



Ridge North America  
200 – 215 Lawrence Avenue  
Kelowna, B.C.  
V1Y 6L2

March 30, 2022  
File: 20912

Attention: Sean Wilson and Rav Soomal

## **Re: Preliminary Geotechnical Investigation Report: Okanagan Gondola Development Highway 97 and Bailey Road, Vernon, BC**

### **1.0 INTRODUCTION**

We understand that a commercial development is proposed at the above referenced site. Based on the DP Application drawing package prepared by Dialog Design, dated January 14, 2022, the proposed development will consist of three gondola stations, which consist of structures of up to three storeys in height. It is anticipated that the development will include retail space, a restaurant, cafés, and lookout platforms. The development will also include a paved parking area.

This report provides the results of the geotechnical investigation of the soil and groundwater conditions of the site and presents preliminary recommendations for the design and construction of the development. This report was prepared exclusively for Ridge North America, for their use and for the use of others on their design and construction team. We expect that the City of Vernon will rely on this report during the permitting process. No other use is permitted without the written consent of GeoPacific Consultants Ltd.

### **2.0 SITE DESCRIPTION**

The proposed building site is located about 12 kilometres south of the Vernon City Centre. The property is bounded by undeveloped land to the north, west and south, a quarry to the south-east and Highway 97 to the west. The proposed site will be accessed from Bailey Road, near the intersection of Highway 97 and Bailey Road. The site slopes down significantly from the west at approximately 785 m geodetic to the east at approximately 500 m geodetic. The site is irregular in shape with an approximate area of 115 hectares. The proposed development is spread out over a majority of the property. The site is currently unimproved and is vegetated with trees, shrubs and grasses.

The location with respect to the surrounding is shown on our Drawing No. 20912-01, following the text of this report.

### **3.0 FIELD INVESTIGATION**

#### **3.1 Site Investigation**

On March 17, 2022, GeoPacific completed 14 test pits on the site, with a John Deere 75 tracked excavator, supplied by First Tracks Contracting Ltd. The test pits were excavated to depths between 0.3 to 2.8 metres below grade. Where bedrock was encountered, the test pits were terminated due to refusal. The test pits were supervised and logged in the field by one of the engineers from our office.

Prior to our investigation, a BC One Call was placed and cleared the test pit locations of any underground services. Following the test pit investigation, all pits were backfilled and sealed in accordance with provincial abandonment requirements following classification and sampling.

The approximate location of the test pits with respect to the surroundings are shown on our attached Drawing No. 20912-01, following the text of this report.

#### **4.0 SUBSURFACE CONDITIONS**

##### **4.1 Soil Profile**

The on-site investigation found the subsurface soil conditions across the site to consist of natural soils which comprise of surficial silty topsoil underlain by compact to dense silty sands and gravels, overlying bedrock to the maximum depth explored in the investigation.

A description of the soils encountered in our test pit locations is given below:

##### **TOPSOIL**

The surficial soil at in all test pit locations consists of a loose-compact topsoil. The topsoil contains varying amounts of silts, sands and gravels, containing roots to rootlets, is damp and extends to depths between 0.15 m to 0.6 m below existing site grades.

##### **SANDS and GRAVELS**

The surficial topsoil is underlain by compact to dense sands and gravels in test pits TP22-01, -02, -03, -04, -06, -08, -12, -13, -14. The sands and gravels were encountered to depths between 0.8 m to 2.8 m below existing site grades. The material contains fine to coarse grained sand, subrounded to angular gravels to boulders, generally becoming dense to very dense with depth, causing refusal in test pits most test pits. It is suspected that bedrock underlays the dense to very dense sands and gravels, but could not be confirmed in these locations due to refusal with the excavator.

##### **BEDROCK (WEATHERED)**

In test pits TP22-05 and TP22-09, the surficial topsoil was underlain by compact weathered bedrock. The weathered bedrock was encountered to depths between 0.8 m and 1.8 metres below existing grades, where the test pits were terminated due to refusal.

##### **BEDROCK**

Bedrock was confirmed to underlay the topsoil and sands and gravels at depths between 0.3 m and 2.5 metres below existing grades in test pits TP-02, -04, -06, -07, -09, -10, -11, -13. Where bedrock was encountered, all test pits were terminated shortly after due to refusal. As mentioned above, bedrock is suspected to underlay a majority of the test pit locations, even though it was not confirmed. A larger excavator or drilling equipment may be required to determine the depth of bedrock in all test pit locations.

For specific subsurface soil descriptions at our test pit locations refer to our test pit logs provided in test pit logs in Appendix A following this report.

## 4.2 Groundwater Conditions

The static groundwater table was not encountered during our investigation and we expect that it is well below the development grades of the site. Seasonal groundwater runoff, however was encountered in one of the test pits close to the natural draw near the Summit Station. Perched groundwater may also form within the fills on any silty lenses or over bedrock.

