Geotechnical Assessment

Proposed Hotel
3070 Kilpatrick Ave
Courtenay, BC

Prepared for:

CGC Holdings Ltd.
2000 Idylwyld Drive
Saskatoon, Sk
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Attention: Grant Smith, Director of Operations

Prepared by:

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December 15, 2008

Project No. SGL08-047

SIMPSON GEOTECHNICAL LTD

Table of Contents

1.0 INTRODUCTION

As requested, Simpson Geotechnical Ltd. (SGL) has conducted a geotechnical assessment for the captioned project in general accordance with our proposal of November 21, 2008, our file reference P053.

The subject property is located near the southern end of Kilpatrick Avenue, and spans from Kilpatrick eastward to Cliffe Ave as shown on Figure 1.

2.0 PROPOSED DEVELOPMENT

We understand that the project generally consists of a four storey hotel with a basement. A swimming pool is proposed at the basement level. Drawings provided to us by Dishlevoy Hagarty Architects dated August 15, 2008 indicate that the site has a total area of 7091 m^2. The hotel structure would be located on the southeastern eastern portion of the property adjacent to Cliffe Avenue while the western and northern portions of the site would be developed with hard surfaced pavement areas. The proposed site layout is shown on Figure 2.

The site topography, as provided by McElhanney Consulting Services Ltd., shows the site to slope down to the northeast for a total elevation change across the site of approximately 9m. The geodetic elevation of the site is shown to range from approximately 8 to 17m.

We understand that the currently proposed basement floor elevation is 9m geodetic, with a main floor elevation of 12m geodetic. Some adjustment of the proposed floor elevations may occur as the design progresses.

3.0 BACKGROUND

Surficial geology mapping of the vicinity published by the Geological Survey of Canada as Map 32-1960 indicates the site to be underlain by a varied stony, sandy and clayey marine veneer generally less than 1.5m thick, overlying ground moraine glacial till. Our experience on other projects in the general area of the site has noted subsurface conditions consistent with the geologic map.

Morainal glacial till is typically very dense and suitable for support of moderate foundation loads on shallow spread and strip footings and as pavement area subgrade. The marine material anticipated to overlie the till is typically of variable consistency and highly sensitive to moisture changes and disturbance.

The online Comox Valley Regional District Habitat Atlas indicated no environmentally sensitive areas located on or in the immediate vicinity of the subject site.

4.0 SITE DESCRIPTION

The site assessment was conducted on November 25, 2008. The general area of the subject property was a mix of commercial and residential use, with the adjacent properties to the north being both commercial and residential use. The adjacent property to the south was developed with single storey commercial structures.

The site was heavily vegetated with brush and occasional trees. The site topography generally sloped gently down towards the northeast at approximately 5 degrees from horizontal. A relatively abrupt grade change was noted near the southern property line with the surface elevation difference between the two properties increasing from west to east, to a maximum of approximately 2m near the southeastern corner of the subject property.

5.0 SUBSURFACE CONDITIONS

5.1 Stratigraphy

Twelve test pits were excavated on the subject property with a Kubota 121 tracked excavator on November 25, 2008. Those test pits encountered a subsurface profile that comprised topsoil, overlying sand with variable silt, clay and gravel content interpreted as marine or glacio-marine material that commonly contained roots, overlying very dense or hard material we interpret as basal glacial till.

The glacial till ranged in gradation from silt/clay to medium grained sand and gravel. Occasional boulders up to 1m in diameter were encountered in the glacial till. The glacial till was typically agglomerated and excavated in hard lumps.

The test pit locations were surveyed by McElhanney Consulting Services Ltd. The resulting test pit locations are indicated on Figure 2. Logs of the test pits are appended and the test pits are summarized in Table 1.

Table 1 – Test Pit Summary

Test Pit No.	Depth from ground surface (m)			
	Marine	Glacial Till	Groundwater Seepage	Comments
TP-1	0.7	1.1	1.2	Sand and gravel from 0.4 to 0.7m depth
TP-2	0.2	0.7	n/e	
TP-3	0.7	1.3	1.2	Sand and gravel layer from 0.25 to 0.7m depth
TP-4	0.4	0.7	1.2	Water bearing sand layer from 1.1 to 2.2m depth with moderate to heavy seepage
TP-5	0.3	1.1	1.1	
TP-6	0.3	1.4	1.4	Water bearing sand layer from 1.4 to 2.1m depth with heavy seepage, 1m diameter boulder encountered at 2m depth
TP-7	0.3	0.7	n/e	
TP-8	0.5	0.8	n/e	
TP-9	0.2	0.9	n/e	
TP-10	0.25	n/e	n/e	
TP-11	0.3	1.3	n/e	
TP-12	0.3	n/e	n/e	

n/e = not encountered

5.2 Groundwater

Heavy groundwater seepage was encountered from a sandy layer in Test Pits 4 and 6 at 1.1 and 1.4m depth respectively. Light groundwater seepage was also encountered in Test Pits 1, 3 and 5 at depths of 1.1 to 1.2m below the ground surface.

Groundwater levels may fluctuate with seasonal climactic variations and changes in the land use.

5.3 Laboratory Testing

Laboratory tests were carried out by McElhanney Consulting Services Ltd. on selected soil samples. The following tests were conducted on the selected soil samples:

- 15 Moisture Tests
- 4 Grain Size Analyses

The moisture contents are shown on the test pit logs and the grain size analyses charts are appended.

6.0 RECOMMENDATIONS

The recommendations presented in the following sections of this report are based on the information available regarding the proposed development, the results obtained from our test holes and laboratory tests, and our experience with similar projects. Because the test holes represent a very small statistical sampling of subsurface conditions, it is possible that conditions may be encountered during construction that are substantially different from those indicated by the soil test holes. In these instances adjustments to design and construction may be necessary.

6.1 Site Preparation

Vegetation, topsoil and roots should be removed from building and pavement areas to expose an approved, undisturbed and inorganic subgrade. The test pits and any other excavations and/or objects that are encountered should be excavated to undisturbed original ground and the grade restored with engineered fill under the review of SGL.

Site clearing, stripping and grubbing should be performed during dry weather conditions. Operation of heavy equipment on the site during wet conditions could result in excessive rutting and mixing of organic debris with the underlying soils.

The fine grained marine material encountered in the test pits had limited strength in it’s existing condition in some of the test pits, which would provide poor support to construction traffic.

The fine grained site materials will be readily eroded by storm water runoff. Contractors should be prepared to provide siltation control measures to prevent silt laden runoff from leaving the site.

6.2 Excavations

Temporary construction slopes should be in accordance with the Occupational Health and Safety Regulation. The contractor is solely responsible for protecting excavations by shoring, sloping, benching or other means as required to maintain stability of both the excavation sides and bottom. SGL does not assume any responsibility for construction site safety or the activities of the contractor.

