P7 Highway 1 – King Road Realignment
Supplementary Geotechnical Exploration
Factual Geotechnical Report
Revision 01



PRESENTED TO
McElhanney Ltd.

MAY 16, 2024
ISSUED FOR USE | REVISION 01
FILE: 704-ENG.VGEO04080-07

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DOCUMENT CONTROL AND REVISION STATUS

Project: Highway 1 - King Rd Realignment Supplementary Geotechnical Investigation

Client: McElhanney Ltd.

Document Title: Factual Geotechnical Report

Document No.: 704-ENG.VGEO04080-07_02 Rev. 1

Project No.: 704-ENG.VGEO04080-07

Submitted By: Electronic

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Document Control					
Rev. No.	**Issued for:**	**Format**	**Issue Date**	**Prepared by**	**Reviewed by**
0	Use	Electronic	April 19, 2024	FH/SR	EP
1	Use	Electronic	May 16, 2024	FH/SR	EP

Prepared by: Fabio Hernandez (FH)
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TABLE OF CONTENTS

1.0 INTRODUCTION 1

2.0 EXPLORATION SUMMARY 1
2.1 Permits and Site Access 2
2.2 Site Exploration Program 2
2.2.1 Buried Utilities 3
2.2.2 Traffic Management 3

3.0 SOIL DRILLING PROGRAM 3
3.1 Exploration Methods 3
3.1.1 Solid Stem Auger and DCPT Soundings 3
3.1.2 Monitoring Well Installations 3
3.1.3 Decommissioning of Testholes 4

4.0 LABORATORY TESTING 4
4.1 Soil Description and Classification 4
4.2 Natural Moisture Content 5
4.3 Fines Content and Particle Size Determinations 5

5.0 SUMMARY OF GEOTECHNICAL CONDITIONS 5
5.1 Surficial Geology 5
5.2 Soil Stratigraphy 5
5.3 Groundwater 6

6.0 CLOSURE 7

REFERENCES 8

LIST OF TABLES IN TEXT

Table 2-1: Summary of Completed Subsurface Exploration 2

APPENDIX SECTIONS

FIGURES

Figure 1 Site Plan Overview

APPENDICES

Appendix A Tetra Tech's Limitations on the Use of this Document
Appendix B Geotechnical Borehole Logs
Appendix C Geotechnical Laboratory Test Data

ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
ASTM	American Society for Testing and Materials
BC MoTI	British Columbia Ministry of Transportation and Infrastructure
CoA	City of Abbotsford
DCPT	Dynamic Cone Penetration Test
GSC	Geological Survey of Canada
Omega	Omega Environmental Drilling Ltd.
SSA	Solid Stem Auger
Tetra Tech	Tetra Tech Canada Inc.
TMP	Traffic Management Plan

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1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) is pleased to present McElhanney Ltd. (McElhanney) and the British Columbia Ministry of Transportation and Infrastructure (BC MoTI) with the following geotechnical factual data report for the proposed King Road Realignment project (here forth referred to as Project 7), as part of the Fraser Valley Highway 1 Corridor Improvement Program in Abbotsford, BC.

Based on the information provided by McElhanney and review of project plans, it is our understanding that the proposed project work activities involve the realignment of King Road, which has been designated for a future widening of Highway 1 in the vicinity of three stop intersection with Riverside Road. The P7 requires excavation of a soil cut approximately 185 m in length with a maximum cut height of approximately 8 m along the southern side of King Road.

A soil nail reinforced slope is being considered for a section of the proposed cut on the south side of King Road. Considering the cost associated with the installation of the soil nails, a supplementary ground investigation program was proposed to evaluate the potential elimination and/or optimization of the soil nails during the value engineering process.

Details of the field and laboratory activities relevant to the 2024 supplementary geotechnical site exploration as part of the P7 scope of work are presented in this report. This report is factual in nature and does not provide any interpretation of the results. Use of this report is subject to the terms and conditions stated in Tetra Tech's Limitations on the Use of This Document, included in Appendix A.

2.0 EXPLORATION SUMMARY

Site-specific geotechnical information about the characteristics and relative density/consistency of the subsurface soils were not available at or near the specific area of the proposed soil-nail-reinforced slope. The intent of the supplementary geotechnical investigation program was to reduce uncertainties regarding subsurface soil and groundwater conditions and to confirm geotechnical engineering design parameters considered for the detailed design of the proposed reinforced and unreinforced soil cuts along King Road.

The site exploration program was completed between March 25 and 27, 2024. The executed scope of work consisted of four (4) Solid Stem Auger (SSA) boreholes to depths ranging between 6.1 m to 12.2 m, paired with Dynamic Cone Penetration Testing (DCPT) to depths ranging between 4.4 m to 7.6 m (where practical refusal was reached). The ground exploration plan is presented in Figure 1. Further details on the components of the 2024 site exploration are discussed in the subsequent sections of this report.

A representative from Tetra Tech was on-site during the site exploration to provide full-time supervision. This included coordinating the work schedule, verifying the testhole locations in the field, completing utility locate checks, logging and photographing the recovered soil samples, selecting depths for sampling to classify the subsurface materials, and supervising monitoring well installations at two testhole locations.

The coordinates for the testhole locations were recorded by the Tetra Tech field engineer during the field program through the Google Earth navigation application. The summary of completed subsurface exploration locations, including approximate coordinates and elevations for each testhole, is presented in Table 2-1. All depths presented in this report are referenced to the ground surface at the time the testing was performed.

Table 2-1: Summary of Completed Subsurface Exploration

Test ID	Exploration Method (1)	Installation	UTM Coordinates (2)		Elevation (3)	Date Drilled	AH / DCPT Completion Depth (4) (m)
			Easting	Northing			
AH/MW24-01	SSA/DCPT	Nested Monitoring Well	553090.93	5431338.54	33.2	March 26, 2024	10.20 / 6.0 (5)
AH24-02	SSA/DCPT	-	553095.13	5431356.05	32.0	March 27, 2024	12.20 / 7.6 (5)
AH/MW24-03	SSA/DCPT	Monitoring Well	553008.00	5431367.00	34.6	March 25, 2024	9.15 / 4.4 (5)
AH24-04	SSA/DCPT	-	553017.82	5431370.89	33.6	March 25, 2024	6.10 / 4.7 (5)

Notes:
(1) Exploration methods included Solid Stem Auger (SSA), and Dynamic Cone Penetration Test (DCPT).
(2) Coordinates were estimated through Google Earth navigation app upon completion of the subsurface exploration program. Horizontal accuracy: (± 5 m). Datum: UTM Z10 NAD CSRS
(3) Elevations provided are approximate and were inferred from McElhanney Drawing No. SKT-002-P7-00815 based on the original project wide field survey that was completed by Stantec Consulting Ltd. from March to May 2021.
(4) Depths are referenced to the existing ground surface at the time the testing was performed.
(5) Test terminated due to practical refusal.

2.1 Permits and Site Access

The exploration program was conducted within the jurisdictions of BC MoTI the City of Abbotsford (CoA). Tetra Tech engaged in discussions with both BC MoTI and the CoA to identify suitable drilling locations and to secure the necessary authorizations and permits for drilling activities. Additionally, Tetra Tech ensured compliance with CoA's requirements by providing a Traffic Management Plan (TMP) to manage traffic around the work areas along King Road. In accordance with CoA's instructions, Tetra Tech also coordinated the field activities with the City's works inspector, Mr. Evan Johnson, prior to the commencement of field activities.

2.2 Site Exploration Program

The subsurface exploration program was completed between March 25 and 27, 2024, by Tetra Tech and Omega Environmental Drilling Ltd. (Omega). The final scope of work for the geotechnical exploration program included the following components:

- Two (2) solid stem auger holes with DCPT to a maximum depth of about 9.2 m on the southern shoulder of King Road, situated 180 m to the west of the three-way intersection with Riverside Road.
- Two (2) solid stem auger holes with DCPT to approximate depth of 12.2 m up slope of the proposed cut, on BC MoTI's property located south of King Road.
- Three (3) standpipe piezometer installations: Two (nested) standpipe piezometers were installed at the location of AH/MW24-01 and one standpipe piezometer was installed at the location of AH/MW24-03.
- Classification testing of recovered samples, including moisture contents and particle size analyses.

Further details on the components of the site exploration listed above are discussed in subsequent sections of the report.

2.2.1 Buried Utilities

The testing locations were selected based on a review of existing utility plans. Buried utility locates were carried out to avoid any damage to services during the subsurface exploration program. Tetra Tech conducted a BC One Call (Ticket No. 20241105220) to identify potential buried services at the site and engaged Western Utility and Technical Service Ltd. to locate and mark all underground services in the field. Utility locates were completed on March 25, 2024. Ground penetrating radar and electromagnetic scanning were utilized to verify the locations of existing utilities.

2.2.2 Traffic Management

Traffic management was necessary in areas where drilling activities were conducted on the southern road shoulder of King Road or near the rig access ramp to BC MoTI property. To ensure smooth operation and safety, Tetra Tech engaged the services of Omega's traffic division. This division was responsible for preparing the TMP and providing traffic control personnel during the exploration program.

3.0 SOIL DRILLING PROGRAM

3.1 Exploration Methods

3.1.1 Solid Stem Auger and DCPT Soundings

Solid stem auger boreholes and DCPTs were conducted by Omega using an M5 track-mounted drill rig. Boreholes were drilled using the solid stem auger method in continuous 1.5 m flights until the target depth or practical refusal was reached. The recovered soils were visually classified and logged in the field following BC MoTI Soil Log standards and Tetra Tech's internal geotechnical soil classification work method. This method is based on the guidelines provided in the Canadian Foundation Engineering Manual (4th Edition, 2006) and relevant ASTM Standards. After inspection, logging, and photography, representative disturbed samples were selected for classification testing in the geotechnical laboratory. Detailed descriptions of the subsurface conditions encountered, sampling intervals, and information on test hole backfilling are provided in the borehole logs, presented in Appendix B.

DCPTs were completed at the location of all boreholes prior to auger drilling. DCPTs were carried out to a maximum depth of 7.6 m. The DCPT blow count (N) was continuously recorded over 300 mm penetration intervals until reaching the target depth or practical refusal. The DCPT sounding logs can also be found in Appendix B.

3.1.2 Monitoring Well Installations

A total of three standpipe piezometers were installed in the auger testholes to monitor groundwater levels and their variations. These piezometers were consisted of threaded 51 mm Schedule 40 PVC pipe, with a 1.5 m long slotted screen. At the AH/MW24-01 location, a nested monitoring well was installed to evaluate a potential confined aquifer, separated by low-permeability intermediate layers. The nested monitoring wells at AH/MW24-01 were installed from 3.1 m to 4.6 m and from 7.6 m to 9.1 m in depth. At the AH/MW24-03 location, a monitoring well was placed between 7.6 m and 9.1 m in depth.

Generally, the lower portion of the borehole was backfilled with bentonite and/or filter sand up to the targeted installation depth of the piezometer. The standpipe was then inserted to the designated depth, followed by the addition of filter sand to approximately 0.6 m above the screened section. A bentonite seal, around 0.6 m thick, was

placed to isolate the screened portion. The remaining part of the hole was backfilled with a mix of bentonite chips and sand up to the surface, in compliance with the *BC Groundwater Protection Regulation*. The piezometers were sealed with a J-plug and covered with a flush-mount cover, which was cemented in place using a quick-set cement mix. Details on the standpipe piezometer installation backfill are provided in the borehole logs found in Appendix B.

