

Appendix B – Tetra Tech Geotechnical Report

ISSUED FOR USE

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Memo No.: 001

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Subject: Johnson Canyon Pedestrian Fencing Subsurface Exploration and Geotechnical Recommendations

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by COWI North America Ltd. (COWI) to provide geotechnical engineering services for a 1,055 m extension of the pedestrian fencing along the upper trail section of Johnston Canyon in Banff National Park. Tetra Tech's scope of work included a geotechnical exploration of the subsurface conditions and analysis of data to evaluate the required foundation embedment of the proposed fencing based on loading demands provided by COWI.

Tetra Tech carried out two phases of subsurface exploration, with the first occurring between June 16 to 18, 2021 and the second occurring on November 3 and 4, 2021. The exploration included the use of hand-held equipment to characterize the foundation conditions along the alignment of the fencing. Hand equipment was used to minimize potential impacts to the Park and to facilitate access. This report summarizes the site exploration, presents the factual geotechnical data that were collected, and provides recommendations for foundation design and construction.

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2.0 BACKGROUND

Johnston Canyon is a popular tourist destination and hiking trail within Banff National Park, Alberta. The trail starts from a parking area on Highway 1A and travels north, increasing in elevation to the upper falls area which is approximately 2.6 km from the parking area. The trail comprises sections of elevated walkways (catwalks), gravel, and asphalt sections. A trail spur starting at the Upper Falls lookout connects the Johnston Canyon Trail with the Ink Pots via Moose Meadows trail.

The Johnston Canyon trail is typically paved with a layer of asphalt and generally follows the west side of the canyon within a forested area. As the trail increases in elevation past Catwalk 6, several areas become close to the edge of the canyon or have steep side slopes where the trail crosses gullies. In these areas, pedestrian fencing and railings have previously been installed by others.

Due to the high levels of visitors within the trail system and to prevent people from straying off the trail into sensitive areas within the canyon, additional pedestrian fencing is being considered between the existing locations. An additional eight (8) sections of fencing are proposed to infill and extend the existing pedestrian fencing along the trail.

The foundation requirements of the fencing were evaluated considering the following:

- When the slope outside the trail was less than 1V:2H, as assessed by COWI, the fencing design will be fulfilled by the British Columbia Ministry of Transportation and Infrastructure (BC MOTI) Standard Specification for Fence Construction Section 741 (British Columbia Ministry of Transportation and Infrastructure, 2020). The BC MOTI standard specification requires foundations for terminal posts to be installed to 0.75 m below ground surface (mbgs) and foundations for in line posts to be installed to 0.6 mbgs in soils.
- Where the slope outside of the trail is steeper than 1V:2H, as assessed by COWI, the fencing is to be designed based on railing loading outlined in the 2015 National Building Code of Canada (NBCC). The required foundation depths are evaluated in Section 4.0 of this report.

3.0 SITE EXPLORATION

Tetra Tech undertook a geotechnical subsurface exploration program from June 16 to 18, 2021 to collect information on the subsurface conditions along the trail in areas where additional pedestrian fencing is proposed. A subsequent exploration phase was conducted from November 3 to 4, 2021 to supplement previously obtained data in areas where deeper foundations may be required based on the interpreted bedrock profile and trail geometry. The proposed fencing installation comprises eight (8) sections that are typically between existing fencing locations. Table 3-1 presents the length of each section and general description of the location.

Table 3-1: Summary of Proposed Pedestrian Fencing Sections

Section No.	Start and End of Section	Length of Section
1	End of Catwalk 6 to fencing at lookout	87 m
2	Fencing at lookout to fencing installed at steep embankment	331 m
3	Fencing installed at steep embankment to Canyon viewpoint at 530 m from Upper Falls	82 m
4	Canyon viewpoint at 530 m from Upper Falls to Falls and Canyon Outlook	23 m
5	Falls and Canyon Outlook to Canyon Overlook	140 m
6	Canyon Overlook to Junction of Chutes (Catwalk #7) and Upper Falls Lookout	145 m
7	Junction of Chutes (Catwalk #7) to Upper Falls Lookout	138 m
8	Upper Falls Lookout to 105 m along trail to Ink Pots	128 m
Total		1,074 m

The exploration included completion of soil probe holes, hand auger holes and Dynamic Cone Penetration Tests (DCPTs) and is summarized in Table 3-2.

Table 3-2: Summary of Geotechnical Exploration

Section No.	Soil Probe Holes	Hand Auger Holes	DCPT Tests
1	12	2	1
2	36	6	19
3	9	1	4
4	3	0	0
5	18	4	6
6	15	2	0
7	15	0	0
8	12	0	1
Total	120	15	31

Soil probing was undertaken to evaluate the depth to bedrock at various points along the trail during the Phase 1 exploration program. During soil probing, additional observations of the trail width, edge of trail widths, and slope angles were recorded. Data was recorded using an Apple iPad. The field measurements are presented in Table A1.

Disturbed soil samples were collected at selected depths from the auger sampler for visual review. Additionally, rock samples were taken from surface for point load tests (PLTs) that were completed following the Phase 2 exploration program.

The DCPTs were conducted using a Wildcat Dynamic Cone Penetrometer to provide information on the penetration resistance of the material. The DCPT N value reported is the uncorrected value for a 15.9 kg (35 lb) hammer free falling a distance of 381 mm (15 inches) to advance the driving rod 300 mm. The DCPT advancement was recorded in 100 mm intervals with the DCPT N value being the summation for a 300 mm interval. During the Phase 2 exploration, frozen ground conditions were encountered up to approximately 0.3 m below ground surface throughout the site. The DCPT blow counts are reported for completeness; however, interpretation of blow counts as an indicator of in-situ soil consistency should be avoided due to over estimation of soil strength.

Observations collected during the subsurface exploration program are discussed in the subsequent sections of this report. The locations of the hand auger holes and DCPT tests are shown in Figure 1, and a summary of the completion depths and locations is included in Table A2. The hand auger and DCPT logs are included in Appendix B and Appendix C, respectively. Annotated photos of the site exploration can be found in Appendix D. The results of the PLTs are included in Appendix E.

4.0 GEOTECHNICAL CONDITIONS

4.1 Section 1

This section of new fencing runs from the end of Catwalk 6 to a lookout. The trail is less than 1.5 m wide between CH000 to ~CH080. A wooden bridge has been installed between CH060 and CH069 and confines the trail with timber curbs.

CH000 to CH065: Alongside the trail, the ground is relatively level (see Photos 1 and 2). The subsurface conditions typically consist of loose granular materials to 0.6 m below ground surface, however areas were found with approximately 1 m of loose soil overlying denser soils.

CH065 to CH087: The ground slopes down from the trail through this section (see Photos 3 and 4). The surficial soils typically consist of loose granular soils up to 0.5 m thick overlaying bedrock. In some areas, the soil probe encountered refusal on inferred bedrock at depths less than 0.5 m. The loose material was noted to contain cobbles and boulders.

4.2 Section 2

Section 2 is the longest of the seven fencing sections, continuing from the fencing at the lookout to the fencing installed at a section of steep embankment. Ground conditions and trail geometry vary greatly along the length of the section. From CH000 to ~CH200, the trail is generally greater than 1.5 m wide. Between ~CH200 and ~CH260, the trail is less than 1.5 m wide, with narrowest measurement at CH240 where the trail was measured to be 1.1 m wide. From CH260 to the end of the section, the trail was generally wider than 1.5 m. Cobbles and boulders were noted alongside the trail and were inferred within the subsurface soil layers based on readings and observations taken using the invasive test methods.

CH000 to CH060: At the start of the section, timber curb along the trail creates a vertical drop off the edge of the trail, which will require longer posts for the pedestrian fencing (see Photo 5). Areas of sloping ground are present below the trail (see Photo 6). The soil conditions typically consist of loose soil up to 0.5 m thick overlaying bedrock. Bedrock was inferred at less than 0.5 m below grade in some areas of this segment, with outcrops present at the trail level.

CH060 to CH145: Shallow sloping ground is present below this section of trail. See Photo 7. The surficial soil conditions typically consist of loose soils to greater than 0.7 m below ground surface.

CH145 to CH180: Sloping ground is present below this section of trail (see Photo 7). Timber-edged section of trail starts at 133 m (see Photos 9 and 10). The ground conditions typically consist of loose soil to approximately 2.3 m below ground surface.

CH180 to CH331: Along this section of the trail the typical soil conditions encountered consisted of approximately 1 m of loose soil overlaying a dense soil layer. The DCPT probe met refusal between 0.64 m and 1.65 m bgs. The total thickness of the underlying dense materials was not able to be determined.

4.3 Section 3

Section 3 runs from the fencing installed at a section of steep embankment to Canyon viewpoint which is located 530 m from Upper Falls. Cobbles and boulders were noted alongside the trail and were inferred within the subsurface soil layers based on readings and observations taken using the invasive test methods

CH000 CH040: There is sloping ground on the downslope side of the trail (see Photo 15). The ground conditions typically consist of approximately 1 m of loose soil over dense material; however, one DCP test was advanced to 1.45 m.

CH040 to CH070: The area next to the trail is approximately the same grade as the trail. The ground conditions typically consist of loose soils to greater than 0.7 m below ground surface.

CH070 to CH082: The soil cover becomes thinner through this section, with bedrock encountered at less than 0.6 m (Photo 16).

4.4 Section 4

Section 4 is the shortest section of proposed new pedestrian fencing running from the Canyon Viewpoint to the Falls and Canyon Outlook. The ground along this section is relatively level with a short area of sloping ground near the end of Section 4 (see Photo 17). Soil probe measurements indicated the soil thickness to be greater than 0.7 m at the start of the section (CH000), with inferred bedrock encountered between 0.5 m and 0.6 m below ground surface along the rest of the section.

4.5 Section 5

Section 5 of the proposed fencing extension runs from the Falls and Canyon Outlook to the Canyon Overlook. The downslope portion of the trail generally is sloping along this section of trail (see Photos 18 to 20). The loose soil throughout this section was noted to contain cobbles and boulders.

CH000 to CH015: Approximately 0.5 m of loose soil was found to overlay denser soil materials.

CH015 to CH060: Approximately 1 m of loose soil was found to overlay dense material.

CH060 to CH113: Approximately 0.5 m of loose soil was found to overlay denser soil materials.

CH113.5 and CH117.5: There are two wooden bridges which cross watercourses. The abutment between the two bridges appears to be constructed of fill containing cobbles and boulders (see Photos 21 and 22). The DCPT probe was advanced 1.15 m at CH113.5 and 1.71 m at CH117.5 before meeting refusal. Due to the fill materials containing large clasts, the fill is inferred to be loose.

CH118 to CH140: Approximately 0.5 m of loose soil was found to overlay denser soil materials.

4.6 Section 6

Section 6 of the new pedestrian fencing installation runs from the Canyon Overlook to the Junction of Chutes (Catwalk #7) and Upper Falls Lookout (see Photo 24). Generally, the ground adjacent to the trail is level with the exception around CH080, where the trail has been built up using rock fill, and at the end of Section 6 (Photos 26 and 27). The ground conditions typically consist of up to 0.5 m of loose soil over dense material or bedrock. The loose soil long this section was noted to contain cobbles and boulders.

4.7 Section 7

The proposed pedestrian fencing along Section 7 runs from the Junction of Chutes (Catwalk #7) to the Upper Falls Lookout (see Photo 28). Soil cover along this section of trail was found to be relatively shallow, with most of the probe holes refusing on inferred bedrock at less than 0.6 m depth. Photo 29 shows the area of trail looking down chainage from CH060. From approximately CH064 to CH085 and again near CH130, the ground slopes away below the trail (Photo 30 and 31). Photo 32 is looking down chainage from the end of Section 7.

CH000 to CH065: The soil probe typically met refusal on inferred bedrock at less than 0.6 m of the ground surface.

CH065 to CH085: Bedrock was inferred at approximately 0.3 m depth based on soil probe refusal.

CH085 to CH125: The soil probe typically met refusal on inferred bedrock at less than 0.6 m of the ground surface.

CH125 to CH138: Bedrock was inferred to be up to 0.5 m depth based on soil probe refusal.

4.8 Section 8

The proposed fencing along Section 8 runs from the Upper Falls Lookout to approximately 128 m, including 10 m of existing railing, northwest up along the trail to an area where the trail turns west and moves away from the canyon. For the purpose of this report, we have assigned CH000 to be the end of the existing rail. The trail is not paved in this section with the trail surface comprised of native soils and exposed bedrock. The trail increases in elevation along Section 8, with the area perpendicular to the trail generally being at similar elevation. The soil cover in this section is typically less than 0.3 m, with several areas where bedrock can be observed at the surface adjacent to the trail. Between CH020 and CH040, bedrock was inferred at slightly deeper depths between 0.4 m and 0.5 m through soil probe measurements.

5.0 FOUNDATION EVALUATION AND INTERPRETED SUBSURFACE CONDITIONS

5.1 Foundation Embedment Evaluation

For areas where the slope immediately outside the trail was steeper than 1V:2H, the fencing foundations were assessed for railing loading requirements of the NBCC. Analyses were conducted evaluating the requirements for a 200 mm circular pile foundation based on the loading conditions provided by COWI. The loading demands provided by COWI are presented in Table 5-1 below.

Table 5-1: Loading Conditions provided by COWI

Load Case	NBCC Loading Requirements at Top of Foundation		
	Factored Moment (kN*m)	Factored Shear (kN)	Factored Axial Load (kN)
Typical Span 1,070 mm High Fencing with 3.4 m Max Foundation Spacing	4.1	3.8	7.7
Increased Span 1,070 mm High Fencing with 4.94 m Max Foundation Spacing	5.56	5.95	11.12

To evaluate the required embedment depths of the foundations, the analyses were conducted using the computer software LPILE (v2019.11.08) developed by Ensoft Inc. LPILE evaluates soil response to pile loading by using non-linear lateral soil springs (p-y curves), and the solution is iterated out to accommodate the non-linear response of the pile and soil at any depth below ground surface. The p-y curves considered for the analyses have been developed based on published recommendations for various types of soils. The p-y curves were factored considering a Geotechnical Resistance Factor of 0.5 considering a typical degree of understanding. Additionally, due to some of the piles being placed either on or near a slope, additional sloping ground reduction factors were applied to account for sloping ground effects. The sloping ground factors considered for the analyses were

estimated based on the paper by Nimiyongskul et al. (2012), which results in a reduction to the p-y curves to a depth with respect to the pile's diameter (Nimiyongskul, Barker, & Ashford, 2012). Lateral pile analyses to estimate the required pile embedment depths were performed based on the loading cases in Table 5-1 for each condition.

The foundation requirements for two stratigraphic conditions were assessed based on the observations of the two site exploration phases. The first assessed condition considered relatively poor soils for the entire required foundation depth. The second assessed condition considered 1 m of loose material over dense soil. The strength properties two soil layers were assessed based on the DCPT results and field observations. Empirical correlations were consulted to evaluate the friction angle based on in situ consistency observations (Bowles, 1997). Additional considerations, such as the areas where the different ground profiles are anticipated are discussed further in Section 5.2. The results of the LPile analyses based on the two soil profiles for the NBCC railing load cases is presented in Table 5-2 and Table 5-3.

Table 5-2: Required Footing Embedment Depths for Areas with Loose Soils to the Design Depth

Soil Properties				Diameter of Pile (mm)	Condition	Required Foundation Embedment Depth (m)	
Depth (mbgs)	Unit Weight (kN/m ³)	Friction Angle (φ, °)	Cohesion (c', kPa)			Typical Span	Increased Span
0 – 2.5	18	30	0	200	Flat Ground	1.75	2.00
					Within 0.8 m of Crest of Slope	2.10	2.30
					On Slope	2.40	2.55

Table 5-3: Required Footing Embedment Depths for Areas with Denser Underlying Soils

Soil Properties				Diameter of Pile (mm)	Condition	Required Foundation Embedment Depth (m)	
Depth (mbgs)	Unit Weight (kN/m ³)	Friction Angle (φ, °)	Cohesion (c', kPa)			Typical Span	Increased Span
0 – 1.0	18	30	0	200	Flat Ground	1.65	1.85
					Within 0.8 m of Crest of Slope	1.95	2.10
1.0 – 2.5	19	38	0		On Slope	2.10	2.35

If bedrock is encountered at shallower depths than those listed in Table 5-2 or Table 5-3, a reduction in the embedment is possible. The minimum embedment into competent bedrock is recommended to be 400 mm for both the typical and increased span load cases. Where bedrock is at surface, 400 mm embedment depth into competent bedrock is required. Competent bedrock in this context is defined as bedrock with surficial loose material removed.

5.2 Interpreted Subsurface Conditions and Foundation Type

The observations obtained during the field exploration phases have been interpreted to provide an anticipated foundation condition for the fence foundations along the eight (8) sections. In areas where the fence is being designed to resist NBCC loading, where loose soil was found overlying dense soil as per Table 5-3, practical refusal was typically observed with the DCPT in the dense soil layer. In these areas, it is possible bedrock may be within the design depth of the fence foundation. If bedrock is encountered, a reduction of the foundation length is allowable to the minimum of 400 mm into bedrock or the design depth listed in Table 5-3. For constructability, it is anticipated the majority of the NBCC loading condition foundations will be placed within 0.8 m of the crest of the slope. If the foundations are placed directly on the slope, a nominal increase in embedment is required as shown in Table 4-2 and Table 4-3.

Based on surficial observations and the PLT results, the contractor should be prepared to drill through bedrock up to R5 strength (very strong) with an RQD ranging from 20% to 70%. The PLT results are included in Appendix E. Cobbles and boulders were inferred throughout the project area and may present challenging drilling conditions for the installation of the fence foundations. Additionally, the area surrounding the two wooden bridges in fencing Section 5 appear to be constructed with fill containing cobbles and boulders, which may complicate installation of the foundations at this location (Photo 21 and 22).

