HAZARD ACCEPTABILITY THRESHOLDS

FOR DEVELOPMENT APPROVALS

October, 2020

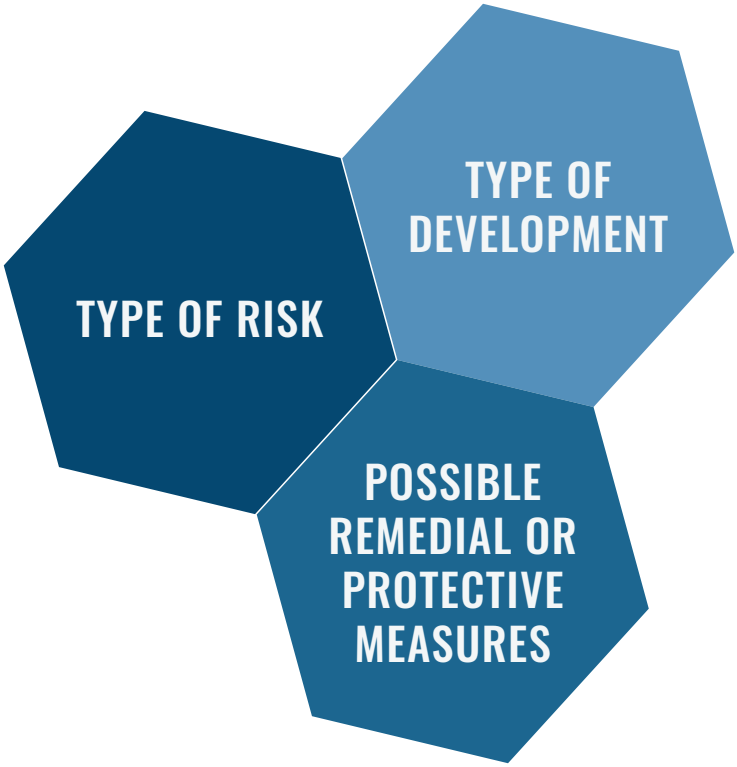
Fraser Valley Regional District

ENSURING SAFE DEVELOPMENT

In 1991, the Fraser Valley Regional District (then the Regional District of Fraser-Cheam) prepared the *Geo-Hazard Acceptability Thresholds for Development Approvals*. These acceptability thresholds have since informed policy on geo-hazards throughout the Fraser Valley Regional District (FVRD) by guiding the development approval decisions and land use planning in hazardous areas.

Local governments must define what acceptable risk is. The association of Engineers and Geo-scientists of British Columbia (EGBC) are clear that defining levels of safety is "not the role of a Professional Engineer or Professional Geoscientist"; rather acceptable risk must be "established and adopted by the local government or provincial government after considering a range of social values"[1]. Professional Engineers and Geoscientists are critical to ensure safety by characterizing the geo-hazard and providing a professional opinion to the FVRD. However, it is ultimately the responsibility of the FVRD to determine levels of acceptable risk in development approvals.

Key Considerations For Acceptable Risk



These factors are analyzed in matrices (Tables 1 - 9) that allow the FVRD to ensure consistency in the development approvals process in geo-hazard lands. The tables and figures in the following pages detail at which point developments may be subject to additional regulatory responses, ranging from outright refusal of development to unconditional acceptance. Generally, developments which involve greater increases in land use density and those exposed to greater risks are less likely to be approvable.

The complete *1993 Hazard Acceptability Thresholds for Development Approvals by Local Government* is available from the FVRD's Planning Department.

1 Engineers and Geoscientists of BC (EGBC) Guidelines for Legislated Landslide Assessments for proposed Residential Developments in British Columbia, 2008, p 4.

TYPES OF DEVELOPMENT

In the face of geo-hazards, seven types of development application are distinguished in order to evaluate their acceptability. They are ranked in order of increasing intensity of land use, from a minor building repair to a major rezoning, reflecting corresponding increases in exposure to risk.

