+18.85 RT	STOP	RELOCATE WITH NEW POST
G-8	1	-	STA 103+18.85 RT	STREET NAME: SCHETXWEN RD	INSTALL NEW
P-008	1	1	STA 103+77.03 LT	NO PARKING	INSTALL NEW
W-317-L	1	1	STA 104+92.13 LT	TRUCK CROSSING/TURNING AHEAD	RELOCATE
R-001-1R	1	1	STA 104+03.08 LT	STOP	INSTALL NEW
G-8	1	-	STA 104+03.08 LT	STREET NAME: TSULICH DR	INSTALL NEW
W-108-2	1	1	STA 104+13.27 LT	HUMP	INSTALL NEW
P-008	1	1	STA 104+32.38 RT	NO STOPPING	INSTALL NEW
P-008	1	1	STA 105+56.68 LT	NO STOPPING	INSTALL NEW
R-001-1R	1	1	STA 105+73.43 LT	STOP	INSTALL NEW
G-8	1	-	STA 105+73.43 LT	STREET NAME: KUNUT AVE	INSTALL NEW
W-108-2	1	1	STA 105+83.55 LT	HUMP	INSTALL NEW
P-008	1	1	STA 105+96.26 RT	NO STOPPING	INSTALL NEW

FOR PLAN SEE DWG R1-980-101 TO 103

FOR PROFILES SEE DWG R1-980-201 TO 202

FOR TYPICAL SECTIONS SEE DWG R1-980-301 TO 302

FOR DRAINAGE AND UTILITIES SEE DWG R1-980-701 TO 704



DESIGN VEHICLE
WB-20: "L100" THROUGH MOVEMENT
HSU: SIDE ROADS

DESIGN SPEED 50 km/h "L100"

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V6E 0C5 | Canada

SCALE 0 5 1:500 25m

CAD FILENAME R1-980-401 TO 403
PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER
DATE 2024-01-16

DESIGNED Z. JIANG DATE 2021-03-31
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R. WONG DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

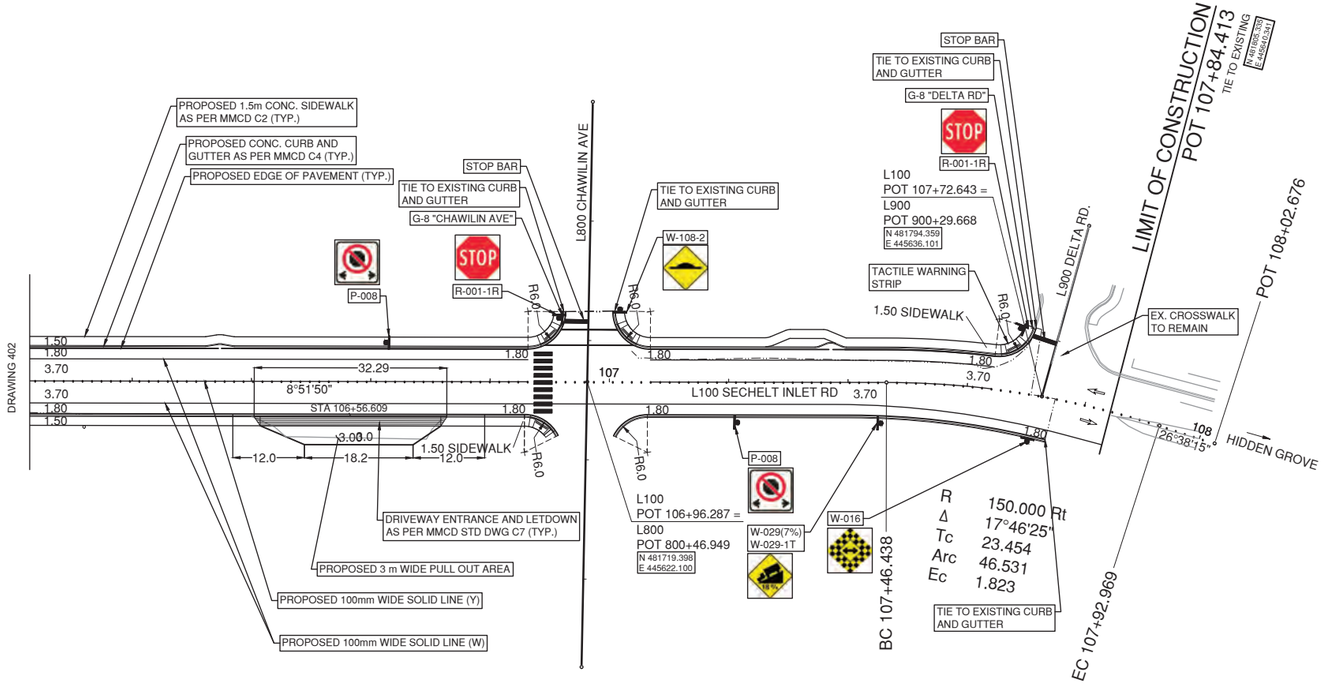
GEOMETRICS, LANING, SIGNAGE AND PAVEMENT MARKINGS

EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 100+35.905 TO 107+84.413

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-402	--

PLOT DATE: 2024/01/16 \\sli02621\Project\DATA\678324-PorpoiseBay&SechelttInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\400_GeometricsLaning\R1-980-401 to 403.dwg



SIGN ASSOCIATED WITH THIS DRAWING					
SIGN TYPE	No. REQUIRED		LOCATION	DESCRIPTION	COMMENTS
	SIGNS	POSTS			
P-008	1	1	STA 106+62.93 LT	NO PARKING	INSTALL NEW
R-001-1R	1	1	STA 106+91.57 LT	STOP	INSTALL NEW
G-8	1	-	STA 106+91.57 LT	STREET NAME: CHAWILIN AVE	INSTALL NEW
W-108-2	1	1	STA 107+01.78 LT	HUMP	INSTALL NEW
P-008	1	1	STA 107+21.10 RT	NO STOPPING	INSTALL NEW
W-029-1	1	1	STA 107+45 RT	STEEP GRADE WARNING (7%)	INSTALL NEW
W-029-1T	1	1	STA 107+45 RT	TRUCKS GEAR DOWN	INSTALL NEW
R-001-1R	1	1	STA 107+68.88 LT	STOP	INSTALL NEW
G-8	1	-	STA 107+68.88 LT	STREET NAME: DELTA RD	INSTALL NEW
W-016	1	1	STA 107+71.50 RT	CHECKBOARD SIGN	INSTALL NEW

FOR PLAN SEE DWG R1-980-101 TO 103

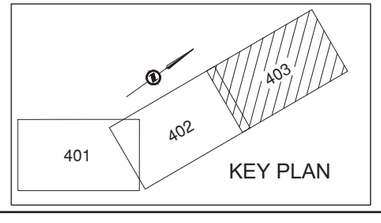
FOR PROFILES SEE DWG R1-980-201 TO 202

FOR TYPICAL SECTIONS SEE DWG R1-980-301 TO 302

FOR DRAINAGE AND UTILITIES SEE DWG R1-980-701 TO 704

DESIGN VEHICLE
WB-20: "L100" THROUGH MOVEMENT
HSU: SIDE ROADS

DESIGN SPEED 50 km/h "L100"



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Vancouver | British Columbia
V6E 0C5 | Canada

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CAD FILENAME R1-980-401 TO 403

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 2024-01-16

DESIGNED Z. JIANG DATE 2021-03-31
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R. WONG DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

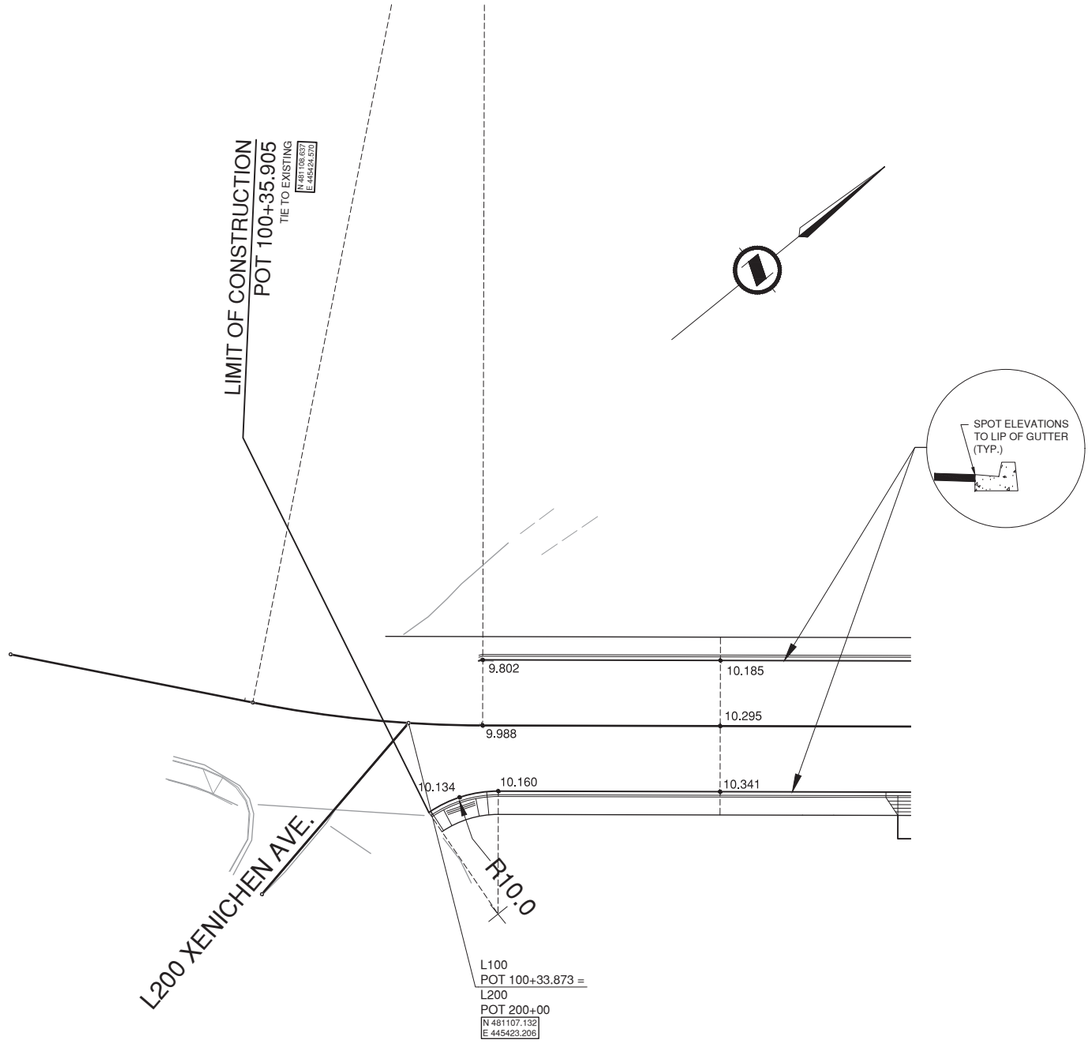
GEOMETRICS, LANING, SIGNAGE AND PAVEMENT MARKINGS

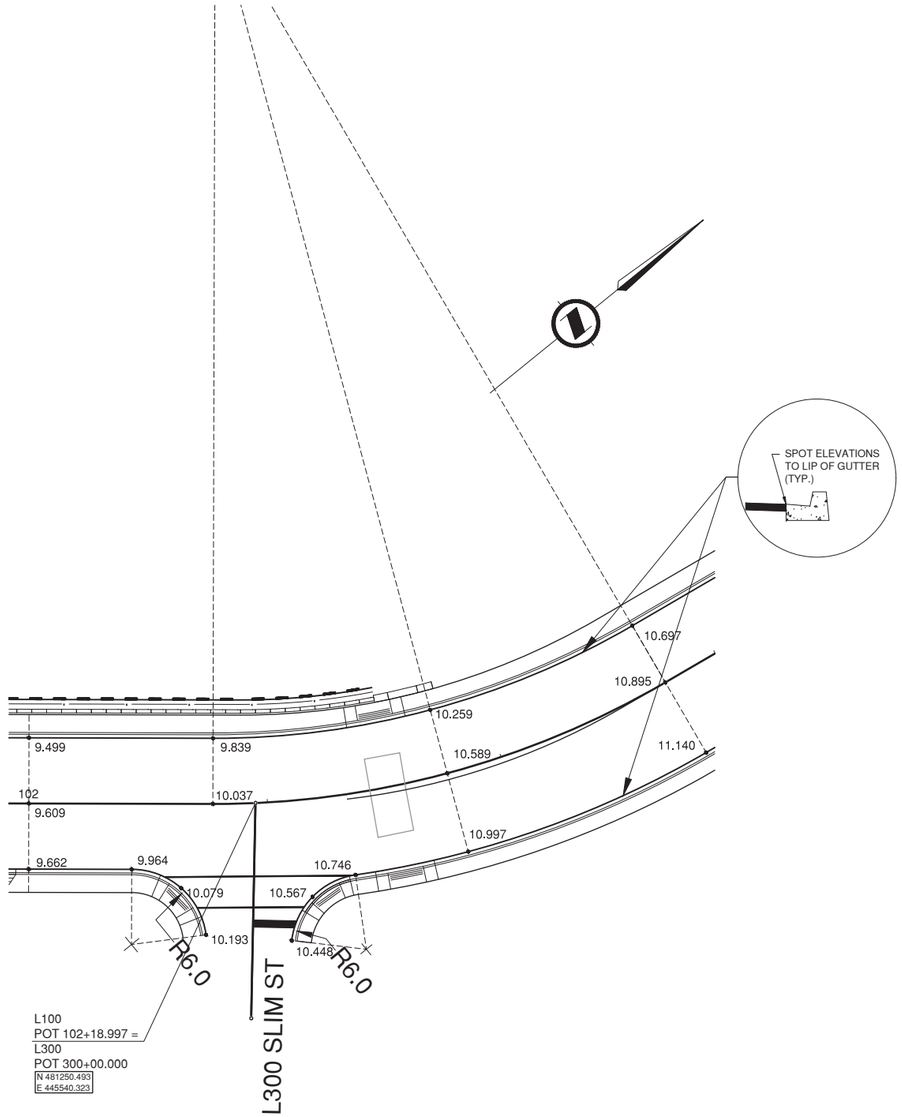
EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 100+35.905 TO 107+84.413

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-403	--

PLOT DATE: 2024/01/16 \\sll\026221\Project\DATA\678324-PorpoiseBay&SechelInlet\41 - Civil Engineering\SechelI_Inlet_Road\DrawingProduction\400_Geometrics\Laning\R1-980-401 to 403.dwg





FOR PLAN SEE DWG R1-980-101 TO 103

FOR PROFILES SEE DWG R1-980-201 TO 202

FOR TYPICAL SECTIONS SEE DWG R1-980-301 TO 302

FOR DRAINAGE AND UTILITIES SEE DWG R1-980-701 TO 704

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CAD FILENAME R1-980-501 TO 503

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 1/16/2024

DESIGNED Z. JIANG DATE 2022-03-14
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R.WONG/S.S.DEEPAK DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

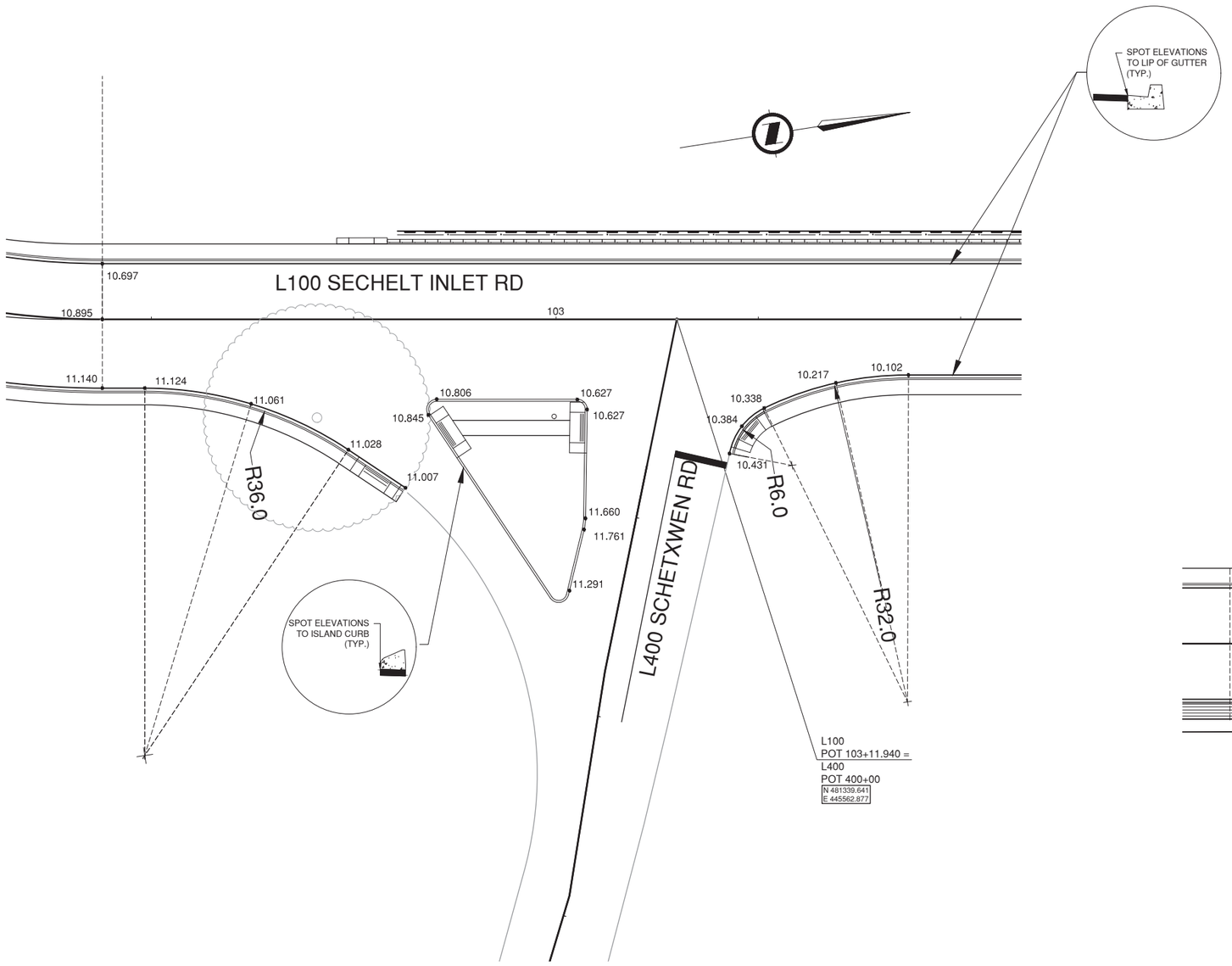
SPOT ELEVATION

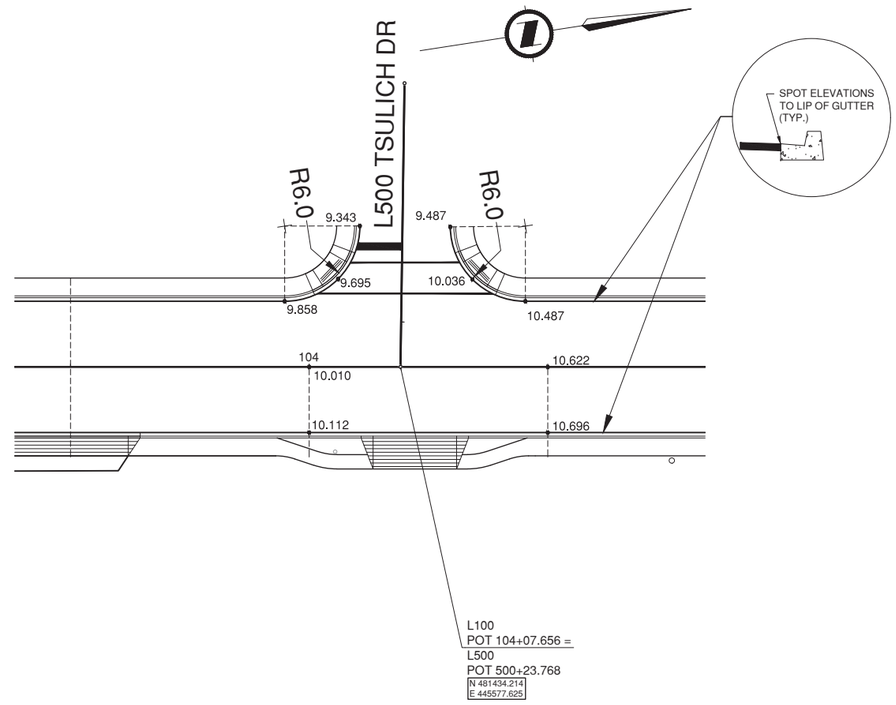
EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 100+35.905 TO 107+84.413

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-501	--

PLOT DATE: 2024/01/16 \\sli\2621\Project\DATA\678324-PorpoiseBay&SechelttInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\500_SpotElevations\R1-980-501 to 503.dwg





FOR PLAN SEE DWG R1-980-101 TO 103

FOR PROFILES SEE DWG R1-980-201 TO 202

FOR TYPICAL SECTIONS SEE DWG R1-980-301 TO 302

FOR DRAINAGE AND UTILITIES SEE DWG R1-980-701 TO 704

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V6E 0C5 | Canada

SCALE 0 2 1:250 12m

CAD FILENAME R1-980-501 TO 503

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 1/16/2024

DESIGNED Z. JIANG DATE 2022-03-14
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R.WONG/S.S.DEEPAK DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

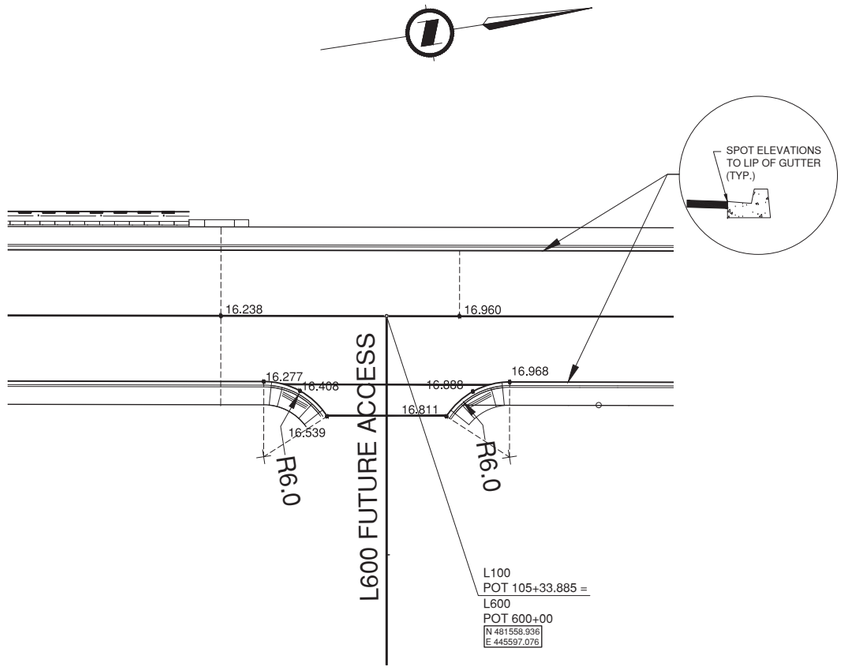
SPOT ELEVATION

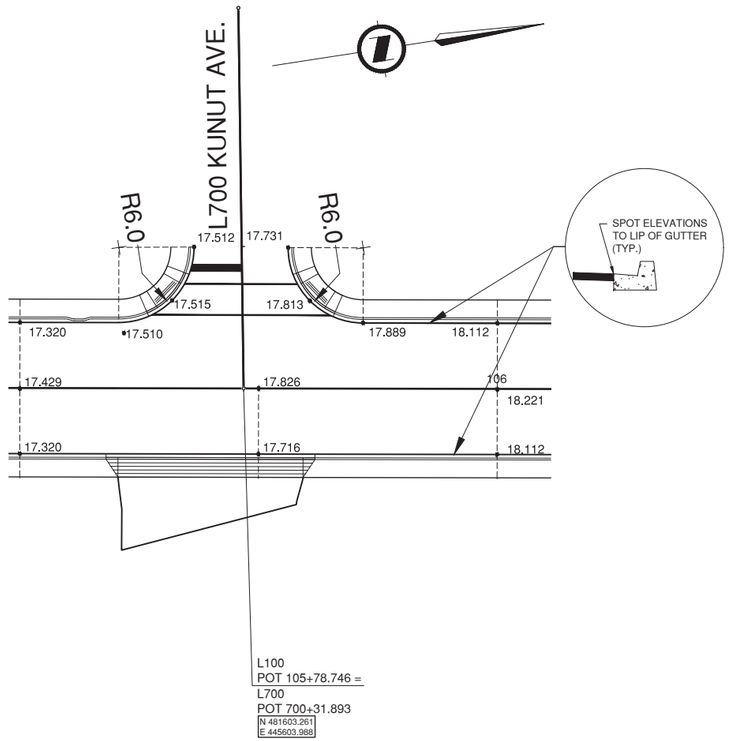
EAST PORPOISE BAY ROAD IMPROVEMENTS

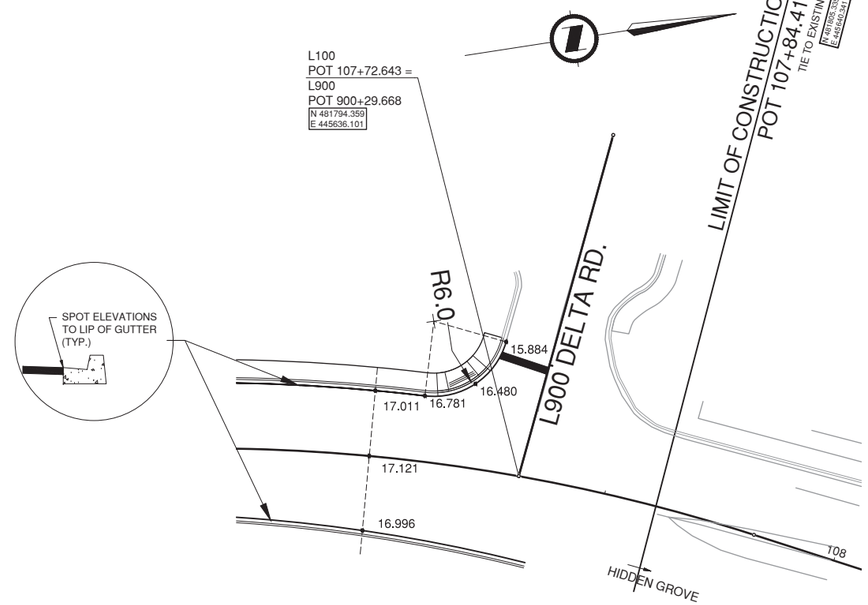
STA. 100+35.905 TO 107+84.413

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-502	--

PLOT DATE: 2024/01/16 \\sli0262\1\xProject\DATA\678324-PorpoiseBay&SechelitInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\500_SpotElevations\R1-980-501 to 503.dwg







FOR PLAN SEE DWG R1-980-101 TO 103

FOR PROFILES SEE DWG R1-980-201 TO 202

FOR TYPICAL SECTIONS SEE DWG R1-980-301 TO 302

FOR DRAINAGE AND UTILITIES SEE DWG R1-980-701 TO 704

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V6E 0C5 | Canada

SCALE 0 2 1:250 12m

CAD FILENAME R1-980-501 TO 503

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 2022-05-13

DESIGNED Z. JIANG DATE 2022-03-14
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R.WONG/SS DEPW DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

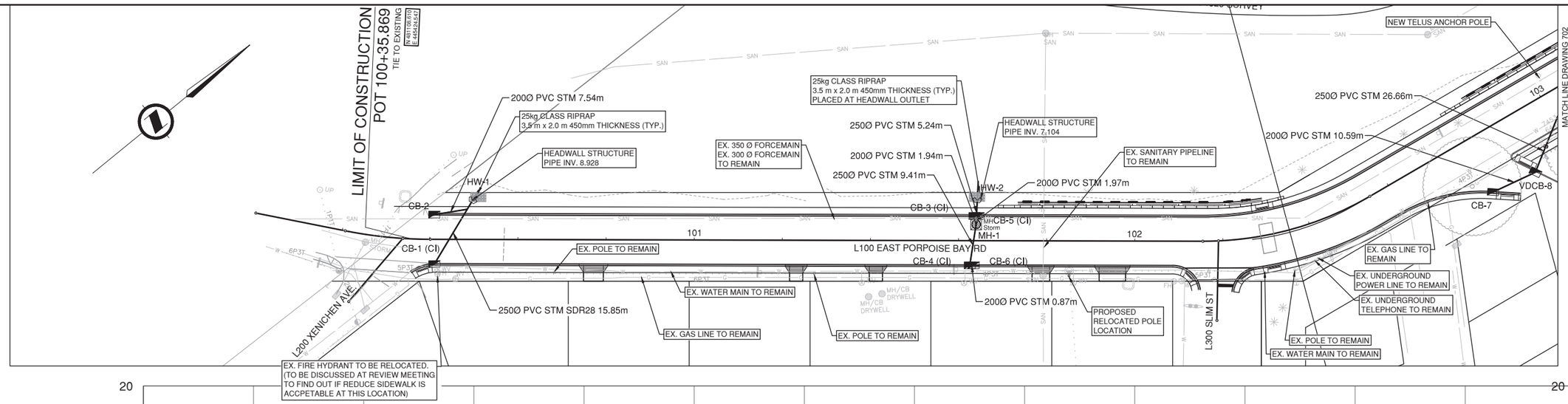
SPOT ELEVATION

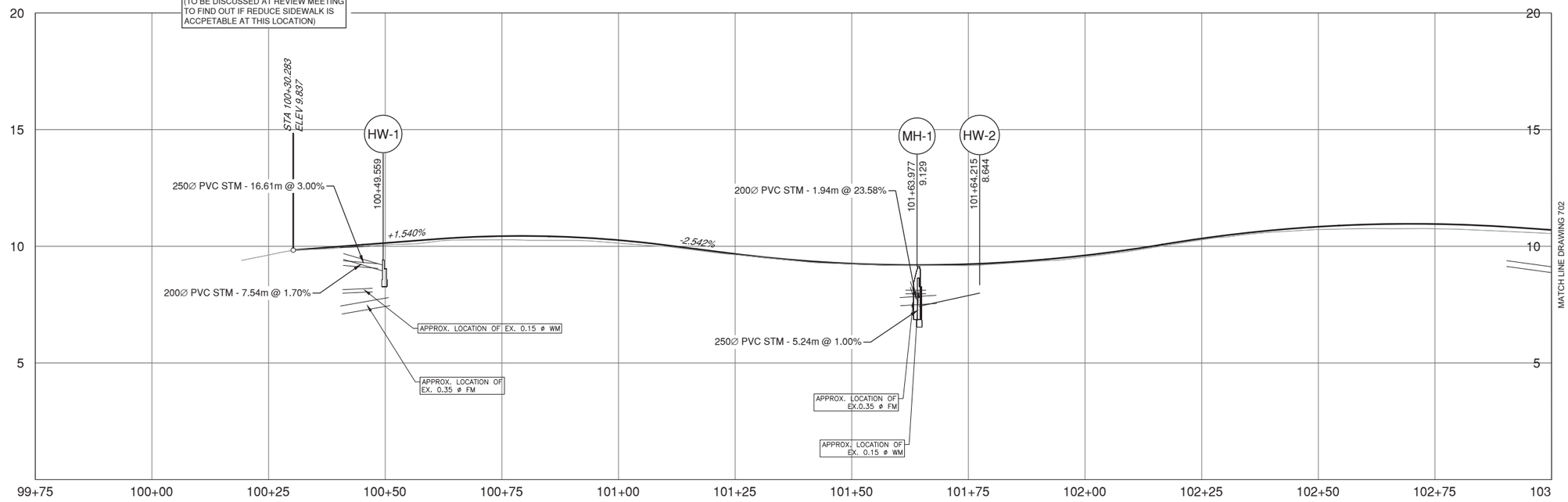
EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 100+35.905 TO 107+84.413

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-503	--

PLOT DATE: 2024/01/16 \\sli\0262\TxProject\DATA\678324-PorpoiseBay&SechelltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\500_SpotElevations\R1-980-501 to 503.dwg





NOTE:

1. MAINTAIN 0.5 m VERTICAL CLEARANCE FROM ALL EXISTING FORCE MAINS AND WATER MAINS.
2. CATCH BASINS LABELED (CI) ARE CAST IRON CATCH BASINS WITH SDR 28 CB LEADS THAT ARE TO BE INSTALLED AT 5% GRADE OR OTHERWISE NOTED.
3. ALL STORM SEWER WORKS SHALL BE IN ACCORDANCE WITH MMCD SECTION 33 40 01 - STORM SEWER.
4. AL SANITARY SEWER WORKS SHALL BE IN ACCORDANCE WITH MMCD SECTION 33 30 01 - SANITARY SEWERS.
5. ALL OFFSETS ARE MEASURED TO THE CENTRE OF CATCH BASIN BARRELS.

