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Mosaic
500 – 2609 Granville Street
Vancouver, B.C.
V6H 3H3

April 14, 2022
File: 13648

Attention: Adrien Herberts

Re: Geotechnical Investigation Report – Proposed Mixed Use Development
3015, 3033, 3093 Murray Street, Port Moody, B.C.

1.0 INTRODUCTION

We understand that Mosaic intends to develop the above referenced property with a mixed use development. Architectural drawings indicate the proposed development would include three residential low-rise buildings all over a shared podium which consists of up to two levels of at-grade commercial/retail units (CRU) at the north of the development, transitioning south to a partial below grade parking level with a raised parking level through the south portion of the development. The development would be founded at/near existing grade at the north end of the site and be partially buried (up to approximately 2.4 m from existing grade to top of slab-on-grade) at the south end of the site. We expect wood framed construction for residential, up to 5 storeys, and reinforced concrete construction for at-grade podium CRU and parking areas. Information obtained from the structural consultant indicates unfactored column loads of up to 2450 kN, so that loading is would be moderately heavy.

This report presents the results of our geotechnical investigation and provides recommendations for the design and construction of the proposed development. The report has been prepared exclusively for Mosaic, for their use and the use of others on their design and construction team. We also expect this report will be relied upon by the City of Port Moody during their permit process. No other use of this report is permitted without written consent of GeoPacific.

2.0 SITE DESCRIPTION

The development site is rectangular in shape and is bounded by Murray Street to the north, Electronic Avenue to the east, Canadian Pacific Railway and Evergreen Line Rapid Transit right-of-ways to the south, and a private property to the west. The site has a frontage of approximately 180 m along Murray Street and 50 m along Electronic Avenue. In addition, the site slopes gradually down from north to south and from east to with elevations of approximately 8.0 to 11.0 m geodetic according to the City of Port Moody GIS. CP Rail tracks are set back approximately 14 m from the south property line. The site is currently improved with a masonry industrial building, and the surrounding surface consists of a mix of compacted gravel and asphalt paving. The location of the site is shown on Drawing No. 13648-01, following the text of this report.

3.0 FIELD INVESTIGATION

GeoPacific Consultants Ltd. conducted a preliminary investigation at the above referenced site on February 11, 2016 and a supplementary investigation on January 20, 2017. A total of thirteen test holes were completed to depths of up to 19.8 m below existing grades.

To provide subsurface profiling, test holes were supplemented with seven dynamic cone penetration test (DCPT) soundings to depths up to 19.8 m, four electronic cone penetration test (CPT) soundings to depths up to 9.3 m, and two seismic cone penetration test (SCPT) soundings to depths up to 9.3 m.

Test hole logs are presented in Appendix A, CPT soundings and interpreted indices are presented in Appendix B through Appendix D, and shear wave velocity profiles are presented in Appendix E, following the text of this report.

The CPT is an in-situ testing device which is pushed into the ground by employing a hydraulic ram on the drill rig. The cone penetrometer records measurements of tip resistance, sleeve resistance, dynamic pore water pressure, temperature, and inclination in 5 centimetre increments. The data obtained may be correlated to engineering parameters such as shear strength, relative density, soil behaviour type, and consolidation coefficients. The SCPT is an in-situ test, used in conjunction with the CPT, to obtain shear wave velocity profiles which assist in the seismic design of building foundations.

The investigation was organized and supervised by a member of our technical staff who logged the soils and collected samples for laboratory testing. All test holes were backfilled in accordance with provincial requirements immediately upon completion. The approximate locations of the test holes with respect to existing site boundaries are shown on Drawing No. 13648-01.

4.0 SUBSURFACE CONDITIONS

4.1 Soil Conditions

In general, the soil profile noted from the surface downwards at our test holes consists of FILL, overlying SILT/SAND, overlying an inferred basal layer of GLACIAL TILL. A general description of the soils encountered is as follows.

FILL

Fill was encountered at all test hole locations and extends to depths of 0.5 to 2.4 m below existing grades. Typically, grey sand and gravel, similar to road base fill, was observed near the surface and is underlain by brown sand with trace fine gravel.

SILT/SAND

Fill is underlain by loose to dense sand with variable amounts of silt and gravel at all test hole locations. Interbedded layers of sand and silt were observed at depths with gravel and cobble observed in some test holes. This material was observed to range from brown to grey in colour and extends to depths of up to 19.8 m at test hole locations. Recovery was limited on the auger as depth increased.

GLACIAL TILL

We infer the colluvium is underlain by dense to very dense glacial till composed of sand and silt with trace to some gravel and occasional cobbles. The top of this layer is inferred to be between 13.1 and 19.8 m depth. Our experience in the area indicates that boulders are commonly present within the glacial deposits present on-site.

For a more detailed description of the subsurface soil conditions, refer to the appendices.

4.2 Groundwater Conditions

Observations made during our site investigation indicate that there is a significant amount of perched water present with the free water level at approximately 0.6 to 0.9 m below grade. We expect excavation below the perched water elevation can generally be controlled by temporary sumps and sump pumps. Some localized temporary de-watering wells may be required through saturated sands for deeper excavations.

5.0 DISCUSSION

Architectural drawings indicate the proposed development would include three residential low-rise buildings all over a shared at-grade CRU and parking podium, with a raised parking level through the south portion of the development. We expect wood framed construction for residential, up to 5 storeys, and reinforced concrete construction for at-grade podium and parking areas.

The building would be founded at/near existing grade through the north of the property; however, due to the sloping of the site and partially below grade lower parking level, slab-on-grade is anticipated to be up to 2.4 m below existing grades along portions of the south property line. Excavations for heavily loaded foundations such as stair and elevator cores are expected to extend up to 5 m below existing grades. The subsurface conditions at underside of foundation are expected to be relatively variable, existing fill, sand and gravel, and/or silt and sand. We expect that the structure could be on conventional foundations with ground improvement in the form of full displacement rigid columns.

We confirm, from a geotechnical point of view, that the proposed development is feasible provided the recommendations outlined in this report are incorporated into the overall design.

6.0 RECOMMENDATIONS

6.1 Site Preparation

Existing structures, pavements, underground services, all organic materials, vegetation, topsoil, unsuitable fills, and loose or otherwise disturbed soils must be removed from the construction area. Based on the inferred founding depth and expected loading, we anticipate that ground improvement beneath bulk foundation elements will be required to support conventional foundations.

The subgrade soils present on-site are likely susceptible to disturbance at the excavated surface due to groundwater seepage, precipitation, personnel, and vehicular traffic. We expect for these conditions all subgrades should be blinded with a minimum thickness of 150 mm clear crushed gravel, increasing to 500 mm of crushed rock in areas where vehicular traffic must traverse the site. Subgrades should be graded to inhibit ponding of water. Any water softened/disturbed soils must be excavated to expose undisturbed subgrade.

In the event over-excavation is required due to poor quality soils near the excavated surface, reinstatement of subgrade should be completed with compacted "engineered fill". In the context of this report, engineered fill is defined as clean sand or sand and gravel, compacted in 300 mm loose lifts to a minimum of 98% Standard Proctor dry density (ASTM D698), at a moisture content that is within 2% of its optimum for compaction.

The subgrade must be reviewed prior to the placement of any engineered fill or clear crushed gravel.

6.2 In-situ Ground Improvement

The subsurface soil includes some weak zones of silt and clay which cannot support the type of structure proposed without some type of ground improvement. We expect in-situ ground improvement with full displacement columns may be utilized to densify the subgrade and improve bearing capacity below foundation elements. Columns installed using a full displacement bottom feed impact method such as Rammed Impact Piers (RIP), Continuous Flight Auger (CFA), or Controlled Modulus Column (CMC) would be placed beneath pad and strip foundation elements to improve bearing stresses and reduce liquefaction potential. For RIP, the columns can be grouted for additional vertical support and increase foundation bearing pressure, or non-grouted for reduced vertical support and reduced foundation bearing pressure.

Information obtained from the structural consultant indicates unfactored column loads up to 2450 kN, so that loading is expected to be moderately heavy. The building would be founded at/near existing grade through the north of the property; however, due to the sloping of the site, slab-on-grade is anticipated to be up to 2.4 m below existing grades along portions of the south property line. We expect excavations for strip foundations would extend up to 3.0 m below existing grades at these areas. Excavations for heavily loaded foundations such as stair and elevator cores are also expected to extend up to 5 m below existing grades.

Due to the variability in subsurface soil stratigraphy, we recommend rigid columns (grouted RIP, CFA or CMC) extend up to 13-18 m below existing grades into the dense till-like soil and achieve a minimum 0.6 m in diameter at each column. For non-grouted RIP, we recommend columns extend up to 10 m through the surficial silt/clay and sand and into the lower stratum of silt/clay and achieve a minimum 0.6 m in diameter at each column.

GeoPacific will provide ground improvement drawings and must be contacted for the review of the installation of all ground improvement elements.

6.3 Conventional Foundations

Upon completion of in-situ ground improvement, conventional pad and strip footings can be used to support the proposed structure. We recommend the foundations are designed using a Serviceability Limit States (SLS) bearing pressure of **400 kPa for rigid grouted RIP, CFA, or CMC methods**. We recommend the foundations are designed using a Serviceability Limit States (SLS) bearing pressure of **200 kPa for non-grouted RIP stone columns.** Ultimate Limit States (ULS) may be taken as 1.5 × SLS bearing pressures provided.

Irrespective of the allowable bearing pressures provided, pad footings should not be less than 600 mm by 600 mm and strip footings should not be less than 450 mm in width. Footings should also be buried a minimum of 450 mm below the surface for frost protection. We estimate for foundations designed as per recommended, settlements will not exceed 25 mm total and 20 mm in 10 metres differential.

Adjacent foundations constructed at differing elevations should be offset from each other by a minimum distance of 2H:1V. Excavation, including excavation for utility trenches, is not permitted within 2H:1V of outside edge of bottom of footing locations.

Footing subgrade inspection is required prior to placement of fill or footing construction.

6.4 Slab-on-grade Floors

In order to provide suitable support for slab-on-grade floors we recommend that any fill placed under the slab should be granular and essentially "clean" with not more than 5% passing the #200 sieve. In addition, this granular fill must be compacted to a minimum of 98% Standard Proctor (ASTM D698) maximum dry density with water content within 2% of optimum for compaction. Floor slabs should be directly underlain by a minimum of 150 mm of 19 mm clear crushed gravel, hydraulically connected to perimeter drainage. A moisture barrier should underlie the slab directly above the free draining granular material.

Slab-on-grade fill compaction must be reviewed by GeoPacific

6.5 Site and Foundation Drainage Systems

We recommend that a perimeter drainage system be included in the mechanical design for the proposed building to prevent the development of water pressures on the foundation walls and slab on grades where the finished grade will be above the slab elevation. Flows should be relatively light at less than 50 litres/minute for the site. During construction, some temporary higher flows may be encountered for deeper excavations.

6.6 Seismic Design of Foundations

For structures constructed at the above referenced site with ground improvement below foundation elements, the Site Classification, as defined in Section 4.1.8.4 of the 2018 BCBC, should be assumed to be "Site Class C" in accordance with Table 4.1.8.4.A. We have considered the 1 in 2,475 year design seismic hazard as described in the 2018 BCBC. The associated firm ground peak horizontal ground acceleration at this location is 0.324g.

6.7 Temporary Excavations

We anticipate that excavation depths for perimeter strip foundation will be up to 3.0 m below existing grades along the south property line at localized areas. We expect shoring will be required in order to construct the south foundation wall where it extends to or near the south property line, and in some other areas along the west and east. Due to the relatively shallow height of the shoring system, we expect a cantilever shotcrete shoring system with vertical minipiles can be used to avoid anchor encroachment into the CP Rail lands with vertical shoring and/or anchors; however, some areas of the proposed below grade development extend close/to the south property line, and at these areas encroachment may be required. Face saving measures should be anticipated where wet sand is encountered. We anticipate a sloped and/or lock-block wall system can be used where space permits.

We expect temporary slopes can be achieved at 1H:1V in the surficial soils. Shallower slopes may be required where perched water is encountered, or lock block retaining systems may be utilized for deeper excavations. We envisage excavations will require temporary sumps and sump pumps to control perched groundwater ingress; however, localized temporary de-watering wells may be required through saturated sands for deeper excavations. All excavations and trenches must conform to the latest Occupational Health and Safety Regulation supplied by the Work Safe BC. Any excavation in excess of 1.2 metres in depth requiring worker entry must be reviewed by a professional geotechnical engineer. All slopes should be covered with poly sheeting.

GeoPacific may provide a shoring and excavation design upon request.

6.8 Earth Pressures on Foundation Walls

Earth pressures against the foundation walls are dependent on factors such as, available lateral restraint along the wall, surcharge loads, backfill materials, compaction of the backfill and drainage conditions. We assume that the backfill between foundation walls and shoring would be a free-draining granular material such as birds eye gravel. The foundation wall is expected to be partially yielding and fully restrained between the parkade floors. We recommend that the foundation walls be designed to resist the pressures presented on the following page.

