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Memorandum

Date: November 23, 2022
Reference No.: VAN-22003875-A0
To: Lamme Zarei, P.Eng., MBA
Total No. of Pages: 10 +Appendix
Company: Project Manager, Design-Build/P3
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Project Name: Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC
Subject: Preload impact on underground utilities and CN Rail

As requested by McElhanney Engineering Services Ltd. (“MESL”), this memorandum discusses the effect of preload/surcharge on underground utilities located at ADESA and along Blundell Road. Also, estimates the settlements of CN rail during preload and construction.

The underground utilities at ADESA are GAS Line and TELUS optic Fiber in accordance with the drawing “DWG: 356-135-RD-201, Rev A” provided by McElhanney.

Along Blundell Road north of CN Rail, the existing GAS line, TELUS, Storm Pipeline, Sanitary Pipeline, and Watermain Pipeline are recognized on the drawing “KEY PLAN BLUNDELL ROAD STA 97+85 TO STA 104+05” provided by McElhanney dated June 2022, Appendix D.

1. Introduction

The proposed Portside Blundell Improvement Project consists of the widening of Blundell Road from 2 lanes to 4 lanes, the improvement of portside road, the construction of the new overpass over the CN rail line and connecting Blundell Road to Portside Road, also a new Multi-Use Pass MUP along Portside and Blundell Road.

Based on the proposed overpass design, a new overpass bridge is to be located approximately 120m west of the existing at-grade crossing of Blundell Road and No.8 road. The bridge is linked to Blundell Road by an about 250m long semi-round ramp on the north side and an approximately 220m long round embankment to Portside Road on the south side. About 50m long MSE walls are currently considered an option for both sides of the north and south embankments, with approximately 14m long abutment walls.

To meet the project post-construction settlement requirement, a surcharge fill above the final grade of the embankment is recommended. The fill surcharge at the north side is proposed about 2 to 2.5 m above the final grade at the North abutment with an approximate length of 140m. In contrast, at the south abutment/embankments, the fill surcharge is recommended to be about 1 to 1.5 m above the



Memorandum (cont'd)

Preload impact on underground utilities and CN Rail
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC
Reference No.: VAN-22003875-A0
November 23, 2022

final grade with about 250m in length. The footprints of the recommended preload/surcharge fill are presented in Appendix C.

The proposed road widening and surcharge fill are suspected of inducing a consolidation settlement on the existing underground utilities and CN rail close to Blundell road. The location and type of underground utilities are discussed in the following:

- Along the south of Blundell Road and north of CN rail
 - 400mm force main pipeline sanitary
 - 1200 to 1650 mm gravity storm sewer pipeline
 - 350mm force main pipeline main water
 - TELUS duct
 - GAS line
- ADESA
 - TELUS fiber optic duct along the existing ditch
 - GAS Line with a length of about 150 m in the northeast-southwest direction located within the proposed embankment area. The GAS line is continued in the direction southeast to No. 8 Road and direction northeast, far away from the proposed embankment location.

The underground utility plan is shown in Appendix D.

This memorandum presents our geotechnical assessments of the potential preload and impact on the underground utilities and CN rail due to the construction of the proposed Portside Blundell Improvement project. It considers raising Blundell Road approach embankments for the rail overpass and a new retaining wall along the CN rail. As well it includes our recommendations for instrumentation and monitoring for them.

2. Requirement Of Design- Build Agreement

The settlement design criteria are specified in the Design-Build Agreement (“DBA”) Schedule 6 Part 2 and Article 5. Based on our review and understanding of the DBA, and for the completeness of this memorandum, the following, except from the initial DBA dated March 12, 2021, related to settlement and differential settlement is presented:

5.4.2- Settlement and Differential Settlement

- (a) *All bridge end approach fills, roadway pavements, movement joints, electrical ducts, and bridge foundations are to be designed to mitigate against short and long-term settlements and differential settlements and designed to avoid ponding, water sheeting, abnormal cross-slopes, and to maintain pavement drainage and a smooth pavement profile.*



Memorandum (cont'd)

Preload impact on underground utilities and CN Rail
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC
Reference No.: VAN-22003875-AO
November 23, 2022

- (b) *New construction shall not impact the safety, driveability, drainage or functionality of existing roads or utilities. Any differential and total settlements of existing Structures as a result of new Structures shall not impact the functionality of those existing Structures.*
- (c) *The total settlement and differential settlement criteria for bridges and approaches are as follows:*
- (i) *Maximum total settlement of a pier or substructure element shall be 50mm at the end of the warranty period and 75mm at 30 years after Substantial Completion.*
 - (ii) *Maximum differential settlement gradient (measured relative to the design slope or design elevation, as applicable) between the abutment-supported end and grade-supported end of the abutment approach slab shall be less than 0.5% at the end of the Warranty Period and projected to be less than 1.0% at 30 years after Substantial Completion.*
 - (iii) *Maximum differential settlement gradient between piers or between one substructure element and another shall be 0.5% at the end of the warranty period and 1.0% at 30 years after Substantial Completion.*
 - (d) *The Design-Builder shall use industry-recognized geotechnical engineering analysis methods to develop total settlement predictions up to 30 years after Substantial Completion. Predicted total and differential settlements shall not exceed the 30-year settlement criteria listed above.*
 - (e) *At the end of the Warranty Period, the Design-Builder shall update the 30-year settlement predictions to take into account all field measurements of actual settlements taken throughout the Warranty Period and submit them to the Owner.*
- If the actual settlements at the end of the Warranty Period exceed the allowable settlements, the Design-Builder shall make all repairs necessary to rectify the deficiency.*

3. Subsurface Condition

The following generalized subsurface condition at the subject site is based on the available geotechnical information, as provided in Appendix A and Appendix B, and surficial geology mapping from the Geological Survey of Canada (Map 1486A).

The following general stratigraphic sequence underlies the subject site in order of increasing depth:

- *Surficial layer (Asphalt/ Upper fill)* – the test holes at the ADESA Parking Lot located north of Blundell Road were surfaced with approximately 50mm thick asphalt, except for AH22-03 and CPT22-02, were drilled on the existing soil path area. A layer of fill comprising sand, trace to some silt, and trace gravel were encountered below the asphalt.



Memorandum (cont'd)

Preload impact on underground utilities and CN Rail
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC
Reference No.: VAN-22003875-AO
November 23, 2022

The test holes drilled on Area V, located south of Portside Road, encountered a fill layer comprised of sand, trace to some silt.

The fill thickness ranged from 1.4m to 5.0m. Based on the drilling effort, the relative density of fill was judged to be ranging from loose to compact.

- Lower Fill (Municipal Waste/Wood debris) – lower fill included municipal waste and wood debris overlain by sand. Based on the drilling effort, the relative density/consistency of the lower fill was judged to be ranging from very soft to soft.
 - Municipal Waste: the test holes located on ADESA encountered a layer of waste fills mixed with wood debris beneath the sand fill extending to depths ranging from approximately 2.0m to 9.1m, below the existing grade surface (elevation +5 to -2, geodetic). The composition of the encountered fill was municipal waste such as plastic bags, glass, construction waste, fabric, and organics mixed with sand and silt.
 - Wood debris: the test holes located in Area V were underlain by wood debris extended to a depth ranging from 5.3m to 6.1m below the existing ground surface (Elevation 0 to -1.0m geodetic).
- Peat – the waste fill layer was underlain by a layer of Peat with trace wood fibres, extending to depths ranging from about 5.2m to 11.4m below grade (Elevation 0 to -6.4 geodetic). Based on the drilling effort and our visual review of the samples retrieved from this layer, relative consistency/density was judged to be ranging from very soft to soft. The moisture contents of the samples collected from this deposit ranged from 124 to 322 percent.
- Silt, trace to some sand– The peat was underlain by a layer of silt, with some sand extending to depths ranging from about 6.5m to 15.9m below the existing grade surface (Elevation -1.5 to -10.5). The silt with some sand encountered in the test holes was located south of Blundell Road and Area V. Based on the pocket penetrometer test and drilling effort, the relative consistency/density of encountered silt layer was judged to be firm to very stiff. The moisture contents of the samples collected from this layer ranged from 41 to 81 percent.
- Fraser River Sand – the CPTs interpretation shows a layer of sand beneath the silt layer extending to depths ranging from approximately 15m to 36m below the existing grade surface (Elevation -10 to -31). The composition of the encountered sand was fine sand, with a trace of some silt. Based on CPT tip resistance, the relative consistency/density of encountered silt layer was judged compact to dense.
- Marine Clay - the CPTs interpretation shows a marine clay layer extended at approximate depths ranging from 36m to at least 50m below the existing ground surface (Elevation -31 to -45, geodetic). This layer consists of clay to silty clay.



Memorandum (cont'd)

*Preload impact on underground utilities and CN Rail
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC
Reference No.: VAN-22003875-A0
November 23, 2022*

4. Preload impact

To meet the Design-Build Agreement settlement criteria at the proposed abutment and embankment, it is estimated that a 2.0 m high surcharge along the footprint of the proposed northern embankment and abutment location and a 1.0m high surcharge along the southern embankment and abutment location would be required. The preload period is anticipated to be in the order of twelve (12) months or more, subject to field instrumentation monitoring.

The proposed preload at the location of the Cast in Place (CIP) concrete wall along Blundell Road is considered to construct to the final grade of the wall with a spill slope of 1.5H: 1V into a 2 m wide construction easement in front of the wall. The duration of preload is expected to be three months.

The site is underlain by medium to high-compressible soils, including silt and clay, which are overlain by high-decomposition material consisting of municipal /construction waste, wood debris, and peat. To estimate the soil settlement due to the new fill placement, settlement analysis was completed using the commercially available software Settle3 (version 5.010) developed by Rocscience.

The soil consolidation parameters used to characterize soil layers within the Preload Areas are based on the following:

- Our engineering experience with the soil conditions at infrastructure projects and high-rise buildings near the subject site;
- Geotechnical data from George Massey Tunnel Replacement (GMTR) Project; and,
- Available relevant test hole information.

Empirical correlations such as Mesri and Godlewski (1977) were used to estimate soil parameters such as the coefficient of secondary consolidation. The generalized soil profiles and consolidation parameters used for the settlement analysis are tabulated in the Table below.

Table 1: Soil Parameters for Settlement Analysis

| Soil Unit | Thickness (m) | Unit Weight γ (kN/m ³) | Elastic Modulus E_s (kPa) | Comp. Index C_c | Recomp. Index C_r | Consol. Coefficient C_v (m ² /s) | Reconsol. Coefficient C_{vr} (m ² /s) | Initial Void Ratio e_0 | Over-Consol. Margin OCM (kPa) | Secondary Consol. Method | $C\alpha/Cc$ |
|-----------------------------|---------------|---|-----------------------------|-------------------|---------------------|---|--|--------------------------|-------------------------------|--------------------------|--------------|
| Silty Sand (Fill) | 1.5 to 3 | 18.5 | 30000 | - | - | - | - | - | - | - | - |
| Municipal waste | 4 to 8 | 15 | - | 3 | 0.30 | 0.0015 | 0.015 | 3.0 | 60 | Mersi | 0.07 |
| Peat | 1 to 2.5 | 12 | - | 3 | 0.30 | 0.0001 | 0.001 | 6.25 | 50 | Mesri | 0.08 |
| Silt/Clayey Silt | 3.5 | 17.5 | - | 0.7 | 0.07 | 2 e-6 | 2e-5 | 1.85 | 50 | Mesri | 0.04 |
| Sand, compacted | 6.2 | 18 | 50000 | - | - | - | -- | - | - | - | - |
| Sand/Silty Sand, very dense | 17.8 | 18.5 | 80000 | - | - | - | - | - | - | - | - |
| Marine Clay | 30 | 18 | - | 0.3 | 0.03 | 1e-7 | 1e-6 | 1.0 | 25 | Mesri | 0.03 |

Notes:

1. Groundwater table is 4m below the existing grade (top of the silt layer).the perched water considered at 2.0m below the existing grade
2. The topsoil and organic soils above the Silt/ Clayey Silt layer should be stripped out prior to the embankment fill placement.
3. Load Vs. Vertical pressure ratio for settlement cut-off is considered 0.05 (5%).
4. For the ADESA, AREA V, and Blundell roads, different fill and waste layer thicknesses are considered.

The estimated total settlement of the underground utilities located at ADESA and Blundell Road due to the proposed preload and during construction is shown in Table 2 and Table 3, respectively. Appendix E illustrates the settlement profile of underground utilities.



Table 2: Estimated total settlement of underground utilities along Blundell Road

| Utility | Total Settlement (mm) | | | | |
|--------------------|--------------------------------------|--------------------------|-----------|------------|------------|
| | End of Preload (3-month duration) | During Post Construction | | | |
| | | PC- 1year | PC- 5year | PC- 10year | PC- 30year |
| SANITARY | 68 | 88 | 4 | 5 | 16 |
| STORM | 68 | 28 | 6 | 5 | 18 |
| WATER MAIN | 82 | 8 | 7 | 5 | 18 |
| TELUS | 22 | 7 | 7 | 5 | 18 |
| GAS | 28 | 7 | 7 | 5 | 18 |
| CN Rail - North | 8 | 64 | 3 | 5 | 16 |
| CN Rail- South | 4 | 41 | 3 | 2 | 7 |

Table 3: Estimated total Settlement of underground at ADESA

| Utility | Total Settlement (mm) | | | | |
|---------|---------------------------------------|--------------------------|-----------|------------|------------|
| | End of Preload (12-month duration) | During Post Construction | | | |
| | | PC- 1year | PC- 5year | PC- 10year | PC- 30year |
| TELUS | 935 | 0 | 0 | 7 | 19 |
| GAS | 1169 | 0 | 6 | 8 | 20 |

The underground utilities located in ADESA subject to high settlement during construction; therefore, relocated those utilities is highly recommended by Thurber engineering due to a received Email from Paul Wilson dated, October 19, 2022.

It should be noted that actual settlement may vary between -50% to 50% of the above settlement estimates.

5. Settlement And Monitoring Plan

The settlement and monitoring plan is proposing to evaluate the performance of the proposed preload/surcharge, assess and monitor the settlement impact of the preload on nearby city structures (such as railways, and large utilities), evaluate post-construction settlement and compare survey reading to design settlement estimate.

It is proposed to use shallow surface settlement gauges to monitor settlement along the railway during preload and construction. Also, digital soil settlement gauges are recommended to be installed every 200m along the railway to confirm the analog settlement gauges' records. (Appendix F)



Memorandum (cont'd)

*Preload impact on underground utilities and CN Rail
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC
Reference No.: VAN-22003875-A0
November 23, 2022*

Deep settlement gages will be used for underground utilities installed on top of utilities at 12 m spacing along the utility line. Installation of wire vibration piezometers associated with the settlement gauge is necessary to confirm settlement data. (Appendix G)

5.1 Railway Track Monitoring

- Settlement monitoring for CN rail would be completed in accordance with Transport Canada Rules respecting track safety, Railway Agreement and CN Rail requirements
- Settlement monitoring for the existing railway located within 20m of the substructure construction would be monitored in pairs (i.e. one next to each rail), based on the following spacing:
 - At 2m on-centers within the proposed construction assess road with the first set centred at the proposed access road centerline.
 - At 7.5m on centers outside of the proposed construction, assess the road
- Settlement monitoring for the existing railway located within 20m to 40m from the substructure construction area would be completed using monitoring points (one next to each rail) at 12m spacing.
- Th baseline would be established as three (3) independent sets of readings taken on different days
- Vertical settlement will be recorded with Prism on Rail Ties. One target point will be established for each monitoring point
- Monitoring would be carried out monthly during the active construction period thereafter to the end of the Warranty Period

5.2 Underground Utility Monitoring

- Underground utilities within proximity to the preload would be monitored using deep settlement
- Underground utility monitoring points would consist of deep utility monitoring gauges at 12 m spacing along the utility line.
- The settlement monitoring for general underground utilities would be carried out monthly during the active construction period thereafter to the end of the Warranty Period.
- The collected survey readings would be submitted to the Geotechnical Engineer within the next business day.



Memorandum (cont'd)

*Preload impact on underground utilities and CN Rail
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC
Reference No.: VAN-22003875-A0
November 23, 2022*

- Proposed monitoring frequencies are subject to change based on the findings of the monitoring survey and the judgement of the Proposed monitoring frequencies are subject to change based on the survey results and the judgement of the Geotechnical Engineer and third-party utility owners.

6. Monitoring Survey Requirement

Settlement monitoring will be surveyed, and vertical movements recorded on a monthly basis from the time of asphalt pavement construction until the end of the Warranty Period.

All manual surveys would be completed with tolerances of $\pm 3\text{mm}$ relative to established, reliable, stable benchmarks located on the competent ground, which benchmarks shall not be subject to deformations.

7. Closure

The information presented in this memorandum is based on the referenced information and EXP's understanding of the project as described herein. If the project information differs from those described in this report, EXP should be notified promptly in order to review the geotechnical aspects of the project and modify them if necessary.

This memorandum has been prepared for the exclusive use of MESL and its designated consultants or agents. Any use of the materials contained in this report for other than its intended purpose or by any other party must first be verified in writing by EXP Services Inc.

The attached "Interpretation & Use of Study and Report" forms an integral part of this report and must be included with any copies of this report. EXP does not accept any responsibility or damages as a result of any other party relying on or using the information and recommendations contained in this memorandum.

We trust that this meets your current requirements. Should you have any concerns or questions, please do not hesitate to contact the undersigned.



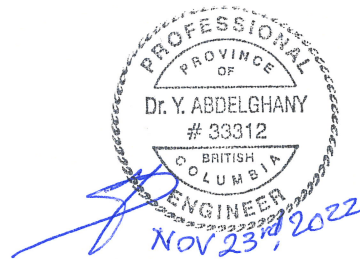
Memorandum (cont'd)

Preload impact on underground utilities and CN Rail
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC
Reference No.: VAN-22003875-A0
November 23, 2022

Submitted by:
EXP Services Inc.

Parisa Ahadi, MSc., E.I.T.
Junior Geotechnical Engineer (P3/DB)

Reviewed by:



Yasser Abdelghany, Ph.D., P.Eng.; PMP
Geotechnical Lead, Alternative Project Delivery

- Appendix A – Test hole Location Plan
- Appendix B – Test hole Logs and CPTs Plot
- Appendix C – Preload sketches
- Appendix D – Utility locations plan
- Appendix E – Settlement profile
- Appendix F- Digital Soil Settlement Gauge Specific
- Appendix G- Sketch of proposed settlement Gauge installation.

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INTERPRETATION & USE OF STUDY AND REPORT

1. STANDARD OF CARE

This study and Report have been prepared in accordance with generally accepted engineering consulting practices in this area. No other warranty, expressed or implied, is made. Engineering studies and reports do not include environmental consulting unless specifically stated in the engineering report.

2. COMPLETE REPORT

All documents, records, data and files, whether electronic or otherwise, generated as part of this assignment are a part of the Report which is of a summary nature and is not intended to stand alone without reference to the instructions given to us by the Client, communications between us and the Client, and to any other reports, writings, proposals or documents prepared by us for the Client relative to the specific site described herein, all of which constitute the Report.

IN ORDER TO PROPERLY UNDERSTAND THE SUGGESTIONS, RECOMMENDATIONS AND OPINIONS EXPRESSED HEREIN, REFERENCE MUST BE MADE TO THE WHOLE OF THE REPORT. WE CANNOT BE RESPONSIBLE FOR USE BY ANY PARTY OF PORTIONS OF THE REPORT WITHOUT REFERENCE TO THE WHOLE REPORT.

3. BASIS OF THE REPORT

The Report has been prepared for the specific site, development, building, design or building assessment objectives and purpose that were described to us by the Client. The applicability and reliability of any of the findings, recommendations, suggestions, or opinions expressed in the document are only valid to the extent that there has been no material alteration to or variation from any of the said descriptions provided to us unless we are specifically requested by the Client to review and revise the Report in light of such alteration or variation.

4. USE OF THE REPORT

The information and opinions expressed in the Report, or any document forming the Report, are for the sole benefit of the Client. NO OTHER PARTY MAY USE OR RELY UPON THE REPORT OR ANY PORTION THEREOF WITHOUT OUR WRITTEN CONSENT. WE WILL CONSENT TO ANY REASONABLE REQUEST BY THE CLIENT TO APPROVE THE USE OF THIS REPORT BY OTHER PARTIES AS "APPROVED USERS". The contents of the Report remain our copyright property and we authorise only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of the Report by those parties. The Client and Approved Users may not give, lend, sell or otherwise make the Report, or any portion thereof, available to any party without our written permission. Any use which a third party makes of the Report, or any portion of the Report, are the sole responsibility of such third parties. We accept no responsibility for damages suffered by any third party resulting from unauthorised use of the Report.

5. INTERPRETATION OF THE REPORT

- a. Nature and Exactness of Descriptions: Classification and identification of soils, rocks, geological units, contaminant materials, building envelope assessments, and engineering estimates have been based on investigations performed in accordance with the standards set out in Paragraph 1. Classification and identification of these factors are judgmental in nature and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may fail to locate some conditions. All investigations, or building envelope descriptions, utilizing the standards of Paragraph 1 will involve an inherent risk that some conditions will not be detected and all documents or records summarising such investigations will be based on assumptions of what exists between the actual points sampled. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of, and accept, this risk. Some conditions are subject to change over time and those making use of the Report should be aware of this possibility and understand that the Report only presents the conditions at the sampled points at the time of sampling. Where special concerns exist, or the Client has special considerations or requirements, the Client should disclose them so that additional or special investigations may be undertaken which would not otherwise be within the scope of investigations made for the purposes of the Report.
- b. Reliance on Provided information: The evaluation and conclusions contained in the Report have been prepared on the basis of conditions in evidence at the time of site inspections and on the basis of information provided to us. We have relied in good faith upon representations, information and instructions provided by the Client and others concerning the site. Accordingly, we cannot accept responsibility for any deficiency, misstatement or inaccuracy contained in the report as a result of misstatements, omissions, misrepresentations or fraudulent acts of persons providing information.
- c. To avoid misunderstandings, EXP Services Inc. (EXP) should be retained to work with the other design professionals to explain relevant engineering findings and to review their plans, drawings, and specifications relative to engineering issues pertaining to consulting services provided by EXP. Further, EXP should be retained to provide field reviews during the construction, consistent with building codes guidelines and generally accepted practices. Where applicable, the field services recommended for the project are the minimum necessary to ascertain that the Contractor's work is being carried out in general conformity with EXP's recommendations. Any reduction from the level of services normally recommended will result in EXP providing qualified opinions regarding adequacy of the work.

6.0 ALTERNATE REPORT FORMAT

When EXP submits both electronic file and hard copies of reports, drawings and other documents and deliverables (EXP's instruments of professional service), the Client agrees that only the signed and sealed hard copy versions shall be considered final and legally binding. The hard copy versions submitted by EXP shall be the original documents for record and working purposes, and, in the event of a dispute or discrepancy, the hard copy versions shall govern over the electronic versions. Furthermore, the Client agrees and waives all future right of dispute that the original hard copy signed version archived by EXP shall be deemed to be the overall original for the Project.

The Client agrees that both electronic file and hard copy versions of EXP's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EXP. The Client warrants that EXP's instruments of professional service will be used only and exactly as submitted by EXP.

The Client recognizes and agrees that electronic files submitted by EXP have been prepared and submitted using specific software and hardware systems. EXP makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.



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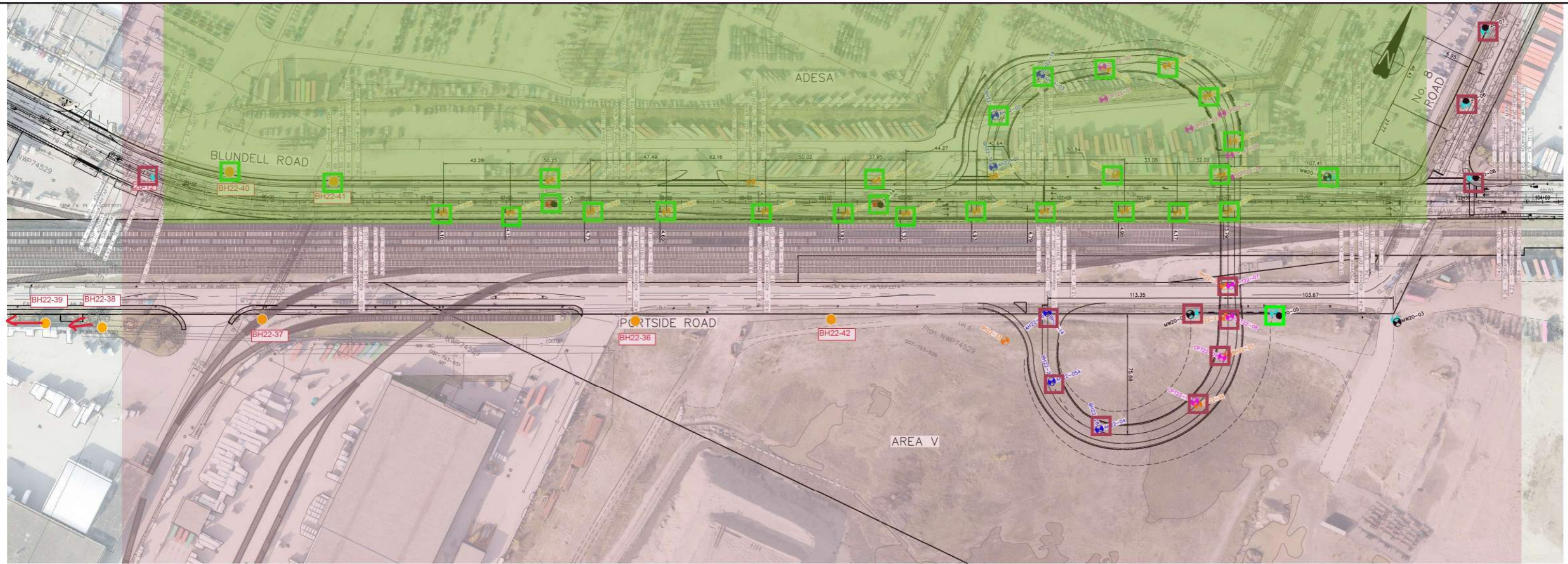
*Preliminary Geotechnical Recommendations and Comments on Use of EPS and Densification
for Overpass Design Options 1 and 3
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC*

*Reference No.: VAN-22003875-A0
November 23, 2022*

Appendix A

Test hole Location Plan

TITLE BLOCK: BPT_1001_088
 DATE: 20220518 - 2:28pm
 PATH: \\C:\12111100 - CB Projects\12111100 - Portside and Blundell Rd Imp\12111100.DWG\20220518_10.33_Smthsh\12111100-ACCS-SK-101.dwg



| BH - ENVIRONMENTAL INVESTIGATION | | | |
|----------------------------------|-------------|------------|--------------|
| POINT TYPE | NORTHING | EASTING | DIST. TO P/L |
| BH22-01A | 5446930.944 | 497878.400 | 4.10 |
| BH22-02A | 5446949.339 | 497917.465 | 4.15 |
| BH22-03A | 5446971.679 | 497962.484 | 4.73 |
| BH22-04A | 5446992.253 | 498005.284 | 4.69 |
| BH22-05A | 5447019.236 | 498061.284 | 4.69 |
| BH22-06 | 5447040.159 | 498106.727 | 3.82 |
| BH22-07A | 5447056.186 | 498141.133 | 3.32 |
| BH22-08A | 5447076.852 | 498180.311 | 4.93 |
| BH22-09A | 5447095.234 | 498218.781 | 4.79 |
| BH22-10A | 5447117.336 | 498264.229 | 4.98 |
| BH22-11 | 5447130.989 | 498294.377 | 4.17 |
| BH22-12 | 5447031.964 | 498044.983 | / |
| BH22-13 | 5446978.349 | 497931.056 | / |
| BH22-15 | 5447067.285 | 498115.641 | / |

| BH - ENVIRONMENTAL INVESTIGATION | | | |
|----------------------------------|-------------|------------|--------------|
| POINT TYPE | NORTHING | EASTING | DIST. TO P/L |
| BH22-19 | 5447193.104 | 498215.082 | / |
| BH22-20 | 5447211.113 | 498248.626 | / |
| BH22-21 | 5447205.215 | 498279.699 | / |
| BH22-22 | 5447186.121 | 498306.408 | / |
| BH22-23 | 5447145.512 | 498322.909 | 3.79 |
| BH22-24 | 5447102.026 | 498340.752 | / |
| BH22-25 | 5447064.097 | 498361.518 | / |
| BH22-26 | 5447027.478 | 498358.715 | / |
| BH22-27 | 5447084.752 | 498349.430 | / |
| BH22-30 | 5447135.521 | 498249.505 | / |
| BH22-31 | 5447164.161 | 498309.369 | / |
| BH22-32 | 5447101.215 | 498180.613 | / |
| BH22-33 | 5447011.286 | 498231.696 | / |

| BH - GEOTECHNICAL INVESTIGATION | | |
|---------------------------------|-------------|------------|
| POINT TYPE | NORTHING | EASTING |
| CP122-01 | 5447175.042 | 498221.888 |
| CP122-02 | 5447192.803 | 498212.413 |
| CP122-03 | 5447181.288 | 498278.427 |
| CP122-04 | 5447198.729 | 498292.808 |
| CP122-05 | 5447177.323 | 498308.642 |
| CP122-07 | 5447104.051 | 498344.312 |
| CP122-08 | 5447086.215 | 498352.470 |
| CP122-09 | 5447061.208 | 498359.091 |
| CP122-10 | 5447028.467 | 498355.925 |
| SCPT22-06 | 5447164.884 | 498314.843 |

| BH (SHARED) ENVIRONMENTAL / GEOTECHNICAL | | |
|--|-------------|------------|
| POINT TYPE | NORTHING | EASTING |
| AH22-01 / BH22-16 | 5447106.487 | 498177.800 |
| AH22-02 / BH22-17 | 5447135.742 | 498164.677 |
| AH22-03 / BH22-18 | 5447171.183 | 498179.564 |
| AH22-04 / BH22-28 | 5446987.051 | 498309.393 |
| AH22-05A / BH22-29 | 5447001.157 | 498269.238 |
| AH22-06 / BH22-14 | 5447038.843 | 498247.892 |

NOTE:
 1. INFORMATION ON EXISTING UNDERGROUND FACILITIES MAY NOT BE COMPLETE OR ACCURATE. McELHANNAY, ITS EMPLOYEES AND DIRECTORS ARE NOT RESPONSIBLE NOR LIABLE FOR THE LOCATION OF ANY UNDERGROUND CONDUITS, PIPES, CABLES OR OTHER FACILITIES WHETHER SHOWN OR OMITTED FROM THIS PLAN. PRIOR TO THE SOIL INVESTIGATION THE CONTRACTOR SHALL EXPOSE LOCATIONS OF ALL EXISTING FACILITIES BY HAND DIGGING OR HYDROVAC AND ADVISE THE ENGINEER OF POTENTIAL CONFLICTS.
 2. THE DRILLING LOCATIONS ARE SUBJECT TO CHANGE FOLLOWING THE FINALIZED DESIGN DRAWINGS AND UTILITY LOCATE RESULTS.

