Geotechnical Investigation Report HWY97 Skaha Hills Drive Intersection Improvement, Penticton, BC

Presented To:

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

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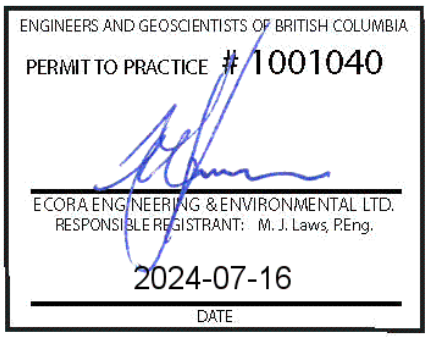

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0	June 21, 2017	SK/IP	MJL	MJL	Issued for Use
1	August 14, 2017	SK/IP	MJL	MJL	Updated to include supplementary investigation results
2	June 23, 2023	MS	MJL	MJL	Updated to include CPT investigation results
3	July 16, 2024	MS	MJL	MJL	Updated business name

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Table of Contents

List of Tables in Text

Appendix Sections

Figures

Appendices

Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
BC	British Columbia
BEF	Bridge End Fill
CCIL	Canadian Council of Independent Laboratories
CPT	Cone Penetration Test
MoTI	Ministry of Transportation and Infrastructure
ODEX	Overburden Drilling Eccentric
OPOH	Old Penticton – Oliver Highway
PGA	Peak Ground Acceleration
PVC	Poly Vinyl Chloride
SGSB	Select Granular Sub-Base
$S_a(T)$	Spectral Acceleration
SPT	Standard Penetration Test

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1. Introduction

1.1 General

The BC Ministry of Transportation and Infrastructure (MoTI) retained Ecora Engineering & Environmental Ltd. (Ecora) to carry out a geotechnical field investigation in support of the detailed design of the Highway 97 Skaha Hills Drive Intersection Improvement Project immediately south of Penticton, BC.

Ecora understands that, in general, the scope of the project comprises the design of a signalized intersection improvement of Highway 97 at Skaha Hills Drive (relocated Old Penticton- Oliver Highway Intersection, OPOH) in Penticton, and access management for Highway 97. The project also included significant highway drainage improvements including a stormwater outfall into Skaha Lake.

MoTI requested that Ecora undertake an intrusive geotechnical site investigation to gain an understanding of the soil properties, groundwater conditions and provide geotechnical recommendations for the proposed intersection development works that is to include pavement design considerations, design of infiltration basins, and MoTI signal and light bases.

This Geotechnical Investigation Report presents the results of our intrusive geotechnical field investigation and laboratory testing work undertaken to date. The intrusive geotechnical field investigations comprised:

- The drilling of six hollow stem auger, one solid stem and five Overburden Drilling Eccentric (ODEX) (Downhole Air Hammer System) test holes;
- The advancement of one Cone Penetration Test (CPT);
- Conducting in-situ strength/consistency testing (i.e., Standard Penetration Testing (SPT);
- The installation of nine standpipe piezometers;
- The advancement of four test pits; and
- Undertaking infiltration testing using a double-ring infiltrometer apparatus.

In addition to the field investigations a laboratory testing program was undertaken on representative soil samples that included moisture content, grain size distribution analysis and Atterberg Limits Tests to gain an understanding of the physical characteristics of the encountered subsurface soils.

This report presents the results of our intrusive geotechnical field investigations and laboratory testing undertaken to date. Geotechnical recommendations in support of the detailed design of the intersection improvement project are provided in a companion geotechnical design report.

1.2 Site Description

The project area is located within Penticton Indian Band Reserve Lands and is situated along the northern shore of Skaha Lake between Airport Road and Riva Ridge Drive (Figure 1.2). The proposed Skaha Hills Drive intersection will be located within a 235 m radius curve near the bottom of a 6% slope, where the highway transitions from a two-lane rural section to four-lane semi urban.

There are currently two commercial developments situated along this stretch of Highway 97 including Wrights Beach Campground to the south and Lakeside Villa Inn & Suites and Barefoot Beach Resort to the northeast of the project area.

The project area is generally characterized by gently sloping terrain. Existing slopes are fairly consistent within the project area with overall grades ranging between 4% and 6%.

2. Background Review

2.1 Surficial Geology

Reference to the BC Department of Mines and Petroleum Resources Bulletin No.46 “Late Glacial History and Surficial Deposits of the Okanagan Valley, British Columbia” (Nasmith H., 1962) indicates that the site is underlain by alluvial fans, deltas, and associated gullies and stream channels along the southwest portion and by beaches, spits and dunes in the northeast portion of the site (Figure 2.1).

2.2 Bedrock Geology

Reference to the BC Geological Survey Map (Scale 1:100,000) “Okanagan Watershed” (Okulitch A.V., 2013) indicates that bedrock underlying the subject area comprises conglomerate, granite boulder, arkose, wacke, volcanic, breccia and rhyolite from the Kettle River Formation. It is anticipated that bedrock would be encountered at a significant depth below the site.

2.3 Review of Aerial Photographs

A review of aerial photographs was undertaken to assess the historical changes at the outlet of the Okanagan River into Skaha Lake. The earliest available air photographs date back to 1938 and the most recent photos reviewed are from 1996. Table 2.3.1 lists the aerial photographs used for this report.

In general, the aerial photographs indicate no significant development or changes to the topography within the project area, with the exception of the existing highway construction however the following changes were observed in the surrounding areas:

- Channelization of Okanagan River: Work on the project commenced in 1950 and was completed in 1958. The outlet of the Okanagan River into Skaha Lake was moved west approximately 200 m from its original location. The original meandering river bends and oxbows are visible in the aerial photos and are located directly east and adjacent to the Penticton Airport. The aerial photos indicate Okanagan River has continued to deposit alluvial material at the outlet in close proximity of the project area.
- Construction of Penticton Airport: The Penticton airport was constructed at its current location in 1940. The airport is located to the northeast of the project area and lies between the current Okanagan River channel and the Kettle Valley Railway Trail.
- Construction of Hwy 97 (OPOH bypass): The current Hwy 97 alignment was constructed after 1951 and prior to 1985 (approximately 1969). Prior to the new Hwy 97 construction, the OPOH was the route from Penticton to Oliver, BC. The OPOH route is still present today.

Table 2.3.1 Aerial Photographs Used in the Assessment

Aerial Photograph Date	Roll Number	Photo Number
1938	BC104	64-65
1949	BC741	65
1950	BC1113	32
1951	BC1244	6
1985	BCC362	100-101
1990	BCB90004	71-72
1996	BCC96045	22-23

2.4 Seismicity

The GSC has developed a probabilistic (6th Generation) seismic hazard model (Kolaj et al., 2020) that forms the basis of the seismic design provisions of the 2020 National Building Code of Canada (NBCC, 2020), British Columbia Building Code (BCBC, 2018), and Canadian Highway Bridge Design Code (CHBDC; CSA, 2019).

Peak Ground Accelerations (PGA) and Spectral Accelerations (Sa(T)) for “Site Class D” (stiff soil) can be obtained from the Earthquakes Canada website for various return periods. The reference values for the project location are summarized in Table 2.4.1 below.

Table 2.4.1 “Site Class D” Design PGA and Sa(T) for Skaha Hills, Penticton, BC

Annual Exceedance Probability (AEP)	PGA (g)	Sa (0.2) (g)	Sa (0.5) (g)	Sa (1.0) (g)	Sa (2.0) (g)
1/2,475	0.124	0.3	0.292	0.224	0.156

3. Geotechnical Investigation

3.1 Intrusive Site Investigation Program

Ecora conducted an intrusive geotechnical site investigation at the site from April 26 to 28, 2017 using a truck mounted drill rig operated by On-the-Mark of West Kelowna, BC. The subsurface investigation comprised the advancement of five ODEX test holes and six hollow stem auger test holes. A supplementary investigation was conducted on August 1, 2017 that comprised of the advancement of four test pits using a rubber tire backhoe operated by Rital Enterprises of Penticton, BC. One proposed test hole (TH16-12) was not completed due to conflicts with underground utilities. The type, location, termination depths, and the geotechnical testing locations are summarized in Table 3.1.1. The test hole drilling was supervised by Mr. Steve Kalinocka, P.Eng. and the test pit excavation was supervised by Mr. Pete Wittstock, E.I.T. who maintained continuous logs of the encountered soils including the soil types, consistency, colour and moisture and collected representative soil samples.

Standard Penetration Testing (SPT) was also carried out at regular intervals within the depth zone investigated by the test holes. The SPT is an in-situ dynmic penetration test designed to provide information on the geotechnical engineering properties of soil. It comprises a thick-walled sample tube, with an outside diameter of 50 mm and an inside diameter of 35 mm, and a length of around 650 mm. This is driven into the ground at the bottom of a test hole by blows from a drop hammer with a weight of 63.5 kg (140 lb) falling through a distance of 760 mm (30 in). The sample tube is driven 150 mm into the ground and then the number of blows needed for the tube to penetrate each 150 mm (6 in) up to a depth of 450 mm (18 in) is recorded. The sum of the number of blows required for the second and third 150 mm (6 in) of penetration is termed the "standard penetration resistance" or the "N-value".

50 mm (2'') diameter poly vinyl chloride (PVC) standpipes were installed in nine of the test holes to allow for future ground water table measurements. The standpipe installation details are provided on the test hole logs in Appendix A. Standpipes installed within the existing roadway or pavement section were installed with flush mount road boxes. A stick-up protective casing was installed at test hole TH16-06.\

Ecora conducted a supplemental intrusive site investigation on June 2, 2023, to obtain information on the subsurface conditions along the proposed drainage pipe outfall alignment. The supplemental site investigation comprised the advancement of one solid-stem auger test hole and one CPT. The borehole drilling and piezocone testing for the investigation, including the supply and operation of all necessary equipment, were carried out by On-the-Mark of West Kelowna, BC and Schwartz Soil Technical Inc. (Schwartz) out of Vancouver, BC. The test hole drilling was supervised by Meghan Sherwood, E.I.T., who logged the encountered subsurface conditions and collected representative soil samples for laboratory testing.

Samples retrieved from the test holes and test pits were returned to Ecora's Canadian Council of Independent Laboratories (CCIL) certified laboratory for moisture content and grain size analysis tests. A site plan showing the location of the test holes is provided in Figure 1.2. The test hole logs and CPT data are attached in Appendix A and C, respectively.

Table 3.1.1 Summary of Test holes and Test Pits

Test hole No.	Northing (m)	Easting (m)	Approximate Station	Termination Depth (m)	Drilling Method	Notes
TH-16-01	5480608.548	310729.024	1+095	2.9	Hollow Stem Auger	
TH-16-02	5480640.155	310717.394	1+125	9.1	ODEX	50 mm PVC Standpipe Installed
TH-16-03	5480723.540	310760.219	1+215	9.4	ODEX	50 mm PVC Standpipe Installed
TH-16-04	5480778.676	310772.505	1+270	6.7	ODEX	50 mm PVC Standpipe Installed
TH-16-05	5480824.151	310818.179	1+335	5.9	Hollow Stem Auger	50 mm PVC Standpipe Installed
TH-16-06	5480849.418	310772.970	2+100 (Skaha Hills Drive)	7.9	Hollow Stem Auger	50 mm PVC Standpipe Installed
TH-16-07	5480917.409	310757.166	2+150 (Skaha Hills Drive)	8.2	ODEX	50 mm PVC Standpipe Installed
TH-16-08	5480842.814	310892.203	1+410	3.0	Hollow Stem Auger	
TH-16-09	5480906.389	310919.783	1+455	6.7	Hollow Stem Auger	50 mm PVC Standpipe Installed
TH-16-10	5480942.161	310926.422	1+455	5.2	ODEX	50 mm PVC Standpipe Installed
TH-16-11	5480879.958	310979.521	1+510	4.6	Hollow Stem Auger	50 mm PVC Standpipe Installed
TP-17-01	5480833.77	310797.55	1+330	2.5	Excavation	
TP-17-02	5480790.84	310765.47	1+275	2.5	Excavation	
TP-17-03	5480771.34	310748.68	1+255	2.1	Excavation	
TP-17-04	5480755.41	310740.59	1+235	2.2	Excavation	
TH23-01	5480845.2*	310986.1*	900+210	18.3	Solid Stem Auger	
CPT23-01	5480845.1*	310985.4*	900+210	19.3	CPT	

*Coordinates acquired using hand-held GPS

At the completion of the geotechnical field program the testing locations were surveyed by the Ecora Penticton Survey Group.

3.2 Infiltration Testing

Ecora also performed Double-Ring Infiltrometer testing on May 12, 2017, following the procedure in ASTM D3385-03. The infiltration testing was completed at the proposed infiltration basin location adjacent to test holes TH16-09 and TH16-10 as shown in Figure 1.2.

The Double-Ring Infiltrometer test method consists of driving two open rings, one inside the other, into the ground. The rings are then filled with water and the water level is maintained at a constant level. The volume of water added to the inner ring corresponds to the volume of water infiltrating the soil and is converted to an incremental infiltration rate.

Prior to performing the infiltration testing, the upper fill soils were removed (approximately 300 mm) to expose the native silty sand soil. The outer and inner rings were driven into the ground using a sledge hammer and driving cap to a depth of 75 mm and 50 mm respectively. The test was completed in three trials, allowing for refilling of the auxiliary water tanks. The water level in the rings was maintained at a constant head by manually controlling the flow of water into the rings. The water level in the liquid containers was measured every 15 minutes during the test. The average infiltration rate within the inner ring over the three trials was 1.7 x 10^{-3} cm/sec.

Although the units of infiltration rate and hydraulic conductivity of soils are similar, there is a distinct difference between these two quantities. They cannot be directly related unless the hydraulic boundary conditions are known, such as hydraulic gradient and the extent of lateral flow of water. The test results are summarized in Table 3.2.1. Detailed results can be found in Appendix B.

Table 3.2.1 Summary of Infiltration Testing

Trial No.	Elapsed Time (min)	Water Temperature (°C)	Infiltration Rate (cm/sec)
1	15	N/A	2.3 x 10^{-3}
2	30	N/A	9.2 x 10^{-4}
3	45	15.2	1.2 x 10^{-3}
4	60	15.1	2.0 x 10^{-3}
5	75	15.0	2.4 x 10^{-3}
6	90	15.0	2.1 x 10^{-3}
7	105	14.8	9.5 x 10^{-4}
		Average	1.7 x 10^{-3}

3.3 Cone Penetration Testing

The CPT was carried out using CPT equipment supplied and operated by Schwartz with a track-mounted rig provided by On-the-Mark, employing a 15-ton pushing force. The CPT consists of a special probe equipped with electronic sensing elements to continuously measure tip resistance, local side friction on a sleeve, porewater pressure and cone inclination. It is pushed into the ground at a constant rate of 2 cm/s (ASTM D5778-20) and a nearly continuous stratigraphic profile together with inferred engineering properties such as shear strength and stress history, can be interpreted from the results. The penetration tests use a 15 cm^2 tip base area probe, with an equal end area friction sleeve, and tip and sleeve capacities of 1,300 bar (130 MPa) and 10 bar (1 MPa), respectively.

Shear wave velocity testing was also carried out at the location of CPT23-01. A built-in geophone within the cone penetration probe recorded seismic wave traces from a surface source as the CPT was advanced. Measurements were recorded at roughly 1 m intervals. Results of the CPT sounding are presented in Appendix C.

4. Encountered Subsurface Conditions

4.1 Existing Pavement Structure

Road structure was encountered at all test hole locations advanced within the existing roadway. The existing pavement structure generally extended to approximately 0.76 m below the road surface, with the exception of test hole TH16-11 where the pavement structure/fill soil extended to a depth of approximately 1.8 m below the existing road surface. The additional fill at this location is likely due to the grade/elevation difference between the highway and adjacent ground elevation.

Asphalt varied in thickness from 100 mm to 200 mm. The existing asphalt was observed to be in good condition with no evidence of major cracking, rutting or deterioration of the pavement surface noted during the field investigation. Due to the drilling method used (ODEX), it was difficult to determine the type and extent of each of the existing road structure material types (i.e. base, sub-base).

4.2 Soils

The following material types were encountered within the depth zone investigated during the 2016 and 2017 site investigations (i.e., down to a maximum termination depth of 9.45 m) by the five ODEX test holes, six hollow stem auger test holes and four test pits in the following sequence:

- **Asphalt:** ranging from 100 to 200 mm thick;
- **Fill**: consisting of loose to compact, dry to moist, fine to coarse grained, angular to sub-rounded, uniformly graded gravelly sand with some silt and occasional cobbles, underlain by;
- **Alluvial Deposits**: comprising loose to compact, dry to wet (moisture content increasing with depth), fine to coarse grained, well graded sand, some gravel, and trace to some silt, that extends beyond the depth zone investigated.

The SPT data indicates that the Alluvial deposits within the investigation depth are in a very loose to very dense state with SPT blow counts (‘N’ values uncorrected) ranging from 2 to 74. During the advancement of TH-16-02 and TH-16-10, very loose sand with SPT N-values of less than 4 approximately 5 m below existing ground level was encountered. Figure 4.2 shows a geotechnical section along the proposed highway alignment.

Given the nature of the encountered material deposition (i.e., by water) some variability across the site in the nature and consistency of these materials should be anticipated. It was however noted that there was generally no significant variation in the nature and consistency of the soil layers encountered at corresponding depth between the borehole data, inferring continuous horizontal soil layering.

The following material types were encountered within TH23-01 in the following sequence:

- **Alluvial Deposits**: comprising SAND, trace to some silt, trace to some gravel, well graded, dry to moist, light brown, to a depth of 2.7 m below existing ground surface, underlain by;

- **Glaciolacustrine Deposits**: ranging from SILT and SAND, trace clay to SILT, some sand to sandy, trace clay, extending to the termination depth of 18.3 m below existing ground surface. The deposit was observed to be saturated, non plastic to low plasticity and dark grey in colour.

4.3 Groundwater

At the time of the investigation, the depth of the groundwater was measured in each test hole upon completion. The easily accessible piezometers were read on June 16, 2017. The results are summarized in Table 4.3.1.

It should be noted that the groundwater measurements taken on June 16, 2017 were recorded during very high lake levels compared to historical levels. The elevation of Skaha Lake on June 16, 2017 was 338.047 m. The highest recorded historical lake elevation was 338.520 m in 1948, with the average level from 1943 to 2015 at 337.875 m. Groundwater levels are seasonal and therefore some fluctuations in groundwater elevations are anticipated.

Table 4.3.1 Summary of Groundwater

Test hole No.	Well Depth (m)	Slotted Depth (m)	Depth to Groundwater (m)	Groundwater elevation (m)	Date of Reading
TH-16-02	9.1	6.1 – 9.1	Dry	N/A	April 27, 2017
TH-16-03	9.1	6.1 – 9.1	8.67	338.94	June 16, 2017
TH-16-04	6.1	3.1 – 6.1	Dry	N/A	April 27, 2017
TH-16-05	5.33	2.3 – 5.3	3.8	338.87	April 26, 2017
TH-16-06	7.9	4.9 – 7.9	6.50	339.12	June 16, 2017
TH-16-07	7.62	4.6 – 7.6	Dry	N/A	June 16, 2017
TH-16-09	4.6	1.5 – 4.6	1.03	338.62	June 16, 2017
TH-16-10	4.6	1.5 – 4.6	1.21	338.67	June 16, 2017
TH-16-11	4.6	1.6 – 4.6	2.3	338.19	April 28, 2017

4.4 Laboratory Testing

Laboratory testing was conducted on selected soil samples to confirm the field observations and their physical characteristics. Seventeen grain size analysis and moisture content tests were conducted on the split spoon samples, and bulk samples obtained during the investigations. Representative samples obtained from the test pits were plotted to MoTI aggregate gradation curves for Select Granular Sub-Base (SGSB) and Bridge End Fill (BEF). It was noted that these samples generally fall within the SGSB gradation specification. Results of these tests are summarized in Table 4.4.1 and presented in detail in Appendix D.

The laboratory tests indicate the majority of the soils encountered during the site investigation along Highway 97 have less than 13% fines and range from well to poorly graded gravels and sands as per the classification given in Table 4.4.1.

Table 4.4.1 Summary of Grain Size Analysis Results

Test hole No.	Sample Depth (m)	Moisture Content	Gravel (%)	Sand (%)	Fines (%)		Classification
					Silt	Clay	
TH-16-02	0.76 – 1.36	8.9	19	53	28		SM2
TH-16-02	4.5 – 5.1	13.3	13	54	33		SM3
TH-16-03	1.52 – 2.12	13.2	49	39	12		GM1
TH-16-04	0.76 – 1.36	3.7	52	37	11		GW-GM
TH-16-05	2.29 – 2.89	3.9	41	52	7		SW-SM

Test hole No.	Sample Depth (m)	Moisture Content	Gravel (%)	Sand (%)	Fines (%)		Classification
					Silt	Clay	
TH-16-06	1.52 – 2.12	4.0	50	37	13		GM1
TH-16-07	3.05 – 3.65	3.1	19	70	11		SP-SM
TH-16-08	0.76 – 1.36	5.2	37	59	4		SW
TH-16-09	0.76 – 1.36	10.8	17	77	6		SP-SM
TH-16-10	0.76 – 1.36	13.8	1.9	94	4		SP
TH-16-11	0.76 – 1.36	3.8	44	49	7		GW-GM
TH-16-11	3.05 – 3.65	14.5	18	78	4		SW
TP-17-01	0.5 – 0.7	4.9	50	40	10		GW-GM
TP-17-01	2.0 - 2.2	3.0	63	36	1		GW
TP-17-02	0.7 – 0.9	1.8	52	44	4		GW
TP-17-03	0.6 – 0.8	1.8	52	44	4		GW
TP-17-04	1.4 – 1.6	4.9	62	31	7		GW-GM
TH23-01	1.8 – 2.3	22.3	1	87	11		SW-SM
TH23-01	3.5 – 4.0	34.1	0	71	23	7	SM2
TH23-01	5.2 – 5.8	36.8	0	38	57	4	ML
TH23-01	6.7 – 7.2	38.3	0	47	50	3	ML
TH23-01	8.5 – 9.0	37.3	0	32	64	4	ML

Table 4.4.2 Summary of Atterberg Limits Test Results

Test Hole No.	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Soil Description
TH23-01	3.5 – 4.0	0	0	0	Non Plastic Silt
TH23-01	5.2 – 5.8	0	0	0	Non Plastic Silt
TH23-01	6.7 – 7.2	0	0	0	Non Plastic Silt
TH23-01	8.5 – 9.0	0	0	0	Non Plastic Silt

5. Summary

The following presents a summary of our investigation:

- The aerial photographs reviewed covered the period from 1938 to 1996, that indicated the Okanagan River has continued to deposit alluvial material at the outlet immediately to the east of the project area;
- The site investigations comprised a total of 12 test holes, four test pits, CPT, in-situ SPT, installation of standpipe piezometers in nine test holes, and double-ring infiltration testing;
- The surficial soil profile along HWY97 consists of 100 to 200 mm asphalt, which is underlain by fill that comprises sands and gravels and then underlain by Alluvial deposits that comprise loose to very dense, moist to wet, fine to coarse, well graded sand, some gravel trace to some silt.
- The surficial soil profile near the shore of Skaha Lake along the proposed drainage pipe alignment consists of Alluvial Deposits comprising fine to coarse grained, well graded, SAND, trace to some silt, trace to some gravel to a depth of 3.4 m below existing ground surface. The Alluvial Deposits are underlain by Glaciolacustrine Deposits ranging in composition from SILT

and SAND, trace clay, to SILT, some sand to sandy, trace clay, extending to the termination depth of 18.3 m below existing ground surface;

- The SPT testing indicates that the Alluvial deposits within the investigation depth are in a very loose to very dense state with SPT blow counts ('N' values uncorrected) ranging from 2 to 74;
- At the time of investigation on April 26-28, 2017 and on June 16, 2017 the groundwater level measured in the test holes ranged from 338.19 to 339.12 m;
- Laboratory testing included sieve and hydrometer analyses and Atterberg Limits testing conducted on 22 samples from various test holes and depths.
- Double-Ring Infiltrometer testing was carried out between TH16-09 and TH16-10. The results indicate an average infiltration rate of 1.7×10^{-3} cm/sec.
- The encountered native alluvial sands and gravel generally fall within the SGSB gradation specification.

6. Closure

We trust this report meets your present requirements. Do not hesitate to contact us if you have any questions or comments.