3.1.3 Decommissioning of Testholes

All the testholes without monitoring well installation (i.e., AH24-02 and AH24-04) were backfilled in general accordance with the *BC Groundwater Protection Regulation* with a combination of bentonite chips, filter sand and drill cuttings. Testholes were sealed using bentonite chips at the base and near the top to 0.3 m below ground surface. The ground surface was then reinstated using filter sand at each location.

4.0 LABORATORY TESTING

Laboratory tests were performed on disturbed soil samples recovered during the drilling program. Laboratory testing was performed at the Tetra Tech geotechnical laboratory facility located in Richmond, BC between April 3 and April 5, 2024.

The following soil tests were completed as part of the testing program:

- Soil Description and Classification
- Natural Moisture Content (21)
- Fines Content and Particle Size Determinations (7)

The numbers in brackets refer to the total number of each test type performed on the samples from the boreholes.

The tests completed as part of the laboratory testing program for this subsurface exploration are briefly described in the following sections. The methodology used for each testing generally reflects the procedures outlined by the ASTM standards. The results of the laboratory testing are presented in Appendix C.

4.1 Soil Description and Classification

In the field, immediately upon recovery, the soil samples were classified visually and by texture in accordance with Tetra Tech internal geotechnical soil classification work method by Tetra Tech engineers. Tetra Tech geotechnical soil classification work method has been developed based on the general guidelines provided in the Canadian Foundation Engineering Manual 4th Edition and ASTM Standards.

The detailed soil descriptions include the following information:

- Main soil type
- Secondary soil components
- Qualitative assessment of grading (coarse-grained soils)
- Structure, texture, or other relevant descriptions
- Colour

Soils have been classified as coarse-grained (granular) or fine-grained (cohesive). Granular soils are described in terms of the relative proportions of the grain sizes. Cohesive soils are classified based on plasticity (Atterberg limits) as per ASTM Standard D2487-17.

On the borehole logs in Appendix B, the field descriptions have been revised to consider the results of the laboratory classification tests at the specific depth of the samples.

4.2 Natural Moisture Content

Twenty-one (21) moisture content determinations were performed on the samples recovered from the boreholes. Natural moisture contents are determined from the difference in measured total and dry weights after oven drying of specimens taken from soil samples recovered from the borehole. Measurements are performed in accordance with the procedures described in ASTM Standard D2216-19.

The results of the natural water content tests are plotted on the borehole logs presented in Appendix B and are included in Appendix C.

4.3 Fines Content and Particle Size Determinations

A total of six (6) particle size distribution tests and one (1) fines content determination were performed on the recovered soil samples. The samples from the same layer were combined to create a composite sample for the sieve analysis, which is representative of the soil grain size distribution. Particle size distribution tests were performed in accordance with ASTM Standard D6913-17 and D422-07 and the results are presented on a semi-logarithmic plot with grain size (log) versus percentage passing by weight finer than the grain (sieve) size. For fines content determinations, the proportion of fines (silt and clay) in a specimen was determined by washing the material through the #200 (75 µm) sieve and computing the percentage passing.

The results of the grain size distributions are tabulated and presented graphically in Appendix C, as well as a table with the fines content tests results. The relative proportions of gravel, sand and fines are indicated on the borehole logs (Appendix B). Data from the referred tests were used to verify the visual descriptions made in the field.

5.0 SUMMARY OF GEOTECHNICAL CONDITIONS

5.1 Surficial Geology

According to Geological Survey of Canada (GSC) Surficial Geology Map 1485A, the project site is located on the Sumas Drift Pleistocene sediments. The surficial geology at the subject site is primarily composed of "advance glaciofluvial deposits." These are sediments that were deposited by meltwater streams from retreating glaciers and are consisting of proglacial channel fill, floodplain, deltaic sediments including gravel and sand thick layers up to 40 m thick.

5.2 Soil Stratigraphy

Based on the information collected from test holes AH/MW24-01 and AH24-02, the typical soil stratigraphy upslope south of King Road consists of the following layers:

TOPSOIL: Consists primarily of organic materials, fine to coarse sand and silt, with some fine gravel, generally moist and very loose. The thickness is generally about 0.2 m to 0.3 m.

SILT and SAND to sandy SILT: This unit primarily comprises non-plastic silt with poorly graded fine to medium sand, and trace fine to coarse gravel. This unit extends from approximately 0.3 m to about 6.0 m to 7.0 m depth and is generally firm to stiff in the upper 3 meters and becoming very stiff to hard with depth with DCPT blow counts ranging from 24 to 80.

Silty SAND to SAND: This unit primarily comprises well graded fine to coarse sand with approximately 20% to 38% low plastic fines, and trace fine gravel. Occasional lenses (~50 mm) of very stiff clay are present within this unit. This unit is generally very dense extending from about 6.0 m to 7.0 m depth to the maximum depth of exploration. DCPT refusal was encountered within this silty sand unit at about 6.0 m to 7.5 m depth below ground surface.

Based on the subsurface information collected from testholes AH/MW24-03 and AH24-04, the typical soil stratigraphy at the toe of the slope along King Road consists of:

SAND to Gravelly SAND (FILL): This unit primarily comprises well graded fine to coarse sand and fine to coarse gravel, with trace fines. The soil is generally brown and moist and is approximately 2.0 m thick. This unit is compact to dense with DCPT blow counts ranging between 15 and 47. Lower DCPT blow counts were measured near ground surface and increasing rapidly with depth.

Silty SAND: This unit primarily comprises well graded fine to coarse silty sand with fines content of approximately 23% and some fine to coarse gravel and occasional cobbles. This unit extends from approximately 2.0 m depth to the maximum investigation depth of about 9.2 m. This unit is dense to very dense with DCPT blow counts ranging from 46 to 98. DCPT refusal was encountered at about 4.5 m below ground surface within this unit.

5.3 Groundwater

At the boreholes completed south of King Road, upslope of the proposed cut on BC MoTI property, two distinct groundwater regimes were observed. Groundwater was observed at depth of approximately 3.0 m in both testholes AH/MW24-01 and AH24-02. A deeper groundwater regime at a depth of about 7.5 m was also observed AH/MW24-01. The soils immediately below the shallower groundwater level were observed to have relatively low moisture content extending to a depth of about 7.5 m where the deeper groundwater regime was observed.

At the location of AH/MW24-03, near the toe of the existing slope along King Road, the groundwater level was detected at an approximate depth of 7.9 m below the ground surface. No evidence of groundwater was observed at AH2404 location which terminated at a depth of 6.1 m. The reported groundwater depths are from measurements completed on the last day of drilling corresponding to 1 day and 2 days after the installation of monitoring wells at AH24-01 and AH24-03, respectively. The groundwater level may vary with seasonal changes, precipitation, and local infiltration of surface water.

6.0 CLOSURE

The objective of this report is solely to present the results of the supplementary geotechnical exploration performed for P7 Highway 1 - King Road Realignment. The report is purely factual in nature.

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

Respectfully Submitted,
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PERMIT NUMBER: 1001972

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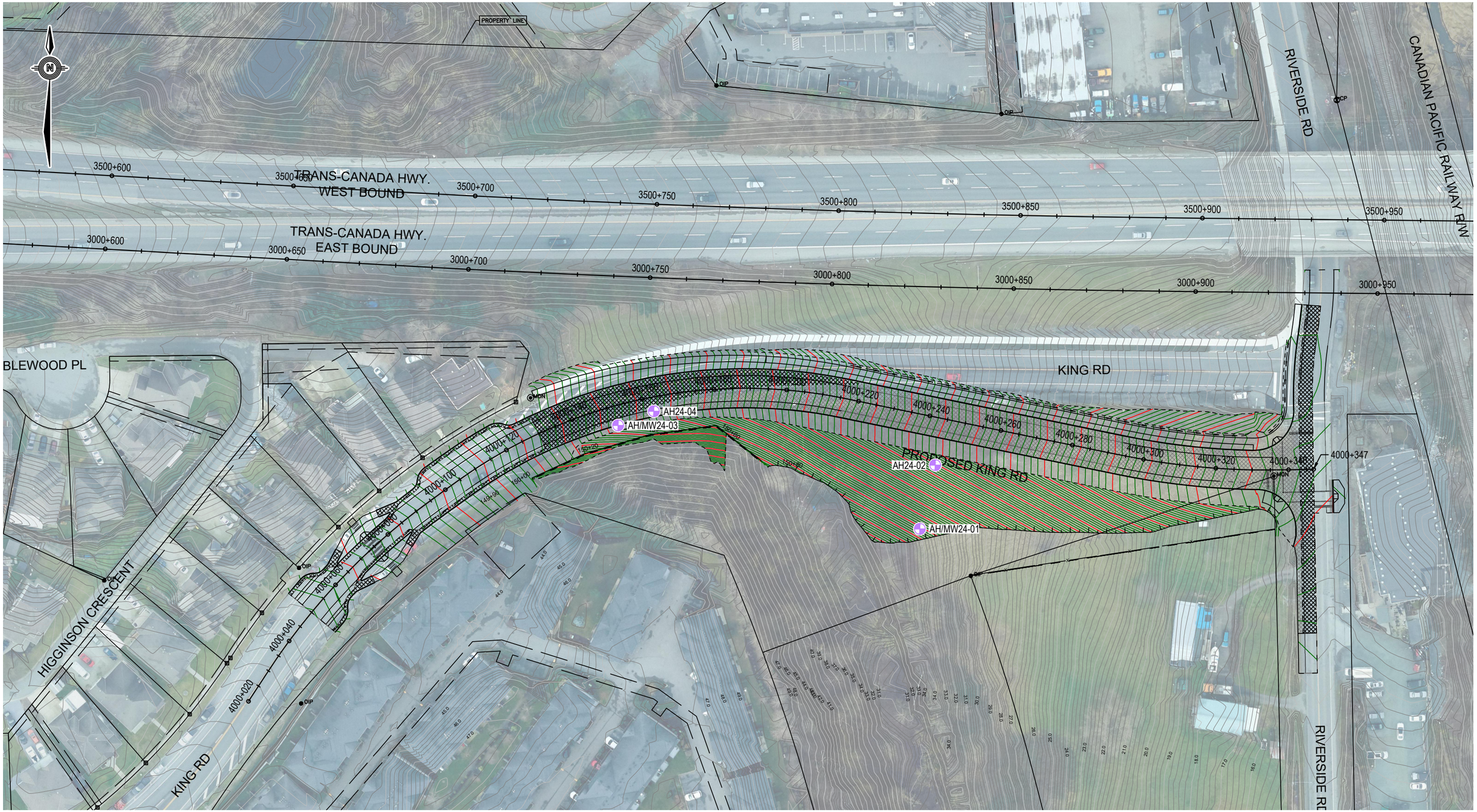
Google Earth Pro (2022) Google Earth Pro, version 7.3.6.9345 (64-bit), Data SIO, NOAA, U.S. Navy, NGA. GEBCO, accessed March 2021

FIGURE

Figure 1 Site Plan Overview



LEGEND

- Testhole by Tetra Tech (2024)

NOTES

1. Layout based on dwg. no SKT-002-P7-00815 dated June 28, 2023.

ISSUED FOR USE

0 50m

Scale: 1:1,000 @ 11"x17"

CLIENT

BRITISH COLUMBIA Ministry of Transportation and Infrastructure

TETRA TECH

P7 - KING ROAD REALIGNMENT

SITE PLAN

PROJECT NO.	DWN	CKD	REV
ENG.VGEO04080-07	RH	SR	0
OFFICE: VANC	DATE: April 18, 2024		

Figure 1

Q:\Vancouver\Drafting\Engineering\VGEO\ENG.VGEO04080-07\ENG.VGEO04080-07 2024 P7 King Road Realignment ROd.dwg [2024P7KING] April 18, 2024 - 9:37:36 am (BY: HALL, ROBERT J)

APPENDIX A

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LIMITATIONS ON USE OF THIS DOCUMENT

GEOTECHNICAL

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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.