MANHOLES

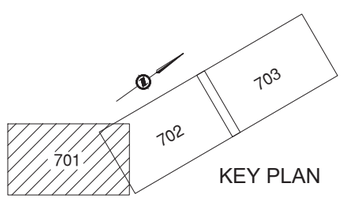
ID	NORTHING	EASTING	RIM ELEV.	INVERT ELEV.	MANHOLE DESCRIPTION
MH-1	481210.150	445502.740	9.129	E INV. 7.379 W INV. 7.157 NWINV. 7.207 SWINV. 7.429	1200mm PRECAST REINFORCED CONCRETE MANHOLE SP582-03.01

CATCH BASINS

ID	STA	OFFSET	GRATE ELEV.	GRATE TYPE	INVERT ELEV.	CATCH BASIN DESCRIPTION
CB-1 (CI)	100+41.053	5.611	10.151	TYPE 'B' R	INV. 9.436	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-2	100+41.007	-5.605	9.830	TYPE 'B' R	INV. 9.181	PRECAST REINFORCED CONCRETE CATCH BASIN SP582-02.01 WITH BICYCLE SAFE GRATE SP582-05.02
CB-3 (CI)	101+63.588	-5.605	9.092	TYPE 'B' R	INV. 7.888	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-4 (CI)	101+62.559	5.605	9.087	TYPE 'B' R	INV. 8.287 INV. 8.237	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02

CATCH BASINS

ID	STA	OFFSET	GRATE ELEV.	GRATE TYPE	INVERT ELEV.	CATCH BASIN DESCRIPTION
CB-5 (CI)	101+64.491	-5.605	8.785	TYPE 'B' R	INV. 8.210	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-6 (CI)	101+63.430	5.605	9.088	TYPE 'B' R	INV. 8.292	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-7	102+79.809	13.236	11.025	TYPE 'B' R	INV. 9.821	PRECAST REINFORCED CONCRETE CATCH BASIN SP582-02.01 WITH BICYCLE SAFE GRATE SP582-05.02
VDCB-8	102+90.359	14.188	11.061	TYPE 'B' R	INV. 9.610 INV. 9.135	PRECAST REINFORCED CONCRETE VARIABLE DEPTH CATCH BASIN SP582-02.02 WITH BICYCLE SAFE GRATE SP582-05.02



KEY PLAN

AtkinsRéalis
Suite 1100 - 745 Thurlow St.
Vancouver | British Columbia
V6E 0C5 | Canada

SCALE 0 5 H 1:500 25m
0 1 V 1:100 5m

CAD FILENAME R1-980-701 TO 731
PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA
MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER
DATE 2024-01-16

DESIGNED Z. JIANG DATE 2021-03-31
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R.WONG/S.S DEPW DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

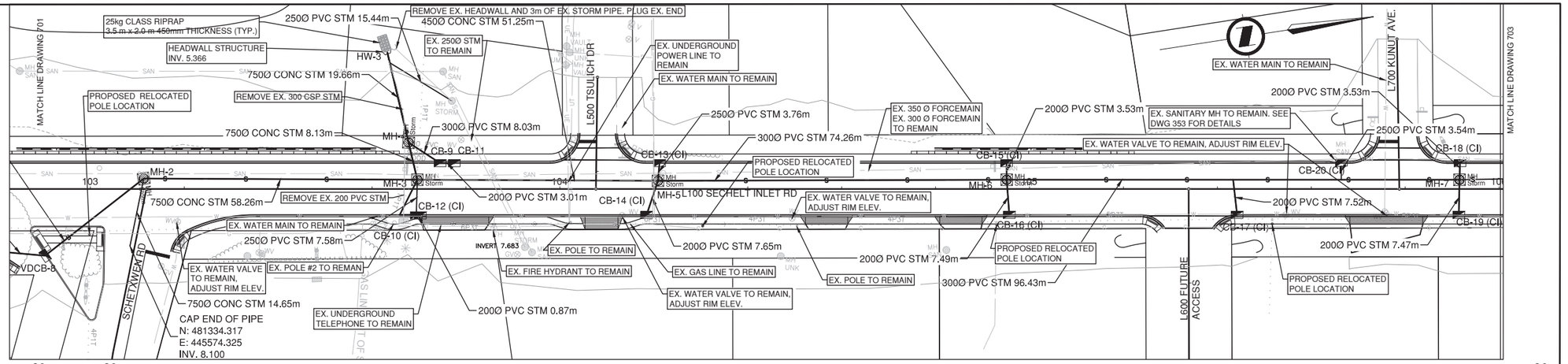
DRAINAGE DESIGN AND UTILITY RELOCATION

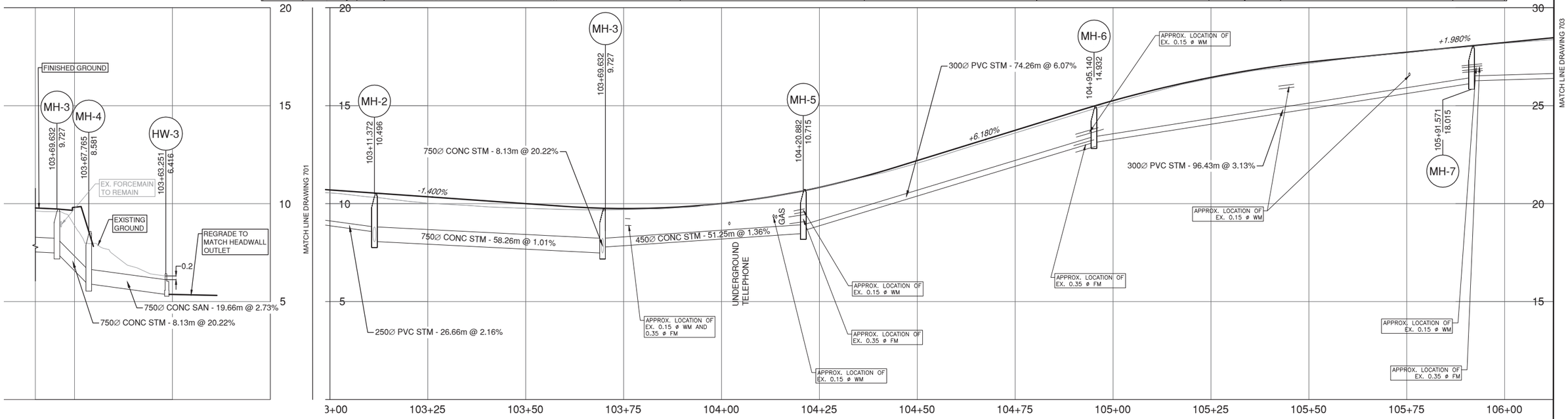
PLAN AND PROFILE
EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 100+18.000 TO 102+35.000

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-701	--

PLOT DATE: 2024/01/16 \\sli02621\xProject\DATA\678324-PorpoiseBay&SechelltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\700_DrainageUtilities\R1-980-701 to 731.dwg





MANHOLES

ID	NORTHING	EASTING	RIM ELEV.	INVERT ELEV.	MANHOLE DESCRIPTION
MH-2	481339.423	445560.594	10.496	INV. 8.067 INV. 8.559 INV. 8.056	1200mm PRECAST REINFORCED CONCRETE MANHOLE SP582-03.01
MH-3	481396.948	445569.818	9.727	INV. 7.478 INV. 7.479 INV. 7.779 INV. 7.965	1200mm PRECAST REINFORCED CONCRETE MANHOLE SP582-03.01
MH-4	481396.323	445561.712	8.581	INV. 5.835 INV. 5.903 INV. 7.883	1200mm PRECAST REINFORCED CONCRETE MANHOLE SP582-03.01
MH-5	481447.552	445577.933	10.715	INV. 9.790 INV. 8.476 INV. 8.619 INV. 8.927	1200mm PRECAST REINFORCED CONCRETE MANHOLE SP582-03.01
MH-6	481520.958	445589.157	14.932	INV. 13.129 INV. 14.178 INV. 13.116 INV. 14.390	PRECAST REINFORCED CONCRETE MANHOLE SP582-03.01

MANHOLES

ID	NORTHING	EASTING	RIM ELEV.	INVERT ELEV.	MANHOLE DESCRIPTION
MH-7	481616.237	445604.016	18.015	INV. 16.136 INV. 17.245 INV. 16.963 INV. 16.266	1200mm PRECAST REINFORCED CONCRETE MANHOLE SP582-03.01

NOTE:

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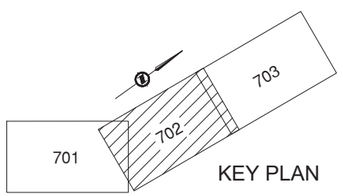
CATCH BASINS

ID	STA	OFFSET	GRATE ELEV.	GRATE TYPE	INVERT ELEV.	CATCH BASIN DESCRIPTION
CB-9	103+74.488	-5.500	9.896	TYPE 'B' R	INV. 8.745 INV. 8.483	PRECAST REINFORCED CONCRETE CATCH BASIN SP582-02.01 WITH BICYCLE SAFE GRATE SP582-05.02
CB-10 (CI)	103+69.413	5.605	8.682	TYPE 'B' R	INV. 8.054 INV. 8.107	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-11	103+77.500	-5.500	9.719	TYPE 'B' R	INV. 8.784	PRECAST REINFORCED CONCRETE CATCH BASIN SP582-02.01 WITH BICYCLE SAFE GRATE SP582-05.02
CB-12 (CI)	103+70.284	5.605	8.703	TYPE 'B' R	INV. 8.128	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-13 (CI)	104+21.211	-5.500	10.766	TYPE 'B' R	INV. 10.241	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-14 (CI)	104+18.455	5.500	10.664	TYPE 'B' R	INV. 8.964	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02

CATCH BASINS

ID	STA	OFFSET	GRATE ELEV.	GRATE TYPE	INVERT ELEV.	CATCH BASIN DESCRIPTION
CB-15 (CI)	104+95.107	-5.500	15.095	TYPE 'B' R	INV. 14.520	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-16 (CI)	104+95.696	5.500	14.973	TYPE 'B' R	INV. 14.498	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-17 (CI)	105+44.208	5.500	17.078	TYPE 'B' R	INV. 16.603	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-18 (CI)	105+91.673	-5.500	18.077	TYPE 'B' R	INV. 17.602	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-19 (CI)	105+91.415	5.500	17.942	TYPE 'B' R	INV. 16.205	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-20 (CI)	105+66.406	-5.606	16.139	TYPE 'B' R	INV. 15.614	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02



KEY PLAN

AtkinsRéalis
Suite 1100 - 745 Thurlow St.
Vancouver | British Columbia
V6E 0C5 | Canada

SCALE 0 5 H 1:500 25m
0 1 V 1:100 5m

CAD FILENAME R1-980-701 TO 731
PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER
DATE 2024-01-16

DESIGNED Z. JIANG DATE 2021-03-31
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R.WONG/S.S.DEPW DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

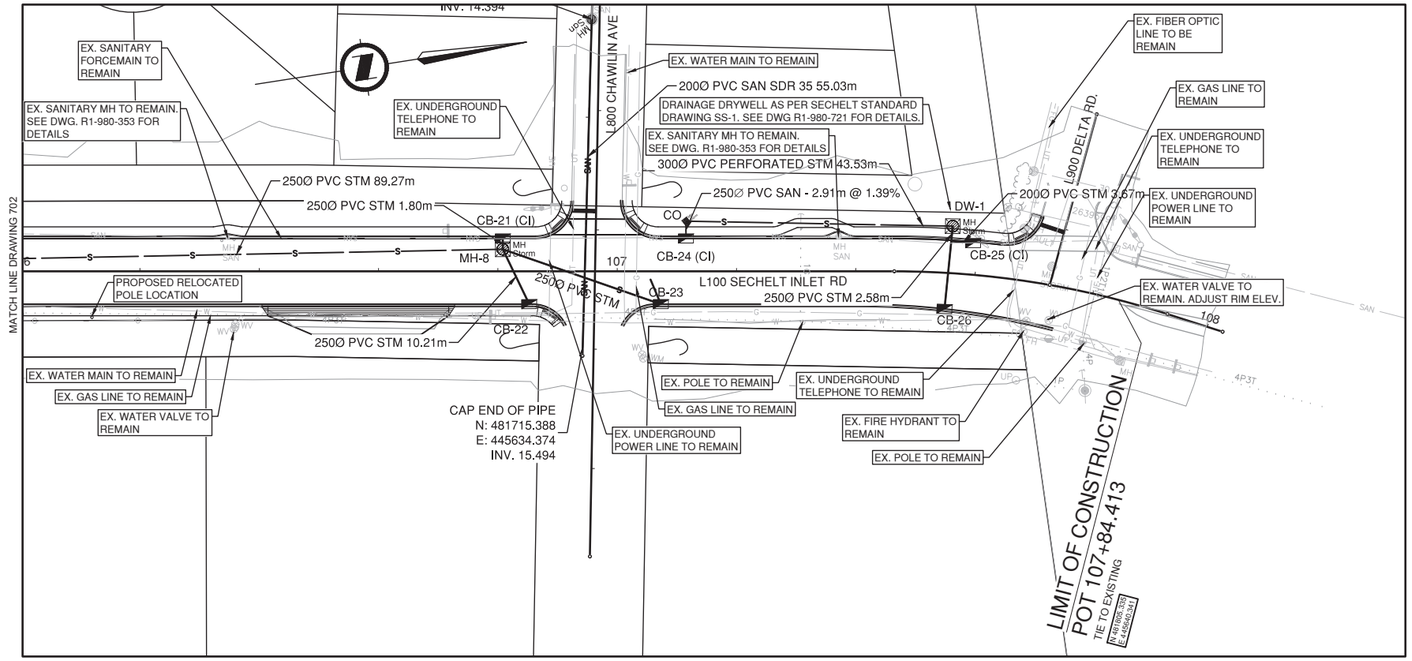
DRAINAGE DESIGN AND UTILITY RELOCATION

PLAN AND PROFILE
EAST PORPOISE BAY ROAD / SECHELT INLET ROAD - IMPROVEMENTS

STA. 102+35.000 TO 106+00.000

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-702	--

PLOT DATE: 2024/01/16 \\sli0262\TxProject\DATA\678324-PorpoiseBay&SechelInlet41 - Civil Engineering\SechelI_Inlet_Road\DrawingProduction\700_DrainageUtilities\R1-980-701 to 731.dwg



CATCH BASINS

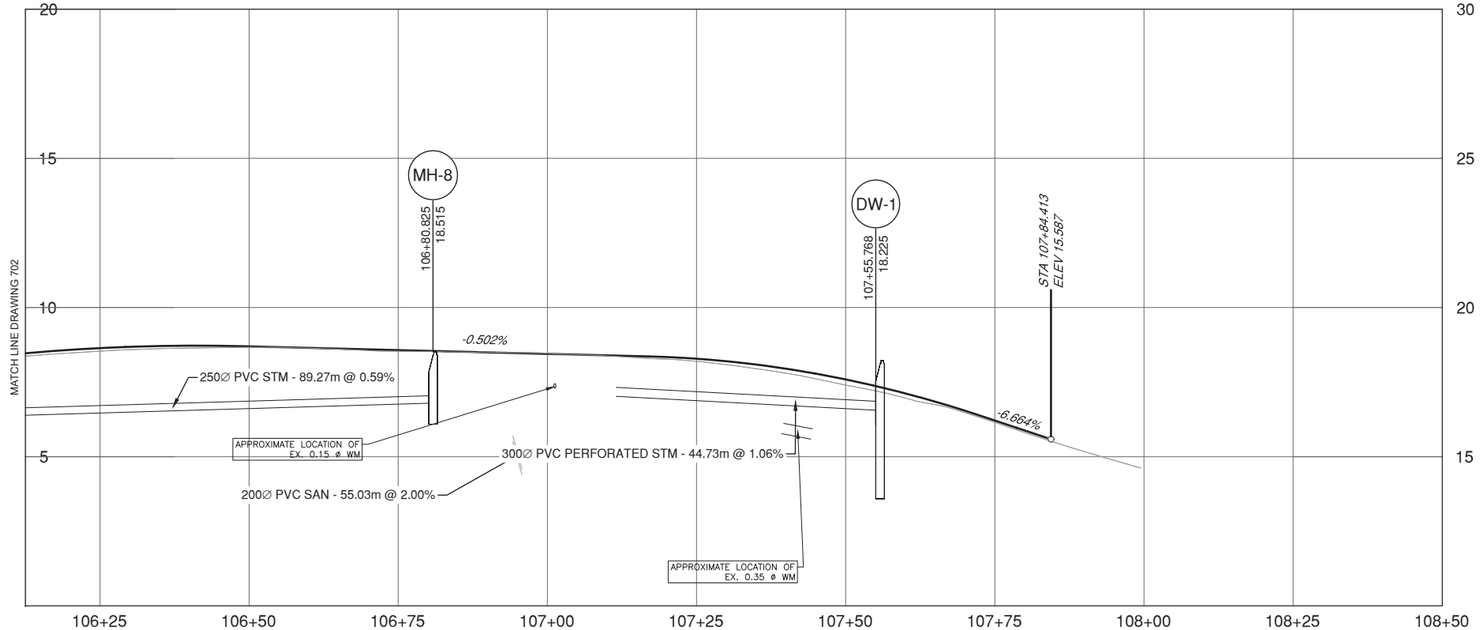
ID	STA	OFFSET	GRATE ELEV.	GRATE TYPE	INVERT ELEV.	CATCH BASIN DESCRIPTION
CB-21 (CI)	106+80.828	-5.500	18.395	TYPE 'B' R	INV. 17.770	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-22	106+85.258	5.500	18.621	TYPE 'B' R	INV. 17.351	PRECAST REINFORCED CONCRETE CATCH BASIN SP582-02.01 WITH BICYCLE SAFE GRATE SP582-05.02
CB-23	107+07.321	5.500	18.494	TYPE 'B' R	INV. 16.669	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-24 (CI)	107+11.527	-5.500	18.280	TYPE 'B' R	INV. 16.455	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-25 (CI)	107+59.224	-5.289	17.154	TYPE 'B' R	INV. 16.679	CAST IRON CATCH BASIN BOX SP582-02.05 WITH BICYCLE SAFE GRATE SP582-05.02
CB-26	107+55.222	6.060	17.226	TYPE 'B' R	INV. 16.383	PRECAST REINFORCED CONCRETE CATCH BASIN SP582-02.01 WITH BICYCLE SAFE GRATE SP582-05.02

DRYWELLS

ID	NORTHING	EASTING	RIM ELEV.	INVERT ELEV.	DRYWELL DESCRIPTION
DW-1	481779.814	445623.859	18.225	INV. 16.001 INV. 16.550	DRAINAGE DRYWELL MANHOLE AS PER D.O.S. STD. DWG. SS-1. SECHELT MANHOLE FRAME AND COVER PER D.O.S. STD. DWG. SS-4.

MANHOLES

ID	NORTHING	EASTING	RIM ELEV.	INVERT ELEV.	MANHOLE DESCRIPTION
MH-8	481704.692	445616.062	18.515	INV. 17.590 INV. 16.947 INV. 16.797 INV. 16.389	1200mm PRECAST REINFORCED CONCRETE MANHOLE SP582-03.01



NOTE:

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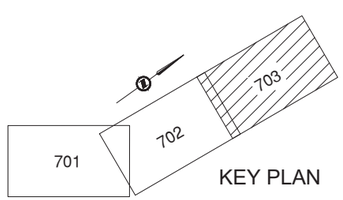


KEY PLAN

AtkinsRéalis
Suite 1100 - 745 Thurlow St.
Vancouver | British Columbia
V6E 0C5 | Canada

SCALE 0 5 H 1:500 25m / 0 1 V 1:100 5m

CAD FILENAME R1-980-701 TO 731

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 2024-01-16

DESIGNED Z. JIANG DATE 2021-03-31
QUALITY CONTROL B. POMPHREY DATE 2022-06-03
QUALITY ASSURANCE R.WONG/S.S.DEEPAK DATE 2022-06-03
DRAWN Z. JIANG DATE 2022-06-02

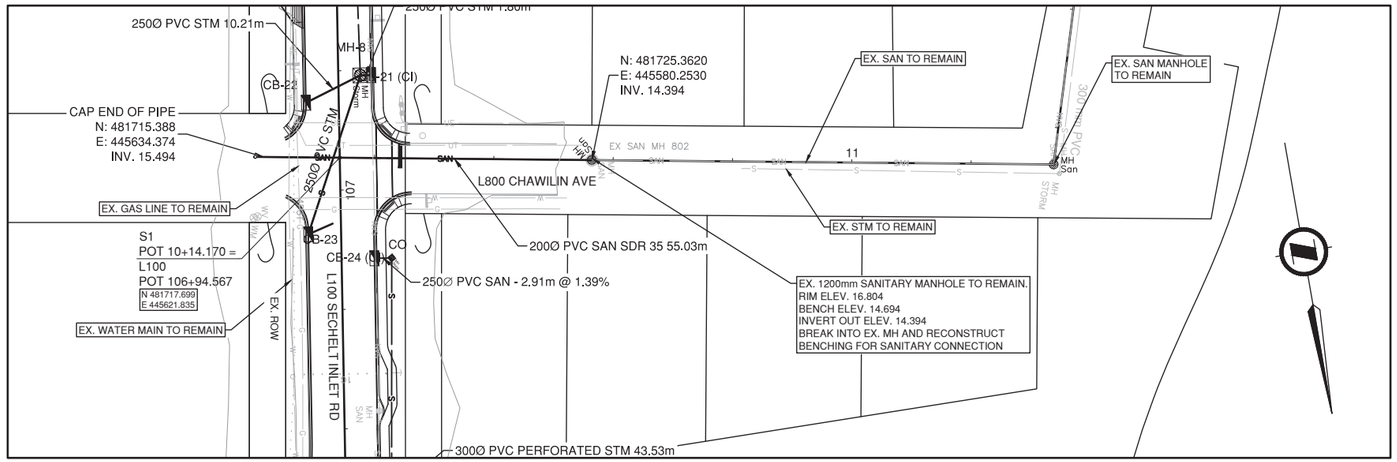
DRAINAGE DESIGN AND UTILITY RELOCATION

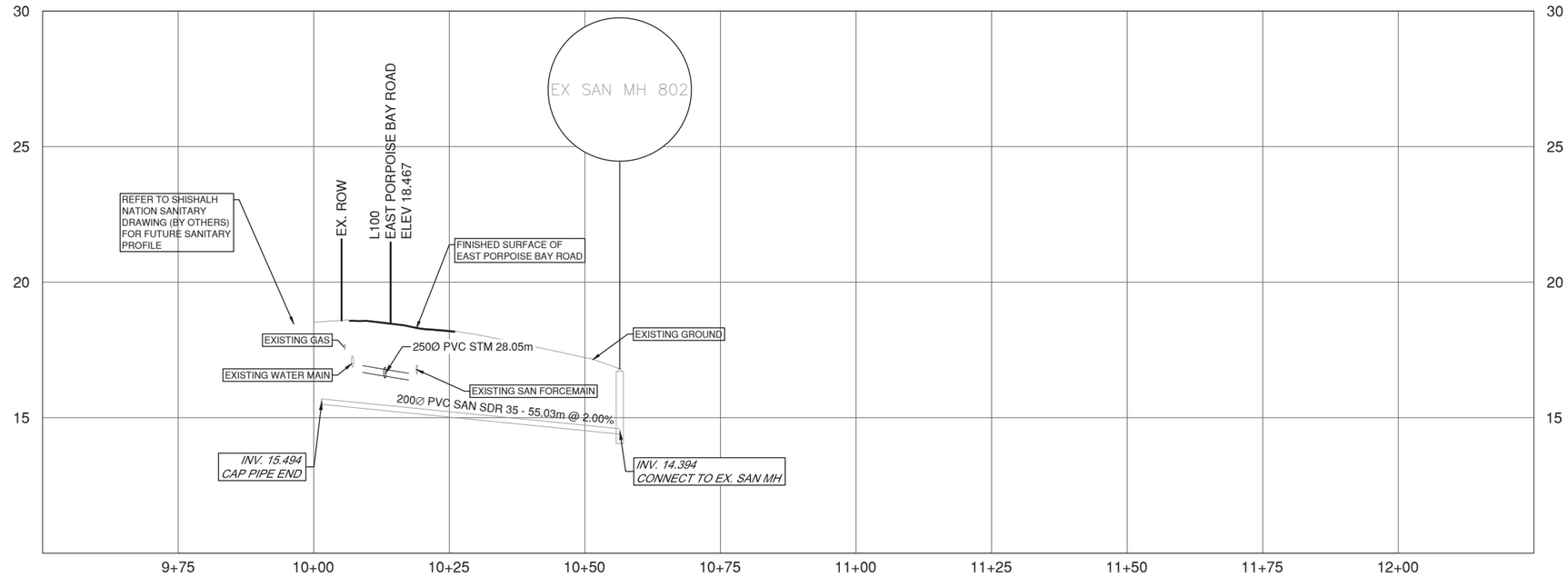
PLAN AND PROFILE
EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 106+00.000 TO 107+84.000

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-703	--

PLOT DATE: 2024/01/16 \\sli02621\TxProject\DATA\678324-PorpoiseBay&SechelInlet\41 - Civil Engineering\SechelI_Inlet_Road\DrawingProduction\700_DrainageUtilities\R1-980-701 to 731.dwg





NOTE:

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DRAWN Z. JIANG DATE 2022-03-31

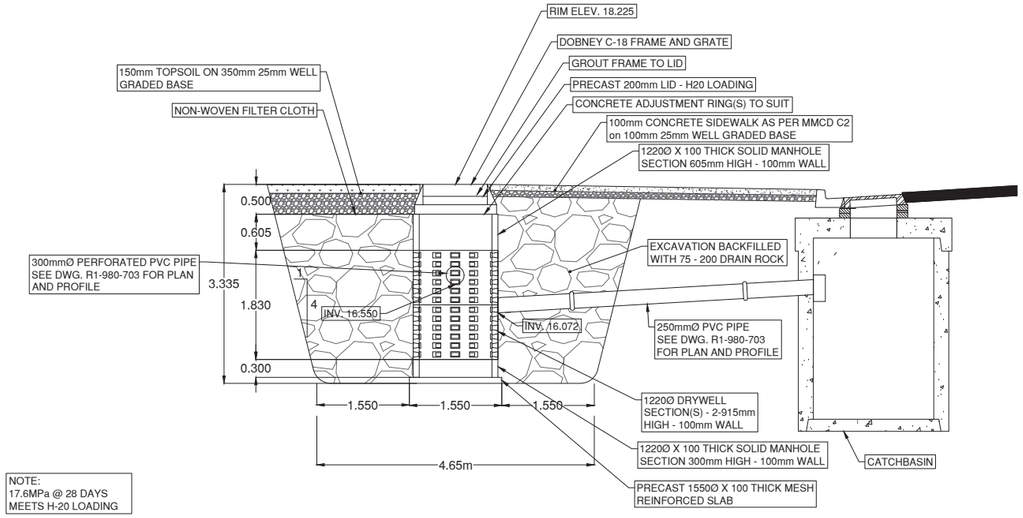
SANITARY DESIGN

PLAN PROFILE
EAST PORPOISE BAY ROAD - IMPROVEMENTS

STA. 100+26.500 TO 107+85.633

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-704	PA

PLOT DATE: 2024/01/16 \\sli0262\Tx\Project\DATA\678324-PorpoiseBay&SechelItInlet\41 - Civil Engineering\SechelI_Inlet_Road\DrawingProduction\700_DrainageUtilities\R1-980-701 to 731.dwg



NOTE:
17.6MPa @ 28 DAYS
MEETS H-20 LOADING

DRAINAGE DRYWELL DETAIL

AtkinsRéalis
Suite 1100 - 745 Thurlow St.
Vancouver | British Columbia
V6E 0C5 | Canada

SCALE 0 0.5 1:50 2.5m

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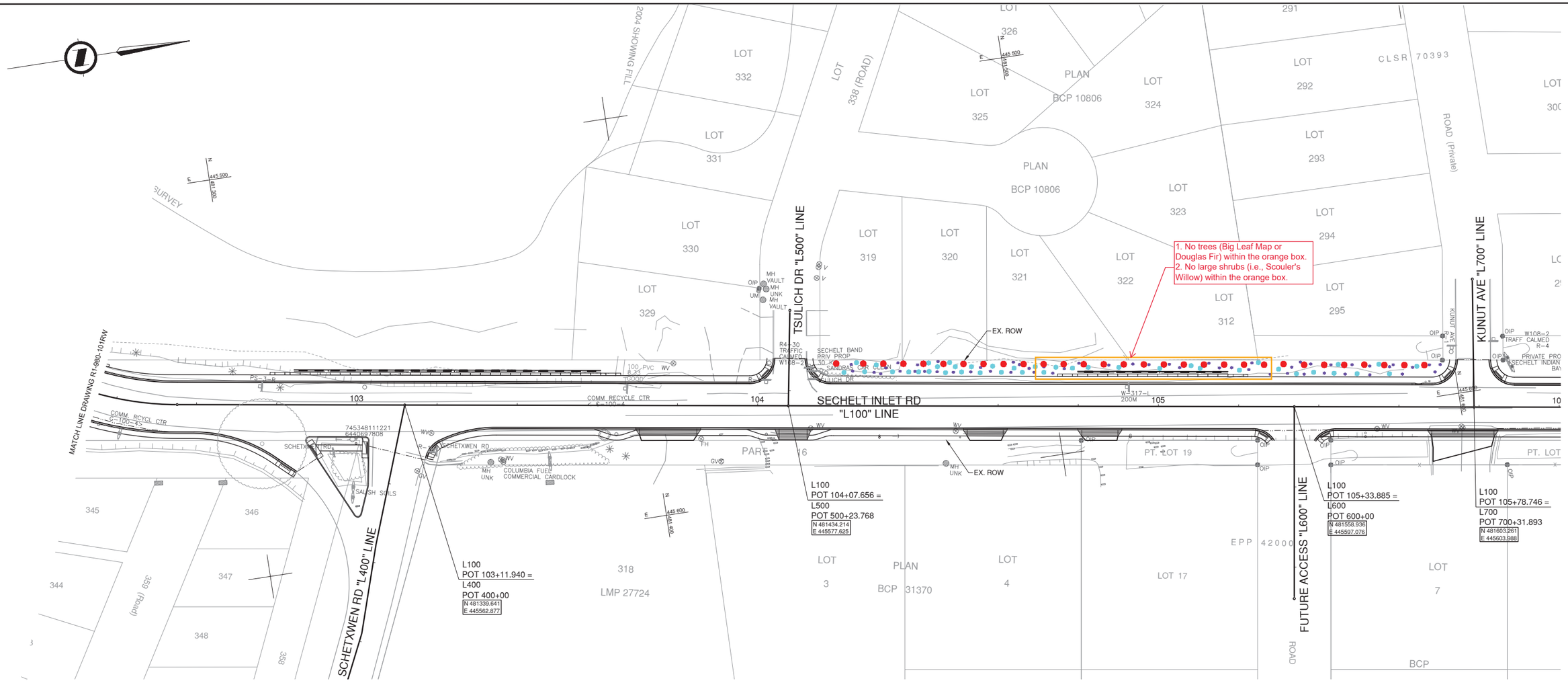
DRAWN Z. JIANG DATE 2022-06-02

DRAINAGE DESIGN AND UTILITY RELOCATION

DRAINAGE - DETAILS
EAST PORPOISE BAY ROAD IMPROVEMENTS
--

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-721	--



LEGEND

ENGLISH NAME	LATIN NAME	TYPE	POT SIZE	#	COMMENTS	MAP COLOUR
COASTAL STRAWBERRY	FRAGARIA CHILOENSIS	GROUNDCOVER	15 cm TO 1 gal	20	SUCCESSFUL IN POOR SOILS. GOOD FOR EROSION CONTROL.	
KINNICKINICK	ARCTOSTAPHYLOS UVA–URSI	GROUNDCOVER	15 cm TO 1 gal	20	DROUGHT TOLERANT. TOLERATES POOR SOIL CONDITIONS.	
TRAILING BLACKBERRY	RUBUS URSINUS	GROUNDCOVER	15 cm TO 1 gal	15		
NATIVE SEED BLEND	N/A	GROUNDCOVER	SEED	75kg/ha	COASTAL LOW–GROWING, ANNUAL GRASS AND WILDFLOWER SEED MIX.	
SCOULER'S WILLOW	SALIX SCOULERIANA	SHRUB	1 gal	25	RAPID GROWTH. DROUGHT TOLERANT. GOOD FOR EROSION CONTROL. IF LIVE STAKES ARE USED, DOUBLE PLANTING NUMBERS.	
OCEANSPRAY	HOLODISCUS DISCOLOR	SHRUB	1 gal	10	TOLERATES A WIDE RANGE OF CONDITIONS. GREAT FOR EROSION CONTROL.	
TALL OREGON GRAPE	MAHONIA AQUIFOLIUM	SHRUB	1 gal	10	DROUGHT TOLERANT. TOLERATES POOR SOIL CONDITIONS.	
NOOTKA ROSE	ROSA NUTKANA	SHRUB	1–3 gal	10	SUCCESSFUL IN A RANGE OF CONDITIONS. CAN COMPLETE WITH HIMALAYAN BLACKBERRY.	
BIG LEAF MAPLE	ACER MACROPHYLLUM	TREE	5–7 gal	15	RAPID GROWTH. TOLERATES RANGE OF SOIL CONDITIONS.	
DOUGLAS FIR	PSUEDOTSUGA MENZIEII	TREE	1–3 gal	15	VERY DROUGHT TOLERANT. LARGER SPECIMENS CAN SUFFER TRANSPLANT SHOCK.	