References

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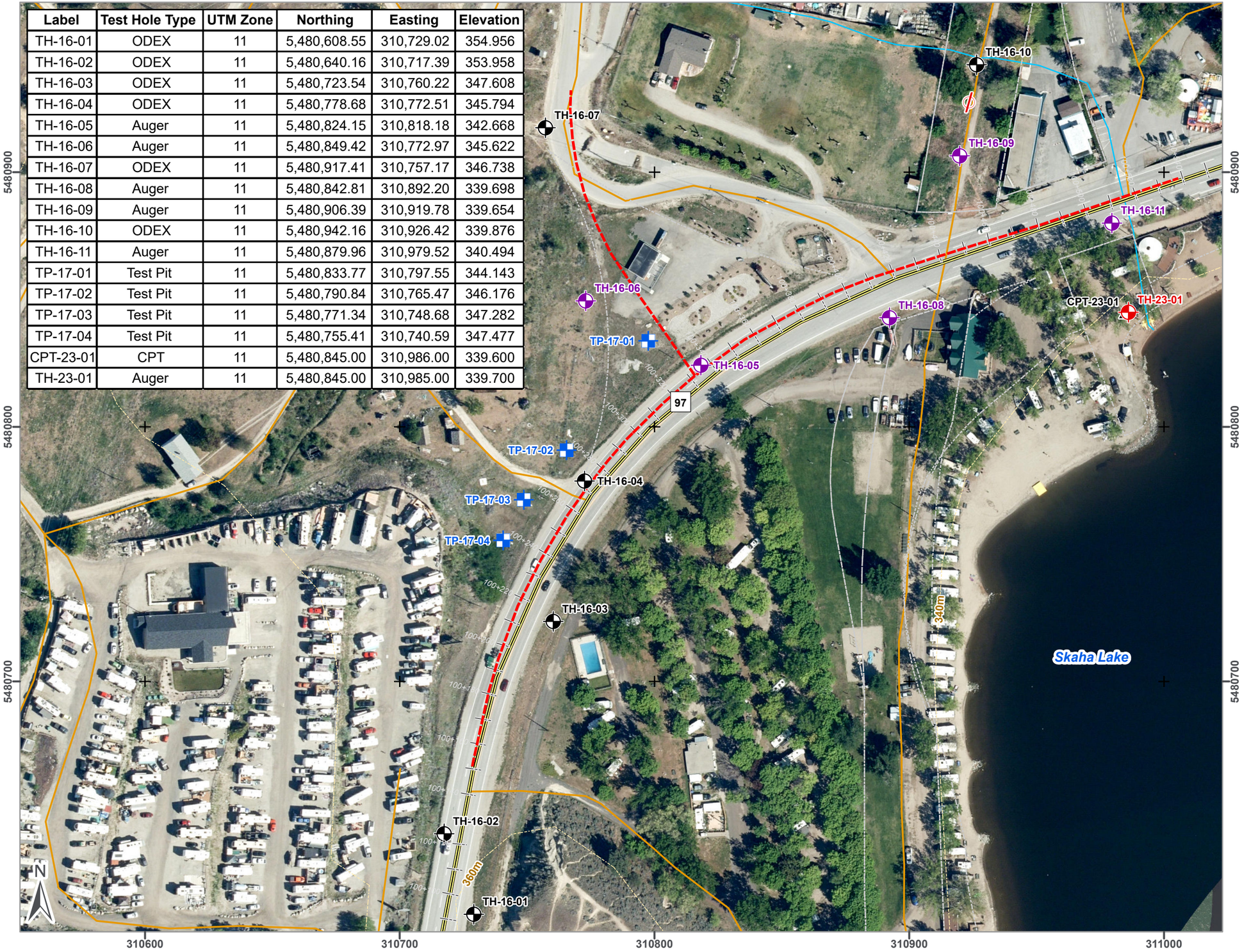
Figures

SITE PLAN

Label	Test Hole Type	UTM Zone	Northing	Easting	Elevation
TH-16-01	ODEX	11	5,480,608.55	310,729.02	354.956
TH-16-02	ODEX	11	5,480,640.16	310,717.39	353.958
TH-16-03	ODEX	11	5,480,723.54	310,760.22	347.608
TH-16-04	ODEX	11	5,480,778.68	310,772.51	345.794
TH-16-05	Auger	11	5,480,824.15	310,818.18	342.668
TH-16-06	Auger	11	5,480,849.42	310,772.97	345.622
TH-16-07	ODEX	11	5,480,917.41	310,757.17	346.738
TH-16-08	Auger	11	5,480,842.81	310,892.20	339.698
TH-16-09	Auger	11	5,480,906.39	310,919.78	339.654
TH-16-10	ODEX	11	5,480,942.16	310,926.42	339.876
TH-16-11	Auger	11	5,480,879.96	310,979.52	340.494
TP-17-01	Test Pit	11	5,480,833.77	310,797.55	344.143
TP-17-02	Test Pit	11	5,480,790.84	310,765.47	346.176
TP-17-03	Test Pit	11	5,480,771.34	310,748.68	347.282
TP-17-04	Test Pit	11	5,480,755.41	310,740.59	347.477
CPT-23-01	CPT	11	5,480,845.00	310,986.00	339.600
TH-23-01	Auger	11	5,480,845.00	310,985.00	339.700

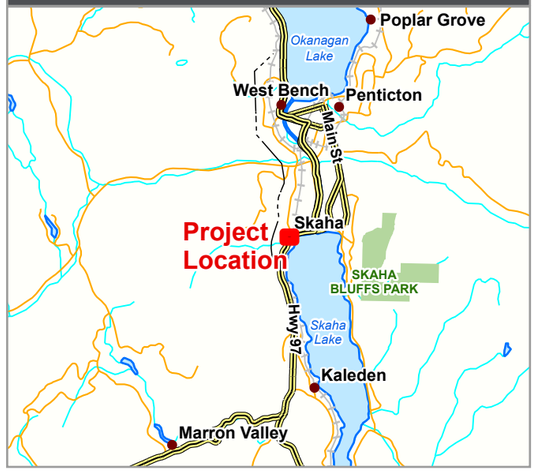


GEOTECHNICAL ASSESSMENT HWY97 SKAHA HILLS DRIVE INTERSECTION IMPROVEMENT PENTICTON, BC

Legend

- Cone Penetration Test Location
- Hollow Stem Auger Test Hole Locations
- Solid Stem Auger Test Hole Location
- ODEX Test Hole Locations
- Test Pit Locations
- Infiltration Test Location
- Proposed Alignment
- Road Stations
- 20m TRIM Contour Lines
- Highways
- Digital Road Atlas Roads
- Fresh Water Atlas Streams
- PMBC Legal Parcels

LOCATION MAP



1:1,500

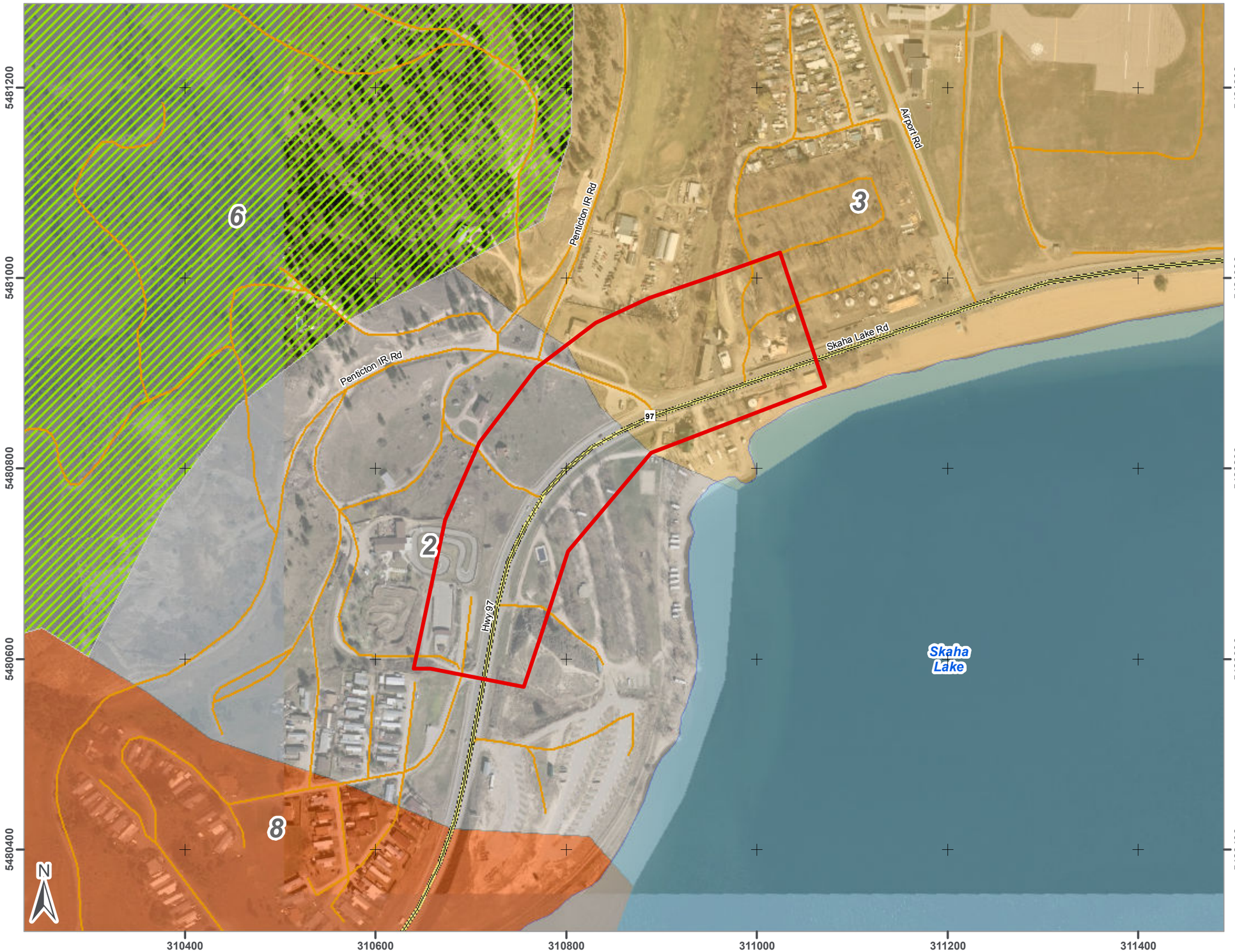
0 50 100 Meters

Project No.: 221266-26
Client: Ministry of Transportation & Infrastructure
NAD 1983 UTM Zone 11N

Date: 2023/06/22
Drawn: SC Check: MJL

Figure 1.2

SURFICIAL GEOLOGY



SKAHA INTERSECTION HIGHWAY 97 BRITISH COLUMBIA

Legend

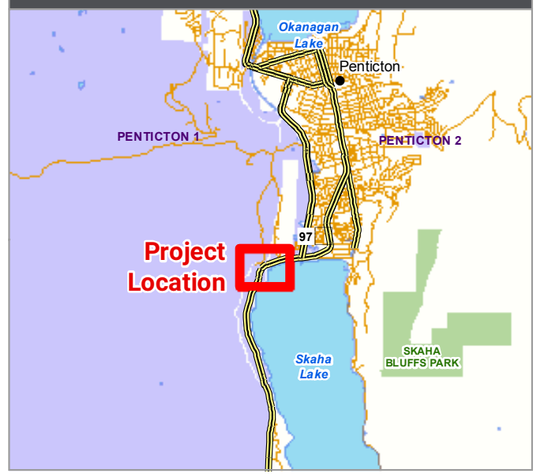
- 20m TRIM Contours
- 100m TRIM Contours
- Digital Atlas Roads
- Highways
- Streams
- Rivers and Lakes
- Project Boundary

Surficial Geology

- 2 - Alluvial fans, deltas, and associated gullies and stream channels
- 3 - Beaches, spits, and dunes
- 6 - Outwash terraces
- 8 - Glacial lake sediments

Reference: Nasmith, H 1962. Late Glacial History and Surficial Deposits of the Okanagan Valley, British Columbia. BC Department of Mines and Petroleum Resources.

LOCATION MAP



1:4,000

0 100 200 Meters

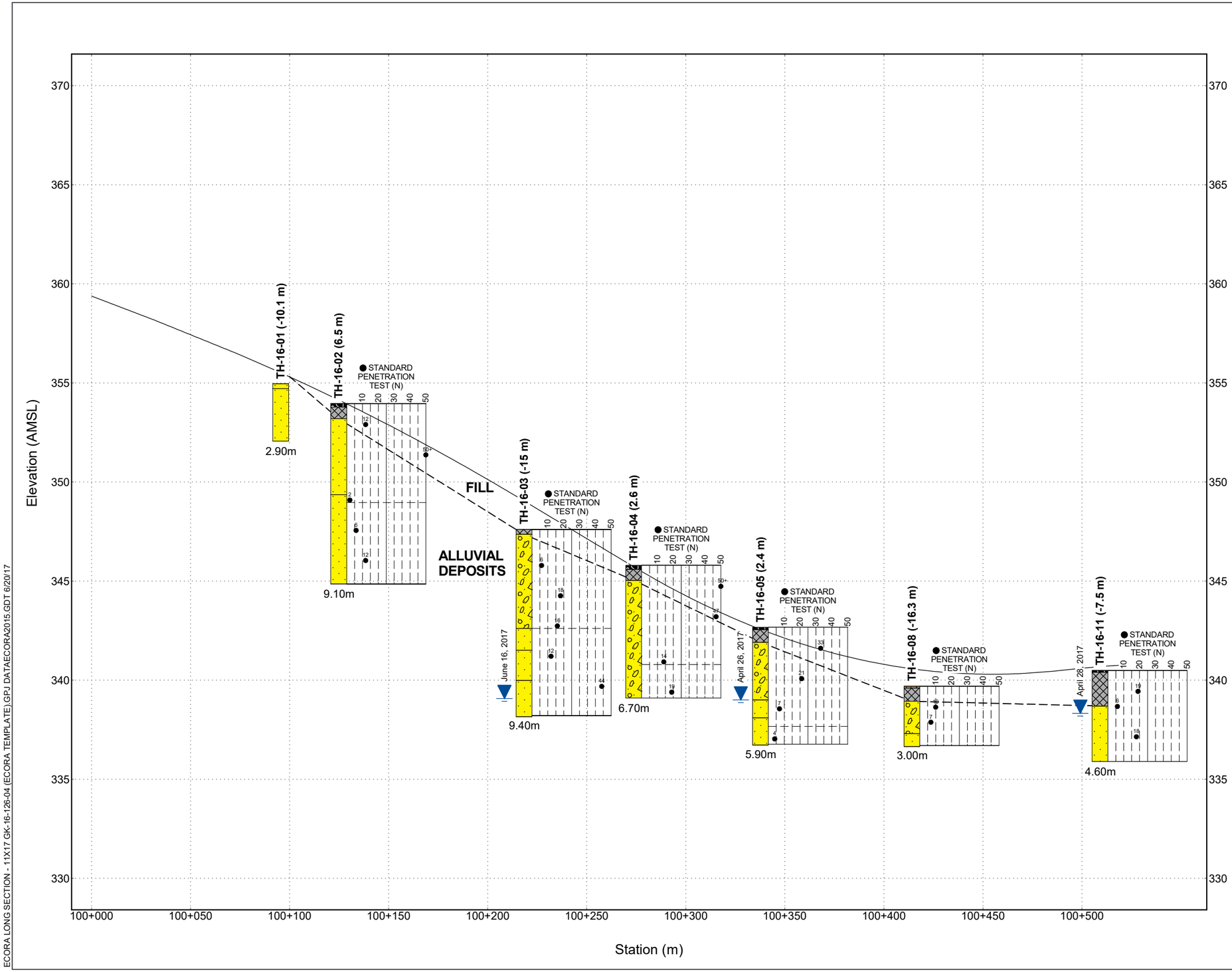
Project No.: GK-16-126-MOT-04
Date: 2016/10/03
Client: Ministry of Transportation and Infrastructure
Drawn: DET Check:
NAD 1983 UTM Zone 11N

Figure 2.1

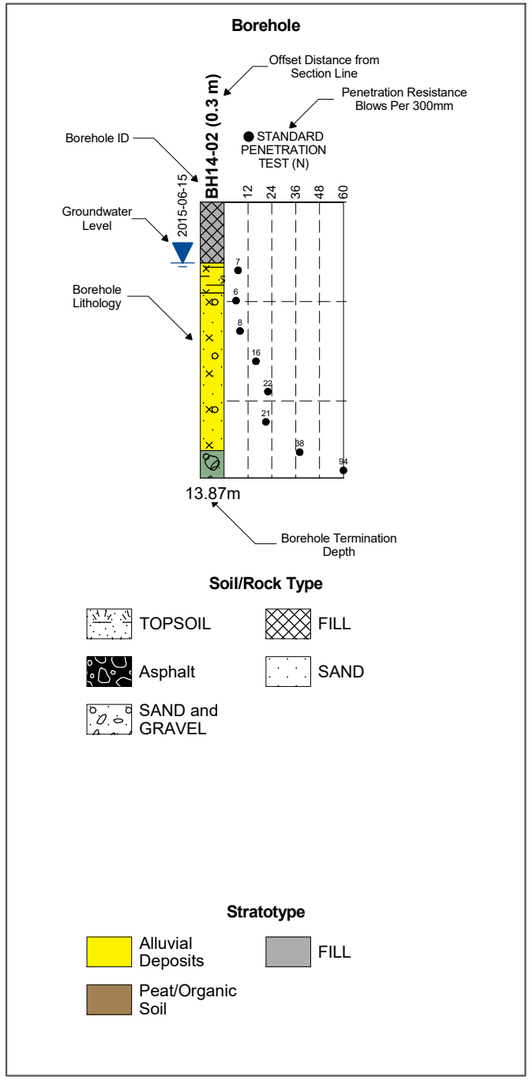
GEOTECHNICAL SECTION A-A'

ecora

Skaha Hills Drive Intersection Improvement Project



ECORA LONG SECTION - 11X17 GK-16-126-04 (ECORA TEMPLATE).GPJ DATAECORA2015.GDT 6/20/17



Project No.: GK-16-126-MOT-04
Client: Ministry of Transportation and Infrastructure
Office: Kelowna
Horizontal Scale: 1:2000
Vertical Scale: 1:200 **REV:** 0
Paper Size: 11 x 17 **DWN:** IP
Date: 2017-06-20 **CHK:** MJL

Figure 4.2

Appendix A

Test Hole Logs

SUMMARY LOG

Ministry of Transportation and Infrastructure — British Columbia

Drill Hole #: TH16-01

Project: **Skaha Hills Drive Intersection Improvement Project**
Location: Penticton, BC

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group
Logged by: SK Reviewed by:

Datum: Alignment:
Northing/Easting: 5480608.548 , 310729.024 Station/Offset:
Elevation: 354.96 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/28/2017
Drilling Company: On The Mark
Driller:
Drill Make/Model: Truck Mount
Drilling Method: Hollow Stem Auger

DEPTH (m)	DRILLING DETAILS (SPT)	Pocket Penetrometer ✕ / Shear Strength (kPa) 100 200 300 400; ✳ DYNAMIC CONE (BLOWS/300 mm) ✳; + Natural Vane (KPa) ⊕ Remold Vane (KPa); ▲ SPT "N" (BLOWS/300 mm) ▲; W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING — Drillers Estimate {G % S % F %}	ELEVATION (m)
0	5, 12, 14, 12	26 ▲		S1	75		Loose SAND (Fill), Silty, some Gravel, trace Organics & Rootlets, moist, dark brown			
							0.25m — Compact SAND, gravelly, trace Silt, occasional Cobbles, damp, light brown			
1	12, 18, 23, 10	41 ▲		S2	25					354
2										353
	3, 6, 10, 15	16 ▲		S3	38					
3							2.9m — Target Depth Achieved			352
4										351
5										350
6										349
7										348
8										347
9										346
10										

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

Final Depth of Hole: 2.9 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

SUMMARY LOG

Drill Hole #: **TH16-02**

Ministry of Transportation and Infrastructure

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group
Logged by: SK Reviewed by:

Datum: Alignment:

Northing/Easting: 5480640.155 , 310717.394 Station/Offset:

Elevation: 353.96 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/27/2017
Drilling Company: On The Mark
Driller:
Drill Make/Model: Truck Mount
Drilling Method: ODEX

DEPTH (m)	DRILLING DETAILS SPT	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; DYNAMIC CONE (BLOWS/300 mm); Natural Vane (kPa) / Remold Vane (kPa); SPT "N" (BLOWS/300 mm); W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	MONITORING WELL	ELEVATION (m)
0							Asphalt (180 mm thick)				
							0.18m Compact SAND (Fill), Gravelly, some to trace Silt, dry, brown				
							0.76m Compact SAND, Silty, some Gravel, occasional Cobbles, moist, brown		**Sieve** (Sa#S1) G:19% S:53% F:28%		
1	3 4 8 10	12		S1	50						353
2							Becoming dense				352
	4 47 15 20	62		S2	50						
3											351
4											350
	3 1 1 2	2		S3	54		4.6m Very loose SAND, Silty, some Gravel, moist, light brown		**Sieve** (Sa#S3) G:13% S:54% F:33%		
5											349
6											348
	3 3 3 3	6		S4							
7											347
8	4 6 6 6	12		S5			Becoming moist to wet				346
9											345
							9.1m Target Depth Achieved				
10											

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

Legend Installation: Sand; Grout; Cemen; Bentonite; Drill Cuttings; Slotted; Slough; Piezometer

Final Depth of Hole: 9.1 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

SUMMARY LOG

Drill Hole #: **TH16-03**

Ministry of Transportation and Infrastructure

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group
Logged by: SK Reviewed by:

Datum: Alignment:

Northing/Easting: 5480723.54 , 310760.219 Station/Offset:

Elevation: 347.61 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/28/2017
Drilling Company: On The Mark
Driller:
Drill Make/Model: Truck Mount
Drilling Method: ODEX

DEPTH (m)	DRILLING DETAILS (SPT)	Pocket Penetrometer ✕ / Shear Strength (kPa) 100 200 300 400; ✳ DYNAMIC CONE (BLOWS/300 mm) ✳; + Natural Vane (KPa) ⊕ Remold Vane (KPa); ▲ SPT "N" (BLOWS/300 mm) ▲; W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	MONITORING WELL	ELEVATION (m)
0							Loose SAND (Fill), Silty, Gravelly, trace Organics & Rootlets, moist, dark brown				347.61
							0.25m Compact SAND and GRAVEL, some Silt, occasional Cobbles, damp, light brown				
1											
2	4 2 4 4	6		S1	42				**Sieve** (Sa#S1) G:49% S:38% F:13%		346
3	5 6 12 21	18		S2							345
4											344
5	8 10 6 3	16		S3	50		5.0m Compact SAND, some Silt, some Gravel, occasional Cobbles, damp, light brown				343
6	4 6 6 7	12		S4	88		6.1m Compact SAND, Silty, trace Gravel; fine grained, moist, brown, orange staining				342
7											341
8	14 24 20 17	44		S5	63		7.62m Dense SAND, Gravelly, trace Silt, moist, brown				340
9		Water-8.7m 2017/6/16									339
10							9.45m Target Depth Achieved				338

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

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

Final Depth of Hole: 9.4 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

SUMMARY LOG

Drill Hole #: **TH16-04**

Ministry of Transportation and Infrastructure

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

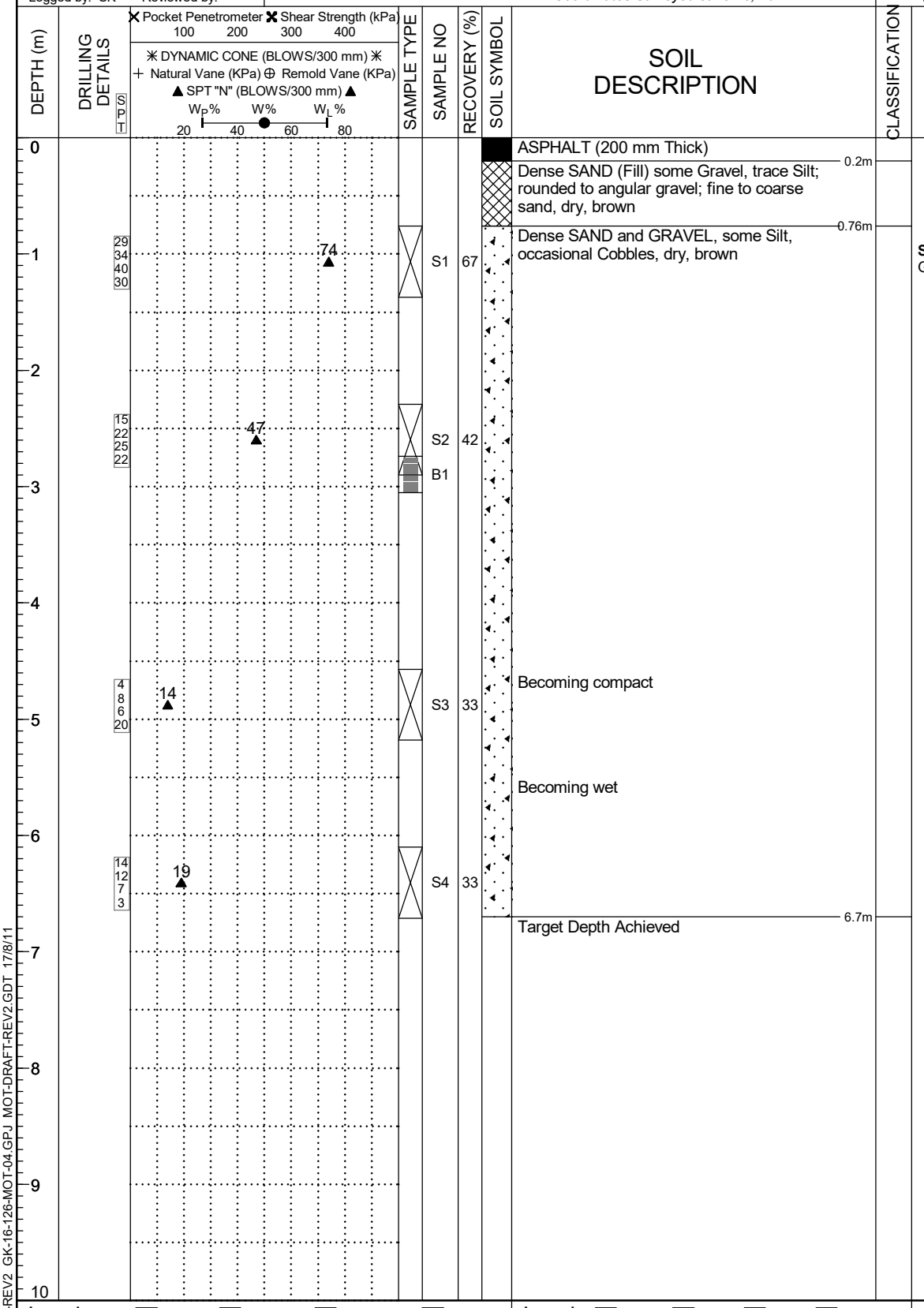
Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group
Logged by: SK Reviewed by:

Datum: Alignment:

Northing/Easting: 5480778.676 , 310772.505 Station/Offset:

Elevation: 345.79 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/27/2017
Drilling Company: On The Mark
Driller:
Drill Make/Model: Truck Mount
Drilling Method: ODEX



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

Legend Installation:
Sand Grout Cemen Bentonite
Drill Cuttings Slotted Slough Piezometer

Final Depth of Hole: 6.7 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

SUMMARY LOG

Drill Hole #: **TH16-05**

Ministry of Transportation and Infrastructure

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group

Logged by: SK Reviewed by:

Datum: Alignment:

Northing/Easting: 5480824.151 , 310818.179 Station/Offset:

Elevation: 342.67 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/26/2017
Drilling Company: On The Mark
Driller:
Drill Make/Model: Truck Mount
Drilling Method: Hollow Stem Auger

DEPTH (m)	DRILLING DETAILS (SPT)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; DYNAMIC CONE (BLOWS/300 mm); Natural Vane (KPa) / Remold Vane (KPa); SPT "N" (BLOWS/300 mm); W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	MONITORING WELL	ELEVATION (m)
0							Asphalt (120 mm thick) 0.12m				342
							Dense SAND (Fill), some gravel, trace silt; fine to coarse sand; subangular to angular gravel, dry, light brown 0.76m				
1	11 20 13 13	33		S1	50		Dense SAND and GRAVEL, trace Silt, occasional Cobbles, fine to coarse sand; coarse rounded to angular gravel, dry, light brown				341
2	6 7 14 10	21		S2	58				**Sieve** (Sa#S2) G:41% S:52% F:7%		340
3							3.66m				339
	Water-3.8m 2017/4/26						Loose SAND, some silt to silty, trace gravel; fine grained, wet, grey				
4	4 3 3 2	7		S3	54		4.57m				338
5							Loose SAND, trace silt, trace gravel; fine to medium grained, wet, brown				
	0 2 2 3	4		S4	75		5.94m				337
6							Target Depth Achieved				
7											336
8											335
9											334
10											333

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

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

Final Depth of Hole: 5.9 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

SUMMARY LOG

Drill Hole #: **TH16-06**

Ministry of Transportation and Infrastructure

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group
Logged by: SK Reviewed by:

Datum: Alignment:

Northing/Easting: 5480849.418 , 310772.97 Station/Offset:

Elevation: 345.62 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/26/2017
Drilling Company: On The Mark
Driller:
Drill Make/Model: Truck Mount
Drilling Method: Hollow Stem Auger

DEPTH (m)	DRILLING DETAILS SPT	Pocket Penetrometer ✕ / Shear Strength (kPa) 100 200 300 400; DYNAMIC CONE (BLOWS/300 mm) ✳; Natural Vane (KPa) + / Remold Vane (KPa) ⊕; SPT "N" (BLOWS/300 mm) ▲; W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	MONITORING WELL	ELEVATION (m)
0							Dense SAND and GRAVEL, some Silt, occasional Cobbles, moist, brown				345
1	14 35 30 25	65 ▲		S1	42				**Sieve** (Sa#S1) G:50% S:37% F:13%		
2	6 10 10 12	20 ▲		S2	83		2.3m Compact SAND, Silty, some Gravel, occasional Cobbles, dry, light brown				344 343
3											
4	9 20 23 18	43 ▲		S3	96		Becoming dense, trace Silt, Gravelly				342
5							5.33m Compact SAND, trace Silt, trace Gravel; fine to medium grained, moist, light brown				341
6	10 11 10 7	21 ▲		S4	88						340
7	2 4 5 6	9 ▲		S5	38		Becoming wet				339 338
8							7.9m Target Depth Achieved				337
9											
10											336

Water-6.5m 2017/6/16

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

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

Final Depth of Hole: 7.9 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

SUMMARY LOG

Drill Hole #: **TH16-07**

Ministry of Transportation and Infrastructure

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group
Logged by: SK Reviewed by:

Datum: Alignment:

Northing/Easting: 5480917.409 , 310757.166 Station/Offset:

Elevation: 346.74 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/27/2017
Drilling Company: On The Mark
Driller:
Drill Make/Model: Truck Mount
Drilling Method: ODEX

DEPTH (m)	DRILLING DETAILS SPT	Pocket Penetrometer ✕ / Shear Strength (kPa) 100 200 300 400; ✳ DYNAMIC CONE (BLOWS/300 mm) ✳; + Natural Vane (kPa) ⊕ Remold Vane (kPa); ▲ SPT "N" (BLOWS/300 mm) ▲; W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	MONITORING WELL	ELEVATION (m)
0							Loose SAND (Fill), Silty, trace Gravel, moist, brown				346
1							1.5m Very Loose SAND and SILT (Burried Topsoil), trace gravel, organics and rootlets, moist, dark brown 1.8m				
2	2 3 4 5	7 ▲		S1	67		Compact SAND, some Gravel, some Silt; fine to medium grained sand; subrounded to angular gravel, dry, light brown				345
3	4 7 14 11	21 ▲		S2	67				**Sieve** (Sa#S2) G:19% S:69% F:12%		344
4											343
5	2 3 2 3	5 ▲		S3	21		Compact SAND, some Silt, trace Gravel; fine to medium grained sand; subrounded to angular gravel, dry, light brown				342
6	4 5 5 6	10 ▲		S4	79						341
7							Becoming wet				340
8	1 2 2 3	4 ▲		S5			8.2m Target Depth Achieved				339
9											338
10											337

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

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

Final Depth of Hole: 8.2 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

SUMMARY LOG

Ministry of Transportation and Infrastructure — British Columbia

Drill Hole #: TH16-08

Project: **Skaha Hills Drive Intersection Improvement Project**
Location: Penticton, BC

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group
Logged by: SK Reviewed by:

Datum: Alignment:
Northing/Easting: 5480842.814 , 310892.203 Station/Offset:
Elevation: 339.7 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/28/2017
Drilling Company: On The Mark
Driller:
Drill Make/Model: Truck Mount
Drilling Method: Hollow Stem Auger

DEPTH (m)	DRILLING DETAILS (SPT)	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; DYNAMIC CONE (BLOWS/300 mm); Natural Vane (KPa) / Remold Vane (KPa); SPT "N" (BLOWS/300 mm); W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING — Drillers Estimate {G % S % F %}	ELEVATION (m)
0							SAND and SILT (Topsoil), organics and rootlets, moist, dark brown, organic odour — 0.1m			339
							Compact SAND (Fill), some Gravel, trace Silt; coarse grained sand, moist, brown — 0.76m			
1	5 5 5 6	10		S1	79		Loose SAND and GRAVEL, trace Silt; coarse grained sand, moist, brown		**Sieve** (Sa#S1) G:37% S:59% F:4%	338
2	5 3 4 3	7		S2						
				S3			Loose SAND, some Silt, trace Gravel; fine to medium grained sand, wet, grey — 2.4m			337
3							Target Depth Achieved — 3.05m			
4										336
5										335
6										334
7										333
8										332
9										331
10										330

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

Final Depth of Hole: 3.0 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

SUMMARY LOG

Drill Hole #: **TH16-09**

Ministry of Transportation and Infrastructure

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group

Logged by: SK Reviewed by:

Datum: Alignment:

Northing/Easting: 5480906.389 , 310919.783 Station/Offset:

Elevation: 339.65 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/27/2017
Drilling Company: On The Mark
Driller:
Drill Make/Model: Truck Mount
Drilling Method: Hollow Stem Auger

DEPTH (m)	DRILLING DETAILS	SPT	Pocket Penetrometer ✕ / Shear Strength (kPa) 100 200 300 400; DYNAMIC CONE (BLOWS/300 mm) ✳; Natural Vane (KPa) + / Remold Vane (KPa) ⊕; SPT "N" (BLOWS/300 mm) ▲; W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	MONITORING WELL	ELEVATION (m)
0								Loose SAND, Silty, trace Gravel, trace organics and rootlets, moist, brown				339
								0.3m Loose SAND, some Gravel, trace Silt; coarse grained sand, moist, brown				
1	Water-1.0m 2017/6/15	3 3 4 5	7 ▲		S1	50		Becoming moist to wet		**Sieve** (Sa#S1) G:17% S:77% F:6%		338
2		5 5 5 7	10 ▲		S2	42		Becoming compact, trace to some Silt, wet, grey				337
3		1 1 3 1	4 ▲		S3	75		3.0m Loose SAND, trace silt; fine grained sand, wet, grey				336
4												335
5												334
6								6.7m Target Depth Achieved				333
7												332
8												331
9												330
10												

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

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

Final Depth of Hole: 6.7 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

SUMMARY LOG

Drill Hole #: **TH16-10**

Ministry of Transportation and Infrastructure

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group

Logged by: SK Reviewed by:

Datum: Alignment:

Northing/Easting: 5480942.161 , 310926.422 Station/Offset:

Elevation: 339.88 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/27/2017

Drilling Company: On The Mark

Driller:

Drill Make/Model: Truck Mount

Drilling Method: ODEX

DEPTH (m)	DRILLING DETAILS	SPT	Pocket Penetrometer / Shear Strength (kPa) 100 200 300 400; DYNAMIC CONE (BLOWS/300 mm); Natural Vane (KPa) / Remold Vane (KPa); SPT "N" (BLOWS/300 mm); W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	MONITORING WELL	ELEVATION (m)
0								Loose SAND, Silty, trace Gravel, moist, brown				339
								0.3m Compact SAND, trace Silt, trace Gravel; coarse grained sand, moist, brown				
1	3 3 2 2	5			S1	75		Becoming moist to wet		**Sieve** (Sa#S1) G:2% S:94% F:4%		338
	Water-1.2m 2017/6/16											
2	5 6 8 14	14			S2			Becoming medium to coarse grained, wet, grey				337
3	2 2 2 2	4			S3			Grading to trace to some Silt				336
4												335
5	0 1 1 1	2			S4			5.2m Target Depth Achieved				334
6												333
7												332
8												331
9												330
10												

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

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

Final Depth of Hole: 5.2 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

Ministry of Transportation and Infrastructure

SUMMARY LOG

Drill Hole #: TH16-11

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group

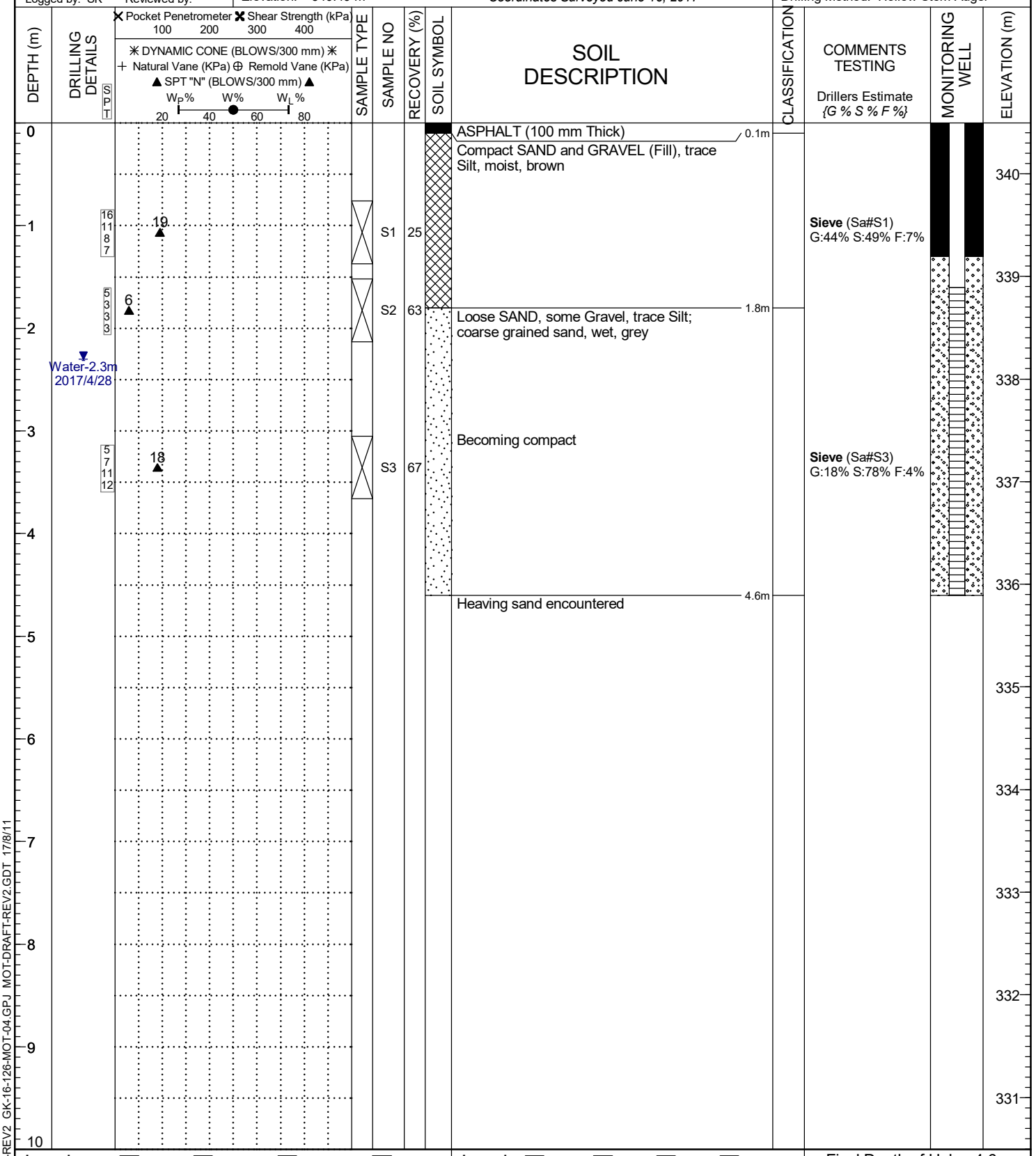
Logged by: SK Reviewed by:

Datum: Alignment:

Northing/Easting: 5480879.958 , 310979.521 Station/Offset:

Elevation: 340.49 m *Coordinates Surveyed June 16, 2017*

Date(s) Drilled: 04/28/2017
Drilling Company: On The Mark
Driller:
Drill Make/Model: Truck Mount
Drilling Method: Hollow Stem Auger



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

Legend Installation:
Sand, Grout, Cemen, Bentonite
Drill Cuttings, Slotted, Slough, Piezometer

Final Depth of Hole: 4.6 m
Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

TEST PIT LOG

Test Pit #: **TP17-01**

Ministry of Transportation and Infrastructure — British Columbia

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Prepared by: GK-16-126-MOT-04 Ecora Engineering & Resource Group

Logged by: PW Reviewed by: SK

Datum: NAD83 Alignment: N/A

Northing/Easting: 5480833.77 , 310797.55 Station/Offset: 100+330

Elevation: 344.14 m *Coordinates Surveyed August 1, 2017*

Date(s) Drilled: 08/01/2017

Excavating Company: Rital Enterprises

Operator: CJ

Excavator: Rubber tire backhoe

Pocket Penetrometer ✖ Shear Strength (kPa) 100 200 300 400

✳ DYNAMIC CONE (BLOWS/300 mm) ✳

+ Natural Vane (kPa) ⊕ Remold Vane (kPa)

▲ SPT "N" (BLOWS/300 mm) ▲

W_P% W% W_L% 20 40 60 80

DEPTH (m)	DRILLING DETAILS (S.O.T.)	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	ELEVATION (m)
0						Loose SAND and GRAVEL, silty, trace cobbles, dry, light brown			344
						from 0.4 -1.9 m: compact, becoming trace silt, moist			
		●	1					**Sieve** (Sa#1) G:50% S:40% F:10%	
1							GW-GM		343
						1.9m Compact SAND, gravelly, some cobbles, trace fines, medium to coarse grained sand			
2		●	2				GW	**Sieve** (Sa#2) G:63% S:36% F:1%	342
						2.5m Maximum reach of backhoe, no groundwater encountered			
3									

Legend

Sample Type: **A**-Auger **C**-Core **G**-Grab **V**-Vane

L#-Lab Sample **S**-Split Spoon **O**-Odex (air rotary) **W**-Wash (mud return) **T**-Shelby Tube

Final Depth of Hole: 1.9 m

Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

TEST PIT LOG

Test Pit #: **TP17-02**

Ministry of Transportation and Infrastructure

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Date(s) Drilled: 08/01/2017

Excavating Company: Rital Enterprises

Operator: CJ

Excavator: Rubber tire backhoe

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group

Logged by: PW Reviewed by: SK

Datum: NAD83 Alignment: N/A

Northing/Easting: 5480790.84 , 310765.47 Station/Offset: 100+280

Elevation: 346.18 m *Coordinates Surveyed August 1, 2017*

DEPTH (m)	DRILLING DETAILS (S.P.T.)	Pocket Penetrometer (kPa) 100 200 300 400 / DYNAMIC CONE (BLOWS/300 mm) / Natural Vane (KPa) ⊕ Remold Vane (KPa) / SPT "N" (BLOWS/300 mm) / W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate *{G % S % F %}*	ELEVATION (m)
0							Loose SILT (Topsoil), some organics, dry			346
							0.05m Compact SAND and GRAVEL, silty, rootlets present, dry, dark brown			
							from 0.3 - 2.5 m: becoming some silt, compact, light brown			
				1			at 0.8 m: some cobbles, some to trace silt		**Sieve** (Sa#1) G:52% S:44% F:4%	
1							at 1.0 m: cobbles			345
								GW		
2							2.5m Maximum reach of backhoe, no groundwater encountered			344
3										

Legend

Sample Type:

A-Auger **C**-Core **G**-Grab **V**-Vane

L#-Lab Sample **S**-Split Spoon **O**-Odex (air rotary) **W**-Wash (mud return) **T**-Shelby Tube

Final Depth of Hole: 2.5 m

Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

TEST PIT LOG

Test Pit #: **TP17-03**

Ministry of Transportation and Infrastructure

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Date(s) Drilled: 08/01/2017

Excavating Company: Rital Enterprises

Operator: CJ

Excavator: Rubber tire backhoe

Prepared by: GK-16-126-MOT-04
Ecora Engineering & Resource Group

Logged by: PW Reviewed by: SK

Datum: NAD83 Alignment: N/A

Northing/Easting: 5480771.34 , 310748.68 Station/Offset: 100+260

Elevation: 347.28 m *Coordinates Surveyed August 1, 2017*

DEPTH (m)	DRILLING DETAILS (S O I L)	Pocket Penetrometer ✕ / Shear Strength (kPa) 100 200 300 400; ✳ DYNAMIC CONE (BLOWS/300 mm) ✳; + Natural Vane (KPa) ⊕ Remold Vane (KPa); ▲ SPT "N" (BLOWS/300 mm) ▲; W_P% W% W_L% 20 40 60 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	ELEVATION (m)
0							Loose SILT (Topsoil), some organics, dry			
							0.05m Compact GRAVEL, sandy, silty, trace rootlets, compact, dry, dark brown			347
				1						
							0.5m Compact SAND and GRAVEL, trace silt, trace cobbles, dry			
				2					**Sieve** (Sa#2) G:52% S:44% F:4%	
1							at 1.1 m: some cobbles			
							at 1.3 m: becoming cobbly	GW		346
							at 1.4 m: becoming moist			
2							2.1m End of test pit due to sloughing, no groundwater encountered			345
3										

Legend

Sample Type:

A-Auger **C**-Core **G**-Grab **V**-Vane

L#-Lab Sample **S**-Split Spoon **O**-Odex (air rotary) **W**-Wash (mud return) **T**-Shelby Tube

Final Depth of Hole: 2.1 m

Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

TEST PIT LOG

Test Pit #: **TP17-04**

Ministry of Transportation and Infrastructure — British Columbia

Project: **Skaha Hills Drive Intersection Improvement Project**

Location: Penticton, BC

Prepared by: GK-16-126-MOT-04 Ecora Engineering & Resource Group

Logged by: PW Reviewed by: SK

Datum: NAD83 Alignment: N/A

Northing/Easting: 5480755.41 , 310740.59 Station/Offset: 100+240

Elevation: 347.48 m *Coordinates Surveyed August 1, 2017*

Date(s) Drilled: 08/01/2017

Excavating Company: Rital Enterprises

Operator: CJ

Excavator: Rubber tire backhoe

Pocket Penetrometer ✖ Shear Strength (kPa) 100 200 300 400

✳ DYNAMIC CONE (BLOWS/300 mm) ✳

+ Natural Vane (KPa) ⊕ Remold Vane (KPa)

▲ SPT "N" (BLOWS/300 mm) ▲

W_P% W% W_L% 20 40 60 80

DEPTH (m)	DRILLING DETAILS (S.P.T.)	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	ELEVATION (m)
0						Loose SILT (Topsoil), some organics, dry			
						0.05m Compact GRAVEL, sandy, some silt, trace rootlets, dry			
						from 0.3 - 0.5 m: becoming moist			347
			1						
1						1.3m Compact SAND and GRAVEL, trace silt, trace cobbles, moist, light brown	GW-GM	**Sieve** (Sa#2) G:62% S:31% F:7%	346
			2			at 1.9 m: boulders, up to 30 cm diameter			
2						at 2.0 m: becoming moist and brown			
						2.2m End of test pit due to sloughing, no groundwater encountered			345
3									

Legend

Sample Type: **A**-Auger **C**-Core **G**-Grab **V**-Vane

L#-Lab Sample **S**-Split Spoon **O**-Odex (air rotary) **W**-Wash (mud return) **T**-Shelby Tube

Final Depth of Hole: 2.2 m

Depth to Top of Rock:

MOT-SOIL-REV2 GK-16-126-MOT-04.GPJ MOT-DRAFT-REV2.GDT 17/8/11

SUMMARY LOG

Drill Hole #: **TH23-01**

Ministry of Transportation and Infrastructure

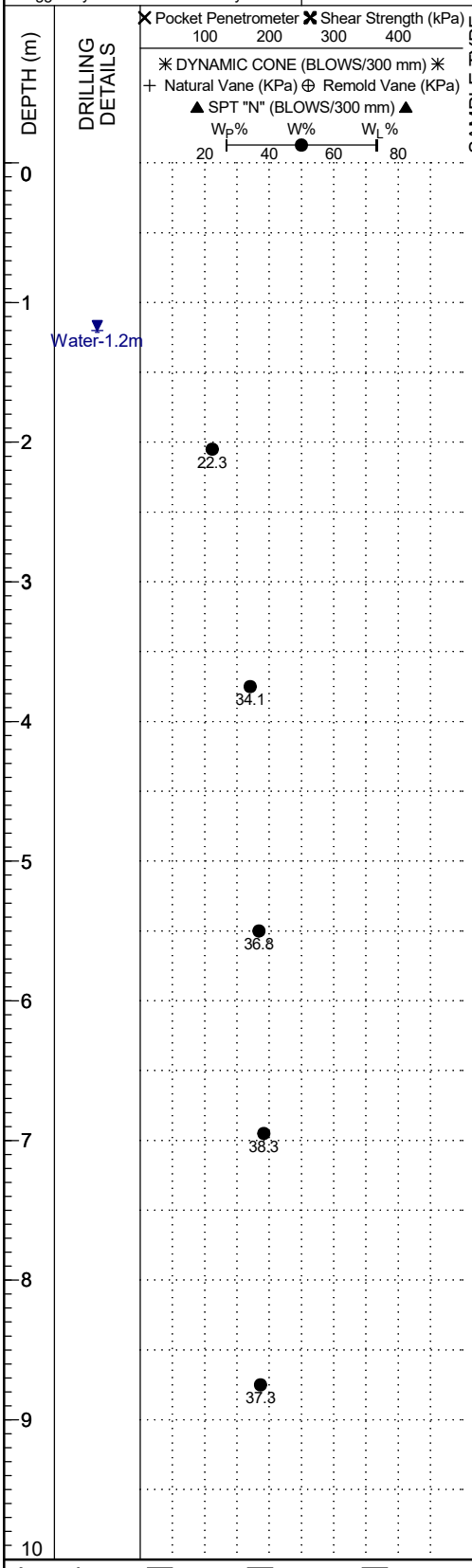
Project: **HWY97 Skaha Hills Drive Intersection Improvement**