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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.

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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.

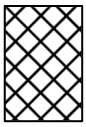
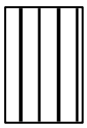
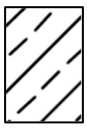
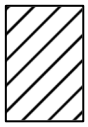
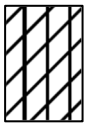
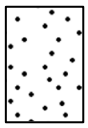
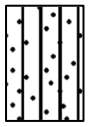
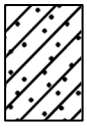
1.18 APPLICABLE CODES, STANDARDS, GUIDELINES & BEST PRACTICE

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

GEOTECHNICAL BOREHOLE LOGS

SYMBOLS USED ON THE BOREHOLE LOG
TYPE OF SOIL

	TS	(TOPSOIL)		FILL	(FILL)
	PT	PEAT		OL	ORGANIC SILT
	ML - MH	SILT		OH	ORGANIC CLAY
	CL – CH	CLAY		CL – ML CI – MI CH – MH	CLAY-SILT Mixtures
	SP/SW	SAND		SM	SAND-SILT Mixtures
	GP/GW	GRAVEL		SP – GP	SAND-GRAVEL Mixtures
	TILL	(TILL-LIKE)		SC	SAND-CLAY Mixtures

BRITISH COLUMBIA | Ministry of Transportation and Infrastructure

Notes for Completion of Soil Field Logs

Sample Type

A	AUGER
C	CORE
G	GRAB
L	LAB SAMPLE
O	ODEX
S	SPILT SPOON
T	SHELBY TUBE
W	WASH (MUD RETURN)

Soil Type/ Description Order

1	CLASSIFICATION	CAPITAL LETTERS eg; GP, SP-SM, SC4, ML
2	SOIL GROUP	CAPITAL LETTERS eg GRAVEL, SAND and GRAVEL, SILTY CLAY
3	Description of Primary Components	Coarse Grained Soils: Particle size, grading and shape (optional) Fine Grained Soils: Plasticity
4	Description of Secondary / Minor Components	Coarse Grained Soils: estimate percentage (optional), particle size Fine Grained Soils: Plasticity
5	Minor Components	any other minor components
6	Colour	Note primary colour in its moist condition, note if soil is dry
7	Structure	eg. Fissuring, cementation
8	Contamination	if applicable; staining and odour
9	Additional Observations	Presence of cobbles/boulders, origin of geological notes (FILL, Glacial TILL, Alluvium) or mineralogy (calcareous, micaceous)
10	Behaviour	non-cohesive or cohesive
11	Moisture	Non-cohesive Soils: field moisture condition Cohesive soils: water content
12	Compactness or Consistency	Non-cohesive Soils: Compactness Cohesive soils: Consistency

1. Classification

Major Divisions		Symbol	Soil Type
Coarse Grained Soils	Gravel and Gravelly Soils	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM*	Silty gravels, gravel-sand-silt mixtures
		GC*	Clayey gravels, gravel-sand-clay mixtures
	Sand and Sandy Soils	SW*	Well-graded sands or gravelly sands, little to no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM*	Silty sands, sand-silt mixtures
		SC*	Clayey sands, sand-clay mixtures
Fine Grained Soils	Silts and Clays LL<50	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silt-clays of low palsticity
	Silts and Clays LL>50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
Organic Soils		Pt	Peat and other highly organic soils
Topsoil		TS	Topsoil with roots, etc.
Cobbles		SB	Rock fragments and cobbles, particle size 75mm to 300mm diameter
Boulders		LB	Boulders, particle size over 300mm in diameter

*GP-GM ; GP-GC; SP-SM; SP-SC; 6-12% Passing #200 (0.075mm) Sieve

* GM1; GC1; SM1; SC1; 12-20% Passing #200 (0.075mm) Sieve

* GM2; GC2; SM2; SC2; 20-30% Passing #200 (0.075mm) Sieve

* GM3; GC3; SM3; SC3; 30-40% Passing #200 (0.075mm) Sieve

* GM4; GC4; SM4; SC4; 40-50% Passing #200 (0.075mm) Sieve

2. Soil Group (Organic Soils)

	Category	ORGANIC CONTENT (% by Weight)	NAME	DISTINGUISHING CHARACTERISTICS FOR VISUAL IDENTIFICATION
ORGANIC SOILS	Highly Organic Soils	75% to 100%	Fibrous PEAT	Light weight, spongy and often elastic at natural water content. Plant structure easily identifiable. Shrinks considerably upon air drying. Much water squeeze from sample
		75% to 100%	Amorphous PEAT	Light weight, spongy but not usually elastic at natural water content. Plant structure visiably altered to unidentifiable. Shrinks considerably upon air drying. Much water squeeze from sample
		30% to 75%	SILTY PEAT	Relatively light weight, spongy. Thread usually weak and spongy near plastic limit. Shrinks on air drying; medium dry strength. Usually can squeeze water from sample readily. Low dilatancy.
		30% to 75%	SANDY PEAT	Sand fraction visible. Thread weak and friable near palstic limit, shrinks on air drying; low dry strength. Usually can squeeze water from sample readilty, high dilatancy, "gritty"
	Organic Soils	5% to 30%	ORGANIC CLAYEY SILT	Often has a strong H_2S odour. Thread may be tough depending on clay fraction. Medium dry strength, low dilatancy.
		5% to 30%	ORGANIC SAND or ORGANIC SILT	Threads weak and friable near plastic limit, or threads may not be rolled. Low dry strength; medium to high dilatancy

2. Soil Group continued (Fine and Coarse Grained Soils)

	CLASSIFICATION	CH	CI	CL	OH	MH	OL	ML	ML
FINE GRAINED SOILS	SOIL NAME	CLAY	SILTY CLAY	SILTY CLAY	ORGANIC SILT	CLAYEY SILT	ORGANIC SILT	CLAYEY SILT	SILT
	Dilatancy	None	None	None	None	Slow to Very Slow	Slow to Very Slow	Slow	Rapid
	Dry Strength	High	Medium to High	Low to Medium	Medium to High	Low to Medium	Low to Medium	None to Low	None
	Thread diameter(mm)	<1	1 to 3	~3	1 to 3	3 to 6	3 to 6	3 to 6	>6
	Toughness (of 3mm thread)	High	Medium	Low to Medium	Medium to High	Low to Medium	Low	None to Low	Can't roll 3mm
	Organic Content (%)	0 to 30	0 to 30	0 to 30	5 to 30	<5	5 to 30	<5	<5

	CLASSIFICATION	SW	SP	SC	SM	GW	GP	GC	GM
COARSE GRAINED SOILS	SOIL NAME	SAND	SAND	CLAYEY SAND	SILTY SAND	GRAVEL	GRAVEL	CLAYEY GRAVEL	SILTY GRAVEL
	Size of Coarse Fraction	SANDS (>50% of coarse fraction is smaller than 4.75mm)				GRAVELS (>50% of coarse fraction is larger than 4.75mm)			
	Fines Content	<12% fines		>12% Fines		<12% Fines		>12% Fines	
	Gradation or Plasticity	Well Graded	Poorly Graded	Plastic Fines	Non-plastic Fines	Well Graded	Poorly Graded	Plastic Fines	Non-plastic Fines

3. Description of Primary Components

Soil Consituent	Particle Size	Millimeters (Sieve Size)
BOULDERS	Not applicable	>300
COBBLES	Not applicable	75 to 300
GRAVEL	Coarse Grained	19 to 75
	Fine Grained	4.75 to 19
SAND	Coarse Grained	2.00 to 4.75
	Medium Grained	0.425 to 2.00
	Fine Grained	0.075 to 0.425
SILT/CLAY	Not applicable	<0.075

Particle Shape & Angularity		DESCRIPTION
Angularity	Rounded	Smoothly curved sides, no edges, smooth or polished surfaces
	Sub-rounded	Plane sides, Well-rounded edges, Partially polished surfaces
	Sub-angular	Plane sides, Partially rounded edges, unpolished surfaces
	Angular	Plane sides, sharp edges, unpolished surfaces
Shape (Gravel)	Flat	Width to thickness ration >3
	Elongated	Length to width ratio >3

Particle Size Distribution		DESCRIPTION
Well Graded		Even distribution of particle sizes
Poorly Graded	-	Uneven distribution of particle sizes
	Gap Graded	Intermediate particle sizes absent
	Uniformly	Primarily one particle size

4. Description of Secondary Components
5. Description of Minor Components

Components	% (by mass)	MODIFIER
Minor	<10	use "trace" or omit
	10 to 20	use "some"
Secondary	20 to 35	Prefix primary soil name eg. gravelly, clayey
	>35	use "and" to combine major consituents eg. SAND and GRAVEL

6. Colour

COLOUR
Describe the colour of the soil in its moist condition
Note if soil represents dry condition eg. grey (dry)
Use primary colour modified, if appropriate, with single adjective
Border cases can be hyphenated eg. grey-brown
Describe streaks or splotches of other colors as "mottled"

7. Structure

ZONING & FISSURES	DESCRIPTION
Heterogeneous	Soil mass of non-uniform, variable compostition or structure
Homogeneous	Soil mass is of uniform compostion or structure
REPETITIVE STRUCTURES	
Laminated	Closely spaced, alternating layers of differing soils and/or differing colours or shades of soils of similar gradation, usually arranged in a regular pattern **Thinly Laminated**: spacing under 6mm **Thickly Laminated**: spacing 6mm to 20mm
Stratified or Layered	Differing soils or visible variations in soil consituents or colour arranged in layers, generally but not necessarily parallel to one another **Very Thinly Bedded**: 20mm to 60mm **Thinly Bedded**: 60mm to 200mm **Medium Bedded**: 200mm to 600mm **Thickly Bedded**: 600mm to 2m **Very thickly Bedded**: over 2m
DISCRETE LAYERS OR FEATURES	
Varved	A laminated soil consisting of two distinct soils (usually clay and silt) occuring in a regularly repeating pattern resulting from seasonal variations in sediment load in a lacustrine environment
Lens	An inclusion of a different soil type within surrounding soils, which thins out laterally (horizontally) and may not be continuous over any significant distance. Typically identified by test pits or correlations between boreholes
Parting	Paper thin separation of one soil type by another. Usually applied to fine grained soils.
Pocket	A different soil type of very limited thickness or lateral extent (a small lens)
Seam	A soil layer of considerable extent but with a thickenss of less than about 10mm
Fissured	Generally applied to dried or overconsolidated fine grained soils (silts or clays) containing cracks or physical discontinuities which can be vertical, horizontal or inclined. Described as highly, moderately and slightly fissured
Friable, Blocky or Platy	Otherwise cohesive soil breaks into small (friable), larger (blocky), or thin plate like (platy) fragments with little effort
Slickensided	Polished or striated surfaces. Often an indication of an existing failure or slip surface. If continuous slickensided shear zones are found an estimate should be made of their angle in relation to the horizontal plane