FOR PLAN SEE DWG R1-980-101 TO 103

FOR PROFILES SEE DWG R1-980-201 TO 202

FOR TYPICAL SECTIONS SEE DWG R1-980-301 TO 302

FOR GEOMETRICS AND LANING SEE DWG R1-980-401 TO 403

FOR DRAINAGE AND UTILITIES SEE DWG R1-980-701 TO 704

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SCALE 0 5 1:500 25m

CAD FILENAME R1-980-1101

PLOT DATE 1/16/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 1/16/2024

DESIGNED Z. JIANG DATE ----
QUALITY CONTROL B. POMPHREY DATE ----
QUALITY ASSURANCE K. MACINTOSH DATE ----
DRAWN D. MANDIC DATE ----

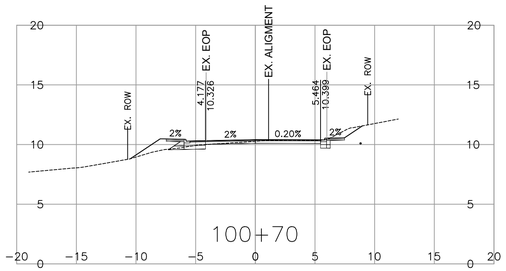
RE-VEGETATION PLAN

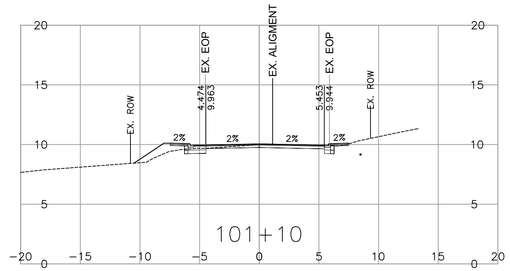
EAST PORPOISE BAY ROAD - IMPROVEMENTS

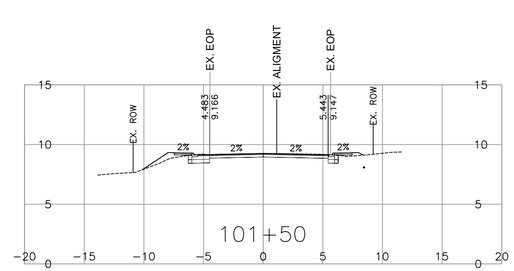
STA. 102+35.000 TO 106+00.000

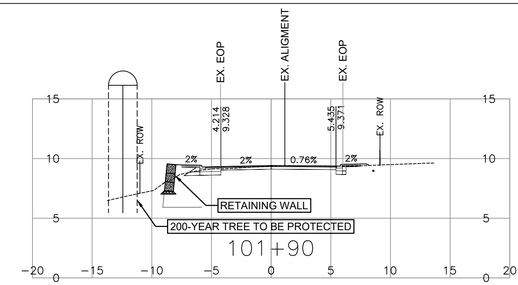
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-1101	PA

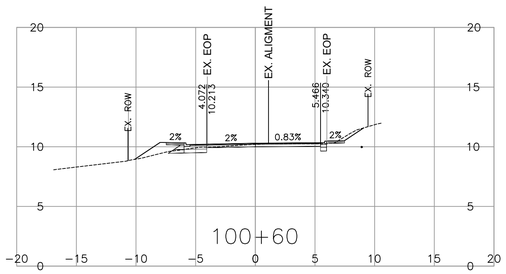
PLOT DATE: 2024/01/16 \\sil\0282\Tx-Project\DATA\678324-PorpoiseBay&SechelltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\1100_Subdisciplines\Landscaping\R1-980-1101.dwg

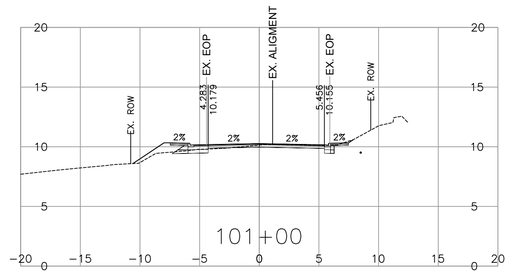


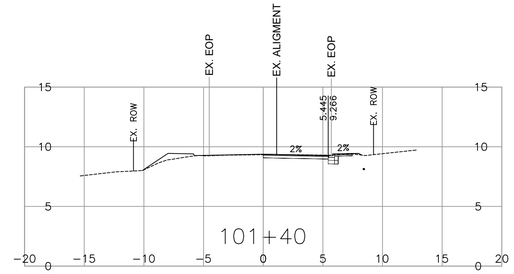


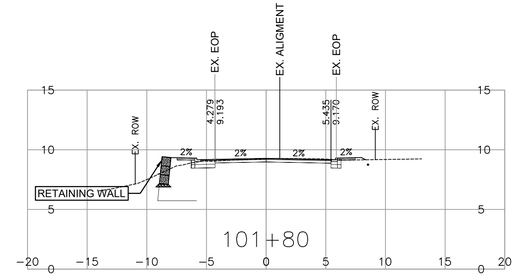


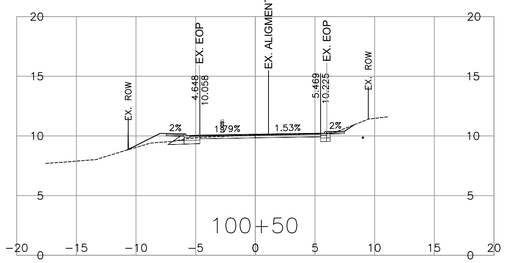


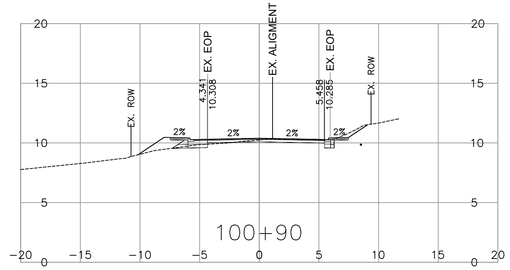


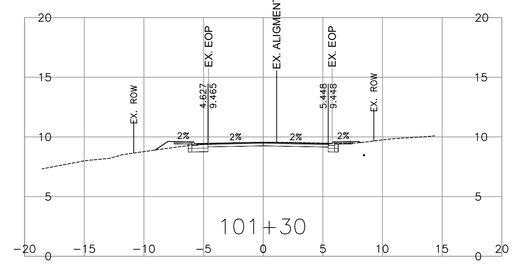


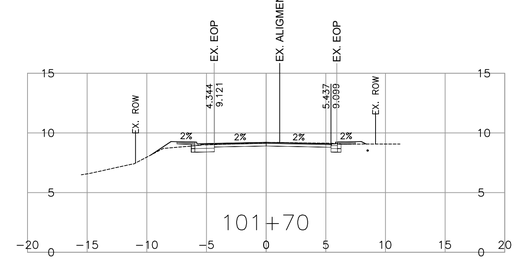


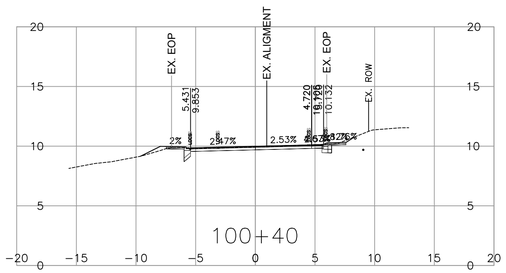


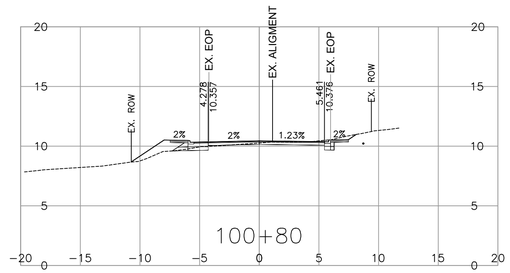


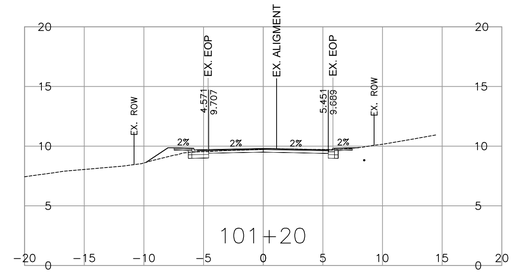


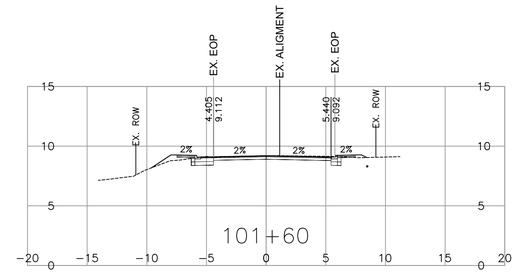












PLOT DATE: 2024/01/24 \\sli\0262\TxProject\DATA\678324-PorpoiseBaySechelt\Inlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\1000_DesignSections\R1-980-1001 to 1005.dwg

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MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 2022-03-31

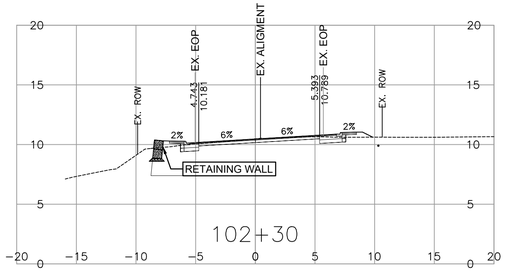
DESIGNED V. GIOREV DATE 2022-03-31
QUALITY CONTROL Z. JIANG DATE 2022-06-03
QUALITY ASSURANCE R. WONG DATE 2022-06-03
DRAWN V. SAM DATE 2022-06-02

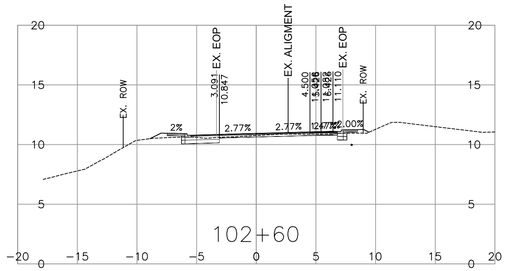
DETAILS

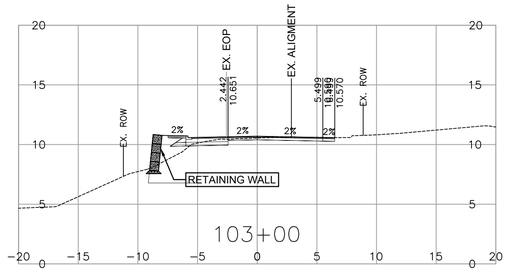
PLAN PROFILE
EAST PORPOISE BAY ROAD IMPROVEMENTS

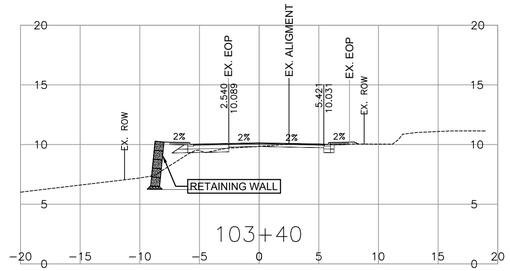
STA. 100+35.905 TO 107+84.413

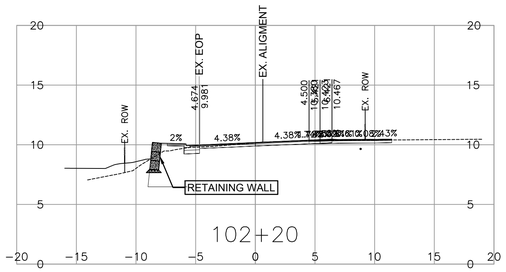
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-1001	--

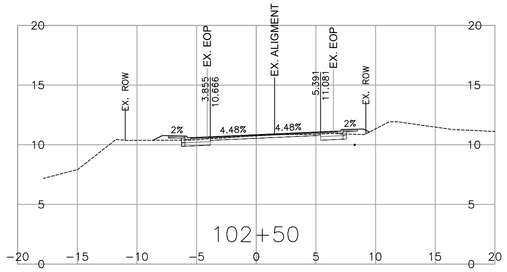


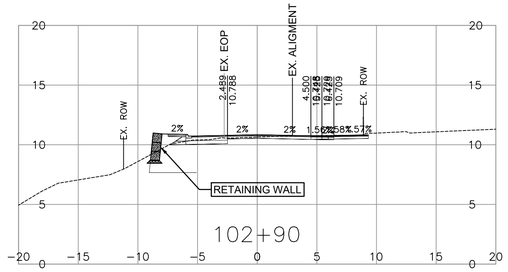


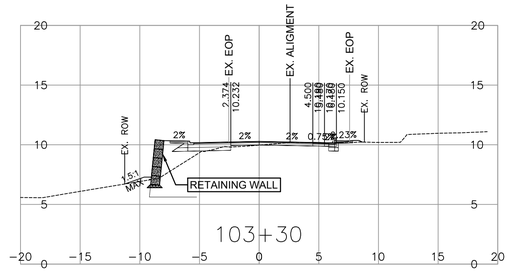


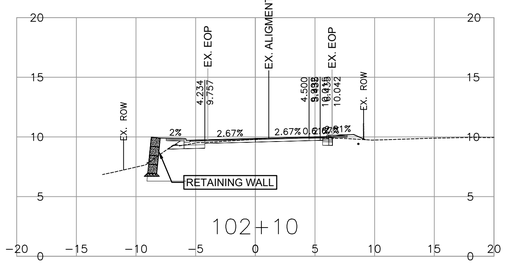


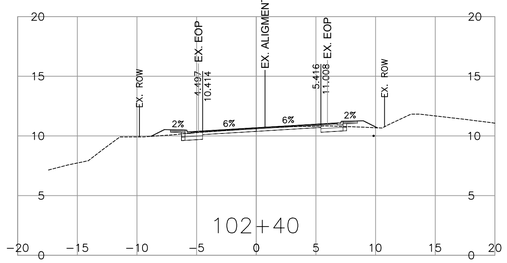


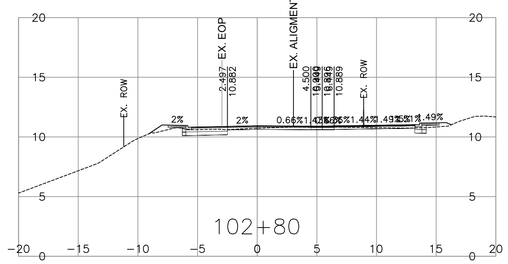


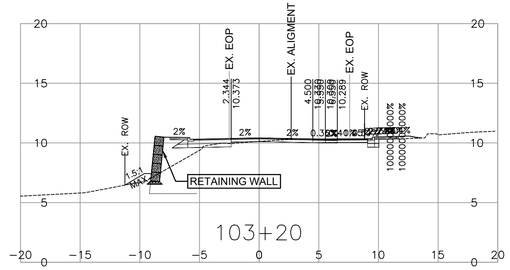


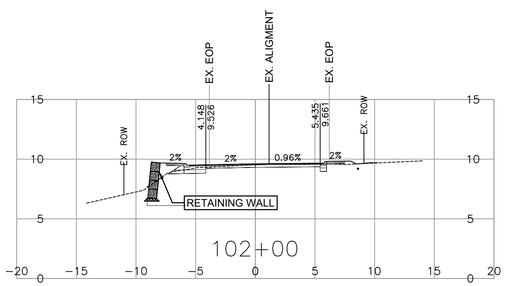


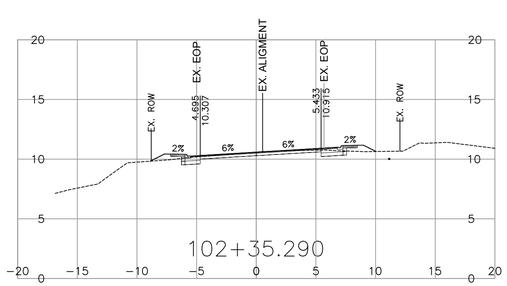


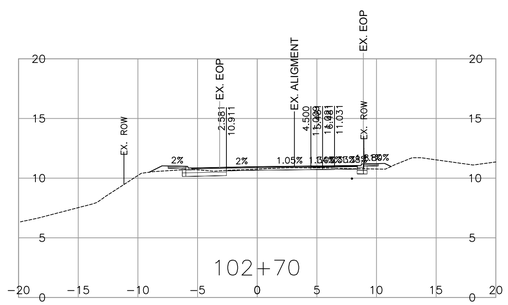


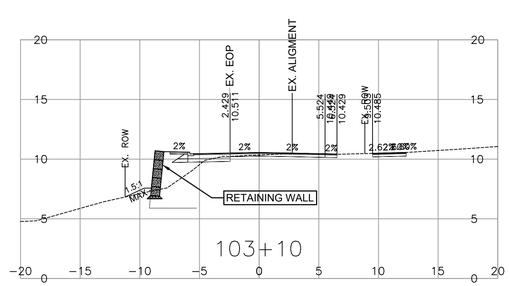












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MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 2022-03-31

DESIGNED	V. GIOREV	DATE	2022-03-31
QUALITY CONTROL	Z. JIANG	DATE	2022-06-03
QUALITY ASSURANCE	R. WONG	DATE	2022-06-03
DRAWN	V. SAM	DATE	2022-06-02

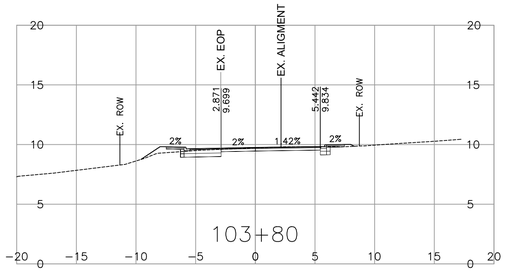
DETAILS

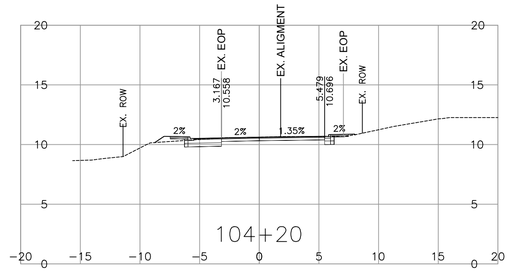
PLAN PROFILE
EAST PORPOISE BAY ROAD IMPROVEMENTS

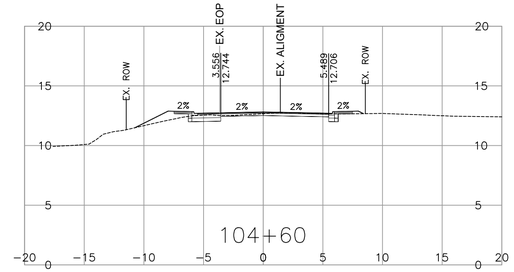
STA. 100+35.905 TO 107+84.413

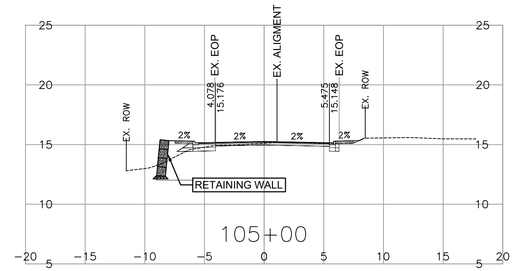
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-1002	--

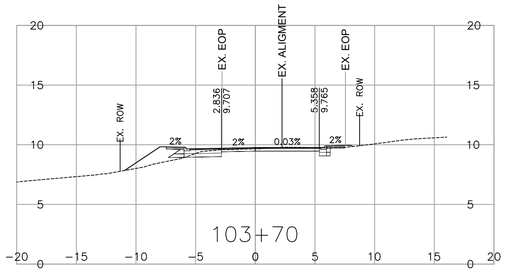
PLOT DATE: 2024/01/24 \\sli0262\TxProject\DATA\678324-PorpoiseBay&SechelItInlet\41 - Civil Engineering\SechelIt_Inlet_Road\DrawingProduction\1000_DesignSections\R1-980-1001 to 1005.dwg

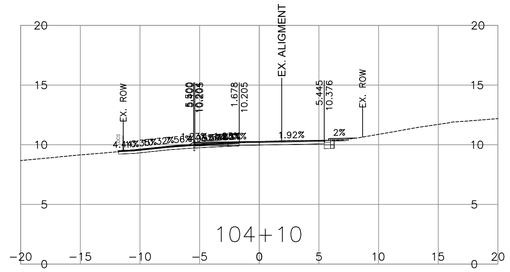


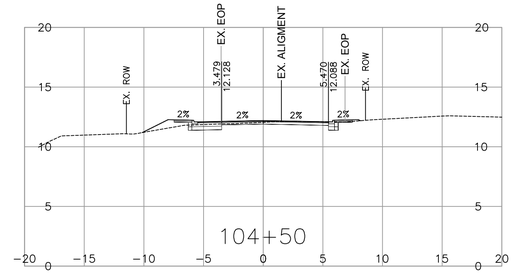


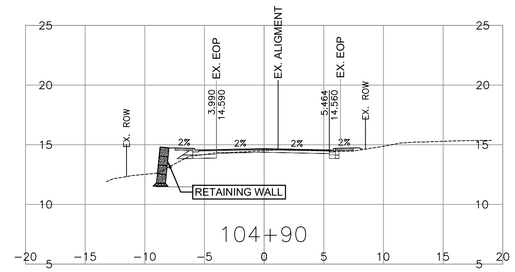


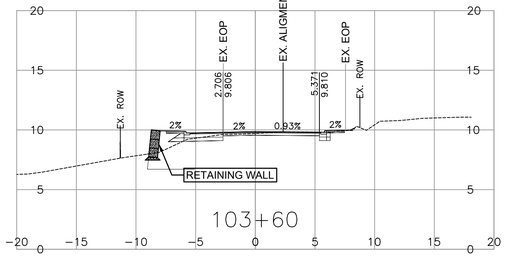


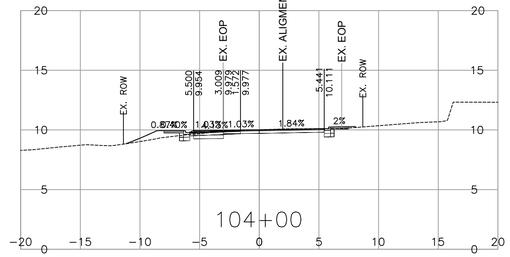


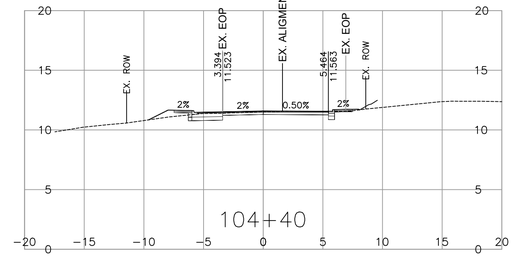


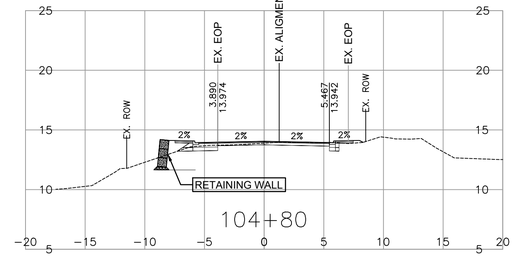


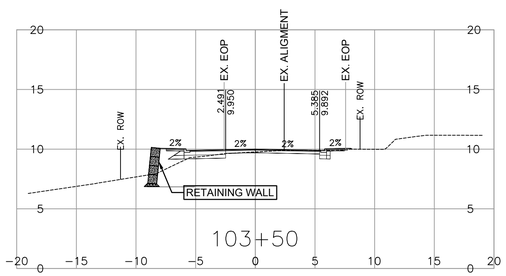


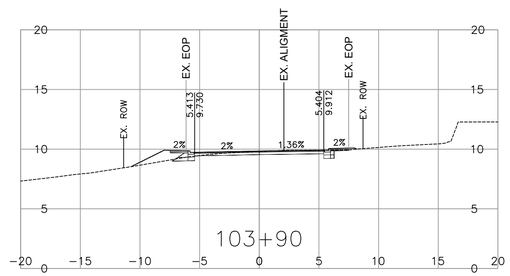


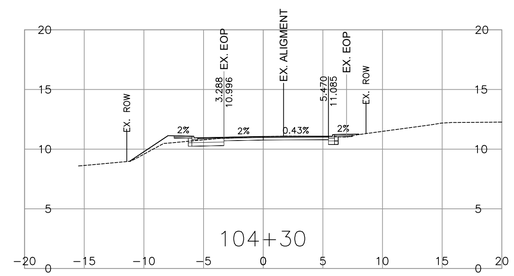


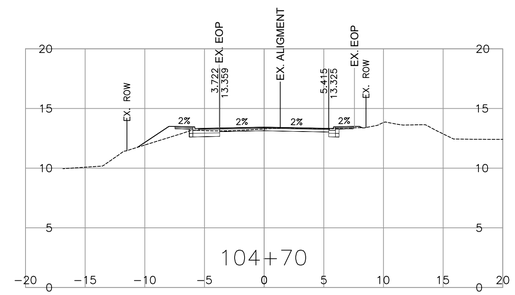












PLOT DATE : 2024/01/24 \\sli02621\x-Project\DATA\678324-PorpoiseBay&SechelltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\1000_DesignSections\R1-980-1001 to 1005.dwg

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PLAN PROFILE
EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 100+35.905 TO 107+84.413

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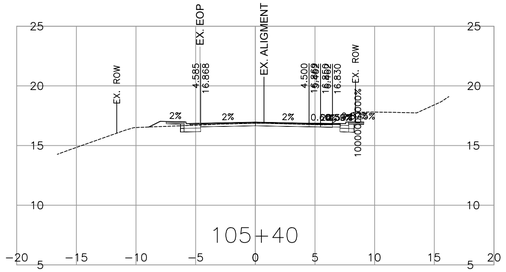
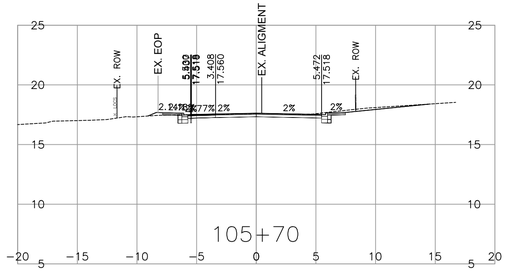
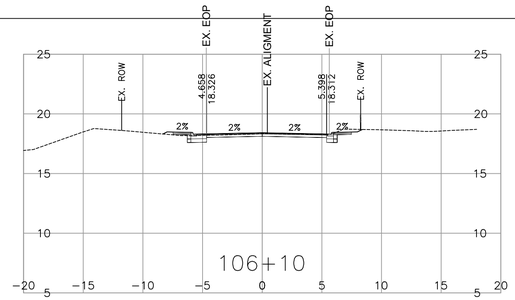
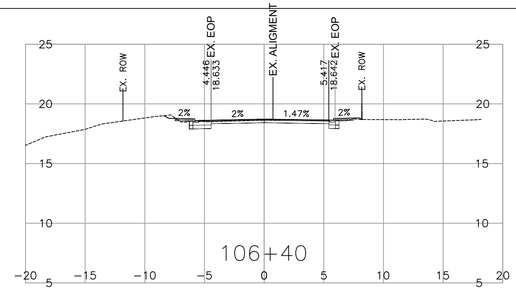
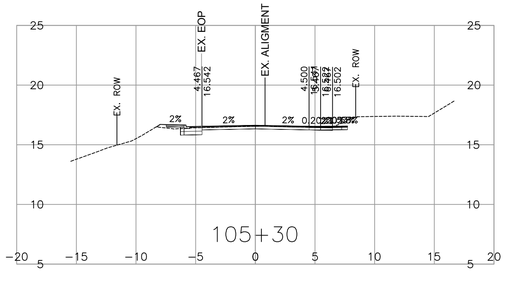
871CS0999	13004-0001	1	R1-980-1003	--

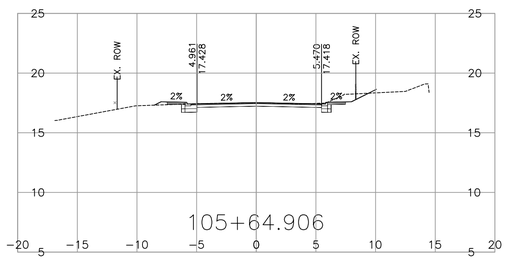


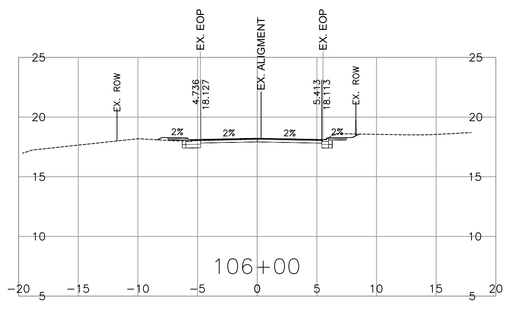


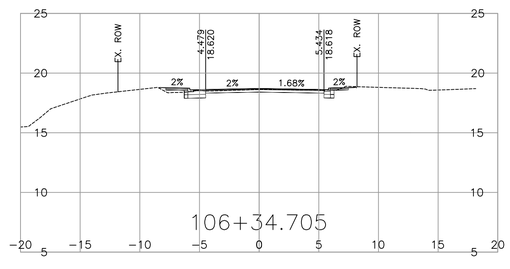


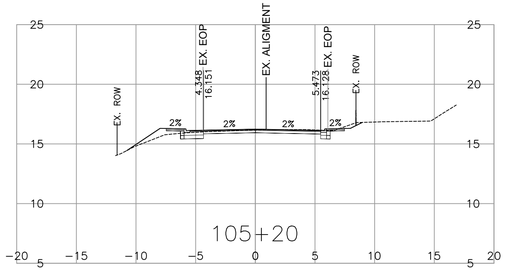


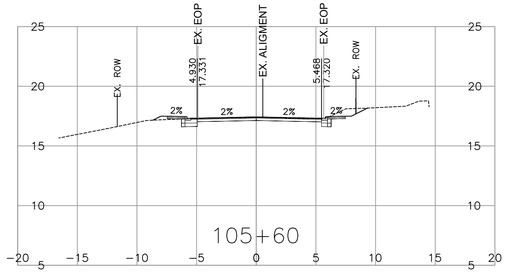


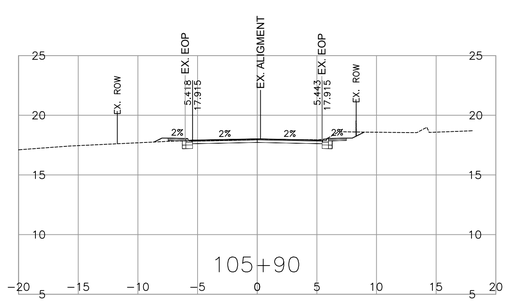


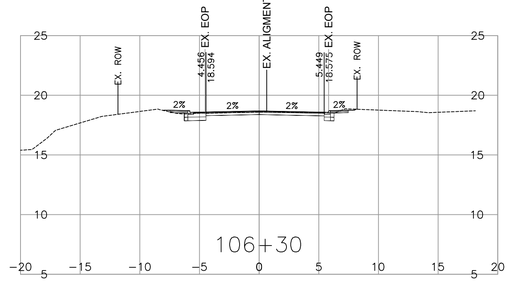


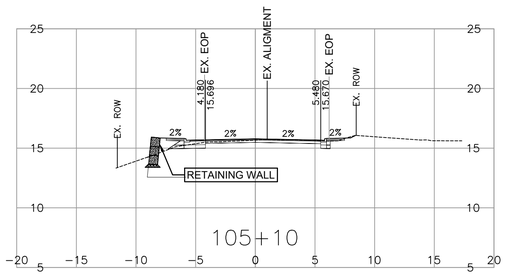


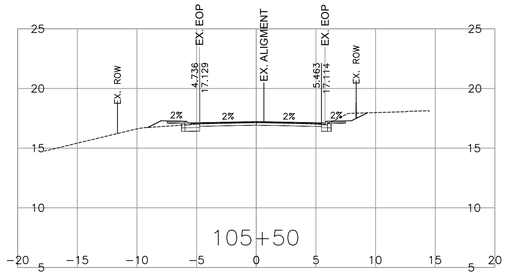


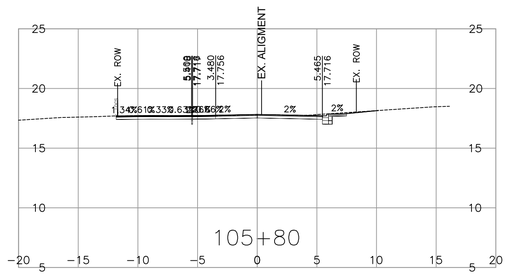


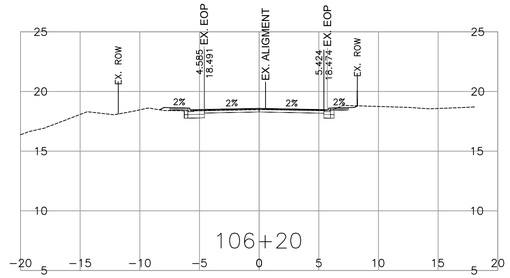












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CAD FILENAME R1-980-1001 TO 1005

