



Addendum to the Geotechnical Evaluation and Remedial Plan

**Cell 20-1, Slope Issues - Clean Harbors
Lambton Facility Landfill Corunna, Ontario**

Clean Harbors Canada, Inc.

December 17, 2021

GHD

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1. Introduction

This report is an addendum report to the GHD Report titled “Geotechnical Evaluation and Remedial Plan- Cell 20-1, Slope Issues”, (herein referred to as the Slope Issues Report), for the Clean Harbors Lambton Facility Landfill, located in Corunna, Ontario. The Slope Issues Report is dated November 12, 2021. The Slope Issues Report was prepared to address the Ministry of Environment, Conservation and Parks (MECP) Condition 46, as follows:

46. The Owner shall not place any waste into the eastern half of cell 19-3 or Cell 20-1 until a report is prepared by a Professional Engineer confirming that landfilling can resume in these cells in a manner that is protective of the health and safety of people and the environment.

This Addendum to the Slope Issues Report provides the following additional information and discussion:

- The results and a summary of investigative work completed in December, 2021, in and around the Cell, including cone penetration testing (CPTs), subsurface sampling, and installation of vibrating wire piezometers (VWPs);
- A review of contours obtained on October 13, 2021 from a drone aerial survey, after the completion of the repairs to the West Slope; and
- Updated modelling for the assessment of the stability of the West Slope, utilizing the information obtained from the drone survey of October 13, and the investigative activities completed in December 2021.
- GHD’s conclusion based on the above information collected during the supplemental investigative works, as presented in this Addendum report, that landfilling in Cell 20-1 any adjacent cells can resume in a manner that is protective of the health and safety of people and the environment.

2. Summary of Field Investigations

Figure 1 shows the locations of the CPT and VWP investigations that were completed in December 2021. The aerial photograph shown on Figure 1 was obtained from the drone camera on October 13, 2021. Ground surface contours generated from the drone flight are shown on Figure 2.

The field work consisted of:

- Eight CPTs (CPT-1 to CPT-8). The CPTs were installed using the services of Conetec Investigations Ltd. (Conetec). Conetec was contracted by Ron Murphy Contracting (Murphy Contracting);
- Two investigative boreholes (VWP-1-21 and VWP-2-21). The boreholes were drilled using mud rotary techniques by Conetec. Standard Penetration Tests (SPTs) were performed in the boreholes, and the associated penetration values (N values) are plotted on the borehole logs. Shelby tube samples were collected at selected depths for further geotechnical index testing; and
- Installation of three VWPs in each of the two investigative boreholes, for long-term monitoring of piezometric pressures in the subsurface units.

The investigative depths for the CPTs and VWP boreholes is summarized in Table 2.1. The boreholes were located in the field by GHD staff. Murphy Contracting provided the coordinates and ground surface elevations of the staked CPT and VWP locations. Ground surface elevations at the staked locations are provided in Table 2.1. At each CPT and VWP location, an additional wood stake was driven as a future reference point for ground surface movement, referred to as survey points (SPs). Three additional SPs (SP-9, SP-10, and SP-11) were also installed at the northeast, southeast and southwest corners of Cell 20-1, as shown on Figure 1.

The boreholes were terminated on the assumed bedrock surface, based on refusal to penetration of the split spoon sampler during SPTs. Samples obtained from the SPT and Shelby tube sampling were brought to our Waterloo laboratory for moisture content testing and geotechnical index testing. The CPTs and VWP boreholes were backfilled using the cement-bentonite grout slurry, in accordance with Ontario Regulation 903.

3. Geotechnical Laboratory Testing

The geotechnical laboratory testing program consisted of moisture content tests on all recovered split spoon samples. Four Shelby tube samples (three samples from VWP-1-21, and one from VWP-2-21) were also collected for further geotechnical testing as noted below.

- Grainsize distribution analysis (ASTM D6913-17) and Atterberg limits tests (ASTM D4318) on two Shelby tube samples, and one split spoon sample
- Unconfined compressive strength test (ASTM D2166) on three Shelby tubes samples.
- bulk density (unit weight) test (ASTM D7263) on three Shelby tube samples.
- Consolidated undrained (CU) triaxial compression tests (ASTM D4767) on one Shelby tube sample.

The laboratory test results are summarized in Table 2.2, and shown at their corresponding depths on the individual borehole logs provided in Appendix A. Detailed laboratory test results are provided in Appendix C. Note that at the time of preparation of this report, some of the laboratory test results were pending, as noted in Table 2.2.

4. Subsurface Conditions

Details of the subsurface conditions encountered in the VWP boreholes, and the CPTs, are included in the detailed logs presented in Appendix A and B. Subsurface information to an approximate depth of 25 m below existing grade were obtained in the 2020 geotechnical investigation work.

The purpose of the VWP boreholes was to obtain deep subsurface information, and to confirm the depth and elevation of the bedrock deposit (Kettle Point Shale Formation). Subsurface conditions in VWP-1-21 and VWP-2-21 were consistent with our 2020 boreholes, and encountered clayey silt deposits to the base of the boreholes. Both boreholes were terminated at refusal to split spoon penetration on inferred shale bedrock, which was encountered at a depth of 42.7 and 42.4 m bgs respectively, corresponding to elevations 158.07 and 158.15 m AMSL. These bedrock depths are consistent with the expected bedrock elevations in this area, based on the 2013 bedrock surface topography map, prepared by RWDI Air Inc. (included in Appendix D). Bedrock monitoring well TW-34-94-I, installed in 1994, to the northwest of Cell 20-1, is included in Appendix D for reference. Similar geologic conditions were noted in TW-34-94-I, to those that were observed in our two VWP boreholes and 2020 boreholes.

The purpose of the CPTs was to obtain additional details on the in situ geotechnical properties of the subsurface deposits, confirm bedrock depths around the perimeter of Cell 20-1, and to investigate the presence of a possible disturbed or remoulded layer in the suspected rotational plane of the west slope. The CPTs consist of hydraulically pushing an instrumented cone tip into the ground using a conventional drill rig. The instrumented cone tip records tip resistance, side friction, and pore water pressures, at 2 cm intervals as the tip is pushed into the ground. This data is included using an onboard data acquisition system. In situ resistivity was also measured using the cone at some of the CPT locations. Plots of the data collected with depth are provided in Appendix B.

CPT 1 and 2 were advanced in the west portion of the floor of Cell 20-1, and CPT 3, 4, and 5, were advanced through the rotated bench on the upper portion of the west slope. Plots of the tip resistance (qt), and pore water pressure (u) are provided for reference on a cross-section through the west slope (see Figures 3A and 3B). The CPT 3 plot shows some evidence of disturbed soil (erratic and elevated pore water pressures) to a depth of about elevation 182 m AMSL. This corresponds to the approximate depth of the estimated rotational plane, as shown on Figure 3B. Evidence of a remoulded zone in CPT 1 and CPT 2 was not obvious.

CPT 7 and CPT 8 were advanced on the north and east sides of the Cell 20-1. The inferred bedrock surface is estimated to be at the refusal depths of the CPT penetration. Refusal occurred at 42.3 and 42.4 m respectively, corresponding to elevation 158.40 and 158.15 m AMSL. Of note is a dense sand seam at a depth of around 30 to 33 m bgs in CPT 8. This sandy seam was also observed during our SPT sampling at VWP2-21. The CPT penetration originally refused to advance in this dense sand seam, however, after restarting the CPT on a more secure work platform, and adjusting the anchoring of the drill rig, the CPT was able to penetrate the sandy seam, and was advanced through the underlying clayey silt deposit, until reaching ultimate refusal on the bedrock surface. A similar situation occurred at CPT 6, with refusal in this dense sandy seam occurring at 28.2 m bgs. Unfortunately due to other Conetec project commitments for the CPT rig, the CPT rig could not be set up again at this location. Further CPT penetration at this location could be carried out in 2022, if necessary. However, based on the CPT and VWP boreholes that were able to be advanced to the top of the inferred bedrock surface, the elevations obtained in this field work were very consistent with the expected bedrock surface elevations.

5. Piezometric Conditions

VWP boreholes VWP-1-21 and VWP-2-21 were instrumented with vibrating wire style pneumatic pore water pressure transducers. These piezometers were installed to targeted depths based on the results of the CPT probes and expected subsurface conditions, and then the boreholes were fully grouted using a cement bentonite slurry. Each piezometer has a thin wire cable that extends from the piezometer tip up to the ground surface, and each cable is connected to a data logger. The piezometers record the piezometric head at the piezometer tip depth. Data is recorded on a daily basis. After initial stabilization of pressures due to installation, the piezometric data will provide long-term readings of the stabilized piezometric pressure at the installed depths. The piezometers were installed at the following depths:

- VWP-1-21: 14.0 m, 21.6 m, and 41.5 m bgs; and
- VWP-2-21: 14.0 m, 29.0 m, and 41.5 m bgs.

Data plots of the piezometric surface collected as of the time of issuing this report are shown on Figure 4. The piezometric surface for the piezometers is showing stabilized conditions at between elevation 196.7 and 196.8 m AMSL for VWP-1-21. VWP-2 piezometric readings are in the range of 197.3 to 197.9 m AMSL, but may not be in a stabilized state at the time of issuance of this report.

6. Updated Slope Stability Modelling

The Slope Issues Report provided slope stability modelling based on the proposed buttress remediation that was substantially completed on September 30. However, a new drone contour surface of the completed works was not available at the time the Slope Issues Report was issued. GHD used the new drone surface contours obtained on

October 13, 2021, and the results of the field investigations, to update the slope stability model for the west slope in this current report. Based on the findings of the CPTs within the west slope, no changes in the geotechnical parameters presented in the previous model of this area are necessary. The CPT results at CPT 3 suggest that the rotational plane is materially consistent with the assumed depth presented in the Slope Issues Report. The model included on Figure 5 does show a revised surface topography of the completed buttress, based on the cross-section of the area shown on Figure 3A. The calculated factor of safety (FS) is similar to that presented in the Slope Issues Report, and is 1.30 in the revised model, as shown on Figure 5.

7. Verification of North, South, and East Excavation Side Slope Stability

Based on the results of CPT 7, CPT 8, and CPT 6, and our on-going visual observations of the stability of these slopes, the following conclusions can be made with respect to the stability of the north, east, and south slopes of Cell 20-1:

- The slopes have remained visually stable since their excavation, with no evidence of seepage or localized instability; and
- The results of CPT 7 and CPT 8 confirm that the bedrock elevation is at the elevation expected in this area.

Visual evidence and the technical data both support GHD's conclusion that the north, east, and south slopes of Cell 20-1 are stable. If consideration is given to the removal of the ramp along the east side of Cell 20-1, GHD will re-evaluate the stability of the east slope considering the influence of the sandy seam encountered at a depth of 30 to 33 m in VWP2-21 and in CPT 8. This evaluation must take place prior to initiating the removal of the ramp.

8. Conclusion

The Slope Issues have been stabilized by the construction of the berm and clay buttress. As such, for the reasons outlined herein, GHD concludes that landfilling of the Cell and any adjacent cells can resume in a manner that is protective of the health and safety of people and the environment.

9. Limitations

This report: has been prepared by GHD for Clean Harbors Canada, Inc. and may only be used and relied on by Clean Harbors Canada, Inc. for the purpose agreed between GHD and Clean Harbors Canada, Inc. as set out in section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Clean Harbors Canada, Inc. arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

All of Which is Respectfully Submitted,

GHD





Bruce Polan, M.A.Sc., P.Eng.

James R. Yardley, P.Eng.

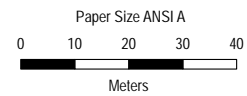


Legend

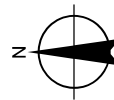
-  CPT/WVP Location
-  Survey Point Location

Aerial Drone Photo taken on October 13, 2021

Q:\GIS\PROJECTS\1440003\144985\Layouts\SlopeCollapse\044985_SitePlan_GIS003.mxd



Map Projection: Transverse Mercator
 Horizontal Datum: North American 1983
 Grid: NAD 1983 UTM Zone 17N



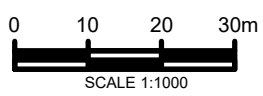
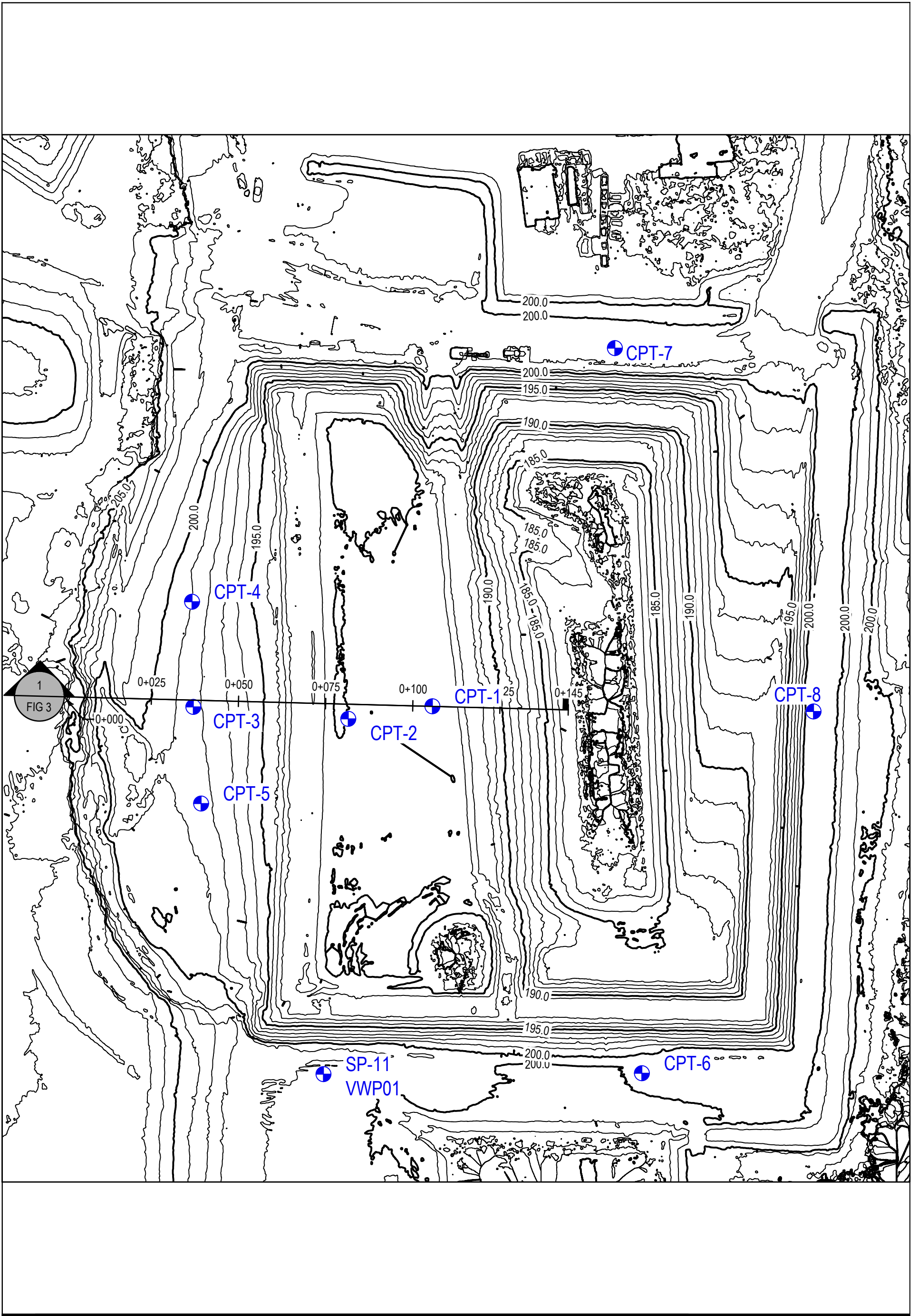
Clean Harbours Lambton Facility Landfill
 4090 TELFER ROAD,
 ST. CLAIR TOWNSHIP,
 COUNTY OF LAMBTON

CPT AND WVP Locations

Project No. 044985
 Revision No. -
 Date **December 17, 2021**

FIGURE 1

Data Source: Drone imagery captured on-site by GHD on August 4th, 2021. Basemap: ESRI