Location: 4200 Skaha Lake Road, Penticton, BC

Prepared by: 221266-26
Ecora Engineering & Resource Group
Logged by: MS Reviewed by: MJL

Datum: Alignment:
Northing/Easting: 5480845.2 , 310986.1 Station/Offset:
Elevation: 339.7 m *Coordinates taken with GPS*

Date(s) Drilled: June 2, 2023
Drilling Company: On The Mark
Driller: Jesse McLeod
Drill Make/Model: B54 Truck Mounted
Drilling Method: Solid Stem Auger



SOIL DESCRIPTION

Depth	Description	CLASSIFICATION	COMMENTS TESTING (Drillers Estimate {G % S % F %})	ELEVATION (m)
0.0	Silty SAND, trace gravel, trace cobble, dry, light brown.	SM1		339
0.3m	SAND, trace to some gravel, medium to coarse grained, dry to moist, light brown. Observed rusty oxidation staining from 0.5 m to 1.2 m.	SP		
1.2m	SAND, some silt, trace gravel, well graded, wet, dark grey.	SW-SM	**Sieve** (Sa#2) G:1% S:87% F:11%	338
2.7m	Silty SAND, trace clay, fine grained sand, wet to saturated, non plastic, dark grey.	SM2	**Sieve** (Sa#3) G:% S:71% F:% Clay:7% Silt:23%	337
4.3m	SILT and SAND, trace clay, fine-grained sand, saturated, non plastic, dark grey.	ML	**Sieve** (Sa#4) G:% S:38% F:% Clay:4% Silt:57%	336
			Sieve (Sa#5) G:% S:47% F:% Clay:3% Silt:50%	335
8.2m	SILT, some sand to sandy, trace to some clay, fine-grained sand, saturated, non plastic, dark grey.		**Sieve** (Sa#6) G:% S:32% F:% Clay:4% Silt:64%	334
				333
				332
				331
				330

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

Final Depth of Hole: 18.3 m
Depth to Top of Rock:

SUMMARY LOG

Drill Hole #: **TH23-01**

Ministry of Transportation and Infrastructure

Project: **HWY97 Skaha Hills Drive Intersection Improvement**

Location: 4200 Skaha Lake Road, Penticton, BC

Prepared by: 221266-26
Ecora Engineering & Resource Group
Logged by: MS Reviewed by: MJL

Datum: Alignment:
Northing/Easting: 5480845.2 , 310986.1 Station/Offset:
Elevation: 339.7 m *Coordinates taken with GPS*

Date(s) Drilled: June 2, 2023
Drilling Company: On The Mark
Driller: Jesse McLeod
Drill Make/Model: B54 Truck Mounted
Drilling Method: Solid Stem Auger

DEPTH (m)	DRILLING DETAILS	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING	ELEVATION (m)
10	Pocket Penetrometer ✕ Shear Strength (kPa) 100 200 300 400; ✳ DYNAMIC CONE (BLOWS/300 mm) ✳; + Natural Vane (KPa) ⊕ Remold Vane (KPa); ▲ SPT "N" (BLOWS/300 mm) ▲; W_P% W% W_L% 20 40 60 80					SILT, some sand to sandy, trace to some clay, fine-grained sand, saturated, non plastic, dark grey. *(continued)*	ML	Drillers Estimate *{G % S % F %}*	329
11			8						328
12									327
13			9			12.5m SILT, trace to some clay, trace to some fine grained sand, saturated, non plastic to low plasticity, dark grey and black, with organic inclusions and wood debris.			326
14			10				ML		325
15									324
16			11			15.7m Silty SAND, trace to some gravel, well graded, saturated, dark grey.	SM-SP		323
17			12			16.2m SILT, trace to some clay, trace to some fine grained sand, saturated, non plastic to low plasticity, dark grey.	ML		322
18									321
19						18.3m End of hole at 18.3 m. Hole backfilled with cuttings upon completion. Target depth achieved.			320
20									

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

Final Depth of Hole: 18.3 m
Depth to Top of Rock:

Appendix B

Infiltration Test Results

DOUBLE-RING INFILTROMETER TEST RESULTS

Project No.	GK-16-126-MOT-04
Location	5480919.51 N, 310921.68 E Skaha Hills Drive and Highway 97 Intersection, Penticton, BC
Date	May 12, 2017
Time	Start: 10:55 End: 13:21
Weather Conditions	10:20 - Cloudy, light rain
	11:55 - Cloudy, no rain
	12:30 - Mix of sun and clouds, no rain
	13:15 - Mix of sun and clouds, no rain
Tested By	Colm Frier, Isabelle Piche
Test Site	Adjacent to the side of the gravel pathway, between TH-16-09 and TH-16-10. Hand excavated 300 mm to expose native silty sand. Could possibly be fill material based on surrounding area observations.
Liquid	Potable water from Ecora's Penticton laboratory

RING AREAS

Area of Inner Ring	684 cm^2
Area of Outer Ring	2837 cm^2
Area of Annular Space	2153 cm^2

TEMPERATURES

Soil	15.9 °C	at 10:35
Water in Liquid Containers	13.8 °C	at 10:35
	16.8 °C	at 11:55
	16 °C	at 12:36

TEST RESULTS

Depth of Liquid in Rings = 8.9 cm

Test 1

Start Time	10:55
Duration	30 min

		Inner Ring		Annular Space		
Time	Elapsed Time	Volume Used	Infiltration Rate	Volume Used	Infiltration Rate	Water Temperature
	min	cm^3	cm/sec	cm^3	cm/sec	°C
10:55						N/A
11:10	15	1414	2.3E-03	10143	5.2E-03	N/A
11:25	30	565	9.2E-04	8518	4.4E-03	N/A

Test 2

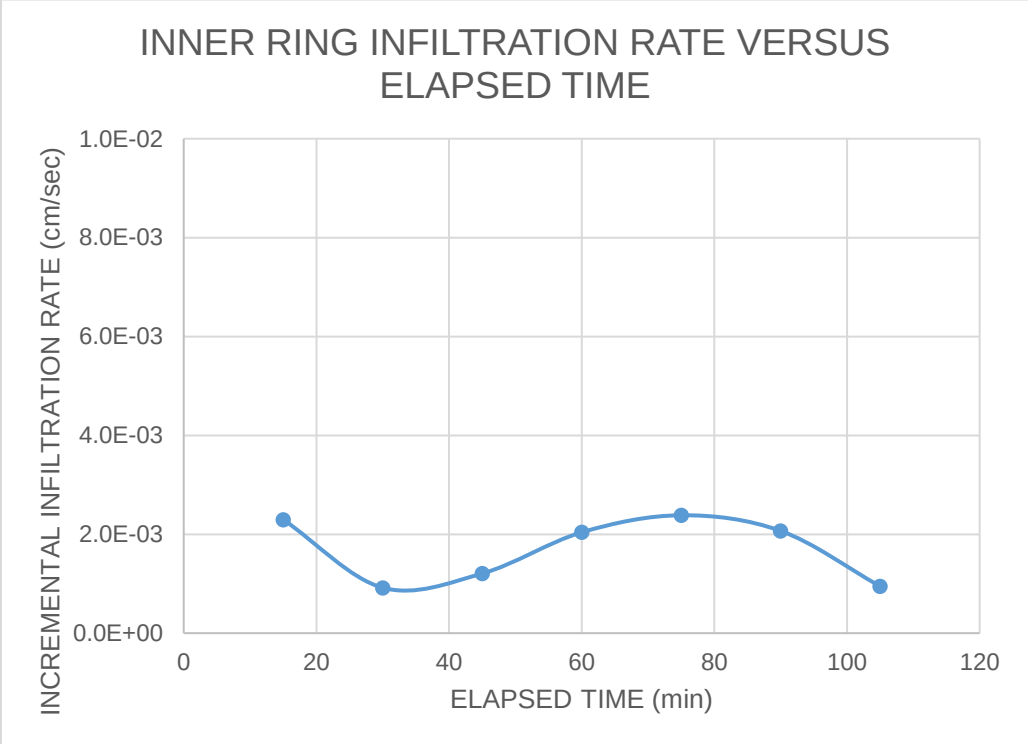
Start Time	11:55
Duration	30 min

		Inner Ring		Annular Space		
Time	Elapsed Time	Volume Used	Infiltration Rate	Volume Used	Infiltration Rate	Water Temperature
	min	cm^3	cm/sec	cm^3	cm/sec	°C
11:55						16.5
12:10	45	742	1.2E-03	6415	3.3E-03	15.2
12:25	60	1255	2.0E-03	7493	3.9E-03	15.1

Test 3

Start Time	12:36
Duration	45 min

		Inner Ring		Annular Space		
Time	Elapsed Time	Volume Used	Infiltration Rate	Volume Used	Infiltration Rate	Water Temperature
	min	cm^3	cm/sec	cm^3	cm/sec	°C
12:36						16.0
12:51	75	1467	2.4E-03	6150	3.2E-03	15.0
13:06	90	1272	2.1E-03	7157	3.7E-03	15.0
13:21	105	583	9.5E-04	15639	8.1E-03	14.8

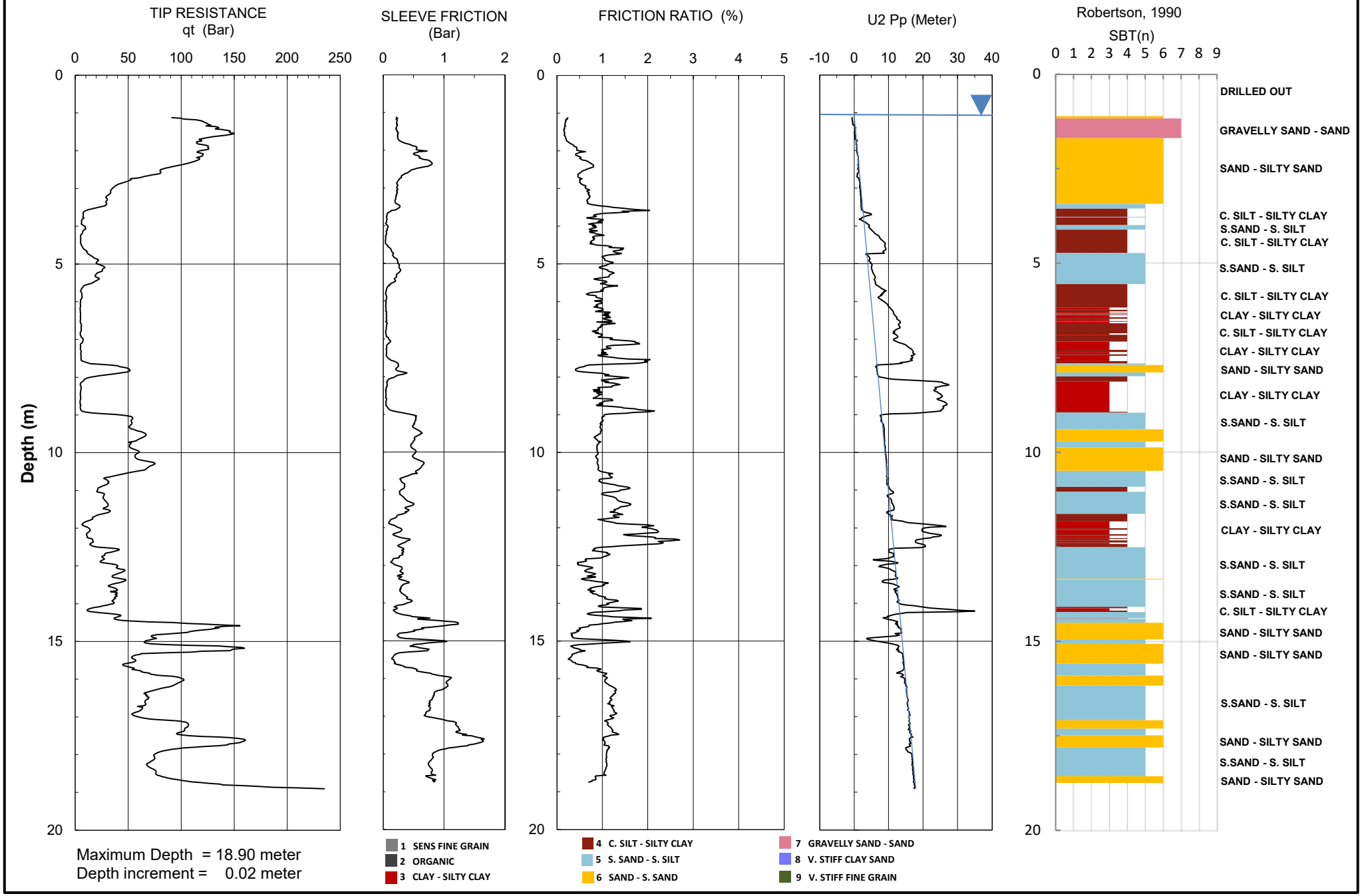


Appendix C

CPT Data

Operator: Schwartz Soil Technical
Sounding: SCPT23 - 01
Cone ID: 1427

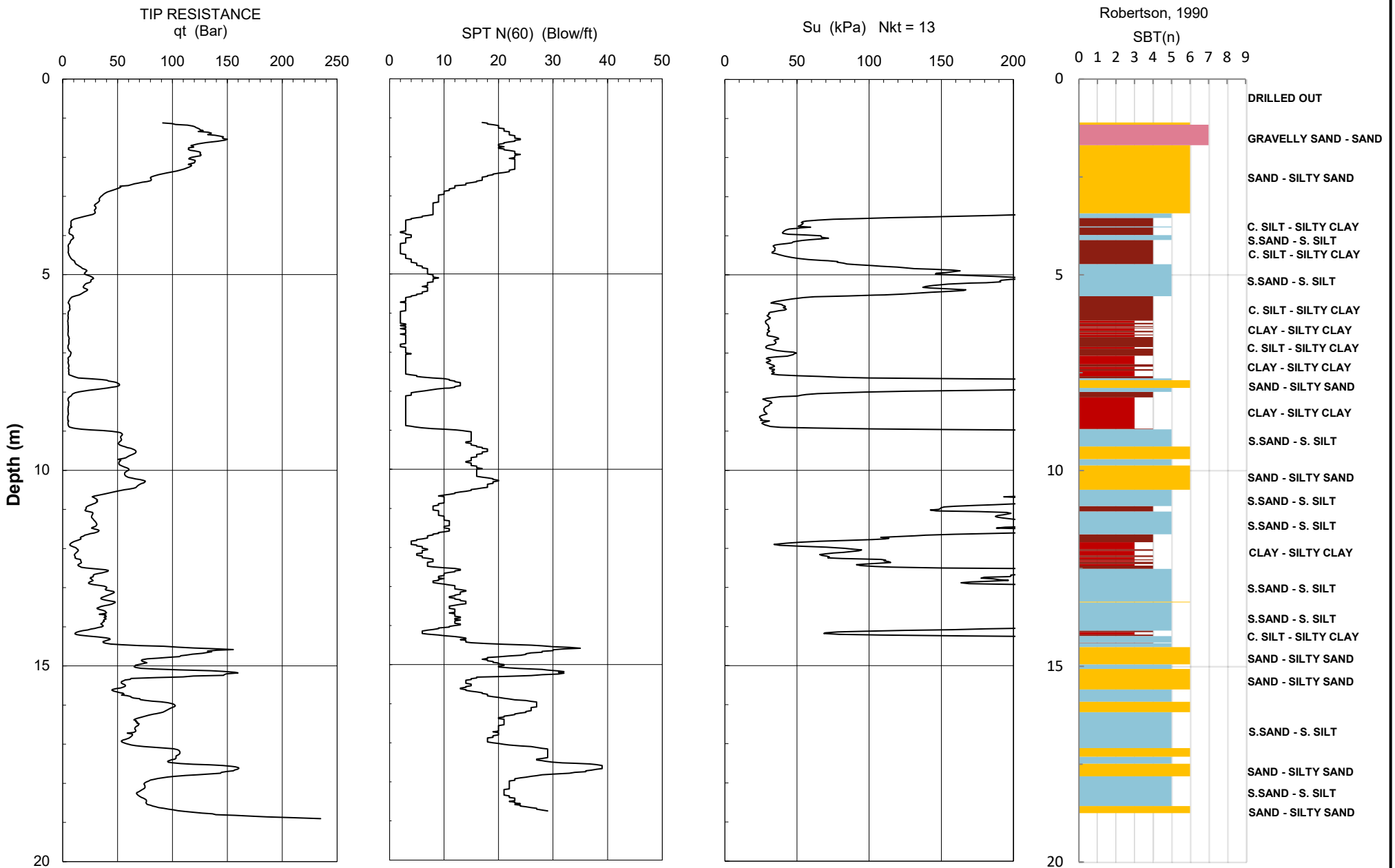
Date: June 2, 2023
Site: Hwy 97 at Skaha Hills Dr
Ecora project no: 221266 - 26



Maximum Depth = 18.90 meter
Depth increment = 0.02 meter

Operator: Schwartz Soil Technical
Sounding: SCPT23 - 01
Cone ID: 1427

Date: June 2, 2023
Site: Hwy 97 at Skaha Hills Dr
Ecora project no: 221266 - 26



Maximum Depth = 18.90 meter
Depth increment = 0.02 meter

1 SENS FINE GRAIN
2 ORGANIC
3 CLAY - SILTY CLAY
4 C. SILT - SILTY CLAY
5 S. SAND - S. SILT
6 SAND - S. SAND
7 GRAVELLY SAND - SAND
8 V. STIFF CLAY SAND
9 V. STIFF FINE GRAIN

Schwartz
SOIL TECH

SHEAR WAVE VELOCITY DATA

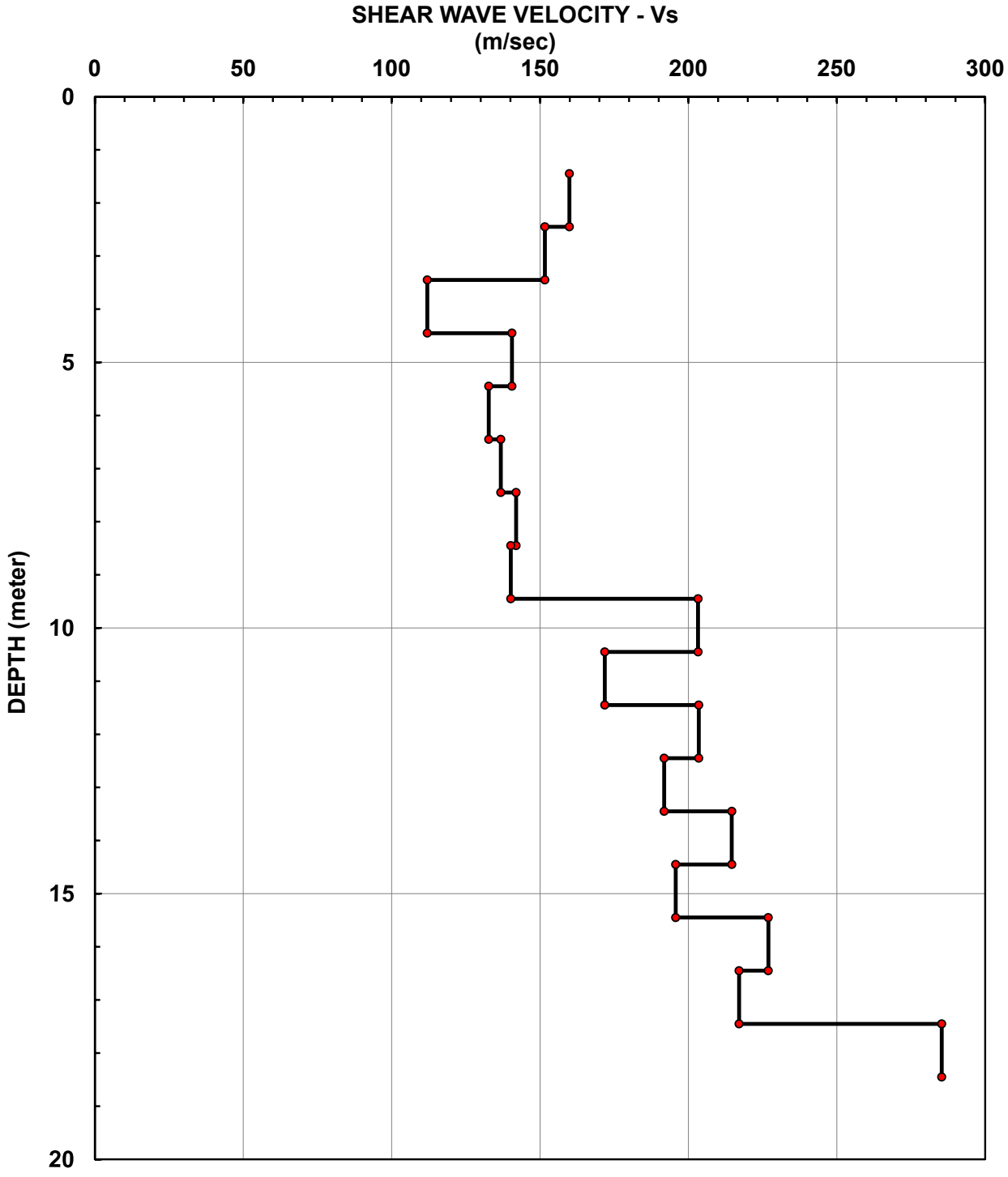
Client:	Ecora	**Date:**	June 2, 2023
Test:	SCPT23 - 01	**Cone ID:**	1427
Site:	Hwy 97 at Skaha Hills Dr Skaha Lake, BC	**Source offset:**	0.90 m
		Source:	Impact Brackets

Cone tip Depth (m)	Geophone Depth (m)	Wave Path Length (m)	Wave Path Interval (m)	Wave Travel Time interval (ms)	Interval Velocity (m/sec)
1.70	1.45	1.71			
			0.90	5.65	160
2.70	2.45	2.61			
			0.96	6.30	152
3.70	3.45	3.57			
			0.97	8.70	112
4.70	4.45	4.54			
			0.98	7.00	141
5.70	5.45	5.52			
			0.99	7.45	133
6.70	6.45	6.51			
			0.99	7.25	137
7.70	7.45	7.50			
			0.99	7.00	142
8.70	8.45	8.50			
			0.99	7.10	140
9.70	9.45	9.49			
			1.00	4.90	203
10.70	10.45	10.49			
			1.00	5.80	172
11.70	11.45	11.49			
			1.00	4.90	204
12.70	12.45	12.48			
			1.00	5.20	192
13.70	13.45	13.48			
			1.00	4.65	215
14.70	14.45	14.48			
			1.00	5.10	196
15.70	15.45	15.48			
			1.00	4.40	227
16.70	16.45	16.47			
			1.00	4.60	217
17.70	17.45	17.47			
			1.00	3.50	285
18.70	18.45	18.47			

Schwartz SOIL TECH

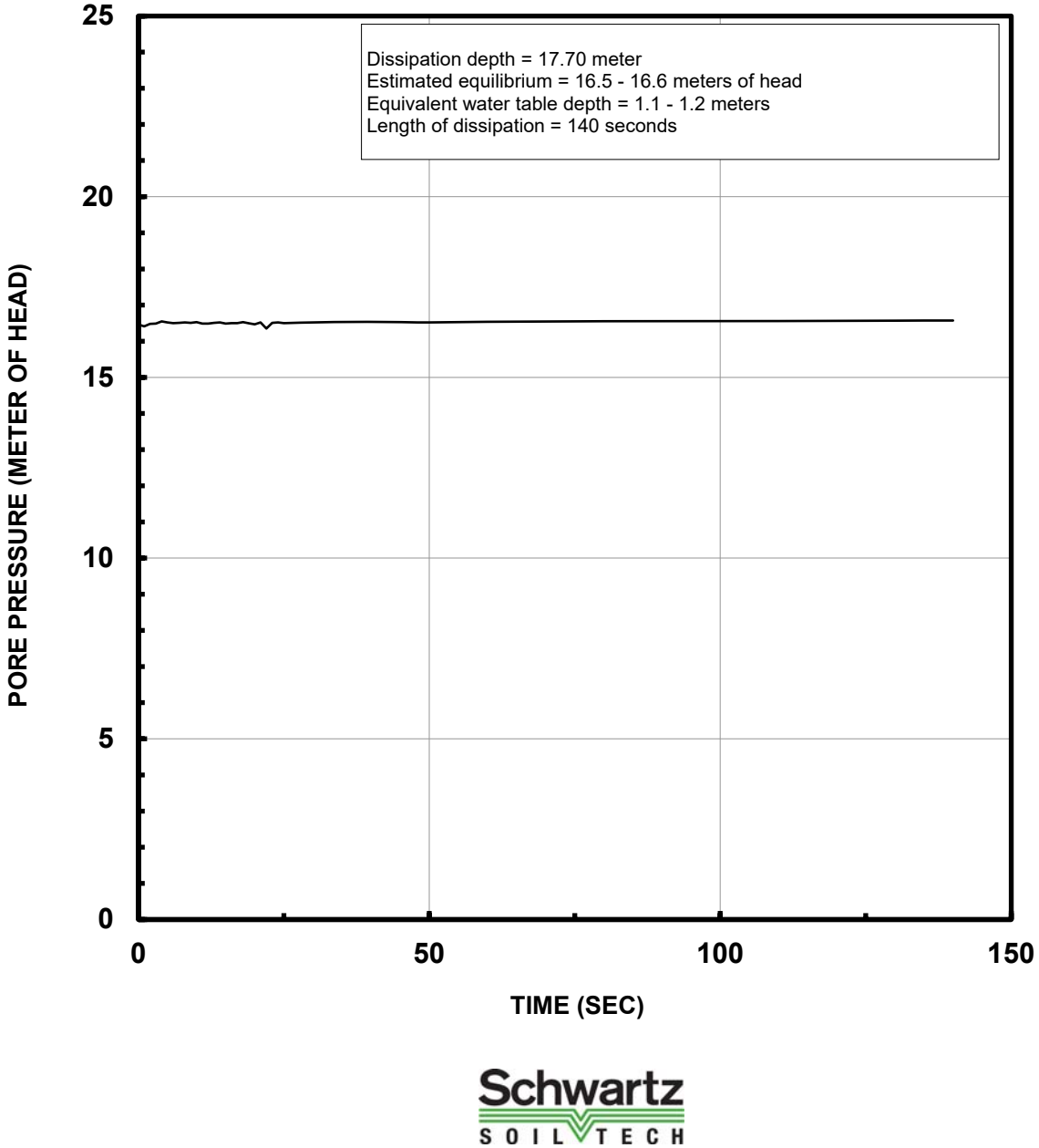
SHEAR WAVE VELOCITY PROFILE

Client:	Ecora	**Date:**	June 2, 2023
Test:	SCPT23 - 01	**Cone ID:**	1427
Site:	Hwy 97 at Skaha Hills Dr Skaha Lake, BC	**Source offset:**	0.90 m
		Source:	Impact Brackets



ECORA

U2 PORE PRESSURE DISSIPATION
HWY 97 AT SKAHA HILLS DR
SCPT23 - 01
17.70 METER DEPTH
JUNE 2, 2023



Schwartz
SOIL TECH

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598 West 24 Avenue, Vancouver, B.C. V5Z 2B4 Tel: (604) 418-1072
billschwartzcpt@telus.net

The enclosed CPTU data interpretation files use the correlations shown in the "Guide to Cone Penetration Testing", P.K. Robertson
6th Edition, 2015.