## 5.0 DISCUSSION

### 5.1 General Comments

As noted in Section 1.0, the proposed development will consist of three gondola stations, with at grade construction. The development will also include retail space, a restaurant, café's, asphalt roadways/parking and associated utilities and landscaping. We have not received any structural information, but we expect the structural loads to be relatively heavy.

Based on our review of the soil profile, the proposed structures can be supported on conventional spread and strip footings founded on natural *compact to dense sands and gravels, dense to very bedrock, compact blast rock fill or compact engineered fill.*

The subsurface soils are not considered prone to liquefaction or other forms of ground softening under the design earthquake defined under the 2018 British Columbia Building Code.

Final grading plans should be provided to GeoPacific well in advance of construction to provide further recommendations for the design and construction of the proposed subdivision, if necessary.

We confirm, from a geotechnical stand point, that the proposed development is feasible provided that the recommendations outlined in Section 6.0 are incorporated into the overall design.

### 5.2 Slope Stability

We utilized the "*Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC*", revised May 2010 by APEGBC/EGBC for our slope stability assessment. The guidelines require that all new development be assessed for the potential of a landslide occurring in the area, and that the risk must be less than a 0.5% probability of occurrence in 50 years (annual probability of 1:10,000), for a life-threatening or catastrophic landslide. It is difficult to equate probabilistic analysis of the mass to a factor of safety, however, a published report by the Pipeline Research Council, (C-Core, D.G. Honegger Consulting, SSD Inc., 2009 (see Bibliography)) states that a factor of safety of 1.4 has a probabilistic equivalent of landslide occurrence of less 1 in 10,000 years.

Provided that our recommendations in Section 6 of this report are followed, we are of the opinion that the development will meet the required return period of 10,000 years for life-threatening or catastrophic landslides, under both static and seismic conditions. Therefore, we are satisfied that the property can be safely used for the intended purpose of the proposed development, provided that our recommendations are adhered to. GeoPacific must be provided final grading and development plans well in advance of construction to confirm the proposed slopes and structure alignments meet the mentioned factor of safety.

GeoPacific has completed a cursory visual review of the adjacent properties and confirm the proposed development will have no slope stability related impacts on the adjoining properties based on the current topography beyond the property. GeoPacific accepts no responsibility for slope stability related impacts on the development property as a result of activities conducted on adjoining lands.

The Landslide Assessment Assurance Statement is presented in Appendix D of this report.

## 6.0 RECOMMENDATIONS

### 6.1 Site Preparation

Prior to construction of foundations, grade supported slabs, and pavement structures, all vegetation, fill, soils containing organics and loose or otherwise disturbed materials should be removed to expose a subgrade of *compact to dense sands and gravels, dense to very dense bedrock, compact to dense blast rock fill or engineered fill*

In a situation where the building pad straddles either the natural overburden or structural fill and the bedrock surface, then we recommend that the bedrock surface be over-blasted a minimum of 0.6 metres below the foundation elevation and be stripped to expose the competent bedrock surface. The blast rock should then be replaced and compacted to form the base of the building pad. This will minimize the risk of differential settlement of the foundation.

Stripping should extend out beyond the building envelope and roads at a distance equal to the thickness of proposed engineered fill beneath the footings. For example, if 1 metre of engineered fill will underlie a footing then stripping should extend a minimum distance of 1 metre beyond the outer edge of that footing. This is also required in the areas noted where Peat may be present and requires removal.

In the case where fill is used to raise the elevation beneath the pavement section or the building embankment footprint using blast rock fill, all blast rock particles greater than 0.2 metres in diameter must be removed. Oversized particles may be resized to the project specifications and used for fill. During fill placement, care should be taken to avoid large rocks from “nesting” together, creating excessive voids in the fill. Where nesting has occurred, we recommend that the large rocks be over excavated and replaced with smaller diameter blast rock fill.

Any grade reinstatement in the building or paved areas should be done using engineered fill. In the context of this report, engineered fill is defined as clean sand, or sand and gravel fill, with less than 8% fines (passing the #200 sieve), compacted in 300 mm loose lifts to a minimum of 95% of the ASTM D1557 (Modified Proctor).

*Stripped subgrades, engineered fill materials and compaction must be reviewed by the geotechnical engineer.*

### 6.2 Foundations

Footings which are founded on competent *compact to dense sands and gravels, blast rock fill or engineered fill*, can be designed on the basis of a serviceability limit state (SLS) bearing pressure of 125 kPa for strip or pad footings. For footings constructed on *competent bedrock*, a SLS bearing pressure of 800 kPa may be used.

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 pressure provided above.

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 600 mm below the surface for frost protection.

Should the foundation subgrade be disturbed during the course of excavation and construction, we recommend the subgrade be compacted to a minimum 95% of Modified Proctor maximum dry density in accordance with ASTM D1557.

Adjacent footings should achieve a maximum elevation difference equal to half of their horizontal distance (2H:1V) to avoid superimposing the upper foundation loading to the lower foundation.

