



Committee Report

Date of Report: June 29, 2021
Date & Type of Meeting: July 14, 2021, Rural Affairs Committee
Author: Stephanie Johnson, Planner
Subject: SITE SPECIFIC FLOODPLAIN SETBACK EXEMPTION
File: F2103F-07750.030-MYRAM-FLD00059
Electoral Area/Municipality: Area F

SECTION 1: EXECUTIVE SUMMARY

This report seeks the Board's consideration of site specific floodplain exemption application at 2168 Annable Road, North Shore, Electoral Area 'F'.

The applicant is requesting a relaxation to the floodplain setback from Crystal Springs Creek as specified under the Regional District's *Floodplain Management Bylaw No. 2080, 2009* from 15 metres to 9 metres for the construction of an addition to an existing single family dwelling.

Staff recommends that the Board approve the site specific floodplain setback exemption subject to the registration of a Section 219 restrictive covenant for the exemption, indemnifying the Regional District and confirming that the proposed addition and setback are safe for the intended use.

SECTION 2: BACKGROUND/ANALYSIS

GENERAL INFORMATION	
Property Owners:	Lindsey and Kurt Myram
Property Location:	2168 Annable Road, North Shore, Electoral Area 'F'
Legal Description:	LOT 3 DISTRICT LOT 4780 KOOTENAY DISTRICT PLAN 5416 (PID 014-442-698)
Property Size:	0.16 hectares
OCP Designation:	Country Residential (CR)
Zoning:	Country Residential (R2)

SURROUNDING LAND USES	
NORTH:	Annable Road and Residential uses – zoned Country Residential (R2)
EAST:	Residential uses – zoned Country Residential (R2)
SOUTH:	Residential uses – zoned Country Residential (R2)
WEST:	Residential uses – Zoned Country Residential (R2)

Site Context

The subject property is designated Country Residential (CR) under *Electoral Area 'F' Official Community Plan Bylaw no. 2214, 2012* and zoned Country Residential (R2) under the *Zoning Bylaw No. 1675, 2004*. The 0.16 ha in size subject property is bounded by country residential uses, and a quarry is located approximately 50 metres to

the east from the subject property (also on Annable Road). Crystal Springs Creek runs adjacent to the property line to the north. The subject property is not located in an alluvial fan or geohazard area. An existing residence and detached garage currently occupy the site.

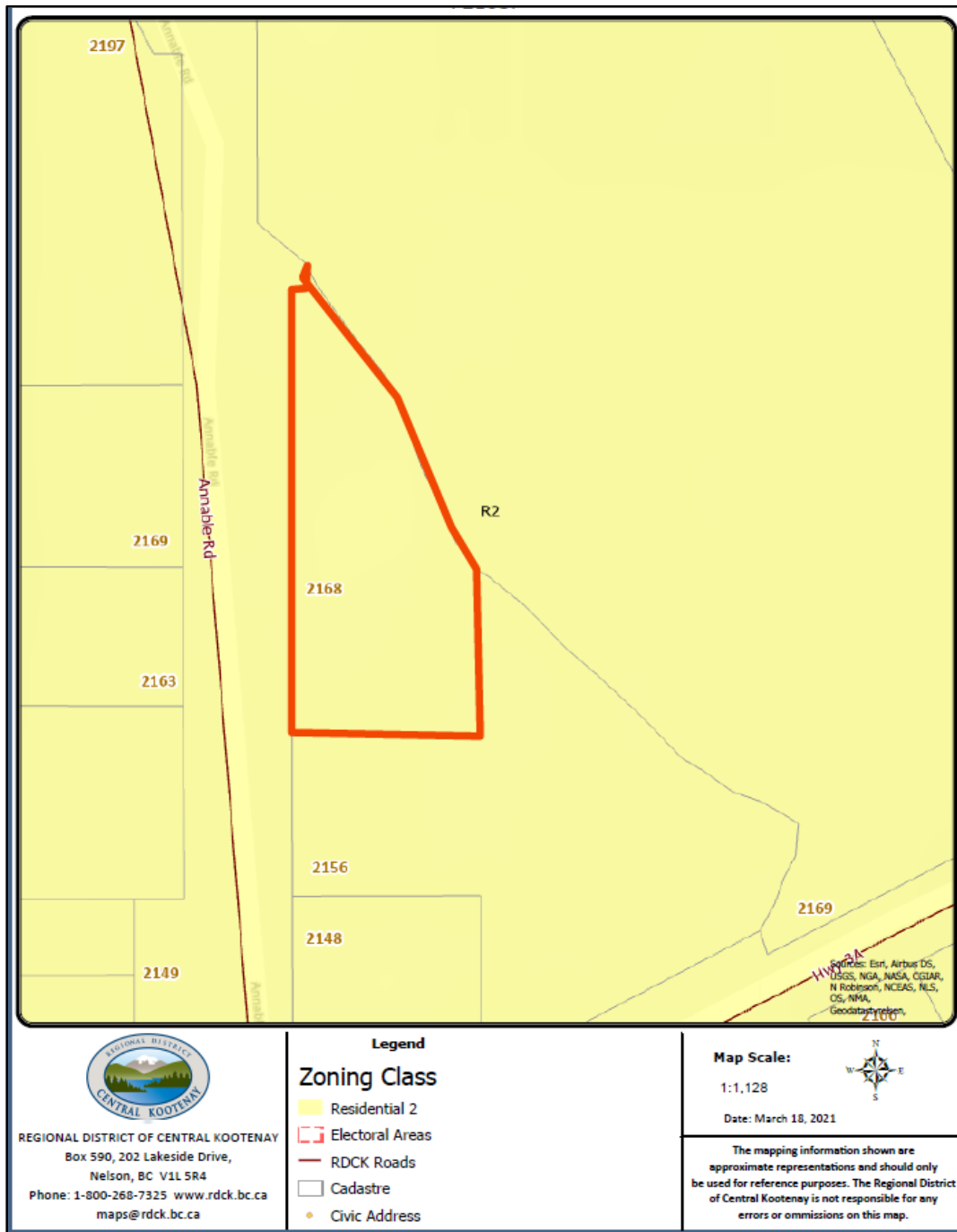


Figure 1: Location and Zoning Overview Map

Development Proposal

This application is for a site specific floodplain exemption. The applicant seeks to reduce the floodplain setback for Crystal Springs Creek from 15 metres to 9 metres under the RDCK's *Floodplain Management Bylaw No. 2080, 2009* to allow for a proposed rear addition to the existing residence.



Figure 2: Site Visit Photo

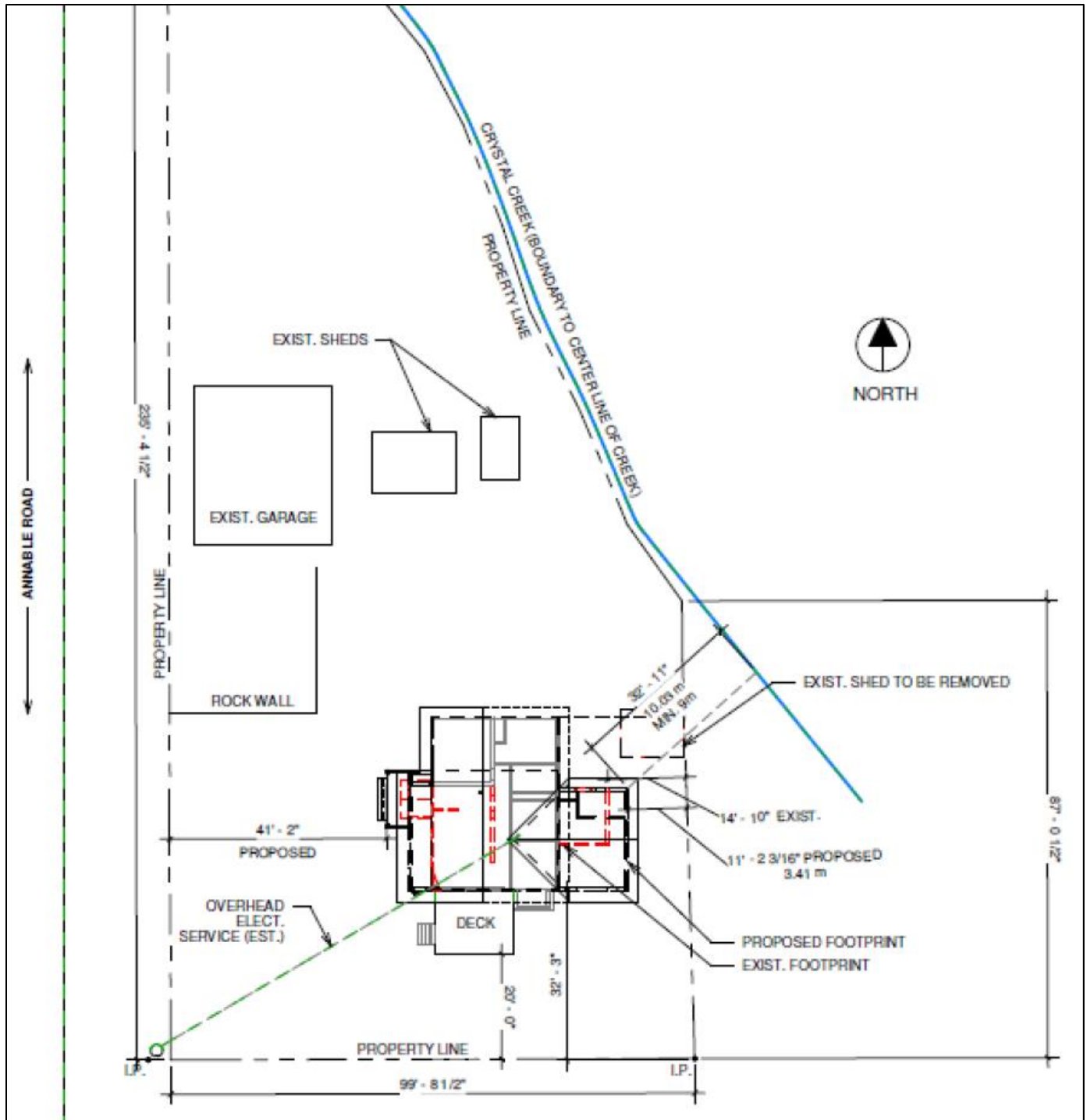


Figure 3: Site Plan

Legislative Framework and Applicable Policy

The general floodplain setback for watercourses is 15.0 metres from the natural boundary. Under Section 524 of the *Local Government Act (LGA)*, a local government may exempt a person from the application of a floodplain bylaw in relation to a specific building if the local government considers it advisable and either:

- Considers that the exemption is consistent with the Provincial Guidelines; or
- Has received a report that the land may be used safely for the use intended where such a report is certified by a person who is a professional engineer or geoscientist and experienced in geotechnical engineering.

The Board adopted ‘Terms of Reference for Professional Engineers/Geoscientists undertaking Geotechnical Reports/Flood Hazard Assessment Reports’ to outline basic information that should be included in such reports. The Flood Hazard Assessment Report prepared by SNT Geotechnical Ltd., dated June, 2021, was submitted in conjunction with the application for an exemption (please see Attachment A) and meets the requirements set out under the above Terms of Reference. The report verified that “*the land may be used safely for its intended use*”. The Provincial Flood Hazard Area Land Use Management Guidelines for landowner requests for modification of bylaws provides the following guidance:

Setback requirements should not be reduced unless a serious hardship exists and no other reasonable option is available. A valid hardship should only be recognized where the physical characteristics of the lot (e.g., exposed bedrock, steep slope, the presence of a watercourse, etc.) and size of the lot are such that building development proposals, consistent with land use zoning bylaws, cannot occur unless the requirements are reduced. In order to avoid setting difficult precedents these site characteristics should be unique to the subject property and environment. The economic circumstances or design and siting preferences of the owner should not be considered as grounds for hardship. Before agreeing to a modification, consideration should be given to other options such as the use of alternate building sites, construction techniques and designs (e.g., constructing an additional storey and thereby reducing the size of the ‘building footprint’).

SECTION 3: DETAILED ANALYSIS

3.1 Financial Considerations – Cost and Resource Allocations:

Included in Financial Plan: Yes No Financial Plan Amendment: Yes No
 Debt Bylaw Required: Yes No Public/Gov’t Approvals Required: Yes No

The \$500 fee for a Site Specific Floodplain Exemption application has been paid pursuant to the RDCK’s *Planning Procedures and Fees Bylaw No. 2457, 2015*.

3.2 Legislative Considerations (Applicable Policies and/or Bylaws):

Under Section 524 of the *LGA*, the Board has the authority to exempt a parcel from flood proofing and floodplain setback requirements provide a report prepared by a professional engineer or geoscientist is received stating that the land may be used safely for the use intended.

3.3 Environmental Considerations

No environmental impacts are anticipated on this developed site.

3.4 Social Considerations:

No negative social impacts are associated with the proposed floodplain setback reduction.

3.5 Economic Considerations:

No economic considerations are anticipated in response to this proposal.

3.6 Communication Considerations:

In accordance with the RDCK’s *Planning Procedures and Fees Bylaw No. 2457, 2015* staff referred the

application to all relevant government agencies, local First Nations, internal RDCK departments and the Director for Electoral Area 'F' for review. The following comments were received:

Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD)

"The MFLNRORD's Terrestrial Resource Management Division reviewed this Floodplain Exemption application...and determined that this project should not impact the Resource Management Division's legislated responsibilities as long as the following recommendations are considered.

It is recommended that no vegetation in removed adjacent to the stream. This overstory and understory vegetation provides bank stability and key habitat for terrestrial and aquatic species within the stream and riparian environment.

Any future works within or directly adjacent (floodplain and or high water mark) to a stream are subject to the Provincial Water Sustainability Act. Please review the Kootenay Region's Terms and Conditions for Instream works and timing windows available through the Kootenay Boundary Region drop down menu at: <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-licensing-rights/working-around-water/regional-terms-conditions-timing-windows> to ensure that you can abide by these guidelines".

FortisBC Inc.

"There are no FortisBC Inc (Electric) ("FBC(E)") facilities affected by this application. As such FBC(E) has no concerns with this circulation."

Interior Health (IH)

"An initial review has been completed and no health impacts associated with this proposal have been identified. As such, IH's interests are unaffected by this proposal".

Building Department

"The report, prepared by SNT Geotechnical Ltd. has been reviewed and found to be in accordance with the terms of reference. Compliance is required with the SNT Geotechnical Ltd. Flood Hazard Assessment Report and conditions therein as prepared by Dwain Boyer, P.Eng and dated June 2021. The proposed building can be located in the designated building area with a relaxed setback distance from Crystal Creek prescribed in the Floodplain Management Bylaw. The setback distance can be relaxed from the prescribed 15m to 9 m to permit the proposed addition".

3.7 Staffing/Departmental Workplace Considerations:

Should the Board support the requested site-specific floodplain exemption to reduce the proposed floodplain, including registration of a restrictive covenant on title, a Building Permit would then be required for the construction of the addition.

3.8 Board Strategic Plan/Priorities Considerations:

This application falls under the operational role of Planning Services.

SECTION 4: OPTIONS & PROS / CONS

Planning Discussion

Staff have reviewed this site-specific floodplain exemption application, and conducted a site visit. Other than the reduced floodplain setback requested, the proposal is consistent with the relevant Country Residential objectives and policies under the *Electoral Area 'F' Official Community Plan Bylaw No. 2214, 2012*, and the RDCK

Zoning Bylaw No. 1675, 2004 .

Planning staff support the requested floodplain setback reduction, since:

- The proposed addition complies with all of the other land use and siting requirements contained within the *RDCK's Zoning Bylaw No. 1675, 2004*;
- The applicants have engaged a professional geotechnical engineer, SNT Geotechnical Ltd., who have submitted a report confirming that the proposed siting of the addition, as designed, is safe for the use intended;
- The *Electoral Area 'F' Official Community Plan Bylaw No. 2214, 2012* does not have a Watercourse Development Permit Area;
- Due to the existing services (i.e. water and septic) the proposed addition cannot be sited in an alternative location;
- The proposed development meets the requirements of hardship due to the restrictive building envelope associated with the subject property; and,
- The flood hazard assessment report submitted has been reviewed by Regional District staff and meets the necessary assurance requirements and is consistent with the Provincial flood hazard land use management guidelines.

OPTIONS

Option 1: That the Board APPROVE a Site Specific Exemption to reduce the required setback to Crystal Springs Creek from 15 metres from the natural boundary to 9 metres from the natural boundary in accordance with the Engineering Report prepared by SNT Geotechnical Ltd. for property located at 2168 Annable Road, North Shore, Electoral Area 'F' and legally described as LOT 3 DISTRICT LOT 4780 KOOTENAY DISTRICT PLAN 5416 (PID 014-442-698) SUBJECT to preparation by Lindsey and Kurt Myram of a restrictive covenant under Section 219 of the Land Title Act and Section 56 of the Community Charter in favour of the Regional District of Central Kootenay.

Option 2: That the Board NOT APPROVE a Site Specific Exemption to reduce the required setback to Crystal Springs Creek from 15 metres from the natural boundary to 9 metres from the natural boundary in accordance with the Engineering Report prepared by SNT Geotechnical Ltd. for property located at 2168 Annable Road, North Shore, Electoral Area 'F' and legally described as LOT 3 DISTRICT LOT 4780 KOOTENAY DISTRICT PLAN 5416 (PID 014-442-698).

SECTION 5: RECOMMENDATION

That the Board APPROVE a Site Specific Exemption to reduce the required setback to Crystal Springs Creek from 15 metres from the natural boundary to 9 metres from the natural boundary in accordance with the Engineering Report prepared by SNT Geotechnical Ltd. for property located at 2168 Annable Road, North Shore, Electoral Area 'F' and legally described as LOT 3 DISTRICT LOT 4780 KOOTENAY DISTRICT PLAN 5416 (PID 014-442-698) SUBJECT to preparation by Lindsey and Kurt Myram of a restrictive covenant under Section 219 of the Land Title Act and Section 56 of the Community Charter in favour of the Regional District of Central Kootenay.

Respectfully submitted,

"Submitted electronically"

Stephanie Johnson

CONCURRENCE

Planning Manager – Nelson Wight

General Manager of Development and Community Sustainability – Sangita Sudan

Chief Administrative Officer – Stuart Horn

ATTACHMENTS:

Attachment A – Geotechnical Report prepared by SNT Engineering



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Flood Hazard Assessment at 2168 Annable Road, North Shore
Nelson
June 2021

Report Number: 21.540.34

Distribution:

Lindsey Myram – 1 copy

SNT Geotechnical Ltd. – 1 copy



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1. INTRODUCTION

This report replaces a previous report entitled “Flood Hazard Assessment at 2168 Annable Road, North Shore, Nelson May 2021” signed and sealed by the undersigned on May 22, 2021 and letter amendments dated June 7 and 8, 2021.

At the request of Lindsey Myram, SNT Geotechnical Ltd. (SNTG) has completed a flood hazard assessment report for 2168 Annable Road (LOT 3, PLAN NEP5416, DISTRICT LOT 4780, KOOTENAY LAND DISTRICT). The report is a precondition for the issuance of a Site Specific Exemption from the provisions of Regional District Central Kootenay’s (RDCK) Floodplain Management Bylaw 2080. The Myram’s have applied to the RDCK for a relaxation of the building setback distance from Crystal Creek to accommodate the construction of an addition to an existing building. The setback distance specified in the bylaw is 15 m. The existing building setback distance is 9 m. The proposed new building footprint would result in the building being located 0.762 m closer to the creek..

2. SITE LOCATION

The property is located 6 km north east of Nelson as shown in Figure 1 and 2.



Figure 1. Property Location – source Google Earth Image

Figure 2 shows the location of Crystal Creek channel as it appears on the RDCK webmap. Figure 3 is a depiction of the creek channel observed during field inspections. It also is apparent on LiDAR maps. Figure 4 is a site plan showing the proposed building footprint and Crystal Creek.



Flood Hazard Assessment Report – 2168 Annable Road, Willow Point, June 2021

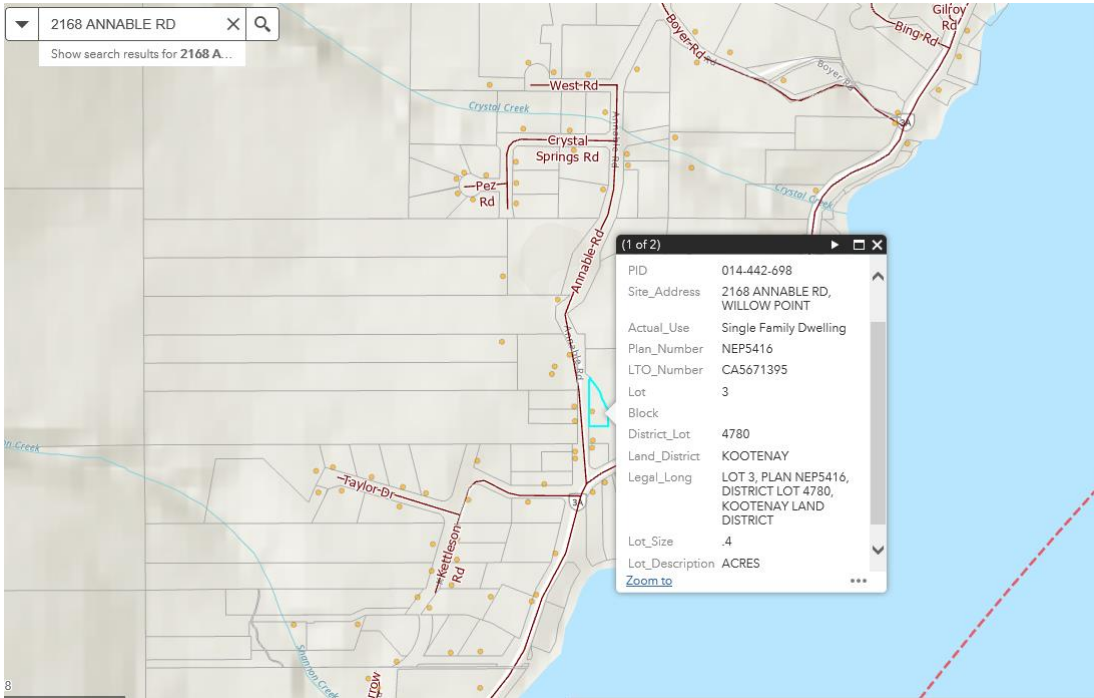


Figure 2. Property Location –Source RDCK webmap

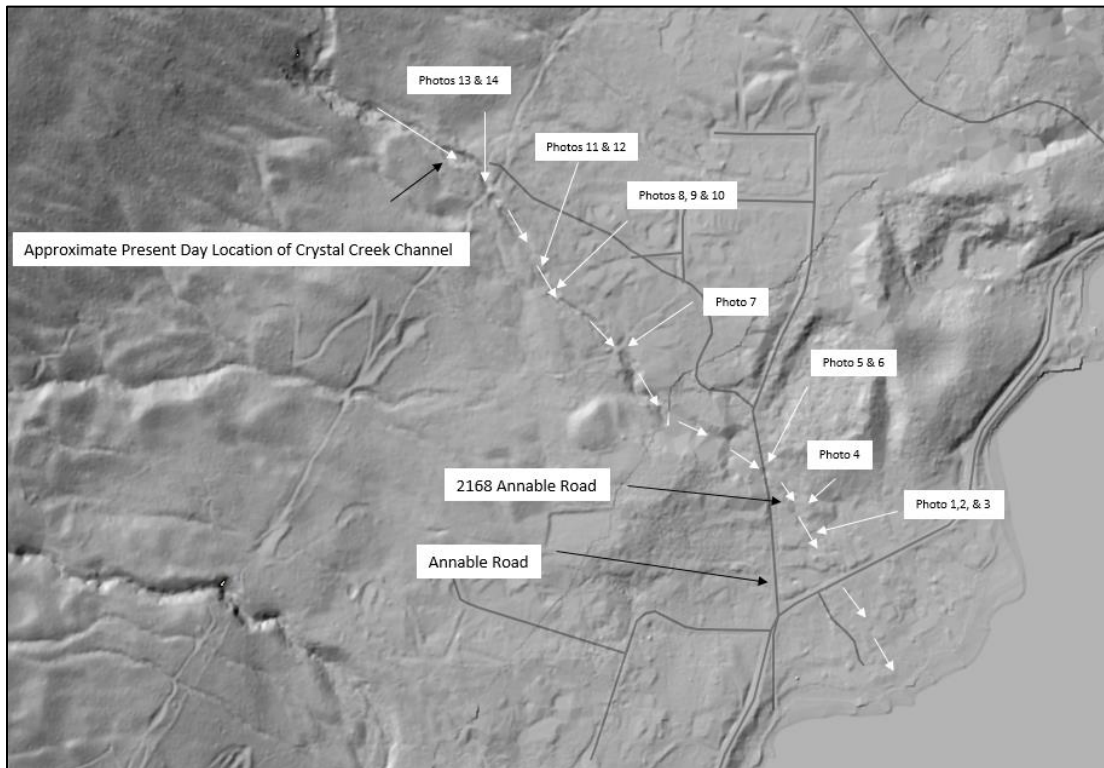


Figure 3: Approximate Actual Location of Crystal Creek Channel

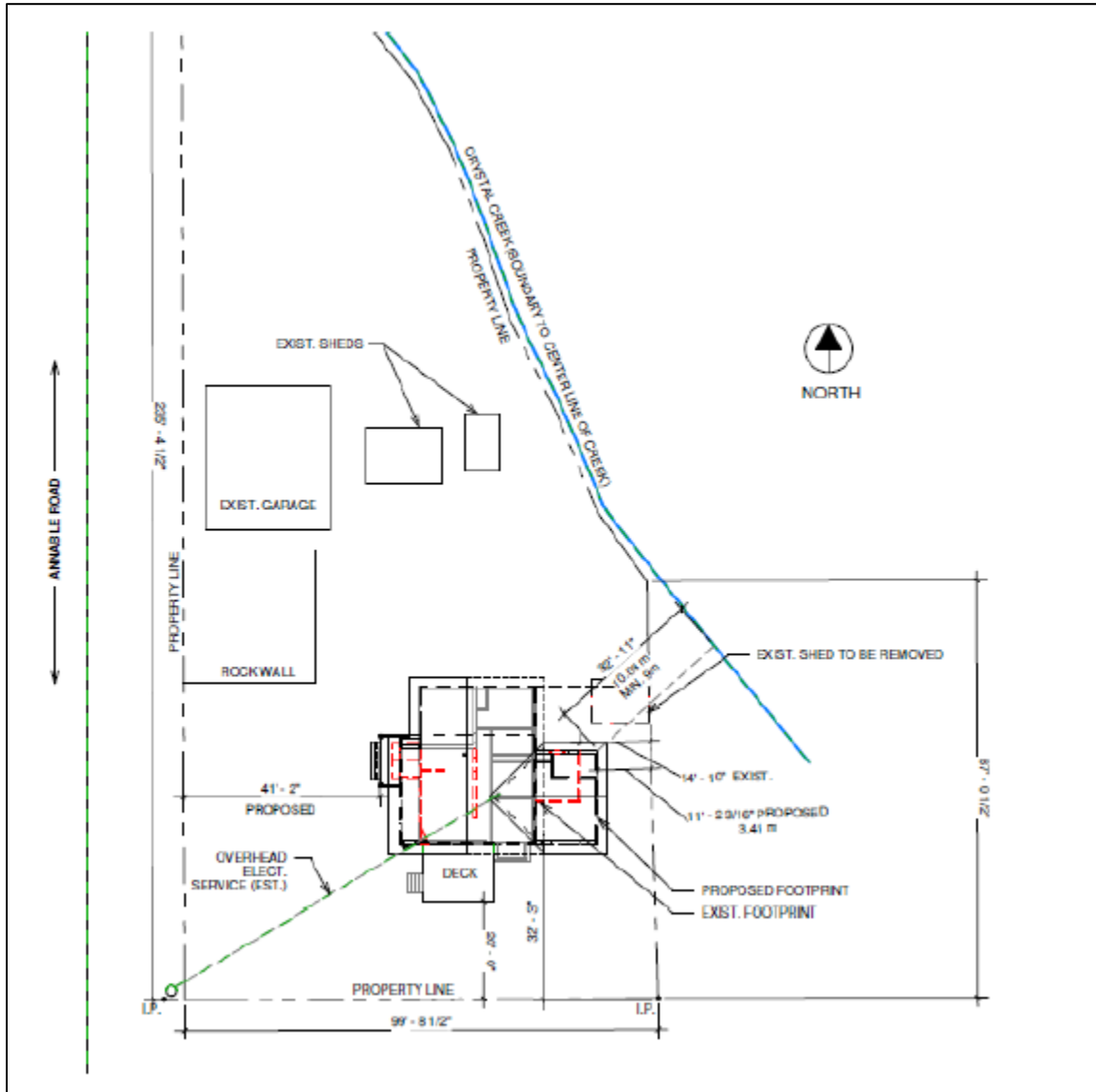


Figure 4: Site Plan – Source Lindsey Myram

3. PROJECT SCOPE

Table 1 provides the list of tasks completed.

Table 1. Task List

Activity	Task
Field Review	Inspect subject property and Crystal Creek channel
	Observe and record hazard information
Office	Review background information
	Identify hydrogeomorphic hazards
	Assess hazards considering provincial thresholds for safety
	Analyses and Report writing

4. BACKGROUND INFORMATION

4.1. RDCK Floodplain Bylaw: The bylaw requires a building setback distance of 15 m from the natural boundary of Crystal Creek and a flood construction level of 1.5 m above the natural boundary of Crystal Creek. As shown in Figure 5 the bylaw also identifies a Non Standard Flooding Erosion Area polygon for Crystal Creek. The subject property is located south of the polygon.

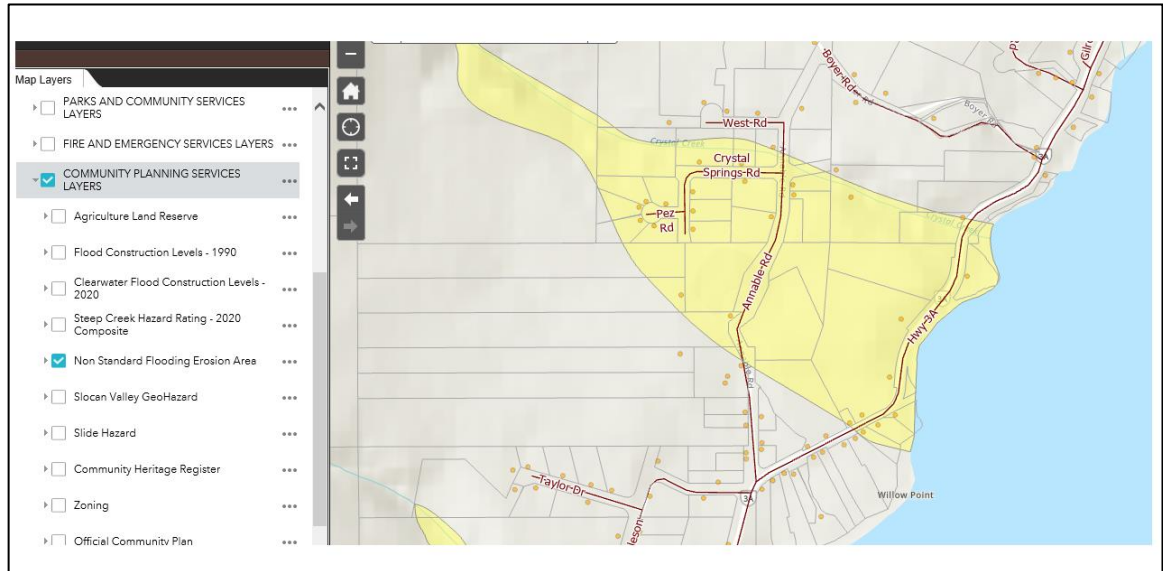


Figure 5: Non Standard Flooding Erosion Area for Crystal Creek – Source RDCK webmap

4.2. Land Title Search: The land title search did not identify any flood hazard related restrictive covenants on the property (Appendix A).

4.3 Existing Reports:

4.3.1 Ministry of Forests Lands Natural Resource Operations and Rural Development (MFLNRORD) Kootenay Regional Hazard Inventory:

The Crystal Creek fan was first identified as a potentially hazardous area in 1998 when Klohn-Crippen Ltd was retained by MFLNRORD to provide an inventory of flood and debris flow fans in the Kootenay region (Klohn-Crippen 1998). The Klohn-Crippen report identified the approximate location of the apex of the fan using air photographs and available topographic maps but did not provide an outline of the fan boundaries. Subsequently, terrain mapper Carol Wallace P. Geo. was retained to delineate the fan boundaries and create a polygon for mapping purposes, using air photographs. Detailed field work and analysis was not undertaken to identify the hydrogeomorphic process or processes involved with the formation of the fan.

The Klohn-Crippen report provided a useful summary of several characteristics of the fan and watershed area.

4.3 BGC Engineering Ltd (BGC) Debris Flood Susceptibility Map: BGC produced region wide debris flood and debris flow susceptibility maps for the RDCK in conjunction with a 2020 report entitled ‘RDCK Floodplain and Steep Creek Study’. BGC modelling results are shown in Figures 6 and 7.

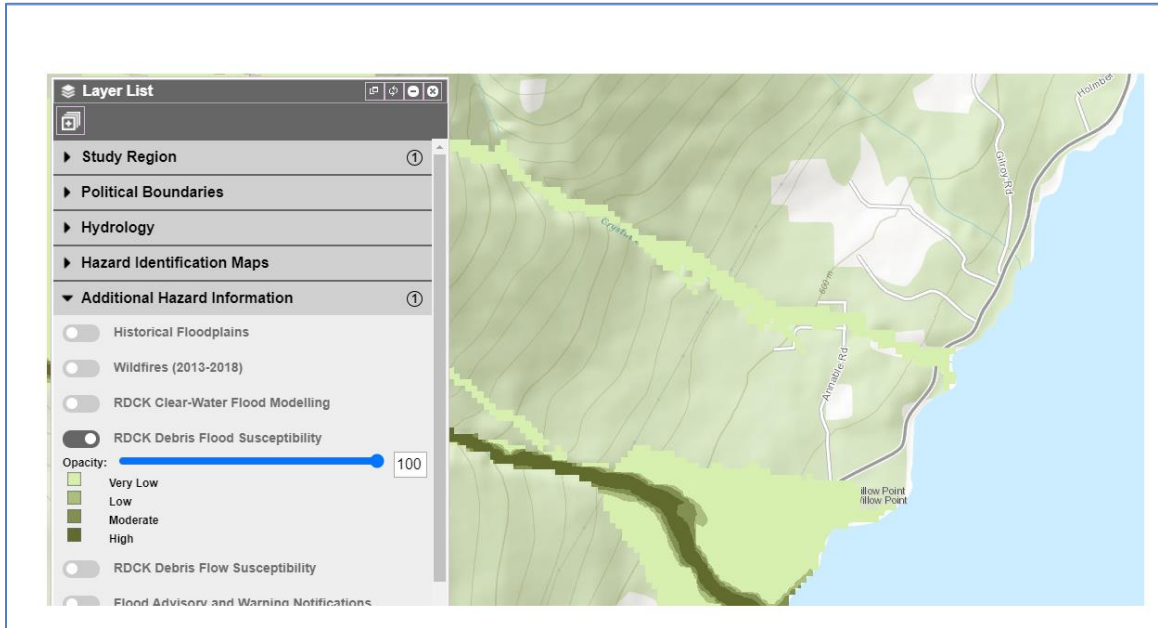


Figure 6: Crystal Creek Debris Flood Susceptibility Map – Source BGC (2020)

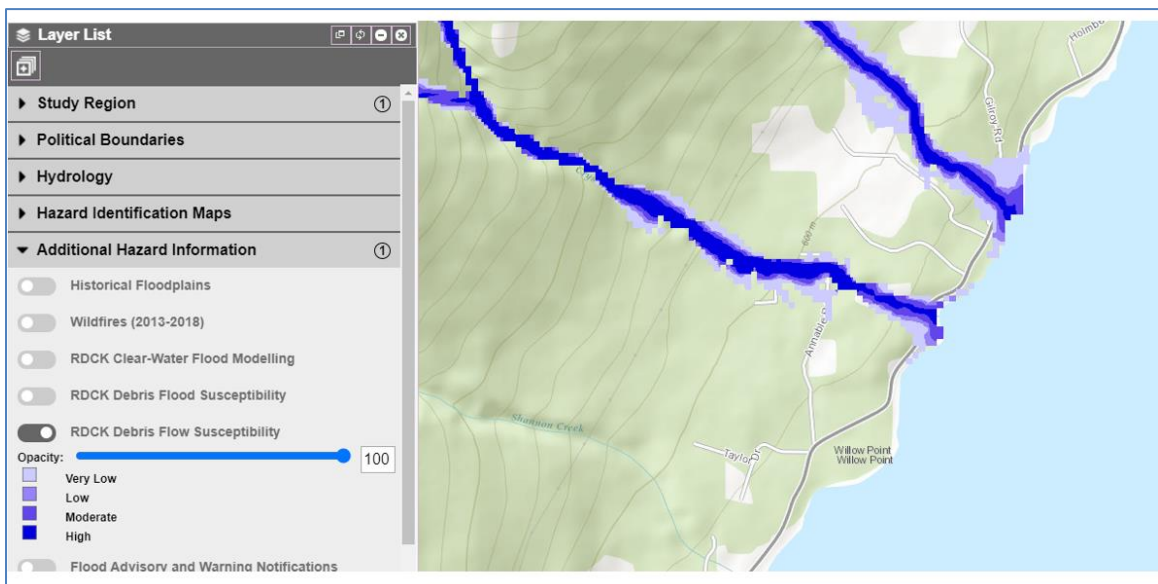


Figure 7: Crystal Creek Debris Flow Susceptibility Map – Source BGC (2020)

4.4 Orthoimagery SNTG reviewed the historical aerial photographs shown in Table 2.

Table 2: Air Photographs Reviewed



Air Photo	Photos Numbers	Year
BC 147	41-41	1939
BC 144	18-21	1939
A7735	15-16	1945
A7735	73-74	1945
BC1458	31-33	1952
BC1458	45-46	1952
BC2444	45-47	1958
BC2475	94-97	1958
BC7108	173-176	1968
BC7108	211-214	1968
BC78143	68-70	1978
BC83003	16-19	1983
BC83003	52-54	1983
BC88089	174-177	1988
BC88090	8-10	1988
BCB97047	36-38	1979
BCB97047	103-106	1979
BCB00038	35-38	2000
BCB00038	67-69	2000
BCC06061	72-74	2006
BCC06061	44-45	2006

The review of these air photos did not identify any evidence of landslide or debris flows in the Crystal Creek watershed area or on the fan. The photos also indicate that the creek likely flowed in the present day channel shown in Figure 3 since 1939.

5 FIELD OBSERVATIONS

Field reviews were completed by the undersigned on May 11 and May 14, 2021. Measurements were taken using tape and inclinometer to complete a cross section of the Crystal Creek channel adjacent to the existing dwelling (Figure 8). The creek channel was traversed upstream from the property to elevation 730 m. Stream channel gradients, road crossings and other stream channel morphology information was recorded. Photographs taken are shown in Appendix B.

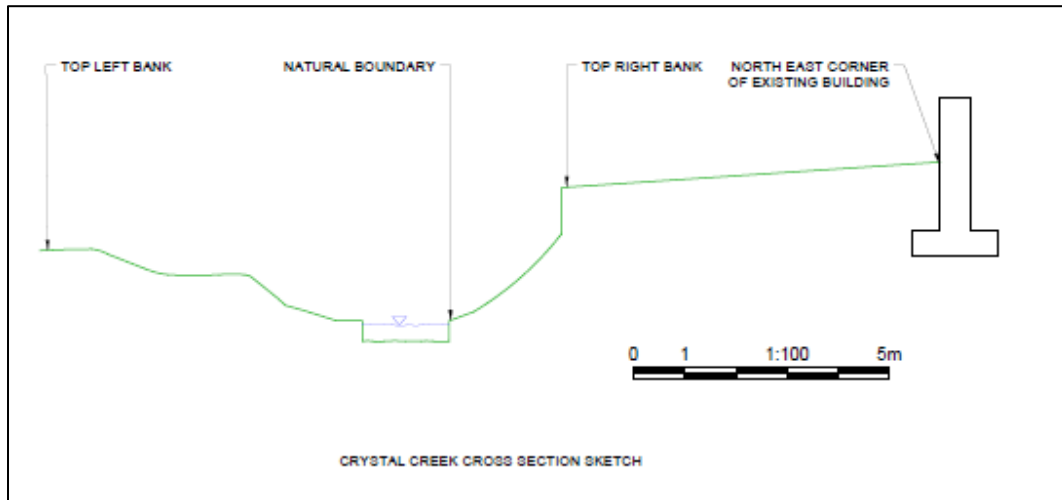


Figure 8: Crystal Creek Cross Section Sketch

6 HAZARD ASSESSMENT

6.1 Hazard Identification and Threshold Levels of Safety

While the property under investigation is shown to be southwest of and outside of the Crystal Creek fan polygons shown on the RDCK webmap and BGC mapping (Figures 5, 6, and 7) field investigations and the review of LiDAR maps indicate that the channel adjacent to 2168 Annable Road conveys the main flow of Crystal Creek from the upper watershed area to the lake approximately as shown in Figure 3.

Crystal Creek flows onto a paraglacial fan approximately as shown in Figure 9. This is typical of the small steep watersheds along the north shore of Kootenay Lake north of Nelson (BGC 2020). The creek flows from the apex of the paraglacial fan over the fan and past 2168 Annable Road in an incised channel. While field investigations did not include a review of the stream channel downstream of 2168 Annable Road it is suspected that there is small active portion of the fan at the confluence with the lake.

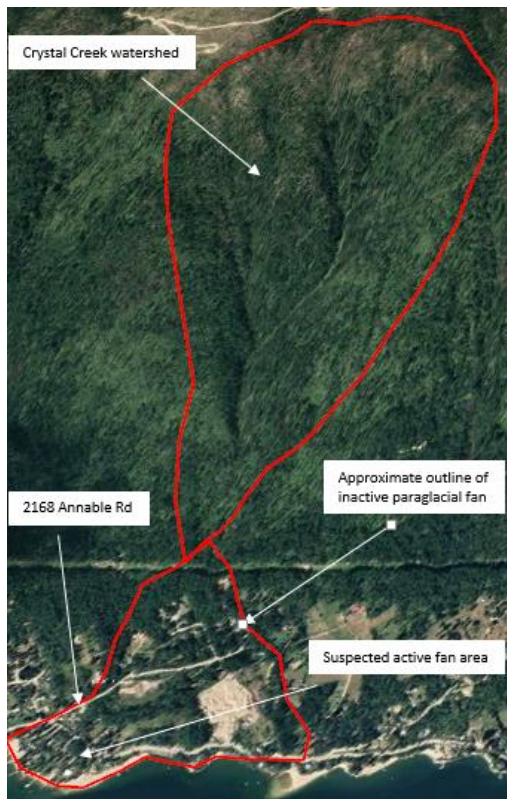


Figure 9: Google Image Showing Approximate Boundaries of Crystal Creek Watershed Area and Inactive Paraglacial Fan

Melton's Ruggedness Number (MRN) and watershed length are two parameters that can be used to provide an indication of the type of hazard on a postglacial fan (Wilford 2004) (Boyer 1999) (Jackson 1987). The MRN is calculated by dividing the watershed relief by the square root of the watershed area. The MRN calculated for Crystal Creek is 0.72. The watershed length; the distance from the fan apex to the most distant point on the watershed boundary for Crystal Creek, is 3 km. These values are plotted on the MRN vs Watershed Length graph extracted from the 2020 BGC report. The plot predicts that the fan area may be exposed to both debris floods and/or debris flows hazards (Figure 10). Kohn-Crippen (Kohn-Crippen 1998) calculated an MRN of 0.74.

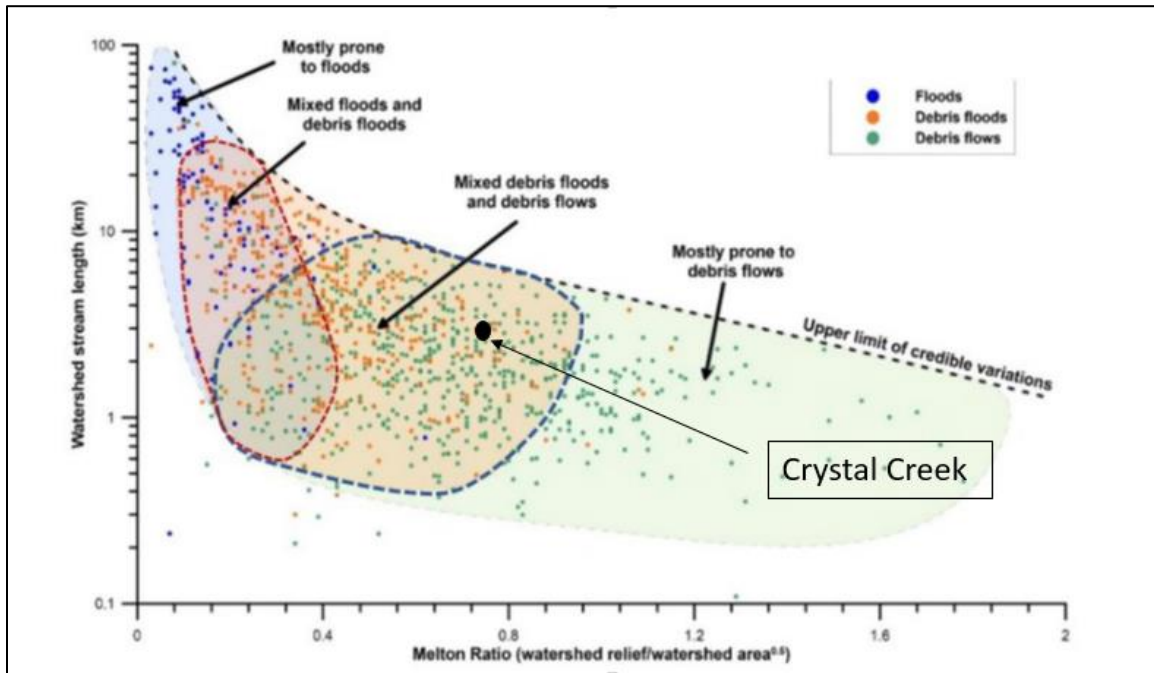


Figure 10. Melton Ratio vs Watershed Length for Crystal Creek – Source BGC 2020

The gradient of the channel at the property and 450m upstream is approximately 10%. This angle has been shown to be too shallow to enable the continued transport of boulders and timber debris associated with a debris flows. Photos 8 to 12 show debris flow deposits in the channel where the channel gradient transitions from 15%-20% to 10%. However, it is likely that sediment and debris laden runoff from the watershed area and/or a residual effect of a debris flow runout near the apex of the fan can flow farther downstream in the channel adjacent to 2168 Annable Road as a debris flood.

The identification of and assessment of the process or processes involved in the formation of a fan is important because different landslide/flood processes have different associated hazard characteristics (Wilford 2004). For example, debris flows can be very destructive with very high peak discharges 5 to 40 times greater than floods, while debris floods have relative peak discharges of at most 2-3 times that of flood discharges (Hungr et al. 2001 and Hungr 2005).

The level of safety on properties affected by river flooding in BC is assessed using a design flood event with a 200-year return period (MFLNRORD, 2004). Recognizing that flooding can be more unpredictable and extreme on alluvial fans the Engineers and Geoscientists of BC (EGBC) recommends the use of a higher return period flood (500 years) when the area may be subject to debris floods and debris flows without warning.

The Ministry of Transportation and Infrastructure (MOTI) also provides guidance on the acceptable threshold level of safety for assessing landslide hazard. For a building site where a landslide could cause damages, the recommended annual probability of occurrence of a landslide (in this case a debris flood) recommended for consideration is 1/475.



The MOTI guidance also states that “Where life-threatening catastrophic events are known as a potential natural hazard to a building lot the Qualified Professional is to consider events having a probability of occurrence of 1 in 10,000 years and is to identify areas beyond the influence of these extreme events.

Due to the channel characteristics, location of historical debris lobes, channel gradients, and house location, SNTG has concluded that the building site exposure to debris flow hazards is less than the hazards noted in the MOTI guidance provided above..

6.2 Hydrologic Analysis

The assessment of the risk associated with decreasing the building setback distance requires an estimate of expected flood flow depth and velocity in the channel during an extreme flood event. For this study a flood discharge with an annual likelihood of occurrence of 0.005 or one in two hundred year recurrence interval discharge (Q_{200}) is used. Crystal Creek does not have flow records available to allow a flood frequency analysis to estimate the magnitude of an extreme event. Consequently, a Crystal Creek Q_{200} estimate was calculated using flow data from the Anderson Creek hydrometric station located approximately 7 km south of Crystal Creek. This station has a watershed area of 9.07 km² and a flow record from 1945 to present. Flood frequency analysis of Anderson Creek data undertaken during a previous study was used to establish a unit discharge to apply to the Crystal Creek watershed. The Crystal Creek watershed area is 2.6 km² and the estimated Q_{200} is 2.4 m³/s. The discharge estimate includes an allowance for climate change uncertainty consistent with the advice of EGBC (EGBC 2018). The guidelines recommend applying an upward adjustment of 20% for the design discharge to account for likely future change in water input from precipitation.

An additional 50% allowance was included to account for increased peak discharge from a potential debris flood; as suggested by Hunger et al (2001) resulting in a Q_{200} flow estimate of 3.6 m³/s.

The field review identified three road crossings upstream of 2168 Annable Road which would likely be compromised during a Q_{200} event. The creek is conveyed through the road fill on the powerline near the apex of the fan through a 900 mm diameter culvert as shown in Photos 13 and 14 Appendix B. A blockage at this site could result in a road washout. However, water and debris would be contained in the gully and would cause a minor surge of water and debris downstream. The second crossing is a 600 mm diameter crossing at a private driveway as shown in Photo 7. A blockage here would cause some minor out of channel flow but the main flow in the channel will still continue down the gully resulting in a surge in flow that would impact the next crossing downstream at Annable Road. The creek is conveyed under Annable Road through a 600 mm diameter culvert (Photo 5). A blockage here would result in flow down Annable Road as shown in Photo 6.



Manning flow equation was used in conjunction with the estimated Q_{200} (assuming all the flow reaches the site) and the measured cross sectional area of the channel adjacent to the dwelling (Figure 8) to calculate the flow depth expected during a Q_{200} flood event. The calculations yield a depth ranging from 0.6 to 0.8 m. This indicates that the channel/gulley adjacent to the dwelling has sufficient capacity to pass a Q_{200} magnitude flood event without overtopping. The estimated high water level would be 1.7 m below the top of the bank.

6.3 Bank Erosion Hazard Assessment

During a Q_{200} event, stream flow velocities in the channel adjacent to 2168 Annable Road were calculated to be in the 2 to 3 m/s range. These velocities are expected to cause some erosion at the toe of the channel bank. However, due to the coarse nature of the material forming the channel bank (a high percentage of boulders to cobble sized rock fragments), there is a low likelihood of erosion and/or lateral shifting of the bank causing damage to the proposed building addition.

7.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations resulting from the investigation:

1. The property is situated on an inactive paraglacial fan of Crystal Creek.
2. Crystal Creek flows from the apex of the fan down to and past 2168 Annable Road in an incised channel. This channel conveys most of the flow from the watershed area above the powerline down to the lake.
3. Debris flow runout deposits were observed near the apex of the fan approximately 0.5 km upstream of the property. There is a very low probability that any coarse debris flow material (boulder, cobbles and timber debris) will travel down the channel to 2168 Annable Road.
4. Calculations indicate that the channel adjacent to 2168 Annable Road has the capacity to pass a Q_{200} flood event and that the bank erosion hazard is low.
5. It is recommended that the building setback distance from the natural boundary for Crystal Creek prescribed in Floodplain Management Bylaw 2080 be relaxed from 15 m to 9 m to permit the proposed addition.
6. The use intended is identified as an addition to an existing residence at 2168 Annable Road. The land may be used safely for the intended use as required under Section 56 of the Community Charter.

8.0 FLOOD HAZARD ASSURANCE STATEMENT

A flood hazard assurance statement is included in Appendix C.

9.0 CLOSURE – REPORT USE AND LIMITATIONS

This report is prepared for the exclusive use of Lindsay Myram and the RDCK and may not be used by other parties without the written permission of SNT Geotechnical Ltd.



The use of this report is subject to the conditions on the Report Interpretation and Limitations sheet which is included with this report (Appendix D). The reader's attention is drawn specifically to those conditions, as it is considered essential that they be followed for proper use and interpretation of this report.

The material in this report reflects SNTG's best judgment and professional opinion in light of the information available to it at the time of preparation. Any use which a third party makes of this report or any reliance on or decision to be made based on it are the responsibility of such third parties. SNTG accepts no responsibility for damages, if any, suffered by any third party as a result of decision made or action based, or lack thereof, on this report. No other warranty is made, either expressed or implied.

The report and assessment have been carried out in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering profession currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report.

Prepared by:

Reviewed by:



Dwain Boyer, P.Eng
SNT Geotechnical Ltd.

Doug Nicol, P.Eng
SNT Geotechnical Ltd.

10.0 REFERENCES

1. BGC Engineering Inc, 2020, RDCK Floodplain and Steep Creek Study
2. Engineers and Geoscientists of BC, 2018, Professional Practice Guidelines, Legislated Landslide Assessments for Proposed Residential Development in BC Version 3.0
3. Engineers and Geoscientists of BC 2018 Professional Practice Guidelines, Legislated Flood Assessments in a changing Climate in BC Version 2.1 August 28, 2018
4. Klohn-Crippen, Feb 1998, Terrain Stability Inventory Alluvial and Debris Torrent Fans Kootenay Region, MFLNRO Report # 1020.
5. MFLNRORD, 2004 Flood Hazard Area Land Use Management Guidelines



Flood Hazard Assessment Report – 2168 Annable Road, Willow Point, June 2021

6. Regional District of Central Kootenays, Nov. 2009, Terms of Reference for Requirements for Professional Engineering/Geoscientists Undertaking Geotechnical Reports/Flood Hazard Assessments Reports
7. Wallace, C. Alluvial Fan Boundary Mapping in Nelson Region, MFLNRO Report # 1395
8. Wilford, D. et al, 2004, Recognition of Debris Flow, Debris Flood and Flood Hazard Through Watershed Morphometrics.



Appendix A

Land Title Search Results



Flood Hazard Assessment Report – 2168 Annable Road, Willow Point, June 2021

TITLE SEARCH PRINT

2021-05-17, 17:11:24

File Reference:

Requestor: Dwain Boyer

Declared Value \$280000

CURRENT INFORMATION ONLY - NO CANCELLED INFORMATION SHOWN

Land Title District	NELSON
Land Title Office	NELSON
Title Number	CA5671395
From Title Number	KX102424
Application Received	2016-11-25
Application Entered	2016-11-29
Registered Owner in Fee Simple	
Registered Owner/Mailing Address:	KURT RUSSELL MYRAM, JOURNEYMAN CARPENTER LINDSEY ELIZABETH REED, JUNIOR ACCOUNTANT 2168 ANNABLE ROAD NELSON, BC V1L 6K5 AS JOINT TENANTS
Taxation Authority	Nelson Trail Assessment Area
Description of Land	
Parcel Identifier:	014-442-698
Legal Description:	LOT 3 DISTRICT LOT 4780 KOOTENAY DISTRICT PLAN 5418
Legal Notations	
	THIS TITLE MAY BE AFFECTED BY A PERMIT UNDER PART 14 OF THE LOCAL GOVERNMENT ACT, SEE CA8471528
Charges, Liens and Interests	
Nature:	EASEMENT
Registration Number:	69849D
Registration Date and Time:	1985-05-28 14:30
Remarks:	APPURTENANT TO LOTS 1 AND 2 OF DISTRICT LOT 4780 KOOTENAY DISTRICT PLAN 5418
Nature:	MORTGAGE
Registration Number:	CA5671396
Registration Date and Time:	2016-11-25 10:03
Registered Owner:	KOOTENAY SAVINGS CREDIT UNION INCORPORATION NO. F138



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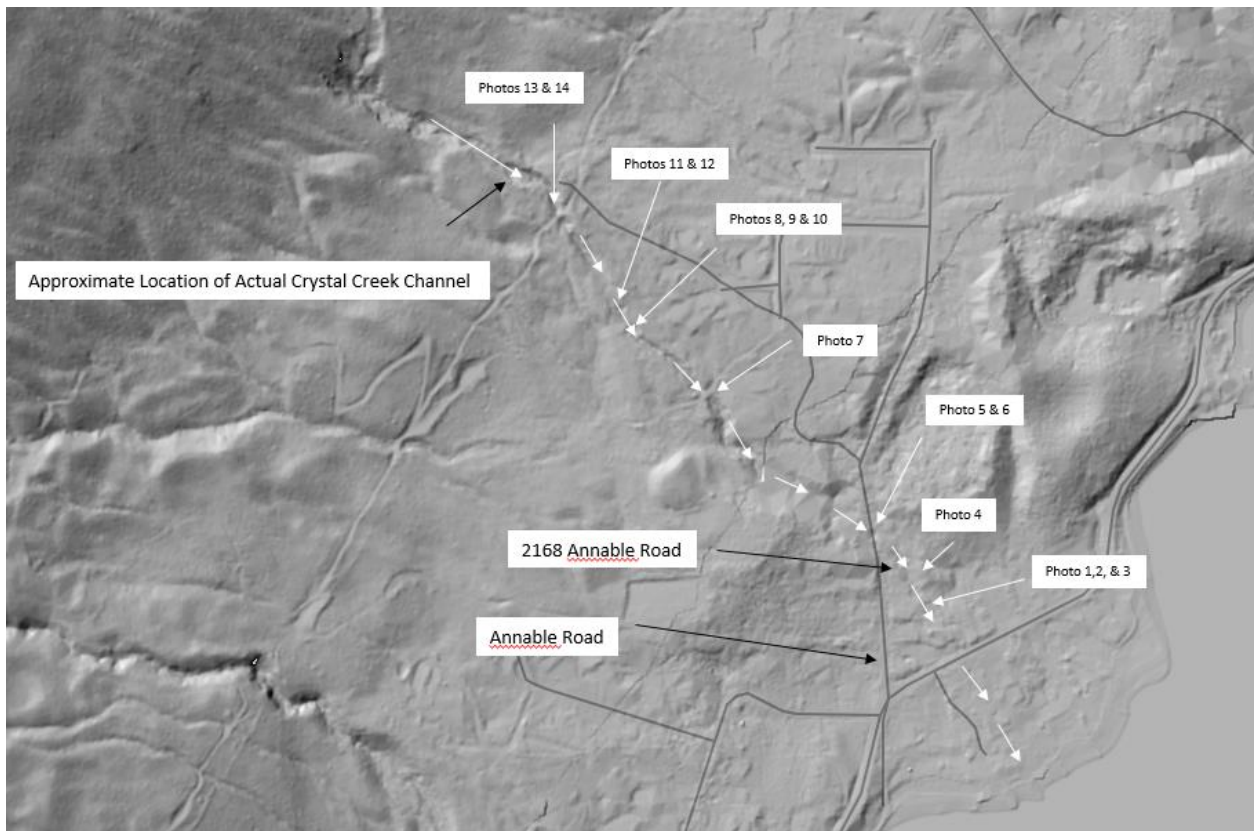
Duplicate Infeasible Title NONE OUTSTANDING

Transfers NONE

Pending Applications NONE

Appendix B

Photographs



Map Showing Locations of Photographs



Photo 1: View of Crystal Creek Channel Looking Upstream Adjacent to Dwelling on 2168 Annable Rd May 11, 2021. Location of Cross Section



Photo 2: View of Right (south west) Creek Bank and Location of Cross Section Figure 8. Dwelling visible in background behind Shed – May 11, 2021



Photo 3: View of left (north east) Bank and location of cross section Figure 8. May 11, 2021



Photo 4: View of Crystal Creek channel approximately 30 m upstream from the dwelling and photos 1 to 3. Dwelling on 2168 Annable Rd shown on right background. Stream channel gradient 10%. May 11, 2021



Photo 5: View of entrance to 600 mm diameter culvert at Annable Rd crossing at on north end of the property approximately 60 m upstream from dwelling. May 11, 2021



Photo 6: View of looking down (south) Annable Road at creek crossing (600 mm CMP). Culvert blockage during an extreme flood will result in water flowing down the road to the Hwy away from the dwelling on 2168 Annable Road. The road surface gradient is 10%. May 14, 2021



Photo 7: View at entrance to 600 mm diameter culvert crossing at private road crossing approximately 340 m upstream from the Annable Road crossing. Channel gradient 10% May 14, 2021



Photo 8: View looking upstream at debris flow deposit approximately 450 m upstream from Annable Road crossing. Channel gradient downstream 10%. May 14, 2021



Photo 9: View looking downstream at mid-channel debris flow deposit from vantage point at upstream of lobe. May 14, 2021



Photo 10: View looking downstream from mid channel debris lobe shown in Photo 8. Channel gradient 10%.



Photo 11: View looking down stream from water intake and channel widening approximately 1 m upstream from the Annable Rd crossing. upstream end of debris flow deposit shown in Photos 8 & 9 is in the back ground. Note significant channel widening.



Photo 12: View of channel at water intake approximately 450 m upstream of Annable Rd crossing. Here the channel widens and grade changes from 15% to 10%. May 14, 2021



Photo 13: Road crossing at powerline looking north. Flow left to right threw 900 mm CMP. May 11, 2021



Photo 14 : View looking upstream at downstream side of 900 mm CMP road crossing at powerline. May 14, 2021



Appendix C

Flood Hazard And Risk Assurance Statement



APPENDIX J: FLOOD HAZARD AND RISK ASSURANCE STATEMENT

Note: This Statement is to be read and completed in conjunction with the "APEGBC Professional Practice Guidelines - Legislated Flood Assessments in a Changing Climate, March 2012 ("APEGBC Guidelines") and is to be provided for flood assessments for the purposes of the Land Title Act, Community Charter or the Local Government Act. Italicized words are defined in the APEGBC Guidelines.

To: The Approving Authority

Date: June 9, 2021

ROCK
202 Lakeside Drive Nelson

Jurisdiction and address

With reference to (check one):

- Land Title Act (Section 86) – Subdivision Approval
 Local Government Act (Sections 919.1 and 920) – Development Permit
 Community Charter (Section 56) – Building Permit
 Local Government Act (Section 910) – Flood Plain Bylaw Variance
 Local Government Act (Section 910) – Flood Plain Bylaw Exemption

For the Property: Lot 3, Plan NEP 6416, D.L. 4780, KLD

Legal description and civic address of the Property

2168 Annable Rd

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

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

Check to the left of applicable items

1. Collected and reviewed appropriate background information
 2. Reviewed the proposed *residential development* on the Property
 3. Conducted field work on and, if required, beyond the Property
 4. Reported on the results of the field work on and, if required, beyond the Property
 5. Considered any changed conditions on and, if required, beyond the Property
 6. For a *flood hazard analysis* or *flood risk analysis* I have:
 6.1 reviewed and characterized, if appropriate, floods that may affect the Property
 6.2 estimated the *flood hazard* or *flood risk* on the property
 6.3 included (if appropriate) the effects of climate change and land use change
 6.4 identified existing and anticipated future *elements at risk* on and, if required, beyond the Property
 6.5 estimated the potential *consequences* to those *elements at risk*
 7. Where the *Approving Authority* has adopted a specific level of *flood hazard* or *flood risk* tolerance or return period that is different from the standard 200-year return period design criteria⁽¹⁾, I have
 7.1 compared the level of *flood hazard* or *flood risk* tolerance adopted by the *Approving Authority* with the findings of my investigation
 7.2 made a finding on the level of *flood hazard* or *flood risk* tolerance on the Property based on the comparison
 7.3 made recommendations to reduce the *flood hazard* or *flood risk* on the Property

⁽¹⁾ *Flood Hazard Area Land Use Management Guidelines* published by the BC Ministry of Forests, Lands, and Natural Resource Operations and the 2009 publication *Subdivision Preliminary Layout Review – Natural Hazard Risk* published by the Ministry of Transportation and Public Infrastructure. It should be noted that the 200-year return period is a standard used typically for rivers and purely fluvial processes. For small creeks subject to debris floods and debris flows return periods are commonly applied that exceed 200 years. For life-threatening events including debris flows, the Ministry of Transportation and Public Infrastructure stipulates in their 2009 publication *Subdivision Preliminary Layout Review – Natural Hazard Risk* that a 10,000-year return period needs to be considered.



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8. Where the *Approving Authority* has not adopted a level of *flood risk* or *flood hazard tolerance* I have:
- 8.1 described the method of *flood hazard analysis* or *flood risk analysis* used
 - 8.2 referred to an appropriate and identified provincial or national guideline for level of *flood hazard* or *flood risk*
 - 8.3 compared this guideline with the findings of my investigation
 - 8.4 made a finding on the level of *flood hazard* or *flood risk* tolerance on the Property based on the comparison
 - 8.5 made recommendations to reduce *flood risks*.
9. Reported on the requirements for future inspections of the Property and recommended who should conduct those inspections.

Based on my comparison between

- Check one
- the findings from the investigation and the adopted level of *flood hazard* or *flood risk* tolerance (item 7.2 above)
 - the appropriate and identified provincial or national guideline for level of *flood hazard* or *flood risk* tolerance (item 8.4 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* (Sections 919.1 and 920), my report will "assist the local government in determining what conditions or requirements under [Section 920] subsection (7.1) it will impose in the permit".
 - for a building permit, as required by the *Community Charter* (Section 56), "the land may be used safely for the use intended".
 - Check one
 - with one or more recommended registered *covenants*.
 - without any registered *covenant*.
 - for flood plain bylaw variance, as required by the *Flood Hazard Area Land Use Management Guidelines* associated with the *Local Government Act* (Section 910), "the development may occur safely".
 - for flood plain bylaw exemption, as required by the *Local Government Act* (Section 910), "the land may be used safely for the use intended".

Dwain Boyer
Name (print)

Dwain Boyer
Signature

3196 Hedde Rd
Address

Nelson, B.C.

250-551-0345
Telephone

June 9, 2021
Date



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

I am a member of the firm SNT Geotechnical Ltd
and I sign this letter on behalf of the firm. (Print name of firm)



Appendix D

Report Interpretation and Limitations



REPORT INTERPRETATION AND LIMITATIONS

1. STANDARD OF CARE

SNT Geotechnical Ltd. (SNTG) has prepared this report in a manner consistent with generally accepted engineering consulting practices in this area, subject to the time and physical constraints applicable. No other warranty, expressed or implied, is made.

2. COMPLETENESS OF THIS REPORT

This Report represents a summary of paper, electronic and other documents, records, data and files and is not intended to stand alone without reference to the instructions given to SNTG by the Client, communications between SNTG and the Client, and/or to any other reports, writings, proposals or documents prepared by SNTG for the Client relating to the specific site described herein.

This report is intended to be used and quoted in its entirety. Any references to this report must include the whole of the report and any appendices or supporting material. SNTG cannot be responsible for use by any party of portions of this report without reference to the entire report.

3. BASIS OF THIS REPORT

This report has been prepared for the specific site, development, design objective, and purpose described to SNTG by the Client or the Client's Representatives or Consultants. The applicability and reliability of any of the factual data, findings, recommendations or opinions expressed in this document pertain to a specific project as described in this report and are not applicable to any other project or site, and are valid only to the extent that there has been no material alteration to or variation from any of the descriptions provided to SNTG. SNTG cannot be responsible for use of this report, or portions thereof, unless we were specifically requested by the Client to review and revise the Report in light of any alterations or variations to the project description provided by the Client.

If the project does not commence within 18 months of the report date, the report may become invalid and further review may be required.

The recommendations of this report should only be used for design. The extent of exploration including number of test pits or test holes necessary to thoroughly investigate the site for conditions that may affect

Construction costs will generally be greater than that required for design purposes. Contractors should rely upon their own explorations and interpretation of the factual data provided for costing purposes, equipment requirements, construction techniques, or to establish project schedule.

The information provided in this report is based on limited exploration, for a specific project scope. SNTG cannot accept responsibility for independent conclusions, interpretations, interpolations or decisions by the Client or others based on information contained in this Report. This restriction of liability includes decisions made to purchase or sell land.

4. USE OF THIS REPORT

The contents of this report, including plans, data, drawings and all other documents including electronic and hard copies remain the copyright property of SNTG. However, we will consider any reasonable request by the Client to approve the use of this report by other parties as "Approved Users."

With regard to the duplication and distribution of this Report or its contents, we authorize only the Client and Approved Users to make copies of the Report only in such quantities as are reasonably necessary for the use of this Report by those parties. The Client and "Approved Users" may not give, lend, sell or otherwise make this Report or any portion thereof available to any other party without express written permission from SNTG. Any use which a third party makes of this Report – in its entirety or portions thereof – is the sole responsibility of such third parties. **SNT GEOTECHNICAL LTD. ACCEPTS NO RESPONSIBILITY FOR DAMAGES SUFFERED BY ANY PARTY RESULTING FROM THE UNAUTHORIZED USE OF THIS REPORT.**

Electronic media is susceptible to unauthorized modification or unintended alteration, and the Client should not rely on electronic versions of reports or other documents. All documents should be obtained directly from SNTG.

5. INTERPRETATION OF THIS REPORT

Classification and identification of soils and rock and other geological units, including groundwater conditions have been based on exploration(s) performed in accordance with the standards set out in Paragraph 1.



Flood Hazard Assessment Report – 2168 Annable Road, Willow Point, June 2021

These tasks are judgmental in nature; despite comprehensive sampling and testing programs properly performed by experienced personnel with the appropriate equipment, some conditions may elude detection.

As such, all explorations involve an inherent risk that some conditions will not be detected.

Further, all documents or records summarizing such exploration will be based on assumptions of what exists between the actual points sampled at the time of the site exploration. Actual conditions may vary significantly between the points investigated and all persons making use of such documents or records should be aware of and accept this risk.

The Client and “Approved Users” accept that subsurface conditions may change with time and this report only represents the soil conditions encountered at the time of exploration and/or review. Soil and ground water conditions may change due to construction activity on the site or on adjacent sites, and also from other causes, including climactic conditions.

The exploration and review provided in this report were for geotechnical purposes only. Environmental aspects of soil and groundwater have not been included in the exploration or review or addressed in any other way.

The exploration and Report are based on information provided by the Client or the Client’s Consultants, and conditions observed at the time of our site reconnaissance or exploration. SNTG has relied in good faith upon all information provided. Accordingly, SNTG cannot accept responsibility for inaccuracies, misstatements, omissions, or deficiencies in this Report resulting from misstatements, omissions, misrepresentations or fraudulent acts of persons or sources providing this information.

6. DESIGN AND CONSTRUCTION REVIEW

This report assumes that SNTG will be retained to work and coordinate design and construction with other Design Professionals and the Contractor. Further, it is assumed that SNTG will be retained to provide field reviews during construction to confirm adherence to building code guidelines and generally accepted engineering practices, and the recommendations provided in this report. Field services recommended for the project represent the minimum necessary to confirm that the work is being carried out in general conformance with SNTG’s recommendations and generally accepted engineering standards. It is the Client’s or the Client’s Contractor’s responsibility to provide timely notice to SNTG to carry out site reviews.

The Client acknowledges that unsatisfactory or unsafe conditions may be missed by intermittent site reviews by SNTG. Accordingly, it is the Client’s or Client’s Contractor’s responsibility to inform SNTG of any such conditions.

Work that is covered prior to review by SNTG may have to be re-exposed at considerable cost to the Client. Review of all Geotechnical aspects of the project are required for submittal of unconditional Letters of Assurance to regulatory authorities. The site reviews are not carried out for the benefit of the Contractor(s) and therefore do not in any way effect the Contractor(s) obligations to perform under the terms of his/her Contract.

7. SAMPLE DISPOSAL

SNTG will dispose of all samples 3 months after issuance of this report, or after a longer period of time at the Client’s expense if requested by the Client. All contaminated samples remain the property of the Client and it will be the Client’s responsibility to dispose of them properly.

8. SUBCONSULTANTS AND CONTRACTORS

Engineering studies frequently requires hiring the services of individuals and companies with special expertise and/or services which SNT Geotechnical Ltd. does not provide. These services are arranged as a convenience to our Clients, for the Client’s benefit. Accordingly, the Client agrees to hold the Company harmless and to indemnify and defend SNT Geotechnical Ltd. from and against all claims arising through such Sub consultants or Contractors as though the Client had retained those services directly. This includes responsibility for payment of services rendered and the pursuit of damages for errors, omissions or negligence by those parties in carrying out their work. These conditions apply to specialized sub consultants and the use of drilling, excavation and laboratory testing services, and any other Sub consultant or Contractor.

9. SITE SAFETY

SNT Geotechnical Ltd. assumes responsibility for site safety solely for the activities of our employees on the jobsite. The Client or any Contractors on the site will be responsible for their own personnel. The Client or his representatives, Contractors or others retain control of the site. It is the Client’s or the Client’s Contractors responsibility to inform SNTG of conditions pertaining to the safety and security of the site – hazardous or otherwise – of which the Client or Contractor is aware.

Exploration or construction activities could uncover previously unknown hazardous conditions, materials, or substances that may result in the necessity to undertake emergency procedures to protect workers, the public or the environment. Additional work may be required that is outside of any previously established budget(s). The Client agrees to reimburse SNTG for fees and expenses resulting from such discoveries. The Client acknowledges that some discoveries require that certain regulatory bodies be informed. The Client agrees that notification to such bodies by SNTG Geotechnical Ltd. will not be a cause for either action or dispute.