Static:	Triangular soil pressure distribution of 5.0H kPa (where H is equal to the total wall height below grade).
Seismic:	Inverted triangular seismic surcharge of 3.5H kPa (where H is equal to the total backfill height in metres).

Any additional surcharge loads located near the foundation walls should be added to the earth pressures given.

7.0 DESIGN REVIEWS AND CONSTRUCTION INSPECTIONS

The preceding sections make recommendations for the design and construction of the proposed residential development. We have recommended the review of certain aspects of the design and construction in this report. In summary, geotechnical reviews are required for the aspects of work listed on the following page.

1. Stripping/Excavation	Review of stripping, temporary cut slopes, and soil conditions
2. General Compaction	Review of compaction of engineered fill and clear crushed gravel
3. Foundation	Review of foundation subgrades
4. Ground Improvement	Review of rigid column installation, testing
5. Slab on-grade	Review of subgrade, under-slab fill materials, and compaction.

It is important that these reviews are carried out to ensure that our intentions have been adequately communicated. It is also important that the contractors working on the site review this document prior to commencing their work and notify GeoPacific at least 48 hrs in advance of the required field reviews.

8.0 CLOSURE

This report has been prepared exclusively for our client, for the purpose of providing geotechnical recommendations for the design and construction of the development described herein. The report remains the property of GeoPacific Consultants Ltd. and unauthorized use of, or duplication of, this report is prohibited.

We are pleased to be of assistance to you on this project and we trust that our recommendations are both helpful and sufficient for your current purposes. If you would like further details or would like clarification of any of the above, please do not hesitate to call.

Permit to Practice EGBC 1000782

APR 14 2022

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA M. J. KOKAN # 21364

For:
GeoPacific Consultants Ltd.

Wyatt Johnson, B.Eng., EIT
Project Engineer

Reviewed by:

Matt Kokan, M.A.Sc., P.Eng.
Principal

LEGEND:

- SCPT#-# – SIESMIC CONE PENETRATION TEST (SCPT) LOCATION
- CPT#-# – CONE PENETRATION TEST (CPT) LOCATION
- TH#-# – TEST HOLE (TH) LOCATION
- DCPT – DYNAMIC CONE PENETRATION TEST

SITE PLAN

*TEST LOCATIONS ARE APPROXIMATE

REFERENCE:
ViewPort – Port Moody's Public GIS/Mapping System

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Vancouver, B.C. V6P 6G5
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DATE:	2016-Feb-11	
DRAWN BY: ED	APPROVED BY: MK	REVIEWED BY: MK
SCALE: NO SCALE		

SITE REDEVELOPMENT
3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC
TEST HOLE SITE PLAN

FILE NO.: 13648
DWG. NO.: 13648-01

REVISIONS:
A.
B.
C.

APPENDIX A - TEST HOLE LOGS

Test Hole Log: TH16-01 (SCPT16-01)

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

GEOPACIFIC CONSULTANTS
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INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
0 / 0		Ground Surface					
		Asphalt (4cm)	0.0				
		Sand and gravel	0.3	54.2			
		dense SAND and GRAVEL fill, some fines, grey, dry	0.6			▼	0.6m estimated water table depth
1 / 1		***Sand***		24.9			
		compact SAND fill, some organics, dark brown, slightly moist	1.5				
2 / 2		***Sand***					
		compact silty SAND, grey, wet					
		Sand and gravel		20.2			
3 / 3		dense medium to coarse grained SAND and GRAVEL, light brown, wet					
		Sand					poor recovery past 3.0m soil profile is inferred from CPT past 3.0m
		compact to dense medium grained SAND, some fines, light brown, wet		14.7			
4 / 4		grery after 3.0m					
		trace gravel after 3.0m	4.0				
		Silt					
		stiff to firm sandy SILT to SILT	4.5				
5 / 5		***Sand***					
		compact to dense SAND, some silt lenses, traces of gravel, wet					
6 / 6		End of Borehole	6.1				
7 / 7							
8 / 8							
9 / 9							

Logged: ED
Method: Solid stem auger/CPT
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.01

Test Hole Log: TH16-02 (CPT16-02)

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

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INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
0 / 0		Ground Surface					
		Sand and gravel dense SAND and GRAVEL fill, brown, moist	0.0				
			0.5	58.6		▼	0.6m estimated water table depth
3 / 1		**Sand** compact SAND and ORGANICS fill, brown, moist	0.9				
		Silt stiff SILT, some sand, some organics, brown, moist		15.4			
7 / 2		**Sand** compact to dense silty SAND, brown, wet	2.4				
		Sand comapct to dense medium to coarse grained SAND, grey, brown, wet		20.9			
10 / 3			3.0				poor recovery past 3.0m soil profile is inferred from CPT past 3.0m
		Sand compact medium grained silty SAND, light brown, wet	3.9				
13 / 4		**Sand** compact medium grained SAND, some fines, grey, wet		15.2			
16 / 5		**Silt and sand** stiff SILT to sandy SILT, grey, wet dense SAND lens at 5.6m					
		Sand and gravel dense silty SAND and GRAVEL, till like, grey, wet	5.6	10.9			
20 / 6			6.1				
		End of Borehole					
23 / 7							
26 / 8							
29 / 9							
32							

Logged: ED
Method: Solid stem auger/CPT
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.02

Test Hole Log: TH16-03

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

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INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
0 / 0		Ground Surface					
		Asphalt (6cm)	0.0				
		Sand and gravel	0.3	63.3			
		dense SAND and GRAVEL fill, grey, dry	0.6			▼	0.8m estimated water table depth
1 / 1		***Silt***					
		very stiff SILT, some organics, brown, slightly moist		22.2			
		Sand	1.5				
2		dense medium grained SAND, brown, moist					
		Sand					
		compact silty SAND, light brown, wet					
		Sand		19.4			
3		compact medium grained SAND, trace fines, light brown, wet	3.0				
		Sand					
		compact medium grained silty SAND, grey, wet		15.4			
4		trace gravel after 4.9m					
5							
6		***Sand and gravel***	5.8				
		dense silty SAND and GRAVEL, till like, grey, moist		15.6			poor recovery past 6.1m
		compact to dense and wet after 6.1m					
7		SAND and GRAVEL, some fines after 6.1m					
8				12.1			
9							
		End of Borehole	9.1				

Logged: ED
Method: Solid stem auger
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.03
Page: 1 of 1

Test Hole Log: TH16-04 (CPT16-03)

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

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INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
0 / 0		Ground Surface					
		Asphalt (8cm)	0.0				
		Sand and gravel	0.3				
3 / 1		compact to dense SAND and GRAVEL fill, some fines, grey, dry		38.4		▼	0.9m estimated water table depth
		Silt	1.1				
		very stiff SILT, some woody organics, dark brown, slightly moist					
7 / 2		***Silt***					
		stiff sandy SILT to silty SAND, grey, brown, moist to wet		16.4			
		Sand					
10 / 3		compact medium grained SAND, trace gravel and coarse grained sand, brown, wet	3.0				
		Sand					
13 / 4		compact medium grained SAND, some fines, grey, wet		15.5			
		trace to some gravel after 4.0m					
20 / 6		***Sand and gravel***	6.1				
		compact to dense silty SAND and GRAVEL, non-cohesive, grey, wet					
23 / 7		stiff SILT lens at 6.7m		13.1			
28 / 8		***Sand and gravel***	8.5				
29 / 9		dense SILT SAND and GRAVEL, till like, cohesive, grey, moist					
			9.1				
32		End of Borehole					

Logged: ED
Method: Solid stem auger/CPT
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.04

Test Hole Log: TH16-05

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

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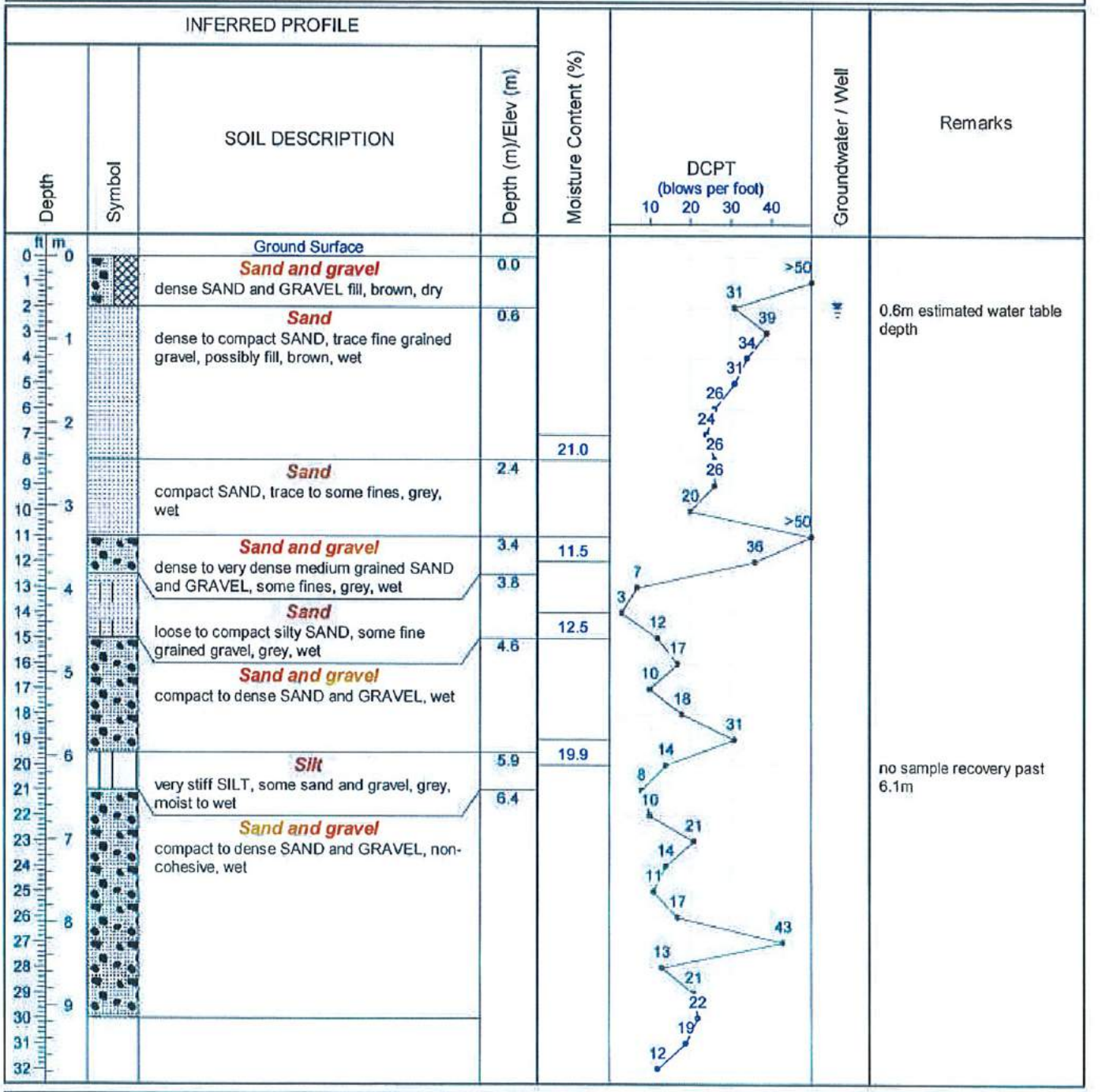

Logged: ED
Method: Solid stem auger/DCPT
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.05

Test Hole Log: TH16-05

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

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Depth	Symbol	INFERRED PROFILE: SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
33 10					10		
34					10		
35					12		
36 11					12		
37					14		
38					11		
39					14		
40 12					41		
41					>50		
42					40		
43 13					41		
44					45		
45		End of Borehole	13.4				
46 14							
47							
48							
49 15							
50							
51							
52 16							
53							
54							
55							
56 17							
57							
58							
59 18							
60							
61							
62 19							
63							
64							

Logged: ED
Method: Solid stem auger/DCPT
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.05

Test Hole Log: TH16-06 (SCPT16-04)

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

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INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
0 / 0		Ground Surface					
		Sand	0.0				
1 /		very dense SAND fill, trace gravel, brown, moist wet after 0.5m dense after 0.8m				▽	0.5m estimated water table depth
2 / 1		***Sand***	1.7				
3 /		dense to very dense medium grained SAND, some fines, grey, wet		18.5			
4 /		***Sand and gravel***	2.3				
5 /		dense medium to coarse grained SAND and GRAVEL, trace to some fines, grey, wet		10.9			
6 / 2							
7 /				9.7			
8 /							
9 / 3							
10 /		cohesive silty SAND and GRAVEL from 5.3m to 5.6m		9.4			
11 /							
12 / 4							poor recovery past 6.1m
13 /							
14 /							
15 / 5							
16 /							
17 /				10.8			
18 / 6							
19 /							
20 /							
21 / 7							
22 /							
23 /							
24 / 8							
25 /							
26 /							
27 / 9							
28 /							
29 /							
30 /		End of Borehole	9.1				
31 /							
32 /							