Correlation References

1 SBT – Non-normalized SBT type (Robertson et al 2010)

2 Ic SBT – Non-normalized soil behavior type index

3 a – Soil unit weights see the correlation chart on pg 36

4 o',v – Overburden stress based on the soil unit weights

5 u0 – In-situ pore pressure based on a pre determined water table depth

6 o',v – Effective overburden stress based on the assigned water table depth

7 Qt1 – Normalized cone tip restistance (dimensionless)

8 Fr – Normalized friction ratio (dimensionless)

9 Bq – Normalized pore pressure ratio

10 SBTn – Normalized soil behavior type number (Robertson 1990)

11 n – Stress normalization exponent factor determined from numerous iterations.

12 Cn – Normalization factor $Cn = (Pa/E.O.S)^n$

13 Ic - Soil Behavior type index (normalized)

14 Qtn – Normalized cone restistance based on stress component n
$Qtn = ((qt – O.S.)/Pa)^n$

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Correlation References
Pg2

15 k – Estimated soil permeability correlation table is shown on page 52 and is based on the SBT zone.

16 SPTN(60) – Estimated equivalent SPT blow count based on the Robertson 2012 method that includes insensitive clays.

17 M – Constrained modulus correlation is shown on page 58

18 Dr – Relative density (only applies to SBTn 5, 6, 7 and 8)
Comments and the correlation formula are shown on page 43.

19 Phi – Friction angle correlations shown on page 47.

20 Es – Youngs modulus correlation is shown on page 48 using normalized CPTU data and the Ic value.

21 Go – Shear modulus correlation is shown on page 49.

22 Nkt – Cone factor for estimating the soil Su values (Nkt = 13)

23 Su – Undrained shear strength using the Nkt formula method shown on page 37.

24 Shear strength ratio = Su/E.O.S.
A common value for N.C. clays is approximately 0.22
See additional comments on page 39.

25 Kocr – Shows the estimated soil OCR value using the Su/EOS ratio and P.I. value. Correlation chart is shown on page 41.

26 OCR – Over consolidation ratio based on the Robertson 2009 method shown on page 40.

27 State parameter – Estimated soil state parameter
See Robertson correlation chart on page 45 for an estimate of the state parameter based on the normalized CPTU data.

Correlation References
Pg 3

28 Ko – In-situ soil stress ratio estimate
This correlation is an estimate. An estimation of this value can made using the soil OCR and the correlation table shown on page 41.

29 St – Soil sensitivity correlation for fine grained soils shown on page 38

30 Peak phi – Peak friction angle correlation shown on page 47.

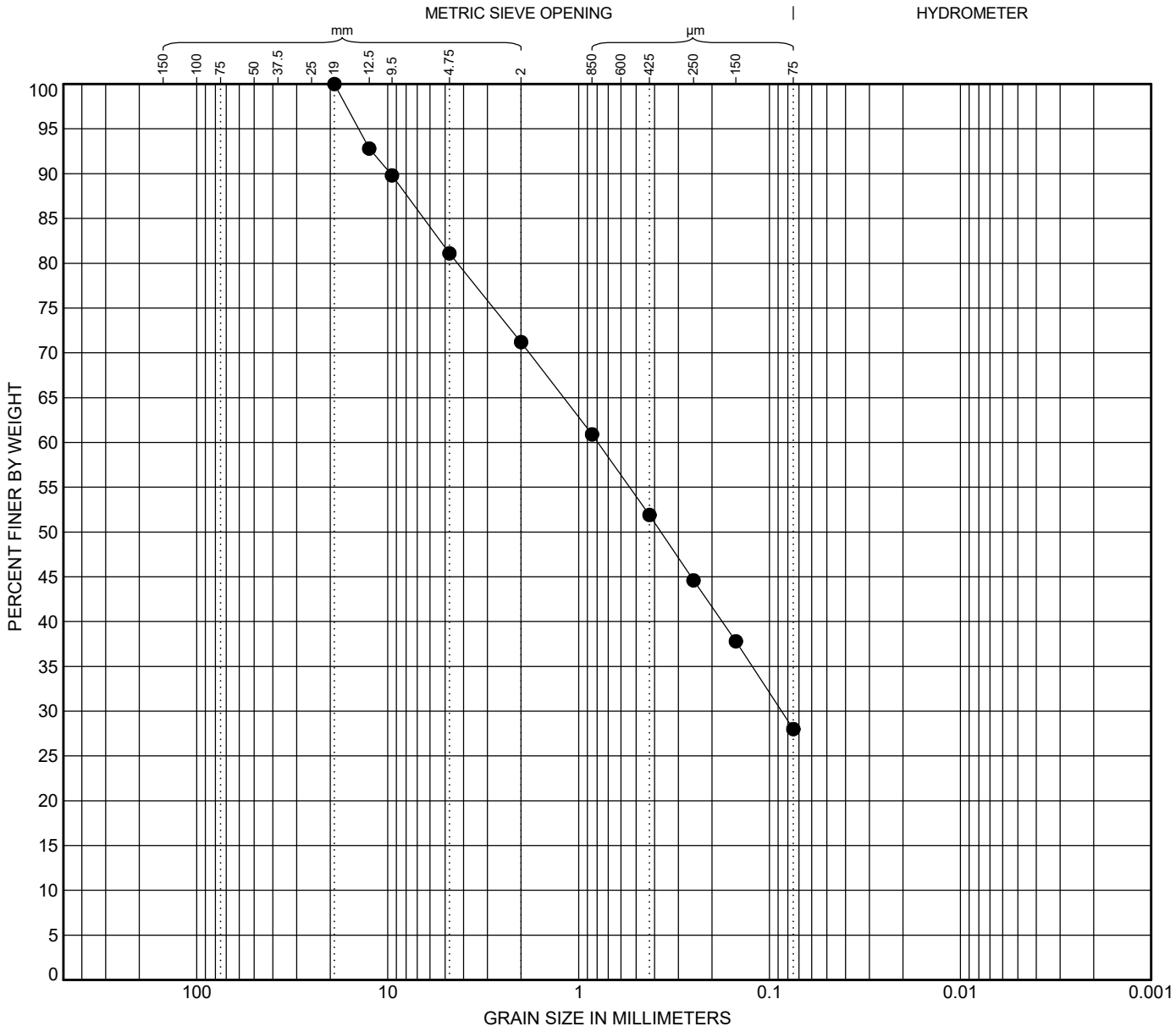
Appendix D

Laboratory Test Results

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-02

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 0.76 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
19	**6.481**	**0.793**	**0.086**					**19**	**53**	**28**	

Description: SAND, Silty, some Gravel
Natural Moisture Content: 8.9 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 108-17
Date Tested: 2017-05-03
Tested By: RG

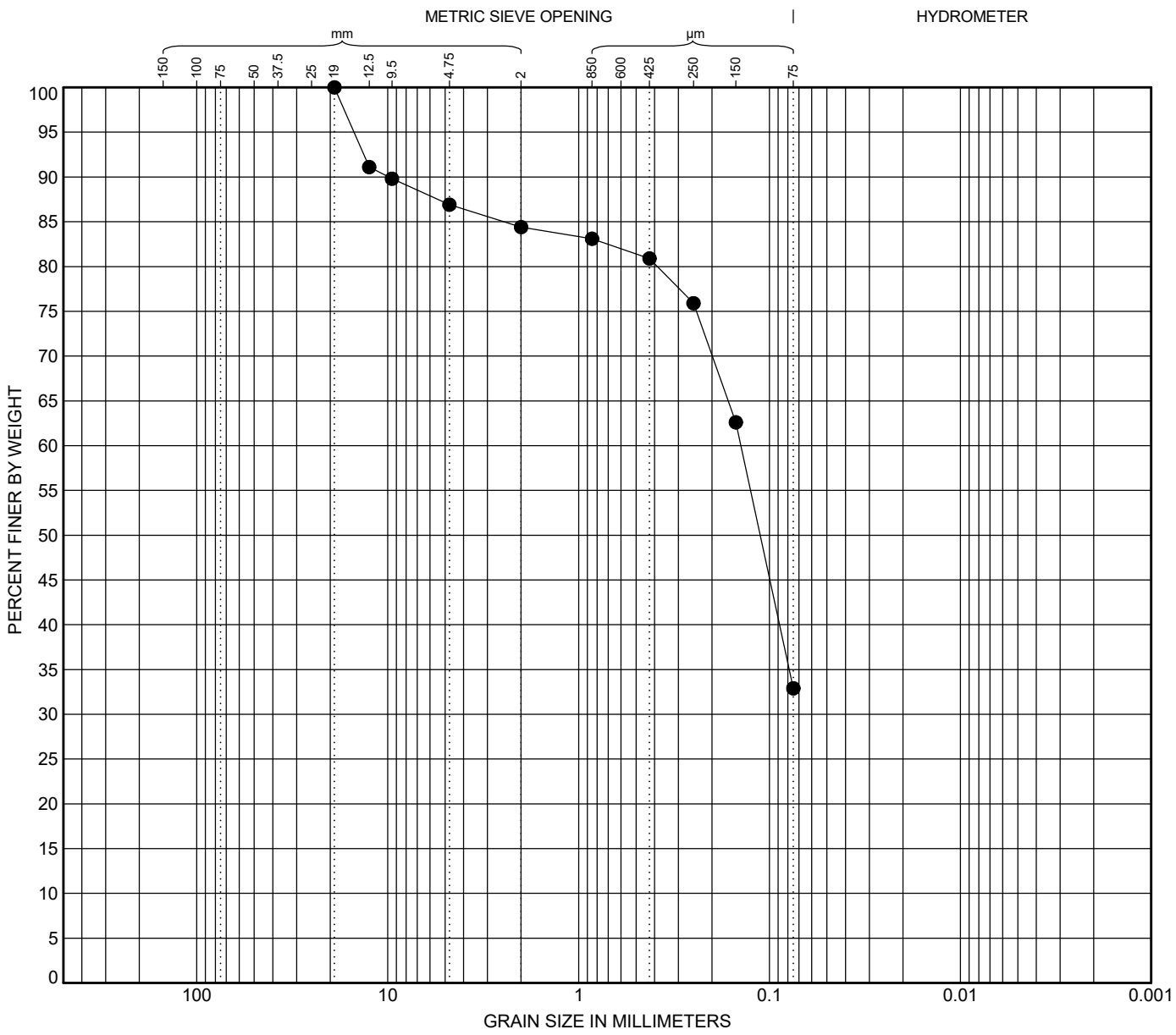
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-02

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 4.5 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
19	**2.461**	**0.141**						**13**	**54**	**33**	

Description: SAND, Silty, some Gravel
Natural Moisture Content: 13.3 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 109-17
Date Tested: 2017-05-03
Tested By: RG

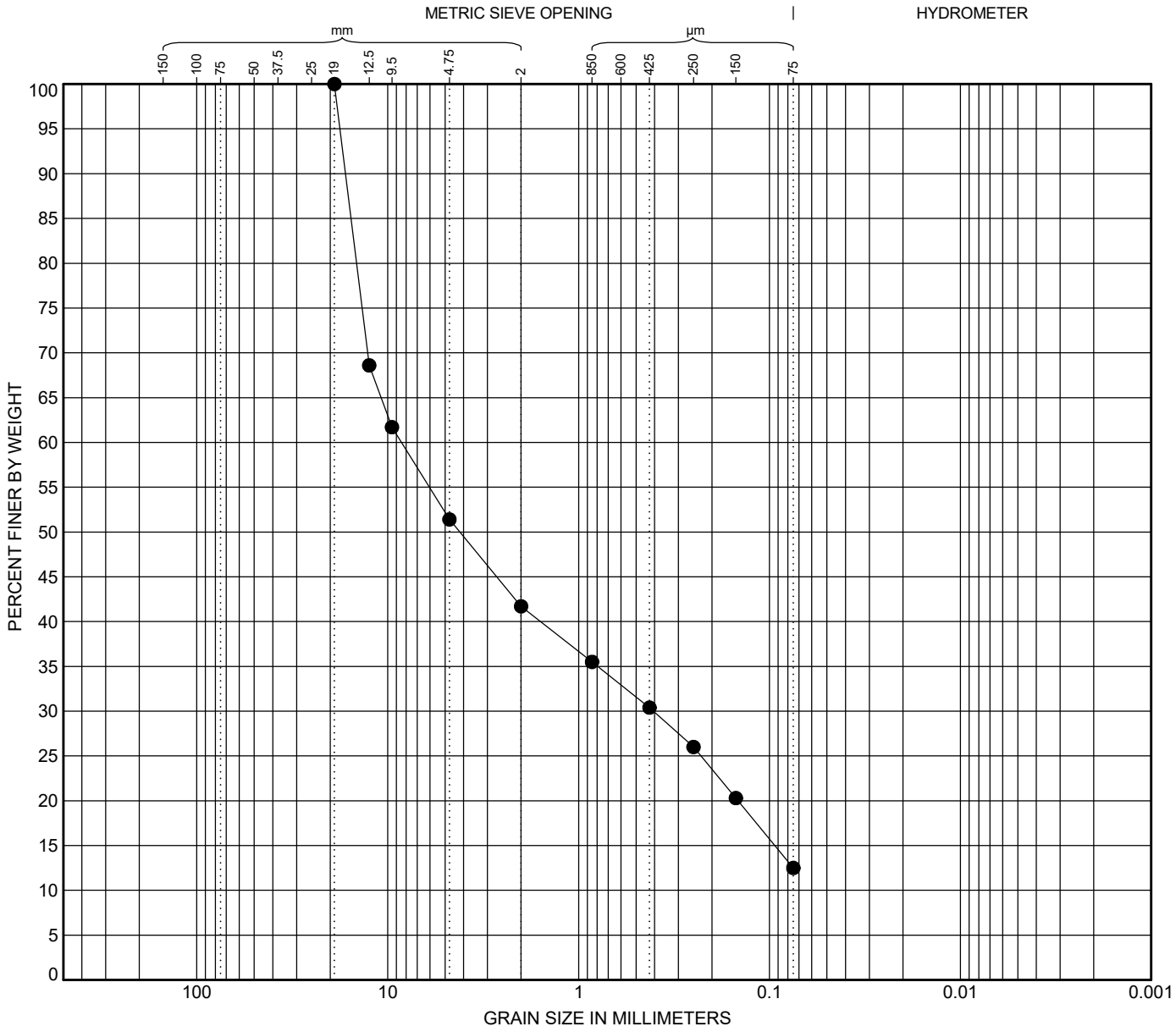
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-03

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 1.52 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
19	**15.556**	**8.473**	**0.405**	**0.094**				**49**	**39**	**12**	

Description: GRAVEL and SAND, some Silt
Natural Moisture Content: 13.2 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 110-17
Date Tested: 2017-05-03
Tested By: RG

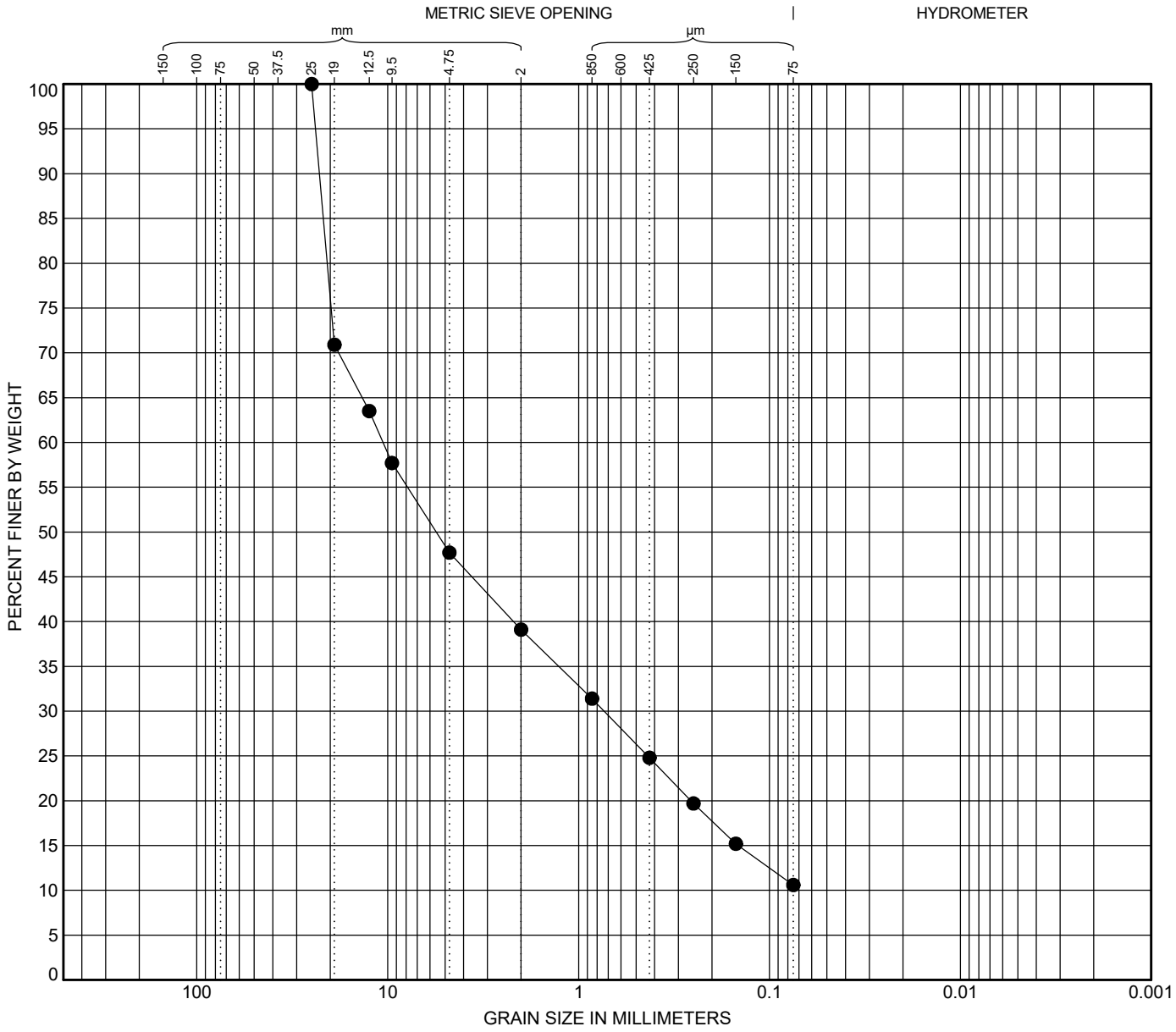
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-04

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 0.76 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
25	**21.702**	**10.592**	**0.734**	**0.146**		**0.74**	**154.59**	**52**	**37**	**11**	

Description: GRAVEL and SAND, some Silt
Natural Moisture Content: 3.7 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 111-17
Date Tested: 2017-05-04
Tested By: RG

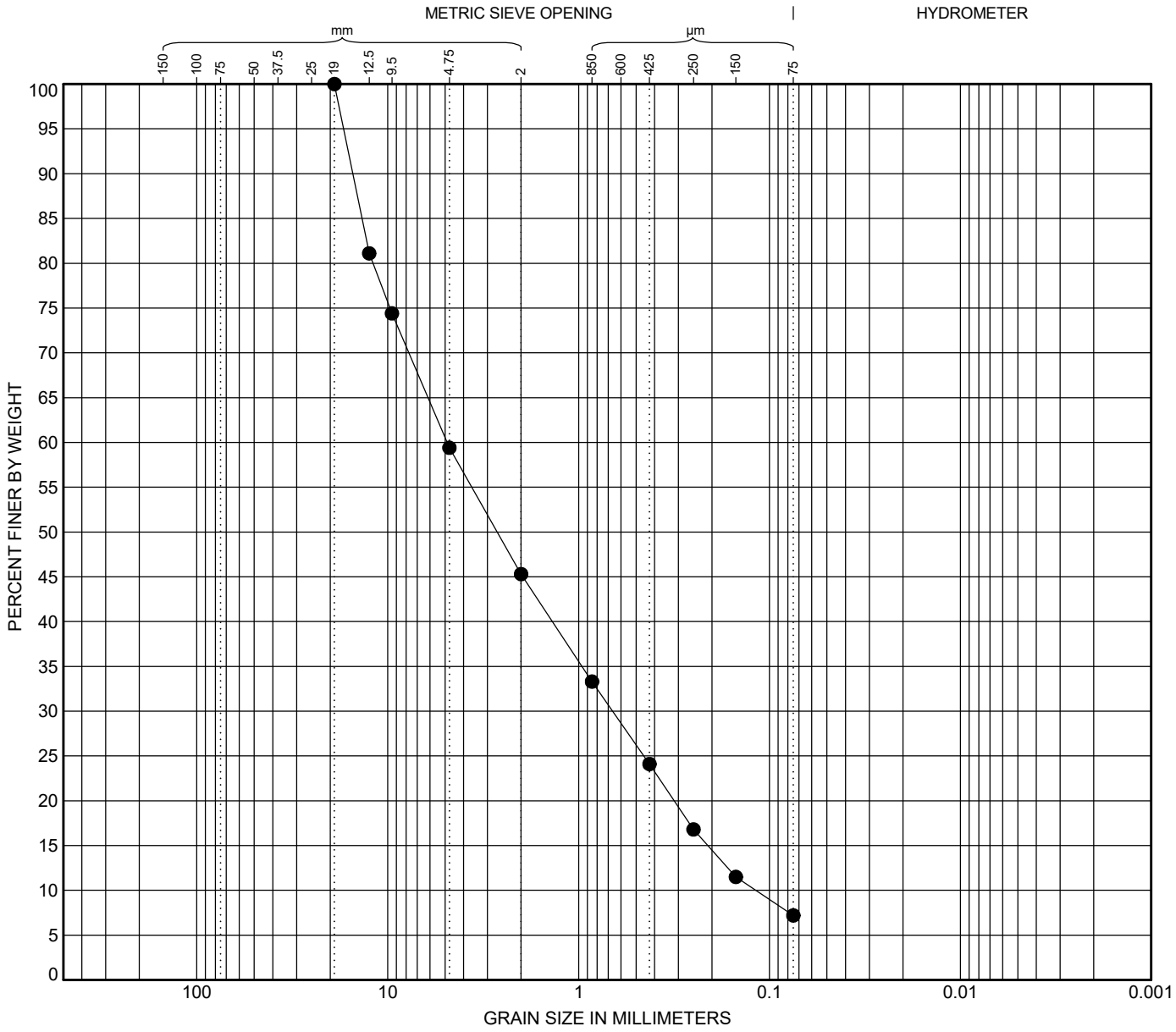
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-05

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 2.29 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
19	**13.628**	**4.884**	**0.663**	**0.21**	**0.118**	**0.76**	**41.46**	**41**	**52**	**7.2**	

Description: SAND and GRAVEL, trace Silt
Natural Moisture Content: 3.9 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 112-17
Date Tested: 2017-05-04
Tested By: RG