Legend:

- Wood Waste & Garbage (plastic, glass, cloth, metals, fabric, organics, etc.) to ~20'/30'**
- Wood Wste to ~20'**

LEGEND

- BH-02-00 PROPOSED BOREHOLE
- CLEAN SPOT
- CONTAMINATED SPOT
- AH
- CPT
- BH-XXXX AH-22-00 SHARED ENVIRONMENTAL / GEOTECHNICAL PROPOSED BOREHOLE
- MW20-00 EXISTING GROUNDWATER MONITORING WELL
- 20-00 BOREHOLE INSTALLED BY GHD

Figure 2 Inferred Extents of Municipal Waste/Wood Waste

LEDOR
 Suite 200
 1460 152nd Avenue
 Surrey BC
 Canada V3T 5X3
 T 604 596 0391

PRELIMINARY NOT FOR CONSTRUCTION

THIS DRAWING HAS NOT BEEN APPROVED, AND MAY CONTAIN ERRORS AND OMISSIONS.

| No. | Date | REVISION | Dr'n | Ch'd |
|-----|-----------|--|------|------|
| C | 2022MAY18 | PROPERTY OFFSETS ARE ADDED TO BOREHOLES ON G&R ROW | EY | LZ |
| B | 2022MAY16 | EXISTING UTILITY OFFSET ADDED | EY | LZ |
| A | 2022MAY05 | FOR DISCUSSION ONLY | EY | LZ |

PORT of Vancouver
Vancouver Fraser Port Authority
 ENGINEERING DEPARTMENT

GREATER VANCOUVER GATEWAY 2030
PORTSIDE BLUNDELL ROAD IMPROVEMENT PROJECT
PORTSIDE ROAD AND BLUNDELL OVERPASS
GEOTECHNICAL & ENVIRONMENTAL INVESTIGATION PLAN

DESIGN BY: TB
 DRAWN BY: EY
 APPROVED: LZ
 DATE: 2022MAY18
 SCALE: 1:1000
 YPPA SITE: 306

SIZE: DWG. 356-135-SK-101
 SHEET: 1 of 1
 REV: C



Memorandum (*cont'd*)

*Preliminary Geotechnical Recommendations and Comments on Use of EPS and Densification
for Overpass Design Options 1 and 3
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC*

*Reference No.: VAN-22003875-A0
November 23, 2022*

Appendix B

Test hole Logs and CPTs Plot



EXP Services Inc.

RECORD OF AUGERHOLE : AH22-04

PROJECT NUMBER VAN-22003875-A0

CLIENT Vancouver Fraser Port Authority

PROJECT NAME Portside/Blundell Road Improvement Project

PROJECT LOCATION Richmond, BC

DRILLING DATE 2022-05-27 to 2022-05-27

AUGERHOLE LOCATION _____

DRILLING CONTRACTOR VanMars Drilling

ELEVATION _____

DRILLING METHOD Solid Stem Auger

GROUND WATER DEPTHS: ▽ AT TIME OF DRILLING 3.0m

EQUIPMENT TYPE MARL M6 drilled rig

▽ AT END OF DRILLING ---

LOGGED BY PA CHECKED BY BC

▽ AFTER DRILLING ---

| DEPTH (m) | STRATA | SOIL DESCRIPTION | ELEV. DEPTH (m) | SAMPLES | | | SPT N VALUE BLOWS/0.3m | POCKET PEN. (kPa) | FINES CONTENT (%) |
|-----------|-------------------------|---|-----------------|---------|------|-------------|-------------------------|------------------------|---|
| | | | | NUMBER | TYPE | RECOVERY % | 20 40 60 80 | 100 200 300 400 | 20 40 60 80 |
| | | | | | | | DYNAMIC CONE BLOWS/0.3m | FIELD VANE SHEAR (kPa) | PLASTIC & LIQUID LIMIT MOISTURE CONTENT |
| | | | | | | 20 40 60 80 | Peak 40 80 120 160 | Remold | PL MC LL |
| 1 | [Cross-hatched pattern] | SAND, some silt to silty, brown, damp, loose to compact (FILL) | | GB1 | AU | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 3 | | ▽ -at 2.9m, becomes grey, wet Wood debris, brown, damp | 3.0 | GB2 | AU | | | | |
| 4 | | | | GB3 | AU | | | | |
| 5 | | | | | | | | | |
| 6 | | Peat, trace rootlets, redish brown, damp, soft | 5.2 | GB4 | AU | | | | |
| 7 | | SILT, some clay to clayey, frequent sand lenses, frequent pocket of peat and wood fibers, brown, moist to wet, soft to firm | 6.1 | GB5 | AU | | | | |
| 7 | | -From 7.0m, becomes grey, moist, firm | | GB6 | AU | | | | |
| 8 | | -At 7.6m, becomes trace clay, frequent pocket of peat | | | | | | | |
| 9 | | | | | | | | | |

Bottom of hole at 9.1m.



EXP Services Inc.

RECORD OF AUGERHOLE : AH22-05

PROJECT NUMBER VAN-22003875-A0

CLIENT Vancouver Fraser Port Authority

PROJECT NAME Portside/Blundell Road Improvement Project

PROJECT LOCATION Richmond, BC

DRILLING DATE 2022-05-27 to 2022-05-27

AUGERHOLE LOCATION _____

DRILLING CONTRACTOR VanMars Drilling

ELEVATION _____

DRILLING METHOD Solid Stem Auger

GROUND WATER DEPTHS: ▽ AT TIME OF DRILLING 3.4m

EQUIPMENT TYPE MARL M6 drilled rig

▽ AT END OF DRILLING ---

LOGGED BY PA CHECKED BY BC

▽ AFTER DRILLING ---

| DEPTH (m) | STRATA | SOIL DESCRIPTION | ELEV. DEPTH (m) | SAMPLES | | | SPT N VALUE BLOWS/0.3m | POCKET PEN. (kPa) | FINES CONTENT (%) |
|-----------|-------------------------|--|-----------------|---------|------|------------|-------------------------|------------------------|---|
| | | | | NUMBER | TYPE | RECOVERY % | 20 40 60 80 | 100 200 300 400 | 20 40 60 80 |
| | | | | | | | DYNAMIC CONE BLOWS/0.3m | FIELD VANE SHEAR (kPa) | PLASTIC & LIQUID LIMIT MOISTURE CONTENT |
| | | | | | | | | | |
| 1 | [Cross-hatched pattern] | SAND, some silt to silty, brown, damp to moist, loose to compact (FILL) | | GB1 | AU | | | | |
| 2 | | -At 1.5m, becomes FINE SILTY SAND, trace gravel, trace garbage, grey, moist -From 2.2m, becomes SILT, some sand, pockets of organic, bluish grey, soft (FILL) | | GB2 | AU | | | | |
| 3 | | | | GB3 | AU | | | | |
| 4 | [Cross-hatched pattern] | Wood debris, garbage, black, wet (FILL) | 3.0 | GB4 | AU | | | | |
| 5 | | | | GB5 | AU | | | | |
| 6 | [Wavy pattern] | Peat, trace rootlets, reddish brown, damp, very soft | 5.3 | | | | | | |
| 7 | [Vertical lines] | SILT, frequent pocket of peat, brown, moist, soft to firm -At 6.0m, becomes firm to stiff | 5.8 | GB6 | AU | | | | |
| 8 | | | | GB7 | AU | | | | |
| 9 | | -From 7.6m, becomes grey, trace to some clay, trace peat, damp to moist | | GB8 | AU | | | | |

Bottom of hole at 9.1m.



EXP Services Inc.

RECORD OF AUGERHOLE : AH22-06

PROJECT NUMBER VAN-22003875-A0

CLIENT Vancouver Fraser Port Authority

PROJECT NAME Portside/Blundell Road Improvement Project

PROJECT LOCATION Richmond, BC

DRILLING DATE 2022-05-27 to 2022-05-27

AUGERHOLE LOCATION _____

DRILLING CONTRACTOR VanMars Drilling

ELEVATION _____

DRILLING METHOD Solid Stem Auger

GROUND WATER DEPTHS: ▽ AT TIME OF DRILLING 4.0m

EQUIPMENT TYPE MARL M6 drilled rig

▽ AT END OF DRILLING ---

LOGGED BY PA CHECKED BY BC

▽ AFTER DRILLING ---

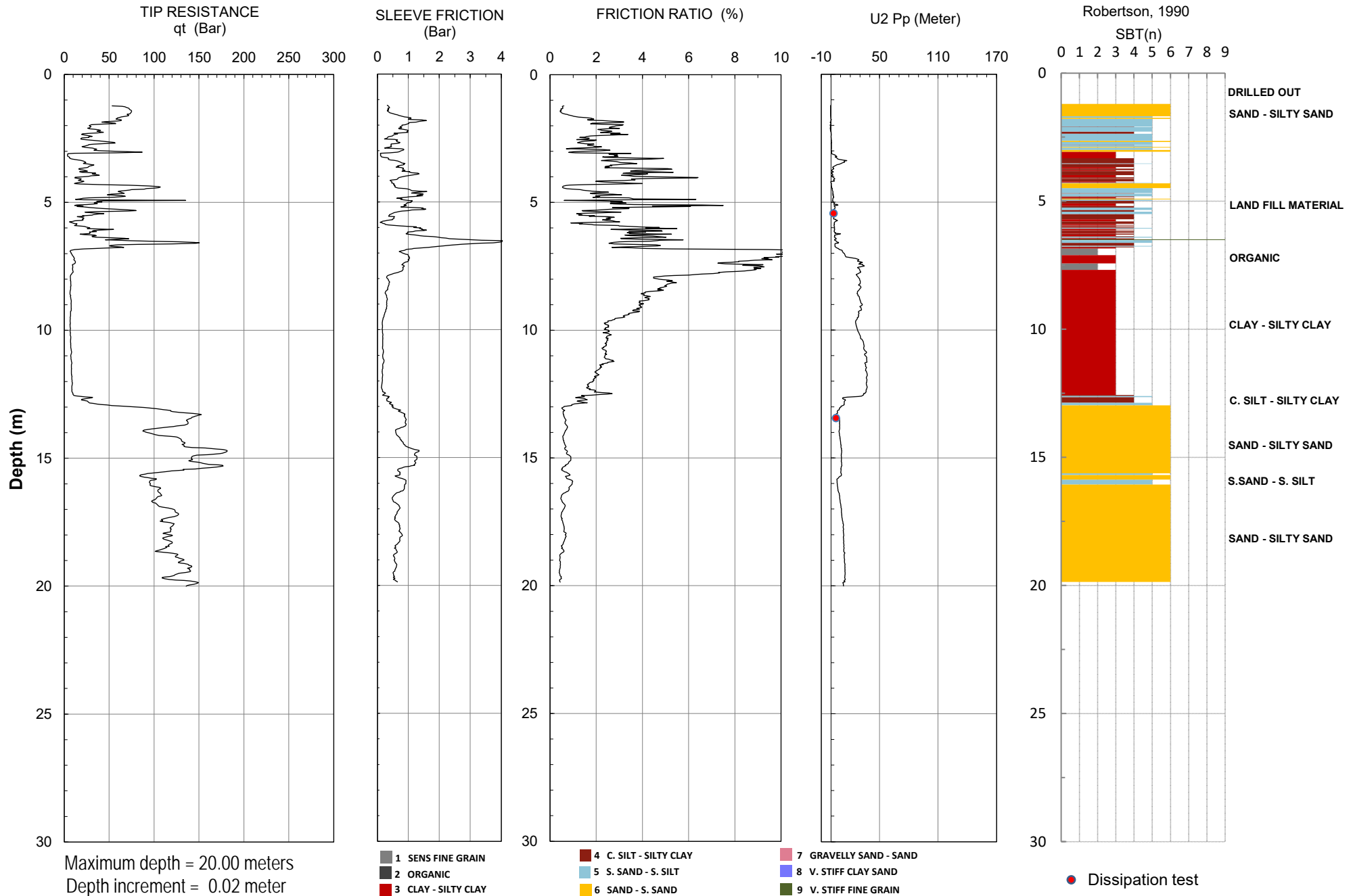
| DEPTH (m) | STRATA | SOIL DESCRIPTION | ELEV. DEPTH (m) | SAMPLES | | | SPT N VALUE BLOWS/0.3m | POCKET PEN. (kPa) | FINES CONTENT (%) |
|-----------|-------------------------|---|-----------------|---------|------|------------|-------------------------|------------------------|---|
| | | | | NUMBER | TYPE | RECOVERY % | 20 40 60 80 | 100 200 300 400 | 20 40 60 80 |
| | | | | | | | DYNAMIC CONE BLOWS/0.3m | FIELD VANE SHEAR (kPa) | PLASTIC & LIQUID LIMIT MOISTURE CONTENT |
| | | | | | | | | | |
| 1 | [Cross-hatched pattern] | SAND, some silt, coarse sand, light brown, damp, loose to compact (FILL) | | GB1 | AU | | | | |
| 2 | | -At 1.5m, becomes FINE SILTY SAND, trace wood debris, grey, moist | | GB2 | AU | | | | |
| 3 | [Horizontal lines] | Wood fiber, brown, moist | 2.7 | | | | | | |
| 4 | [Cross-hatched pattern] | Wood debris, garbage, trace to some sand, trace gravel, black, wet (FILL) | 3.0 | GB3 | AU | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 6 | [Horizontal lines] | Peat, trace rootlets, redish brown, moist, very soft | 5.8 | GB4 | AU | | | | |
| 7 | [Vertical lines] | SILT, trace to some clay, frequent pocket of peat, brown, moist, soft to firm | 6.1 | GB5 | AU | | | | |
| 8 | | -From 6.5m, becomes grey, trace peat, damp to moist, firm | | GB6 | AU | | | | |
| 9 | | | | | | | | | |

Bottom of hole at 9.1m.



Operator: Schwartz Soil Technical
 Sounding: CPT22 - 01
 Cone ID: DPG1603

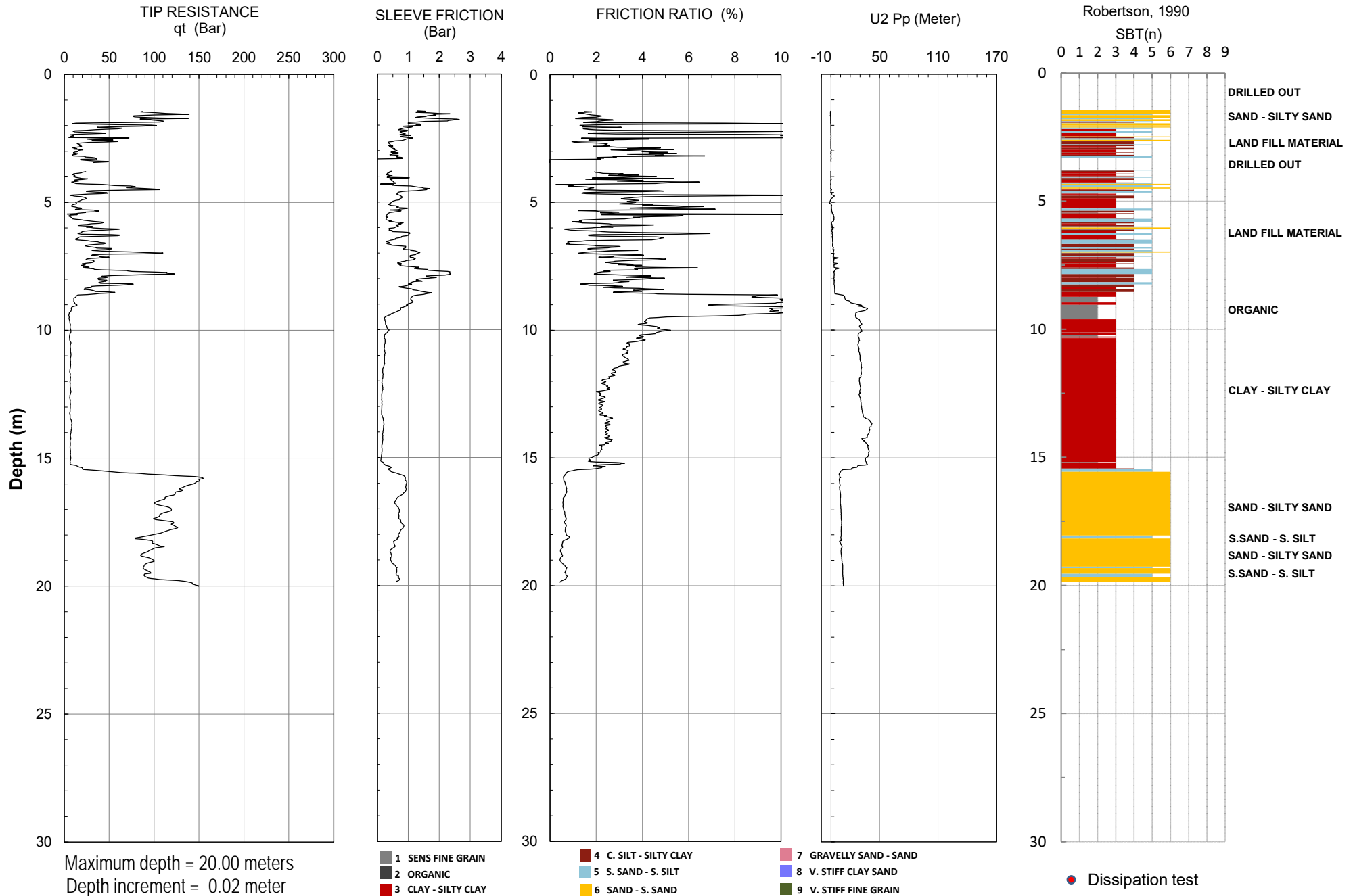
Date: May 30, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: CPT22 - 02
 Cone ID: DPG1603

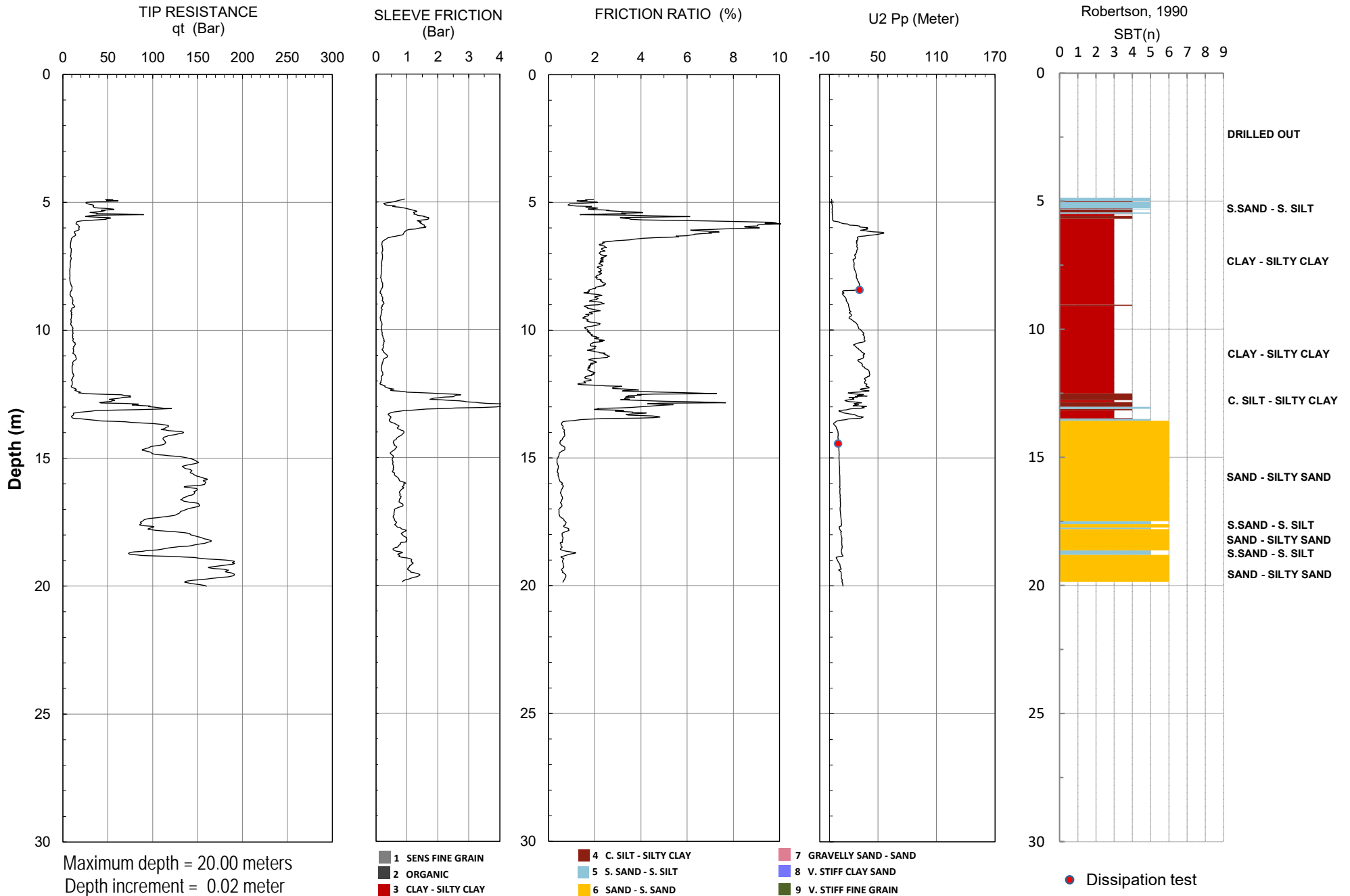
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 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: CPT22 - 03
 Cone ID: DPG1603

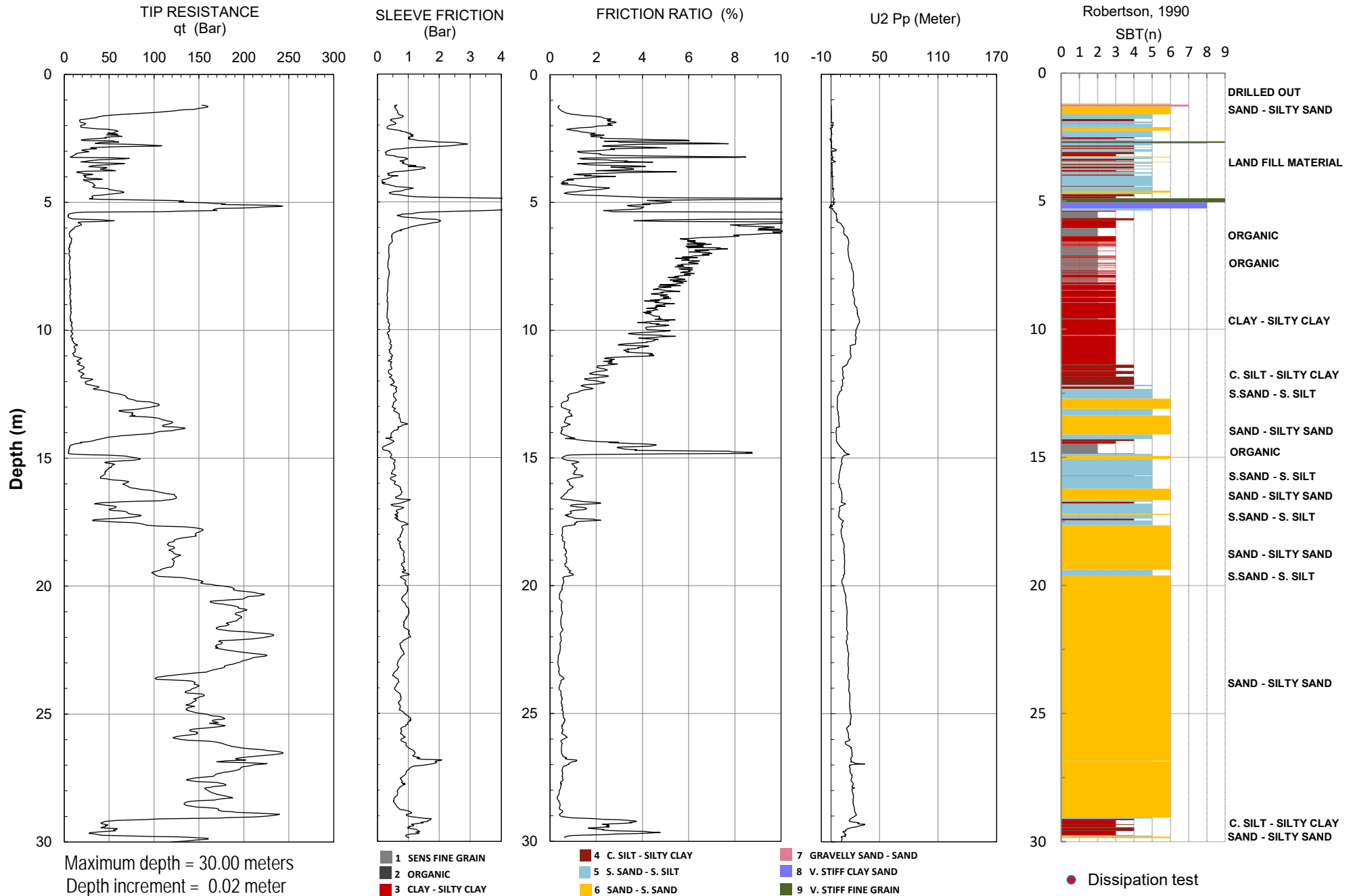
Date: May 30, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: CPT22 - 04
 Cone ID: DPG1603

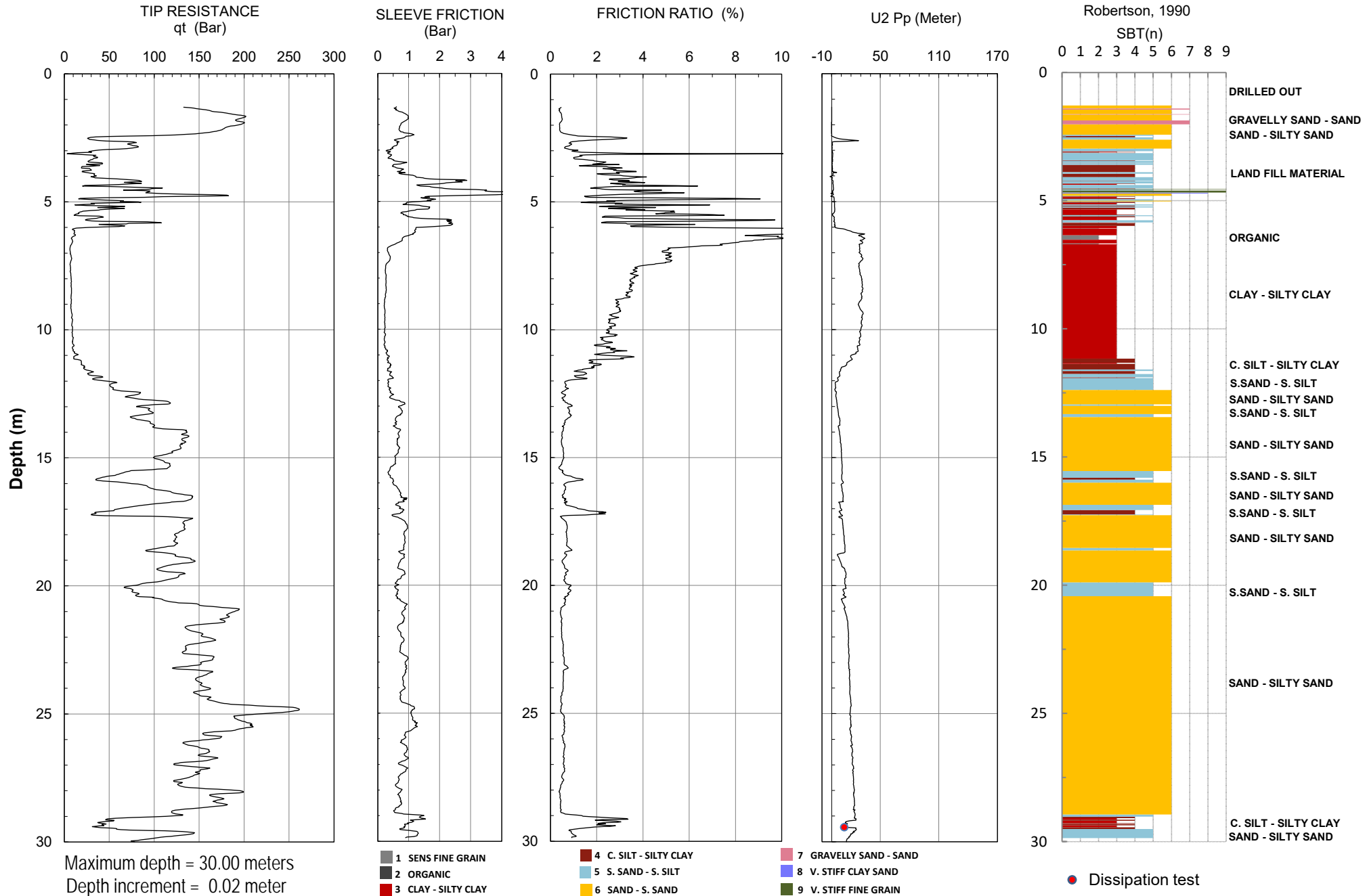
Date: May 30, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: CPT22 - 05
 Cone ID: DPG1603