There may be opportunity for over steepened temporary excavation slopes in the very hard or dense glacial till material, subject to site review and written instructions from a geotechnical engineer in accordance with Workers Compensation Board requirements.

Seepage rates from glacial till materials are typically low allowing temporary excavation dewatering to usually be managed with conventional sumps and pumps. However, heavier groundwater seepage rates may occur within the till, as was encountered in TP-4 and 6, which would be exposed by the proposed basement excavation.

Groundwater seepage and excavation dewatering from within the excavation would reduce the stability of temporary excavation slopes.

6.3 Material Reuse

The marine or glacio-marine materials encountered in the test pits was fine grained and is not considered suitable for reuse as engineered fill for support of buildings or hard surfaced areas.

The glacial till encountered in the test pits was of highly variable composition and excavated in hard lumps. However, with appropriate handling, moisture conditioning and compaction techniques the glacial till material could be reused as pavement area subgrade fill under ideal, dry, weather conditions. The variable composition of the glacial till would make compaction control problematic and increased field review and field density test frequency during glacial till placement and compaction should be provided for quality control and assurance.

6.4 Foundations

A spread and strip foundation system bearing on the undisturbed, inorganic, dense or hard glacial till is considered the most practical foundation system for the proposed structure. Glacial till was encountered in the test pits at depths that ranged from 0.7 to 1.4m below the existing site surface in the test pits excavated in the proposed building area (TP-1, 3, 4, 6 and 7). Deeper excavation may be required to remove roots and unsuitable materials from test pits and previously backfilled excavations that may be encountered.

The site may be considered Site Class C in accordance with the 2006 BC Building Code Section 4.1.8.4. The dense and hard glacial till encountered in the test holes is not considered to be susceptible to seismic liquefaction.

Foundations that bear on the undisturbed glacial till may be designed based on a Factored Geotechnical Resistance at Ultimate Limit States (ULS) of 400 kPa and a Geotechnical Resistance at Serviceability Limit States (SLS) of 200 kPa. The geotechnical resistance at

SLS is intended to limit total settlement to less than 25mm and differential settlement to less than 15mm between a typical column spacing of 4.5m.

Approved footing subgrade may be raised or leveled with engineered fill. Engineered fill for support of footings should comprise well graded 75mm minus, inorganic, sand and gravel with less than 5% passing the No. 200 sieve. Engineered fill should extend laterally beyond the edges of footings a distance at least equal to the thickness of fill beneath the footing, plus one metre. Engineered fill should be placed and uniformly compacted in maximum 200mm loose lift thickness to at least 100% of the Standard Proctor maximum dry density. Fill compaction should be verified by field density testing.

The geotechnical resistance at ULS and SLS should be reduced to 300 and 150 kPa respectively when underlain by more than 300mm thickness of engineered fill.

All footings should be provided with a minimum 450mm of soil cover for frost protection and confinement.

All footings should be located so that the smallest lateral clear distance between footings will be at least equal to the difference in their bearing elevations. Please contact SGL for specific review if that distance cannot be maintained.

All foundation bearing surfaces should be reviewed by SGL prior to the placement of engineered fill, footing formwork or concrete. Following approval of subgrade surfaces, concrete should be placed as quickly as possible to avoid exposure of the foundation sub-soils to wetting, drying or freezing. If soils in the areas of foundation support are subjected to such conditions, the footing subgrade should be re-evaluated by SGL prior to concrete placement. The fine grained glacial till material will be moisture sensitive and easily disturbed by construction traffic when saturated.

6.5 Below Grade Basement Walls

Below grade basement walls should be designed to resist the lateral earth pressures as shown on the attached Figure in Appendix D, based on the parameters shown below.

CS = 21 kPa
K = 0.4
Kae = 0.73 (2% in 50 year seismic event)
γ = 21 kN/m3

These lateral earth pressures assume that the slope of the ground surface on the high side of the wall will be no steeper than 10 degrees from horizontal.

The backfill for basement walls should consist of well graded, inorganic, 75mm minus sand and gravel with a maximum of 2% passing the No. 200 sieve. Basement wall backfill should be compacted to at least 93% of Standard Proctor maximum dry density (SPD) in landscaped areas and 97% of SPD in hard surfaced areas. Fill compaction should be verified by field density testing.

6.6 Floor Slabs on Ground

The undisturbed, inorganic, dense or hard glacial till is considered suitable for support of grade supported floor slabs.

Floor slab on grade subgrade may be raised and leveled with engineered fill comprised of 75mm minus, inorganic, well graded sand and gravel with less than 5% passing the No. 200 sieve. The engineered fill should be placed and uniformly compacted in maximum 300mm loose lift thickness' to at least 98% of the Standard Proctor maximum dry density. Fill compaction should be verified by field density testing.

Floor slabs on grade should be immediately underlain by a minimum 150mm thickness of crushed 19mm minus well graded sand and gravel uniformly compacted to at least 100% of Standard Proctor maximum dry density.

The floor slab should be designed to float independently of load-bearing walls and columns to minimizing potential cracking that can occur along and around the foundation system. A 100mm thick cushion of floor slab base aggregate is also recommended between the floor slab and top of column pad and wall footings. Resting the floor slab directly on top of footings is not recommended.

6.7 Permanent Drainage

A foundation drainage system in accordance with the BC Building Code requirements, utilizing rigid PVC pipe, is recommended for the building. In addition to the foundation drainage system a sub-slab drainage system comprised of a perforated pipe network surrounded in drainage gravel should be provided below the basement floor slab and be connected to the site storm drainage system. Final site grading should provide positive drainage away from the buildings.

The basement excavation may intercept water bearing sand seams in the glacial till material. The completed excavation should be reviewed by SGL to determine if additional foundation drainage provisions are required. Addition drainage provisions may consist of a geocomposite drainage product or a free draining gravel drainage zone against the basement walls.

6.8 On-Site Pavements

On-site pavement subgrade may consist of undisturbed, inorganic, stiff marine silt/clay with variable sand content or glacial till. Proof rolling of the subgrade or top of the subbase may be required during preparation of the pavement areas, at the engineer's discretion. The following asphaltic concrete pavement section is recommended atop approved pavement subgrade.

Recommended On-Site Asphaltic Pavement Section

Component	Thickness (mm)	
	Light Passenger Vehicle Traffic	Moderate Truck Traffic
Asphaltic concrete	50	75
25mm minus crushed Base	100	150
75mm minus subbase	300	300
Total pavement structure thickness	450	525

All pavement materials and compaction should be in accordance with City of Courtenay specifications. Pavement subgrade should be shaped to promote drainage.

6.9 Buried Utilities

All underground utilities should be installed, bedded and backfilled in accordance with City of Courtenay Specifications. The excavated site materials will be fine grained, moisture sensitive and excavate in hard lumps and as such are not considered suitable for reuse as utility trench backfill below pavement areas. Imported sand and gravel in accordance with City of Courtenay specifications should be used for utility trench backfill to subgrade elevation.