PLOT DATE 1/24/2024

REV	DATE	REVISIONS	NAME

BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
SOUTH COAST REGION
HIGHWAY ENGINEERING AND GEOMATICS

SENIOR DESIGNER

DATE 2022-03-31

DESIGNED	V. GIOREV	DATE	2022-03-31
QUALITY CONTROL	Z. JIANG	DATE	2022-06-03
QUALITY ASSURANCE	R. WONG	DATE	2022-06-03
DRAWN	V. SAM	DATE	2022-06-02

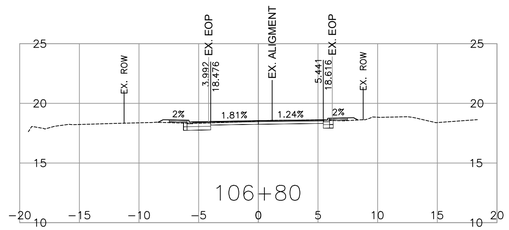
DETAILS

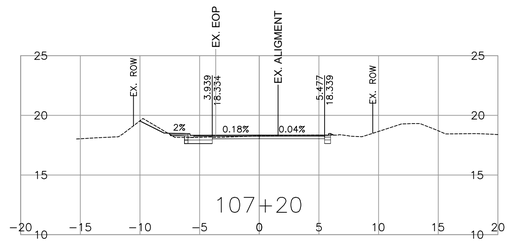
PLAN PROFILE
EAST PORPOISE BAY ROAD IMPROVEMENTS

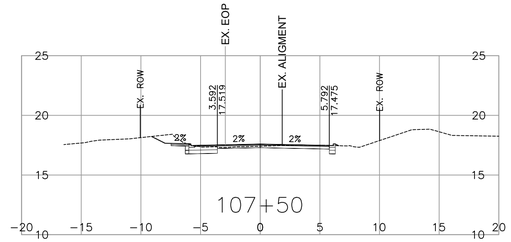
STA. 100+35.905 TO 107+84.413

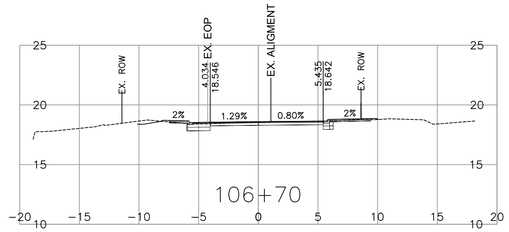
FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-1004	--

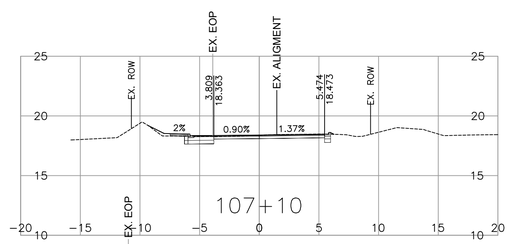
PLOT DATE: 2024/01/24 \\sli0262\TxProject\DATA\678324-PorpoiseBay&SecheltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\Drawing\Production\1000_DesignSectionsR1-980-1001 to 1005.dwg

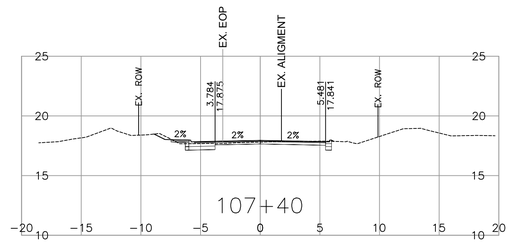


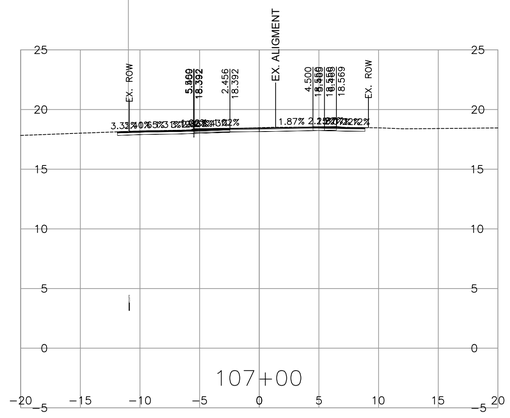


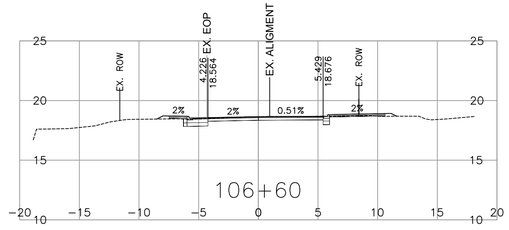


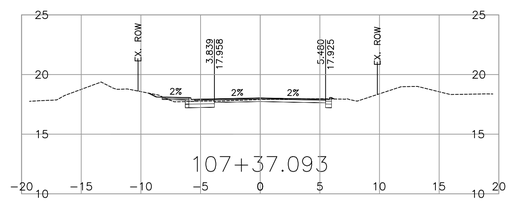


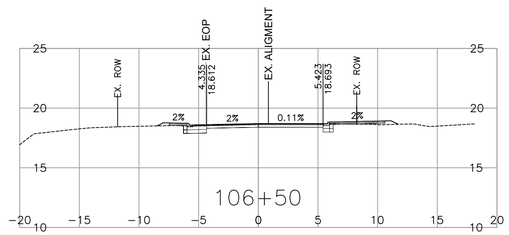


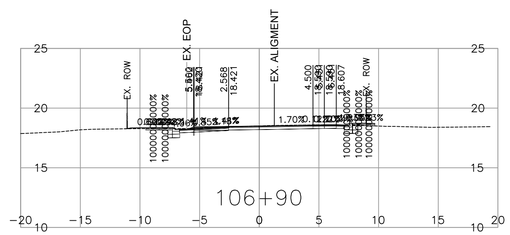


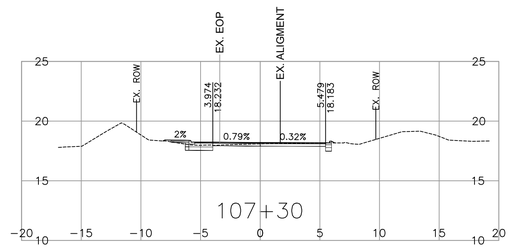












PLOT DATE: 2024/01/24 \\sll0262\TxProject\DATA\678324-PorpoiseBay&SechelltInlet\41 - Civil Engineering\Sechelt_Inlet_Road\DrawingProduction\1000_DesignSections\R1-980-1001 to 1005.dwg

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BRITISH COLUMBIA

MINISTRY OF TRANSPORTATION AND INFRASTRUCTURE
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DETAILS

PLAN PROFILE
EAST PORPOISE BAY ROAD IMPROVEMENTS

STA. 100+35.905 TO 107+84.413

FILE NUMBER	PROJECT NUMBER	REG	DRAWING NUMBER	REV
871CS0999	13004-0001	1	R1-980-1005	--

APPENDIX C

BOREHOLE LOGS

Borehole No: **BH22-01**

BRITISH COLUMBIA
Ministry of Transportation & Infrastructure

Project: Geotechnical Investigation	Project No: 704-TRN.PAVE03225-08
Location: East Porpoise Bay Road	
Sechelt, BC	UTM: 445552.63 E; 5481270.54 N; Z 10

Depth (m)	Method	Core Diameter (mm)	Soil Description	Graphical Representation	Sample Type	Sample Number	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0	Solid Stem Auger		Asphalt 102 mm.					0
			SAND and GRAVEL (ROAD BASE), trace silt, dry, dense (Inferred), dark brown.			G 1		
			SAND and GRAVEL (SUBBASE), trace silt, damp, dense (Inferred), light brown.			G 2		
1								1 2 3 4 5
			End of Borehole at 1.52 m. - Borehole backfilled with cuttings, bentonite (from 1.22 to 1.52 m), and patched with cold mix asphalt. - No groundwater observed upon completion. - Borehole location measured using handheld GPS. Locations considered accurate to +/- 5 m horizontal.					
2								6 7 8 9 10
3								11 12 13 14 15
4								16 17 18 19
5								
6								

TETRA TECH

Contractor: Omega Drilling	Completion Depth: 1.52 m
Drilling Rig Type: B54 Auger Truck	Start Date: 2022 May 4
Logged By: EE	Completion Date: 2022 May 4
Reviewed By: KS	Page 1 of 1

Borehole No: **BH22-02**

BRITISH COLUMBIA
Ministry of Transportation & Infrastructure

Project: Geotechnical Investigation	Project No: 704-TRN.PAVE03225-08
Location: Sechelt Inlet Road	
Sechelt, BC	UTM: 445585.09 E; 5481463.26 N; Z 10

Depth (m)	Method	Core Diameter (mm)	Soil Description	Graphical Representation	Sample Type	Sample Number	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0			Asphalt 102 mm.					0
			SAND and GRAVEL (ROAD BASE), trace silt, dry, dense (Inferred), dark brown.			G 1		
			SAND and GRAVEL (SUBBASE), trace silt, damp, dense (Inferred), light brown.					1
1	Solid Stem Auger					G 2		2
								3
								4
			SAND (INFERRED NATIVE), some gravel, trace silt, damp, compacted (Inferred), light brown					5
2								6
								7
						G 3	●	8
								9
3								10
			End of Borehole at 3.05 m. - Borehole backfilled with cuttings, bentonite (from 2.74 to 3.05 m), and patched with cold mix asphalt. - No groundwater observed upon completion. - Borehole location measured using handheld GPS. Locations considered accurate to +/- 5 m horizontal.					11
								12
4								13
								14
								15
5								16
								17
								18
								19
6								

TETRA TECH

Contractor: Omega Drilling	Completion Depth: 3.05 m
Drilling Rig Type: B54 Auger Truck	Start Date: 2022 May 4
Logged By: EE	Completion Date: 2022 May 4
Reviewed By: KS	Page 1 of 1

Borehole No: **BH22-03**

BRITISH COLUMBIA
Ministry of Transportation & Infrastructure

Project: Geotechnical Investigation	Project No: 704-TRN.PAVE03225-08
Location: Sechelt Inlet Road	
Sechelt, BC	UTM: 445601.38 E; 5481572.48 N; Z 10

Depth (m)	Method	Core Diameter (mm)	Soil Description	Graphical Representation	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Silt & Clay (%): Clay (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0												0
	Solid Stem Auger		Asphalt 130 mm.									
			SAND and GRAVEL (ROAD BASE), trace silt, dry, dense (Inferred), dark brown.			G 1	36	57.2	6.8		●	
			SAND and GRAVEL (SUBBASE), trace silt, damp, dense (Inferred), light brown.									
1						G 2					●	1–5
			End of Borehole at 1.52 m. - Borehole backfilled with cuttings, bentonite (from 1.22 to 1.52 m), and patched with cold mix asphalt. - No groundwater observed upon completion. - Borehole location measured using handheld GPS. Locations considered accurate to +/- 5 m horizontal.									
2												6–10
3												10–15
4												13–20
5												16–25
6												19

TETRA TECH

Contractor: Omega Drilling	Completion Depth: 1.52 m
Drilling Rig Type: B54 Auger Truck	Start Date: 2022 May 4
Logged By: EE	Completion Date: 2022 May 4
Reviewed By: KS	Page 1 of 1

Borehole No: **BH22-04**

Project: Geotechnical Investigation	Project No: 704-TRN.PAVE03225-08
Location: Sechelt Inlet Road	
Sechelt, BC	UTM: 445629.87 E; 5481777.39 N; Z 10

Depth (m)	Method	Core Diameter (mm)	Soil Description	Graphical Representation	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Silt & Clay (%): Clay (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0			Asphalt 130 mm.									0
			SAND and GRAVEL (ROAD BASE), trace silt, dry, compact (Inferred), dark brown.			G 1						
			SAND (SUBBASE), some gravel to gravelly, trace silt, damp, compact (Inferred), light brown.									1
1						G 2	22	74.2	3.8			3
												4
												5
2	Solid Stem Auger											6
												7
			SAND (INFERRED NATIVE), gravelly, trace silt, damp, loose (Inferred), light brown.			G 3						8
												9
3												10
												11
			SAND, some gravel, trace silt, damp, loose (Inferred), light brown to orange-brown; coarse sand									12
												13
4						G 4	15	81.2	3.8			14
												15
			End of Borehole at 4.57 m. - Borehole backfilled with cuttings, bentonite (from 4.27 to 4.57m), and patched with cold mix asphalt. - No groundwater observed upon completion. - Borehole location measured using handheld GPS. Locations considered accurate to +/- 5 m horizontal.									16
5												17
												18
												19
6												

Contractor: Omega Drilling	Completion Depth: 4.57 m
Drilling Rig Type: B54 Auger Truck	Start Date: 2022 May 4
Logged By: EE	Completion Date: 2022 May 4
Reviewed By: KS	Page 1 of 1

Borehole No: **BH22-05**

BRITISH COLUMBIA
Ministry of Transportation & Infrastructure

Project: Geotechnical Investigation	Project No: 704-TRN.PAVE03225-08
Location: Sechelt Inlet Road	
Sechelt, BC	UTM: 445613.59 E; 5481674.4 N; Z 10

Depth (m)	Method	Core Diameter (mm)	Soil Description	Graphical Representation	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Silt & Clay (%): Clay (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0												0
	Solid Stem Auger		Asphalt 200 mm.									
			SAND and GRAVEL (ROAD BASE), some silt, dry, dense (Inferred), dark brown.			G 1	37	52.7	10.3		●	
1			SAND (SUBBASE), some gravel, trace silt, damp, dense (Inferred), light brown.			G 2						1 2 3 4 5
			End of Borehole at 1.52 m. - Borehole backfilled with cuttings, bentonite (from 1.22 to 1.52 m), and patched with cold mix asphalt. - No groundwater observed upon completion. - Borehole location measured using handheld GPS. Locations considered accurate to +/- 5 m horizontal.									
2												6 7 8 9 10
3												11 12 13 14 15
4												16 17 18 19
5												
6												

TETRA TECH

Contractor: Omega Drilling	Completion Depth: 1.52 m
Drilling Rig Type: B54 Auger Truck	Start Date: 2022 May 4
Logged By: EE	Completion Date: 2022 May 4
Reviewed By: KS	Page 1 of 1

Borehole No: **BH22-06**

BRITISH COLUMBIA
Ministry of Transportation & Infrastructure

Project: Geotechnical Investigation	Project No: 704-TRN.PAVE03225-08
Location: Sechelt Inlet Road	
Sechelt, BC	UTM: 445566.99 E; 5481366.96 N; Z 10

Depth (m)	Method	Core Diameter (mm)	Soil Description	Graphical Representation	Sample Type	Sample Number	Particle Size Distribution: Gravel (%)	Sand (%)	Silt & Clay (%): Silt (%)	Silt & Clay (%): Clay (%)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0												0
	Solid Stem Auger		Asphalt 130 mm.									
			SAND and GRAVEL (ROAD BASE), trace silt, dry, dense (Inferred), dark brown.			G 1						
			SAND (SUBBASE), some gravel, trace silt, damp, dense (Inferred), light brown.			G 2						
1												1
												2
												3
			SAND (INFERRED NATIVE), some gravel, some wood remnants, trace silt, compact (Inferred), damp, light brown.									4
						G 3						5
2												6
			SAND, some gravel to gravelly, trace silt, damp, compact (Inferred), light brown									7
						G 4	26	69.1	4.9		●	8
												9
3												10
			End of Borehole at 3.05 m. - Borehole backfilled with cuttings, bentonite (from 2.74 to 3.05m), and patched with cold mix asphalt. - No groundwater observed upon completion. - Borehole location measured using handheld GPS. Locations considered accurate to +/- 5 m horizontal.									11
												12
												13
4												14
												15
												16
5												17
												18
												19
6												

TETRA TECH

Contractor: Omega Drilling	Completion Depth: 3.05 m
Drilling Rig Type: B54 Auger Truck	Start Date: 2022 May 4
Logged By: EE	Completion Date: 2022 May 4
Reviewed By: KS	Page 1 of 1

Borehole No: **BH22-07**

Project: Geotechnical Investigation	Project No: 704-TRN.PAVE03225-08
Location: East Porpoise Bay Road	
Sechelt, BC	UTM: 445490.17 E; 5481193.7 N; Z 10

Depth (m)	Method	Core Diameter (mm)	Soil Description	Graphical Representation	Sample Type	Sample Number	Field Blowcount (blows/300 mm) □ SPT (20 40 60 80)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0			Asphalt 130 mm.						0
			SAND and GRAVEL (ROAD BASE), trace silt, dry, very dense, dark brown.						
			SPT at 0.13 m: 29/42/52/38/17 (N=94) - 100% Recovery - Sample collected from depth range 0.25 - 0.91 m - Gravel clast stuck in spoon			SPT 1	□		
			SAND (SUBBASE), some gravel, trace silt, damp, dense, light brown.			G 1			
1	Solid Stem Auger								3
			SPT at 1.52 m: 29/7/5/5/5 (N=12) - 100% Recovery - Sample collected from depth range 1.52 - 2.28 m						
2			SAND (INFERRED NATIVE), some gravel, some silt, compact, damp, light brown.			SPT 2	□	●	6
						G 2			
3			End of Borehole at 3.05 m. - Borehole backfilled with cuttings, bentonite (from 2.74 to 3.05m), and patched with cold mix asphalt. - No groundwater observed upon completion. - Borehole location measured using handheld GPS. Locations considered accurate to +/- 5 m horizontal.						10
4									13
5									16
6									19

TETRA TECH

Contractor: Omega Drilling	Completion Depth: 3.05 m
Drilling Rig Type: B54 Auger Truck	Start Date: 2022 May 4
Logged By: EE	Completion Date: 2022 May 4
Reviewed By: KS	Page 1 of 1

Borehole No: **BH22-08**

Project: Geotechnical Investigation	Project No: 704-TRN.PAVE03225-08
Location: East Porpoise Bay Road	
Sechelt, BC	UTM: 445431.31 E; 5481119.43 N; Z 10

Depth (m)	Method	Core Diameter (mm)	Soil Description	Graphical Representation	Sample Type	Sample Number	Field Blowcount (blows/300 mm) SPT	Plastic Limit / Moisture Content / Liquid Limit	Depth (ft)
0			Asphalt 130 mm.						0
			SPT at 0.13 m: 11/11/10/9/7 (N=21) - 100% Recovery - Sample collected from depth range 0.13 - 0.91 m			SPT 1	20 40 60 80	20 40 60 80	
			SAND and GRAVEL (ROAD BASE), trace silt, dry, compact, dark brown.			G 1			
1			SAND (SUBBASE), some gravel, some silt, damp, compact, light brown.						1 2 3 4
	Solid Stem Auger		SAND (INFERRED NATIVE), some gravel, trace silt, damp, loose to compact, light brown. SPT at 1.52 m: 1/4/6/6/7 (N=10) - 100% Recovery - Sample collected from depth range 1.52 - 2.28 m			SPT 2			5 6 7 8
2						G 2			9
3			SAND, silty, some gravel, damp, dense, light brown. SPT at 3.05 m: 0/5/19/24/26 (N=24) - 100% Recovery - Sample collected from depth range 3.05 - 3.81 m			SPT 3			10 11 12
						G 3			
4									13 14
	SPT		SPT at 4.57 m: 5/15/20/23/25 (N=35) - 100% Recovery - Sample collected from depth range 4.57 - 5.33 m			SPT 4			15 16
5									17
			End of Borehole at 5.33 m. - Borehole backfilled with cuttings, bentonite (from 4.27 to 4.57m), and patched with cold mix asphalt. - No groundwater observed upon completion. - Borehole location measured using handheld GPS. Locations considered accurate to +/- 5 m horizontal.						18 19
6									

Contractor: Omega Drilling	Completion Depth: 5.33 m
Drilling Rig Type: B54 Auger Truck	Start Date: 2022 May 4
Logged By: EE	Completion Date: 2022 May 4
Reviewed By: KS	Page 1 of 1

BRITISH COLUMBIA
Ministry of Transportation & Infrastructure

Borehole No: **BH22-09**

Project: Geotechnical Investigation	Project No: 704-TRN.PAVE03225-08
Location: Sechelt Inlet Road	
Sechelt, BC	UTM: 445629.28 E; 5481776.06 N; Z 10

Depth (m)	Method	Core Diameter (mm)	Soil Description	Graphical Representation	Sample Type	Sample Number	Field Blowcount (blows/300 mm) □ SPT (20 40 60 80)	Plastic Limit / Moisture Content / Liquid Limit (20 40 60 80)	Depth (ft)
0			Asphalt 130 mm.						0
			SPT at 0.13 m: 9/13/15/13/12 (N=28) - 100% Recovery - Sample collected from depth range 0.13 - 0.91 m			SPT 1	□		1
			SAND and GRAVEL (ROAD BASE), trace silt, dry, compact, dark brown.						2
			SAND (SUBBASE), some gravel, trace silt, damp, compact, light brown.			G 1			3
1									4
			SPT at 1.52 m: 6/8/12/13/12 (N=20) - 100% Recovery - Sample collected from depth range 1.52 - 2.28 m			SPT 2	□	●	5
2	Solid Stem Auger								6
			SAND (INFERRED NATIVE), gravelly, trace silt, damp, loose, light brown.						7
						G 2			8
									9
3			SPT at 3.05 m: 2/3/6/5/5 (N=9) - 100% Recovery - Sample collected from depth range 3.05 - 3.81 m			SPT 3	□	●	10
									11
			SAND, trace gravel, trace silt, damp, loose, orange-brown; coarse sand.						12
						G 3			13
4									14
									15
	SPT		SPT at 4.57 m: 3/6/7/9/7 (N=13) - 100% Recovery - Sample collected from depth range 4.57 - 5.33 m			SPT 4	□	●	16
5									17
			End of Borehole at 5.33 m. - Borehole backfilled with cuttings, bentonite (from 4.27 to 4.57m), and patched with cold mix asphalt. - No groundwater observed upon completion. - Borehole location measured using handheld GPS. Locations considered accurate to +/- 5 m horizontal.						18
									19
6									

TETRA TECH

Contractor: Omega Drilling	Completion Depth: 5.33 m
Drilling Rig Type: B54 Auger Truck	Start Date: 2022 May 4
Logged By: EE	Completion Date: 2022 May 4
Reviewed By: KS	Page 1 of 1

APPENDIX D

LABORATORY TESTING RESULTS

MOISTURE CONTENT TEST RESULTS

ASTM D2216

Project: Geotechnical Investigation, Sechelt Inlet Road
Project No.: 704-TRN.PAVE03225-08
Client: MoTI
Project Engineer: Vipin Sharma

Sample No.: 110
Date Tested: May 18, 2022
Tested By: EE
Page: 1 of 1

B.H. Number	Sample Number Depth (m)	Moisture Content (%)	Visual Description of Soil
BH22-01	G2 @ 0.6 - 0.9	1.2	GRAVEL and SAND, trace silt, dry, brown
BH22-02	G3 @ 2.4 - 2.7	3.0	SAND, trace gravel, trace silt, damp, light brown
BH22-03	G2 @ 0.9 - 1.2	2.5	SAND and GRAVEL, trace silt, damp, light brown
BH22-06	G1 @ 0.1 - 0.3	3.3	SAND and GRAVEL, trace silt, damp, brown
BH22-07	SPT2 @ 1.5 - 2.3	1.9	SAND, trace gravel, trace silt, dry, light brown
BH22-08	SPT2 @ 1.5 - 2.3	3.4	SAND, trace gravel, damp, light brown; coarse
BH22-08	G3 @ 3.7 - 4.0	3.4	SAND, some silt, trace gravel, damp, light brown
BH22-08	SPT4 @ 4.6 - 5.3	2.8	SAND, trace silt, damp, light brown
BH22-09	SPT2 @ 1.5 - 2.3	2.8	SAND, trace gravel, trace silt, damp, light brown; medium to coarse
BH22-09	SPT3 @ 3.0 - 3.8	3.3	SAND, some gravel, trace silt, damp, light brown; coarse
BH22-09	SPT4 @ 4.6 - 5.3	2.3	SAND, some gravel, trace silt, damp, orange brown; coarse

Reviewed By: _____ ASc.T.

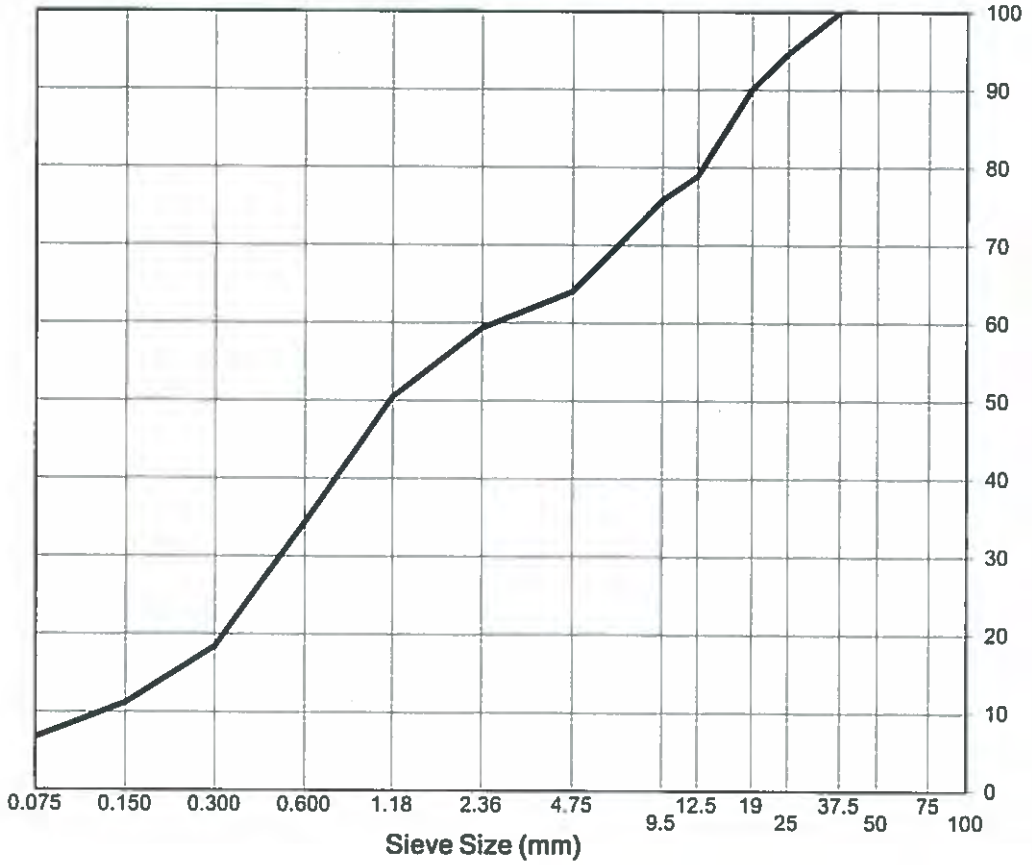
TETRA TECH

SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.:	704-TRN.PAVE03225-08	Sample No.:	111
Project:	Geotechnical Investigation, Sechelt Inlet Road	Date Sampled:	May 4, 2022
Client:	MoTI	Sampled by:	EE
Attention:		Date Tested:	May 18, 2022
Email:		Tested by:	EE Office: Nanaimo
Description:	SAND and GRAVEL, trace silt, damp, brown	Moisture Content (as received):	4.9%
		No. Crushed Faces:	Two (2) or Three (3)
Source:	BH22-03	By particle mass:	
Supplier:	N/A		
Sample Location:	G1 @ 0.1 - 0.2 m		
Specification:	N/A		

Sieve Size	Percent Passing
37.5	100
25	95
19	90
12.5	79
9.5	76
4.75	64
2.36	59
1.18	50
0.600	34
0.300	18
0.150	11
0.075	6.8



Remarks:

Reviewed By: ASc.T.

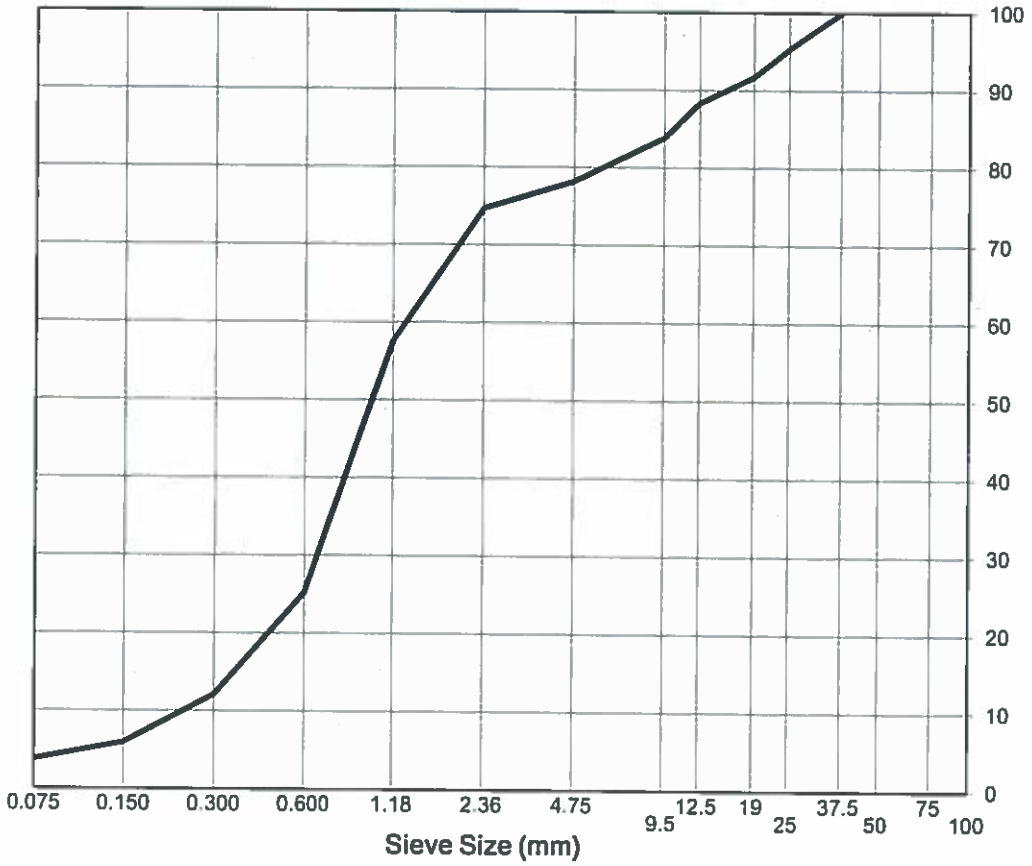
TETRA TECH

SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.:	704-TRN.PAVE03225-08	Sample No.:	112
Project:	Geotechnical Investigation, Sechelt Inlet Road	Date Sampled:	May 4, 2022
Client:	MoTI	Sampled by:	EE
Attention:		Date Tested:	May 18, 2022
Email:		Tested by:	EE Office: Nanaimo
Description:	SAND, gravelly, trace silt, damp, light brown	Moisture Content (as received):	3.0%
		No. Crushed Faces:	Two (2) or Three (3)
Source:	BH22-04	By particle mass:	
Supplier:	N/A		
Sample Location:	G2 @ 0.9 - 1.2 m		
Specification:	N/A		

Sieve Size	Percent Passing
37.5	100
25	95
19	92
12.5	88
9.5	84
4.75	78
2.36	75
1.18	58
0.600	25
0.300	12
0.150	6
0.075	3.8



Remarks:

Reviewed By: _____ ASc.T.