The anticipated fence foundation conditions within the required depth of the foundations are summarized within Table 5-4.

Table 5-4: Anticipated Ground Conditions

Section	Chainages ¹	Anticipated Fence Condition	Anticipated Ground Conditions for Fence Foundations
1	CH000 to CH010	NBCC Loading	Approximately 1 m of loose soil over dense material (foundation depths as per Table 5-3)
	CH010 to CH070	MOTI Fence	Loose Soils to Design Depth
	CH070 to CH087	NBCC Loading	Up to 0.5 m of Loose soil above Bedrock
2	CH000 to CH015	MOTI Fence	Up to 0.5 m of Loose soil above Bedrock
	CH015 to CH020	NBCC Loading	Up to 0.5 m of Loose soil above Bedrock
	CH020 to CH060	MOTI Fence	Up to 0.5 m of Loose soil above Bedrock
	CH060 to CH145	MOTI Fence	Loose Soils to Design Depth
	CH145 to CH180	NBCC Loading	Loose Soils to Design Depth (foundation depths as per Table 5 2)
	CH180to CH331	NBCC Loading	Approximately 1 m of loose soil over dense material (foundation depths as per Table 5-3)
3	CH000 to CH035	NBCC Loading	Approximately 1 m of loose soil over dense material (foundation depths as per Table 5-3)
	CH035 to CH070	MOTI Fence	Loose Soils to Design Depth
	CH070 to CH082	MOTI Fence	Approximately 0.5 m of loose soil over dense material

Table 5-4: Anticipated Ground Conditions

Section	Chainages ¹	Anticipated Fence Condition	Anticipated Ground Conditions for Fence Foundations
4	CH000 to CH0+23	MOTI Fence	Approximately 0.6 m of loose soil over dense material or bedrock. Bedrock is inferred to be between 0.5 to 0.6 mbgs in the last 15 m of this section.
5	CH000 to CH015	MOTI Fence	Approximately 0.5 m of loose soil over dense material
	CH015 to CH060	NBCC Loading	Approximately 1 m of loose soil over dense material (foundation depths as per Table 5-3)
	CH060 to CH080	MOTI Fence	Approximately 0.5 m of loose soil over dense material
	CH080 to CH113	NBCC Loading	Approximately 0.5 m of loose soil over dense material (foundation depths as per Table 5-3)
	CH113 to CH118	NBCC Loading	Approximately 0.5 m of loose soil over dense material, increased span (foundation depths as per Table 5-3)
	CH118 to CH140	NBCC Loading	Approximately 0.5 m of loose soil over dense material (foundation depths as per Table 5-3)
6	CH000 to CH075	MOTI Fence	Up to 0.5 m of loose soil over dense material
	CH075 to CH085	NBCC Loading	Approximately 0.5 m of loose soil above Bedrock
	CH085 to CH147	MOTI Fence	Up to 0.5 m of loose soil above Bedrock
7	CH000 to CH065	MOTI Fence	Up to 0.6 m of loose soil above Bedrock
	CH065 to CH085	NBCC Loading	Up to 0.3 m of loose soil above Bedrock
	CH085 to CH125	MOTI Fence	Up to 0.6 m of loose soil above Bedrock
	CH125 to CH138	NBCC Loading	Up to 0.5 m of loose soil above Bedrock
8	CH000 to CH128	MOTI Fence	Up to 0.5 m of loose soil above Bedrock

1. Chainage of each section starts at the end of existing fencing and are rounded up and down to nearest 5 m chainage for the railing areas unless the end chainage corresponded to the end of section.

6.0 LIMITATIONS OF REPORT

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

7.0 CLOSURE

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

Respectfully submitted,
Tetra Tech Canada Inc.

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Enclosure: Tables (2)
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Appendix B: Hand Auger Soil Logs
Appendix C: Dynamic Cone Penetrometer Test Logs
Appendix D: Annotated Site Photographs
Appendix E: Point Load Test Results



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TABLES

Table A1	Summary of Field Measurements
Table A2	Testhole Location Summary

Table A1: Summary of Field Measurements

Trail Section	Distance [m]	Station [m]	Tool	Depth of Practical Refusal [m]	Trail Width [m]	Approximate Slope Angle Below Trail (degrees)	Comments
1	1	1/1	Probe	> 0.65	1.4	23	First 5m of the ground surface is sloping away. Hard layer 0.5 m off trail and 0.2 m deep.
1	6	1/2	Probe	> 0.7	1.4	-	Roots and sand layer within 0.5 m of trail.
1	15.5	1/3	Probe	>0.65	1.3	-	Roots & Rocks.
1	25.5	1/4	Probe	>0.6	1.4	-	Trail narrows to 1.2 m width approximately 2 m up distance.
1	31.2	1/5	Probe	>0.6	1.22	-	Roots and rocks.
1	49.9	1/7	Probe	>0.7	1.22	-	Rocky soil.
1	60	1/8	Probe	>0.6	1.35 (Used Bridge Width)	-	Rocky soil, difficult to get bedrock depth. Wood edge of bridge 0.35 m above ground. Photos 100-3028 to 100-3033 taken looking up and down the trail.
1	65.3	1/9	Probe	>0.6	1.35 (Used	-	Easier to push probe.
1	70					-	Observation: At ~70 m in Section 1 start of shallow bedrock [rock foundation].
1	72.7	1/10	Probe	0.5	1.25	-	Ground surface starts to slope away from trail.
1	78.8	1/11	Probe	0.2	1.44	31	Bedrock outcrop
1	82.6	1/12	Probe	0.2	1.57	46	Junction with fire road spur.
1	86.1						At distance 86.1 m there is a section of timber edging without rail (~ 3.9 m) with a vertical drop of ~ 0.35 to 0.4 m behind edging.
1	86.7	1/13	Probe	0.2	1.65	37	End of section.
2	0	2/1	Probe	0.47	1.8	25	Bedrock outcrop on upslope trail side.
2	11.4	2/2	Probe	0.37	1.6	-	0.33 m drop on back of timber.
2	18.2	2/3	Probe	0.53	1.5	36	Slope starts 0.4 m away from trail.
2	25.5	2/4	Probe	0.13	1.65	23	Photos taken 100-3033 to 3035.
2	31	2/5	Probe	0.43	1.8	19	Ground surface drops steeply 2.2 m from trail. The trail material itself has a 0.09 m drop.
2	34.9	2/6	Probe	0.33	2.2	-	
2	43.2	2/7	Probe	0.48	1.63	-	Tree roots.
2	53.3	2/8	Probe	0.3	1.6	-	Bedrock outcrop
2	60		Probe	0.58	1.9	-	Tree roots.
2	70		Probe	>0.75	1.75	-	
2	80		Probe	>0.7	1.7	18	Easy penetration because gravely soil.
2	90	Near 2/13	Probe	>0.7	1.7	-	
2	100	Near 2/14	Probe	>0.7	1.7	18	Easy penetration. Photos taken 100-3036 to 3037.
2	110	Near 2/16	Probe	0.63	1.73	-	Old asphalt and clayey top. Cobbles and sand? Variable penetration depths.
2	120		Probe	0.66	1.65	18	
2	130		Probe	0.46	1.53	23	Probe refusal but not bedrock.
2	133						113 m timber edge, trail sloping. 113 m slope is 1.0:0.3. 113 m there was probe refusal at 0.46 m but felt like gravel rather than bedrock.
2	140		Probe	>0.7	1.5 (2.0 outside)	15	Section of trail with Timber edging built in 2015. Top of timbers approximately 150 mm above back of ground.
2	146						146 to 160 m is very wet ground, green cattail growing on downslope side of trail; pictures of this area are 3038 to 3045. Photographs 3036 to 3037 taken into sign before timber edged trail.
2	150	2/21 between	Probe	>0.7	1.5 (2.0 outside)	30	Near steel culvert.
2	153						153 m to 156 m 2x timber tall trail edging with back of timber being 0.38 m above ground
2	160		Probe	>0.7	1.5 (2.0 outside)	36	Soft, wet ground.
2	170	2/22	Probe	>0.7	1.65	25	Soft ground.
2	180		Probe	>0.7	1.47	32	Soft ground.
2	190		Probe	>0.7	1.4	38	
2	200		Probe	>0.7	1.51	35	Slope drops steeply away from the trail.
2	210	2/26	Probe	>0.7	1.63	32	Soil material on upslope side of trail.
2	220	2/29	Probe	0.55	1.45	31	Probe refusal at 0.55 m but does not feel like bedrock.
2	230	2/30	Probe	>0.7	1.35	44	0.45 m of level soil next to trail before steep drop.
2	240	2/32	Probe	>0.7	1.1	29	Soil material on upslope of trail.

Table A1: Summary of Field Measurements

Trail Section	Distance [m]	Station [m]	Tool	Depth of Practical Refusal [m]	Trail Width [m]	Approximate Slope Angle Below Trail (degrees)	Comments
2	250	Near 2/35	Probe	0.645	1.41	46	No rock present but refusal at 0.55 m penetration. 1.41 m trail width with sloughed soil slope
2	260	Between 2/35 and 2/36	Probe	>0.7	1.53	22	Gravelly soil with cobbles.
2	270	Between 2/36 and 2/37	Probe	0.6	1.5	-	Photos taken 3046 to 3048.
2	280	Between 2/37 and 2/38	Probe	0.69	1.56	62	Probe refusal but not BR.
2	290	Between 2/38 and 2/40	Probe	>0.7	1.53	42	
2	300	Near 2/40	Probe	>0.7	1.47	57	
2	310	Near 2/42	Probe	>0.7	1.6	47	Gravelly soil with cobbles.
2	320		Probe	>0.7	1.9	39	
2	330	2/44	Probe	>0.7	1.38	37	Soil sloughing on upslope side of trail.
3	0	3/1	Probe	0.66	1.56	55	Probe refusal not bedrock.
3	8.4	3/2				-	
3	10		Probe	>0.7	1.48	50	Photos 3049 to 3052.
3	20		Probe	>0.7	1.3	39	
3	30		Probe	>0.7	1.6	33	Soft material.
3	31.2	3/5					
3	39.8	3/6					
3	40		Probe	>0.7	1.6	-	
3	50		Probe	>0.7	1.63	-	Shallow slope away from trail.
3	60		Probe	>0.7	1.4	-	Shallow slope away from trail.
3	70		Probe	0.46	1.45	-	Shallow forest floor. Probe refusal feels like hard gravel rather than BR.
3	80		Probe	0.56	1.6	-	Hard gravel layer at probe refusal depth.
3	82.5						End of Section 3.
4	0	4/1	Probe	>0.7	1.42	-	Soft ground.
4	10		Probe	0.58	1.65	-	Cobbles/rock in soil.
4	20		Probe	0.52	1.5	-	Bedrock outcrop upslope side of trail.
5	0	5/1	Probe	0.5	1.5	-	
5	10	Near 5/3	Probe	0.69	1.5	37	~110 mm of asphalt drop to soil.
5	20		Probe	>0.7 ~0.75	1.4	29	
5	30		Probe	>0.7 ~0.75	1.4	35	
5	40		Probe	>0.7	1.4	34	
5	50		Probe	0.65	1.6	45	
5	60		Probe	0.51	1.5	-	Probe refusal feels like gravel not bedrock.
5	70	5/14	Probe	0.42	1.55	-	Probe refusal feels like gravel not bedrock. Photos 3055 to 3057.
5	80		Probe	0.64	1.48	46	
5	90	5/17	Probe	0.55	1.4	55	
5	100		Probe	0.45	1.46	40	Stacked cobbles along trail grade resulting in probe refusal. Slope drops steeply away from trail. Photos 3058 to 3061. From 100-113.5 steep slope with limited post room.
5	110		Probe	0.67	1.6	31	
5	113.5		Probe	0.62	1.88	40	Refusal on rock supporting slope. Start of first timber bridge.
5	115.3		Probe	0.375	1.88	35	Refusal on rock supporting slope.
5	117.3		Probe	>0.7	1.6	38	End of second timber bridge.
5	120		Probe	0.7	1.65	48	NOT gravel material at problem, possible tree root?
5	130		Probe	0.47	1.65	48	Asphalt ~0.05 m thick drop to soil. Refusal on possible tree root?
5	140		Probe	0.43	1.7	37	Probe refusal on gravel not bedrock. Slope drops steeply below trail.
6	0	6/1	Probe	0.5	1.5	-	Probe refusal on gravel not bedrock.
6	10		Probe	0.35	1.53	-	Probe refusal on gravel not bedrock.
6	20		Probe	0.57	1.6	-	Probe refusal by hitting roots at bottom.
6	30		Probe	0.465	1.48	-	Probe refusal by hitting roots at bottom. Photos 3071 to 3073 taken.
6	40		Probe	0.275	1.55	-	Roots outcrop on upslope side of trail, no outcrops until cliff downslope of the trail. Maybe bedrock?
6	50		Probe	0.4	1.56	-	Hard surface in multiple holes of same depth.

Table A1: Summary of Field Measurements

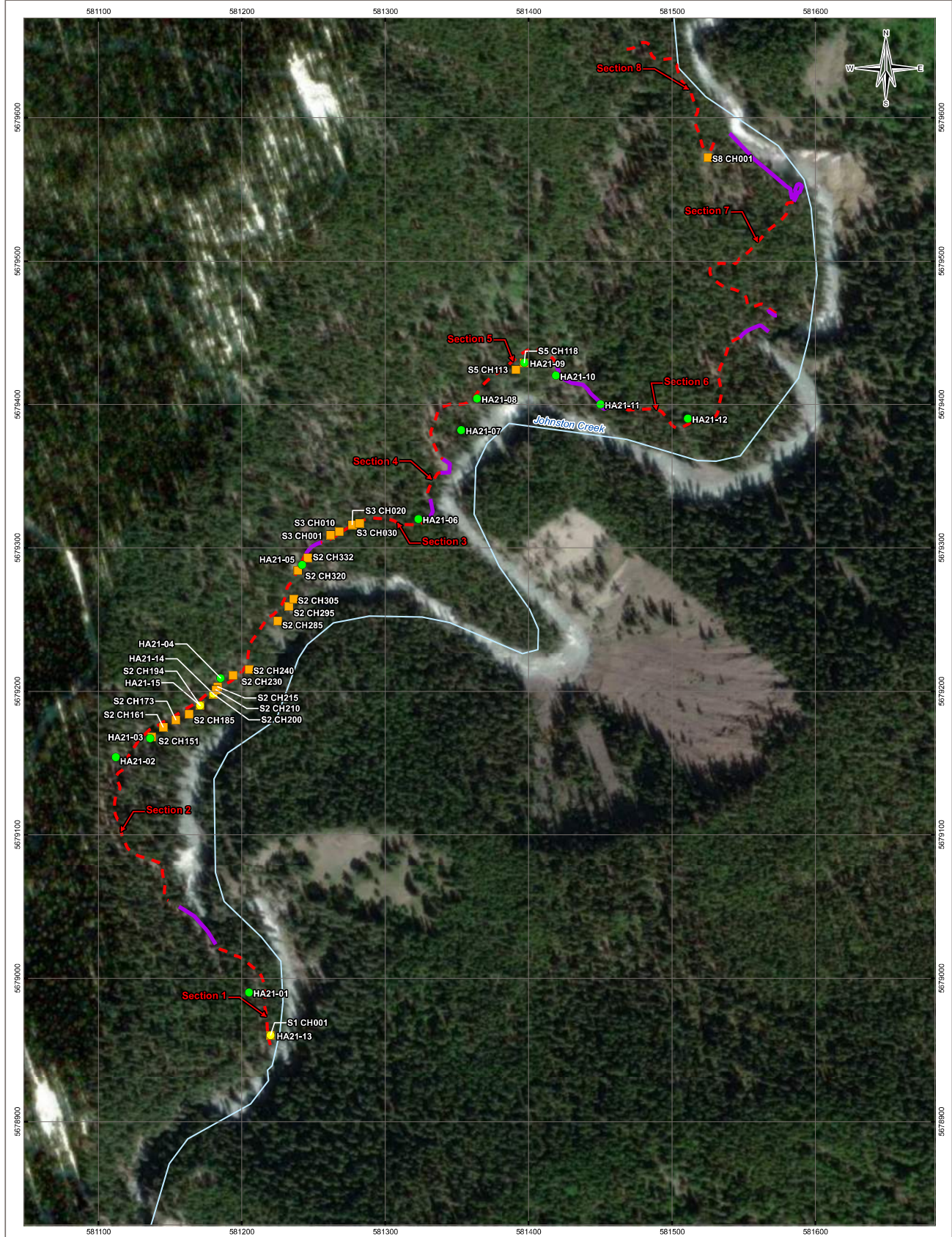
Trail Section	Distance [m]	Station [m]	Tool	Depth of Practical Refusal [m]	Trail Width [m]	Approximate Slope Angle Below Trail (degrees)	Comments
6	60		Probe	0.27	1.3	-	
6	70		Probe	0.36	1.6	-	Photos 3074 to 3078 taken.
6	75						75 m to 85 m the trail is supported by stacked rocks and the slope dips steeply away from the trail.
6	80		Probe	0.25	1.5	47	Trail supported by rocks.
6	90		Probe	0.32	1.3	-	Edge of endangered bird closure area.
6	100		Probe	0.3	1.47	-	Encountered rock at probe refusal depth.
6	110		Probe	>0.7	1.42	-	
6	120		Probe	0.55	1.35	-	
6	130		Probe	0.4	1.48	-	
6	140		Probe	0.4	1.5	24	~130 mm drop off edge of the trail. End of section 6 at 145.5 m distance.
7	0	7/1	Probe	0.38	1.6	-	Start of section is on upslope side of trail to Upper Lookout. Rock outcrop before 7/1 stake.
7	10		Probe	0.63	1.4	-	
7	20		Probe	0.65	1.51	-	Second set of stairs leading up to the upper falls.
7	30		Probe	0.25	1.4	-	Lots of rocks and tree roots but outcrops near trail.
7	40		Probe	0.42	1.27	-	Flat soil opposite side of trail.
7	50		Probe	0.43	1.3	-	
7	60		Probe	0.22	1.5	-	Edge of stair. Rocks along next ~9 m of trail. Photos 3079 to 3082 taken.
7	70		Probe	0.22	1.32	44	Trail drops off. Slope after edge: 0.4H:0.3V
7	80		Probe	0.34	1.53	37	
7	90		Probe	0.41	1.63	-	
7	100		Probe	0.26	1.26	-	
7	105						Dip in rock profile.
7	110		Probe	>0.7	1.46	-	Rock profile dip.
7	120		Probe	0.55	1.5	-	Trail slopes upwards after 120 m distance.
7	130		Probe	0.19	1.3	35	Photos 3083 to 3085 taken.
7	140		Probe	>0.7	1.8	-	End of Section 7 at 144.5 m distance.
8	1		Probe	0.70	1.22	-	Start of wood stair.
8	10		Probe	0.03	2.4	-	
8	20		Probe	0.50	2.1	-	Can't advance probe, not bedrock
8	30		Probe	0.42	2	-	Can't advance probe, hard clay soil
8	40		Probe	0.40	2.3	-	Can't advance probe, hard clay soil
8	50		Probe	0.10	1.8	-	Rock
8	60		Probe	0.10	2.1	-	Rock
8	70		Probe	0.00	2.2	-	Rock at surface
8	80		Probe	0.00	2.2	-	Rock at surface
8	90		Probe	0.45	2.3	-	Refusal
8	100		Probe	0.05	2.3	-	Rock
8	105		Probe	0.20	1.7	-	Rock