Groundwater seepage may be encountered in excavations, both near the surface of the glacial till deposit and from water bearing seams within the glacial till.

6.10 Permanent Cut and Fill Slopes

Permanent cut slopes less than 3m in vertical height in the fine grained marine and glacio-marine material should be sloped at 2.5 horizontal to 1 vertical or flatter. Permanent cut slopes in the glacial till material should be sloped at 1.5 : 1 or flatter. Permanent fill slopes of sand and gravel engineered fill should be no steeper than 2 horizontal to 1 vertical. Flatter slopes or seepage control measures may be required if groundwater breakout occurs on slopes.

The recommendations for cut and fill slopes provided above are for long term slope stability. Shallower slopes may be required for non-geotechnical reasons, such as to allow vegetation to establish and grass cutting.

Specific geotechnical input should be obtained for permanent cut or fill slopes that exceed 3m in vertical height.

6.11 On-Site Landscape Retaining Walls

We understand that a landscape retaining wall constructed of 0.75m x 0.75m x 1.5m interlocking concrete blocks (lock block type) is proposed along the northern boundary of the site. It is understood that the wall is proposed to be tiered, with each tier in the order of 1 to 1.5m in height. Vehicle parking or driveway areas would be located near the top of the retaining wall.

Figure 4 shows a preliminary landscape retaining wall design for two block high, three block high and tiered walls with passenger vehicle loads near the top of the wall. The design shown is based on resisting static and moderate seismic earth pressures. Deformation of the retaining wall should be expected to result from major seismic events.

SGL should review the site grading plan and revise the retaining wall design as may be required.

7.0 ADDITIONAL GEOTECHNCAL SERVICES

The recommendations presented in this report are contingent on SGL observing and/or monitoring:

- Construction documents for conformance to the geotechnical recommendations provided herein;
- Building area subgrade preparation for footings and floor slabs on grade;
- Landscape retaining wall construction;
- Suitability of engineered fill materials;
- Placement and compaction of engineered fill.

8.0 CLOSURE

We trust that this report will assist in the design and construction of the proposed project. Should you have any questions, please do not hesitate to contact us.

This report was prepared for the exclusive use of CGC Holdings Ltd. and their appointed agents for the proposed development described herein. Any use or reliance made on this report by an unauthorized third party is the responsibility of that third party. The City of Courtenay is considered an authorized third party and may rely on this report subject to the terms and conditions under which it was prepared. Contractors should make their own assessment of the property for the purposes of bidding on and performing work on the site.

The recommendations in this report are based upon the data obtained from widely spaced test holes. The nature and extent of variations between these test holes may not become evident until construction. If significant variation in subsurface conditions from those described in this report is encountered SGL should be contacted to review those conditions and update our recommendations as may be required.

This report has been prepared in accordance with standard geotechnical engineering practice. No other warranty is provided, either expressed or implied.

Yours truly,
Simpson Geotechnical Ltd.

Per:
Richard Simpson, P.Eng.

Attachments:

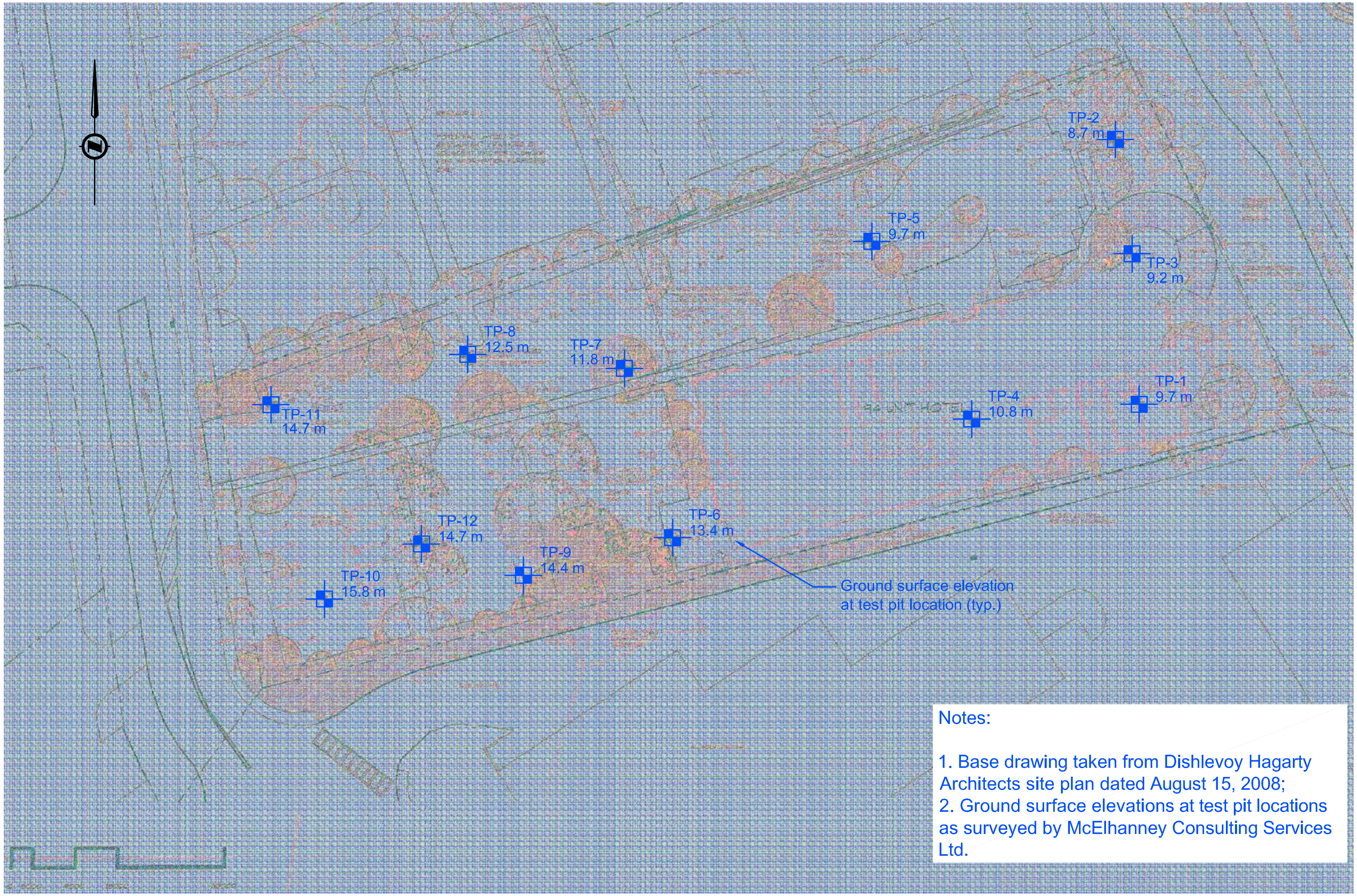
Appendix A
Appendix B
Appendix C
Appendix D