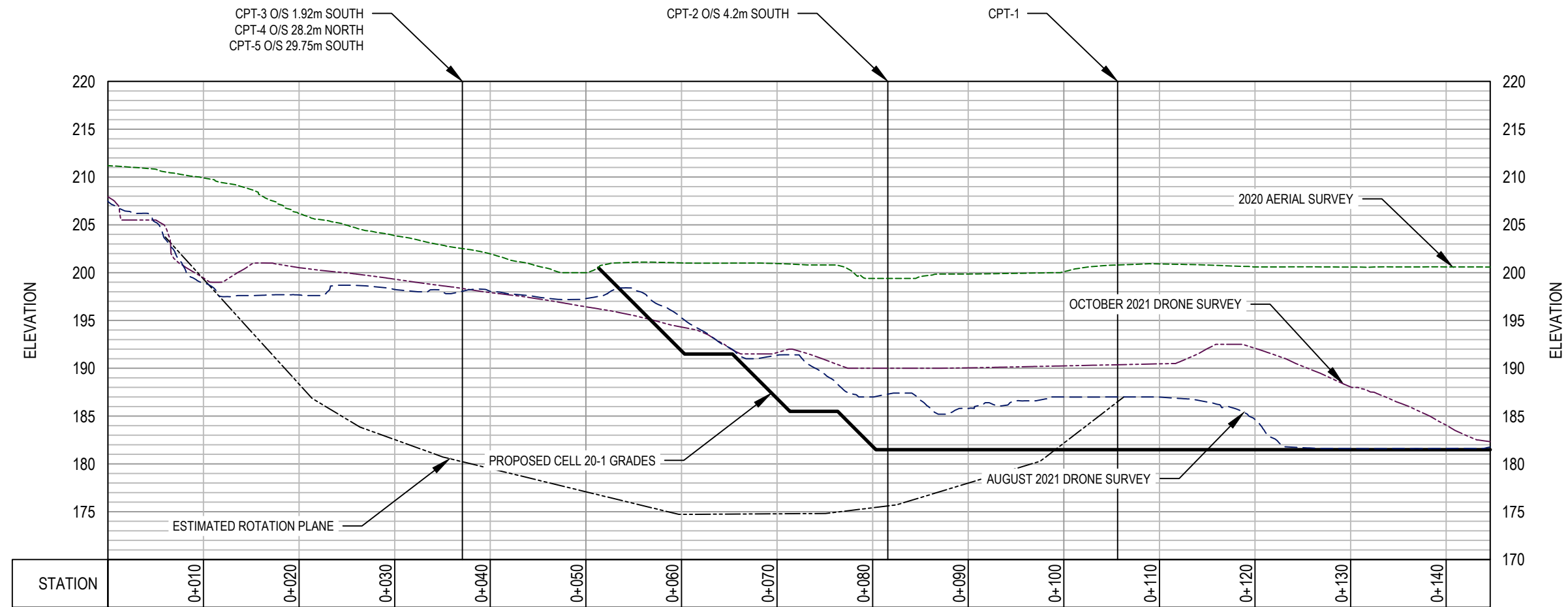


CLEAN HARBORS CANADA, INC.
LAMBTON COUNTY, ONTARIO

Project No. 44985
Date Dec 10, 2021

DRONE AERIAL SURFACE CONTOURS
OCTOBER 13, 2021

Figure 2



1 SECTION
FIG 2 1:500

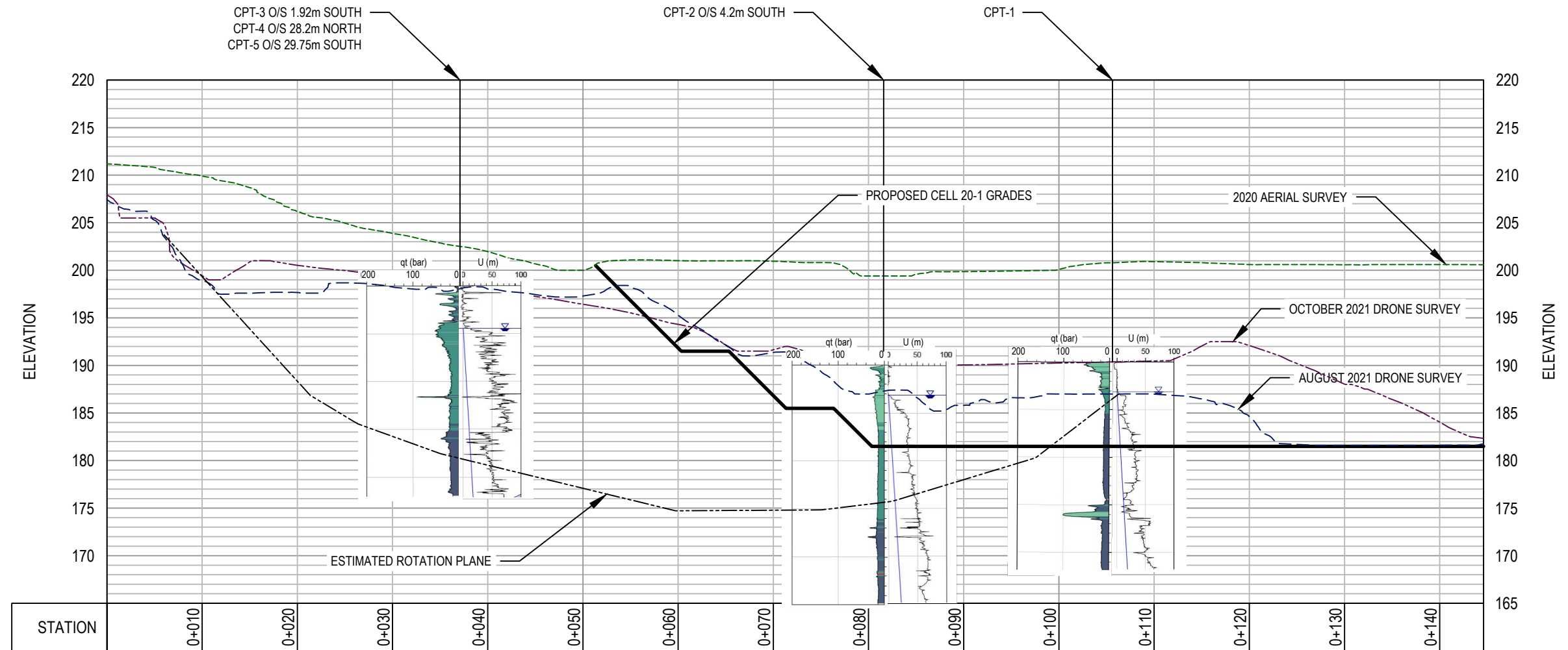


CLEAN HARBORS CANADA, INC.
LAMBTON COUNTY, ONTARIO

Project No. 44985
Date Dec 10, 2021

CROSS-SECTION 1
WEST SLOPE

Figure 3A



1 SECTION
FIG 2 1:500



CLEAN HARBORS CANADA, INC.
LAMBTON COUNTY, ONTARIO

Project No. 44985
Date Dec 10, 2021

CROSS-SECTION 1
WEST SLOPE

Figure 3B

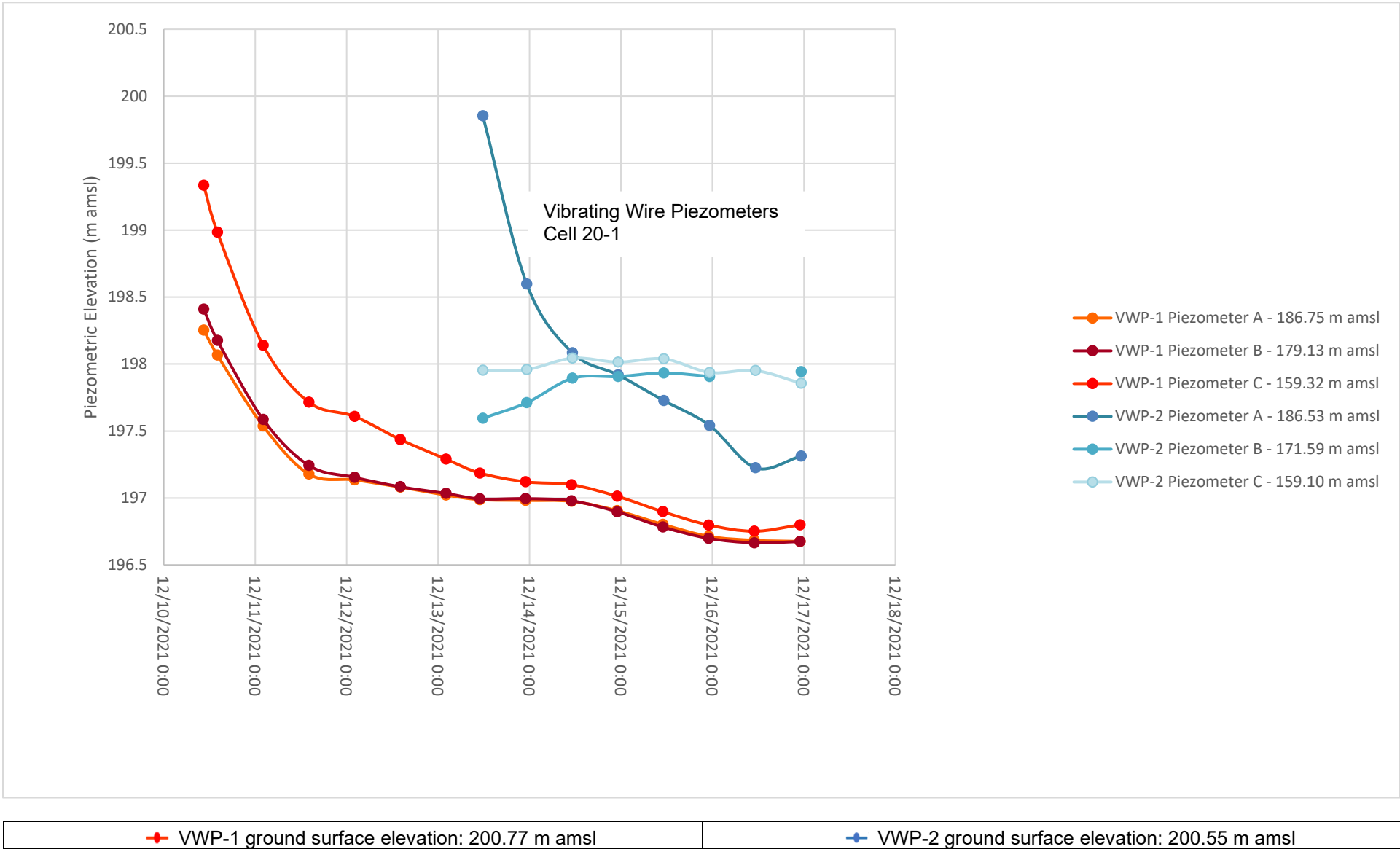
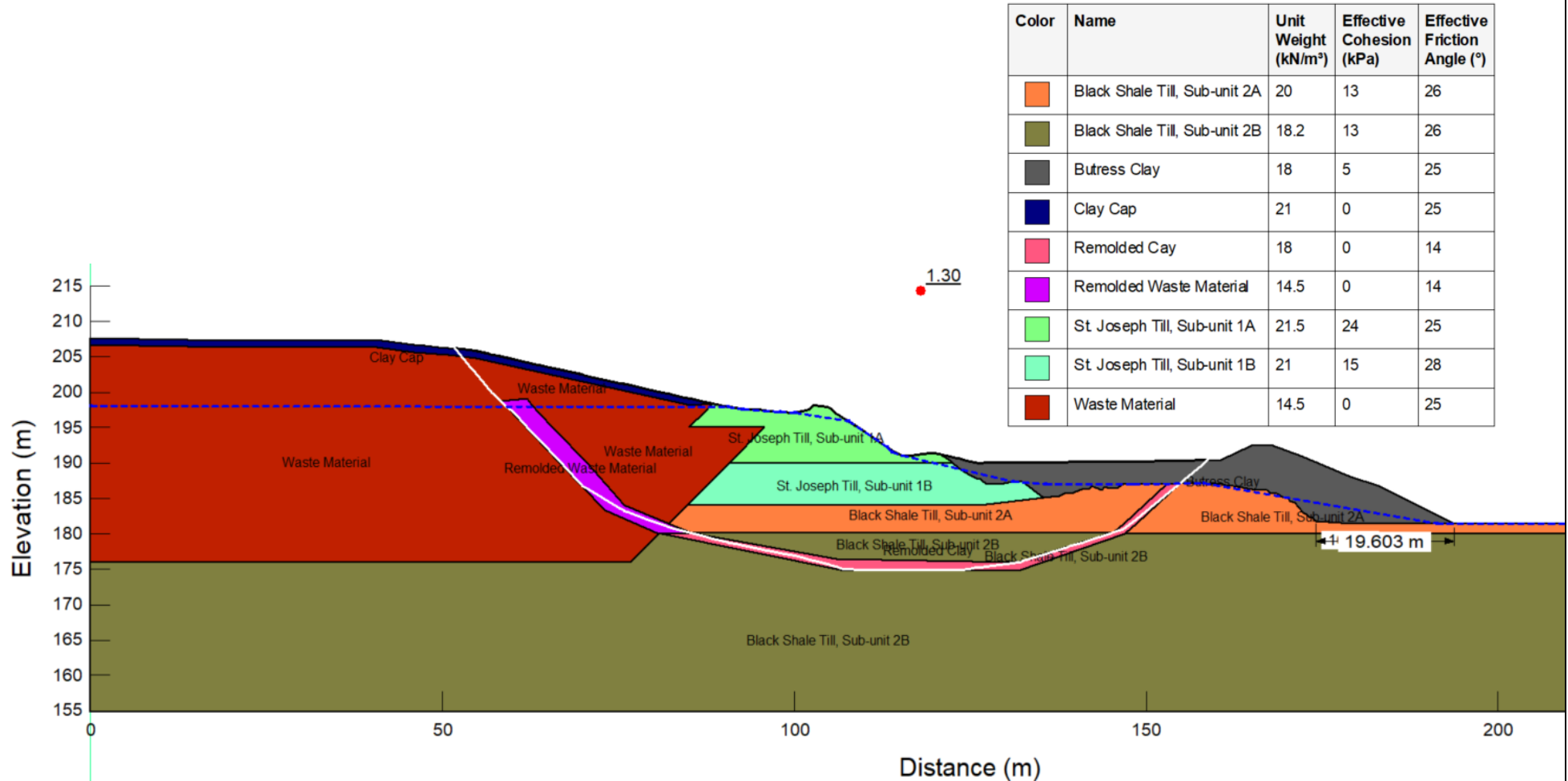


Figure 4
Vibrating Wire Piezometric Elevations- Cell 20-1



Figure 5

West Slope- As-Constructed Butress Stabilization and Pre-1986 Waste Cell Graded and Capped



Client :	Clean Harbors Canada Inc.	
Projet :	Cell 20 Slope Issues	
Reference :	044985	
Location :	West Slope	
Analysis :	Static Drained	F.S : 1.30



TABLE 2.1

SUMMARY OF CONE PENETRATION TEST AND BOREHOLE DEPTHS
 CELL 20-1 SUPPLEMENTAL GEOTECHNICAL INVESTIGATION
 CLEAN HARBORS LAMBTON FACILITY, CORUNNA, ON

<i>CPT/BH Number</i>	<i>Surveyed Ground Surface Elevation</i>	<i>CPT Target Depth</i>	<i>Termination Elevation</i>	<i>Target Information/Notes</i>
CPT-1	189.95	22.0	167.95	Cell 20-1 Floor.
CPT-2	189.82	25.0	164.82	Cell 20-1 Floor. Possible remoulded zone at 175 m.
CPT-3	198.00	30.0	168.00	West side wall. Possible remoulded zone at 175 to 180 m
CPT-4	198.09	30.0	168.09	West side wall. Possible remoulded zone at 175 to 180 m
CPT-5	198.24	30.0	168.24	West side wall. Possible remoulded zone at 175 to 180 m
CPT-6	200.02	42.0	158.02	Bedrock Refusal. CPT hit practical refusal at 28.2 m within a sandy zone.
CPT-7	200.70	42.3	158.40	Bedrock Refusal
CPT-8	200.55	42.4	158.15	Bedrock Refusal
VWP-1	200.77	42.7	158.07	Bedrock Refusal. VWPs installed at 14.0 m, 21.6 m, and 41.5 m
VWP-2	200.55	42.4	158.15	Bedrock Refusal. VWPs installed at 14.0 m, 29.0 m, and 41.5 m



TABLE 2.2

**SUMMARY OF GEOTECHNICAL LABORATORY TEST RESULTS
ADDENDUM TO GEOTECHNICAL EVALUATION AND REMEDIAL PLAN- CELL 20-1 SLOPE ISSUES
CLEAN HARBORS LAMBTON FACILITY, CORUNNA, ON**

Sample Number	Sample Location	Sample Date	Sample Type	Material Description	Sample Depth (metres below grade)	Laboratory Sample No.	Particle Size Distribution (%)					As Received Moisture Content (%)	Atterberg Limits (%)			Unconfined Compression Shear Strength (kPa)	Bulk Unit Weight (kN/m ³)	CU Compression Test	
							Gravel	Sand	Silt	Passing No. 200 Sieve	Clay (< 0.002 mm)		Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)			Effective Strength (kPa)	Effective Angle of Internal Friction (degree)
1	BH1-20, ST-1	5-Oct-20	Shelby Tube	Silt and Clay, trace sand, trace gravel	13.0 m - 13.6 m	WLT 453-1	1	6	57	93	36	19	32	17	15	143.9	20.1		
2	BH1-20, ST-2	5-Oct-20	Shelby Tube	Clay and Silt, trace sand, trace gravel	22.9 m - 23.5 m	WLT 453-2	1	7	43	92	49	24	41	21	20	32.6	20.0	22	25
3	BH2-20, ST-1	8-Oct-20	Shelby Tube	Silt and Clay, some sand, trace gravel	10.7 m - 11.3 m	WLT 453-3	1	17	46	82	36	19	30	15	15	63.5	21.0	27	26
4	BH2-20, ST-2	8-Oct-20	Shelby Tube	Clayey Silt	21.3 m - 21.9 m	WLT 453-4										64.3	18.1		
5	BH3-20, ST-1	7-Oct-20	Shelby Tube	Clayey Silt	10.7 m - 11.3 m	WLT 453-5										105.0	21.0		
6	BH3-20, ST-2	7-Oct-20	Shelby Tube	Clay and Silt, trace sand, trace gravel	21.3 m - 21.9 m	WLT 453-6	2	7	42	91	49	25	41	21	20	42.9	19.9		
7	BH4-20, ST-1	6-Oct-20	Shelby Tube	Clayey Silt	10.7 m - 11.3 m	WLT 453-7										104.6	21.1		
8	BH4-20, ST-2	6-Oct-20	Shelby Tube	Clay and Silt, trace sand, trace gravel	21.3 m - 21.9 m	WLT 453-8	1	8	44	91	47	27	41	20	21	26.2	20.0	24	21
9	VWP-1, ST-1	9-Dec-21	Shelby Tube	Gradation and Atterberg Pending	32.0 m - 32.6 m	WLT 731-2						29				53.9	19.4		
10	VWP-1, ST-3	9-Dec-21	Shelby Tube	Gradation and Atterberg Pending	38.1 m - 38.7 m	WLT 731-1						26				61.6	19.2		
11	VWP-2, SS-3	10-Dec-21	Split Spoon	Gradation and Atterberg Pending	30.2 m - 30.8 m	WLT 731-4										--	--		
12	VWP-2, ST-1	10-Dec-21	Shelby Tube	Gradation and Atterberg Pending, CU test Pending	35.1 m - 35.7 m	WLT 731-3						27				73.0	19.3		

Notes:
 (1) NP denotes Non Plastic
 (1) "--" denotes Not Tested

Appendices

Appendix A

2021 Vibrating Wire Borehole Logs



BOREHOLE No.: WVP1-21
ELEVATION: 200.77 m

BOREHOLE REPORT

Page: 1 of 4

CLIENT: Clean Harbors - Lambton Facility

PROJECT: Geotechnical Investigation - VWP Installations - Cell 20-1

LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON

DESCRIBED BY: Owen Reynolds CHECKED BY: Abdul Hafeez Khan

DATE (START): 8 December 2021 DATE (FINISH): 9 December 2021

LEGEND

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ▭ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		△ Field							
									w _p	w _L	□ Lab							
0	200.77		GROUND SURFACE		%			N	10	20	30	40	50	60	70	80	90	
1			NATIVE: CLAYEY SILT - brown, very stiff (unsampled) Augered to 9.2 m, and installed casing. Mud rotary drilling below 9.2 m															
2																		
3	1.0																	
4																		
5	2.0																	
6																		
7																		
8																		
9																		
10	2.90	197.87	greyish brown, trace sand, trace gravel, moist	SS-1	40	16	4-7-10-12	17										
11																		
12																		
13	4.0																	
14																		
15																		
16	5.0																	
17																		
18																		
19	5.80	194.97	becoming grey, stiff, some sand, trace gravel	SS-2	75	13	3-3-5-7	8										
20	6.0																	
21																		
22																		
23	7.0																	
24																		
25																		
26	8.0																	
27																		
28																		
29																		
30	9.0																	
31																		
32																		
33	10.0																	
34																		
35																		
36	11.0																	
37																		

SOIL LOG WITH GRAPH+WELL_044985-50-06 BOREHOLE LOGS (FINAL).GPJ_GHD_Geotechnical_17/12/21

Data Loggers

Cement Bentonite Grout

25 mm PVC Guide Pipe (Grouted)



