

**DATE:** May 28, 2020**FILE:** 3160-20/FR 1A 20**TO:** Chair and Directors  
Electoral Areas Services Committee**FROM:** Russell Dyson  
Chief Administrative OfficerSupported by Russell Dyson  
Chief Administrative Officer**R. Dyson****RE:** **Site Specific Floodplain Setback Reduction  
6428 and 6448 South Island Highway (Hebblethwaite)  
Baynes Sound – Denman/Hornby Islands  
Lot 1, District Lot 12 (Situate Partly within Lots 31G and 40G), Section 2A,  
Nelson District, Plan VIP67160, PID 024-214-787****Purpose**

To consider a request for a site specific exemption to the floodplain setback of proposed additions to an existing single detached dwelling from 15 metres to 8.7 metres from the natural boundary of the Strait of Georgia.

**Recommendation from the Chief Administrative Officer:**

THAT the Board grant a site specific exemption of the floodplain specifications that reduces floodplain setback from 15 metres to 8.7 metres from the natural boundary of the Strait of Georgia (FR 1A 20, Hebblethwaite) for the proposed additions to a single detached dwelling with an attached garage on property described as Lot 1, District Lot 12 (Situate Partly within Lots 31G and 40G), Section 2A, Nelson District, Plan VIP67160, PID 024-214-787 (6428 and 6448 South Island Highway);

AND FINALLY THAT, as a condition of the site specific exemption, the property owners, at their own expense, register a restrictive covenant under Section 219 of the *Land Title Act*, specifying conditions that would enable the land to be safely used for the use intended according to the terms of the engineer's report by Peter Bullock, P. Eng., M. Eng. of Base Geotechnical Inc., dated April 15, 2020, which will form part of the restrictive covenant, as well as an acknowledgement that no Disaster Financial Assistance funding is available for the building or its contents and releasing and indemnifying the Comox Valley Regional District from liability in the event any damage is caused by flooding or erosion.

**Executive Summary**

- The property, located at 6428 and 6448 South Island Highway, is a 2.24 hectare waterfront lot. It is developed with a single detached dwelling with an attached garage, a second single detached dwelling and two accessory buildings.
- The single detached dwelling with the attached garage was built prior to the 1970s, when no floodplain bylaw was in effect then. It has one storey and a partial basement.
- The applicants would like to renovate this dwelling by expanding the main floor, adding a second storey and enlarging the partial basement.
- As the location of this dwelling is less than 15 metres from the present natural boundary (PNB) of the Strait of Georgia, the proposal requires a floodplain exemption approval.
- In support of their proposal, the applicants submitted a Geotechnical Assessment. According to the engineer, the proposed additions with habitable space are above the flood

construction level (FCL) of the year 2100. The proposal will not alter the flood risk to the dwelling. The engineer certifies that the land may be used safely for the use intended.

- Staff recommends the site specific exemption of the floodplain specifications be granted on the basis that the proposed additions of habitable space are above the FCL of the year 2100, that the existing topographic barriers (i.e., rip rap and elevated fill) provide protection from wave debris, and that the proposal is supported by a Geotechnical Assessment. Further, the applicants are required to register a Section 219 Restrictive Covenant to acknowledge that no Disaster Financial Assistance funding is available for the building or its contents, and to release and indemnify the Comox Valley Regional District (CVRD) from liability.

Prepared by:

***B. Chow***

Brian Chow, RPP, MCIP  
Rural Planner

Concurrence:

***T. Trieu***

Ton Trieu, RPP, MCIP  
Manager of Planning Services

Concurrence:

***S. Smith***

Scott Smith, RPP, MCIP  
General Manager of  
Planning and Development  
Services Branch

### Government Partners and Stakeholder Distribution (Upon Agenda Publication)

Applicants	✓
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### Background/Current Situation

The subject property is a 2.24 hectare waterfront lot (Figures 1 and 2). It is located at 6428 and 6448 South Island Highway in the Baynes Sound – Denman/Hornby Islands Electoral Area (Electoral Area A). The subject property is developed with a single detached dwelling with an attached garage, a second single detached dwelling and two accessory buildings.

The area between the single detached dwelling with attached garage and the foreshore was built up with fill to create a level lawn area. The fill is contained and protected by a rip rap wall that was approved by the CVRD in 2003. This single detached dwelling was constructed prior to the 1970s, when no floodplain bylaw was in effect. It is a one storey dwelling unit with a partial basement. The main floor area is 197 square metres and the partial basement is 141 square metres.

The applicants would like to renovate this dwelling. The proposed renovation includes an addition to the main floor of 33 square metres, an addition of a second storey of 61 square metres, and an addition to the crawlspace of 23 square metres (Figure 3). There will be a size increase to the deck, but there will not be any additional encroachment toward the sea.

The location of this dwelling is less than 15 metres from the PNB of the Strait of Georgia. The dwelling is as close to 8.77 metres from the PNB because of existing deck posts. Given this location, a floodplain exemption is required for the proposed additions.

### Planning Analysis

#### Official Community Plan Analysis

Bylaw No. 337, being the “Rural Comox Valley Official Community Plan Bylaw No. 337, 2014” (OCP), designates the subject property within Rural Settlement Areas (RSAs). Sections 15 and 16 of the OCP provides objectives and policies regarding development in the vicinity of natural hazards. Section 15(2) states, “To direct new development away from hazard areas” and Section 16(1) states, “Do not permit new development in hazard areas, including mapped floodplains, steep slopes and areas of active erosion.” The proposed increase in floor area is above the FCL of the year 2100. Therefore, the proposal is

consistent with the OCP.

#### Zoning Bylaw Analysis

The subject property is zoned Country Residential One (CR-1) which allows for residential use up to a maximum of two dwelling units if the property is 1.0 hectares or larger. The proposed additions meet the minimum rear yard setback of 7.5 metres. The proposal is consistent with the Zoning Bylaw.

#### Floodplain Management Bylaw Analysis

Section 303(1) of Bylaw No. 600, being the “Floodplain Management Bylaw No. 600, 2020” states, “*The following distances are specified as floodplain setbacks: (d) 15.0 metres from the natural boundary of the sea, any lake, wetland, or pond*”. The applicants are proposing additions to the single detached dwelling, but the current location of the dwelling is already less than 15.0 metres. (Figure 3).

Section 403 of the bylaw allows for a property owner to apply for a site specific exemption. In support of the application, the applicants submitted a Geotechnical Assessment prepared by Peter Bullock, P.Eng., M. Eng. of Base Geotechnical Inc., dated April 15, 2020 (Appendix A). According to the engineer, the existing grade of the main floor of the single detached dwelling is 5.80 metres geodetic. By the year 2100, the FCL is approximately 5 metres. Therefore, all of the proposed additions with habitable space are above the FCL of the year 2100.

The proposed development will include installation of multiple posts outside of the existing foundation to support the main floor and deck space. These posts will not alter the flood risk to the dwelling, and they are well protected by the rip rap wall, lawn space and existing trees. These barriers are expected to provide a suitable degree of protection from wave driven debris.

The proposed renovation will not increase the geohazard risk, and will remain within the flood risk tolerance of the property and the development may occur safely. The engineer certifies that the land may be used safely for the use intended if the land is used in accordance with the conditions specified in the Geotechnical Assessment.

Should the CVRD Board grant the exemption, the bylaw requires the property owners to prepare and register a Section 219 Restrictive Covenant that releases and indemnifies the CVRD from liability in the event any damage is caused by flooding or erosion.

Staff recommends the floodplain exemption be granted on the basis that the proposed additions of habitable space are over the FCL of the year 2100, that the existing topographic barriers (i.e., rip rap and elevated fill) provide protection from wave debris, and that the proposal is supported by a Geotechnical Assessment.

#### **Policy Analysis**

Section 524 of the *Local Government Act* (RSBC, 2015, c. 1) (LGA) authorizes a local government to establish a bylaw to designate a flood plain and specify a setback from a watercourse, body of water or dike to any landfill or structural support required to elevate a floor system or pad above the flood level. Sections 524(7) and (8) allow a local government to grant an exemption to a floodplain bylaw upon receipt of a report by a qualified professional that the land may be used safely for the use intended and that the exemption may include terms and conditions the local government considers necessary or advisable.

**Options**

The Board may choose to grant or refuse the site specific exemption of the floodplain specifications. Based on the discussions outlined in this report, the Board is recommended to grant the floodplain exemption request.

**Financial Factors**

Applicable fees have been collected for this application under the “Comox Valley Regional District Planning Procedures and Fees Bylaw No. 328, 2014.”

**Legal Factors**

This report and recommendation contained herein are in compliance with the LGA and CVRD bylaws.

**Regional Growth Strategy Implications**

Bylaw No. 120, being the “Comox Valley Regional District Regional Growth Strategy Bylaw No. 120, 2010” (RGS), designates the subject property within RSAs. Policy 1D-2 of the RGS, pertaining to the public costs of housing, states, *“Direct new housing away from high risk natural hazard areas such as flood plains, areas exposed to sea-level rise...”* Policy 8F-6 pertaining to planning for climate change adaption states, *“All new development within established floodplains should be discouraged and redevelopment of lands within floodplain areas should only be supported where technical analysis by a qualified professional has been undertaken to ensure that lands are safe for use, development will not impact floodplain functions, and construction levels include safety factors to account for climate change and potential sea level rise and associated extreme storm surges.”* The proposed renovation is supported by recommendations from a Qualified Professional.

**Intergovernmental Factors**

There are no intergovernmental factors.

**Interdepartmental Involvement**

This proposal was referred to applicable internal departments. None of the departments had any concerns or comments on this application.

**Citizen/Public Relations**

There are no citizen and/or public relations factors related to this report

Attachment: Appendix A – “Engineer’s Report by Peter Bullock, P. Eng., M. Eng. of Base Geotechnical Inc., dated April 15, 2020”

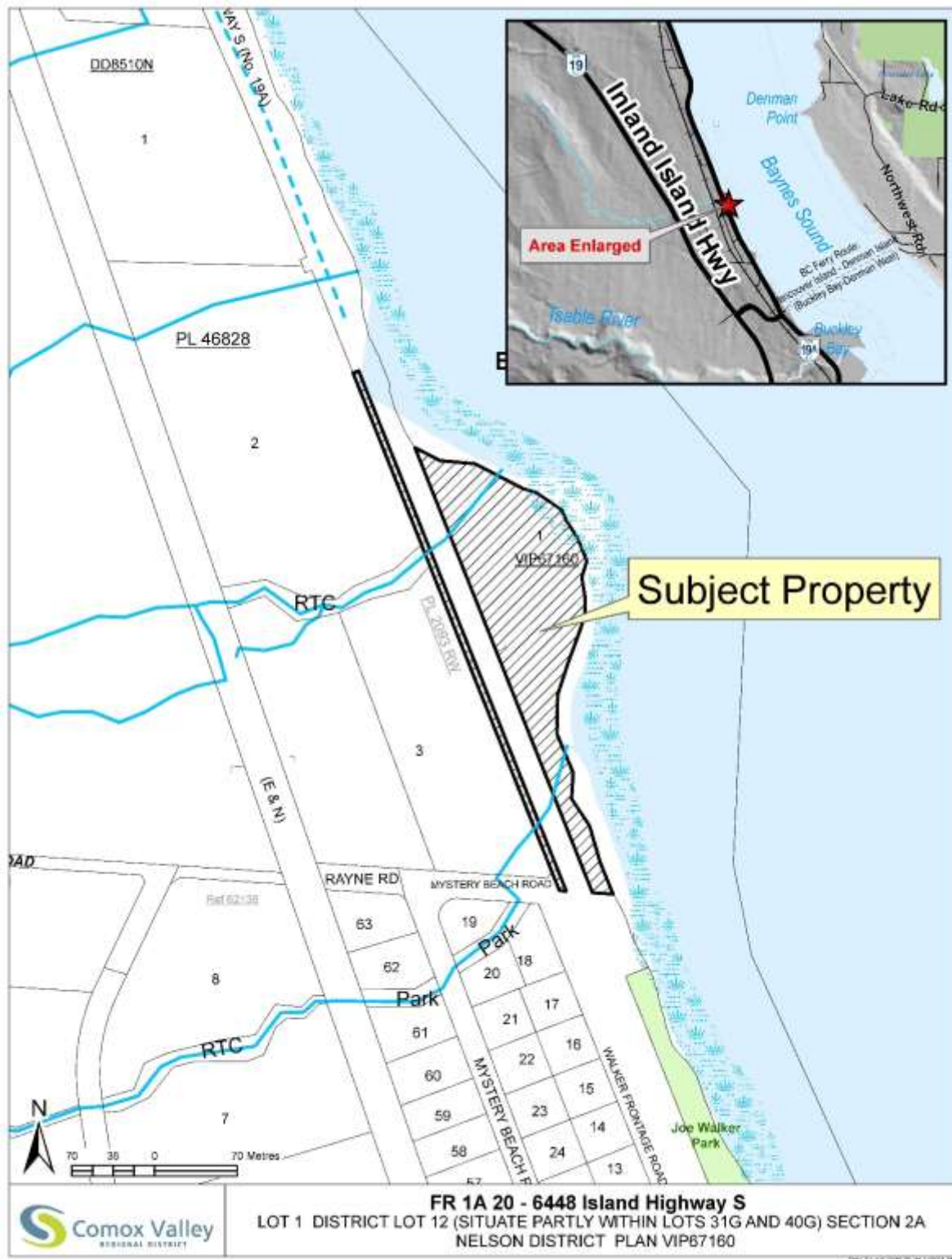


Figure 1: Subject Property Map





Figure 2: Air Photo

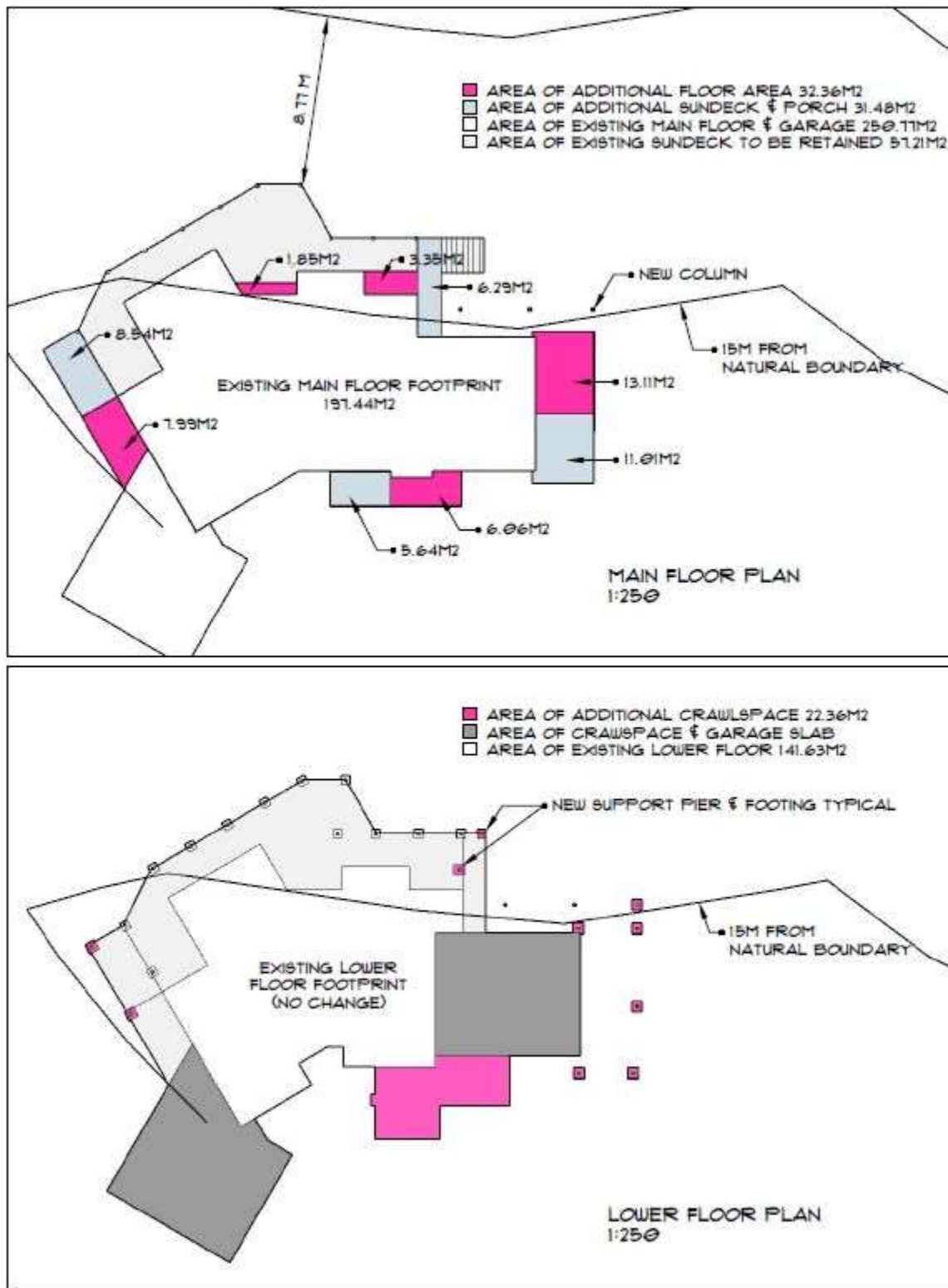


Figure 3: Site Plan and 3D Renderings of the Proposed Additions



Figure 3: Site Plan and 3D Renderings of the Proposed Additions (Cont.)





Figure 3: Site Plan and 3D Renderings of the Proposed Additions (Cont.)



Figure 3: Site Plan and 3D Renderings of the Proposed Additions (Cont.)

INNOVATIVE  
ENGINEERING  
SPECIALISTS

## Flood Hazard Overview

6448 Island Highway South  
Union Bay, BC

*Prepared for:*

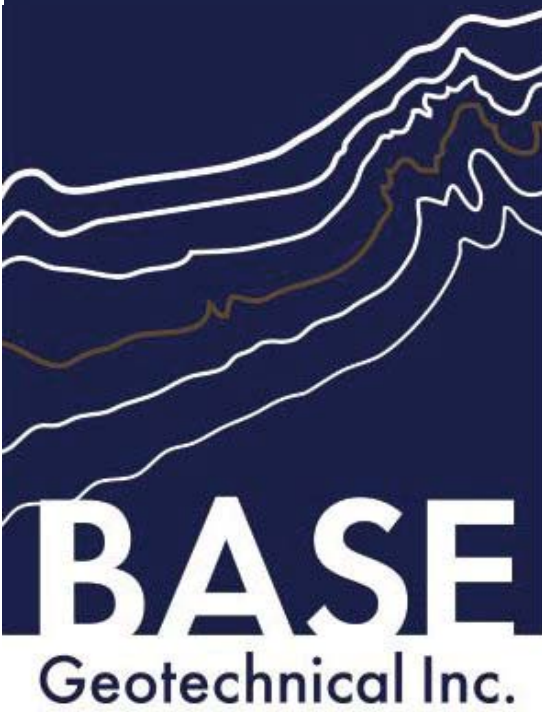
Russ and Terry Hebblethwaite  
6448 Island Highway South  
Union Bay, BC

*Prepared By:*

Base Geotechnical Inc.  
[www.basegeotechnical.ca](http://www.basegeotechnical.ca)

Peter Bullock, P.Eng., M.Eng.  
Principal

April 15, 2020  
BGI File: 23520200316



## 1. Introduction

This report contains the geotechnical ocean flood hazard review in support of your application for a Floodplain Relief Application. The application is being submitted as part of your proposed renovation plans of the existing home at 6448 South Island Highway in Union Bay, BC.

It is understood that the main floor of the home is going to undergo extensive renovations/reconstruction. In addition there will be an upper level of 60 m<sup>2</sup> (650 ft<sup>2</sup>) added. It is also understood the renovation will include several minor adjustments/“bump outs” increasing the main floor footprint by approximately 19%. The partial (half buried) basement and foundation will remain unchanged except for interior renovations. The basement floor level was constructed at an elevation below the current flood construction level standards; however we have confidence that it will remain habitable, and safe from flooding hazards through the life expectancy of the home.

BGI engineers Peter Bullock, P.Eng., M.Eng., and Adrian Chesham, P.Eng. inspected the property on March 20, 2020 with Mr. John Gower of Gower Design Group (GDG). Photographs taken of the site are also provided in Appendix A.

## 2. Property Description

**Property Address:** 6448 Island Highway South, Union Bay

**Legal Description:** DISTRICT LOT 12, NELSON DISTRICT, PLAN VIP67160

**PID:** 024-214-787

**Lot: B, Size:** 5.53 Acres

**Zoning:** CR-1

## 3. Site Description

The subject property is a level, isolated (no neighbours) ocean front property with two homes accessed from the Island Highway 19 built out on a small delta. The development includes a main dwelling with attached garage, large shop and shed as shown in Appendix A. There is also a secondary dwelling to the north within the same property boundary. The majority of the property is an open forest but around the homes and foreshore area is landscaped with low beds and lawn area. There are a number of large mature trees across the waterfront side the property that will remain unaltered.

An unnamed water course runs between the homes. This “water course” was essentially a constructed ditch with very little flow that went underground before reaching the sea at the time of the inspection.

The area between the home and foreshore was built up with fill to create a level lawn area. The fill was contained/protected by a low, two boulder high “rip rap wall”. In front of the wall was an expanse of eel grass across the cobble beach between the boulders and the high tide zone approximately 15m away. Driftwood was observed on the beach near the present natural boundary. The attached figure shows the location of the Present Natural Boundary which appears to correspond to an Elevation = 2.6 m Geodetic.

## 4. House Description

The existing home was understood have been constructed prior to 1970's. It was a 1 story home with a partial basement constructed with typical wood frame construction. The home underwent a major renovation in 2001 and has been meticulously maintained since that time.

The house main floor area is 197 m<sup>2</sup> (2125 ft<sup>2</sup>) and it has a partial basement with 141 m<sup>2</sup> (1525 ft<sup>2</sup>).

The elevation of the existing basement top of concrete slab is 3.03 m as shown on the attached cross section. The underside of the footing was approximated from the cross-section to be 2.80 m.

The attached figure provided by GDG shows areas of the existing house that are set-back less than 15 m from the Present Natural Boundary. The majority of the existing house is outside the 15 m buffer; however, there are a few locations that encroach as close to 8.77 m as shown on the plan drawings.

## 5. Proposed Construction

The proposed renovation does not alter the existing basement or foundation area but it has several infills and additions upstairs which increase the footprint of the main floor by 38 m<sup>2</sup> (409 ft<sup>2</sup>) as shown on the attached figure. This additional floor area will account for a 19% increase in habitable floor area.

There will be a slight increase to the deck area as well, but no additional encroachment toward the sea.

## 6. Geology

The surficial geology mapping for this site is defined as: 5d/3 (Fyles, 1960).

5d = MARINE DEPOSITS (INCLUDING GLACIO-MARINE): varied stony, gravelly, and sandy marine-veneer deposits (thickness generally less than 5 feet).

3 = GROUND MORaine DEPOSITS: till, lenses of gravel, sand, and silt.

Soil conditions were judged by the exposed ground surface.

Bedrock structure could not be seen in exposures within the foreshore area.

Aerial photographs from Google Earth and the CVRD files for the site were reviewed to assess visible land features.

## 7. Flood Bylaws

The current bylaw at the time of writing is: **Comox Valley Regional District (CVRD) Bylaw 2782:**

The relevant CVRD Bylaw 2782 information (Sections 303, 401, 402 and 403) are provided below.

However, **Comox Valley Regional District (CVRD) Floodplain management Bylaw 600, 2020** will be in place prior to the final project approval and the standards of this new bylaw have been considered in this report.

### **303 Floodplain Setbacks**

1d) 15.0 metres (49.2 feet) from the natural boundary of the sea, any lake, wetland, or pond.



### 403 Site Specific Exemptions

1) An application by a property owner to the Regional District for a site-specific exemption of Floodplain Specifications shall be completed in the form provided by the Regional District and submitted in accordance with the instructions on the application. This provision is not a substitute for any requirements under Section 56 of the Community Charter.

2) As a condition of a site-specific exemption, the property owner will be required at his/her own expense to commission a Professional Engineer's Report that addresses exemption precedents in the surrounding area and provides a report containing a description of the proposed development, and recommendations for conditions addressing floodproofing, as applicable.

The **Rural Comox Valley Official Community Plan (OCP)** has the following policies to discourage or prevent new development within floodplains:

- o Section 15(2): To direct new development away from hazard areas.
- o Section 16(1): Do not permit new development in hazard areas, including mapped floodplains, steep slopes and areas of active erosion.
- o Section 16(7): Explore facilitating managed retreat, as appropriate, of development in those areas prone to flooding and facing challenges due to sea level rise.

## 8. Flood Construction Level (FCL)

### Background

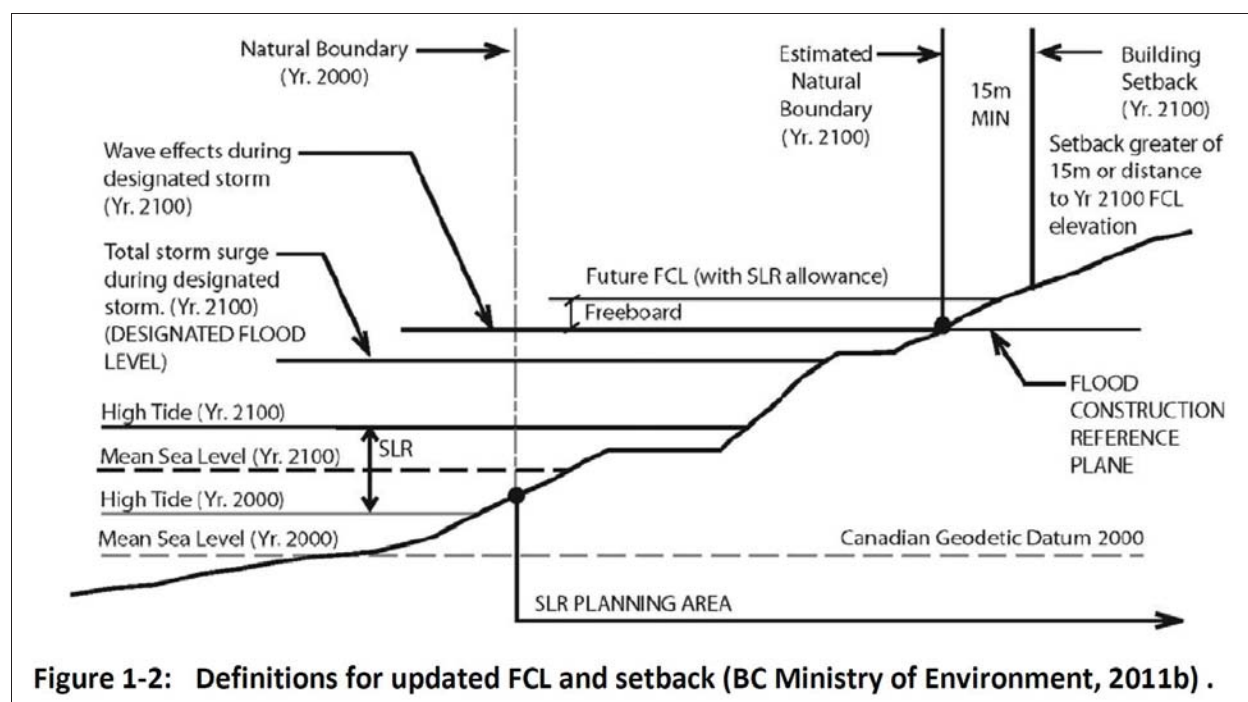
Historically, the derivation of a coastal flood construction level has been based on the concept of the "natural boundary", which refers to the effect that the ocean has on the land in terms of making a change in the soil and the vegetation. The coastal flood construction level has often been defined simply as the elevation of the natural boundary plus 1.5 m. This definition becomes problematic when considering processes such as sea level rise, because the position of a future natural boundary cannot be theoretically determined nor established in the field through observations. In order to deal with this challenge, one must approximate the position of the natural boundary under a rising sea.

Requirements for new buildings, subdivisions, and zoning should allow for sea level rise (SLR) to the year 2100 (APEGBC, 2017). The Year 2100 FCL should be the minimum elevation for the underside of a wooden floor system or top of concrete slab for habitable buildings. The Year 2100 FCL can be determined by the 'Combined Method' as described in the Ausenco Sandwell (2011) reports. The FCL formula is:

$$\text{FCL} = \text{HHWLT} + \text{SLR} + \text{Storm Surge} + \text{Wave Effect} + \text{Freeboard}.$$

The Year 2100 FCL is determined as the sum of the following components:

- Allowance for future Sea Level Rise (SLR) to the year 2100;
- Allowance for regional uplift, or subsidence to the year 2100;
- Higher high-water large tide (HHWLT);
- Estimated storm surge for the Designated Storm with an AEP of 1:200 or 1:500 as per Table 6-1 in AS (2011a);
- Estimated wave effects associated with the Designated Storm; and,
- A minimum freeboard of 0.3 m. Given that the Combined Method provides conservative values for Year 2100 Designated Flood Levels (because the method assumes the Designated Storm occurs in conjunction with a high tide) the freeboard may be reduced from 0.6 m to 0.3 m for this method for situations where the full FCL may be difficult to achieve.



Some of the above components are specified in the literature, such as the global allowance for future sea level rise, and freeboard. Other components may be estimated in a straightforward manner, such as the HHWLT. However, estimation of storm surge and an allowance for wave effect requires a site-specific coastal engineering study, which were not undertaken in this report assessment.

Ausenco Sanwell (2011b) provided preliminary 2100 FCL estimates for various locations, including East Vancouver Island. The summary is provided as follows:

2100 FCL Component	Vancouver Island (East Coast) meters, Geodetic Datum
Global SLR (2100)	1.0
Regional Adjustment	-0.17
HHWLT	1.6
Storm Surge (allows for local wind setup)	1.3
Wave Effect (assumes runup on natural gravel-pebble shoreline)	0.65
Freeboard	0.6
FCL (relative to Canadian Vertical Geodetic Datum)	5.0

For comparison, NHC (2018) estimated the 2100 Flood Construction Level for numerous segments along the Campbell River shoreline. NHC recommended 2100 FCL ranges between 4.1 m GD at Tye Point and 5.7 m GD at Painter Barclay with an overall average of 5.2 m GD. NHC based this result on an HHWLT = 1.7 m. It should be noted that NHC Phase 3 Campbell River report selected both 2050 and 2100 because the design life is typically on the order of 50 to 100 years. Tides in the Baynes Sound area are typically 0.2m lower than Campbell River.

**Sea Level Rise (SLR)**

Rates of SLR for BC have been estimated based on the research by Ausenco Sandwell, 2011a. A 1 m rise is suggested between 2000 and 2100 and a further 1 m by the year 2200 (see Figure below).

**Regional Uplift or Subsidence**

Site specific adjustments to SLR are required to account for the uplift or subsidence of the land surface in the area of interest. The ground appears to be generally rising along the coast, with local areas of subsidence. Some uplift and subsidence rates for coastal BC are given by KWL (2011) and Natural Resources Canada also provide rates of ground movement.

**Higher High-Water Large Tide (HHWLT)**

Higher high-water large tide is a specific parameter, which is the average of the highest high-water levels from 18.6 years of data.

HHWLT levels are published by the Canadian Hydrographic Service (CHS) for a number of reference stations and can be determined for a network of secondary ports. The HHWLT levels are available in "Canadian Tide and Current Tables – Volumes 5, 6 and 7 published annually by Fisheries and Oceans Canada, Catalogue No. FS 74. Reference stations and secondary port locations are shown in the Coastal Floodplain Mapping Guidelines and Specifications (KWL, 2011). The "Mean Water Level" published by CHS can be taken to be equal to the 0 m elevation for the Canadian Geodetic Vertical Datum 1928 (CGVD28). CGVD28 = 0.0 m = +2.9 m CD.

**Storm Surges**

Design Storm surges for different parts of the BC coast have been proposed in the Coastal Floodplain Mapping Guidelines and Specifications (KWL, 2011).

Based on the work by Ausenco Sandwell (2011a, c) suggested deep water storm surge magnitudes for the Georgia Strait of 1.3 m for the 1:200-year designated storm.

**Wave Effects**

The presence of breaking waves, during design conditions, along the shoreline of an area being mapped must also be considered. Breaking waves will further increase the depth of water near the shoreline and will result in wave runup and possibly wave overtopping that may result in flooding. The extent of the flooding depends on the terrain located landward of the shoreline.

Coastal engineering study is required to estimate wave effect. The wind/wave analysis must be consistent with the designated storm adopted for storm surge of 1.3 m.

The wave effect can be estimated to be fifty percent of the wave run-up (Ausenco Sandwell, 2011b). The wave run-up is the vertical distance that waves run-up the seaward slope of a structure or a shoreline. The vertical distance is measured from the mean water level, which is the same as the Designated Flood Level.

**Freeboard**

In the regulatory context, freeboard is used to determine the FCL by providing an allowance above the design flood level. Typical freeboard values for "water" floods that have been adopted in BC are 0.3 m

above the maximum instantaneous design flood level or 0.6 m above the mean daily design flood level, whichever is higher (APEGBC, 2017).

## 9. Discussion/Conclusion

The main purpose of this report was to describe the property and potential impacts of the proposed renovations to support the Floodplain Relief Application. The primary considerations for this application are encroachment and the flood construction level (FCL).

We need to remember this property is already developed with well maintained and habitable home. The existing structure was constructed well and met the standards of the day when it was built. The existing home has a fully finished basement with living and mechanical within it. The basement slab elevation is at 3.03m above geodetic sea level and has a setback of 12.8m from the Present Natural Boundary and has performed well through all these decades. With or without the renovations the basement use will remain unchanged.

As per Ausenco Sanwell (2011b) the appropriate FCL should be approximately 5 m above geodetic with a minimum set back of 15m from the PNB.

The proposed development will focus on the main floor well above the 5m FCL. There will be the addition of multiple piers outside the existing foundation to support the main floor and deck space however these will in no way alter the flood risk of the home and they are well protected by the Rip Rap wall, lawn space and large conifers. These barriers are expected to provide a suitable degree of protection from wave driven debris.

The lower elevation of the basement is not ideal, but it is 1.4m above the current High-high tide and will remain 0.6m above the projected 2100AD high-high tide as well. Based on the Probabilistic Method we offer the following:

- The Ausenco Sanwell (2011b) uses the more conservative Combined Method and established an FCL of 5 m. This was derived with the consideration of the perfect storm occurring at the same time as the highest tides.
  - o The probability of this combination is very low,
  - o would be of very short duration as the tide cycles are 12 hrs long, with only half of that time above the mean average, too short for the ground between the beach and the home to backwater and saturate.
  - o Further to that a significant portion of the new standards of the FCL is based on wave break height. Considering that the property is well protected by Denman Island and the Comox Peninsula the opportunity for wave build up is significantly reduced as compared the exposed portions of coastline outside of these shadows.
- Additionally, the ground profile along the foreshore is also considered favourable for the protection of the home. The steep boulder “wall” will effectively dissipate wave energy and buffer against wave run up. Any water that carries past the wall area is expected to disperse quickly across the level lawn area, well short of the home.
- With the uses of BC Building Code perimeter drains maintaining groundwater levels and under the current sea level projections there is no chance for the basement to truly flood. Based off this assessment the only foreseeable risk is log debris getting pushed ahead of waves and

coming against the home but based on all probabilistic risk this is extremely low, and would not be life or structure threatening.

- Should there be need for mitigation (i.e. sea level rise is more/faster than predicted) there are several strategies that could easily implemented. Examples of potential strategies could include, Rip Rap wall build up, emergency sump pump installation or groundwater cut off wall.
- Lastly, this renovation does not increase the risk of flooding, i.e. if the renovation was not allowed, then the existing home would continue to exist with the same flood risk.

## 10. Summary

The home is below the current FCL standards but since the proposed work is a renovation of an existing home, we believe it should not be bound by the Section 15.2, 16.1, 16.7 of the OCP. The renovation will not adversely affect the environment nor increase geohazard risk to the property. Based on all the various aspects mentioned in this report, we believe the proposed renovation will not increase the geohazard risk, will remain within the Flood Risk Tolerance of the property and “the development may occur safely”.

## 11. References

APEGBC. 2017. Flood Mapping in BC: APEGBC Professional Practice Guidelines V1.0. 51 pp.

Ausenco Sandwell. 2011a. Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use: Draft Policy Discussion Paper. (Prepared for BC Ministry of Environment.) Available online at [www.env.gov.bc.ca/wsd/public\\_safety/flood/pdfs\\_word/draft\\_policy\\_rev.pdf](http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/draft_policy_rev.pdf). 75 pp.

Ausenco Sandwell. 2011b. Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use: Guidelines for Management of Coastal Flood Hazard Land Use. (Prepared for BC Ministry of Environment.) Available online at: [www.env.gov.bc.ca/wsd/public\\_safety/flood/pdfs\\_word/guidelines\\_for\\_mgr\\_coastal\\_flood\\_land\\_use-2012.pdf](http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/guidelines_for_mgr_coastal_flood_land_use-2012.pdf). 45 pp.

Ausenco Sandwell. 2011c. Climate Change Adaptation Guidelines for Sea Dikes and Coastal Flood Hazard Land Use: Sea Dike Guidelines (Prepared for BC for Ministry of Environment.) Available online at: [www.env.gov.bc.ca/wsd/public\\_safety/flood/pdfs\\_word/sea\\_dike\\_guidelines.pdf](http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/sea_dike_guidelines.pdf). 59 pp.

Ausenco Sandwell. Section 3.5 and 3.6 – Flood Hazard Area Land Use Management Guidelines

Comox Valley Regional District, 2005. Bylaw No. 2782. Floodplain Management Bylaw.

Fyles, J.G., 1960. Surficial geology, Courtenay, Comox, Nelson, Nanaimo and Newcastle districts, Vancouver Island, British Columbia. Geological Survey of Canada, Map 32-1960, scale 1:63,360.

Kerr Wood Leidal Associates (KWL). 2011. Coastal Floodplain Mapping – Guidelines and Specifications. (Prepared for BC Ministry of Forests, Lands and Natural Resources and Natural Resources Canada.) Available online at: [www.env.gov.bc.ca/wsd/public\\_safety/flood/pdfs\\_word/coastal\\_floodplain\\_mapping-2011.pdf](http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/coastal_floodplain_mapping-2011.pdf). 91 pp.

Northwest Hydraulic Consultants Ltd. 2018. City of Campbell River Sea Level Rise Study, Phase 3 – Additional FCL Assessment prepared for the City of Campbell River. NHC Ref No. 3003194. 27 pp.



## 12. Acknowledgements

Base Geotechnical Inc. acknowledges that:

- a. We certify that the land may be used safely for the use intended if the land is used in accordance with the conditions specified in this report.
- b. this report may be requested by Approving Officers and Building Inspectors as a support document for Floodplain Relief Application.
- c. this report has been prepared solely for, and at the expense of, the owner of the subject land.

## 13. Limitations

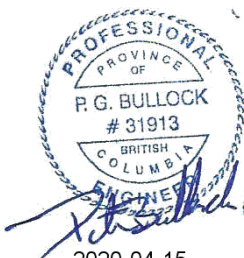
- d. The conclusions and recommendations submitted in this report are based upon the data obtained from surface observations and government documents. Although not expected, should undiscovered conditions become apparent later (e.g. during excavation for construction) our office should be contacted immediately to allow reassessment of the recommendations provided.
- e. The current scope of investigation was selected to provide an assessment of obvious geotechnical hazards. If stakeholders in these matters desire a greater degree of certainty, additional investigations can be carried out.
- a. Our recommendations apply to the specific proposed structure and building location described in the report above. Other structures or locations may have unique requirements and so our recommendations should not be considered applicable to other locations or other developments, even within the same property.

## Closure

- a. This report has been prepared for the exclusive use of Russ and Terry Hebblethwaite and their appointed agents. Any use or reliance made on this report by an unauthorized third party in the responsibility of that third party. This report may also be relied upon by the Comox Valley Regional District in considering a Floodplain Relief application.
- b. This report has been prepared by Peter Bullock, a Professional Engineer in good standing with the Engineers and Geoscientists of British Columbia and has adequate experience to provide this report.

Base Geotechnical Inc. appreciates the opportunity to be of service on this project. We trust that this report meets your needs. If you have any comments, or additional requirements, please contact us at your convenience.

Respectfully Submitted,



2020-04-15  
Peter Bullock, P.Eng., M.Eng.  
Principal - Base Geotechnical Inc.

Reviewed by:

Adrian Chesham, P.Eng., M.Eng.  
Senior Geotechnical Engineer - Base Geotechnical Inc.

Attachments – Appendix A

## General Conditions and Limitations

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### 1.0 USE OF REPORT AND OWNERSHIP

This geotechnical report pertains to a specific site, a specific development and a specific scope of work. It is not applicable to any other sites nor should it be relied upon for types of development other than that to which it refers. Any variation from the site or development would necessitate a supplementary geotechnical assessment.

This report and the recommendations contained in it are intended for the sole use of Base Geotechnical Inc.'s (BGI) Client. BGI does not accept any responsibility for the accuracy of any of the data, the analyses or the recommendations contained or referenced in the report when the report is used or relied upon by any party other than BGI's Client unless otherwise authorized in writing by BGI. Any unauthorized use of the report is at the sole risk of the user.

This report is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of BGI. Additional copies of the report, if required, may be obtained upon request.

### 2.0 ALTERNATE REPORT FORMAT

Where BGI submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed BGI's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by BGI shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of BGI's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except BGI. BGI's instruments of professional service will be used only and exactly as submitted by BGI.

Electronic files submitted by BGI have been prepared and submitted using specific software and hardware systems. BGI makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

### 3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless stipulated in the report, BGI has not been retained to investigate, address or consider and has not investigated, addressed or considered any environmental or regulatory issues associated with development on the subject site.

### 4.0 NATURE AND EXACTNESS OF SOIL AND ROCK DESCRIPTIONS

Classification and identification of soils and rocks are based upon commonly accepted systems and methods employed in professional geotechnical practice. This report contains descriptions of the systems and methods used. Where deviations from the system or method prevail, they are specifically mentioned.

Classification and identification of geological units are judgmental in nature as to both type and condition. BGI does not warrant conditions represented herein as exact, but infers accuracy only to the extent that is common in practice.

Where subsurface conditions encountered during development are different from those described in this report, qualified geotechnical personnel should revisit the site and review recommendations in light of the actual conditions encountered.

### 5.0 LOGS OF TESTHOLES

The testhole logs are a compilation of conditions and classification of soils and rocks as obtained from field observations and laboratory testing of selected samples. Soil and rock zones have been interpreted. Change from one geological zone to the other, indicated on the logs as a distinct line, can be, in fact, transitional. The extent of transition is interpretive. Any circumstance which requires precise definition of soil or rock zone transition elevations may require further investigation and review.

### 6.0 STRATIGRAPHIC AND GEOLOGICAL INFORMATION

The stratigraphic and geological information indicated on drawings contained in this report are inferred from logs of test holes and/or soil/rock exposures. Stratigraphy is known only at the locations of the test hole or exposure. Actual geology and stratigraphy between test holes and/or exposures may vary from that shown on these drawings. Natural variations in geological conditions are inherent and are a function of the historic environment. BGI does not represent the conditions illustrated as exact but recognizes that variations will exist. Where knowledge of more precise locations of geological units is necessary, additional investigation and review may be necessary.

### 7.0 PROTECTION OF EXPOSED GROUND

Excavation and construction operations expose geological materials to climatic elements (freeze/thaw, wet/dry) and/or mechanical disturbance which can cause severe deterioration. Unless otherwise specifically indicated in this report, the walls and floors of excavations must be protected from the elements, particularly moisture, desiccation, frost action and construction traffic.

## **8.0 SUPPORT OF ADJACENT GROUND AND STRUCTURES**

Unless otherwise specifically advised, support of ground and structures adjacent to the anticipated construction and preservation of adjacent ground and structures from the adverse impact of construction activity is required.

## **9.0 INFLUENCE OF CONSTRUCTION ACTIVITY**

There is a direct correlation between construction activity and structural performance of adjacent buildings and other installations. The influence of all anticipated construction activities should be considered by the contractor, owner, architect and prime engineer in consultation with a geotechnical engineer when the final design and construction techniques are known.

## **10.0 OBSERVATIONS DURING CONSTRUCTION**

Because of the nature of geological deposits, the judgmental nature of geotechnical engineering, as well as the potential of adverse circumstances arising from construction activity, observations during site preparation, excavation and construction should be carried out by a geotechnical engineer. These observations may then serve as the basis for confirmation and/or alteration of geotechnical recommendations or design guidelines presented herein.

## **11.0 DRAINAGE SYSTEMS**

Where temporary or permanent drainage systems are installed within or around a structure, the systems which will be installed must protect the structure from loss of ground due to internal erosion and must be designed so as to assure continued performance of the drains. Specific design detail of such systems should be developed or reviewed by the geotechnical engineer. Unless otherwise specified, it is a condition of this report that effective temporary and permanent drainage systems are required and that they must be considered in relation to project purpose and function.

## **12.0 BEARING CAPACITY**

Design bearing capacities, loads and allowable stresses quoted in this report relate to a specific soil or rock type and condition. Construction activity and environmental circumstances can materially change the condition of soil or rock. The elevation at which a soil or rock type occurs is variable. It is a requirement of this report that structural elements be founded in and/or upon geological materials of the type and in the condition assumed. Sufficient observations should be made by qualified geotechnical personnel during construction to assure that the soil and/or rock conditions assumed in this report in fact exist at the site.

## **13.0 SAMPLES**

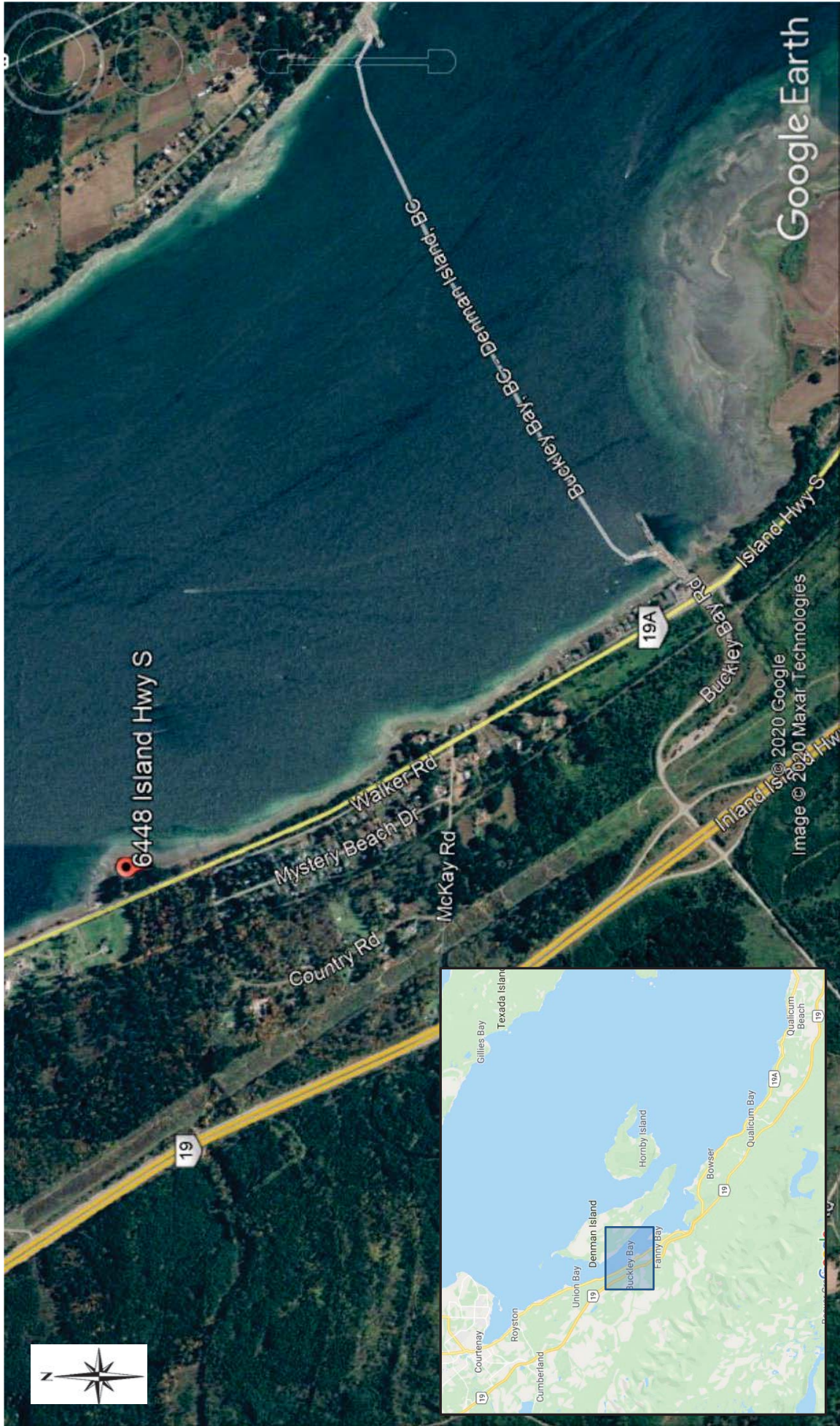
BGI will retain all soil and rock samples for 30 days after this report is issued. Further storage or transfer of samples can be made at the Client's expense upon written request, otherwise samples will be discarded.

## **14.0 INFORMATION PROVIDED TO BGI BY OTHERS**

During the performance of the work and the preparation of the report, BGI may rely on information provided by persons other than the Client. While BGI endeavours to verify the accuracy of such information when instructed to do so by the Client, BGI accepts no responsibility for the accuracy or the reliability of such information which may affect the report

# Appendix A

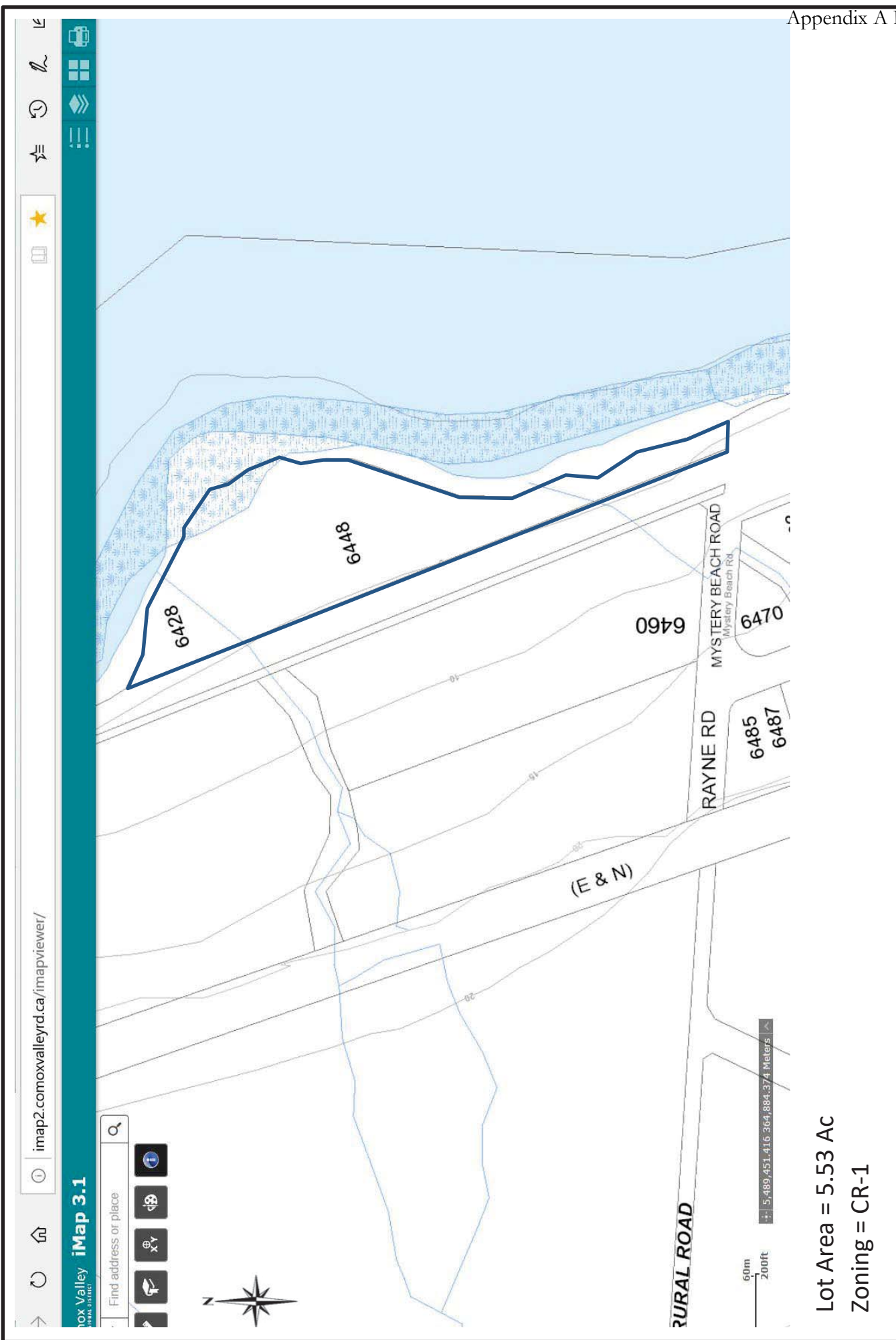




Lot Area = 5.53 Ac  
Zoning = CR-1



<p>Project:</p> <p>6448 Island Hwy South, Union Bay (Comox Valley Regional District)</p> <p>DISTRICT LOT 12, Nelson District, Plan VIP67160</p> <p>PID 024-214-787</p>	<p>Subject:</p> <p>Appendix A</p>		
	<p>Date: March 18, 2020</p>	<p>Rev. A</p>	<p>Page 1</p>



Project: 6448 Island Hwy South, Union Bay (Comox Valley Regional District) DISTRICT LOT 12, Nelson District, Plan VIP67160 PID 024-214-787	Subject: Appendix A
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**BASE**  
Geotechnical Inc.

<p><b>Project:</b>          6448 Island Hwy South, Union Bay (Comox Valley Regional District)          DISTRICT LOT 12, Nelson District, Plan VIP67160          PID 024-214-787</p>	<p><b>Subject:</b>          Appendix A</p>	<p><b>Date:</b> March 18, 2020</p>	<p><b>Rev.</b> A</p>	<p><b>Page</b> 3</p>
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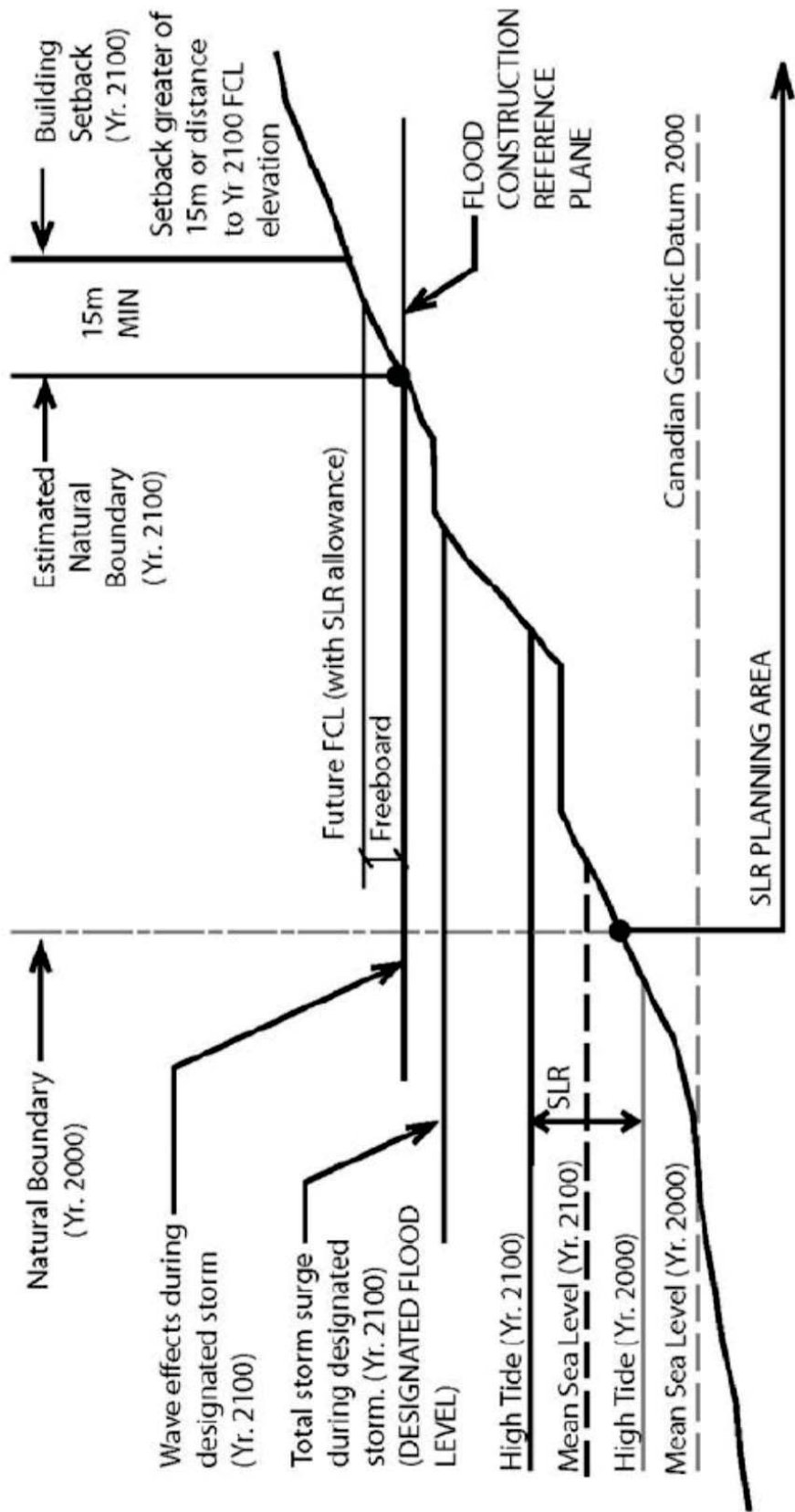
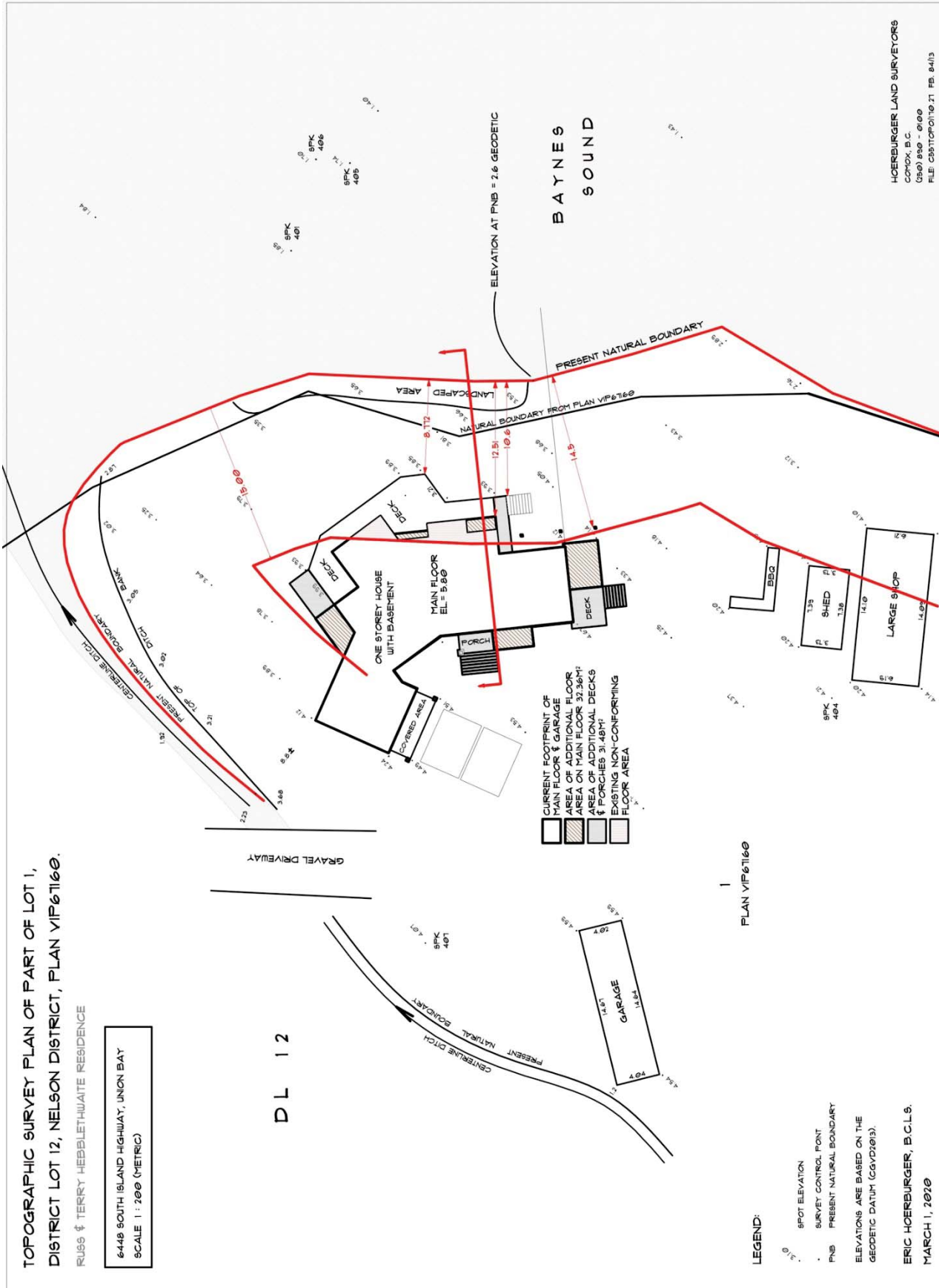


Figure 1-2: Definitions for updated FCL and setback (BC Ministry of Environment, 2011b) .

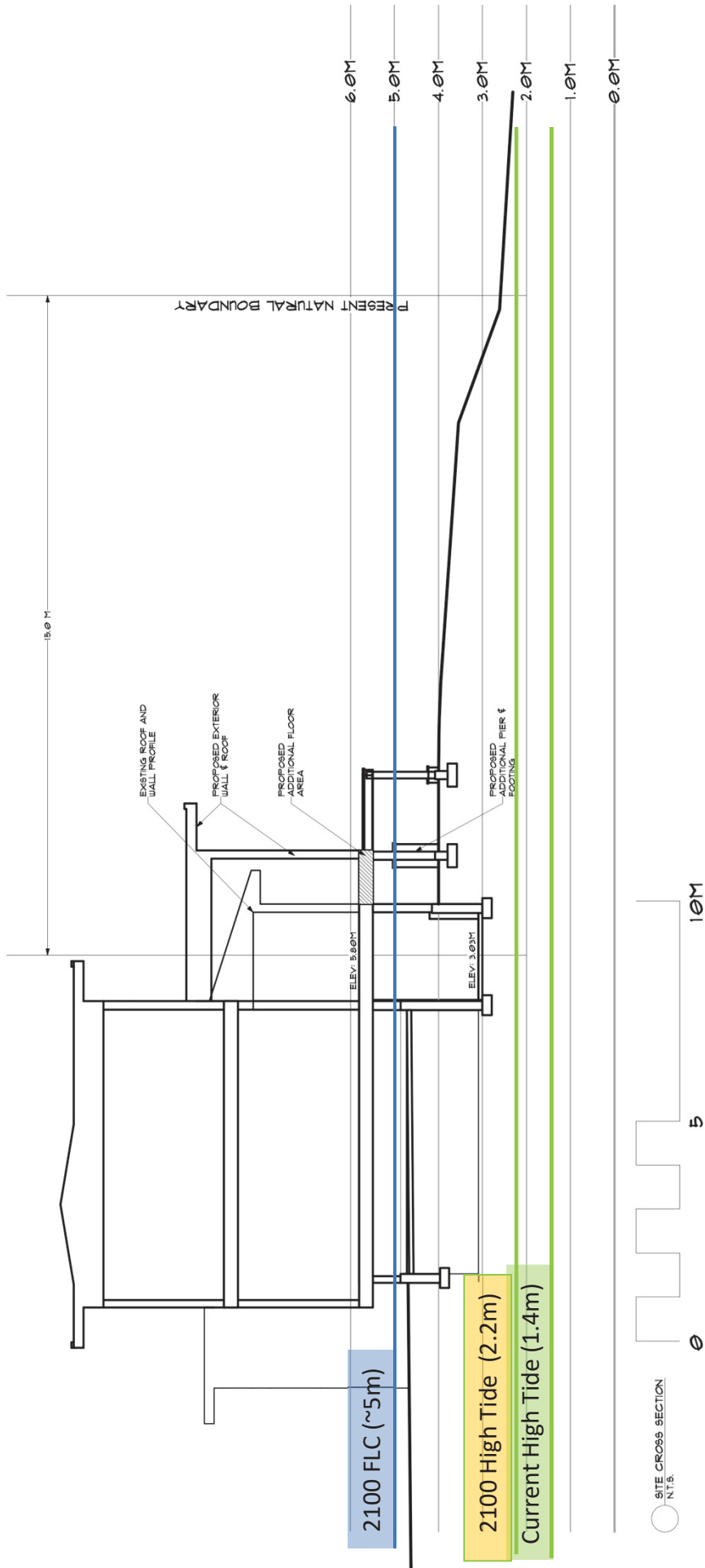



Project: 6448 Island Hwy South, Union Bay (Comox Valley Regional District) DISTRICT LOT 12, Nelson District, Plan VIP67160 PID 024-214-787	Subject: Appendix A			Page 4
	Date: March 18, 2020	Rev. A		



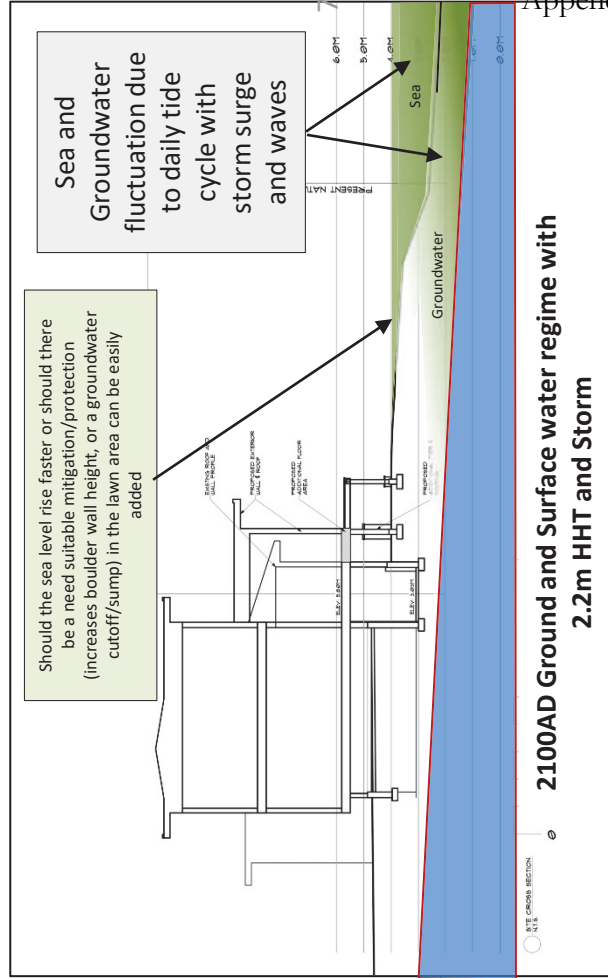
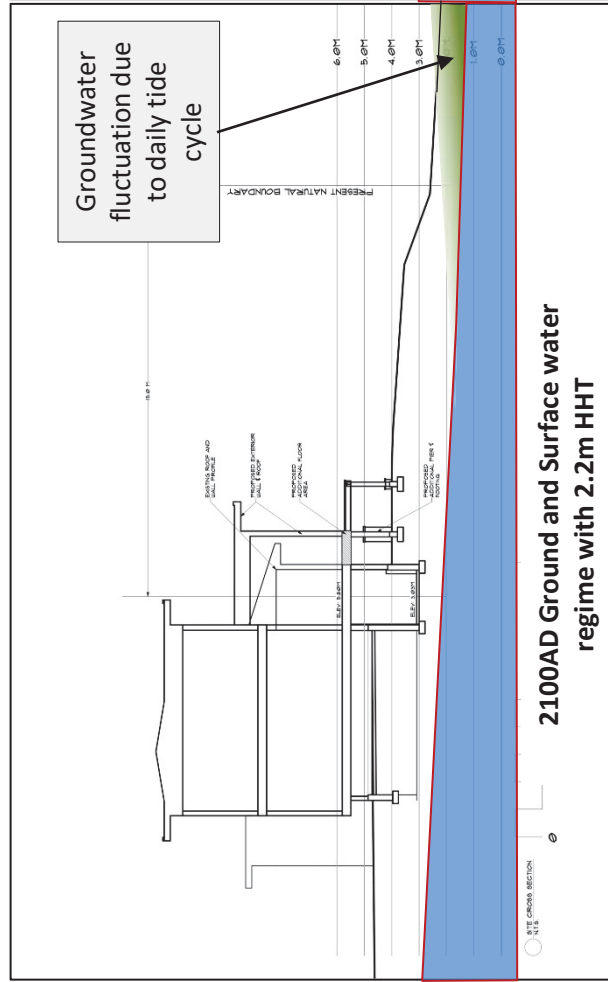
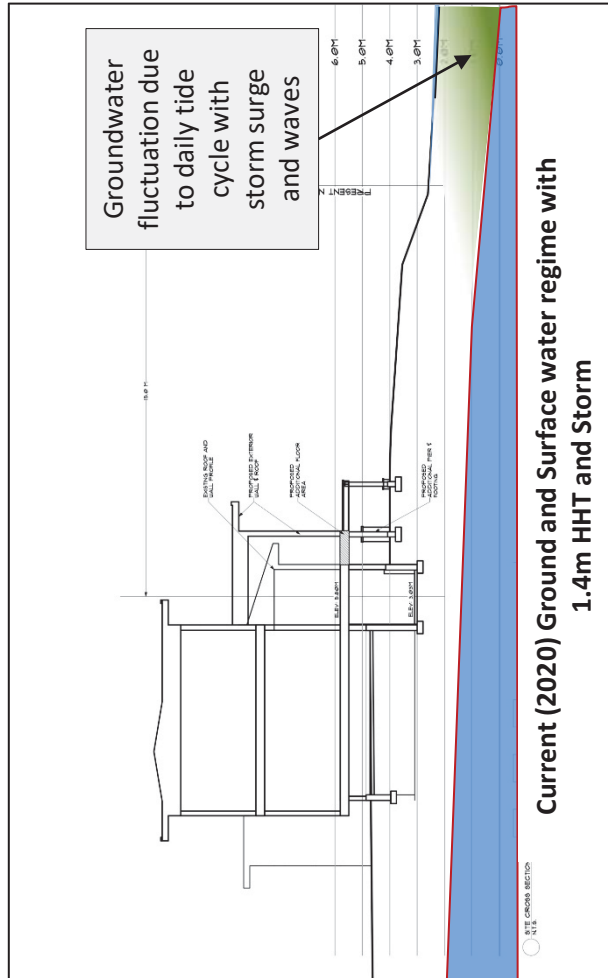
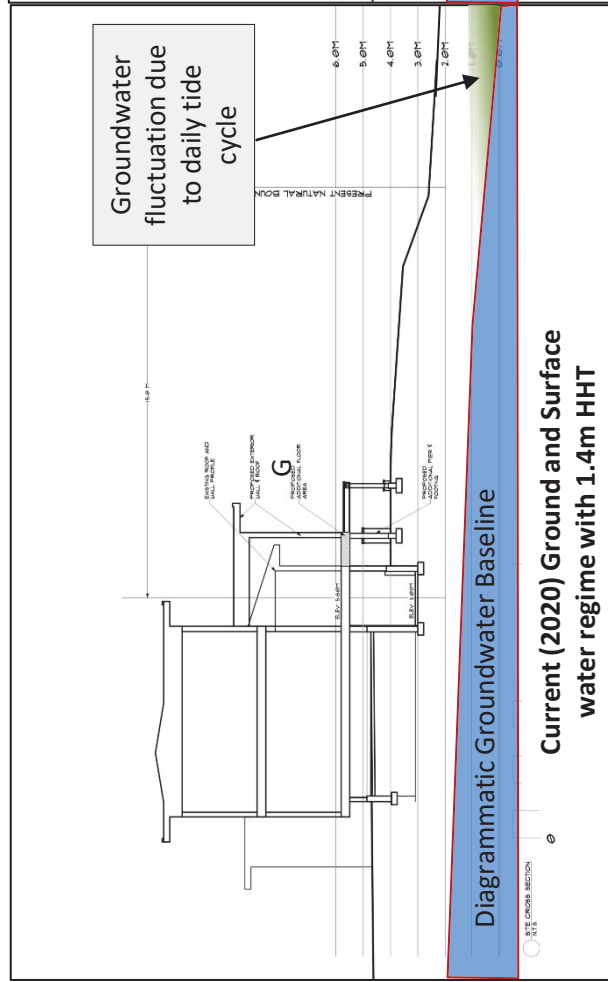


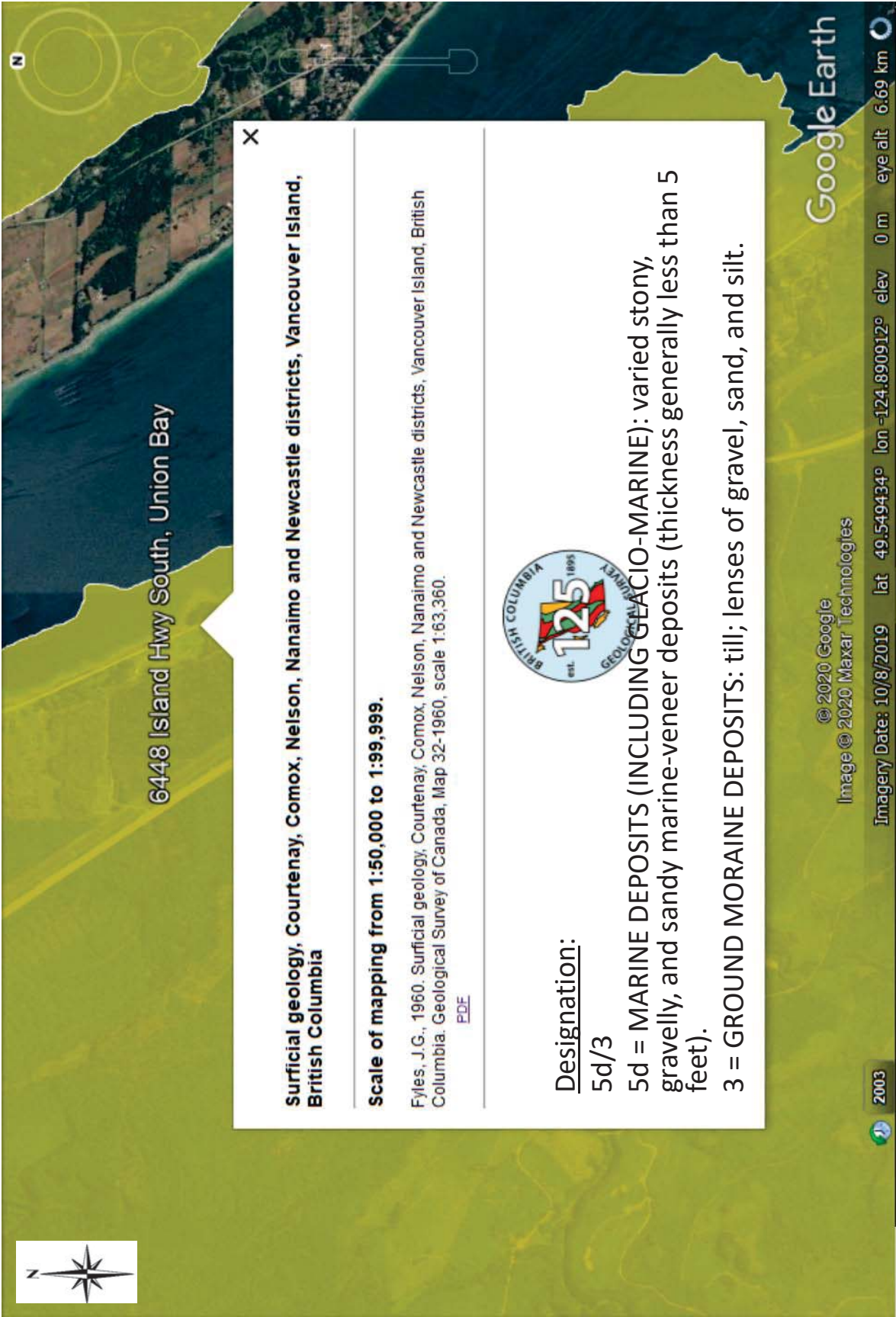
Subject: Appendix A	Project: 6448 Island Hwy South, Union Bay (Comox Valley Regional District) DISTRICT LOT 12, Nelson District, Plan VIP67160 PID 024-214-787
Date: March 18, 2020 Rev. A	Page 5



	Subject: Appendix A		
	Date: March 18, 2020	Rev. A	Page 6
Project: 6448 Island Hwy South, Union Bay (Comox Valley Regional District) DISTRICT LOT 12, Nelson District, Plan VIP67160 PID 024-214-787			







Lot Area = 5.53 Ac  
Zoning = CR-1



Project: 6448 Island Hwy South, Union Bay (Comox Valley Regional District) DISTRICT LOT 12, Nelson District, Plan VIP67160 PID 024-214-787	Subject: Appendix A	
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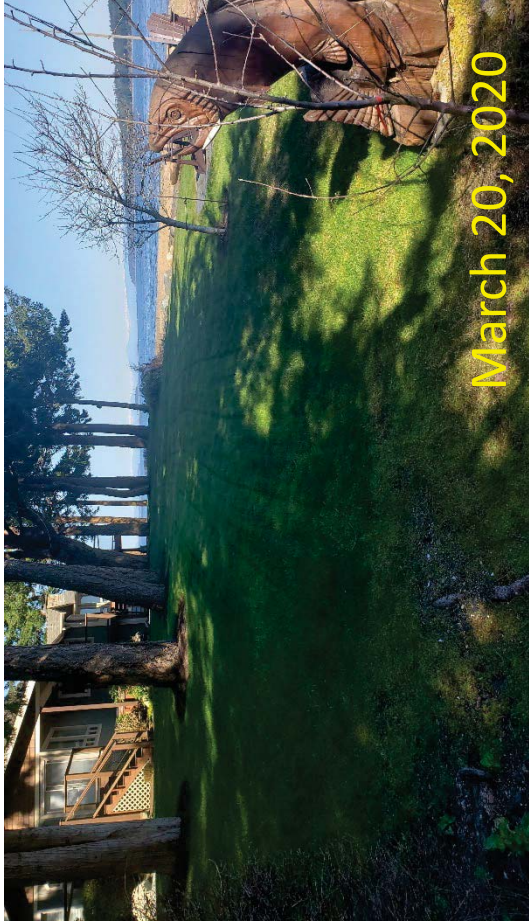


Photo 1 – Front yard looking across north.

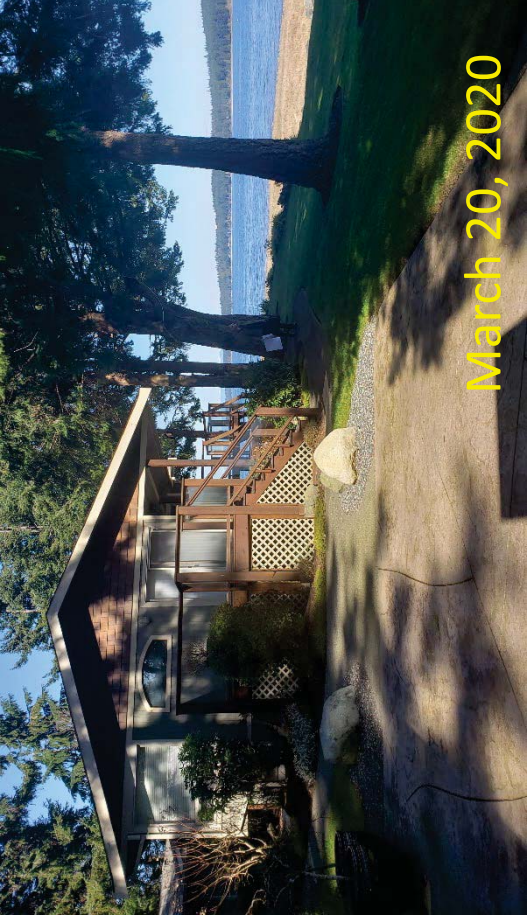


Photo 2 – Looking north at south side of house.

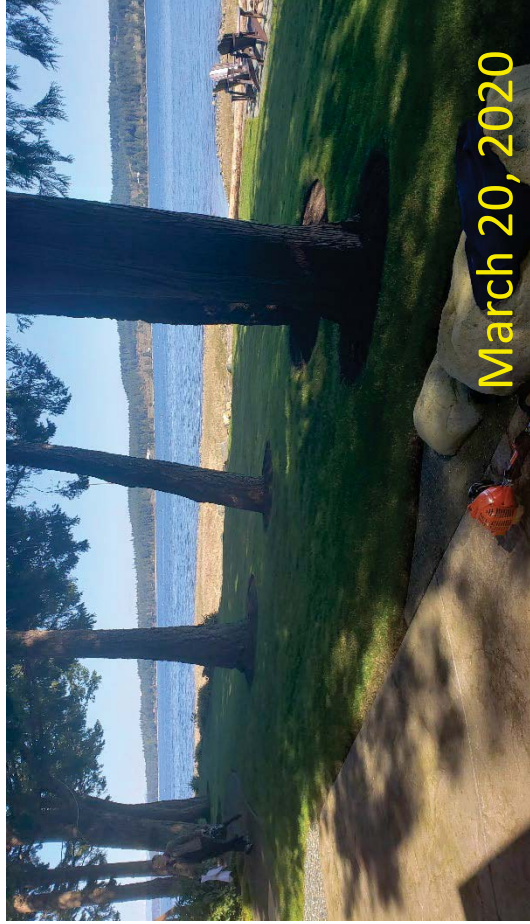


Photo 3 – Looking east across yard.

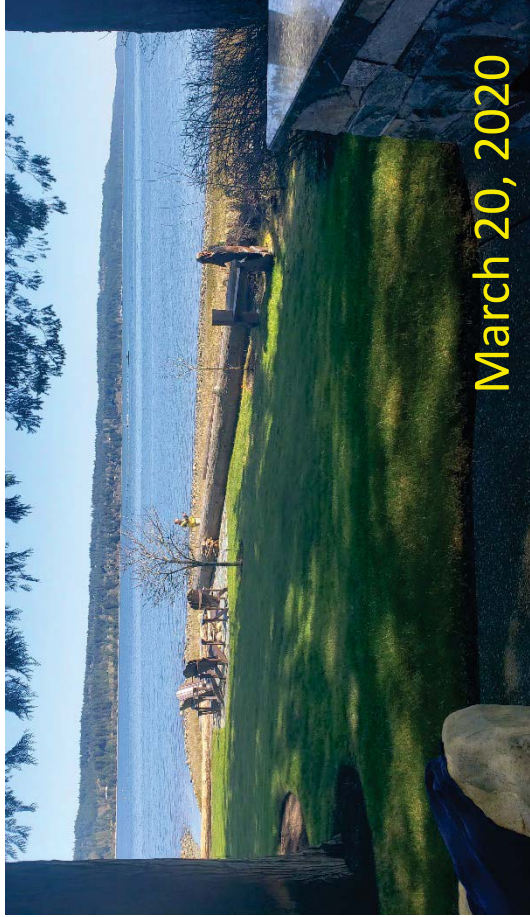


Photo 4 – Looking east across yard.

<b>Project:</b> 6448 Island Hwy South, Union Bay (Comox Valley Regional District) DISTRICT LOT 12, Nelson District, Plan VIP67160 PID 024-214-787	<b>Subject:</b> Appendix A		
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Photo 5 – Looking east at north side of the house.



Photo 6 –



Photo 7 – Looking east at front of the house.



Photo 8 – Front garage entry.

<b>Project:</b> 6448 Island Hwy South, Union Bay (Comox Valley Regional District) DISTRICT LOT 12, Nelson District, Plan VIP67160 PID 024-214-787	<b>Subject:</b> Appendix A		
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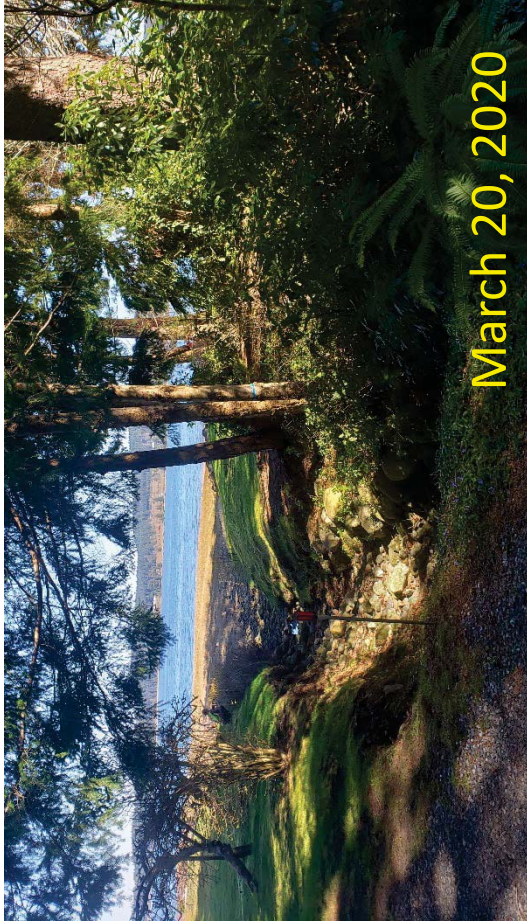


Photo 9 – Existing drainage swale looking east.



Photo 10 – Looking west at the existing house.



Photo 11 – Looking north along beach.



Photo 12 – Looking west from foreshore.

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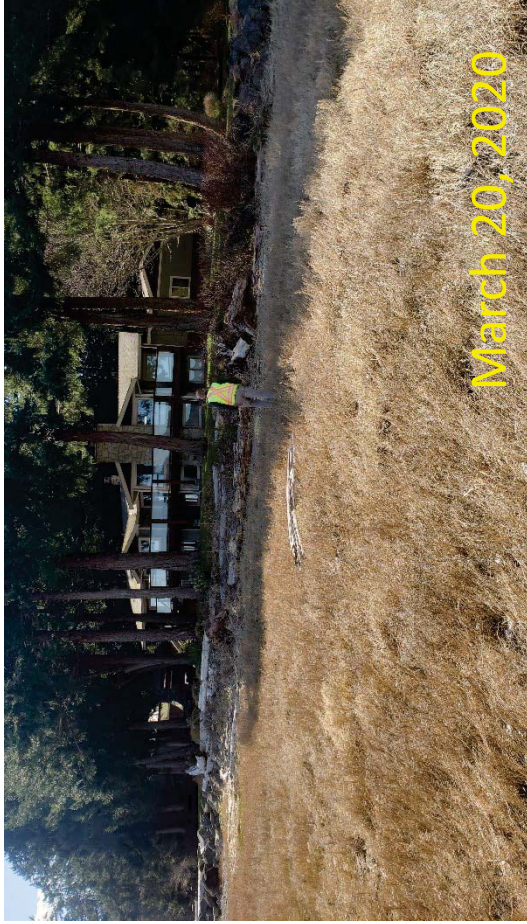


Photo 13 – Looking west across foreshore. Note the long run up with beach grass then the steepened Rip Rap foreshore before the lawn. All good aspects to dissipate wave breaks.



Photo 14 – Looking north across foreshore.

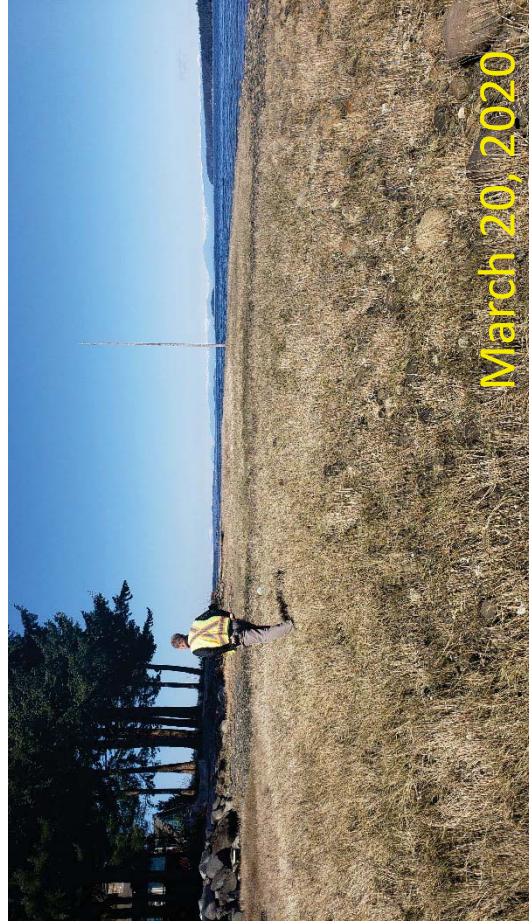


Photo 15 – Looking north across foreshore.

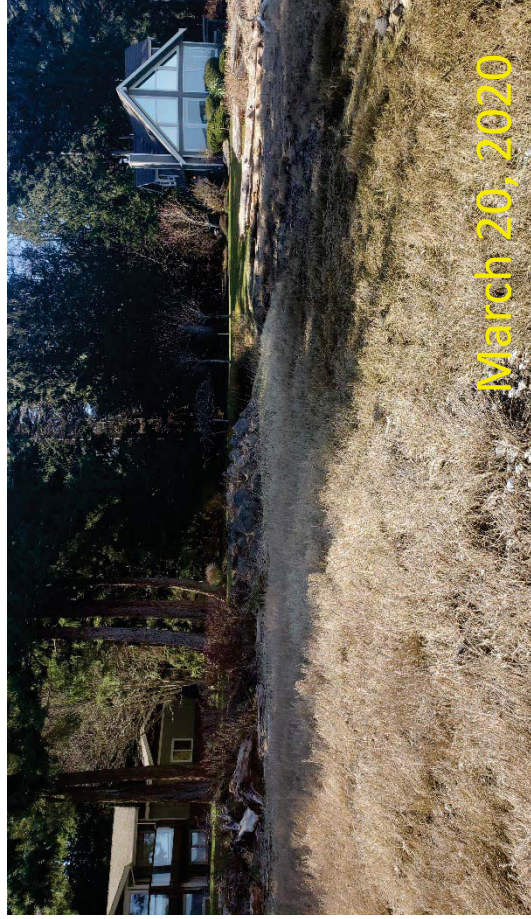


Photo 16 – Looking west across foreshore.

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## FLOOD ASSURANCE STATEMENT

Note: This statement is to be read and completed in conjunction with the current Engineers and Geoscientists BC *Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC* ("the guidelines") and is to be provided for flood assessments for the purposes of the *Land Title Act*, Community Charter, or the *Local Government Act*. Defined terms are capitalized; see the Defined Terms section of the guidelines for definitions.

To: The Approving Authority

Date: April 15, 2020

Comox Valley Regional District

600 Comox Rd, Courtenay BC

Jurisdiction and address

With reference to (CHECK ONE):

- ☐ *Land Title Act* (Section 86) – Subdivision Approval
- ☐ *Local Government Act* (Part 14, Division 7) – Development Permit
- ☐ Community Charter (Section 56) – Building Permit
- ☒ *Local Government Act* (Section 524) – Flood Plain Bylaw Variance
- ☐ *Local Government Act* (Section 524) – Flood Plain Bylaw Exemption

For the following property ("the Property"):

DISTRICT LOT 12, NELSON DISTRICT, PLAN VIP67160, 6448 Island Highway South, Union Bay

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 who fulfils the education, training, and experience requirements as outlined in the guidelines.

I have signed, sealed, and dated, and thereby certified, the attached Flood Assessment Report on the Property in accordance with the guidelines. That report and this statement must be read in conjunction with each other. In preparing that Flood Assessment Report I have:

[CHECK TO THE LEFT OF APPLICABLE ITEMS]

- ☒ 1. Consulted with representatives of the following government organizations:  
CVRD
- ☒ 2. Collected and reviewed appropriate background information
- ☒ 3. Reviewed the Proposed Development on the Property
- ☒ 4. Investigated the presence of Covenants on the Property, and reported any relevant information
- ☒ 5. Conducted field work on and, if required, beyond the Property
- ☒ 6. Reported on the results of the field work on and, if required, beyond the Property
- ☒ 7. Considered any changed conditions on and, if required, beyond the Property
- 8. For a Flood Hazard analysis I have:
  - ☒ 8.1 Reviewed and characterized, if appropriate, Flood Hazard that may affect the Property
  - ☒ 8.2 Estimated the Flood Hazard on the Property
  - ☒ 8.3 Considered (if appropriate) the effects of climate change and land use change
  - ☒ 8.4 Relied on a previous Flood Hazard Assessment (FHA) by others
  - ☒ 8.5 Identified any potential hazards that are not addressed by the Flood Assessment Report
- 9. For a Flood Risk analysis I have:
  - ☒ 9.1 Estimated the Flood Risk on the Property
  - ☒ 9.2 Identified existing and anticipated future Elements at Risk on and, if required, beyond the Property
  - ☒ 9.3 Estimated the Consequences to those Elements at Risk

## FLOOD ASSURANCE STATEMENT

10. In order to mitigate the estimated Flood Hazard for the Property, the following approach is taken:
- ☐ 10.1 A standard-based approach
  - ☒ 10.2 A Risk-based approach
  - ☐ 10.3 The approach outlined in the guidelines, Appendix F: Flood Assessment Considerations for Development Approvals
  - ☐ 10.4 No mitigation is required because the completed flood assessment determined that the site is not subject to a Flood Hazard
11. Where the Approving Authority has adopted a specific level of Flood Hazard or Flood Risk tolerance, I have:
- ☐ 11.1 Made a finding on the level of Flood Hazard or Flood Risk on the Property
  - ☐ 11.2 Compared the level of Flood Hazard or Flood Risk tolerance adopted by the Approving Authority with my findings
  - ☐ 11.3 Made recommendations to reduce the Flood Hazard or Flood Risk on the Property
12. Where the Approving Authority has not adopted a level of Flood Hazard or Flood Risk tolerance, I have:
- ☒ 12.1 Described the method of Flood Hazard analysis or Flood Risk analysis used
  - ☒ 12.2 Referred to an appropriate and identified provincial or national guideline for level of Flood Hazard or Flood Risk
  - ☒ 12.3 Made a finding on the level of Flood Hazard or Flood Risk tolerance on the Property
  - ☒ 12.4 Compared the guidelines with the findings of my flood assessment
  - ☒ 12.5 Made recommendations to reduce the Flood Hazard or Flood Risk
- ☒ 13. Considered the potential for transfer of Flood Risk and the potential impacts to adjacent properties
- ☒ 14. Reported on the requirements for implementation of the mitigation recommendations, including the need for subsequent professional certifications and future inspections.

Based on my comparison between:

[CHECK ONE]

- ☐ The findings from the flood assessment and the adopted level of Flood Hazard or Flood Risk tolerance (item 11.2 above)
- ☒ The findings from the flood assessment and the appropriate and identified provincial or national guideline for level of Flood Hazard or Flood Risk tolerance (item 12.4 above)

I hereby give my assurance that, based on the conditions contained in the attached Flood 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* (Part 14, Division 7), my Flood Assessment Report will "assist the local government in determining what conditions or requirements it will impose under subsection (2) of this section [Section 491 (4)]".
- ☐ 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* and the *Amendment Section 3.5 and 3.6* associated with the *Local Government Act* (Section 524), "the development may occur safely".
- ☐ For flood plain bylaw exemption, as required by the *Local Government Act* (Section 524), "the land may be used safely for the use intended".

## FLOOD ASSURANCE STATEMENT

I certify that I am a Qualified Professional as defined below.

April 15, 2020

Date

Peter Bullock

Prepared by

Peter Bullock, P.Eng., M.Eng.

Name (print)



Signature

720 Fern Road East

Address

Qualicum Beach

250.228.2421

Telephone

Solutions@basegeotechnical.ca

Email

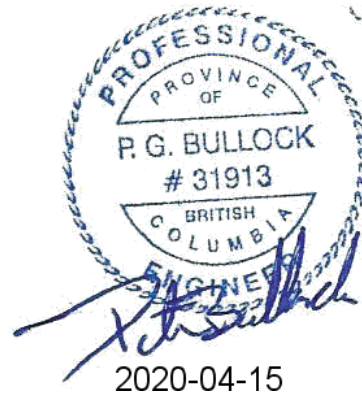
Reviewed by

Adrian Chesham, P.Eng., M.Eng.

Name (print)



Signature



(Affix PROFESSIONAL SEAL here)

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

I am a member of the firm **Base Geotechnical Inc.**

and I sign this letter on behalf of the firm.

(Name of firm)