8. Contamination

if applicable; note staining and/or odour

9. Additional Observations

See note in Soil Type/Decsription order table

10. Behaviour

Non-Cohesive or Cohesive

11. Moisture

TERM	FIELD MOISTURE IDENTIFICATION (Non-Cohesive)
Dry	Soil flows freely through fingers
Moist	Soils are darker than in the dry condition and may feel cool
Wet	As moist, but with free water forming on hands when handled

TERM	WATER CONTENT IDENTIFICATION (Cohesive)
w < PL	Material is estimated to be drier than the Plastic Limit (cannot be rolled to a thread diameter of 4mm)
w ~ PL	Material is estimated to be close to the Plastic Limit (can be rolled to a thread diameter of between 2mm & 4mm
w > PL	Material is estimated to be wetter than the Plastic Limit (can be rolled to a thread diameter of less than 2mm)

12. Compactness (Non-Cohesive)

TERM	SPT "N" (Blows/ 0.3m)	FIELD IDENTIFICATION OF SOIL EXPOSURES
Very Loose	0 to 4	Easily penetrated with shovel handle
Loose	4 to 10	Easily excavated with hand shovel.
Compact	10 to 30	Difficult to excavate with hand shovel
Dense	30 to 50	Must be loosened with pick to excavate
Very Dense	>50	Very difficult to excavate even with pick

12. Consistency (Cohesive)

TERM	FIELD IDENTIFICATION	Undrained Shear Strength (KPa)	Unconfined Compressive Strength (KPa)	SPT "N" (blows /0.3m)
Very Soft	Extrudes between fingers when squeezed	<12	<25	0 to 2
Soft	Moulded by light finger pressure	12 to 25	25 to 50	2 to 4
Firm	Moulded by strong finger pressure	25 to 50	50 to 100	4 to 8
Stiff	Indented by thumb	50 to 100	100 to 200	8 to 15
Very Stiff	Indented by thumbnail	100 to 200	200 to 400	15 to 30
Hard	Difficult to indent with thumbnail	>200	>400	30

SUMMARY LOG

Ministry of Transportation and Infrastructure — BRITISH COLUMBIA

Drill Hole #: AH/MW24-01

Project: **Highway 1 - King Road Realignment Supplementary Geotechnical Exploration**

Location: 34338 King Rd, Abbotsford, BC.

Prepared by: Tetra Tech
704-ENG.VGEO04080-07

Logged by: FH Reviewed by: SR

Datum: 10 U Alignment: N/A

Northing/Easting: 5431338.54 , 553090.93 Station/Offset: N/A

Elevation: 33.2 m *Coordinates taken with GPS*

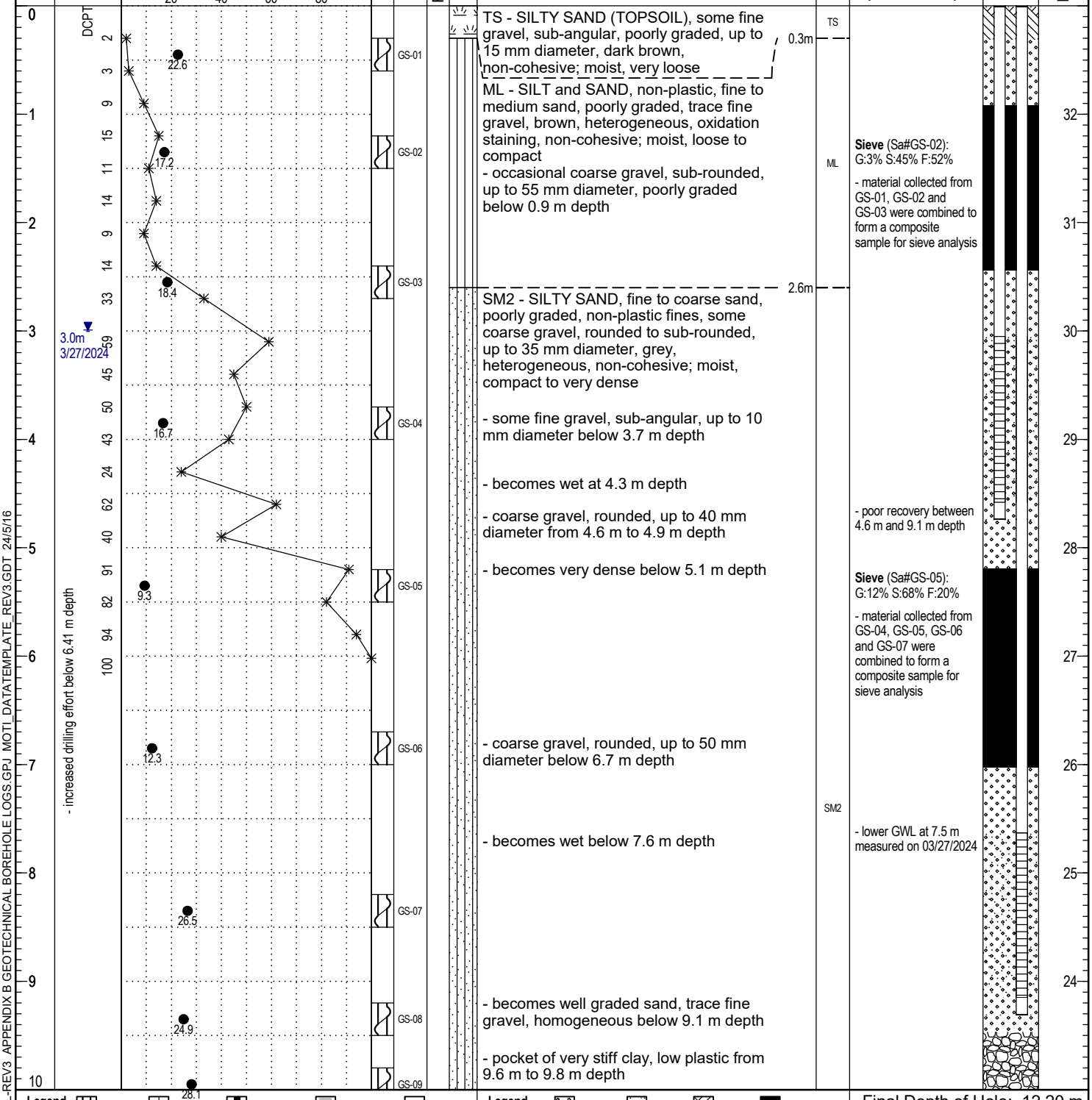
Date(s) Drilled: 03/26/2024

Company: Omega Environmental Drilling

Driller: Clay Duralia

Drill Make/Model: M5D Track Rig

Drilling Method: Solid Stem Auger



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

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

Final Depth of Hole: 12.20 m

Depth to Top of Rock: N/A

MOTI-SOIL-REV3 APPENDIX B GEOTECHNICAL BOREHOLE LOGS.GPJ MOTI_DATATEMPLATE_REV3.GDT 24/5/16

SUMMARY LOG

Drill Hole #:**AH/MW24-01**

Ministry of Transportation and Infrastructure

Project: **Highway 1 - King Road Realignment Supplementary Geotechnical Exploration**

Location: 34338 King Rd, Abbotsford, BC.

Prepared by: Tetra Tech
704-ENG.VGEO04080-07

Logged by: FH Reviewed by: SR

Datum: 10 U Alignment: N/A

Northing/Easting: 5431338.54 , 553090.93 Station/Offset: N/A

Elevation: 33.2 m *Coordinates taken with GPS*

Date(s) Drilled: 03/26/2024

Company: Omega Environmental Drilling

Driller: Clay Duralia

Drill Make/Model: M5D Track Rig

Drilling Method: Solid Stem Auger

DEPTH (m)	DRILLING DETAILS	✳DCP (BLOWS/300 mm)✳ Wp% 20 W% 40 60 WL% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	MONITORING WELL	ELEVATION (m)
10							SM2 - SILTY SAND, fine to coarse sand, poorly graded, non-plastic fines, some coarse gravel, rounded to sub-rounded, up to 35 mm diameter, grey, heterogeneous, non-cohesive; moist, compact to very dense *(continued)*				22
11		19;3		GS-10			- pockets of very stiff clay, 25 mm to 50 mm thick below 10.0 m depth - occasional fine gravel, sub-rounded, up to 15 mm diameter, poorly graded below 11.3 m depth		- poor recovery between 10.7 m and 12.2 m depth		
12		25;3		GS-11			12.2m END OF TESTHOLE AT 12.20 m DEPTH. DCPT refusal at 6.0 m depth. - Testhole coordinates based on estimates through Google Earth navigation app (+/- 5 m). - Elevations are approximate and were inferred from the original project wide field survey completed by Stantec Consulting Ltd. in 2021. - Soil descriptions are based on visual classification and field observations, in combination with in-situ and laboratory testing results. Some variation throughout the interpreted soil layers is expected. - Upon completion of drilling, a Nested Monitoring Well was installed at this location consisting of two (2) 51 mm diameter Schedule 40 PVC pipes with a 1.5 m slotted screen from 3.0 m to 4.5 m and from 7.6 m to 9.1 m depth.				21
13											20
14											19
15											18
16											17
17											16
18											15
19											14
20											

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

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

Final Depth of Hole: 12.20 m
Depth to Top of Rock: N/A

MOTI-SOIL-REV3 APPENDIX B GEOTECHNICAL BOREHOLE LOGS.GPJ MOTI_DATATEMPLATE_REV3.GDT 24/5/16

SUMMARY LOG

Drill Hole #:**AH24-02**

Ministry of Transportation and Infrastructure

Project: **Highway 1 - King Road Realignment Supplementary Geotechnical Exploration**

Location: 34338 King Rd, Abbotsford, BC.