BOREHOLE No.: WVP1-21
ELEVATION: 200.77 m

BOREHOLE REPORT

Page: 2 of 4

CLIENT: Clean Harbors - Lambton Facility

PROJECT: Geotechnical Investigation - VWP Installations - Cell 20-1

LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON

DESCRIBED BY: Owen Reynolds CHECKED BY: Abdul Hafeez Khan

DATE (START): 8 December 2021 DATE (FINISH): 9 December 2021

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- WATER LEVEL

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	200.77		GROUND SURFACE			%			N				10 20 30 40 50 60 70 80 90		
38																
39	12.0															
40																
41						SS-4	95	19	3-4-6-7	10						
42																
43	13.0															
44																
45																
46	14.0	186.77		VWP-1A installed at 14.0 m bgs												
47	14.00															
48	14.60	186.17		becoming very stiff, trace sand, trace gravel												
49	15.0															
50																
51						SS-5	80	21	3-8-12-17	20						
52																
53	16.0															
54																
55																
56	17.0															
57																
58	17.70	183.07		becoming stiff												
59	18.0															
60																
61						SS-6	95	25	3-5-7-8	12						
62	19.0															
63																
64																
65	20.0															
66																
67																
68																
69	21.0															
70																
71	21.60	179.17		VWP-1B installed at 21.6 m bgs		SS-7	0	--	2-4-6-8	10						
72	22.0															
73																
74																
75																

SOIL LOG WITH GRAPH+WELL_044985-50-06 BOREHOLE LOGS (FINAL).GPJ_GHD_Geotechnical_17/12/21



BOREHOLE No.: WVP1-21
ELEVATION: 200.77 m

BOREHOLE REPORT

Page: 3 of 4

CLIENT: Clean Harbors - Lambton Facility

PROJECT: Geotechnical Investigation - VWP Installations - Cell 20-1

LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON

DESCRIBED BY: Owen Reynolds CHECKED BY: Abdul Hafeez Khan

DATE (START): 8 December 2021 DATE (FINISH): 9 December 2021

LEGEND

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ▭ RC - ROCK CORE
- ▼ - WATER LEVEL

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	200.77		GROUND SURFACE			%			N				10 20 30 40 50 60 70 80 90		
76																
77																
78																
79	24.0															
80																
81						SS-8	100	28	3-4-5-6	9						
82	25.0															
83																
84																
85	26.0															
86																
87																
88	27.0															
89						SS-9	100	25	4-4-6-8	10						
90																
91	28.0															
92																
93																
94	29.0															
95																
96																
97	30.0															
98																
99																
100																
101	31.0					SS-10	100	28	4-6-7-8	13						
102																
103																
104	32.0	168.77		Shelby tube sample at 32.0 m bgs		ST-1	100	--	--	--						
105	32.00															
106																
107																
108	32.90	167.87		occasional gravel, moist-wet												
109	33.0															
110																
111	34.0					SS-11	100	30	3-5-7-7	12						
112																

SOIL LOG WITH GRAPH+WELL_044985-50-06 BOREHOLE LOGS (FINAL).GPJ_GHD_Geotechnical_17/12/21



BOREHOLE No.: WVP1-21
ELEVATION: 200.77 m

BOREHOLE REPORT

Page: 4 of 4

CLIENT: Clean Harbors - Lambton Facility

PROJECT: Geotechnical Investigation - VWP Installations - Cell 20-1

LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON

DESCRIBED BY: Owen Reynolds CHECKED BY: Abdul Hafeez Khan

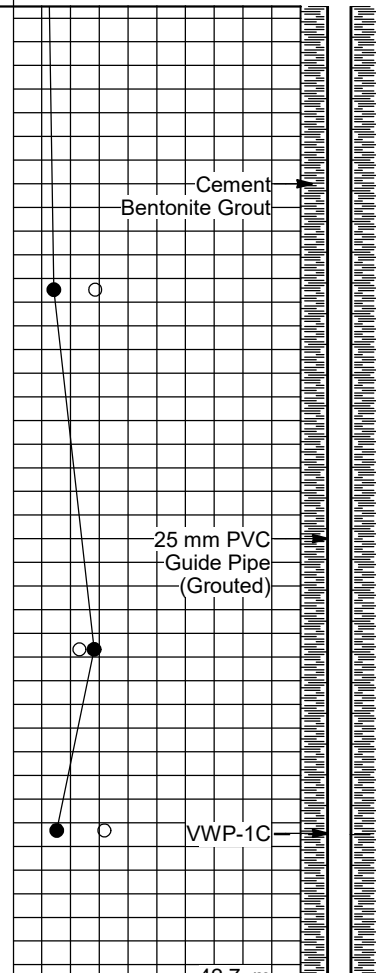
DATE (START): 8 December 2021 DATE (FINISH): 9 December 2021

LEGEND

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ▭ RC - ROCK CORE
- ▼ - WATER LEVEL

SOIL LOG WITH GRAPH+WELL_044985-50-06 BOREHOLE LOGS (FINAL).GPJ_GHD_Geotechnical_17/12/21

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	200.77		GROUND SURFACE		%			N						
114															
115	35.0	165.67		Shelby tube attempted at 35.1 m bgs (no recovery)	ST-2	0	--	--	--						
116	35.10														
117															
118	36.0														
119															
120															
121	37.0				SS-12	100	28	5-6-8-9	14						
122															
123															
124															
125	38.0	162.67		Shelby tube sample at 38.1 m bgs	ST3	100	--	--	--						
126	38.10			Grainsize Analysis: Gr =%, Sa =%, Cl & Si =%											
127															
128	39.0	161.77		becoming very stiff, trace sand, trace gravel, moist											
129	39.00														
130															
131	40.0				SS-13	100	23	6-12-16-23	28						
132															
133															
134	40.80	159.97		becoming stiff, trace gravel, moist-wet to wet, occasional Shale fragments											
135	41.0														
136	41.50	159.27		VWP-1C installed at 41.5 m bgs	SS-14	100	32	7-7-8-8	15						
137															
138	42.0														
139															
140	42.70	158.07		END OF BOREHOLE AT 42.7 m bgs on inferred Shale bedrock.	SS-15	0	--	Bouncing	--						
141	43.0														
142				Annular space of borehole and guide pipe backfilled with cement-bentonite grout.											
143															
144	44.0														
145				m bgs - refers to meters below ground surface											
146				Gr =gravel; Sa =sand; Cl & Si =clay & silt											
147															
148	45.0														
149															
150															





BOREHOLE No.: WVP2-21
ELEVATION: 200.55 m

BOREHOLE REPORT

Page: 1 of 4

CLIENT: Clean Harbors - Lambton Facility

PROJECT: Geotechnical Investigation - VWP Installations - Cell 20-1

LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON

DESCRIBED BY: Owen Reynolds / Bruce Polan **CHECKED BY:** Abdul Hafeez Khan

DATE (START): 10 December 2021 **DATE (FINISH):** 11 December 2021

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

Depth	Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)		△ Field
										○ Water content (%)	□ Lab	
Feet	Metres	200.55	GROUND SURFACE			%				<input checked="" type="checkbox"/> w _p <input checked="" type="checkbox"/> w _L	<input checked="" type="checkbox"/> Atterberg limits (%) <input checked="" type="checkbox"/> "N" Value (blows / 12 in.-30 cm)	
0			NATIVE: CLAYEY SILT - brown, stiff (unsampled to 24.4 m)						N	10 20 30 40 50 60 70 80 90		
1												
2												
3	1.0											
4												
5												
6	2.0											
7												
8												
9												
10	3.0											
11												
12												
13	4.0											
14												
15												
16	5.0											
17												
18												
19												
20	6.0											
21												
22												
23	7.0											
24												
25												
26	8.0											
27												
28												
29												
30	9.0											
31												
32												
33	10.0											
34												
35												
36	11.0											
37												

SOIL LOG WITH GRAPH+WELL_044985-50-06 BOREHOLE LOGS (FINAL).GPJ_GHD_Geotechnical_17/12/21

Data Loggers

Cement Bentonite Grout

25 mm PVC Guide Pipe (Grouted)



BOREHOLE No.: WVP2-21
ELEVATION: 200.55 m

BOREHOLE REPORT

Page: 2 of 4

CLIENT: Clean Harbors - Lambton Facility

PROJECT: Geotechnical Investigation - VWP Installations - Cell 20-1

LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON

DESCRIBED BY: Owen Reynolds / Bruce Polan CHECKED BY: Abdul Hafeez Khan

DATE (START): 10 December 2021 DATE (FINISH): 11 December 2021

LEGEND

- SS - SPLIT SPOON
- ST - SHELBY TUBE
- RC - ROCK CORE
- ▼ - WATER LEVEL

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	△ Field
Feet	Metres										○ Water content (%)	□ Lab
		200.55		GROUND SURFACE			%			N	w _p , w _L Atterberg limits (%)	
38											● "N" Value (blows / 12 in.-30 cm)	
39	12.0											
40												
41												
42												
43	13.0											
44												
45												
46	14.0	186.55		VWP-2A installed at 14.0 m bgs								
47	14.00											
48												
49	15.0											
50												
51												
52	16.0											
53												
54												
55												
56	17.0											
57												
58												
59	18.0											
60												
61												
62	19.0											
63												
64												
65												
66	20.0											
67												
68												
69	21.0											
70												
71												
72	22.0											
73												
74												
75												

SOIL LOG WITH GRAPH+WELL: 044985-50-06 BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 17/12/21

186.55

VWP-2A installed at 14.0 m bgs

VWP-2A

25 mm PVC Guide Pipe (Grouted)

Cement Bentonite Grout



BOREHOLE No.: WVP2-21
ELEVATION: 200.55 m

BOREHOLE REPORT

Page: 3 of 4

CLIENT: Clean Harbors - Lambton Facility

PROJECT: Geotechnical Investigation - VWP Installations - Cell 20-1

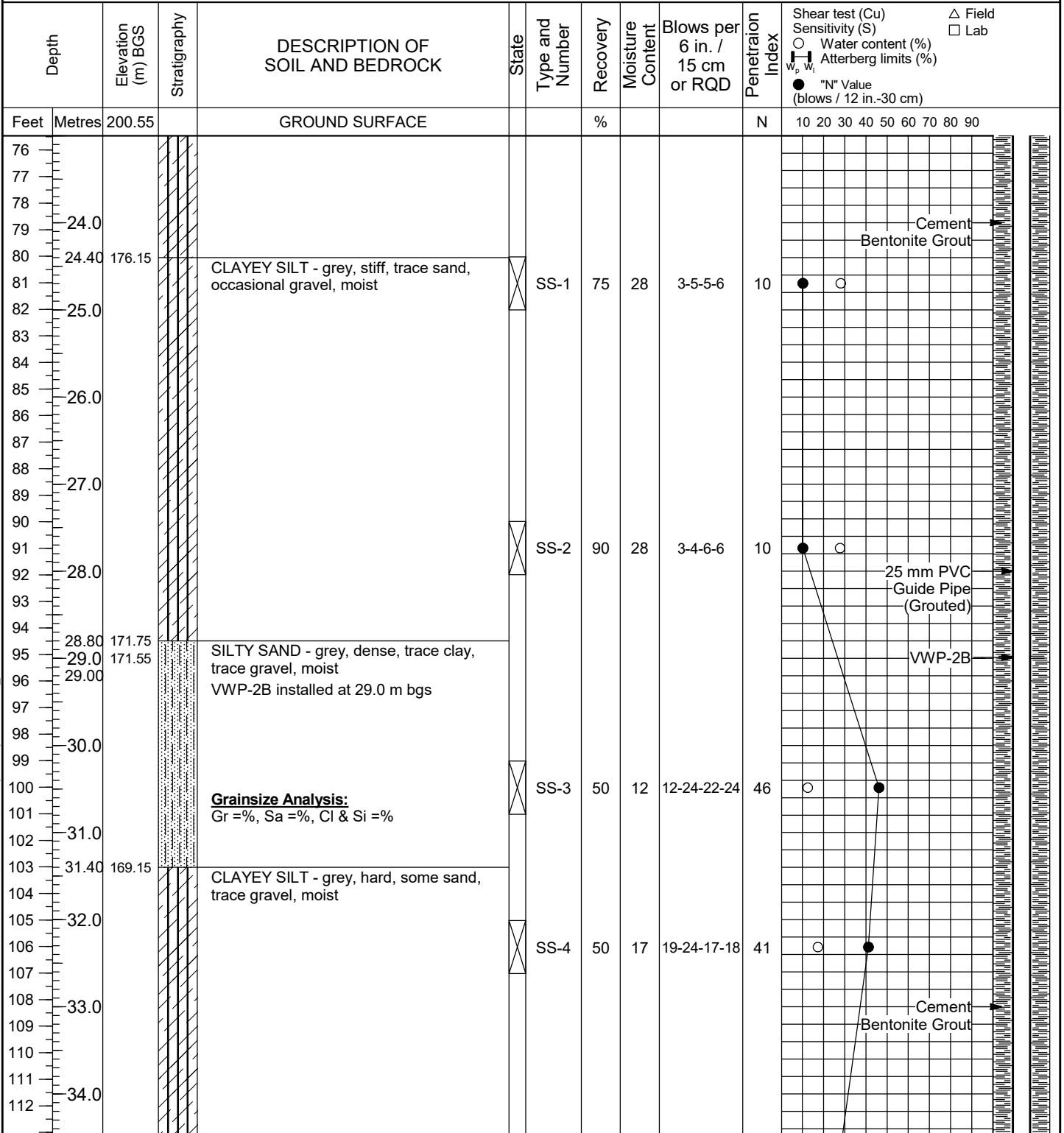
LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON

DESCRIBED BY: Owen Reynolds / Bruce Polan CHECKED BY: Abdul Hafeez Khan

DATE (START): 10 December 2021 DATE (FINISH): 11 December 2021

LEGEND

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ▭ RC - ROCK CORE
- ▼ - WATER LEVEL



SOIL LOG WITH GRAPH+WELL. 044985-50-06 BOREHOLE LOGS (FINAL).GPJ GHD_Geotechnical 17/12/21



BOREHOLE No.: WVP2-21
ELEVATION: 200.55 m

BOREHOLE REPORT

Page: 4 of 4

CLIENT: Clean Harbors - Lambton Facility

PROJECT: Geotechnical Investigation - VWP Installations - Cell 20-1

LOCATION: Clean Harbors Lambton Facility, 4090 Telfer Rd. Corunna, ON

DESCRIBED BY: Owen Reynolds / Bruce Polan CHECKED BY: Abdul Hafeez Khan

DATE (START): 10 December 2021 DATE (FINISH): 11 December 2021

LEGEND

- ☒ SS - SPLIT SPOON
- ▨ ST - SHELBY TUBE
- ▭ RC - ROCK CORE
- ▼ - WATER LEVEL

SOIL LOG WITH GRAPH+WELL_044985-50-06 BOREHOLE LOGS (FINAL).GPJ_GHD_Geotechnical_17/12/21

Depth		Elevation (m) BGS	Stratigraphy	DESCRIPTION OF SOIL AND BEDROCK	State	Type and Number	Recovery	Moisture Content	Blows per 6 in. / 15 cm or RQD	Penetration Index	Shear test (Cu) Sensitivity (S)	Water content (%)	Atterberg limits (%)	"N" Value (blows / 12 in.-30 cm)	Field	Lab
Feet	Metres	200.55		GROUND SURFACE			%			N				10 20 30 40 50 60 70 80 90		
114																
115	35.0	165.45		Shelby tube sample at 35.1 m bgs		ST-1	100	--	--	--						
116	35.10			Grainsize Analysis: Gr =%, Sa =%, Cl & Si =%												
117																
118	36.0	164.55		becoming stiff												
119	36.00															
120																
121	37.0					SS-5	100	28	5-7-8-8	15						
122																
123																
124																
125	38.0															
126																
127																
128	39.0	161.55		becoming moist-wet												
129	39.00															
130																
131	40.0					SS-6	100	22	4-3-5-4	8						
132																
133																
134	41.0	159.55		occasional Shale fragments, moist												
135	41.00															
136	41.50	159.05		VWP-2C installed at 41.5 m bgs		SS-7	100	20	6-8-11-20	19						
137																
138	42.0															
139	42.40	158.15		END OF BOREHOLE AT 42.4 m bgs on inferred bedrock.		SS-8	0	--	Bouncing	--						
140																
141	43.0			Annular space of borehole and guide pipe backfilled with cement-bentonite grout.												
142																
143																
144	44.0			m bgs - refers to meters below ground surface												
145				Gr =gravel; Sa =sand; Cl & Si =clay & silt												
146																
147																
148	45.0															
149																
150																

Cement Bentonite Grout

25 mm PVC Guide Pipe (Grouted)

VWP-2C

42.4 m



Notes on Borehole and Test Pit Reports

Soil description :

Each subsurface stratum is described using the following terminology. The relative density of granular soils is determined by the Standard Penetration Index ("N" value), while the consistency of clayey soils is measured by the value of undrained shear strength (Cu).

Classification (Unified system)			
Clay	< 0.002 mm		
Silt	0.002 to 0.075 mm		
Sand	0.075 to 4.75 mm	fine	0.075 to 0.425 mm
		medium	0.425 to 2.0 mm
		coarse	2.0 to 4.75 mm
Gravel	4.75 to 75 mm	fine	4.75 to 19 mm
		coarse	19 to 75 mm
Cobbles	75 to 300 mm		
Boulders	>300 mm		

Terminology	
"trace"	1-10%
"some"	10-20%
adjective (silty, sandy)	20-35%
"and"	35-50%

Relative density of granular soils	Standard penetration index "N" value (BLOWS/ft – 300 mm)
Very loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Consistency of cohesive soils	Undrained shear strength (Cu)	
	(P.S.F)	(kPa)
Very soft	<250	<12
Soft	250-500	12-25
Firm	500-1000	25-50
Stiff	1000-2000	50-100
Very stiff	2000-4000	100-200
Hard	>4000	>200

Rock quality designation	
"RQD" (%) Value	Quality
<25	Very poor
25-50	Poor
50-75	Fair
75-90	Good
>90	Excellent

STRATIGRAPHIC LEGEND			
Sand	Gravel	Cobbles & boulders	Bedrock
Silt	Clay	Organic soil	Fill

Samples:

Type and Number

The type of sample recovered is shown on the log by the abbreviation listed hereafter. The numbering of samples is sequential for each type of sample.

SS: Split spoon

ST: Shelby tube

AG: Auger

SSE, GSE, AGE: Environmental sampling

PS: Piston sample (Osterberg)

RC: Rock core

GS: Grab sample

Recovery

The recovery, shown as a percentage, is the ratio of length of the sample obtained to the distance the sampler was driven/pushed into the soil

RQD

The "Rock Quality Designation" or "RQD" value, expressed as percentage, is the ratio of the total length of all core fragments of 4 inches (10 cm) or more to the total length of the run.