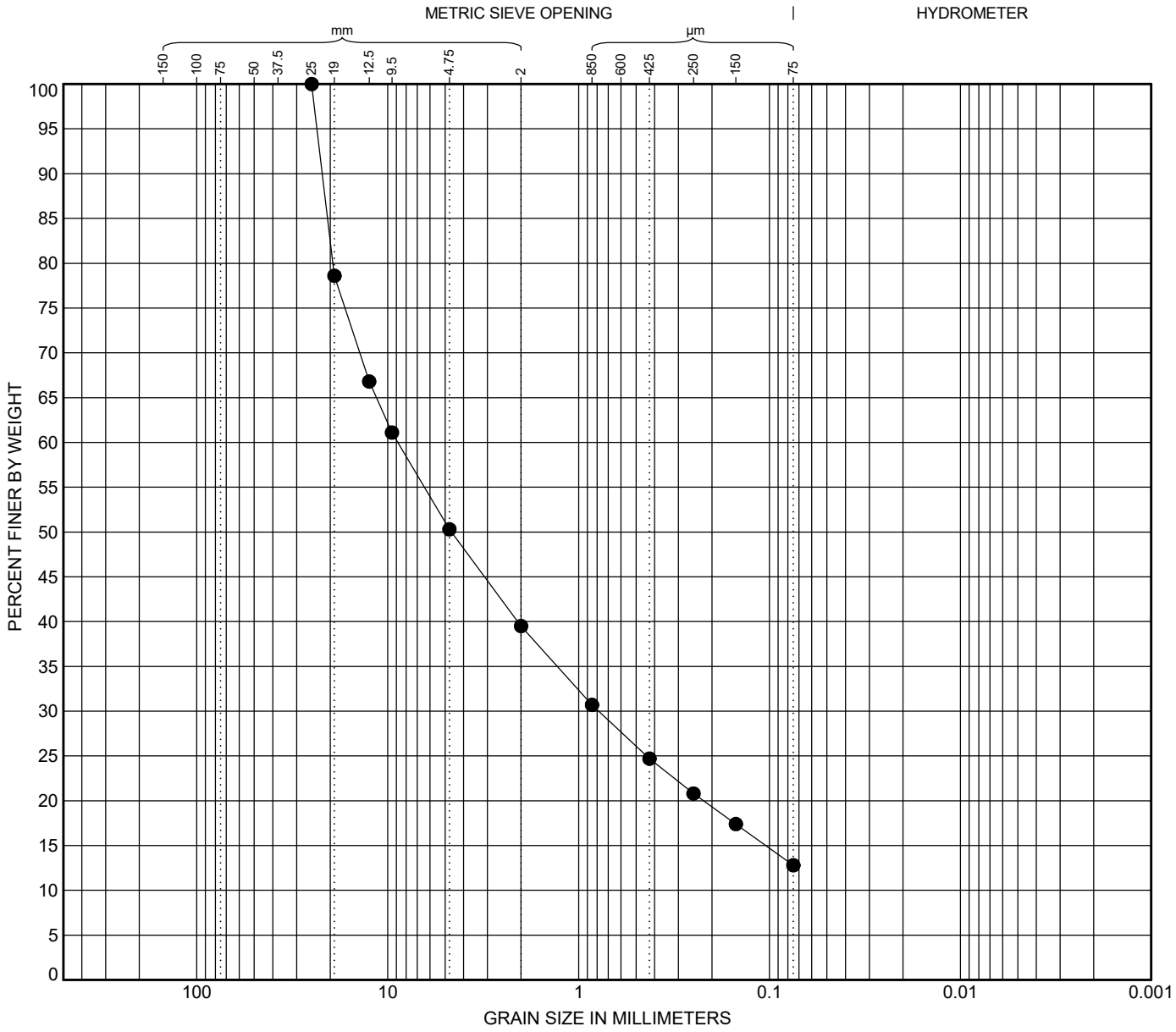
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-06

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 1.52 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
25	**20.625**	**8.852**	**0.784**	**0.104**				**50**	**37**	**13**	

Description: GRAVEL and SAND, some Silt
Natural Moisture Content: 4.0 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 113-17
Date Tested: 2017-05-04
Tested By: RG

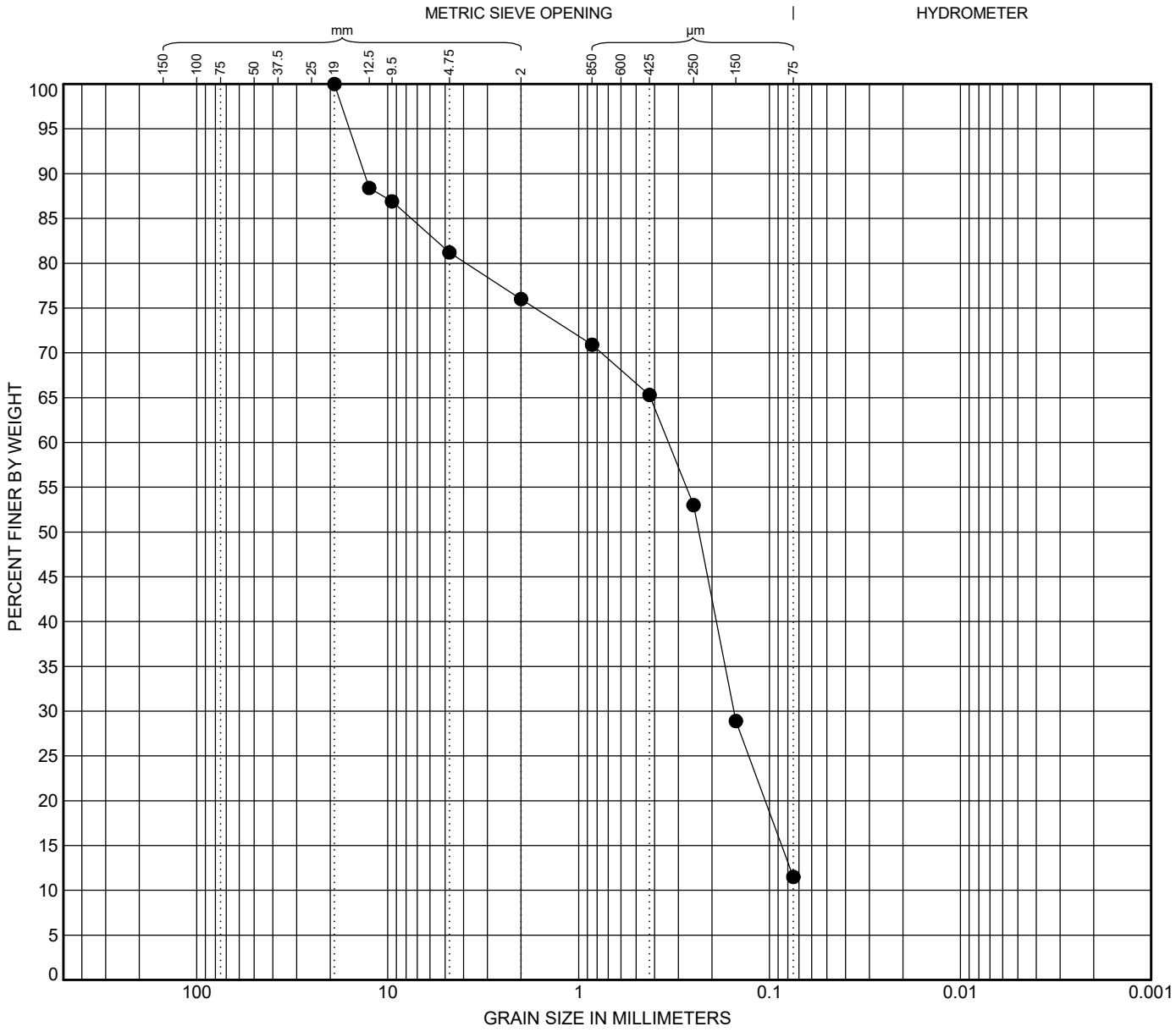
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-07

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 3.05 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
19	**7.54**	**0.338**	**0.154**	**0.086**		**0.99**	**4.79**	**19**	**70**	**11**	

Description: SAND, some Gravel, some Silt
Natural Moisture Content: 3.1 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 114-17
Date Tested: 2017-05-05
Tested By: RG

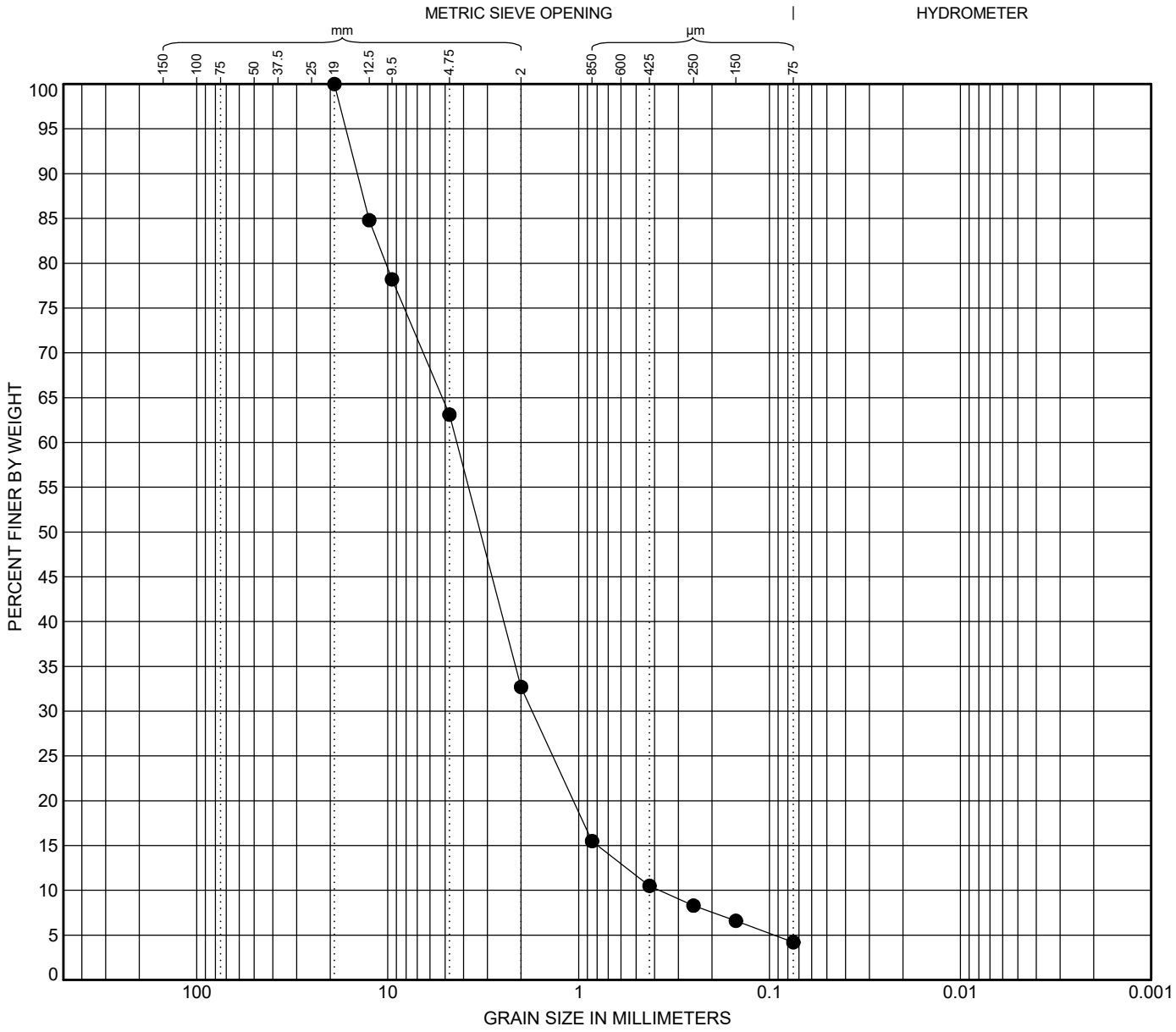
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-08

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 0.76 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
19	**12.569**	**4.349**	**1.749**	**0.793**	**0.377**	**1.87**	**11.54**	**37**	**59**	**4.2**	

Description: SAND and GRAVEL, trace Silt
Natural Moisture Content: 5.2 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 115-17
Date Tested: 2017-05-05
Tested By: RG

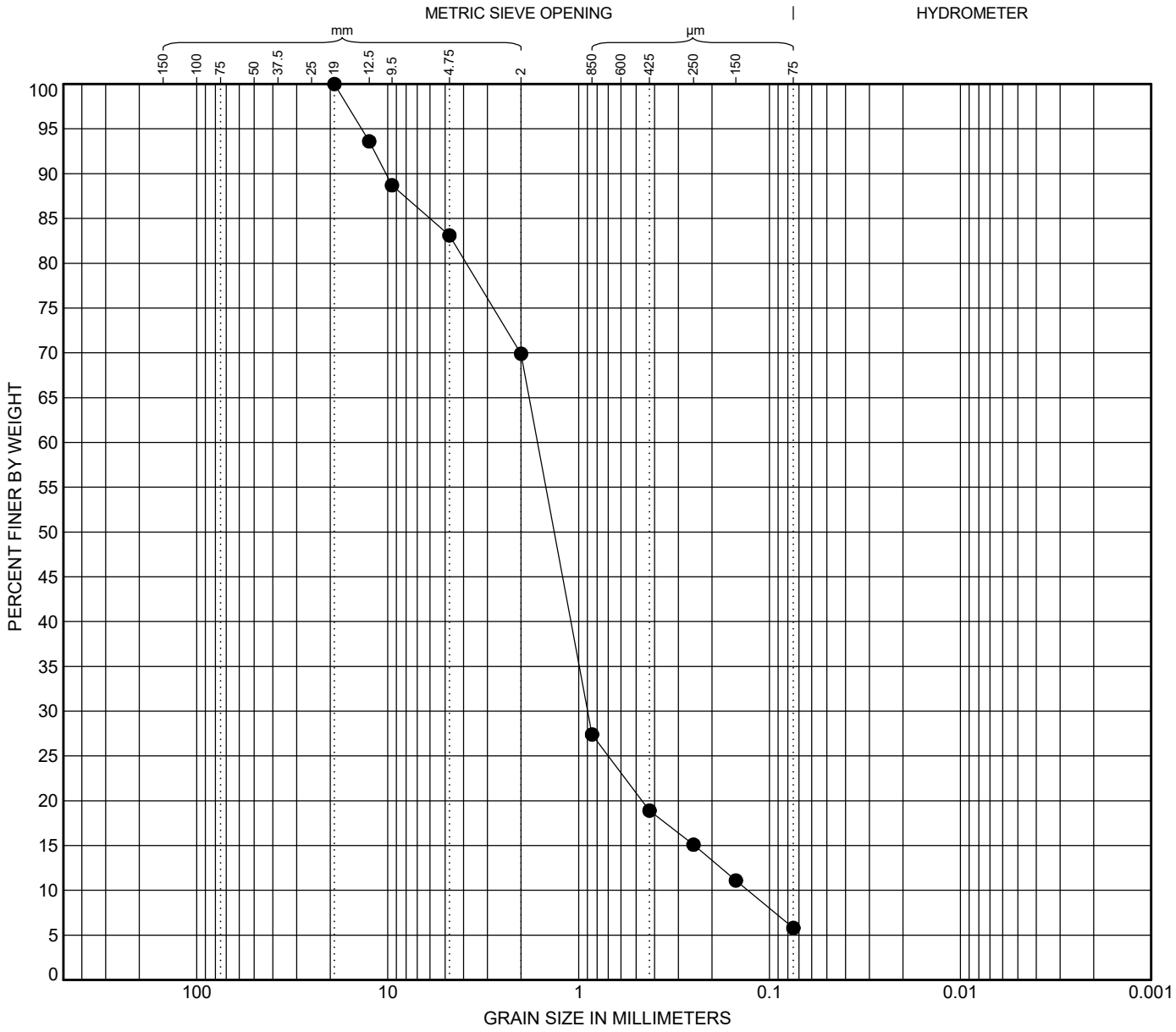
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-09

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 0.76 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
19	**6.009**	**1.639**	**0.896**	**0.247**	**0.13**	**3.77**	**12.61**	**17**	**77**	**5.8**	

Description: SAND, some GRAVEL, trace Silt
Natural Moisture Content: 10.8 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 116-17
Date Tested: 2017-05-05
Tested By: RG

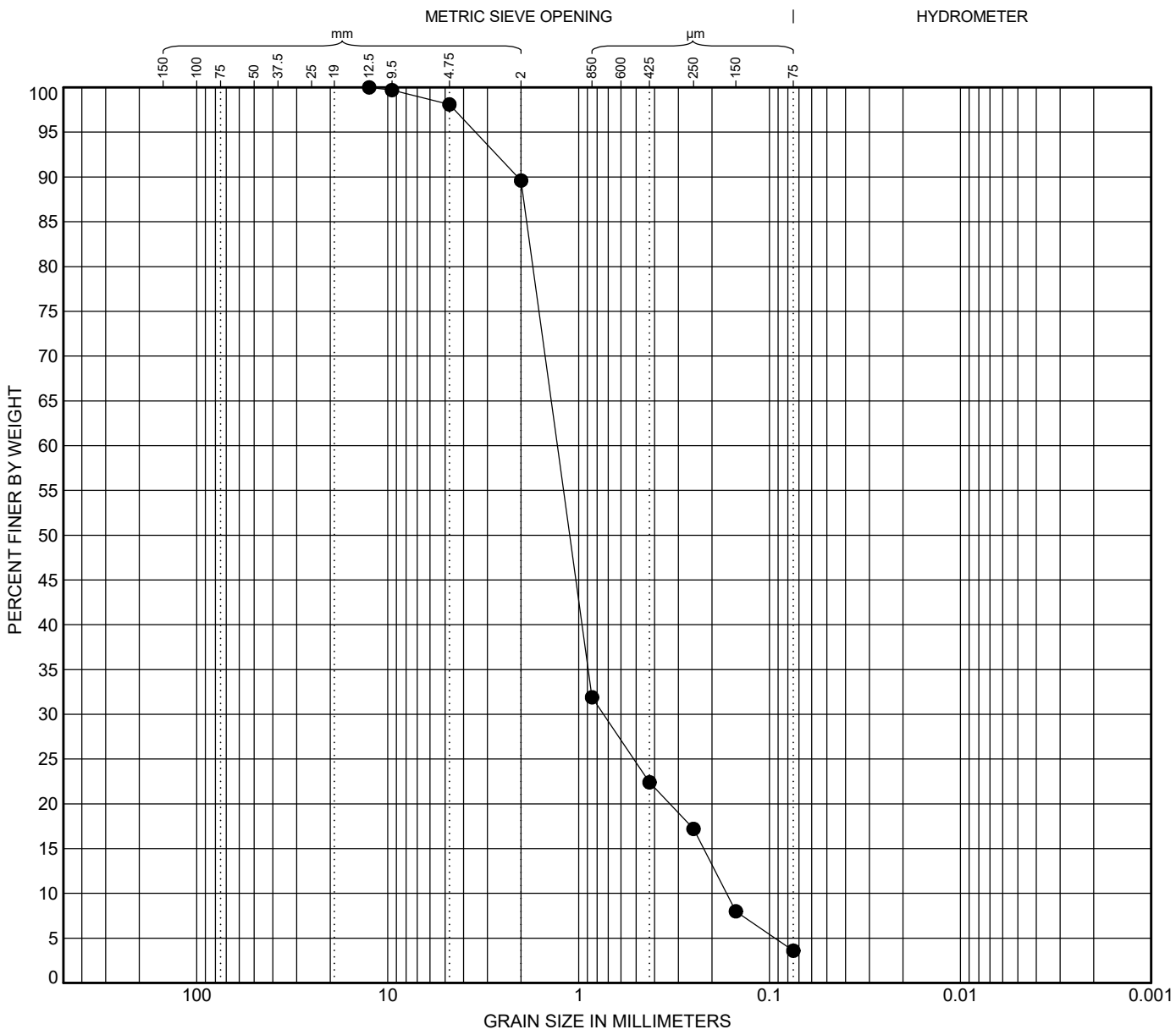
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-10

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 0.76 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
12.5	**1.868**	**1.289**	**0.74**	**0.221**	**0.168**	**2.53**	**7.69**	**1.9**	**94**	**3.6**	

Description: SAND, trace Silt, trace Gravel
Natural Moisture Content: 13.8 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 117-17
Date Tested: 2017-05-05
Tested By: RG

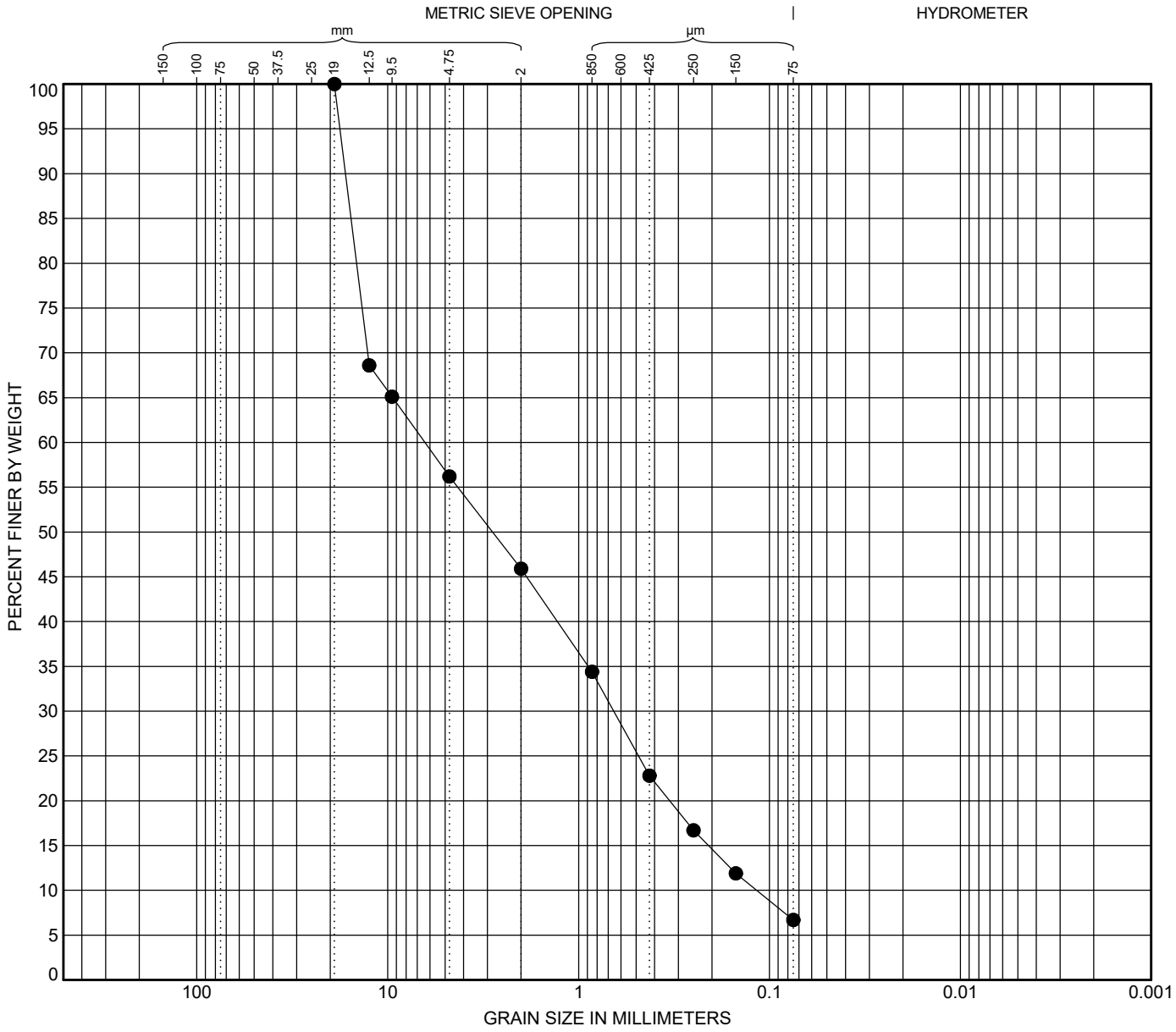
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-11

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 0.76 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
19	**15.556**	**6.386**	**0.653**	**0.209**	**0.116**	**0.57**	**54.84**	**44**	**49**	**6.7**	

Description: SAND and GRAVEL, trace Silt
Natural Moisture Content: 3.8 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 118-17
Date Tested: 2017-05-05
Tested By: RG