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

### **6.3 Building/Foundation Settlements**

Based on our analysis and the anticipated loading, we estimate for foundations designed, settlement will not exceed 25 mm total and the differential settlements are expected to be less than 1:500.

### **6.4 Seismic Design of Foundations**

We have considered the 2018 BCBC design earthquake with a 2% probability of exceedance over a 50 year period which equates to a return period of 2475 years. Accordingly, we have considered an earthquake having a peak horizontal ground acceleration of 0.06g for this site (Ref. National Resources Canada, Site Coordinates: 50.177 deg. North, 119.364 deg. West).

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

### **6.5 Slab-On-Grade Floors**

Floor slabs 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 that is 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.*

### **6.6 Foundation Drainage**

A perimeter drainage system will be required for below grade structures (basements/crawlspaces) to prevent the development of water pressure on foundation walls and basement floor slabs. Foundation drainage is not required for any geotechnical purposes if the site is graded away from the buildings at a slope of at least 2% and the slab is at least 150 mm above exterior grades. Surface water should be directed to catch basins and lawn basins directed to the site storm water system. If these requirements cannot be met then perimeter drainage should be installed.

## 6.7 Temporary Excavations

We expect that temporary excavations would be generally less than 2.0 m in depth and sloped where possible since it is more economical to do so. We would expect that slopes cut to a 1H:1V (1 horizontal to 1 vertical) can be constructed in the existing surficial *topsoil, and engineered fill*, while 3H:4V may be constructed in the *blast rock fill*.

Excavations may encountered perched groundwater seepage and can be handled using sumps and sump pumps.

*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, prior to worker-entry.*

## 6.8 New Pavement Structures

As indicated above, new asphaltic concrete pavements are anticipated throughout the development. Following the recommended site preparation in Section 6.1, we expect that the following pavement design structure, given in Table 1, are sufficient to carry the anticipated vehicle loads on-site.

**Table 1: Recommended Minimum Pavement Structure**

Material	Thickness (mm)	CBR
Asphaltic Concrete	75	N/A
19 mm minus crushed aggregate base course	100	80
75 mm minus crushed tailings sub-base course	300	20

All base and sub-base fills should be compacted to a minimum of 95% Modified Proctor dry density with a moisture content within 2% of optimum for compaction. Base and subbase materials should be washed sieve tested to confirm gradations meet MMCD standards.

The stripped road subgrade should be proof rolled to locate any soft/loose spots. Where existing soils are soft/loose and cannot be re-compacted to a minimum of 95% Modified Proctor dry density, they must be excavated and replaced with engineered fill.

## 6.9 Permanent Grading and Temporary Stockpiles

We recommend that all permanent slopes within the development area be graded to a 2H:1V or flatter in compact to dense sands and gravels or engineered fill slopes. Permanent slopes constructed using blast rock fill, if any, can be constructed at slopes of up to 1.5H:1V. Slopes of 4H:1V or flatter may be desirable for landscape maintenance purposes.

All slopes should be permanently vegetated or protected by other means to prevent erosion.

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

Storage of temporary fills and excavated soils should be kept a minimum of 5.0 m from the crest of slopes. Furthermore, stockpiles should be covered with poly sheeting to prevent erosion.

Should retaining walls be proposed as part of the site development, GeoPacific should be provided with detailed retaining wall design drawings well in advance of construction and can design the retaining walls under a separate cover.

The final grading plan must be reviewed by GeoPacific well in advance of construction to provide additional or revised recommendations, if necessary.

### 6.9.1 Rock Cuts

Bedrock exposures on site, and adjacent sites, typically include a heavily weathered and fractured volcanic rock. We preliminarily recommend that the bedrock be excavated at a slope of 0.25H:1V. Final proposed rock cuts must be reviewed by a rock mechanics specialist to confirm the rock condition and cut methodology.

The proposed rock cuts provide an opportunity for rock fall events. Proper design of a rock fall protection system will limit the risk of a rock fall posing a hazard to the public. We recommend that a rock fall catchment be constructed at the toe of the rock cut. To minimize the ditch width, we recommend that the base of the ditch be inclined at 4H:1V. All future owners must be made aware that the rock fall catchment ditches must be maintained. This will include periodic removal of accumulated rock within the ditch. The requirement of the rockfall ditches should be included in a covenant, on title, so that all future owners of the property are aware of the requirement and their obligations to maintain the ditches. The following provides a list of ditch widths suitable for the height of the rock cut.

It should be noted that the table below provides ditch widths that will contain 95% of rock fall events; however, isolated sections of the rock cut may have irregular orientations that cause falling rocks to bounce over the catchment berm. As much as 5% of the events may roll out of the catchment onto the road.

**Table 2: Rock Cut Ditch Dimensions**

Rock Cut Height	Minimum Ditch Width
3m	1.5m
4m	1.75m
5m	2.0m
6m	2.25m
7m	2.5m
8m	3.0m

It should be noted that the fractures in the rock mass, orientation of the joint sets and the orientation of the road cut may leave unstable rock masses which may require additional work to stabilize. The extra work may include heavy scaling, meshing or rock bolting. As the rock cut is exposed, we recommend that the face be assessed to determine the extent of any stabilization, if required.

