



MEMO

TO: Scott Cosman, P.Eng.
COMPANY: BC Ministry of Transportation and Infrastructure
FROM: Brad Cheng, P.Eng., WSP
DATE: 15 February 2023
CC: Zach Crippen, PMP, R.F. Binnie & Associates Ltd.
John Laxdal, P.Eng., WSP
PROJECT NO.: VG07796A02
SUBJECT: **Preliminary Findings for Geotechnical Site Investigation
Columbia Valley Recovery
Maple Bay and Robinson Road near Cultus Lake, BC**

1 INTRODUCTION

This memo provides preliminary findings for the geotechnical site investigation at DFAA Project sites on Columbia Valley Road near Robinson Road (Project No. 14118) and Maple Bay (Project No. 14117) near Cultus Lake, BC. Due to time constraints, this memo has been prepared in advance of a Geotechnical Site Assessment Report (the Report) which requires lab testing and data analysis to complete. The information provided in this memo is considered preliminary and is subject to change upon the completion of the Report.

2 FIELD WORK

A total of three boreholes were completed by On Track Drilling using a track-mounted drill rig using solid and hollow stem drill methods. Underground utility locating was provided by Quadra Utility Locating Limited. WSP obtained and reviewed BC One Call tickets prior to the investigation.

The boreholes were completed within the existing roadway to characterize the existing pavement structure and subgrade soils. During drilling, in-situ split-spoon sampling using the Standard Penetration Test (SPT) was conducted at every 1.5 m intervals to obtain disturbed soil samples and provide information on in-situ consistency. Borehole depths ranged between 3.8 and 18.9 m. One borehole (BH23-01) near Maple Bay, and two boreholes (BH23-02 and 03) were advanced near Robinson Road intersection. The borehole locations are presented in Figure 1 and 2 attached in Attachment A.

In summary, the geotechnical investigation program consisted of the following (Table 1):

Table 1 Geotechnical Borehole Summary

BOREHOLE ID	TOTAL DEPTH (M)	IN-SITU TESTING	INSTALLATION
BH23-01	3.8	SPT	No installation. Borehole backfilled according to BC Groundwater Protection Guidelines
BH23-02	14.6	SPT	
BH23-03	18.9	SPT	50 mm standpipe Piezometer

3 SUBSURFACE CONDITIONS

Subsurface and groundwater conditions are included in the following subsections. The draft soil logs, subject to change and be confirmed by lab test results, are attached in Attachment B.

3.1 COLUMBIA VALLEY NEAR MAPLE BAY

Borehole BH23-01 was conducted on the southbound lane of Columbia Valley Rd. The borehole was terminated at a depth of 3.81 m due to auger refusal. No groundwater or seepage was noted during drilling. Based on the test hole information, the subject area is generally underlain by the following subsurface soil conditions:

- Asphalt: thickness of 152 mm
- Granular Fill: Sand, fine to coarse, angular, some gravel, fine, angular, grey and brown, moist
- Sand: fine to coarse, subangular to angular, some gravel, fine to coarse, subangular to angular, brown, moist
- Sand and gravel: fine to coarse, subangular to angular, some gravel fine to coarse, subangular to angular, dark brown, moist.
- Sand: fine, trace silt, grey, wet

3.2 COLUMBIA VALLEY NEAR ROBINSON ROAD

Two boreholes were conducted at this location, one within each lane. Boreholes were advanced with solid stem auger between 3 to 4.5 meters, and then continued with hollow stem auger to refusal.

Borehole BH23-02 was conducted on the northbound lane, where extensive cracking and road deformation was observed. The borehole was terminated at a depth of 14.6 m due to auger refusal. No groundwater or seepage was noted during drilling, however, a wet sand lens was found at 11.6 m depth.

- Asphalt: thickness of 127 mm
- Granular Fill: gravelly sand, fine to coarse, subangular to angular, trace silt, dark grey, very loose, to 1.07 m depth.
- Sand: fine, some gravel to gravelly, subangular to angular, light brown sand and black fractured gravel, very loose to 5.5 m depth. Rootlets and wood chunks were observed at 3 m depth.
- Silt: low plastic, some clay, light grey, very stiff to 13.1 m depth. A sand lens, grey, wet with a thickness of 0.4 m, was found between 11.6 and 12.0 m depth.
- Sand: fine to coarse, subangular to subrounded, trace silt, grey, moist, compact to 14.6 m depth.

Borehole BH23-03 was conducted on the south bound lane to a depth of 18.9 m. No major cracks or road deformation was observed. This borehole was completed with a slotted PVC standpipe with a flush mount cover to facilitate future monitoring of depth to groundwater. No groundwater was observed after the installation of the standpipe on February 1st, 2023.

- Asphalt: thickness of 102 mm

- Granular Fill: gravelly sand, fine to coarse, subangular to angular, trace silt, dark grey, loose to 0.24 m depth.
- Sand: fine, light brown, moist, loose to 4.4 m depth
- Silt: non plastic, sandy, fine, brown, wet, loose to 5.5 m depth
- Organics: silty, rootlets, fragmented gravel, oxidation, dark brown, moist to 5.6 m depth
- Silt: low plastic to non-plastic, some clay, trace sand, fine to coarse, subangular, brown and grey, stiff to 16.2 m depth. At 14.8 m, a sand lens, gravelly, fine to coarse, subangular to subrounded, brown, moist, dense was encountered, 0.2 m thick.
- Sand: silty, fine, brown, moist, dense, to 18.0 m depth
- Weathered bedrock: to 18.9 m depth

4 CLOSURE

This memo was prepared for the exclusive use of BC MoTI. Additional limitations are attached.