IN-SITU TESTS:

N: Standard penetration index

Nc: Dynamic cone penetration index

k: Permeability

R: Refusal to penetration

Cu: Undrained shear strength

ABS: Absorption (Packer test)

Pr: Pressure meter

LABORATORY TESTS:

I_p: Plasticity index

H: Hydrometer analysis

A: Atterberg limits

C: Consolidation

O.V.: Organic vapor

W_l: Liquid limit

GSA: Grain size analysis

w: Water content

CS: Swedish fall cone

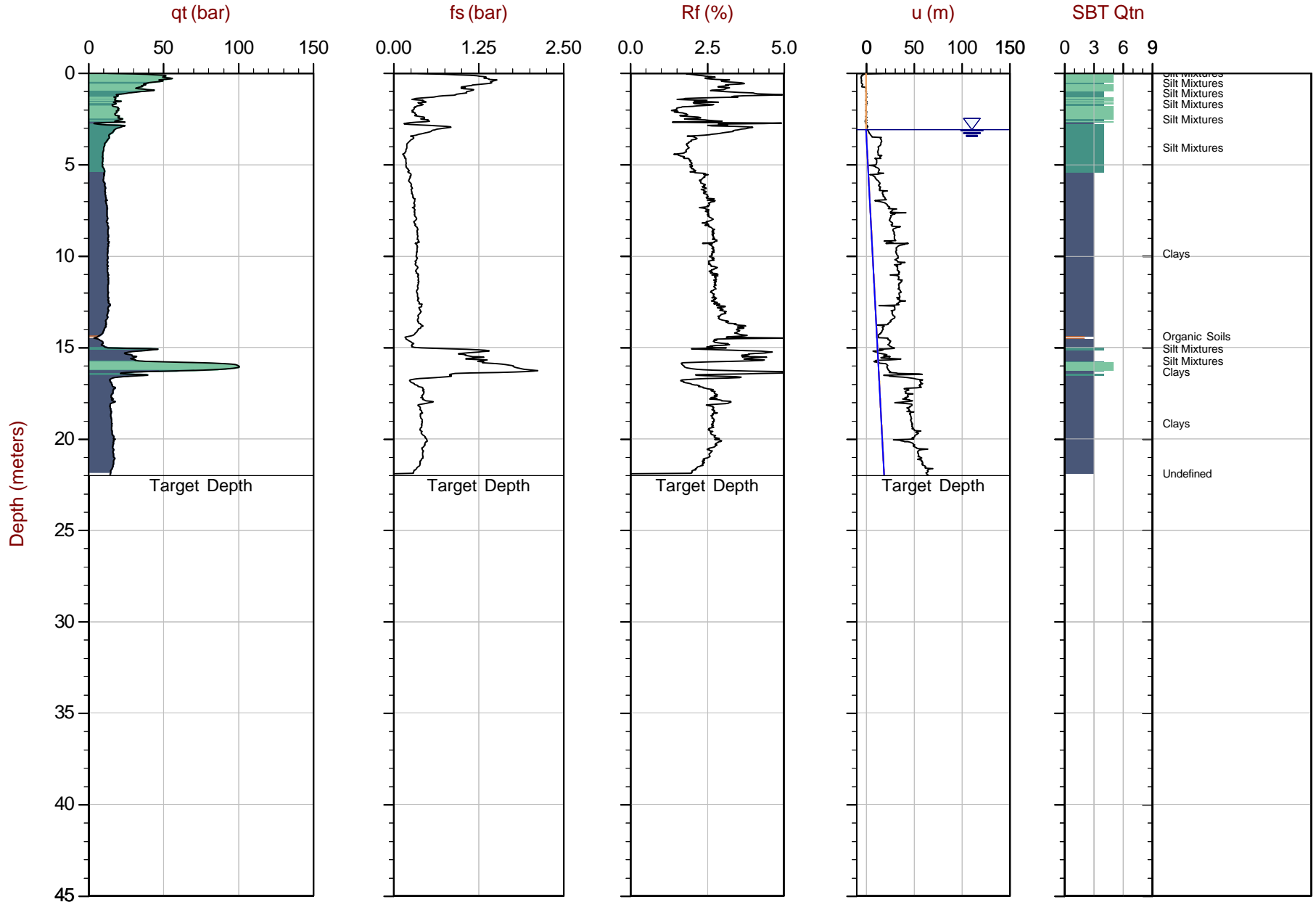
W_p: Plastic limit

γ: Unit weight

CHEM: Chemical analysis

Appendix B

Cone Penetration Test Results



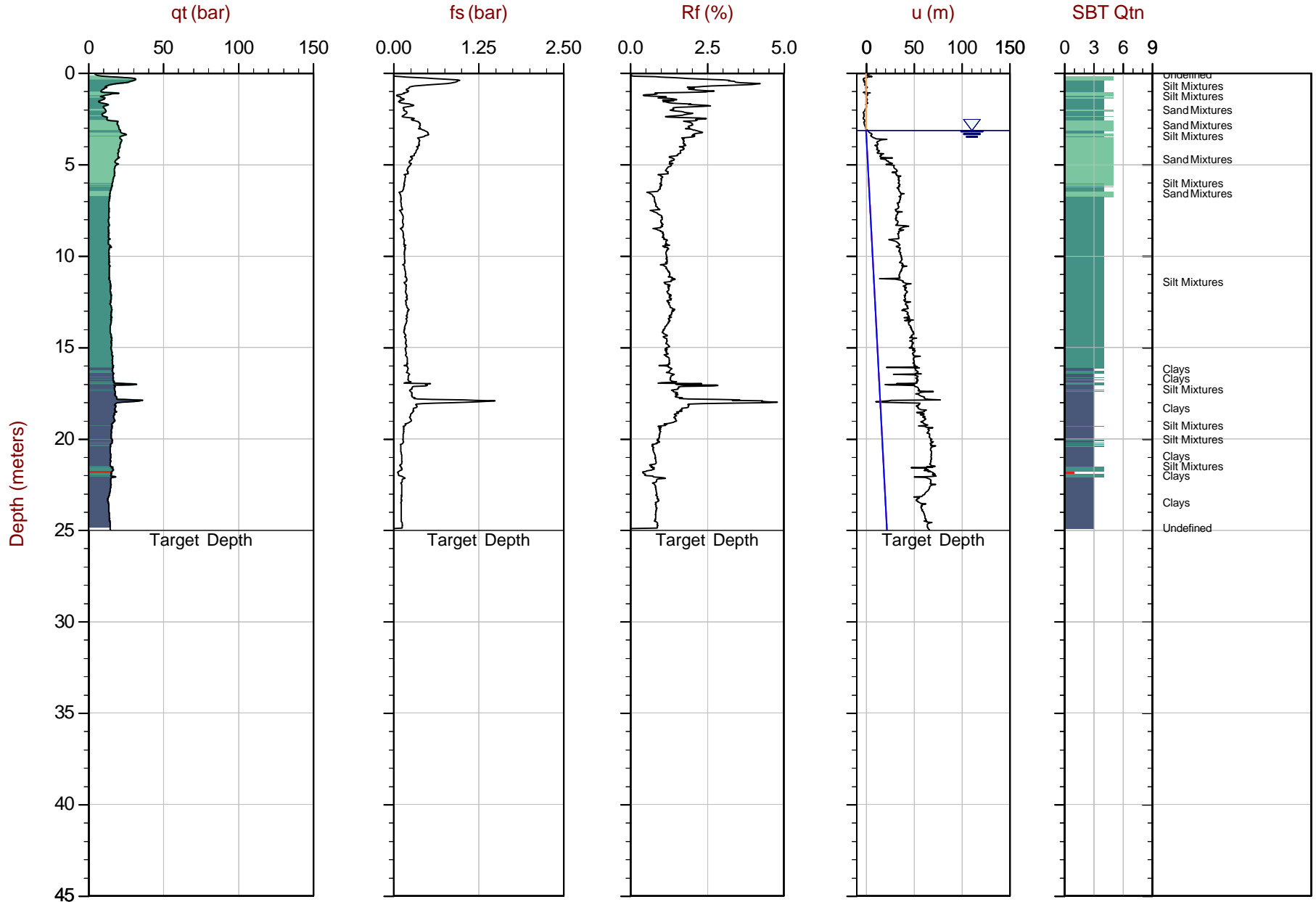
Max Depth: 22.000 m / 72.18 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: Every Point

File: 21-05-23225_RP01.COR
 Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747825 E: 394229
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



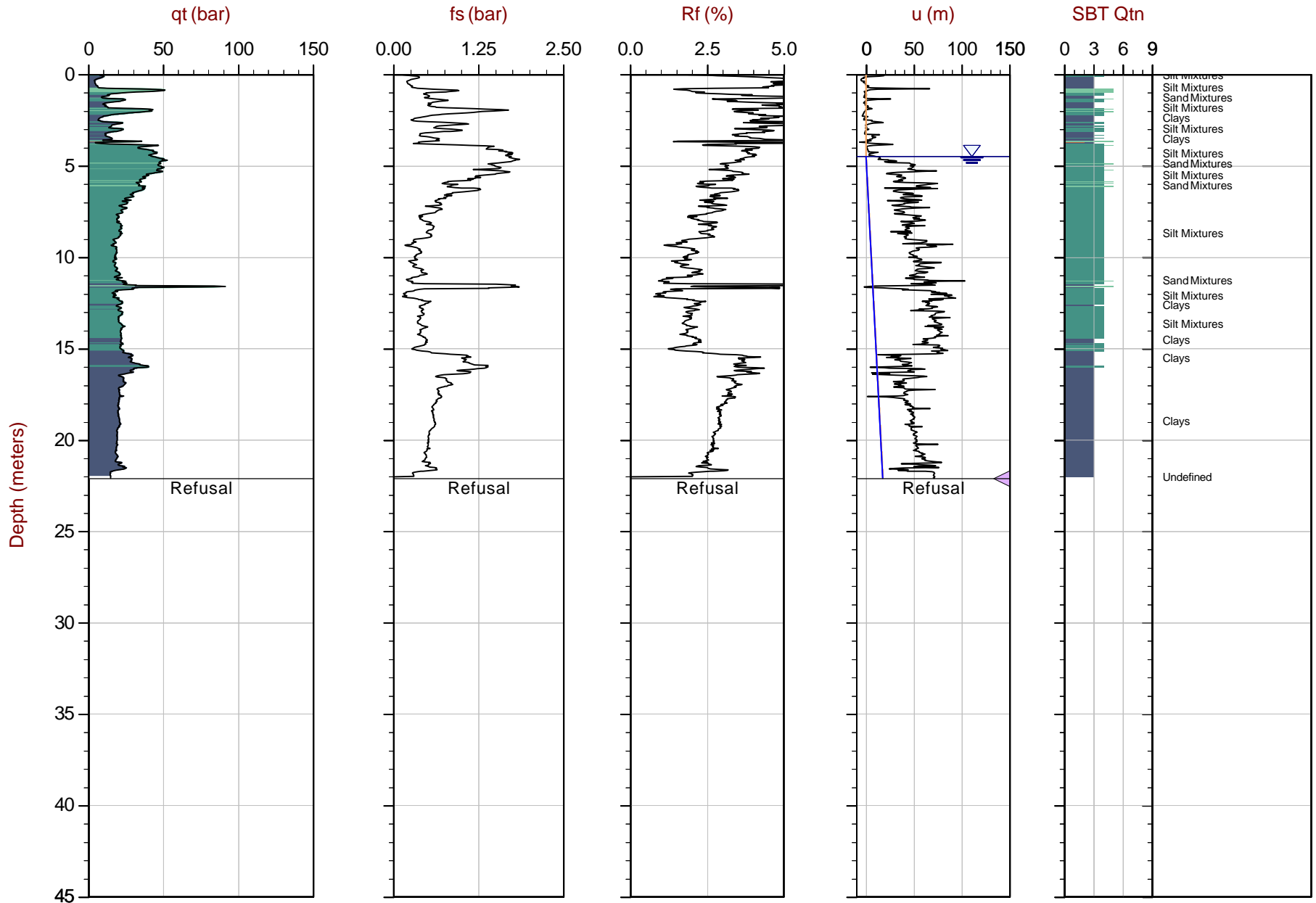
Max Depth: 25.000 m / 82.02 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: EveryPoint

File: 21-05-23225_RP02.COR
 Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747817 E: 394206
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



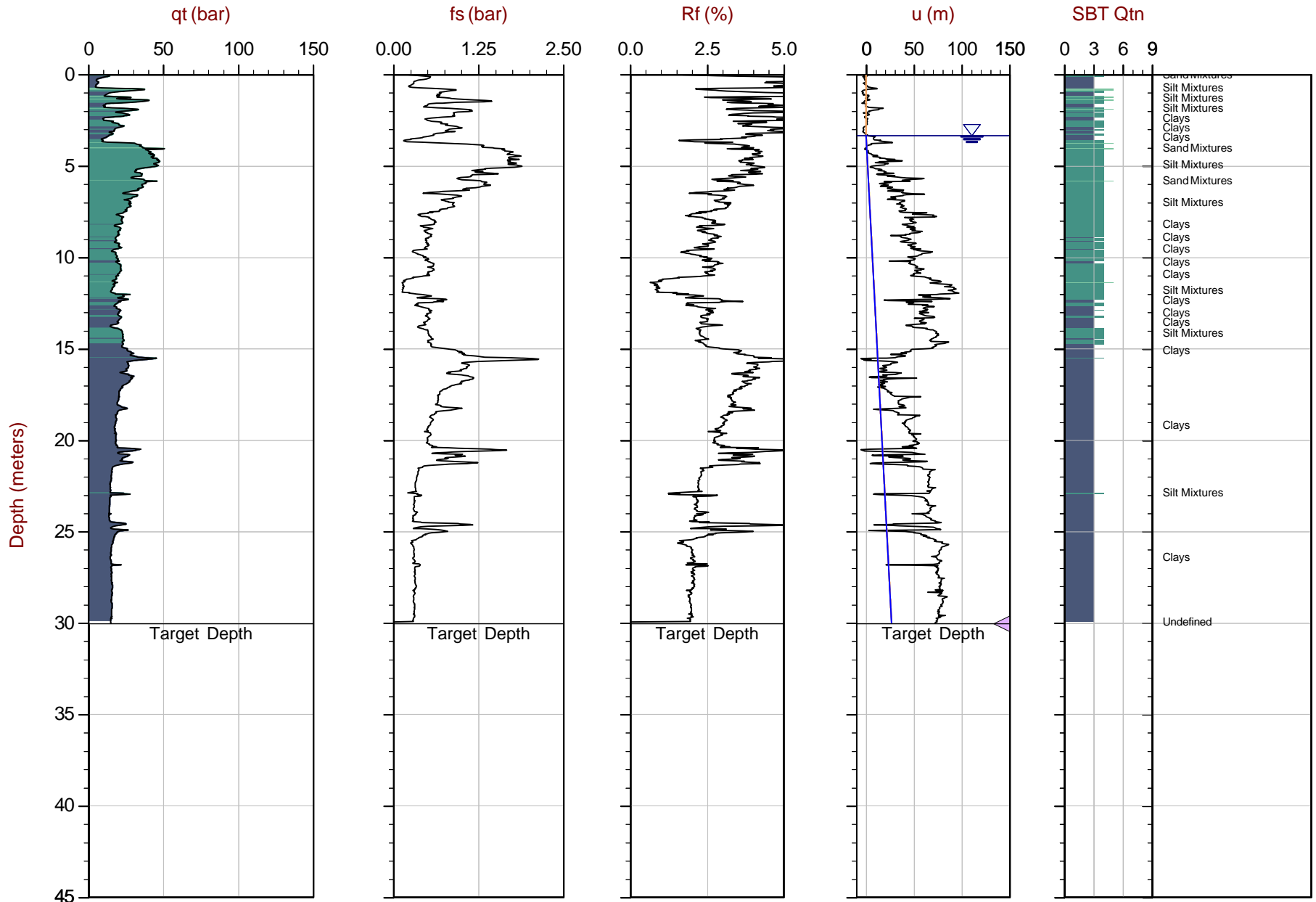
Max Depth: 22.100 m / 72.51 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: Every Point

File: 21-05-23225_CP03.COR
 Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747816 E: 394157
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



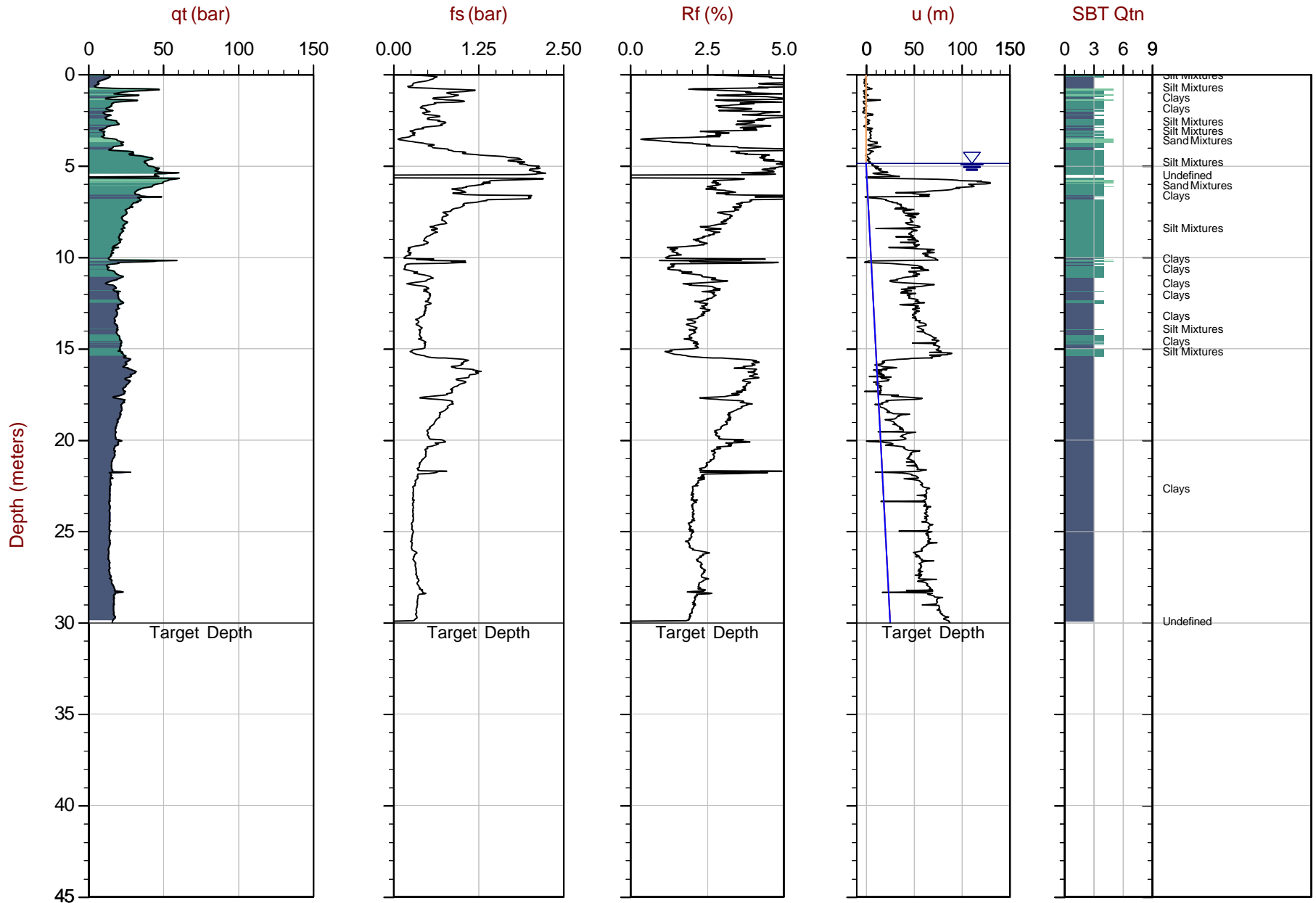
Max Depth: 30.025 m / 98.51 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: Every Point

