

Appendix E: Geotechnical Report

RYZUK GEOTECHNICAL
Engineering & Materials Testing

28 Crease Avenue, Victoria, BC, V8Z 1S3 Tel: 250-475-3131 Fax: 250-475-3611 www.ryzuk.com

April 15, 2020
Revised May 20, 2020
File No: 6935-3



Sooke, BC
V8Z 0J5

Attn: 

Dear 

Rc: Geotechnical Site Assessment – 1st Revision
7004 East Sooke Road – Sooke, BC

As requested, we attended the above referenced site on August 20, 2019, to complete an assessment of the existing inland steep slopes and foreshore conditions to establish the rockfall and flooding hazards, respectively. We understand the proposed development consists of renovation of the existing residence including reconstruction of the wooden deck and a new wood-framed vestibule at the south entrance door. The existing single-family residence is partially located in Development Permit Areas (DPA). As such, the Capital Regional District (CRD) requires an assessment to support a development permit application for projects within DPAs associated with steep slopes and the Present Natural Boundary (PNB) of the ocean (further defined below). Our observations, comments, and recommendations are included herein. Our work has been undertaken in accordance with, and is subject to, the previously provided Terms of Engagement.

The site is generally rectangular in shape with an approximate area of 8500 m². It is bounded by the shore of Sooke Inlet to the north, East Sooke Road to the south, and similar residential properties to the east and west. Topography throughout the site generally slopes down from south to north with a level area within the central portion of the site and a localized topographic high point within the central-west portion of the site. A small creek within the southwest corner of the site discharges water into two ponds, present within the above noted level area which then drains into the subsurface. Additionally, a steep foreshore slope is present along the north property boundary. The site layout and topography are shown on the attached Location Plan, drawing 6935-3-1.

Ryzuk Geotechnical

Geotechnical Site Assessment
7004 East Sooke Road - Sooke, BC

May 20, 2020

The existing single-family residence, built at-grade, is located within the northwest portion of the site. The residence is situated between the northern extent of the noted topographic high point, which consists of a 5 m high steep rock face at that location, and the local shorefront. The grades surrounding the residence follow the general topography and continue to slope down towards the ocean, varying in pitch from 5 to 15% but steepen to near vertical along the shorefront. While on site, we observed that the minimum offset from the existing residence to the steep inland rock slope was approximately 12 m. Additionally, we observed that the offset from existing residence to the PNB of the ocean ranged from approximately 10 m to 25 m. We have taken the PNB of the ocean to be the crest of the steep rock slope lining the shorefront, given the exposed rock was free of vegetation and mineral soils. We noted the exposed shoreline rock face to consist of strong massive bedrock, typical in the Sooke area and known to have low-credibility.

Section 510 of the East Sooke Official Community Plan (Bylaw No. 4000) stipulates a development permit is required for any proposed development sited on a steep slope. The bylaw defines a steep slope as any slope with a pitch greater than 30% (16.7 degrees) over a horizontal distance (run) greater than 10 m. As such, the siting of future developments would be permissible without a development permit for much of the site surrounding the existing residence. However, we recommend an offset of approximately 5 m from steep inland rock slopes to account for the expected rare occurrence of rockfall associated with the natural weathering of the rock mass.

Section 513 of Bylaw No. 4000 requires that any proposed development within a steep slope DPA must be designed to avoid alterations to the existing steep slope geometry, soil cover thickness, hydrology, and/or site vegetation. Given that the proposed addition will be not significantly increase the existing building footprint, we consider any alterations to the existing slope geometry, hydrology, soil cover thickness, and/or vegetation at the site will be negligible. However, we recommend that temporary sedimentation and erosion control measures, such as hay bails or silt fencing/booms, be implemented during construction if any required earthworks create a preferential drainage pathway(s) and that following construction the original conditions are reinstated. Furthermore, as the proposed addition is to extend from the south side of the existing residence, within the existing level parking area, we expect that the additional foundation loads placed in this area would not impact the global slope stability in the area.

Similarly, Section 520 of Bylaw No. 4000 stipulates a development permit is required for any proposed development sited within 15 m of the PNB of the ocean. Section 523 of Bylaw No. 4000 requires that erosion and sedimentation must be avoided during and after construction to maintain foreshore stability. Given that the proposed addition will extend from the south side of the existing residence, the offset from the PNB will be approximately 18 to 20 m which places the proposed addition outside of the DPA and in accordance with Section 524.

Section 525 of Bylaw No. 4000 further indicates that a Flood Construction Level (FCL) assessment, completed by a qualified professional, can be used to support an offset variance. As such, we have assessed the flooding hazard at the site due to severe storm events and ocean level rise associated with climate change.

Based on contour information provided by the online CRD Regional Map, the main floor elevation of the existing residence is between 7 and 10 m geodetic and a local shoreline elevation of roughly 1.5 m geodetic.

Geotechnical Site Assessment
7004 East Sooke Road - Sooke, BC

May 20, 2020

The CRD Coastal Sea Level Rise Risk Assessment indicates that the predicted extreme high water level for a large tide (HHWLT + storm surge) for the year 2100 would be 3.69 m geodetic. However, this value was calculated using the previous methodology for estimating the projected FCL, defined as the minimum required elevation of the underside of a wooden floor system or the top of a concrete slab floor for habitable buildings.

As such, we have calculated an updated FCL using the currently accepted/legislated methodology, prescribed by the Provincial “Guidelines for Management of Coastal Flood Hazard Land Use,” published in January 2011 and the Provincial Guidelines for “Coastal Floodplain Mapping” published in June 2011. Furthermore, the “Flood Hazard Area Land Use Management Guidelines” with amendments of January 1, 2018, specifically related to coastal flood construction levels was also reviewed.

The FCL was calculated following the “Combined Method” provided in the FHALUM Guidelines. Additional information required to establish the FCL was obtained from the Canadian Hydrographic Service (CHS). The FCL methodology utilizes the highest predicted tide (HHWLT) which was provided by the CHS as a base, upon which the predicted Sea Level Rise (SLR), storm surge, wave effect, local uplift, as well as an additional free board factor were considered.

The Provincial Guidelines outline a 1.0 m sea level rise, and accordingly, a factor of 1.0 m was applied to account for the predicted 100-year sea level rise (Ausenco Sandwell). In addition, a correction factor has been added to account for regional uplift and isostatic rebound. A regional uplift rate of 3.1 mm/year was selected for the Sooke area based on “Coastal Sea Level Risk Assessment” by AECOM (2015); therefore, the FCL has been decreased by 0.31 m over the 100-year sea level rise period. An estimated wave effect of 0.65 m, and a nominal freeboard amount of 0.3 m have also been included in the analysis. Table 1 summarizes the values used to establish the site-specific FCL.

Table 1: Summary of FCL Calculations

Item:	(m geodetic)	Notes:
Higher High Water Large Tide (HHWLT)	1.9	As per CHS ¹ – based on Sooke Tidal Gauges
Total Storm Surge during “designated storm”	1.3	As per Guidelines for Victoria – 1:500 annual probability of exceedance storm event
Estimated wave effect	0.65	Limited, due to protection of surrounding topography and adjacent buildings ²
Regional Uplift	(0.31)	3.1 mm/year decrease for Sooke, BC
Sea Level Rise (SLR)	1.0	As per Guidelines
Free Board Factor	0.3	As per Guidelines ²
FLOOD CONSTRUCTION LEVEL (m geodetic)	+4.84	

¹ Canadian Hydrographic Service

² Following Amendment Section 3.5 and 3.6 of “Flood Hazard Area Land Use Management Guidelines” (2018)

The storm surge and estimated wave effect components of the FCL were estimated based on recommendations for the area in the Guidelines. However, the storm surge and wave effect will vary based on the local conditions of a given site. No site-specific analyses were completed to quantify the effect of local conditions at the site on the storm surge and wave effect.

Geotechnical Site Assessment
7004 East Sooke Road - Sooke, BC

May 20, 2020

We have not undertaken detailed wave run-up analyses or associated magnitude return period frequency analyses of tsunami events to quantify the hazard at the referenced site. A review of the tsunami modelling completed for the Capital Regional District by AECOM (2013) indicates a maximum water level of 2.5 m for entrance of Sooke Harbour (inclusive of the mean tidal elevation) for a design 1:500 annual probability of exceedance earthquake. As per Amendment Section 3.5 of "Flood Hazard Area Land Use Management Guidelines" (2018) the greater of the tsunami maximum water level and FCL shall apply. The FCL is the greater of the two for the subject site, and as such the FCL of 4.84 m is recommended. However, we do recommend that residents review and understand the Provincial Tsunami Advanced Warning System.

Based on the above, and in accordance with the Guidelines, an FCL (or minimum elevation for habitable spaces) of **4.84 m** has been determined for this site.

Given that the main floor elevation is well above the calculated FCL elevation and that the grading around the inhabited portion of the site descends towards the ocean we do not consider the site to be subject to a flooding hazard caused by the ingress of ocean water into the site. Similarly, we do not consider the wave action during strong storm events to cause a flooding hazard either given the noted residence elevation, site grading, and the relatively short wave run-up/fetch length of less than 1.4 km.

Based on the above, we consider a reduction in the PNB offset from 15 m to 10 m to be appropriate for the site as it would not negatively impact any future development at the site. The CRD Approving Officer and Building Inspectors may rely on the above information when reviewing the permit applications for the proposed project. Note that we have based our recommendations on a probably of exceedance of 10% in 50 year for marine events and 2% in 50 year for seismic events.

Furthermore, we consider the proposed development, as noted, feasible from a geotechnical perspective and consider the land may be used safely for the use intended, pursuant to Section 56 of the Community Charter.

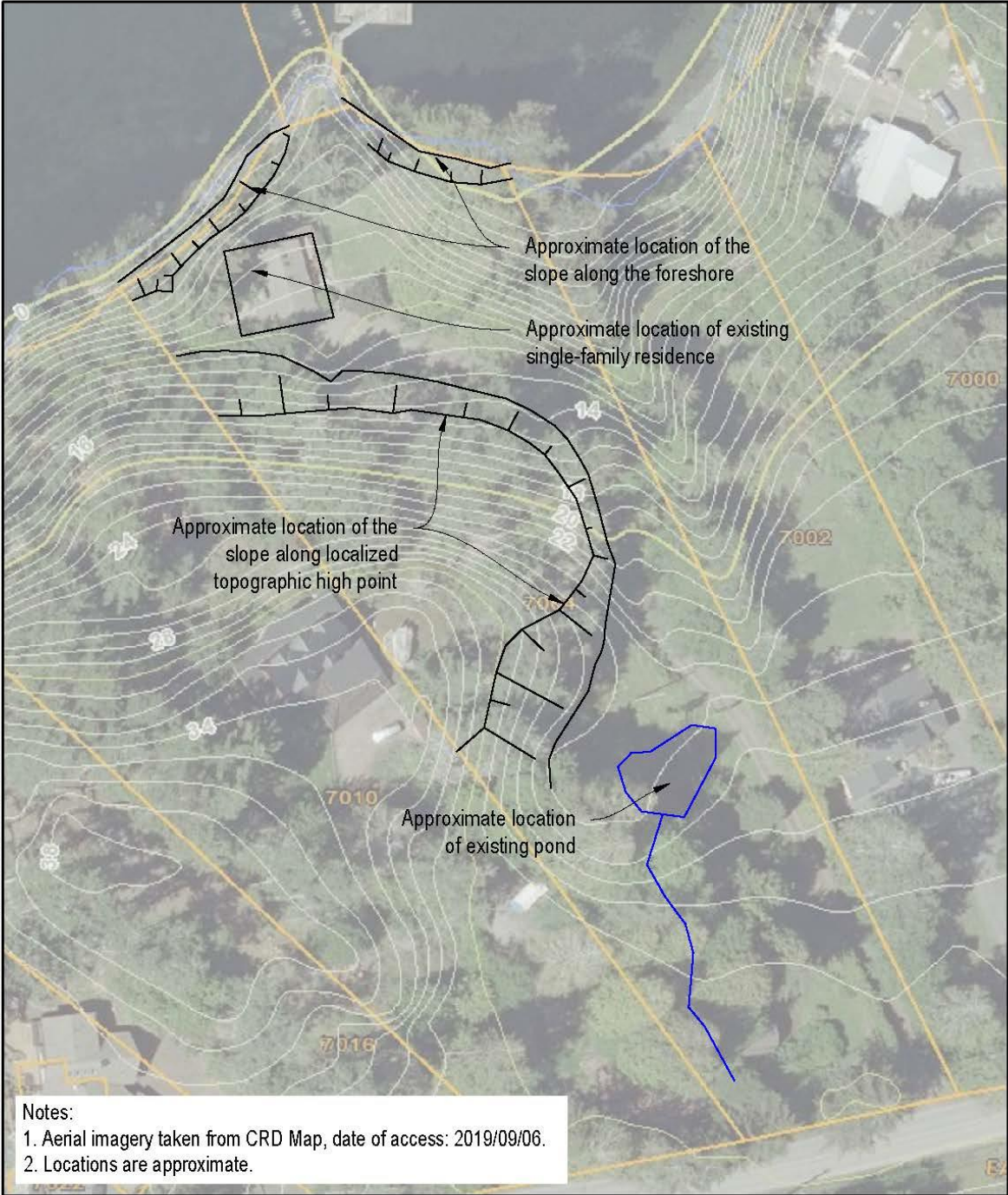
We trust that the preceding is suitable for your purposes at present, however if you have any questions with respect to the above, please contact us.

Best regards,
Ryzuk Geotechnical



Richard T. Moser, P.Eng.
Project Engineer





	[Redacted]		DRAWN	RN
	LOCATION PLAN		DATE	September, 2019
	Proposed Single-Family Residence		APPROVED	
	7004 East Sooke Road	Sooke, B.C.	SCALE	1:800
	RYZUK GEOTECHNICAL	Engineering & Materials Testing	DRAWING No.	8935-3-1