We trust this provides sufficient overview of the conditions encountered. If you have any questions concerning this plan or require additional information, please contact the undersigned.

Yours sincerely,

WSP E&I Canada Limited



2023-02-15
EGBC Permit to Practice NO. 1004452
Brad Cheng, M.Sc., P.Eng.
Senior Geotechnical Engineer

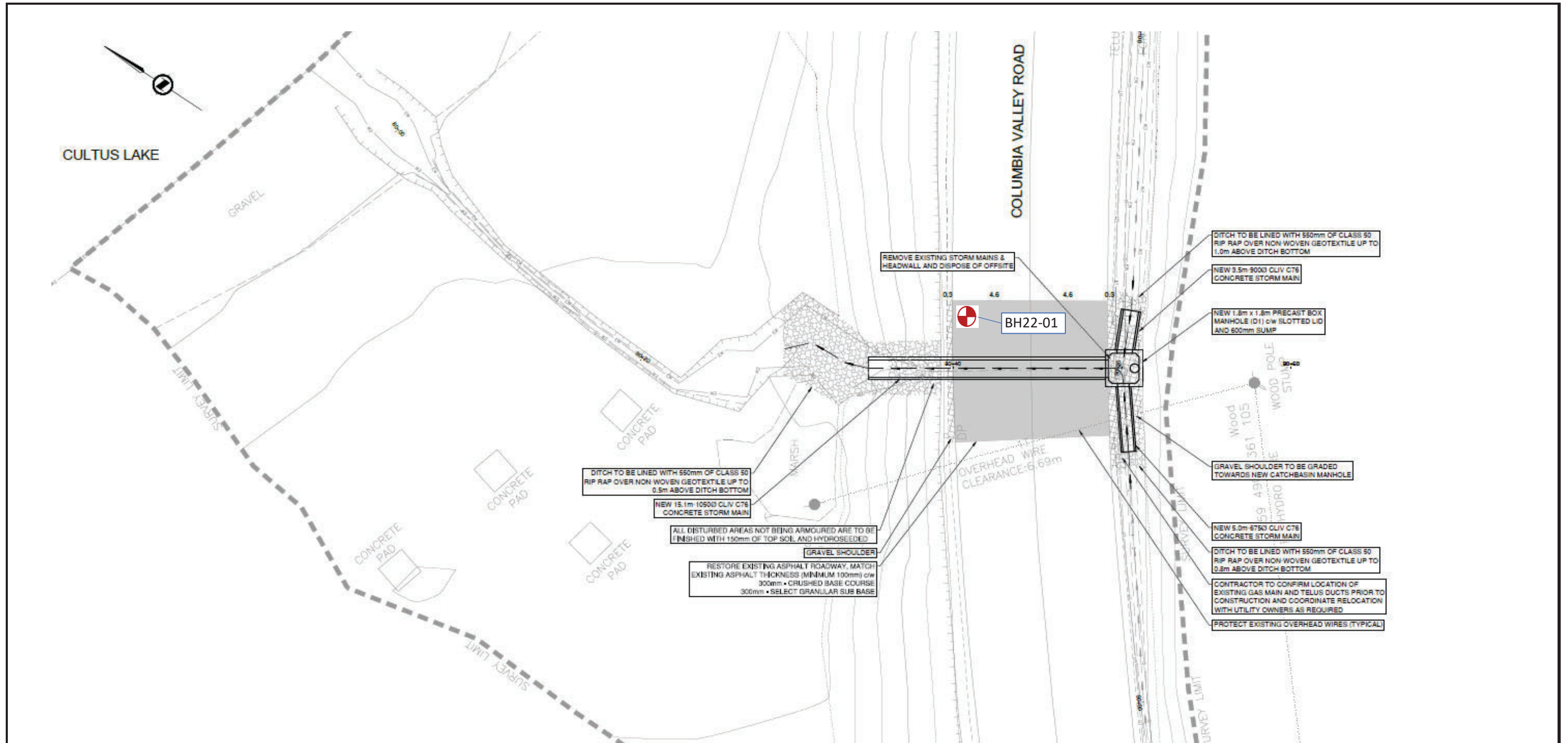
John Laxdal, P.Eng.
Principal Geotechnical Engineer