Appendix A

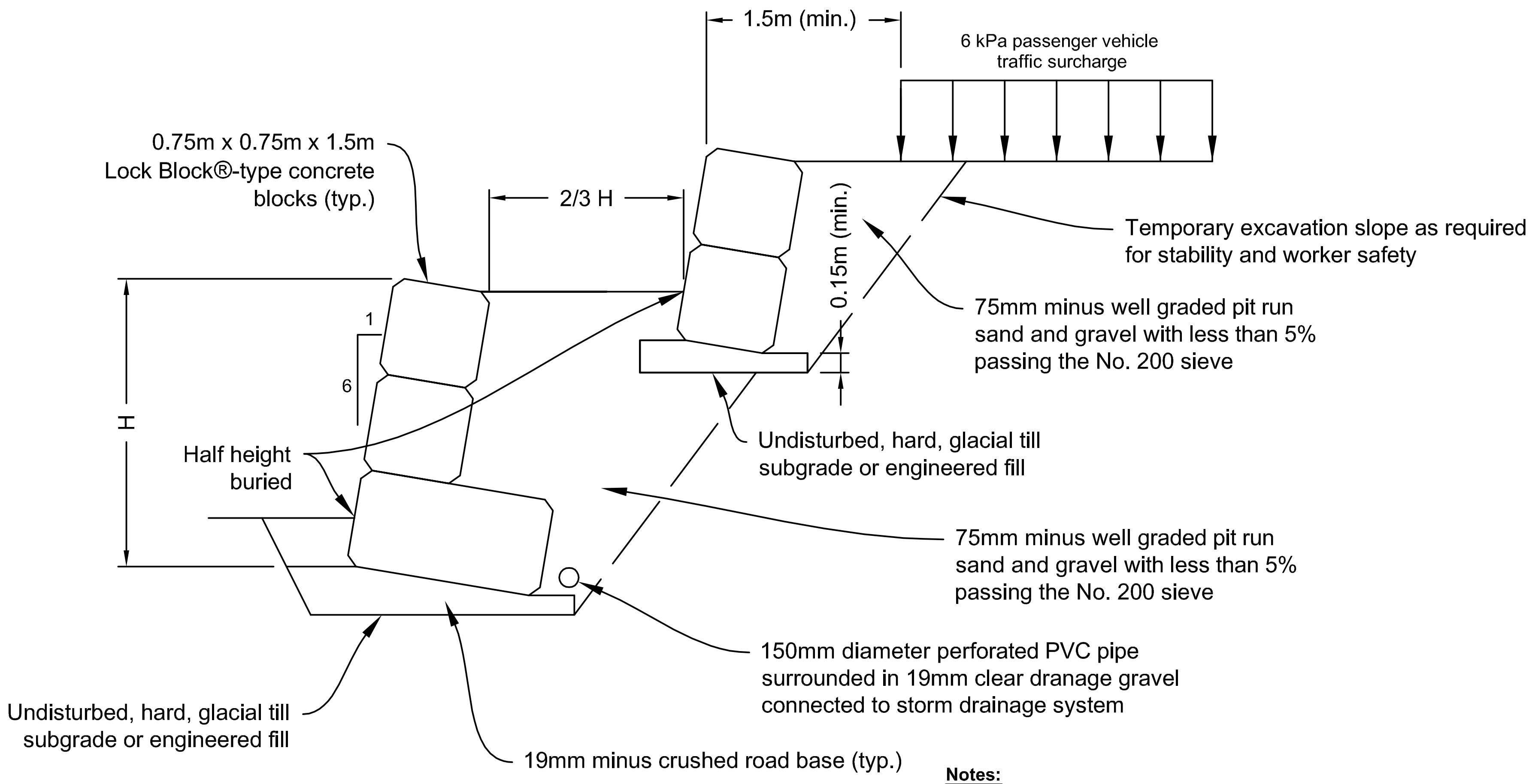
Figures

Notes:
1. Base plan from Comox Valley Regional District online habitat atlas.

Project:	Proposed Hotel						SIMPSON Geotechnical Ltd		
Title:	Site Location Plan								
Client:	CGC Holdings Ltd.								
File:	SGL08-047	**Drawn by:**	rrs	**Scale:**	NTS	**Date:**	Dec 2008	**Dwg. No.:**	Figure 1



Project: Proposed Hotel			SIMPSON Geotechnical Ltd	
Title: Geotechnical Site Plan				
Client: CGC Holdings Ltd.				
File: SGL08-047	**Drawn by:**	**Scale:** 1 : 750	**Date:** December 2008	**Dwg. No.:** Figure 2



Notes:

1. Subgrade to be reviewed and approved by Simpson Geotechnical Ltd. prior to placement of any fill materials or blocks;
2. All fill materials to be approved by Simpson Geotechnical prior to use;
3. All fill materials to be compacted to 100% of Standard Proctor maximum dry density;
4. Fill compaction is to be verified by field density testing.
5. Drawing is to be read in conjunction with geotechnical report of December 15, 2008, File Ref. SGL08-047.

Project: Proposed Hotel - 3070 Kilpatrick Ave, Courtenay

Title: Landscaping Retaining Wall - Preliminary Design

Client: CGC Holdings Ltd.

SIMPSON GEOTECHNICAL LTD

File:	Drawn by:	Scale:	Date:	Dwg. No.:
SGL08-047	RRS	1 : 50	December 2008	Figure 4

Appendix B

Test Pit Logs

Test Pit Logs

3070 Kilpatrick Ave, Courtenay, BC

Test Pits Excavated November 25, 2008

Test Hole No.	Depth (m)	Description
TP-1	**Ground surface elevation = 9.720 m** **Proposed basement floor elevation = 9.0 m**	
	0 – 0.4	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.4 – 0.7	Sand and gravel, silty, some cobbles and boulders, compact, damp, reddish brown
	0.7 – 1.1	Silt/clay, trace of fine sand, stiff, moist, tan, mottled, P.P. = 150 to 250 kPa, contains a trace of roots, M @ 0.9m = 30.4% (probable marine deposit)
		Proposed basement floor at 0.720m depth
	1.1 – 2.1	Sand and gravel, trace to some silt/clay, trace of cobbles and boulders to 400mm diameter, very dense, hard digging, damp to moist, dark brown, excavates in hard lumps, M @ 2.0m = 11.7% (Till-like)
	2.1 – 3.0	Sandy, gravelly silt/clay, very hard, damp, grey, P.P. > 450 kPa (Till-like)

- end of test pit at 3.0m in dense sandy, gravelly silt/clay
- light seepage at 1.2m depth and from local zones below
- no sloughing of test pit walls