Logged: ED
Method: Solid stem auger/CPT
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.06
Page: 1 of 1

Test Hole Log: TH16-07

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

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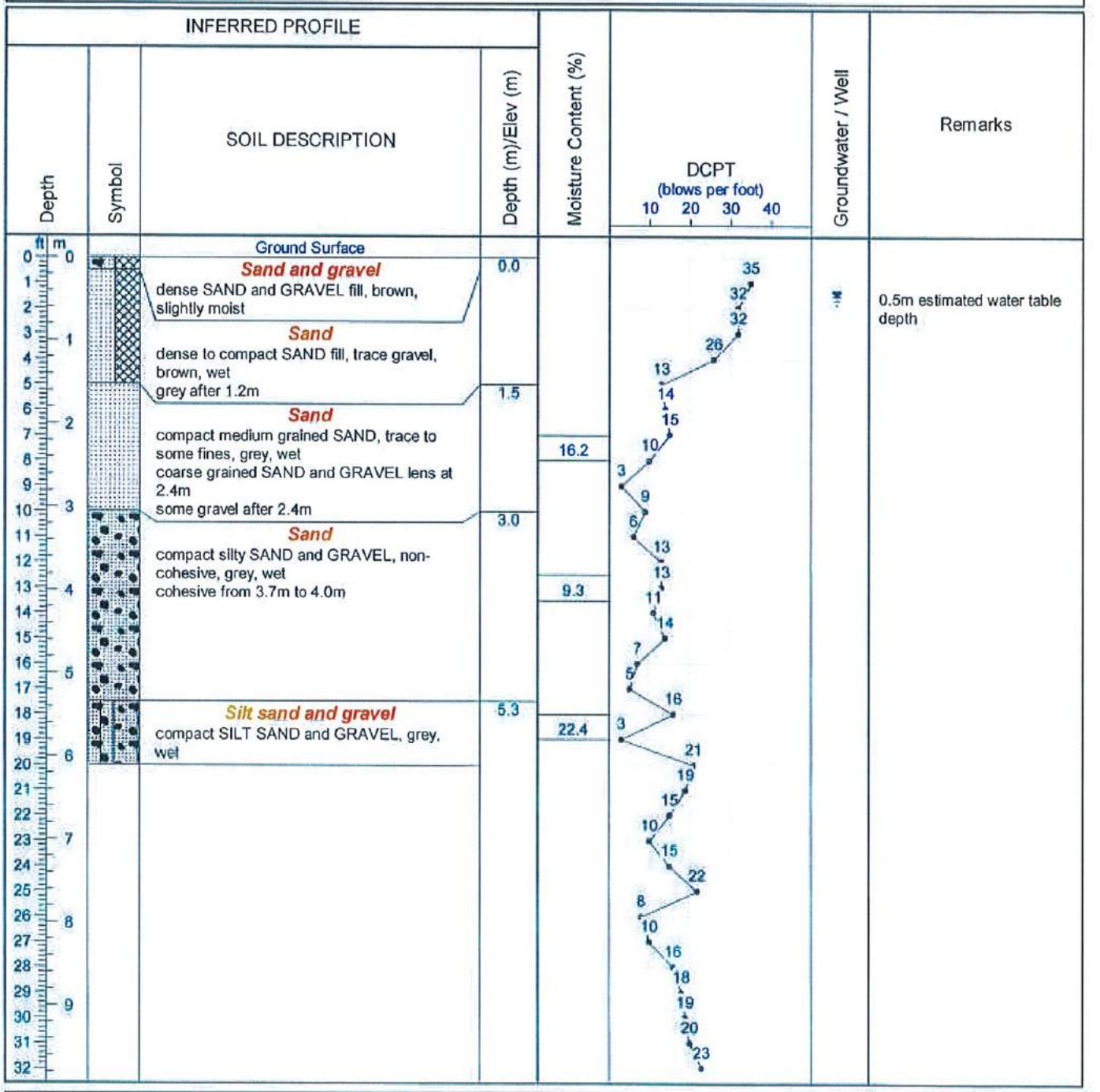

Logged: ED
Method: Solid stem auger/DCPT
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.07

Test Hole Log: TH16-07

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

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Tel: 604-439-0922 Fax:604-439-0189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
33 10					30		
34					33		
35					28		
36 11					30		
37					32		
38					37		
39 12		End of Borehole	11.9		32		
40							
41							
42 13							
43							
44							
45 14							
46							
47							
48 15							
49							
50							
51 16							
52							
53							
54 17							
55							
56							
57 18							
58							
59							
60 19							
61							
62							
63							
64							

Logged: ED
Method: Solid stem auger/DCPT
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.07

Test Hole Log: TH16-08

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

GEOPACIFIC CONSULTANTS
215 - 1200 West 73rd Avenue, Vancouver, BC, V6P 6G5
Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)
0 / 0		Ground Surface	
		Sand and gravel dense SAND and GRAVEL fill, grey, slightly moist	0.0
1 / 1		***Sand*** compact SAND fill, some gravel, brown, moist; wet after 0.8m; some silt after 1.2m	
2			2.1
3		***Sand*** compact medium to coarse grained SAND, trace to some fines, grey, wet	
4		***Sand and gravel*** compact silty SAND and GRAVEL, grey, wet; silty SAND, some gravel from 4.0m to 4.6m	3.7
5			
6			
7			
8			
9			

Moisture Content (%): 15.8; 10.2

DCPT (blows per foot) 10 20 30 40: 30, 33, 28, 24, 18, 21, 20, 19, 28, 18, 2, 8, 29, 5, 9, 18, 24, 18, 20, 31, 30, 18, 26, 19, 15, 14, 17, 15, 6, 33, 28, 15

Groundwater / Well: ▼ 0.8m estimated water table depth

Remarks

Logged: ED
Method: Solid stem auger/DCPT
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.08

Test Hole Log: TH16-08

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

GEOPACIFIC CONSULTANTS
215 - 1200 West 73rd Avenue, Vancouver, BC, V6P 6G5
Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE				Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)				
33 10					16		
34					13		
35					11		
36 11					12		
37					12		
38					13		
39 12		End of Borehole	11.9		16		
40							
41							
42							
43 13							
44							
45							
46 14							
47							
48							
49 15							
50							
51							
52 16							
53							
54							
55							
56 17							
57							
58							
59 18							
60							
61							
62 19							
63							
64							

Logged: ED
Method: Solid stem auger/DCPT
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.08

Test Hole Log: TH16-09

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Site Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC

GEOPACIFIC CONSULTANTS
215 - 1200 West 73rd Avenue, Vancouver, BC, V6P 6G5
Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Moisture Content (%)	DCPT (blows per foot) 10 20 30 40	Groundwater / Well	Remarks
0 / 0		Ground Surface					
		Sand and gravel	0.0			▼	0.3m estimated water table depth
		dense SAND and GRAVEL fill, trace cobble, grey, dry	0.3				
1 / 1		***Sand***					
		dense to compact SAND fill, trace gravel, brown, wet		19.8			
2							
		Sand	2.3				
		compact SAND, some fines, grey, wet		19.5			
3		***Sand and gravel***	2.7				
		compact to dense coarse grained SAND and GRAVEL, some fines, grey, wet		9.9			
4 / 5							
6		***Silt sand and gravel***	5.8	18.6			
		very stiff/ compact to dense SILT SAND and GRAVEL, grey, moist					
7 / 8				8.0			
9							
		End of Borehole	9.1				

Logged: ED
Method: Solid stem auger
Date: 2016-Feb-11

Datum: Ground elevation
Figure Number: A.09

Test Hole Log: TH17-01

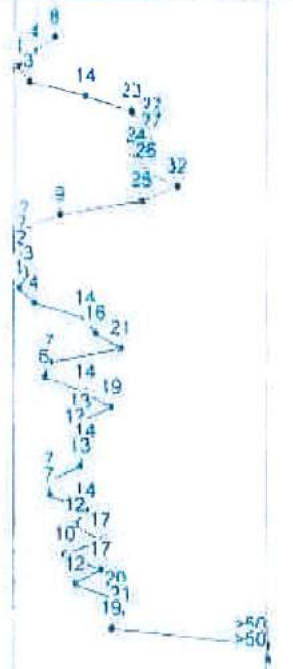
File: 13648
Project: Site Redevelopment
Client: Mosaic
Site Location: 3015-3093 Murray St, Port Moody, BC

GEOPACIFIC
1779 West 75th Avenue, Vancouver, BC, V6P 6P2
Tel: 604-439-0922 Fax:604-439-9189

Depth (m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)
0		Ground Surface	0.0
1		**FILL** Loose, black silt and sand with gravel	
2		**FILL** Loose to compact, brown to grey, sandy silt. Lens of red colour at 9'	3.0
3		**SAND** Loose to compact, grey, silty sand with some gravel. Interbedded thin stiff silt lenses	
4			
5			
6			
7			
8			
9			9.1
10		**SILT** Firm to stiff, grey silt with trace sand and gravel	
11			
12			
13			13.1
14		**TILL** Very dense, dry silt sand and gravel Inferred till	
15			15.2
16		End of Borehole	
17			
18			
19			
20			
21			

Moisture Content (%)

DCPT (blows per foot) 10 20 30 40



Groundwater / Well

Remarks

Logged: KGD
Method: Solid Stem Auger
Date: Jan 20, 2017

Datum: Existing Ground
Figure Number:
Page: 1 of 1

Test Hole Log: TH17-02

File: 13648
Project: Site Redevelopment
Client: Mosaic
Site Location: 3015-3093 Murray St, Port Moody, BC

GEOPACIFIC CONSULTANTS
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Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)
0 m		Ground Surface	0.0
1		***FILL*** Compact to dense, brown to grey sand with some silt and gravel	1.5
2		***SAND*** Compact grey sand with some silt and gravel	3.0
3		***SAND*** Loose to compact, grey, silty sand with some gravel and cobble	
4			
5			
6			
7			
8			
9			9.1
10		***SILT and SAND*** Interbedded Silt and Sand with some gravel. Minimal Recovery	
11			
12			
13			
14			
15			
16			
17			
18			18.6
19		***TILL*** Very dense, dry silt sand and gravel Inferred till	19.3
20		End of Borehole	
21			

Moisture Content (%)

DCPT (blows per foot) 10 20 30 40

Groundwater / Well

Remarks

Logged: KGD
Method: Solid Stem Auger
Date: Jan 20, 2017

Datum: Existing Ground
Figure Number:

Test Hole Log: TH17-03

File: 13648
Project: Site Redevelopment
Client: Mosaic
Site Location: 3015-3093 Murray St, Port Moody, BC

GEOPACIFIC CONSULTANTS
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Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)
0		Ground Surface	0.0
1–3		**FILL** Compact to dense, brown to grey, sand with some silt and gravel	3.0
4–19		**SILT and SAND** Interbedded Silt and Sand with some gravel. Minimal Recovery	19.8
20–21		**TILL** Very dense dry silt sand and gravel Inferred till — End of Borehole	21.3

Moisture Content (%)

DCPT (blows per foot)
10 20 30 40

Groundwater / Well

Remarks

Logged: KGD
Method: Solid Stem Auger
Date: Jan 20, 2017

Datum: Existing Ground
Figure Number:
Page: 1 of 1

Test Hole Log: TH17-04

File: 13648
Project: Site Redevelopment
Client: Mosaic
Site Location: 3015-3093 Murray St, Port Moody, BC

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Tel: 604-439-0922 Fax:604-439-9189

INFERRED PROFILE

Depth (ft / m)	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)
0		Ground Surface	0.0
20		End of Borehole	19.8

Moisture Content (%)

DCPT (blows per foot) 10 20 30 40

Groundwater / Well

Remarks

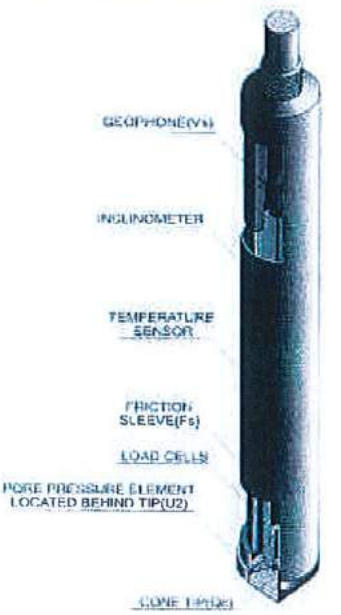
Logged: KGD
Method: Solid Stem Auger
Date: Jan 20, 2017

Datum: Existing Ground
Figure Number:
Page: 1 of 1

APPENDIX B - ELECTRONIC CONE PENETRATION RESULTS

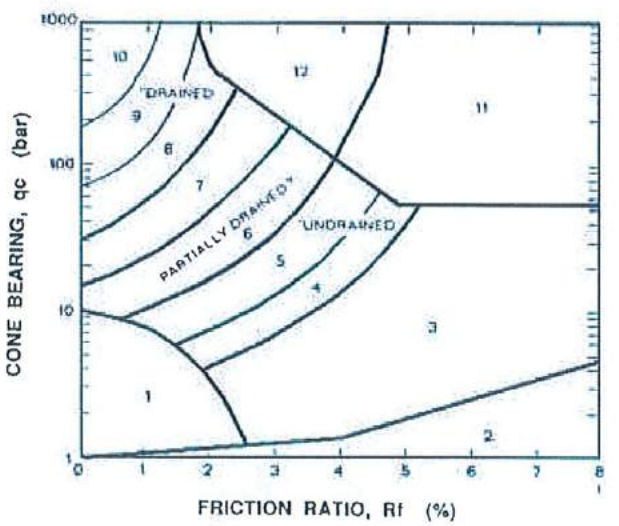
The system used is owned and operated by GeoPacific and employs a 35.7 mm diameter cone that records tip resistance, sleeve friction, dynamic pore pressure, inclination and temperature at 5 cm intervals on a digital computer system. The system is a Hogentogler electronic cone system and the cone used was a 10 ton cone with pore pressure element located behind the tip and in front of the sleeve as shown on the adjacent figure.