Attachments: Borehole location plans
 Draft soil logs
 Limitations

Attachment A

Borehole Location Plans





REMOVE EXISTING STORM MAINS & HEADWALL AND DISPOSE OF OFFSITE

BH22-01

DITCH TO BE LINED WITH 550mm OF CLASS 50 RIP RAP OVER NON WOVEN GEOTEXTILE UP TO 1.0m ABOVE DITCH BOTTOM

NEW 3.5m 9000 CLIV C75 CONCRETE STORM MAIN

NEW 1.8m x 1.8m PRECAST BOX MANHOLE (D1) c/w SLOTTED LID AND 600mm SUMP

GRAVEL SHOULDER TO BE GRADED TOWARDS NEW CATCHBASIN MANHOLE

NEW 5.0m 6750 CLIV C75 CONCRETE STORM MAIN

DITCH TO BE LINED WITH 550mm OF CLASS 50 RIP RAP OVER NON WOVEN GEOTEXTILE UP TO 0.8m ABOVE DITCH BOTTOM

CONTRACTOR TO CONFIRM LOCATION OF EXISTING GAS MAIN AND TELUS DUCTS PRIOR TO CONSTRUCTION AND COORDINATE RELOCATION WITH UTILITY OWNERS AS REQUIRED

PROTECT EXISTING OVERHEAD WIRES (TYPICAL)

DITCH TO BE LINED WITH 550mm OF CLASS 50 RIP RAP OVER NON WOVEN GEOTEXTILE UP TO 0.5m ABOVE DITCH BOTTOM

NEW 15.1m 10500 CLIV C75 CONCRETE STORM MAIN

ALL DISTURBED AREAS NOT BEING ARMoured ARE TO BE FINISHED WITH 150mm OF TOP SOIL AND HYDROSEEDING

GRAVEL SHOULDER

RESTORE EXISTING ASPHALT ROADWAY, MATCH EXISTING ASPHALT THICKNESS (MINIMUM 100mm) c/w 300mm • CRUSHED BASE COURSE 300mm • SELECT GRANULAR SUB BASE

OVERHEAD WIRE CLEARANCE: 6.69m

LEGEND:

BOREHOLE LOCATION

NOTES:

1. BASE MAP: ISL 14033-000, R1-XXXX-701
2. BOREHOLE LOCATIONS ARE APPROXIMATE



PROJECT: **COLUMBIA VALLEY HIGHWAY CULVERT REPLACEMENTS**

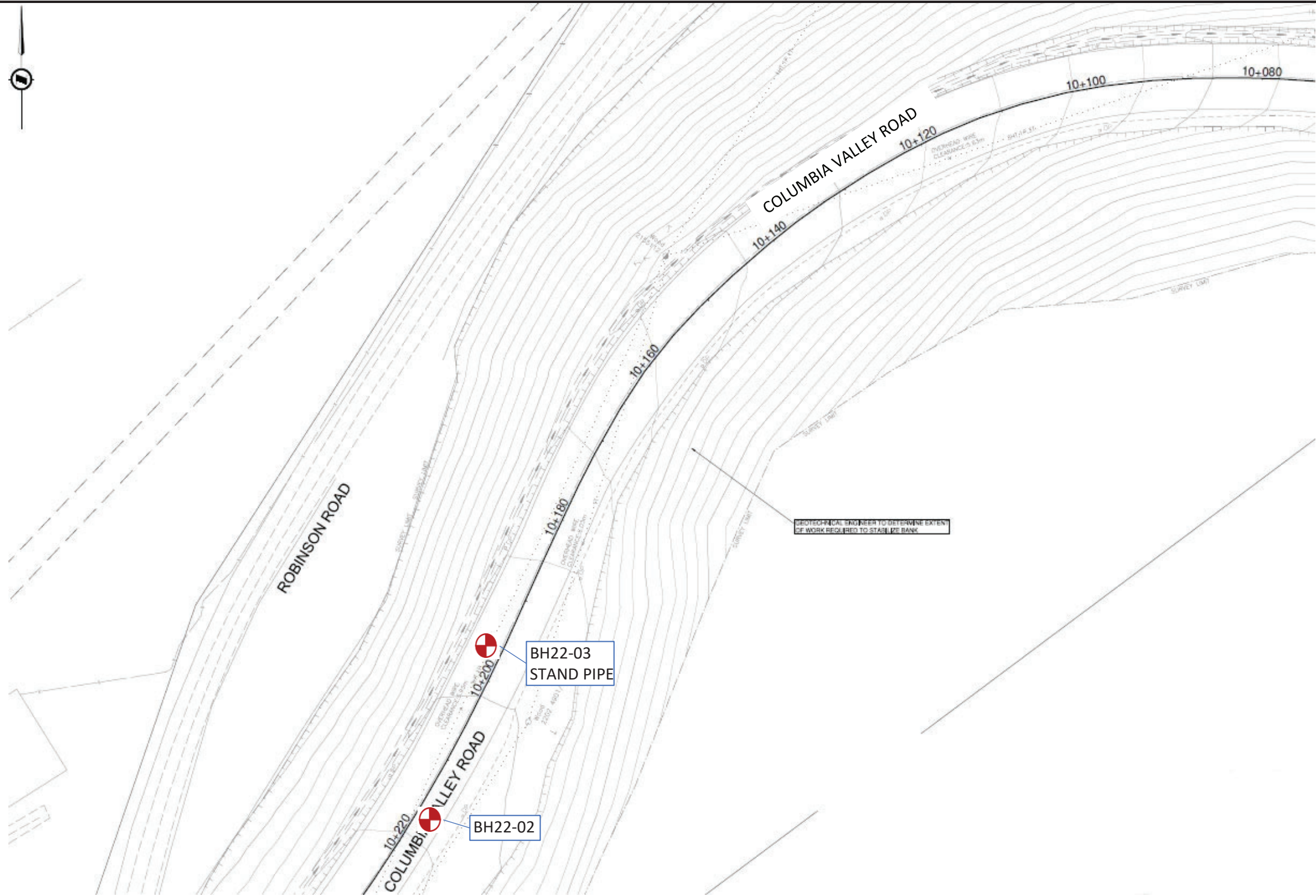
TITLE: **BOREHOLE LOCATION PLAN - MAPLE BAY DITCH AT COLUMBIA VALLEY ROAD**

CLIENT :