Minor Repair

- Costs less than 25% of the assessed value of the structure before repair.
- Includes health and safety repairs (i.e. leaking roof or fireplace replacement).
- Covenant to identify mitigation works that may be necessary.
- Discourages extending the lifespan of a building in life-threatening risk area.

Major Repair

- Cost exceeds 25% of the assessed value of the structure before repair.
- Extends the lifespan of the building but increases long term exposure to the geo-hazard.
- May require mitigation to reduce hazard risk.
- Suited to areas with low frequency events.

Reconstruction

- Construction or replacement of an existing building after destruction, demolition or removal.
- Consider re-siting the building to a safer area and reduce the geo-hazard risk.

Extension

- Expansion of an existing building footprint.
- Does not include increased density or reloction of the building.

New Building

- New building or structure.
- Mitigation may be required.
- Site specific or subdivision geo-hazard report may be necessary.

Subdivision

- Division of a lot into two or more smaller parcels.
- Subdivision increases the density of land use and potential exposure to geo-hazards.

Major Rezoning & Community Plan Amendment

- Bylaw amendment to permit an alternate type of development (i.e. involves converting industrial or agricultural land to residential use).
- Often includes increased density.
- Opportunity to ensure development avoids hazardous lands.

THE ACCEPTABILITY OF RISK IN THE FRASER VALLEY

Approvability depends on the probability of a geo-hazard incident occurring. The likelihood of an incident, combined with the probable severity of the incident, will dictate whether or not a development is approvable without conditions, approvable with conditions, or not approvable.