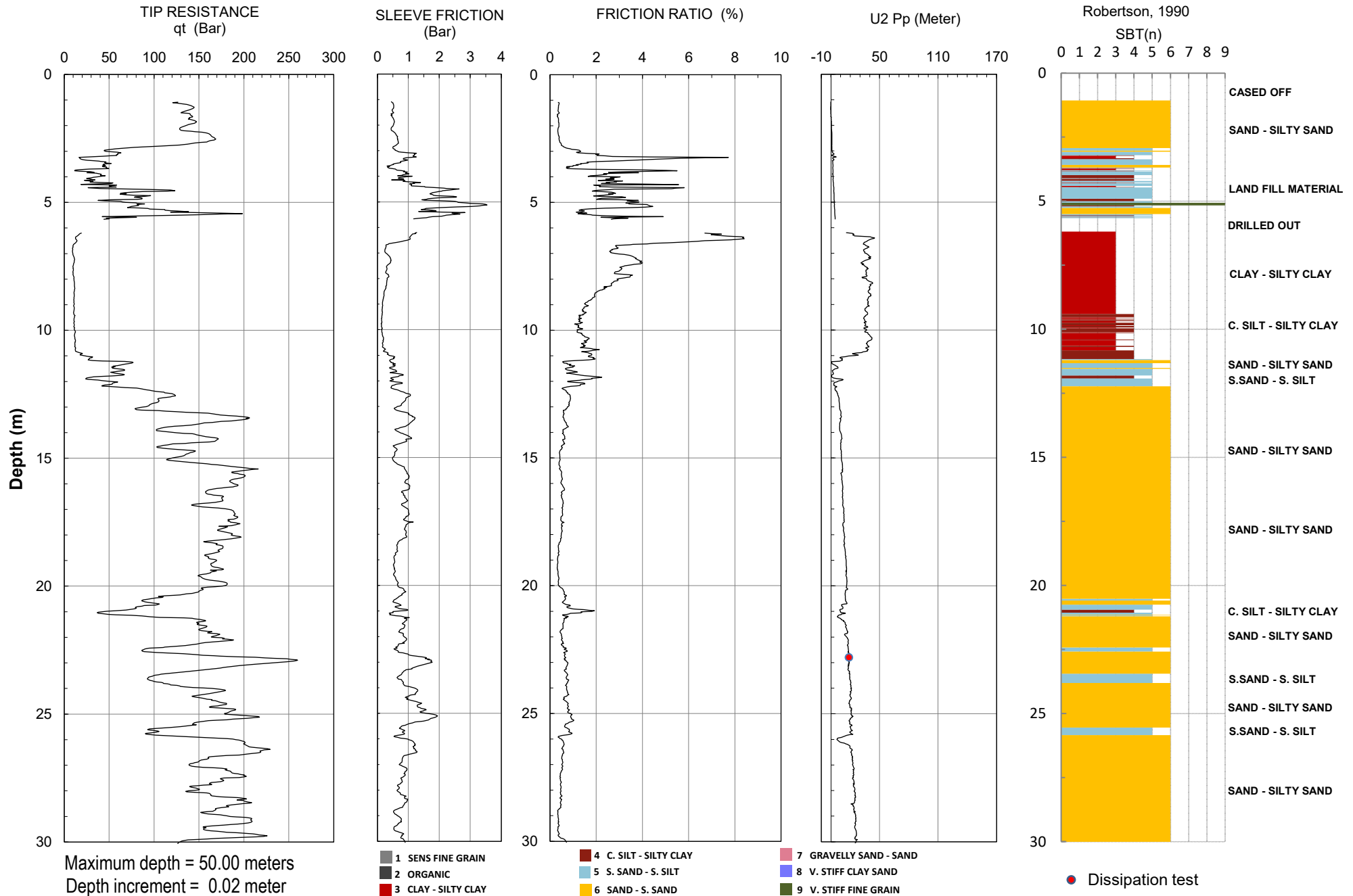
Date: May 30, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: CPT22 - 07
 Cone ID: DPG1603

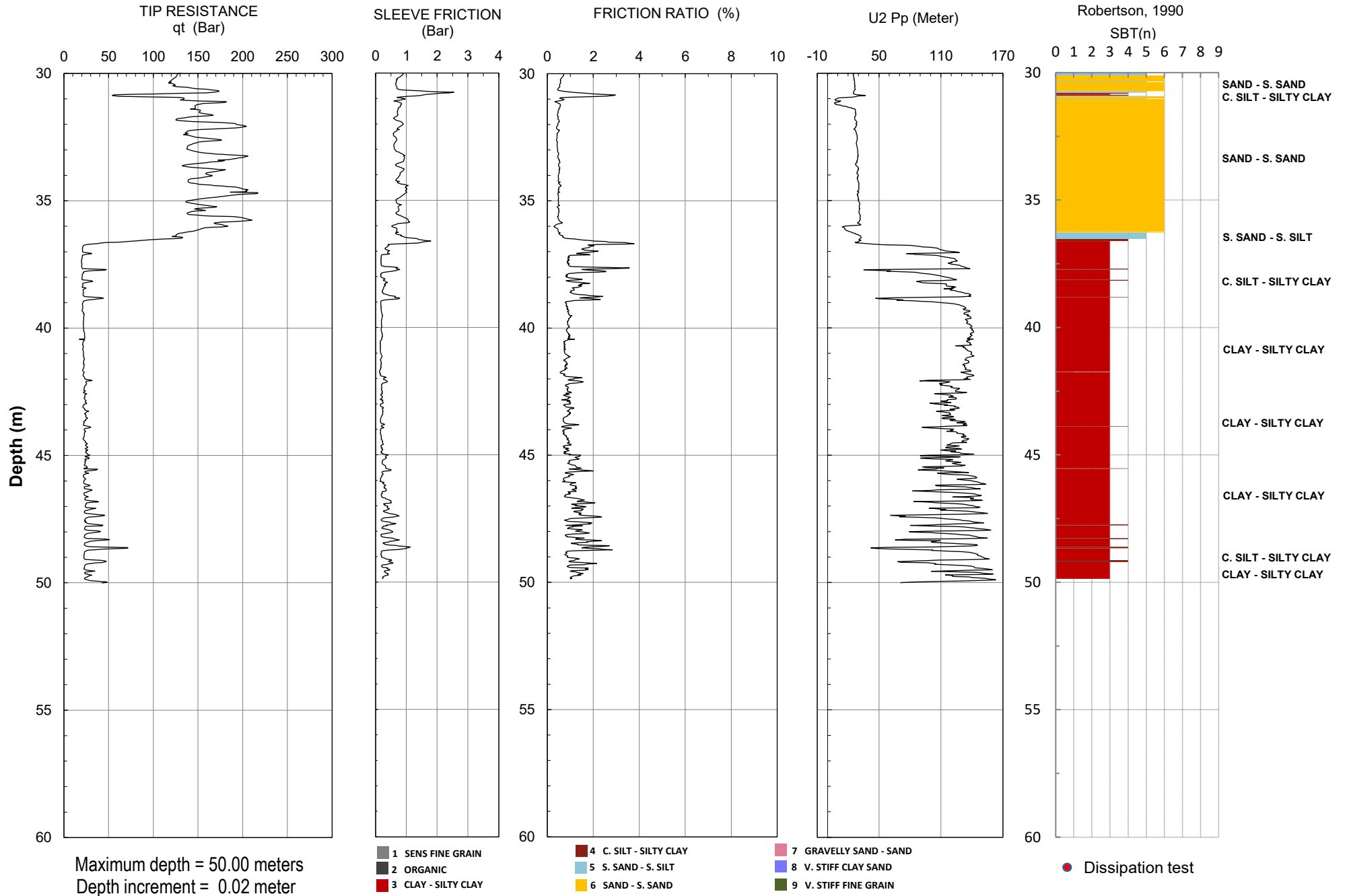
Date: June 3, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: CPT22 - 07
 Cone ID: DPG1603

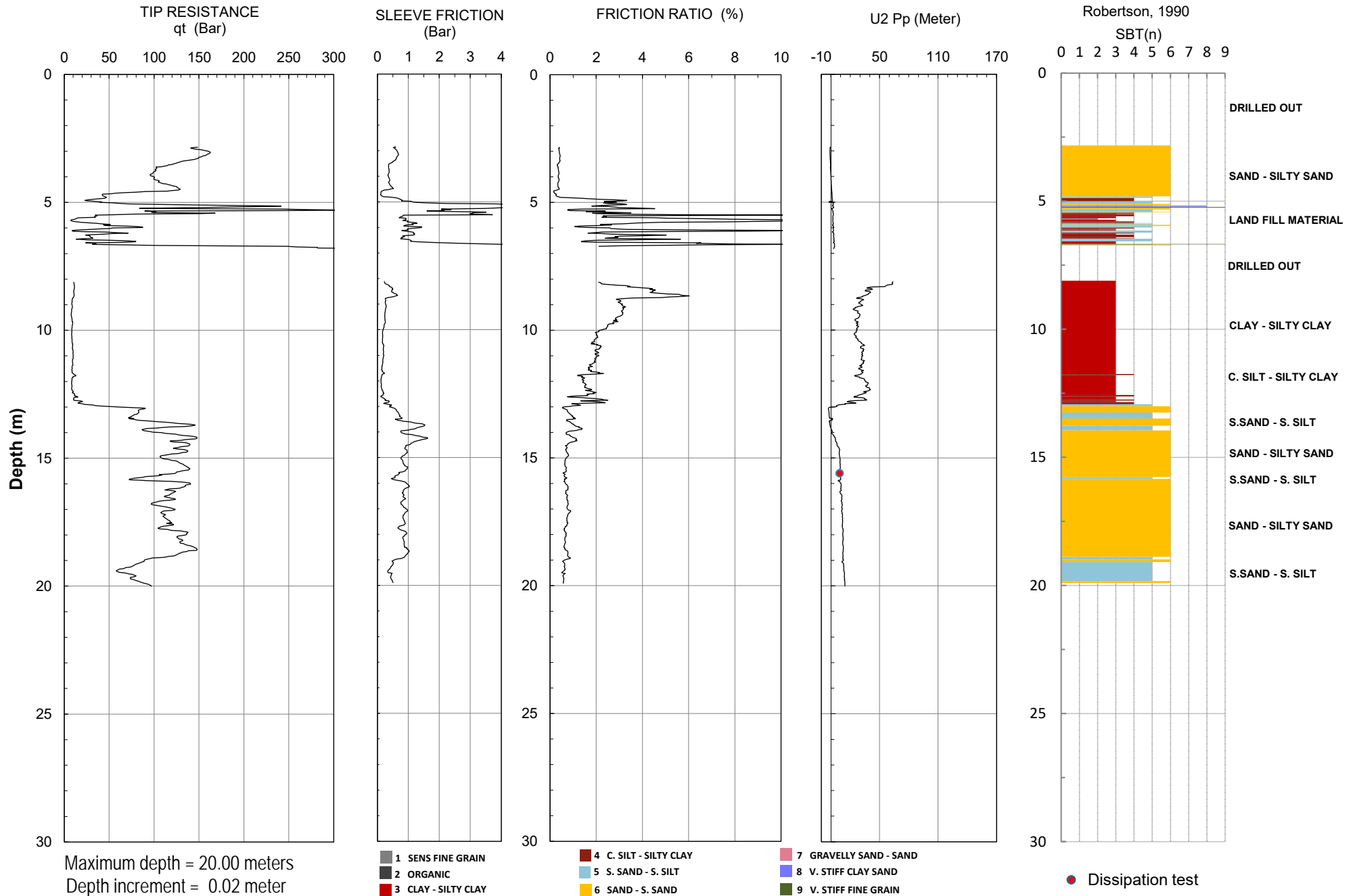
Date: June 3, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: CPT22 - 08
 Cone ID: DPG1433

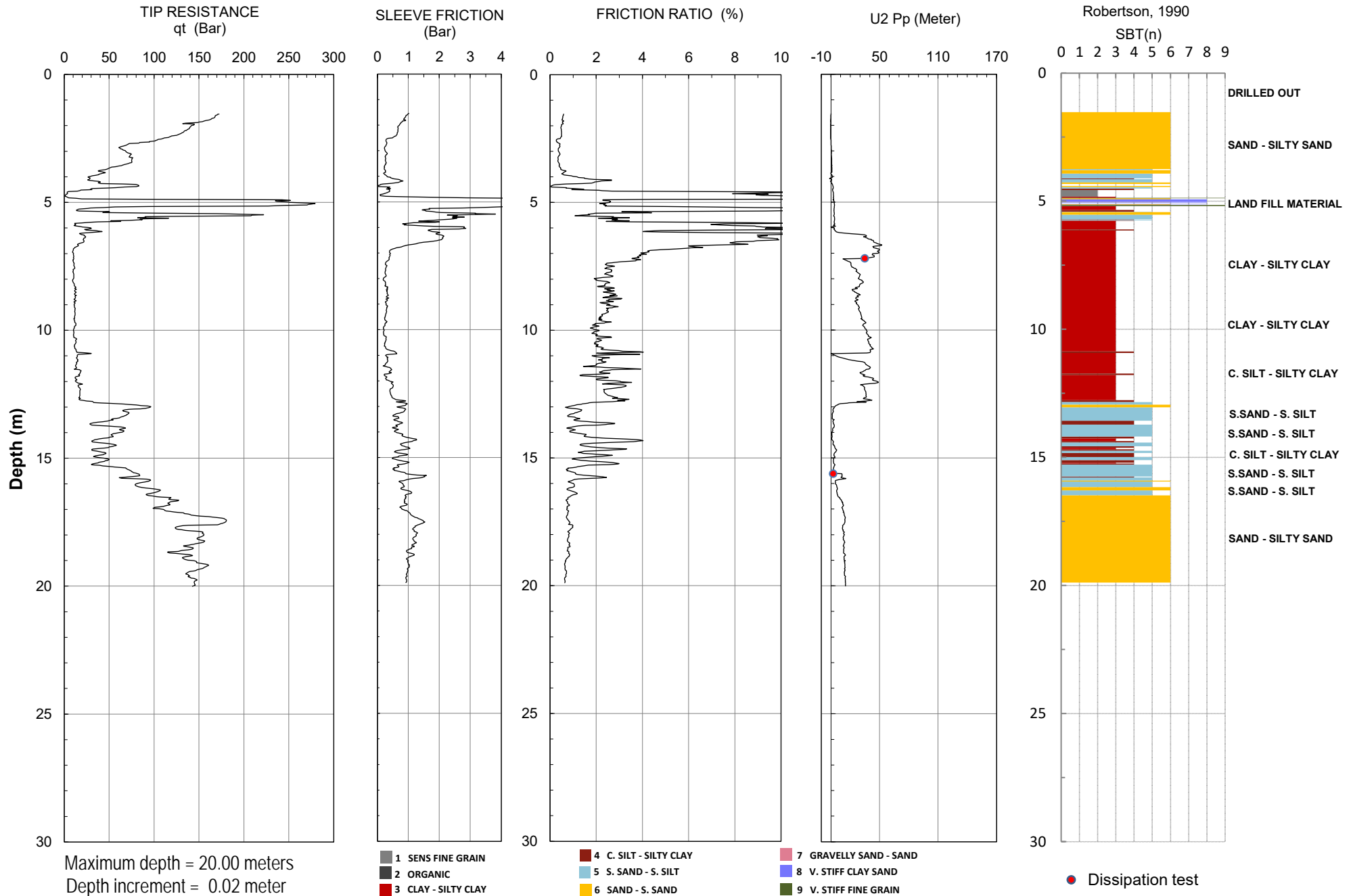
Date: May 27, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: CPT22 - 09
 Cone ID: DPG1433

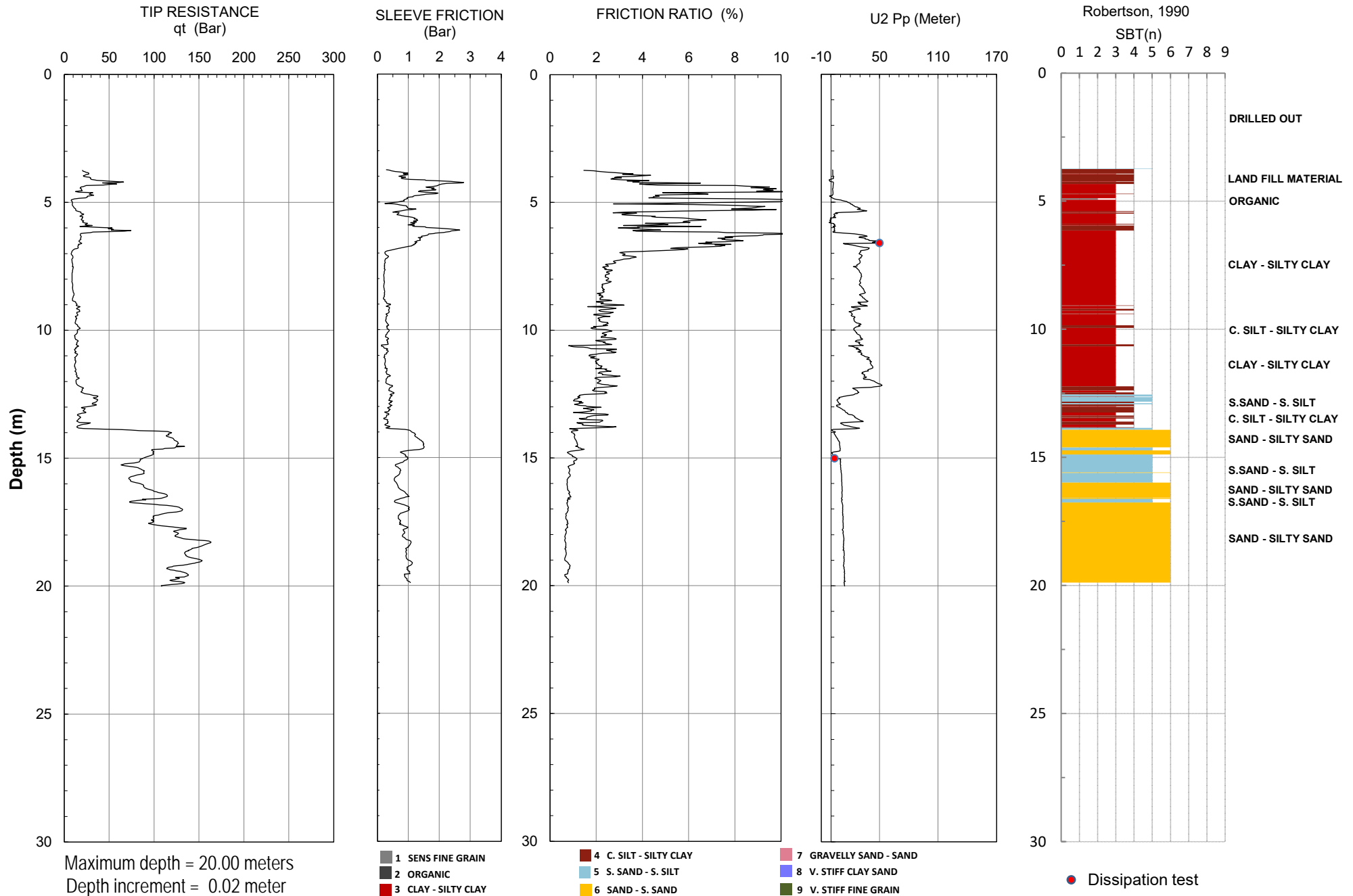
Date: May 26, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: CPT22 - 10
 Cone ID: DPG1433

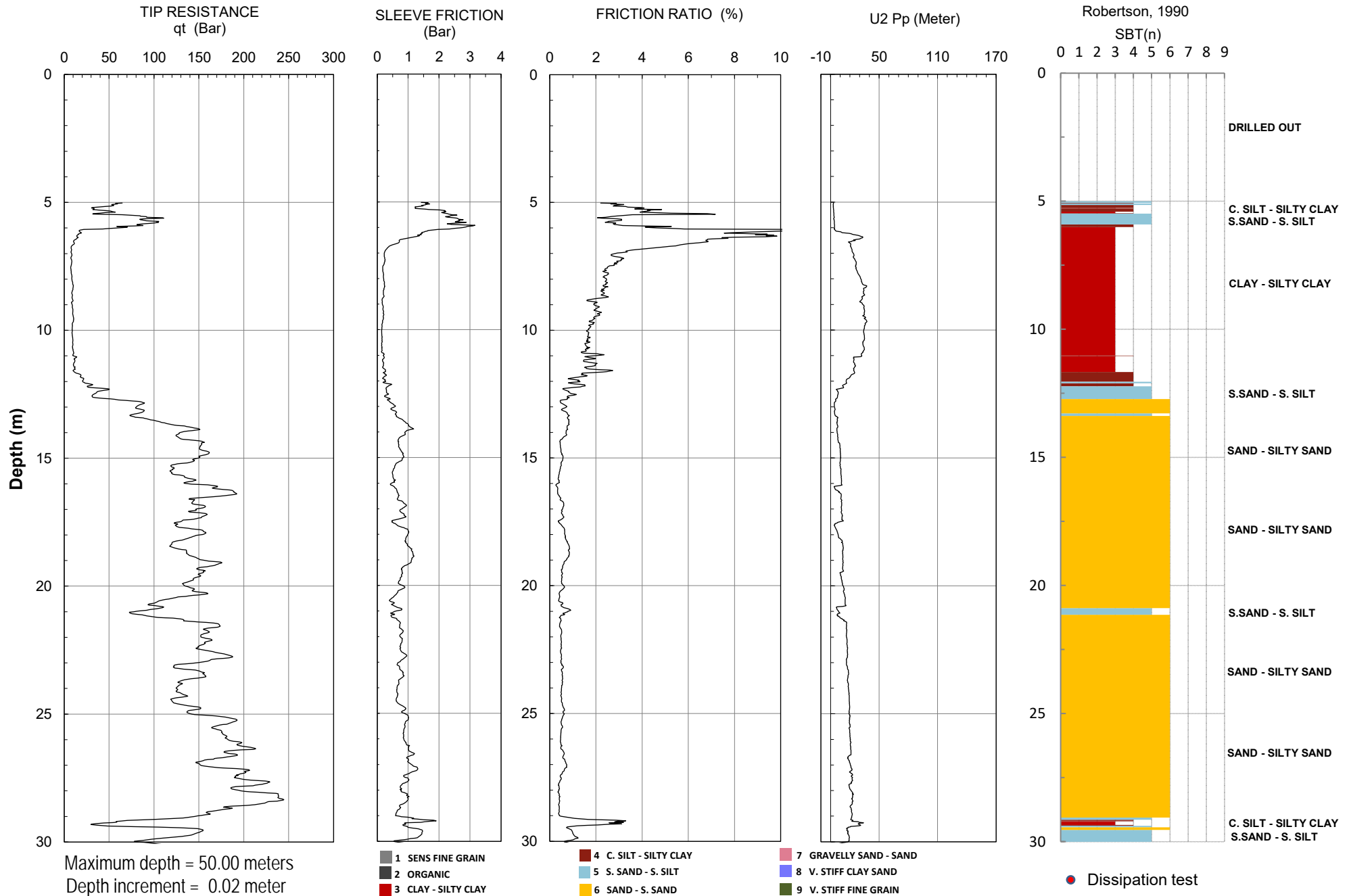
Date: May 26, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: SCPT22 - 06
 Cone ID: DPG1603

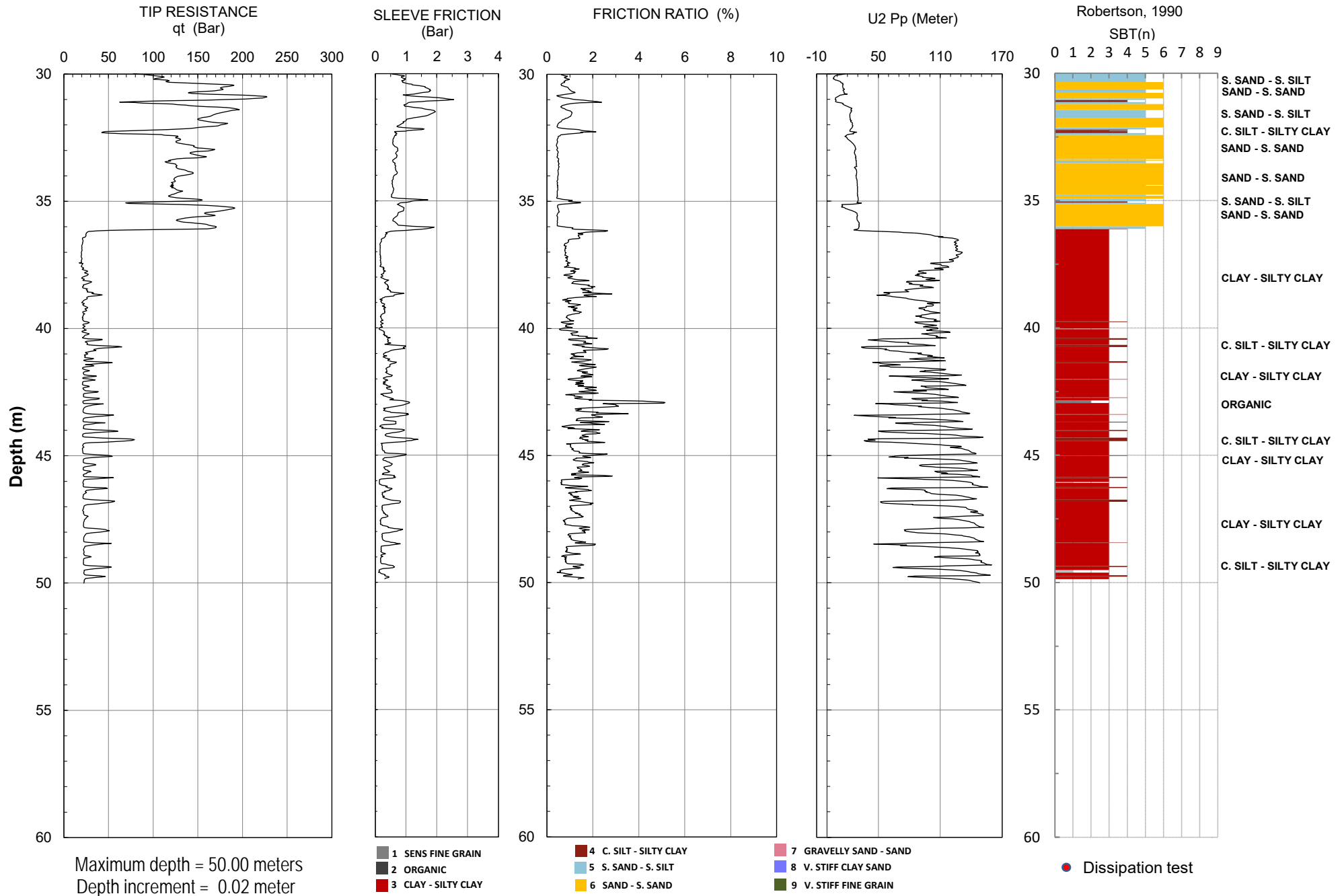
Date: May 31, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Operator: Schwartz Soil Technical
 Sounding: SCPT22 - 06
 Cone ID: DPG1603

Date: May 31, 2022
 Site: Portside Blundell Rd Overpass
 Exp project: VAN - 22003875 - AO





Memorandum (*cont'd*)

*Preliminary Geotechnical Recommendations and Comments on Use of EPS and Densification
for Overpass Design Options 1 and 3
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC*