Test Pit Logs

3070 Kilpatrick Ave, Courtenay, BC

Test Pits Excavated November 25, 2008

Test Hole No.	Depth (m)	Description
TP-2	**Ground Surface Elevation = 8.752 m**	
	0 – 0.2	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.2 – 0.7	Silty/clayey sand, some gravel, occasional cobble, compact, damp, brown, trace of roots (weathered marine)
	0.7 – 1.1	Sand and gravel, trace to some silt, trace to some cobbles and small boulders to 300mm diameter, very dense, damp, brown, excavates in hard lumps, M @ 1.0m = 15.2% (till-like)

- end of test pit at 1.1m in till-like sand and gravel
- no seepage
- no sloughing of test pit walls

Test Pit Logs

3070 Kilpatrick Ave, Courtenay, BC

Test Pits Excavated November 25, 2008

Test Hole No.	Depth (m)	Description
TP-3	**Ground Surface Elevation = 9.204 m** **Proposed basement floor elevation = 9.0 m**	
	0 – 0.25	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
		Proposed basement floor at 0.204 m depth
	0.25 – 0.7	Sand and gravel, trace of silt, occasional small cobble, some roots, dense, damp, dark brown, M @ 0.5m = 9.9%
	0.7 – 1.3	Silt/clay, trace of fine sand, occasional cobble, trace of roots, very stiff, P.P. = 300 to 400 kPa, damp to moist, grey, mottled, M @ 1.0m = 31.0% (marine)
	1.3 – 2.6	Sand and gravel, some silt clay, excavates in hard lumps, some cobbles and boulders to 300mm diameter, very dense, hard digging, damp, brown, M @ 2.0m = 22.1% (till-like)
	2.6 – 3.1	Silt/clay, some sand, some gravel, some cobbles, contains water bearing sandy stringers, hard, P.P. > 450 kPa, damp, blue-grey, excavates in hard lumps, M @ 2.8m = 12.6% (till-like)
		- end of test pit at 3.1m in till-like silt/clay - light seepage at 1.2m depth - no sloughing of test pit walls

Test Pit Logs

3070 Kilpatrick Ave, Courtenay, BC

Test Pits Excavated November 25, 2008

Test Hole No.	Depth (m)	Description
TP-4		**Ground Surface Elevation = 10.795 m** **Proposed basement floor elevation = 9.0 m**
	0 – 0.4	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.4 – 0.7	Sandy silt/clay, occasional cobble, contains roots, stiff, damp, grey, mottled (marine)
	0.7 – 1.1	Sand and gravel, some silt/clay, very hard, damp, brown, excavates in hard lumps (till-like)
	1.1 – 2.2	Sand, fine to medium grained, very dense, brown, saturated and water bearing, M @ 1.4m = 22.0%
		Proposed basement floor at 1.795 m depth
	2.2 – 2.5	Sand and gravel, some silt/clay, very hard, damp, brown, excavates in hard lumps (till-like)

- end of test pit at 2.5m in till-like sand and gravel
- moderate seepage at 1.2m to 2.2m depth
- no sloughing of test pit walls
- piping of sand from 1.2 to 2.2m depth

Test Pit Logs

3070 Kilpatrick Ave, Courtenay, BC

Test Pits Excavated November 25, 2008

Test Hole No.	Depth (m)	Description
TP-5	**Ground surface elevation = 9.698 m**	
	0 – 0.3	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.3 – 1.1	Silt/clay, some fine sand, trace of gravel, stiff, P.P. = 125 kPa, tan, mottled, contains rootlets, local pocket or organics at 0.9m depth, M @ 0.7m = 35.1% (marine)
	1.1 – 1.7	Sand and gravel in silt/clay matrix, very hard, damp, tan, excavates in hard lumps (till-like)
		- end of test pit at 1.7m in till-like sand and gravel - light seepage at 1.1m depth - no sloughing of test pit walls

Test Pit Logs

3070 Kilpatrick Ave, Courtenay, BC

Test Pits Excavated November 25, 2008

Test Hole No.	Depth (m)	Description
TP-6	**Ground surface elevation = 13.427 m** **Proposed main floor elevation = 12.0 m** **Proposed basement floor elevation = 9.0 m**	
	0 – 0.3	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.3 – 1.4	Silt/clay, trace of fine sand, blocky structure, very hard, P.P. > 450 kPa, damp, grey, mottled, roots to 1.0m depth, M @ 0.7m = 33.2% (glacio-marine)
	1.4 – 2.1	Sand, medium grained, trace of silt, 1m diameter boulder, dense, saturated, brown, water bearing, M @ 1.7m = 16.2% (probable till)
		Proposed main floor at 1.427 m depth
	2.1 – 2.9	Sand and gravel, trace of silt, some cobbles and boulders to 1m diameter, very dense, brown, excavates in lumps, grain size analysis sample No. 1 @ 2.9m (till-like)
		Proposed basement floor at 4.427 m depth
		- end of test pit at 2.9m in till-like sand and gravel - heavy seepage at 1.4m depth - sloughing of test pit walls below seepage

Test Pit Logs

3070 Kilpatrick Ave, Courtenay, BC

Test Pits Excavated November 25, 2008

Test Hole No.	Depth (m)	Description
TP-7	**Ground surface elevation = 11.775 m** **Proposed main floor elevation = 12.0 m** **Proposed basement floor elevation = 9.0 m**	
		Proposed main floor at 0.225 m above existing grade
	0 – 0.3	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.3 – 0.7	Silt, some sand, trace of gravel, contains roots, firm, damp, reddish-brown (marine)
	0.7 – 1.5	Sand and gravel, some silt, some cobbles and small boulders, very dense, damp, brown, excavates in hard lumps, M @ 1.4m = 13.1% (till-like)
		Proposed basement floor at 2.775 m depth
		- end of test pit at 1.5m in till-like sand and gravel - no seepage - no sloughing of test pit walls

Test Pit Logs

3070 Kilpatrick Ave, Courtenay, BC

Test Pits Excavated November 25, 2008

Test Hole No.	Depth (m)	Description
TP-8	**Ground surface elevation = 12.411 m**	
	0 – 0.5	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.5 – 0.8	Silty sand, some gravel, and cobbles, occasional small boulders to 250mm diameter, compact, moist, reddish-brown, contains roots (marine)
	0.8 – 1.4	Gravelly sand, trace to some silt, some cobbles and small boulders to 250mm diameter, compact to dense, moist, tan, grain size analysis sample No. 2 @ 1.0m (till-like)
		- end of test pit at 1.4m in till-like silty sand and gravel - no seepage - no sloughing of test pit walls
TP-9	**Ground surface elevation = 14.411 m**	
	0 – 0.2	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.2 – 0.9	Silt/clay, trace of fine sand, trace of fine gravel, blocky structure, hard, P.P. > 450 kPa, damp, tan, mottled, trace of roots, M @ 0.5m = 24.5% (glacio-marine)
	0.9 – 1.3	Sand and gravel, trace of silt/clay, some cobbles and small boulders, very dense/hard, damp, tan, excavates in lumps, grain size analysis sample No. 3 @ 1.1m (till-like)
		- end of test pit at 1.3m in till-like sand and gravel - no seepage - no sloughing of test pit walls

Soil classification based on Canadian Foundation Engineering Manual, 4th Edition
P.P. = unconfined compressive strength by pocket penetrometer
M = Natural moisture content as percent of dry weight
Ground surface elevations as provided by McElhanney Consulting Services Ltd.

