# DEVELOPMENT PERMIT

NO. **DP-2019-26**
**DP-2019-27**
**DP-2019-28**

TO: [redacted]

ADDRESS: [redacted]
(Permittee)

1) This Development Permit is issued subject to compliance with all of the Bylaws of the Town of Gibsons applicable thereto, except those specifically varied or supplemented by this Permit.

2) The Development Permit applies to those "lands" within the Town of Gibsons described below:

**Parcel Identifier:** **008-820-210**

**Legal Description:** **Lot 5 Block 34 District Lot 685 Plan 12680**

**Civic Address:** **689 Franklin Road**

3) These lands are within Development Permit Areas of the Town of Gibsons Official Community Plan (Bylaw 985, 2005). This permit applies to the following Development Permit Area:

- Development Permit Area No. 1 (Geotechnical Hazard Area) for the purpose of protection of development from hazardous conditions.
- Development Permit Area No. 2 (Environmentally Sensitive Areas) for the purpose of protection of the natural environment.
- Development Permit Area No. 9 (Gibsons Aquifer) for the purpose of the protection of the Gibsons Aquifer.

4) The "land" described herein shall be developed strictly in accordance with the terms and conditions and provisions of this Permit, and any plans and specifications attached to this Permit which shall form a part thereof; specifically:

*Attachment A - Geotechnical Report dated December 6, 2019, by Davies Geotechnical Inc., stamped by Ben Davies., P.Eng.,*

*Attachment B - Marine Foreshore Environmental Assessment, dated October 31, 2019, by Cam Forrester & Associates Ltd., stamped by Cam Forrester, R.P.F. #2118.*

5) All requirements of the plans are to be followed. On site monitoring by the Geotechnical Engineer and Qualified Environmental Professional during construction as outlined in the plans is required.

6) Minor changes to the aforesaid drawings that do not affect the intent of this Development Permit are permitted only with the approval of the Town of Gibsons and Geotechnical Engineer and Qualified Environmental Professional.

7) If the Permittee does not commence the development permitted by this Permit within twenty four months of the date of this Permit, this Permit shall lapse.

8) Upon completion of the works, letters from the Geotechnical Engineer and Qualified Environmental Professional are required to confirm all conditions of this Permit have been met.

9) This Permit is NOT a Building Permit.

ISSUED THIS 19TH DAY OF FEBRUARY 2020

Lesley-Anne Staats, MCIP, RPP
Director of Planning

Copy of permit to the Geotechnical Engineer and the Qualified Environmental Professional

Foundations, Excavation, & Shoring Specialists

**DAVIES GEOTECHNICAL INC.**

1520 Cliveden Avenue, Unit 2
Delta, B.C. Canada V3M 6J8

T: 604.395.2300
F: 604.395.2301

www.daviesgeotechnical.com

Foundation Design

Excavation & Shoring Design and Monitoring

Slope Stability

Retaining Wall Design

Earthquake Engineering

Liquefaction Assessment

Storm Water Management Design

Sediment & Erosion Control Design

Design Build

**COMMERCIAL**

**RESIDENTIAL**

**INFRASTRUCTURE**

Date: December 6, 2019
Project No: R086

**Mithrush Construction**

**Attn: Blake Mithrush**
**Re: Geotechnical Report**
**Proposed Single Family Residence**
**689 Franklin Road, Gibsons, BC**

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Dear Sir:

In response to your request, Davies Geotechnical Inc. has completed a desktop review and walkthrough investigation of the property located at 689 Franklin Road, in Gibsons, B.C.

The purpose of this assessment was to collect information regarding the soil and groundwater conditions at the property to enable us to provide design recommendations for the proposed single-family residence.

This geotechnical report provides a summary of the existing site conditions, the site and laboratory work completed, the soil stratigraphy encountered during the site review and presents recommendations regarding slope stability, site preparation, foundation design, seismic design, floor slabs, perimeter drainage, and basement wall design.

The following background information was used for the preparation of this geotechnical report.

- Geologic Survey information from the Town of Gibsons and Sunshine Coast
- Seismic Hazard Map provided by National Resource Canada
- Survey by Strait Land Surveying – October 4, 2019
- Architectural Drawings by Mithrush Construction – November 13, 2019
- Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC – May 2010
- Town of Gibsons Official Community Plan Reconnaissance Study of Geotechnical Hazards and Biophysical Environment – October 22, 1991
- Smartplan Gibsons Official Community Plan – March 2015
- Guidelines for Management of Coastal Flood Hazard Land Use – Ausenco Sandwell – January 27, 2011
- Aquifer Mapping Study Town of Gibsons BC – Waterline Resources Inc. – May 13, 2013
- Flowing Artesian Wells Water Stewardship Information Series – Ministry of Environment

Report Attachements:

- Figure 1: Site Plan with cross section location

- Figure 2: Cross Section A
- Figure 3: Lateral Earth Pressure for Basement Design

## 1.0 SITE DESCRIPTION

The subject property is located on the south side of Franklin Road bounded by residential properties to the east and west, and the Pacific Ocean (Georgia Straight north of Howe Sound and Squamish) to the south. At the time of our walk through, the site was occupied by an existing two storey residence founded over a basement level.

Topographic information obtained from the site survey conducted by Strait Land Surveying – October 4, 2019 indicates the north two thirds of the property are relatively flat with approximate elevation of 13 meters. The south two thirds of the property is sloping south down toward the ocean. Slope grades vary with the steepest slope being approximately 1V:1.5H along the south east corner of the site. Elevations of this slope range 12 meters and 0 meters.

## 2.0 PROPOSED DEVELOPMENT

Review of architectural drawings provided by Mithrush Construction dated November 13, 2019 show the proposed residence will be 1.5 storeys tall over one partially below grade basement level. The proposed basement slab elevation is 11.89 meters. The proposed building will be set back a minimum of 9 meters from the crest of the slope.

We understand that the building will be setback approximately 2.1 meters from the adjacent east and west property lines. Adjacent buildings are estimated to be approximately 1.5 to 2 meters from the property lines. Maximum excavation depts are anticipated to be in the order of 2 meters deep to bottom of footing.

## 3.0 GEOTECHNICAL ASSESSMENT

### 3.1 Site Walkthrough

Davies Geotechnical Inc. conducted a geotechnical site walkthrough investigation on November 1, 2019, which included the completion of hand dug test pitting through the face of the slope to review subgrade soils on the subject site slopes and adjacent slopes above the beach.

The soils were logged by an engineer from Davies Geotechnical Inc. Soil samples considered representative of the soil horizons encountered at the site were collected at each layer and returned to our laboratory for further classification. The soil identification and sampling work was completed by qualified staff from Davies Geotechnical Inc.

## 4.0 SUBSURFACE CONDITIONS

### 4.1 Site Geology

Our research into the Town of Gibsons surficial geology indicates that the site is located within an area underlain by a layer of Capilano Sediments. The site is closely bordered by areas underlain by Late Jurassic Granodiorite bedrock.

### 4.2 Soil Conditions

Our site review and test pitting revealed the soils within the slopes consisted of approximately 8 meters of dense silty fine sand to fine sandy silt consistent with the Capilano Sediments found in the area, over bedrock at the bottom of the slopes.
The results of the site investigation confirmed that conditions at the site generally conform to the known geology of the area.

### 4.3 Ground water

Minimal seepage was noted between the interface of the bedrock and the silty fine sand soils. Davies Geotechnical did not find any notable sources of water coming through the face of the slope or at the interface between the bedrock and soil during our site review. We estimate that a perched water table may develop on top of the bedrock due to differences in permeability and above the fine sandy silt Capilano sediments. This water is expected to vary seasonally with rainfall and flow downhill into the ocean below the site.

## 5.0 SEISMIC CONSIDERATIONS

The site is located in a seismically active area where the effects of a major earthquake must be considered in the design of the proposed building. BCBC 2018 specifies the design earthquake as a magnitude 7 earthquake with a 2% chance of exceedance in 50 years or a 2475-year return period. The peak hard ground acceleration associated with the design earthquake is anticipated to be 0.366g.

The soils encountered at the site are generally dense and not susceptible to strength or stiffness loss or liquefaction during cyclic loading. Based upon the soil conditions encountered the site should be considered a Class "C" site as defined by BCBC (2018).

## 6.0 NATURAL HAZARD ASSESSMENT

The site is within the town of Gibsons and is subject to meeting the following permit requirements of the Town of Gibsons:

- Geotechnical Hazard Development Permit Area No. 1.
- Marine Shoreline DPA Boundary Development Permit Area No. 2.
- Aquifer Protection Area Development Permit Area No. 9.

Davies Geotechnical has completed a desk top study paired with the findings of our field inspection and test pits to review the risk of natural hazard occurrence at the subject property and to address the

concerns of each of the development permit requirements. The Hazards considered for this study were as follows:

- Inundation due to oceanfront flooding
- Slope instability and seismic risk
- Flood and debris flow
- Aquifer protection and artesian flow
- Marine shoreline environment and habitat risks

A discussion regarding each of these hazards as well as environmental protection is provided within the following sections of this report.

### 6.1 Ocean Front Flooding

Typically, buildings are sited at an adequate distance from the waterfront and an adequate elevation to limit the risk of damage due to flooding or exposure to wind driven spray.

Development of a suitable flood protection elevation for the property requires consideration of several parameters, as follows:

- Future sea level rise
- High high-water elevation (King Tide)
- Storm surge
- Wind and wave action

Our review of previous studies completed by Ausenco (2011) indicate that the following allowances should be made for each of these parameters.

- Future sea level rise (SLR) = 1 meter
- High high-water elevation (King Tide) = 2.05 meters
- Storm surge = 1.3 meters
- Wave effect = 0.65 meters
- Free board = 0.6 meters

The resulting minimum flood construction level (FCL) for the site would then be elevation 5.6 meters geodetic.