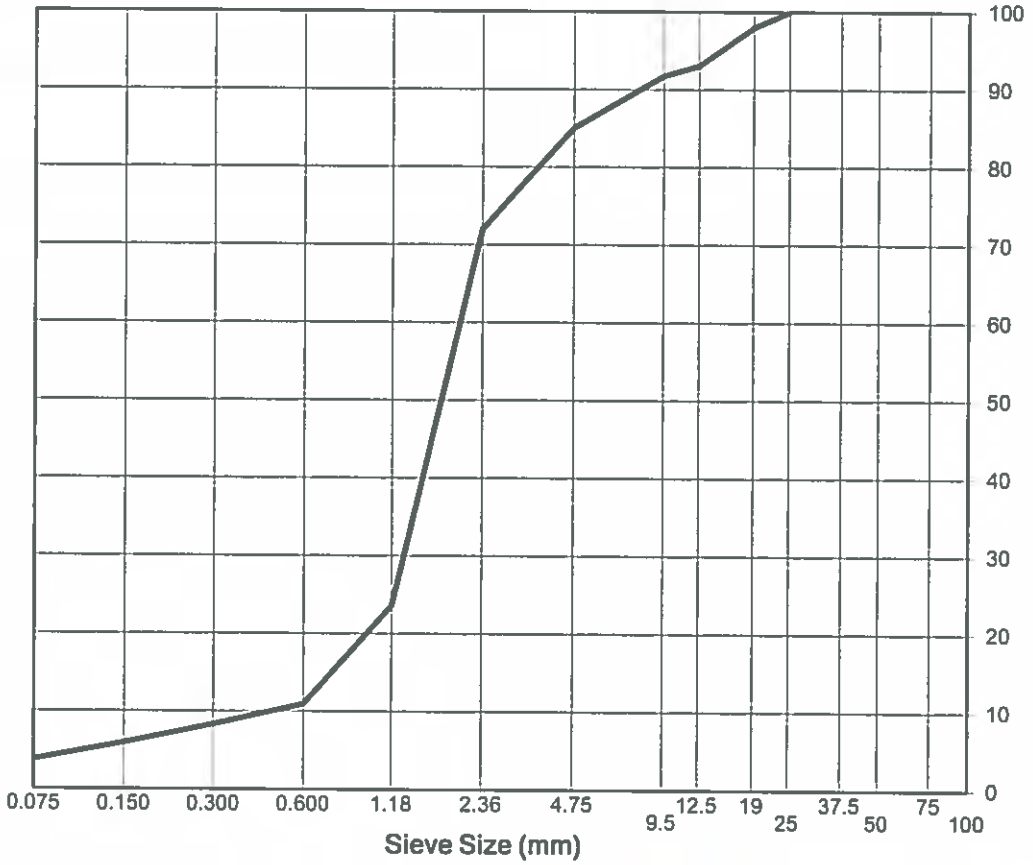
TETRA TECH

SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.:	704-TRN.PAVE03225-08	Sample No.:	113
Project:	Geotechnical Investigation, Sechelt Inlet Road	Date Sampled:	May 4, 2022
Client:	MoTI	Sampled by:	EE
Attention:		Date Tested:	May 18, 2022
Email:		Tested by:	EE Office: Nanaimo
Description:	SAND, some gravel, trace silt, damp, light brown	Moisture Content (as received):	4.1%
		No. Crushed Faces:	Two (2) or Three (3)
Source:	BH22-04	By particle mass:	
Supplier:	N/A		
Sample Location:	G4 @ 4.0 - 4.3 m		
Specification:	N/A		

Sieve Size	Percent Passing
25	100
19	98
12.5	93
9.5	92
4.75	85
2.36	72
1.18	24
0.600	11
0.300	8
0.150	6
0.075	3.8



Remarks:

Reviewed By: ASc.T.

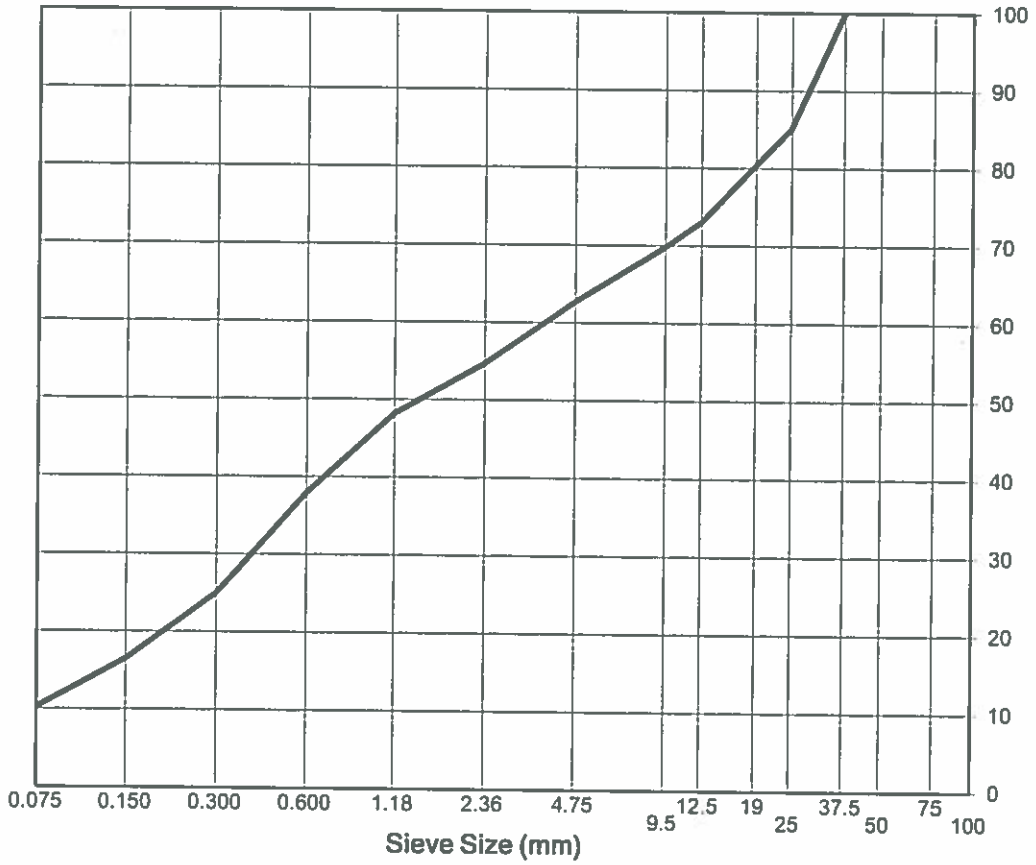
TETRA TECH

SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.:	704-TRN.PAVE03225-08	Sample No.:	114
Project:	Geotechnical Investigation, Sechelt Inlet Road	Date Sampled:	May 4, 2022
Client:	MoTI	Sampled by:	EE
Attention:		Date Tested:	May 18, 2022
Email:		Tested by:	EE Office: Nanaimo
Description:	SAND and GRAVEL, some silt, damp, brown	Moisture Content (as received):	3.7%
		No. Crushed Faces:	Two (2) or Three (3)
Source:	BH22-05	By particle mass:	
Supplier:	N/A		
Sample Location:	G1 @ 0.1 - 0.2 m		
Specification:	N/A		

Sieve Size	Percent Passing
37.5	100
25	85
19	80
12.5	73
9.5	70
4.75	63
2.36	55
1.18	48
0.600	38
0.300	25
0.150	17
0.075	10.3



Remarks:

Reviewed By: ASc.T.

TETRA TECH

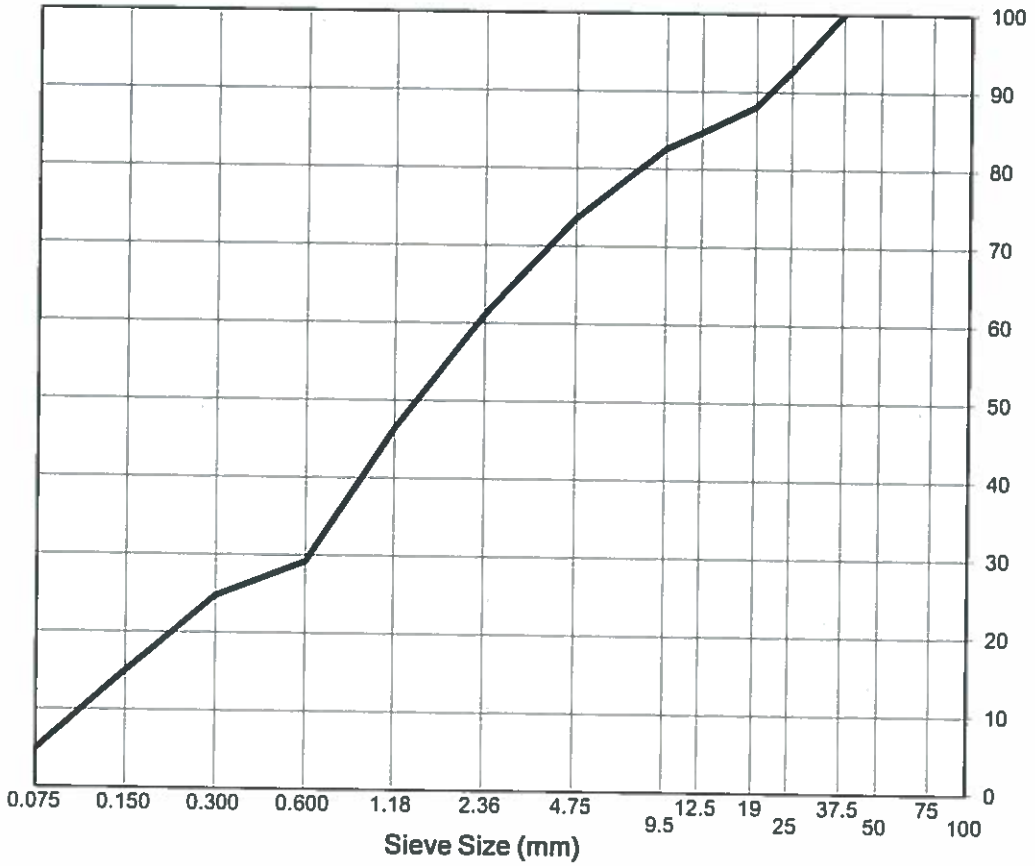
SIEVE ANALYSIS REPORT

Washed Sieve: ASTM C136 and C117

Project No.: 704-TRN.PAVE03225-08
Project: Geotechnical Investigation, Sechelt Inlet Road
Client: MoTI
Attention:
Email:
Description: SAND, gravelly, trace silt, damp, light brown
Source: BH22-06
Supplier: N/A
Sample Location: G4 @ 2.4 - 2.7 m
Specification: N/A

Sample No.: 115
Date Sampled: May 4, 2022
Sampled by: EE
Date Tested: May 18, 2022
Tested by: EE Office: Nanaimo
Moisture Content (as received): 3.1%
No. Crushed Faces: Two (2) or Three (3)
By particle mass:

Sieve Size	Percent Passing
37.5	100
25	93
19	88
12.5	85
9.5	83
4.75	74
2.36	61
1.18	46
0.600	29
0.300	25
0.150	15
0.075	4.9



Remarks:

Reviewed By: ASc.T.

TETRA TECH

APPENDIX E

CLIMATE CHANGE DESIGN CRITERIA

Design Criteria Sheet for Climate Change Resilience

Highway Infrastructure Engineering Design and Climate Change Adaptation
BC Ministry of Transportation and Infrastructure
(Separate Criteria Sheet per Discipline)
(Submit all sheets to the Chief Engineers Office at:
BCMoTI-ChiefEngineersOffice@gov.bc.ca)

Project:	*East Porpoise Bay Road Improvements*
Type of work:	*Retaining Wall Design*
Location:	*East Porpoise Bay Road / Sechelt Inlet Rd (between Xenichen Ave and Delta Rd)*
Discipline:	*Geotechnical*

Design Component	Design Life or Return Period	Design Criteria + (Units)	Design Value Without Climate Change	Change in Design Value from Future Climate	Design Value Including Climate Change	Adaptation Cost Estimate ($)	Comments / Notes / Deviations / Variances
Retaining Wall and Embankment Slopes	100 year	Phreatic Surface Elevation (m)	Ambient	+1.5 m	Ambient + 1.5 m	N/A	See below

Explanatory Notes / Discussion:

The stability of the embankment and retaining wall slopes for the project is dependent on the phreatic surface through the slopes. While no guidance is provided by MoTI (2022) in the S6-19 Supplement for the phreatic surface to be used in embankment stability analysis, stability is typically based on ambient conditions of the phreatic surface observed during drilling and/or from monitoring wells/piezometers on site. Climate change has the potential to increase the phreatic surface, resulting in reduced stability. Climate change may also reduce groundwater levels (e.g., due to more prolonged drought), but this would result in improved stability, so is not discussed here.

We have divided potential increases in the phreatic surface due to climate change is divided into 2 components (or causes):

1) Infiltration of surface water from a climate change adjusted design storm event (accounts for approximately 0.5 m increase in phreatic surface)
2) Increase in groundwater elevation from increase in sea level (accounts for approximately 1.0 m increase in phreatic surface).

<u>Component 1 – Infiltration from storm event</u>

The first component causing a rise in phreatic surface is infiltration from a design storm event. A storm event with return period of 100 years was considered (for a design life extending to 2100) and considered rainfall accumulation over a 2-day (48 hour) period.

- Rainfall intensity estimated for the ungauged project location from the IDF_CC Tool, Version 6.5 (Simonovic et al, 2015) to the year 2100, using a PCIC – Bias Corrected CMIP6 climate change model with shared socioeconomic pathway (SSP) 8.5 climate change scenario, which represents a “non-climate” policy pathway.
    - IDF_CC tool indicates that total 24-hour rainfall for 100-year return period storm under this scenario is 119 mm.
    - IDF_CC tool does not provide 48-hour rainfall intensities. The 24-hour rainfall was doubled to get a 48-hour total rainfall of 238 mm.
- The site is located in an area that is primarily residential and light industrial/commercial and includes a small amount of forested area. The terrain in the area is generally gently rolling to flat (with the exception of the road embankment

drop off where the retaining walls are located). Per MoTI (2019) Supplement to TAC Geometric Design Guide, these areas will have runoff coefficients of 0.4 to 0.8, resulting in 20% to 60% infiltration (assuming no evapotranspiration), with larger infiltration occurring in forested area. For this project, we have assumed an infiltration rate of 50%, which is considered conservative, given the limited amount of forest cover in the area.

- Porosity of the soil materials is variable, but was assumed to range from 0.25 to 0.6, and it was assumed that all the pore space would be filled with water. The lower end porosity was assumed, as this would result in the in the largest increase in phreatic surface elevation.

Resulting increase in phreatic surface elevation = $(0.238\ m) \times (0.5) \div (0.25) = 0.48\ m\ (rounded\ up\ to\ 0.5\ m\ for\ modelling)$

Rainfall Infiltration Porosity

Component 2 – Sea Level Rise

The second component contributing to the rise in the phreatic surface is sea level rise due to climate change. According to the British Columbia Ministry of Environment, it is suggested to consider a sea level rise of 1.0 meter by 2100 (Sunshine Coast Regional District, 2021).

Adaptation Cost Estimate

Given the relatively low water table in the area, it was found that even an increase in phreatic surface level of 1.5 m would not significantly impact the wall design. Since this doesn't govern, there is no significant adaptation cost estimate.

REFRENCES

GEOSLOPE International Ltd. (GeoSlope). 2021. Geostudio 2021.3 Slope/W, Version 11.0.1.21429.

MoTI. 2019. Supplement to TAC Geometric Design Guide, MoTI Section 1000, Hydraulic Chapter. April, 2019.

MoTI. 2022. Bridge Standards and Procedures Manual Volume 1 Supplement to CHBDC S6:19. July, 2022.

Simonovic, S.P., Schardong, A., Srivastav, R., and Sandink, D. 2015. IDF_CC Web-based Tool for Updating Intensity-Duration-Frequency Curves to Changing Climate – ver 6.5. Western University Facility for Intelligent Decision Support and Institute for Catastrophic Loss Reduction. https://idf-cc-uwo.ca/idfgrid [accessed June 29, 2023].

Sunshine Coast Regional District. 2021. Community Action Plan. Future Climatic Projections. https://letstalk.scrd.ca/climate?utm_source=coast%20reporter&utm_campaign=coast%20reporter%3A%20outbound&utm_medium=referral [accessed on July 5, 2023]

Recommended by: Engineer of Record: _____
(Print Name / Provide Seal & Signature)

Date: _____

Engineering Firm: _____

Accepted by BCMoTI Consultant Liaison: _____
(For External Design)

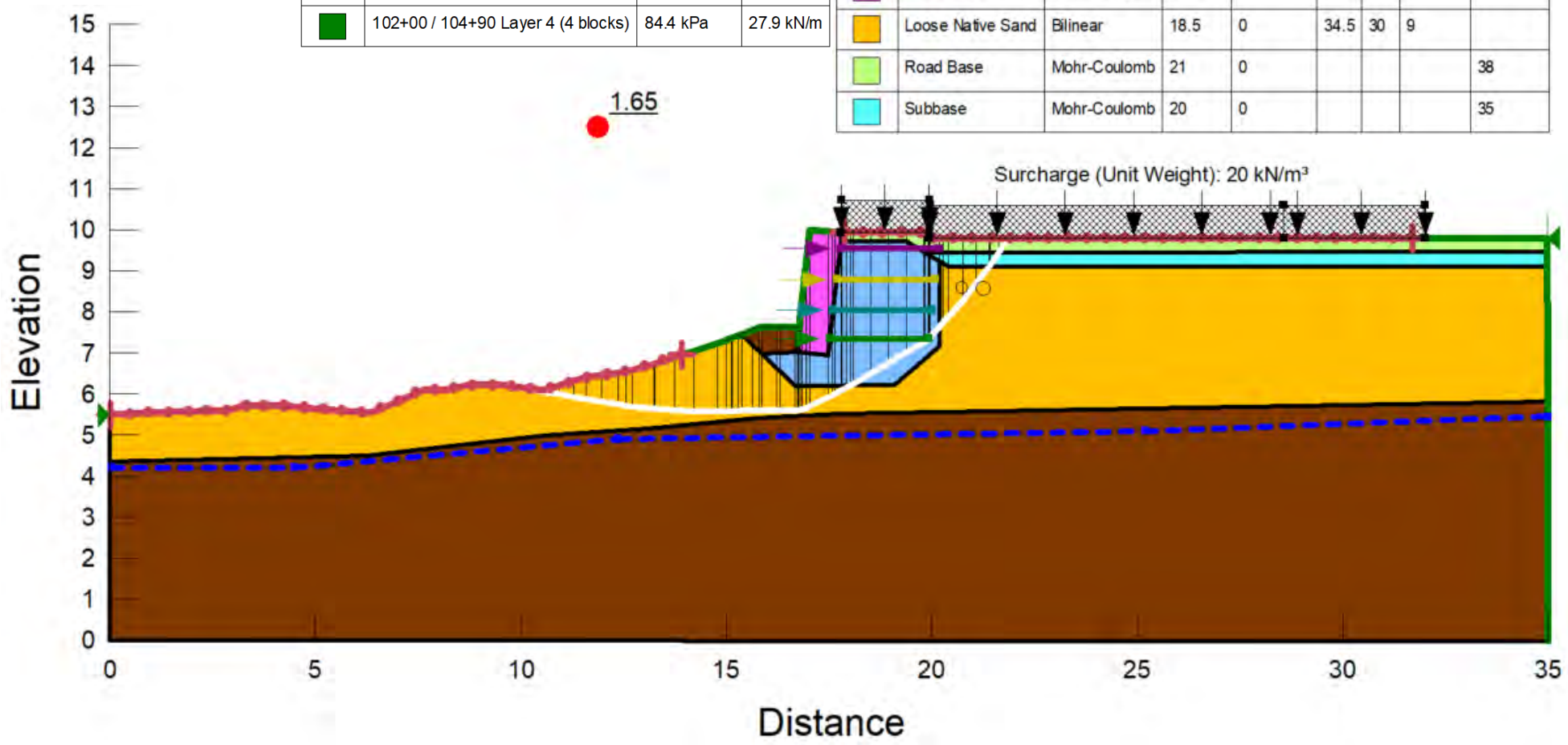
Deviations and Variances Approved by the Chief Engineer: _____
Program Contact: Chief Engineer BCMoTI

APPENDIX F

STABILITY MODELLING RESULTS

Color	Name	Factored Pullout Resistance	Factored Tensile Capacity
	102+00 / 104+90 Layer 1 (4 blocks)	9.9 kPa	27.9 kN/m
	102+00 / 104+90 Layer 2 (4 blocks)	27.3 kPa	27.9 kN/m
	102+00 / 104+90 Layer 3 (4 blocks)	52.1 kPa	27.9 kN/m
	102+00 / 104+90 Layer 4 (4 blocks)	84.4 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY STATIC LOADING STATION 102+00

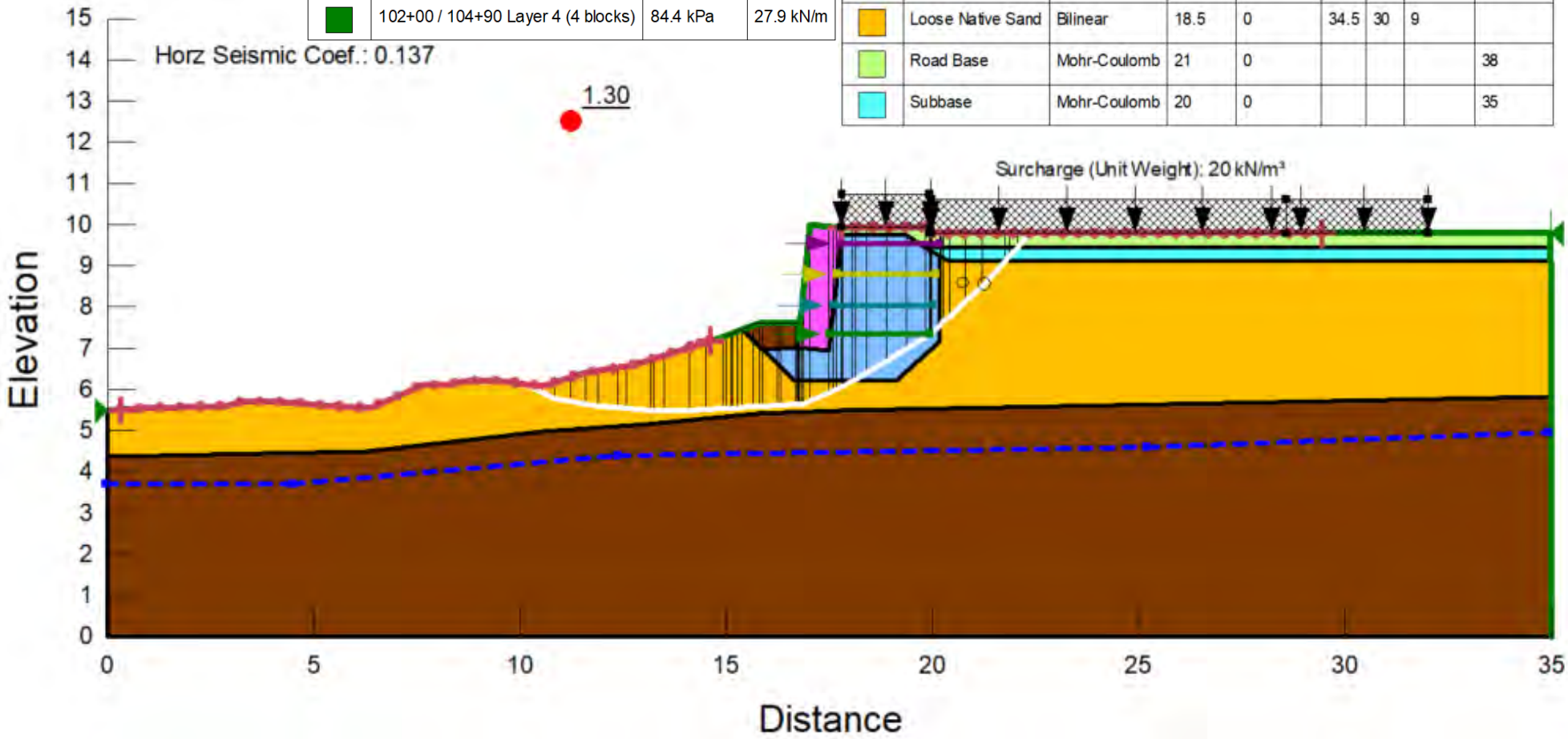
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE	DATE
VANCOUVER	JANUARY 24, 2023

Figure F1

Color	Name	Factored Pullout Resistance	Factored Tensile Capacity
	102+00 / 104+90 Layer 1 (4 blocks)	9.9 kPa	27.9 kN/m
	102+00 / 104+90 Layer 2 (4 blocks)	27.3 kPa	27.9 kN/m
	102+00 / 104+90 Layer 3 (4 blocks)	52.1 kPa	27.9 kN/m
	102+00 / 104+90 Layer 4 (4 blocks)	84.4 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY PSEUDO-STATIC LOADING STATION 102+00

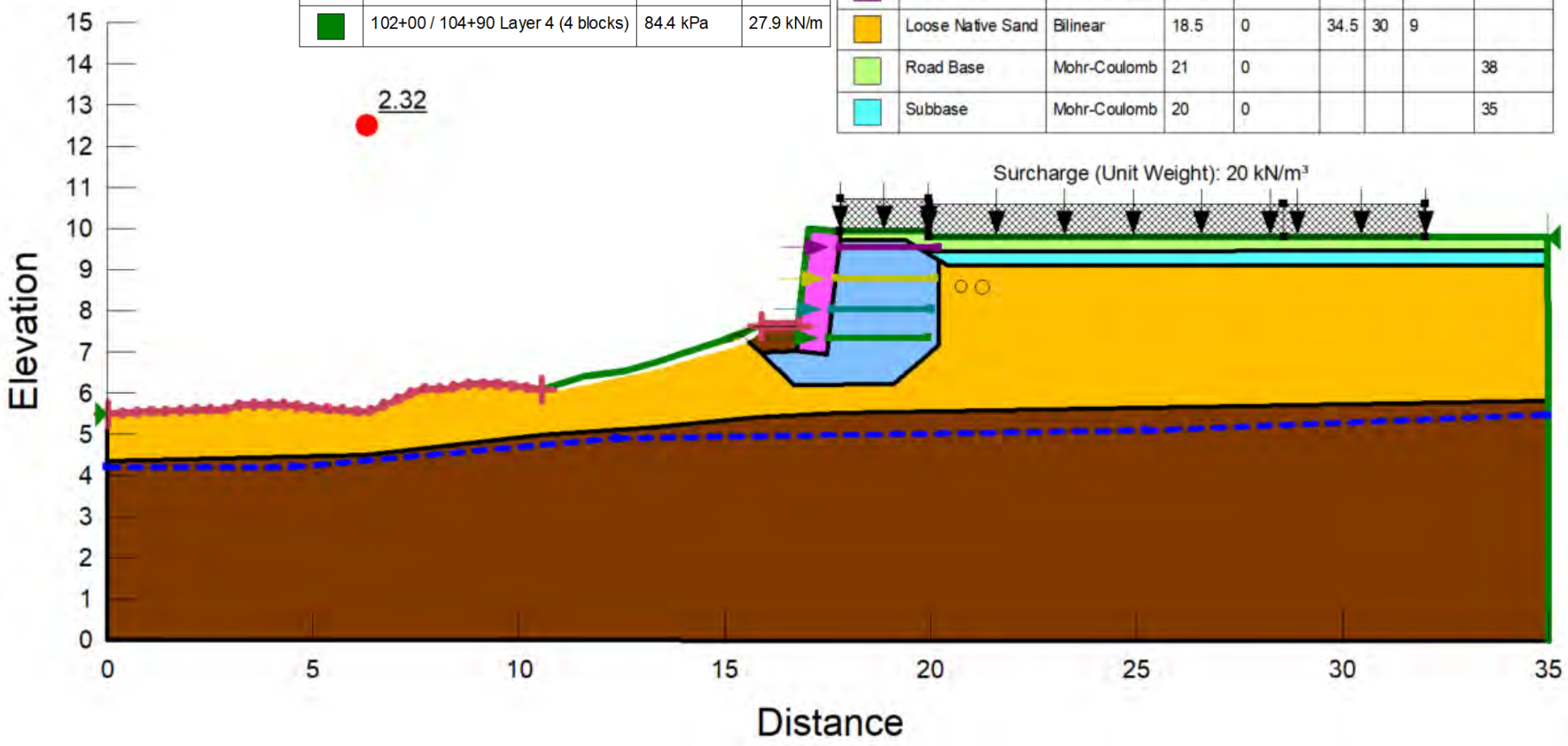
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F2

Color	Name	Factored Pullout Resistance	Factored Tensile Capacity
	102+00 / 104+90 Layer 1 (4 blocks)	9.9 kPa	27.9 kN/m
	102+00 / 104+90 Layer 2 (4 blocks)	27.3 kPa	27.9 kN/m
	102+00 / 104+90 Layer 3 (4 blocks)	52.1 kPa	27.9 kN/m
	102+00 / 104+90 Layer 4 (4 blocks)	84.4 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY STATIC LOADING STATION 102+00

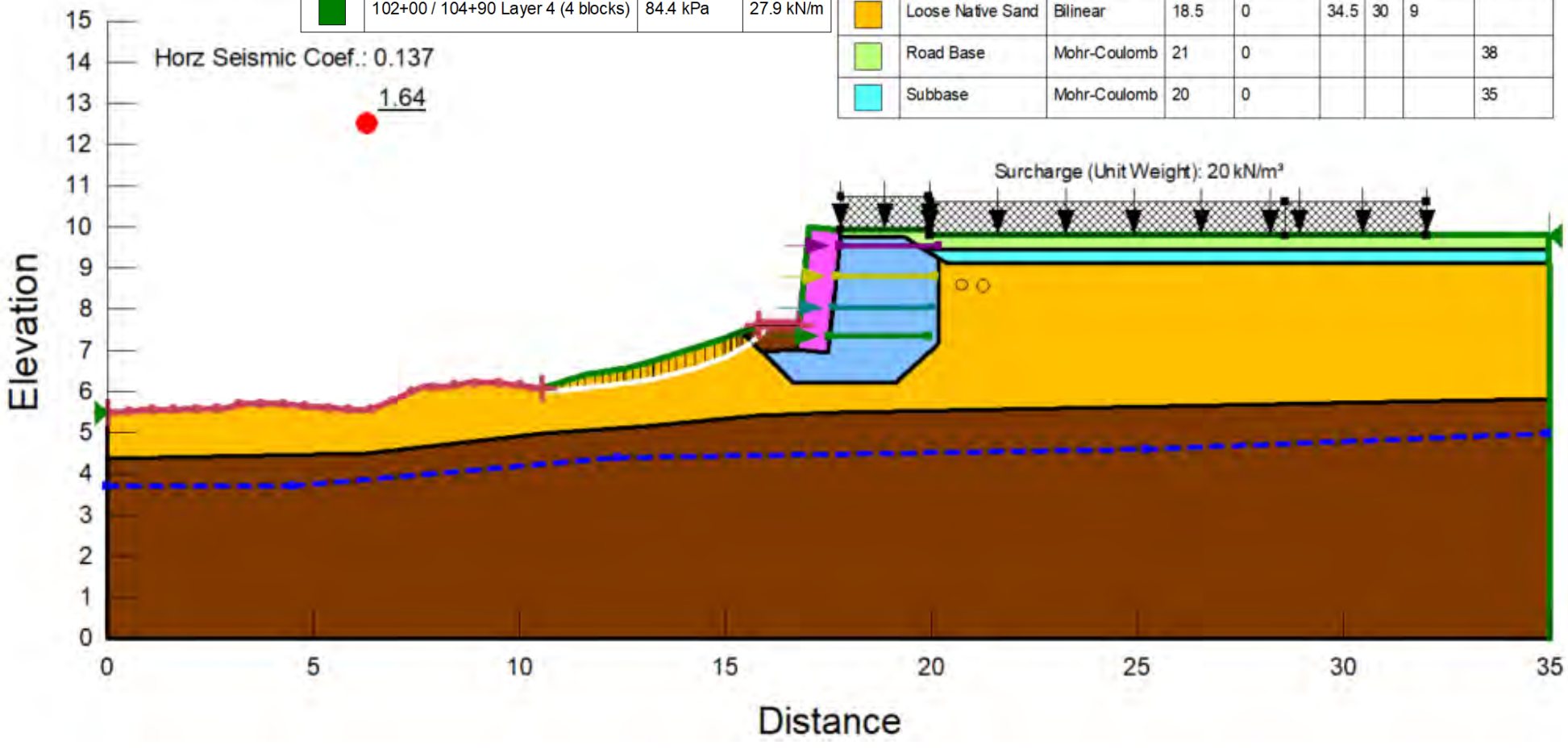
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F3