Prepared by: Tetra Tech
704-ENG.VGEO04080-07

Logged by: FH Reviewed by: SR

Datum: 10 U Alignment: N/A

Northing/Easting: 5431356.05 , 553095.13 Station/Offset: N/A

Elevation: 32.0 m *Coordinates taken with GPS*

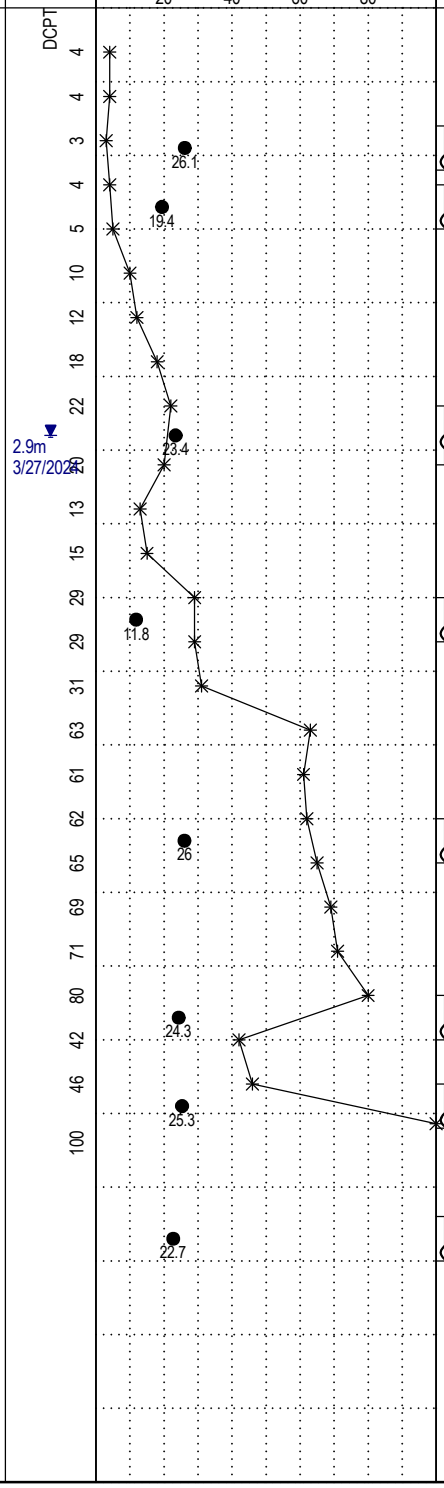
Date(s) Drilled: 03/27/2024

Company: Omega Environmental Drilling

Driller: Clay Duralia

Drill Make/Model: M5D Track Rig

Drilling Method: Solid Stem Auger



DEPTH (m)	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate *{G % S % F %}*	ELEVATION (m)
0					TS - SAND (TOPSOIL), some fine gravel, sub-angular, up to 10 mm diameter, some silt, brown, presence of vegetation (roots); moist, very loose	TS		
0.2m					ML - SANDY SILT, low plastic fines, fine sand, uniformly graded sand, some fine to coarse gravel, sub-angular, up to 25 mm diameter, brown, heterogeneous, cohesive; w < PL, soft	ML		
0.9m					SM4 - SAND and SILT, fine to coarse sand, well graded, non-plastic fines, trace fine gravel, brown, heterogeneous, oxidation stains, non-cohesive; moist, loose to compact - some fine to coarse gravel, up to 30 mm diameter, sub-angular below 2.1 m depth	SM4	**% Fines** (Sa#GS-02): F:43%	30
1		GS-01						
		GS-02						29
2								
2.7m					ML - SILT, non-plastic, some sand, fine to coarse sand, poorly graded, occasional cobble, brown, ~cohesive; w < PL, firm		- poor recovery between 3.0 m and 4.6 m depth	28
3		GS-03						
		GS-04			- becomes light grey below 4.3 m depth - some fine to coarse gravel, up to 25 mm diameter below 4.6 m depth	ML	**Sieve** (Sa#GS-04): G:0% S:17% F:83% - material collected from GS-03, GS-04 and GS-05 were combined to form a composite sample for sieve analysis	27
4								
5		GS-05			- becomes wet below 5.5 m depth			26
6							- poor recovery between 6.1 m and 12.2 m depth	25
6.6m					SC - CLAYEY SAND, fine to coarse sand, well graded, low plastic fines, trace fine gravel, light grey, heterogeneous, non-cohesive; wet, dense	SC		
7		GS-06						24
7.3m					SM3 - SILTY SAND, fine to coarse sand, well graded, low plastic fines, grey, non-cohesive; wet, dense to very dense - occasional pockets of clay, grey, 15 mm thick, w ~ PL, low plastic from 6.3 m to 8.8 m depth			
		GS-07						
8		GS-08					**Sieve** (Sa#GS-08): G:0% S:62% F:38% - material collected from GS-07, GS-08, GS-09 and GS-10 were combined to form a composite sample for sieve analysis	23
9								22
10						SM3		

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

Final Depth of Hole: 12.20 m
Depth to Top of Rock: N/A

SUMMARY LOG

Drill Hole #:**AH24-02**

Ministry of Transportation and Infrastructure

Project: **Highway 1 - King Road Realignment Supplementary Geotechnical Exploration**

Location: 34338 King Rd, Abbotsford, BC.

Prepared by: Tetra Tech
704-ENG.VGEO04080-07

Logged by: FH Reviewed by: SR

Datum: 10 U Alignment: N/A

Northing/Easting: 5431356.05 , 553095.13 Station/Offset: N/A

Elevation: 32.0 m *Coordinates taken with GPS*

Date(s) Drilled: 03/27/2024

Company: Omega Environmental Drilling

Driller: Clay Duralia

Drill Make/Model: M5D Track Rig

Drilling Method: Solid Stem Auger

DEPTH (m)	DRILLING DETAILS	✳DCP (BLOWS/300 mm)✳ Wp% 20 W% 40 60 WL% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	ELEVATION (m)
10		26.6		GS-09			SM3 - SILTY SAND, fine to coarse sand, well graded, low plastic fines, grey, non-cohesive; wet, dense to very dense *(continued)* - pocket of very stiff clay, 80 mm thick, medium plasticity at 10.5 m depth			20
11		31.1		GS-10			- pocket of very stiff clay, 50 mm thick, medium plasticity at 11.7 m depth			19
12							12.2m END OF TESTHOLE AT 12.20 m DEPTH. DCPT refusal at 7.6 m depth. - Testhole coordinates based on estimates through Google Earth navigation app (+/- 5 m). - Elevations are approximate and were inferred from the original project wide field survey completed by Stantec Consulting Ltd. in 2021. - Soil descriptions are based on visual classification and field observations, in combination with in-situ and laboratory testing results. Some variation throughout the interpreted soil layers is expected. - Upon completion, the testhole was backfilled with drilling cuttings and bentonite pellets, reinstated in accordance with the BC Groundwater Protection Regulation.			18
13										17
14										16
15										15
16										14
17										13
18										12
19										
20										

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

Final Depth of Hole: 12.20 m
Depth to Top of Rock: N/A

SUMMARY LOG

Drill Hole #:**AH/MW24-03**

Ministry of Transportation and Infrastructure

Project: **Highway 1 - King Road Realignment Supplementary Geotechnical Exploration**

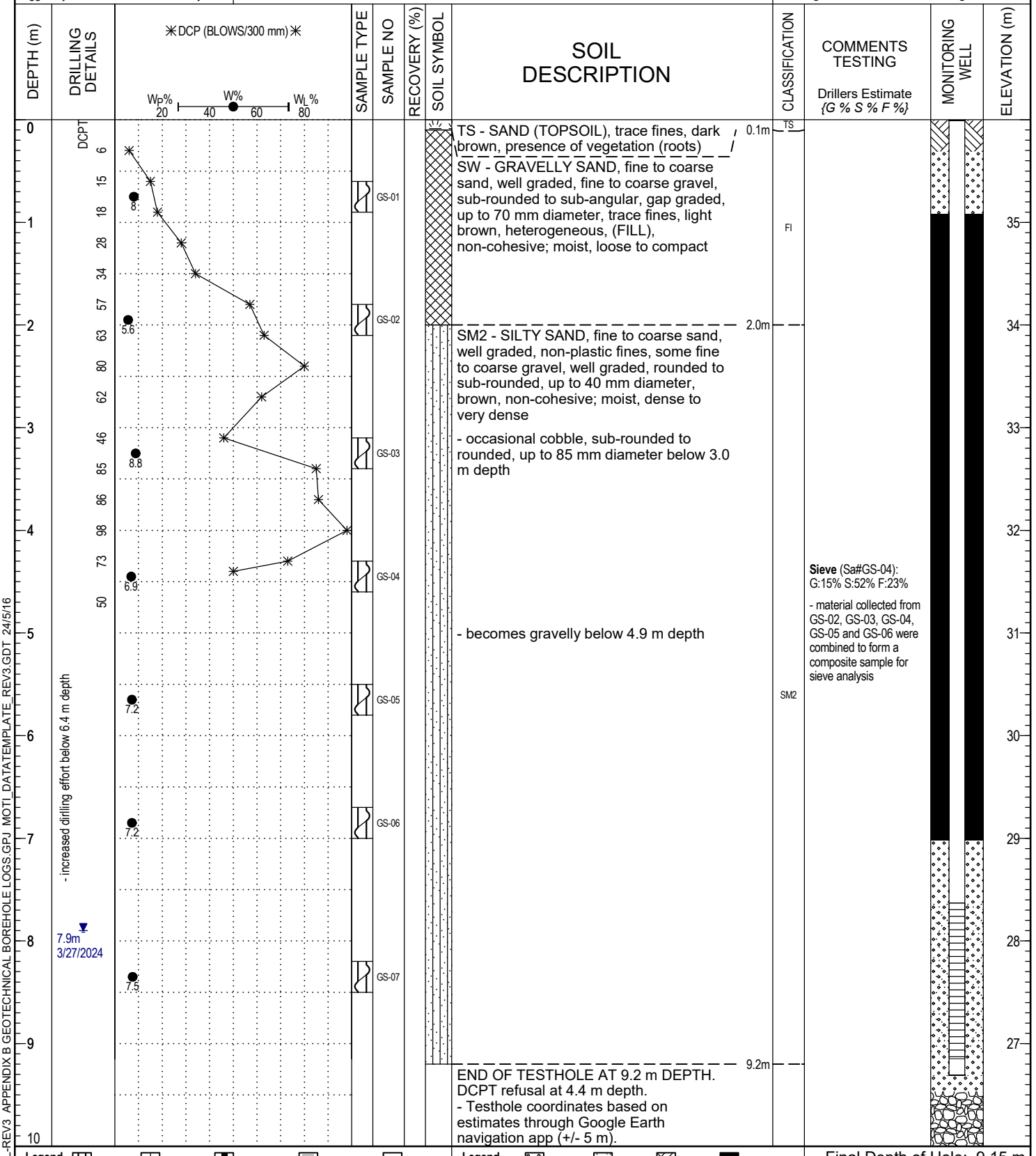
Location: 34281 King Rd, Abbotsford, BC.

Prepared by: Tetra Tech
704-ENG.VGEO04080-07

Logged by: FH Reviewed by: SR

Datum: 10 U
Northing/Easting: 5431367 , 553008
Elevation: 34.6 m
Alignment: N/A
Station/Offset: N/A
Coordinates taken with GPS

Date(s) Drilled: 03/25/2024
Company: Omega Environmental Drilling
Driller: Clay Duralia
Drill Make/Model: M5D Track Rig
Drilling Method: Solid Stem Auger



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

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

Final Depth of Hole: 9.15 m
Depth to Top of Rock: N/A

MOTI-SOIL-REV3 APPENDIX B GEOTECHNICAL BOREHOLE LOGS.GPJ MOTI_DATATEMPLATE_REV3.GDT 24/5/16

Ministry of Transportation and Infrastructure

SUMMARY LOG

Drill Hole #:**AH/MW24-03**

Project: **Highway 1 - King Road Realignment Supplementary Geotechnical Exploration**

Location: 34281 King Rd, Abbotsford, BC.

Prepared by: Tetra Tech
704-ENG.VGEO04080-07

Logged by: FH Reviewed by: SR

Datum: 10 U
Northing/Easting: 5431367 , 553008
Elevation: 34.6 m

Alignment: N/A
Station/Offset: N/A
Coordinates taken with GPS

Date(s) Drilled: 03/25/2024
Company: Omega Environmental Drilling
Driller: Clay Duralia
Drill Make/Model: M5D Track Rig
Drilling Method: Solid Stem Auger

DEPTH (m)	DRILLING DETAILS	✳DCP (BLOWS/300 mm)✳ Wp% 20 W% 40 60 WL% 80	SAMPLE TYPE	SAMPLE NO	RECOVERY (%)	SOIL SYMBOL	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate {G % S % F %}	MONITORING WELL	ELEVATION (m)
10							- Elevations are approximate and were inferred from the original project wide field survey completed by Stantec Consulting Ltd. in 2021. - Soil descriptions are based on visual classification and field observations, in combination with in-situ and laboratory testing results. Some variation throughout the interpreted soil layers is expected. - Upon completion of drilling, a Monitoring Well was installed at this location consisting of a 51 mm diameter Schedule 40 PVC pipe with a 1.5 m slotted screen between 7.6 m and 9.1 m.				
11											25
12											24
13											23
14											22
15											21
16											20
17											19
18											18
19											17
20											

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

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

Final Depth of Hole: 9.15 m
Depth to Top of Rock: N/A

MOTI-SOIL-REV3 APPENDIX B GEOTECHNICAL BOREHOLE LOGS.GPJ MOTI_DATATEMPLATE_REV3.GDT 24/5/16

SUMMARY LOG

Ministry of Transportation and Infrastructure — BRITISH COLUMBIA

Drill Hole #:AH24-04

Project: **Highway 1 - King Road Realignment Supplementary Geotechnical Exploration**

Location: 34281 King Rd, Abbotsford, BC.