Electronic Cone Penetrometer



In addition to the capabilities described above, the cone can be stopped at specified depths and dissipation tests carried out. These dissipation tests can be used to determine the groundwater pressures at the specified depth. This is very useful for identifying artesian pressures within specific layers below the ground surface.

Interpretation of the cone penetration test results are carried out by computer using the interpretation chart presented below by Robertson[1]. Raw data collected by the field computer includes tip resistance, sleeve friction and pore pressure. The tip resistance is corrected for water pressure and the friction ratio is calculated as the ratio of the sleeve friction on the side of the cone to the corrected tip resistance expressed as a percent. These two parameters are used to determine the soil behaviour type as shown in the chart below. The interpreted soil type may be different from other classification systems such as the Unified Soil Classification that is based upon grain size and plasticity.



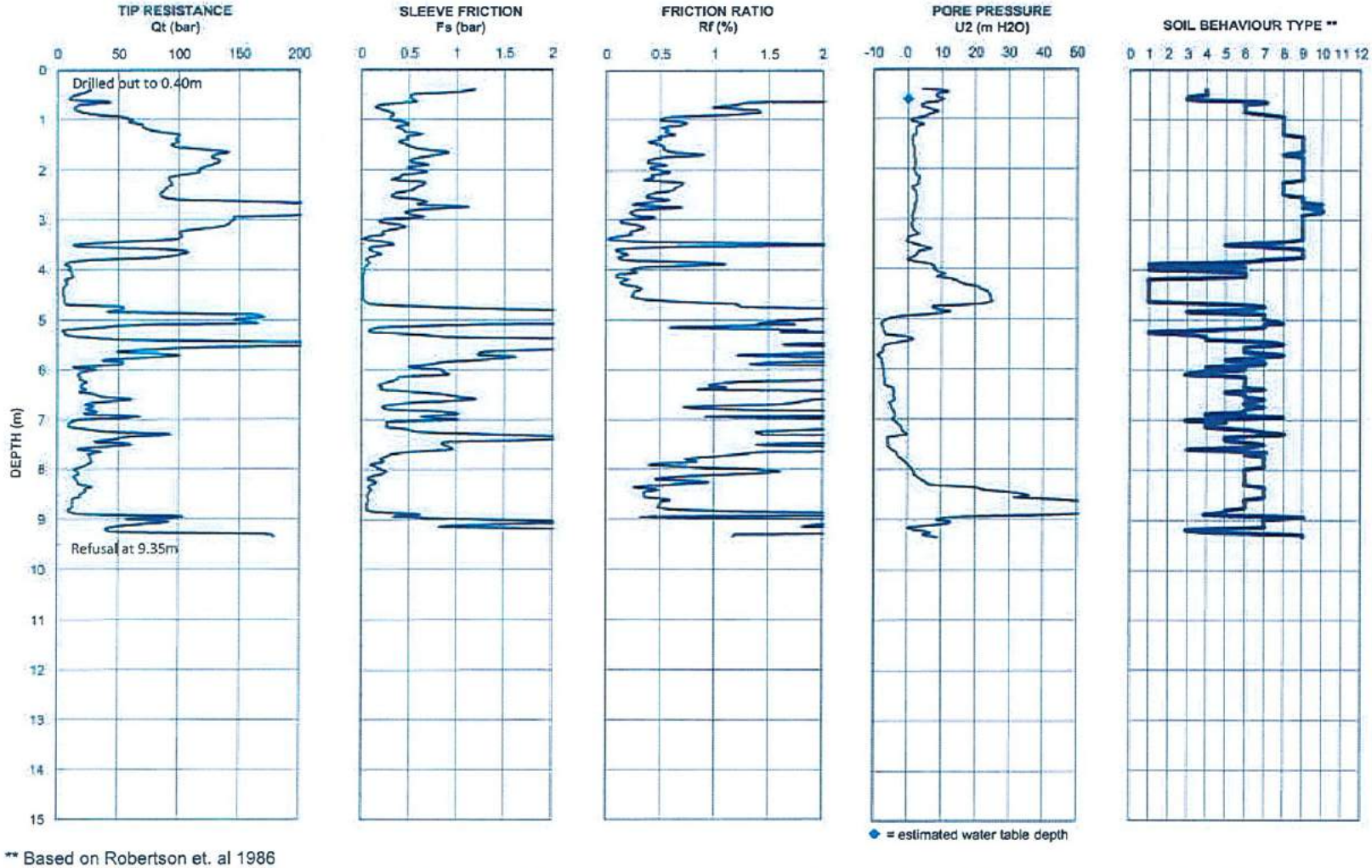
ZONE	SOIL BEHAVIOUR TYPE
1	sensitive fine grained
2	organic material
3	clay
4	silty clay to clay
5	clayey silt to silty clay
6	sandy silt to clayey silt
7	silty sand to sandy silt
8	sand to silty sand
9	sand
10	gravelly sand to sand
11	very stiff fine grained (*)
12	sand to clayey sand (*)

(*) overconsolidated or cemented

---

1 Robertson, P.K., 1990, "Soil Classification using the cone penetration test", 1990 Canadian Geotechnical Colloquium, Canadian Geotechnical Journal, Vol. 27, No. 1, 1990

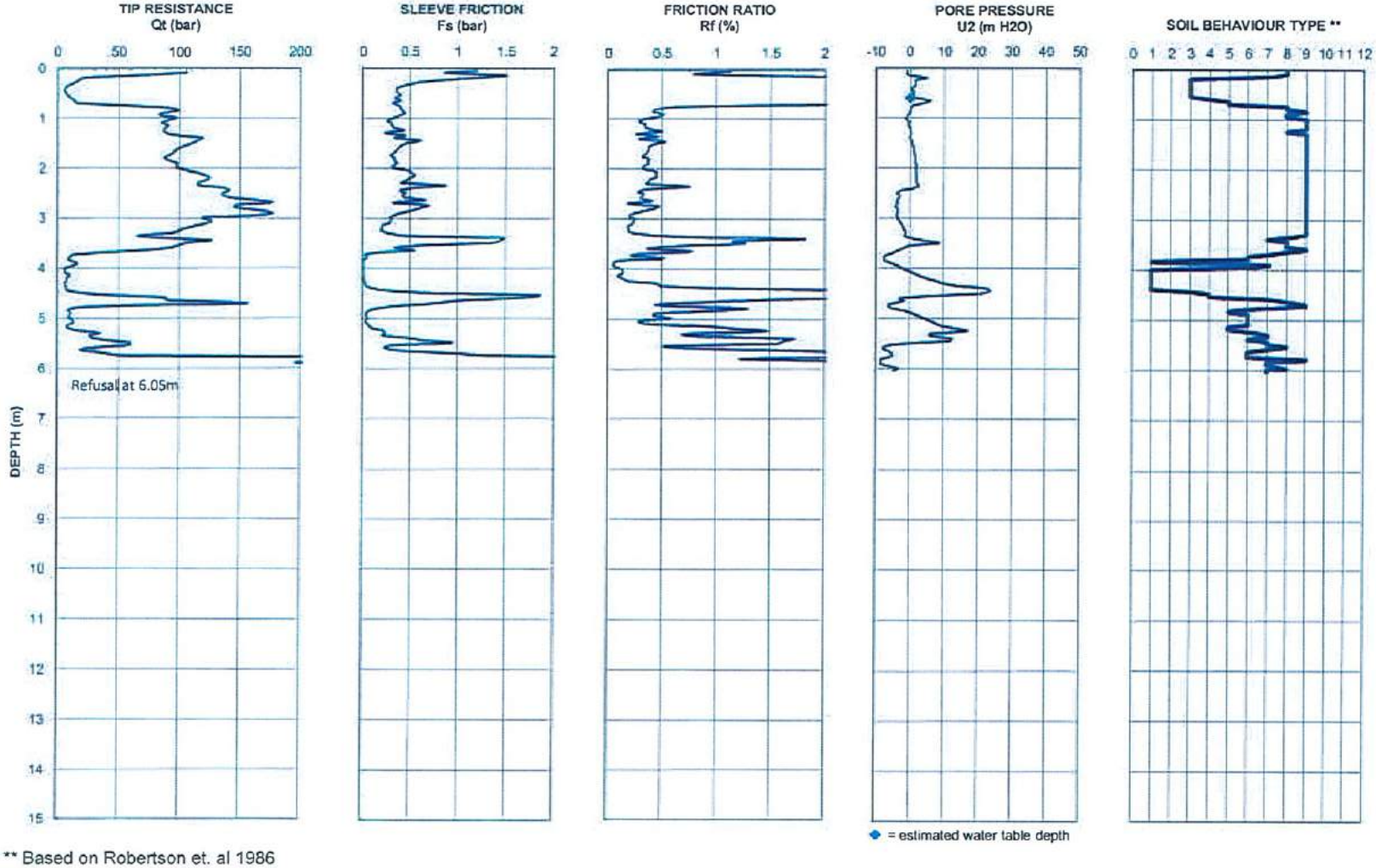
GEOPACIFIC VANCOUVER EDMONTON CALGARY	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: SCPT16-01	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: B.01



** Based on Robertson et. al 1986

1 Sensitive Fine Grained
2 Organic Material
3 Clay
4 Silty Clay to Clay
5 Clayey Silt to Silty Clay
6 Sandy Silt to Clayey Silt
7 Silty Sand to Sandy Silt
8 Sand to Silty Sand
9 Sand
10 Gravelly Sand to Sand
11 Very Stiff Fine Grained
12 Sand to Clayey Sand

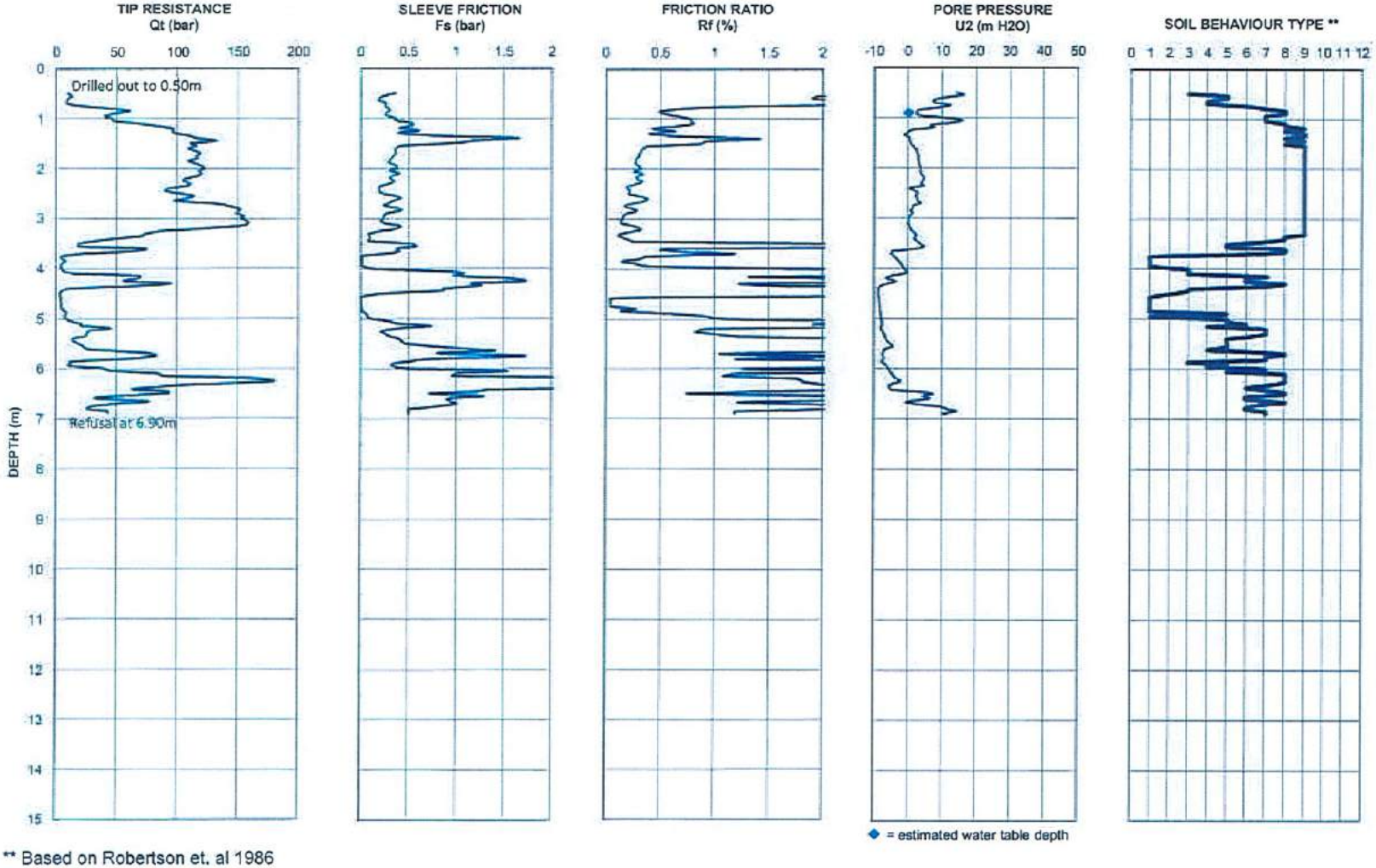
GEOPACIFIC VANCOUVER KAMLOOPS CALGARY	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: CPT16-02	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: B.02