Color	Name	Factored Pullout Resistance	Factored Tensile Capacity
	102+00 / 104+90 Layer 1 (4 blocks)	9.9 kPa	27.9 kN/m
	102+00 / 104+90 Layer 2 (4 blocks)	27.3 kPa	27.9 kN/m
	102+00 / 104+90 Layer 3 (4 blocks)	52.1 kPa	27.9 kN/m
	102+00 / 104+90 Layer 4 (4 blocks)	84.4 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY PSEUDO-STATIC LOADING STATION 102+00

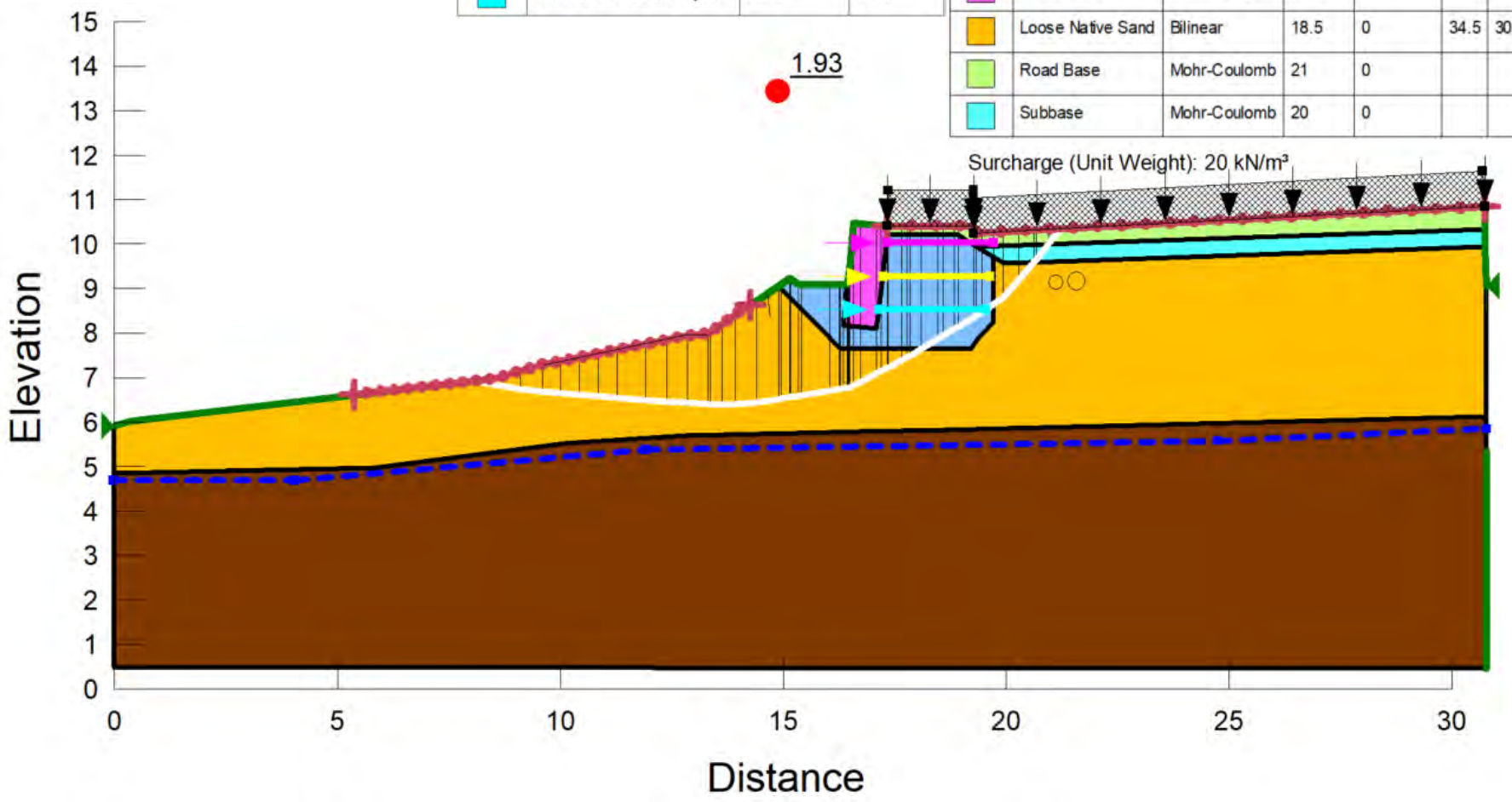
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F4

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
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TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS
GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY
STATIC LOADING
STATION 102+30

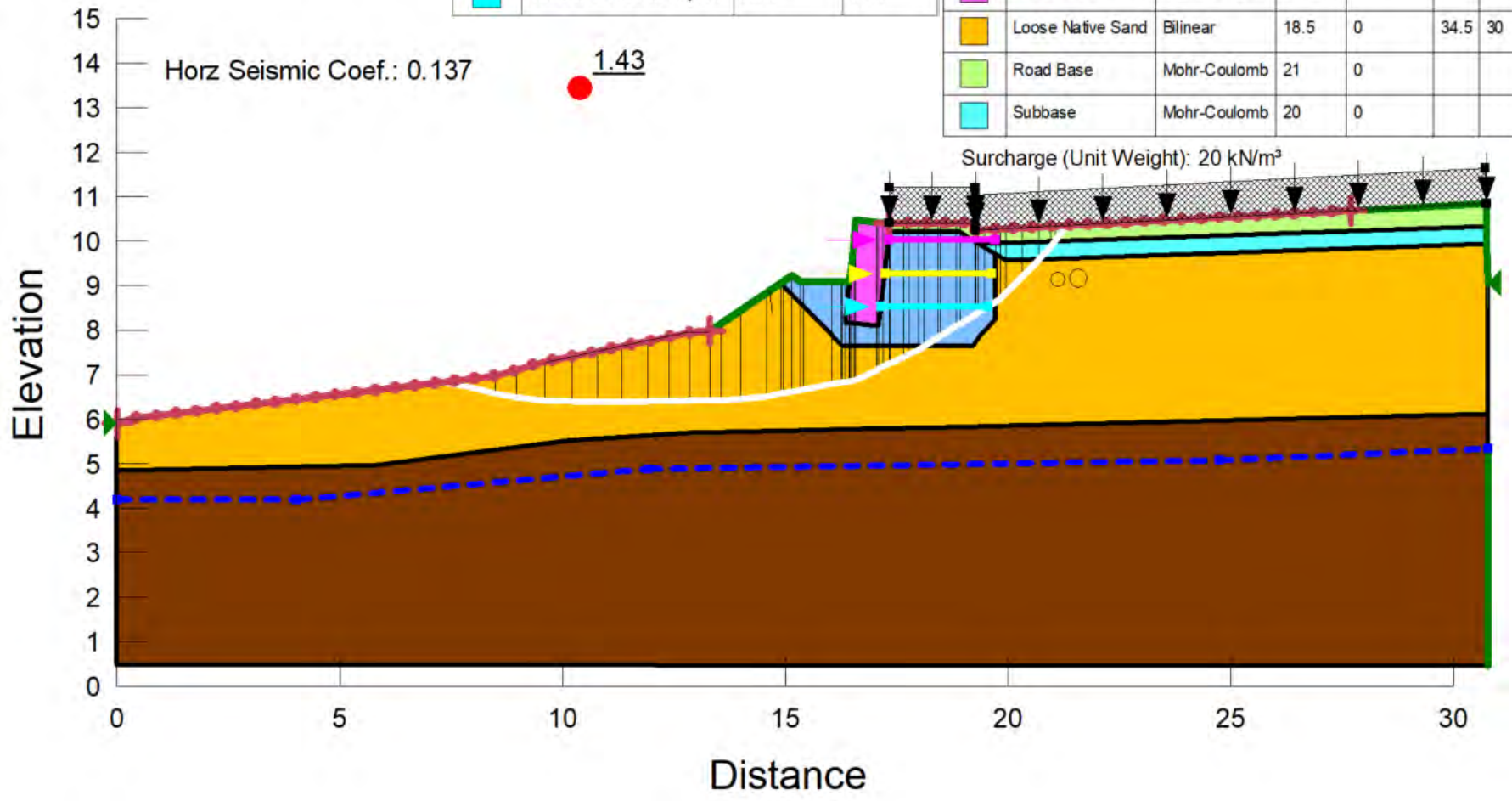
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F5

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
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TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY PSEUDO-STATIC LOADING STATION 102+30

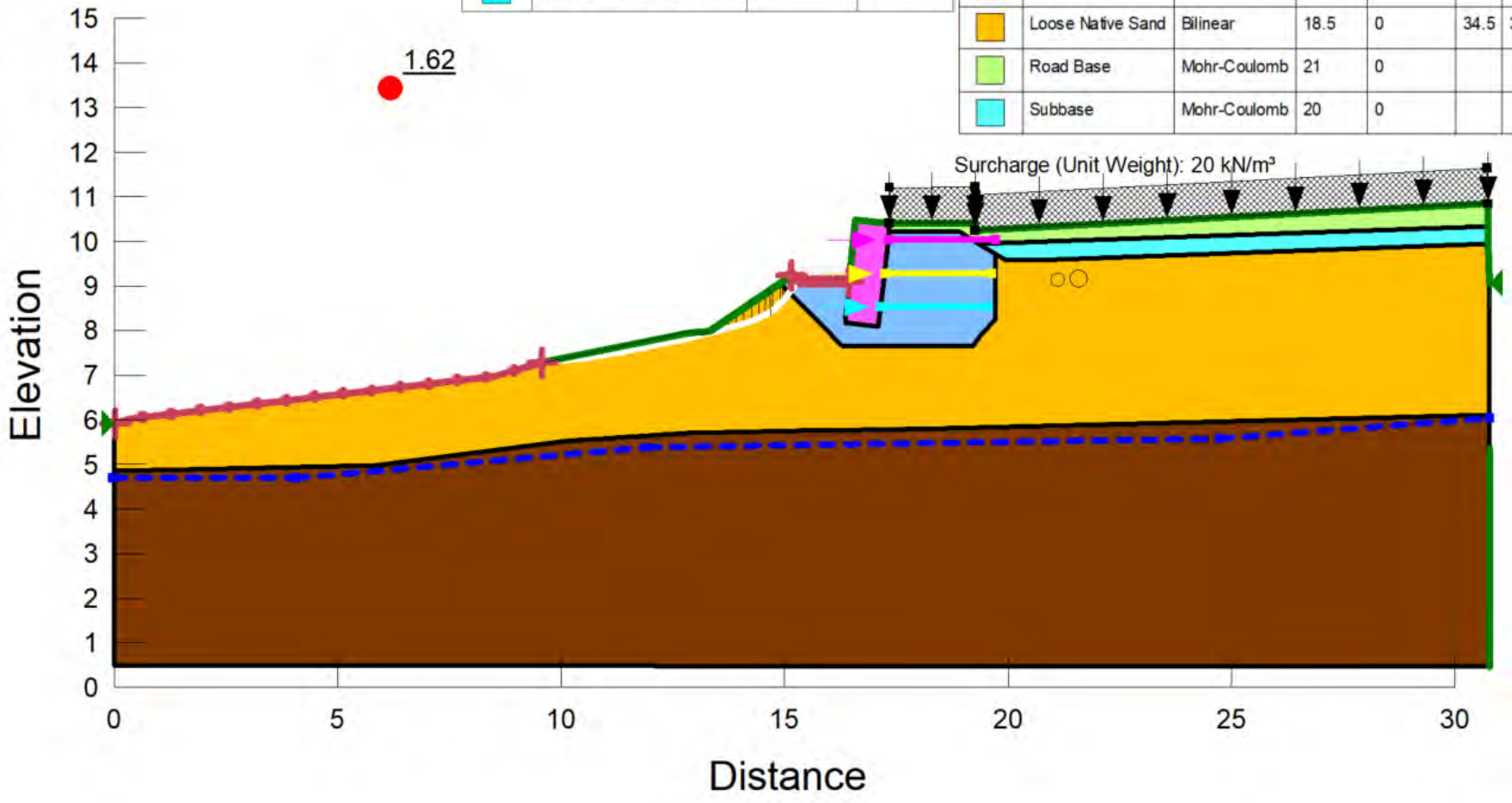
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE	DATE
VANCOUVER	JANUARY 24, 2023

Figure F6

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
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TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY STATIC LOADING STATION 102+30

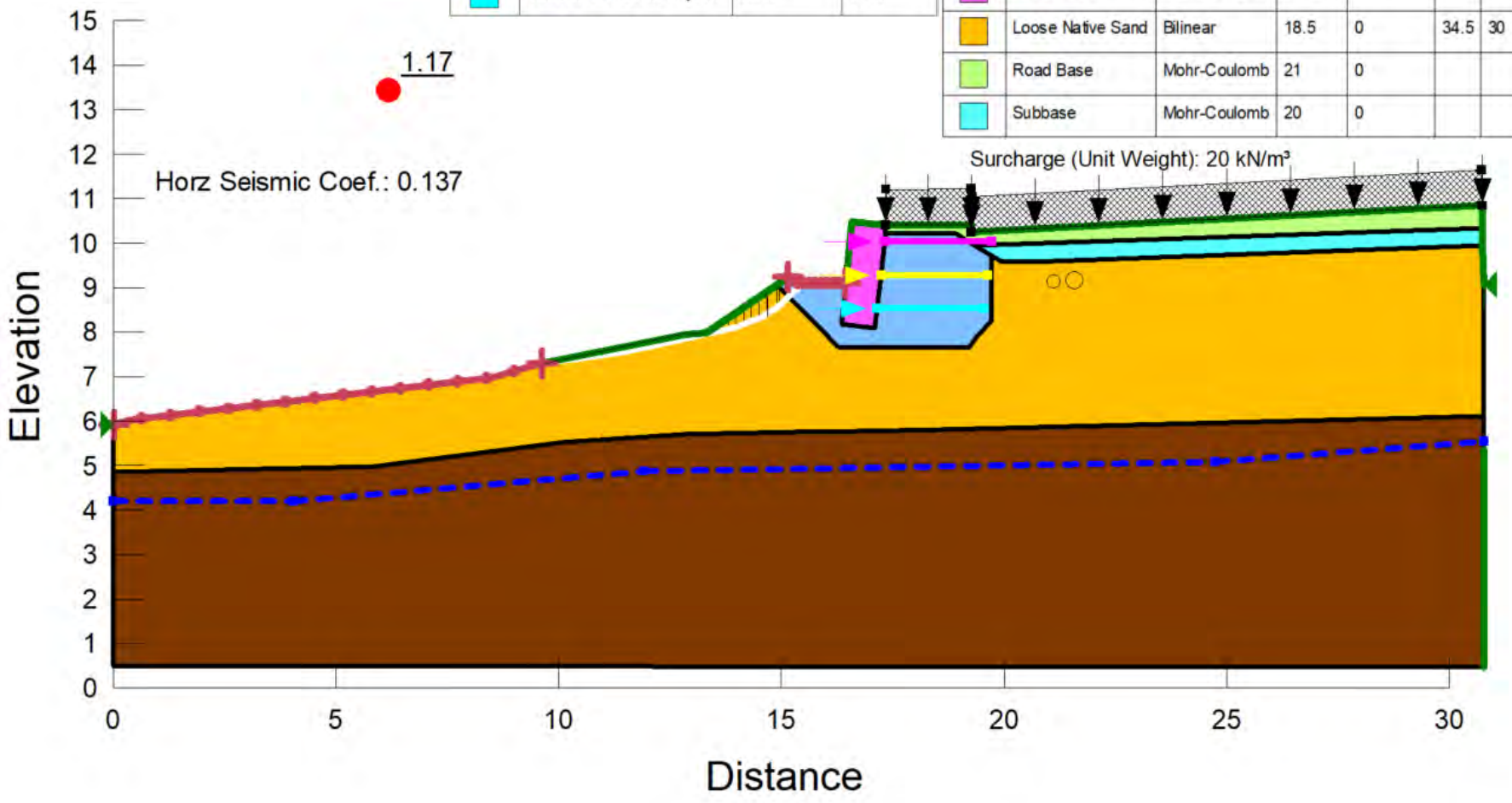
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F7

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

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EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY PSEUDO-STATIC LOADING STATION 102+30

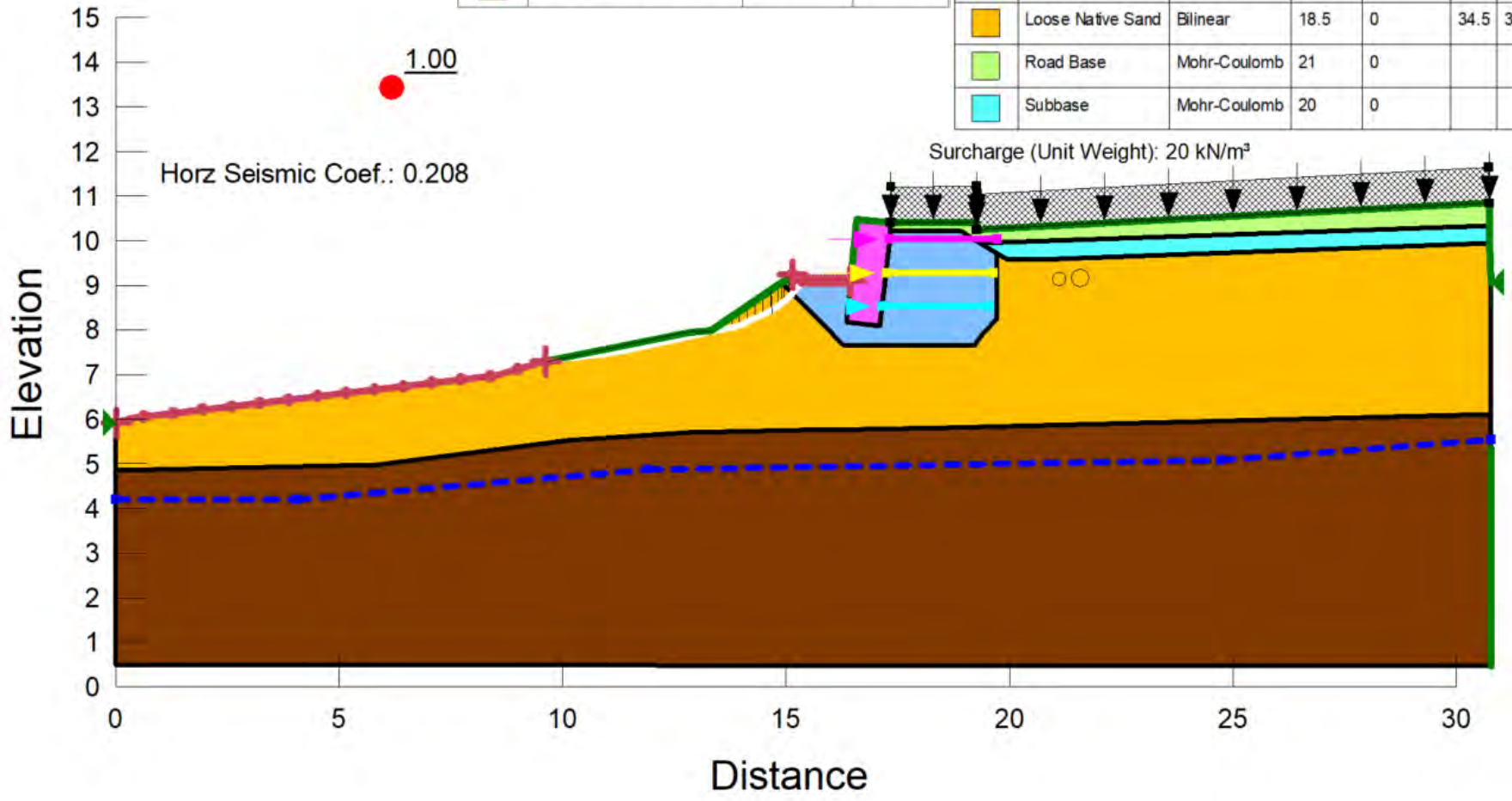
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F8

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

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TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY PSEUDO-STATIC LOADING - YIELD STATION 102+30

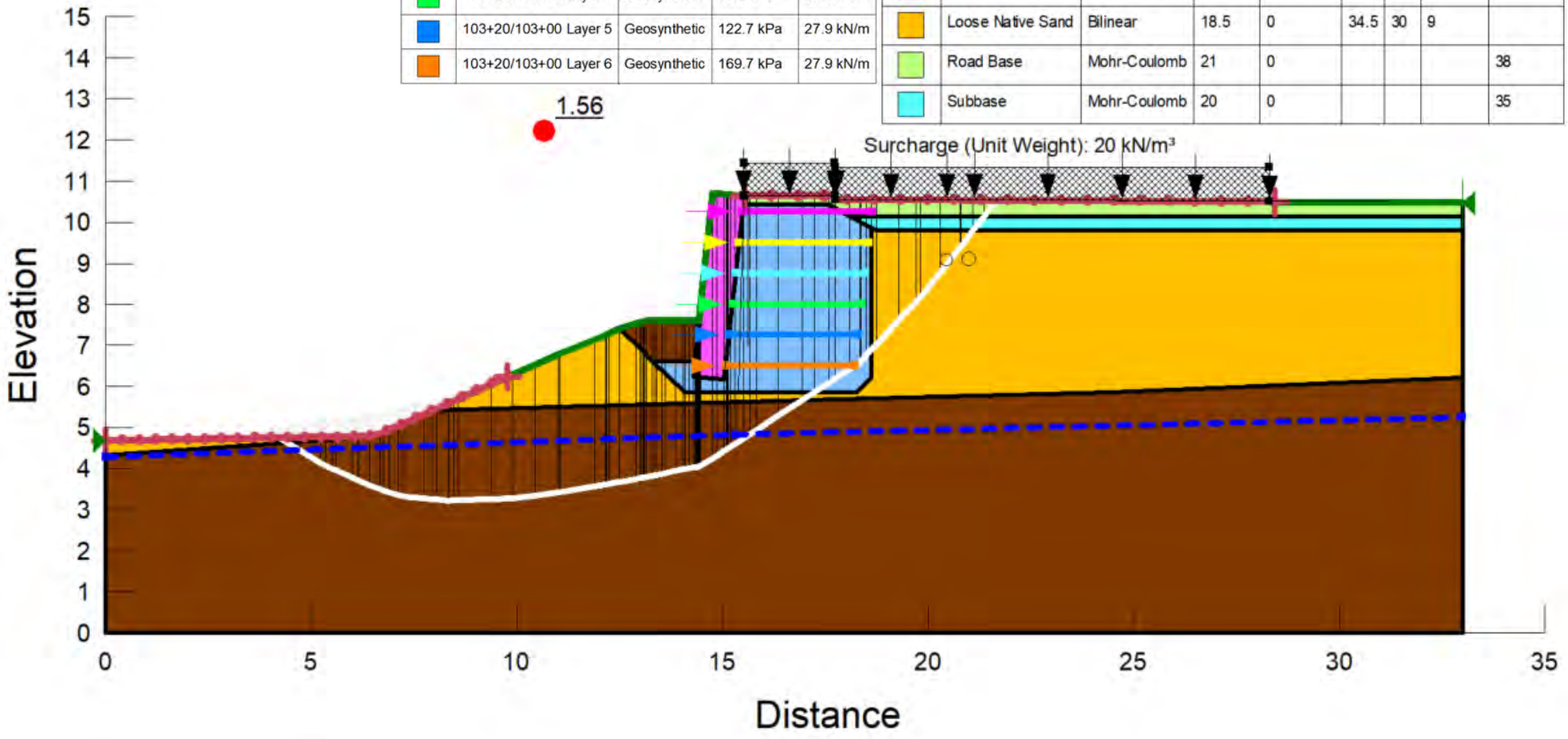
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F9

Color	Name	Type	Factored Pullout Resistance	Factored Tensile Capacity
	103+20/103+00 Layer 1	Geosynthetic	9.6 kPa	27.9 kN/m
	103+20/103+00 Layer 2	Geosynthetic	26.7 kPa	27.9 kN/m
	103+20/103+00 Layer 3	Geosynthetic	51.2 kPa	27.9 kN/m
	103+20/103+00 Layer 4	Geosynthetic	83.2 kPa	27.9 kN/m
	103+20/103+00 Layer 5	Geosynthetic	122.7 kPa	27.9 kN/m
	103+20/103+00 Layer 6	Geosynthetic	169.7 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

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EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY STATIC LOADING STATION 103+00

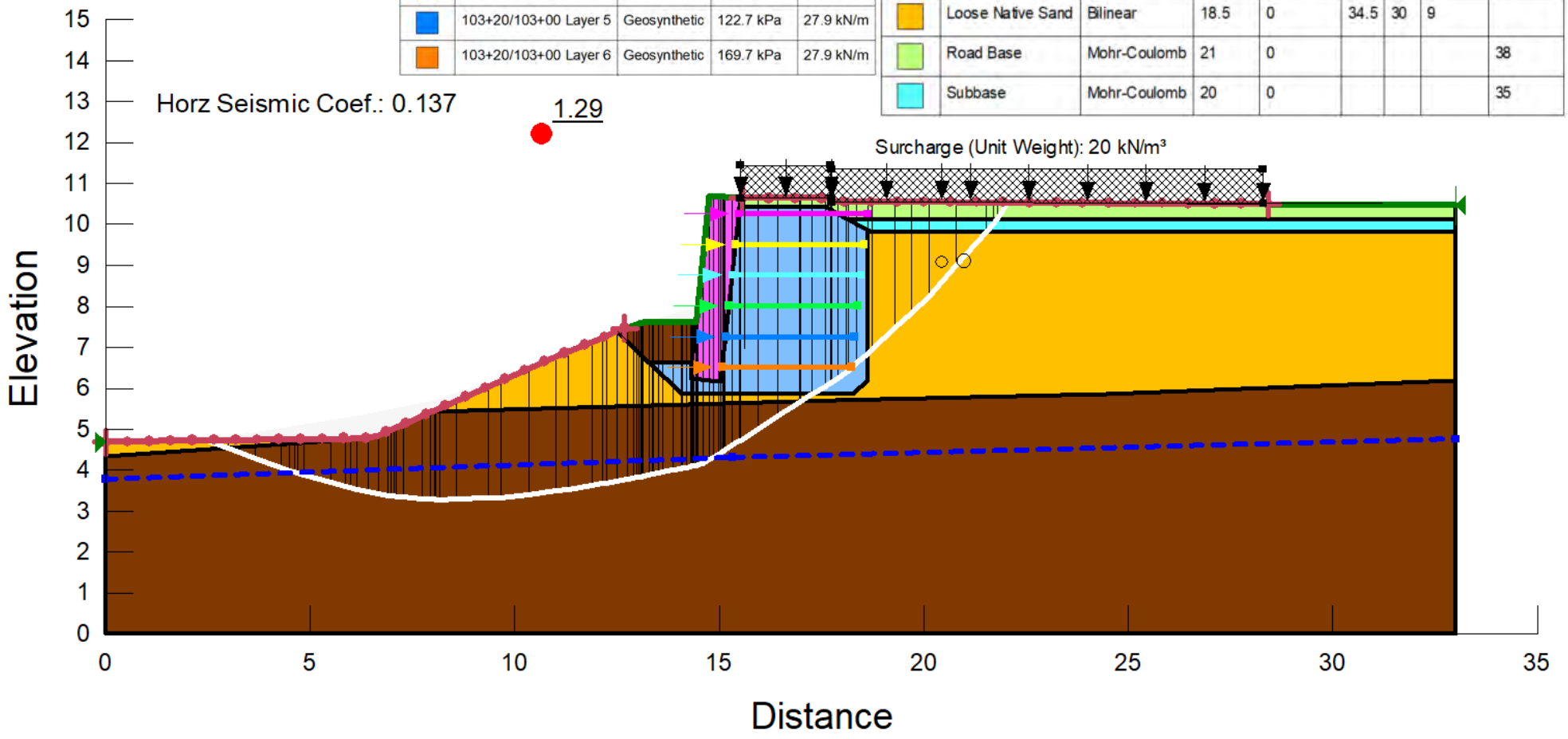
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F10

Color	Name	Type	Factored Pullout Resistance	Factored Tensile Capacity
	103+20/103+00 Layer 1	Geosynthetic	9.6 kPa	27.9 kN/m
	103+20/103+00 Layer 2	Geosynthetic	26.7 kPa	27.9 kN/m
	103+20/103+00 Layer 3	Geosynthetic	51.2 kPa	27.9 kN/m
	103+20/103+00 Layer 4	Geosynthetic	83.2 kPa	27.9 kN/m
	103+20/103+00 Layer 5	Geosynthetic	122.7 kPa	27.9 kN/m
	103+20/103+00 Layer 6	Geosynthetic	169.7 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
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EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY PSEUDO-STATIC LOADING STATION 103+00

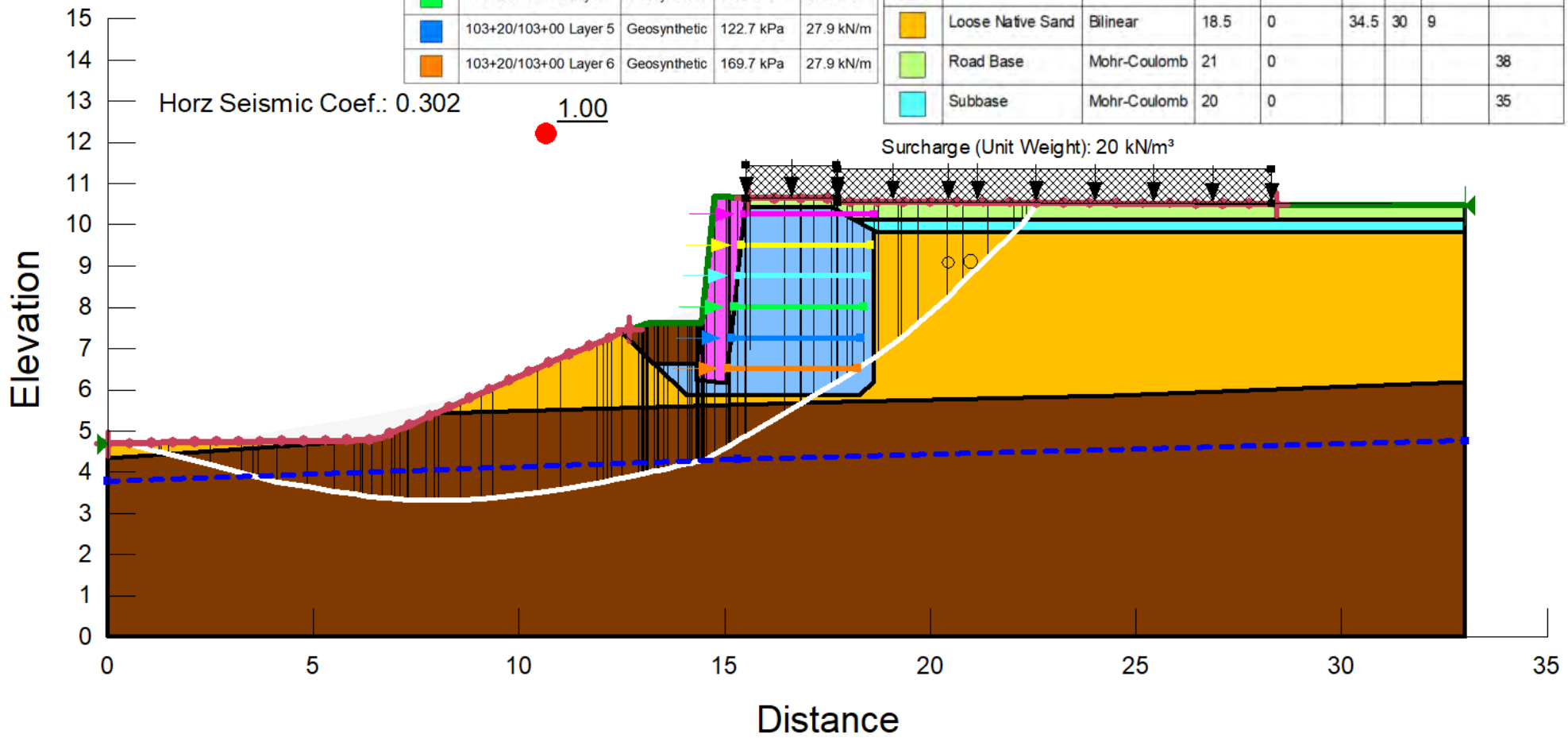
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE	DATE
VANCOUVER	JANUARY 24, 2023