Table A2: Summary of Test Hole Locations

Name	Type	Easting	Northing	UTM	Termination Depth (mbgs)
HA21-01	Phase 1 Hand Auger Hole Location	581205	5678990	Zone 11	0.50
HA21-02	Phase 1 Hand Auger Hole Location	581112	5679154	Zone 11	0.50
HA21-03	Phase 1 Hand Auger Hole Location	581136	5679167	Zone 11	1.05
HA21-04	Phase 1 Hand Auger Hole Location	581185	5679209	Zone 11	0.70
HA21-05	Phase 1 Hand Auger Hole Location	581242	5679288	Zone 11	0.50
HA21-06	Phase 1 Hand Auger Hole Location	581323	5679320	Zone 11	0.45
HA21-07	Phase 1 Hand Auger Hole Location	581353	5679382	Zone 11	0.60
HA21-08	Phase 1 Hand Auger Hole Location	581364	5679404	Zone 11	0.40
HA21-09	Phase 1 Hand Auger Hole Location	581397	5679429	Zone 11	0.95
HA21-10	Phase 1 Hand Auger Hole Location	581419	5679420	Zone 11	0.50
HA21-11	Phase 1 Hand Auger Hole Location	581450	5679400	Zone 11	0.50
HA21-12	Phase 1 Hand Auger Hole Location	581511	5679390	Zone 11	0.30
HA21-13	Phase 2 Hand Auger Hole Location	581220	5678960	Zone 11	1.30
HA21-14	Phase 2 Hand Auger Hole Location	581180	5679198	Zone 11	0.80
HA21-15	Phase 2 Hand Auger Hole Location	581171	5679190	Zone 11	0.70
S1 CH001	Phase 2 DCPT Location	581220	5678960	Zone 11	1.40
S2 CH151	Phase 2 DCPT Location	581137	5679168	Zone 11	2.50
S2 CH161	Phase 2 DCPT Location	581145	5679175	Zone 11	2.50
S2 CH173	Phase 2 DCPT Location	581154	5679180	Zone 11	2.35
S2 CH185	Phase 2 DCPT Location	581163	5679184	Zone 11	1.35
S2 CH194	Phase 2 DCPT Location	581171	5679190	Zone 11	1.13
S2 CH200	Phase 2 DCPT Location	581180	5679198	Zone 11	0.85
S2 CH210	Phase 2 DCPT Location	581182	5679201	Zone 11	0.50
S2 CH215	Phase 2 DCPT Location	581183	5679203	Zone 11	1.65
S2 CH230	Phase 2 DCPT Location	581194	5679211	Zone 11	0.65
S2 CH240	Phase 2 DCPT Location	581205	5679215	Zone 11	1.02
S2 CH285	Phase 2 DCPT Location	581225	5679249	Zone 11	0.64
S2 CH295	Phase 2 DCPT Location	581233	5679259	Zone 11	0.70
S2 CH305	Phase 2 DCPT Location	581236	5679264	Zone 11	0.84
S2 CH320	Phase 2 DCPT Location	581239	5679284	Zone 11	0.75
S2 CH332	Phase 2 DCPT Location	581246	5679293	Zone 11	1.00
S3 CH001	Phase 2 DCPT Location	581262	5679309	Zone 11	0.84
S3 CH010	Phase 2 DCPT Location	581268	5679311	Zone 11	1.11
S3 CH020	Phase 2 DCPT Location	581277	5679316	Zone 11	1.45
S3 CH030	Phase 2 DCPT Location	581282	5679317	Zone 11	1.05
S5 CH113	Phase 2 DCPT Location	581391	5679424	Zone 11	1.15
S5 CH118	Phase 2 DCPT Location	581397	5679429	Zone 11	1.71
S8 CH001	Phase 2 DCPT Location	581525	5679572	Zone 11	0.70

FIGURES

Figure 1 Test Locations



LEGEND

- Phase 1 Hand Auger Hole Location
- Phase 2 Hand Auger Hole Location
- Phase 2 DCPT Location
- Existing Fence Location
- - - Proposed Fence Location
- ~ Watercourse

NOTES
Base data source:
Imagery from ESRI, Maxar (2018).

PRELIMINARY GEOTECHNICAL MEMO JOHNSTON CANYON RAILINGS EXTENSION

Test Locations

PROJECTION UTM Zone 11	DATUM NAD83	CLIENT
Scale: 1:2,500		
50 25 0 50		
Metres		
FILE NO. ROCK03205-01_Fig01_TestingLocations.mxd		
OFFICE Tt-VANC	DWN SL	CKD YL
DATE November 17, 2021	APVD AN	REV 0
PROJECT NO. ENG. ROCK03205-01		



Figure 1

STATUS
ISSUED FOR USE

APPENDIX A

LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

1.1 USE OF DOCUMENT AND OWNERSHIP

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

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

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

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

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

1.3 STANDARD OF CARE

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

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

1.4 DISCLOSURE OF INFORMATION BY CLIENT

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

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

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

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

1.6 GENERAL LIMITATIONS OF DOCUMENT

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

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

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

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

1.7 ENVIRONMENTAL AND REGULATORY ISSUES

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

1.8 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

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

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

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

1.9 LOGS OF TESTHOLES

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

1.10 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

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

1.11 PROTECTION OF EXPOSED GROUND

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

1.12 SUPPORT OF ADJACENT GROUND AND STRUCTURES

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

1.13 INFLUENCE OF CONSTRUCTION ACTIVITY

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

1.14 OBSERVATIONS DURING CONSTRUCTION

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

1.15 DRAINAGE SYSTEMS

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

1.16 DESIGN PARAMETERS

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

1.17 SAMPLES

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

1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

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

APPENDIX B

HAND AUGER SOIL LOGS



Borehole No: HA21-01

Project: Johnston Canyon Subsurface Exploration

Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1492 m

Alberta

UTM: 581204 E; 5678991 N; Z 11 NAD83

Depth (m)	Method	Soil Description	Graphical Representation	Moisture Content (%)	Elevation (m)
0				<div> <div>Plastic Limit</div> <div>Moisture Content</div> <div>Liquid Limit</div> </div> <div> <div>20</div> <div>40</div> <div>60</div> <div>80</div> </div>	
0.2	Hand Auger	ORGANIC SILT, trace sand, some roots and woody debris, damp, low plastic, brown; fine sand			1491.8
0.4	Hand Auger	SILT, trace gravel, trace clay, damp, low to medium plastic, reddish brown; fine gravel, sub-angular			1491.6
0.6	Hand Auger	GRAVEL, silty, trace clay, damp, reddish brown; fine gravel, angular to sub-angular			1491.4
0.8	Hand Auger	End of Hand Auger Hole at 0.50 m, practical refusal.			1491.2
1.0	Hand Auger	- Upon completion of drilling, the hand auger hole was backfilled with drilling cuttings.			1491.0
1.2	Hand Auger	- Soil descriptions were based on visual classification and field observations, in combination with in-situ testing results. Some variation throughout the interpreted soil layers is expected.			1490.8
1.4	Hand Auger	- UTM coordinates are approximate (+/- 5 m) and were collected using a handheld GPS.			1490.6
1.6	Hand Auger				1490.4
1.8	Hand Auger				1490.2
2.0	Hand Auger				1490.0



TETRA TECH

Contractor:

Completion Depth: 0.5 m

Equipment Type: Hand Auger

Start Date: June 18, 2021

Logged By: AN/LT

Completion Date: June 18, 2021

Reviewed By: CL

Page 1 of 1



Borehole No: HA21-02

Project: Johnston Canyon Subsurface Exploration

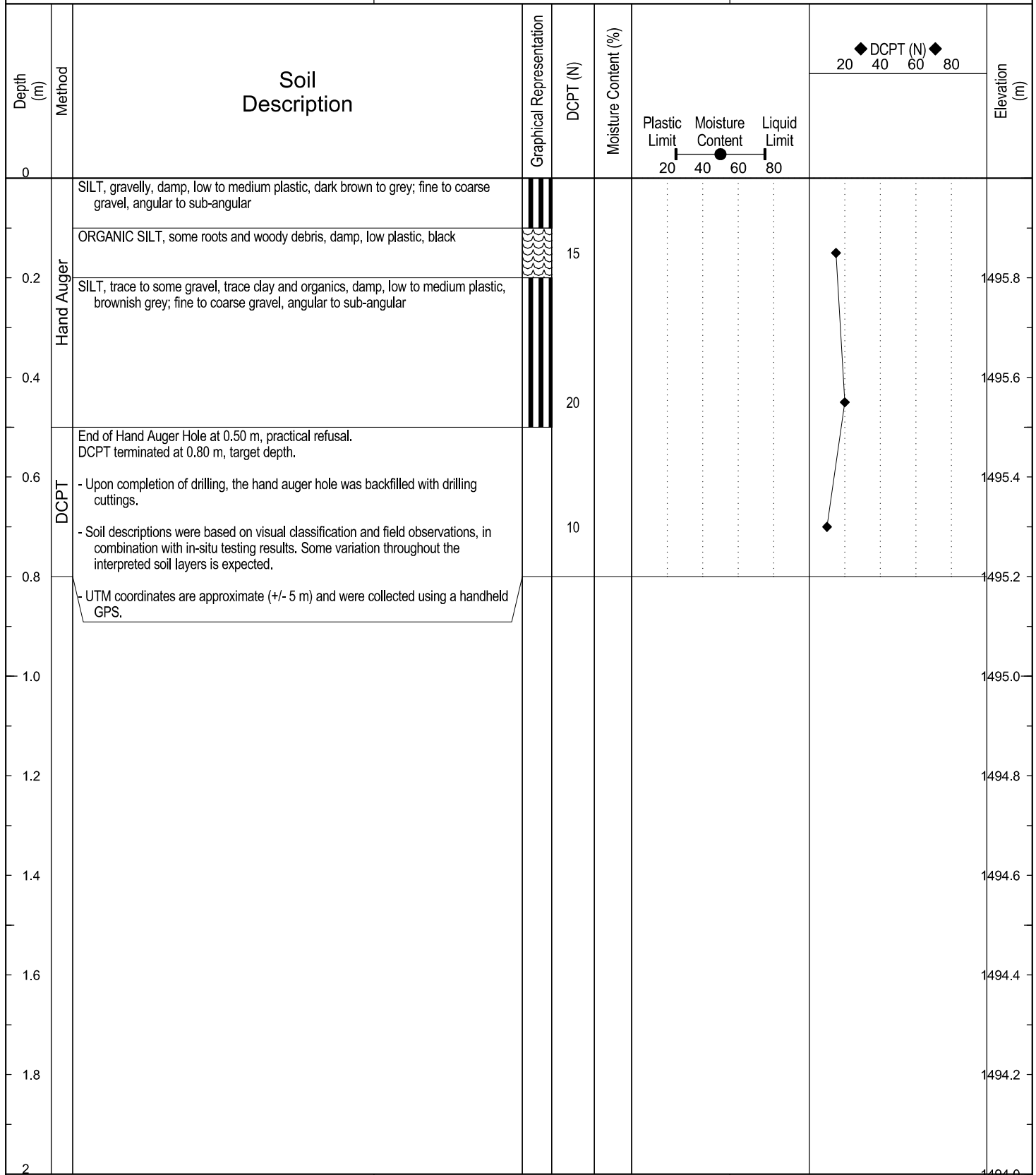
Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1496 m

Alberta

UTM: 581111 E; 5679155 N; Z 11 NAD83



TETRA TECH

Contractor:

Completion Depth: 0.8 m

Equipment Type: Hand Auger

Start Date: June 18, 2021

Logged By: AN/LT

Completion Date: June 18, 2021

Reviewed By: CL

Page 1 of 1



Borehole No: HA21-03

Project: Johnston Canyon Subsurface Exploration

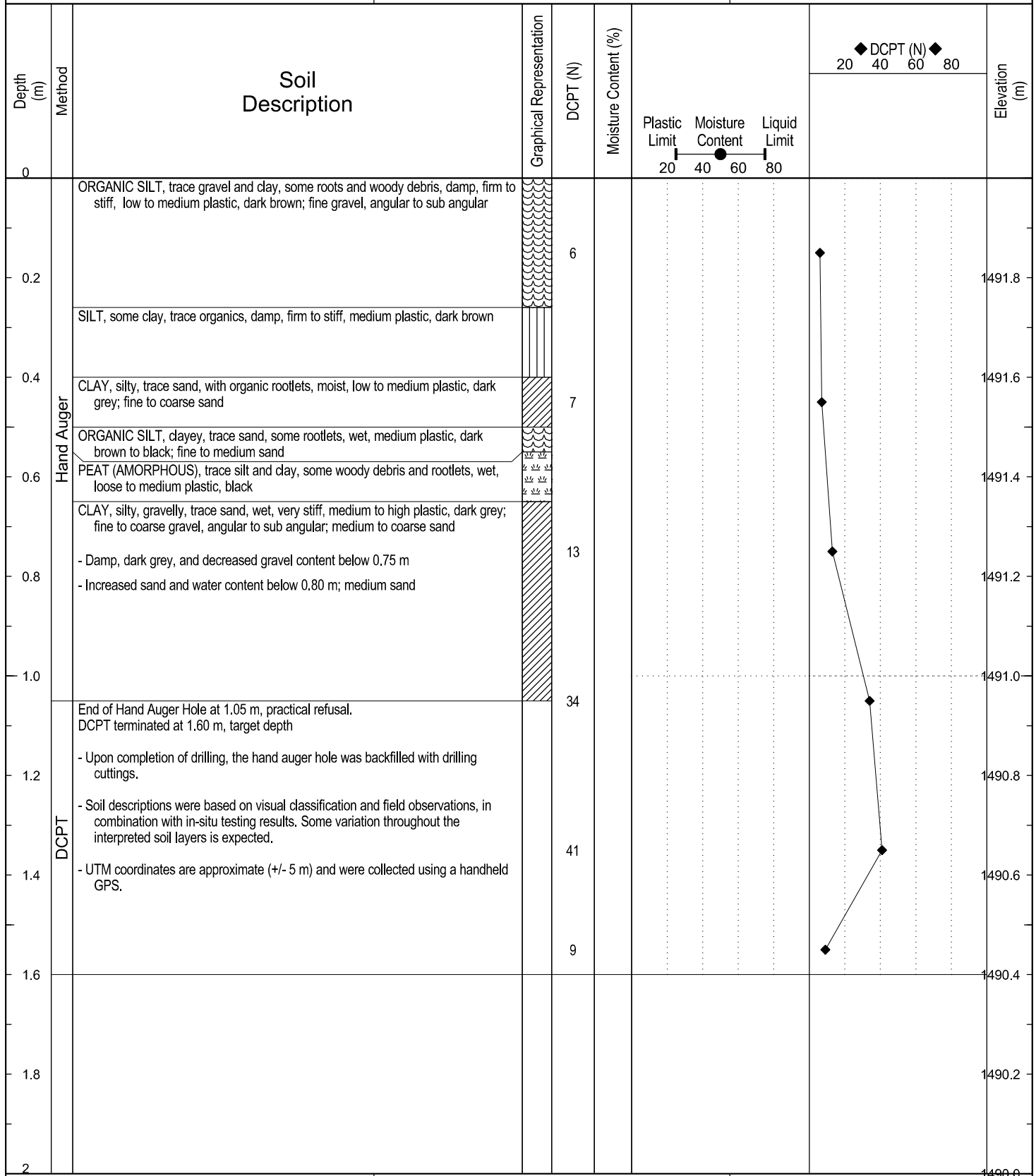
Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1492 m

Alberta

UTM: 581135 E; 5679168 N; Z 11 NAD83



TETRA TECH

Contractor:

Completion Depth: 1.6 m

Equipment Type: Hand Auger

Start Date: June 18, 2021

Logged By: AN/LT

Completion Date: June 18, 2021

Reviewed By: CL

Page 1 of 1



Borehole No: HA21-04

Project: Johnston Canyon Subsurface Exploration

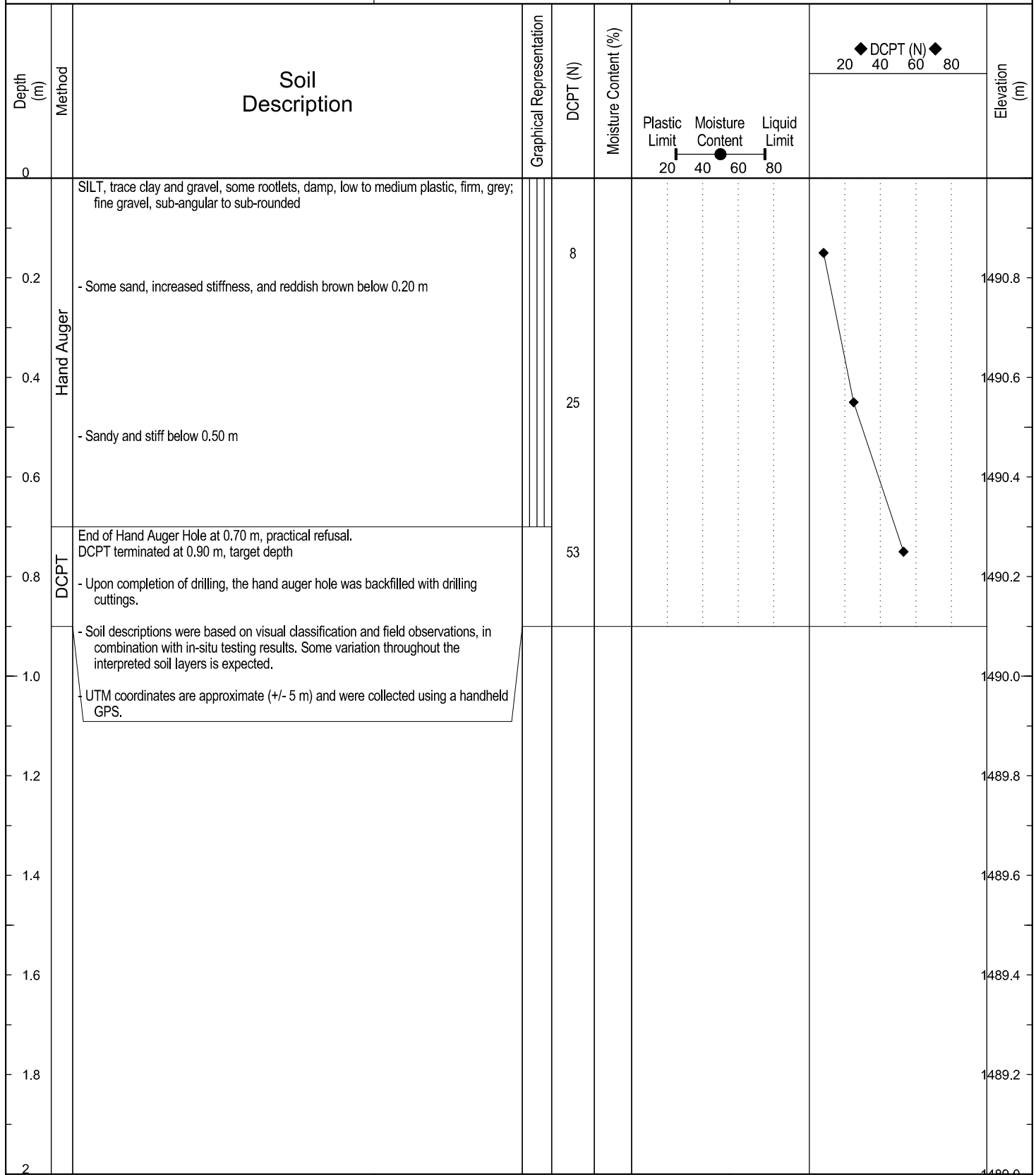
Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1491 m

Alberta

UTM: 581184 E; 5679210 N; Z 11 NAD83



TETRA TECH

Contractor:

Completion Depth: 0.9 m

Equipment Type: Hand Auger

Start Date: June 18, 2021

Logged By: AN/LT

Completion Date: June 18, 2021

Reviewed By: CL

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Borehole No: HA21-05

Project: Johnston Canyon Subsurface Exploration

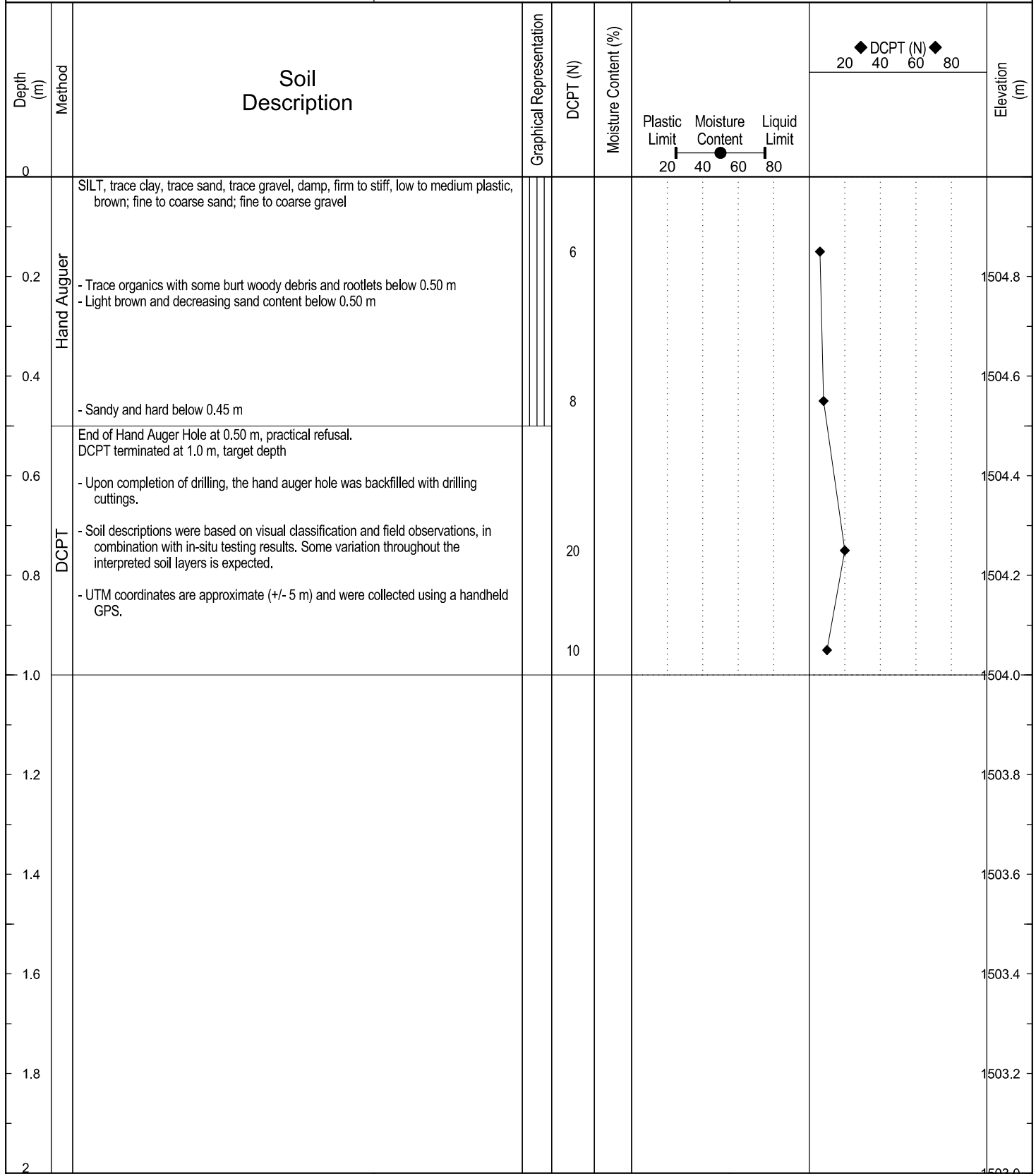
Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1505 m

Alberta

UTM: 581241 E; 5679289 N; Z 11 NAD83



TETRA TECH

Contractor:

Completion Depth: 1 m

Equipment Type: Hand Auger

Start Date: June 18, 2021

Logged By: AN/LT

Completion Date: June 18, 2021

Reviewed By: CL

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Borehole No: HA21-06

Project: Johnston Canyon Subsurface Exploration

Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1525 m

Alberta

UTM: 581322 E; 5679321 N; Z 11 NAD83

Depth (m)	Method	Soil Description	Graphical Representation	Moisture Content (%)	Elevation (m)
0				<div>Plastic Limit: 20, Moisture Content: 40, Liquid Limit: 80</div>	
0.2	Hand Auger	SILT, sandy, trace gravel and organics, damp, low plastic, dark brown to black; fine to coarse sand; fine to coarse gravel			1524.8
0.4		- Reddish brown and decreasing gravel content below 0.20 m - Increasing gravel content below 0.35 m			1524.6
0.6		End of Hand Auger Hole at 0.45 m, practical refusal. - Upon completion of drilling, the hand auger hole was backfilled with drilling cuttings. - Soil descriptions were based on visual classification and field observations, in combination with in-situ testing results. Some variation throughout the interpreted soil layers is expected. - UTM coordinates are approximate (+/- 5 m) and were collected using a handheld GPS.			1524.4
0.8					1524.2
1.0					1524.0
1.2					1523.8
1.4					1523.6
1.6					1523.4
1.8					1523.2
2					1523.0



TETRA TECH

Contractor:

Completion Depth: 0.45 m

Equipment Type: Hand Auger

Start Date: June 17, 2021

Logged By: AN/LT

Completion Date: June 17, 2021

Reviewed By: CL

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Borehole No: HA21-07

Project: Johnston Canyon Subsurface Exploration

Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1523 m

Alberta

UTM: 581352 E; 5679383 N; Z 11 NAD83

Depth (m)	Method	Soil Description	Graphical Representation	Moisture Content (%)	Elevation (m)
0				<div>Plastic Limit: 20, Moisture Content: 40, Liquid Limit: 80</div>	
0.2	Hand Auger	SILT, trace sand, damp, non-plastic, reddish brown; fine sand			1522.8
0.4		- Some sand and gravel below 0.40 m; fine gravel, sub-angular to sub-rounded			1522.6
0.6		End of Hand Auger Hole at 0.60 m, practical refusal.			1522.4
0.8		- Upon completion of drilling, the hand auger hole was backfilled with drilling cuttings. - Soil descriptions were based on visual classification and field observations, in combination with in-situ testing results. Some variation throughout the interpreted soil layers is expected. - UTM coordinates are approximate (+/- 5 m) and were collected using a handheld GPS.			1522.2
1.0					1522.0
1.2					1521.8
1.4					1521.6
1.6					1521.4
1.8					1521.2
2					1521.0



TETRA TECH

Contractor:

Completion Depth: 0.6 m

Equipment Type: Hand Auger

Start Date: June 17, 2021

Logged By: AN/LT

Completion Date: June 17, 2021

Reviewed By: CL

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Borehole No: HA21-08

Project: Johnston Canyon Subsurface Exploration

Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1523 m

Alberta

UTM: 581363 E; 5679405 N; Z 11 NAD83

Depth (m)	Method	Soil Description	Graphical Representation	Moisture Content (%)	Elevation (m)
0				<div>Plastic Limit: 20, Moisture Content: 40, Liquid Limit: 80</div>	
0.2	Hand Auger	SILT, trace clay, damp, low plastic, brown to black - Sandy, trace clay and organics below 0.20 m; fine to medium sand and gravel, sub-angular to sub-rounded			1522.8
0.4		End of Hand Auger Hole at 0.40 m, practical refusal. - Upon completion of drilling, the hand auger hole was backfilled with drilling cuttings. - Soil descriptions were based on visual classification and field observations, in combination with in-situ testing results. Some variation throughout the interpreted soil layers is expected. - UTM coordinates are approximate (+/- 5 m) and were collected using a handheld GPS.			1522.6
0.6					1522.4
0.8					1522.2
1.0					1522.0
1.2					1521.8
1.4					1521.6
1.6					1521.4
1.8					1521.2
2					1521.0



TETRA TECH

Contractor:

Completion Depth: 0.4 m

Equipment Type: Hand Auger

Start Date: June 17, 2021

Logged By: AN/LT

Completion Date: June 17, 2021

Reviewed By: CL

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Borehole No: HA21-09

Project: Johnston Canyon Subsurface Exploration

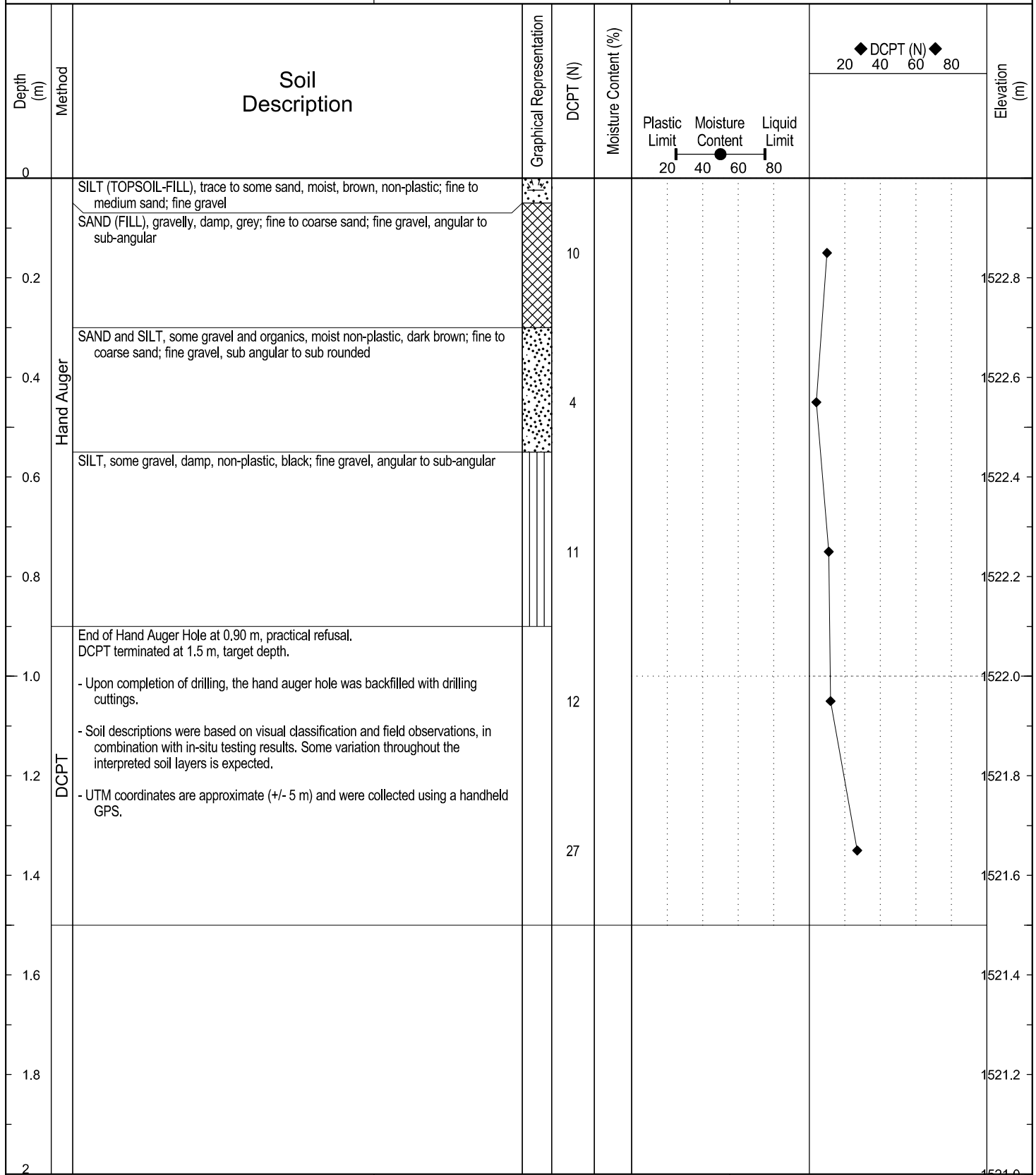
Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1523 m

Alberta

UTM: 581396 E; 5679430 N; Z 11 NAD83



TETRA TECH

Contractor:

Completion Depth: 1.5 m

Equipment Type: Hand Auger

Start Date: June 17, 2021

Logged By: AN/LT

Completion Date: June 17, 2021

Reviewed By: CL

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Borehole No: HA21-10

Project: Johnston Canyon Subsurface Exploration

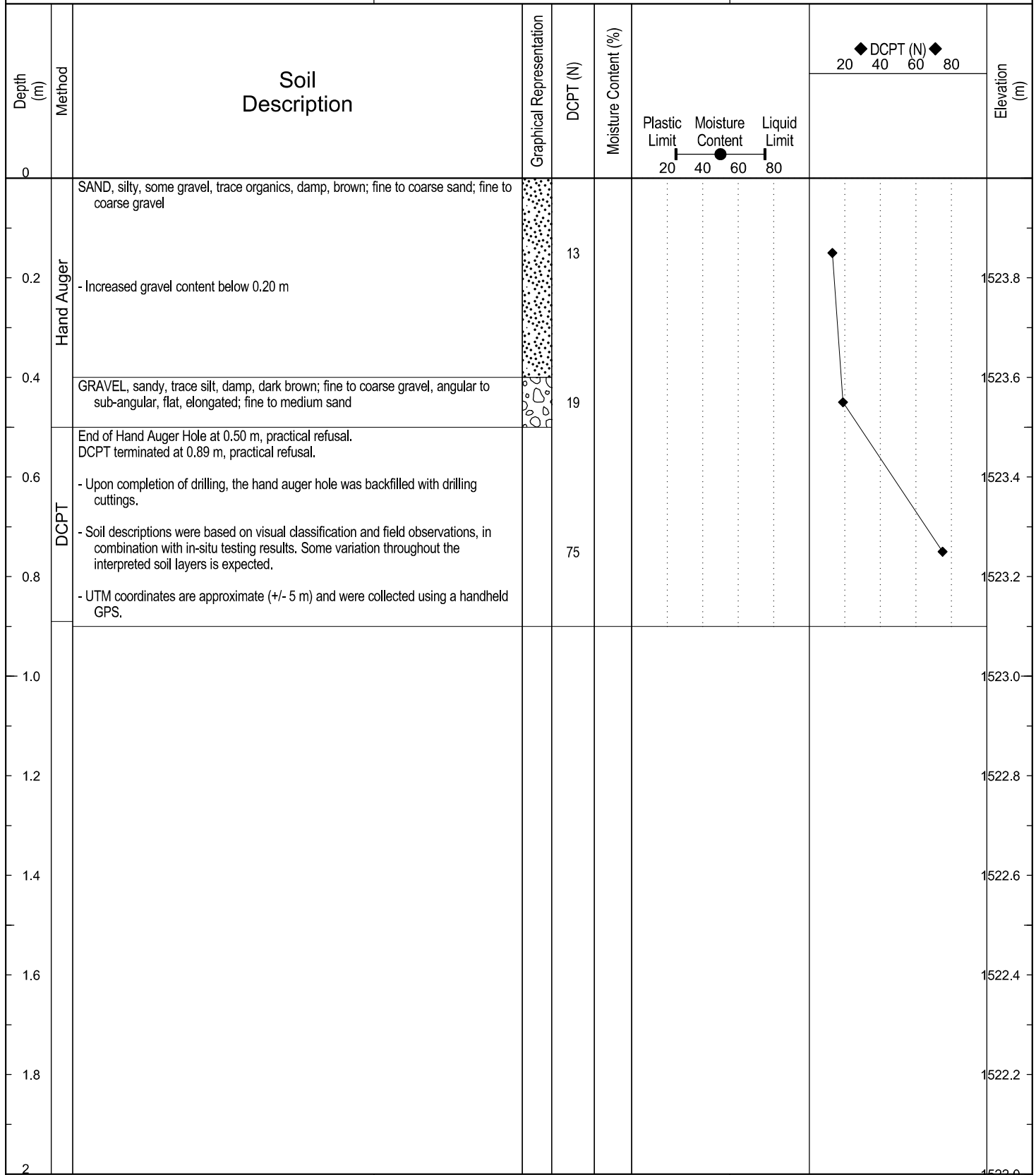
Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1524 m

Alberta

UTM: 581418 E; 5679421 N; Z 11 NAD83



TETRA TECH

Contractor:

Completion Depth: 0.9 m

Equipment Type: Hand Auger

Start Date: June 18, 2021

Logged By: AN/LT

Completion Date: June 18, 2021

Reviewed By: CL

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Borehole No: HA21-11

Project: Johnston Canyon Subsurface Exploration

Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1527 m

Alberta

UTM: 581449 E; 5679401 N; Z 11 NAD83

Depth (m)	Method	Soil Description	Graphical Representation	Moisture Content (%)	Elevation (m)
0				<div>Plastic Limit: 20, Moisture Content: 40, Liquid Limit: 80</div>	
0.2	Hand Auger	SILT and SAND, trace gravel, damp, non-plastic, black; fine to coarse sand; fine gravel, sub-angular to sub-rounded			1526.8
0.4					1526.6
0.6		End of Hand Auger Hole at 0.50 m, practical refusal. - Upon completion of drilling, the hand auger hole was backfilled with drilling cuttings. - Soil descriptions were based on visual classification and field observations, in combination with in-situ testing results. Some variation throughout the interpreted soil layers is expected. - UTM coordinates are approximate (+/- 5 m) and were collected using a handheld GPS.			1526.4
0.8					1526.2
1.0					1526.0
1.2					1525.8
1.4					1525.6
1.6					1525.4
1.8					1525.2
2					1525.0



TETRA TECH

Contractor:

Completion Depth: 0.5 m

Equipment Type: Hand Auger

Start Date: June 17, 2021

Logged By: AN/LT

Completion Date: June 17, 2021

Reviewed By: CL

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Borehole No: HA21-12

Project: Johnston Canyon Subsurface Exploration

Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1536 m

Alberta

UTM: 581510 E; 5679391 N; Z 11 NAD83

Depth (m)	Method	Soil Description	Graphical Representation	Moisture Content (%)	Elevation (m)
0				<div>Plastic Limit: 20, Moisture Content: 40, Liquid Limit: 80</div>	
0.2	Hand Auger	SAND, silty, trace gravel, damp, reddish brown; fine to medium sand; fine to coarse gravel, angular to sub-angular, flat, elongated			1535.8
0.4		End of Hand Auger Hole at 0.3 m, practical refusal. - Upon completion of drilling, the hand auger hole was backfilled with drilling cuttings. - Soil descriptions were based on visual classification and field observations, in combination with in-situ testing results. Some variation throughout the interpreted soil layers is expected. - UTM coordinates are approximate (+/- 5 m) and were collected using a handheld GPS.			1535.6
0.6					1535.4
0.8					1535.2
1.0					1535.0
1.2					1534.8
1.4					1534.6
1.6					1534.4
1.8					1534.2
2					1534.0



TETRA TECH

Contractor:

Completion Depth: 0.3 m

Equipment Type: Hand Auger

Start Date: June 17, 2021

Logged By: AN/LT

Completion Date: June 17, 2021

Reviewed By: CL

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Borehole No: HA21-13

Project: Johnston Canyon Subsurface Exploration

Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1502 m

Alberta

UTM: 581219 E; 5678961 N; Z 11 NAD83

Depth (m)	Method	Soil Description	Graphical Representation	Moisture Content (%)	Elevation (m)
0				<div>Plastic Limit: 20, Moisture Content: 40, Liquid Limit: 80</div>	
0.2		SILT (TOPSOIL), sandy, trace gravel and woody debris, moist, non-plastic, brown; fine to medium sand; fine gravel			1501.8
0.4					1501.6
0.6	Hand Auger	SILT, some sand, trace gravel, moist, non-plastic, light brown; fine to coarse sand; fine gravel, angular			1501.4
0.8					1501.2
1.0					1501.0
1.2					1500.8
1.4		End of Hand Auger Hole at 1.30 m, practical refusal. - Upon completion of drilling, the hand auger hole was backfilled with drilling cuttings. - Soil descriptions were based on visual classification and field observations, in combination with in-situ testing results. Some variation throughout the interpreted soil layers is expected. - UTM coordinates are approximate (+/- 5 m) and were collected using a handheld GPS.			1500.6
1.6					1500.4
1.8					1500.2
2					1500.0



TETRA TECH

Contractor:

Completion Depth: 1.3 m

Equipment Type: Hand Auger

Start Date: November 3, 2021

Logged By: TS

Completion Date: November 3, 2021

Reviewed By: CL

Page 1 of 1



Borehole No: HA21-14

Project: Johnston Canyon Subsurface Exploration

Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1494 m

Alberta

UTM: 581179 E; 5679199 N; Z 11 NAD83

Depth (m)	Method	Soil Description	Graphical Representation	Moisture Content (%)	Elevation (m)
0				<div> <div>Plastic Limit</div> <div>Moisture Content</div> <div>Liquid Limit</div> </div> <div> <div>20</div> <div>40</div> <div>60</div> <div>80</div> </div>	
0.2	Hand Auger	SILT (TOPSOIL), sandy, trace gravel and woody debris, moist, non-plastic, brown ; fine to medium sand; fine gravel			1493.8
0.4	Hand Auger	SAND and SILT, trace gravel, dry, light brown; fine to coarse sand; fine to coarse gravel, sub-rounded			1493.6
0.6	Hand Auger				1493.4
0.8	Hand Auger	End of Hand Auger Hole at 0.80 m, practical refusal.			1493.2
1.0	Hand Auger	<ul style="list-style-type: none"> - Upon completion of drilling, the hand auger hole was backfilled with drilling cuttings. - Soil descriptions were based on visual classification and field observations, in combination with in-situ testing results. Some variation throughout the interpreted soil layers is expected. - UTM coordinates are approximate (+/- 5 m) and were collected using a handheld GPS. 			1493.0
1.2	Hand Auger				1492.8
1.4	Hand Auger				1492.6
1.6	Hand Auger				1492.4
1.8	Hand Auger				1492.2
2	Hand Auger				1492.0



TETRA TECH

Contractor:

Completion Depth: 0.8 m

Equipment Type: Hand Auger

Start Date: November 4, 2021

Logged By: TS

Completion Date: November 4, 2021

Reviewed By: CL

Page 1 of 1



Borehole No: HA21-15

Project: Johnston Canyon Subsurface Exploration

Project No: 704.ENG.ROCK03205-01

Location: Banff National Park

Ground Elev: 1492 m

Alberta

UTM: 581170 E; 5679191 N; Z 11 NAD83

Depth (m)	Method	Soil Description	Graphical Representation	Moisture Content (%)	Elevation (m)
0				<div> <div>Plastic Limit</div> <div>Moisture Content</div> <div>Liquid Limit</div> </div> <div> <div>20</div> <div>40</div> <div>60</div> <div>80</div> </div>	
0.2	Hand Auger	SILT (TOPSOIL), sandy, trace gravel and woody debris, moist, non-plastic, brown ; fine to medium sand; fine gravel			1491.8
0.4	Hand Auger	SILT, some sand, trace gravel, dry, non-plastic, light brown; fine to coarse sand; fine to coarse gravel, sub-angular to sub-rounded			1491.6
0.6	Hand Auger				1491.4
0.8	Hand Auger	End of Hand Auger Hole at 0.70 m, practical refusal.			1491.2
1.0	Hand Auger	<ul style="list-style-type: none"> - Upon completion of drilling, the hand auger hole was backfilled with drilling cuttings. - Soil descriptions were based on visual classification and field observations, in combination with in-situ testing results. Some variation throughout the interpreted soil layers is expected. - UTM coordinates are approximate (+/- 5 m) and were collected using a handheld GPS. 			1491.0
1.2	Hand Auger				1490.8
1.4	Hand Auger				1490.6
1.6	Hand Auger				1490.4
1.8	Hand Auger				1490.2
2	Hand Auger				1490.0



TETRA TECH

Contractor:

Completion Depth: 0.7 m

Equipment Type: Hand Auger

Start Date: November 4, 2021

Logged By: TS

Completion Date: November 4, 2021

Reviewed By: CL

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APPENDIX C

DYNAMIC CONE PENETROMETER TEST LOGS

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 06-18-2021

DATE COMPLETED: 06-18-2021

HOLE #: Section 2 HA21-02

CREW: Aaron Nickoli

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	6	26.6	.....	7	LOOSE	FIRM
-	4	17.8	.....	5	LOOSE	FIRM
- 1 ft	5	22.2	.....	6	LOOSE	FIRM
-	7	31.1	.....	8	LOOSE	FIRM
-	7	31.1	.....	8	LOOSE	FIRM
- 2 ft	6	26.6	.....	7	LOOSE	FIRM
-	5	22.2	.....	6	LOOSE	FIRM
-	5	22.2	.....	6	LOOSE	FIRM
- 3 ft						
- 1 m			Termination Depth: 0.8 m Target depth reached.			
- 4 ft						
-						
- 5 ft						
-						
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 06-18-2021

DATE COMPLETED: 06-18-2021

HOLE #: Section 2 HA21-03

CREW: Aaron Nickoli

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	2	8.9	••	2	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 1 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 2 ft	3	13.3	•••	3	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
-	6	26.6	•••••	7	LOOSE	FIRM
- 3 ft	5	22.2	•••••	6	LOOSE	FIRM
- 1 m	9	40.0	•••••••	11	COMPACT	STIFF
-	17	65.6	••••••••••	18	COMPACT	VERY STIFF
- 4 ft	8	30.9	•••••	8	LOOSE	FIRM
-	22	84.9	••••••••••	24	COMPACT	VERY STIFF
-	12	46.3	•••••••	13	COMPACT	FIRM
- 5 ft	7	27.0	•••••	7	LOOSE	STIFF
-	9	34.7	•••••••	9	LOOSE	STIFF
-						
- 6 ft			Termination Depth: 1.6 m			
-			Target depth reached.			
- 2 m						
-						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 06-18-2021

DATE COMPLETED: 06-18-2021

HOLE #: Section 2 (216.5 m) HA21-04

CREW: Aaron Nickoli

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	3	13.3	...	3	VERY LOOSE	SOFT
-	2	8.9	..	2	VERY LOOSE	SOFT
- 1 ft	3	13.3	...	3	VERY LOOSE	SOFT
-	5	22.2	.....	6	LOOSE	FIRM
-	8	35.5	.....	10	LOOSE	STIFF
- 2 ft	12	53.3	.....	15	COMPACT	STIFF
-	14	62.2	.....	17	COMPACT	VERY STIFF
-	19	84.4	.....	24	COMPACT	VERY STIFF
- 3 ft	20	88.8	.....	25	COMPACT	VERY STIFF
- 1 m						
-						
- 4 ft			Termination Depth: 0.9 m Target depth reached.			
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
-						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
- 3 m						
- 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
- 4 m						
- 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 06-18-2021

DATE COMPLETED: 06-18-2021

HOLE #: Section 2 (325 m) HA21-05

CREW: Aaron Nickoli

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	3	13.3	...	3	VERY LOOSE	SOFT
-	2	8.9	..	2	VERY LOOSE	SOFT
- 1 ft	1	4.4	.	1	VERY LOOSE	VERY SOFT
-	2	8.9	..	2	VERY LOOSE	SOFT
-	3	13.3	...	3	VERY LOOSE	SOFT
- 2 ft	3	13.3	...	3	VERY LOOSE	SOFT
-	4	17.8	5	LOOSE	FIRM
-	7	31.1	8	LOOSE	FIRM
- 3 ft	9	40.0	11	COMPACT	STIFF
- 1 m	10	44.4	12	COMPACT	STIFF
- 4 ft			Termination Depth: 1.0 m Target depth reached.			
-						
- 5 ft						
-						
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
- 3 m						
- 10 ft						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m						
- 13 ft						

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 06-18-2021

DATE COMPLETED: 06-18-2021

HOLE #: Section 5 (117.5 m) HA21-09

CREW: Aaron Nickoli

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	4	17.8	.....	5	LOOSE	FIRM
-	5	22.2	.....	6	LOOSE	FIRM
- 1 ft	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
- 2 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
-	7	31.1	.....	8	LOOSE	FIRM
- 3 ft	2	8.9	••	2	VERY LOOSE	SOFT
- 1 m	4	17.8	.....	5	LOOSE	FIRM
-	4	15.4	....	4	VERY LOOSE	SOFT
- 4 ft	4	15.4	....	4	VERY LOOSE	SOFT
-	9	34.7	.....	9	LOOSE	STIFF
-	7	27.0	.....	7	LOOSE	FIRM
- 5 ft	11	42.5	.....	12	COMPACT	STIFF
-						
- 6 ft			Termination Depth: 1.5 m Target depth reached.			
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 06-18-2021

DATE COMPLETED: 06-18-2021

HOLE #: Section 5 (146 m) HA21-10

CREW: Aaron Nickoli

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	6	26.6	7	LOOSE	FIRM
-	3	13.3	...	3	VERY LOOSE	SOFT
- 1 ft	4	17.8	5	LOOSE	FIRM
-	4	17.8	5	LOOSE	FIRM
-	9	40.0	11	COMPACT	STIFF
- 2 ft	6	26.6	7	LOOSE	FIRM
-	9	40.0	11	COMPACT	STIFF
-	16	71.0	20	COMPACT	VERY STIFF
- 3 ft	50	222.0	25+	VERY DENSE	HARD
- 1 m			Termination Depth: 0.89 m 50 blows / 9 cm Practical refusal.			
-						
- 4 ft						
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
-						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
- 3 m						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
- 4 m						
- 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 1 (1 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	11	48.8	.....	13	COMPACT	STIFF
- 1 ft	5	22.2	.....	6	LOOSE	FIRM
-	6	26.6	.....	7	LOOSE	FIRM
-	5	22.2	.....	6	LOOSE	FIRM
- 2 ft	6	26.6	.....	7	LOOSE	FIRM
-	6	26.6	.....	7	LOOSE	FIRM
-	7	31.1	.....	8	LOOSE	FIRM
- 3 ft	6	26.6	.....	7	LOOSE	FIRM
- 1 m	5	22.2	.....	6	LOOSE	FIRM
-	4	15.4	...	4	VERY LOOSE	SOFT
- 4 ft	10	38.6	.....	11	COMPACT	STIFF
-	21	81.1	.....	23	COMPACT	VERY STIFF
-	25	96.5	.....	25+	COMPACT	VERY STIFF
- 5 ft						
-						
- 6 ft			Termination Depth: 1.4 m Target depth reached.			
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (151 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	7	31.1	.....	8	LOOSE	FIRM
- 1 ft	6	26.6	.....	7	LOOSE	FIRM
-	6	26.6	.....	7	LOOSE	FIRM
-	3	13.3	...	3	VERY LOOSE	SOFT
- 2 ft	7	31.1	.....	8	LOOSE	FIRM
-	4	17.8	....	5	LOOSE	FIRM
-	5	22.2	.....	6	LOOSE	FIRM
- 3 ft	2	8.9	..	2	VERY LOOSE	SOFT
- 1 m	5	22.2	.....	6	LOOSE	FIRM
-	4	15.4	...	4	VERY LOOSE	SOFT
- 4 ft	7	27.0	.....	7	LOOSE	FIRM
-	6	23.2	.....	6	LOOSE	FIRM
-	3	11.6	...	3	VERY LOOSE	SOFT
- 5 ft	4	15.4	....	4	VERY LOOSE	SOFT
-	3	11.6	...	3	VERY LOOSE	SOFT
-	2	7.7	..	2	VERY LOOSE	SOFT
- 6 ft	6	23.2	.....	6	LOOSE	FIRM
-	4	15.4	....	4	VERY LOOSE	SOFT
- 2 m	6	23.2	.....	6	LOOSE	FIRM
- 7 ft	10	34.2	.....	9	LOOSE	STIFF
-	10	34.2	.....	9	LOOSE	STIFF
-	10	34.2	.....	9	LOOSE	STIFF
- 8 ft	12	41.0	.....	11	COMPACT	STIFF
-	9	30.8	.....	8	LOOSE	FIRM
- 9 ft						
-			Termination Depth: 2.5 m			
-			Target depth reached.			
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (161 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE				N'	TESTED CONSISTENCY	
			0	50	100	150		NON-COHESIVE	COHESIVE
-	0	0.0					0	VERY LOOSE	VERY SOFT
-	0	0.0					0	VERY LOOSE	VERY SOFT
-	1 ft	1	•				1	VERY LOOSE	VERY SOFT
-		2	••				2	VERY LOOSE	SOFT
-		2	••				2	VERY LOOSE	SOFT
-	2 ft	1	•				1	VERY LOOSE	VERY SOFT
-		2	••				2	VERY LOOSE	SOFT
-		1	•				1	VERY LOOSE	VERY SOFT
-	3 ft	2	••				2	VERY LOOSE	SOFT
-	1 m	1	•				1	VERY LOOSE	VERY SOFT
-		2	••				2	VERY LOOSE	SOFT
-	4 ft	4	••••				4	VERY LOOSE	SOFT
-		3	•••				3	VERY LOOSE	SOFT
-		4	••••				4	VERY LOOSE	SOFT
-	5 ft	5	•••••				5	LOOSE	FIRM
-		10	••••••••				11	COMPACT	STIFF
-		5	•••••				5	LOOSE	FIRM
-	6 ft	4	••••				4	VERY LOOSE	SOFT
-		10	••••••••				11	COMPACT	STIFF
-	2 m	6	•••••				6	LOOSE	FIRM
-	7 ft	8	••••••				7	LOOSE	FIRM
-		9	•••••••				8	LOOSE	FIRM
-		12	••••••••				11	COMPACT	STIFF
-	8 ft	14	•••••••••				13	COMPACT	STIFF
-		16	••••••••••				15	COMPACT	STIFF
-	9 ft		Termination Depth: 2.5 m Target depth reached.						
-									
-	3 m 10 ft								
-									
-									
-	11 ft								
-									
-	12 ft								
-									
-	4 m 13 ft								