Ministry of Transportation and Infrastructure

DATE:	JOB NO.:	CAD FILE:	FIGURE NO.:	REV
2022 NOV			1	1





LEGEND:

 BOREHOLE LOCATION

NOTES:

1. BASE MAP: ISL 14033-000, R1-14118-101
2. BOREHOLE LOCATIONS ARE APPROXIMATE

		PROJECT: COLUMBIA VALLEY HIGHWAY CULVERT REPLACEMENTS			
		TITLE: BOREHOLE LOCATION PLAN - COLUMBIA VALLEY ROAD SLOPE STABILIZATION EAST OF COLUMBIA VALLEY ROAD			
CLIENT:				Ministry of Transportation and Infrastructure	
DATE:	JOB NO.:	CAD FILE:	FIGURE NO.:	REV	
2022 NOV			2	1	

Attachment B

Draft Soil Logs





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SUMMARY LOG

Drill Hole #: **BH23-01**

Prepared by: VG07796A02
WSP E&I Canada Limited

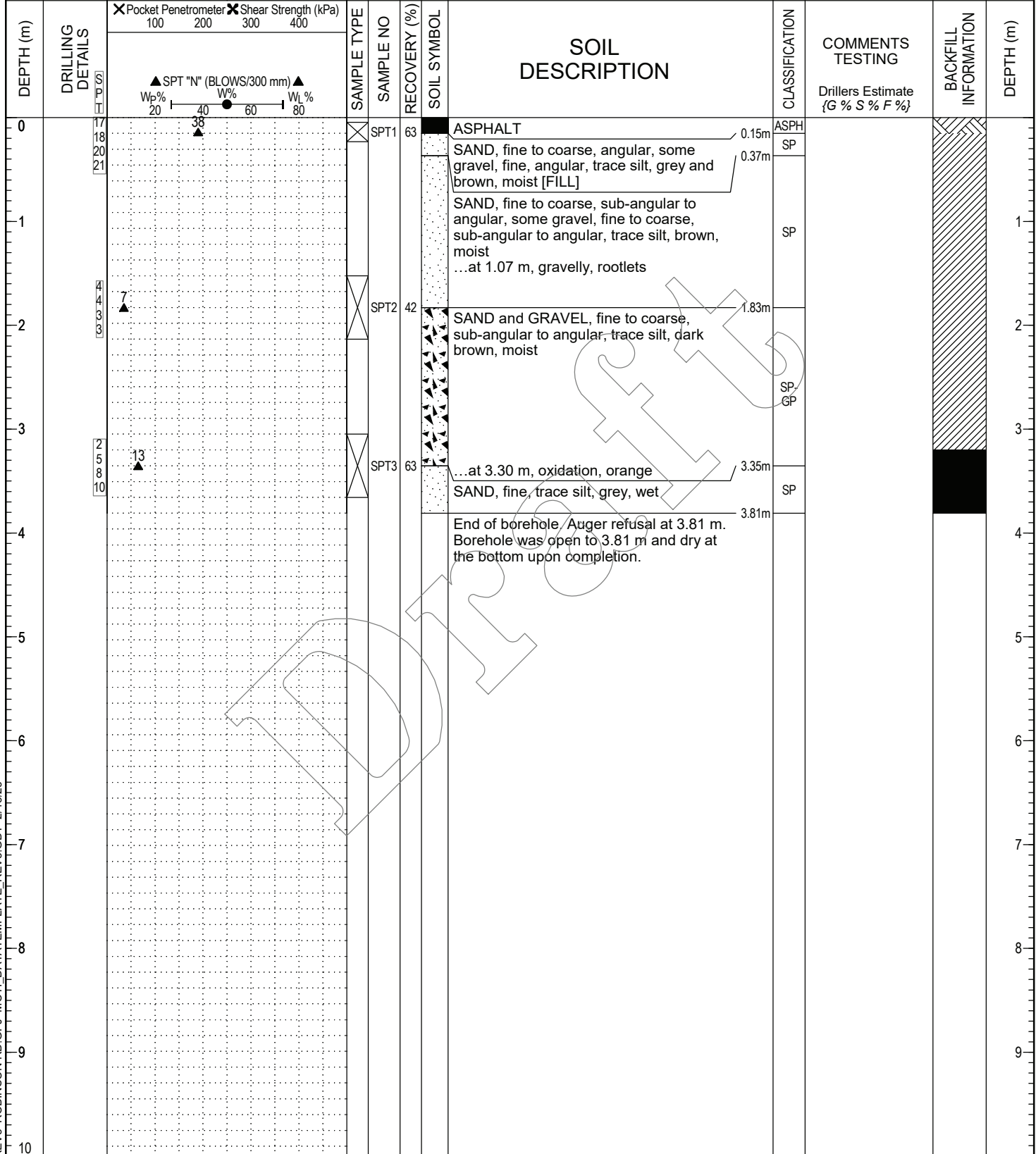
Project: **Columbia Valley**
Location: Columbia Valley Rd & Maple Bay
Datum: 10U
Northing/Easting: 5431764, 573169