Test Pit Logs

3070 Kilpatrick Ave, Courtenay, BC

Test Pits Excavated November 25, 2008

Test Hole No.	Depth (m)	Description
TP-10	**Ground surface elevation = 15.777 m**	
	0 – 0.25	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.25 – 0.7	Sand and silt, trace of gravel, trace of cobbles, loose to compact, damp, reddish-brown, contains roots (weathered marine)
	0.7 – 1.5	Silt/clay, trace of fine sand, trace of gravel, blocky structure, hard, P.P. @ 0.9m = 250 kPa, P.P. @ 1.2m > 450 kPa, damp, grey-tan, contains roots to 1m depth, M @ 1.0m = 32.8% (probable glacio-marine)
		- end of test pit at 1.5m in till-like silt/clay - no seepage - no sloughing of test pit walls
TP-11	**Ground surface elevation = 14.666 m**	
	0 – 0.3	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.3 – 0.7	Sand and silt, trace of gravel, trace of cobbles, loose to compact, damp, reddish-brown, contains roots, layer locally extends to 1.2m depth (marine)
	0.7 – 1.3	Gravelly sand, some silt/clay, trace to some gravel, trace of cobbles, firm, damp, tan, grain size analysis sample No. 4
	1.3 – 1.5	Cobbly sand and gravel, some silt/clay, very dense, damp, tan (till-like)
		- end of test pit at 1.5m in till-like cobbly sand and gravel - no seepage - no sloughing of test pit walls

Soil classification based on Canadian Foundation Engineering Manual, 4th Edition
P.P. = unconfined compressive strength by pocket penetrometer
M = Natural moisture content as percent of dry weight
Ground surface elevations as provided by McElhanney Consulting Services Ltd.

Test Pit Logs

3070 Kilpatrick Ave, Courtenay, BC

Test Pits Excavated November 25, 2008

Test Hole No.	Depth (m)	Description
TP-12	**Ground surface elevation = 14.737 m**	
	0 – 0.3	Organic silt and sand, trace of gravel, loose, damp, dark brown (Topsoil)
	0.3 – 1.2	Silt/clay, trace of fine sand, contains rootlets, blocky structure, very stiff to hard, damp, grey, mottled, M @ 0.8m = 30.5% (glacio-marine) P.P. @ 0.4m = 200 kPa P.P. @ 0.6m = 300 kPa P.P. @ 0.8m > 450 kPa - end of test pit at 1.2m in silt/clay - no seepage - no sloughing of test pit walls

Appendix C

Grain Size Analyses

McElhanney

Report of:

Grain Size Analysis

Client: Simpson Geotechnical Ltd.
Att:

Project No: 2211-80003-9
Project: 3070 Kilpatrick - Days Inn
Sample Date: 25-Nov-08
Sample By: Client
Test Date: 08-Dec-08
Tested By: AB

SAMPLE INFORMATION:

Material Type: Gravelly SAND; trace silt
Source: TP-06
Specification: N/A
Sample Location: 2.9 m
Sample No: 1

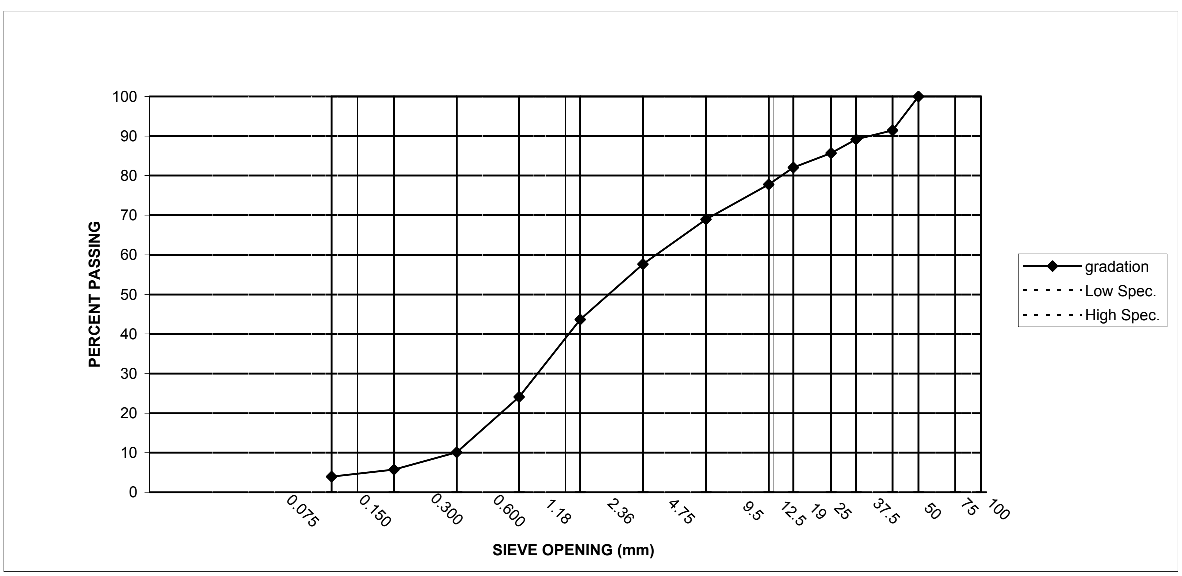
Moisture Content: 16.4%
Fracture: N/A
Washed Sieve: X
Dry Sieve:

Sieve Analysis			
Sieve (mm)	% Passing	Low Spec.	High Spec.
100.0			
75.0			
50.0	100.0		
37.5	91.4		
25.0	89.2		
19.0	85.7		
12.5	82.0		
9.50	77.8		
4.75	68.9		
2.36	57.6		
1.18	43.7		
0.600	24.1		
0.300	10.1		
0.150	5.7		
0.075	4.0		

Sample Properties

Gravel (+4.75 mm):	31.1	%
Sand (+0.075 to -4.75 mm):	65.0	%
Silt and / or Clay (-0.075 mm):	4.0	%

AGGREGATE GRADATION:



Comments:

per:
Kerry Barth, AScT

This report represents a testing service only.
No engineering interpretation opinion is expressed or implied.
Engineering review and interpretation can be provided on written request.