*Reference No.: VAN-22003875-A0
November 23, 2022*

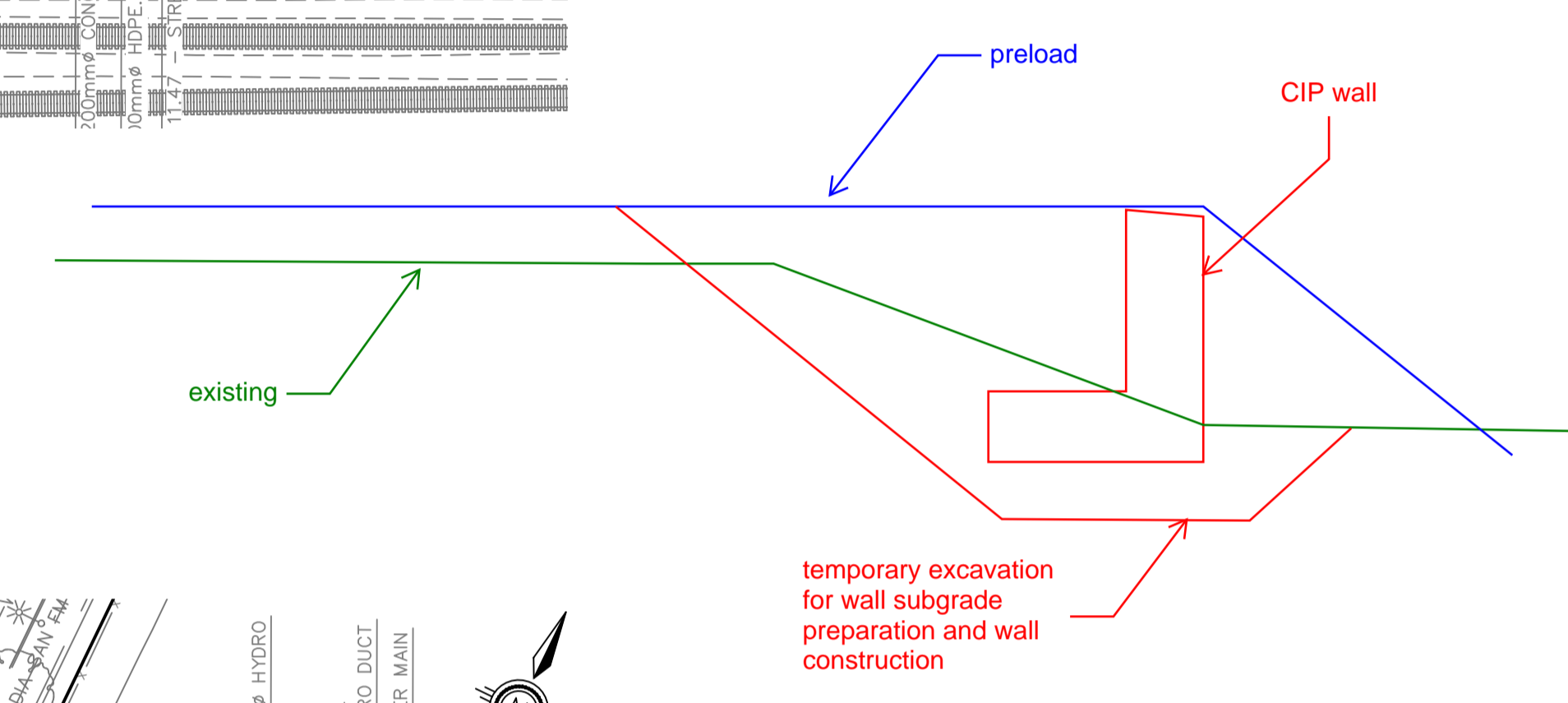
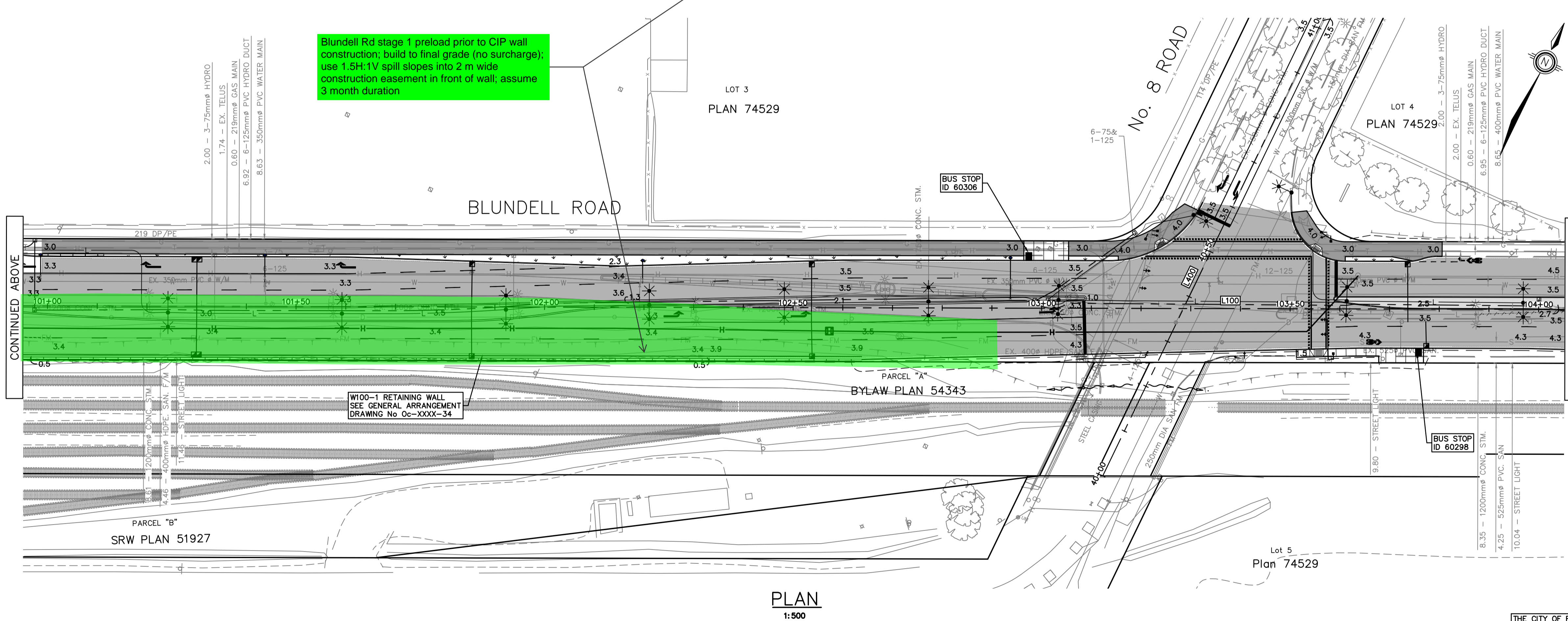
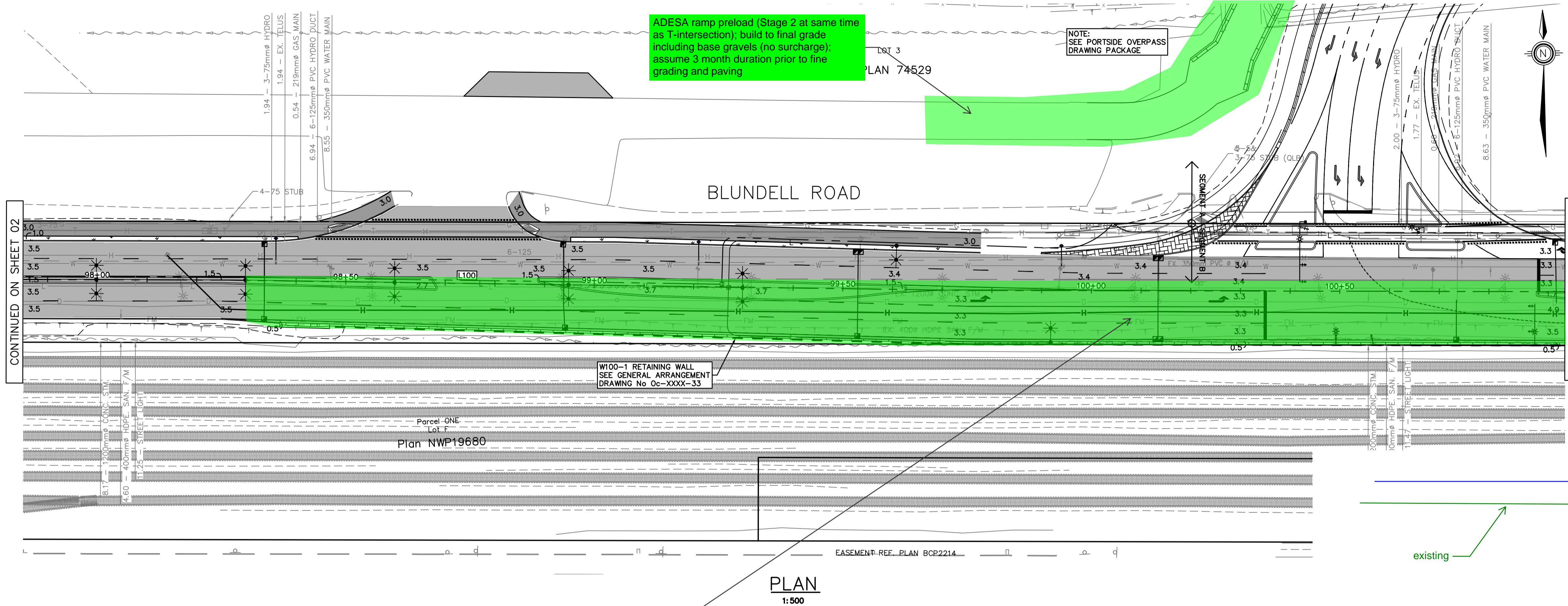
Appendix C

Preload sketches

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LEGEND - ROADWORKS

| | |
|--|------------------------|
| | ASPHALT ROAD |
| | ASPHALT MULTI-USE PATH |
| | CONCRETE SIDEWALK |
| | MEDIAN |
| | BOULEVARD |

TECOR
Suite 500-1055 HASTINGS ST W, VANCOUVER, BC CANADA V6E 2E9

McElhanney
2300 - 13450 - 102 Avenue, Surrey, BC Canada V3T 5X3 T: 604-596 0391

City of Richmond
6911 No. 3 ROAD RICHMOND B.C. V6Y 2C1

B.C. GAS SERVICES

THE DEVELOPER OR CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING EXISTING LOCATION OF GAS SERVICE LINES, AND WHERE NECESSARY ARRANGE FOR THEIR RELOCATION IN ORDER TO FACILITATE INSTALLATION OF THE WORKS SHOWN ON THESE PLANS. A LIST OF SERVICE LINE LOCATIONS MAY BE OBTAINED FROM:

B.C. GAS SERVICE RECORDS DEPARTMENT
TELEPHONE 293-8552

NOTE - B.C. GAS REQUIRES 10 DAYS NOTICE PRIOR TO THE COMMENCEMENT OF ANY WORK.

BENCHMARK

ALL ELEVATIONS ARE TO GEODETIC DATUM AND REFER TO RICHMOND BENCHMARK NUMBER:

MONUMENT 02H2412

ELEVATION **4.562 (CVD28GVRD2018)** FIELD BOOK NO. _____

CITY WORK ORDER NO. _____ TENDER / PROJECT NO. _____

CONTRACTOR WORK ORDER NO. _____ ACCOUNT NO. _____

REFERENCE DRAWINGS

| | |
|-----------------------------|----|
| PROPERTY ACQUISITION | Aq |
| SURVEY PLAN & PROFILE | Pp |
| ROAD CONSTRUCTION | Oc |
| STORM SEWER INSTALLATION | Lc |
| WATERMAIN INSTALLATION | Wc |
| ORNAMENTAL STREET LIGHTING | Tc |
| TRAFFIC SIGNALS | Ec |
| SANITARY SEWER INSTALLATION | |
| OTHER | |

NOTE - PROVE LOCATION OF ALL UTILITIES / SERVICES BEFORE STARTING CONSTRUCTION.

| NO. | DATE | BY | CH. | DESCRIPTION |
|-----|------------|----|-----|--|
| B | 2022-09-13 | HG | VM | INDICATIVE DESIGN SUBMISSION DRAFT FOR IDR |
| A | 2022-06-30 | ST | JA | PRELIMINARY DESIGN |

THE CITY OF RICHMOND IS NOT RESPONSIBLE FOR ERROR NOR OMISSIONS

PRELIMINARY NOT FOR CONSTRUCTION

THIS DRAWING HAS NOT BEEN APPROVED AND MAY CONTAIN ERRORS AND OMISSIONS

TITLE: KEY PLAN BLUNDELL ROAD STA 97+85 TO STA. 104+05

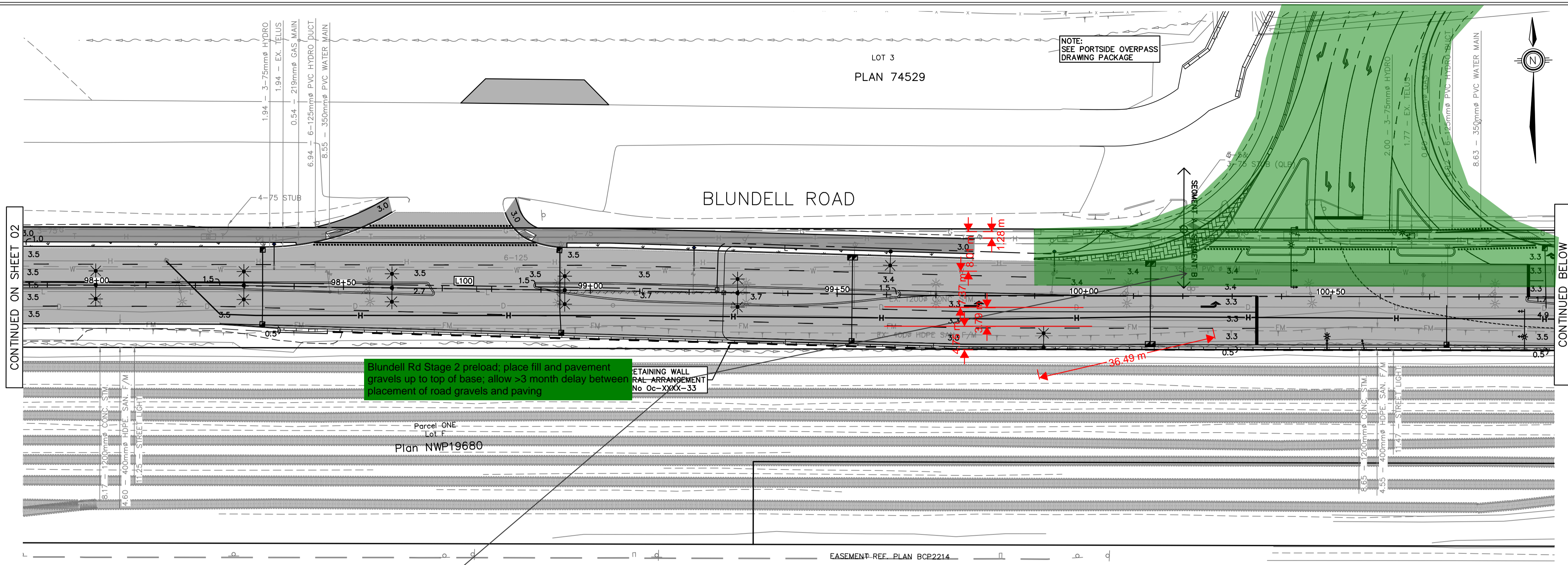
| | |
|--------------|------------------|
| DESIGN: TB | DWG. NO: Oc-XXXX |
| DRAWN: ST | SCALE: 1:500 |
| CHECKED: JA | DATE: JUNE 2022 |
| ENGINEER: LZ | SEC. NO: _____ |
| | SHT. NO: 3 OF 37 |

Plot: September 13, 2022, 14:46:56, X:\2111\1.00 - 08 Projects\2111-40118-00_Landsc - Portside-Blundell Rd Imp\10.0 DRAWINGS\10.2 Civil\020208\10.3.1 Sheets\020208-MCS-DWG-CV-100-MEY.dwg\Oc-XXXX-3

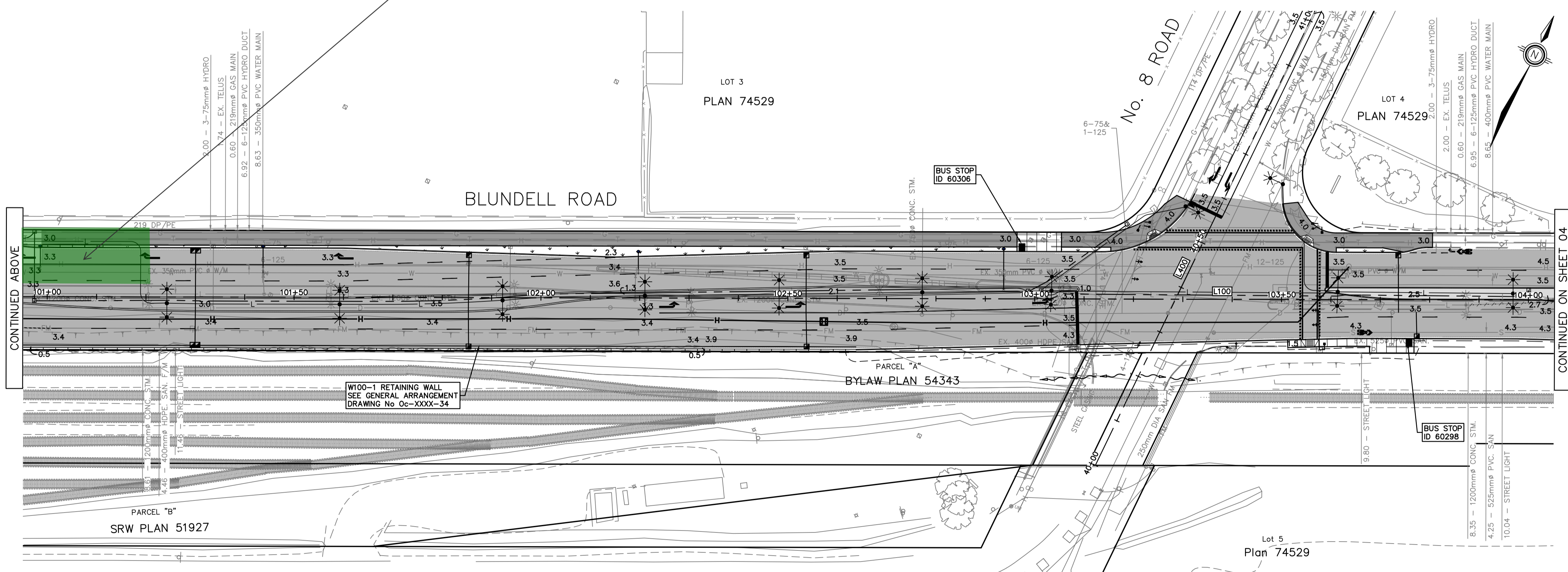
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PLAN 1:500



PLAN 1:500

LEGEND - ROADWORKS

| | |
|--|------------------------|
| | ASPHALT ROAD |
| | ASPHALT MULTI-USE PATH |
| | CONCRETE SIDEWALK |
| | MEDIAN |
| | BOULEVARD |

TECOR
Suite 500-1055 HASTINGS ST W, VANCOUVER, BC CANADA V6E 2E9

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6911 No. 3 Road RICHMOND B.C. V6Y 2C1

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TELEPHONE 293-8552

NOTE - B.C. GAS REQUIRES 10 DAYS NOTICE PRIOR TO THE COMMENCEMENT OF ANY WORK.

BENCHMARK

ALL ELEVATIONS ARE TO GEODETIC DATUM AND REFER TO RICHMOND BENCHMARK NUMBER:

MONUMENT 02H2412

ELEVATION **4.562 (CVD28GVRD2018)** FIELD BOOK NO. _____

CITY WORK ORDER NO. _____ TENDER / PROJECT NO. _____

CONTRACTOR WORK ORDER NO. _____ ACCOUNT NO. _____

REFERENCE DRAWINGS

| | |
|-----------------------------|----|
| PROPERTY ACQUISITION | Aq |
| SURVEY PLAN & PROFILE | Pp |
| ROAD CONSTRUCTION | Oc |
| STORM SEWER INSTALLATION | Lc |
| WATERMAIN INSTALLATION | Wc |
| ORNAMENTAL STREET LIGHTING | Tc |
| TRAFFIC SIGNALS | Ec |
| SANITARY SEWER INSTALLATION | |
| OTHER | |

NOTE - PROVE LOCATION OF ALL UTILITIES / SERVICES BEFORE STARTING CONSTRUCTION.

| NO. | DATE | BY | CH. | DESCRIPTION |
|-----|------------|----|-----|--|
| B | 2022-09-13 | HG | VM | INDICATIVE DESIGN SUBMISSION DRAFT FOR IDR |
| A | 2022-06-30 | ST | JA | PRELIMINARY DESIGN |

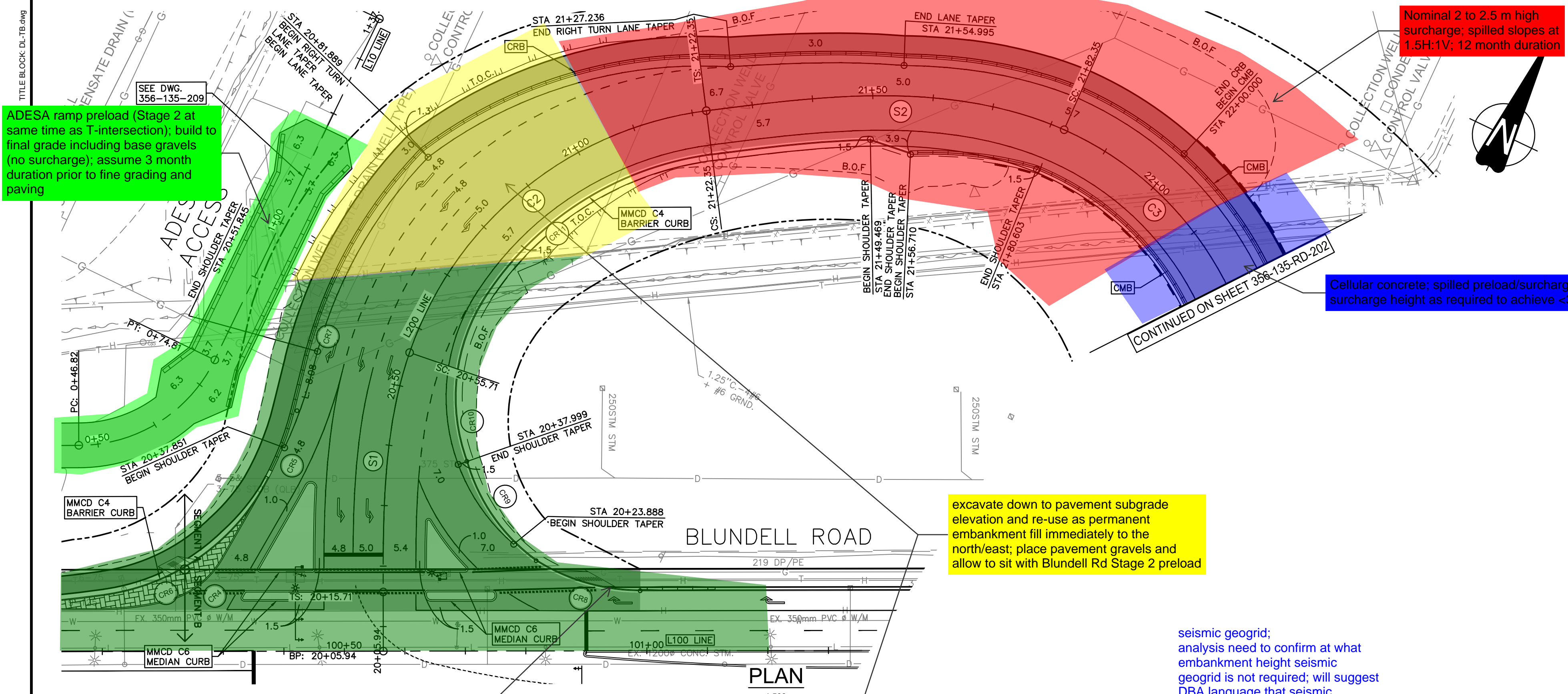
PRELIMINARY NOT FOR CONSTRUCTION

THIS DRAWING HAS NOT BEEN APPROVED AND MAY CONTAIN ERRORS AND OMISSIONS

TITLE: **KEY PLAN BLUNDELL ROAD STA 97+85 TO STA. 104+05**

| | |
|--------------|------------------|
| DESIGN: TB | DWG. NO: Oc-XXXX |
| DRAWN: ST | SCALE: 1:500 |
| CHECKED: JA | DATE: JUNE 2022 |
| ENGINEER: LZ | SEC. NO: _____ |
| | SHT. NO: 3 OF 37 |

Plot: September 13, 2022, 1:44:46 PM; X:\2111\1-00 - 08 Projects\2111-40118-00 Lincor - Portside-Blundell Rd Imp\10.0 DRAWINGS\10.2 Civil\020208\10.3.1 Sheets\020208-MCS-DWG-CV-100-MEY.dwg\Oc-XXXX-3



| CURVE TABLE | | | | | | | |
|-------------|--------|-----------|---------|--------|----------|----------|-------------------------------|
| CURVE No. | RADIUS | DELTA | TANGENT | LENGTH | B.C. STA | E.C. STA | C.C. COORD. |
| C2 | 60.00 | 63°37'49" | 37.22 | 66.63 | 2+055.71 | 2+122.34 | N 5447140.427 E 498230.327 |
| C3 | 55.00 | 45°10'45" | 22.88 | 43.37 | 2+182.35 | 2+225.72 | N 5447158.538 E 498253.994 |

| SPIRAL DATA | | | | | | |
|-------------|--------|----------|--------|------------------|-------------------------------|-------------------------------|
| SPIRAL No. | A | R | L | START DIRECTION | START COORD. | END COORD. |
| S1 | 48.990 | INFINITY | 40.000 | N25° 43' 30.30"W | N 5447095.952 E 498183.926 | N 5447133.503 E 498170.728 |
| S2 | 57.446 | INFINITY | 60.000 | N57° 00' 13.78"E | N 5447190.753 E 498197.659 | N 5447213.513 E 498252.320 |

| CURVE RETURN TABLE | | | | | | | |
|--------------------|--------|-----------|---------|--------|----------|----------|-------------------------------|
| CURVE No. | RADIUS | DELTA | TANGENT | LENGTH | B.C. STA | E.C. STA | C.C. COORD. |
| CR4 | 15.40 | 46°15'57" | 6.58 | 12.44 | 1+059.23 | 1+071.66 | N 5447090.529 E 498142.654 |
| CR5 | 50.40 | 15°58'21" | 7.07 | 14.05 | 1+031.71 | 1+045.76 | N 5447106.570 E 498108.755 |
| CR6 | 36.30 | 52°05'31" | 17.74 | 33.00 | 1+045.77 | 1+078.78 | N 5447105.526 E 498122.717 |
| CR7 | 77.51 | 3°33'54" | 2.41 | 4.82 | 1+016.55 | 1+021.38 | N 5447140.646 E 498208.219 |
| CR8 | 32.30 | 32°27'27" | 9.40 | 18.30 | 2+025.27 | 2+043.56 | N 5447143.326 E 498208.216 |
| CR9 | 30.80 | 38°19'43" | 10.70 | 20.60 | 2+043.56 | 2+064.17 | N 5447141.558 E 498209.906 |
| CR10 | 30.80 | 53°27'23" | 15.51 | 28.74 | 2+064.17 | 2+092.90 | N 5447143.326 E 498208.216 |
| CR11 | 53.10 | 24°45'59" | 11.66 | 22.95 | 2+092.90 | 2+115.86 | N 5447140.427 E 498230.327 |

excavate down to pavement subgrade elevation and re-use as permanent embankment fill immediately to the north/east; place pavement gravels and allow to sit with Blundell Rd Stage 2 preload

Cellular concrete; spilled preload/surcharge slopes at 1.5H:1V; 12 month duration; surcharge height as required to achieve <30 mm at end of warranty and <60 mm at 30 years

seismic geogrid: analysis need to confirm at what embankment height seismic geogrid is not required; will suggest DBA language that seismic performance not required for embankments less than 3 m high similar to Hwy 91/17

assume pavement structure above cellular concrete 0.5 m thick

Blundell Rd Stage 2 preload, place fill and pavement gravels up to top of base, allow >3 month delay between placement of road gravels and paving