Alignment:
Station/Offset:

Logged by: SS Reviewed by: BC

Elevation:

Date(s) Drilled: 1/31/2023
Company: On Track Drilling
Driller: Truck mounted multi - power
Drill Make/Model:
Drilling Method: Solid stem auger



MOTI-SOIL-REV3 ROBINSON RD.GPJ MOTI_DATATEMPLATE_REV3.GDT 2/13/23

- Legend**
Sample Type:
- A-Auger
 - B-Becker
 - C-Core
 - G-Grab
 - V-Vane
 - L#-Lab Sample
 - S-Split Spoon
 - O-Odex (air rotary)
 - W-Wash (mud return)
 - T-Shelby Tube

- Legend**
Installation:
- Sand
 - Grout
 - Cement
 - Bentonite
 - Drill Cuttings
 - Slotted
 - Slough
 - Piezometer

Final Depth of Hole: 3.8 m
Depth to Top of Rock:
Page 1 of 1



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SUMMARY LOG

Drill Hole #: **BH23-02**

Prepared by: VG07796A02
WSP E&I Canada Limited

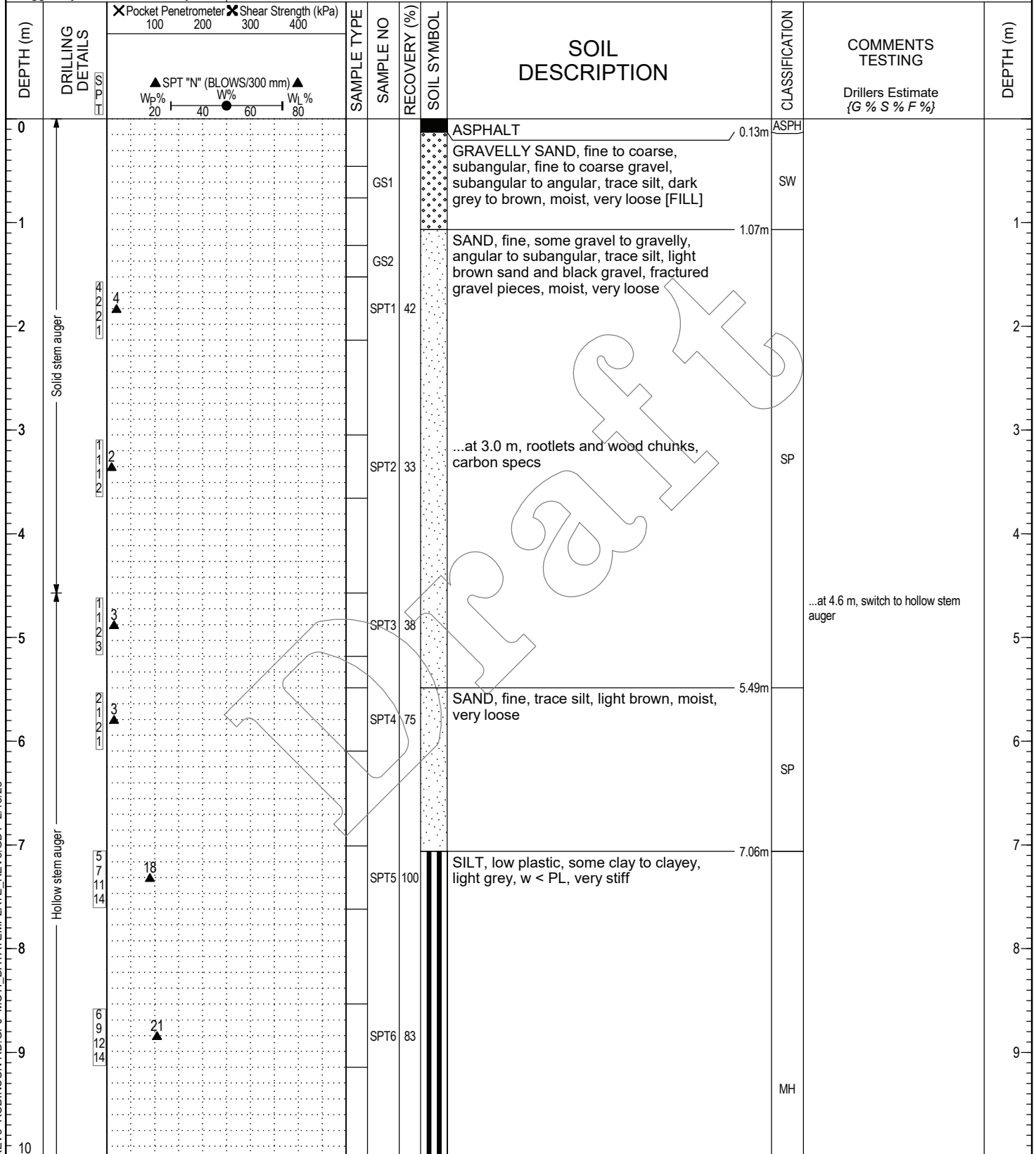
Project: **Columbia Valley**
Location: Columbia Valley & Robinson Road
Datum: 10U
Northing/Easting: 5431319, 570079