See attached figure 2 for a diagram illustrating the new FCL, future natural boundary, proposed building setback, minimum building setback from future natural boundary, and estimated future slope regression due to beach erosion from sea level rise.

The figure shows the proposed building footing elevation in relation to the slope. The proposed building top of slab elevation is 11.9 meters which is far above the future FCL of 5.6 meters and outside of the minimum 15-meter setback from the future natural boundary recommended by the 1991 Thurber report.

It should be noted that sea level rise between 2100 and 2200 is expected to be an additional 1 meter.

## 6.2 Slope Instability

The site is bordered by steep slopes along the south and south east boundaries. Site slopes are steepest at the south east corner where slopes are approximately 8 meters high above bedrock graded at 1V:1.5H. Davies Geotechnical found during our field investigation the soils within the top 8 meters of the slope consist of dense silty fine sand over top of bedrock. Davies Geotechnical has confirmed by visual inspection bedrock exists at the bottom of the slopes throughout the site extending to the end of the lock block wall east of the site. The slope was found to be heavily vegetated and no evidence of slides or erosion were found during our review. Some small pockets of soils were found to be exposed in the south west area of the site just above the bedrock.

Geotechnical Hazard Development Permit Area No. 1 geotechnical hazards map indicates this site is subject to the ocean shoreline active geomorphic boundary of 15 meters from natural boundary due to the future high high-water mark. The site is also at the edge of the "high probability of geotechnical occurrence" boundary which mandates a 30-meter setback from the natural boundary.

Using the soil information inferred from our site review paired with the topographic survey conducted by Strait Land Surveying – October 4, 2019, we were able to complete a slope stability analysis for seismic stability of the slope based on current slope and soil conditions paired with future sea level rise. Using the anticipated top of bedrock as a boundary for ocean caused erosion, we found that the top of slope would likely regress due to erosion approximately 3.6 meters back from its current location. We have assumed the slope would likely regress due to toe erosion to a similar slope as its current state at a slope of 1V:1.5H. The analysis found a 9-meter setback from the top of slope to be an acceptable distance to meet BC landslide assessment criteria for the current slope and future slope resulting from water and wave action and sea level rise. Details of this analysis are located in section 6.2.1 to section 6.2.5 of this report.

See attached figure 2 for existing slope and estimated future slope due to erosion driven by sea level rise. The proposed development will be approximately 19.5 meters setback from the year 2100 future natural boundary and 23 meters from the current natural boundary placing it outside of the mandatory 15-meter setback.

Davies Geotechnical has reviewed the October 22, 1991 Thurber report titled *"Town of Gibsons Official Community Plan Reconnaissance Study of Geotechnical Hazards and Biophysical Environment"*. The report identifies the pocket beaches along Franklin road having significant ongoing evidence of slope movement and cause for concern from a geotechnical perspective resulting in the recommendation of 30-meter setbacks for lots located north of these slopes. The pocket beach boundaries and 30-meter setback end where bedrock is found at the bottom of the slopes in the middle of Franklin Drive and at the east and west ends of the beaches. The subject site is situated at the eastern boundary of the middle bedrock outcrop and is immediately adjacent the pocket beach where the report found significant cause for concern in the form of heavy slope erosion and small landslides. See below for map with geotechnical hazards highlighted by the 1991 Thurber report. Within the map dark purple indicates a site requires 30-meter setback while light purple indicates 15-meter setback is required.


*Schedule C – Geotechnical Hazards Development Permit Area No. 1 (setbacks not to scale)*

Davies Geotechnical found that the subject site should not be subject to the same 30-meter setback as the adjacent pocket beaches for the following reasons:

- The bottom of slopes at the subject site are bedrock which is strong and relatively not susceptible to erosion unlike the pocket beaches which are above an erodible beach environment that extend deep below the slope. Wave action on the beach erodes the soils at the bottom of the slope which undermines the slopes above causing slope instability. The slope instability above the beaches found by Thurber is the reason the lots above the pocket beaches are subject to the 30-meter setback established in the 1991 Thurber report. Because the subject site does not have an erodible bottom of slope, this site is subject to a much lower risk of slope failure than the adjacent beach lots and therefore should not be subject to the same setback. See attached figure 2 for estimated future slope regression due to effects of future sea level rise erosion and attached slope stability results and slope stability analysis methodology in section 6.2.1 to 6.2.5 of this report.
- The subject sites slopes appear to be stable from our site review with no significant recent slope instability evidence. The slopes have nearly continuous vegetation coverage over them. The adjacent pocket beach slopes have sparser vegetation coverage, significant amounts of exposed silty sand soils and evidence of soil sloughing and erosion. The lack of evidence of slope instability at the subject site compared to the slope instability evidence above the beach is evidence to suggest that the bedrock below the slopes on the subject site protects the slopes from significant toe erosion. The presence of bedrock at the bottom of the slopes was the only identifiable significant difference we found between the two slope areas during our site review where we witnessed the same soils within the slopes as the ones within the top 8 meters of soil below the subject site. Therefore, the site is not anticipated to see the same risk as the adjacent properties.
- The steepest slope angle at the site is 1V:1.5H at the east end of the site. The slopes along the beach according to the Sunshine Coast GIS map elevation data are 1V:1H. The steeper slopes from a geotechnical perspective are most likely due to the erosional environment at the bottoms of the slopes. As the subject site has bedrock at the bottom of the slopes to an elevation of approximately 4 meters the slopes are not exposed to significant erosion and as a result are more stable with a lower probability of slope instability.
- Because of the nonerodable toe of slope surface (bedrock) the subject site is similar to its neighbours to the west which are not subject to the 30-meter setback requirement. The map seen above shows the subject lot has a very small amount of overlap with the 30-meter setback likely due to the uncertainty of the start/end of bedrock at the eastern edge of the property. Davies

geotechnical has confirmed the bottom of the slopes at the eastern edge of the property is bedrock and therefore should only be categorized similar to the bedrock-controlled slopes to the west.

Using the above data regarding sea level rise, bedrock elevation, soil strength, Davies Geotechnical is able to follow the process set out in the "Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC" to provide slope stability conclusions.

### *6.2.1 Slope Stability Assessment*

Based on the site review investigation, the site soil parameters, ground water level, and soil stratigraphy, have been assumed and limit equilibrium slope stability models have been prepared, as per the "Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC." Slope stability models were created using the engineering software Slope/W, developed by GeoStudio (2007).

### *6.2.2 Design Assumption and Soil Parameters*

A review of the slope profile for on cross section of the lot has been completed and summarized in the table below. The cross section is the steepest part of the site slope and is shown modeled as the current site slope and the estimated slope in the year 2100 resulting from sea level rise and ocean erosion of the toe of the slope. Slope stability analysis was carried out on the most critical slope conditions to assess the overall stability of the adjacent slopes to the proposed building given static and seismic loading condition. Topographic details were acquired from the survey conducted by Strait Land Surveying – October 4, 2019. The following two critical cases were reviewed and summarized in this report:

- South east slope with average angle of 35 degrees in its current state
- South east slope with average angle of 35 degrees future state year 2100

See Figure 1 and 2 for plan view and cross sections of the site.

**Table 1. cross section summary**

| Cross Section | Offset of slope crest from proposed building (m) | Maximum slope angle (degrees) | Average Slope angle (degrees) | Slope Height (m) |
|---|---|---|---|---|
| X South east slope with average angle of 36 degrees in its current state | 9 | 35 | 33 | 8 |
| South east slope with average angle of 36 degrees future state year 2100 | 5.5 | 35 | 33 | 7.4 |

At the time this report was prepared, details regarding sustained loads existing near the crests of the slopes and plans for future development were not available, hence, no surcharges were included in this analysis. As the proposed building is planned to have a partial basement the load from the building will likely be offset from the basement excavation unload.

Based on the results of our site investigation, the following soil parameters have been assumed for the major soil layers and applied to our stability analyses.

**Table 2. slope stability analysis soil parameters**

| Soil Type | Thickness (m) | Unit Weight (kN/m³) | Friction Angle (º) | Cohesion (kPa) |
|---|---|---|---|---|
| fine sandy silt | 8-7.4 | 20 | 35 | 0 |
| Bedrock | ~ | 26.5 | impenetrable | impenetrable |

Because of the difference in permeability between the bedrock and the fine sandy silt we have assumed the bedrock has a perched water level above it and an Ru coefficient value of 0.1 was used to model pore water conditions within the fine silty sand above the bedrock. See below slope stability analysis results for further details.

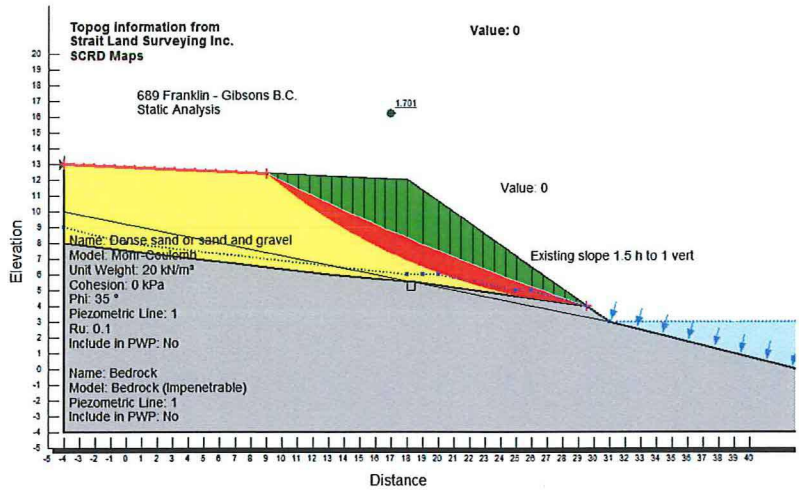
### *6.2.3 Static Analysis Results*

As shown in figures below, the static slope stability analysis, for the cross sections of the existing and future slopes, indicates that the slope profiles will have the following static factors of safety:

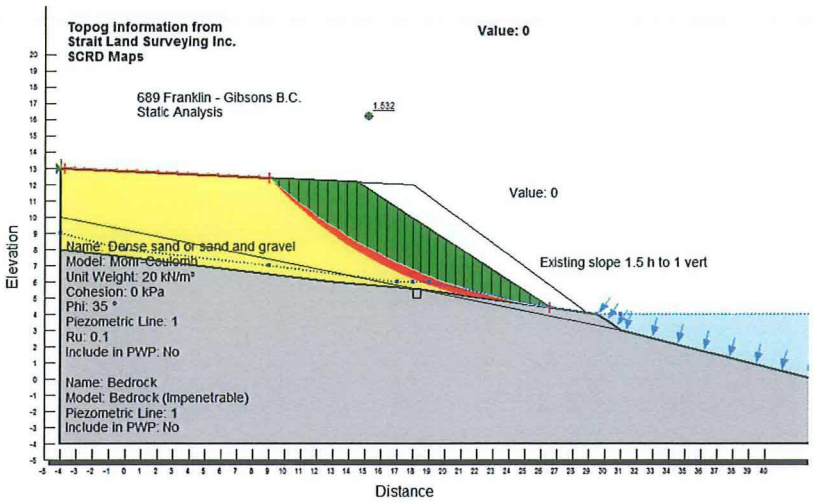
**Table 3. static analysis results**

| Cross Section | Static Factor of Safety |
|---|---|
| Current Conditions – cross section with setback of 9 meters | 1.701 |
| Future year 2100 Conditions – cross section with new setback of 5.5 meters | 1.532 |

"Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC" recommends a minimum static factor of safety of 1.5 and therefore, all factors of safety calculated are considered adequate for the global stability of the slopes.




*Existing Slope Static Factor of Safety (FOS 1.701)*




*Year 2100 Future Estimated Slope Static Factor of Safety (FOS 1.532)*

### *6.2.4 Seismic Analysis Results*

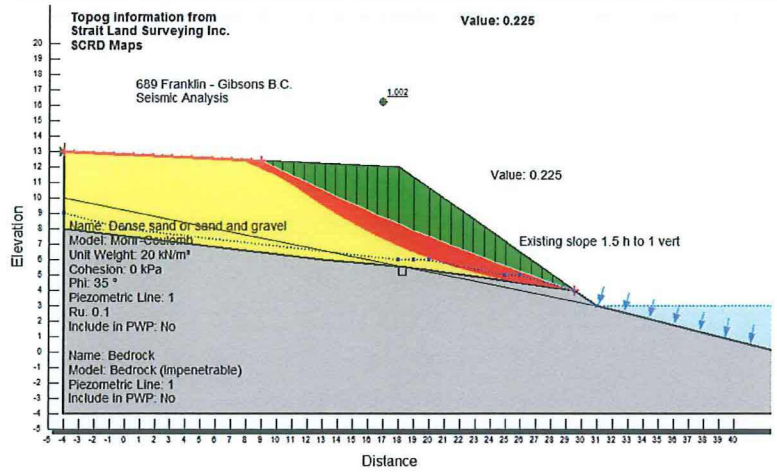
In order to determine the potential ground movements during a characteristic earthquake, as defined by British Columbia Building Code (BCBC, 2018), a slope stability assessment for this property has been completed according to the "Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC." This guideline recommends using the seismic slope displacement procedure prescribed by Bray and Travasarou (2007).

The magnitude 7 crustal earthquake and the magnitude 9 subduction earthquake parameters were used assuming a 1 in 2475-year occurrence for this analysis. As per the report by Cave (1993) this lot can be characterized as requiring "Approval, but with siting requirements to avoid the hazard" for small-scale localised landslips, and "Approval without conditions relating to hazards" for a major catastrophic landslide.

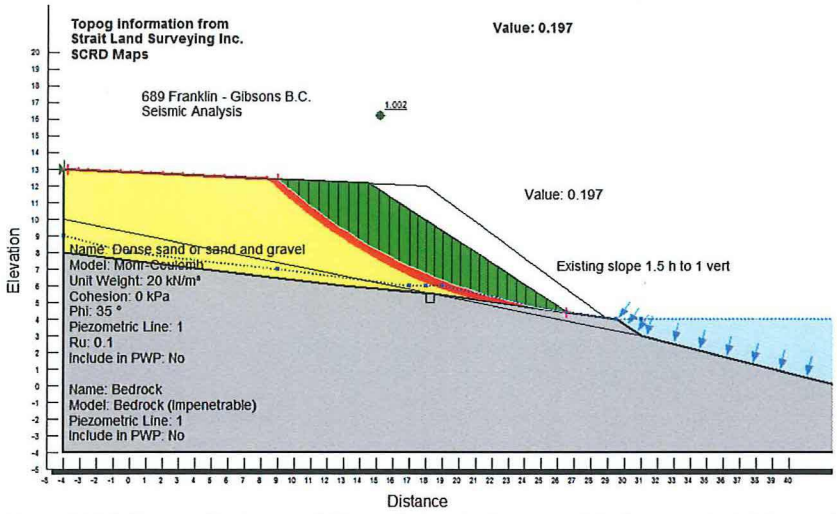
The results of the seismic analysis for the two slopes and two earthquake scenarios are shown below. The results indicate that the following displacements could be anticipated given the seismic event prescribed by BCBC (2018):

**Table 4. seismic analysis results**

| Cross Section | Earthquake Magnitude | Vs (m/s) | Ky when FOS = 1 | Displacement (cm) | Probability of Exceeding 15 cm Displacement |
|---|---|---|---|---|---|
| Current Conditions – cross section setback of 9 meters | 7 | 200 | 0.225 | 6.42 | 0.0992 |
| Current Conditions – cross section setback of 9 meters | 9 | 200 | 0.225 | 0.53 | 0.0 |
| Future year 2100 Conditions – cross section new setback of 5.5 meters | 7 | 200 | 0.197 | 8.09 | 0.1746 |
| Future year 2100 Conditions – cross section new setback of 5.5 meters | 9 | 200 | 0.197 | 0.56 | 0.0 |




*Existing Slope Seismic Factor of Safety and yield acceleration (FOS 1)*




*Year 2100 Future Estimated Slope Seismic Factor of Safety and yield acceleration (FOS 1)*

"Guidelines for Legislated Landslide Assessments for Proposed Residential Developments in BC" recommends slope displacements along the slip surface of 15 cm or less is considered acceptable when the sliding surface is between the proposed residential building and the face of the slope. Therefore, these displacements are not expected to impact the development of the property provided recommended setbacks are followed.

### *6.2.5 Slope Stability Assessment Conclusions*

Based on our analysis results regarding global stability given static and seismic loading, it has been determined that the factor of safety and anticipated slope displacements are within the acceptable ranges, as per the standard design practices for this region. This lot is safe for redevelopment provided that a setback from the existing top of slope of 9 meters is used for construction of the proposed residence, vegetation is maintained on the face of the slope, and no increase of grades or loading at the top of the slope are added.

To prevent surficial instability of the slopes at the subject site Davies Geotechnical recommends storm water and all landscape watering be directed away from the slopes on the south side of the property. Davies Geotechnical recommends that landscape watering and irrigation systems should not be used within the slope setbacks.

Continuous vegetation above and below the slopes should be maintained to minimize potential slope instability slides. If decks or patios are installed, surface vegetation will be lost below them. The surface below these areas should be replaced with impermeable surfaces that collect water and direct it away from the slopes to prevent a preferential pathway for water flow below these structures. Development on the slopes is not recommended as it can cause surficial instability due to loss of vegetation and introduction of increased water flows to slope soil surfaces.

### 6.3 Flooding and Debris Flow from Creeks

The available maps indicate that there are no creeks within or adjacent to the site and therefore there is no risk of flooding or debris flow from creeks.

### 6.4 Ground Water, Aquifers, and Artesian Flow

The proposed building will be largely situated above the layout of the existing building. The existing basement elevation is 12.4 meters and the proposed basement elevation is 11.9 meters. Excavations of 0.5 meters deeper than existing basement level footings will be required to build the proposed building. The excavation depth is anticipated to be approximately 2 meters deep at its maximum.

We are aware of the hydrological ground layer considerations that must be accounted for while excavating within the Town of Gibsons which includes, the Pre Vashon (Gibsons) Aquifer, the Vashon Deposited (Till) Aquitard, and the Capilano soils Aquifer (unconfined perched aquifer). Our desktop review found information regarding these different aquifer soil strata from Waterline Resources Inc. which presented the different aquifer layers throughout Gibsons. The subject site was found to only partially have the same soil profile normal to Gibsons. Soils within the face of the slopes below the site were found to have the following profile:

- Capilano Sediments: 0 – 8 meters below grade
- Late Jurassic Granodiorite bedrock: 8 meters + below grade

See figure 2 cross section for soil layers below the site.

Digging into the Vashon deposited soil layers increases the risk of ground water contamination, breaching the aquitard, lowering aquifer pressure, and artesian flow. The subject site is found to be only underlain by Capilano sediments and bedrock. As the existing Capilano sediments found have very low permeability due to high fines content a perched water layer is likely to develop near the surface of these soils and possibly below them on top of the bedrock however confined aquifers with artesian potential are not likely as no significant signs of water seepage were found during our site review coming from the slope face. Additionally, no evidence of Vashon or Pre-Vashon soils were found above the bedrock, therefore, Davies Geotechnical finds the possibility of the proposed excavation breaching into the confined Pre-Vashon Gibsons aquifer very low.