File: 21-05-23225_RP03A.COR
 Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747812 E: 394158
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



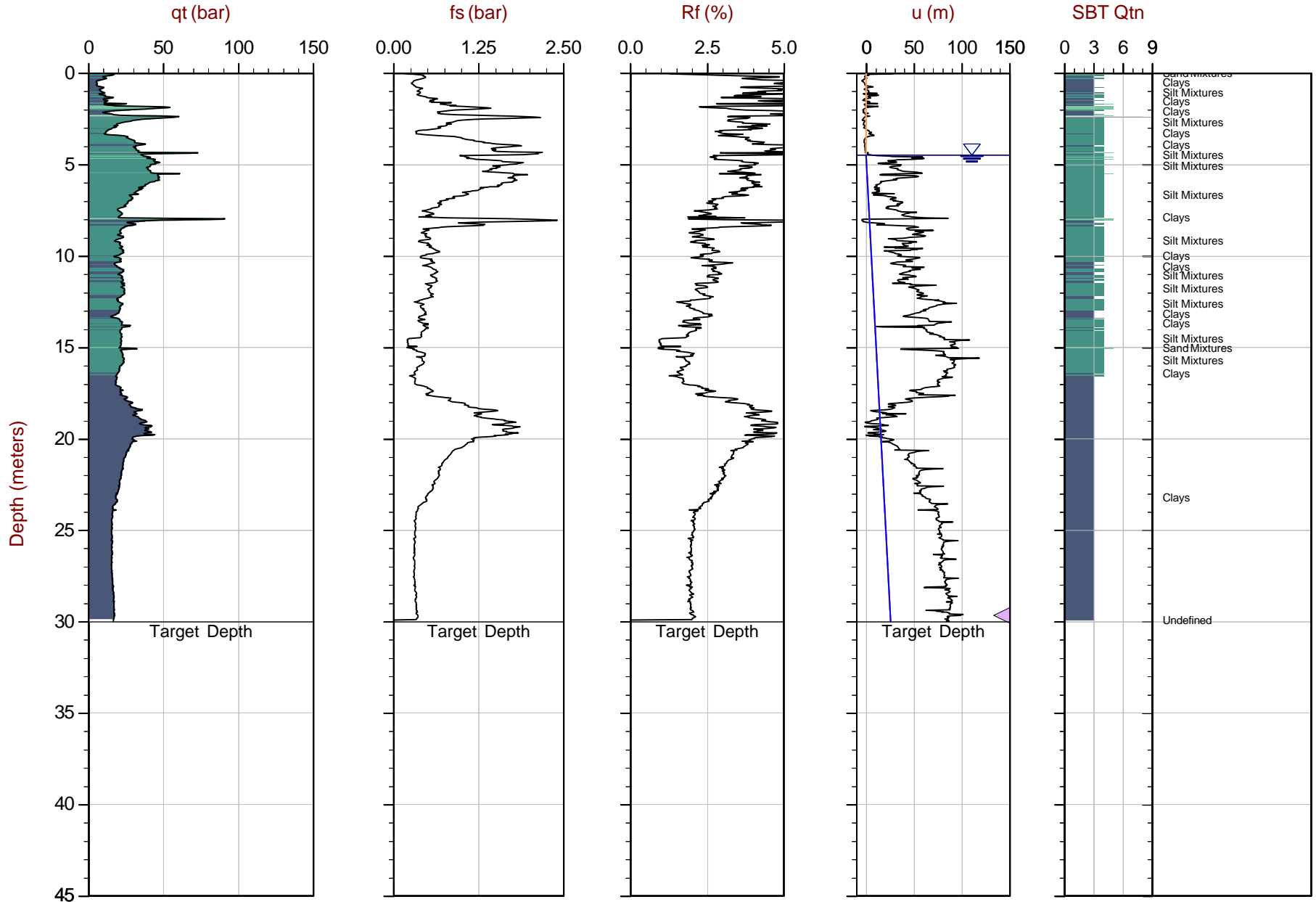
Max Depth: 30.000 m / 98.42 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: Every Point

File: 21-05-23225_RP04.COR
 Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747852 E: 394155
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



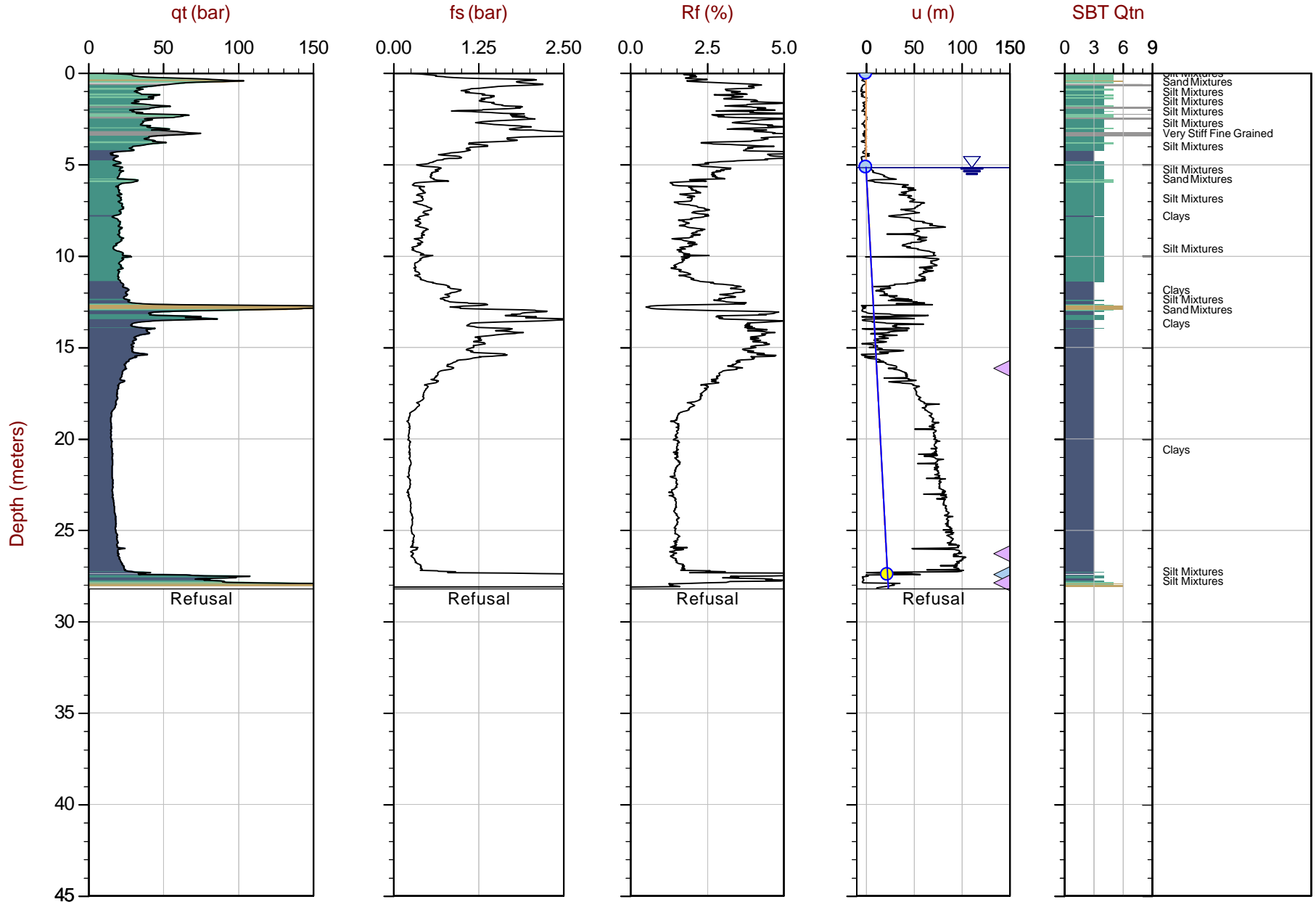
Max Depth: 30.000 m / 98.42 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: Every Point

File: 21-05-23225_RP05.COR
 Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747784 E: 394163
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



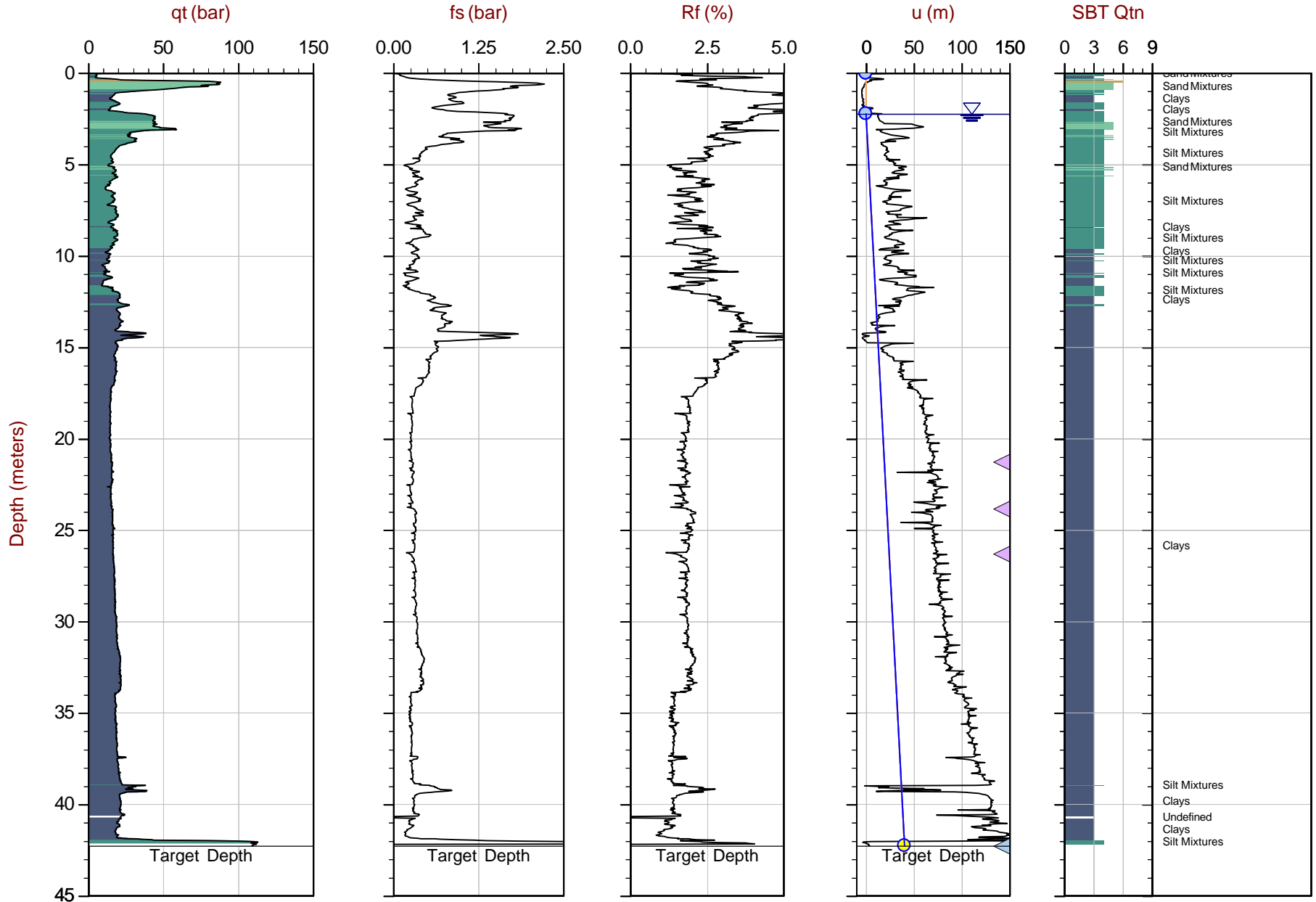
Max Depth: 28.200 m / 92.52 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: EveryPoint

File: 21-05-23225_CP06.COR
 Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747708 E: 394292
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



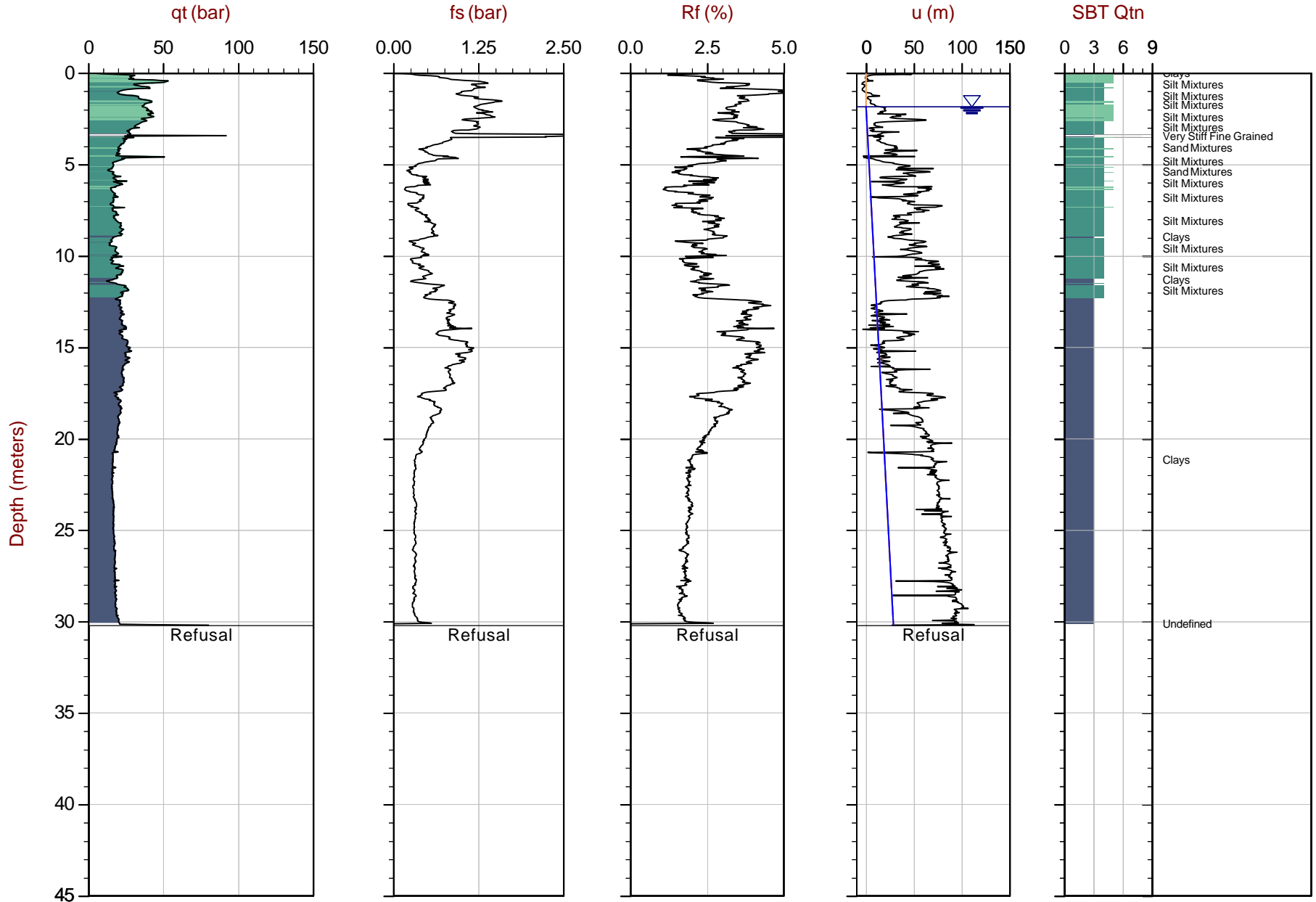
Max Depth: 42.275 m / 138.70 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: Every Point

File: 21-05-23225_RP07.COR
 Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
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 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



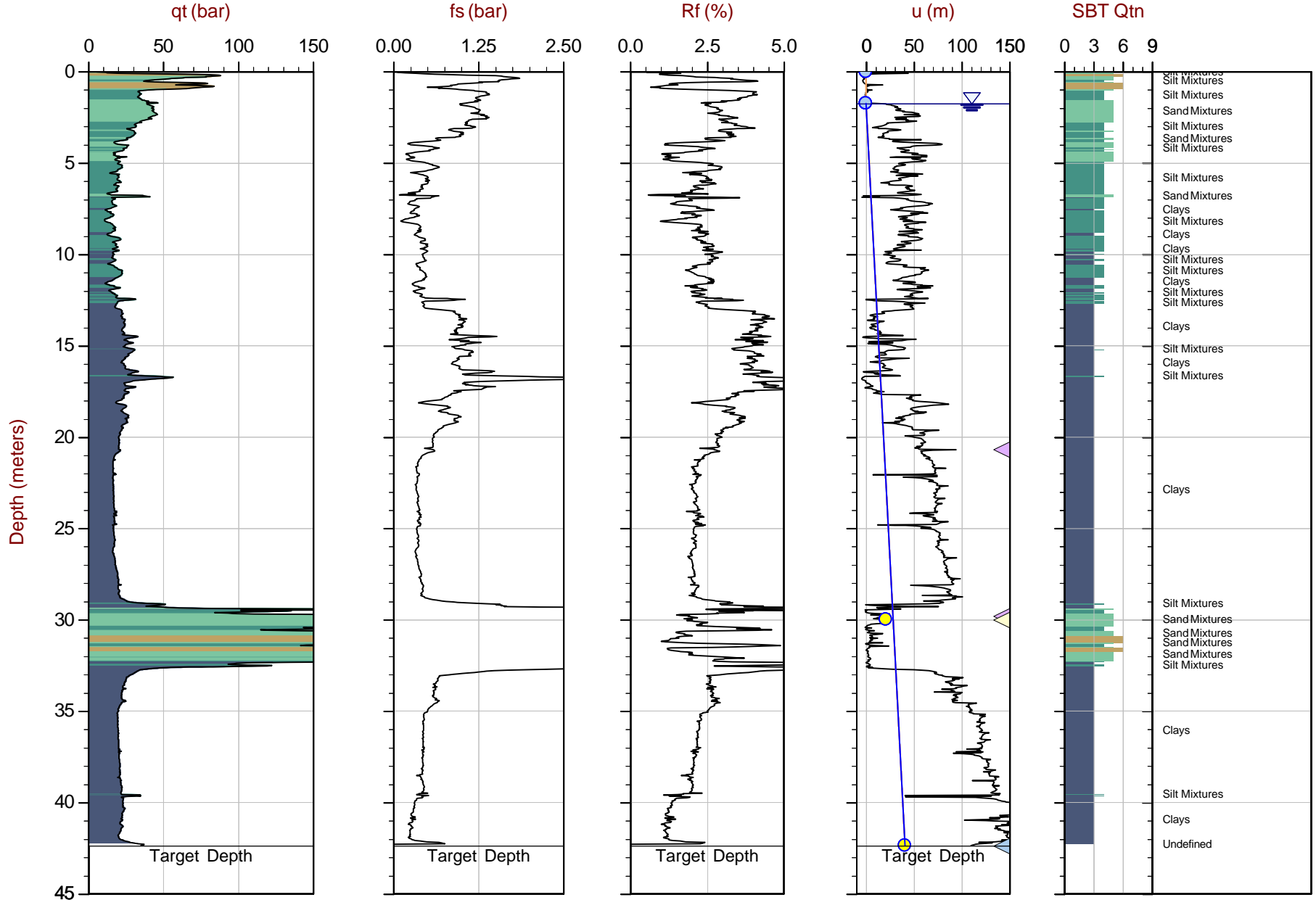
Max Depth: 30.200 m / 99.08 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: Every Point