** Based on Robertson et. al 1986

1 Sensitive Fine Grained
2 Organic Material
3 Clay
4 Silty Clay to Clay
5 Clayey Silt to Silty Clay
6 Sandy Silt to Clayey Silt
7 Silty Sand to Sandy Silt
8 Sand to Silty Sand
9 Sand
10 Gravelly Sand to Sand
11 Very Stiff Fine Grained
12 Sand to Clayey Sand

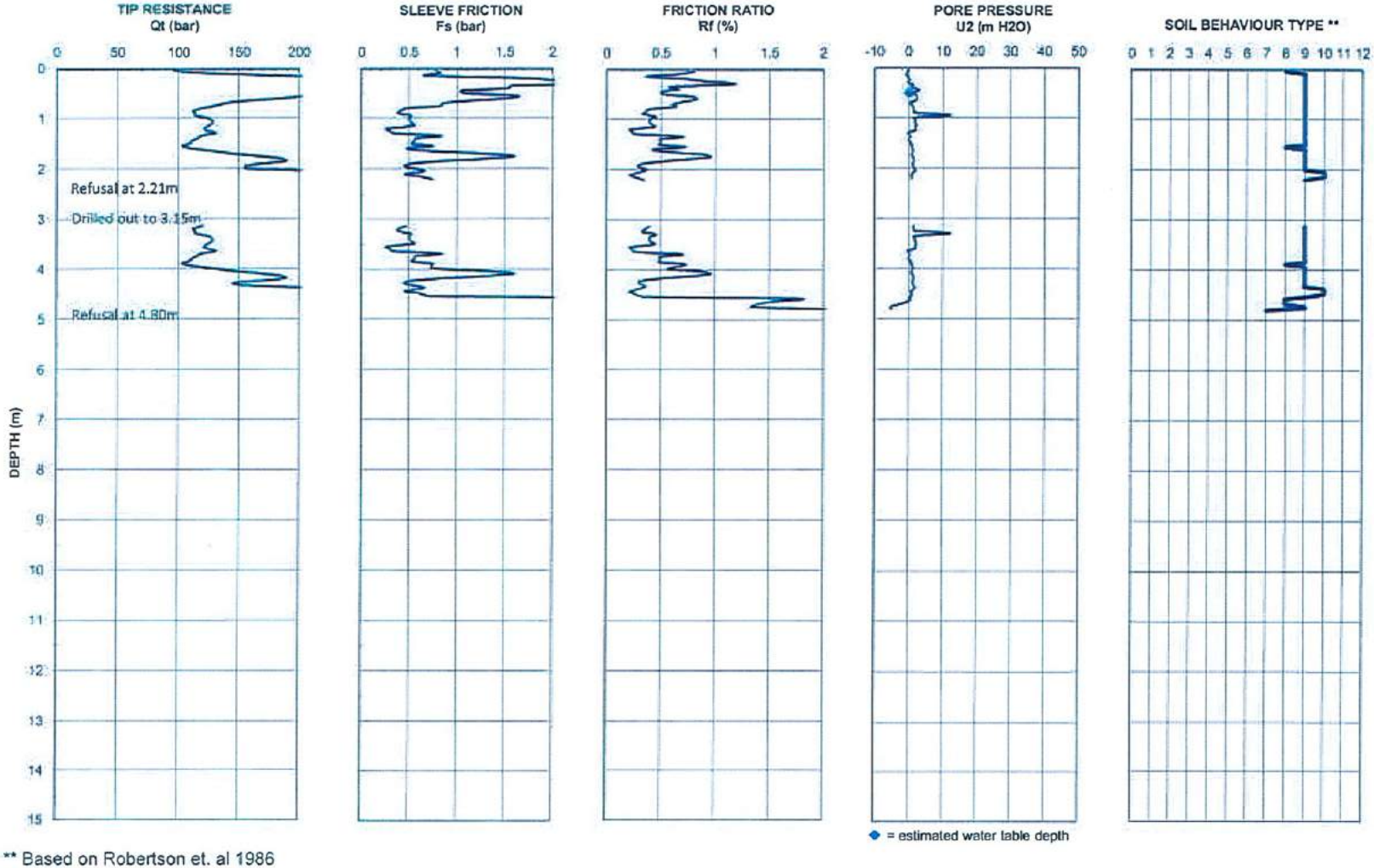
GEOPACIFIC VANCOUVER KAMLOOPS CALGARY	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: CPT16-03	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: B.03



** Based on Robertson et. al 1986

1 Sensitive Fine Grained
2 Organic Material
3 Clay
4 Silty Clay to Clay
5 Clayey Silt to Silty Clay
6 Sandy Silt to Clayey Silt
7 Silty Sand to Sandy Silt
8 Sand to Silty Sand
9 Sand
10 Gravelly Sand to Sand
11 Very Stiff Fine Grained
12 Sand to Clayey Sand

GEOPACIFIC VANCOUVER KAMLOOPS CALGARY	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: SCPT16-04	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: B.04



** Based on Robertson et. al 1986

1 Sensitive Fine Grained
2 Organic Material
3 Clay
4 Silty Clay to Clay
5 Clayey Silt to Silty Clay
6 Sandy Silt to Clayey Silt
7 Silty Sand to Sandy Silt
8 Sand to Silty Sand
9 Sand
10 Gravelly Sand to Sand
11 Very Stiff Fine Grained
12 Sand to Clayey Sand

APPENDIX C - INTERPRETED PARAMETERS

The following charts plot the Standard Penetration Test (SPT) values and the undrained strength of fine grained soils based upon generally accepted correlations. The methods of correlation are presented below.

STANDARD PENETRATION TEST CORRELATION

The Standard Penetration Test $N_{1(60)}$ value is related to the cone tip resistance through a Qc/N ratio that depends upon the mean grain size of the soil particles. The soil type is determined from the interpretation described in Appendix B and the data of Table C.1 below is used to calculate the value of $N_{(60)}$.

Table C.1. Tablulated $Qc/N_{1(60)}$ Ratios for Interpreted Soil Types

Soil Type	Qc/N Ratio
Organic soil - Peat	1.0
Sensitive Fine Grained	2.0
Clay	1.0
Silty Clay to Clay	1.5
Clayey Silt to Silty Clay	2.0
Silt	2.5
Silty Sand to Sandy Silt	3.0
Clean Sand to Silty Sand	4.0
Clean Sand	5.0
Gravelly Sand to Sand	6.0
Very Stiff Fine Grained	1.0
Sand to Clayey Sand	2.0

The $Qc/N_{1(60)}$ ratio is based upon the published work of Robertson (1985)[2]. The values of N are corrected for overburden pressure in accordance with the correction suggested by Liao and Whitman using a factor of 0.5. Where the correction is of the form:

$$N_1 = \sigma^{0.5} * N$$

All calculations are carried out by computer using the software program CPTint.exe developed by UBC Civil Engineering Department. The results of the interpretation are presented on the following Figures.

UNDRAINED SHEAR STRENGTH CORRELATION

It is generally accepted that there is a correlation between undrained shear strength of clay and the tip resistance as determined from the cone penetration testing. Generally the correlation is of the form:

$$S_u = \frac{(q_c - \sigma_v)}{N_k}$$

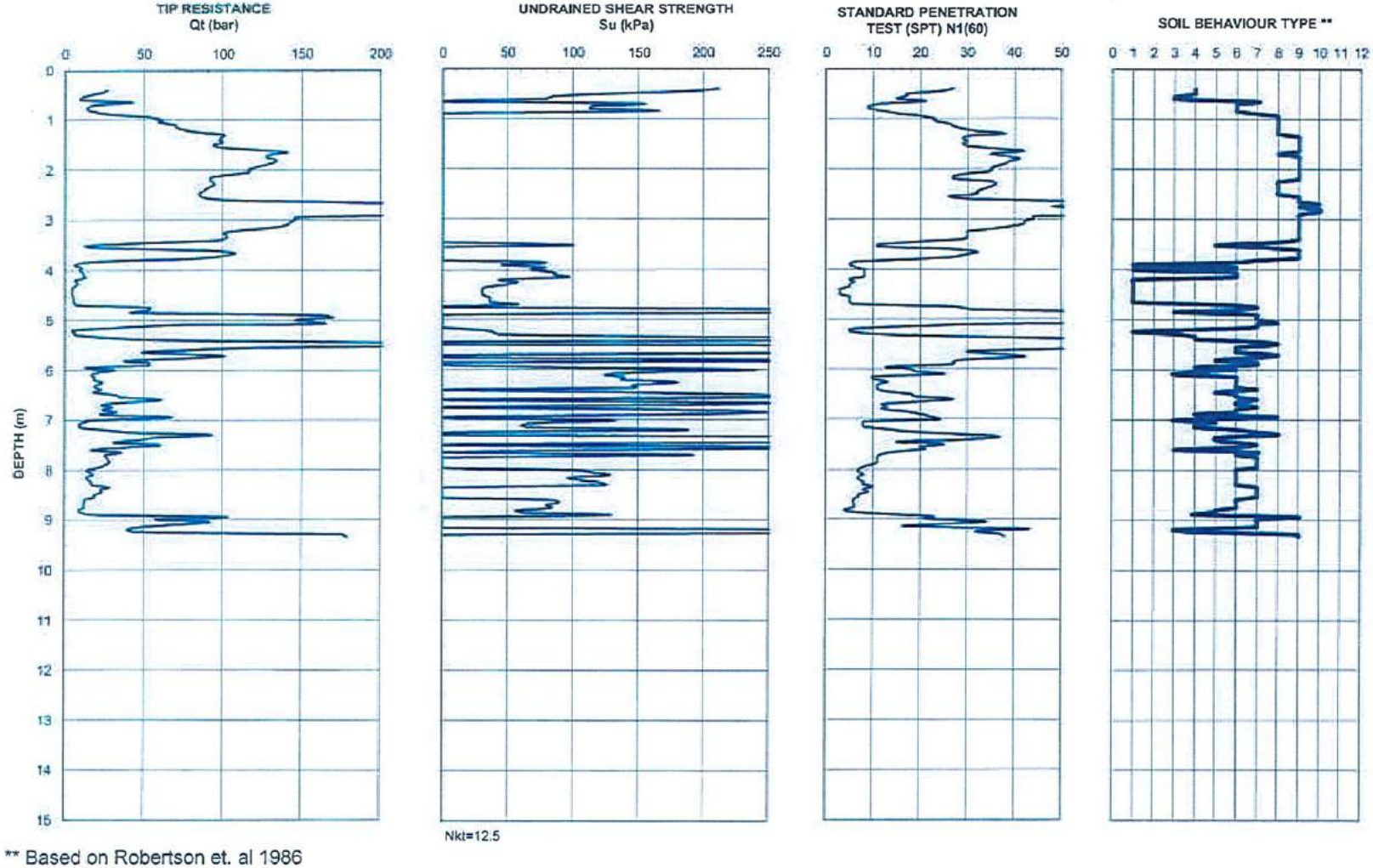
where q_c = cone tip resistance, σ = in situ total stress, N_k = cone constant

The undrained shear strength of the clay has been calculated using the cone tip resistance and an N_k factor of 12.5. All calculations have been carried out automatically using the program CPTint.exe. The results are presented on the Figures following.