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (173 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	6	26.6	.....	7	LOOSE	FIRM
- 1 ft	7	31.1	.....	8	LOOSE	FIRM
-	3	13.3	..	3	VERY LOOSE	SOFT
-	2	8.9	..	2	VERY LOOSE	SOFT
- 2 ft	2	8.9	..	2	VERY LOOSE	SOFT
-	2	8.9	..	2	VERY LOOSE	SOFT
-	2	8.9	..	2	VERY LOOSE	SOFT
- 3 ft	2	8.9	..	2	VERY LOOSE	SOFT
- 1 m	5	22.2	.....	6	LOOSE	FIRM
-	6	23.2	.....	6	LOOSE	FIRM
- 4 ft	9	34.7	.....	9	LOOSE	STIFF
-	8	30.9	.....	8	LOOSE	FIRM
-	8	30.9	.....	8	LOOSE	FIRM
- 5 ft	15	57.9	.....	16	COMPACT	VERY STIFF
-	11	42.5	.....	12	COMPACT	STIFF
-	10	38.6	.....	11	COMPACT	STIFF
- 6 ft	9	34.7	.....	9	LOOSE	STIFF
-	18	69.5	.....	19	COMPACT	VERY STIFF
- 2 m	16	61.8	.....	17	COMPACT	VERY STIFF
- 7 ft	17	58.1	.....	16	COMPACT	VERY STIFF
-	19	65.0	.....	18	COMPACT	VERY STIFF
-	19	65.0	.....	18	COMPACT	VERY STIFF
- 8 ft	30	102.6	.....	25+	COMPACT	VERY STIFF
-						
- 9 ft			Termination Depth: 2.35 m 30 blows / 5 cm Practical refusal.			
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (185 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	4	17.8	.....	5	LOOSE	FIRM
-	3	13.3	...	3	VERY LOOSE	SOFT
-	2	8.9	..	2	VERY LOOSE	SOFT
- 2 ft	3	13.3	...	3	VERY LOOSE	SOFT
-	3	13.3	...	3	VERY LOOSE	SOFT
-	3	13.3	...	3	VERY LOOSE	SOFT
- 3 ft	2	8.9	..	2	VERY LOOSE	SOFT
- 1 m	3	13.3	...	3	VERY LOOSE	SOFT
-	3	11.6	...	3	VERY LOOSE	SOFT
- 4 ft	6	23.2	.....	6	LOOSE	FIRM
-	12	46.3	.....	13	COMPACT	STIFF
-	25	96.5	.....	25+	COMPACT	VERY STIFF
- 5 ft						
-						
- 6 ft			Termination Depth: 1.35 m			
-			25 blows / 5 cm			
- 2 m			Practical refusal.			
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (194 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 1 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 2 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	4	17.8	••••	5	LOOSE	FIRM
-	7	31.1	•••••••	8	LOOSE	FIRM
- 3 ft	4	17.8	••••	5	LOOSE	FIRM
- 1 m	21	93.2	••••••••••••••••••••	25+	COMPACT	VERY STIFF
-	28	108.1	••••••••••••••••••••	25+	COMPACT	VERY STIFF
- 4 ft	25	96.5	••••••••••••••••••••	25+	COMPACT	VERY STIFF
-						
-						
- 5 ft			Termination Depth: 1.13 m 25 blows / 3 cm Practical refusal.			
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (200 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	2	8.9	..	2	VERY LOOSE	SOFT
-	4	17.8	....	5	LOOSE	FIRM
-	5	22.2	.....	6	LOOSE	FIRM
- 2 ft	3	13.3	...	3	VERY LOOSE	SOFT
-	4	17.8	....	5	LOOSE	FIRM
-	12	53.3	.....	15	COMPACT	STIFF
- 3 ft	25	111.0	.....	25+	DENSE	HARD
- 1 m						
-						
- 4 ft			Termination Depth: 0.85 m			
-			25 blows / 5 cm			
-			Practical refusal.			
- 5 ft						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (210 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	3	13.3	...	3	VERY LOOSE	SOFT
-	5	22.2	.....	6	LOOSE	FIRM
-	20	88.8	.....	25	COMPACT	VERY STIFF
- 2 ft						
-			Note: Refusal, suspected root.			
-						
- 3 ft						
- 1 m						
-						
- 4 ft						
-						
- 5 ft						
-						
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (215 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	8	35.5	.....	10	LOOSE	STIFF
- 1 ft	7	31.1	.....	8	LOOSE	FIRM
-	5	22.2	.....	6	LOOSE	FIRM
-	26	115.4	.....	25+	DENSE	HARD
- 2 ft	7	31.1	.....	8	LOOSE	FIRM
-	7	31.1	.....	8	LOOSE	FIRM
-	8	35.5	.....	10	LOOSE	STIFF
- 3 ft	10	44.4	.....	12	COMPACT	STIFF
- 1 m	10	44.4	.....	12	COMPACT	STIFF
-	9	34.7	.....	9	LOOSE	STIFF
- 4 ft	10	38.6	.....	11	COMPACT	STIFF
-	16	61.8	.....	17	COMPACT	VERY STIFF
-	22	84.9	.....	24	COMPACT	VERY STIFF
- 5 ft	22	84.9	.....	24	COMPACT	VERY STIFF
-	24	92.6	.....	25+	COMPACT	VERY STIFF
-	28	108.1	.....	25+	COMPACT	VERY STIFF
- 6 ft						
- 2 m			Termination Depth: 1.65 m 28 blows / 5 cm Practical refusal.			
- 8 ft			Notes: Cobble inferred at 0.5 m.			
- 9 ft						
- 3 m 10 ft						
- 11 ft						
- 12 ft						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (230 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	9	40.0	.....	11	COMPACT	STIFF
-	10	44.4	.....	12	COMPACT	STIFF
-	13	57.7	.....	16	COMPACT	VERY STIFF
- 2 ft	20	88.8	.....	25	COMPACT	VERY STIFF
-	25	111.0	.....	25+	DENSE	HARD
- 3 ft						
- 1 m			Termination Depth: 0.65 m 25 blows / 5 cm Practical refusal.			
- 4 ft						
-						
- 5 ft						
-						
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (240 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	6	26.6	.....	7	LOOSE	FIRM
- 2 ft	9	40.0	.....	11	COMPACT	STIFF
-	15	66.6	.....	19	COMPACT	VERY STIFF
-	21	93.2	.....	25+	COMPACT	VERY STIFF
- 3 ft	28	124.3	.....	25+	DENSE	HARD
- 1 m	24	106.6	.....	25+	COMPACT	VERY STIFF
-	25	96.5	.....	25+	COMPACT	VERY STIFF
- 4 ft						
-			Termination Depth: 1.02 m			
- 5 ft			25 blows / 2 cm			
-			Practical refusal.			
- 6 ft						
- 2 m						
- 7 ft						
- 8 ft						
- 9 ft						
- 3 m 10 ft						
- 11 ft						
- 12 ft						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (285 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	2	8.9	..	2	VERY LOOSE	SOFT
- 1 ft	3	13.3	...	3	VERY LOOSE	SOFT
-	12	53.3	.....	15	COMPACT	STIFF
-	25	111.0	.....	25+	DENSE	HARD
- 2 ft	25	111.0	.....	25+	DENSE	HARD
-	25	111.0	.....	25+	DENSE	HARD
-						
- 3 ft						
- 1 m			Termination Depth: 0.64 cm			
-			25 blows / 4 cm			
- 4 ft			Practical refusal.			
-						
-						
- 5 ft						
-						
-						
- 6 ft						
-						
- 2 m						
-						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (295 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	0	0.0		0	VERY LOOSE	VERY SOFT
-	7	31.1	.....	8	LOOSE	FIRM
-	17	75.5	.....	21	COMPACT	VERY STIFF
- 2 ft	23	102.1	.....	25+	COMPACT	VERY STIFF
-	50	222.0	.....	25+	VERY DENSE	HARD
- 3 ft						
- 1 m			Termination Depth: 0.7 m Practical refusal.			
- 4 ft						
-						
- 5 ft						
-						
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (305 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	4	17.8	.....	5	LOOSE	FIRM
-	8	35.5	.....	10	LOOSE	STIFF
-	12	53.3	.....	15	COMPACT	STIFF
- 2 ft	15	66.6	.....	19	COMPACT	VERY STIFF
-	36	159.8	.....	25+	DENSE	HARD
-	40	177.6	.....	25+	DENSE	HARD
- 3 ft	25	111.0	.....	25+	DENSE	HARD
- 1 m						
-						
- 4 ft			Termination Depth: 0.84 m 25 blows / 4 cm Practical refusal.			
-						
- 5 ft						
-						
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (320 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	11	48.8	.....	13	COMPACT	STIFF
-	16	71.0	.....	20	COMPACT	VERY STIFF
-	16	71.0	.....	20	COMPACT	VERY STIFF
- 2 ft	24	106.6	.....	25+	COMPACT	VERY STIFF
-	35	155.4	.....	25+	DENSE	HARD
-	25	111.0	.....	25+	DENSE	HARD
- 3 ft						
- 1 m						
-			Termination Depth: 0.75 m			
- 4 ft			25 blows / 5 cm			
-			Practical refusal.			
-						
- 5 ft						
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-03-2021

DATE COMPLETED: 11-03-2021

HOLE #: Section 2 (332 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	9	40.0	.....	11	COMPACT	STIFF
-	5	22.2	.....	6	LOOSE	FIRM
-	6	26.6	.....	7	LOOSE	FIRM
- 2 ft	10	44.4	.....	12	COMPACT	STIFF
-	17	75.5	.....	21	COMPACT	VERY STIFF
-	15	66.6	.....	19	COMPACT	VERY STIFF
- 3 ft	20	88.8	.....	25	COMPACT	VERY STIFF
- 1 m	50	222.0	.....	25+	VERY DENSE	HARD
-						
- 4 ft						
-			Termination Depth: 1.0 m			
-			Practical refusal.			
- 5 ft						
-						
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-04-2021

DATE COMPLETED: 11-04-2021

HOLE #: Section 3 (1 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	12	53.3	.....	15	COMPACT	STIFF
- 1 ft	21	93.2	.....	25+	COMPACT	VERY STIFF
-	11	48.8	.....	13	COMPACT	STIFF
-	20	88.8	.....	25	COMPACT	VERY STIFF
- 2 ft	14	62.2	.....	17	COMPACT	VERY STIFF
-	18	79.9	.....	22	COMPACT	VERY STIFF
-	26	115.4	.....	25+	DENSE	HARD
- 3 ft	25	111.0	.....	25+	DENSE	HARD
- 1 m						
-			Termination Depth: 0.84 m			
- 4 ft			25 blows / 4 cm			
-			Practical refusal.			
-						
-						
-						
- 6 ft						
-						
- 2 m						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
- 3 m						
- 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
- 4 m						
- 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-04-2021

DATE COMPLETED: 11-04-2021

HOLE #: Section 3 (10 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	10	44.4	.....	12	COMPACT	STIFF
- 1 ft	6	26.6	.....	7	LOOSE	FIRM
-	5	22.2	.....	6	LOOSE	FIRM
-	6	26.6	.....	7	LOOSE	FIRM
- 2 ft	6	26.6	.....	7	LOOSE	FIRM
-	8	35.5	.....	10	LOOSE	STIFF
-	11	48.8	.....	13	COMPACT	STIFF
- 3 ft	17	75.5	.....	21	COMPACT	VERY STIFF
- 1 m	20	88.8	.....	25	COMPACT	VERY STIFF
-	20	77.2	.....	22	COMPACT	VERY STIFF
- 4 ft	25	96.5	.....	25+	COMPACT	VERY STIFF
-						
-						
- 5 ft			Termination Depth: 1.11 m 25 blows / 1 cm Practical refusal.			
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-04-2021

DATE COMPLETED: 11-04-2021

HOLE #: Section 3 (20 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 1 ft	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	4	17.8	••••	5	LOOSE	FIRM
-	6	26.6	•••••	7	LOOSE	FIRM
- 2 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	20	88.8	••••••••••••••••	25	COMPACT	VERY STIFF
-	29	128.8	••••••••••••••••	25+	DENSE	HARD
- 3 ft	15	66.6	••••••••••	19	COMPACT	VERY STIFF
- 1 m	8	35.5	•••••••	10	LOOSE	STIFF
-	12	46.3	••••••••	13	COMPACT	STIFF
- 4 ft	15	57.9	••••••••	16	COMPACT	VERY STIFF
-	14	54.0	••••••••	15	COMPACT	STIFF
-	17	65.6	••••••••	18	COMPACT	VERY STIFF
- 5 ft	26	100.4	••••••••••••••	25+	COMPACT	VERY STIFF
-						
- 6 ft			Termination Depth: 1.45 m			
-			26 blows / 5 cm			
- 2 m			Practical refusal.			
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-04-2021

DATE COMPLETED: 11-04-2021

HOLE #: Section 3 (30 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	7	31.1	.....	8	LOOSE	FIRM
- 1 ft	3	13.3	...	3	VERY LOOSE	SOFT
-	7	31.1	.....	8	LOOSE	FIRM
-	12	53.3	.....	15	COMPACT	STIFF
- 2 ft	15	66.6	.....	19	COMPACT	VERY STIFF
-	9	40.0	.....	11	COMPACT	STIFF
-	14	62.2	.....	17	COMPACT	VERY STIFF
- 3 ft	15	66.6	.....	19	COMPACT	VERY STIFF
- 1 m	20	88.8	.....	25	COMPACT	VERY STIFF
-	30	115.8	.....	25+	DENSE	HARD
- 4 ft						
-			Termination Depth: 1.05 m			
- 5 ft			30 blows / 5 cm			
-			Practical refusal.			
- 6 ft						
- 2 m						
- 7 ft						
- 8 ft						
- 9 ft						
- 3 m 10 ft						
- 11 ft						
- 12 ft						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-04-2021

DATE COMPLETED: 11-04-2021

HOLE #: Section 5 (40 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 1 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	6	26.6	••••••	7	LOOSE	FIRM
-	15	66.6	••••••••••••••••	19	COMPACT	VERY STIFF
- 2 ft	12	53.3	••••••••••	15	COMPACT	STIFF
-	12	53.3	••••••••••	15	COMPACT	STIFF
-	10	44.4	••••••••	12	COMPACT	STIFF
- 3 ft	7	31.1	•••••••	8	LOOSE	FIRM
- 1 m	11	48.8	•••••••••	13	COMPACT	STIFF
-	18	69.5	••••••••••••	19	COMPACT	VERY STIFF
- 4 ft	25	96.5	••••••••••••••••	25+	COMPACT	VERY STIFF
-						
- 5 ft			Termination Depth: 1.13 m 25 blows / 3 cm Practical refusal.			
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-04-2021

DATE COMPLETED: 11-04-2021

HOLE #: Section 5 (113 m) Attempt 1

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
-	8	35.5	••••••••	10	LOOSE	STIFF
- 2 ft						
-			Termination Depth: 0.5 m			
-			Practical refusal.			
- 3 ft						
- 1 m			Notes: 0.4 m off trail.			
-						
- 4 ft						
-						
- 5 ft						
-						
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-04-2021

DATE COMPLETED: 11-04-2021

HOLE #: Section 5 (113 m) Attempt 2

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 1 ft	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	7	31.1	••••••••	8	LOOSE	FIRM
- 2 ft	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	4	17.8	••••	5	LOOSE	FIRM
-	7	31.1	••••••••	8	LOOSE	FIRM
- 3 ft	6	26.6	••••••	7	LOOSE	FIRM
- 1 m	3	13.3	•••	3	VERY LOOSE	SOFT
-	17	65.6	••••••••••••••	18	COMPACT	VERY STIFF
- 4 ft	25	96.5	••••••••••••••	25+	COMPACT	VERY STIFF
-						
-						
- 5 ft			Termination Depth: 1.15 m 25 blows / 5 cm Practical refusal.			
-						
- 6 ft						
-						
- 2 m			Notes: 0.8 m off trail.			
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-04-2021

DATE COMPLETED: 11-04-2021

HOLE #: Section 5 (117.5 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	4	17.8	.....	5	LOOSE	FIRM
-	3	13.3	...	3	VERY LOOSE	SOFT
-	2	8.9	..	2	VERY LOOSE	SOFT
- 2 ft	1	4.4	.	1	VERY LOOSE	VERY SOFT
-	1	4.4	.	1	VERY LOOSE	VERY SOFT
-	1	4.4	.	1	VERY LOOSE	VERY SOFT
- 3 ft	10	44.4	.....	12	COMPACT	STIFF
- 1 m	8	35.5	.....	10	LOOSE	STIFF
-	6	23.2	.....	6	LOOSE	FIRM
- 4 ft	5	19.3	.....	5	LOOSE	FIRM
-	12	46.3	.....	13	COMPACT	STIFF
-	6	23.2	.....	6	LOOSE	FIRM
- 5 ft	13	50.2	.....	14	COMPACT	STIFF
-	13	50.2	.....	14	COMPACT	STIFF
-	23	88.8	.....	25	COMPACT	VERY STIFF
- 6 ft	25	96.5	.....	25+	COMPACT	VERY STIFF
-						
- 2 m			Termination Depth: 1.71 m			
- 7 ft			25 blows / 1 cm			
-			Practical refusal.			
-						
- 8 ft						
-						
- 9 ft						
-						
- 3 m 10 ft						
-						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m 13 ft						

WILDCAT DYNAMIC CONE LOG

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COWI North America, Ltd.
138 13th Street East, Suite 400
North Vancouver, BC, V7L 0E5

PROJECT NUMBER: ENG.ROCK03205-01

DATE STARTED: 11-04-2021

DATE COMPLETED: 11-04-2021

HOLE #: Section 8 (1 m)

CREW: Aaron Nickoli, Tyler Southam

PROJECT: Johnston Canyon Subsurface Exploration

ADDRESS: Johnston Canyon, Bow Valley Parkway

LOCATION: Banff National Park, Alberta

SURFACE ELEVATION: _____

WATER ON COMPLETION: _____

HAMMER WEIGHT: 35 lbs.

CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm ²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY	
					NON-COHESIVE	COHESIVE
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	3	13.3	...	3	VERY LOOSE	SOFT
- 1 ft	4	17.8	....	5	LOOSE	FIRM
-	8	35.5	.....	10	LOOSE	STIFF
-	9	40.0	.....	11	COMPACT	STIFF
- 2 ft	11	48.8	.....	13	COMPACT	STIFF
-	25	111.0	.....	25+	DENSE	HARD
- 3 ft						
- 1 m			Termination Depth: 0.7 m Practical refusal.			
- 4 ft						
-						
- 5 ft						
-						
- 6 ft						
- 2 m						
- 7 ft						
-						
- 8 ft						
-						
- 9 ft						
- 3 m						
- 10 ft						
-						
- 11 ft						
-						
- 12 ft						
-						
- 4 m						
- 13 ft						

APPENDIX D

ANNOTATED SITE PHOTOGRAPHS



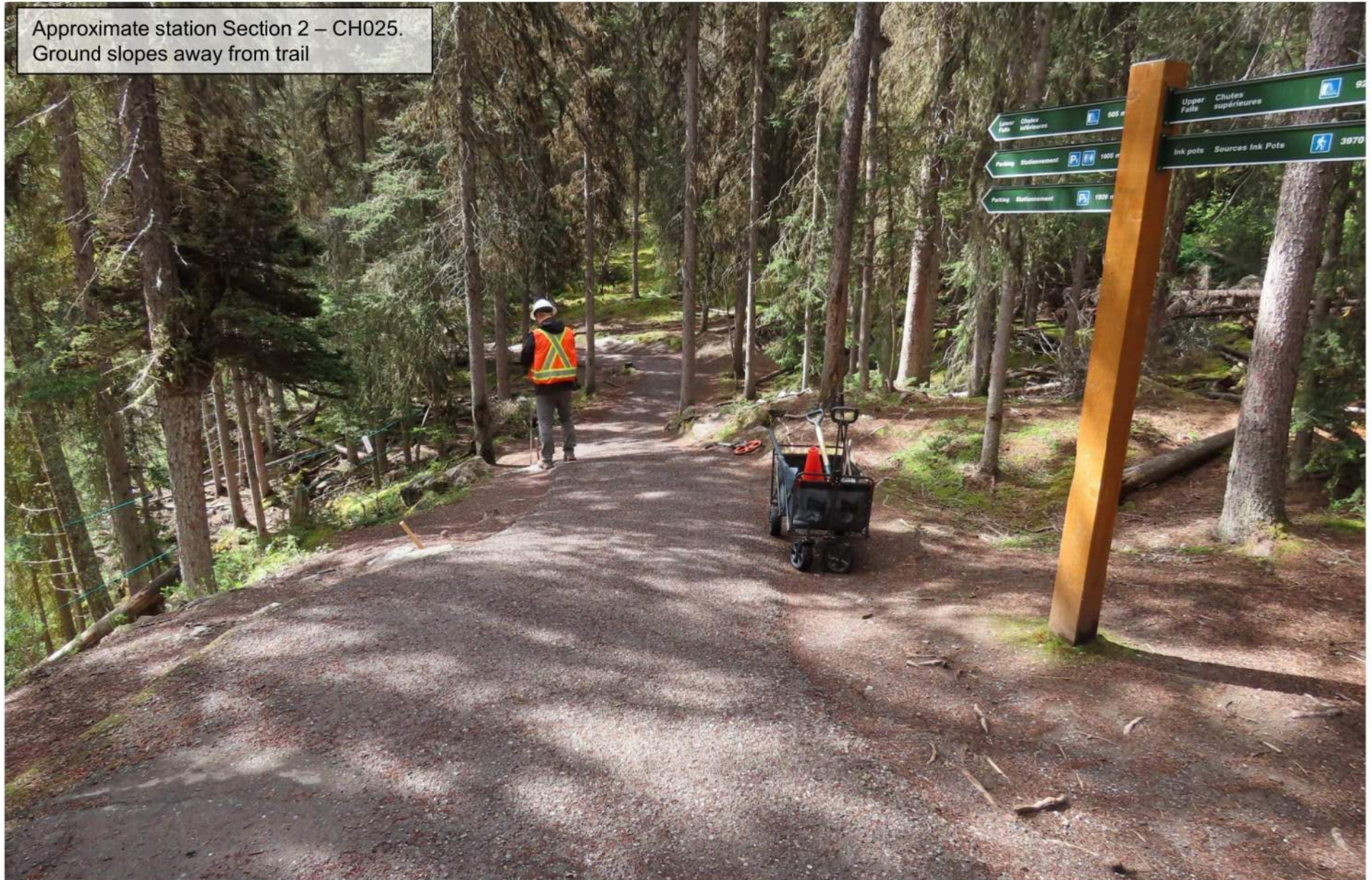








Approximate station Section 2 – CH025.
Ground slopes away from trail





Approximately Section 2 – CH100



Approximate station Section 2 – CH125
Location of Section 2 Auger 1 and DCPT hole



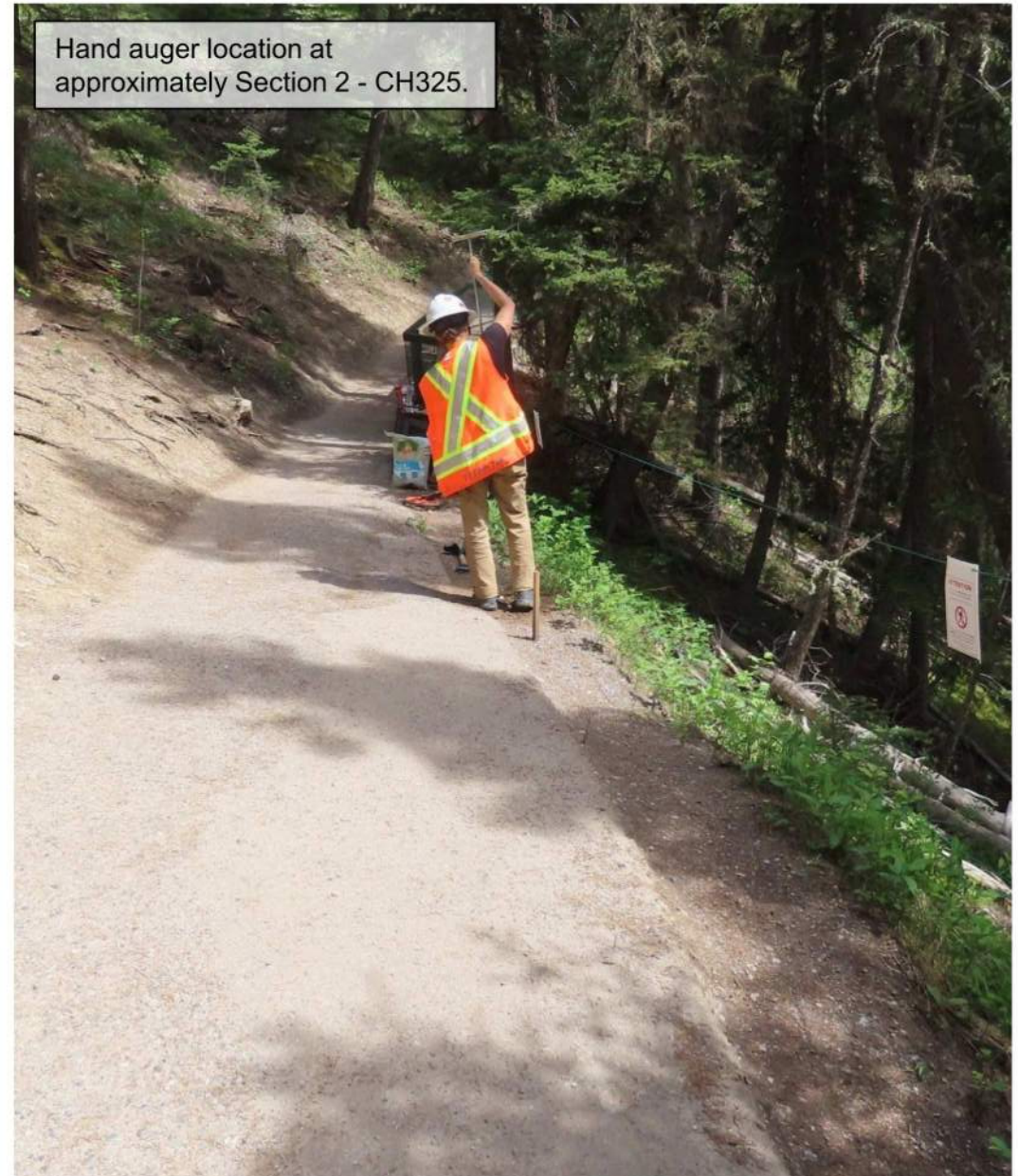




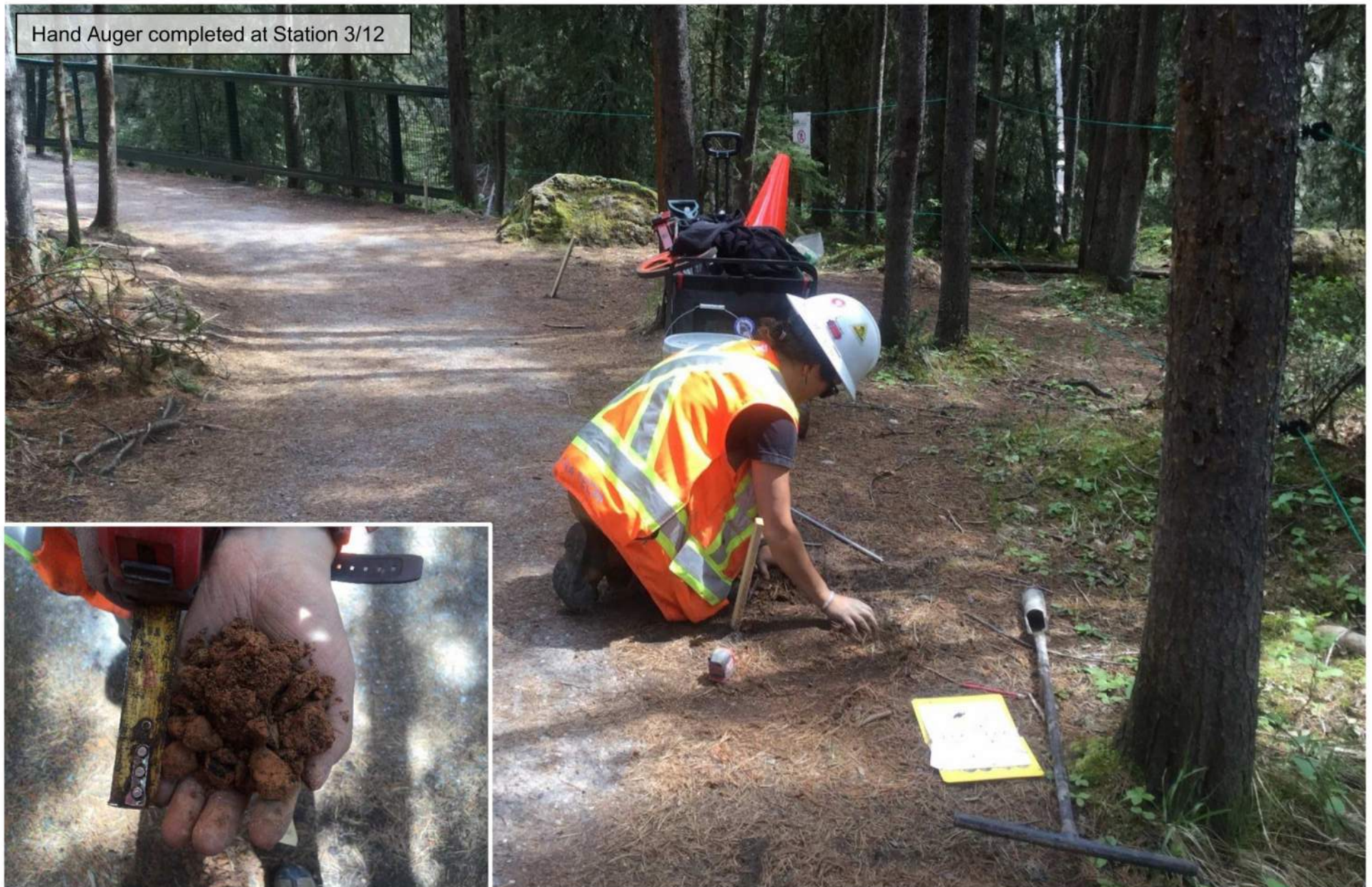














Start of Section 5. Shallow sloping ground away from trail.







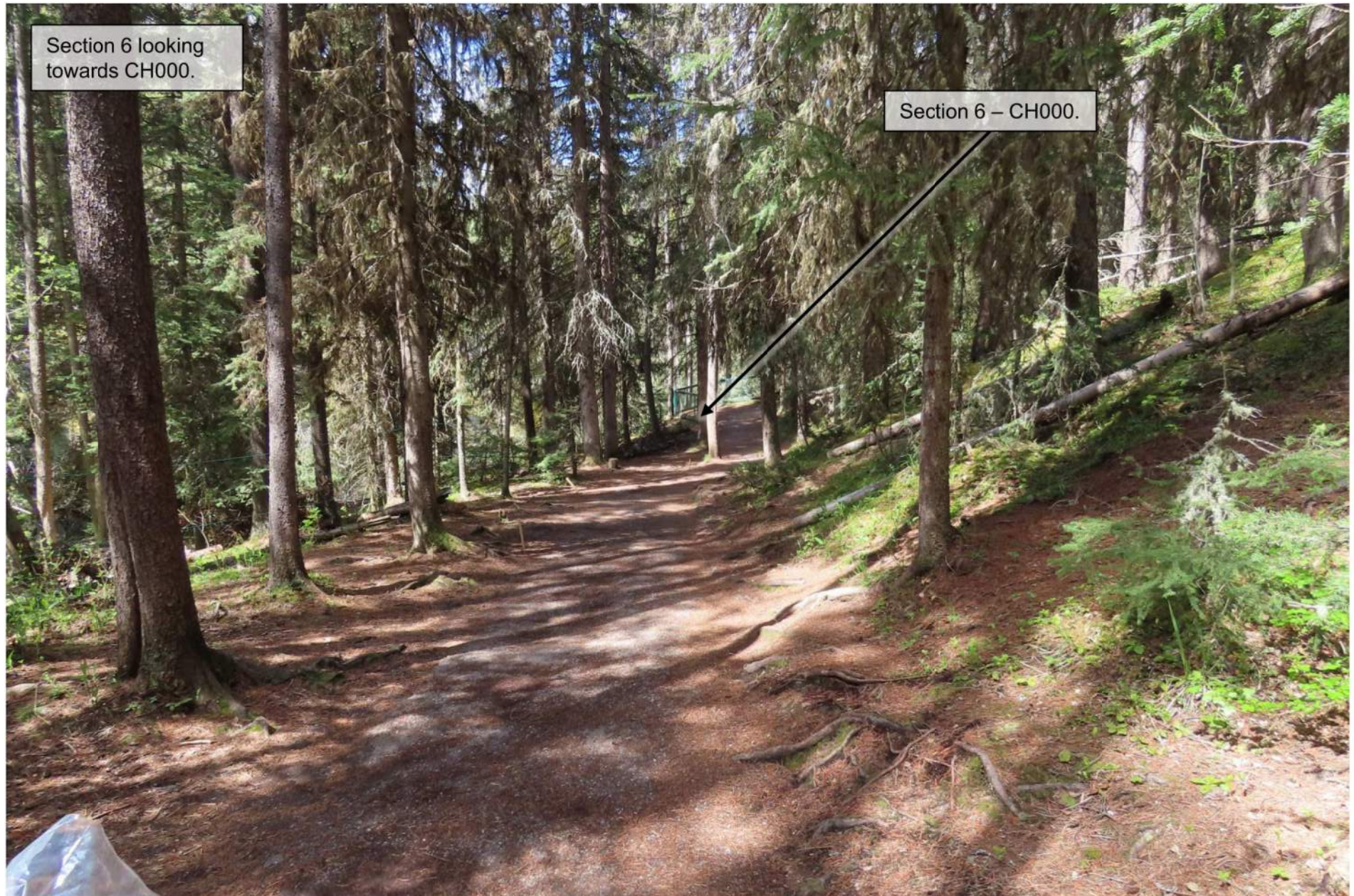
Sloping ground below trail on approach to twin bridge structure.