File: 21-05-23225_CP08.COR
 Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747818 E: 394341
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



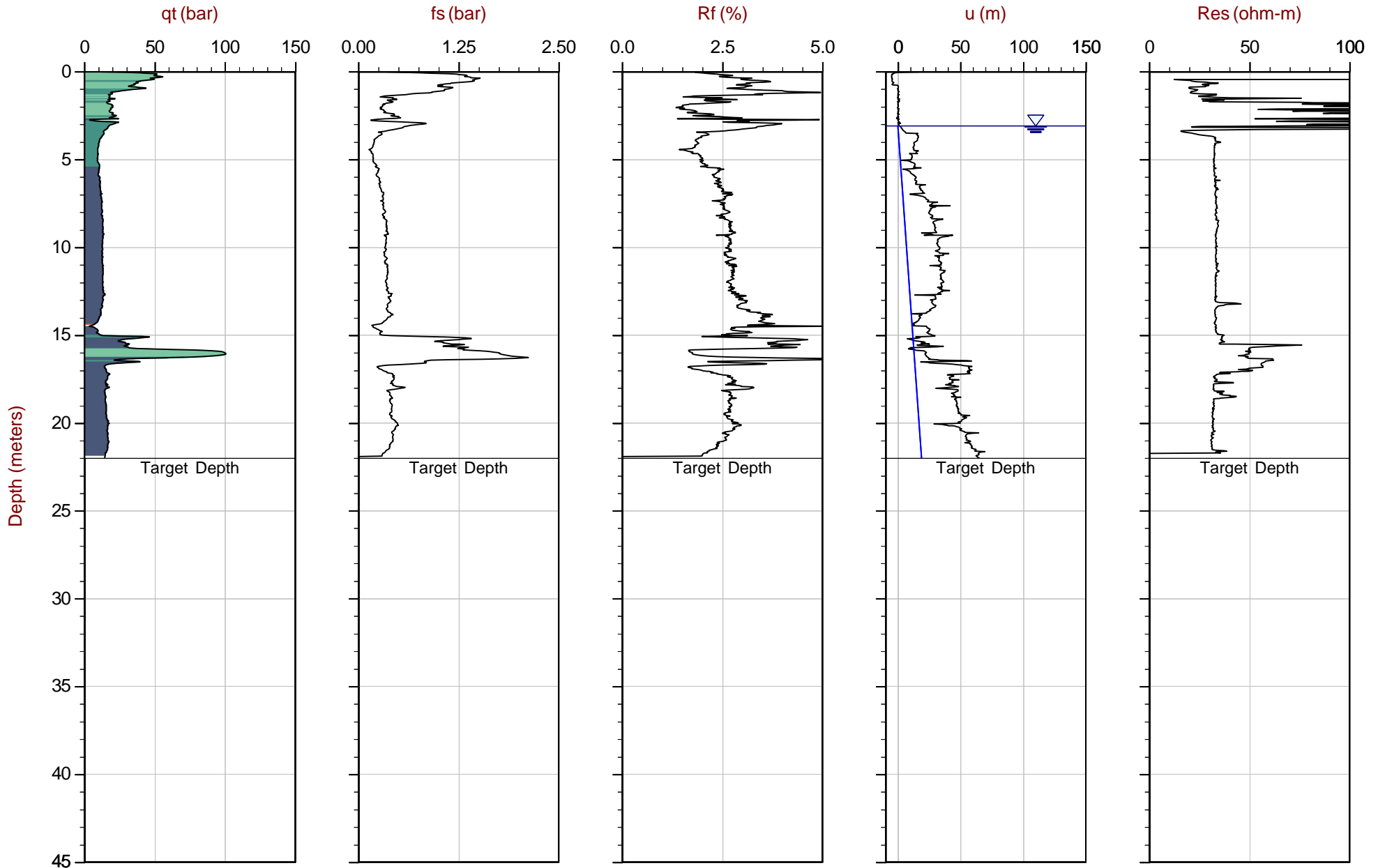
Max Depth: 42.375 m / 139.02 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: Every Point

File: 21-05-23225_RP08.COR
 Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747824 E: 394339
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



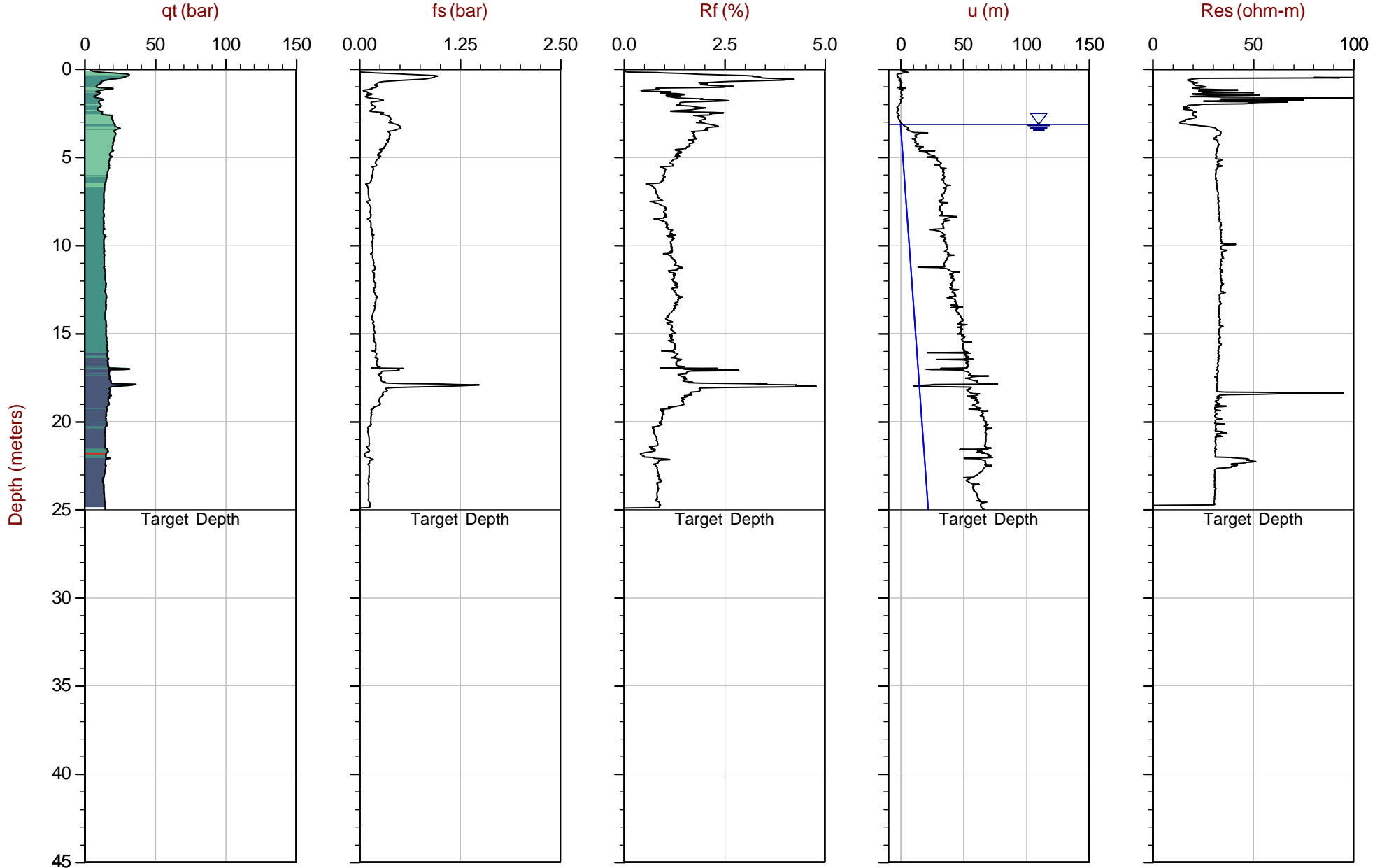
Max Depth: 22.000 m / 72.18 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: EveryPoint

File: 21-05-23225_RP01.COR
 Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747825 E: 394229
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



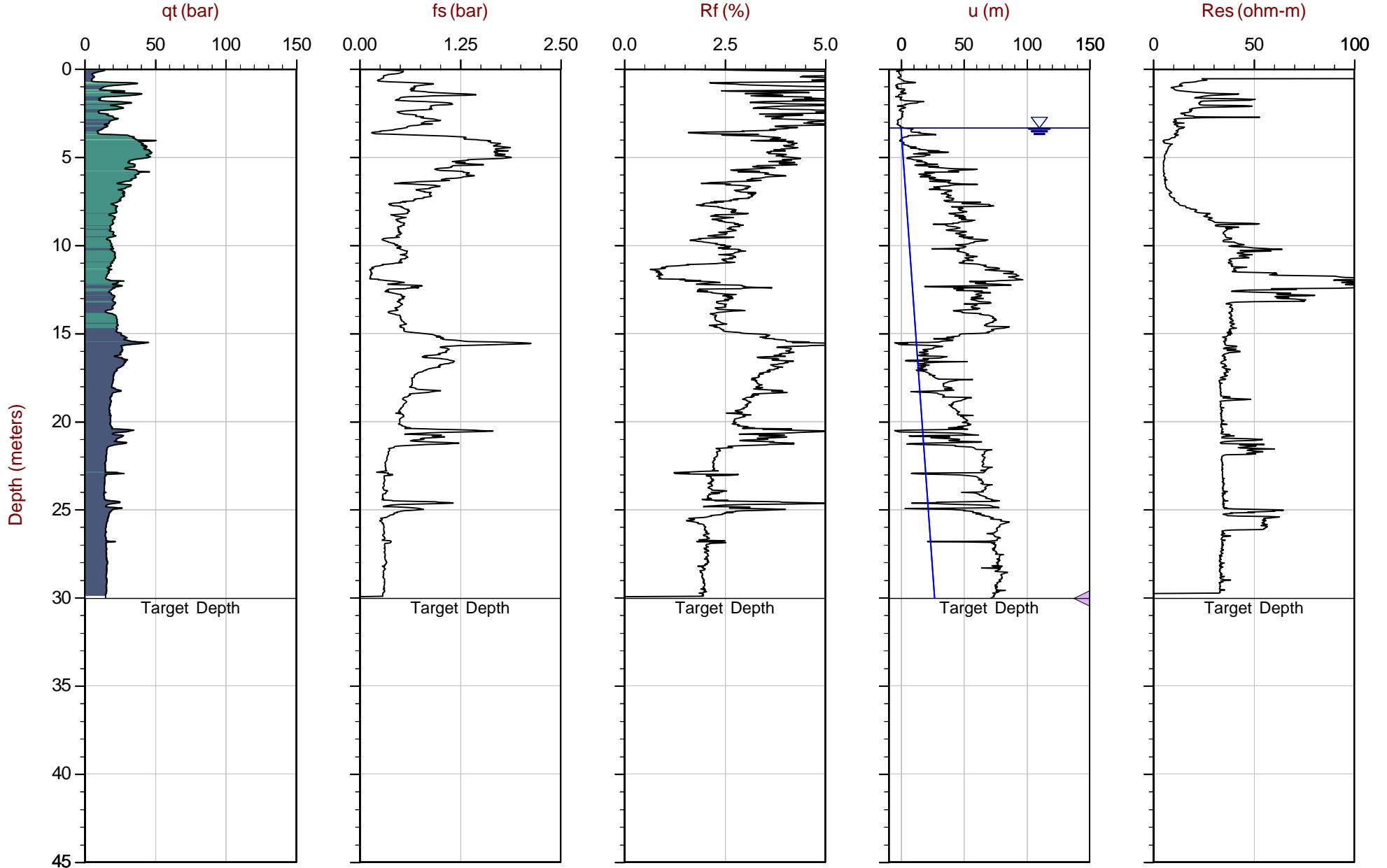
Max Depth: 25.000 m / 82.02 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: EveryPoint

File: 21-05-23225_RP02.COR
 Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747817 E: 394206
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



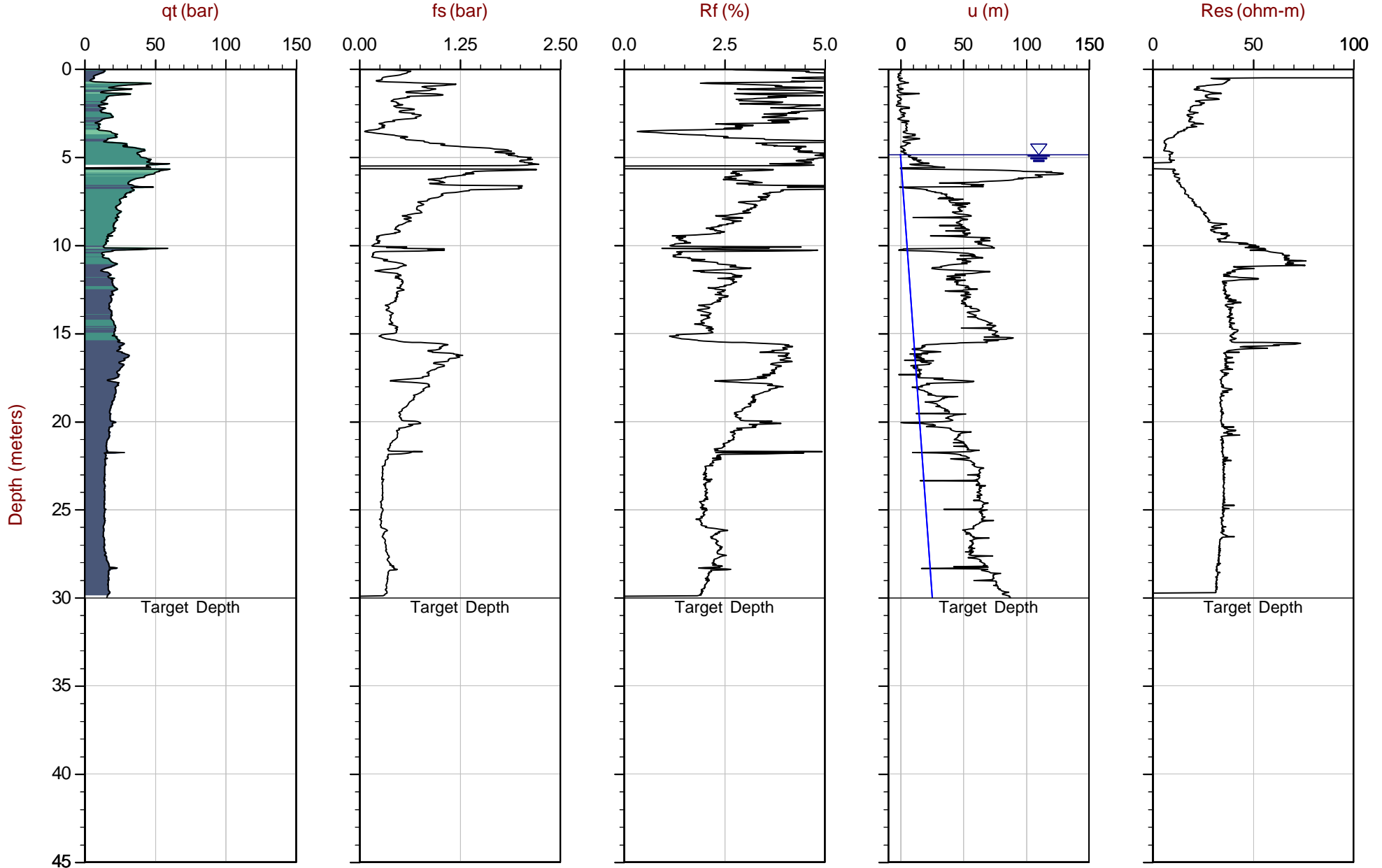
Max Depth: 30.025 m / 98.51 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: EveryPoint

File: 21-05-23225_RP03A.COR
 Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747812 E: 394158
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