---

2 Robertson, P.K., 1985, "In-Situ Testing and Its Application to Foundation Engineering", 1985 Canadian Geotechnical Colloquium, Canadian Geotechnical Journal, Vol. 23, No. 23, 1986

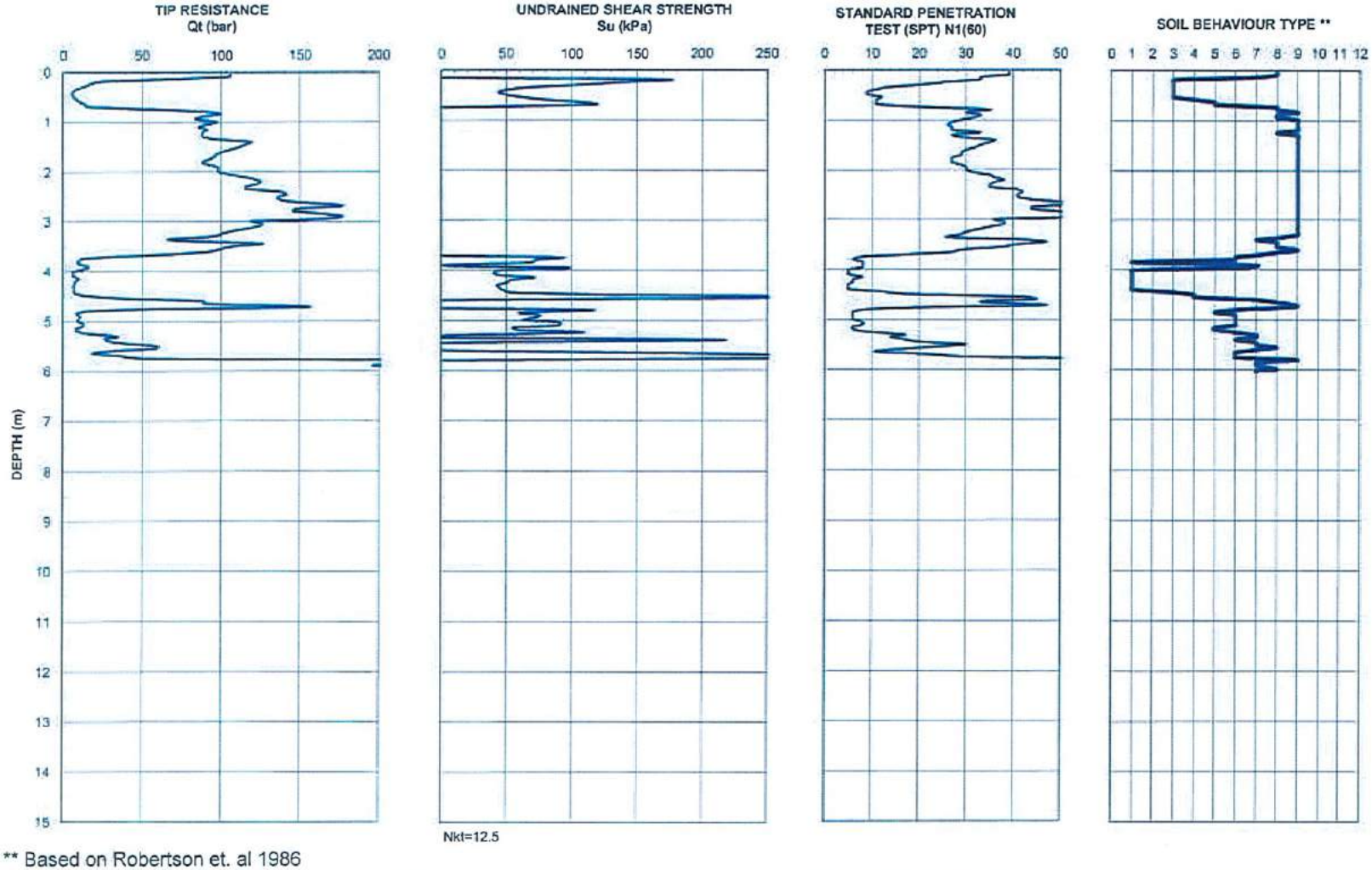
GEOPACIFIC VANCOUVER KAMLOOPS CALGARY	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: SCPT16-01	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: C.01



** Based on Robertson et. al 1986

1 Sensitive Fine Grained
2 Organic Material
3 Clay
4 Silty Clay to Clay
5 Clayey Silt to Silty Clay
6 Sandy Silt to Clayey Silt
7 Silty Sand to Sandy Silt
8 Sand to Silty Sand
9 Sand
10 Gravelly Sand to Sand
11 Very Stiff Fine Grained
12 Sand to Clayey Sand

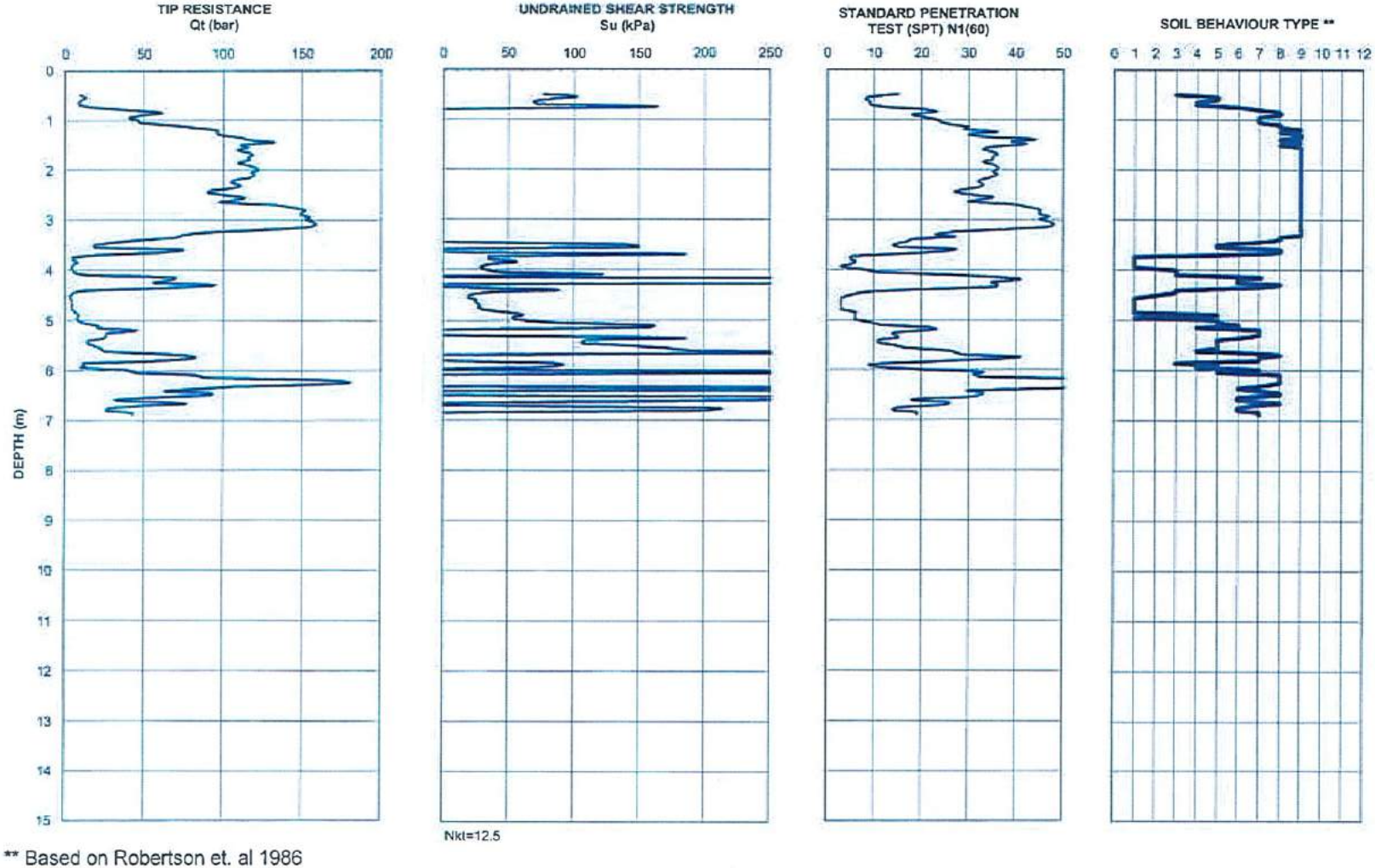
GEOPACIFIC VANCOUVER KAMLOOPS CALGARY	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: CPT16-02	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: C.02



** Based on Robertson et. al 1986

1 Sensitive Fine Grained
2 Organic Material
3 Clay
4 Silty Clay to Clay
5 Clayey Silt to Silty Clay
6 Sandy Silt to Clayey Silt
7 Silty Sand to Sandy Silt
8 Sand to Silty Sand
9 Sand
10 Gravelly Sand to Sand
11 Very Stiff Fine Grained
12 Sand to Clayey Sand

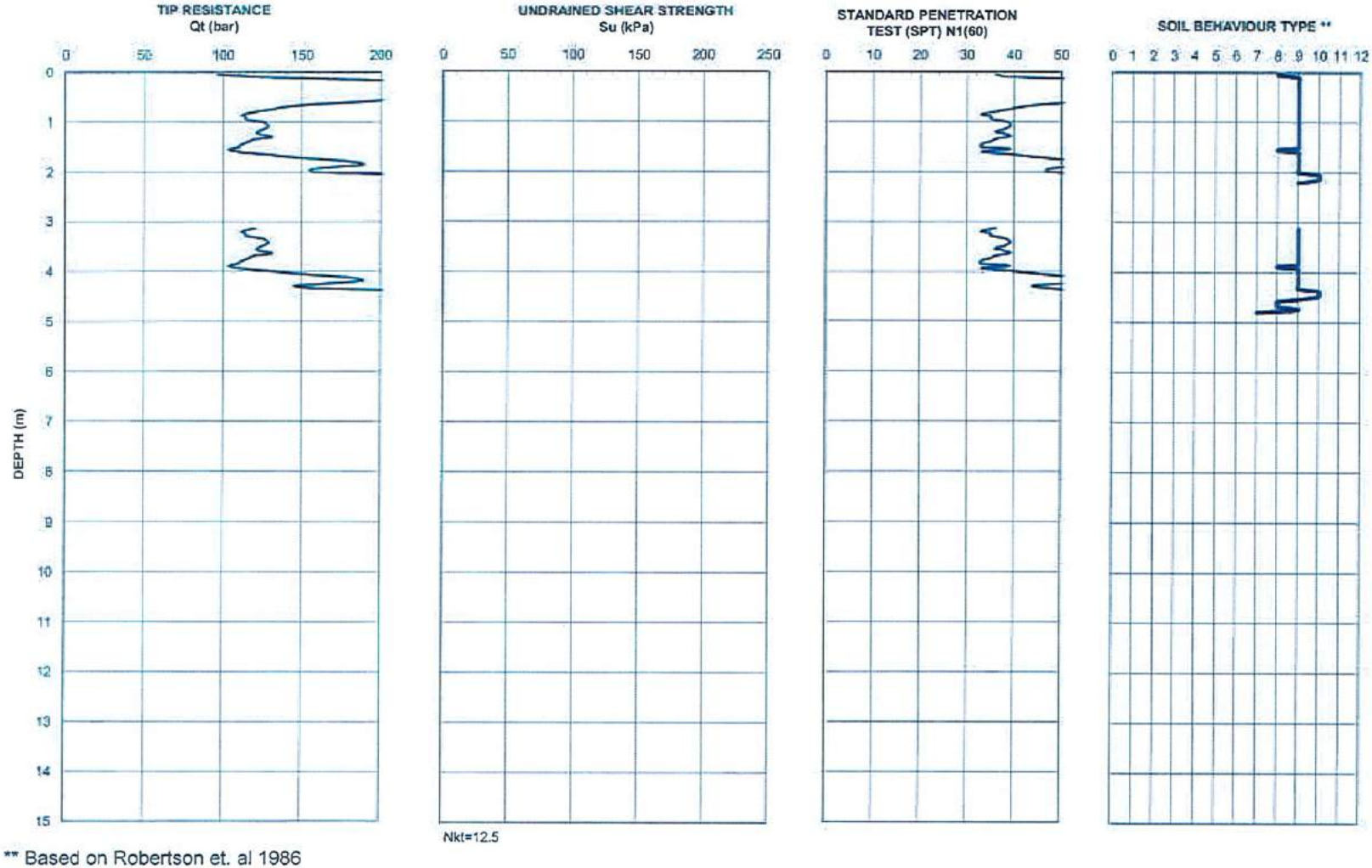
GEOPACIFIC VANCOUVER KAMLOOPS CALGARY	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: CPT16-03	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: C.03



** Based on Robertson et. al 1986

1 Sensitive Fine Grained
2 Organic Material
3 Clay
4 Silty Clay to Clay
5 Clayey Silt to Silty Clay
6 Sandy Silt to Clayey Silt
7 Silty Sand to Sandy Silt
8 Sand to Silty Sand
9 Sand
10 Gravelly Sand to Sand
11 Very Stiff Fine Grained
12 Sand to Clayey Sand

GEOPACIFIC VANCOUVER KAMLOOPS CALGARY	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: SCPT16-04	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: C.04



** Based on Robertson et. al 1986

1 Sensitive Fine Grained
2 Organic Material
3 Clay
4 Silty Clay to Clay
5 Clayey Silt to Silty Clay
6 Sandy Silt to Clayey Silt
7 Silty Sand to Sandy Silt
8 Sand to Silty Sand
9 Sand
10 Gravelly Sand to Sand
11 Very Stiff Fine Grained
12 Sand to Clayey Sand

APPENDIX D - LIQUEFACTION ANALYSIS

Assessment of the liquefaction potential of the ground has been determined by the Cone Penetration Test (CPT). The method of analysis is presented in the following sections.