Davies Geotechnical has reviewed available data regarding the Gibsons aquifer, based on the information found we understand that the site is subject to the Gibsons Aquifer Development Permit Area however it is not within the Gibsons Well Head Protection Area. Given the lack of evidence of the Pre-Vashon Gibsons aquifer soil deposit below the site as well as the site being outside of the well head protection area, the possibility of contamination of the Gibsons aquifer water supply is unlikely due to the activities at the subject site. The proposed building construction is not anticipated to be a significant source of potential hazardous contaminants. Regardless care should be taken on any project to ensure potential contaminants from machine fuels lubricants etc. are not introduced into the ground water and soils below the site. As the site soils are found to have very low permeability, to protect the ground water and any nearby wells it should be possible to remove all soils within spill areas with contaminants on there surface, from the site to be treated before they leach into the ground water supply. Additionally, the contractor completing works must have appropriate spill response equipment on site at all times to address any potential spills.

Based on the existing subgrade soils found during our review of the site, Davies Geotechnical anticipates low risk to the Gibsons Aquifer following the proposed building plan and basement elevation. To prevent risk of artesian flow or making contact with the aquifer, care should be taken by the contractor during excavation to ensure the basement excavation is limited to minimum excavation level of 11.45 meters for footing subgrade.

### 6.5 Marine Shore Environment and Habitat Risk

Development permit area No. 2 requires consideration of the marine shore area as it is considered an integral component of the marine environment and essential fish habitat. Davies Geotechnical understands based on the 1991 Thurber report that a minimum setback of 15 meters from the natural boundary is to be adhered to protect the marine shore environment. The proposed development will be approximately 19.5 meters setback from the year 2100 future natural boundary and 23 meters from the current natural boundary placing it outside of the mandatory 15-meter setback. Davies Geotechnical understands Mithrush Construction has hired an environmental consultant to further review this.

## 7.0 COMMENTS AND RECOMMENDATIONS

The results of the investigation and our analysis confirm that the site is safe for the intended use.

### 7.1 Site Preparation

The first stage of site preparation will involve the demolition and removal of all existing buildings, old foundations, and underground utilities. The topsoil and existing loose fills found on site should also be removed.

To satisfy the requirements of WorksafeBC, all cut slopes deeper than 1.2 meters should be excavated at 1V:1H within the subgrade soils and covered with poly. Poly is to be installed immediately after excavation to protect the slopes from saturation and disturbance. The protective layer of poly should be securely fastened at the top and the bottom of the slope to limit the infiltration of run-off and precipitation below the poly.

The existing soils on site contain fines in excess of 10% and therefore will not be suitable for use as structural fill. Structural fill should consist of well graded granular soils free from clay, boulders and

organics and should be placed with moisture content within 2% of the optimum moisture content as defined by the Modified Proctor test. Structural fill should be placed in loose lifts not exceeding 300 mm in thickness with each lift compacted to at least 95% of Modified Proctor maximum dry density.

Based on the low permeability soils found during the investigation and the relatively shallow depth of excavation, ground water seepage is expected to be very low. We anticipate that excavation water flows can be managed with temporary pumped sumps at the base of the excavation.

### 7.2 Foundation Design

The dense native fine sandy silt soils are estimated to be near current grade level and are suitable to support the proposed building using typical pad and strip footings.

Footings may be placed on the dense native fine sandy silt or compacted structural fill placed over the native soils free of organics or loose material. If loose fill or organics are found at footing grade, Davies Geotechnical recommends removing the loose fill below the proposed bottom of footing elevation and replacing it with well compacted structural fill. Davies Geotechnical should be contacted for review of possible requirement for deeper excavation prior to excavating deeper to prevent issues related to the aquifer below.

For structural design, footings placed over the dense native fine sandy silt or structural fill, can be designed with a serviceability limit states bearing pressure of 75 kPa and a factored ultimate bearing capacity of 113 kPa.

Structural fill should consist of well graded granular soils free from clay, boulders and organics and should be placed with moisture content within 2% of the optimum moisture content as defined by the Modified Proctor test. Structural fill should be placed in loose lifts not exceeding 300 mm in thickness with each lift compacted to at least 95% of Modified Proctor maximum dry density.

Prior to placing concrete, the geotechnical engineer should inspect and approve of all bearing surfaces.

For sliding and passive capacity of footings, the sliding coefficient of concrete footings cast on well compacted structural fill or native dense soils is 0.4 and the passive pressure coefficient of footings backfilled with well compacted structural fill is Kp=3.4.

Adjacent footings bearing on varying elevations in soil should have a minimum of 1 vertical to 2 horizontal slope between adjacent edges bearing surfaces. Footings adjacent excavations or building sumps at lower elevations should have a minimum of 1 vertical to 2 horizontal slope between bottoms of adjacent excavations or structures.

### 7.3 Floor Slab

Building slabs should be placed over a minimum 0.15-meter-thick drainage layer consisting of 19 mm clear crushed gravel in order to create a capillary break.

Floor slabs may be poured as slab on grade on compacted structural fill or the very dense native soils found below the site.

Structural fill should consist of well graded sand and gravel with less than 5% passing the # 200 sieve (silt and clay content of less than 5%) and be compacted to at least 95% of the Modified Proctor Maximum dry density, in accordance with ASTM D 1557.

Based upon the geotechnical site investigation, the subgrade soils are not suitable to re-use as structural fill.

### 7.4 Basement Wall Design

Basement walls should be designed to resist the applicable lateral pressures associated with earth pressure, hydrostatic pressure (if any), surcharge loadings, compaction loadings, and seismic loads.

Attached to this report (Figure 3) is a lateral earth pressure diagram providing the design pressure diagrams for both static loading and static plus seismic loading. The following assumptions were made by Davies Geotechnical Inc. in the provision of the attached lateral earth pressure diagram.

- The backfill adjacent to the proposed basement is free draining and, therefore, there are no hydrostatic water pressures.
- Backfill is granular in nature and is compacted in lifts to at least 95% of the Modified Proctor Maximum dry density, in accordance with ASTM D 1557.
- Grades adjacent to the proposed building are flat and level for a distance at least equivalent to the wall height.
- The basement is provided with a perimeter drain system connected to a suitable discharge point.
- The basement is free to rotate at the top of the wall equivalent to 0.002 times the wall height, allowing mobilization of the peak shear strength of the backfill adjacent to the basement wall.
- The maximum surface horizontal acceleration a=0.366g (BCBC 2018) ($k_h$=0.65*PGA)

In the case where all of the above noted conditions are not satisfied, the geotechnical engineer should complete a specific assessment of lateral earth pressure loading for design.

### 7.5 Building Perimeter Drainage and Perimeter Backfill

Backfill adjacent to the below grade walls should consist of clean draining sand and gravel with less than 5% passing the # 200 sieve. This backfill should be placed in 300 mm thick lifts and compacted to at least 95% of Modified Proctor maximum dry density. A 300 mm thick drainage chimney should be placed against backfilled walls consisting of 19 mm clear crushed gravel. The chimney should be hydraulically connected to the footing drains. Perimeter drainage should conist of a minimum 100 mm PVC perforated pipe with holes facing down surrounded by a minimum of 6" of clear crushed gravel wrapped in non woven filter fabric.
Storm water drainage and footings drains should not be drained in a manner that they are introduced to the surface of the adjacent steep slopes. Water should be conveyed to the bottom of them or connected to the town storm water system.

## 8.0 CLOSURE

Davies Geotechnical Inc. has prepared a geotechnical report for the proposed residence to be constructed at 689 Franklin Road in Gibsons, B.C.

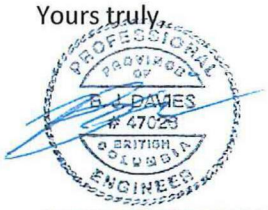
We recommend that, prior to tender, the geotechnical engineer review all design documents and specifications.

In order to satisfy the requirements of the building schedules, Davies Geotechnical Inc. will be required to complete field reviews during the construction process. These field reviews will include the following:

- Inspection of subgrade conditions beneath all fills and surfacing materials prior to the placement of fill or concrete footings
- Review of the compaction of subgrade fills and structural fills
- Review all temporary and permanent slopes.

We trust that the information provided meets your current requirements. If you have any questions, please do not hesitate to contact the undersigned.