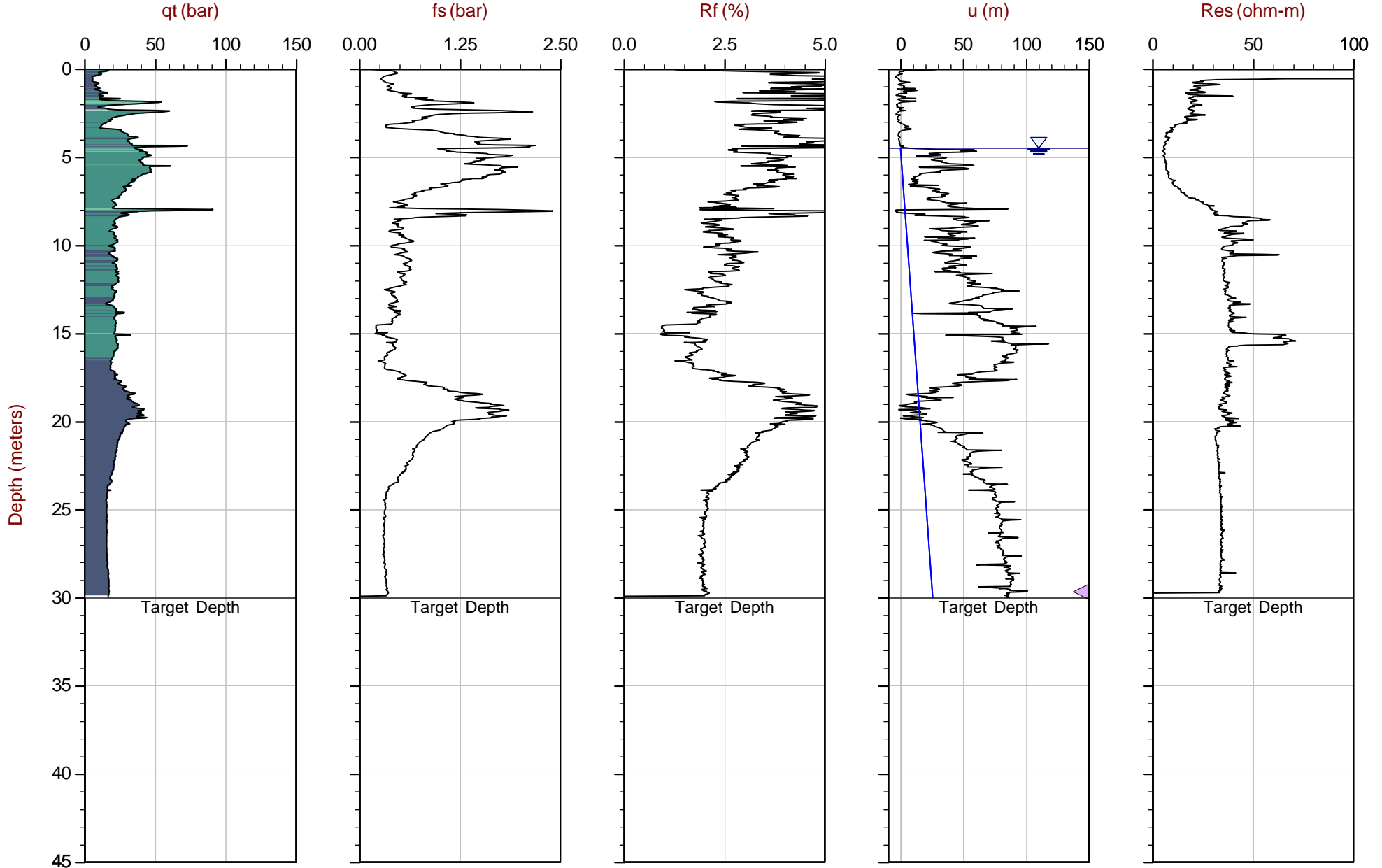
Max Depth: 30.000 m / 98.42 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: EveryPoint

File: 21-05-23225_RP04.COR
 Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747852 E: 394155
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



Max Depth: 30.000 m / 98.42 ft
 Depth Inc: 0.025 m / 0.082 ft
 Avg Int: EveryPoint

File: 21-05-23225_RP05.COR
 Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
 Coords: UTM 17NN: 4747784 E: 394163
 Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

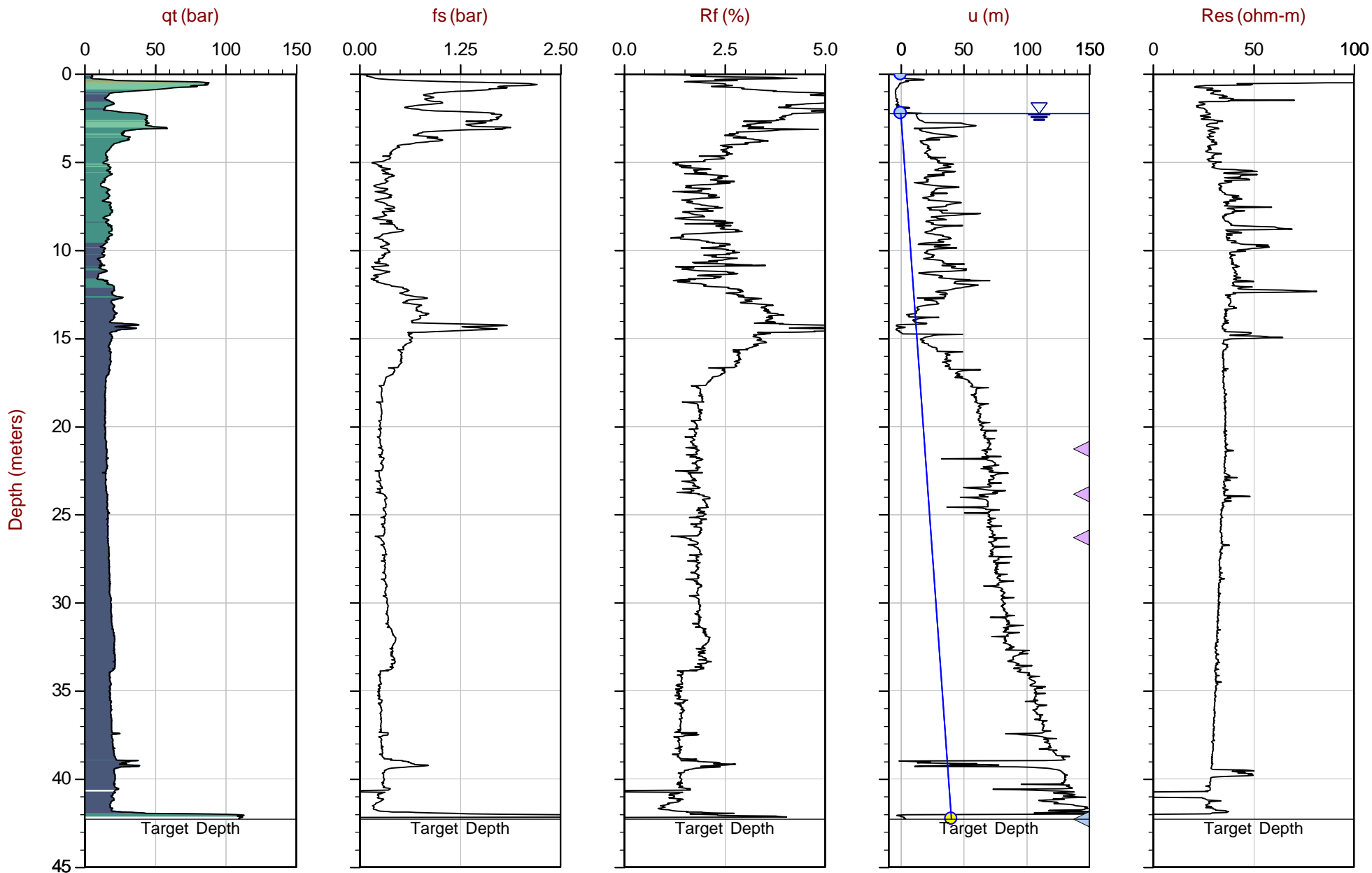
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



Ron Murphy Contracting

Job No: 21-05-23225
Date: 2021-12-09 16:50
Site: 4090 Telfer Road

Sounding: RCPT21-07
Cone: 764:T1500F15U35



Max Depth: 42.275 m / 138.70 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: EveryPoint

File: 21-05-23225_RP07.COR
Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 17NN: 4747921 E: 394280
Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

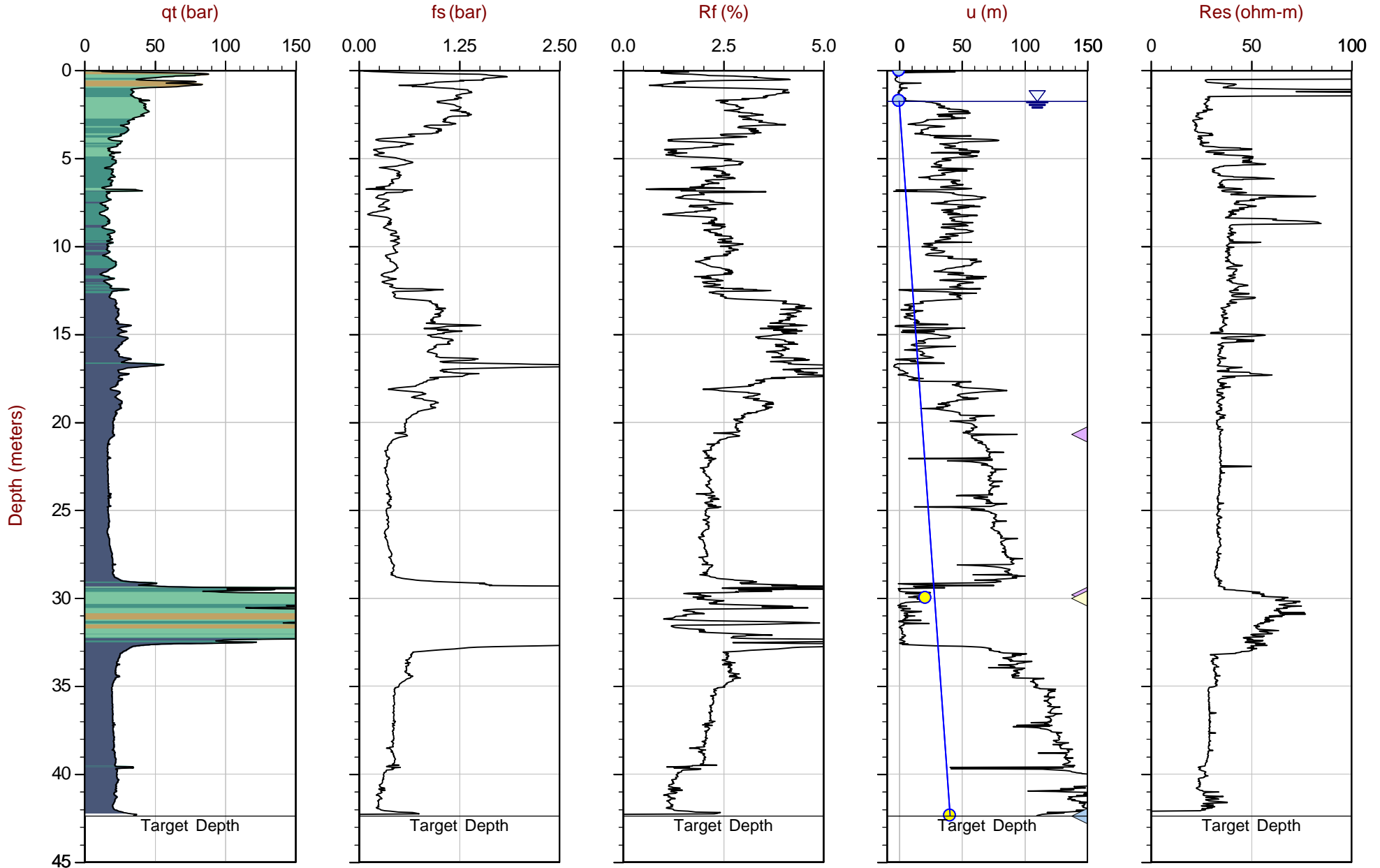
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.



Ron Murphy Contracting

Job No: 21-05-23225
Date: 2021-12-10 07:11
Site: 4090 Telfer Road

Sounding: RCPT21-08
Cone: 764:T1500F15U35



Max Depth: 42.375 m / 139.02 ft
Depth Inc: 0.025 m / 0.082 ft
Avg Int: Every Point

File: 21-05-23225_RP08.COR
Unit Wt: SBTQtn(PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 17NN: 4747824 E: 394339
Sheet No: 1 of 1

Overplot Item: ● Ueq ● Assumed Ueq ◁ Dissipation, Ueq achieved ◁ Dissipation, Ueq not achieved ◁ Dissipation, Ueq assumed — Ueq Line — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Appendix C

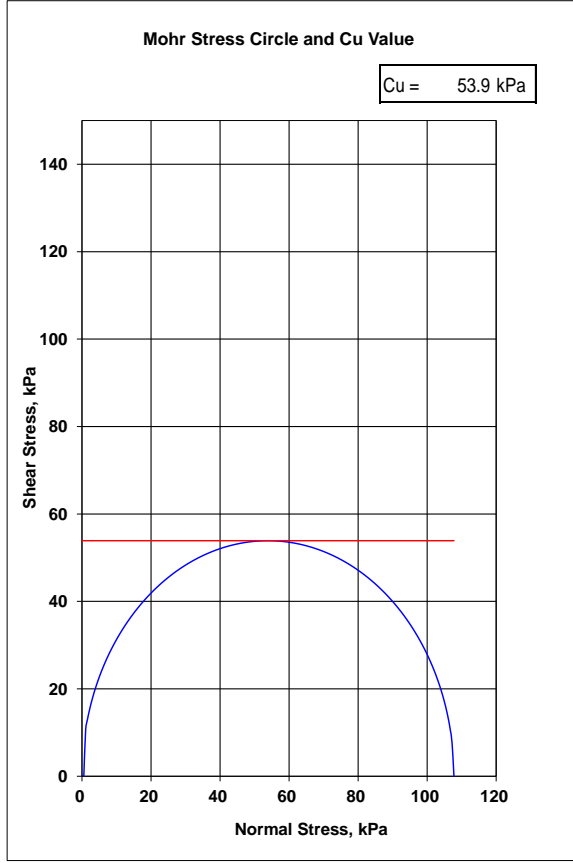
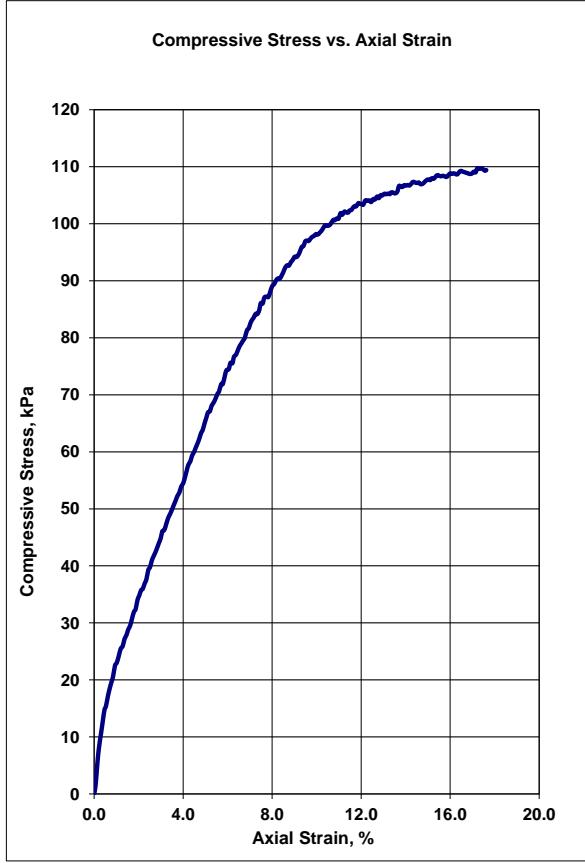
Geotechnical Laboratory Test Results

CLIENT: Clean Harbors Lambton Facility LAB No.: WLT 731-2
 PROJECT/ SITE: Geotechnical Investigation - VWP Installations Cell 20-1 / Coruna, ON PROJECT No.: 044985.05.06
 Borehole No.: VWP-1 Sample No.: ST1
 Depth: 32 - 32.6 m (105'0" - 107'0") Sample description: clayey Silt

Initial Sample Parameters		
Diameter	cm	7.13
Height	cm	14.15
Volume	cm ³	565.6
Height-to-Diameter Ratio		2.0
Wet Mass	g	1118.5
Dry Density	kg/m ³	1535
Bulk Unit Weight	kN/m ³	19.4
*Water Content	%	28.8
Specific Gravity	assumed	2.75
Void Ratio		0.79
Degree of Saturation		1.0

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	107.8
Shear Strength	kPa	53.9
Rate of Strain	%/min	1.0
Strain at Failure	%	15.0
Maximum strain reached	%	17.6



REMARKS: _____

PERFORMED BY: C. Adachi DATE: 16-Dec-21

VERIFIED BY: Michael Braverman DATE: 17-Dec-21

CLIENT: Clean Harbors Lambton Facility LAB No.: WLT 731-1

PROJECT/ SITE: Geotechnical Investigation - VWP Installations Cell 20-1 / Coruna, ON PROJECT No.: 044985.05.06

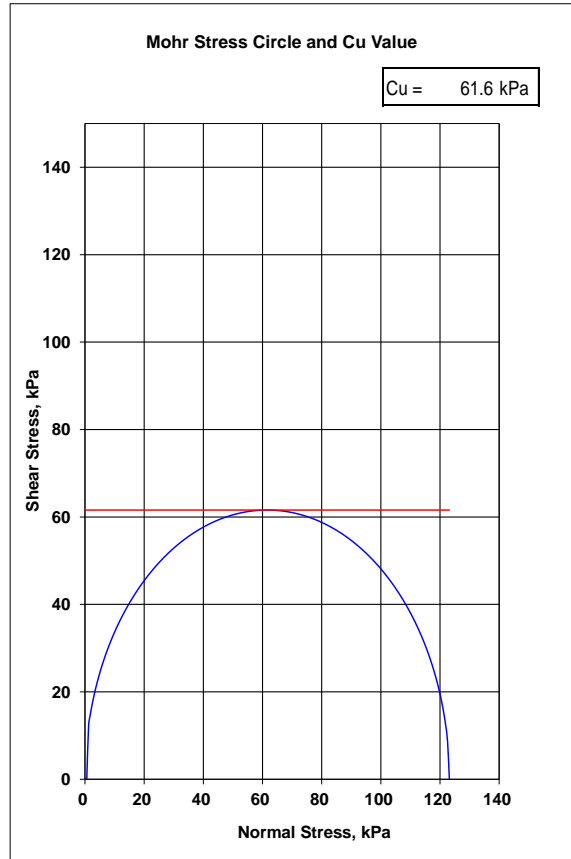
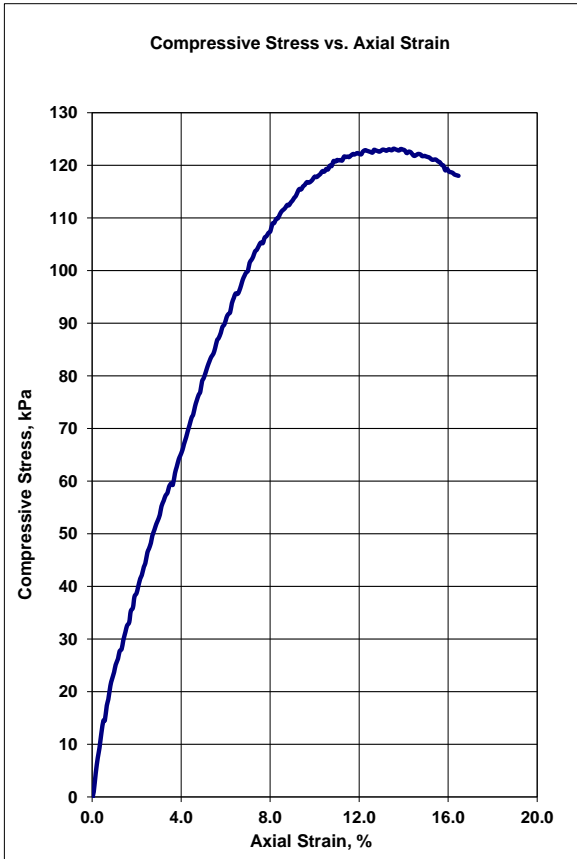
Borehole No.: VWP-1 Sample No.: ST3