FACTOR OF SAFETY AGAINST LIQUEFACTION

The factor of safety against liquefaction calculated here is the ratio of the cyclic resistance of the soil (CRR) to the cyclic stresses induced by the design earthquake (CSR). Where the ratio of CRR/CSR is greater than unity the soils ability to resist cyclic stresses is greater than the cyclic stresses induced by the earthquake and liquefaction will be unlikely. Where the CRR/CSR is less than unity then liquefaction could occur. This ratio is presented as the FOS against Liquefaction on the following charts. Calculation of the factor of safety is based on NCEER (1998)[1] which evaluates the CRR directly from cone penetration test sounding data. The value of the cyclic stress ratio has been calculated based on peak horizontal ground acceleration of 0.35g during the 2012 British Columbia Building Code design earthquake, which is consistent with our experience in this area.

SEISMIC INDUCED SETTLEMENT

In the event of a significant earthquake, settlement of the ground surface could occur as a result of densification of the looser soil layers as a result of liquefaction or due to the expulsion of sand in the form of sand dykes or sills from beneath the site. Tokimatsu and Seed (1987)[2] suggest a method of analysis for estimating vertical settlements as a result of earthquake induced accelerations. In this method the normalized standard penetration blow counts ($N_{1(60)}$) is compared with the cyclic stress ratio for the induced earthquake to determine the volumetric strain resulting from the earthquake shaking. The volumetric strain is assumed to result in only vertical settlement. The vertical settlement is summed for each depth at which settlement is predicted to occur and accumulated from the bottom of the test hole. The results are presented on the following charts labelled as Settlement.

HORIZONTAL DISPLACEMENT

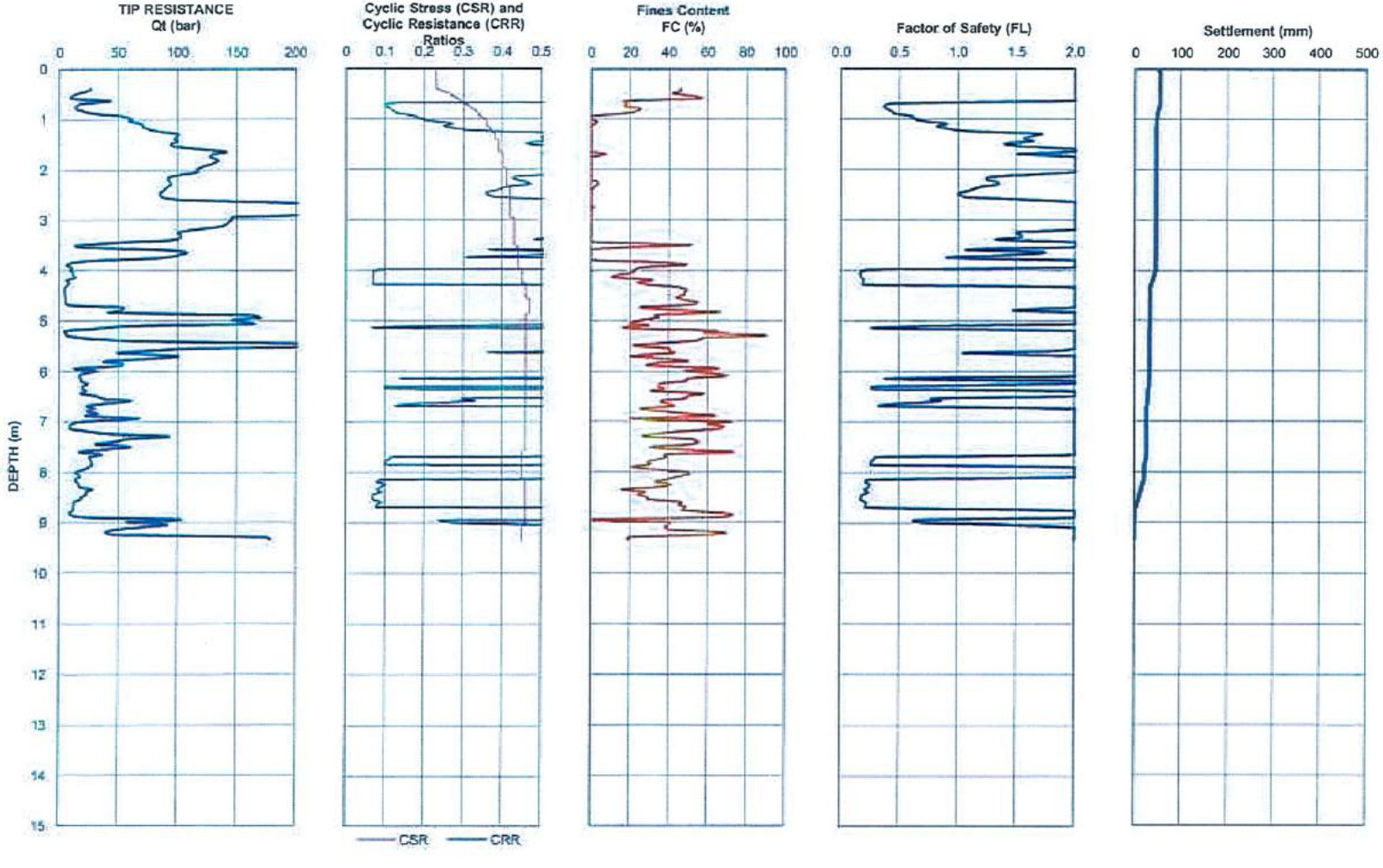
Horizontal ground displacements known as "free field" displacements occur as a result of liquefaction of the ground and are assumed to occur without the influence of any structures. The horizontal displacements presented in our report are generally based upon the lateral spread method by of Youd, Bartlett, & Hansen (2002). Displacements are calculated based on an empirical relationship developed from observations from other earthquake sites on sloping ground or near a free face, such as an abrupt slope. The presence of the proposed embankment on-site is expected to induce a static bias within the soils at the margin of the embankment making the soils and embankment in this area subject to lateral spread induced movements. In the event of a real earthquake of significant magnitude to cause limited liquefaction, actual movements will be influenced by a wide variety of factors including the characteristics of the earthquake including duration, number of significant cycles, variations in peak particle velocity, wavelength, amplitude and frequencies as well as soil damping and variations in density and continuity of the soil layers.

1 Youd, T. L., Idriss, I. M. (2001) "Liquefaction Resistance of Soils: Summary Report from the 1996 and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils", Journal of Geotechnical and Geoenvironmental Engineering, Vol 127, 10, pp. 817-833

2 Tokimatsu, K.A.M. and Seed, H.B., 1987. "Evaluation of Settlement in Sands Due to Earthquake Shaking", Journal of Geotechnical Engineering, ASCE, Vol. 113, No. 8, pp. 861-878

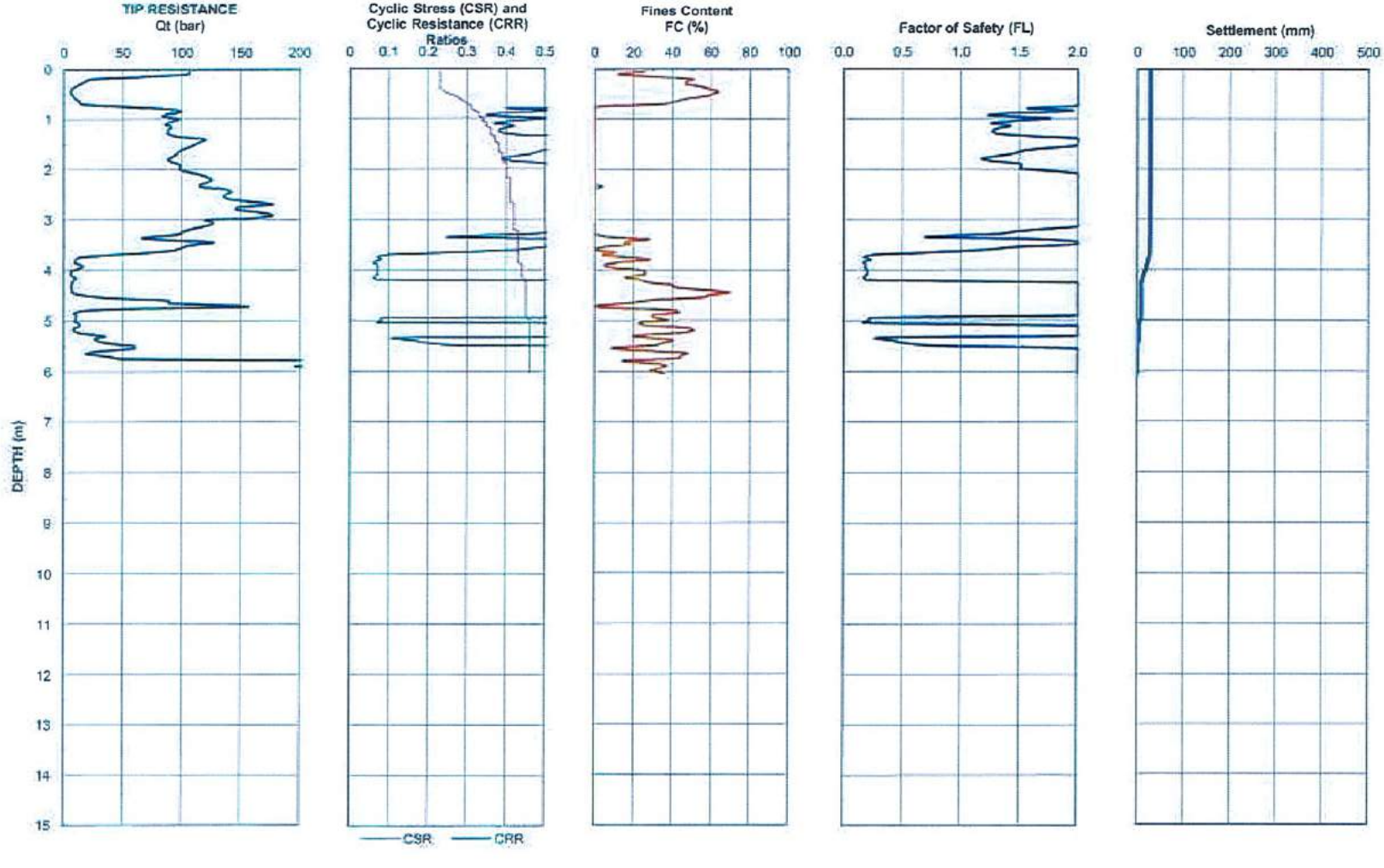
3 Youd, T.L., Bartlett, S.F., Hansen, C.M. (2002), "Revised MultiLinear Regression Equations for Prediction of Lateral Spread Displacements", Journal of Geotechnical and GeoEnvironmental Engineering, Vol. 128, No. 12, pp. 1007-1017

GEOPACIFIC CONSULTANTS	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: SCPT16-01	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: D.01