Report of: ____________________

Grain Size Analysis

Client: Simpson Geotechnical Ltd.
Att:

Project No: 2211-80003-9
Project: 3070 Kilpatrick - Days Inn
Sample Date: 25-Nov-08
Sample By: Client
Test Date: 08-Dec-08
Tested By: AB

SAMPLE INFORMATION:

Material Type: SAND; some gravel, trace silt
Source: TP-08
Specification: N/A
Sample Location: 1.0 m
Sample No: 2

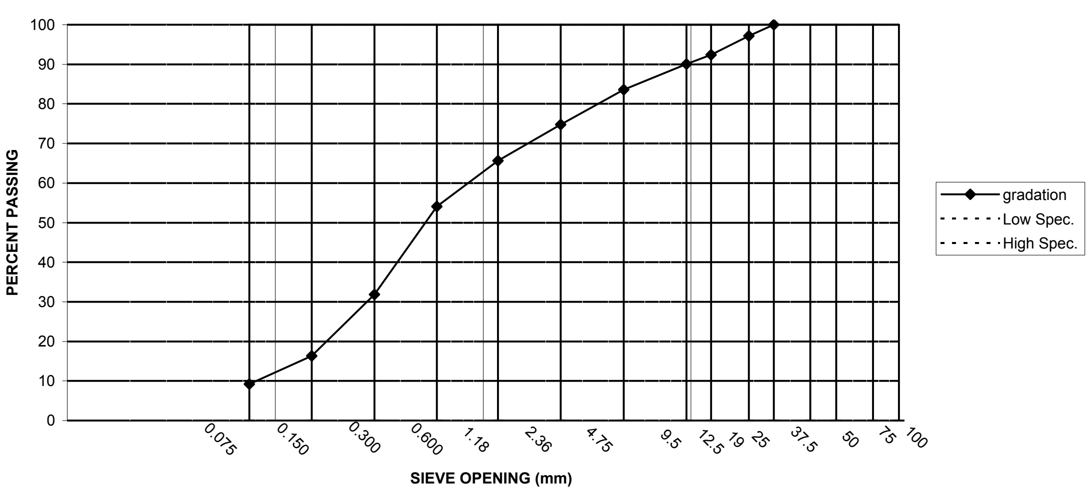
Moisture Content: 21.3%
Fracture: N/A
Washed Sieve: X
Dry Sieve:

Sieve Analysis			
Sieve (mm)	% Passing	Low Spec.	High Spec.
100.0			
75.0			
50.0			
37.5			
25.0	100.0		
19.0	97.1		
12.5	92.4		
9.50	90.0		
4.75	83.6		
2.36	74.8		
1.18	65.6		
0.600	54.1		
0.300	31.8		
0.150	16.3		
0.075	9.2		

Sample Properties

Gravel (+4.75 mm):	16.4	%
Sand (+0.075 to -4.75 mm):	74.4	%
Silt and / or Clay (-0.075 mm):	9.2	%

AGGREGATE GRADATION:



Comments: ____________________

per: ____________
Kerry Barth, AScT

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Report of: ____________________

McElhanney

Grain Size Analysis

Client: **Simpson Geotechnical Ltd.**
Att:

Project No: 2211-80003-9
Project: 3070 Kilpatrick - Days Inn
Sample Date: 25-Nov-08
Sample By: Client
Test Date: 08-Dec-08
Tested By: AB

SAMPLE INFORMATION:

Material Type: Gravelly SAND; trace silt
Source: TP-09
Specification: N/A
Sample Location: 1.1 m
Sample No: 3

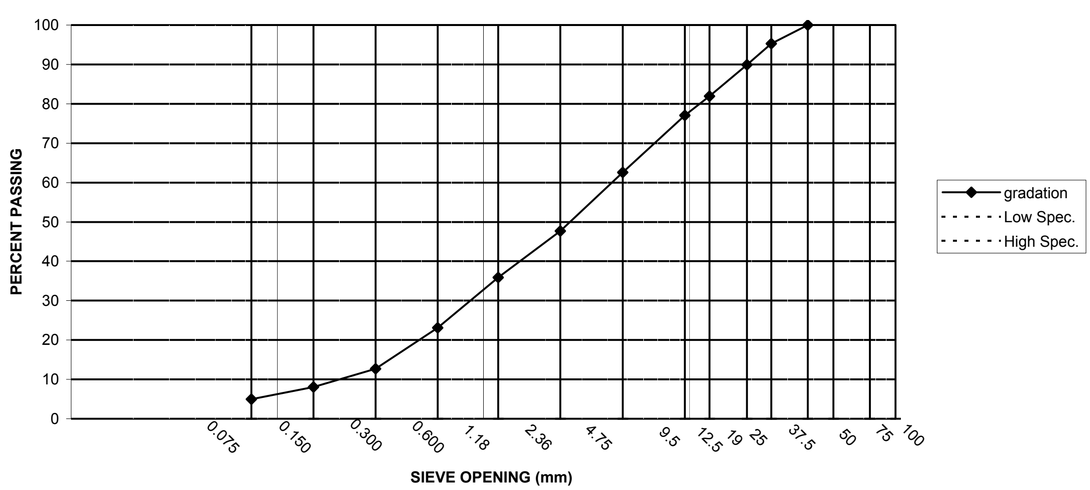
Moisture Content: 10.7%
Fracture: N/A
Washed Sieve: X
Dry Sieve:

Sieve Analysis			
Sieve (mm)	**% Passing**	**Low Spec.**	**High Spec.**
100.0			
75.0			
50.0			
37.5	100.0		
25.0	95.3		
19.0	89.9		
12.5	81.9		
9.50	77.0		
4.75	62.6		
2.36	47.7		
1.18	35.9		
0.600	23.1		
0.300	12.7		
0.150	8.0		
0.075	5.0		

Sample Properties

Gravel (+4.75 mm):	37.4	%
Sand (+0.075 to -4.75 mm):	57.6	%
Silt and / or Clay (-0.075 mm):	5.0	%

AGGREGATE GRADATION:



Comments: ____________________

per: ____________
Kerry Barth, AScT

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Report of: ____________________

McElhanney

Grain Size Analysis

Client: **Simpson Geotechnical Ltd.**
Att:

Project No: 2211-80003-9
Project: 3070 Kilpatrick - Days Inn
Sample Date: 25-Nov-08
Sample By: Client
Test Date: 08-Dec-08
Tested By: AB

SAMPLE INFORMATION:

Material Type: Silty SAND; trace gravel
Source: TP-11
Specification: N/A
Sample Location: 1.1 m
Sample No: 4

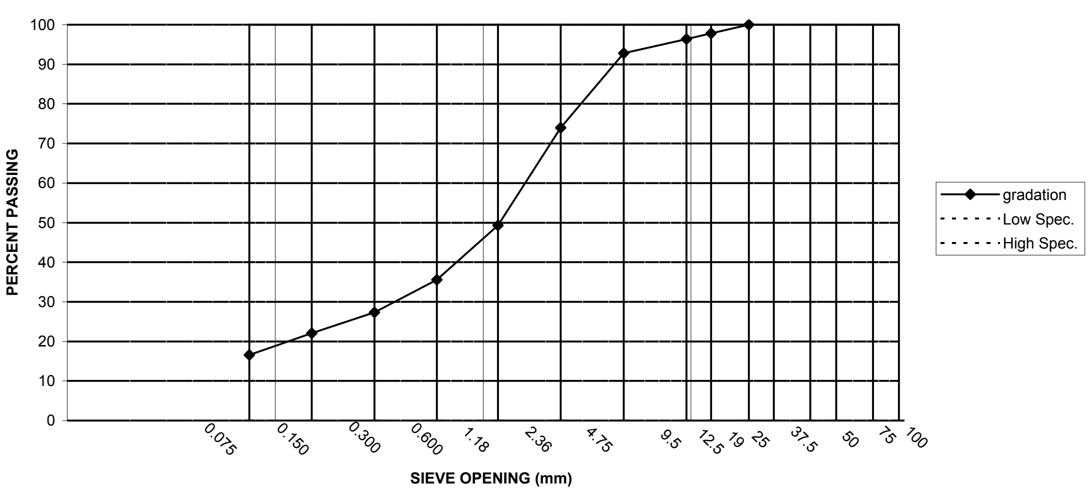
Moisture Content: 31.5%
Fracture: N/A
Washed Sieve: X
Dry Sieve:

Sieve Analysis			
Sieve (mm)	**% Passing**	**Low Spec.**	**High Spec.**
100.0			
75.0			
50.0			
37.5			
25.0			
19.0	100.0		
12.5	97.8		
9.50	96.4		
4.75	92.8		
2.36	74.0		
1.18	49.3		
0.600	35.6		
0.300	27.3		
0.150	22.0		
0.075	16.6		

Sample Properties

Gravel (+4.75 mm):	7.2	%
Sand (+0.075 to -4.75 mm):	76.3	%
Silt and / or Clay (-0.075 mm):	16.6	%

AGGREGATE GRADATION:



Comments: ____________________

per: ____________
Kerry Barth, AScT

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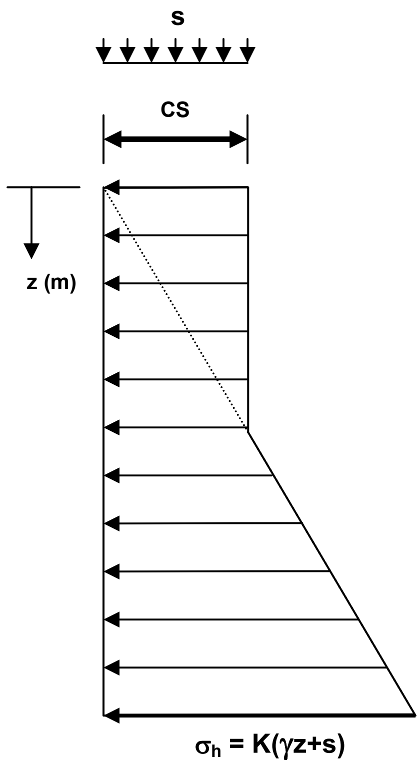
Appendix D

Lateral Earth Pressure

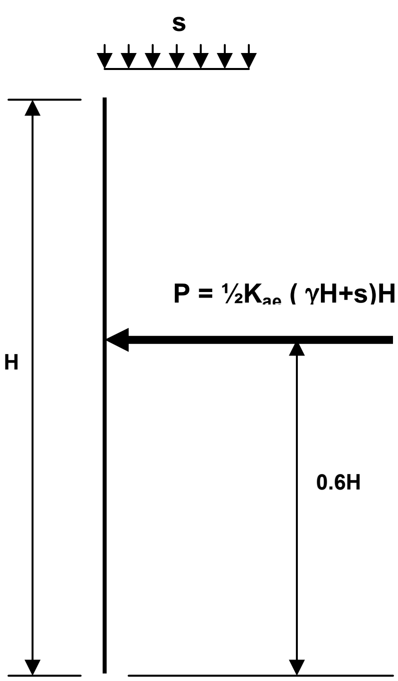
SIMPSON Geotechnical Ltd

Lateral Earth Pressure on Laterally Restrained Retaining Walls



Static Earth Pressure:

Where: s = surcharge load (kPa)
CS = compaction stress (kPa)
z = depth from ground surface
σ_h = lateral earth pressure (in kPa)
K = earth pressure coefficient
γ = unit weight of retained soil (kN/m^3)



Seismic Earth Pressure

Where: P = resultant lateral earth load *including static and seismic loads* (kN)
γ = unit weight of retained soil (kN/m^3)
K_{ae} = seismic earth pressure coefficient
H = height of wall below grade (m)
s = surcharge load (kPa)

2005 National Building Code Seismic Hazard Calculation

INFORMATION: Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Requested by: , Simpson Geotechnical Ltd. December 15, 2008

Site Coordinates: 49.6696 North 124.9777 West

User File Reference: 3070 Kilpatrick Ave, Courtenay

National Building Code ground motions:
2% probability of exceedance in 50 years (0.000404 per annum)

Sa(0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	PGA (g)
0.653	**0.484**	**0.284**	**0.157**	**0.298**

Notes. Spectral and peak hazard values are determined for firm ground (NBCC 2005 soil class C - average shear wave velocity 360-750 m/s). Median (50th percentile) values are given in units of g. 5% damped spectral acceleration (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are tabulated. Only 2 significant figures are to be used. ***These values have been interpolated from a 10 km spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the calculated values.*** Warning: You are in a region which would be affected by the ground motion from a Cascadia subduction event. The interpolator includes consideration of the deterministic ground motions from Cascadia for 0.0021, 0.001 and 0.000404 per annum probabilities, but not for 0.01 per annum.

Ground motions for other probabilities:

Probability of exceedance per annum	0.010	0.0021	0.001
Probability of exceedance in 50 years	40%	10%	5%
Sa(0.2)	0.162	0.339	0.461
Sa(0.5)	0.112	0.245	0.336
Sa(1.0)	0.061	0.138	0.194
Sa(2.0)	0.033	0.076	0.107
PGA	0.081	0.163	0.216

References

National Building Code of Canada 2005 NRCC no. 47666; sections 4.1.8, 9.20.1.2, 9.23.10.2, 9.31.6.2, and 6.2.1.3
Appendix C: Climatic Information for Building Design in Canada - table in Appendix C starting on page C-11 of Division B, volume 2

User's Guide - NBC 2005, Structural Commentaries NRCC no. 48192
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File xxxx
Fourth generation seismic hazard maps of Canada: Grid values to be used with the 2005 National Building Code of Canada (in preparation)

See the websites *www.EarthquakesCanada.ca* and *www.nationalcodes.ca* for more information

Aussi disponible en français