Yours truly,

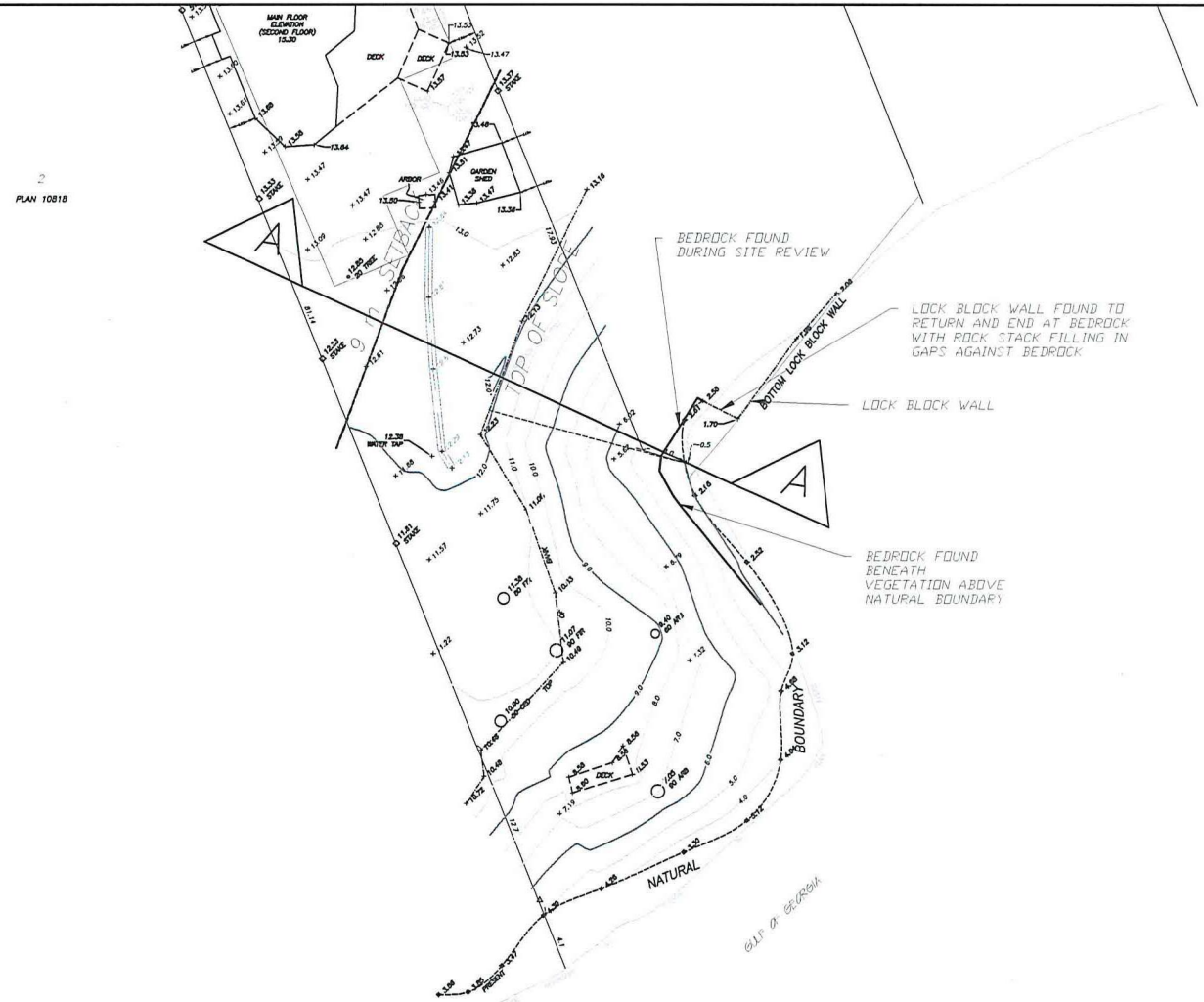



**DAVIES GEOTECHNICAL INC.**
**Ben Davies, P.Eng.**

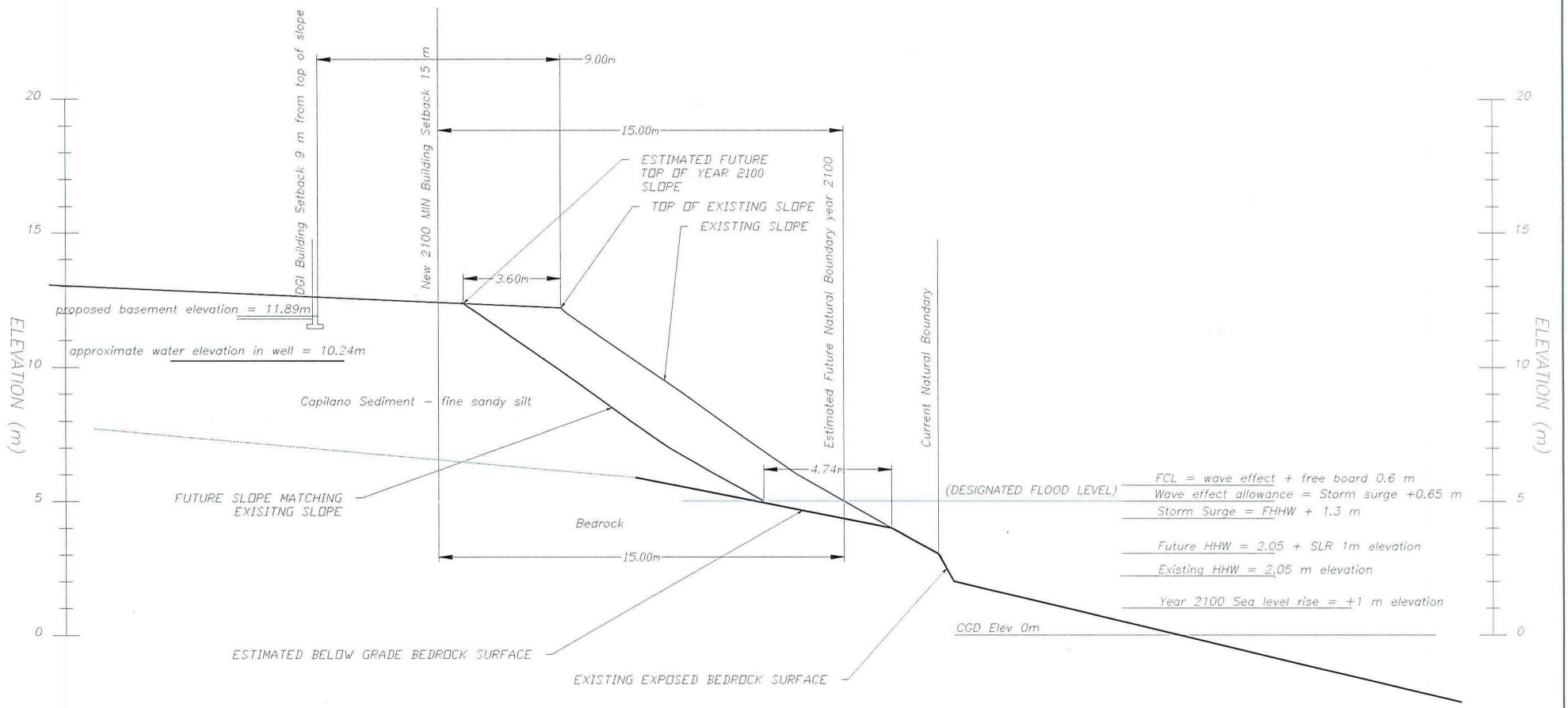
☎ 604-395-2300
🖷 604-395-2301
✉ ben@daviesgeotechnical.com

**DAVIES GEOTECHNICAL INC.**
**Mr. Paul A. Davies, P.Eng., Principal**

☎ 604-395-2300
🖷 604-395-2301
✉ pauldavies@daviesgeotechnical.com




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Davies Geotechnical Inc.<br>#2 - 1520 Cliveden Avenue, Delta, B.C. V3M 6J8<br>Tel 604-395-2300 Fax. 604-395-2301 | DWN BY: BD | PROJECT<br>689 FRANKLIN ROAD,<br>GIBSONS, BC | | DATE: DEC. 4, 2019 |
| | | | | CHK'D BY: PD | | | PROJECT NO: R086 |
| | | | | APP. PD | TITLE<br>SITE PLAN | | REV. NO.: IFBP |
| IFBP | DEC 2018 | ISSUED FOR BUILDING PERMIT | CLIENT<br>MITHRUSH CONSTRUCTION | SCALE NTS | | | DWG No. Figure 1 |
| REV. | DATE | REVISION | | | | | |



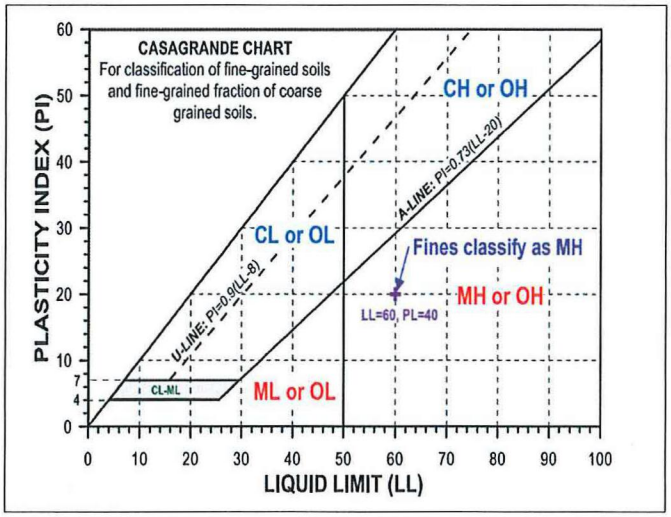

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | DGI Davies Geotechnical Inc. #2 - 1520 Cliveden Avenue, Delta, B.C. V3M 6J8 Tel 604-395-2300 Fax. 604-395-2301 | DWN BY: BD | PROJECT 689 FRANKLIN ROAD, GIBSONS, BC | | DATE: DEC. 4, 2019 |
| | | | | CHK'D BY: PD | | | PROJECT NO: R086 |
| | | | | APP. PD | TITLE CROSS SECTION A | | REV. NO.: IFBP |
| IFBP | DEC 2018 | ISSUED FOR BUILDING PERMIT | CLIENT MITHRUSH CONSTRUCTION | SCALE NTS | | | DWG No. Figure 2 |
| REV. | DATE | REVISION | | | | | |