Figure F11

Color	Name	Type	Factored Pullout Resistance	Factored Tensile Capacity
	103+20/103+00 Layer 1	Geosynthetic	9.6 kPa	27.9 kN/m
	103+20/103+00 Layer 2	Geosynthetic	26.7 kPa	27.9 kN/m
	103+20/103+00 Layer 3	Geosynthetic	51.2 kPa	27.9 kN/m
	103+20/103+00 Layer 4	Geosynthetic	83.2 kPa	27.9 kN/m
	103+20/103+00 Layer 5	Geosynthetic	122.7 kPa	27.9 kN/m
	103+20/103+00 Layer 6	Geosynthetic	169.7 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

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EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY PSEUDO-STATIC LOADING -YIELD STATION 103+00

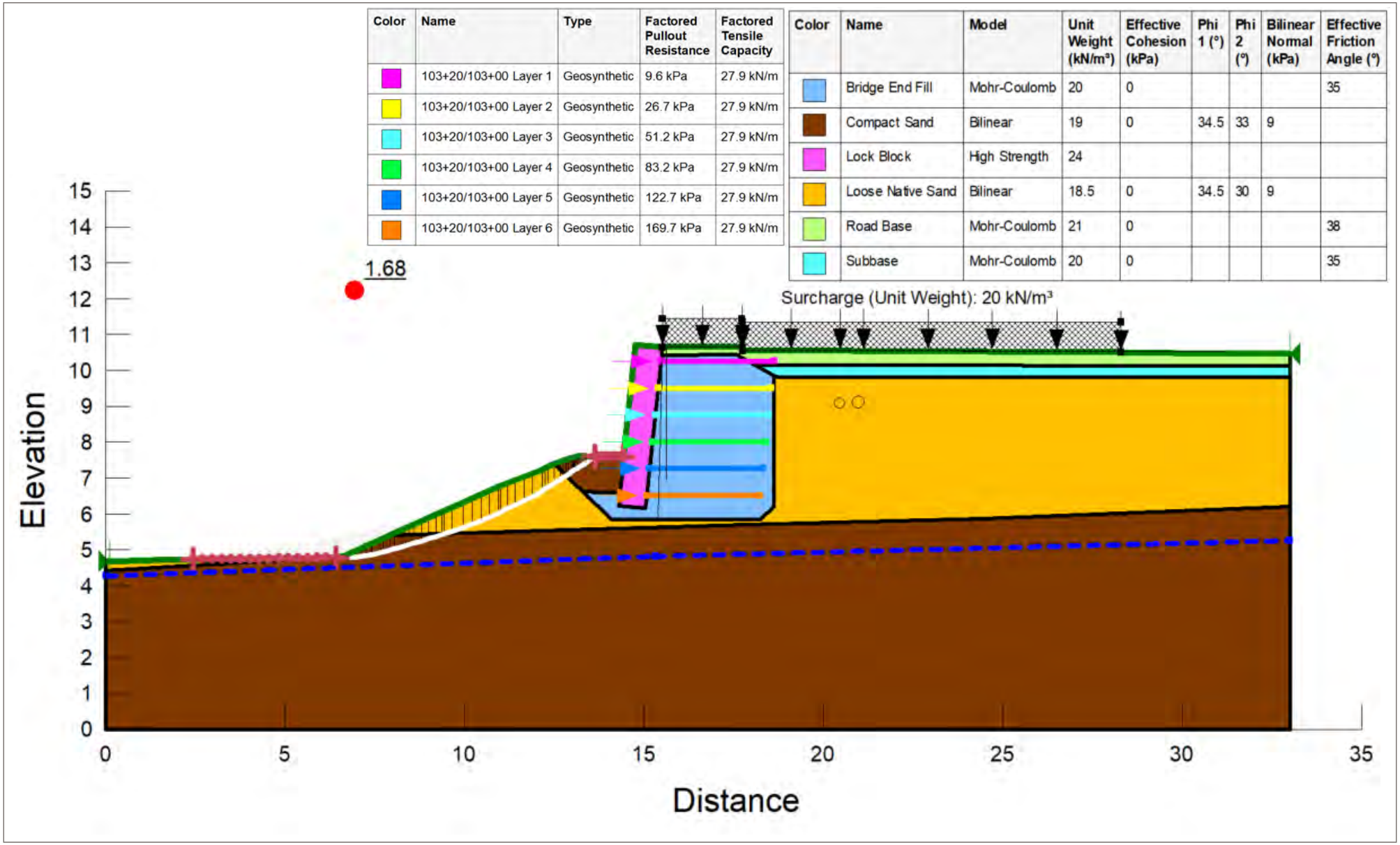
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F12

Color	Name	Type	Factored Pullout Resistance	Factored Tensile Capacity
	103+20/103+00 Layer 1	Geosynthetic	9.6 kPa	27.9 kN/m
	103+20/103+00 Layer 2	Geosynthetic	26.7 kPa	27.9 kN/m
	103+20/103+00 Layer 3	Geosynthetic	51.2 kPa	27.9 kN/m
	103+20/103+00 Layer 4	Geosynthetic	83.2 kPa	27.9 kN/m
	103+20/103+00 Layer 5	Geosynthetic	122.7 kPa	27.9 kN/m
	103+20/103+00 Layer 6	Geosynthetic	169.7 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

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EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY STATIC LOADING STATION 103+00

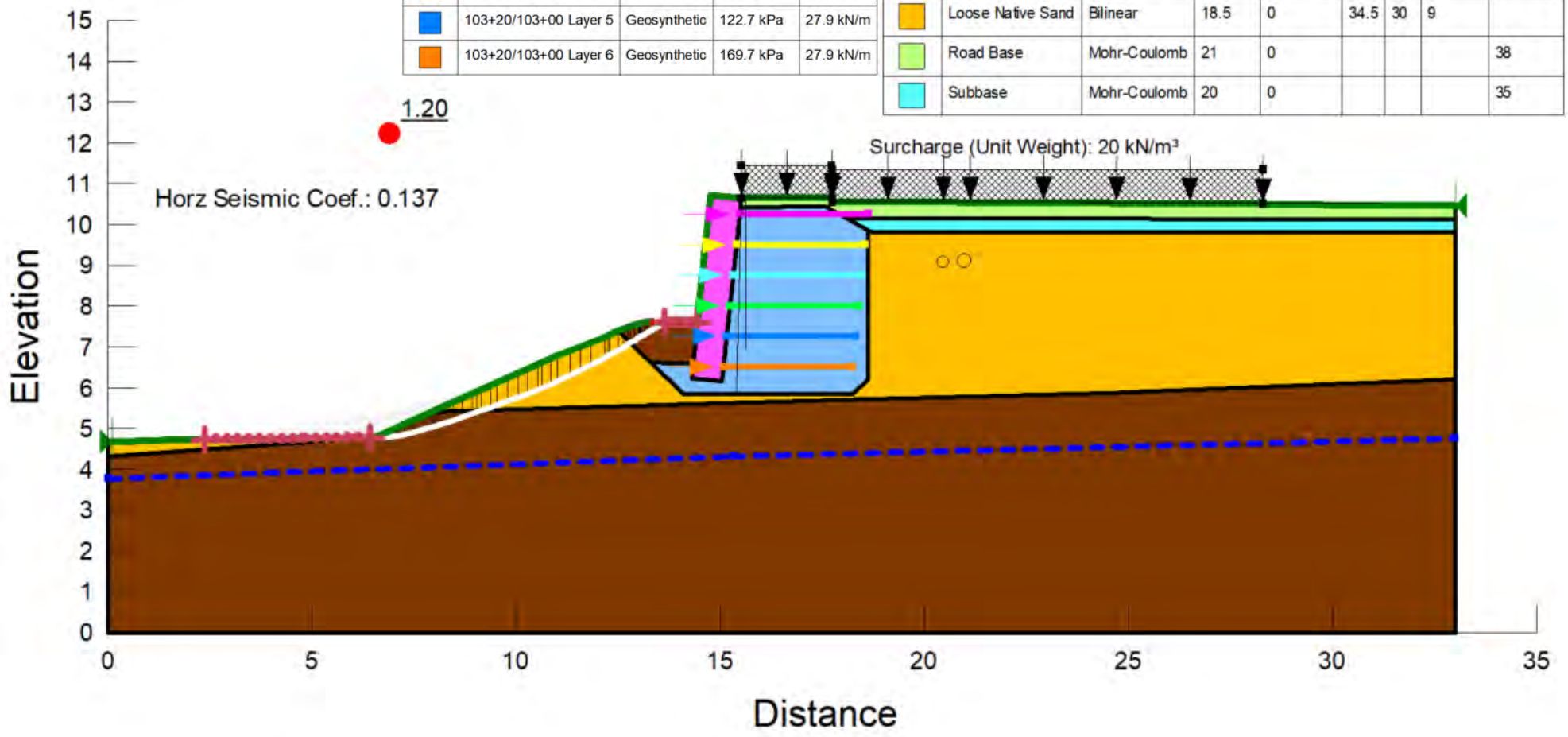
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F13

Color	Name	Type	Factored Pullout Resistance	Factored Tensile Capacity
	103+20/103+00 Layer 1	Geosynthetic	9.6 kPa	27.9 kN/m
	103+20/103+00 Layer 2	Geosynthetic	26.7 kPa	27.9 kN/m
	103+20/103+00 Layer 3	Geosynthetic	51.2 kPa	27.9 kN/m
	103+20/103+00 Layer 4	Geosynthetic	83.2 kPa	27.9 kN/m
	103+20/103+00 Layer 5	Geosynthetic	122.7 kPa	27.9 kN/m
	103+20/103+00 Layer 6	Geosynthetic	169.7 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

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EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY PSEUDO-STATIC LOADING STATION 103+00

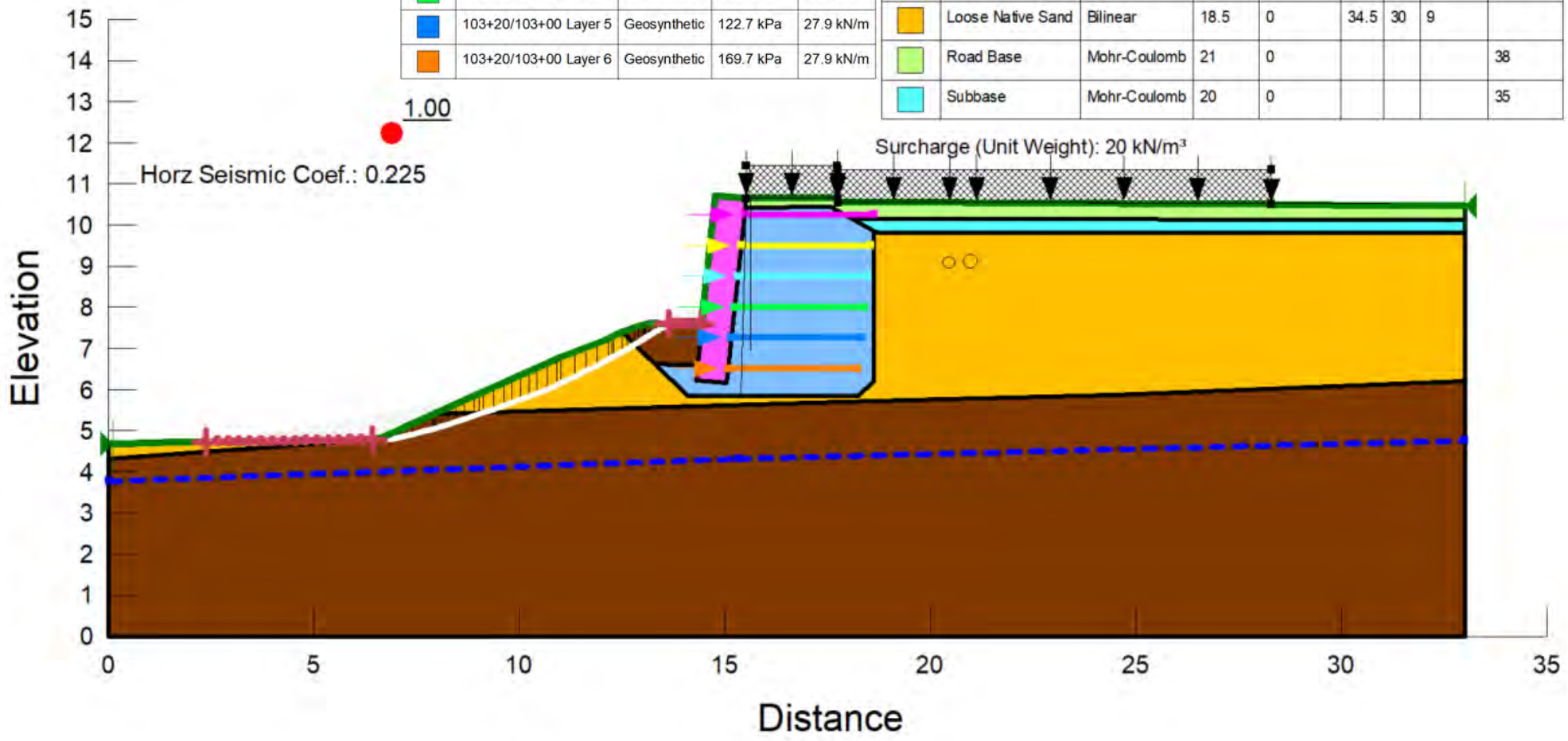
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F14

Color	Name	Type	Factored Pullout Resistance	Factored Tensile Capacity
	103+20/103+00 Layer 1	Geosynthetic	9.6 kPa	27.9 kN/m
	103+20/103+00 Layer 2	Geosynthetic	26.7 kPa	27.9 kN/m
	103+20/103+00 Layer 3	Geosynthetic	51.2 kPa	27.9 kN/m
	103+20/103+00 Layer 4	Geosynthetic	83.2 kPa	27.9 kN/m
	103+20/103+00 Layer 5	Geosynthetic	122.7 kPa	27.9 kN/m
	103+20/103+00 Layer 6	Geosynthetic	169.7 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
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EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY PSEUDO-STATIC LOADING - YIELD STATION 103+00

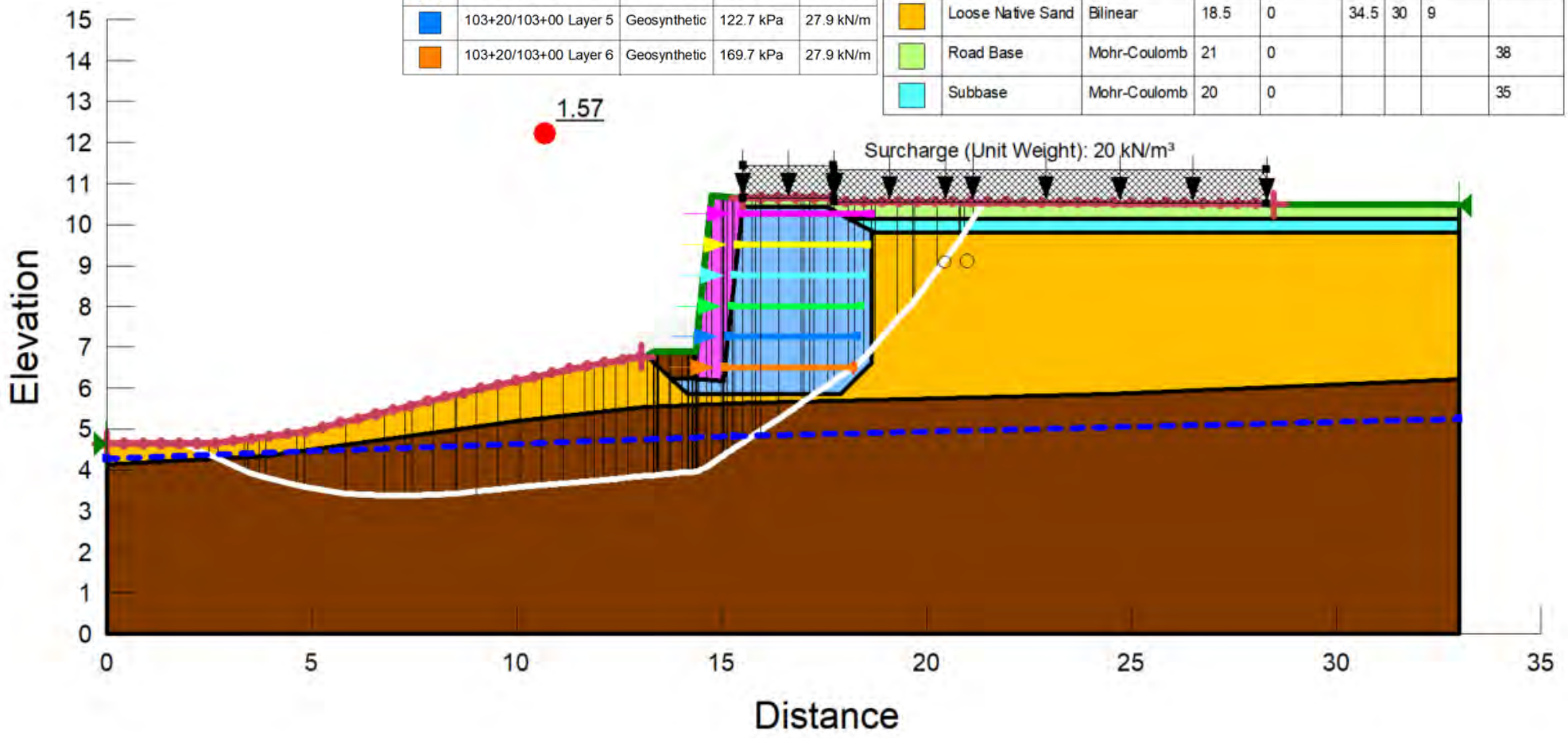
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE	DATE
VANCOUVER	JANUARY 24, 2023

Figure F15

Color	Name	Type	Factored Pullout Resistance	Factored Tensile Capacity
	103+20/103+00 Layer 1	Geosynthetic	9.6 kPa	27.9 kN/m
	103+20/103+00 Layer 2	Geosynthetic	26.7 kPa	27.9 kN/m
	103+20/103+00 Layer 3	Geosynthetic	51.2 kPa	27.9 kN/m
	103+20/103+00 Layer 4	Geosynthetic	83.2 kPa	27.9 kN/m
	103+20/103+00 Layer 5	Geosynthetic	122.7 kPa	27.9 kN/m
	103+20/103+00 Layer 6	Geosynthetic	169.7 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

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TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY STATIC LOADING STATION 103+20

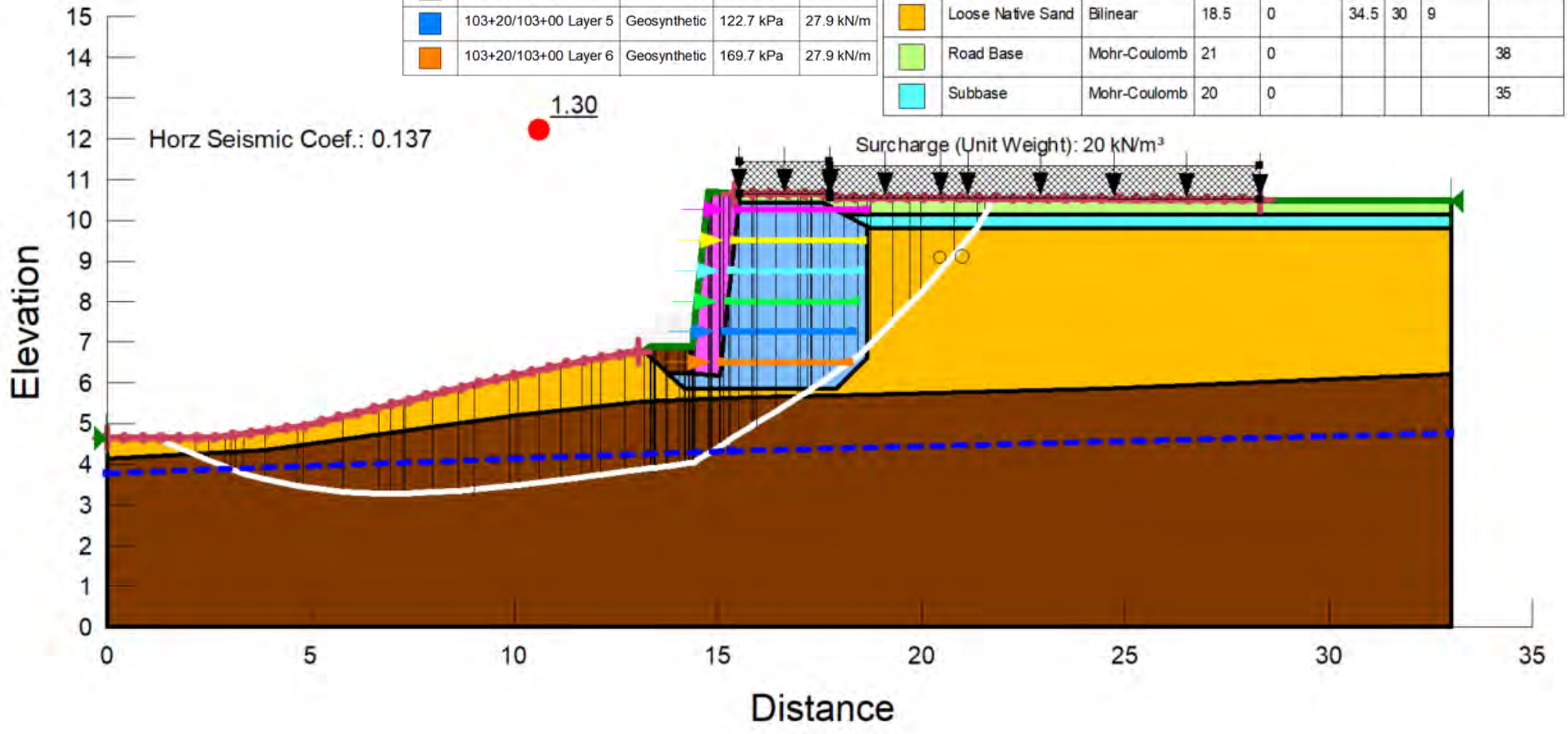
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE	DATE
VANCOUVER	JANUARY 24, 2023

Figure F16

Color	Name	Type	Factored Pullout Resistance	Factored Tensile Capacity
	103+20/103+00 Layer 1	Geosynthetic	9.6 kPa	27.9 kN/m
	103+20/103+00 Layer 2	Geosynthetic	26.7 kPa	27.9 kN/m
	103+20/103+00 Layer 3	Geosynthetic	51.2 kPa	27.9 kN/m
	103+20/103+00 Layer 4	Geosynthetic	83.2 kPa	27.9 kN/m
	103+20/103+00 Layer 5	Geosynthetic	122.7 kPa	27.9 kN/m
	103+20/103+00 Layer 6	Geosynthetic	169.7 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

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TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY PSEUDO-STATIC LOADING STATION 103+20

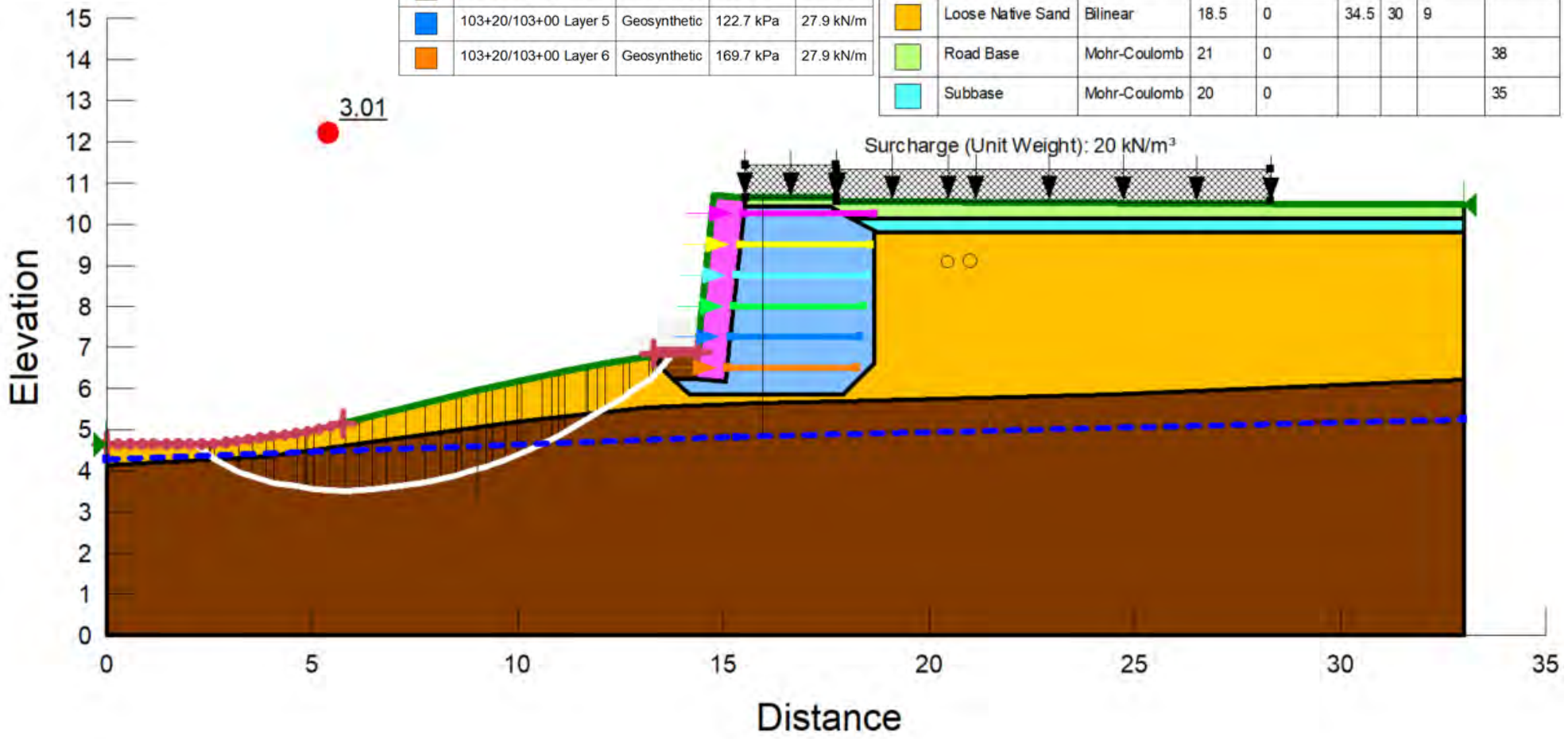
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F17

Color	Name	Type	Factored Pullout Resistance	Factored Tensile Capacity
	103+20/103+00 Layer 1	Geosynthetic	9.6 kPa	27.9 kN/m
	103+20/103+00 Layer 2	Geosynthetic	26.7 kPa	27.9 kN/m
	103+20/103+00 Layer 3	Geosynthetic	51.2 kPa	27.9 kN/m
	103+20/103+00 Layer 4	Geosynthetic	83.2 kPa	27.9 kN/m
	103+20/103+00 Layer 5	Geosynthetic	122.7 kPa	27.9 kN/m
	103+20/103+00 Layer 6	Geosynthetic	169.7 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY STATIC LOADING STATION 103+20

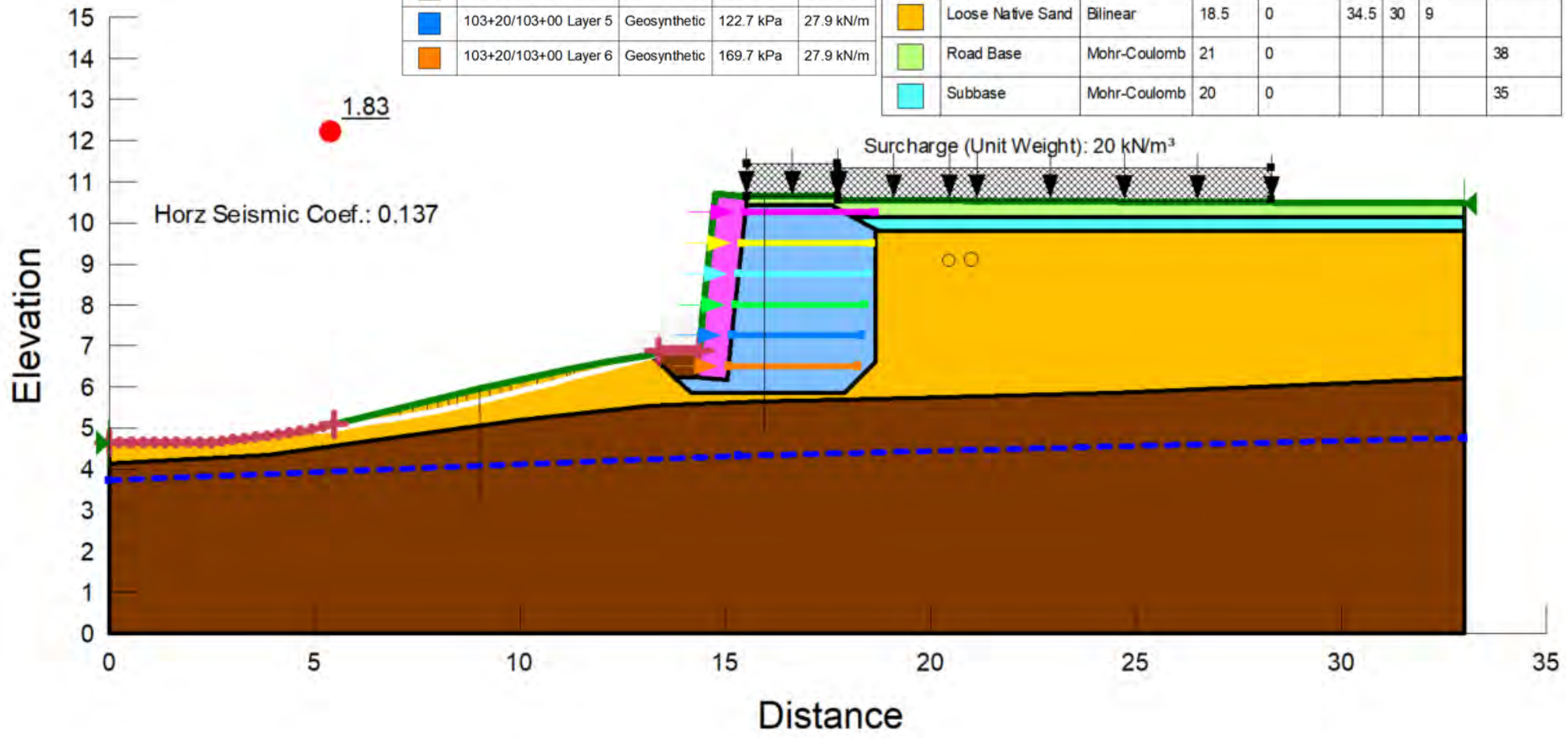
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F18

Color	Name	Type	Factored Pullout Resistance	Factored Tensile Capacity
	103+20/103+00 Layer 1	Geosynthetic	9.6 kPa	27.9 kN/m
	103+20/103+00 Layer 2	Geosynthetic	26.7 kPa	27.9 kN/m
	103+20/103+00 Layer 3	Geosynthetic	51.2 kPa	27.9 kN/m
	103+20/103+00 Layer 4	Geosynthetic	83.2 kPa	27.9 kN/m
	103+20/103+00 Layer 5	Geosynthetic	122.7 kPa	27.9 kN/m
	103+20/103+00 Layer 6	Geosynthetic	169.7 kPa	27.9 kN/m

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
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CLIENT
BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY PSEUDO-STATIC LOADING STATION 103+20