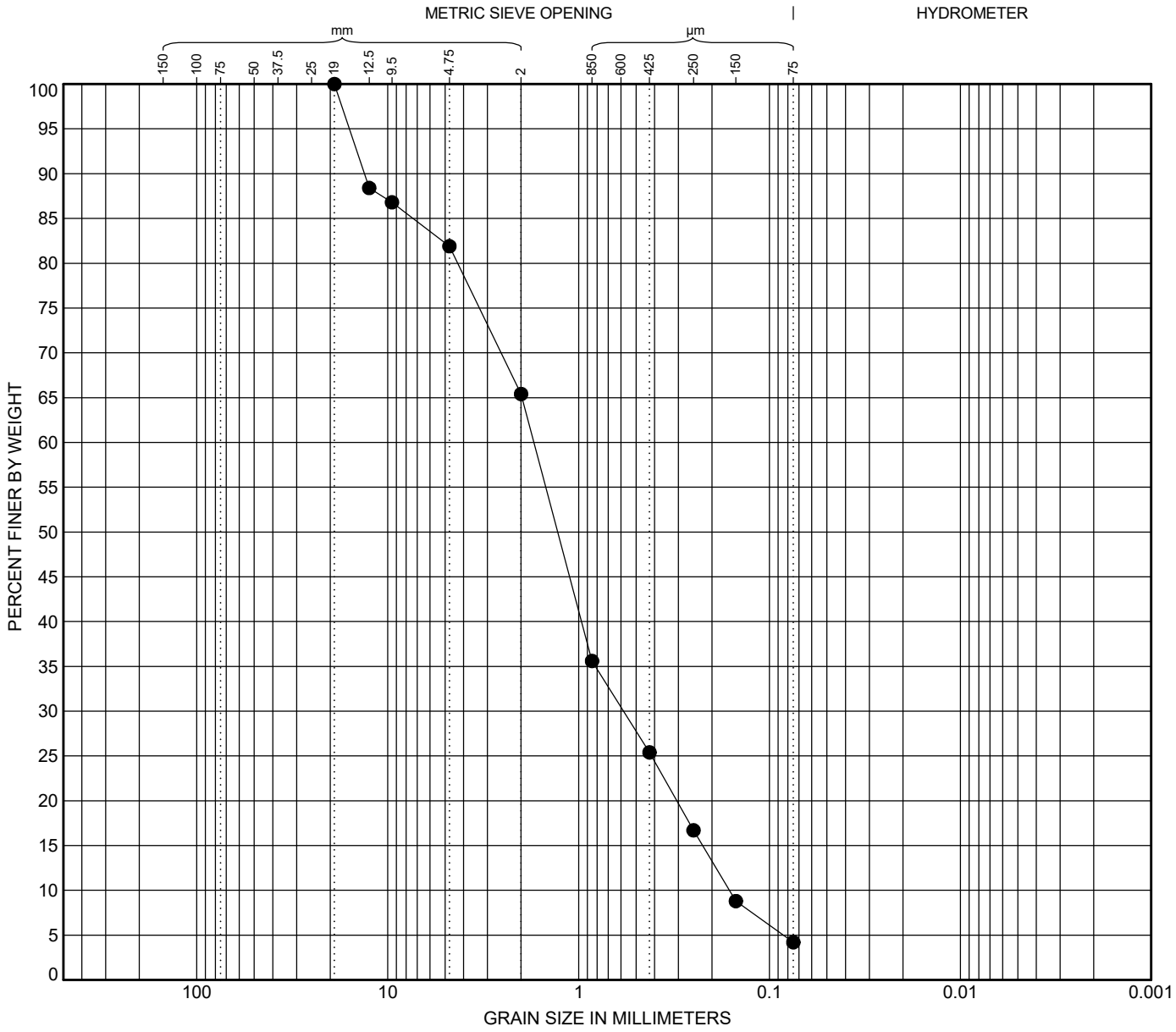
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: TH16-11

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: 3.05 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
19	**7.364**	**1.713**	**0.581**	**0.224**	**0.162**	**1.22**	**10.57**	**18**	**78**	**4.2**	

Description: SAND, some Gravel, trace Silt
Natural Moisture Content: 14.5 %
Material Specification: N/A
Intended Use: N/A
Comments: N/A

Sample Number: 119-17
Date Tested: 2017-05-05
Tested By: RG

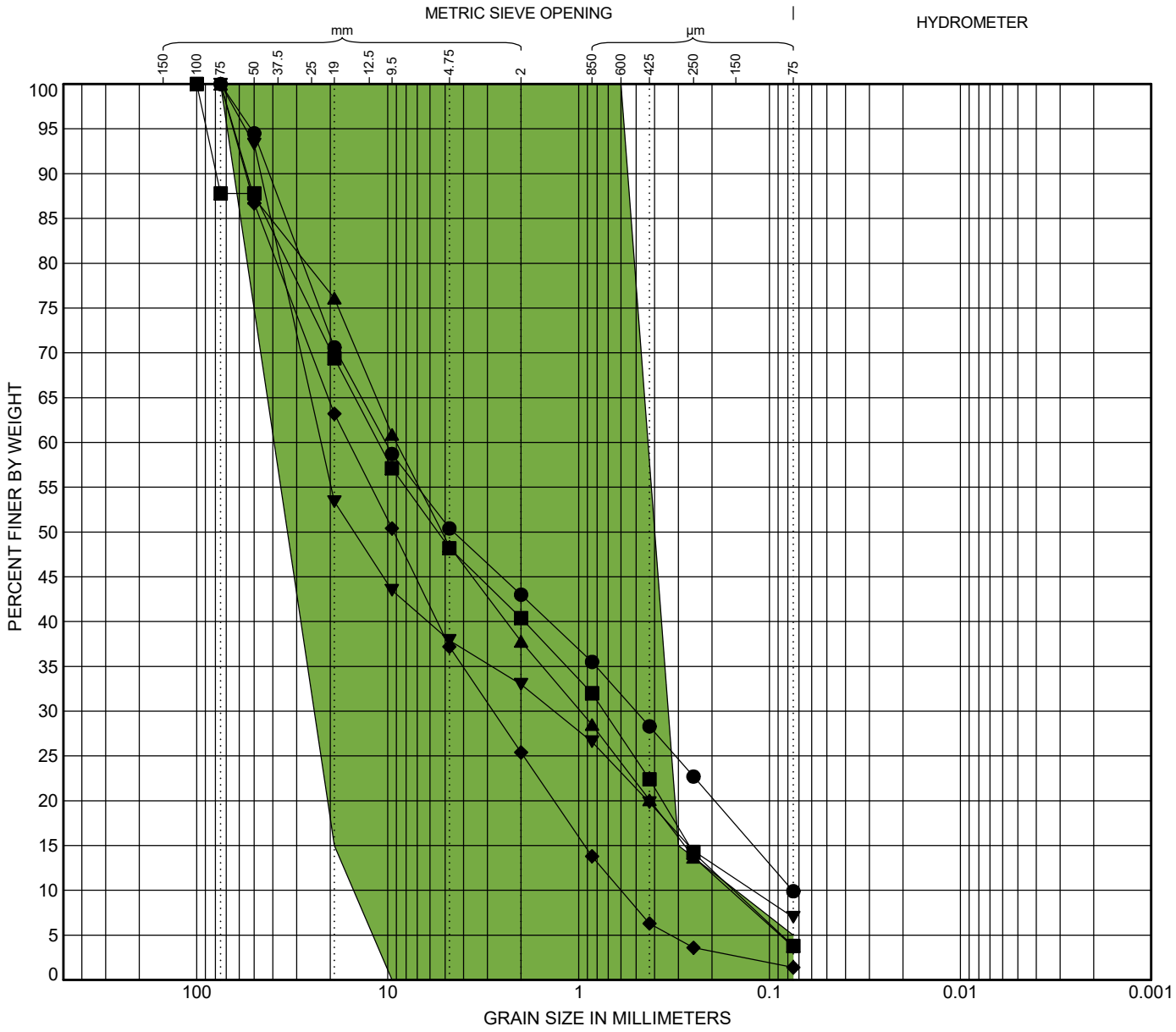
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 FOR SIEVES.GPJ DATAECORA2015.GDT 6/19/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: Various test pits

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: Various



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

◆ TP17-01 0.5 - 0.7 m
● TP17-01 2.0 - 2.2 m
■ TP17-02 0.7 - 0.9 m
▲ TP17-03 0.6 - 0.8 m
▼ TP17-04 1.4 - 1.6 m

Description: N/A
Natural Moisture Content: N/A
Material Specification: BC MoTI Select Granular Sub-Base
Intended Use: N/A
Comments: N/A

Sample Number: N/A
Date Tested: 2017-08-03
Tested By: JS

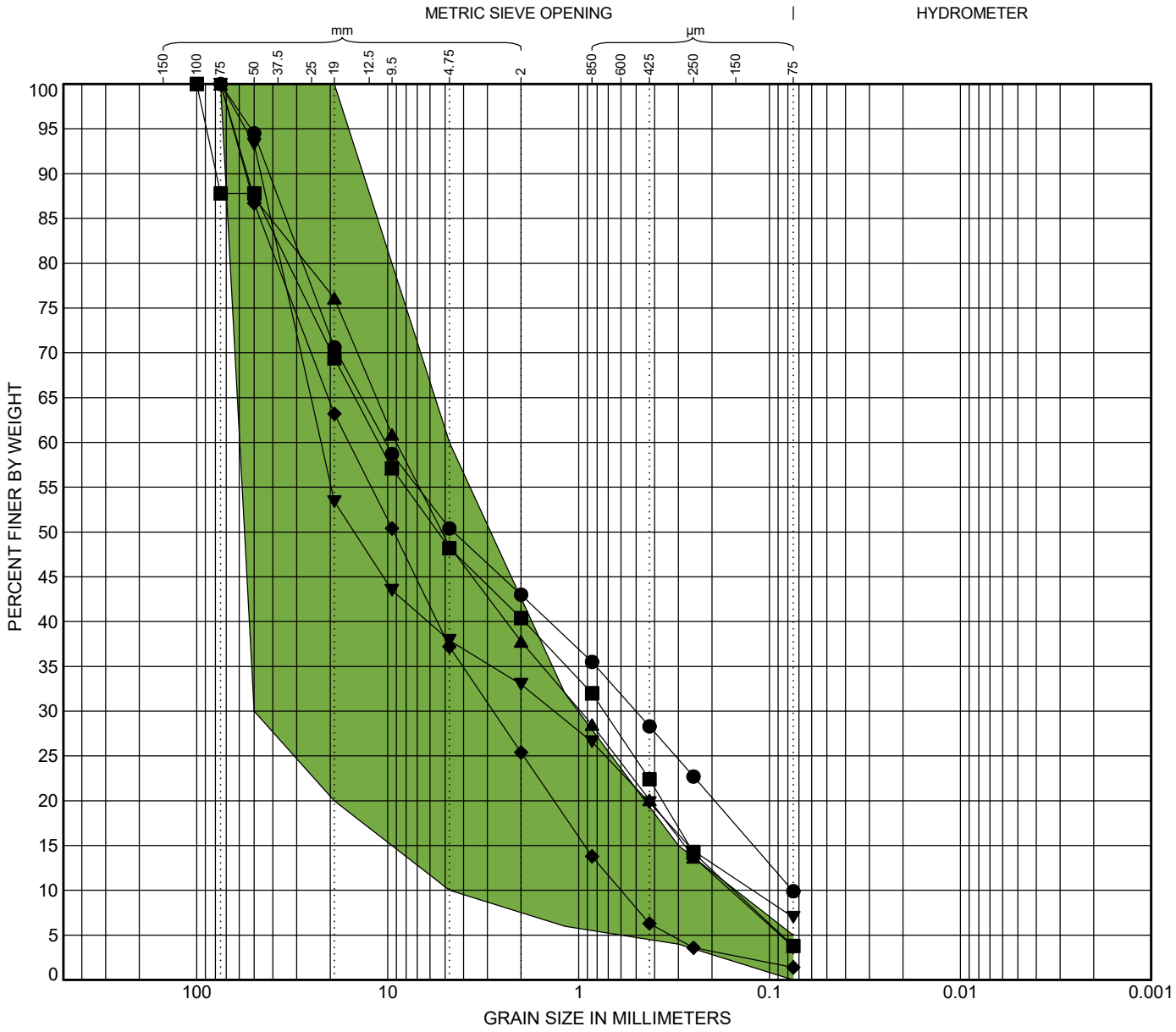
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 (ECORA TEMPLATE).GPJ DATAECORA2015.GDT 8/4/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: Skaha Hills Drive Intersection Improvement Project
Location: Skaha Hills Drive, Penticton, BC
Sample Location/Source: Various test pits

Project No: GK-16-126-MOT-04
Client: MoTI
Depth: Various



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

- ◆ TP17-01 0.5 - 0.7 m
- ● TP17-01 2.0 - 2.2 m
- ■ TP17-02 0.7 - 0.9 m
- ▲ TP17-03 0.6 - 0.8 m
- ▼ TP17-04 1.4 - 1.6 m

Description: N/A
Natural Moisture Content: N/A
Material Specification: BC MoTI Bridge End Fill
Intended Use: N/A
Comments: N/A

Sample Number: N/A
Date Tested: 2017-08-03
Tested By: JS

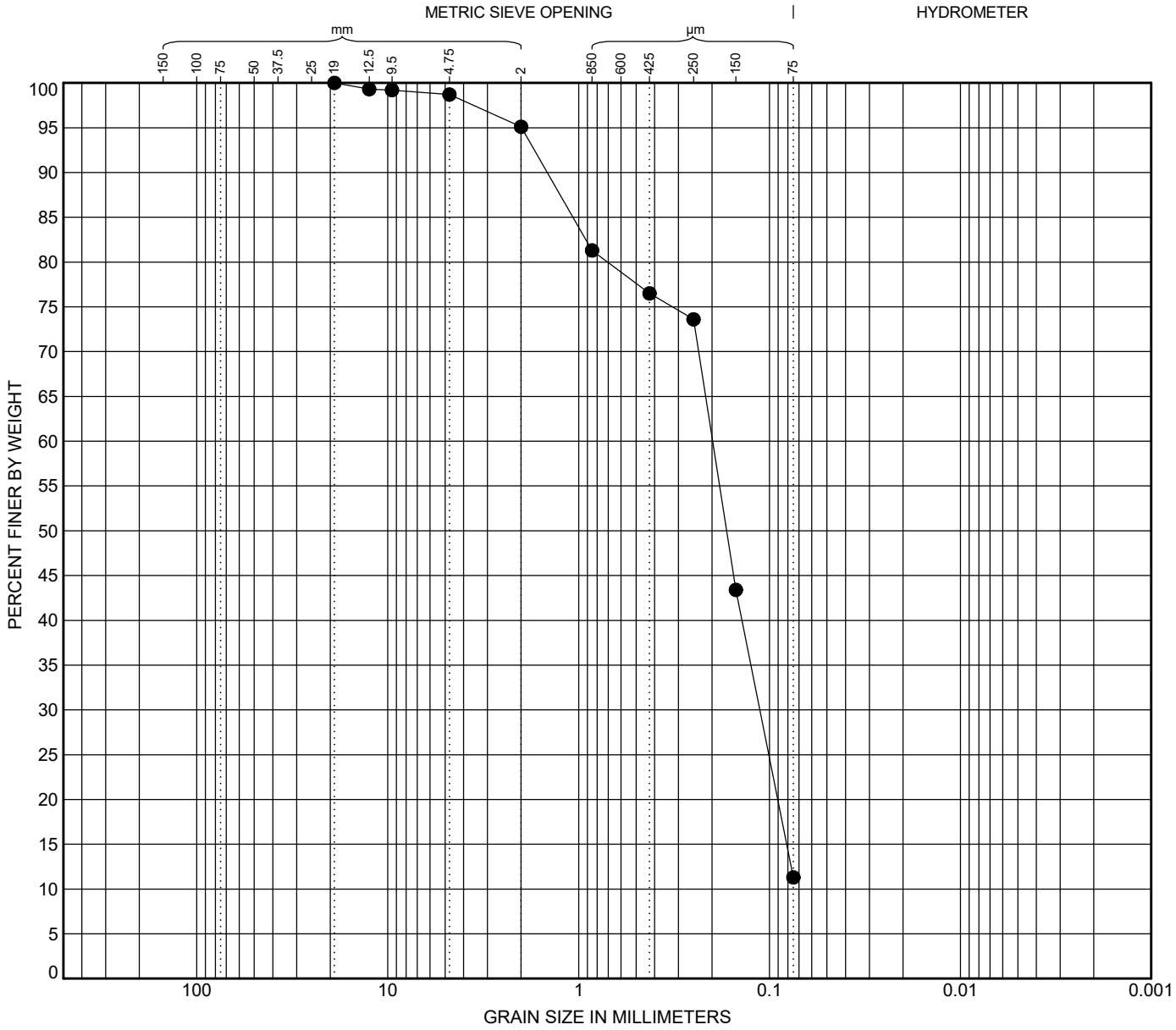
Checked By: _____

GRAIN SIZE DISTRIBUTION GK-16-126-04 (ECORA TEMPLATE).GPJ DATAECORA2015.GDT 8/4/17

GRAIN SIZE DISTRIBUTION ASTM C136

Project: HWY97 Skaha Hills Drive Intersection Improvement
Location: 4200 Skaha Lake Road
Sample Location/Source: TH23-01, G2

Project No: 221266-26
Client: BC MoTI
Depth: 1.8 m to 2.3 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
19	**1.069**	**0.199**	**0.112**	**0.081**		**0.87**	**2.72**	**1.3**	**87.4**	**11.3**	

Description: SAND, some silt, trace gravel
Natural Moisture Content: 22.3 %
Material Specification: N/A
Intended Use: N/A
Comments:

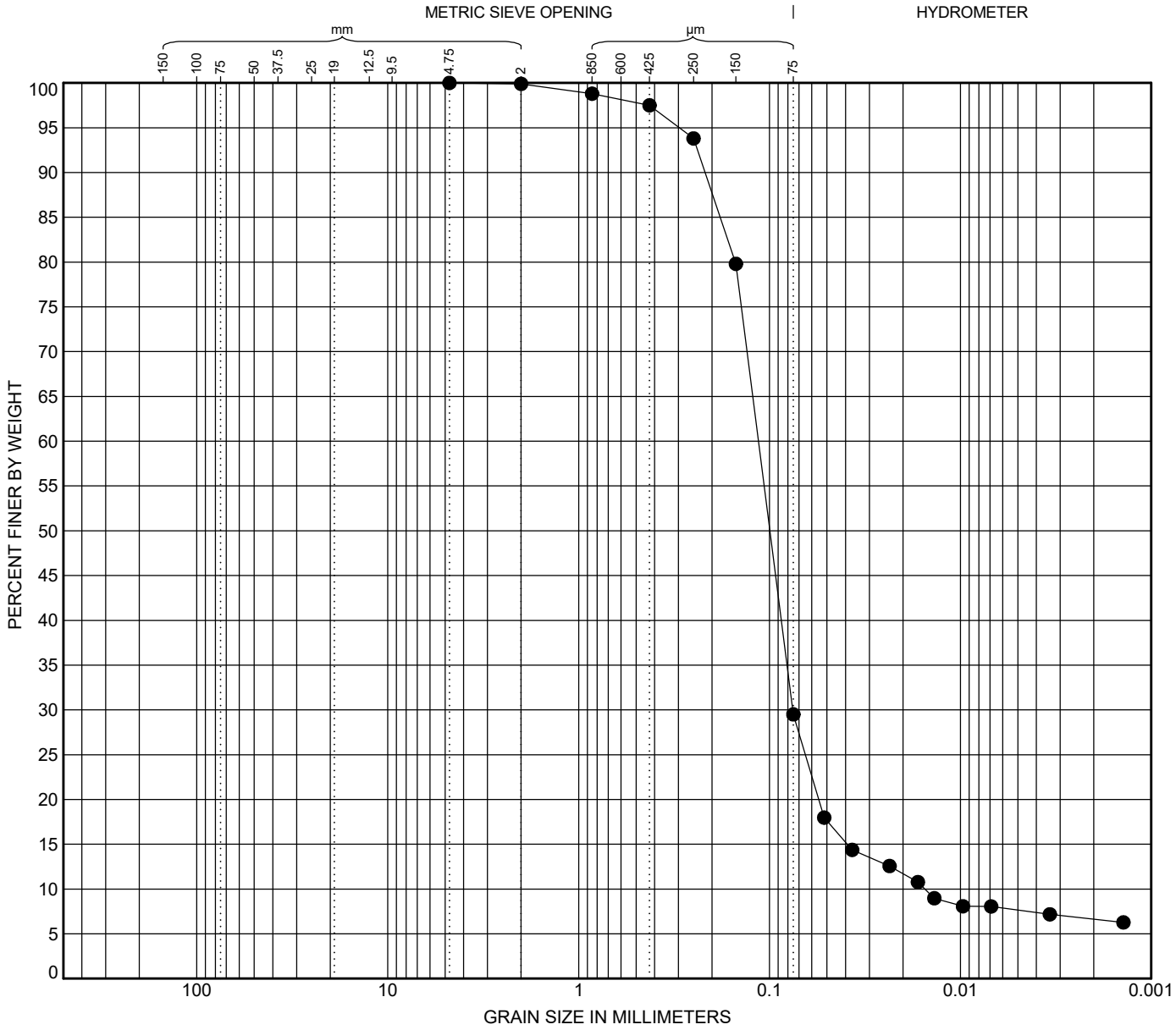
Sample Number: 23-217
Date Tested: 2023-06-22
Tested By: SQ

Checked By:

GRAIN SIZE DISTRIBUTION ASTM D422

Project: HWY97 Skaha Hills Drive Intersection Improvement
Location: 4200 Skaha Lake Road, Penticton, BC
Sample Location/Source: TH23-01, G3

Project No: 221266-26
Client: BC MoTI
Depth: 3.5 m to 4 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
4.75	**0.181**	**0.114**	**0.076**	**0.039**	**0.015**	**3.26**	**7.44**	**0.0**	**70.5**	**22.9**	**6.6**

Description: Silty SAND, trace clay
Natural Moisture Content: 34.1 %
Material Specification: N/A
Intended Use: N/A
Comments:

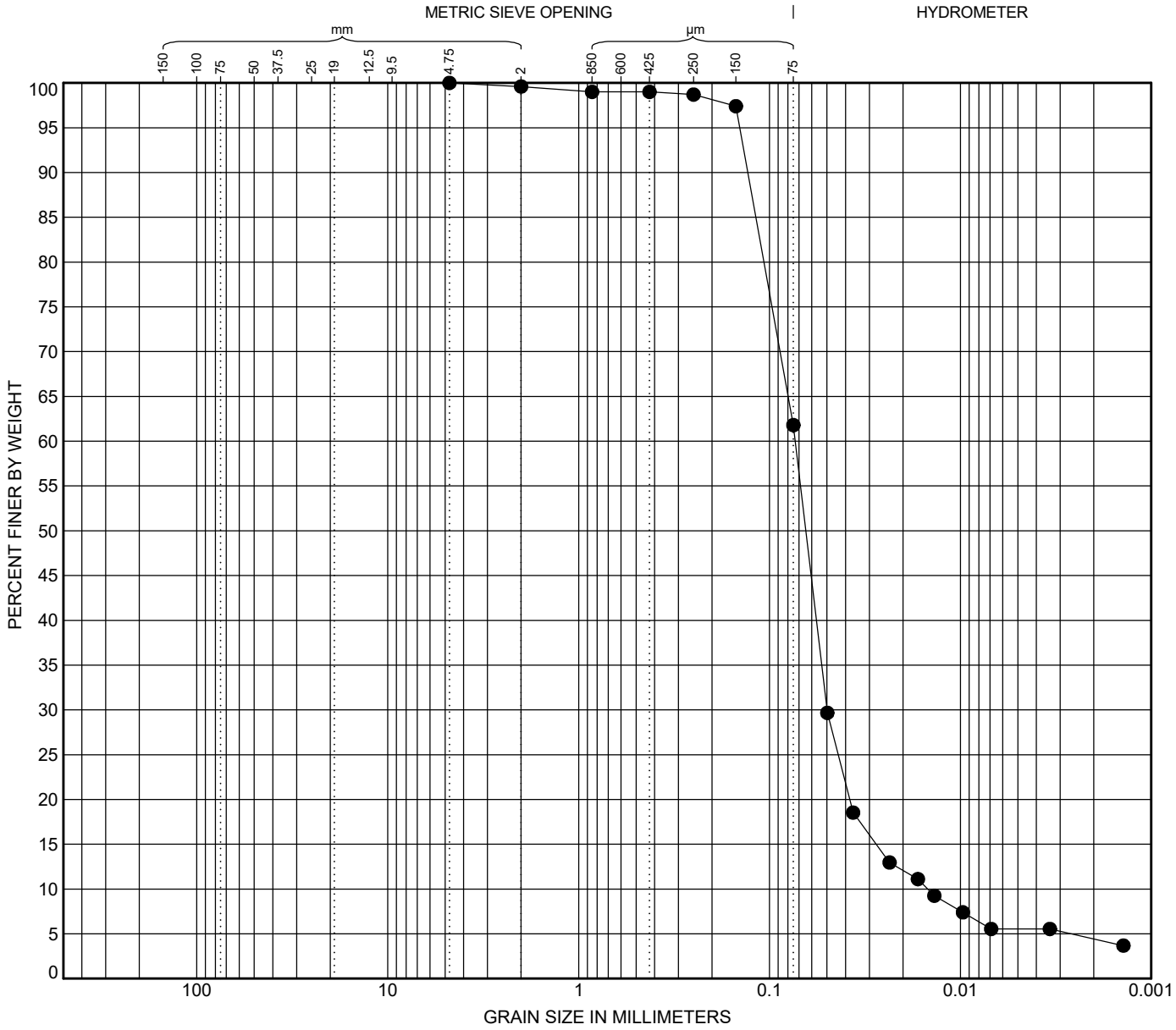
Sample Number: 23-218
Date Tested: 2023-06-22
Tested By: SQ

Checked By:

GRAIN SIZE DISTRIBUTION ASTM D422

Project: HWY97 Skaha Hills Drive Intersection Improvement
Location: 4200 Skaha Lake Road, Penticton, BC
Sample Location/Source: TH23-01, G4