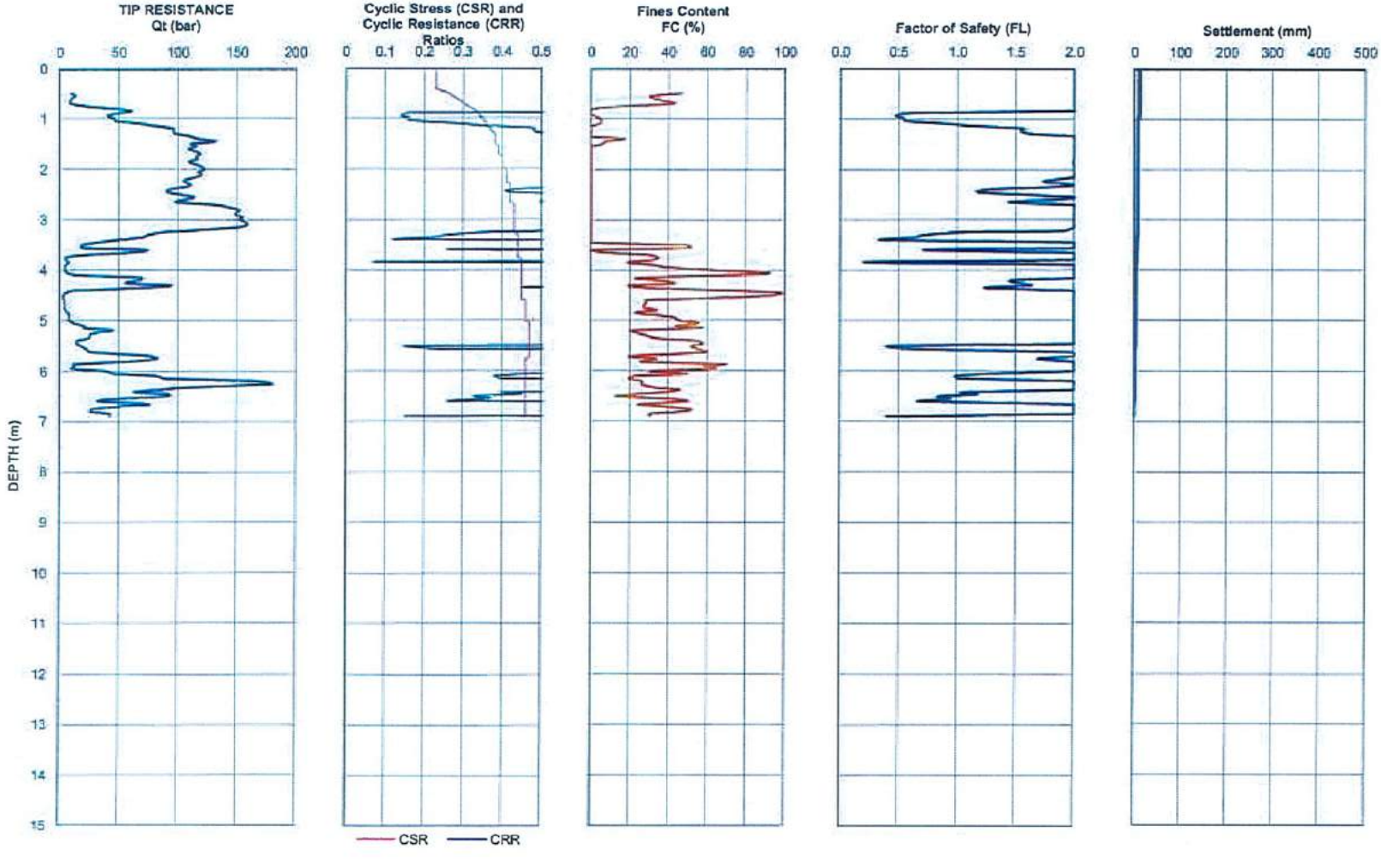
Liquefaction interpretation ran with PGA = 0.35g

GEOPACIFIC CONSULTANTS	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: CPT16-02	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: D.02



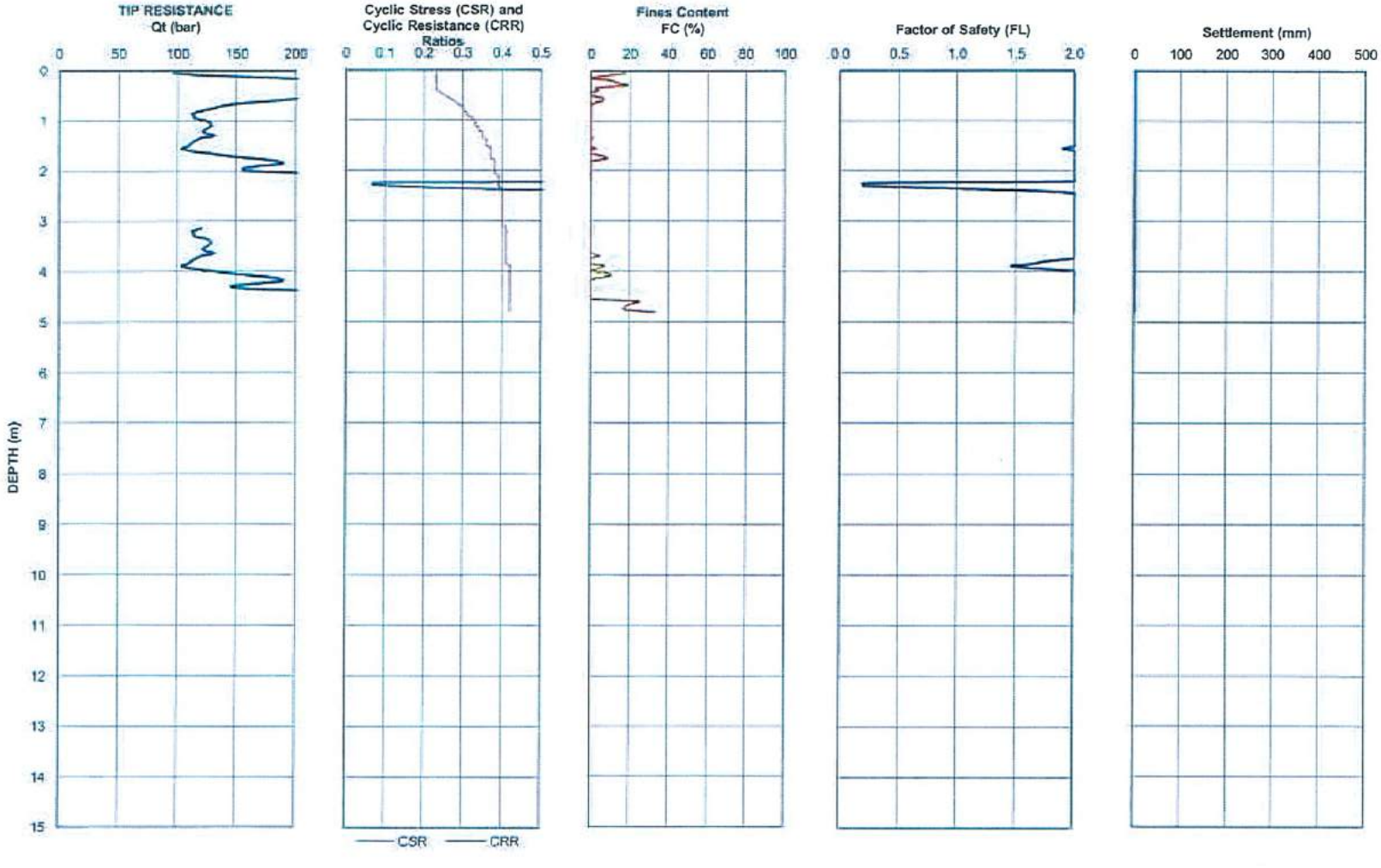
Liquefaction interpretation ran with PGA = 0.35g

GEOPACIFIC CONSULTANTS	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: CPT16-03	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: D.03



Liquefaction interpretation ran with PGA = 0.35g

GEOPACIFIC CONSULTANTS	2016-Feb-11	ARNEIL HOLDINGS LTD	GeoPacific Project #: 13648
	Sounding: SCPT16-04	3015, 3033, 3093 MURRAY STREET, PORT MOODY	Figure: D.04



Liquefaction interpretation ran with PGA = 0.35g

APPENDIX E - SHEAR WAVE VELOCITY DATA (Vs)

GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

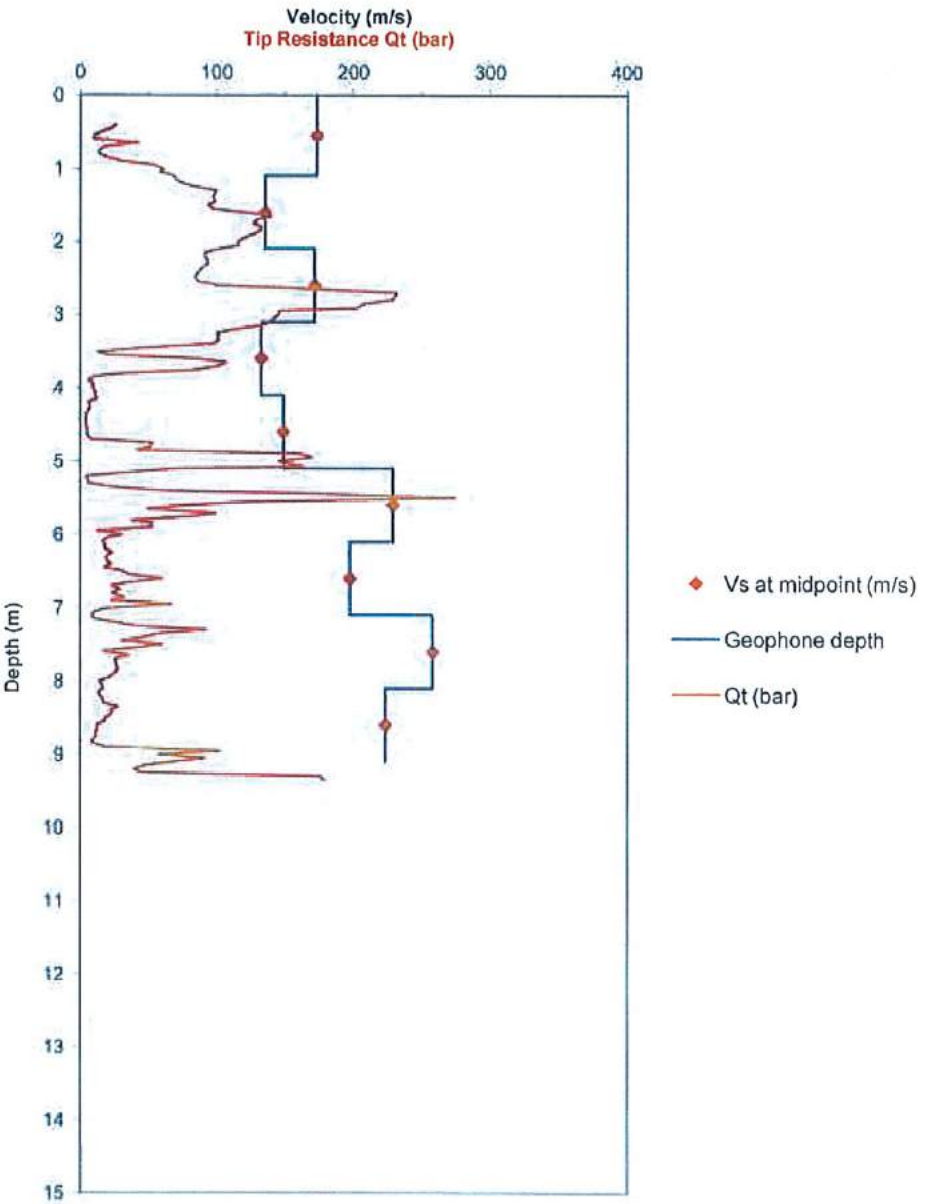
File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC
Sounding: SCPT16-01
Date: 2016-Feb-11

Seismic Source: Beam
Source to cone (m): 0.4

Shear Wave Velocity Data (Vs)

Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference d (m)	Midpoint (m)	Time Difference (ms)	Shear Wave Velocity Vs (m/s)	d/Vs
1.30	1.10	1.17	1.17	0.55	6.74	174	0.0067
2.30	2.10	2.14	0.97	1.60	7.11	136	0.0071
3.30	3.10	3.13	0.99	2.60	5.74	172	0.0057
4.30	4.10	4.12	0.99	3.60	7.48	133	0.0075
5.30	5.10	5.12	1.00	4.60	6.69	149	0.0067
6.30	6.10	6.11	1.00	5.60	4.36	229	0.0044
7.30	7.10	7.11	1.00	6.60	5.06	197	0.0051
8.30	8.10	8.11	1.00	7.60	3.87	258	0.0039
9.30	9.10	9.11	1.00	8.60	4.47	223	0.0045
						Σ(d/Vs)	0.0515
						average Vs = Σd / Σ(d/Vs)	177

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC
Sounding: SCPT16-01
Date: 2016-Feb-11



GEOPACIFIC
VANCOUVER KAMLOOPS CALGARY

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC
Sounding: SCPT16-04
Date: 2016-Feb-11

Seismic Source: Beam
Source to cone (m): 0.4

Shear Wave Velocity Data (Vs)

Depth (m)	Geophone Depth (m)	Ray Path (m)	Ray Path Difference d (m)	Midpoint (m)	Time Difference (ms)	Shear Wave Velocity Vs (m/s)	d/Vs
1.30	1.10	1.17	1.17	0.55	7.27	161	0.0073
2.30	2.10	2.14	0.97	1.60	4.92	197	0.0049
3.30	3.10	3.13	0.99	2.60	5.24	189	0.0052
4.30	4.10	4.12	0.99	3.60	5.55	179	0.0055
4.80	4.60	4.62	0.50	4.35	2.89	173	0.0029
						Σ(d/Vs)	0.0259
						average Vs = Σd / Σ(d/Vs)	179

File: 13648
Project: SITE REDEVELOPMENT
Client: ARNEIL HOLDINGS LTD
Location: 3015, 3033, 3093 MURRAY STREET, PORT MOODY, BC
Sounding: SCPT16-01
Date: 2016-Feb-11