Nominal 2 to 2.5 m high surcharge; spilled slopes at 1.5H:1V; 12 month duration

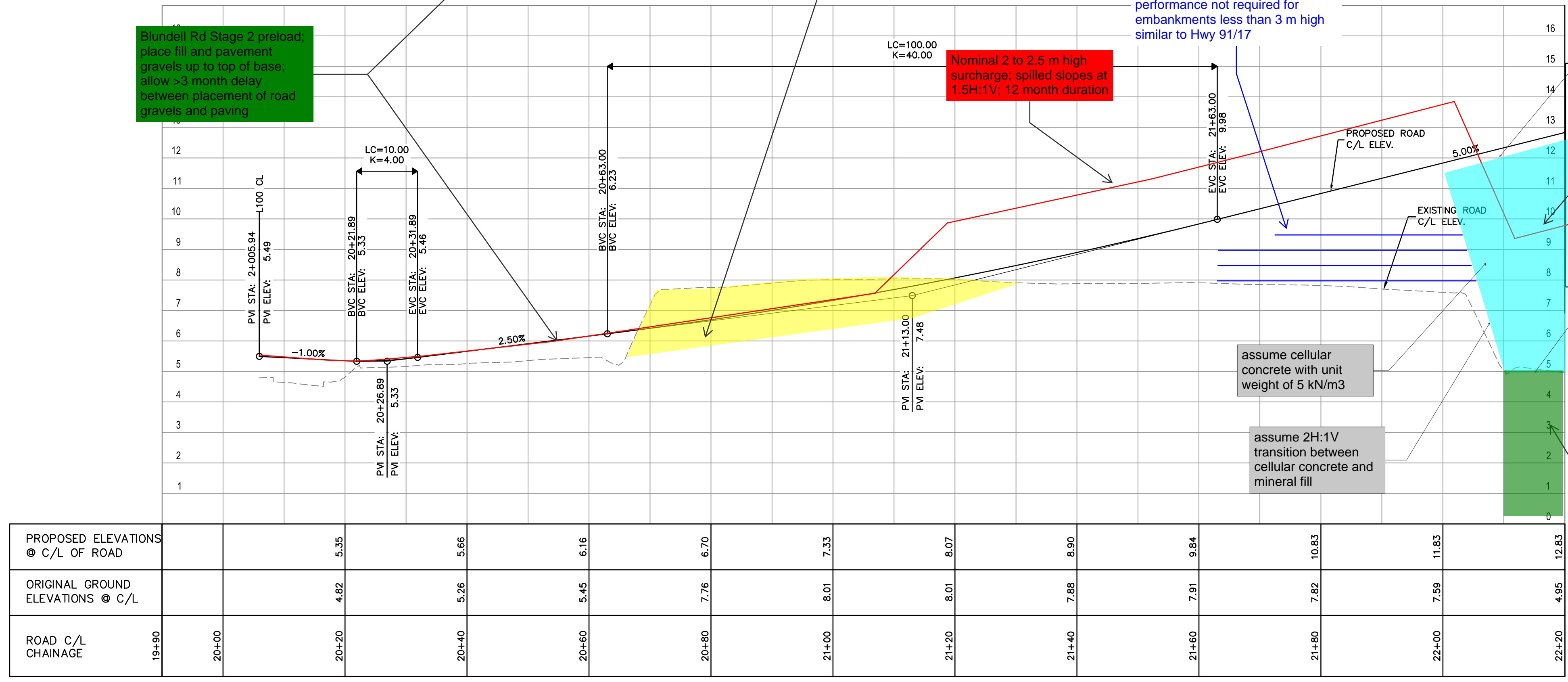
Cellular concrete; spilled preload/surcharge slopes at 1.5H:1V; 12 month duration; surcharge height as required to achieve <30 mm at end of warranty and <60 mm at 30 years

assume base of cellular concrete at El. 5 m

assume cellular concrete with unit weight of 5 kN/m3

assume 2H:1V transition between cellular concrete and mineral fill

rapid impact compaction (RIC) within footprint of cellular concrete embankment



| L200 SUPERELEVATION TABLE | | | | | | |
|---------------------------|---------------|--------------------|---------------------|-----------|------------|----------------|
| SUPERELEVATION REGION | START STATION | DESCRIPTION | LEFT SHOULDER (MUP) | LEFT LANE | RIGHT LANE | RIGHT SHOULDER |
| | 2+005.942m | BEGIN ALIGNMENT | | | | |
| | 2+012.7420m | TIE-IN TO BLUNDELL | | | | |
| 2 | 2+015.710m | TS | 0.00% | 0.00% | 0.00% | 0.00% |
| 2 | 2+035.710m | SRO-IN | 2.00% | 2.00% | -2.00% | -2.00% |
| 2 | 2+055.710m | SC-R60 | 2.00% | 4.00% | -4.00% | -4.00% |
| 2 | 2+122.343m | CS-R60 | 2.00% | 4.00% | -4.00% | -4.00% |
| 3 | 2+182.351m | SC-R55 | 2.00% | 6.00% | -6.00% | -6.00% |
| 3 | 2+225.720m | CS-R55 | 2.00% | 6.00% | -6.00% | -6.00% |
| 3 | 2+252.387m | SRO-OUT | 2.00% | 2.00% | -2.00% | -2.00% |
| 3 | 2+265.720m | ST | 2.00% | 2.00% | -2.00% | -2.00% |
| 12 | 2+340.216m | TS | 2.00% | 2.00% | -2.00% | -2.00% |
| 12 | 2+354.009m | SRO-IN | 2.00% | 2.00% | -2.00% | -2.00% |
| 12 | 2+380.216m | SC-R65 | 2.00% | 5.80% | -5.80% | -5.80% |
| 12 | 2+468.957m | CS-R65 | 2.00% | 5.80% | -5.80% | -5.80% |
| | 2+555.308m | 0% CROSSOVER | 2.00% | 0.00% | 0.00% | 0.00% |
| 13 | 2+605.927m | SC-R500 | 2.00% | -3.40% | 3.40% | 3.40% |
| 13 | 2+770.803m | CS-R500 | 2.00% | -3.40% | 3.40% | |
| | 2+830.000m | END ALIGNMENT | | -2.00% | -2.00% | |

McElhanney

3610 2300
13450 102nd Avenue
Surrey BC
Canada V3T 5X3
T 604 596 0391

PRELIMINARY
NOT FOR
CONSTRUCTION

Vancouver Fraser
Port Authority

DESIGN BY: T. BOOTH
DRAWN BY: E. YANG
APPROVED: L. ZAREI
DATE: 2022-06-30
SCALE: 1:500
VFPA SITE: 356

GREATER VANCOUVER GATEWAY 2030
PORTSIDE / BLUNDELL ROAD IMPROVEMENT PROJECT
PORTSIDE ROAD
ROAD PLAN AND PROFILE

SIZE DWG: 356-135-RD-201
SHEET: 1 of 9
REV: A

TITLE BLOCK CL-TB.rwg

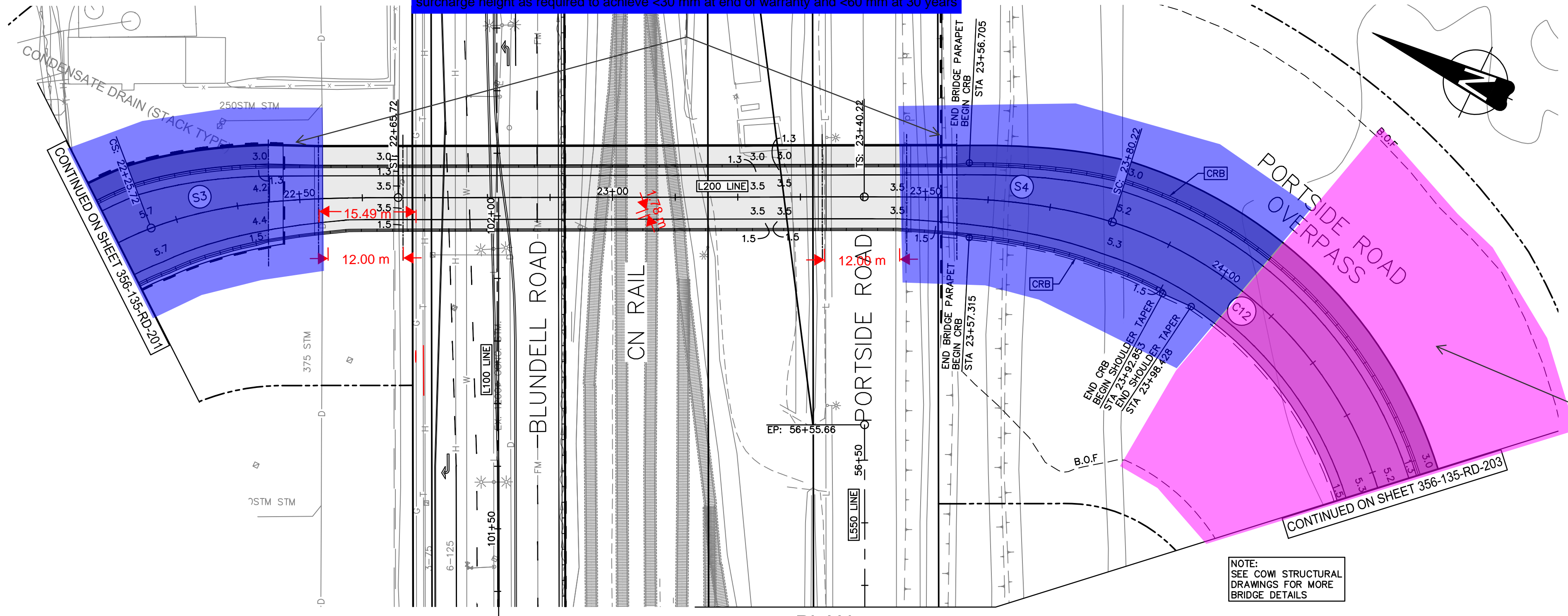
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Cellular concrete / bridge abutment interface. Spilled preload/surcharge slopes at 1.5H:1V; surcharge height as required to achieve <30 mm at end of warranty and <60 mm at 30 years

NOTE:
FOR L200 SUPERELEVATION INFORMATION,
SEE TABLE ON DWG. 365-1325+RD-201

| CURVE TABLE | | | | | | |
|-------------|--------|-----------|---------|--------|----------|----------|
| CURVE No. | RADIUS | DELTA | TANGENT | LENGTH | B.C. STA | E.C. STA |
| C12 | 65.00 | 78°13'22" | 52.85 | 88.74 | 2+380.22 | 2+468.96 |

| SPIRAL DATA | | | | | | |
|-------------|--------|----------|--------|------------------|-------------------------------|-------------------------------|
| SPIRAL No. | A | R | L | START DIRECTION | START COORD. | END COORD. |
| S3 | 46.904 | 55.000 | 40.000 | S46° 33' 53.45"E | N 5447198.476 E 498291.808 | N 5447165.001 E 498313.272 |
| S4 | 50.990 | INFINITY | 40.000 | S25° 43' 48.07"E | N 5447097.891 E 498345.613 | N 5447060.428 E 498359.144 |



PLAN
1:500

NOTE:
SEE COM STRUCTURAL
DRAWINGS FOR MORE
BRIDGE DETAILS

Nominal 1 to 1.5 m high
surcharge; spilled slopes at
1.5H:1V; 12 month duration

Step 2: remove preload/surcharge and
construct cellular concrete
embankment

Step 1: mineral fill preload/surcharge
with crest at future edge of cellular
concrete and 1.5H:1V spill slopes

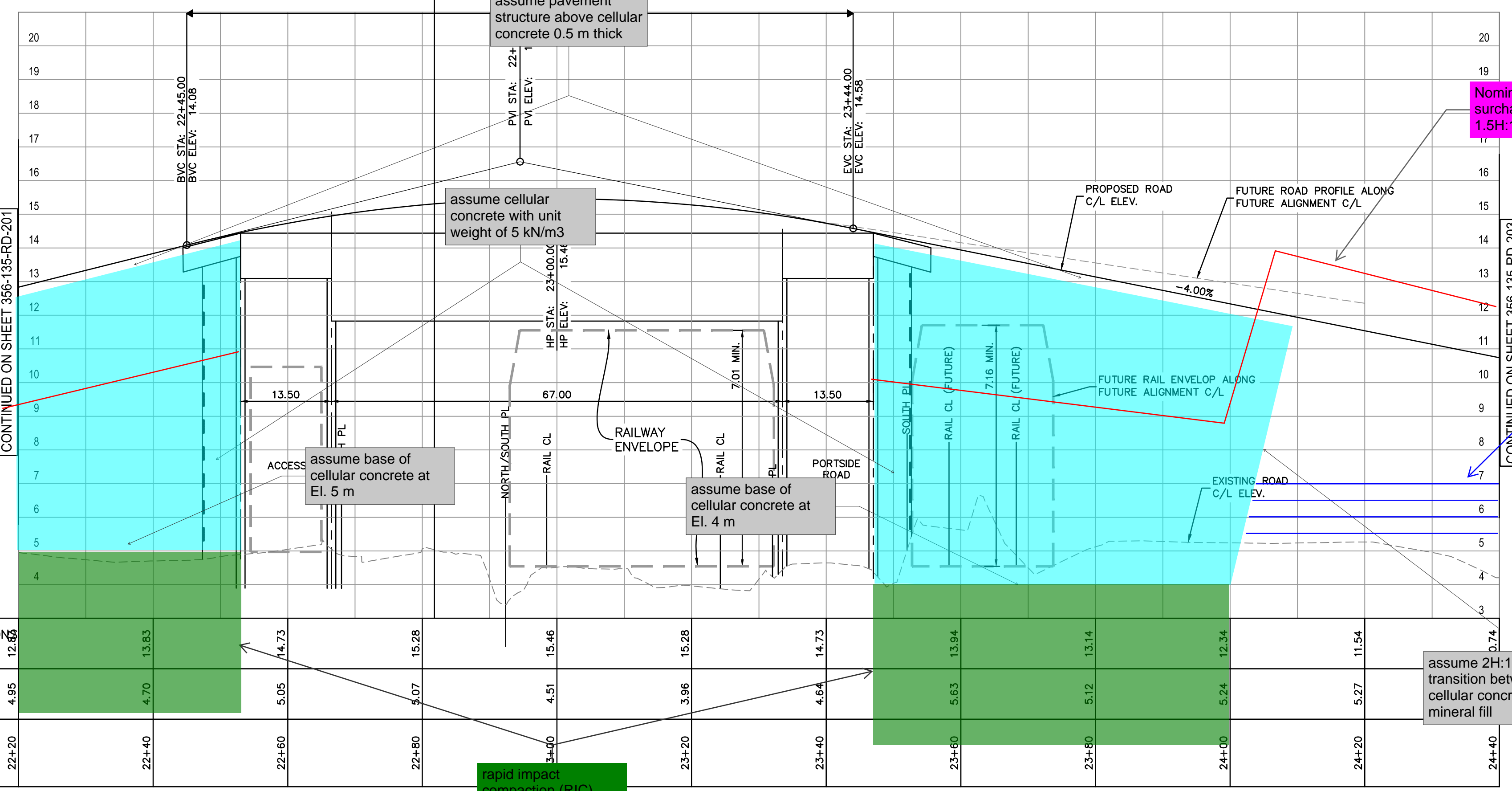
Step 0: Rapid Impact Compaction
(RIC) nominally 4 m (two impact points)
beyond edges of cellular concrete

Nominal 1 to 1.5 m high
surcharge; spilled slopes at
1.5H:1V; 12 month duration

seismic geogrid

assume 2H:1V
transition between
cellular concrete and
mineral fill

rapid impact
compaction (RIC)
within footprint of
cellular concrete
embankment

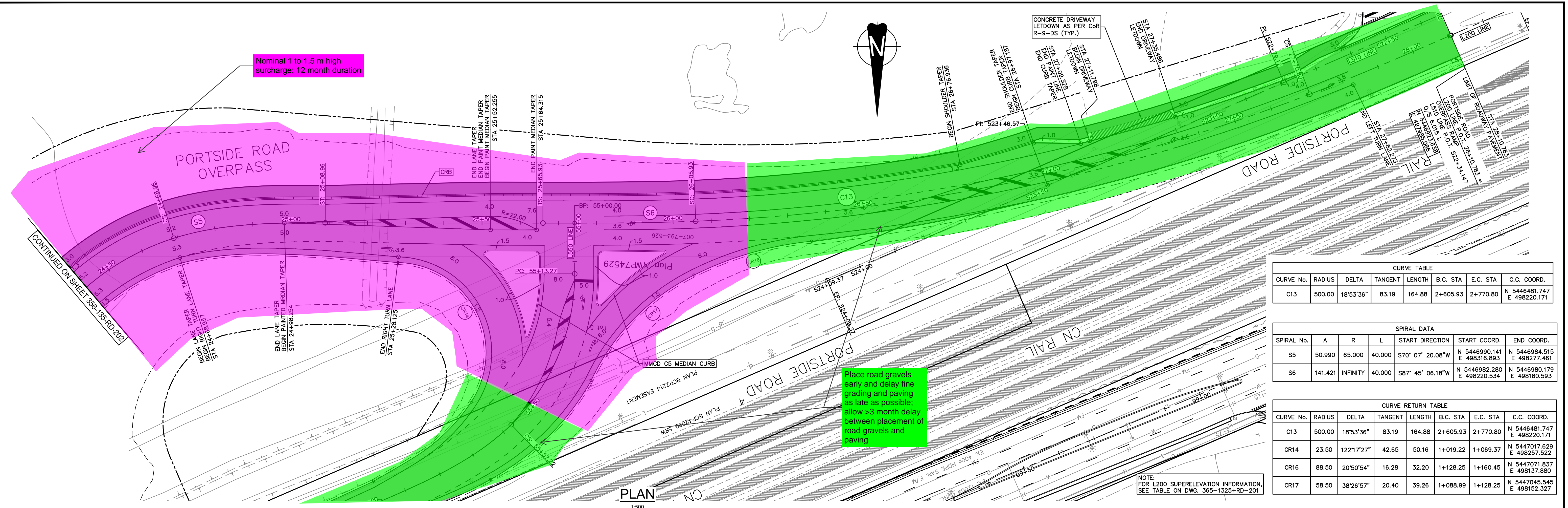


PROFILE
HOR. 1:500
VERT. 1:100

| PROPOSED ELEVATION @ C/L OF ROAD | ORIGINAL GROUND ELEVATIONS @ C/L | ROAD C/L CHAINAGE |
|-------------------------------------|-------------------------------------|----------------------|
| 12.83 | 4.95 | 22+20 |
| 13.83 | 4.70 | 22+40 |
| 14.73 | 5.05 | 22+60 |
| 15.28 | 5.07 | 22+80 |
| 15.46 | 4.51 | 23+00 |
| 15.28 | 3.96 | 23+20 |
| 14.73 | 4.84 | 23+40 |
| 13.94 | 5.63 | 23+60 |
| 13.14 | 5.12 | 23+80 |
| 12.34 | 5.24 | 24+00 |
| 11.54 | 5.27 | 24+20 |
| 10.74 | | 24+40 |

| | | | | | | |
|---|--|--|-----------------------|--|------------------------|-----------------|
| Suite 2300 13450 102nd Avenue Surrey BC Canada V3T 5X3 T 604 596 0391 | PRELIMINARY NOT FOR CONSTRUCTION | Vancouver Fraser Port Authority | DESIGN BY T. BOOTH | GREATER VANCOUVER GATEWAY 2030 PORTSIDE / BLUNDELL ROAD IMPROVEMENT PROJECT ROAD PLAN AND PROFILE | SHEET 2 of 9 | REV B |
| | | | DRAWN BY E. YANG | | | |
| APPROVED L. ZAREI | | | | | | |
| DATE 2022-06-30 | | | | | | |
| SCALE 1:500 | | | | | | |
| THIS DRAWING HAS NOT BEEN APPROVED AND MAY CONTAIN ERRORS AND OMISSIONS | No. Date REVISION B 2022-09-13 INDICATIVE DESIGN SUBMISSION DRAFT FOR IDR HG LZ A 2022-06-30 PRELIMINARY DESIGN SUBMISSION EY LZ | ENGINEERING DEPARTMENT | VPPA SITE 356 | DWG 356-135-RD-202 | | |

TITLE BLOCK: CL-TB.rwg
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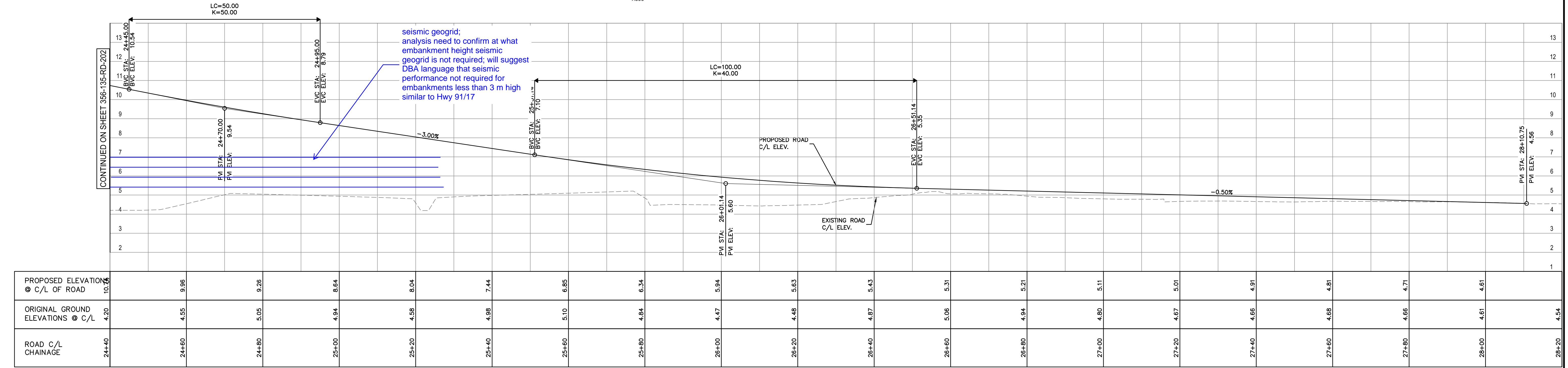


| CURVE TABLE | | | | | | | |
|-------------|--------|-----------|---------|--------|----------|----------|-------------------------------|
| CURVE No. | RADIUS | DELTA | TANGENT | LENGTH | B.C. STA | E.C. STA | C.C. COORD. |
| C13 | 500.00 | 18°53'36" | 83.19 | 164.88 | 2+605.93 | 2+770.80 | N 5446481.747 E 498220.171 |

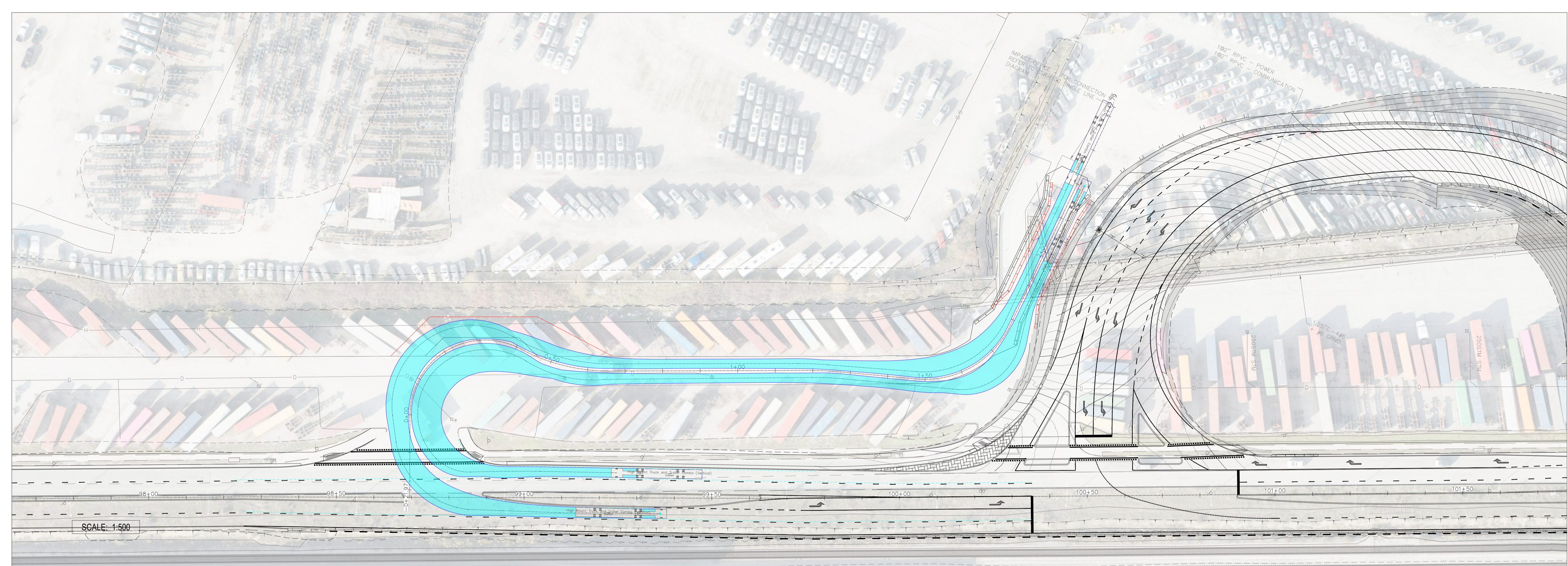
| SPIRAL DATA | | | | | | |
|-------------|---------|----------|--------|------------------|-------------------------------|-------------------------------|
| SPIRAL No. | A | R | L | START DIRECTION | START COORD. | END COORD. |
| S5 | 50.990 | 65.000 | 40.000 | S70° 07' 20.08"W | N 5446990.141 E 498316.893 | N 5446984.515 E 498277.461 |
| S6 | 141.421 | INFINITY | 40.000 | S87° 45' 06.18"W | N 5446982.280 E 498220.534 | N 5446980.179 E 498180.593 |

| CURVE RETURN TABLE | | | | | | | |
|--------------------|--------|------------|---------|--------|----------|----------|-------------------------------|
| CURVE No. | RADIUS | DELTA | TANGENT | LENGTH | B.C. STA | E.C. STA | C.C. COORD. |
| C13 | 500.00 | 18°53'36" | 83.19 | 164.88 | 2+605.93 | 2+770.80 | N 5446481.747 E 498220.171 |
| CR14 | 23.50 | 122°17'27" | 42.65 | 50.16 | 1+019.22 | 1+069.37 | N 5447017.629 E 498257.522 |
| CR16 | 88.50 | 20°50'54" | 16.28 | 32.20 | 1+128.25 | 1+160.45 | N 5447071.837 E 498137.880 |
| CR17 | 58.50 | 38°26'57" | 20.40 | 39.26 | 1+088.99 | 1+128.25 | N 5447045.545 E 498152.327 |

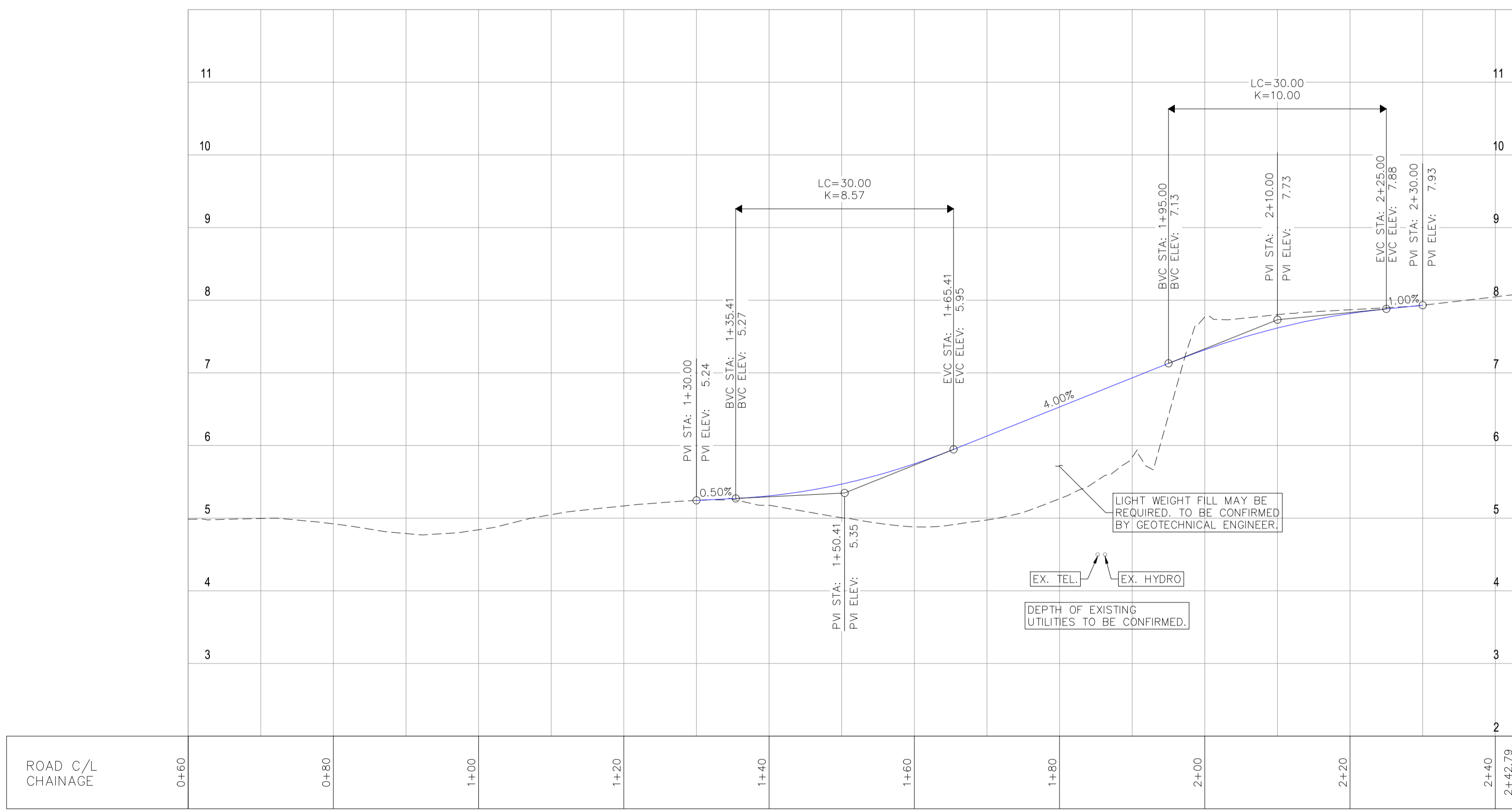
NOTE:
FOR L200 SUPERELEVATION INFORMATION,
SEE TABLE ON DWG. 365-1325+RD-201



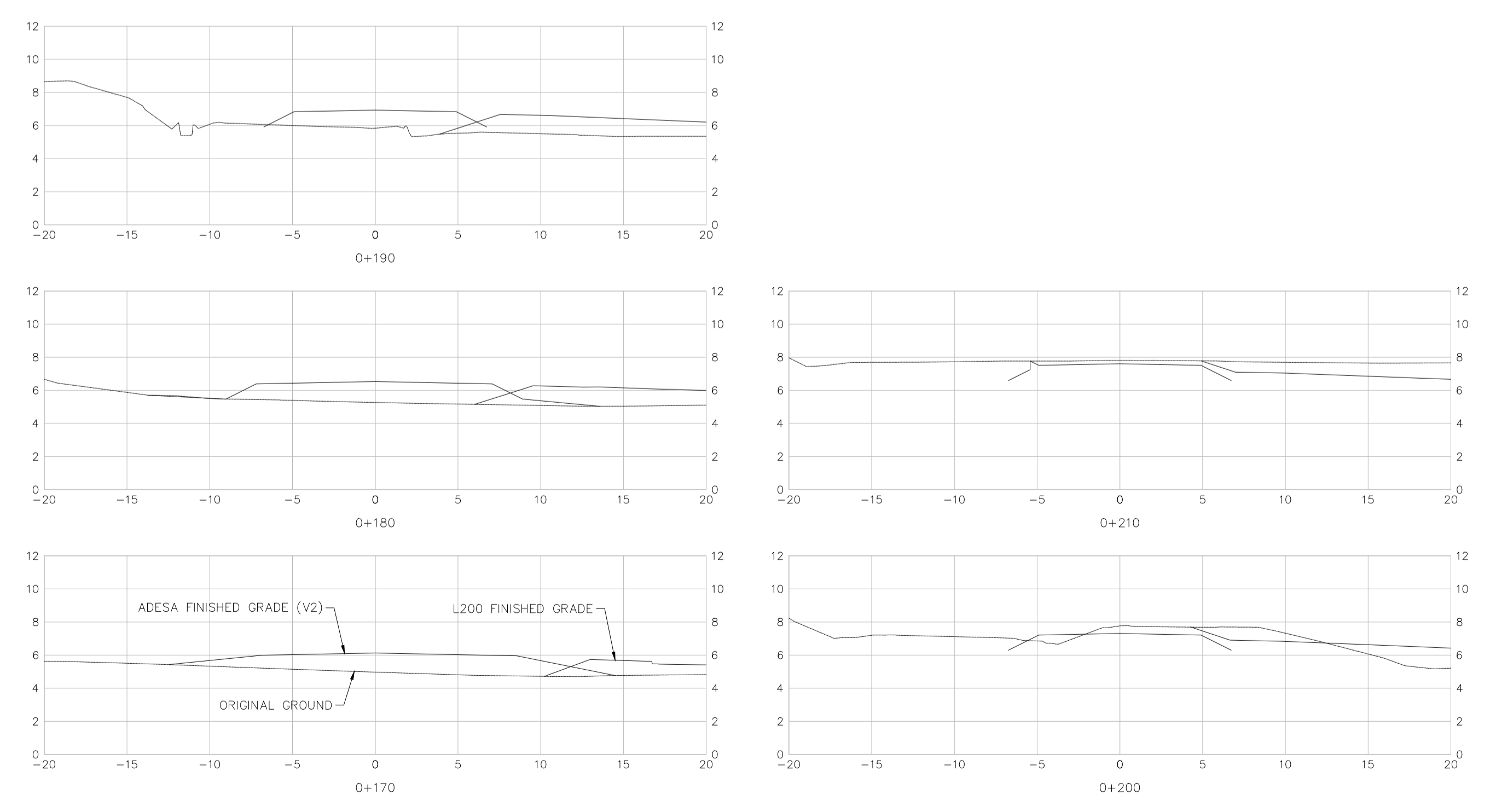
| | | | | | | |
|--|--|---|---|------------------------|----|----------------------------------|
| | | PRELIMINARY NOT FOR CONSTRUCTION | B 2022-09-13 INDICATIVE DESIGN SUBMISSION DRAFT FOR IDR | | HG | LZ |
| | | | A 2022-06-30 PRELIMINARY DESIGN SUBMISSION | | EY | LZ |
| | | | | ENGINEERING DEPARTMENT | | |
| DESIGN BY T. BOOTH DRAWN BY E. YANG APPROVED L. ZAREI DATE 2022-06-30 SCALE 1:500 VFPA SITE 356 | | | GREATER VANCOUVER GATEWAY 2030 PORTSIDE / BLUNDELL ROAD IMPROVEMENT PROJECT PORTSIDE ROAD ROAD PLAN AND PROFILE | | | SIZE DWG |
| REF. No. REFERENCE | | | | | | SHEET 3 of 9 REV B |



SCALE: 1:500



SCALE: H 1:500
V 1:250



SCALE: 1:250

DESIGN VEHICLE:
HIGH MOUNT TRUCK & TRAILER COMBO

DRAFT
FOR DISCUSSION
PURPOSES ONLY

PORTSIDE/BLUNDELL PROJECT
ADESA RAMP V2- TWO LANE RAMP OPTION
DATE: 2022-09-30



Memorandum (*cont'd*)

*Preliminary Geotechnical Recommendations and Comments on Use of EPS and Densification
for Overpass Design Options 1 and 3
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC*

*Reference No.: VAN-22003875-A0
November 23, 2022*

Appendix D

Utility locations plan

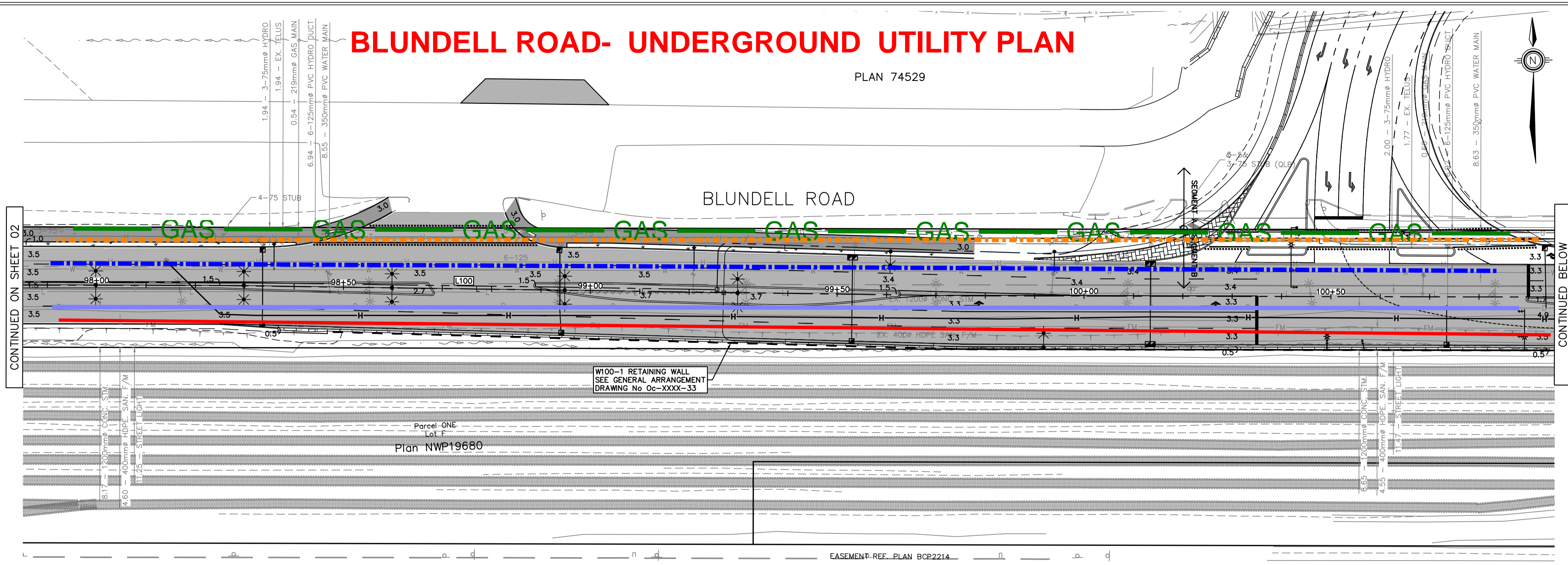
BLUNDELL ROAD- UNDERGROUND UTILITY PLAN

PLAN 74529

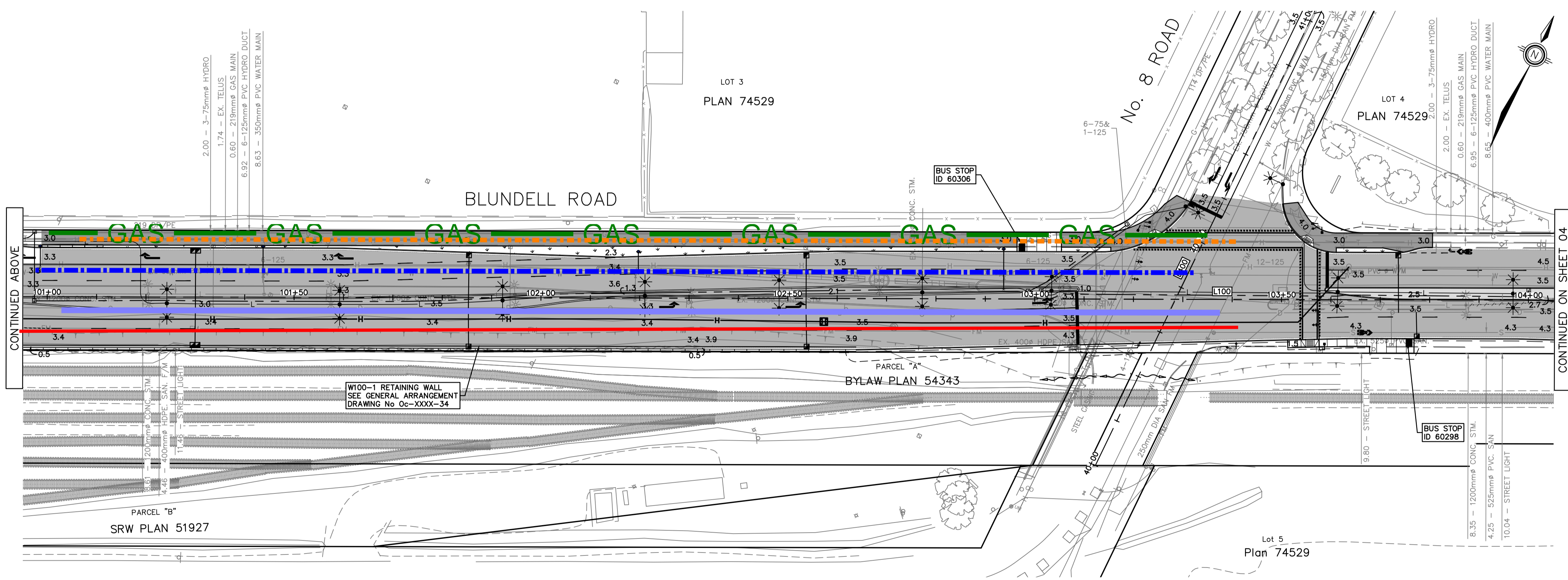
THIS DRAWING AND DESIGN IS THE PROPERTY OF McELHANNY AND SHALL NOT BE USED, REUSED OR REPRODUCED WITHOUT THE CONSENT OF McELHANNY. McELHANNY WILL NOT BE HELD RESPONSIBLE FOR THE IMPROPER OR UNAUTHORIZED USE OF THIS DRAWING AND DESIGN.

THIS DRAWING AND DESIGN HAS BEEN PREPARED FOR THE CLIENT IDENTIFIED. TO MEET THE STANDARDS AND REQUIREMENTS OF THE APPLICABLE PUBLIC AGENCIES AT THE TIME OF PREPARATION, McELHANNY, ITS EMPLOYEES, SUBCONSULTANTS AND AGENTS WILL NOT BE LIABLE FOR ANY LOSSES OR OTHER CONSEQUENCES RESULTING FROM THE USE OR RELIANCE UPON, OR ANY CHANGES MADE TO, THIS DRAWING, BY ANY THIRD PARTY, INCLUDING CONTRACTORS, SUPPLIERS, CONSULTANTS AND STAKEHOLDERS, OR THEIR EMPLOYEES OR AGENTS, WITHOUT McELHANNY'S PRIOR WRITTEN CONSENT.

INFORMATION ON EXISTING UNDERGROUND FACILITIES MAY NOT BE COMPLETE OR ACCURATE. McELHANNY, ITS EMPLOYEES AND DIRECTORS ARE NOT RESPONSIBLE NOR LIABLE FOR THE LOCATION OF ANY UNDERGROUND CONDUITS, PIPES, CABLES OR OTHER FACILITIES WHETHER SHOWN OR OMITTED FROM THIS PLAN. PRIOR TO CONSTRUCTION CONTRACTOR SHALL EXPOSE LOCATIONS OF ALL EXISTING FACILITIES BY HAND DIGGING OR HYDROVAC AND ADVISE THE ENGINEER OF POTENTIAL CONFLICTS.



PLAN 1:500



PLAN 1:500

- SANITARY
- STORM
- - - WATERMAIN / HYDRO
- - - TELUS / HYDRO
- GAS

LEGEND - ROADWORKS

| | |
|--|------------------------|
| | ASPHALT ROAD |
| | ASPHALT MULTI-USE PATH |
| | CONCRETE SIDEWALK |
| | MEDIAN |
| | BOULEVARD |

TECOR
Suite 500-1055 HASTINGS ST W, VANCOUVER, BC CANADA V6E 2E9

McElhanney
2300 - 13450 - 102 Avenue, Surrey, BC Canada V3T 5X3 T: 604-596 0391

City of Richmond
6911 No. 3 ROAD RICHMOND B.C. V6Y 2C1

B.C. GAS SERVICES

THE DEVELOPER OR CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING EXISTING LOCATION OF GAS SERVICE LINES, AND WHERE NECESSARY ARRANGE FOR THEIR RELOCATION IN ORDER TO FACILITATE INSTALLATION OF THE WORKS SHOWN ON THESE PLANS. A LIST OF SERVICE LINE LOCATIONS MAY BE OBTAINED FROM:

B.C. GAS SERVICE RECORDS DEPARTMENT
TELEPHONE 293-8552

NOTE - B.C. GAS REQUIRES 10 DAYS NOTICE PRIOR TO THE COMMENCEMENT OF ANY WORK.

BENCHMARK

ALL ELEVATIONS ARE TO GEODETIC DATUM AND REFER TO RICHMOND BENCHMARK NUMBER:

MONUMENT 02H2412

ELEVATION **4.562 (CVD28GVRD2018)** FIELD BOOK NO. _____

CITY WORK ORDER NO. _____ TENDER / PROJECT NO. _____

CONTRACTOR WORK ORDER NO. _____ ACCOUNT NO. _____

REFERENCE DRAWINGS

| | |
|-----------------------------|----|
| PROPERTY ACQUISITION | Aq |
| SURVEY PLAN & PROFILE | Pp |
| ROAD CONSTRUCTION | Oc |
| STORM SEWER INSTALLATION | Lc |
| WATERMAIN INSTALLATION | Wc |
| ORNAMENTAL STREET LIGHTING | Tc |
| TRAFFIC SIGNALS | Ec |
| SANITARY SEWER INSTALLATION | |
| OTHER | |

NOTE - PROVE LOCATION OF ALL UTILITIES / SERVICES BEFORE STARTING CONSTRUCTION.

| NO. | DATE | BY | CH. | DESCRIPTION |
|-----|------------|----|-----|--|
| B | 2022-09-13 | HG | VM | INDICATIVE DESIGN SUBMISSION DRAFT FOR IDR |
| A | 2022-06-30 | ST | JA | PRELIMINARY DESIGN |

PRELIMINARY NOT FOR CONSTRUCTION

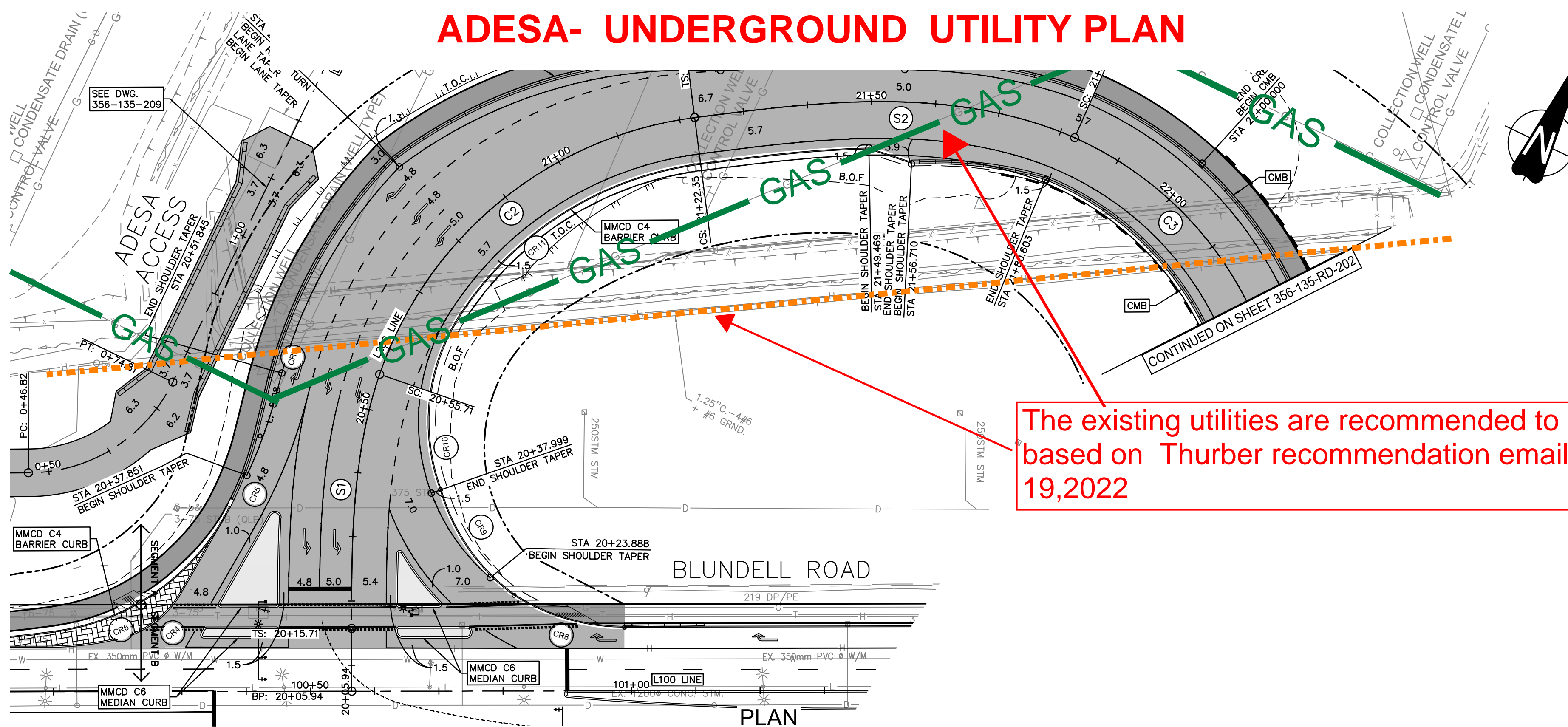
THIS DRAWING HAS NOT BEEN APPROVED AND MAY CONTAIN ERRORS AND OMISSIONS

TITLE: **KEY PLAN BLUNDELL ROAD STA 97+85 TO STA. 104+05**

| | |
|--------------|------------------|
| DESIGN: TB | DWG. NO: Oc-XXXX |
| DRAWN: ST | SCALE: 1:500 |
| CHECKED: JA | DATE: JUNE 2022 |
| ENGINEER: LZ | SEC. NO: _____ |
| | SHT. NO: 3 OF 37 |

Plotdate: September 13, 2022, 1:44:46:McElhanney X:\2111\1.00 - 08 Projects\2111-40118-00 Lincor - Portside-Blundell Rd Imp\10.0 DRAWINGS\0.2 Civil\020208\0.3.1 Sheets\020208-MCS-DWG-CV-100-MEY.dwg\Oc-XXXX-3

ADESA- UNDERGROUND UTILITY PLAN

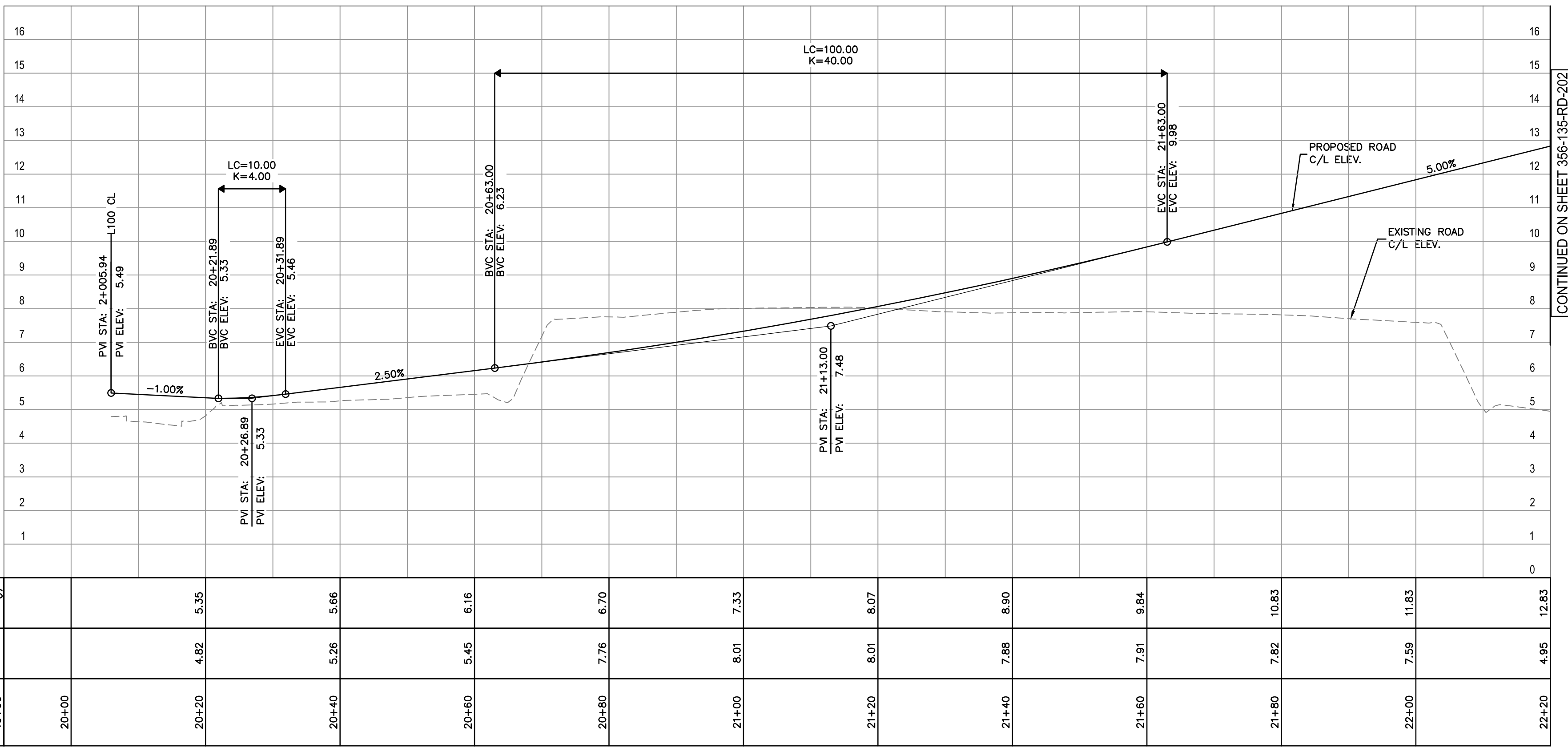


The existing utilities are recommended to be relocated based on Thurber recommendation email dated Oct. 19, 2022

| CURVE TABLE | | | | | | | |
|-------------|--------|-----------|---------|--------|----------|----------|-------------------------------|
| CURVE No. | RADIUS | DELTA | TANGENT | LENGTH | B.C. STA | E.C. STA | C.C. COORD. |
| C2 | 60.00 | 63°37'49" | 37.22 | 66.63 | 2+055.71 | 2+122.34 | N 5447140.427 E 498230.327 |
| C3 | 55.00 | 45°10'45" | 22.88 | 43.37 | 2+182.35 | 2+225.72 | N 5447158.538 E 498253.994 |

| SPIRAL DATA | | | | | | |
|-------------|--------|----------|--------|------------------|-------------------------------|-------------------------------|
| SPIRAL No. | A | R | L | START DIRECTION | START COORD. | END COORD. |
| S1 | 48.990 | INFINITY | 40.000 | N25° 43' 30.30"W | N 5447095.952 E 498183.926 | N 5447133.503 E 498170.728 |
| S2 | 57.446 | INFINITY | 60.000 | N57° 00' 13.78"E | N 5447190.753 E 498197.659 | N 5447213.513 E 498252.320 |

| CURVE RETURN TABLE | | | | | | | |
|--------------------|--------|-----------|---------|--------|----------|----------|-------------------------------|
| CURVE No. | RADIUS | DELTA | TANGENT | LENGTH | B.C. STA | E.C. STA | C.C. COORD. |
| CR4 | 15.40 | 46°15'57" | 6.58 | 12.44 | 1+059.23 | 1+071.66 | N 5447090.529 E 498142.654 |
| CR5 | 50.40 | 15°58'21" | 7.07 | 14.05 | 1+031.71 | 1+045.76 | N 5447106.570 E 498108.755 |
| CR6 | 36.30 | 52°05'31" | 17.74 | 33.00 | 1+045.77 | 1+078.78 | N 5447105.526 E 498122.717 |
| CR7 | 77.51 | 3°33'54" | 2.41 | 4.82 | 1+016.55 | 1+021.38 | N 5447140.646 E 498208.216 |
| CR8 | 32.30 | 32°27'27" | 9.40 | 18.30 | 2+025.27 | 2+043.56 | N 5447143.326 E 498208.216 |
| CR9 | 30.80 | 38°19'43" | 10.70 | 20.60 | 2+043.56 | 2+064.17 | N 5447141.558 E 498209.906 |
| CR10 | 30.80 | 53°27'23" | 15.51 | 28.74 | 2+064.17 | 2+092.90 | N 5447143.326 E 498208.216 |
| CR11 | 53.10 | 24°45'59" | 11.66 | 22.95 | 2+092.90 | 2+115.86 | N 5447140.427 E 498230.327 |



| PROPOSED ELEVATIONS @ C/L OF ROAD | ORIGINAL GROUND ELEVATIONS @ C/L | ROAD C/L CHAINAGE |
|-----------------------------------|----------------------------------|-------------------|
| 5.35 | 4.82 | 19+00 |
| 5.66 | 5.26 | 20+00 |
| 6.16 | 5.45 | 20+20 |
| 6.70 | 7.76 | 20+40 |
| 7.33 | 8.01 | 20+60 |
| 8.07 | 8.01 | 21+00 |
| 8.90 | 7.88 | 21+20 |
| 9.84 | 7.91 | 21+40 |
| 10.83 | 7.82 | 21+60 |
| 11.83 | 7.59 | 21+80 |
| 12.83 | 4.95 | 22+00 |
| | | 22+20 |

| L200 SUPERELEVATION TABLE | | | | | | |
|---------------------------|---------------|--------------------|---------------------|-----------|------------|----------------|
| SUPERELEVATION REGION | START STATION | DESCRIPTION | LEFT SHOULDER (MUP) | LEFT LANE | RIGHT LANE | RIGHT SHOULDER |
| | 2+005.942m | BEGIN ALIGNMENT | | | | |
| | 2+012.7420m | TIE-IN TO BLUNDELL | | | | |
| 2 | 2+015.710m | TS | 0.00% | 0.00% | 0.00% | 0.00% |
| 2 | 2+035.710m | SRO-IN | 2.00% | 2.00% | -2.00% | -2.00% |
| 2 | 2+055.710m | SC-R60 | 2.00% | 4.00% | -4.00% | -4.00% |
| 2 | 2+122.343m | CS-R60 | 2.00% | 4.00% | -4.00% | -4.00% |
| 3 | 2+182.351m | SC-R55 | 2.00% | 6.00% | -6.00% | -6.00% |
| 3 | 2+225.720m | CS-R55 | 2.00% | 6.00% | -6.00% | -6.00% |
| 3 | 2+252.387m | SRO-OUT | 2.00% | 2.00% | -2.00% | -2.00% |
| 3 | 2+265.720m | ST | 2.00% | 2.00% | -2.00% | -2.00% |
| 12 | 2+340.216m | TS | 2.00% | 2.00% | -2.00% | -2.00% |
| 12 | 2+354.009m | SRO-IN | 2.00% | 2.00% | -2.00% | -2.00% |
| 12 | 2+380.216m | SC-R65 | 2.00% | 5.80% | -5.80% | -5.80% |
| 12 | 2+468.957m | CS-R65 | 2.00% | 5.80% | -5.80% | -5.80% |
| | 2+555.308m | 0% CROSSOVER | 2.00% | 0.00% | 0.00% | 0.00% |
| 13 | 2+605.927m | SC-R500 | 2.00% | -3.40% | 3.40% | 3.40% |
| 13 | 2+770.803m | CS-R500 | 2.00% | -3.40% | 3.40% | |
| | 2+830.000m | END ALIGNMENT | | -2.00% | -2.00% | |