Figure 1 Geo-Hazard Acceptability for Development

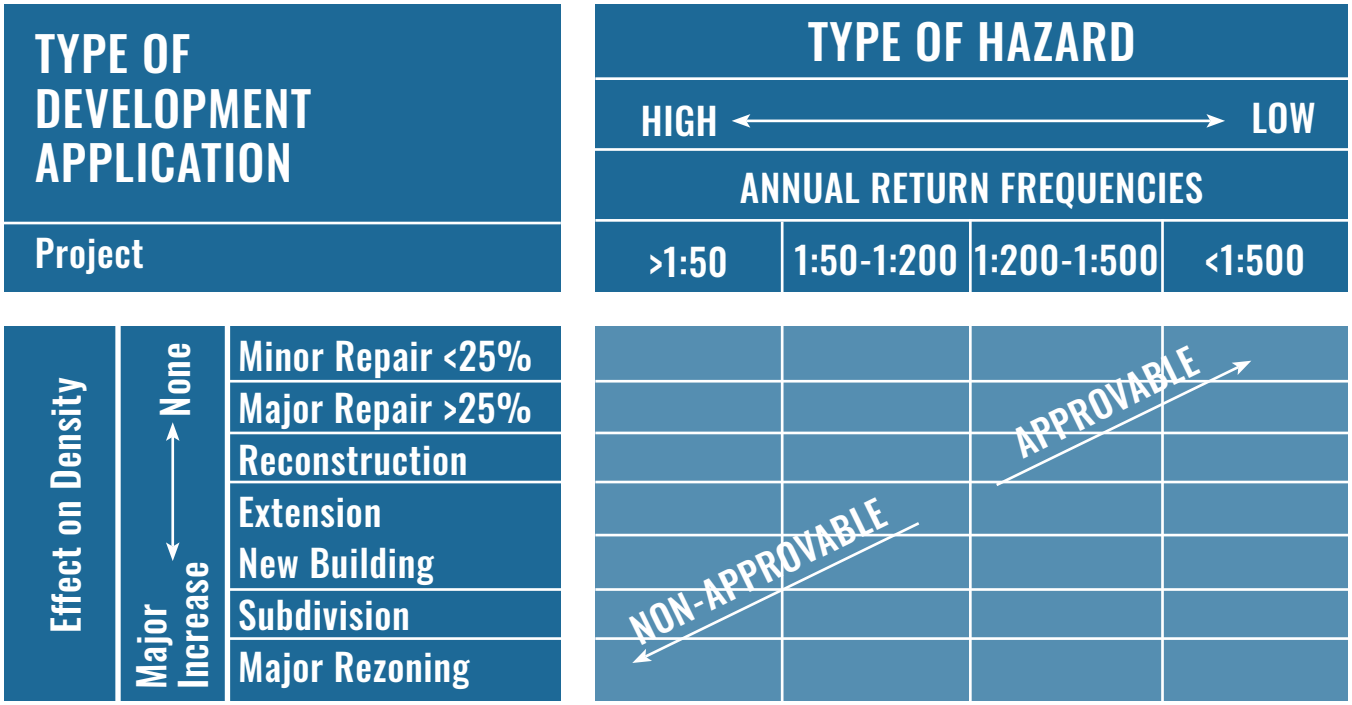


Figure 2 Hazard-Related Responses to Development Approval Applications

1	Approval without conditions relating to hazards.
2	Approval, without siting conditions or protective works conditions but with a covenant including "save harmless" conditions.
3	Approval, but with siting requirements to avoid the hazard, or with requirements for protective works to mitigate the hazard.
4	Approval as #3 above, but with a covenant including "save harmless" conditions as well as siting conditions, protective works or both.
5	Not approvable.

Figure 2 lists the range of regulatory responses to the seven forms of development applications. These are the numbers in Tables 1 - 9.

Regulatory approval charts are subject to change over time as societal standards surrounding geo-hazards change and as scientific knowledge of the subject matter improves.

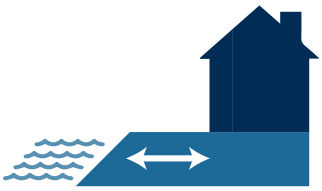
REMEDIAL AND PROTECTIVE MEASURES

Where risks proposed by geo-hazards are considered unacceptably high, action is necessary to mitigate the geo-hazard or to reduce exposure before development approval can be granted. Measures fall into two categories: 1. avoidance (i.e. exposure reduction), and 2. protection (i.e. hazard reduction). Both measures are intended to reduce the geo-hazard or the probability of damage, not eliminate the geo-hazard.

Avoidance Measures

Reduction of exposure to risk by simple avoidance is the most desirable means of mitigating a geo-hazard. Examples of avoidance measures include:

Elevating construction above a flood line



Setback requirements from waterways and slopes

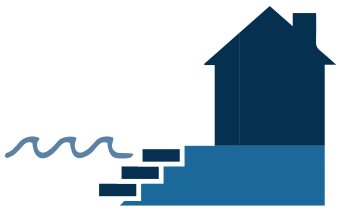
Slope stability monitoring devices

Warning and evacuation procedures

Avoidance measure requirements will vary depending on the proposed land use and the probability of a geo-hazard incident occuring. Avoidance measures are the preferred technique for official community plans and zoning bylaws.

Protective Measures

Protective measures are more visible and generally more popular than avoidance measures, but are less secure in their results and often require maintenance. Examples of protective measures include:



Rip-rap protection of river banks to prevent erosion

Raised, reinforced foundations to protect against debris floods

Protective berms and dikes to protect against flooding

APPROVAL RESPONSE BY GEO-HAZARD TYPES

Inundation[1] by Flood Waters

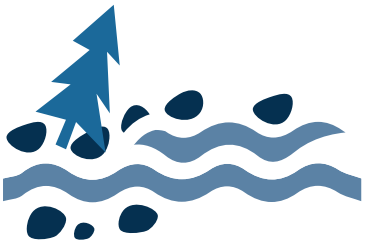
Flood inundation involves the submersion of land or property by flood waters. This includes areas located on the floodplain of the Fraser River and its tributaries, which may be susceptible to inundation by flood waters, particularly during spring thaw or periods of heavy rainfall.