DAVIES GEOTECHNICAL

# Modified Unified Classification System for Soils

| Major Divisions | | | Group Symbol | Typical Names | Laboratory Classification Criteria | | |
|---|---|---|---|---|---|---|---|
| Course-Grained Soils<br>More than 50% retainedon the 0.075 mm (No. 200) sieve | GRAVELS<br>50% or more of course fraction retained on the 4.75 mm (No. 4) sieve | Clean Gravels<br>(Little or No Fines) | GW | Well-graded gravels and gravel-sand mixtures, little or no fines | Determine % of gravel and sand from grain size curve. Depending on % of fines (fraction smaller than 75µm) course grained soils are classified as:<br>Less than 5% : GW, CP, SW, SP<br>More and 12%: GM. GC. SM, SC<br>5% - 12% Borderline cases requiring use of dual symbols | $C_u = \frac{D_{60}}{D_{10}} > 4;\ C_c = \frac{(D_{30})^2}{(D_{10} * D_{60})} = 1 \text{ to } 3$ | |
| | | | GP | Poorly graded gravels & gravel-sand mixtures, little or no fines | | NOT MEETING ALL GRADATION REQUIRMENTS FOR GW | |
| | | Gravels with Fines<br>(Appreciable amount of Fines) | GM | Silty gravels, gravel-sand-silt mixtures | | Atterberg Limits Below "A" Line, Ip less than 4 | Above "A" line with Ip between 4 & 7 are borderline cases requiring use of dual symbols |
| | | | GC | Clayey gravels, gravel-sand-clay mixtures | | Atterberg Limits Above "A" Line, Ip more than 7 | |
| | SANDS<br>50% or more of course fraction passes the 4.75 (No. 4) sieve | Clean Sands<br>(Little or No Fines) | SW | Well-graded sands and gravelly sands, little or no fines | | $C_u = \frac{D_{60}}{D_{10}} > 6;\ C_c = \frac{(D_{30})^2}{(D_{10} * D_{60})} = 1 \text{ to } 3$ | |
| | | | SP | Poorly graded sands and gravelly sands, little or no fines | | NOT MEETING ALL GRADATION REQUIRMENTS FOR SW | |
| | | Sands with Fines<br>(Appreciable amount of Fines) | SM | Silty sands, sand-silt mixtures | | Atterberg Limits Below "A" Line, Ip less than 4 | Above "A" line with Ip between 4 & 7 are borderline cases requiring use of dual symbols |
| | | | SC | Clayey sands, sand-clay mixtures | | Atterberg Limits Above "A" Line, Ip more than 7 | |
| Fine-Grained Soils<br>More than 50% passes the 0.075 mm (No. 200) sieve | SILTS<br>Below "A" Line<br>Negligible Organic Content | wL < 50% | ML | Inorganic silts, very fine sands, rock four, silty or clayey fine sands | Classification is based upon Plasticity Chart (see below)<br><br>Whenever the nature of the fine content has not been determined, it is designated by the letter 'F. Ex: SF is a Mixture of Sand with Silt or Clay | | |
| | | wL > 50% | MH | Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts | | | |
| | CLAYS<br>Above "A" Line<br>Negligible Organic Content | wL < 30% | CL | Inorganic clays of low plasticity, gravelly, sandy, or silty clays, lean clays | | | |
| | | 30% < wL < 50% | CI | Inorganic clays of medium plasticity, gravelly clays, sandy clays, silty clays | | | |
| | | wL > 50% | CH | Inorganic clays or high plasticity, fat clays | | | |
| | Organic SILTS & CLAYS<br>(Below "A" Line) | wL < 50% | OL | Organic Silts and Organic Silty Clays of Low and medium plasticity | | | |
| | | wL > 50% | OH | Organic Clays of high plasticity, organic Silts | | | |
| Highly Organic Soils | | | PT | Peat, muck, and other highly organic soils | Strong Color or Odor, and often Fibrous Texture | | |
| BEDROCK | | | BR | See Report Description | | | |

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic




| Soil Components | | | | | |
|---|---|---|---|---|---|
| Fraction | | Sieve Size (mm) | | Defining Ranges of Percentage by Weight of Minor Components | |
| | | Passing | Retained | Percent | Indentifier |
| GRAVEL | Course | 75 | 19 | 50-35 | AND |
| | Fine | 19 | 4.75 | | |
| SAND | Course | 4.75 | 2 | 35-20 | _____Y |
| | Medium | 2.00 | 0.425 | | |
| | Fine | 0.425 | 0.080 | 20-10 | Some |
| SILT (non-plastic) or CLAY (non-plastic) | | 0.080 | | 10-1 | Trace |
| OVERSIZE MATERICAL | | | | | |
| Rounded or Sub-Rounded COBBLES 75 mm to 200 mm; BOULDERS >200 mm | | | | ANGULAR ROCK FRAGMENT ROCKS > 0.75 $m^3$ in Volume | |

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

# SYMBOLS AND TERMS USED ON TEST HOLE LOGS

## 1. VISUAL TEXTURAL CLASSIFICATION OF MINERAL SOILS

| CLASSIFICATION | APPARENT PARTICLE SIZE | VISUAL IDENTIFICATION |
|---|---|---|
| Boulders | Greater than 200 mm | Greater than 200 mm |
| Cobbles | 75 mm to 200 mm | 75 mm to 200 mm |
| Gravel | 4.75 mm to 75 mm | 5 mm to 75 mm |
| Sand | 0.075 mm to 4.75 mm | Visible particles to 5 mm |
| Silt | 0.002 mm to 0.075 mm | Non-Plastic particles, not visible to the naked eye |
| Clay | Less than 0.002 mm | Plastic particles, not visible to the naked eye |

## 2. TERMS DESCRIBING CONSISTENCY (COHESIVE SOILS ONLY)

| DESCRIPTIVE TERM | APPROXIMATE UNDRAINED SHEAR STRENGTH | | APPROXIMATE SPT * 'N' VALUE |
|---|---|---|---|
| Very Soft | Less than 10 kPa | | Less than 2 |
| Soft | 10 - 25 kPa | | 2 to 4 |
| Firm | 25 - 50 kPa | | 4 to 8 |
| Stiff | 50 - 100 kPa | | 8 to 15 |
| Very Stiff | 100 - 200 kPa | Modified from | 15 to 30 |
| Hard | 200 - 300 kPa | National Building | Greater than 30 |
| Very Hard | Greater than 300 kPa | Code | |

* SPT 'N' Value Standard Penetration Test 'N' Value - refers to the number of blows from a 63.5 kg hammer free falling a height of 0.76m to advance a standard 50mm outside diameter split spoon sampler for 0.3m depth into the undrilled portion of the test hole.

## 3. TERMS DESCRIBING DENSITY (COHESIONLESS SOILS ONLY)

| DESCRIPTIVE TERM | STANDARD PENETRATION TEST (SPT) (Number of Blows per 300 mm) | |
|---|---|---|
| Very Loose | 0 - 4 | |
| Loose | 4 - 10 | |
| Compact | 10 - 30 | Modified from |
| Dense | 30 - 50 | National Building |
| Very Dense | Over 50 | Code |

## 4. LEGEND FOR TEST HOLE LOGS

### SYMBOL FOR SAMPLE TYPE


Shelby Tube


SPT


No Recovery


A-Casing


Grab


Core

### SYMBOLS USED FOR TEST HOLE LOGS

| | |
|---|---|
| MC | MC - Moisture Content (% by weight) of soil sample |
| | Water Level |
| SPT | Standard Penetration Test 'N' Value (Blows/300mm) |
| CPen | Shear Strength determined by pocket penetrometer |
| CVane | Shear Strength determined by pocket vane |
| Cu | Undrained Shear Strength determined by unconfined compression test |
| $SO_4$% | Percent (%) of water soluble sulphate ions |

DAVIES GEOTECHNICAL INC.

## IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

**Standard of Care:** Davies Geotechnical Inc. (DGI) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing in British Columbia, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied, is made.

**Basis and Use of the Report:** This report has been prepared for the specific site, design objective, development, and purpose described to DGI by the Client. The factual data, interpretations, and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans, or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. DGI cannot be responsible for use of this report, or portions thereof, unless DGI is requested to review and, if necessary, revise the report.

The information, recommendations, and opinions expressed in this report are for the sole benefit of the Client. ***No other party may use or rely on this report or any portion thereof without DGI's express written consent. DGI will consent to any reasonable request by the Client to approve the use of this report by other parties as Approved Users.*** The report, all plans, data, drawings, and other documents, as well as, all electronic media prepared by DGI are considered its professional work product and shall remain the copyright property of DGI, who authorizes only the Client and Approved Users to make copies of the report, and only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report of any portion thereof to any other party without the express written permission of DGI. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration, and incompatibility and, therefore, the Client cannot rely upon the electronic media versions of DGI's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to DGI by the Client, communication between DGI and the Client, and to any other reports prepared by DGI for the Client relative to the specific site described in the report. ***In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. DGI cannot be responsible for use by any party of portions of the report without reference to the entire report.***

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs, techniques and equipment choice, scheduling and sequence of operations would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work.

**Soil, Rock and Groundwater Conditions:** Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgement, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, DGI does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect certain conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that DGI interprets to exist between sampling points may differ from those that actually exist.

Groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their measurement. Groundwater conditions may vary between reported locations and can be affected by annual, seasonal and special meteorological conditions or tidal fluctuations. Groundwater conditions may also be altered by construction activity on or in the vicinity of the project site.

**Sample Disposal:** All contaminated samples and materials shall remain the property and responsibility of the Client for proper disposal. DGI will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense.

**Follow-Up and Construction Services:** All details of the design and proposed construction may not be known at the time of submission of DGI's report. DGI should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of DGI's report.

During construction, DGI should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of DGI's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in DGI's report. Adequate filed review, observation and testing during construction is necessary for DGI to be able to provide letters of assurance, in accordance with the requirement of many regulatory authorities.

# Marine Foreshore Environmental Assessment

## Lot 5, Block 34, DL 685, Plan 12680

## 689 Franklin Rd

## Gibsons, BC

October 31, 2019

## 1. Introduction

Mithrush Construction, on behalf of the owners of 689 Franklin Rd has engaged Cam Forrester & Associates to conduct an Environmental Assessment that addresses the environmental requirements of the Gibsons Official Community Plan, Marine, Foreshore and Shoreline Areas (DP2). The objective of DP2 is to: "protect environmentally sensitive areas from development". As it applies to this lot, the main areas of concern are "environmentally sensitive marine shore areas and proximate eelgrass beds".
DP2 requires that a development permit be obtained to ensure that property development will not damage the shoreline and marine environments.
Cam Forrester is a Qualified Professional with expertise in habitat conservation, ecosystem classification and environmental services, who has assessed the foreshore habitat values, development risks and has proposed appropriate mitigation measures.

Paul A Davies, P. Eng, is conducting a Geotechnical assessment for DPA 1 (Geotechnical Hazards) certifying the safe use of the land including recommendations and mitigation measures. That assessment will be concerned with the setback from the marine shore top of bank, contrasting with DPA 2, which is 15m from the natural boundary. At the time of writing, the geotechnical assessment is in a preliminary state. The proposed building site is not finalized, pending the geotechnical considerations. However, based on the intended separation between the building site and the foreshore, there is a low likelihood of construction impacts from proposed developments on the adjacent marine environment. General and specific measures to protect DPA2 are included in this report and are relevant to the final building design and siting. This environmental report will be updated with any relevant geotechnical setback recommendations for weathering and slope regression and any design requirements with respect to the foreshore and shoreline processes.