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| | | | | | | |
|--|--|--|--|--|--|-------------------------|
| | | <p>PRELIMINARY NOT FOR CONSTRUCTION</p> <p>DRAFT</p> | <p>Vancouver Fraser Port Authority</p> | DESIGN BY: T. BOOTH DRAWN BY: E. YANG APPROVED: L. ZAREI DATE: 2022-06-30 SCALE: 1:500 VPFA SITE: 356 | <p>GREATER VANCOUVER GATEWAY 2030 PORTSIDE / BLUNDELL ROAD IMPROVEMENT PROJECT PORTSIDE ROAD ROAD PLAN AND PROFILE</p> | SHEET: 1 of 9 REV: A |
| | | | | REF. No. REFERENCE | | |

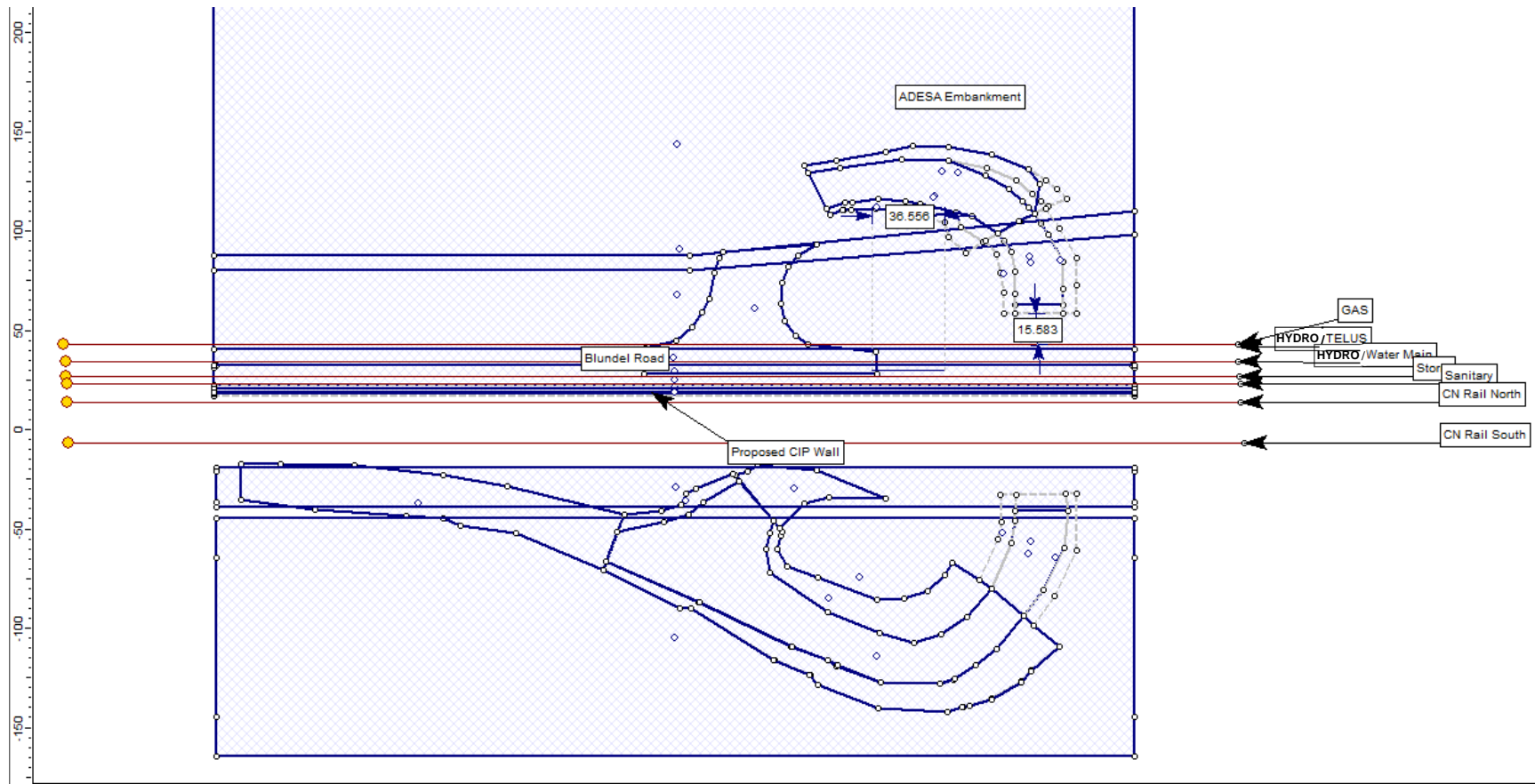


Memorandum (*cont'd*)

*Preliminary Geotechnical Recommendations and Comments on Use of EPS and Densification
for Overpass Design Options 1 and 3
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC
Reference No.: VAN-22003875-A0
November 23, 2022*

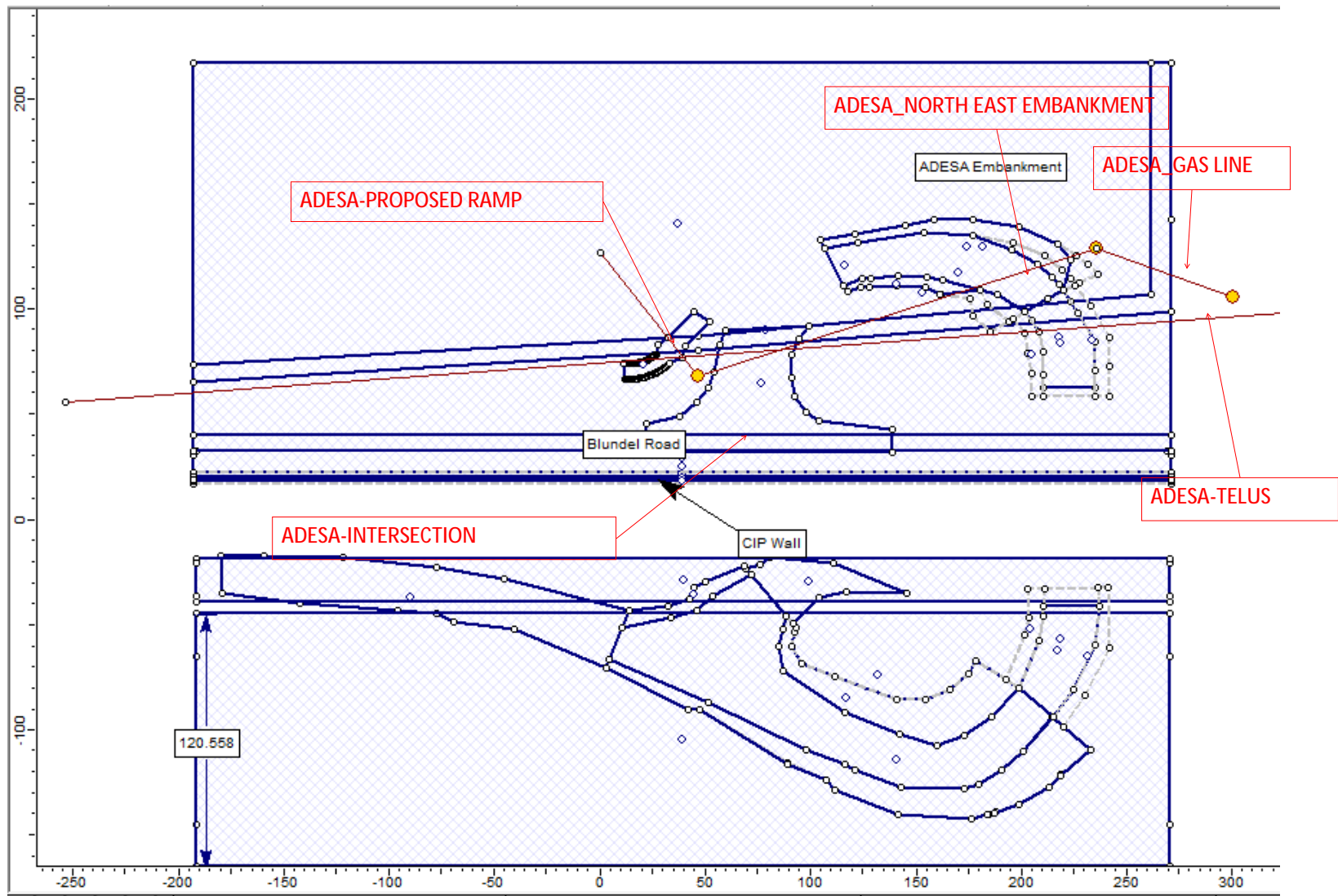
Appendix E

Settlement profile



exp Services Inc.
 275-3001 Wayburne Drive
 Burnaby, British Columbia V5G 4W3
 Telephone: 604-874-1245
 Fax: 604-874-2358
 exp.com

| | | | | | | | |
|-----------------|-------|---------------------------------------|------|------------|--------------------------------|---------|--|
| CLIENT | | Mc Elhanney | | | TITLE: | | |
| PROJECT | | PORTSIDE BLUNDELL IMPROVEMENT PROJECT | | | Blundell Road- Query locations | | |
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| VAN-22003875-A0 | PA | PA | YA | 2022-11-16 | NA | | |



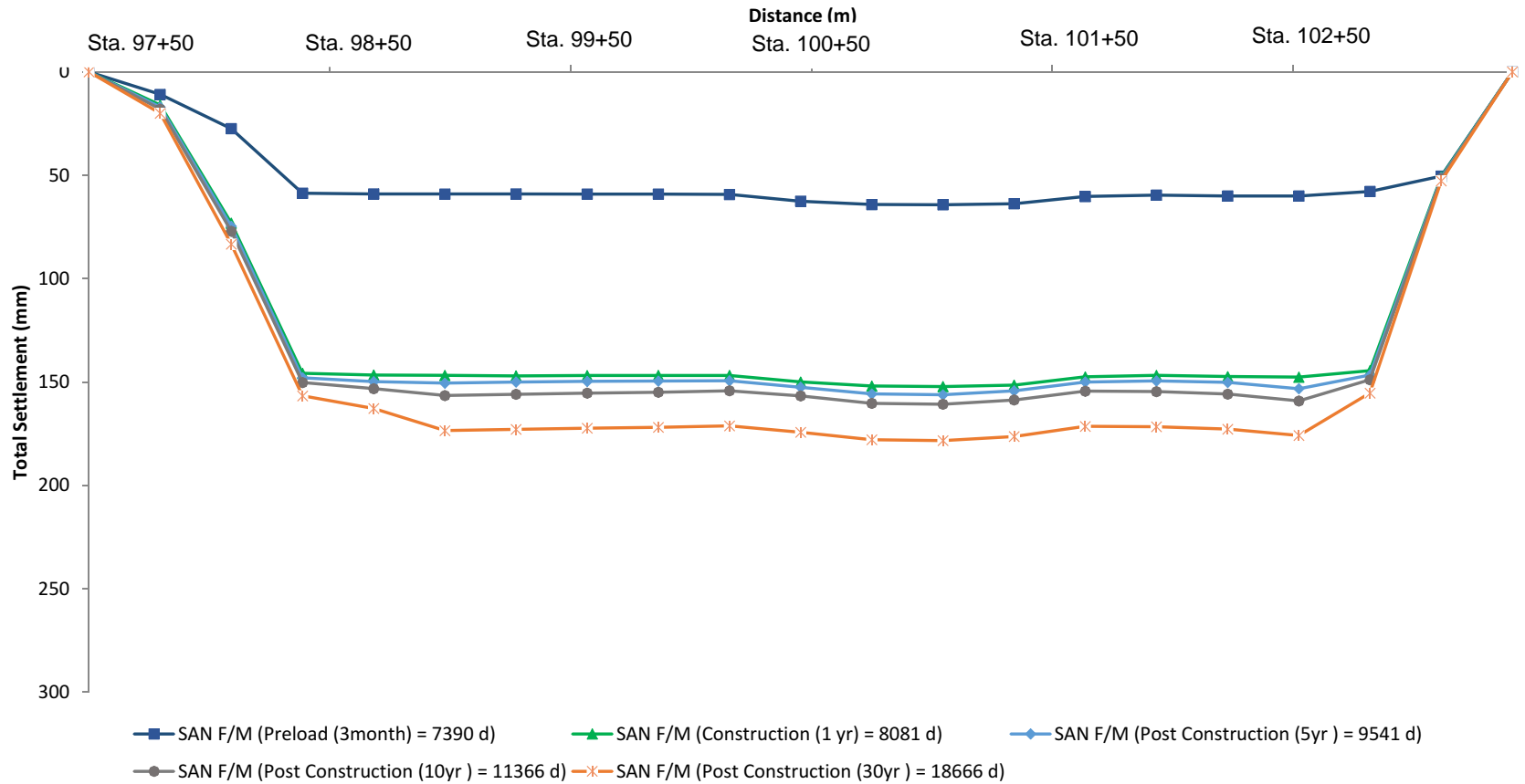
exp Services Inc.
 275-3001 Wayburne Drive
 Burnaby, British Columbia V5G 4W3
 Telephone: 604-874-1245
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 exp.com

| | | | | | | | |
|-----------------|-------|---------------------------------------|------|------------|------------------------|---------|--|
| CLIENT | | Mc Elhanney | | | TITLE: | | |
| PROJECT | | PORTSIDE BLUNDELL IMPROVEMENT PROJECT | | | ADESA- Query locations | | |
| PROJECT NO. | DFTR. | DSGN. | CHK. | DATE | SCALE: | DWG NO. | |
| VAN-22003875-A0 | PA | PA | YA | 2022-11-16 | NA | | |

Distance vs. Total Settlement

1.5m

Below Ground Surface



exp Services Inc.

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 Burnaby, British Columbia V5G 4W3
 Telephone: 604-874-1245
 Fax: 604-874-2358
 exp.com

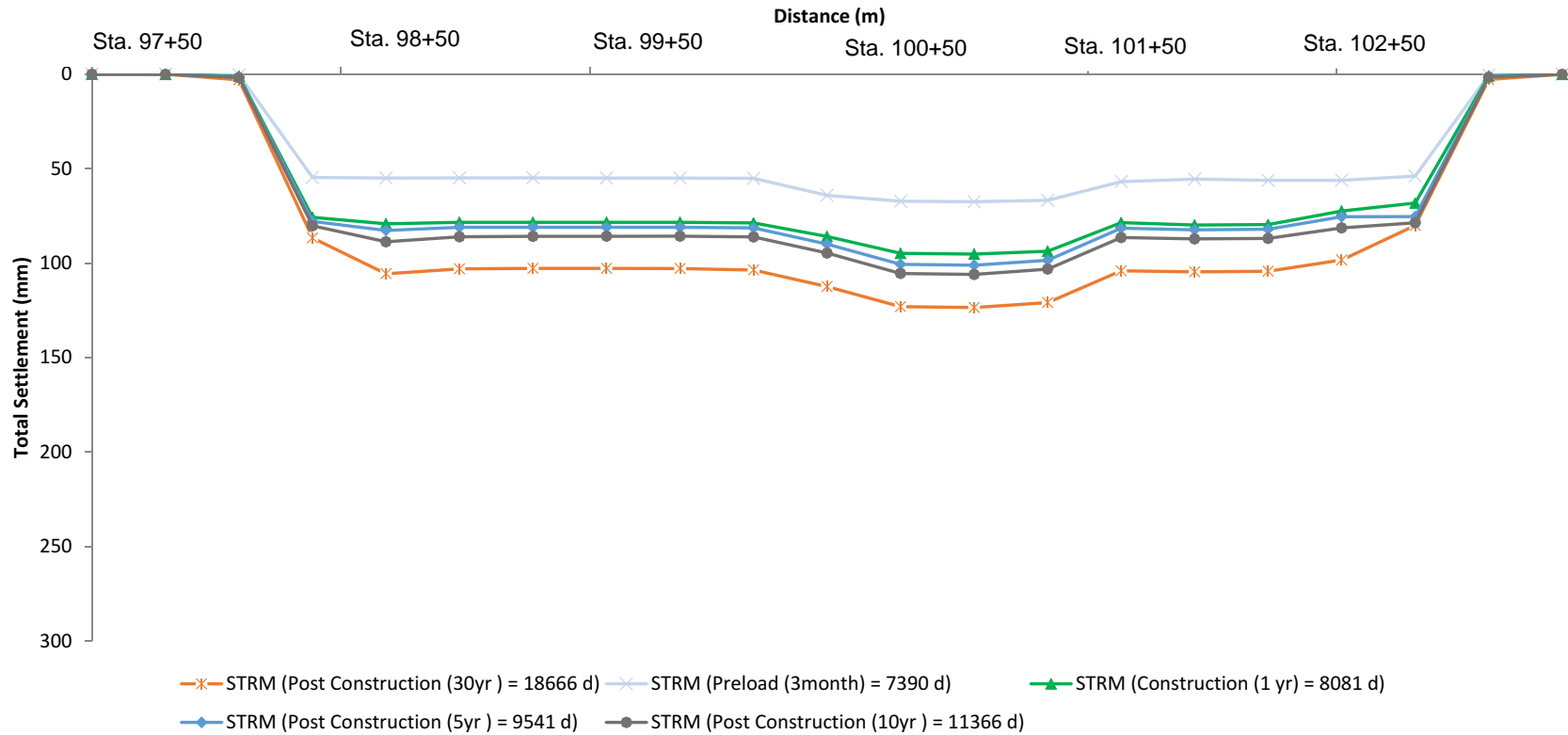
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| CLIENT Mc Elhanney | | PROJECT PORTSIDE BLUNDELL IMPROVEMENT PROJECT | |
| PROJECT NO. VAN-22003875-A0 | DFTR. PA | DSGN. PA | CHK. YA |

| | | |
|--|--------------|---------|
| TITLE: IMPACT OF SURCHAGE LOAD/CONSTRUCTION ON SANTARY, BLUNDELL RD. | | |
| DATE 2022-11-16 | SCALE: NA | DWG NO. |

Distance vs. Total Settlement

1.5m

Below Ground Surface



exp Services Inc.
 275-3001 Wayburne Drive
 Burnaby, British Columbia V5G 4W3
 Telephone: 604-874-1245
 Fax: 604-874-2358
 exp.com

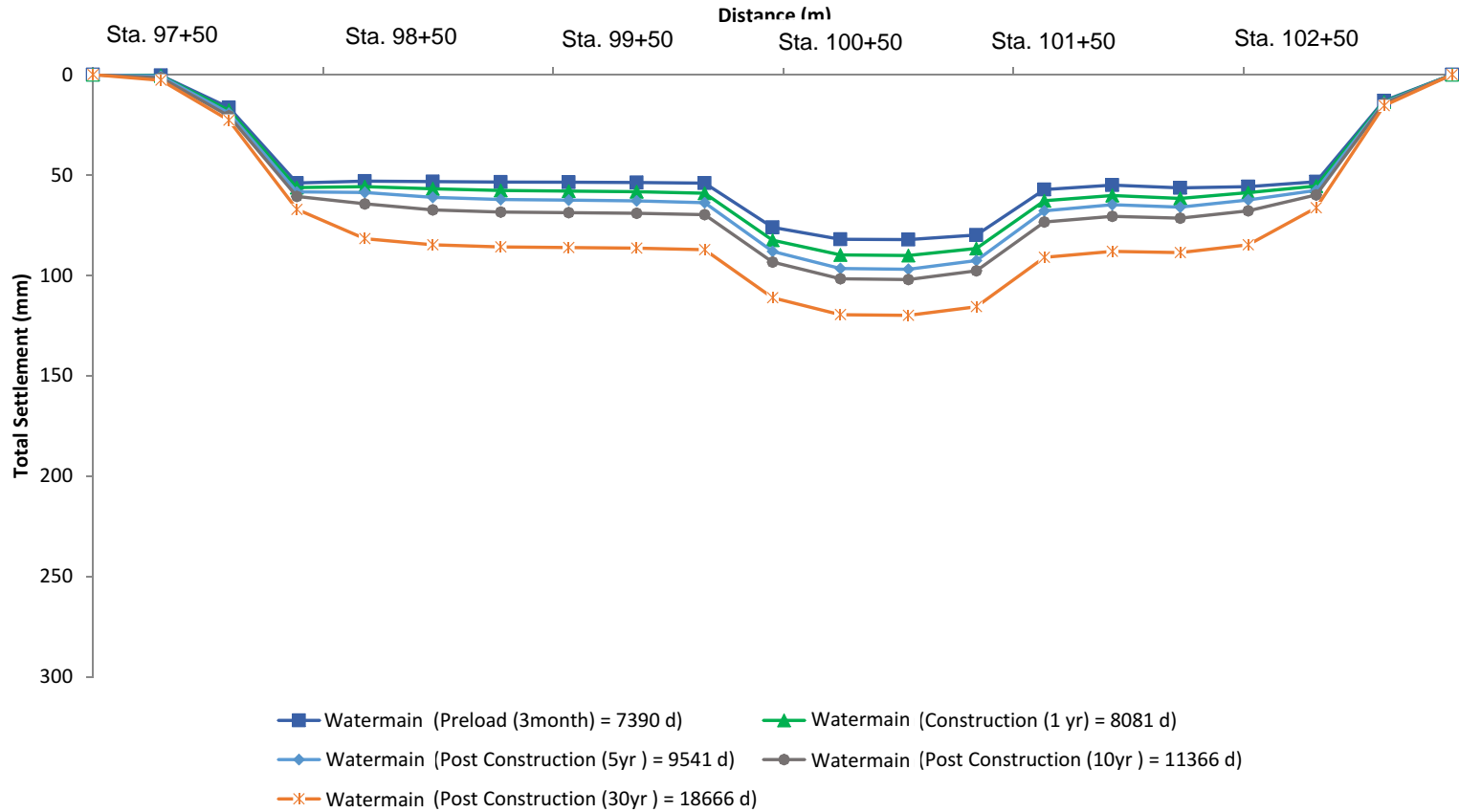
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| PROJECT | | PORTSIDE BLUNDELL IMPROVEMENT PROJECT | | |
| PROJECT NO. | DFTR. | DSGN. | CHK. | DATE |
| VAN-22003875-A0 | PA | PA | YA | 2022-11-16 |

| | | |
|---|---------|--|
| TITLE: | | |
| IMPACT OF SURCHARGE LOAD/CONSTRUCTION ON STORM BLUNDELL RD. | | |
| SCALE: | DWG NO. | |
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Distance vs. Total Settlement

1.5m

Below Ground Surface



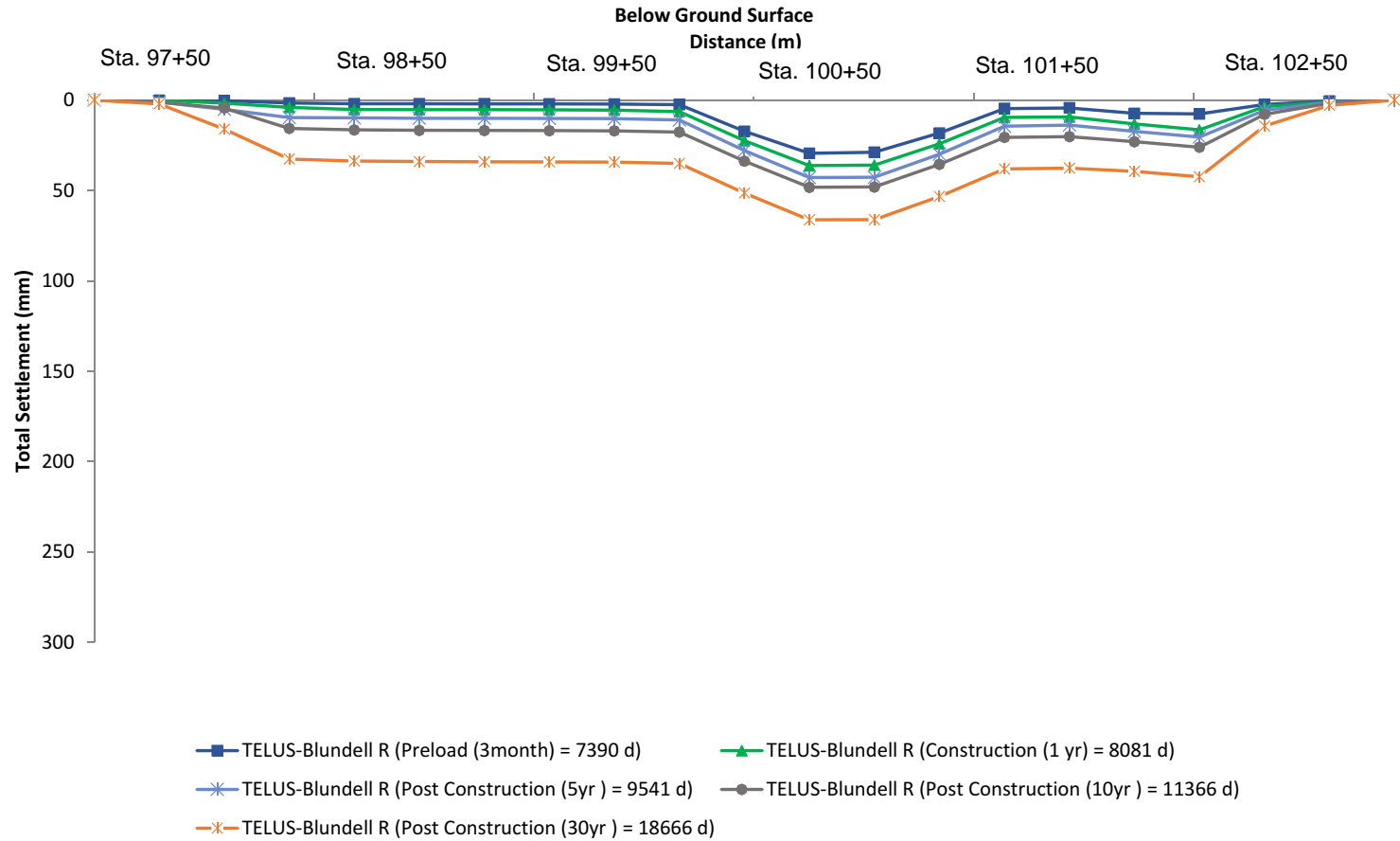
exp Services Inc.
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 Fax: 604-874-2358
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| | | | | |
|--|-------------|---|------------|--------------------|
| CLIENT Mc Elhanney | | TITLE: IMPACT OF SURCHARGE LOAD/CONSTRUCTION ON WATERMAIN/ HYDRO BLUNDELL RD. | | |
| PROJECT PORTSIDE BLUNDELL IMPROVEMENT PROJECT | | | | |
| PROJECT NO. VAN-22003875-A0 | DFTR. PA | DSGN. PA | CHK. YA | DATE 2022-11-16 |

| | |
|--------------|---------|
| SCALE: NA | DWG NO. |
|--------------|---------|

Distance vs. Total Settlement

1.5m



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Fax: 604-874-2358
exp.com

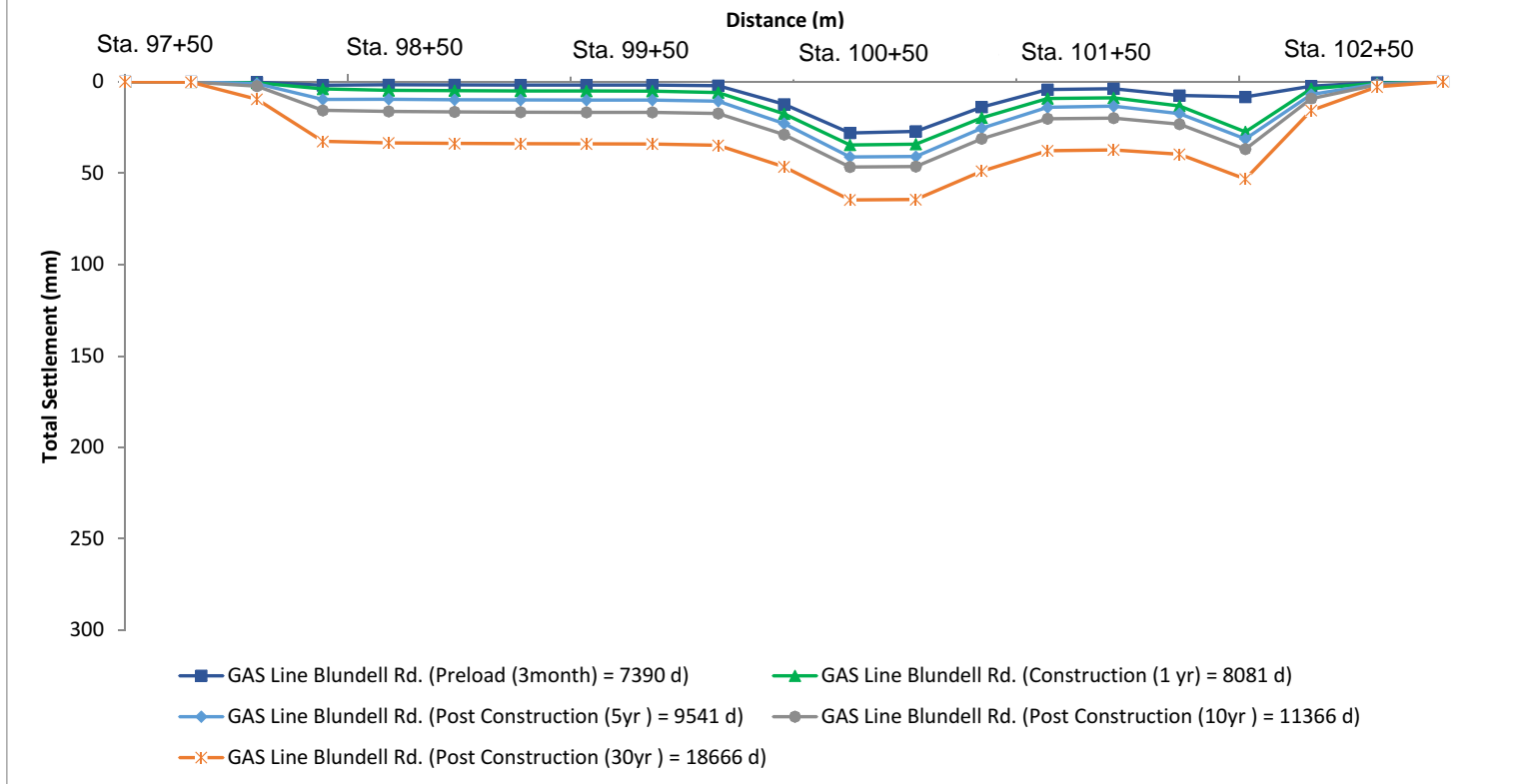
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| CLIENT Mc Elhanney | | PROJECT PORTSIDE BLUNDELL IMPROVEMENT PROJECT | |
| PROJECT NO. VAN-22003875-A0 | DFTR. PA | DSGN. PA | CHK. YA |

| | | |
|---|--------------|---------|
| TITLE: IMPACT OF SURCHARGE LOAD/CONSTRUCTION ON TELUS/HYDRO BLUNDELL ROAD | | |
| DATE 2022-11-16 | SCALE: NA | DWG NO. |

Distance vs. Total Settlement

1.5m

Below Ground Surface



exp Services Inc.