Alignment:
Station/Offset:

Date(s) Drilled: 1/31/2023
Company: On Track Drilling
Driller: Truck mounted multi - power
Drill Make/Model:
Drilling Method: Solid stem auger to 4.5 m, hollow

Logged by: SS Reviewed by: BC

Elevation:



- Legend**
- A-Auger
 - B-Becker
 - C-Core
 - G-Grab
 - V-Vane
 - L#-Lab Sample
 - S-Split Spoon
 - O-Odex (air rotary)
 - W-Wash (mud return)
 - T-Shelby Tube

Final Depth of Hole: 13.3 m
Depth to Top of Rock:
Page 1 of 2

MOTI-SOIL-REV3 ROBINSON RD.GPJ MOTI_DATATEMPLATE_REV3.GDT 2/13/23



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SUMMARY LOG

Drill Hole #: **BH23-02**

Prepared by: VG07796A02
WSP E&I Canada Limited

Project: **Columbia Valley**
Location: Columbia Valley & Robinson Road
Datum: 10U
Northing/Easting: 5431319, 570079
Elevation:

Alignment:
Station/Offset:

Date(s) Drilled: 1/31/2023
Company: On Track Drilling
Driller: Truck mounted multi - power
Drill Make/Model:
Drilling Method: Solid stem auger to 4.5 m, hollow

Logged by: SS Reviewed by: BC

DEPTH (m)	DRILLING DETAILS	<input checked="" type="checkbox"/> Pocket Penetrometer 100 200 300 400 <input checked="" type="checkbox"/> Shear Strength (kPa) 300 400	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	DEPTH (m)
10	6 6 9 11			SPT7	100		SILT, low plastic, some clay to clayey, light grey, w < PL, very stiff (continued)			
11										
12	4 5 5 7			SPT8	100	SAND, fine, trace silt, grey, wet, loose	SP		11.63m
12							SILT, low plastic, some clay, grey, w < PL, stiff	CL		11.99m
13										
13	8 11 17			SPT9	100	SAND, fine to coarse, subangular to subrounded, trace silt, grey, moist, compact	SP		13.11m
14										
15							Auger refusal at 14.6 m. Borehole open to 14.6 m and dry upon completion.			14.63m
16										
17										
18										
19										
20										

MOTI-SOIL-REV3 ROBINSON RD.GPJ MOTI_DATATEMPLATE_REV3.GDT 2/13/23

Legend	A-Auger	B-Becker	C-Core	G-Grab	V-Vane
Type:	L#-Lab Sample	S-Split Spoon	O-Odex (air rotary)	W-Wash (mud return)	T-Shelby

Final Depth of Hole: 13.3 m
Depth to Top of Rock:
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SUMMARY LOG

Drill Hole #: **BH23-03**

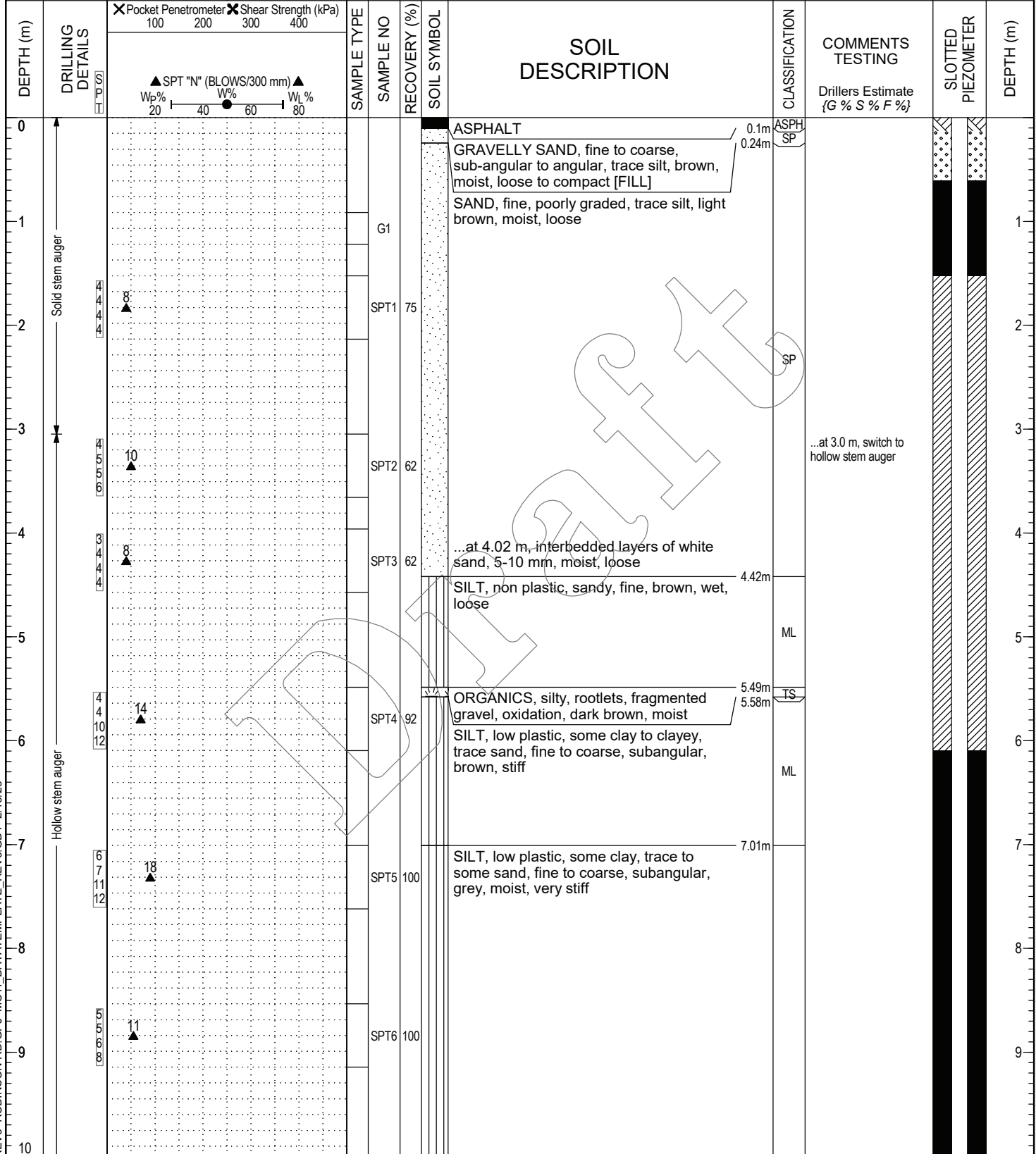
Prepared by: VG07796A02
WSP E&I Canada Limited