Prepared by: Tetra Tech
704-ENG.VGEO04080-07

Logged by: FH Reviewed by: SR

Datum: 10 U Alignment: N/A

Northing/Easting: 5431370.89 , 553017.82 Station/Offset: N/A

Elevation: 33.6 m *Coordinates taken with GPS*

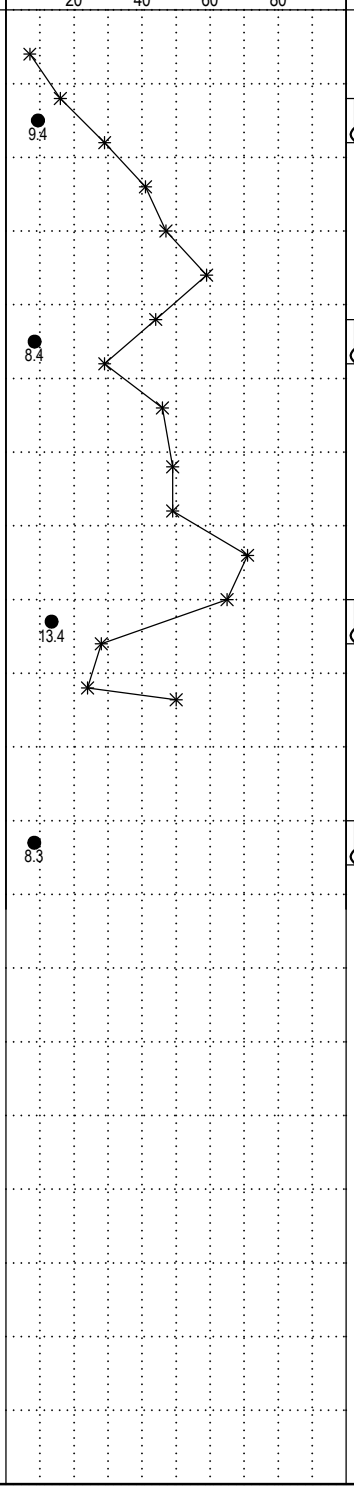
Date(s) Drilled: 03/25/2024

Company: Omega Environmental Drilling

Driller: Clay Duralia

Drill Make/Model: M5D Track Rig

Drilling Method: Solid Stem Auger



DEPTH (m)	SAMPLE NO	RECOVERY (%)	SOIL DESCRIPTION	CLASSIFICATION	COMMENTS TESTING Drillers Estimate *{G % S % F %}*	ELEVATION (m)
0			TS - SAND and GRAVEL (TOPSOIL), trace silt, presence of vegetation (roots)	TS		35
0.1m			SW - SAND, fine to coarse sand, well graded, some fine to coarse gravel, sub-rounded to sub-angular, poorly graded, up to 30 mm diameter, trace fines, brown, heterogeneous, (FILL), non-cohesive; moist, loose to compact	FI		
1	GS-01					
2	GS-02		SM2/GM2 - GRAVELLY SILTY SAND, fine to coarse sand, well graded, low plastic fines, fine to coarse gravel, well graded, rounded to sub-rounded, poorly graded, up to 50 mm diameter, brown, heterogeneous, striation marks on fractured gravel, non-cohesive; moist, compact to very dense			34
2.0m						
3						33
4	GS-03		- becomes dark brown below 4.0 m depth	SM2	**Sieve** (Sa#GS-03): G:21% S:57% F:22% - material collected from GS-02, GS-03 and GS-04 were combined to form a composite sample for sieve analysis	32
5			- occasional cobble up to 95 mm diameter, below 4.6 m depth			31
6	GS-04					30
6.1m			END OF TESTHOLE AT 6.10 m DEPTH. DCPT refusal at 4.7 m depth. - Testhole coordinates based on estimates through Google Earth navigation app (+/- 5 m). - Elevations are approximate and were inferred from the original project wide field survey completed by Stantec Consulting Ltd. in 2021. - Soil descriptions are based on visual classification and field observations, in combination with in-situ and laboratory testing results. Some variation throughout the interpreted soil layers is expected. - Upon completion, the testhole was backfilled with drilling cuttings and bentonite pellets, reinstated in accordance with the BC Groundwater Protection Regulation.			
7						29
8						28
9						27
10						

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

Final Depth of Hole: 6.10 m
Depth to Top of Rock: N/A

APPENDIX C

GEOTECHNICAL LABORATORY TEST DATA

Water Content and Organic Content

Atterberg Limits

Fines Content

Particle Size Distribution

TETRA TECH CANADA INC.

Form Nº TT103

Project:	P7 - King Road Realignment	Project No.:	704-ENG.VGEO04080-07
Location:	Abbotsford, BC	Date:	April 3, 2024
Borehole:	Various	Page:	1 of 2

Water Content and Unit Weight (ASTM D2216)

Sample Nº	Depth (m)	Tin Nº	Wt. of tare (TW) (g)	TW+ Wet weight (g)	TW+ Dry weight (g)	Water Content (%)	Sample Diameter (mm)	Sample Height (mm)	Sample Weight (g)	Volume (cm^3)	Total Unit Weight (kN/m^3)	Dry Unit Weight (kN/m^3)
AH24-01												
GS-01	0.46	49	24.88	173.80	146.34	22.6						
GS-02	1.37	35	35.17	210.23	184.60	17.2						
GS-03	2.59	C09	215.25	1137.63	994.04	18.4						
GS-04	3.81	C101	209.74	1251.53	1102.09	16.7						
GS-05	5.33	C17	206.09	1285.32	1193.88	9.3						
GS-06	6.86	112	106.23	1407.26	1264.33	12.3						
GS-07	8.38	25	34.66	253.80	207.86	26.5						
GS-08	9.30	87	33.77	223.36	185.58	24.9						
GS-09	9.91	36A	24.77	157.35	128.29	28.1						
GS-10	10.82	81	24.07	160.85	138.68	19.3						
GS-11	12.04	4	33.97	188.11	157.01	25.3						
AH24-02												
GS-01	0.91	111	33.10	253.07	207.51	26.1						
GS-02	1.37	46	24.00	194.79	167.02	19.4						
GS-03	2.90	65A	24.13	259.42	214.76	23.4						
GS-04	4.11	75	32.09	165.79	151.66	11.8						
GS-05	5.64	55	24.24	210.19	171.79	26.0						
GS-06	6.86	52A	23.32	182.31	151.27	24.3						
GS-07	7.47	24A	34.69	263.41	217.20	25.3						
GS-08	8.38	8	23.68	194.02	162.53	22.7						
GS-09	9.91	67A	24.04	222.98	181.23	26.6						
GS-10	11.43	53	25.29	276.95	217.26	31.1						

Performed By:	PC	Checked By:	PS	Approved By:	SR
Date:	April 3, 2024	Date:	April 3, 2024	Date:	April 4, 2024

TETRA TECH CANADA INC.

Form Nº TT103

Project:	P7 - King Road Realignment	Project No.:	704-ENG.VGEO04080-07
Location:	Abbotsford, BC	Date:	April 3, 2024
Borehole:	Various	Page:	2 of 2

Water Content and Unit Weight (ASTM D2216)

Sample Nº	Depth (m)	Tin Nº	Wt. of tare (TW) (g)	TW+ Wet weight (g)	TW+ Dry weight (g)	Water Content (%)	Sample Diameter (mm)	Sample Height (mm)	Sample Weight (g)	Volume (cm^3)	Total Unit Weight (kN/m^3)	Dry Unit Weight (kN/m^3)
AH24-03												
GS-01	0.76	P1	337.81	3805.10	3549.00	8.0						
GS-02	1.98	R2	343.23	4307.90	4097.90	5.6						
GS-03	3.20	16	141.28	2991.50	2761.30	8.8						
GS-04	4.42	P5	338.21	3781.70	3559.60	6.9						
GS-05	5.64	H1	195.80	3487.20	3266.10	7.2						
GS-06	6.86	AC10	196.66	3975.10	3722.80	7.2						
GS-07	8.38	R1	331.07	4716.00	4411.60	7.5						
AH24-04												
GS-01	0.76	B5	136.21	1404.82	1296.21	9.4						
GS-02	2.29	C32	142.99	2124.39	1970.52	8.4						
GS-03	4.11	F2	377.54	1871.35	1695.41	13.4						
GS-04	5.64	B34	195.75	3635.40	3371.80	8.3						

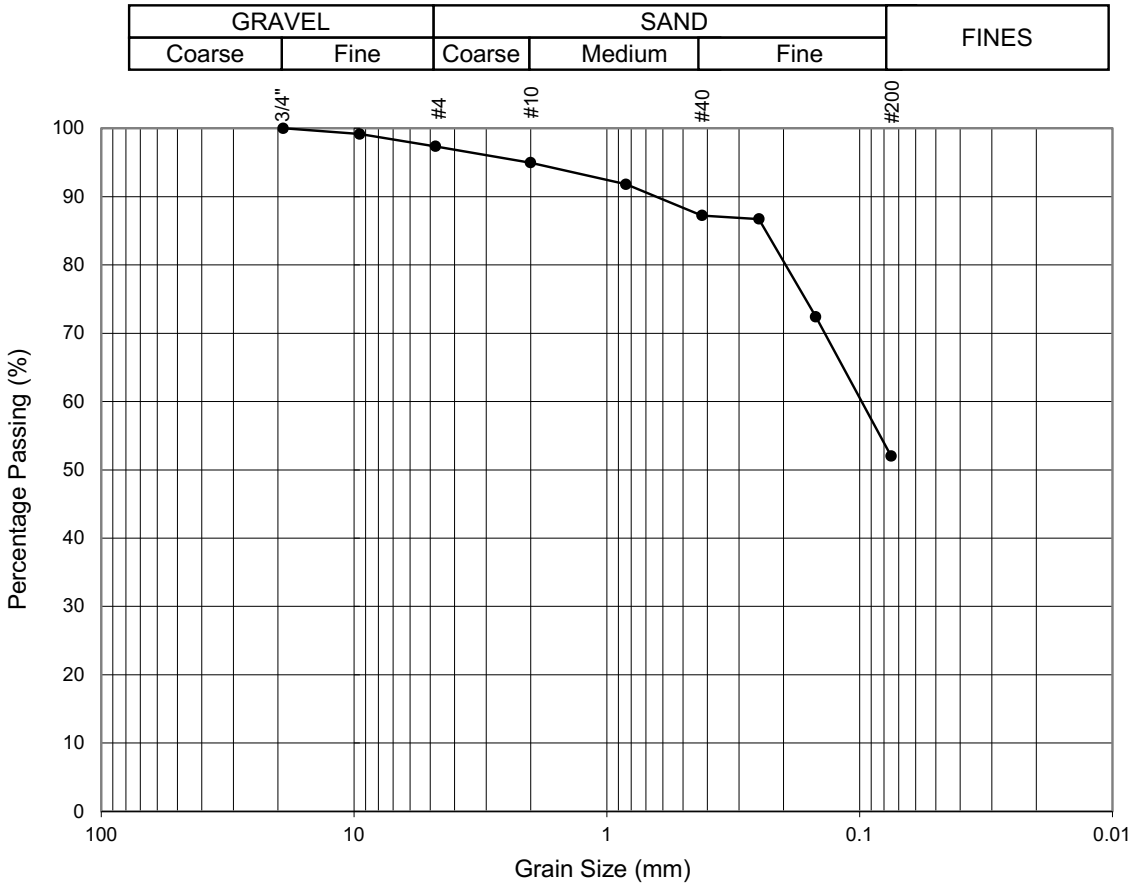
Performed By:	PC	Checked By:	PS	Approved By:	SR
Date:	April 3, 2024	Date:	April 3, 2024	Date:	April 4, 2024

TETRA TECH CANADA INC.