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Burnaby, British Columbia V5G 4W3
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Fax: 604-874-2358
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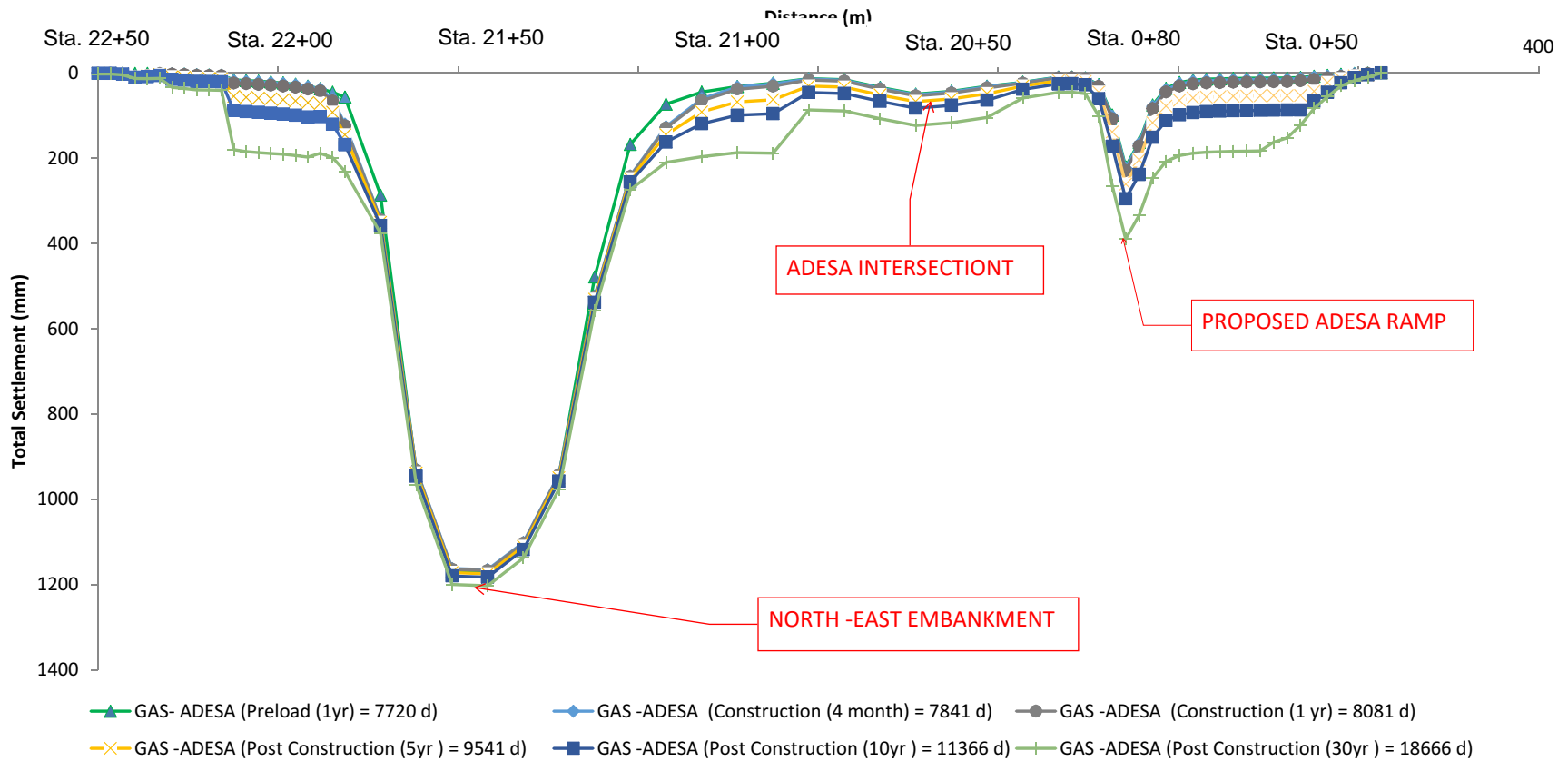
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| PROJECT NO. | DFTR. | DSGN. | CHK. | DATE |
| VAN-22003875-A0 | PA | PA | YA | 2022-11-16 |

| | | |
|--|---------|--|
| TITLE: | | |
| IMPACT OF SURCHARGE LOAD/CONSTRUCTION ON GAS LINE BLUNDELL RD. | | |
| SCALE: | DWG NO. | |
| NA | | |

Distance vs. Total Settlement

1.5m

Below Ground Surface



exp Services Inc.
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 Burnaby, British Columbia V5G 4W3
 Telephone: 604-874-1245
 Fax: 604-874-2358
 exp.com

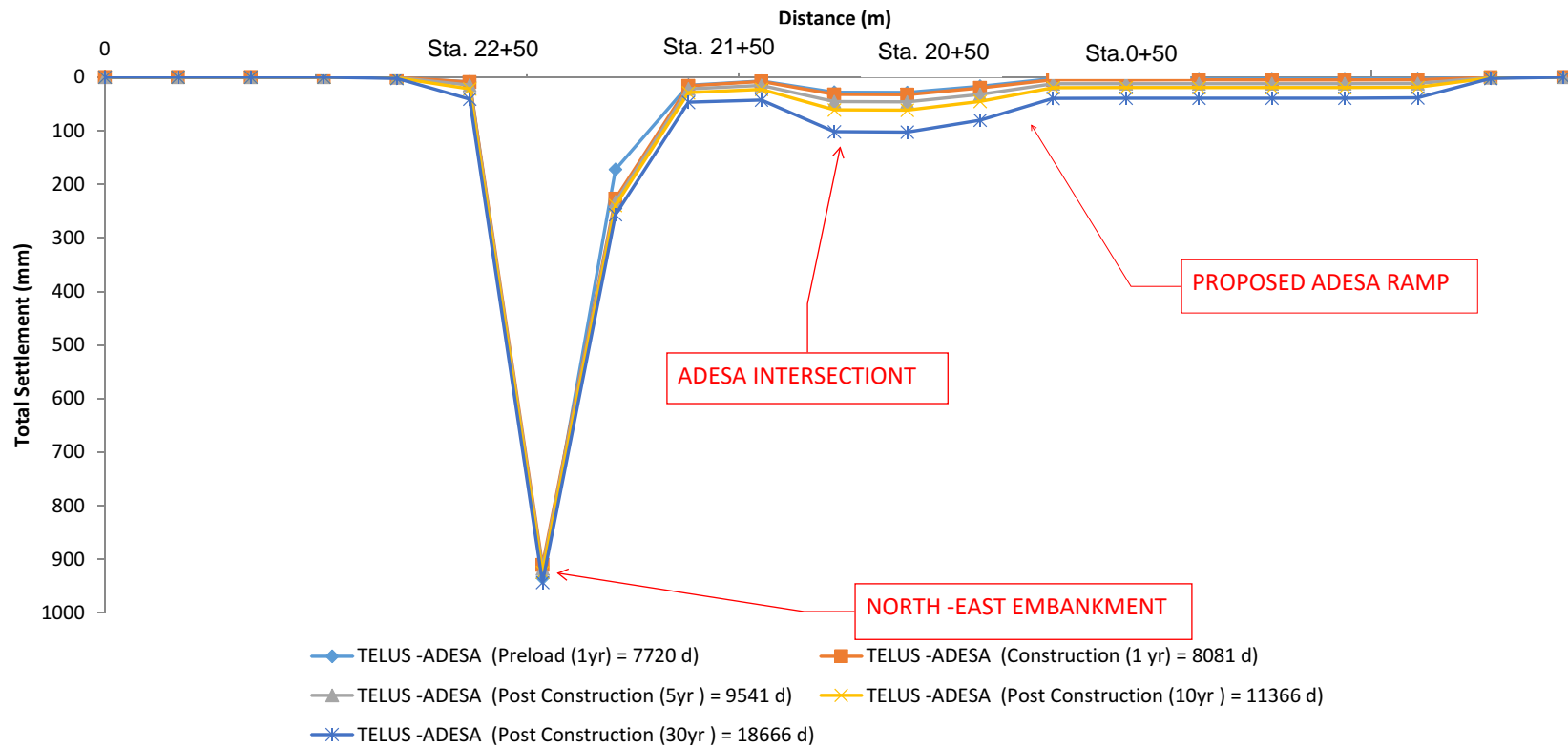
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| PORTSIDE BLUNDELL IMPROVEMENT PROJECT | | | | |
| PROJECT NO. | DFTR. | DSGN. | CHK. | DATE |
| VAN-22003875-A0 | PA | PA | YA | 2022-11-16 |

| | | |
|---|---------|--|
| TITLE: | | |
| IMPACT OF SURCHARGE LOAD/CONSTRUCTION ON GAS-ADESA. | | |
| SCALE: | DWG NO. | |
| NA | | |

Distance vs. Total Settlement

1.5m

Below Ground Surface



exp Services Inc.

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Burnaby, British Columbia V5G 4W3
Telephone: 604-874-1245
Fax: 604-874-2358
exp.com

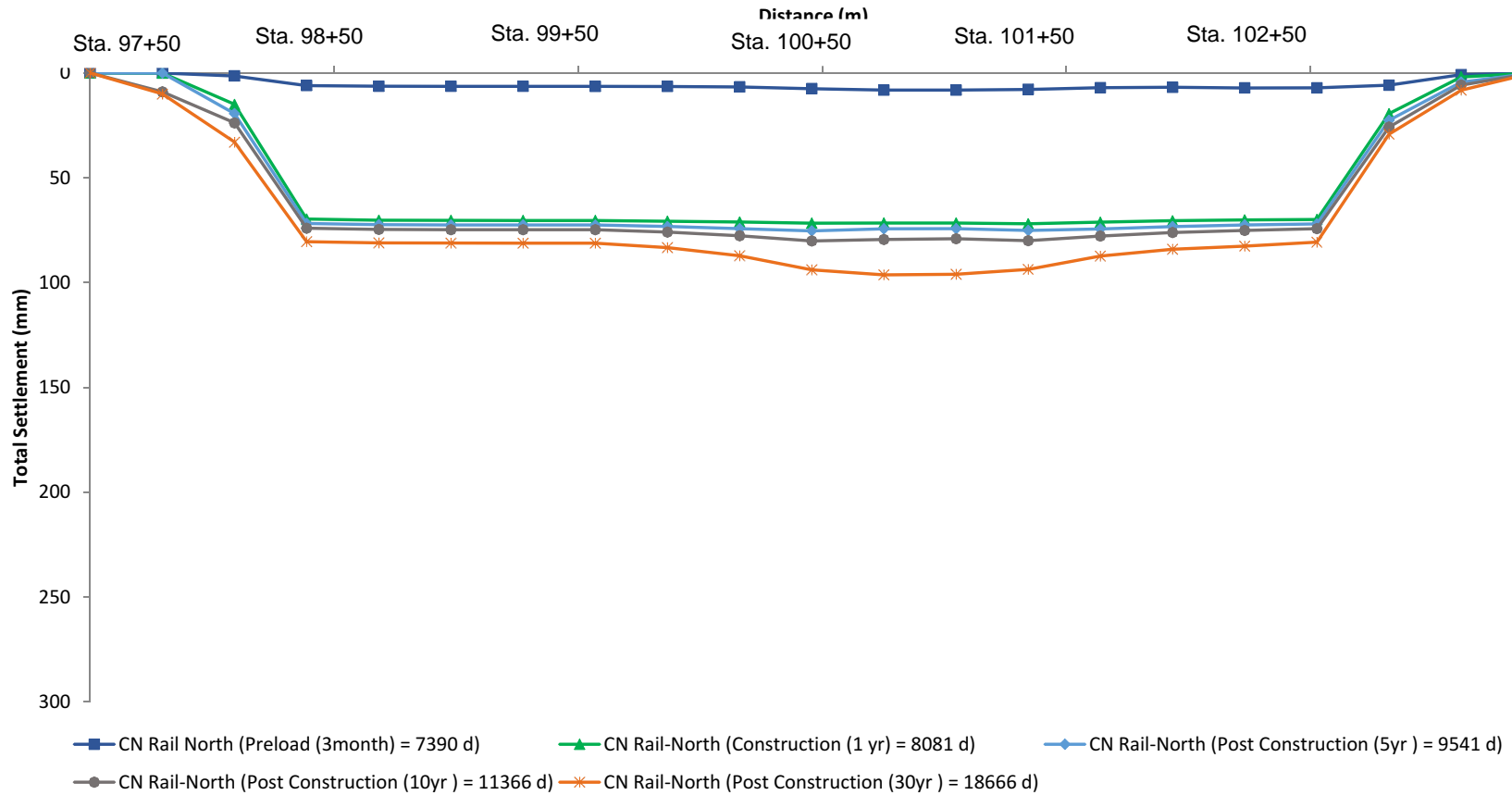
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| PROJECT NO. VAN-22003875-A0 | DFTR. PA | DSGN. PA | CHK. YA |

| | | |
|--|--------------|---------|
| TITLE: IMPACT OF SURCHARGE LOAD/CONSTRUCTION ON TELUS ADESA | | |
| DATE 2022-11-16 | SCALE: NA | DWG NO. |

Distance vs. Total Settlement

1.5m

Below Ground Surface



exp Services Inc.

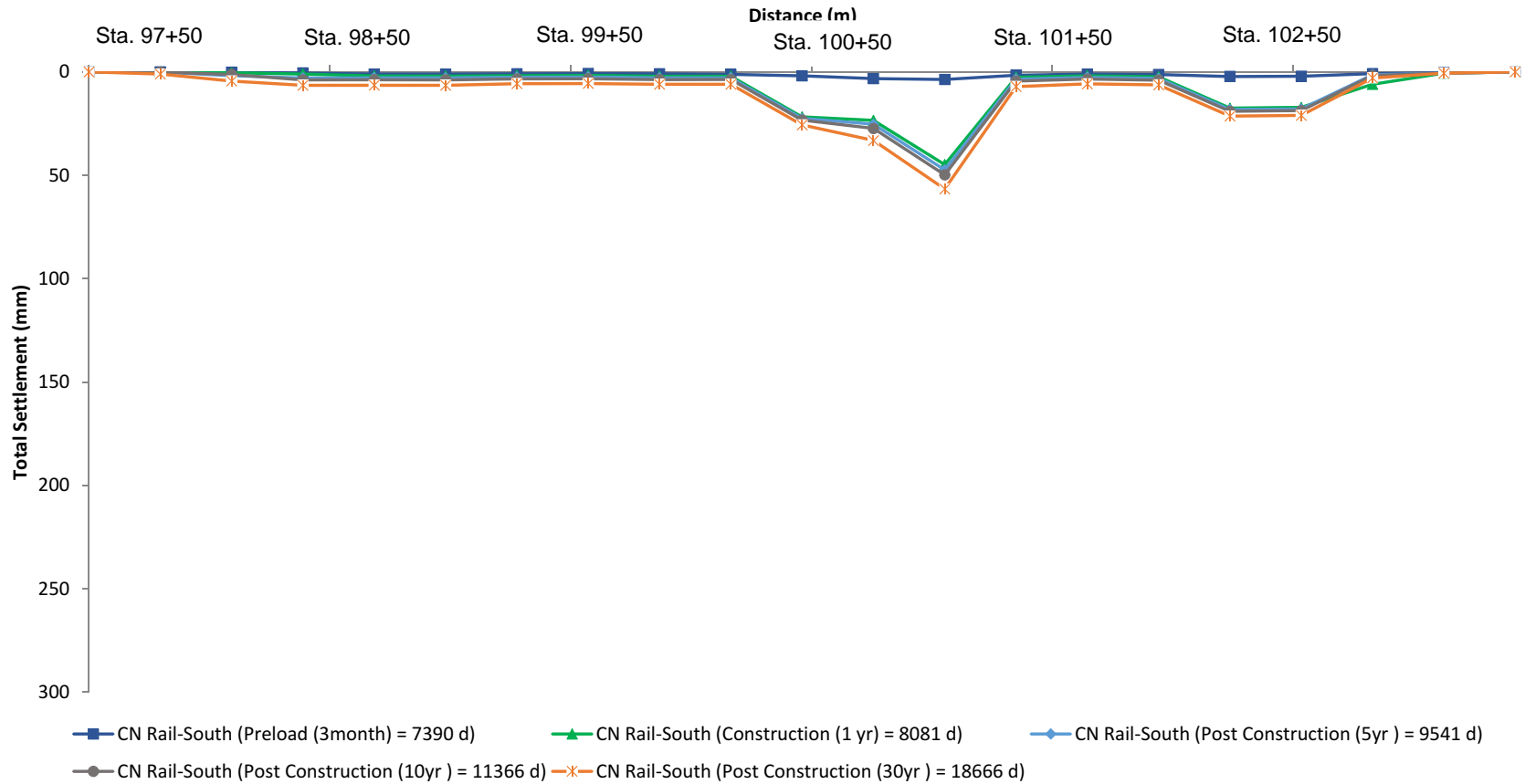
275-3001 Wayburne Drive
 Burnaby, British Columbia V5G 4W3
 Telephone: 604-874-1245
 Fax: 604-874-2358
 exp.com

| | | | | | | | |
|--|-------------|-------------|------------|---|--------------|---------|--|
| CLIENT Mc Elhanney | | | | TITLE: IMPACT OF SURCHARGE LOAD/CONSTRUCTION ON NORTHERN CN RAIL ADJACENT TO PROPOSED CIP WALL ALONG BLUNDELL ROAD | | | |
| PROJECT PORTSIDE BLUNDELL IMPROVEMENT PROJECT | | | | | | | |
| PROJECT NO. VAN-22003875-A0 | DFTR. PA | DSGN. PA | CHK. YA | DATE 2022-11-16 | SCALE: NA | DWG NO. | |

Distance vs. Total Settlement

1.5m

Below Ground Surface



exp Services Inc.

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 Burnaby, British Columbia V5G 4W3
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 Fax: 604-874-2358
 exp.com

| | | | | | | | |
|--|-------------|-------------|------------|--|--------------|---------|--|
| CLIENT Mc Elhanney | | | | TITLE: IMPACT OF SURCHARGE LOAD/CONSTRUCTION ON SOUTHERN CN RAIL ADJACENT TO PROPOSED CIP WALL ALONG | | | |
| PROJECT PORTSIDE BLUNDELL IMPROVEMENT PROJECT | | | | | | | |
| PROJECT NO. VAN-22003875-A0 | DFTR. PA | DSGN. PA | CHK. YA | DATE 2022-11-16 | SCALE: NA | DWG NO. | |



Memorandum (*cont'd*)

*Preliminary Geotechnical Recommendations and Comments on Use of EPS and Densification
for Overpass Design Options 1 and 3
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC
Reference No.: VAN-22003875-A0
November 23, 2022*

Appendix F

Digital Soil Settlement Gauge Specific

SSG - Soil Settlement Gauge

Settlement



ROBUST DESIGN
DESIGNED FOR LONG TERM APPLICATIONS
AVAILABLE WITH VW OR FIBER OPTIC SENSORS

The SSG is a soil settlement gauge used to measure settlement or heave at a precise location in soils.

Description

The SSG consists of a vibrating wire or fiber optic pressure transducer housed in a corrosion-resistant stainless steel body. The housing is normally attached to a base plate and connected to a reference station by a twin tubing filled with water (or anti-freeze solution) and fitted with connectors. The reference station consists of a liquid-filled reservoir open to atmospheric pressure and located at a known elevation. The settlement or heave is measured relative to the elevation of the reservoir.

The SSG is robust and stable. It can be installed in boreholes, standpipes, soil or concrete. The settlement gauge can also be attached to structures for monitoring settlement. To ensure maximum performance, the twin tubing should be flushed at regular intervals to remove air bubbles, and data should be compensated for temperature changes and changes in atmospheric pressure. For best results, de-aired water or antifreeze solution is recommended.

Key Features

- Wide range
- Easy to read
- Robust design for long-term monitoring applications
- Frequency signal of VW sensors easy to process and transmit over long distances
- Fiber optic transducer available that offers immunity to EMI/RFI/lightning and higher accuracy

Applications

- Measuring consolidation of foundation soils
- Measuring settlement of soil within an embankment
- Determining the effectiveness of soil improvement techniques such as wick drains, dynamic compaction and preloading
- Measuring settlement of tank bases
- Monitoring mine induced subsidence



Memorandum (*cont'd*)

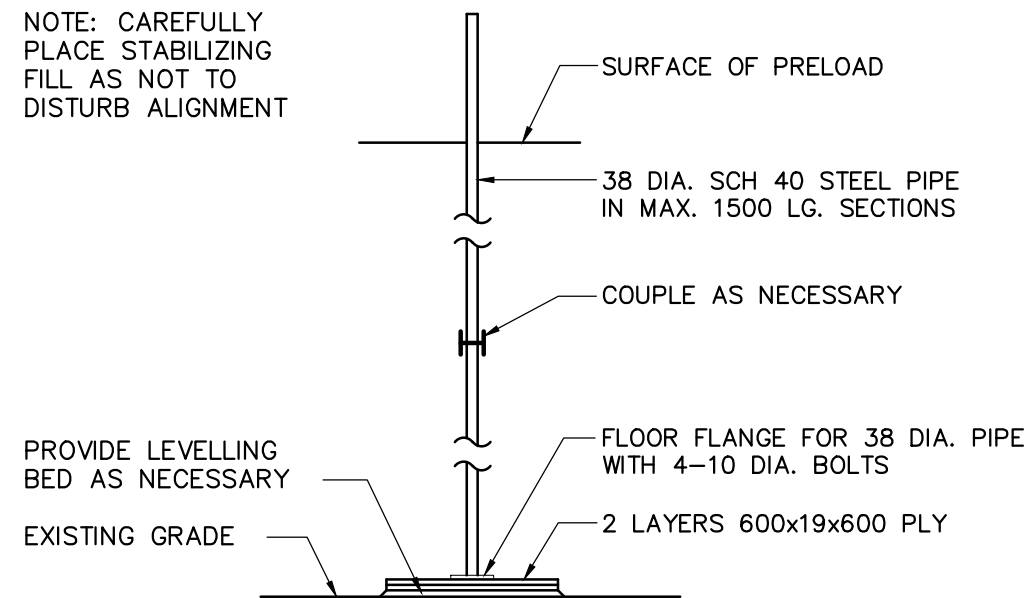
*Preliminary Geotechnical Recommendations and Comments on Use of EPS and Densification
for Overpass Design Options 1 and 3
Portside/Blundell Road Improvement Project (PBRIP)
Richmond, BC*

*Reference No.: VAN-22003875-A0
November 23, 2022*

Appendix G

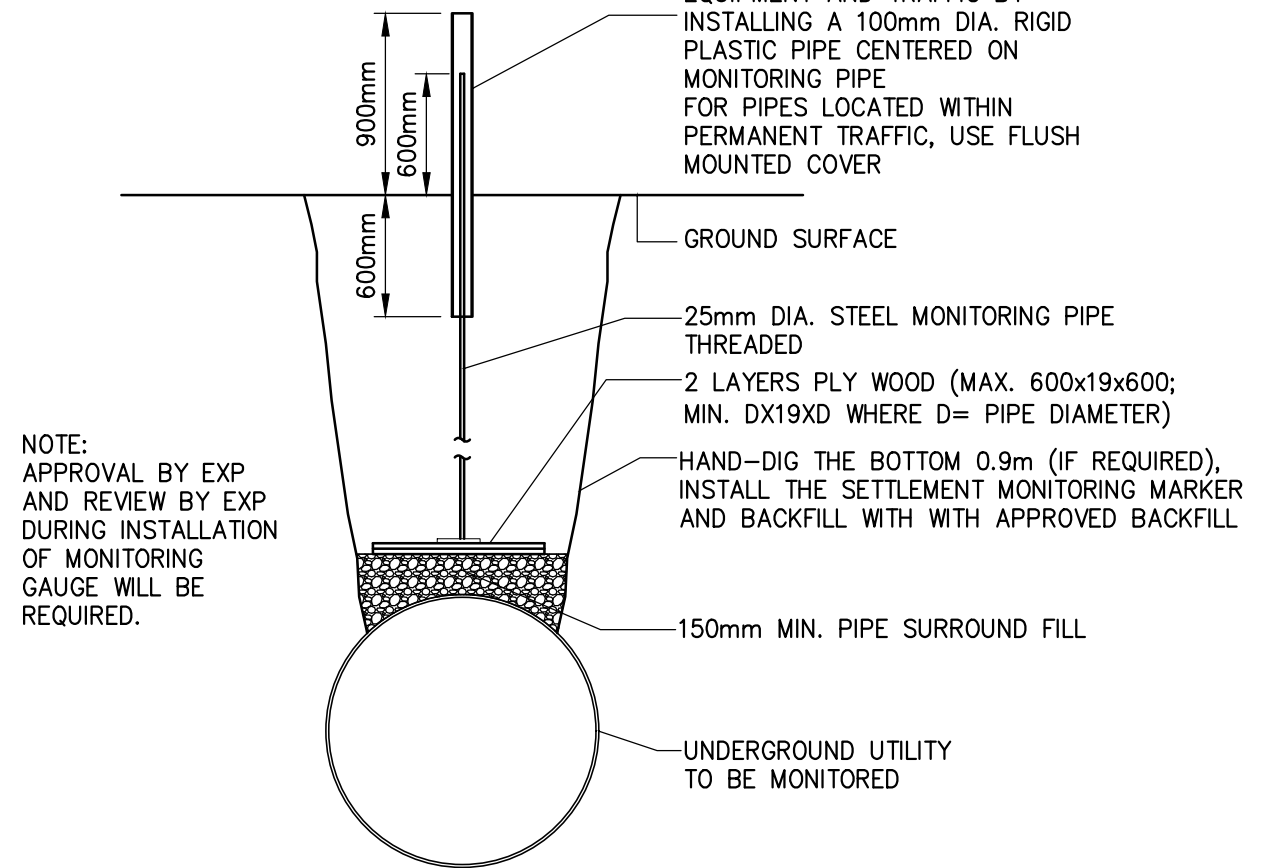
Sketch of proposed settlement Gauge installation

NOTE: CAREFULLY PLACE STABILIZING FILL AS NOT TO DISTURB ALIGNMENT



SHALLOW SURFACE GAUGE DETAIL

PROTECT THE MONITORING PIPE FROM VANDALS AND CONSTRUCTION EQUIPMENT AND TRAFFIC BY INSTALLING A 100mm DIA. RIGID PLASTIC PIPE CENTERED ON MONITORING PIPE FOR PIPES LOCATED WITHIN PERMANENT TRAFFIC, USE FLUSH MOUNTED COVER



DEEP UTILITY MONITORING GAUGE DETAIL



exp Services Inc.
 275-3001 Wayburne Drive
 Burnaby, British Columbia V5G 4W3
 Telephone: 604-874-1245
 Fax: 604-874-2358
 exp.com

| DFT. | No. | REVISIONS | |
|-------|-----|-------------|------|
| | | DESCRIPTION | DATE |
| PA | | | |
| DSGN. | | | |
| PA | | | |
| CHK. | | | |
| YA | | | |

| | |
|-------------|---------------------------------------|
| CLIENT | McElhanney |
| PROJECT | PORT SIDE / BLUNDELL ROAD IMPROVEMENT |
| PROJECT NO. | VAN-22003875-A0 |

| | | | |
|----------|------------------------|--------|-------|
| TITLE: | INSTRUMENTATION DETAIL | | |
| DATE | October 19, 2022 | SCALE: | N.T.S |
| DWG. NO. | | | |