Project: **Columbia Valley**
Location: Columbia Valley & Robinson Road
Datum: 10U
Northing/Easting: 5431338, 570105
Elevation:

Alignment:
Station/Offset:

Date(s) Drilled: 2/1/2023
Company: On Track Drilling
Driller: Truck mounted multi - power
Drill Make/Model:
Drilling Method: Solid stem auger to 3.0 m, hollow

Logged by: SS Reviewed by: BC



MOTI-SOIL-REV3 ROBINSON RD.GPJ MOTI_DATATEMPLATE_REV3.GDT 2/13/23

Legend

Sample Type: A-Auger, B-Becker, C-Core, G-Grab, V-Vane, L#-Lab Sample, S-Split Spoon, O-Odex (air rotary), W-Wash (mud return), T-Shelby Tube

Legend

Installation: Sand, Grout, Cement, Bentonite, Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 18.9 m
Depth to Top of Rock:
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SUMMARY LOG

Drill Hole #: **BH23-03**

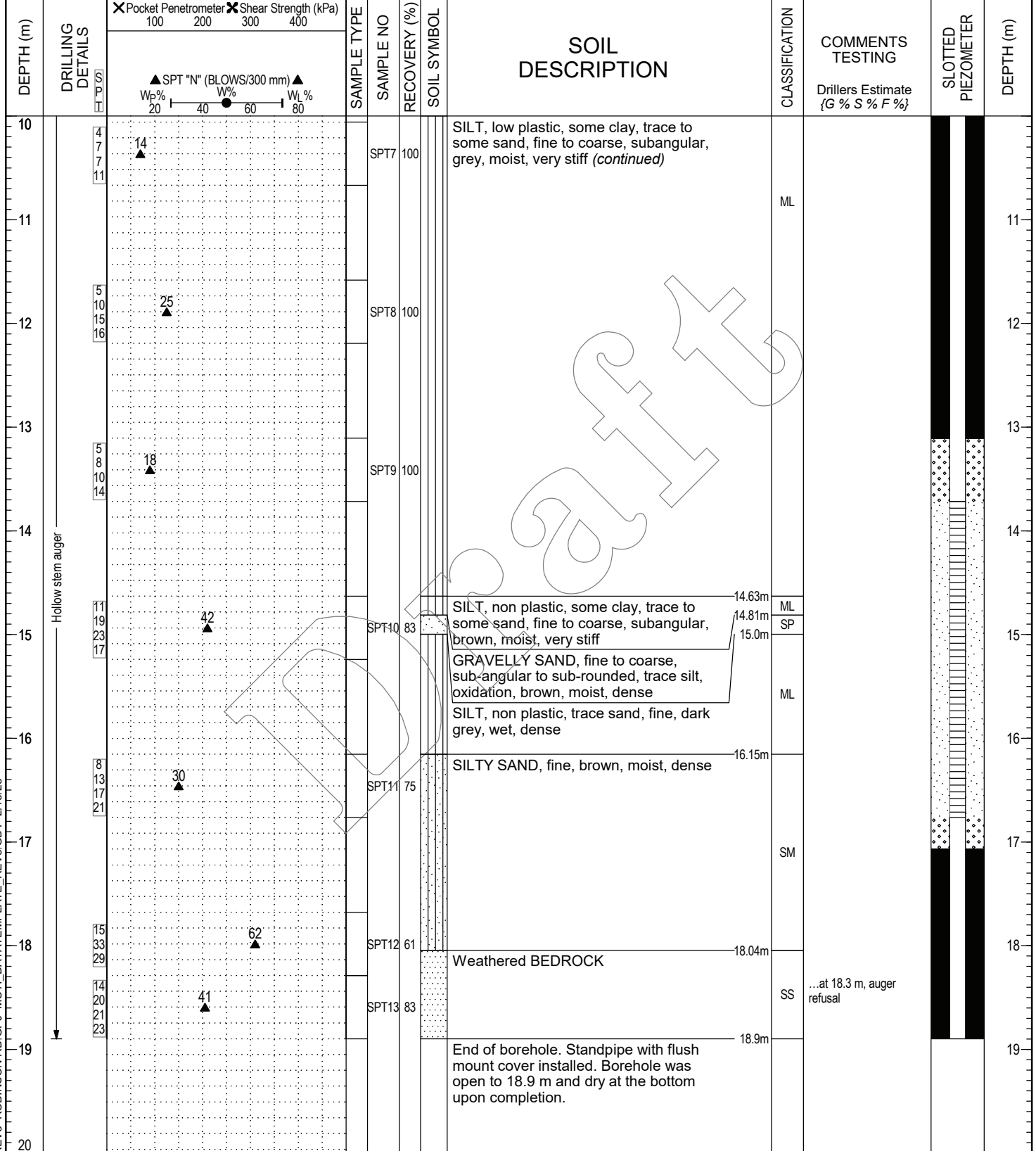
Prepared by: VGO7796A02
WSP E&I Canada Limited