Project No: 221266-26
Client: BC MoTI
Depth: 5.2 m to 5.8 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
4.75	**0.118**	**0.073**	**0.05**	**0.028**	**0.015**	**2.30**	**4.94**	**0.0**	**38.2**	**57.4**	**4.4**

Description: SILT and SAND, trace clay
Natural Moisture Content: 36.8 %
Material Specification: N/A
Intended Use: N/A
Comments:

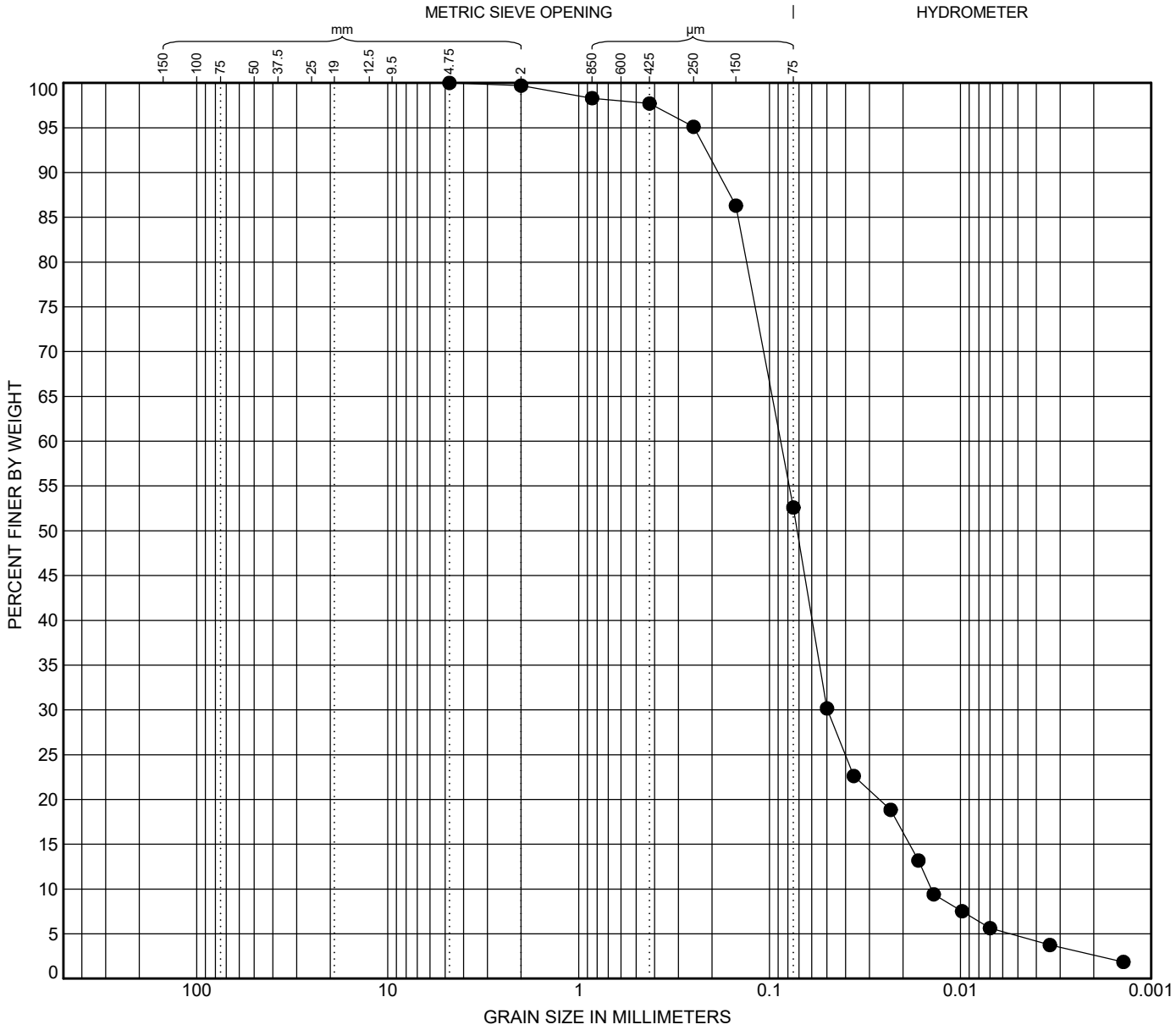
Sample Number: 23-219
Date Tested: 2023-06-22
Tested By: SQ

Checked By:

GRAIN SIZE DISTRIBUTION ASTM D422

Project: HWY97 Skaha Hills Drive Intersection Improvement
Location: 4200 Skaha Lake Road, Penticton, BC
Sample Location/Source: TH23-01, G5

Project No: 221266-26
Client: BC MoTI
Depth: 6.7 m to 7.2 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
4.75	**0.146**	**0.087**	**0.05**	**0.018**	**0.014**	**1.99**	**6.15**	**0.0**	**47.4**	**50.0**	**2.6**

Description: SILT and SAND, trace clay
Natural Moisture Content: 38.3 %
Material Specification: N/A
Intended Use: N/A
Comments:

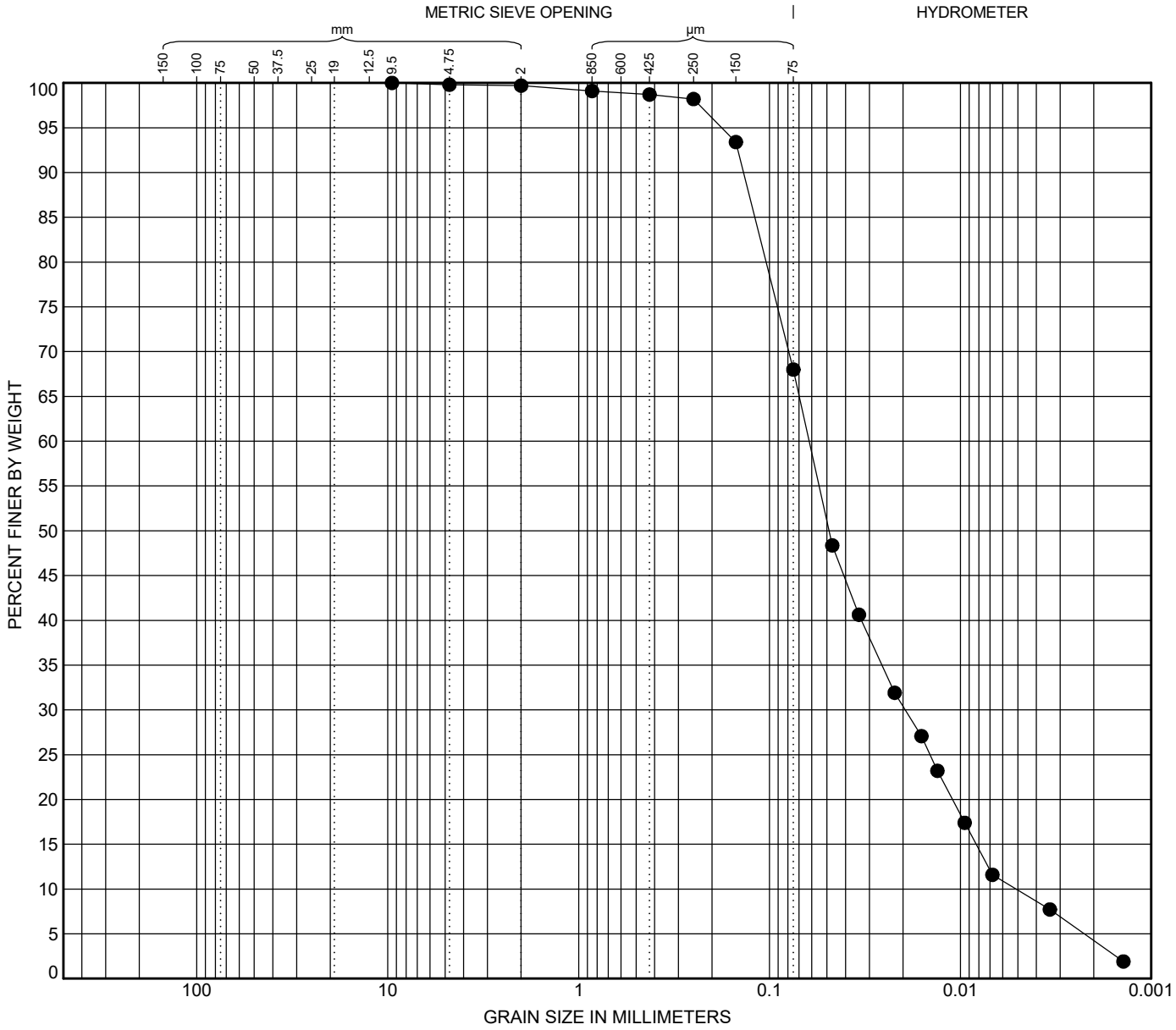
Sample Number: 23-220
Date Tested: 2023-06-22
Tested By: SQ

Checked By:

GRAIN SIZE DISTRIBUTION ASTM D422

Project: HWY97 Skaha Hills Drive Intersection Improvement
Location: 4200 Skaha Lake Road, Penticton, BC
Sample Location/Source: TH23-01, G6

Project No: 221266-26
Client: BC MoTI
Depth: 8.5 m to 9 m



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

D_{100}	D_{85}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u	%Gravel	%Sand	%Silt	%Clay
9.5	**0.119**	**0.062**	**0.019**	**0.008**	**0.005**	**1.19**	**12.10**	**0.2**	**31.8**	**63.8**	**4.2**

Description: Sandy SILT, trace clay
Natural Moisture Content: 37.3 %
Material Specification: N/A
Intended Use: N/A
Comments:

Sample Number: 23-221
Date Tested: 2023-06-22
Tested By: SQ

Checked By:

Ecora Engineering and Resource Group Ltd.
201–284 Main Street, Penticton, BC

Atterberg Limits

ASTM D4318

Project: HWY97 Skaha Hills Drive Intersection Improvement
Location: Penticton, BC
Client: BC Ministry of Transportaion and Infastructure
Material Source: TH23-01 @ 3.5 - 4.0 meters

Project No: 221266-26
Sample No: 23-218
Date Tested: 22-Jun-2023
Tested By: SQ

Liquid Limit			
Trial Number	1	2	3
Tare Number	L1	L2	L3
Number of Blows	0	0	0
Mass of Moisture (g)	0	0	0
Mass of Dry Soil (g)	0	0	0
Moisture Content (%)	0.0	0.0	0.0

Plastic Limit		
Trial Number	1	2
Tare Number	P1	P2
Mass of Moisture (g)	0	0
Mass of Dry Soil (g)	0	0
Moisture Content (%)	0.0	0.0

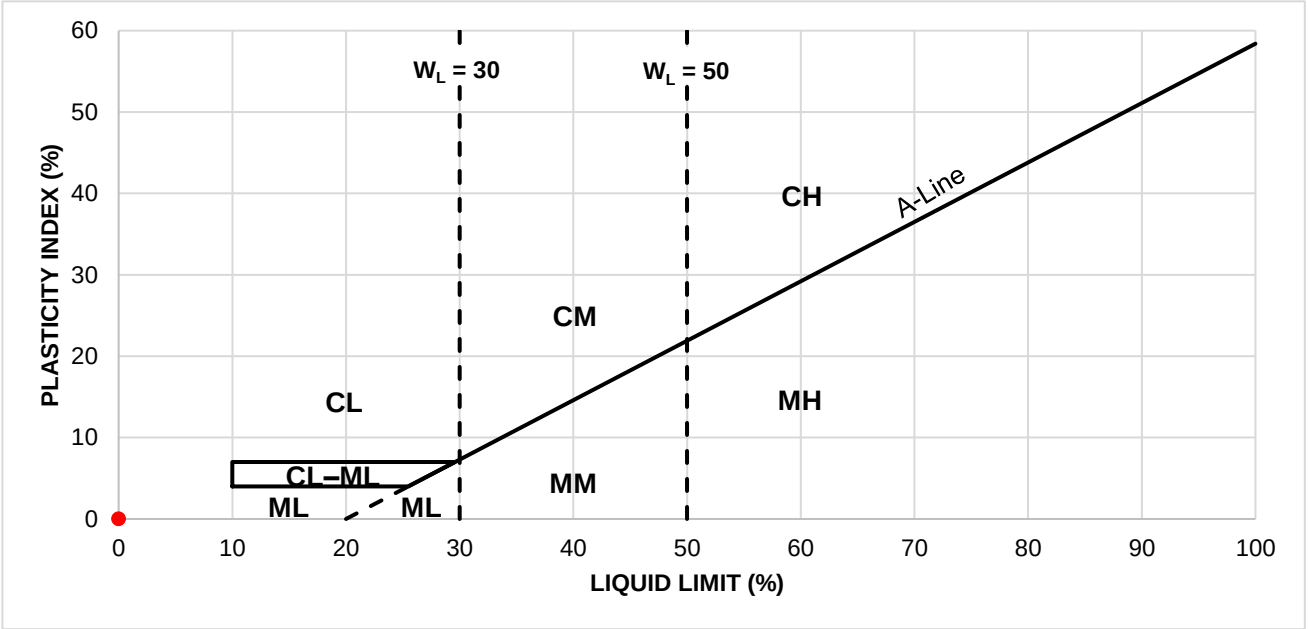
Test Results

Liquid Limit: 0
Plastic Limit: 0
Plasticity Index: 0

Plasticity Classification (based on Liquid Limit WL)

0 to 30	Low Plasticity
30 to 50	Medium Plasticity
> 50	High Plasticity

Sample Description: Non Plastic Silt
Natural Moisture Content: 34.1%



Comments: Thread could not be formed at any moisture content.

Reviewed By:
S. Kraetzer

Ecora Engineering and Resource Group Ltd.
201–284 Main Street, Penticton, BC

Atterberg Limits

ASTM D4318

Project: HWY97 Skaha Hills Drive Intersection Improvement
Location: Penticton, BC
Client: BC Ministry of Transportaion and Infastructure
Material Source: TH23-01 @ 5.2 - 5.8 meters

Project No: 221266-26
Sample No: 23-219
Date Tested: 22-Jun-2023
Tested By: SQ

Liquid Limit			
Trial Number	1	2	3
Tare Number	L1	L2	L3
Number of Blows	0	0	0
Mass of Moisture (g)	0	0	0
Mass of Dry Soil (g)	0	0	0
Moisture Content (%)	0.0	0.0	0.0

Plastic Limit		
Trial Number	1	2
Tare Number	P1	P2
Mass of Moisture (g)	0	0
Mass of Dry Soil (g)	0	0
Moisture Content (%)	0.0	0.0

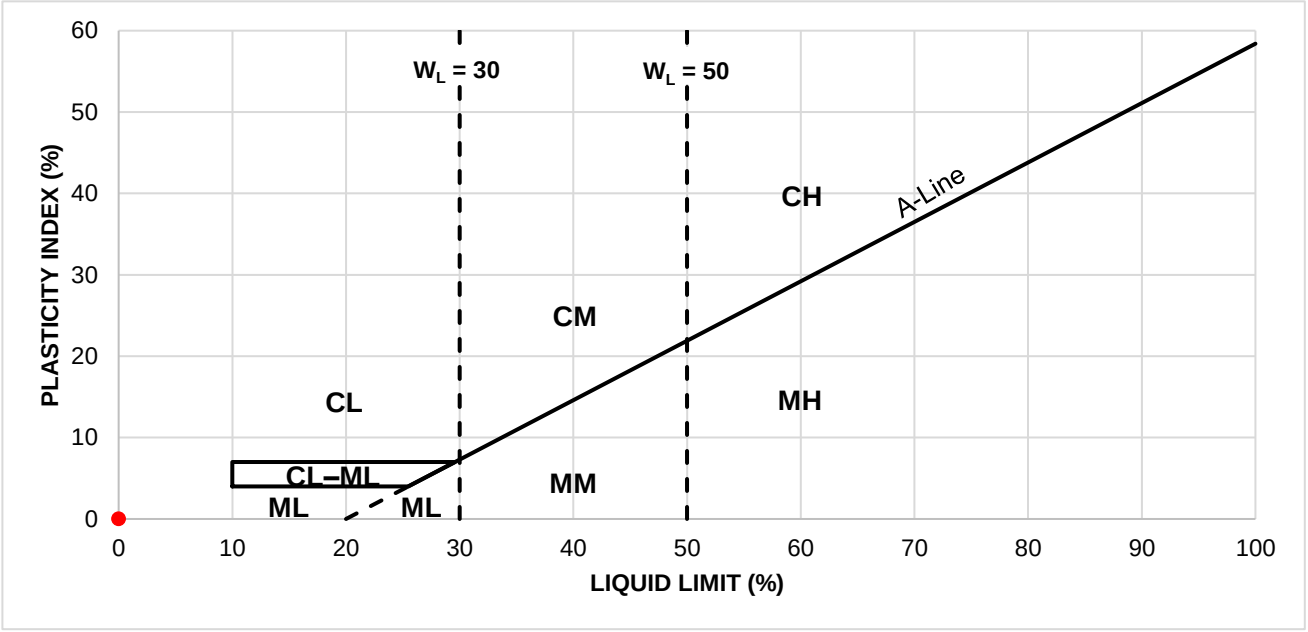
Test Results

Liquid Limit: 0
Plastic Limit: 0
Plasticity Index: 0

Plasticity Classification (based on Liquid Limit WL)

0 to 30	Low Plasticity
30 to 50	Medium Plasticity
> 50	High Plasticity

Sample Description: Non Plastic Silt
Natural Moisture Content: 36.8%



Comments: Thread could not be formed at any moisture content.

Reviewed By:
S. Kraetzer

Ecora Engineering and Resource Group Ltd.
201–284 Main Street, Penticton, BC

Atterberg Limits

ASTM D4318

Project: HWY97 Skaha Hills Drive Intersection Improvement
Location: Penticton, BC
Client: BC Ministry of Transportaion and Infastructure
Material Source: TH23-01 @ 6.7 - 7.2 meters

Project No: 221266-26
Sample No: 23-220
Date Tested: 22-Jun-2023
Tested By: SQ

Liquid Limit			
Trial Number	1	2	3
Tare Number	L1	L2	L3
Number of Blows	0	0	0
Mass of Moisture (g)	0	0	0
Mass of Dry Soil (g)	0	0	0
Moisture Content (%)	0.0	0.0	0.0

Plastic Limit		
Trial Number	1	2
Tare Number	P1	P2
Mass of Moisture (g)	0	0
Mass of Dry Soil (g)	0	0
Moisture Content (%)	0.0	0.0

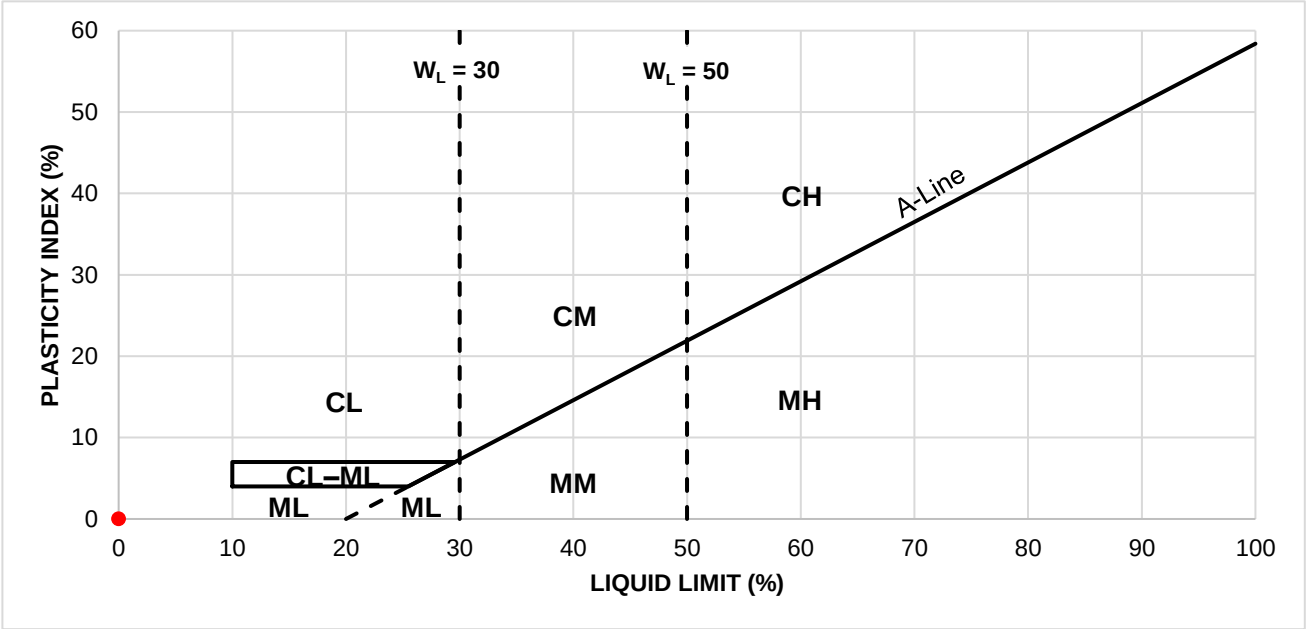
Test Results

Liquid Limit: 0
Plastic Limit: 0
Plasticity Index: 0

Plasticity Classification (based on Liquid Limit WL)

0 to 30	Low Plasticity
30 to 50	Medium Plasticity
> 50	High Plasticity

Sample Description: Non Plastic Silt
Natural Moisture Content: 38.3%



Comments: Thread could not be formed at any moisture content.

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Ecora Engineering and Resource Group Ltd.
201–284 Main Street, Penticton, BC

Atterberg Limits

ASTM D4318

Project: HWY97 Skaha Hills Drive Intersection Improvement
Location: Penticton, BC
Client: BC Ministry of Transportaion and Infastructure
Material Source: TH23-01 @ 8.5 - 9.0 meters

Project No: 221266-26
Sample No: 23-221
Date Tested: 22-Jun-2023
Tested By: SQ

Liquid Limit			
Trial Number	1	2	3
Tare Number	L1	L2	L3
Number of Blows	0	0	0
Mass of Moisture (g)	0	0	0
Mass of Dry Soil (g)	0	0	0
Moisture Content (%)	0.0	0.0	0.0

Plastic Limit		
Trial Number	1	2
Tare Number	P1	P2
Mass of Moisture (g)	0	0
Mass of Dry Soil (g)	0	0
Moisture Content (%)	0.0	0.0

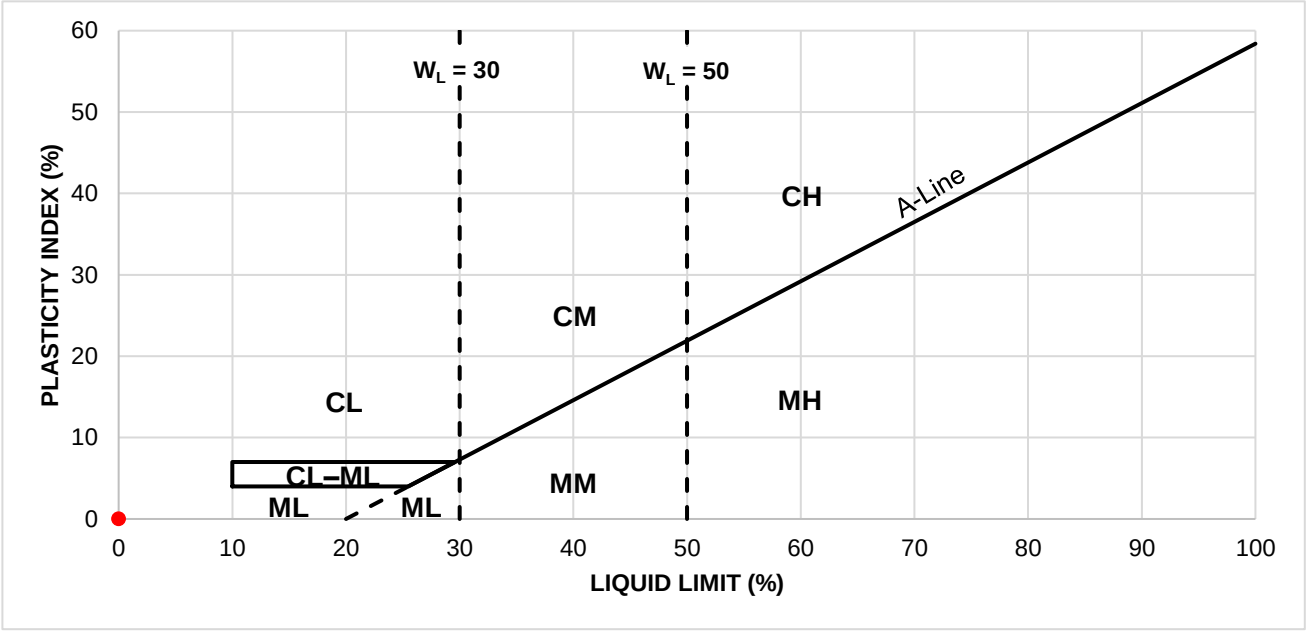
Test Results

Liquid Limit: 0
Plastic Limit: 0
Plasticity Index: 0

Plasticity Classification (based on Liquid Limit WL)

0 to 30	Low Plasticity
30 to 50	Medium Plasticity
> 50	High Plasticity

Sample Description: Non Plastic Silt
Natural Moisture Content: 37.3%



Comments: Thread could not be formed at any moisture content.

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S. Kraetzer