Rock cuts on private property pose a risk to all future occupants of the home and neighbouring properties. The rock fall risk must be evaluated at the time of development and appropriate measures must be taken to reduce the risks to appropriate levels. Such measures may include the application of a rock fall mesh, such as Geobruigg, Deltax, over the exposed rock face, or the construction of a barrier, such as a chain link fence, limiting the access to the rock fall zone and containing rock fall events. The rock fall protection may require a covenant in order that all future property owners are made aware of their obligations.

*The final proposed rock cuts must be reviewed by a professional engineer specializing in rock mechanics.*

## 6.10 Utilities

Utilities are expected to be underlain by competent *compact to dense sands and gravels or dense to very dense bedrock*, which will provide satisfactory foundation support. For utilities bedded on these materials settlements are anticipated to be negligible. Heavier groundwater seepage during and following wetter periods may need to be controlled using sumps and large pumps.

We recommend that any trenches be sloped or shored as per the latest Work Safe BC regulations. We recommend that all service trenches be backfilled with clean granular material, which conforms to municipal standards, compacted to 95% "Modified Proctor" dry density (ASTM D1557), with a moisture content within 2% of optimum for compaction.

## 6.11 Re-Use of Native Soils

The natural sand and gravel deposits underlying the surficial topsoil may be employed as structural fill.

If these soils are to be stockpiled for later use all topsoil must be removed from under the stockpiles and they must be completely covered in tarps or poly sheeting. Surficial runoff must also be directed away from the stockpiles. Despite these measures some moisture ingress into the soil is not uncommon during high humidity conditions, and thus some degradation of the surficial material of the stockpiles is possible.

The higher fines content materials should be separated into different stockpiles from clean sand and gravels. Due to the high fines content of some of the native materials those specific materials are not considered "free draining" and are not suitable for drainage applications. Any native material proposed for use, and specifically for drainage applications, must be reviewed by GeoPacific in advance. The compaction requirements outlined Section 6.1 are also applicable to these materials.

## 6.12 Radon

We recommend that site preparation for the floor slabs include a rough-in for a subfloor depressurization system to protect from soil gas ingress (radon) unless the associated testing is provided and indicates a radon abatement system is not required. Should radon testing not be completed or an abatement system is required, the abatement system is described in detail in Section 9.13.4. of the 2018 BCBC. Accordingly, the 150 mm thick layer of under slab fill required per Section 6.4 of this report can be utilized as part of the abatement system and access through the slab should be provided to allow for depressurization for all contiguous areas. A vapour barrier should be placed between the granular fill and the concrete slab to inhibit the migration of moisture and gas through the slab.

## 7.0 DESIGN REVIEWS AND CONSTRUCTION REVIEWS

As required for Municipal "Letters of Assurance", GeoPacific Consultants Ltd. will carry out sufficient field reviews during construction to ensure that the geotechnical design recommendations contained within this report have been adequately communicated to the design team and to the contractors implementing the design. These field reviews are not carried out for the benefit of the contractors and therefore do not in any way effect the contractors obligations to perform under the terms of his/her contract.

It is the contractors' responsibility to advise GeoPacific Consultants Ltd. (a minimum of 48 hours in advance) that a field review is required. Field reviews are normally required at the time of the following activities:

1. Review of site stripping
2. Review of foundation subgrade prior to footing construction
3. Review of slab-on-grade fill compaction prior to slab construction
4. Review of the compaction of engineered fill
5. Review of any temporary cut slopes or excavation in excess of 1.2 meters in height prior to worker-entry
6. Review of pavement structure subgrade prior to sub-base placement
7. Review of base and sub-base fill materials and compaction
8. Review of permanent rock cuts

It is critical that these reviews are carried out to ensure that our intentions have been adequately communicated. It is also critical that contractors working on the site view this document in advance of any work being carried out so that they become familiar with the sensitive aspects of the works proposed.

It is the responsibility of the developer to notify GeoPacific Consultants Ltd. when conditions or situations not outlined within this document are encountered.

## 8.0 CLOSURE

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

We are pleased to assist you with this project and we trust this information is helpful and sufficient for your purposes at this time. However, please do not hesitate to call the undersigned if you should require any clarification or additional details

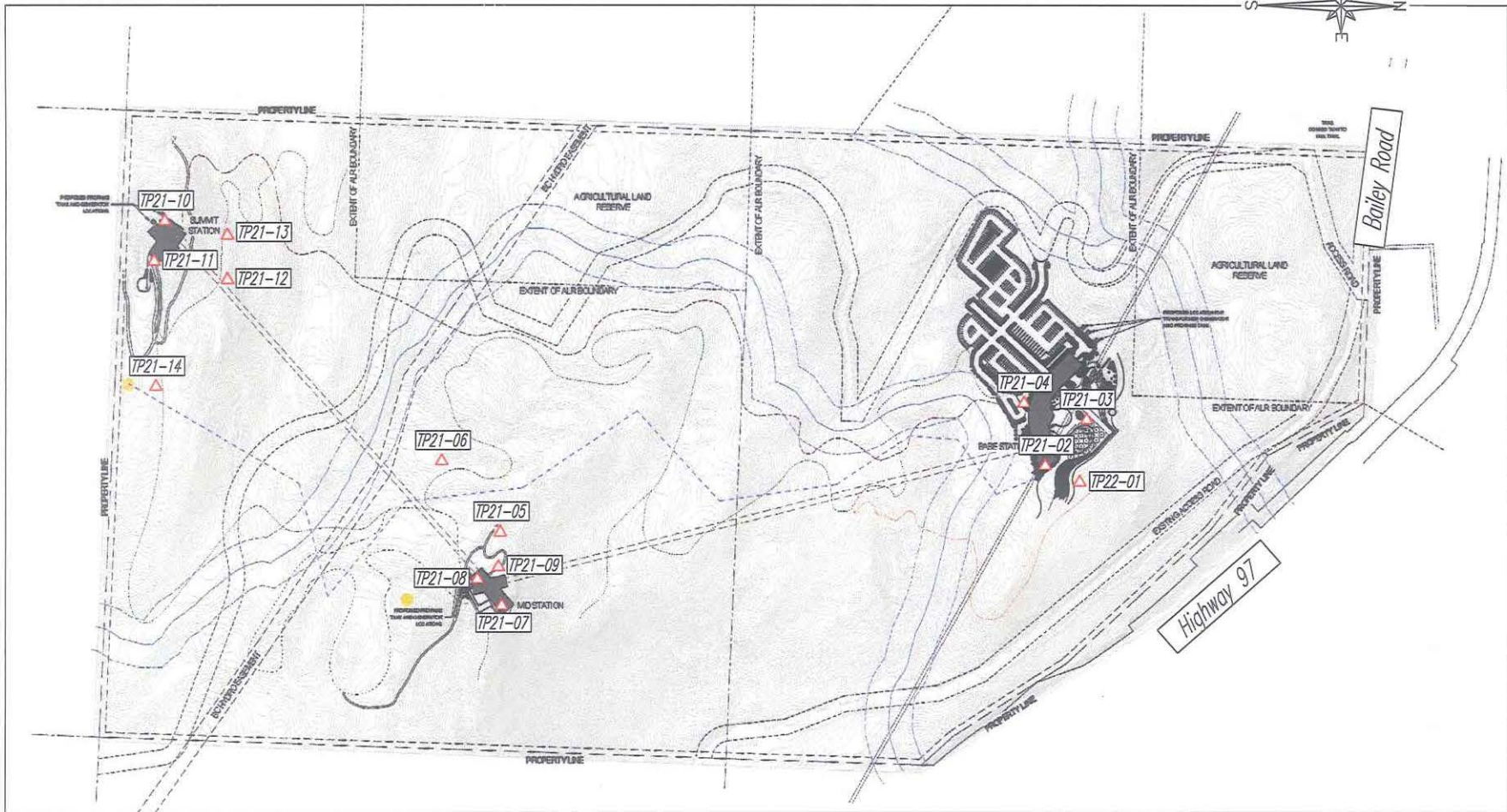
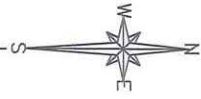
For:  
**GeoPacific Consultants Ltd.**

Aaron Trenn, B.A.Sc., E.I.T.  
Geotechnical Engineer-in-Training

Reviewed By:



Roberto Avendano, B.Eng., P.Eng.  
Principal



**LEGEND:**

△ - TP-# - APPROXIMATE TEST PIT LOCATION

**SITE PLAN**

\*TEST LOCATIONS ARE APPROXIMATE

REFERENCE:

Dialog Design



**GEOPACIFIC**  
CONSULTANTS

201-1889 Spall Road  
Kelowna, B.C. V1Y 4R2  
P 604.439.0922  
F 604.439.9189

DATE:	28-MAR-2022		
DRAWN BY:	APPROVED BY:	REVIEWED BY:	
AT	RA	RA	
SCALE:	NTS		

OKANAGAN GONDOLA DEVELOPMENT  
HIGHWAY 97 AND BAILEY STREET, VERNON, B.C.  
TEST PIT LOCATION PLAN

FILE NO.: 20912  
DWG. NO.: 20912-01

REVISIONS:  
A.  
B.  
C.

**APPENDIX A – TEST PIT LOGS**

Test Pit Log: TP22-01



201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon

INFERRED PROFILE						
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, sandy, dark brown, damp, loose to compact	0.0			
		<b>SAND and GRAVEL</b> medium to coarse grained sand, angular gravel to cobble, some silt, copper brown, damp, compact to dense with depth	-0.2			
			0.2			
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
2		<b>END OF TEST PIT AT 2.0 METRES</b> -refusal of material -no groundwater encountered -no sloughing of sidewalls	-2.0 2.0			

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.01  
Page: 1 of 1

Test Pit Log: TP22-02

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE			Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
Depth	Symbol	SOIL DESCRIPTION				
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, sandy, dark brown, damp, loose to compact	0.0			
-0.2			-0.2			
0.2		<b>SAND and GRAVEL</b> medium to coarse grained sand, angular gravel to cobble, some silt, copper brown, damp, compact to dense with depth	0.2			
1						
2						
3						
4						
5						
6						
7						
2		<b>BEDROCK</b>	-2.0			
2.0			2.0			
7						
2.2		<b>END OF TEST PIT AT 2.2 METRES</b> -refusal of material -no groundwater encountered -no sloughing of sidewalls	-2.2			
2.2			2.2			
8						
9						
10						
3						

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.02  
Page: 1 of 1

Test Pit Log: TP22-03

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



**GEOPACIFIC**  
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201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE		SOIL DESCRIPTION	Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
Depth	Symbol					
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, sandy, dark brown, damp, loose to compact	0.0			
			-0.2			
		<b>GRAVEL and SAND</b> angular gravel to cobble, coarse grained sand, some silt, tan brown, damp, compact to dense with depth	0.2			
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
		<b>END OF TEST PIT AT 2.0 METRES</b> -refusal of material -no groundwater encountered -no sloughing of sidewalls	-2.0 2.0			

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

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

Test Pit Log: TP22-04

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE						
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, sandy, dark brown, damp, loose to compact	0.0			
1		<b>GRAVEL and SAND</b> angular gravel, medium to coarse grained sand, some silt, yellowish brown to tan brown with depth, damp, compact to dense with depth	-0.3 0.3			
2						
3						
4						
5						
6				SA-01	6.9	
7						
8		<b>BEDROCK</b>	-2.5 2.5			
9		<b>END OF TEST PIT AT 2.6 METRES</b> -refusal of material -no groundwater encountered -no sloughing of sidewalls				
10						

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.04  
Page: 1 of 1

Test Pit Log: TP22-05

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



**GEOPACIFIC**  
CONSULTANTS

201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE					Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
Depth	Symbol	SOIL DESCRIPTION						
0		Ground Surface		0.0				
0		<b>TOPSOIL</b> silty, gravelly, roots throughout, dark brown, damp, loose to compact		0.0				
1				-0.5				
2		<b>BEDROCK (WEATHERED)</b> angular rock, some fines, copper brown to medium grey, compact		0.5				
3								
4								
5								
6		<b>END OF TEST PIT AT 1.8 METRES</b> -no groundwater encountered -no sloughing of sidewalls		-1.8				
6				1.8				
7								
8								
9								
10								

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.05  
Page: 1 of 1

Test Pit Log: TP22-06

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE					Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
Depth	Symbol	SOIL DESCRIPTION	Depth (m)	Elev (m)				
0		Ground Surface	0.0	0.0				
0		<b>TOPSOIL</b> silty, gravelly, roots throughout, dark brown, damp, loose to compact	-0.2	0.2				
1		<b>SAND and GRAVEL</b> medium to coarse grained sand, angular gravel, some silt to silty, medium grey brown, moist, compact to dense with depth						
3			-1.0	1.0			-minor groundwater seepage at 1.0 metres	
4		<b>BEDROCK</b>	-1.2	1.2				
4		<b>END OF TEST PIT AT 1.2 METRES</b> -refusal of material -no groundwater encountered -no sloughing of sidewalls						
10								

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.06  
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Test Pit Log: TP22-07

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



**GEOPACIFIC**  
CONSULTANTS

201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE		SOIL DESCRIPTION	Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
Depth	Symbol					
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, roots throughout, dark brown, damp, loose to compact	0.0			
1		<b>BEDROCK</b>	-0.3 0.3			
2		<b>END OF TEST PIT AT 0.6 METRES</b> -refusal of material -no groundwater encountered -no sloughing of sidewalls	-0.6 0.6			
3						
4						
5						
6						
7						
8						
9						
10						

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.07  
Page: 1 of 1

Test Pit Log: TP22-08

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE						
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, sandy, roots throughout, dark brown, damp, loose to compact	0.0			
1		<b>GRAVEL and SAND</b> sub-round to sub-angular gravel, fine to coarse grained sand, silty, medium grey, moist, loose to compact	-0.3 0.3			
2		<b>SAND and GRAVEL</b> medium to coarse grained sand, angular gravel to cobble, some silt, copper brown, damp, compact to dense	-0.6 0.6			
3						
4						
5						
6		<b>GRAVEL and SAND</b> sub-round to sub-angular gravel to boulders, fine to coarse grained sand, silty, medium grey, moist, compact to dense	-1.8 1.8			-boulders up to 0.6 metres in diameter @ 2.0 metres
7						
8						
9						
10		<b>END OF TEST PIT AT 2.8 METRES</b>	-2.8 2.8			

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.08  
Page: 1 of 1

Test Pit Log: TP22-09

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE						
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, roots throughout, dark brown, damp, loose to compact	0.0			
1		<b>BEDROCK (WEATHERED)</b> angular, some fines, compact	-0.3 0.3			
2		<b>BEDROCK</b>	-0.8 0.8			
3		<b>END OF TEST PIT AT 0.9 METRES</b> -refusal of material -no groundwater encountered -no sloughing of sidewalls	-0.9 0.9			
1						
4						
5						
6						
2						
7						
8						
9						
3						
10						

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.09  
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Test Pit Log: TP22-10

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE						
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, rootlets throughout, dark brown, damp, loose to compact	0.0			
			-0.2			
		<b>BEDROCK</b>	0.2			
		<b>END OF TEST PIT AT 0.3 METRES</b> -refusal of material -no groundwater encountered -no sloughing of sidewalls				
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.10  
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Test Pit Log: TP22-11

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



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INFERRED PROFILE		SOIL DESCRIPTION	Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
Depth	Symbol					
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, rootlets throughout, dark brown, damp, loose to compact	0.0			
			-0.2			
		<b>BEDROCK</b>	0.2			
1		<b>END OF TEST PIT AT 0.3 METRES</b> -refusal of material -no groundwater encountered -no sloughing of sidewalls				
2						
3						
4						
5						
6						
7						
8						
9						
10						

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.11  
Page: 1 of 1

Test Pit Log: TP22-12

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE						
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, roots throughout, dark brown, damp, loose to compact	0.0			
1		<b>GRAVEL and SAND</b> sub-angular gravel, fine to coarse grained sand, some silt to silty, moist to wet with depth, loose to compact	-0.3 0.3			
2						-moderate to heavy groundwater seepage at 0.6 metres
3						
4						
5		<b>END OF TEST PIT AT 1.5 METRES</b> -groundwater encountered -no sloughing of sidewalls	-1.5 1.5			
6						
7						
8						
9						
10						

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.12  
Page: 1 of 1

Test Pit Log: TP22-13

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



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201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE						
Depth	Symbol	SOIL DESCRIPTION	Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
0		Ground Surface	0.0			
0		<b>TOPSOIL</b> silty, gravelly, roots throughout, dark brown, damp, loose to compact	0.0			
1			-0.5			
2		<b>SAND and GRAVEL</b> medium to coarse grained sand, angular gravel, some silt to silty, tan brown, moist, compact to dense with depth	0.5			
2			-0.8			
3		<b>BEDROCK</b>	0.8			
3			-0.9			
3		<b>END OF TEST PIT AT 0.9 METRES</b> -refusal of material -minor groundwater encountered -no sloughing of sidewalls	0.9			-minor groundwater seepage at 0.75 metres
4						
5						
6						
7						
8						
9						
10						

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.13  
Page: 1 of 1

Test Pit Log: TP22-14

File: 20912

Project: Okanagan Gondola Development

Client: Ridge North America

Site Location: Highway 97 and Bailey Road, Vernon



201-1889 Spall Road, Kelowna, BC V1R 4R2  
Tel: 604-439-0922

INFERRED PROFILE					Depth (m)/Elev (m)	Sample Number	Moisture Content (%)	Remarks
Depth	Symbol	SOIL DESCRIPTION						
0		Ground Surface		0.0				
0		<b>TOPSOIL</b> silty, gravelly, rootlets, dark brown, damp, loose		0.0				
1		<b>SAND and GRAVEL</b> fine to medium grained sand, sub-angular gravel, some silt to silty, golden yellow brown, damp, compact		-0.3				
0.3				0.3				
2								
3								
4								
5								
6		<b>END OF TEST PIT AT 1.8 METRES</b> -no groundwater encountered -no sloughing of sidewalls		-1.8				
1.8				1.8				
7								
8								
9								
10								

Logged: AT  
Method: John Deere 75 Tracked Excavator  
Date: March 17, 2022

Datum:  
Figure Number: A.14  
Page: 1 of 1

## APPENDIX D: LANDSLIDE ASSESSMENT ASSURANCE STATEMENT

Note: This Statement is to be read and completed in conjunction with the "APEGBC Guidelines for Legislated Landslide Assessments for Proposed Residential Development in British Columbia", March 2006/Revised September 2008 ("APEGBC Guidelines") and the "2006 BC Building Code (BCBC 2006)" and is to be provided for *landslide assessments* (not floods or flood controls) for the purposes of the Land Title Act, Community Charter or the Local Government Act. Italicized words are defined in the APEGBC Guidelines.

March 31, 2022

To: The Approving Authority  
The City of Vernon

Date: \_\_\_\_\_

\_\_\_\_\_  
Jurisdiction and address

With reference to (check one):

- Land Title Act (Section 86) – Subdivision Approval
- Local Government Act (Sections 919.1 and 920) – Development Permit
- Community Charter (Section 56) – Building Permit
- Local Government Act (Section 910) – Flood Plain Bylaw Variance
- Local Government Act (Section 910) – Flood Plain Bylaw Exemption
- British Columbia Building Code 2006 sentences 4.1.8.16 (8) and 9.4.4.4.(2) (Refer to BC Building and Safety Policy Branch Information Bulletin B10-01 issued January 18, 2010)

For the Property: Proposed Okanagan Gondola Development - Hwy 97 and Bailey Road, Vernon, BC

\_\_\_\_\_  
Legal description and civic address of the Property

The undersigned hereby gives assurance that he/she is a *Qualified Professional* and is a *Professional Engineer* or *Professional Geoscientist*.

I have signed, sealed and dated, and thereby certified, the attached *landslide assessment* report on the Property in accordance with the *APEGBC Guidelines*. That report must be read in conjunction with this Statement. In preparing that report I have:

Check to the left of applicable items

- 1. Collected and reviewed appropriate background information
- 2. Reviewed the proposed *residential development* on the Property
- 3. Conducted field work on and, if required, beyond the Property
- 4. Reported on the results of the field work on and, if required, beyond the Property
- 5. Considered any changed conditions on and, if required, beyond the Property
- 6. For a *landslide hazard analysis* or *landslide risk analysis* I have:
  - 6.1 reviewed and characterized, if appropriate, any *landslide* that may affect the Property
  - 6.2 estimated the *landslide hazard*
  - 6.3 identified existing and anticipated future *elements at risk* on and, if required, beyond the Property
  - 6.4 estimated the potential *consequences* to those *elements at risk*
- 7. Where the *Approving Authority* has adopted a *level of landslide safety* I have:
  - 7.1 compared the *level of landslide safety* adopted by the *Approving Authority* with the findings of my investigation
  - 7.2 made a finding on the *level of landslide safety* on the Property based on the comparison
  - 7.3 made recommendations to reduce *landslide hazards* and/or *landslide risks*
- 8. Where the *Approving Authority* has **not** adopted a *level of landslide safety* I have:

- 8.1 described the method of *landslide hazard analysis* or *landslide risk analysis* used
- 8.2 referred to an appropriate and identified provincial, national or international guideline for *level of landslide safety*
- 8.3 compared this guideline with the findings of my investigation
- 8.4 made a finding on the *level of landslide safety* on the Property based on the comparison
- 8.5 made recommendations to reduce *landslide hazards* and/or *landslide risks*
- 9. Reported on the requirements for future inspections of the Property and recommended who should conduct those inspections.

Based on my comparison between

Check one

- the findings from the investigation and the adopted *level of landslide safety* (item 7.2 above)
- the appropriate and identified provincial, national or international guideline for *level of landslide safety* (item 8.4 above)

I hereby give my assurance that, based on the conditions<sup>[1]</sup> contained in the attached *landslide assessment* report,

Check one

- for subdivision approval, as required by the Land Title Act (Section 86), "that the land may be used safely for the use intended"

Check one

- with one or more recommended registered covenants.
- without any registered covenant.
- for a development permit, as required by the Local Government Act (Sections 919.1 and 920), my report will "assist the local government in determining what conditions or requirements under [Section 920] subsection (7.1) it will impose in the permit".

- for a building permit, as required by the Community Charter (Section 56), "the land may be used safely for the use intended"

Check one

- with one or more recommended registered covenants.
- without any registered covenant.
- for flood plain bylaw variance, as required by the "Flood Hazard Area Land Use Management Guidelines" associated with the Local Government Act (Section 910), "the development may occur safely".
- for flood plain bylaw exemption, as required by the Local Government Act (Section 910), "the land may be used safely for the use intended".

Roberto Avendano, P.Eng.

March 31, 2022

Name (print)

Date

Signature

<sup>[1]</sup> When seismic slope stability assessments are involved, *level of landslide safety* is considered to be a "life safety" criteria as described in the National Building Code of Canada (NBCC 2005), Commentary on Design for Seismic Effects in the User's Guide, Structural Commentaries, Part 4 of Division B. This states:

*"The primary objective of seismic design is to provide an acceptable level of safety for building occupants and the general public as the building responds to strong ground motion; in other words, to minimize loss of life. This implies that, although there will likely be extensive structural and non-structural damage, during the DGM (design ground motion), there is a reasonable degree of confidence that the building will not collapse nor will its attachments break off and fall on people near the building. This performance level is termed 'extensive damage' because, although the structure may be heavily damaged and may have lost a substantial amount of its initial strength and stiffness, it retains some margin of resistance against collapse".*

Geopacific Consultants Ltd.

Address

201 - 1889 Spall Road, Kelowna, BC V1Y 4R2

604-439-0922

Telephone

2022-03-31



(Affix Professional Seal Here)

Permit to Practice 1000782

If the *Qualified Professional* is a member of a firm, complete the following.

I am a member of the firm \_\_\_\_\_

Geopacific Consultants Ltd.

and I sign this letter on behalf of the firm.

(Print name of firm)