Project: **Columbia Valley**
Location: Columbia Valley & Robinson Road
Datum: 10U
Northing/Easting: 5431338, 570105
Elevation:

Alignment:
Station/Offset:

Date(s) Drilled: 2/1/2023
Company: On Track Drilling
Driller: Truck mounted multi - power
Drill Make/Model:
Drilling Method: Solid stem auger to 3.0 m, hollow

Logged by: SS Reviewed by: BC



MOTI-SOIL-REV3 ROBINSON RD.GPJ MOTI_DATATEMPLATE_REV3.GDT 2/13/23

- Legend**
Sample Type:
- A-Auger
 - B-Becker
 - C-Core
 - G-Grab
 - V-Vane
 - L#-Lab Sample
 - S-Split Spoon
 - O-Odex (air rotary)
 - W-Wash (mud return)
 - T-Shelby Tube

- Legend**
Installation:
- Sand
 - Grout
 - Cement
 - Bentonite
 - Drill Cuttings
 - Slotted
 - Slough
 - Piezometer

Final Depth of Hole: 18.9 m
Depth to Top of Rock:
Page 2 of 2

Attachment C

Limitations



Limitations

1. The work performed in the preparation of this report and the conclusions presented are subject to the following:
 - a. The Standard Terms and Conditions which form a part of our Professional Services Contract;
 - b. The Scope of Services;
 - c. Time and Budgetary limitations as described in our Contract; and
 - d. The Limitations stated herein.
2. No other warranties or representations, either expressed or implied, are made as to the professional services provided under the terms of our Contract, or the conclusions presented.
3. The conclusions presented in this report were based, in part, on visual observations of the Site and attendant structures. Our conclusions cannot and are not extended to include those portions of the Site or structures, which are not reasonably available, in WSP's opinion, for direct observation.
4. The environmental conditions at the Site were assessed, within the limitations set out above, having due regard for applicable environmental regulations as of the date of the inspection. A review of compliance by past owners or occupants of the Site with any applicable local, provincial or federal bylaws, orders-in-council, legislative enactments and regulations was not performed.
5. The Site history research included obtaining information from third parties and employees or agents of the owner. No attempt has been made to verify the accuracy of any information provided, unless specifically noted in our report.
6. Where testing was performed, it was carried out in accordance with the terms of our contract providing for testing. Other substances, or different quantities of substances testing for, may be present on-site and may be revealed by different or other testing not provided for in our contract.
7. Because of the limitations referred to above, different environmental conditions from those stated in our report may exist. Should such different conditions be encountered, WSP must be notified in order that it may determine if modifications to the conclusions in the report are necessary.
8. The utilization of WSP's services during the implementation of any remedial measures will allow WSP to observe compliance with the conclusions and recommendations contained in the report. WSP's involvement will also allow for changes to be made as necessary to suit field conditions as they are encountered.
9. This report is for the sole use of the party to whom it is addressed unless expressly stated otherwise in the report or contract. Any use which any third party makes of the report, in whole or the part, or any reliance thereon or decisions made based on any information or conclusions in the report is the sole responsibility of such third party. WSP accepts no responsibility whatsoever for damages or loss of any nature or kind suffered by any such third party as a result of actions taken or not taken or decisions made in reliance on the report or anything set out therein.
10. This report is not to be given over to any third party for any purpose whatsoever without the written permission of WSP.
11. Provided that the report is still reliable, and less than 12 months old, WSP will issue a third-party reliance letter to parties that the client identifies in writing, upon payment of the then current fee for such letters. All third parties relying on WSP's report, by such reliance agree to be bound by our proposal and WSP's standard reliance letter. WSP's standard reliance letter indicates that in no event shall WSP be liable for any damages, howsoever arising, relating to third-party reliance on WSP's report. No reliance by any party is permitted without such agreement.