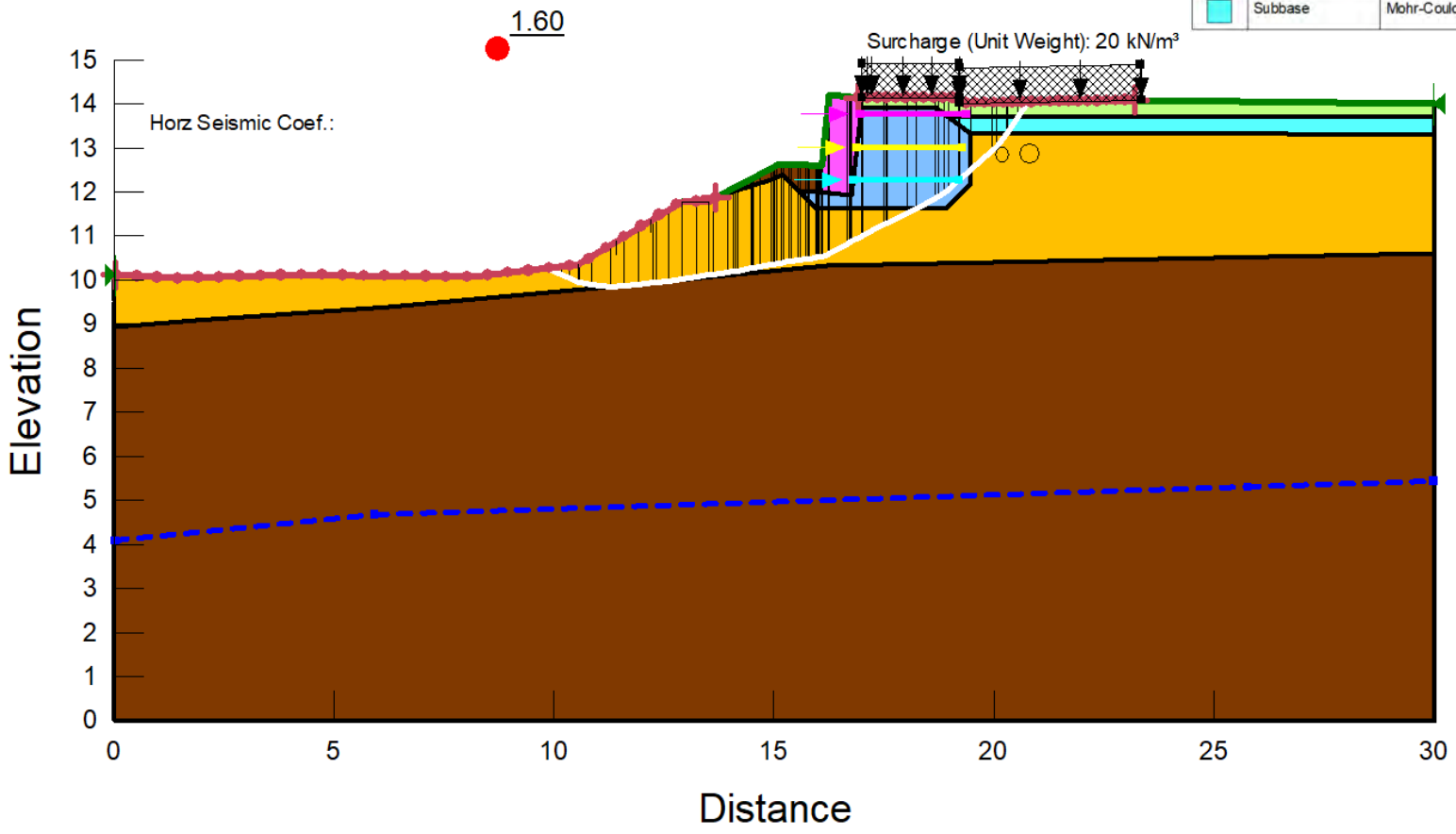
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE	DATE
VANCOUVER	JANUARY 24, 2023

Figure F19

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY STATIC LOADING STATION 104+80

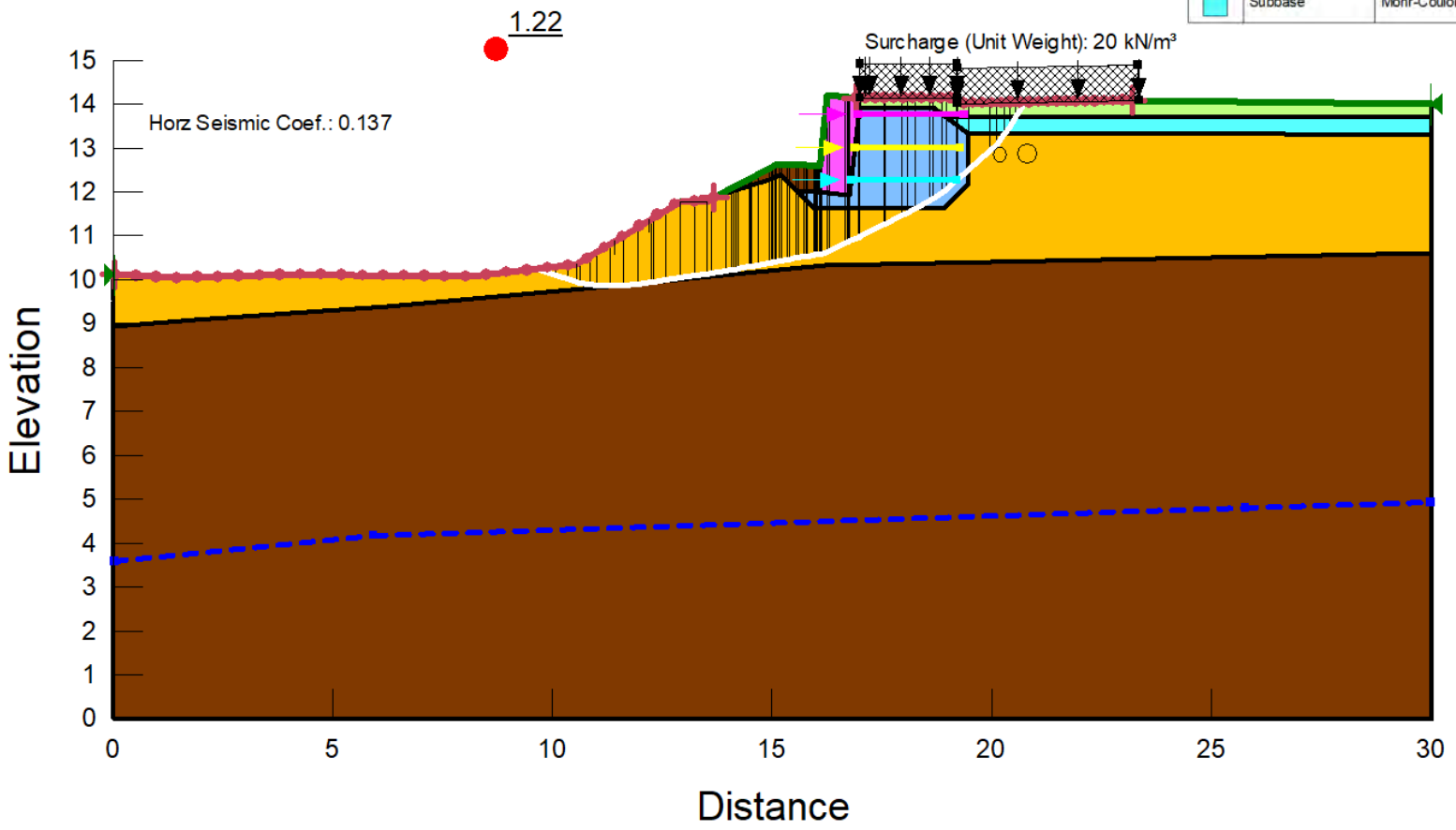
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F20

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS
GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY
PSEUDO-STATIC LOADING
STATION 104+80

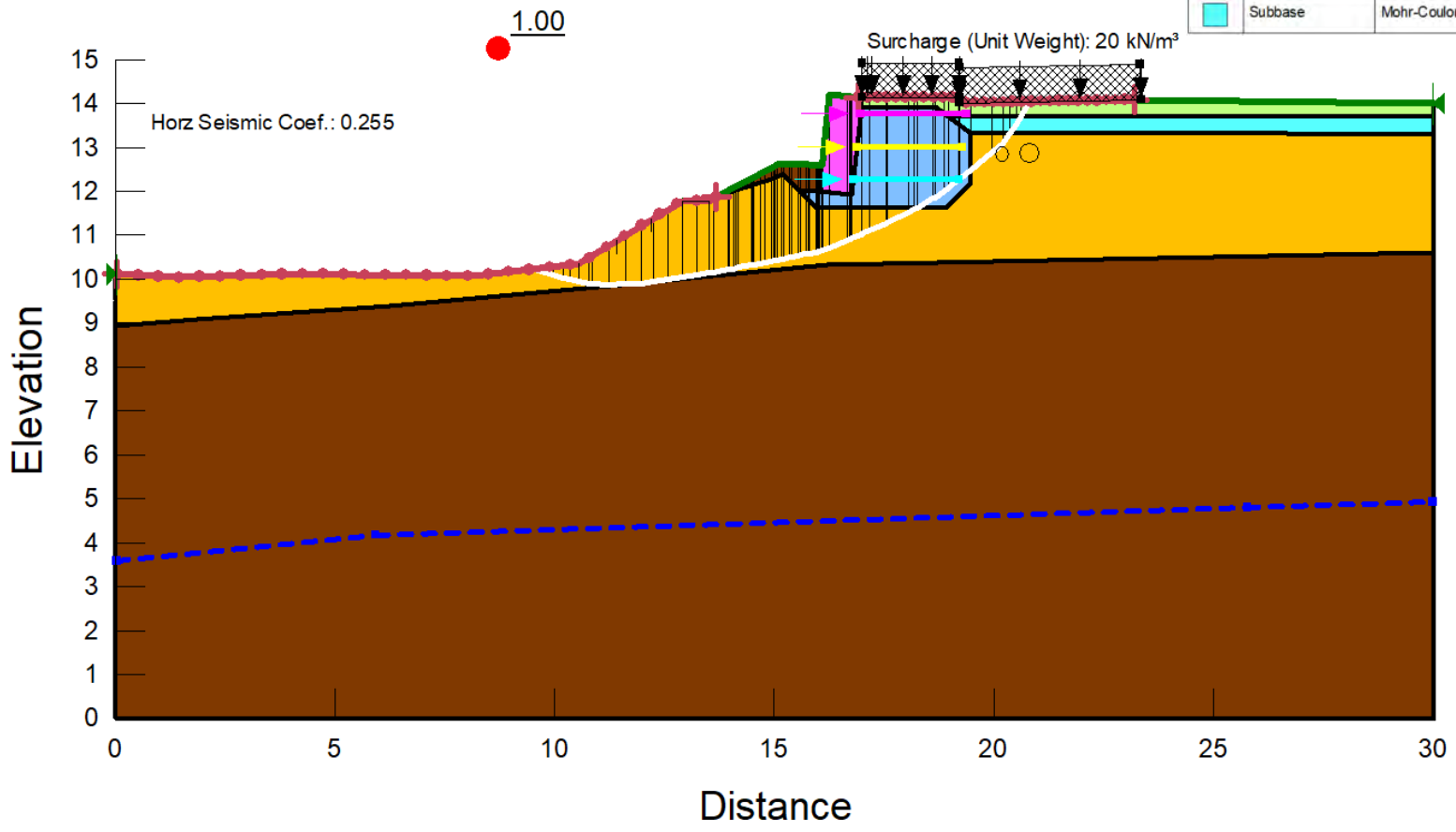
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F21

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY PSEUDO-STATIC LOADING -YIELD STATION 104+80

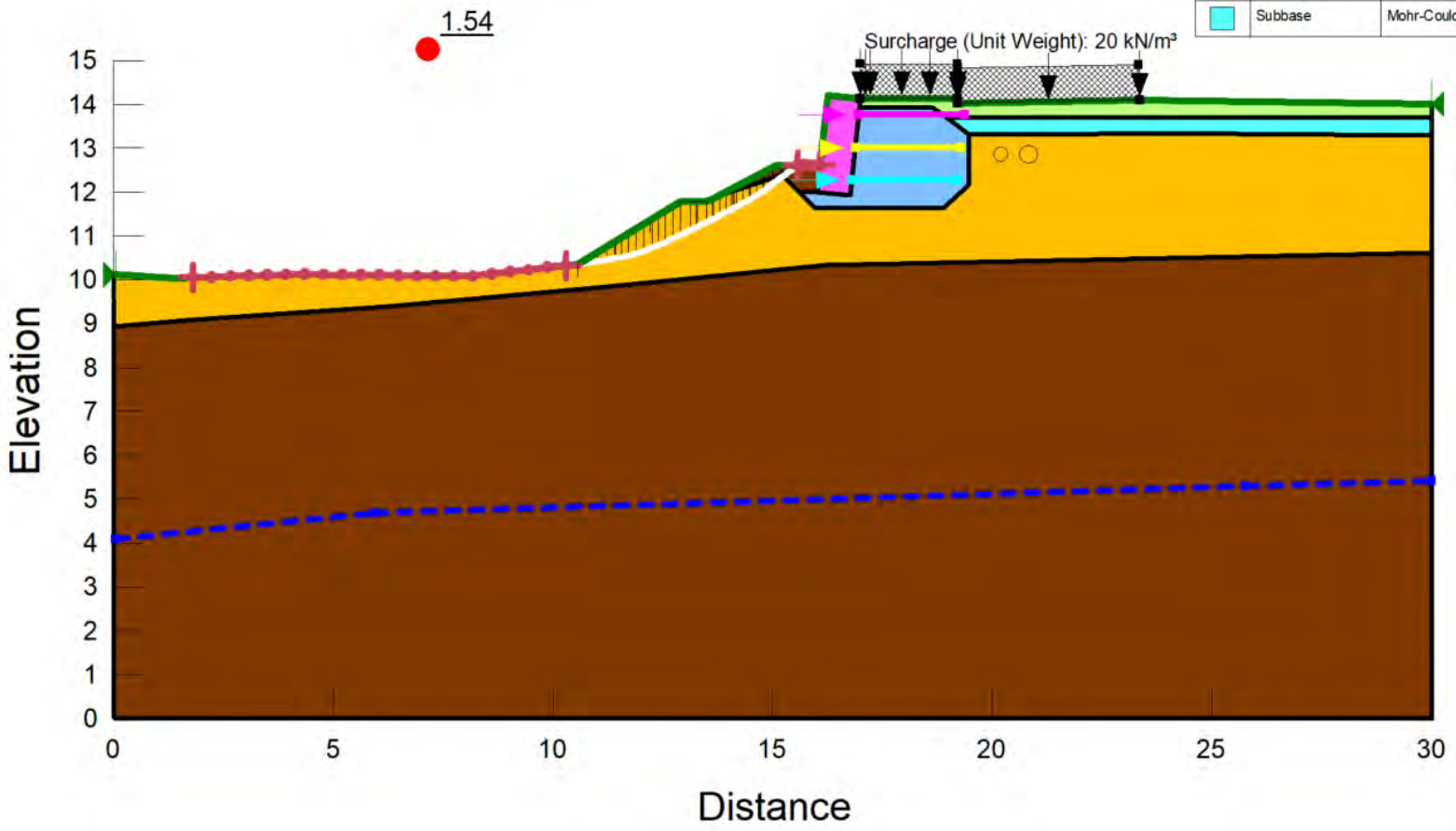
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F22

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY STATIC LOADING STATION 104+80

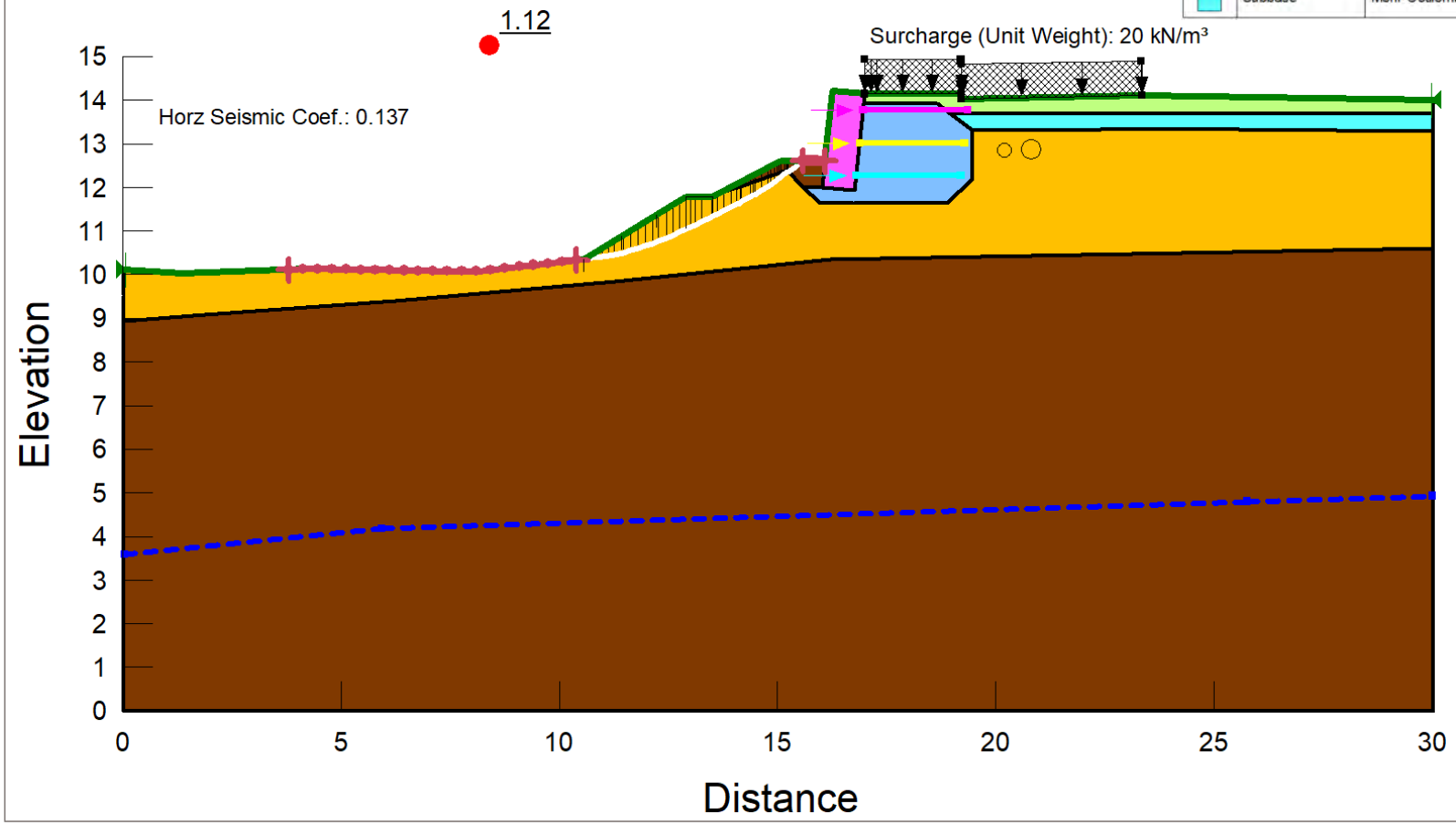
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE	DATE
VANCOUVER	JANUARY 24, 2023

Figure F23

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY PSEUDO-STATIC LOADING STATION 104+80

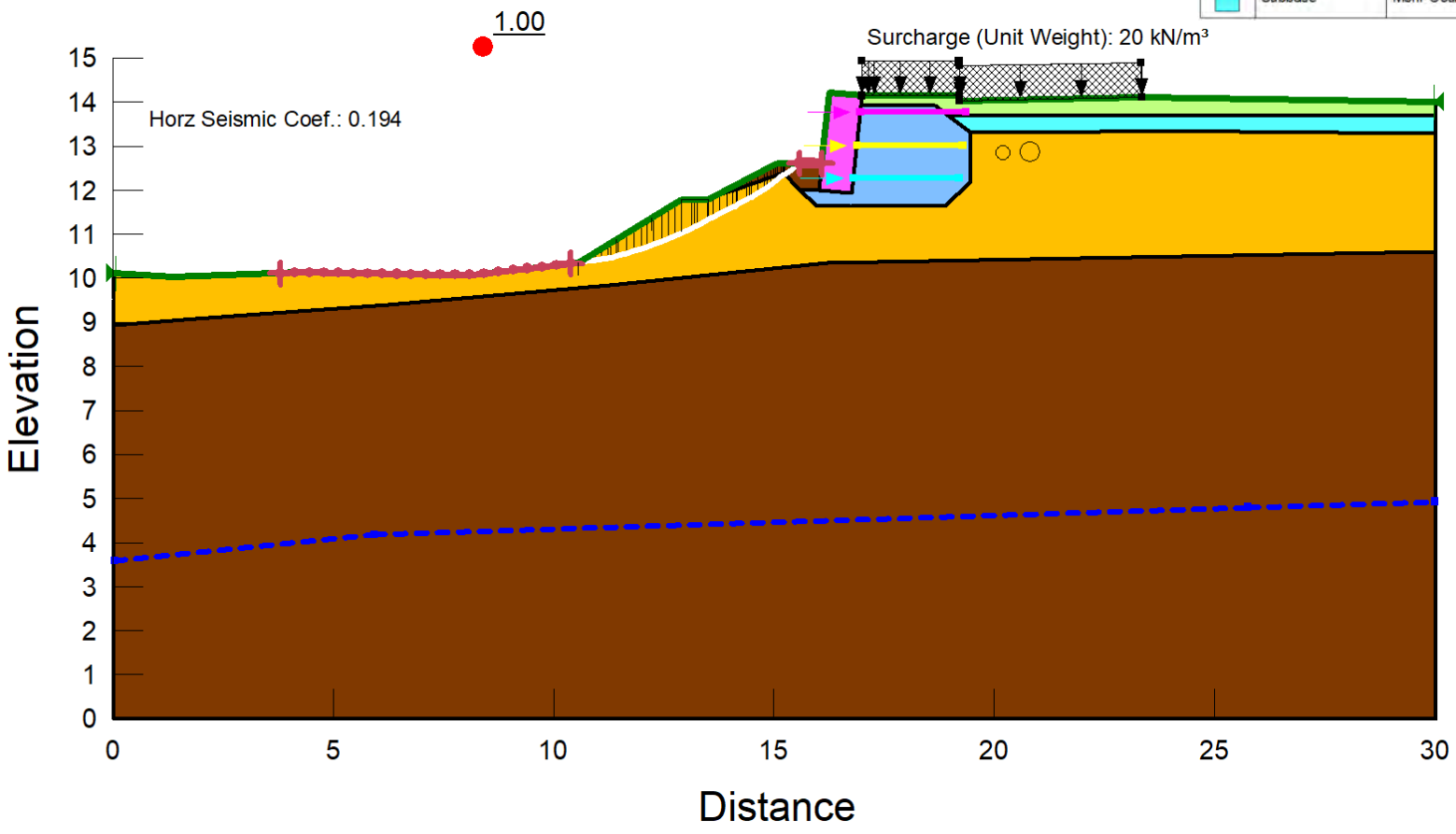
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE	DATE
VANCOUVER	JANUARY 24, 2023

Figure F24

Color	Name	Pullout Resistance (kPa)	Tensile Capacity (kN)
	102+30 / 104+80 Layer 1	13.6	27.9
	102+30 / 104+80 Layer 2	34.7	27.9
	102+30 / 104+80 Layer 3	63.3	27.9

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

LOWER SLOPE STABILITY PSEUDO-STATIC LOADING - YIELD STATION 104+80

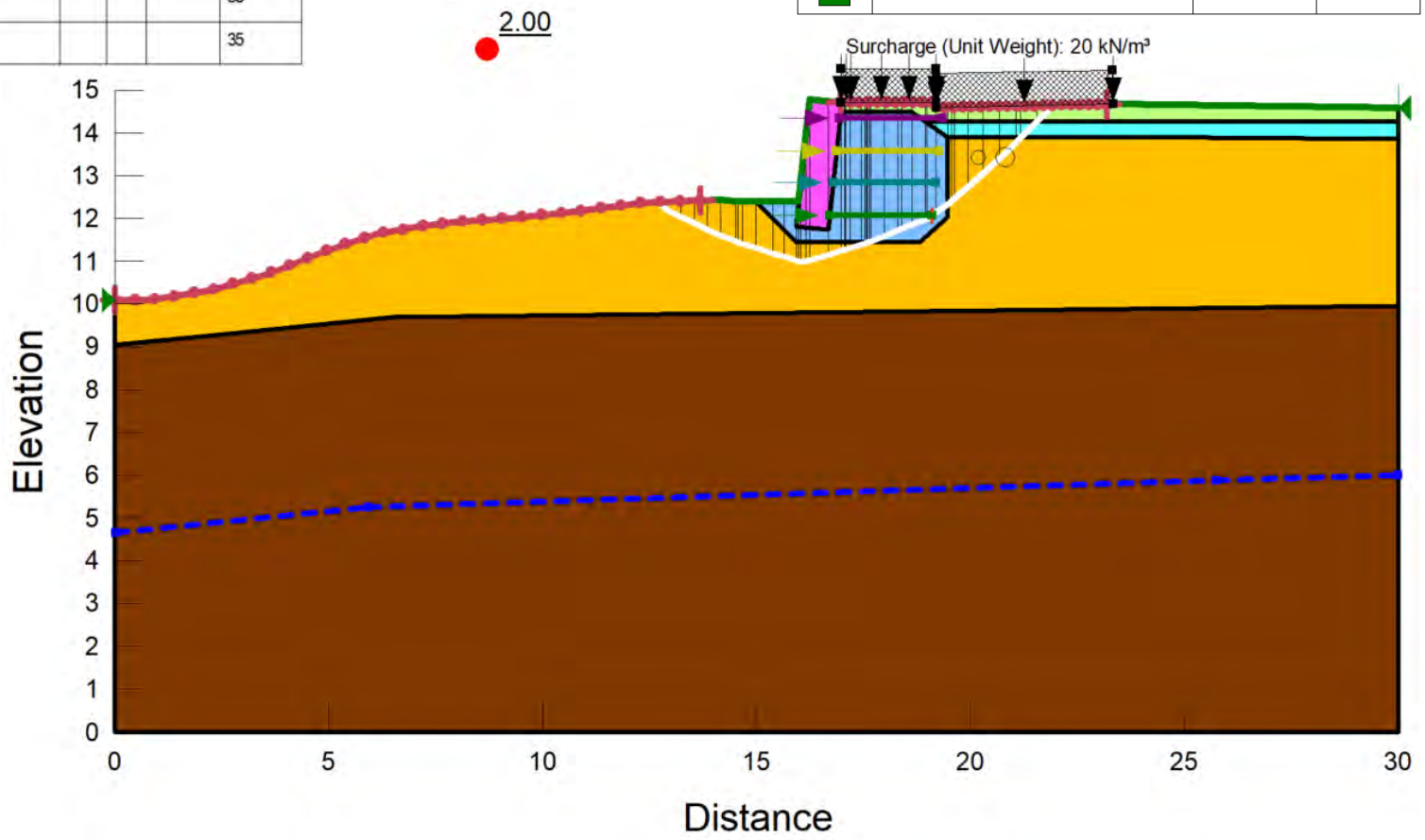
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F25

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35

Color	Name	Factored Pullout Resistance	Factored Tensile Capacity
	102+00 / 104+90 Layer 1 (4 blocks)	9.9 kPa	27.9 kN/m
	102+00 / 104+90 Layer 2 (4 blocks)	27.3 kPa	27.9 kN/m
	102+00 / 104+90 Layer 3 (4 blocks)	52.1 kPa	27.9 kN/m
	102+00 / 104+90 Layer 4 (4 blocks)	84.4 kPa	27.9 kN/m



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
British Columbia Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY STATIC LOADING STATION 104+90

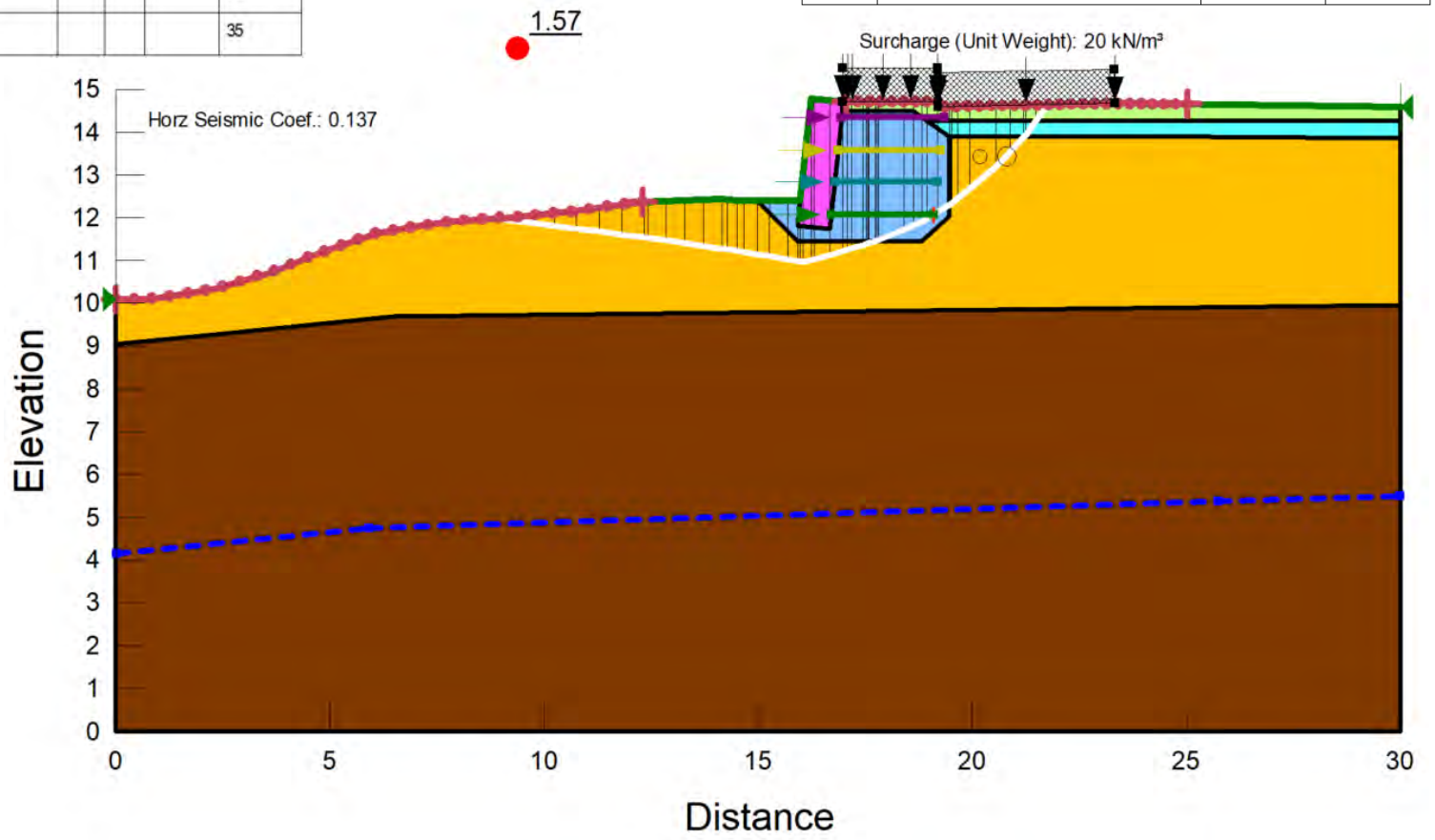
PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F26

Color	Name	Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Phi 1 (°)	Phi 2 (°)	Bilinear Normal (kPa)	Effective Friction Angle (°)
	Bridge End Fill	Mohr-Coulomb	20	0				35
	Compact Sand	Bilinear	19	0	34.5	33	9	
	Lock Block	High Strength	24					
	Loose Native Sand	Bilinear	18.5	0	34.5	30	9	
	Road Base	Mohr-Coulomb	21	0				38
	Subbase	Mohr-Coulomb	20	0				35

Color	Name	Factored Pullout Resistance	Factored Tensile Capacity
	102+00 / 104+90 Layer 1 (4 blocks)	9.9 kPa	27.9 kN/m
	102+00 / 104+90 Layer 2 (4 blocks)	27.3 kPa	27.9 kN/m
	102+00 / 104+90 Layer 3 (4 blocks)	52.1 kPa	27.9 kN/m
	102+00 / 104+90 Layer 4 (4 blocks)	84.4 kPa	27.9 kN/m



LEGEND

NOTES

1. Critical failure surface shown by thick white line.

STATUS
ISSUED FOR USE

CLIENT
BRITISH COLUMBIA Ministry of Transportation and Infrastructure

TETRA TECH

EAST PORPOISE BAY ROAD IMPROVEMENTS GEOTECHNICAL RETAINING WALL DESIGN

GLOBAL STABILITY PSEUDO-STATIC LOADING STATION 104+90

PROJECT NO.	DWN	CKD	APVD	REV
704-TRN.PAVE03224-08	AS	CL	DG	0

OFFICE: VANCOUVER
DATE: JANUARY 24, 2023

Figure F27