## 2. Assessment Area

The environmental assessment area is the waterfront zone of Lot 5, comprised of the intertidal zone combined with the 15m parcel boundary setback (upland from the natural boundary), as defined by DPA 2.

Two obvious strata were identified and assessed; A), - terrestrial (from the natural boundary to 15m inland), which aligns with the distance from the High Tide Line By-law setback zone boundary; and B), - the marine foreshore intertidal zone from the High Tide Line to the Low Tide Line. Relevant information was also collected from inventory resources on the general offshore marine environment affecting the property.

## 3. Methods

The survey was conducted during a site visit in Aug 30, 2019 by Cam Forrester, R.P.F. The terrestrial ecology was assessed and classified in accordance with the British Columbia Biogeoclimatic Ecosystem Classification System. The physical and biological character of the adjacent marine foreshore is classified according to the Physical Shore-Zone Mapping System for British Columbia, the British Columbia Biological Shore-Zone Mapping System and the British Columbia Marine Ecological Classification system.

## 4. Background

The British Columbia Coastal Resource Information System and the Town of Gibsons provides the following inventory-level information for marine-based resources:

### Sensitive Ecosystems

- There are no streams directly affected by this development;
- There is are several inventoried eel grass[1] bed near the property below the low tide line (See Figure 2).

[1] Town of Gibsons Eel Grass Mapping Project, 2015.

- There is one intertidal sensitive ecosystem, a submerged rock reef, directly offshore of the property (See Figure 2).

## Aquaculture Capability

Not assessed. - (Salmon, Japanese scallops, Manilla clams, Pacific Oyster)

## Biological Resources – Bird presence

(Alcids (auks, murrelets etc.), Bald eagles, Oyster catchers, Herons, Cormorants, Dabbling & Diving ducks, Geese, swans & gulls, Loons & grebes).

## Biological Resources – Mammal presence

- Harbour porpoises
- Sea lions (occasional presence)
- Harbour seals
- Pacific white-sided dolphin
- Grey whale, Orca, Humpback whale, - occasional recent sightings
- (Absent are: Sea otter)

## Biological Resources – Significant plant communities

No at risk ecosystems or vascular plants were observed.

## Biological Resources – Fisheries

Commercial (crab, salmon troll).

Recreation (crab, finfish, diving).

## Physical Classification of marine shoreline environment

| Element | Values |
|---|---|
| Marine ecosection | Strait of Georgia |
| Benthic ecosection | - |
| Pelagic | Polyhaline (18-28ppt) - Stratified |
| Current | Low (<3 knots) |
| Depth | Photic (0-20m) to Shallow (<20m) |
| Exposure | Low-medium |
| Slope | 5-20% |

| | |
|---|---|
| Roughness / relief | Medium |
| Repetitive shore types | 5 – rock, sand, gravel |
| Tides | Moderate-Low |

## 5. Physical Description

### Foreshore: Cobble & gravel beach

The mid-southeast segment of the waterfront lot boundary is in a transition zone to an exposed high energy beach, which is characterized as having a permeable sediment mixture of boulders, cobbles, pebbles and sand (>10% sand content and > 10% gravel content). The boulder/cobble material in the lower and middle intertidal zone occurs as armor over a sand gravel mixture. The cobble beach occurs in the lower, middle to upper and intertidal zone, and is also characterized by biological diversity in the form of fish access during high tides and heavy juvenile crustacean (crabs) use in the lower to middle intertidal zones. Storm deposits of logs and woody debris are characteristic of the supra-tidal zone.

The beach slope is in the range of 2° to 5° with no obvious berm.

### Foreshore: Exposed granitic rock outcrops

The majority of the Lot 5 foreshore is characterized by complex weathered granitic rock outcrops. The rock formation is sloping 10-15%, fissured and with numerous intertidal saline pools (Photos 1-3). The complex shapes and texture impart diversity to the backshore, upper/mid/lower intertidal zones and the subtidal zones. At low tide mussel beds are visible along with a carpet of barnacles and seaweed. A lower intertidal rocky reef (Figure 2.) is covered in rockweed and mussels and provides diverse habitat for crabs, sea stars, algae, anemones, Greenling, sculpins, rockfish. At low tide, seabirds, common crows and blue heron were observed perching and foraging on the exposed rock.

### Marine: Eelgrass beds

Several inventoried eel grass beds are located adjacent to Lot 5 (200m+/-) (See Figure 2). Eelgrass provides a number of important ecosystem functions, including foraging areas and shelter to young fish and invertebrates, food for migratory waterfowl and spawning surfaces for species such as the Pacific herring.

### Terrestrial environment description

CWH xm1. The vegetated slope directly above the backshore zone is characterized by a shallow soil veneer, including some areas of bare exposed soil in steep microsites. Beyond the setback zone and overlapping into the setback are pre-existing rustic pathways, decks and gardens. Soils are characterized by thin mor/moder duff layers over a 30-100 cm mesic, gravelly Bf horizon

The terrestrial component of the lot within the 15m setback zone is vegetated with a mix of native and ornamental shrubs and tree species. There is one large open grown Douglas-fir, 2 western red cedar, and 2 large arbutus in the overstory. The pole/sapling understory is characterized by western cherry, dogwood, several western red-cedar, pruned Douglas-fir, bigleaf maple, alder and cascara. The shrub layer is characterized by English ivy, salal, bracken and wild rose. The original native forest on the site would have been a stand of exposed dry site arbutus, Douglas-fir, western hemlock, western red-cedar. Productivity ranges from $SI_{50}$ = 27-33

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## 6. Development Plans

No development under this Development Permit will take place within DPA 2. (See Figures 1 & 2.)

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## 7. Shoreline Processes

The proposed construction is to build a residence outside of both the DPA 1 & DPA 2 setback. The foreshore will not be affected by this development. This DPA 2 environmental report will be updated with any relevant geotechnical setback recommendations for weathering and slope regression and any design requirements with respect to protecting infrastructure from shoreline processes.

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## 8. Recommendations

Minor clearing and disturbance at the outer limits of the DPA 2 15m planning zone will not affect the natural functions and processes that support habitat and shoreline protection. Disturbance is limited to pre-existing rustic pathways and garden landscaping. With due care and attention to construction environmental best management practices, the construction will not result in any additional impact to the terrestrial environment in the setback zone, general marine environment or fish habitat along the marine foreshore.

Foreshore natural resource values can be protected through mitigation measures designed to minimize potential disturbance affecting the setback zone. These are:

## Clearing, & Excavation

Site preparation for the new construction, including, demolition, clearing and excavation will be located outside of the DPA 2 15m setback. Any unavoidable disturbed ground adjacent to the setback will be seeded/vegetated with a reclamation grass mix. A combination of straw mulch and sediment fence may also be employed to minimize and run-off leaving disturbed areas.

## Encroachment

In order to maintain the biological effectiveness of the setback zone, damage to its functions will be avoided. The builder and owner will avoid unplanned trails, refuse dumping, soil disturbance, vegetation conversion or tree clearing in the setback zone. Paths into the setback zone should be constructed with the objective of minimizing impact on the soils and tree rooting zones. Granite or other natural steppingstone-style material should be placed in a fashion that directs traffic to decrease disturbance to erodible soils.

## Protection of Trees

Trees on the bank need to be protected during use and construction by ensuring that equipment remains outside of the prescribed setback using the following measures:

Within the DPA 2 setback, the following practices will apply:

- Do not change ground level;
- Do not change grade;
- No trenching through root zone;
- No paving over root zone;
- No parking or equipment traffic;
- No pollutants or chemical disposal;
- Avoid damage to tree stems.

No Danger trees require removal, but some may be removed in the future using accepted arborist danger tree risk assessment methodology.

## Stormwater Management - Sediment and Erosion Control

Management of sediment and erosion within the assessment area and setback zone shall be considered part of construction and can be implemented with a minimum of effort and costs given the scale of development. Consider the following procedures:

- Minimize soil disturbance by timing, clearing as close to construction as possible to avoid long periods of bare soils being exposed to rain and run-off erosion;
- Install sediment fences at the slope break;
- Mulch or consider plastic covers for exposed soils; and,
- Re-vegetate disturbed areas post-construction.

The objective of sediment and erosion control is to avoid contaminated (sediments) run-off towards the foreshore during construction.

## Environmental Monitoring

An environmental monitoring program is recommended during the rock wall construction phase to ensure that the setback zone is understood and protected. This will consist of:

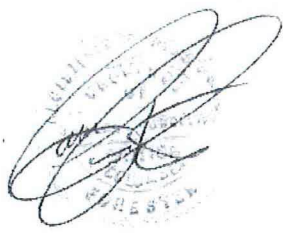
- crew education and standard operating procedures for construction and fuel management around streams;
- pre-work meeting, pre-work plan and crew signoffs;
- on-site monitoring as required to ensure setback zone integrity through following the pre-work plan;
- the ability for the qualified monitor to direct and advise works related to protection of the setback zone, especially on the implementation of erosion and sediment controls;
- the ability to issue stop work orders in the case of practices that are illegal or damaging the setback zone or streams in the sub-division;
- the ability to report environmental infractions related to stream protection regulations;
- Photographs and notes should be taken to document the various phases of construction, any observed environmental events and their resolution.

A Post-development Report is to be completed and kept as a record of the practices and procedures followed during construction.

## 9. Professional Opinion

The proposed construction of a rock wall structure as part of a new residential dwelling will not result in alteration of natural features or foreshore habitat in either the setback zone or marine foreshore.