Start of bridge at Section 5 - CH113.5.





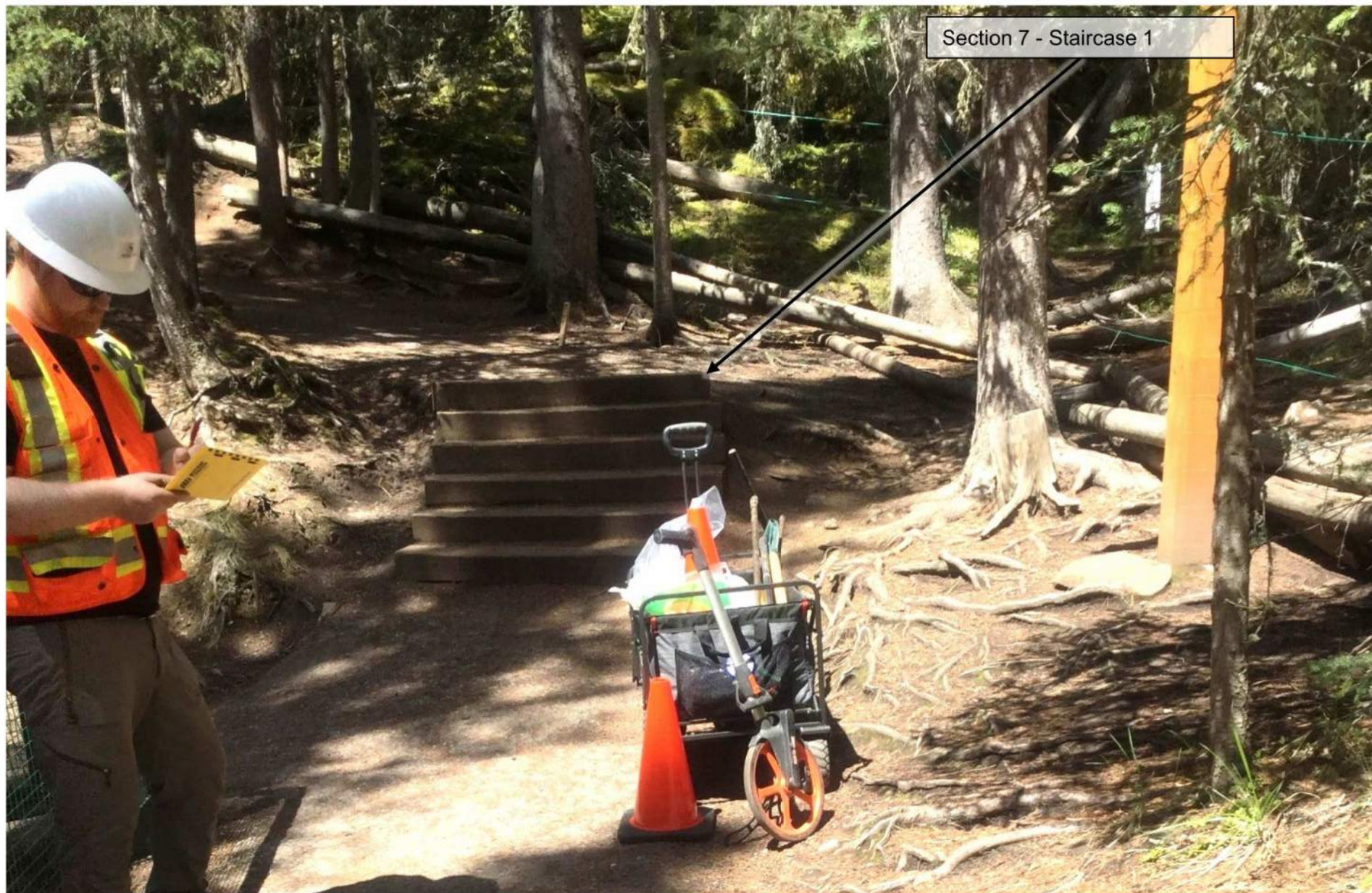








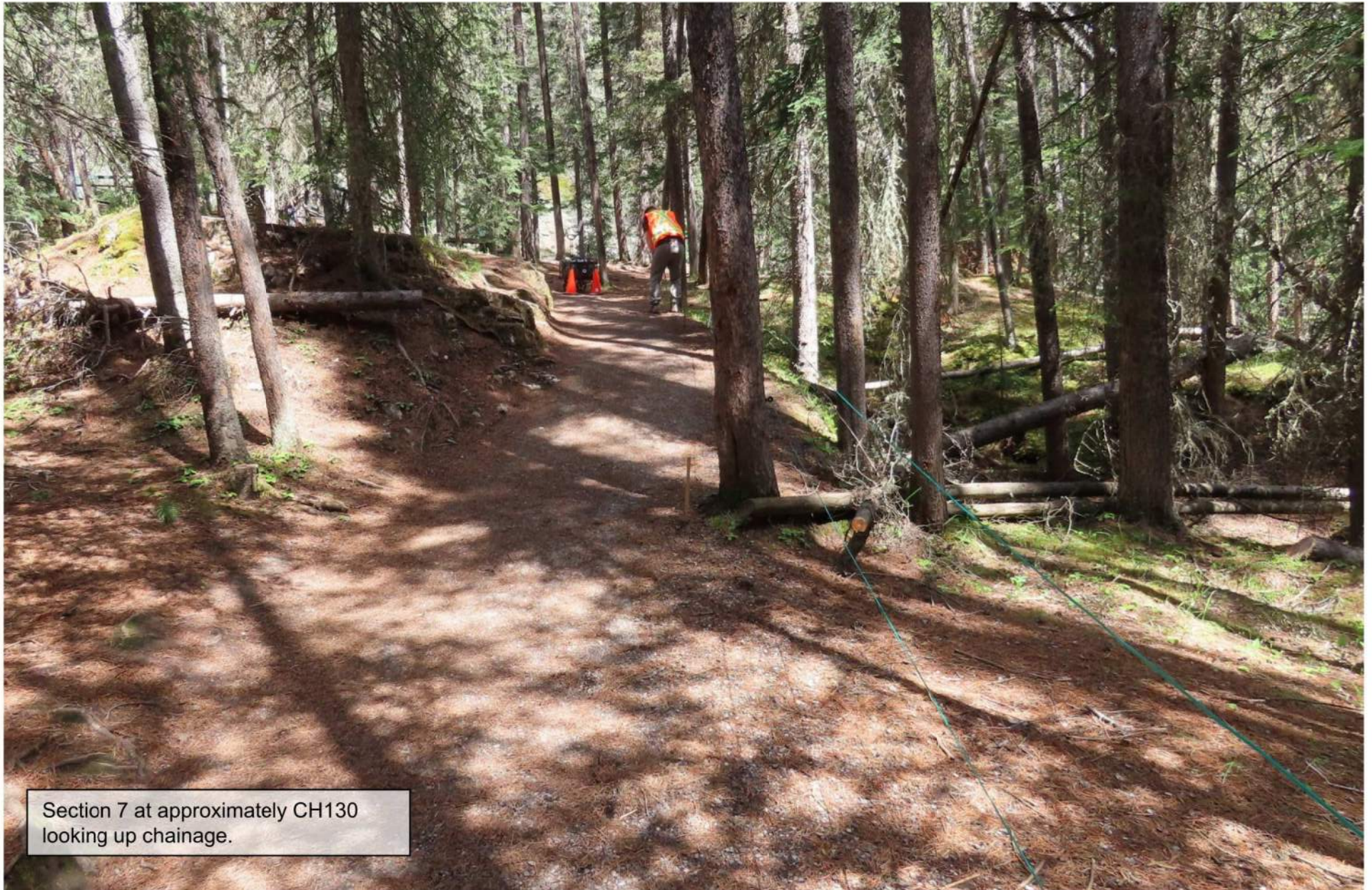








Section 7 at approximately CH060 looking up chainage. Sloping ground along trail section from approximately CH065 to CH085.



Section 7 at approximately CH130
looking up chainage.



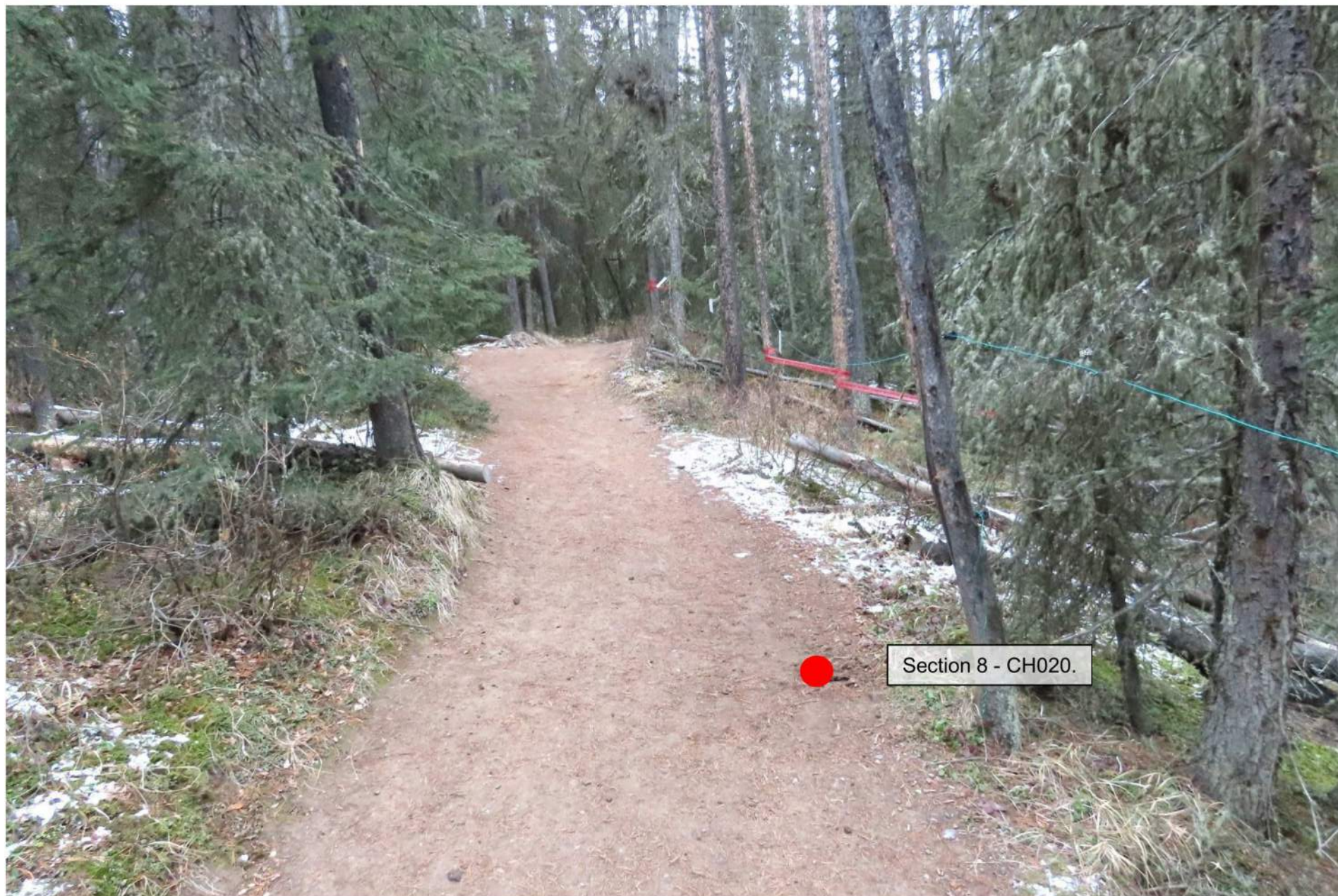


Existing railing section at start of Section 8.



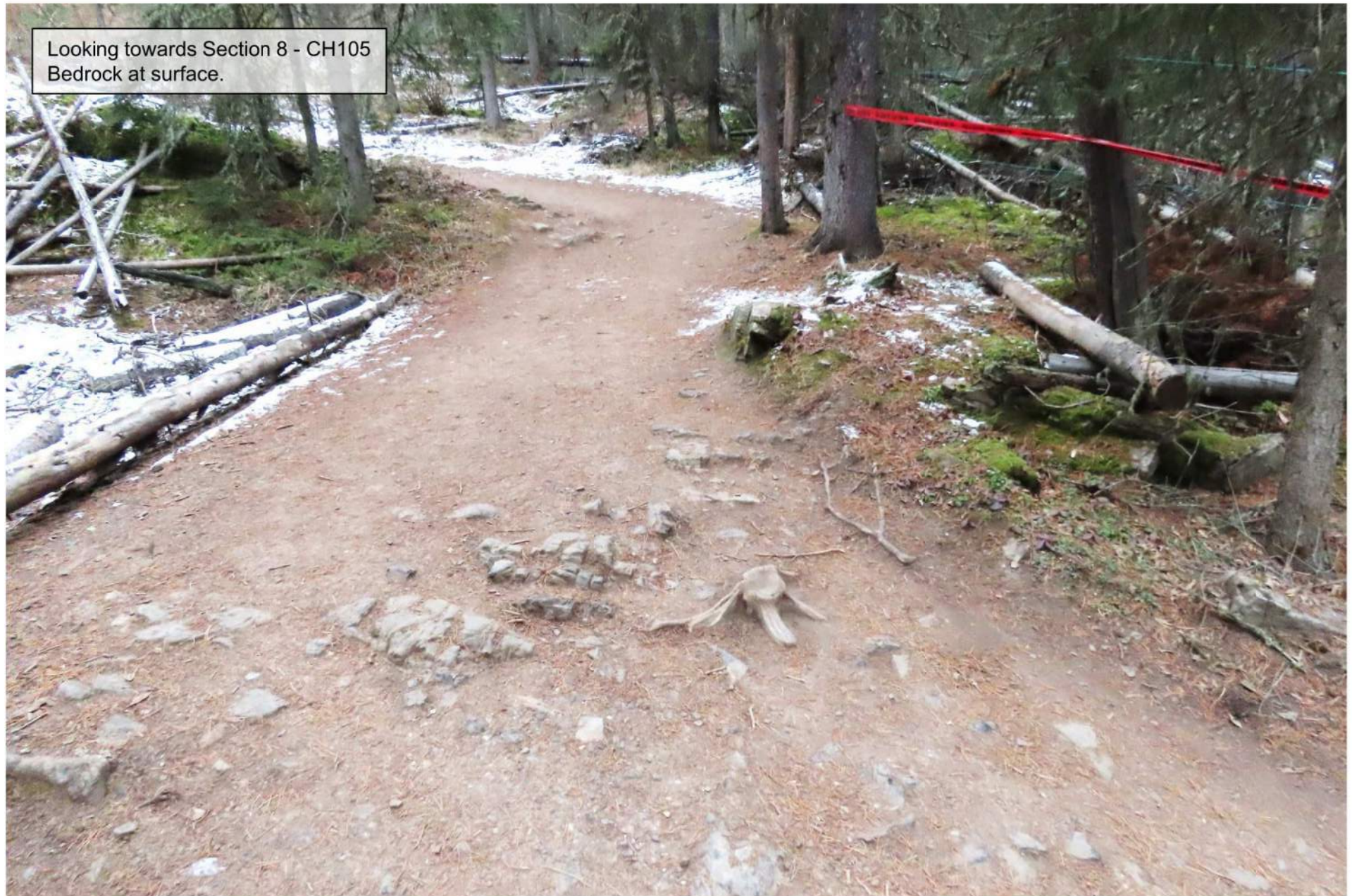


Looking towards Section 8 - CH010.





Section 8 - CH070
Bedrock at surface.



APPENDIX E

POINT LOAD TEST RESULTS

I_s = uncorrected point load strength	$D^2 = D^2$ for diametral tests	F = size correction factor
P_e = load	$D^2 = 4A/\pi$ for axial and lump tests	$F = (D/50)^{0.45}$ or Fig. 7 from 'Suggested Method for Determining Point Load Strength'
D_e = equivalent core diameter	where $A = WD$	$F = \text{SQRT}(D_e/50)$ for tests near the standard (50 mm) size
$I_s = P/D_e^2$	Size Correction	$I_{s(50)} = F \times I_s$

[illegible]

* Valid or Invalid based on description of break according to Fig 4 from 'Suggested Method for Determining Point Load Strength'

This spreadsheet is based on information from 'Suggested Method for Determining Point Load Strength', International Society for Rock Mechanics Commission on Testing Methods, 1985.		Min.	9.65
* Valid or Invalid based on description of break according to Fig 4 from 'Suggested Method for Determining Point Load Strength '		Avg.	16.01
		Max.	23.65
Performed by:	JM	Checked by:	TS
Date:	November 15, 2021	Date:	November 16, 2021
		Approved by:	AF
		Date:	November 19, 2021



Photo Date: November 15, 2021
Description: Grab Sample 1, PLT 1
Depth:



Photo Date: November 15, 2021

Description: Grab Sample 2, PLT 2-1

Depth:



Photo Date: November 15, 2021
Description: Grab Sample 2, PLT 2-2
Depth: