



GEOPACIFIC
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Indy Hundal & Rajeev Mangat
3347 141 Street
Surrey, BC
V4P 3L6

February 26, 2020
Our File #: 13593

Dear Sirs,

**Re: Geotechnical Investigation Report - Proposed Residential Development
13048, 13 Avenue, Surrey, B.C.**

1.0 INTRODUCTION

We understand that it is proposed to construct a new residential building at the above referenced property. Design drawings prepared by Christophe Vaissade Designs Inc., show the proposed development consisting of one level of above grade construction fronting 13 Avenue with 3 levels of below grade construction built into the existing slope with all 4 levels daylighting to the south. The home will be constructed on a modular block Keystone retaining wall with exposed height of up to approximately 9 m. Temporary shoring will be required to construct the retaining wall. A permanent retaining wall (pressure relief system) will be constructed on the development property adjacent to the 13 Avenue with a single row of anchors extending into the right-of-way.

This report presents the results of a geotechnical investigation at the above referenced site and presents recommendations for the design and construction of the proposed development.

This report has been prepared exclusively for Indy Hundal and Rajeev Mangat, for their use and for the use of others on their design and construction team. We also expect that the City of Surrey will use the report in the development and permitting process.

We confirm that the property may be safely used for the intended purpose as described above provided that all of the recommendations in this report are incorporated in the design and construction. Our confirmation of the safe use of the property is null and void if any geotechnical related works are completed on the property without the direction and approval of GeoPacific Consultants Ltd. We also accept no responsibility for future impacts to the development property as a result of works completed on other properties.

2.0 SITE DESCRIPTION

The property is located in South Surrey and directly to the south of 13 Avenue. The site is approximately rectangular in shape measuring approximately 20 m east-west and between 45 and 49 m north-south. Topographic survey of the property by BC Land Surveyors (File 201606) dated February 2016 indicates elevations varying from about 62 to 29 m geodetic. The property slopes down to the south moderately steeply at about 1.15H:1V to an elevation of about +47 m where grades flatten to approximately 1.5H:1V to 1.7H:1V. Grades flatten further at about elevation +34 m to 4H:1V to 2H:1V.

The existing slope is vegetated with both deciduous and coniferous trees and low lying shrubs and bushes. The City of Surrey GIS and the survey indicate the presence of a ditch within the 12B Avenue right-of-way to the south. We did not observe any specific drainage course on the development property at the time of

our investigation.

We did not observe any visual signs of slope instability on the property at the time of our review. However, reference to the City of Surrey GIS air photos extending back to 2001 indicate surficial slumps on the steepest portion of the site near 13 Avenue in 2011 and 2014. There also appears to have been a slump on the westerly neighbour's property into the development site in 2004.

The property is bordered by residential properties to the east and west. The residential homes on the neighbouring properties are set well back from the west and east property lines by approximately 21 m and 18 m, respectively. 13 Avenue is located to the north and the 12B Avenue right-of-way (undeveloped) and Burlington Northern Santa Fe (BNSF) property are located to the south of the site.

3.0 FIELD INVESTIGATION

GeoPacific conducted a site investigation on January 25 and 26, 2016. At that time, one solid stem auger test hole was advanced to a depth of 15.2 m below existing grades using an auger drill rig supplied by Uniwide Drilling of Burnaby, BC. The auger test hole was supplemented with a Dynamic Cone Penetration Test (DCPT) which consists of a 63.6 kg hammer dropped from a consistent height of 0.76 m onto a 63 mm diameter steel rod. The quantity of hammer blows per 0.3 m is recorded and may be correlated to the relative density of the soil. The DCPT data is included with the corresponding test hole log.

Two additional hand excavated test pits were completed on the slope to depths of 0.8 to 1.1 m.

The test holes were logged in the field by a technician from our office and backfilled immediately upon completion of logging. Samples were collected from the test holes for routine laboratory moisture content analyses.

The approximate locations of the test holes are shown on our Drawing 13593-01. Access to the site was significantly restricted due to the dense vegetation and relatively steep slopes.

A supplementary investigation is recommended when the contractor mobilizes to site and completes initial clearing to confirm the soil conditions at the base of the retaining wall.

4.0 SUBSURFACE CONDITIONS

4.1 Soil Conditions

The general geology of the region under investigation is identified as Vashon Sediments according to the Geological Survey of Canada (GSC) map 1484A. These soils are typically characterized by glaciofluvial, glaciomarine, and glacial till deposits, which are sometimes interbedded. Pre-glacial (Quadra) sands underlie the Vashon deposits. The GSC also identifies the area as a location of "recorded slides".

A general description of the subsurface materials encountered in our field investigation is given below. Please refer to the test hole logs located in Appendix A for specific subsurface soil descriptions.

FILL

Silty sand and gravel with some debris and organics was observed at our test hole at the north end of the property adjacent to 13 Avenue. The fill was loose and extends to depth of about 1.1 m. The fill is underlain by a thin layer of topsoil.

GLACIOMARINE (Silt & Sand)

Approximately 1.2 m of very stiff sand and silt with some gravel was observed below the fill and topsoil. The deposit was observed to be relatively dry and light brown.

This deposit was also observed in our hand excavated test pits on the slope. However, the surficial 0.3 to 0.5 m was observed to be loose and weathered.

GLACIAL TILL (Silty Sand & Gravel)

Well graded silty sand and gravel (till) was observed below a depth of 2.4 m. The till was very dense and mottled rusty brown. Moisture content range from 12.5 to 13.4% which are typical of this material.

QUADRA (Sand)

Pre-glacial fine-grained silty sand to sand with some silt was encountered below a depth of 9.1 m. The deposit was gravelly, brown, and very dense. Moisture contents ranged from 5 to 7.6%.

The individual test hole logs should be referred to for the soil conditions at each test hole location.

4.2 Groundwater Conditions

The static groundwater table could not be identified due to the low permeability of the natural soils. Experience in the area suggests the static groundwater table is deep due to the proximity to the adjacent slope. Perched groundwater is likely to be prevalent on this site during wetter periods of the year.

5.0 DISCUSSION

5.1 General Comments

The contemplated development consists of a single level of above grade construction fronting 13 Avenue and likely 3 levels of below grade construction all daylighting to the south. The new home will be constructed on a Keystone retaining wall with a maximum exposed height of about 9 m.

The natural soil conditions observed at our test holes are characteristic for the area consisting of competent glaciated and pre-glacial soils at depth.

The existing slope near 13 Avenue has experienced three surficial soil slumps in the last 15 years according to available air photos. Surficial slope failures are common on the Surrey bluffs particularly where grades are relatively steep such as the upper portion of this lot above the elevation of approximately 47 m geodetic.

These slumps typically occur due to gradual weathering of the upper 0.3 to 0.9 m of the soil profile in conjunction with common triggering mechanisms such as excess water pressure developed during heavy rains and/or vegetation die off. Deep seated failures of the glacial and pre-glacial deposits are not common and the risks of this occurrence are considered remote.

The potential location of the proposed building is within the areas of the soil slumping referenced in the previous paragraph. The slope is relatively steep at this location at about 1.15H:1V. We consider development at this location geotechnically feasible. However, the proposed foundation and site design will have to support the home and also stabilize the existing slopes such that they meet the requirements for development outlined in the “Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC” (APEGBC (now EGBC), 2010) and the City of Surrey DP2 Hazard Lands Guidelines (2014).

5.2 Foundation Design

The proposed retaining wall has been designed to stabilize the slope and provide a relatively level and large building surface for the proposed residential development on conventional strip and pad foundations. Embedment of the wall well below the slope surface elevations (near the toe) will also be required as old slide debris is likely present.

5.3. Slope Stability Analysis

Based on the existing site topography and the location of the proposed building on the slope, we have completed a mechanically stabilized earth (MSE) retaining wall design using Keystone Blocks, geogrid reinforcement, and permanent soil anchors. Details of this design (geometry, location of the retaining wall, backfill materials, geogrid design, etc.) are shown in our design drawings, included in Appendix B).

The internal stability of the MSE wall is controlled by the designed geogrid and anchored reinforcement as shown on the referenced design drawings. We have also considered the global stability of the new slope configuration considering the designed MSE wall and the proposed building loads.

We have undertaken a slope stability assessment of the property in accordance with the requirements set out in the APEGBC (now EGBC) Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in B.C (May, 2010). The location and direction of the selected section (Section A) is shown on Drawing No.: 13593-G-RW1 in Appendix B. The stability analyses were completed using the finite element computer modelling software Ressa 3.0 from Adama Engineering. Our stability assessment was completed for both static and seismic (pseudo-static) conditions.

Given the subsurface data presented in our test hole logs, we have considered the following material strength properties for the slope stability models as listed in Table 1.

Table 1: Material Properties Used in the Stability Analyses					
Type of Soil	Friction Angle (°)		Cohesion (kPa)		Unit Weight (kN/m ³)
	Static	Seismic	Static	Seismic	
Existing Fill / MSE Wall Fill	35	35	0	0	19.5
Till	40	0	100	500	21
Quadra Sand	40	40	0	0	19.5

The minimum factor of safety obtained from our static deep seated analysis is 1.8, which is satisfactory for the development.

Our seismic assessment of the slopes have been completed in accordance with the above referenced guidelines. An analysis employing a horizontal acceleration of 0.381g which represents the Peak Ground Acceleration (PGA) of the design earthquake with a return period of 1:2,475 years for firm ground conditions (obtained from NBCC 2015) was completed to simulate the seismic (pseudo-static) conditions. According to the referenced guidelines, a factor of safety of 1 or higher is considered to be acceptable for a residential development. The seismic stability analysis results presented in Appendix C yielded a minimum factor of safety of 1.2, and is therefore considered satisfactory for the development.

In the slope stability analysis, the average surcharge stress from the proposed building on top of the MSE wall platform was assumed to be 25 kPa. Once the structural drawings are available, GeoPacific will update the surcharge stresses resulting from the proposed residential building (if deemed necessary).

The soil conditions must be confirmed at the location of the base of the retaining wall to confirm the above referenced analysis results.

6.0 RECOMMENDATIONS

6.1 Site Preparation

Prior to construction of conventional strip and pad foundations, retaining walls, and grade supported slabs all materials considered to compromise the design recommendations provided herein are to be removed. These materials include, but are not limited to, vegetation, topsoil, variable fills, landslide debris (colluvium) and loose or otherwise disturbed materials. The site should be stripped just prior to construction. Surficial erosion protection would be required if any stripping is carried out in advance of construction.

The till subgrade will be sensitive to moisture and disturbance, therefore, we recommend that the site be graded to direct water to the perimeter of the excavation to sumps and pumps. The subgrade should also be covered with engineered fill or as dictated by the design for protection and to ensure efficient drainage below the building envelope is achieved.

Grade reinstatement can be achieved if required through the placement and compaction of “engineered fill”, which is defined as clean sand to sand and gravel containing silt and clay less than 5% by weight, compacted in 300 mm loose lifts to a minimum of 95% Modified Proctor maximum dry density at a moisture content that is within 2% of optimum for compaction.

Groundwater encountered during construction can be expected to vary seasonally. Any groundwater encountered should be controlled as part of the site preparation work. We expect that the groundwater encountered during construction may be controlled using conventional techniques, such as trenching and pumps and sumps.

Storage of temporary fills above the retaining wall during or after construction is not permitted.

The geotechnical engineer shall be contacted for the review of stripping and engineered fill placement and

compaction.

6.2 Foundations

We anticipate that spread foundations would be placed on engineered fill. Footings bearing on engineered fill can be designed based on an SLS bearing pressure of 100 kPa. Factored ultimate limit state (ULS) bearing pressures, for transient loads such as those induced by wind and earthquakes, may be taken as 1.5 x the SLS bearing pressures provided above.

We estimate for foundations designed as recommended, settlements will not exceed 25 mm total and 2 mm per metre differential.

Irrespective of the allowable bearing pressures given, 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.

Foundation subgrades must be inspected by the geotechnical engineer prior to footing construction.

6.3 Seismic Design of Foundations

This site qualifies as “Site Class C” as defined in Table 4.1.8.4.A of the 2018 British Columbia Building Code (BCBC).

The soils on-site are not considered liquefiable during the 2018 BCBC design earthquake.

6.4 Floor Slabs

Floor slabs-on-grade should be underlain by a minimum of 150 mm of a free draining granular material, such as 19 mm clear crushed gravel, compacted to a minimum of 95% Modified Proctor Maximum dry density at a moisture content within 2% of optimum for compaction. General grade reinstatement or backfill beneath slab on grade areas should be done with engineered fill, as described in Section 6.1. The under slab fill should be hydraulically connected to the perimeter drainage system to facilitate the removal of any water which accumulates under the slab.

Compaction of the slab-on-grade fill must be reviewed by the geotechnical engineer.

6.5 Site & Foundation Drainage

The home will include foundation walls partially backfilled on the east and west side, with permanently retained slope to the north and daylighting structure to the south. The Keystone wall will be excavated, and installed, into the existing slope.

A perimeter drainage system is recommended for the project as the proposed structures will be submerged below grade. All drains should be hydraulically connected to the under slab and retaining wall drainage blanket fill to ensure that water pressures cannot develop on the foundation walls, beneath the slab, or within the backfill of the retaining wall. Perimeter drainage should be pumped to City facilities on 13 Avenue, or discharged to the base of the ravine below with the permission of the City of Surrey and BNSF railway. A

bottom of ravine drainage design should be detailed by GeoPacific if this is the desired drainage option.

We recommend that all exterior finished grades as well as hard surfaces, such as roofs, patios or slabs, are graded such that all water runoff is directed away from the retaining wall and into catch basins. Runoff should be discharged to the site's storm water disposal system.

6.6 Temporary Excavations and Shoring

Temporary excavations should be sloped where possible since it is more economical to do so. Slopes cut to a 1 vertical to 1 horizontal can be constructed in the existing surficial fill, granular and till-like deposits. Slopes are to be covered with poly sheeting for protection against erosion induced instability.

Shoring will be required to temporarily support the excavation during construction of the retaining wall and home, which is shown on our design drawings provided in Appendix B. Some shoring will also be required on the west and east elevations. Vertical cuts may be supported with the use of a conventional shotcrete membrane tied back with pre-tensioned soil anchors or where the excavation is sufficiently shallow with the use of soldier piles. Installation and decommissioning of the shoring system must be reviewed by GeoPacific.

Permanent shoring is also proposed between the north foundation wall and 13 Avenue where existing slopes are moderately steep at about 1.1H:1V. The retaining wall system will consist of steel soldier piles with shotcrete lagging on the development property with a single row of permanent ground anchors extending into the 13 Avenue right-of-way.

Some excavation induced ground movements are unavoidable, irrespective of the shoring method used. We expect movements at the perimeter of the excavation to be in the order of 10 to 15 mm at the excavation face.

Zones of cohesionless soils may also be encountered throughout the glacial till. Hollow core "IBO" anchors will be required in this instance.

Cobbles and boulders should be expected to be encountered within the glacial till. Where large boulders are encountered splitting will likely be required to facilitate their removal. Blasting is not recommended given the soil conditions and grades of the surrounding lands.

Temporary cut slopes in excess of 1.2 m in height must be covered in poly sheeting and require inspection by a professional engineer in accordance with Work Safe B.C. guidelines.

GeoPacific will provide an excavation design under a separate cover once the development design is finalized.

6.7 Lateral 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 recommend that the foundation walls be designed to resist the following lateral earth pressures:

Static: Triangular soil pressure distribution of $5.2H$ kPa, where H is equal to the total wall height in metres.

Seismic: Inverted triangular soil pressure distribution of $4H$ kPa, where H is equal to the total wall height in metres. This seismic pressure is based on full height construction to 13 Avenue. A deeper excavation or sloped excavation may impact this value.

The preceding loading recommendations assume a clean, free draining sand and gravel backfill behind the foundation walls. Assuming that a perimeter drainage system will be employed no hydrostatic pressures will develop. For the proposed condition at the north foundation wall with the permanent shoring of the existing slope, there will be no lateral earth pressure.

The geotechnical engineer should be contacted for the review of all backfill materials and procedures.

6.8 Landscaping

Vegetation plays an important role in increasing the stability of the slope and protecting it against shallow instabilities. The vegetation lowers water infiltration rates into the surficial soils and adds cohesion through their root systems. It is recommended that the slope's vegetative cover surrounding the retaining wall not be disturbed. Where the slope becomes denuded of vegetation due to minor sloughing or erosion, repairs must be undertaken to re-establish the vegetation.

The addition of large trees to the slope is not recommended as the increased weight would be far more detrimental than any benefit gained by the presence of the root structure.

It is not recommended to dispose of any debris and/or organic waste down the slopes. The debris increases the loading on the slope while also reducing the drainage capacity of the soil. This can potentially lead to slope stability problems.

We understand that the City of Surrey is not supportive of underground irrigation systems on these properties unless a fail-safe valve is incorporated into the design to prevent uncontrolled discharge of water in the event of a break in an irrigation pipes. Fail-safe discharge valve products that are acceptable to the City should be reviewed with them.

We recommend that any denuded portion of slope be re-vegetated with the assistance of an experienced landscaper or slope bio-remediation expert to limit erosion.

6.9 “No-Disturbance” and “Maintenance Access” Zones

Based on the review of the environmental report, prepared by Envirowest on February 4, 2019, we understand that the southern side of the site to about 20 m from the north property line (see the highlighted area on the site plan, included in Appendix B – Drawing No: 13593-G-RW1) is considered as “no-disturbance” zone and/or “maintenance access” zone. We confirm that no construction machinery should encroach into this zone.

7.0 DESIGN REVIEWS AND CONSTRUCTION INSPECTIONS

The preceding sections make recommendations for the design and construction of the proposed residential homes. We have recommended the review of certain aspects of the design and construction. It is important that these reviews are carried out to ensure that our intentions have been adequately communicated. It is also important that any contractors working on the site review this document prior to commencing their

work.

It is the responsibility of the contractors working on-site to inform GeoPacific a minimum of 48 hours in advance that a field review is required. In summary, reviews are required by geotechnical engineer for the following portions of the work.

- | | |
|-------------------------|---|
| 1. Stripping | Review of site stripping. |
| 2. Excavation & Shoring | Review of temporary cut slopes and shoring construction and anchor testing. |
| 3. Retaining Wall | Review of the Keystone wall construction |
| 4. Foundation | Review of foundation subgrade. |
| 5. Slab on-grade | Review of subgrade and under slab fill materials and compaction. |
| 6. Backfill | Review of backfill materials and compaction against foundation walls. |

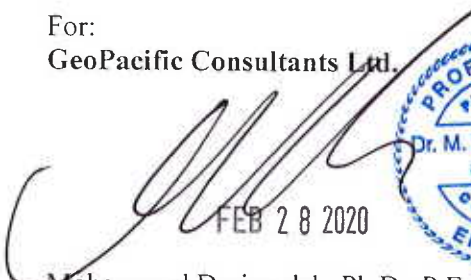
8.0 CLOSURE

Revisions to these recommendations may be required subject to the completion of a supplementary geotechnical investigation of the property.

Please do not hesitate to call the undersigned if you should require any clarification or additional details

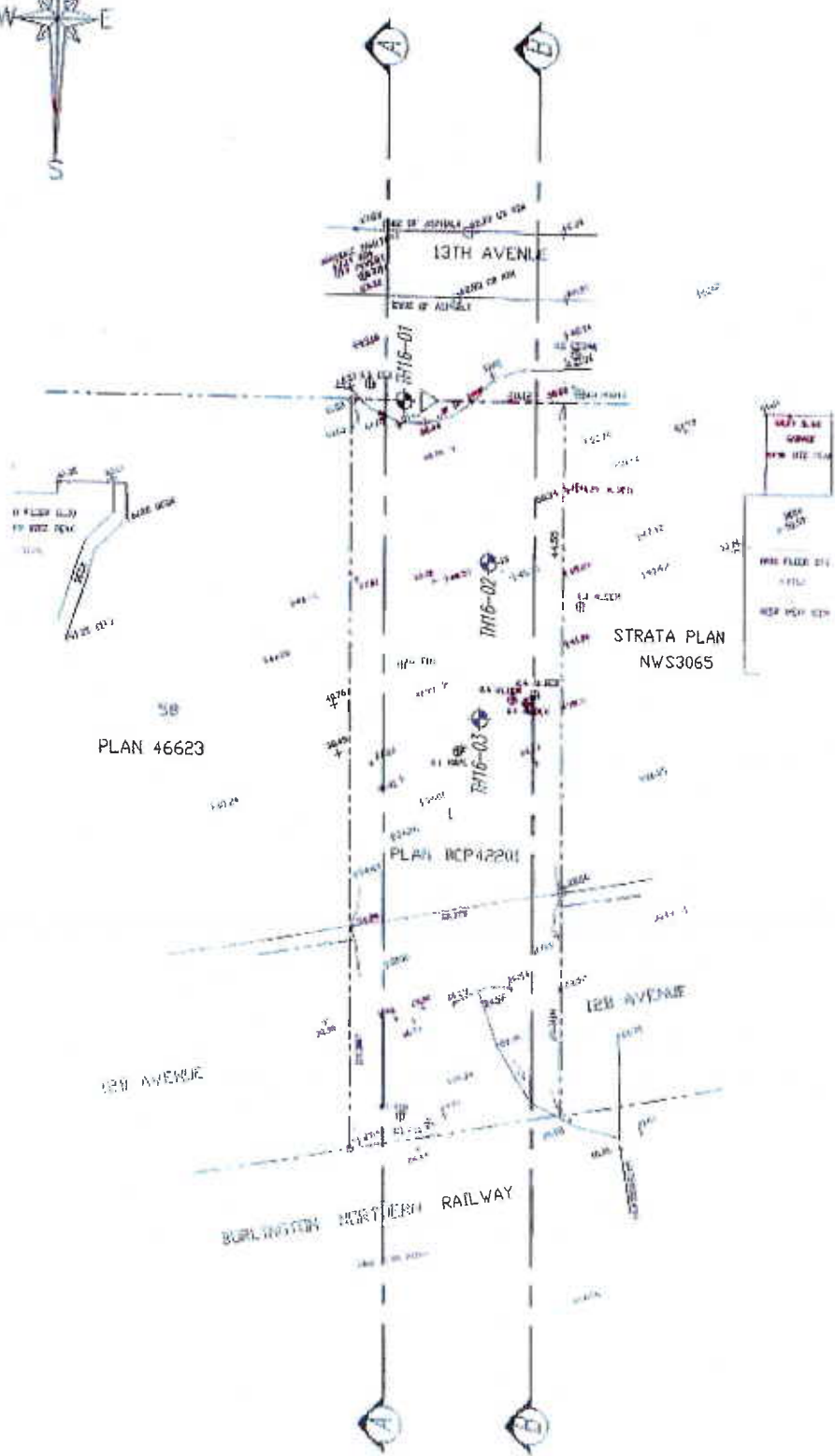
For:
GeoPacific Consultants Ltd.

Reviewed By:


FEB 28 2020

Mohammad Deriszadeh, Ph.D., P.Eng.
Project Manager

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



PLAN 46623

STRATA PLAN
NWS3065

REFERENCE

B.C. LAND SURVEYORS
FILE: 201606
FEBRUARY 2016

940551-3d

FILE NO. 13593

QMG HQ. 13593-01

RESIDENTIAL HOME
13048 13TH AVENUE, SURREY, B.C.
SLOPE ANALYSIS PLAN

SITE PLAN
SCALE: 1:600

FEBRUARY 2, 2016

APPROVED BY: JGC
REVIEWED BY: JGC

11785

0.000000

DATE: BY:

SCALE

15-226-1000 3rd Ave.
Spartanburg, SC 29304

1-800-235-5022
1-800-235-1100

GEOPACIFIC
FARMER'S SAFETY SALVAT



DATE REC'D BY:

 R116-f - TEST HOLE (TH) LOCATION
 DCPY - DYNAMIC CONE PENETRATION TEST (DCPT) LOCATION
 HOLE LOCATIONS ARE APPROXIMATE

100

APPENDIX A
TEST HOLE LOGS AND LOCATIONS

Test Hole Log: TH16-1

File: 13593

Project: Proposed Residential Home

Client: David Nunn

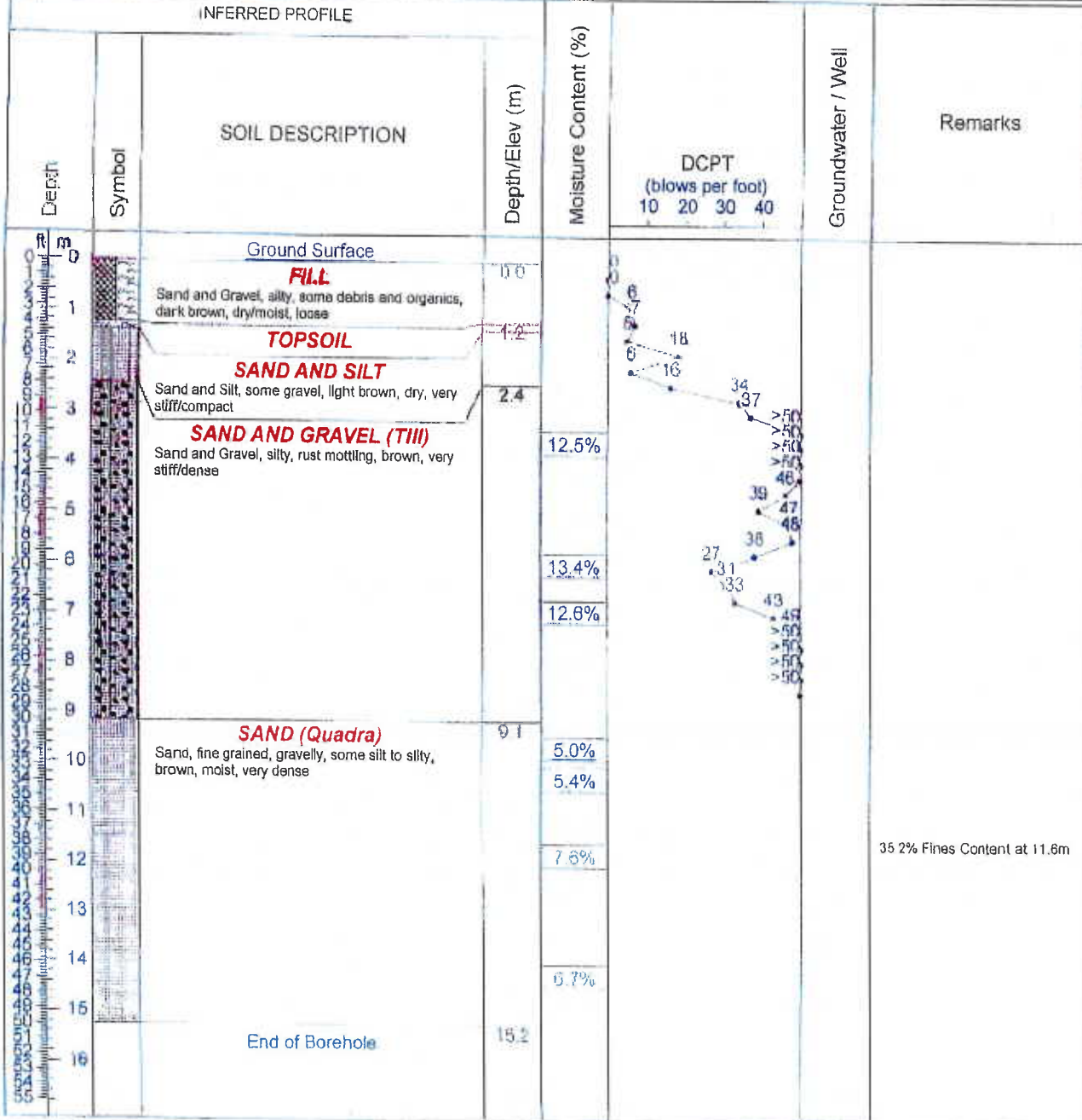
Location: 13048 - 13th Avenue, Surrey, B.C.



GEOPACIFIC
CONSULTANTS

215 - 1200 West 73rd Avenue, Vancouver, BC, V6P 6G6
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE



Logged: MA

Method: Track Mounted Solid Stem Auger (Uniwide)

Date: January 25, 2016

Datum: Ground Surface

Figure Number: A.1

Page: 1 of 1

Test Hole Log: TH16-2

File: 13593

Project: Proposed Residential Home

Client: David Nunn

Location: 13048 - 13th Avenue, Surrey, B.C.



GEOPACIFIC
CONSULTANTS

215 - 1200 West 73rd Avenue, Vancouver, BC, V6P 8G5
Tel: 604-439-0922 Fax: 604-439-9189

INFERRED PROFILE

Depth m / m	Symbol	SOIL DESCRIPTION	Depth/Elev (m)	Moisture Content (%)	DCPT (blows per foot)				Groundwater / Well	Remarks
					10	20	30	40		
0		Ground Surface	0.0							
1		SAND AND SILT Sand and Silt, some gravel, brown, moist/wet, loose								
2		At 0.5m - Moist, Compact to dense		22.2%						
3		Refusal of auger at 1.1m		16.0%						
4		End of Borehole	1.1							
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

Logged: MA

Method: Hand Auger

Date: January 26, 2016

Datum: Ground Surface

Figure Number: A.2

Page: 1 of 1

Test Hole Log: TH16-3

File: 13593

Project: Proposed Residential Home

Client: David Nunn

Location: 13048 - 13th Avenue, Surrey, B.C.



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/Elev (m)				
0.0		Ground Surface	0.0				
0.0		SAND AND SILT Sand and Silt, some gravel, brown, moist/wet, loose	0.0				
0.3		At 0.3m - Compact to dense					
0.8		Refusal of auger at 0.8m	0.8				
0.8		End of Borehole	0.8				
1.0							
1.5							
2.0							
2.5							
3.0							
3.5							
4.0							
4.5							
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12.0							
12.5							
13.0							
13.5							
14.0							
14.5							
15.0							

Logged: MA

Method: Hand Auger

Date: January 26, 2016

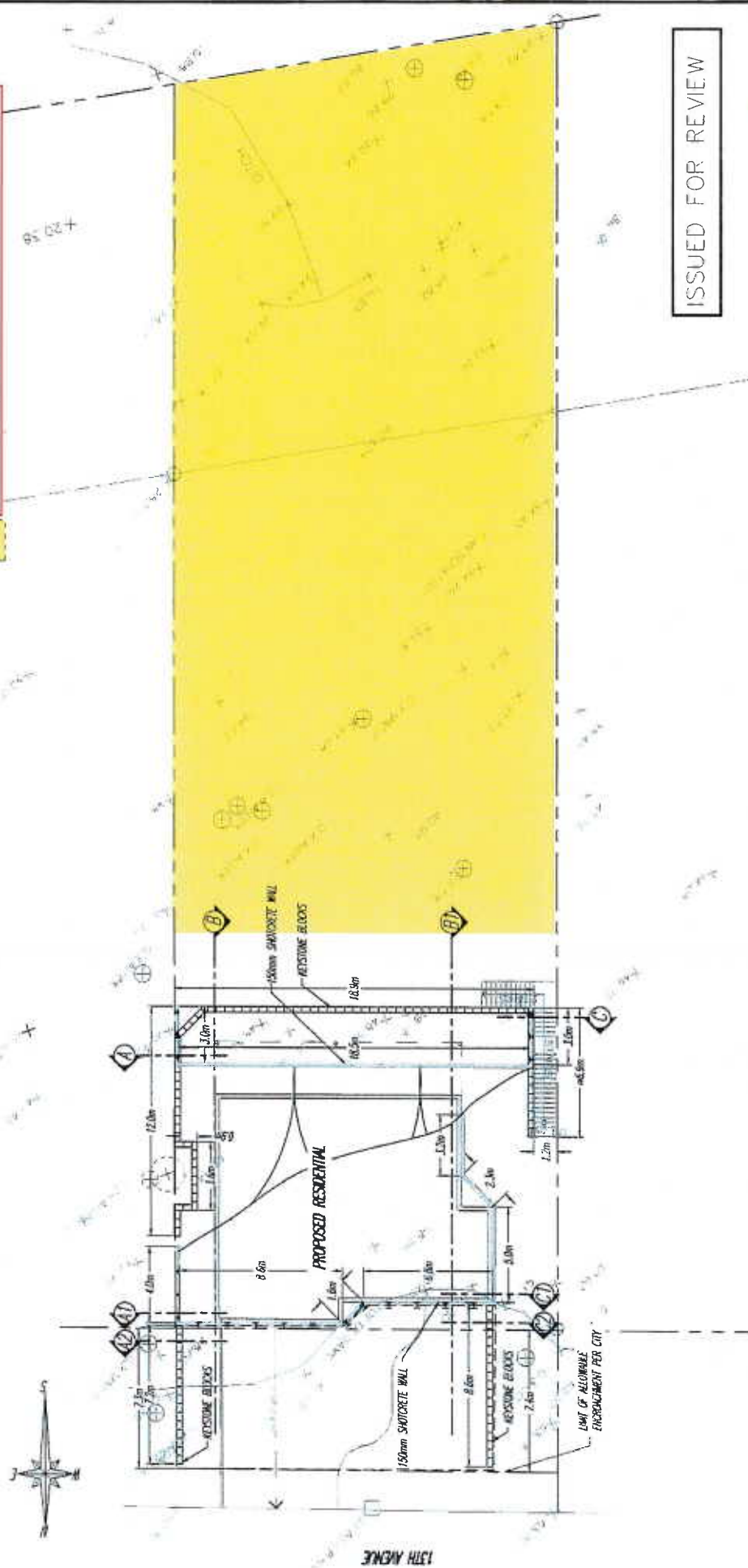
Datum: Ground Surface

Figure Number: A.3

Page: 1 of 1

APPENDIX B
KEYSTONE RETAINING WALL & SHORING DESIGN

No-disturbance/maintenance access zone (no-go zones)



ISSUED FOR REVIEW

SITE PLAN
SCALE = 1:200

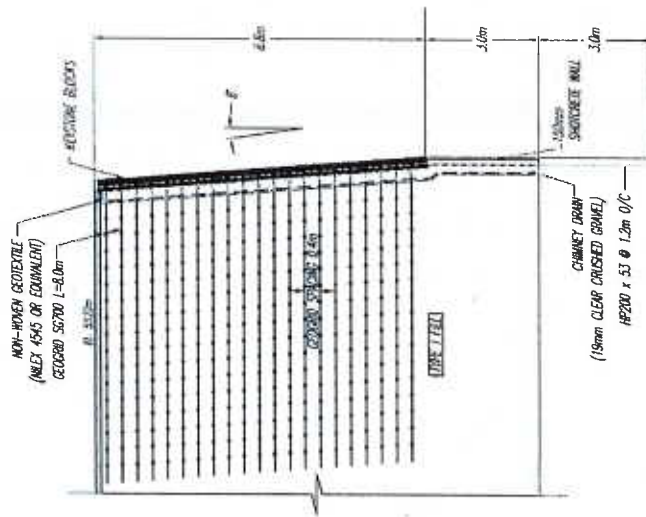
LEGEND:
--- EXISTING GRADE

[Signature]
PROFESSIONAL
DR. M. SCHREIBER
P. ENG. B.C.
JUN 18 2019

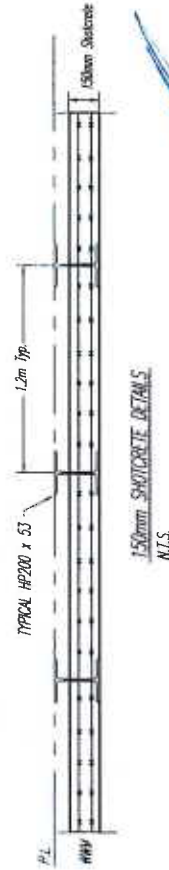
 GEOPACIFIC LANDSCAPE ARCHITECTS	PROJECT INFORMATION Surrey, B.C. V4A 4B4 PROJECT ADDRESS 13048 13th Avenue	AUGUST 31, 2016			RESIDENTIAL HOME 13048 13TH AVENUE, SURREY, B.C. ALAN BLOCK - SITE PLAN	13583	MONDAY 1, 2017 SEPTEMBER 14, 2018 MAY 14, 2019
		C.I.	R.E.	A.L.			
		AS SHOWN					



 GEOPACIFIC INCORPORATED Geopacific Inc. 1200-101 1100 101 Street Suite 100 Vancouver, BC V6E 2K6 Tel: 604.681.1100 Fax: 604.681.1101 Email: info@geopacific.com	AUGUST 31, 2016			RESIDENTIAL HOME 13048 13TH AVENUE, SURREY, B.C. EXCAVATION - EAST ELEVATION	13593	NOVEMBER 1, 2017		
	C.T.					P.L.	R.L.	SEPTEMBER 14, 2018
	AS SHOWN							MAY 14, 2019



SECTION A
SCALE = 1:125



150mm SHOTCRETE DETAILS
N.T.S.



AUGUST 31, 2016

C.I. K.E. A.S.

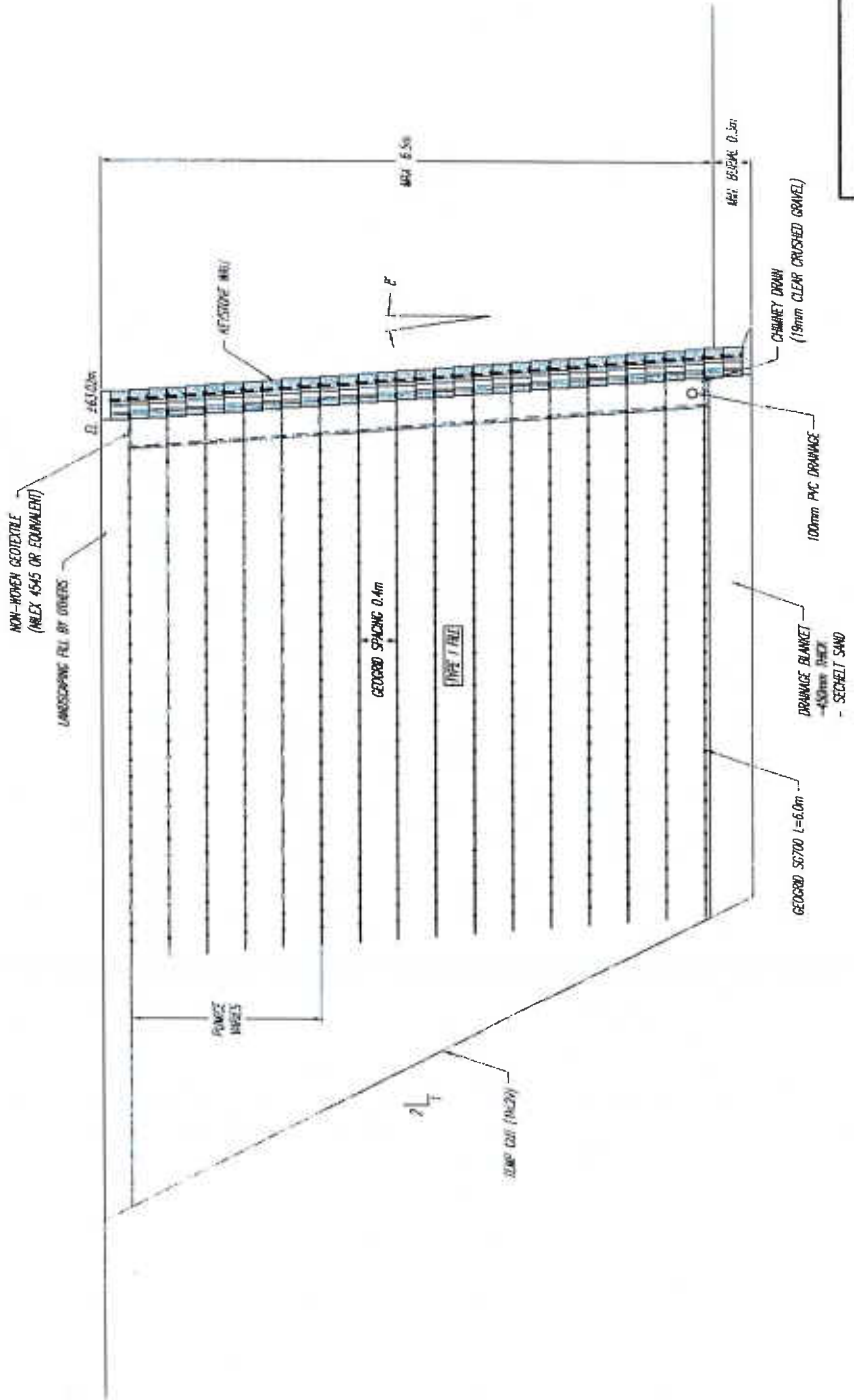
RESIDENTIAL HOME
13440 15TH AVENUE, SURREY, B.C.
EXCAVATION - SECTION A & A1

13593

C-FINISH

NOVEMBER 1, 2017
JUNE 17, 2019 - GEORDB TYPE AND LENGTH





SECTION A2
SCALE = 1:30

STANDARD PLAN



 GEOPACIFIC CONSULTANTS	AUGUST 31, 2016			RESIDENTIAL HOME 13048 13TH AVENUE, SURREY, B.C. EXCAVATION - SECTION A2	13593 G-RWZC	NOVEMBER 1, 2017 JUNE 17, 2019 - GEOTEXTILE TYPE AND LENGTH
	C.I.	A.E.	P.L.			

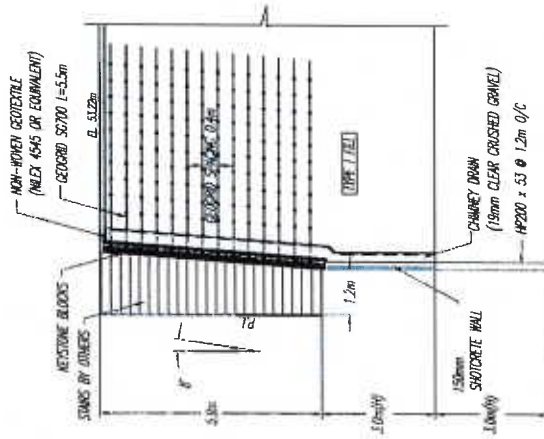


JUN 18 2019



JUN 18 2019

 GEOPACIFIC LAND & CONSTRUCTION			13593		NOVEMBER 1, 2017
	RESIDENTIAL HOME		13048 13TH AVENUE, SURREY, B.C.		SEPTEMBER 14, 2018
	EXCAVATION - SECTION B1		C-ENRSC		JUNE 17, 2019 - GEORED TYPE
	AS SHOWN				



SECTION C
SCALE = 1:125

ISSUED FOR PERVIEW

[Signature]

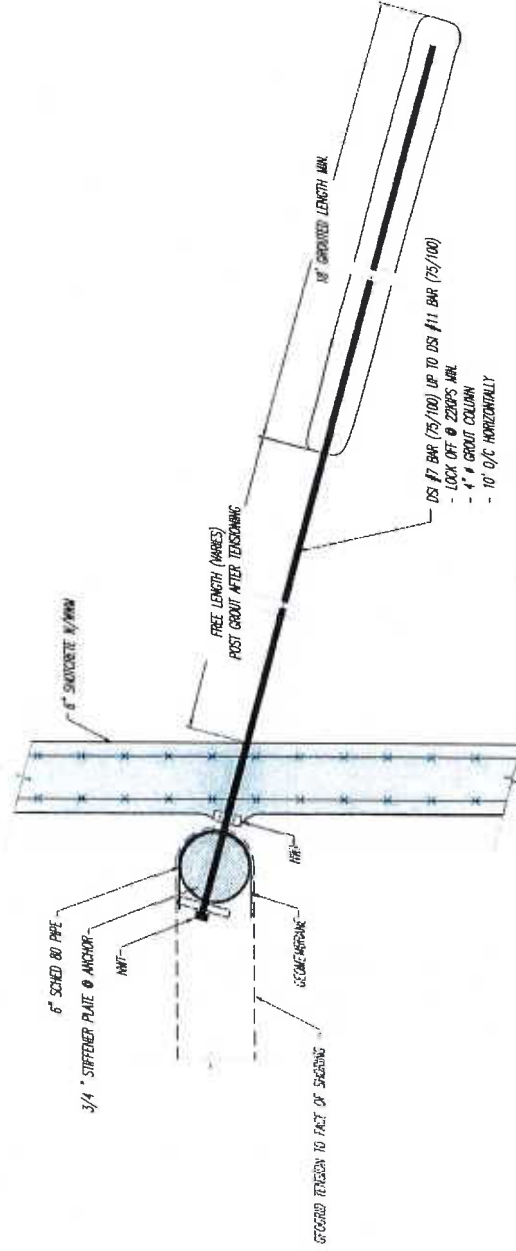


 GEO PACIFIC Geotechnical Engineering & Construction	AUGUST 31, 2016			RESIDENTIAL HOME 13048 13TH AVENUE, SURREY, B.C. EXCAVATION - SECTION C	13593	NOVEMBER 1, 2017 JUNE 17, 2019 - GEOTEXTILE TYPE AND LENGTH
	C.I.	K.B.	K.E.			
	AS SHOWN				G-RWAB	



JUN 18 2019

 GEOPACIFIC INCORPORATED	NO. 100-10100, SUITE 100, VANCOUVER, BC V6P 6G6 TEL: 604-271-8888 FAX: 604-271-8889 WWW.GEOPACIFIC.COM			AUGUST 31, 2016		RESIDENTIAL HOME 13048 13TH AVENUE, SURREY, B.C. EXCAVATION - SECTION C1 & C2	13593 G-RWAC	NOVEMBER 1, 2017 JUNE 17, 2019 - GEORBD TYPE
	C.I.	E.B.	A.B.	AS SHOWN				



ANCHOR DETAIL
R.I.S

ISSUED FOR R.I.S



GEOPACIFIC

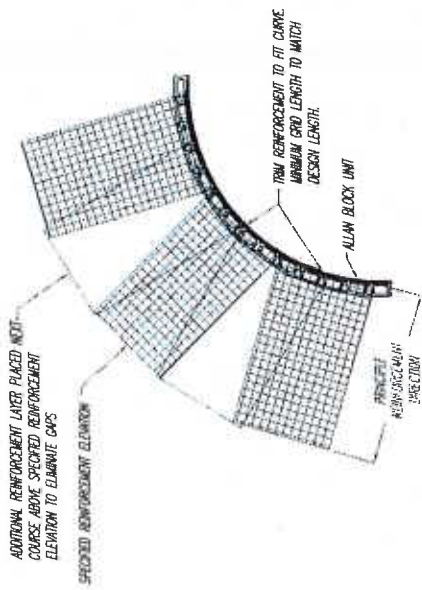
August 31, 2016
C.I. N.B. K.B.
AS SHOWN

RESIDENTIAL HOME
13048 15TH AVENUE, SURREY, B.C.
EXCAVATION - ANCHOR DETAIL

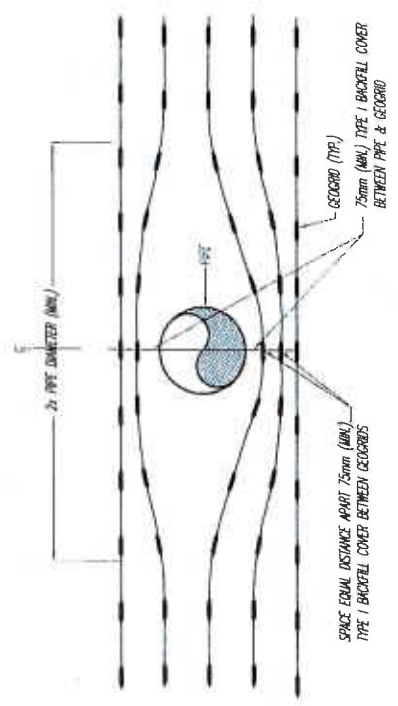
13593
G-RMS

NOVEMBER 1, 2017

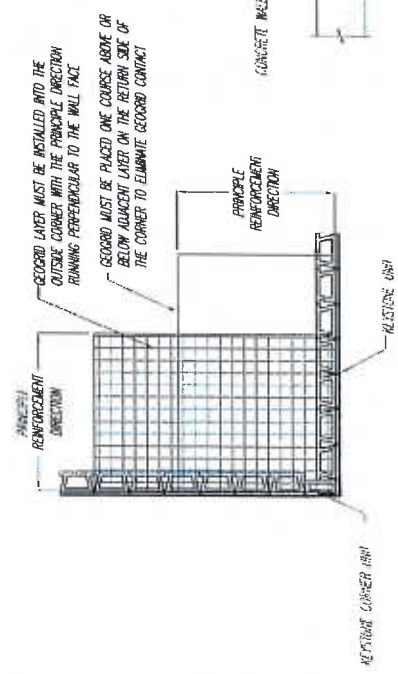
[Signature]
PROFESSIONAL ENGINEER
D.M. DEFREZAR
#43123
JUN 18 2019



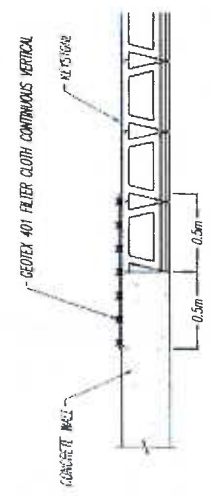
GEOTEXTILE REINFORCEMENT ON CURVES
A1.5



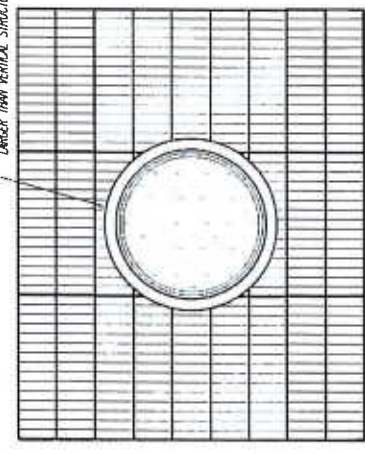
GEOTEXTILE PLACEMENT AT PIPE
A1.5



GEOTEXTILE PLACEMENT AT CORNERS
A1.5



KEYSTONE BLOCK - CONCRETE WALL TIE IN
A1.5



GEOTEXTILE PLACEMENT FOR VERTICAL STRUCTURES
A1.5



 GEOPACIFIC LANDSCAPE ARCHITECTS	NOVEMBER 1, 2017 E.T. J.S.C. J.S.C. J.S.C. AS SHOWN	RESIDENTIAL HOME 13048 13TH AVENUE, SURREY, B.C. KEYSTONE WALL - DETAILS	13593 G-RW6	JUN 18 2019

PART 1 – GENERAL

- 1.01: In these Notes, the Engineer is Geopacific Consultants Ltd.
- 1.02: These Notes must be read in conjunction with DWG G-RW1 to G-RW4C.
- 1.03: The work described and shown involves the supply and installation of geogrid reinforced retaining walls with KEYSTONE WALL (8' batter), or approved equivalent.
- 1.04: It is the Contractor's responsibility to verify all dimensions and report discrepancies to the Engineer.

PART 2 – MATERIALS

- 2.01: KEYSTONE WALL – The proposed retaining walls have been designed on the basis of KEYSTONE WALL units with a wall batter of 8' from vertical. Alternative methods of support system will require redesign of the walls by the Engineer and may not be substituted without written authorization from the Engineer.
- 2.02: GEODRDO – The walls have been designed on the basis of Stratagrad SC700 with a long term design strength of 91.8 kN/m. Alternative geogrid will require redesign of the walls by the Engineer and may not be substituted without written authorization from the Engineer.
- 2.03: LEVELING PAD – The leveling pad shall consist of 19 mm diameter minus, clean sand and crushed gravel or 19mm clear crush gravel. The contractor shall provide samples and/or sieve analyses of the fill to the Engineer prior to use.
- 2.04: UNIT AND DRAINAGE FILL – The drainage layer shall consist of 19 mm diameter, clear crushed gravel. The contractor shall provide samples and/or sieve analysis of the fill to the Engineer prior to use. Unit shall be filled with gravel in the upper 3 courses where a handrail is to be installed. Removal of existing unit fill will be required of the top course of the existing wall, where posts are to be installed.
- 2.05: TYPE 1 FILL (REINFORCED & RETAINED BACKFILL) – TYPE 1 FILL shall consist of clean sand, 19mm minus crushed gravel and containing less than 5% of fines content by weight. Material samples or sieve analysis results shall be provided to the Engineer for approval.
- 2.06: FOUNDATION SUBGRADE – Existing compact gravel fill / or ensured fill (TYPE 1 FILL) with a Serviceability Limit States (SLS) bearing capacity of at least 100 kPa. Fill compaction requirements are specified in Note 3.15.

PART 3 – EXECUTION

- 3.01: Existing fill (Compact sand) / or ensured fill (TYPE 1 FILL) (Retained Soils as shown on DWG G-RW2A TO G-RW4C) shall be sloped at a maximum angle of 1:1 (V:H). Temporary slopes should be covered in poly sheeting for duration of work. Temporary slopes should not encroach beyond a 1:1 (V:H) projection taken from the edge of any adjacent sidewalks. Excavations may need to proceed in controlled panels to sequentially construct the wall and avoid excavation induced damage to the existing sidewalk.
- 3.02: The Contractor shall excavate to the lines and grades shown on the latest landscape architectural drawings. The Engineer will inspect stripping and approve subgrade prior to placement of any fill materials. Where blocks are to be added to the existing upper tier of the KEYSTONE WALL, the existing concrete caps shall be removed and, where handrail posts are to be installed, gravel within 0.3m of the existing top of wall elevation shall be removed. Contractor shall installed lamp-posts prior to the placement of the retained TYPE 1 FILL.
- 3.03: Over-excavation of unsuitable soils, as directed by the Engineer will be replaced with TYPE 1 FILL as defined above. Compaction of fill is required, as specified in Note 3.15.
- 3.04: The leveling pad shall be placed over the approved subgrade prior to placement of the first course of KEYSTONE WALL units. The leveling pad shall be compacted in place, as specified in Note 3.15.
- 3.05: The first course of blocks shall be placed on the approved subgrade/leveling pad and alignment and level checked.

- 3.06: KEYSTONE units should be assembled as per manufacturer instruction manuals and guidelines. All Keystone units should be filled with 15 MPa (Min.) concrete. In addition, 15M steel threaded bars with a minimum yield strength of 500 MPa should be vertically installed inside the Keystone units at a maximum horizontal spacing of 500 mm. Steel bars should have a minimum vertical overlap of 300 mm.

- 3.07: Placement of geogrid reinforcement and compaction of TYPE 1 FILL shall be completed at each facing unit prior to proceeding with the next fill.
- 3.08: TYPE 1 FILL shall be placed and compacted within the extension of the required backfill area as shown on G-RW2A TO G-RW4C.
- 3.09: The geogrid reinforcement shall be placed at the elevations and to the extent shown on the DWG G-RW2 or as directed by the Engineer.
- 3.10: Where geogrid reinforcement is required, the geogrid reinforcement shall be extended near the face of the KEYSTONE WALL units as per the manufacturer's instructions.

- 3.11: The geogrid shall be laid horizontally in its machine direction perpendicular to the face of the retaining wall. The geogrid shall be pulled taut, free of wrinkles and anchored prior to backfill placement on the geogrid.

- 3.12: The geogrid reinforcement shall be continuous (COVERAGE RATIO = 100 %) throughout their embedment lengths. Spliced connections between shorter pieces of geogrid are not permitted.

- 3.13: TYPE 1 FILL shall be placed, spread and compacted in such a manner that minimizes the development of stock in the geogrid reinforcement.

- 3.14: TYPE 1 FILL shall be placed and compacted in lifts not to exceed 200 mm where hand compaction equipment is used and not more than 300 mm where heavy compaction equipment is used.

- 3.15: TYPE 1 FILL shall be compacted to 85% of the maximum density as determined by ASTM D698 (Standard Proctor) or equivalent. The moisture content of the backfill materials prior to and during compaction shall be uniformly distributed throughout each layer and shall be within 2% of the optimum moisture content for compaction.

- 3.16: Only lightweight hand-operated equipment shall be allowed within 0.75 meters of the front face of the facing blocks.

- 3.17: Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 150 mm is required prior to operation of tracked vehicles over the geogrid reinforcement. Tracked vehicles should not turn while within the geogrid zone to prevent tracks from displacing the fill and geogrid or damage the geogrid or cause stock to result in the geogrid reinforcement.

- 3.18: Rubber tired equipment may pass over the geogrid reinforcement at slow speeds less than 10 kph. Sudden braking and sharp turning shall be avoided.

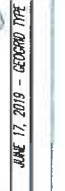
- 3.19: At the end of each day of operation, the Contractor shall slope the last lift of reinforced backfill away from the facing units to direct runoff away from the wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

PART 4 – VEGETATION

- 4.01: Vegetation within 2 metres of the top of the wall shall consist of only grass and/or small to medium sized bushes and shrubs. The planting of trees in these areas is not permitted due to the potential future damage that may be inflicted on the wall as the trees grow in size.

PART 5 – REVIEWS

- 5.01: The Contractor shall notify Geopacific a minimum of 48 hours in advance of the commencement of the following aspects of the work:
1. Site stripping and foundation subgrade
 2. Placement of the initial course of the facing blocks
 3. Placement of the initial course of the geogrid reinforcement

 GEOPACIFIC CONSULTANTS LTD.										
	C.T.	J.C.C.	J.G.C.	J.G.S.	J.G.C.	J.G.C.	J.G.C.	J.G.C.	C-RW7	JUN 18 2019

SHORING CONSTRUCTION NOTES:

1.0 GENERAL

- 1.1 In these Notes, the Engineer is Geopacific Consultants Ltd.
- 1.2 ALL WORK AND METHODOLOGIES USED MUST COMPLY WITH THE REQUIREMENTS OF THE WORKERS SAFE BE CURRENT "OCCUPATIONAL HEALTH AND SAFETY REGULATIONS".
- 1.3 THE CONTRACTOR UNDERTAKING THESE WORKS SHALL BE EXPERIENCED IN THE TYPE OF WORK DESCRIBED HEREIN.
- 1.4 THE CONTRACTOR MUST NOTIFY GEOPACIFIC AT LEAST 1 WEEK PRIOR TO COMMENCING EXCAVATION. ALL WORKERS IN EVERY PROCEEDING STAGE OF THE SHORING DESIGN MUST BE ACCEPTED BY GEOPACIFIC PRIOR TO SUBSEQUENT EXCAVATION STAGES.
- 1.5 THE CONTRACTOR SHALL CONFIRM THE LOCATIONS AND CONDITION OF ALL EXISTING IMPROVEMENTS, INCLUDING SERVICES AND UTILITIES, WHICH MAY BE IMPACTED BY THE SHORING CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO ENSURE EXISTING IMPROVEMENTS ARE NOT DAMAGED.
- 1.6 THE SHORING DESIGN WAS BASED ON AVAILABLE SURVEY INFORMATION AND DRAWINGS PROVIDED. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY ALL DIMENSIONS AND REPORT DISCREPANCIES TO THE ENGINEER.
- 1.7 THE LAYOUT OF THE SHORING WALL IS TO BE BASED ON ARCHITECTURAL DRAWINGS.
- 1.8 ALL TEMPORARY EXCAVATION SLOPES SHALL BE COVERED WITH POLYETHYLENE SHEETING SECURED AS REQUIRED.
- 1.9 THE CONTRACTOR SHALL ERECT AND MAINTAIN A SECURE CLOSED HEARDING AROUND THE SITE FOR THE SAFETY OF ALL PERSONS IN THE VICINITY OF THE WORK SITE AS REQUIRED.
- 1.10 THE CONTRACTOR SHALL INSPECT THE SLOPES AND SHORING DAILY AND REPORT ANY SIGNIFICANT MOVEMENT AND OR DETERIORATION OF THE SHORING AND/OR GROUND CONDITIONS IMMEDIATELY TO GEOPACIFIC AT 1-604-439-0022.
- 1.11 ALL APPLICABLE SHOOTORTE WORK SHALL BE IN GENERAL ACCORDANCE WITH AIO 506-R-5 "GUIDE TO SHOOTORTE".
- 1.12 ALL NOZZLEDAEN MUST BE AIO CERTIFIED. THE SHOOTORTE CONTRACTOR IS TO SUPPLY CERTIFICATION OF NOZZLEDAEN PRIOR TO STARTING WORK.

2.0 SHOOTORTE PILE

- 2.1 MATERIALS
 - 2.1.1 THE PILES SHALL CONSIST OF HP200 x 53 GRADE 300M WALL CERTIFICATES SHALL BE PROVIDED FROM THE STEEL SUPPLIER.
- 2.2 PLACEMENT
 - 2.2.1 PLACEMENT TOLERANCE AT TOP OF PILE SHALL BE 25mm, EXCEPT WHERE ADJACENT TO PROPERTY LINES, ENCROACHMENT BEYOND THE PL IS NOT PERMITTED.
 - 2.2.2 INCLINATION TOLERANCE SHALL BE 1%.
 - 2.2.3 TOP OF PILE TO BE DETERMINED BASED ON FINAL GRADES.
 - 2.2.4 DEPTH OF PILES SHALL BE TO THE ELEVATION SHOWN ON THE DRAWINGS.
- 2.3 QUALITY CONTROL
 - 2.3.1 PILES SHALL BE INSTALLED USING A GUIDE.
 - 2.3.2 INCLINATION OF PILE CASING TO BE VERIFIED BY CONTRACTOR MINIMUM EVERY 3m DURING INSTALLATION.
 - 2.3.3 CONCRETE MIX DESIGN TO BE PROVIDED PRIOR TO STARTING WORK.
 - 2.3.4 CONCRETE MIX DESIGN TO BE PROVIDED PRIOR TO STARTING WORK IF SUPPLIER CHANGED.
 - 2.3.5 THE AIR CONTENT SHALL BE DETERMINED IN ACCORDANCE WITH EITHER CSA A23.2-AC OR CSA A23.2-70 AT THE TRUCK AND ONCE PLACED IN THE SEGMENT PILES. THE CONCRETE USED FOR DETERMINATION OF AIR CONTENT SHALL BE DISCARDED.
 - 2.3.6 THE TEMPERATURE OF THE GROUND, AIR AND MIX SHALL BE RECORDED.
 - 2.3.7 THE AIR CONTENT OF THE CONCRETE SHALL BE BROUGHT UP TO THE SPECIFIED RANGE BY THE CONCRETE SUPPLIER, BY THE ADDITION OF AN AIR-ENTRAPPING AGENT IN THE FIELD IF NECESSARY. WORKING SHALL FOLLOW TO ENSURE PROPER DISPERSION.
- 2.4 QUALITY ASSURANCE
 - 2.4.1 STRENGTH TESTING SHALL BE DAILY FOR 7 DAYS THEN WEEKLY THEREAFTER OR MORE FREQUENTLY FOLLOWING REVIEW OF TEST RESULTS BY GEOPACIFIC.
 - 2.4.2 2 TEST CYLINDERS SHALL BE BROKEN AT 24 HRS, 7 DAYS, AND 28 DAYS (HOWEVER, FOR THE FIRST WEEK AN ADDITIONAL 2 CYLINDERS SHALL BE BROKEN AT 2 DAYS TO ASSESS STRENGTH AGAIN).
 - 2.4.3 STRENGTH TEST CYLINDERS SHALL BE MOULDED AND CURED IN ACCORDANCE WITH CSA A23.2-30.

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JUN 18 2019

 GEOPACIFIC CONSULTANTS LTD.	NOVEMBER 1, 2017 <table><tr><td>C.T.</td><td>J.C.C.</td><td>J.C.C.</td></tr></table> AS SHOWN	C.T.	J.C.C.	J.C.C.	GENERAL NOTES	13593	
		C.T.	J.C.C.	J.C.C.			
		G-RWB (SHEET 1 OF 2)					

3.0 TEMPORARY SHOTCRETE WALL

- 3.1 MATERIALS
- 3.1.1 ANCHORS BAR SIZE SHALL BE SIZED AS DESCRIBED ON THE DESIGN DRAWINGS.
- 3.1.2 GROUT SHALL BE NON-SHANK AND HAVE A MINIMUM COMPRESSIVE STRENGTH OF 10 MPa IN 24 HOURS, 21 MPa IN 3 DAYS AND 40 MPa IN 28 DAYS. GROUT BAR SHOULD BE REVIEWED BY GEOPACIFIC PRIOR TO USE.
- 3.1.3 WELDED WIRE MESH SHALL BE AS SHOWN ON THE DESIGN DRAWINGS WITH MINIMUM YIELD STRENGTH OF 450 MPa AND SHALL CONFORM TO CSA C30.5.
- 3.1.4 THE CONCRETE MIX DESIGN FOR TEMPORARY SHOTCRETE SHALL MEET THE FOLLOWING REQUIREMENTS:
 - A. 35 MPa IN 28 DAYS; 21 MPa IN 2 DAYS AND MIN 10 MPa IN 24 HRS.
 - B. F1 EXPOSURE CLASS.
 - C. TYPE 10 OR 30 CEMENT.
 - D. MAXIMUM NOMINAL AGGREGATE SIZE OF 20 mm.
 - E. MAXIMUM WATER/CEMENT RATIO OF 0.5.
 - F. AIR ENTRAINMENT OF 5 TO 8%.
 - G. CEMENT MATERIALS TO BE USED CAN BE: MS, M20, LH, HS OR ISO.
 - H. AGGREGATE SHALL BE NORMAL-DENSITY, FINE AND COARSE, AND SHALL MEET THE REQUIREMENTS OF CLAUSES 4.2.3.3, 4.2.3.4, 4.2.3.5 AND 4.2.3.9 OF CSA 23.1-04.

3.2 ANCHOR INSTALLATION

- 3.2.1 THE ANCHORS SHALL BE INSTALLED IN A MINIMUM 100 mm DIAMETER BOND ZONE IN HOLES WHICH ARE FREE OF DEBRIS. CENTRALIZERS SHALL BE USED TO ENSURE THAT THE ANCHOR BAR IS CENTERED IN THE HOLE.
- 3.2.2 ANCHORS SHALL BE INSTALLED PERPENDICULAR TO THE SHORING WALL FACE WITHIN A TOLERANCE OF 2.5 DEGREES OF THE DECLINATION SHOWN ON THE DRAWINGS OR AS APPROVED BY THE ENGINEER.
- 3.2.3 GROUT SHALL BE INTRODUCED INTO THE ANCHORED ZONE USING AN INJECT ANCHOR SYSTEM (IAS). THE CONTRACTOR IS TO ENSURE THAT GROUNDWATER AND DEBRIS IS FLOUSED FROM THE HOLE. A BOND BREAKER APPROVED BY THE ENGINEER MUST BE USED.

- 3.2.4 ALL ANCHOR TESTING IS TO BE CARRIED OUT AS DESCRIBED IN THE PAST TENSING INSTITUTE "RECOMMENDATIONS FOR PRESTRESSED ROCK AND SOIL ANCHORS"

- 3.2.5 ALL ANCHORS SHALL BE SUBJECTED TO AN MICROBIAL PROOF LOAD OF 1.33 TIMES THE DESIGN LOAD AND HELD FOR A MINIMUM OF TEN MINUTES. THE ELASTIC DEFORMATION AND CREEP OF THE ANCHOR WILL BE ASSESSED BY GEOPACIFIC. IF THE ANCHOR PERFORMANCE DOES NOT MEET THE DESIGN REQUIREMENTS THE ANCHOR MAY BE DOWNGRADED, REJECTED OR SUBJECTED TO A PERFORMANCE TEST.

- 3.2.6 A MINIMUM OF 2% OF ALL ANCHORS MUST BE SUBJECTED TO PERFORMANCE TESTING. THE NEED FOR FURTHER PERFORMANCE TESTS WILL BE MADE BASED ON THE OUTCOME OF THE PROOF TESTS AT THE DISCRETION OF GEOPACIFIC.

- 3.2.7 THE SHORING CONTRACTOR IS RESPONSIBLE FOR SUPPLYING ALL LABOUR, ANCHOR TESTING EQUIPMENT, DIM. GAUGES, AND STANDS IS REQUIRED TO COMPLETE THE REQUIRED TESTS.

- 3.2.8 ANCHORS WHICH DO NOT MEET THE DESIGN REQUIREMENTS WILL NOT BE ACCEPTED AND WILL BE REPLACED AT THE CONTRACTOR'S EXPENSE.

- 3.2.9 A DAILY RECORD OF PRODUCTION INFORMATION IS TO BE RECORDED BY THE CONTRACTOR. THE INFORMATION IS TO INCLUDE ANCHOR ID, INSTALLATION DATE, INSTALLATION LENGTH, FREE LENGTH, TEST DATE, TEST LOAD, AND LOCK-OFF LOAD AND IS TO BE SUPPLIED TO GEOPACIFIC AT THE END OF THE PRODUCTION DAY.

3.3 SHOTCRETE PLACEMENT

- 3.3.1 CONCRETE SHALL BE KEPT FROM FREEZING, BEING EXPOSED TO ABNORMALLY HIGH TEMPERATURES, PREMATURE DRYING AND MOISTURE LOSS FOR A PERIOD OF TIME NECESSARY TO ACHIEVE 70% OF THE SPECIFIED 24 HOUR STRENGTH.

- 3.3.2 CONCRETE SHALL NOT BE PLACED ON SURFACES WHICH WILL LOWER THE CONCRETE TEMPERATURE BELOW 10 DEGREES CENTIGRADE EXCEPT WHEN ACCELERATORS ARE USED IN ACCORDANCE WITH CLAUSE 7.4.2.5.1 OF CSA 23.1-04 AND AO 300R.

- 3.3.3 IF IT IS FORECAST THAT THE AIR TEMPERATURE WILL DROP BELOW 5 DEGREES CENTIGRADE WITHIN 24 HRS. OF SHOTCRETE APPLICATION, ALL EQUIPMENT NEEDED FOR ADEQUATE PROTECTION AND CURING SHALL BE ON HAND AND READY FOR USE BEFORE CONCRETE PLACEMENT HAS STARTED. METHODS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF CLAUSE 7.4.2.5.1 OF CSA 23.1-04.

- 3.3.4 THE ANCHORS AND SHOTCRETE SHALL BE INSTALLED IN SEQUENCE AND STAGES TO MAINTAIN THE STABILITY OF THE EXCAVATION. STAGES SHALL NOT EXCEED THE HEIGHT SHOWN ON THE DESIGN DRAWINGS.

- 3.3.5 THE EXCAVATION AND CONSTRUCTION SEQUENCE IS AS FOLLOWS:

A. THE PROCEDURE SHALL NOT LEAVE ANY VERTICAL CUTS EXPOSED OVERNIGHT UNLESS SUPPORTED BY A SHOTCRETE AND ANCHORS (WITH ANCHOR NOT HAND TIGHTENED OR TENSIONED) OR SUPPORTED BY A SOIL BERM.

B. WELDED WIRE MESH MUST BE OVERLAPPED BY A MINIMUM 2 SQUARES IN ALL DIRECTIONS.

- 3.3.6 50mm DRAINAGE HOLES MUST BE PROVIDED IN THE SHOTCRETE A MINIMUM OF EVERY 3m HORIZONTAL AND 1.5m VERTICAL. MORE DRAINS MAY BE REQUIRED BY THE ENGINEER SUBJECT TO THE ACTUAL CONDITIONS ENCOUNTERED.

3.4 QUALITY CONTROL

- 3.4.1 THE AIR CONTENT SHALL BE DETERMINED IN ACCORDANCE WITH EITHER CSA 423.2-40 OR CSA 423.2-10 AT THE NOZZLE AND ONCE PLACED ON THE WALL, THE CONCRETE USED FOR DETERMINATION OF AIR CONTENT SHALL BE DISCARDED.

- 3.4.2 THE TEMPERATURE OF THE GROUT, AIR AND MIX SHALL BE RECORDED.

- 3.4.3 THE AIR CONTENT OF THE CONCRETE SHALL BE BROUGHT UP TO THE SPECIFIED RANGE BY THE CONCRETE SUPPLIER, BY THE ADDITION OF AN AIR-ENTRAINING AGENT IN THE FIELD, IF NECESSARY. MIXING SHALL FOLLOW TO ENSURE PROPER DISPERSION.

- 3.4.4 REINFORCEMENT PLACED IN PANELS IS TO BE REVIEWED BY GEOPACIFIC PRIOR TO PLACEMENT OF SHOTCRETE.

3.5 QUALITY ASSURANCE

- 3.5.1 2 TEST CYLINDERS SHALL BE BROKEN AT 24 HRS, 7 DAYS AND 28 DAYS.

- 3.5.2 STRENGTH TEST CYLINDERS SHALL BE MOULDED AND CURED IN ACCORDANCE WITH CSA 423.2-30.

DRAWING LIST

SITE PLANS----- G-RH1
ELEVATIONS, SECTIONS----- G-RH2A G-RH2B G-RH2C G-RH2A G-RH2B G-RH2C
SECTIONAL DETAIL----- G-RH3A G-RH3B G-RH3C
KEYSTONE WALL DETAIL & SPECIFICATION----- G-RH4 G-RH5
SHOTCRETE GENERAL NOTES----- G-RH6 (SHEET 1 TO 2)

NOVEMBER 1, 2017	6.1	40C	40C
	AS SHOWN		



GENERAL NOTES

1.3593
G-RH6 (SHEET 2 OF 2)



APPENDIX C
SLOPE STABILITY ANALYSIS

STATIC ANALYSIS

Residential Home on Slope

Report created by ReSSA(3.0): Update #4.21: Copyright (c) 2001-2016, ADAMA Engineering, Inc.

PROJECT IDENTIFICATION

Title: Residential Home on Slope
Project Number: 13593 -
Client: Indy Hundal & Rajeev Mangat
Designer: JGC

Description:

Company's information:

Name: GeoPacific Consultants Ltd.
Street: 1779 West 75 Avenue
Vancouver, BC V6P 6P2
Telephone #: 604-439-0922
Fax #: 604-439-9189
E-Mail:

Original file path and name: J:\Jobs\13 ic Analysis - Feb 2020\13593_Full Slope_Static.MSE
Original date and time of creating this file: Tue Nov 21 13:14:00 2017

PROGRAM MODE: Analysis of a General Slope using GEOSYNTHETIC as reinforcing material.

INPUT DATA (EXCLUDING REINFORCEMENT LAYOUT)

SOIL DATA

Soil Layer #:	Unit weight, γ [kN/m ³]	Internal angle of friction, ϕ [deg.]	Cohesion, c [kPa]
1.....Existing Surficial Soil/Fill.....	19.5	35.0	0.0
2.....Till.....	21.0	40.0	100.0
3.....Quadra.....	19.5	40.0	0.0

REINFORCEMENT

Reinforcement Type #	Geosynthetic Designated Name	Ultimate Strength, Tult [kN/m]	Reduction Factor for Installation Damage, RFid	Reduction Factor for Durability, RFd	Reduction Factor for Creep, RFc	Additional Reduction Factor, RFa	Coverage Ratio, Rc
1	SG700	172.20	1.20	1.10	1.41	1.00	0.90

Interaction Parameters		== Direct Sliding ==		==== Pullout ====	
Type #	Geosynthetic Designated Name	Cds-phi	Cds-c	Ci	Alpha
1	SG700	0.80	0.00	0.80	0.80

Relative Orientation of Reinforcement Force, ROR = 0.00. Assigned Factor of Safety to resist pullout, Fs-po = 1.50

Design method for Global Stability: Comprehensive Bishop.

WATER

Unit weight of water = 9.81 [kN/m³]

Water pressure is defined by phreatic surface in Effective Stress Analysis.

SEISMICITY

Not Applicable

- Problem geometry is defined along sections selected by user at x,y coordinates.
- X1,Y1 represents the coordinates of soil surface. X2,Y2 represent the coordinates of the end of soil layer 1 and start of soil layer 2, and so on.
- Xw,Yw represents the coordinates of phreatic surface.

Soil profile contains 3 layers (see details in next page)

Phreatic line was specified.

Load Q1 = 25.00 [kPa] inclined from verical at 0.00 degrees, starts at X1s = 31.00 and ends at X1e = 43.00 [m].

Surcharge load, Q2 None

Surcharge load, Q3 None

```

.....None.....

```



0 2 4 6[m]

RESULTS OF ROTATIONAL STABILITY ANALYSIS

Results in the tables below represent critical circles identified between specified points on entry and exit. (Theta-exit set to 50.00 deg.)
The most critical circle is obtained from a search considering all the combinations of input entry and exit points.

Critical circles for each entry point (considering all specified exit points)									
Entry Point #	Entry Point (X, Y) [m]		Exit Point (X, Y) [m]		Critical Circle (Xc, Yc, R) [m]			Fs	STATUS
1	32.00	33.20	-26.35	0.07	-6.81	33.62	38.82	2.48	
2	34.14	33.20	-26.29	0.04	-5.70	34.16	39.85	2.43	
3	36.27	33.20	-26.58	0.25	-3.81	33.23	40.08	2.32	
4	38.41	33.20	-26.63	0.27	-3.42	35.12	41.87	2.12	
5	40.55	33.20	-22.58	0.14	-4.36	42.16	45.80	2.07	
6	42.68	33.20	-22.56	0.14	-2.72	41.90	46.23	2.04	
7	44.82	42.50	-26.55	0.18	-3.52	42.69	48.35	2.01	
8	46.96	42.50	-26.50	0.14	-3.89	45.79	50.95	1.95	
9	49.10	42.50	-26.46	0.11	-3.76	48.18	53.16	1.90	
10	51.23	42.50	-26.41	0.08	-4.24	51.77	56.25	1.86	
11	53.37	42.50	-26.36	0.05	-4.83	55.72	59.68	1.82	
12	55.51	42.50	-26.31	0.03	-5.54	60.06	63.52	1.80	
13	57.64	42.50	-26.26	0.01	-6.39	64.86	67.83	1.78	
14	59.78	42.50	-34.56	0.13	-11.33	74.62	78.03	1.77	OK
15	61.92	42.50	-34.45	0.09	-10.68	76.77	80.27	1.78	
16	64.05	42.50	-34.34	0.06	-10.01	78.94	82.54	1.79	
17	66.19	42.50	-34.15	0.00	-9.34	81.13	84.84	1.81	
18	68.33	42.50	-30.68	0.15	-5.95	79.25	82.88	1.83	
19	70.46	42.50	-30.61	0.13	-5.28	81.45	85.17	1.85	
20	72.60	42.50	-30.54	0.11	-4.60	83.67	87.50	1.87	

Note: In the 'Status' column, OK means the critical circle was identified within the specified search domain. 'On extreme X-entry' means that the critical result is on the edge of the search domain; a lower Fs may result if the search domain is expanded.

Results in the tables below represent critical circles identified between specified points on entry and exit. (Theta-exit set to 50.00 deg.)
The most critical circle is obtained from a search considering all the combinations of input entry and exit points.

Critical circles for each exit point (considering all specified entry points).									
Exit Point #	Exit Point (X, Y) [m]		Entry Point (X, Y) [m]		Critical Circle (Xc, Yc, R) [m]			Fs	STATUS
1	-50.31	0.07	64.05	42.50	-26.41	110.98	113.46	1.93	
2	-46.41	0.09	59.78	42.50	-23.61	97.14	99.70	1.90	
3	-42.52	0.11	59.78	42.50	-19.71	89.70	92.45	1.83	
4	-38.47	0.10	59.78	42.50	-14.97	80.69	83.94	1.81	
5	-34.56	0.13	59.78	42.50	-11.33	74.62	78.03	1.77	OK
6	-30.58	0.16	59.78	42.50	-4.82	62.78	67.71	1.79	
7	-26.26	0.01	57.64	42.50	-6.39	64.86	67.83	1.78	
8	-22.37	0.03	57.64	42.50	-5.09	64.08	66.34	1.79	
9	-18.64	0.89	57.64	42.50	-3.67	64.18	65.03	1.82	
10	-14.76	2.81	57.64	42.50	-0.49	62.66	61.53	1.87	
11	-10.62	4.62	59.78	42.50	-4.05	76.77	72.45	1.90	
12	-6.69	6.52	59.78	42.50	0.54	72.55	66.43	1.91	
13	-2.86	8.42	59.78	42.50	4.07	70.30	62.27	1.93	
14	1.24	10.32	57.64	42.50	10.29	59.98	50.48	1.95	
15	5.14	12.23	57.64	42.50	14.23	57.14	45.82	1.98	
16	9.13	14.12	57.64	42.50	17.50	55.47	42.19	2.03	
17	12.93	16.06	57.64	42.50	21.77	52.14	37.15	2.13	
18	16.93	17.97	57.64	42.50	26.20	48.63	32.03	2.31	
19	21.23	19.74	59.78	42.50	25.79	56.04	36.58	2.55	
20	24.89	21.07	59.78	42.50	30.15	51.62	31.00	2.77	

Note: In the 'Status' column, OK means the critical circle was identified within the specified search domain. 'On extreme X-exit' means that the critical result is on the edge of the search domain; a lower Fs may result if the search domain is expanded.

SEISMIC ANALYSIS

Residential Home on Slope

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PROJECT IDENTIFICATION

Title: Residential Home on Slope
Project Number: 13593 -
Client: Indy Hundal & Ranjeev Mangat
Designer: JGC

Description:

Company's information:

Name: GeoPacific Consultants Ltd.
Street: 1779 West 75 Avenue
Vancouver, BC V6P 6P2
Telephone #: 604-439-0922
Fax #: 604-439-9189
E-Mail:

Original file path and name: J:\Jobs\13 c Analysis - Feb 2020\13593_Full Slope_Seismic.MSE
Original date and time of creating this file: Tue Nov 21 13:31:46 2017

PROGRAM MODE: Analysis of a General Slope using GEOSYNTHETIC as reinforcing material.

Soil profile contains 3 layers. Coordinates in [m.]
 Water was described by phreatic line. Y values are tabulated in the right most column.
 (phreatic)

#	X	Y1	Y2	Y3	Yw
1	-20.10	0.00	-3.00	-9.00	-1.00
2	-20.00	0.00	-3.00	-9.00	-0.98
3	12.50	15.51	12.68	7.46	4.90
4	22.50	20.28	17.50	12.52	7.86
5	24.00	21.00	21.00	13.28	8.31
6	27.00	21.00	21.00	14.80	9.20
7	27.40	28.63	21.02	15.00	9.31
8	27.64	33.20	21.04	15.10	9.39
9	30.60	33.20	21.20	16.36	10.26
10	32.67	33.20	28.50	17.25	10.88
11	37.14	33.20	30.75	19.15	12.20
12	42.00	33.20	33.20	23.54	13.64
13	43.60	33.20	33.20	24.98	14.11
14	43.70	42.50	34.90	25.07	14.14
15	44.00	42.50	40.00	25.34	14.23
16	44.90	42.50	40.00	26.15	14.50
17	47.50	42.50	40.00	28.50	14.52
18	54.40	42.50	40.00	34.60	14.59
19	100.00	42.50	40.00	33.20	15.00

Results in the tables below represent critical circles identified between specified points on entry and exit. (Theta-exit set to 50.00 deg.) The most critical circle is obtained from a search considering all the combinations of input entry and exit points.

Critical circles for each entry point (considering all specified exit points)									
Entry Point #	Entry Point (X, Y) [m]		Exit Point (X, Y) [m]		Critical Circle (Xc, Yc, R) [m]			Fs	STATUS
1	32.00	33.20	-50.03	0.03	-16.38	34.82	48.40	1.81	OK
2	34.79	33.20	-46.04	0.00	-12.56	33.48	47.35	1.97	
3	37.58	33.20	-46.04	0.01	-11.74	35.52	49.37	1.88	
4	40.37	33.20	-46.05	0.01	-10.92	37.65	51.49	1.81	
5	43.16	33.20	-50.49	0.59	-9.59	33.91	52.75	1.61	
6	45.95	42.50	-46.05	0.01	-10.50	43.88	56.47	1.83	
7	48.74	42.50	-26.48	0.15	-1.23	43.28	49.98	1.67	
8	51.53	42.50	-26.27	0.03	0.22	44.00	51.33	1.52	
9	54.32	42.50	-26.32	0.06	0.68	46.59	53.80	1.39	
10	57.11	42.50	-26.29	0.04	0.58	50.40	57.08	1.32	
11	59.90	42.50	-26.23	0.00	0.98	53.38	59.91	1.30	
12	62.68	42.50	-30.44	0.10	-3.85	65.18	70.29	1.30	
13	65.47	42.50	-30.63	0.17	-3.64	69.15	74.07	1.28	
14	68.26	42.50	-30.68	0.18	-3.47	73.39	78.10	1.26	
15	71.05	42.50	-30.59	0.15	-2.54	75.96	80.84	1.25	
16	73.84	42.50	-30.49	0.11	-1.59	78.57	83.61	1.24	
17	76.63	42.50	-30.40	0.08	-0.63	81.20	86.41	1.24	
18	79.42	42.50	-30.29	0.04	0.34	83.86	89.25	1.23	
19	82.21	42.50	-30.21	0.01	0.43	88.91	94.03	1.23	
20	85.00	42.50	-30.45	0.11	4.82	82.47	89.59	1.24	

Results in the tables below represent critical circles identified between specified points on entry and exit. (Theta-exit set to 50.00 deg.) The most critical circle is obtained from a search considering all the combinations of input entry and exit points.

Critical circles for each exit point (considering all specified entry points).									
Exit Point #	Exit Point (X, Y) [m]		Entry Point (X, Y) [m]		Critical Circle (Xc, Yc, R) [m]			Fs	STATUS
1	-50.00	0.00	85.00	42.50	-1.99	83.16	96.02	1.27	OK
2	-46.06	0.01	82.21	42.50	-0.17	76.34	89.06	1.28	
3	-42.12	0.03	85.00	42.50	3.31	75.53	88.12	1.30	
4	-38.58	0.25	85.00	42.50	3.66	78.56	88.97	1.30	
5	-34.44	0.09	85.00	42.50	-4.22	104.37	108.57	1.26	
6	-30.29	0.04	79.42	42.50	0.34	83.86	89.25	1.23	
7	-26.67	0.26	85.00	42.50	12.13	66.42	76.70	1.27	
8	-22.27	0.00	71.05	42.50	4.22	65.54	70.69	1.27	
9	-18.77	1.04	85.00	42.50	13.90	69.86	76.18	1.31	
10	-14.81	2.94	85.00	42.50	17.31	67.59	72.19	1.37	
11	-10.37	4.60	79.42	42.50	10.17	81.25	79.35	1.42	
12	-6.44	6.50	79.42	42.50	14.08	77.94	74.33	1.48	
13	-2.46	8.38	82.21	42.50	18.78	77.80	72.59	1.54	
14	1.52	10.27	85.00	42.50	23.44	77.73	70.93	1.61	
15	5.36	12.20	85.00	42.50	25.75	78.43	69.30	1.68	
16	9.45	14.05	76.63	42.50	27.21	65.65	54.57	1.78	
17	13.03	16.05	85.00	42.50	30.49	79.68	65.99	1.86	
18	16.91	17.96	85.00	42.50	33.60	78.39	62.69	1.95	
19	21.33	19.73	71.05	42.50	33.82	58.14	40.39	2.22	
20	25.11	21.04	85.00	42.50	37.82	79.88	60.20	2.28	

Note: In the 'Status' column, OK means the critical note was identified within the specified search domain. 'On extreme X-exit' means that the critical result is on the edge of the search domain; a lower Fs may result if the search domain is expanded.

CRITICAL RESULTS OF ROTATIONAL AND TRANSLATIONAL STABILITY ANALYSES

Rotational (Circular Arc; Bishop) Stability Analysis

Minimum Factor of Safety = 1.23

Critical Circle: $X_c = 0.34[m]$, $Y_c = 83.86[m]$, $R = 89.25[m]$. (Number of slices used = 65)

Translational (2-Part Wedge; Spencer), Direct Sliding, Stability Analysis

NOT CONDUCTED

Three-Part Wedge Stability Analysis

NOT CONDUCTED

Comment No.	Reference Page No.	Review Comment	Insert Response Type: A = Accept C = Clarify D = Dismiss R = Resolve in future	Responsible Member	Response From Owner/GeoPacific (Issued on 5 February 2020)	Additional Response From Golder (Issued on 19 February 2020)	GeoPacific comments (Issued on 25 February 2020)
North Soldier Pile Wall and Soil Anchor/Nail Wall							
1	3	Based on the majority of the drawing notes, the soldier pile wall will consist of steel H piles at typical 1.5 m centres; however, plan drawing G-RW1A identifies 1.2 m centres. Please confirm design spacing of the H piles.	A	GeoPacific	GeoPacific: Design spacing for steel soldier piles is 1.2 m. This has been noted on plan views and sections views of our drawings. We understand that the soldier pile spacing of 1.5 m has been shown on some elevation views which will be modified in the final design drawings.	-	-
2	4	The staging/sequencing for the installation of the soldier pile system has not been clearly indicated. These and similar details should be provided in the drawings to confirm that temporary / transient loading conditions do not compromise the design intent of the installation. Similarly, the sequencing for when the design loads can be applied to the anchorages should also be indicated in the drawings and/or in the general notes.	A	GeoPacific/Owner	Owner: The staging and sequencing of the installation of the soldier piles cannot be provided now because the work has not been tendered or awarded. The contractor selected will be given acceptable surcharge loads at the time of tender, and if their methods of installation impose higher loads, the soldier pile wall will be redesigned to accommodate the construction loads prior to start of construction. GeoPacific, and Golder if they wish, they will be given the construction loads and sequencing for their review and signoff prior to the start of construction. GeoPacific: Construction surcharge stresses are not known at this stage as no contractor has been selected yet. Prior to the construction, GeoPacific will review the construction surcharge stresses with the contractors (based on the machinery considered by the selected contractor) to ensure the construction stresses are acceptable for the proposed shoring design. We may recommend certain setbacks for construction surcharge in relation to the shoring walls or strengthen the shoring walls.	-	-
3	5	The specifications do not indicate how the soldier piles are to be installed. If the piles are to be driven into place, relevant specifications and details for installation should be provided	A	GeoPacific	GeoPacific: Soldier piles will be installed into drilled holes which are filled with concrete (wet installation into concrete).	-	-
4	5	No information is provided in the specifications on the pumice fill material.	A	GeoPacific	GeoPacific: Pumice material specifications vary somewhat in practice. However, there are generally forms of locally available pumice including red Lava rock with a unit weight of 45 lb/ft3 (about 7.1 kN/m3) or Dacite (white) with a unit weight of 25 lb/ft3. We have assumed Lava rock would be used. Detailed specifications for pumice will be provided at the time of building permit (BP) stage or at the time provide specifications of the available materials for GeoPacific's review.	-	-
5	5	The drawings indicate that the soil anchors/nails are to be fully grouted and have a lock-off load of approximately 200 kN (45 kips), however, with no free stressing length or two-stage grouting program (pre- and post- testing), it is unclear if these have been designed as soil anchors or soil nails. As a result, the design intent and testing requirements of the soil anchors/nails should be confirmed by GeoPacific.	R	GeoPacific	GeoPacific: Fully grouted bars, connected to the north soldier piles are designed to work as soil nails (fully grouted). The provided lock-off load on the drawings is for the purpose of testing.	Assume the lock-off load here will be referred to as the test load in future drawing revisions.	Agreed. Future drawing update will reflect this.
6	5	It is unclear how the loads imposed on the soldier piles are transferred to the soil anchors. These considerations should be included in a summary design report prepared by GeoPacific.	R	GeoPacific	GeoPacific: Given the pile spacing of 1.2 m, and considering that shotcrete walls would be 150 mm thick, reinforced with a double-layer steel wire mesh, we are of the opinion that the lagging system is adequate to transfer the loads from the piles to the soil nails.	Please provide supporting calculations/analyses.	Agreed, the calculations will be provided with the Building Permit submission
7	5	The geotechnical report identifies the slope to the north to be permanently retained (i.e., the soldier pile wall is to provide permanent support for the City property). The soil anchors are not consistent with the PTI requirements for permanent anchors. Therefore, it is recommended that GeoPacific provide additional documentation and requirements for long-term corrosion protection and performance/life expectancy of these soil anchors/nails.	R	GeoPacific	GeoPacific: We noted on the drawings to use galvanized DSI bars. We further noted that if the non-galvanized bars are used, a relatively stronger Titan bar (T 40/16) should be used to account for corrosion effects.	The specifications make reference to the PTI design requirements. PTI does not allow for installation of non-galvanised bars in permanent applications.	GeoPacific: permanent bars are already noted as galvanized on our drawings for permanent soil nails.
8	5	GeoPacific's report indicates that the proposed anchoring design has been reviewed and pre-approved by the City. Can GeoPacific and/or the City provide Golder with further information on this review and approval process?	R	Owner	The earlier reviews by Golder were not as comprehensive as this. We are of the opinion that this comment is not applicable at this time as approval from the City would depend on the new review comments.	Agreed, we recommend that the original report text is deleted or revised to reflect this.	this is done.
Conflicts with Future Below Grade Services / Structures							
9	6	GeoPacific should provide a recommended setback from the permanent works where future utilities can be installed by the City without imposing risk to the long-term performance of the proposed permanent slope support and foundation works.	A	GeoPacific	Owner: The closest row of soil anchors will start at 4.5 m below final grade and extend downward at 30 degrees, putting the tip of the soil anchor approx. 8.3m below grade and 2 m south of the curb line. It is unlikely that any future excavations for City services will encroach upon the zone of influence of the soil anchors. However, the setback distances will be specified by GeoPacific at the BP stage. GeoPacific: Setback from future service lines will be provided at BP stage (upon the review of future service line alignments and depths in this area).	-	-
10	6	The report indicates that no lateral earth pressure has been inferred for the north foundation wall due to the permanent shoring of the existing slope and assuming a perimeter drainage system is to be employed. If the residential building is not structurally connected to the soldier pile wall, how much relative movement (i.e., out of phase motions) between the building and soldier pile wall is expected to occur during the design seismic event? Have the consequences of intimate contact between the building and the soldier pile wall during strong cyclic shaking been evaluated?	A	GeoPacific	GeoPacific: Details of the interaction between the stress relief walls (permanent shoring) and the building walls will be provided at the time of BP submission. We expect no interaction between the permanent shoring walls and the foundation walls as we anticipate a void space in between. This will be coordinated in further details with the structural engineer at the time of building permit.	-	-
11	6	GeoPacific should confirm that the soldier pile and soil anchor/nail supported shotcrete wall has been designed for permanent loading conditions so to prevent static and transient (earthquake) loading conditions being imposed on the north wall of the residence.	R	GeoPacific	GeoPacific: We confirm that the shoring system for the north side (soldier piles and soil nails) are designed to take permanent lateral earth pressures.	Please provide supporting calculations/analyses.	Calculations will be provided with the Building Permit submission
North MSE Walls - City Property							
12	4	The geogrid lengths are defined as 6.0 m for the east return wall and 1.5 m for the west wall. It is unclear whether the geogrid lengths are reduced as the wall heights decrease to the north. Please confirm if the 6.0 m geogrid length is proposed for the entire section of these MSE walls.	R	GeoPacific	GeoPacific: The recommended lengths for the geogrids would be proportional to the retained soil heights. The difference between the length of geogrids for the north MSE walls on the east side and the west side (Sections A2 and C2) is because of the difference in the retained soil heights.	Please confirm that the geogrid lengths are consistent for each layer/lift for the entire alignment at each MSE wall discussed here.	GeoPacific: Yes this is the case.
13	6	The staging/sequencing for the installation of the MSE walls located adjacent to the soldier pile wall has not been clearly indicated. The staging of the shoring and MSE wall construction process should be addressed in the construction drawings/specifications.	A	Owner/GeoPacific	Owner: Staging and sequencing details will be provided to GeoPacific and Golder after tendering and award to the successful contractor. All details regarding construction methods and sequencing will be subject to GeoPacific and Golder review and signoff prior to the start of work. GeoPacific: Details about staging and sequences of construction are typically provided prior to the submission of IFC drawings.	-	-
14	7	GeoPacific shall provide confirmation that the drilling to install the anchors following the placement and installation of the geotextile reinforcement layers will not adversely impact the stability and long-term performance of the MSE wall or visa-versa.	R	GeoPacific	GeoPacific: We confirm that the drilling process to install anchors would not adversely affect the performance of the MSE wall. This process must be reviewed by GeoPacific at the time of construction to provide detailed instructions and construction sequencing. As an alternative approach, GeoPacific may recommend to consider horizontal helical anchors, installed concurrently with geogrid installation for the area of MSE walls to prevent/mitigate the conflict with the geogrids in this area.	-	-
Service Connections							
15	7	GeoPacific should provide confirmation that the future installation of below ground utility connections will not adversely impact the stability and long-term performance of these permanent support structures. It may be advantageous to superimpose these future utilities onto the design drawings for future review.	A	Owner/GeoPacific	Owner: There are no MSE walls that will be constructed beyond the area to be purchased by the Owner, the limits of which have been agreed to by City of Surrey Engineering and Real Estate previously. No encroachment will occur on City lands after the road allowance purchase is completed. GeoPacific: We concur with Golder and we recommend that the final underground service lines in this area should be projected on the BP (or IFC) drawings to ensure clearance from utilities and also to ensure future utility installations would not affect the soils nails adversely. We understand from the owner that no encroachment would occur on City lands after the road allowance purchase is completed. GeoPacific will review this with the owner prior to the commencement of the construction work.	-	-
Surcharge Loading							
16	7	The types of surcharge loads considered in the lateral earth pressure analysis for the foundation walls and soil/fill support structures has not been clearly indicated. GeoPacific should provide comments on the expected temporary surcharges that may develop on the permanent structures during the construction of the site works in a summary design report, including the effects on slope stability, internal/external stability and permanent deformations or otherwise, provide analyses to confirm suitable minimum offsets from these structure for temporary equipment/storage surcharges.	C	GeoPacific	GeoPacific: Please refer to our response to comment # 9	Please clarify this response. Response to #9 refers to setback limits.	GeoPacific: Estimated surcharge stresses for during construction have been taken into account for the shoring design. We require to review the spec's of the proposed construction machinery once the project is awarded to contractors and we will review the surcharge stresses at that time. We will provide additional comments for setbacks for the surcharge stresses at that time (if deemed necessary).
Anchored Slope Behind South MSE Wall							
17	7	Is there a specific reason that conventional anchors were selected here, and self-boring anchors specified as an option for the upper slope?	R	GeoPacific	GeoPacific: In general, self-injecting anchors are used where the drilled anchor holes are not stable. Based on our experience, the drilled anchor holes in glacial till are expected to be stable. If we observe localized unstable drilled holes during the construction, we will recommend to switch to an equivalent self-injecting anchor bar (IBO). As indicated on our drawings, the area of pumice backfill has already been designed based on self-injecting soil nails.	The PTI requirements for permanent anchors require double corrosion protection which is not possible with IBO anchors.	GeoPacific: As stated, we may use galvanized anchors or upsize the anchor bars to take the corrosion effects into account.
18	7	These anchors are not provided with corrosion protection and so long-term degradation/deterioration of the anchorages can be expected. The adjacent MSE wall is understood to be designed as a permanent application for foundation support of the residence. This potential discrepancy in the design life of these coupled support structures could result in slope displacements that detension the geogrid and reduce the internal stability of the MSE wall. Has this been considered by GeoPacific in design?	R	GeoPacific	GeoPacific: Anchors will be upsized (with respect to the design loads) to account for corrosion effects.	See comment above.	GeoPacific: comment above.
19	8	GeoPacific should demonstrate that the potential out-of phase ground motions during strong seismic shaking will not result in buckling of, or other damage to, the lower portion of the wall.	R	GeoPacific	GeoPacific: We confirm that the wall has been designed for seismic loading.	Please provide supporting calculations/analyses.	this will be provided in the summary report at a later stage.

20	8	The specifications and drawings do not state the specific anchor type that is applicable to each row of anchors (see sections B and B1) nor do they not state who is responsible for selecting the anchor.	A	GeoPacific	GeoPacific: We concur with Golder. Anchor bar specifications will be provided on the BP stage drawings.	-	-
21	8	Golder requests a copy of GeoPacific's soil anchor calculations/analyses. This design information and responses to the above queries should be presented in a design summary report.	A	GeoPacific	GeoPacific: The design summary report will be provided at the later stages of the project (when the design is final).	-	-
MSE Wall							
22	8	The drawing for the west elevation of the MSE wall shows a steeply sloping continuous leveling pad underlying the MSE wall. There is a risk that this can create a preferential plane for sliding. As a result, it is our opinion that a stepped, horizontal leveling pad should be used to limit this risk, which has been adopted elsewhere by GeoPacific.	A	GeoPacific	GeoPacific: Given the presence of anchors and the anchor lock-off loads, the frictional resistance along this plane is expected to be sufficient. Nonetheless, we will present this as a stepped leveling pad on the final design drawings.	-	-
23	8	The drawings for the west and east elevations of the lower MSE wall, and Section B, show that the wall units are to be constructed directly overtop of the soldier pile wall. No supplementary drawing details have been provided for this connection. Given this base and bearing condition differs from a conventional soil subgrade and levelling pad, GeoPacific should confirm that this shotcrete base condition has been considered in the MSE wall design.	A	GeoPacific	GeoPacific: Details for the base of the keystone units, located on top of the steel soldier piles will be provided in our final design drawings.	-	-
24	8	As part of this independent review, Golder requests a copy of GeoPacific's MSE wall design calculations/analyses including the geogrid connection between the MSE wall and soil anchors.	A	GeoPacific	GeoPacific: Detailed design calculations for the MSE walls, their connections to anchors using geogrids and anchor design details will be provided at later stages (once the design is final based on final landscape, architectural and structural drawings).	-	-
25	8	Are measures in place to ensure that the anchor plate will not come into contact with the geomembrane/geogrid during placement/compaction of the MSE Wall backfill which could damage the integrity of the geogrid?	A	GeoPacific	GeoPacific: This will be checked during the construction by visual field observations. Depending on our field observations, we expect to slightly change the size of the anchor plates or the elevations of the geogrids during the construction (if deemed necessary).	-	-
26	8	Construction of the soil anchors and MSE wall may require excavation to extend to the south to allow for equipment staging. As a result, the ground in front of the MSE wall will need to be reinstated. The drawings and specifications should include commentary on the material, placement and compaction requirements here.	A	GeoPacific	GeoPacific: Instructions regarding benching for equipment staging will be provided at the time of construction as it would depend on the type, size and reach of the equipment/machinery used by contractors.	-	-
27	8	In addition to the above comment, the temporary excavation geometry is expected to differ at the slopes to the east and west of the MSE wall. Therefore, the soldier pile wall design may need to be modified and extended in consideration of the anticipated temporary excavation geometry.	R	GeoPacific	GeoPacific: Steel soldier pile design has been completed based on the depths of excavations and ground surface elevations, shown on our drawings. If temporary excavations for equipment staging or actual ground elevations on site result in different excavation geometry, GeoPacific will change the soldier pile design accordingly.	Will this be determined once the equipment type and staging is determined? The potential for such design revisions should be accepted by the City of Surrey.	Yes. Any design revisions will be reviewed and requires approval by GeoPacific prior to the commencement of work. If Golder and the City wish to review and approve the design revisions, they will be provided with copies for the review and approval at that time.
28						Blank in original submission.	
29	8	We understand that the aforementioned anchor/shotcrete wall support system is designed for temporary loading conditions, and therefore the western basement wall of the residence should be designed to support the static and seismic earth pressures.	A	Owner	Owner: This will be confirmed with the structural engineer and addressed accordingly on the BP submission GeoPacific: Golder's interpretation regarding the east and west shotcrete wall which are designed for temporary construction is correct. The permanent structural walls on the east and west sides are expected to take the lateral loads for static and seismic conditions based on our lateral earth pressure values presented in our geotechnical report.	-	-
Soldier Pile Walls - General							
30	9	Section 2.1.1 of the specifications indicates that "the piles shall consist of HP200 x 53 grade 300W", however, the drawings also identify HP300 x 53 piles in dwg no. G-RW1A and HP300 x 79 piles in dwg no. G-RW3A. GeoPacific should confirm which pile size satisfies the design requirements.	A	GeoPacific	GeoPacific: In the final design drawings, we will provide consistent designations for the soldier piles on plans and drawing notes.	-	-
31	9	Section 2.3.5 of the soldier pile specifications notes make reference to "secant piles". The design drawings do not include a secant pile support system. Golder assumes this is a typo. In addition, Section 2.3.3 of the soldier pile specifications notes that "concrete mix design is to be provided prior to starting work." Golder assumes this was a previous reference for concrete used in secant piles and is included here in error. Please confirm.	A	GeoPacific	GeoPacific: The reference to "secant piles" in our notes is a typo. It will be changed to "soldier piles". Notes about concrete mix design are in reference to the concrete fill for the drilled holes, considered for the soldier pile installation.	-	-
32	9	The quality assurance notes outlined in Section 2.4 of the specifications relate to the soldier pile wall and make reference to strength testing. GeoPacific should confirm if this section is redundant given Section 3.5 provides specifications for quality assurance of the temporary shotcrete.	A	GeoPacific	GeoPacific: This concrete testing is for the concrete fill in the drilled holes for soldier piles.	-	-
33	9	GeoPacific should confirm if the specifications for temporary shotcrete walls (Section 3.0) also apply to permanent shotcrete construction, as is required for north soldier pile and soil nail wall.	A	GeoPacific	GeoPacific: The specifications for permanent shotcrete walls should be read in conjunction with the structural concrete specifications (once available).	-	-
Soil Anchors/Nails - General							
34	9	Section 3.2.3 of the specifications notes that "Grout shall be introduced into the anchored zone using an inject anchor system (IBO)", however, drawing no. G-RW5 specifies conventional threadedbars "DSI #7 bar (75/100) up to DSI #11 bar (75/100)" which are not compatible with this grouting method. Golder recommends that the designer provides clarification on the anchor type and installation / grouting methodology.	R	GeoPacific	GeoPacific: Some anchor bars will be self-injecting as noted on the drawings. We will modify this note to refer to grouting for both conventional and IBO anchors.	The specifications make reference to the PTI design requirements. PTI does not allow for installation of non-galvanised bars in permanent applications.	GeoPacific: See our response to Comment #17
35	9	Section 1.7 of the specifications indicates that "the layout of the shoring wall is to be based on architectural drawings." The architectural drawings provided to us are not consistent with the geotechnical drawings; however, they pre-date the current version of the geotechnical design drawings. We assume the architectural drawings will be revised to reflect the final shoring design. Please confirm.	A	Owner	Owner: Yes they will be updated and coordinated with the final geotechnical drawings at the time of BP submission. The differences that exist now are considered minor and will not change any of the geotechnical decisions or discussions taking place during the DP application GeoPacific: The shoring design drawings will be based on the architectural drawings. GeoPacific will require the AutoCad files of the updated architectural drawings to update our shoring design accordingly. We are of the opinion that this can be completed for the BP stage.	-	-
36	9	Section 6.0 of the report notes that "Installation and decommissioning of the shoring system must be reviewed by GeoPacific." Golder recommends that the City requests confirmation of the decommissioning intent at the time of permitting.	C	GeoPacific	GeoPacific: We require further clarifications on this comment. With the exception for the temporary soil nails on the east and west sides, all other soil nails and anchors are designed for permanent conditions. The soil nails used for temporary shoring (on the east and west sides) are fully grouted and are not anticipated to be decommissioned.	If no decommissioning is necessary, suggest clarification or removal of such in the report text. Will the structural walls of the residence be formed neat to the temporary shoring faces?	GeoPacific: We will make a clear note on permanent anchors/soil nails at the time of BP drawings. A gap/void is expected to be present between the structural walls and our designed permanent shoring system at the north side. Details will be provided once the structural design is final.
37	9	We have inferred from the design drawings that the fully grouted soil anchors identified as an excavation support system on the west side of the site have been designed as soil nails because they have no free stressing length or lock off load. Golder requests design information on the soil nails located on the west side of the property within the design summary report.	A	GeoPacific	GeoPacific: This can be included in the design summary report that will be provided at later stages.		
38	9	Currently, no testing specifications are provided for soil nails. GeoPacific should confirm these testing requirements in the project specifications.	R	GeoPacific	GeoPacific: We will provide testing criteria for soil nails in the final design drawings. In general, we follow the procedure of FHWA for soil nail testing.		
39	10	The drawings and specifications do not currently provide any size, material or corrosion details for soil nail / anchor plates.	R	GeoPacific	GeoPacific: We have assumed that all permanent steel elements used in the shoring system to be either upsized (to account for corrosion effect) or galvanized (as noted on our drawings). This will be considered as a general note in our final design drawings.		
40	3	Based on the west elevation drawing, the top row of nails is at, or close to, the top of the shotcrete wall. GeoPacific should confirm that the depth of these soil nails, below the top of the cut/wall, is sufficient to provide the required anchor capacity to satisfy the design requirements.	A	GeoPacific	GeoPacific: The soil nails on the west wall are shown to be installed at 1.2 m depth (Section C1) and inclined at 15 degrees (i.e., would be deeper than 1.2 m going further towards the west). We confirm that this depth is sufficient for our design intent.		
MSE Wall - General							
41	10	Section 3.06 of the specifications states that "All Keystone units should be as filled with 15 MPa (Min.) concrete. In addition, 15M steel thread bars... should be vertically installed inside the Keystone units at a maximum horizontal spacing of 500 mm". Given the MSE walls are structures providing critical support to a new residence, Golder recommends that additional specifications are provided for this concrete fill including mix design and quality control / quality assurance requirements and in addition, specifications for the steel reinforcement.	A	GeoPacific	GeoPacific: GeoPacific will provide further details regarding the concrete fill and rebar inside the Keystone units in our final design drawings, issued at the time of BP stage.	-	-
42	10	The architectural drawings include a guardrail incorporated into the MSE wall. No detail of this guardrail connection has been provided in the available geotechnical drawings. This guardrail will impose additional loading on the upper portion of the MSE wall and should be incorporated into the design if not already done so. Please confirm that this has been considered in the MSE wall design.	A	GeoPacific	GeoPacific: In general, guardrails are typically light and may be accepted for the current design of the MSE walls. Our MSE wall design is suitable for the additional loading from a typical guardrail. However, GeoPacific will request the specifications of the guardrails from the owner to ensure our designed MSE wall is sufficient for guardrail loading.	-	-
43	10	Section 2.02 of the specifications requires the geogrid reinforcement to be Stratagrid SG700 with a long-term design strength (LTDS) at machine direction of 91.8 kN/m. The analysis provided with the report uses SG500 with a LTDS of 49.8 kN/m based on material literature, which will provide lower resistance. The summary design report should provide clarification on the specified geogrid reinforcement.	A	GeoPacific	GeoPacific: It was previously agreed with the owner that Stratagrid SG700 should be considered in the construction. The report references the older design. Our report will be updated to reflect this change.	-	-
Seismic Loads							
44	10	GeoPacific should provide their method of assessment of the amplified ground motions and the specific value determined with the specified approach in the summary design report.	A	GeoPacific	GeoPacific: We will update the seismic design (if deemed necessary) based on the new BCBC 2018 code. Further details will be provided a later stage.	-	-
45	11	The building code requirements, and by association the design PGA value, will direct the seismic loading conditions for the site. The City should discuss and confirm their seismic design requirements with GeoPacific.	A	GeoPacific/City	GeoPacific: We will update the seismic design (if deemed necessary) based on the new BCBC 2018 code. Further details will be provided a later stage.	-	-
Global Stability							
46	11	Golder recommends that GeoPacific provides some additional discussion in the report on the global stability analyses, including comments on the surface loads applied, and provides an updated global stability analyses that include all reasonable load contributions.	A	GeoPacific	GeoPacific: GeoPacific will update the slope stability analyses to reflect actual structural loads (once available), updated PGA value (if applicable) and revised entry and exit limits for the critical failure surface. We will also make geometrical changes if our shoring/excavation/MSE wall design is modified based on the latest architectural drawings. Results will be presented in an updated geotechnical report.	-	-
47	11	The global stability analysis completed for the seismic loading condition returned a result at the boundary of the defined entry and exit search parameters and as a result, may not represent the lowest factor of safety against slope failure for the model. Golder recommends that this analysis is repeated with an expanded and/or revised search domain to confirm the critical FoS value. The global stability analysis for the seismic loading condition may also need to consider a revised PGA based on the discussion provided in Golder's report and any changes in ground conditions within the lower portion of the slope as determined from subsequent geotechnical investigation(s) or observations on site.	A	GeoPacific	GeoPacific: GeoPacific will update the slope stability analyses to reflect actual structural loads (once available), updated PGA value and revised entry and exit limits for the critical failure surface. We will also make geometrical changes if our shoring/excavation/MSE wall design is modified based on the latest architectural drawings. Results will be presented in an updated geotechnical report.	-	-
48	11	The global stability analysis results also note that the exit angle of the slip circles is set to 50 degrees. Occasionally, a maximum exit angle can exceed 50 degrees and thereby change the outcome of the analysis. We request that GeoPacific provides comment on the selection of this input parameter e.g., is this a value selected by GeoPacific or defined by the program?	A	GeoPacific	GeoPacific: GeoPacific will update the slope stability analyses to reflect actual structural loads (once available), updated PGA value and revised entry and exit limits for the critical failure surface. We will also make geometrical changes if our shoring/excavation/MSE wall design is modified based on the latest architectural drawings. Results will be presented in an updated geotechnical report.	-	-

49	11	With respect to the global stability analysis, the geotechnical report states that <i>"the soil conditions must be confirmed at the location of the base of the retaining wall to confirm the above referenced analysis results."</i> If the ground conditions are different to that previously understood, additional geotechnical analysis and design modifications will be required.	C	GeoPacific	GeoPacific: GeoPacific confirms that modified slope stability analysis, shoring and MSE wall design will be completed if the subsurface conditions were noted to be different from our anticipated conditions (through field observations during the construction).	Is this acceptable to the City of Surrey?	Owner: Kevin Shackles email of Feb 21, 2020 to Lorne Ebenal & Thomas Madden: <i>Our Engineering staff are accepting of the latest comments and therefore, we ask that GeoPacific revise their report based on the discussions and comments to-date and Golder's peer review comments. Once the report is revised, Golder will need to prepare their Peer Review letter confirming the report is acceptable. Both of these documents will form the basis of the Geotechnical Restrictive Covenant that is to be registered on the property to ensure future construction conforms to the recommendations in the report.</i> <i>Please proceed with updated the Geotechnical Report, Ecosystem Development Plan, and Arborist Report (if necessary) and resubmit to me alongside the Golder Peer Review confirmation letter. Once these are submitted staff will need time to review variance proposal before bringing the application forward to Council for their consideration.</i>
Bearing Capacity							
50	11	Section 2.06 of the specifications indicates that <i>"existing compact gravel fill / or ensured fill (TYPE I FILL) with a Serviceability Limit States (SLS) bearing capacity of at least 100 kPa"</i> . The geotechnical report recommends a SLS bearing capacity of 120 kPa for spread footings on engineered fill. Please confirm the design bearing capacity.	A	GeoPacific	GeoPacific: Bearing capacity of 100 kPa as stated on the drawings should be considered for this project. GeoPacific will review the foundation soils prior to final bearing capacity approval which will be repared in the form of sealed memoranda during the time of construction.	-	-
51	11	The method of analysis and assumptions for the bearing capacity assessment is not discussed in the geotechnical report. The bearing capacity of a footing or retaining wall can be greatly impacted by an adjacent sloping ground and depth of embedment. As part of our review, Golder requests additional information and/or calculations related to the bearing capacity of the residence footings and MSE walls, which should be provided in a summary design report.	A	GeoPacific	GeoPacific: Bearing capacity of 100 kPa as stated on the drawings should be considered for this project. GeoPacific will review the foundation soils prior to final bearing capacity approval which will be repared in the form of sealed memoranda during the time of construction.	-	-
Drainage							
52	12	The MSE walls also include a 100 mm PVC drainage pipe near the heel of the wall with the exception of the south MSE wall (Sections B and B1). Unless alternate measures are in place to carry any water away from this wall, it is our opinion that a PVC pipe is intended to be installed behind each MSE wall. Has analysis been completed to confirm that the drains are adequately sized to manage the anticipated design flows.	A	GeoPacific	GeoPacific: We confirm that all Keystone MSE walls should have a drainage pipe near the toe of the wall and the drainage pipes should direct water to either the City storm system or (depending on the elevation of drainage) to the existing ditch, located at the toe of the slope. The size of the drainage pipes should be confirmed by a civil engineer at BP stage.	-	-
53	12	The drainage management system beyond the MSE walls is not described and we assume it to be part of the design scope for the civil or mechanical consultant. Nonetheless, where and how the water from these drainage pipes is transported and discharged is an important consideration that could adversely impact the long-term bearing support of the MSE wall. Golder recommends that the City considers this when reviewing the civil/mechanical design submission. Also, the drainage pipes may need to protrude through an MSE wall and would need to be considered during construction.	A	GeoPacific	GeoPacific: The runoff water from the roof and hard surfaces are expected to be discharged to the City storm system. Drained water from the top of retaining walls is anticipated to be collected and discharged to the ditch, located at the toe of the slope (upon City approval). For post construction conditions, the amount of surface runoff entering the ditch in the lower area of the slope would be less than the current. Details regarding pipe size, pipe alignments, etc. will be provided by the mechanical engineer for the BP stage.	-	-
54	12	Specific details of the interface conditions between the soldier pile wall and the new building, including but not limited to drainage measures to prevent build-up of hydrostatic pressures, were not addressed in the GeoPacific drawings. Similarly, no drainage measures have been included for any of the shotcrete installations. There is a risk that the stability of the shotcrete panels could be jeopardised if hydrostatic conditions occur and have not been designed for. Have drainage measures been considered for the residence and the shotcrete panels?	A	GeoPacific	GeoPacific: As stated in our geotechnical report, drain tile should be considered for the building to prevent the pore water generation beneath the slabs and against the foundation walls. For the permanent shoring wall (on the north side) drainage mats should be installed behind the shotcrete walls and hydraulically connected to the drain tile.	-	-
Temporary Excavation Cuts							
55	12	Section 3.01 of the specifications states that <i>"Existing fill (Compact sand) / or ensured fill (Type I Fill) (Retained Soils, as shown on DWG G-RW2A to G-RW4C shall be sloped at a maximum angle of 1:1 (V:H)"</i> , however, the drawings show sleeper, temporary cut slopes at 2V:1H. Please confirm the recommended temporary cut slope requirements.	A	GeoPacific	GeoPacific: We understand that our drawings show some temporary cut-slopes which may be steeper than 1:1. Regardless of the slope angle, any temporary sloped excavation will be reviewed by GeoPacific during construction and approved by GeoPacific prior to worker entry. This has been noted in our geotechnical report.		
Design Life							
56	13	The geotechnical report or specifications do not identify the expected design life of the permanent support systems. Given these structures provide important foundation support to a family residence, all components of the retaining structures should have a design life at least equivalent to that of the residential structure. Please confirm the design life the excavation / foundation support systems in the summary design report and/or specifications.	A	GeoPacific	GeoPacific: We will provide notes regarding the expected lifetime of the "permanent" lateral support system in our future design drawings. In general, we expect 75 years would be the minimum lifetime.		
Displacements							
57	13	The GeoPacific report states that they expect movements at the perimeter of the excavation to be in the order of 10 to 15 mm, regardless of the shoring method used. The report says that settlements will not exceed 25 mm total and 2 mm per metre differential. Does this result apply to the retaining wall footings as well as the proposed foundations of the home? Golder requests that the method of analysis used to determine these displacements for static and seismic loading conditions and settlement values are provided in the summary design report.	R	GeoPacific	GeoPacific: The movement values of 10 – 15 mm (referenced in Section 6.6 of the geotechnical report) is for the anticipated movements of the shoring system, while the settlement values of 25 mm total and 2 mm per meter differential, referenced in Section 6.2 of the report are for the foundation materials as a result of the structural loading for our recommended bearing pressure values.	Please provide supporting calculations/analyses.	GeoPacific: Calculations will be provided with the Building Permit Submission
Construction Sequencing							
58	13	Section 3.3.4 of the specifications indicates <i>"The anchors and shotcrete shall be installed in sequence and stages to maintain stability of the excavation. Stages shall not exceed the height shown on the design drawings."</i> Only Section A1 indicates a stage excavation height. GeoPacific should confirm if this applies to all shotcrete and anchor walls.	A	GeoPacific	GeoPacific: Typically, vertical stages for excavation should follow the anchor vertical spacing. We will clarify the lines of staged excavations on all section views of the drawings (where applicable). In the area of new fills, staged excavation is not applicable (e.g., sloped portion of Sections B and B1).	-	-
59	13	The excavation and construction sequence outlined in Section 3.3.5 of the specifications provides no specific order for construction of the multiple support systems. Although it is common to leave this to the discretion of the contractor, we recommend that details should be provided in the drawings or specifications for construction sequencing such that temporary / transient loading conditions do not compromise the design intent of an installation.	A	Owner/GeoPaci	Owner: Agreed. Details regarding sequencing and limitations of loads necessary to prevent any compromise to the shoring system will be provided to the subcontractors bidding the work. They will be required to provide detailed construction sequencing plans for review and signoff by GeoPacific prior to starting work on site. GeoPacific: Details regarding sequencing of the construction to appropriately complete the designed MSE wall, shoring and excavation system should be provided by the contractors to GeoPacific for review. Prior to the construction, GeoPacific will review detailed construction stages/sequences and will provide comments at that time.	-	-
Closure							
60	14	Golder has not been provided with a basis of design document outlining the methods used to evaluate the static and seismic stability (limit conditions) of the various components of the design, the design performance tolerances/objectives of the permanent ground stabilization works for static and seismic loading conditions, and the methods used to evaluate the performance (deformation) of the various stabilization works for the static and seismic loading conditions. Golder requests that these design details, together with responses to our queries provided in this letter report, are provided in a summary design report.	A	GeoPacific	GeoPacific: We understand that the City/Golder requires our design summary report, outlining several aspects of the design and analysis for this project. GeoPacific can provide a design summary report for the final design, once final structural, architectural, landscape drawings are available at the BP stage.	-	-