## Certification

| RPF'S SIGNATURE and SEAL | RPF PRINTED NAME |
|---|---|
|  | Cam Forrester, R.P.F.<br># 2118 |
| RPF'S SIGNATURE and SEAL | Date signed: October 31, 2019 |

## Photos

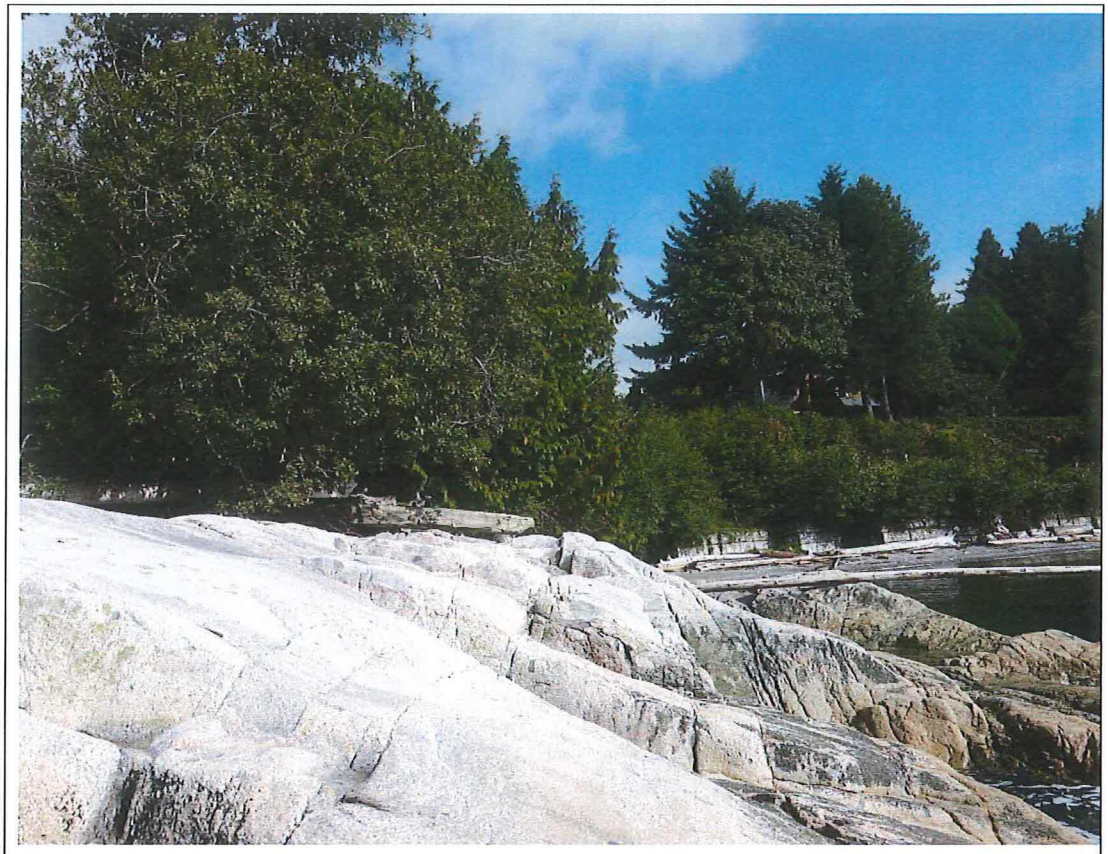


Photo 1: Lot 5 marine foreshore viewing northeast.

Photo 2: Lot 5 marine foreshore viewing northeast.

Photo 3: Lot 5 marine foreshore intertidal pool in fissured granite.

Photo 4: Lot 5 Several large open grown conifer and arbutus at the top of bank, southern extent of Lot 5.

Photo 5: Well vegetated upland at shoreline located at the southern extent of the property viewing north.

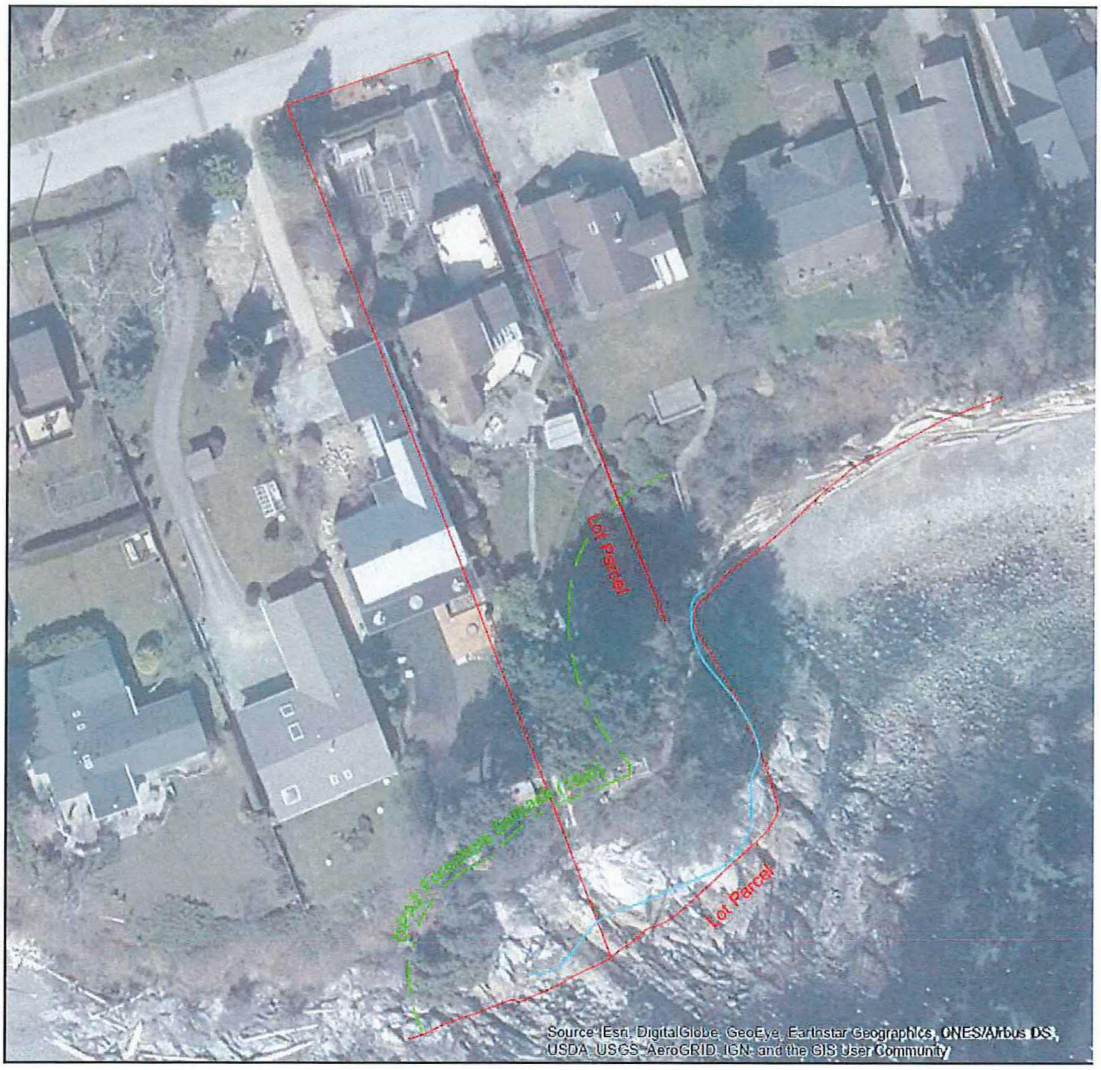
Photo 6: Eastern edge, pre-existing rustic landscaping within DPA 2.

Photo 7: Well vegetated upland located at the southern extent of the property viewing west.

Photo 8: Transition from rocky foreshore to exposed beach. Eastern middle edge of property, viewing south.

Photo 9: Exposed beach. Eastern middle edge of property, viewing east.

## Site Plan / Map




PROJECT
**Environmental Assessment - 689 Franklin Rd - Lot 34, Plan VAP12680**

| PID: **008-820-210** | DATE: **31 OCT 2019** | Cam Forrester & Associates Ltd. |
|---|---|---|
| LEGAL DESCRIPTION<br>**PID: 008-820-210**<br>**FOLIO: 524.00423.000**<br>**LOT: 5**<br>**BLOCK: 34**<br>**DISTRICT LOT: 685**<br>**PLAN: VAP12680** | LEGEND<br>Present Natural Boundary<br>689 Franklin Road (Lot 5)<br>DPA2 Foreshore Setback (15m) | 6231 Sunshine Coast Highway<br>Sechelt, BC V0N 3A7<br><br>phone/fax: 604.885.7112<br>cam_forrester@telus.net |

Coordinate System: NAD 1983 UTM ZONE 10N DATUM: North American 1983

1:650 0 5 10 20 Meters

**Figure 1 DPA 2 setback, and assessment area relative to construction.**

PROJECT

**Environmental Assessment - 689 Franklin Rd - Lot 34, Plan VAP12680**

| PID: 008-820-210 | DATE: 31 OCT 2019 | Cam Forrester & Associates Ltd. |
|---|---|---|
| LEGAL DESCRIPTION<br>**PID: 008-820-210**<br>**FOLIO: 524.00423.000**<br>**LOT: 5**<br>**BLOCK: 34**<br>**DISTRICT LOT: 685**<br>**PLAN: VAP12680** | LEGEND<br>Eelgrass Beds<br>Intertidal Rock Reef<br>Present Natural Boundary<br>689 Franklin Road (Lot 5)<br>DPA2 Foreshore Setback (15m) | 6231 Sunshine Coast Highway<br>Gechelt, BC V0N 3A7<br><br>phone/fax: 604.885.7112<br>cam_forrester@telus.net |

Coordinate System: NAD 1983 UTM ZONE 10N DATUM: North American 1983 1:2,000 0 15 30 60 Metres

**Figure 2 DPA 2 environmentally sensitive features relative to construction and Lot 5.**