Depth: 38.1 - 38.7 m (125'0" - 127'0") Sample description: clayey Silt

Initial Sample Parameters		
Diameter	cm	7.29
Height	cm	14.64
Volume	cm ³	611.6
Height-to-Diameter Ratio		2.0
Wet Mass	g	1198.7
Dry Density	kg/m ³	1552
Bulk Unit Weight	kN/m ³	19.2
*Water Content	%	26.3
Specific Gravity	assumed	2.75
Void Ratio		0.77
Degree of Saturation		0.9

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	123.2
Shear Strength	kPa	61.6
Rate of Strain	%/min	1.0
Strain at Failure	%	13.5
Maximum strain reached	%	16.5



REMARKS: _____

PERFORMED BY: C.Adachi DATE: 16-Dec-21

VERIFIED BY: Michael Braverman DATE: 17-Dec-21

CLIENT: Clean Harbors Lambton Facility LAB No.: WLT 731-3

PROJECT/ SITE: Geotechnical Investigation - VWP Installations Cell 20-1 / Coruna, ON PROJECT No.: 044985.05.06

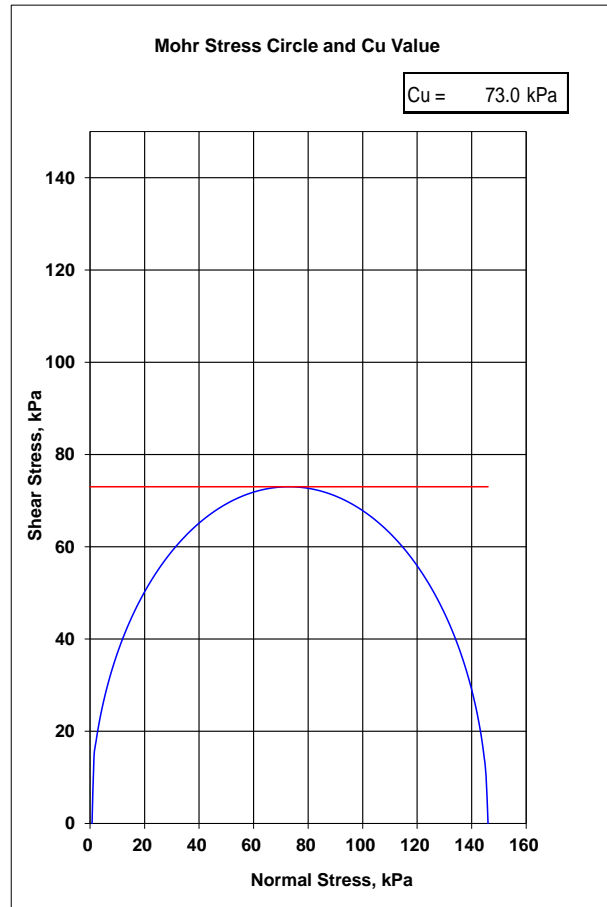
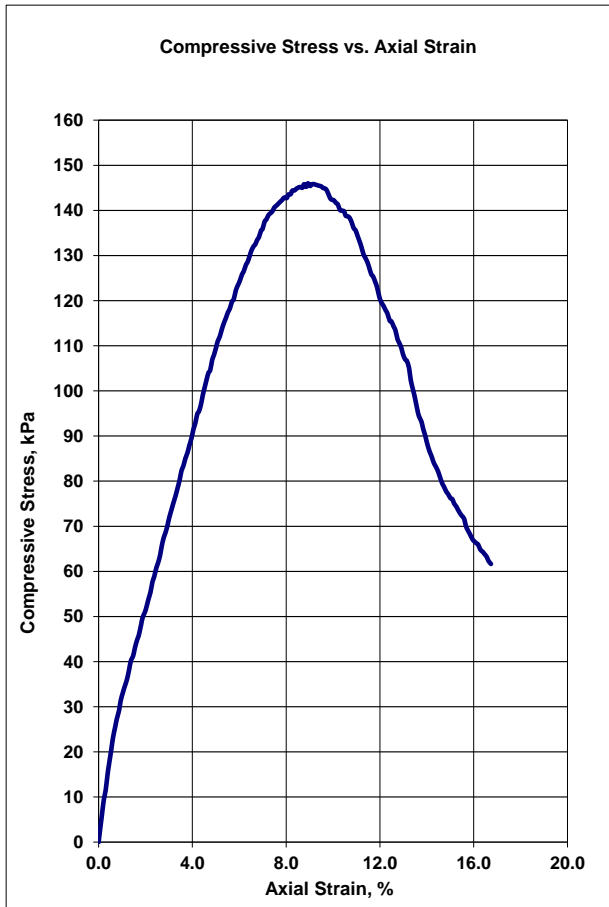
Borehole No.: VWP-2 Sample No.: ST1

Depth: 35.1 - 35.7 m (115'0" - 117'0") Sample description: clayey Silt

Initial Sample Parameters		
Diameter	cm	7.21
Height	cm	14.71
Volume	cm ³	599.9
Height-to-Diameter Ratio		2.0
Wet Mass	g	1179.9
Dry Density	kg/m ³	1544
Bulk Unit Weight	kN/m ³	19.3
*Water Content	%	27.4
Specific Gravity	assumed	2.75
Void Ratio		0.78
Degree of Saturation		1.0

*The water content was obtained after shear from the entire specimen.

Unconfined Compressive Strength	kPa	146.0
Shear Strength	kPa	73.0
Rate of Strain	%/min	1.0
Strain at Failure	%	8.9
Maximum strain reached	%	16.7



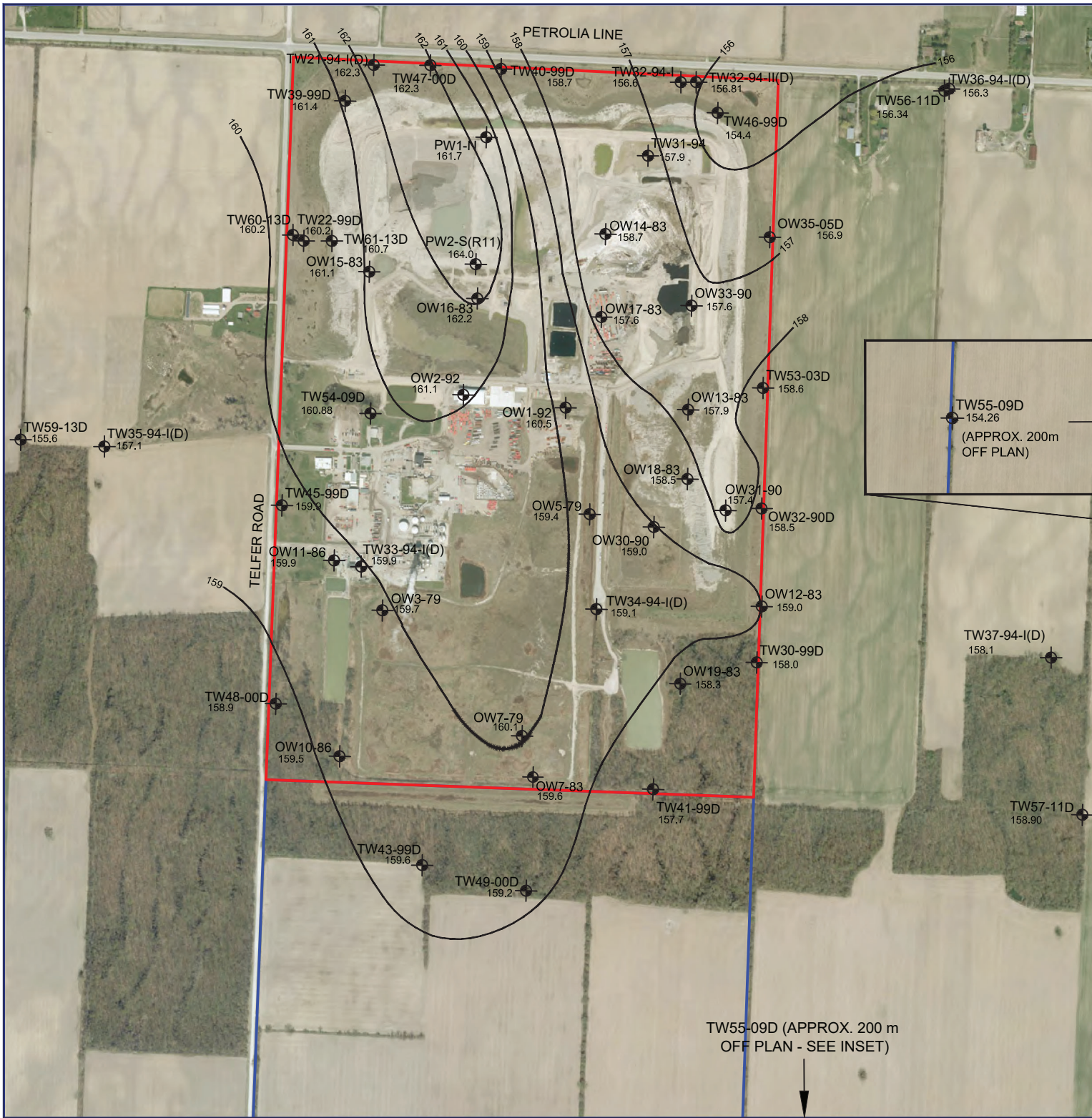
REMARKS: _____

PERFORMED BY: C. Adachi DATE: 16-Dec-21

VERIFIED BY: Michael Braverman DATE: 17-Dec-21

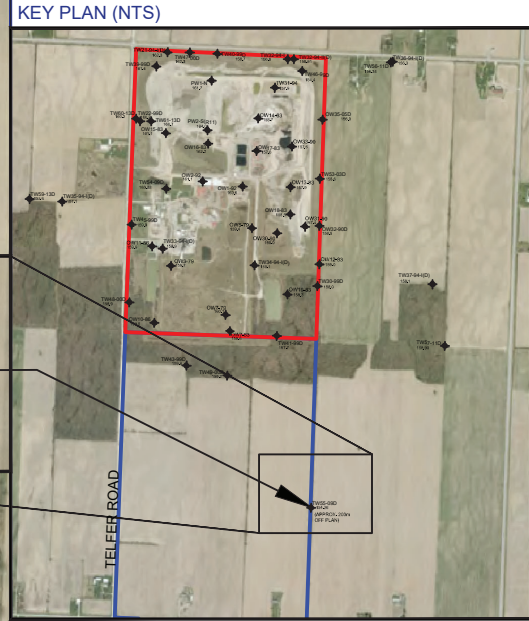
Appendix D

**Bedrock Surface Topography- Lambton
Facility (RWDI, 2013), and Bedrock Log
TW-34-94-I**



LEGEND

- TW39-99D 161.4 MONITORING WELL LOCATION AND ELEVATION OF TOP OF BEDROCK (mASL).
- LAMBTON FACILITY OPERATIONAL AREA AND VERTICAL EXPANSION FOOTPRINT
- PROPOSED SOUTHERN EXPANSION OPTION FOOTPRINT



NOTES:
 1. AIRPHOTO PRODUCED BY FIRST BASE SOLUTIONS, (2010).

0 250 500
 METERS

**BEDROCK SURFACE TOPOGRAPHY
 - LAMBTON FACILITY**

ENVIRONMENTAL ASSESSMENT FOR
 THE EXPANSION OF THE LAMBTON
 FACILITY LANDFILL

*CLEAN HARBORS CANADA, INC.,
 LAMBTON FACILITY LANDFILL*

Project #1300021		
Drawn by: SSL	Fig: 6-7	
Approx. Scale:	1:10,000	
Date Revised:	DEC. 17, 2013	

BOREHOLE NO. TW34-94-I

PROJECT: LAMBTON FACILITY - LANDFILL SERVICE CONTINUATION

PROJECT NO.: 194060.541

CLIENT: LIDLAW ENVIRONMENTAL SERVICES

DATE: MAY 5 - 9, 1994

BOREHOLE TYPE: 108 mm I.D. HOLLOW STEM AUGERS

GEOLOGIST: AMA/JSK

GROUND ELEVATION: 201.57 m A.S.L.

REVIEWER: JTB/JSK

DEPTH (m)	ELEVATION (m A.S.L.)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE				CONE PENETRATION		WATER CONTENT %		REMARKS
					TYPE	% VALUE	% WATER	% RECOVERY	RQD (%)	N VALUE 10 20 30	SHEAR STRENGTH	Wp	
0	201.52	FILL LIGHT BROWN MEDIUM SAND, MOIST.											
0.05					CC1			100					
2		SILTY CLAY TO CLAYEY SILT (ST. JOSEPH TILL), MOTTLED LIGHT BROWN, ORANGE BROWN, DARK BROWN AND GREY TO 2.54 m GREY BROWN TO 5.59 m, GREY BELOW 5.59 m, TRACE DISSEMINATED FINE TO COARSE DOLOSTONE AND SHALE GRAVEL, MASSIVE, SANDY AT 5.59 m TO 7.98 m, 9.22 m TO 9.80 m, 10.54 m (10 mm THICK), SILT AT 5.40 m (6 mm THICK), 7.75 TO 7.98 m (2 mm THICK), 9.53 m (6 mm THICK), 13.49 TO 13.74 m, 13.94 m (25 mm THICK), SANDY SILT LAYERS AT 9.80 TO 10.16 m, RODTLETS TO 1.04 m, FRACTURES TO 5.79 m, DTPL TO 5.03 m AND 13.74 m TO 14.12 m, APL TO 5.03 m, WTPB BELOW 5.03 m, VERY STIFF TO STIFF, WITH A HARD ZONE AT ABOUT 3 m.			SS1	8	24	61					
					CC2			100					
					SS2	38	16	97					
					CC3			100					
					SS3	24	15	44					
					CC4			100					
					SS4	14	14	72					
					CC5			100					
					SS5	12	14	83					
					CC6			90					
					SS6	18	17	100					
					CC7			98					
					SS7	14	19	72					
					CC8			93					
					SS8	15	20	100					
					CC9			96					
					SS9	46	20	83					
14	14.12				CC10			95					
	187.45	SILTY CLAY TO CLAYEY SILT (BLACK SHALE TILL), GREY, TRACE DISSEMINATED SHALE GRAVEL, SANDY AT 19.12 m TO 19.30 m, AND 20.50 m TO 20.70 m, SILT AT 15.57 m (25 mm THICK), 26.70 m TO 26.90 m AND 39.57 m TO 39.80 m, FINE SAND LAYERS AT 7.87 m (12 mm THICK), 13.47 m (25 mm THICK), 25.83 (10 mm THICK), 26.57 m TO 26.70 m, 41.60 m (<1 mm THICK) AND 41.92 m (1 mm THICK), SANDY SILT LAYERS AT 21.64 m (5mm THICK), 22.25 m TO 22.35 m, 22.61 m TO 22.86 m, 26.39 m TO 26.57 m, DTPL FROM 13.74 m TO 20.70 m, APL TO WTPB BELOW 20.70 m, MASSIVE TO LAMINATED, VERY STIFF TO STIFF, WITH HARD ZONES AT ABOUT 14 m, 16.50 m AND BELOW 41 m.			SS10	21	20	100					
					CC11			100					
					SS11	30	20	100					
					CC12			96					
					SS12	24	22	100					
					CC13			100					
20					SS13	24	23	100					

INFERRED CONTACT OF ST. JOSEPH TILL AND BLACK SHALE TILL AT 14.12 m BASED ON GRAVEL TYPE.

BOREHOLE NO. TW34-94-1

PROJECT: LAMBTON FACILITY - LANDFILL SERVICE CONTINUATION

PROJECT NO.: 194060.541

CLIENT: LIDLAW ENVIRONMENTAL SERVICES

DATE: MAY 5 - 9, 1994

BOREHOLE TYPE: 108 mm I.D. HOLLOW STEM AUGERS

GEOLOGIST: AMA/JSK

GROUND ELEVATION: 20157 m A.S.L.

REVIEWER: JTB/JSK

DEPTH (m) ELEVATION (m A.S.L.)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE				CONE PENETRATION		WATER CONTENT %		REMARKS		
				TYPE	N ^o VALUE	% WATER	% RECOVERY	ROD (%)	"N" VALUE				WATER CONTENT %	
									10	20	30		W _p	W _L
20	CLAYEY SILT (BLACK SHALE TILL) SEE DESCRIPTION PROVIDED ABOVE.													
22														
24														
26														
28														
30														
32														
34														
36														
38														
40														

BOREHOLE NO. TW34-94-1

PROJECT: LAMBTON FACILITY - LANDFILL SERVICE CONTINUATION

PROJECT NO.: 194060.541

CLIENT: LIDLAW ENVIRONMENTAL SERVICES

DATE: MAY 5 - 9, 1994

BOREHOLE TYPE: 108 mm I.D. HOLLOW STEM AUGERS

GEOLOGIST: AMA/JSK

GROUND ELEVATION: 201.57 m A.S.L.

REVIEWER: JTB/JSK

DEPTH (m)	STRATIGRAPHIC DESCRIPTION	STRATIGRAPHY	MONITOR DETAILS	SAMPLE				CONE PENETRATION			WATER CONTENT %			REMARKS	
				TYPE	N _v VALUE	% WATER	% RECOVERY	ROD (%)	"N" VALUE			CONTENT %			
									10	20	30	10	20		30
40	CLAYEY SILT (BLACK SHALE TILL) SEE DESCRIPTION PROVIDED ABOVE.			CC27			88							MOISTURE CONTENT NOT DETERMINED FOR SS28. ROCK CONTINUOUSLY CORED WITH HQ DIAMOND BIT FROM 42.52 TO 44.53 m.	
42				SS27	54	17	81								
				CC28			100								
42.16				SS28	60+	NA	73								
42.37	FINE TO COARSE SAND (BASAL TILL) DARK GREY, SOME FINE TO MEDIUM GRAVEL, TRACE TO SOME SILT, SATURATED, VERY DENSE.			RC1			100	98							
42.52	GRAVELLY SAND, SILT, CLAY (BASAL TILL) GREY, WTPL TO SATURATED, VERY DENSE TO HARD.			RC2			84	81							
159.05															
44															
44.53	SHALE (KETTLE POINT FORMATION) BLACK WITH GREENISH GREY SILTSTONE LAYERS, MICROLAMINATED, BROKEN TO BLOCKY, SUBHORIZONTAL FRACTURES AT 42.75 m, 43.23 m, 43.78 m, 43.79 m, 43.92 m, ANGLED FRACTURES FROM 43.48 TO 43.64 m (INFILLED WITH CALCITE), FRACTURE FACES WEATHERED TO 43.92 m, EXCELLENT TO GOOD ROCK QUALITY, BITUMEN (3 mm THICK) AT 43.08 m, MEDIUM HARD. BOREHOLE TERMINATED 44.53 m IN SHALE.														
157.04															
48															
48															
50															
52															
54															
58															
58															
60															