Form Nº TT106a

Project:	P7 - King Road Realignment			Project No.:	704-ENG.VGEO04080-07
Location:	Abbotsford, BC			Date:	April 3, 2024
Borehole:	AH24-01	Sample No.:	GS-01_02_03	Depth (m):	-

Particle Size Distribution (ASTM D6913)



Sample No.	Depth (m)	Percentage of Material by Weight (%)					
		Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	
GS-01_02_03	-	0	3	2	8	35	52

Comments: Material collected from AH24-01 GS-01, GS-02 and GS-03 were combined to form a composite sample

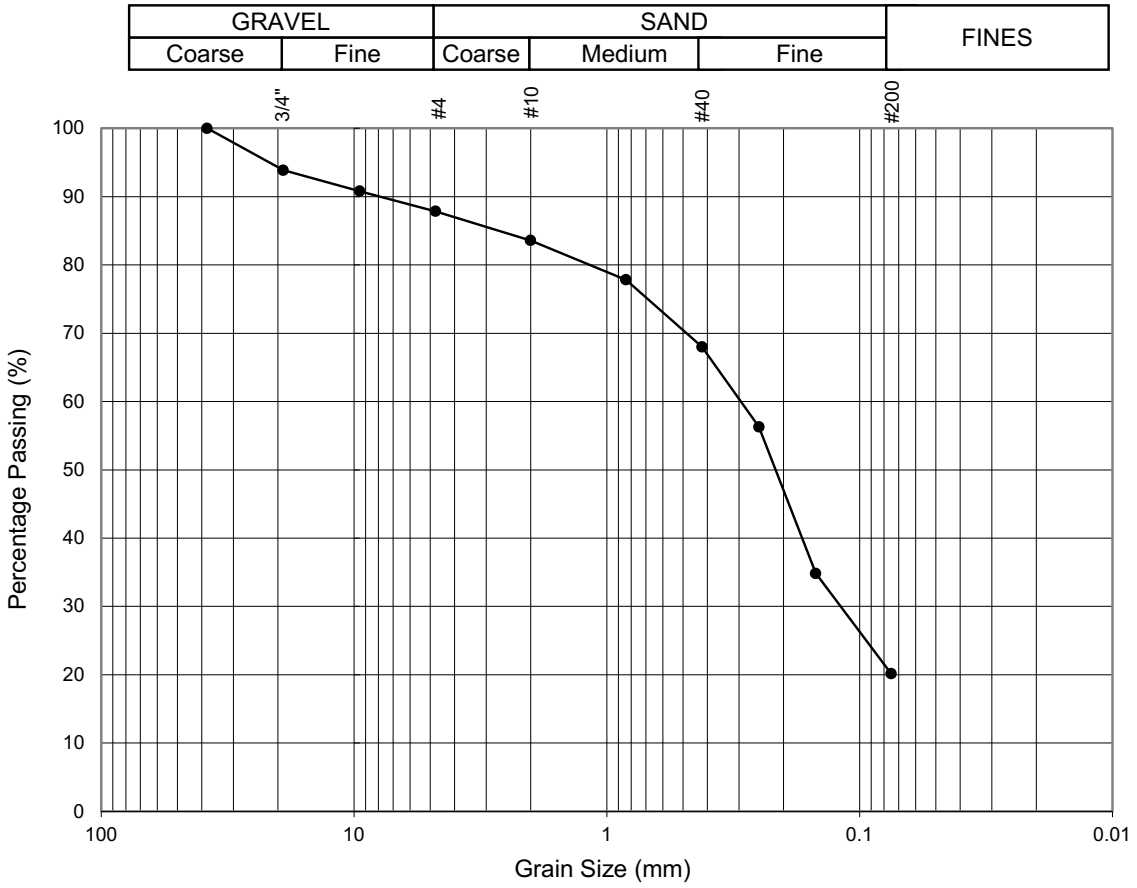
Prepared by:	PC	Checked by:	PS	Approved by:	SR
Date:	April 3, 2024	Date:	April 3, 2024	Date:	April 4, 2024

TETRA TECH CANADA INC.

Form Nº TT106a

Project:	P7 - King Road Realignment			Project No.:	704-ENG.VGEO04080-07
Location:	Abbotsford, BC			Date:	April 3, 2024
Borehole:	AH24-01	Sample No.:	GS-04_05_06_07	Depth (m):	-

Particle Size Distribution (ASTM D6913)



Sample No.	Depth (m)	Percentage of Material by Weight (%)					
		Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	
GS-04_05_06_07	-	6	6	4	16	48	20

Comments: Material collected from AH24-01 GS-04, GS-05, GS-06 and GS-07 were combined to form a composite sample

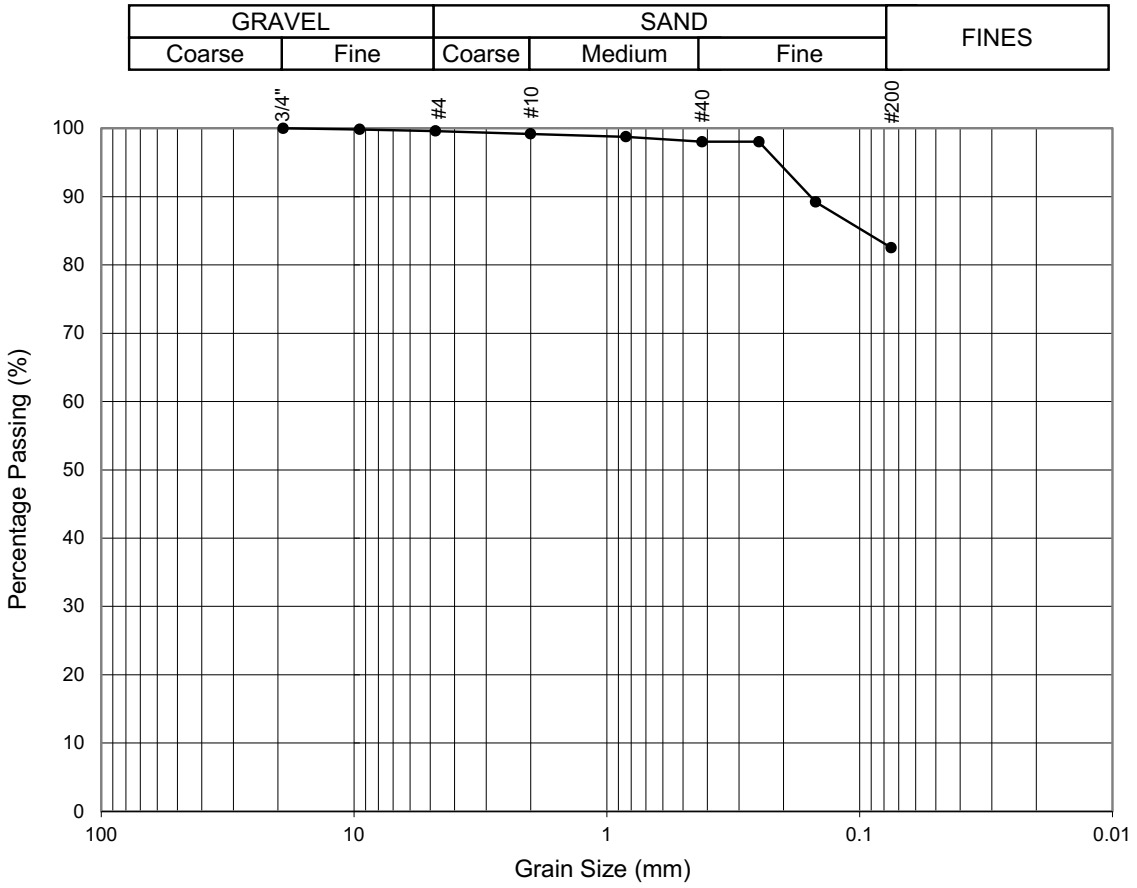
Prepared by:	PC	Checked by:	PS	Approved by:	SR
Date:	April 3, 2024	Date:	April 3, 2024	Date:	April 4, 2024

TETRA TECH CANADA INC.

Form Nº TT106a

Project:	P7 - King Road Realignment			Project No.:	704-ENG.VGEO04080-07
Location:	Abbotsford, BC			Date:	April 3, 2024
Borehole:	AH24-02	Sample No.:	GS-03_04_05	Depth (m):	-

Particle Size Distribution (ASTM D6913)



Sample No.	Depth (m)	Percentage of Material by Weight (%)					
		Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	
GS-03_04_05	-	0	0	0	1	16	83

Comments: Material collected from AH24-02 GS-03, GS-04 and GS-05 were combined to form a composite sample

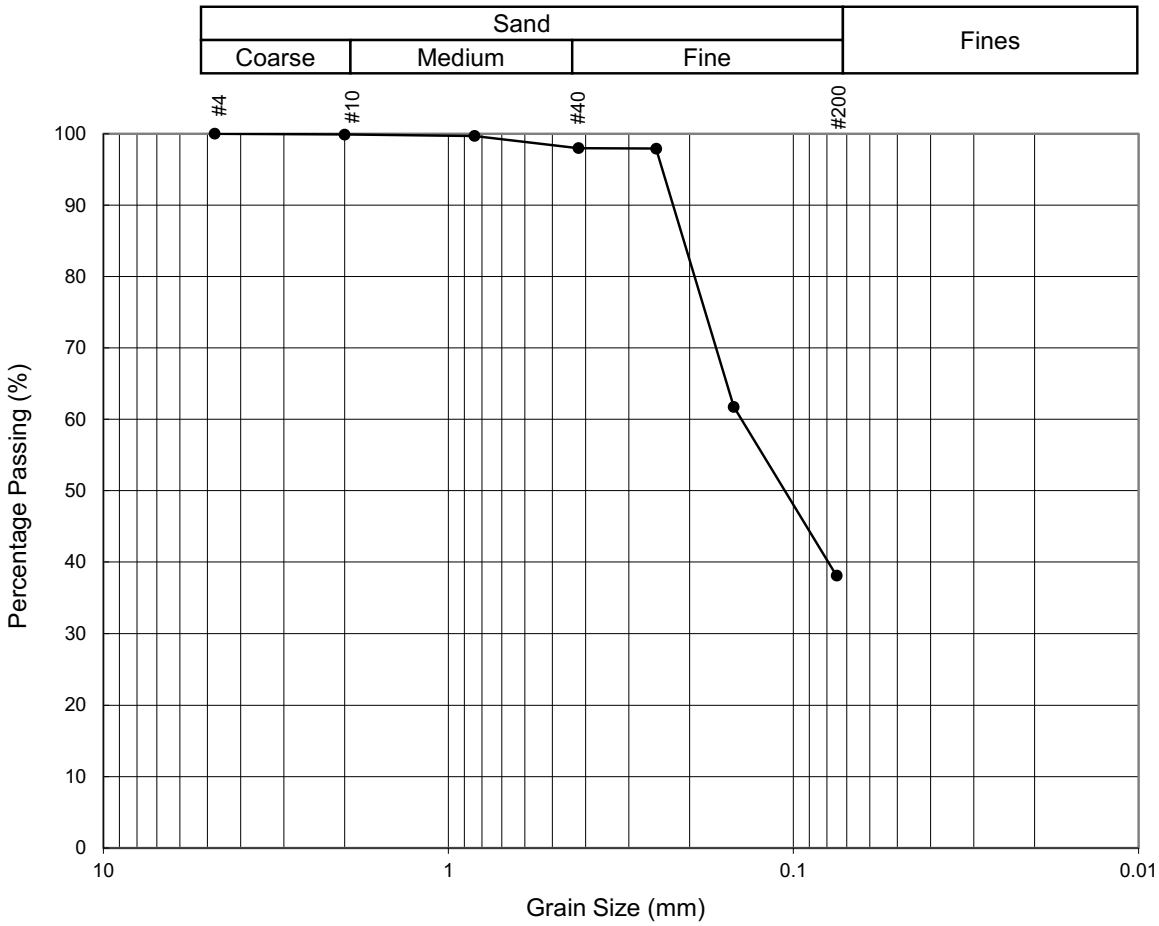
Prepared by:	PC	Checked by:	PS	Approved by:	SR
Date:	April 3, 2024	Date:	April 3, 2024	Date:	April 4, 2024

TETRA TECH CANADA INC.

Form Nº TT106

Project:	P7 - King Road Realignment			Project No.:	704-ENG.VGEO04080-07
Location:	Abbotsford, BC			Date:	April 3, 2024
Borehole:	AH24-02	Sample No.:	GS-07_08_09_10	Depth (m):	-

Particle Size Distribution (ASTM D422)



Sample No.	Depth (m)	Percentage of Material by Weight (%)				
		Gravel	Sand			Fines
			Coarse	Medium	Fine	
GS-07_08_09_10	-	0	0	2	60	38

Comments: Material collected from AH24-02 GS-07, GS-08, GS-09 and GS-10 were combined to form a composite sample

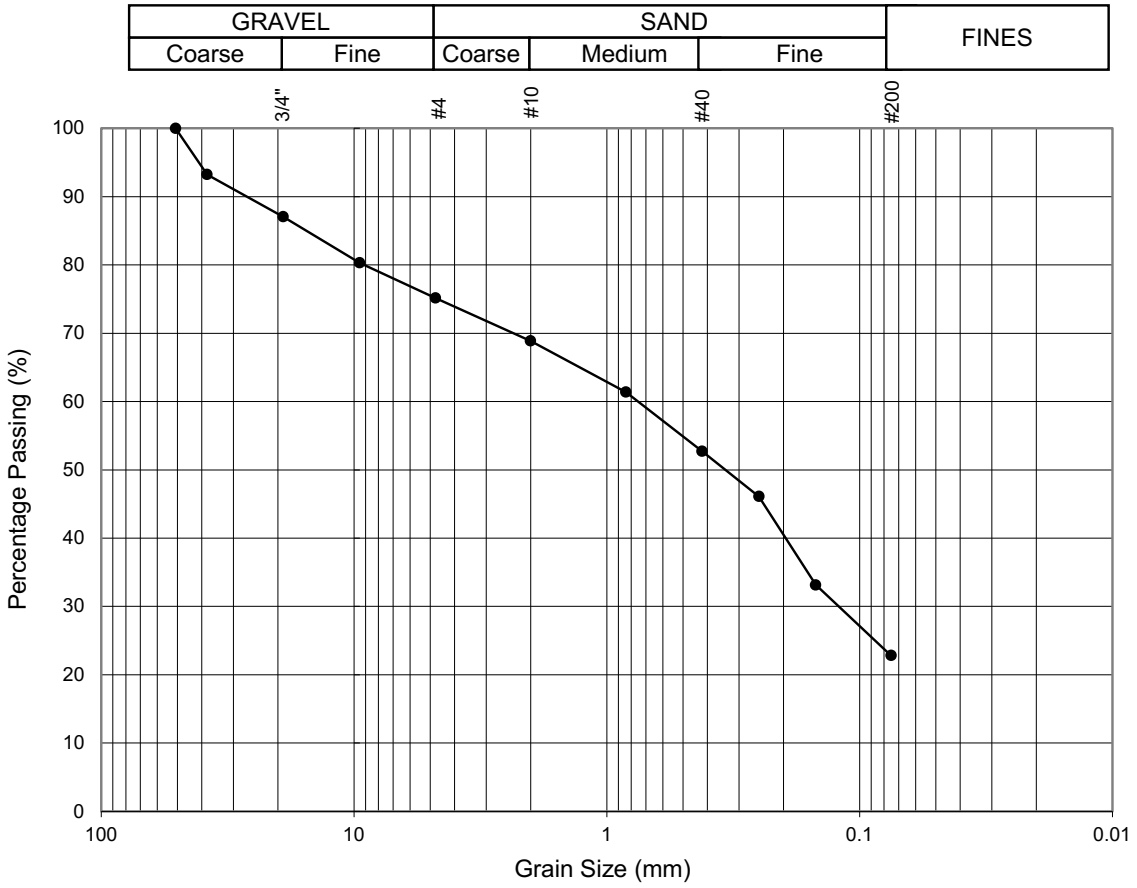
Prepared by:	PC	Checked by:	PS	Approved by:	SR
Date:	April 3, 2024	Date:	April 3, 2024	Date:	April 4, 2024

TETRA TECH CANADA INC.

Form Nº TT106a

Project:	P7 - King Road Realignment	Project No.:	704-ENG.VGEO04080-07
Location:	Abbotsford, BC	Date:	April 4, 2024
Borehole:	AH24-03	Sample No.: GS-02_03_04_05_06	Depth (m): -

Particle Size Distribution (ASTM D6913)



Sample No.	Depth (m)	Percentage of Material by Weight (%)					
		Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	
GS-02_03_04_05_06	-	13	12	6	16	30	23

Comments: Material collected from AH24-03 GS-02, GS-03, GS-04, GS-05 and GS-06 were combined to form a composite sample

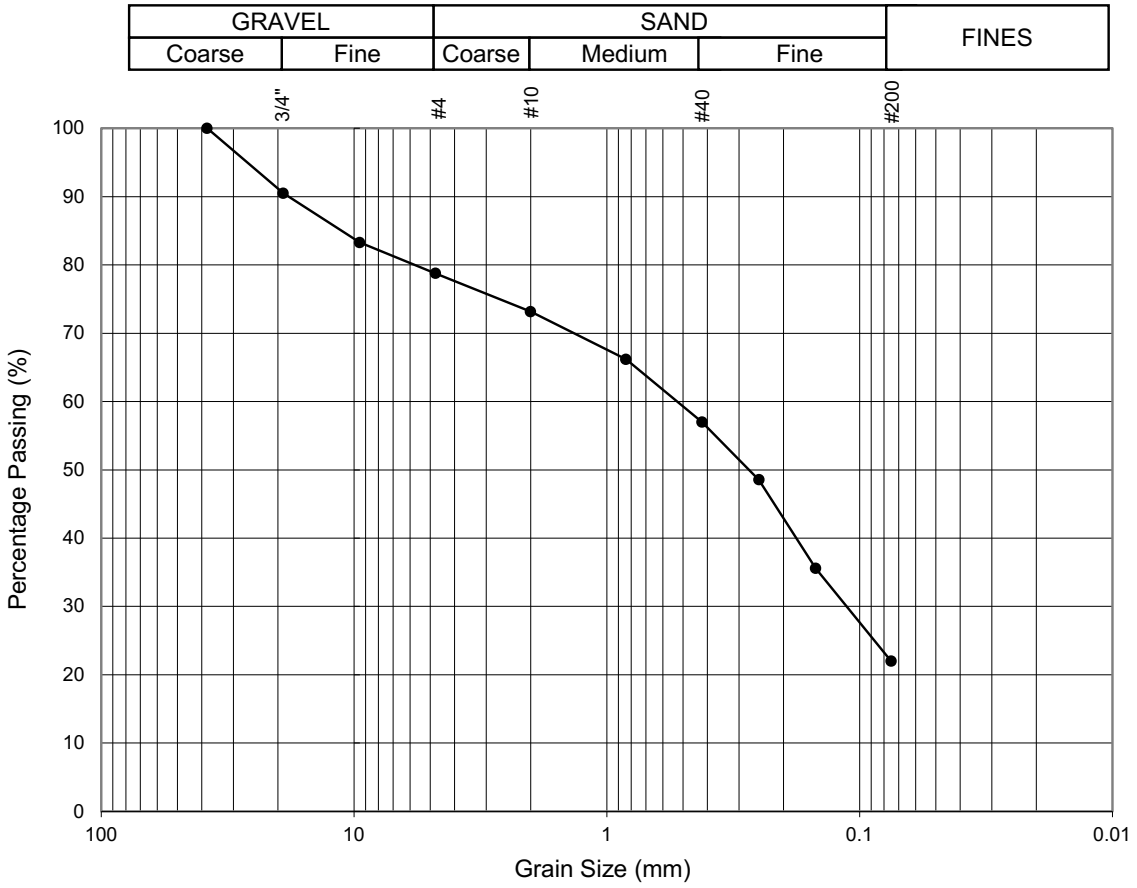
Prepared by:	PC	Checked by:	PS	Approved by:	SR
Date:	April 4, 2024	Date:	April 4, 2024	Date:	April 4, 2024

TETRA TECH CANADA INC.

Form Nº TT106a

Project:	P7 - King Road Realignment			Project No.:	704-ENG.VGEO04080-07
Location:	Abbotsford, BC			Date:	April 4, 2024
Borehole:	AH24-04	Sample No.:	GS-02_03_04	Depth (m):	-

Particle Size Distribution (ASTM D6913)



Sample No.	Depth (m)	Percentage of Material by Weight (%)					
		Gravel		Sand			Fines
		Coarse	Fine	Coarse	Medium	Fine	
GS-02_03_04	-	9	12	6	16	35	22

Comments: Material collected from AH24-04 GS-02, GS-03 and GS-04 were combined to form a composite sample

Prepared by:	PC	Checked by:	PS	Approved by:	SR
Date:	April 4, 2024	Date:	April 4, 2024	Date:	April 4, 2024

TETRA TECH CANADA INC.

Form Nº TT108

Project:	P7 - King Road Realignment	Project No.:	704-ENG.VGEO04080-07
Location:	Abbotsford, BC	Date:	
Borehole:	Various	Page:	1 of 1

Fines Content, % < No. 200 Sieve (ASTM D1140-00)

Sample Nº	Depth (m)	Container + Sample Weight (g)	Weight of Container (g)	Sieve + Soil Weight (g)	Sieve Weight (g)	Retained Weight (g)	% Retained	% Passing
AH24-02								
GS-02	1.37	353.65	210.63	291.49	210.63	80.86	56.5%	43.5%

Performed By:	PC	Checked By:	PS	Approved by:	SR
Date:	April 3, 2024	Date:	4/3/204	Date:	April 4, 2024