Table 1

	1:40	1:40-1:200	<1:200
Minor Repair (<25%)	2	1	1
Major Repair (>25%)	4	3	1
Reconstruction	4	3	1
Extension	4	3	1
New Building	4	3	1
Subdivision (infill/extend)	5	4	1
Rezoning (for new community)	5	5	1

1 Flooding Hazard involves both inundation and erosion/avulsion. Hazard acceptability threasholds must therefore involve assessment of both types of hazards at a given site.

Debris Floods



Debris floods often run out beyond debris flows. As water containing debris flows out across the landscape, it has the potential to deposit cobbles, gravel, sand, and finer materials as water drains from this material. Debris floods are a normal occurrence in floods issuing from mountain creeks.

Table 2

	1:50	1:50-1:200	1:200-1:500	1:500-1:10,000
Minor Repair (<25%)	2	2	1	1
Major Repair (>25%)	4	4	1	1
Reconstruction	4	4	3	1
Extension	4	4	3	1
New Building	4	4	3	1
Subdivision (infill/extend)	5	5	4	2
Rezoning (for new community)	5	5	5	3

Mountain Stream Erosion or Avulsion[1]

Erosion involves the gradual destruction of a stream or river bank. When erosion is rapid, it is known as "avulsion" and becomes unpredictable and potentially life-threatening, due to the speed at which floodwaters can move. During avulsion, sudden changes in creek alignment can occur due to flood flows.

Table 3

	1:10	1:10-1:100	1:100-1:200	1:200-1:500	<1:500
Minor Repair (<25%)	5	2	1	1	1
Major Repair (>25%)	5	4	2	1	1
Reconstruction	5	5	2	2	1
Extension	5	5	2	2	1
New Building	5	5	4	2	1
Subdivision (infill/extend)	5	5	5	4	1
Rezoning (for new community)	5	5	5	5	1

1 Revised 1992 07 21

Debris Flow/Debris Torrent

Debris flows and torrents are rapid, saturated flows of coarse debris and mud, damaged trees, stumps, and smaller organic material. These flows may be contained in steep creek channels or they may spread out on debris fan surfaces. Debris flows and torrents can be life-threatening and damage or destroy property.

Table 4

	1:50	1:50-1:200	1:200-1:500	1:500-1:10,000	<1:10,000
Minor Repair (<25%)	5	2	2	1	1
Major Repair (>25%)	5	4	2	1	1
Reconstruction	5	5	4	3	1
Extension	5	5	4	2	1
New Building	5	5	4	3	1
Subdivision (infill/extend)	5	5	5	4	1
Rezoning (for new community)	5	5	5	5	1

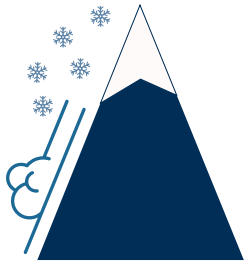
Small Scale Localised Land Slip

Landslides are caused by the de-stabilization of slopes that result in the movement of earth and debris downwards; sometimes gradually occurring but often in a sudden and rapid fashion. Landslides pose a risk to development beneath both steep and shallow slopes.

Table 5

	1:50	1:50-1:200	1:200-1:500	1:500-1:10,000	<1:10,000
Minor Repair (<25%)	5	2	2	1	1
Major Repair (>25%)	5	4	4	1	1
Reconstruction	5	4	4	3	1
Extension	5	4	4	3	1
New Building	5	4	4	3	1
Subdivision (infill/extend)	5	5	5	4	1
Rezoning (for new community)	5	5	5	5	1

Snow Avalanche



Snow avalanches are caused by the de-stabilization of large amounts of snow from steep mountain slopes, which travel down the mountain and cause damage and destruction. Generally, the settled areas in the Fraser Valley are not posed a snow avalanche risk, however some residential properties are affected in Hemlock Valley Canadian Avalanche Association (CAA) Zones are reflected in the table below.

Table 6

	Red Zone	Blue Zone	White Zone	
	1:30	1:30-1:300	1:300-1:10,000	<1:10,000
Minor Repair (<25%)	5	2	1	1
Major Repair (>25%)	5	4	1	1
Reconstruction	5	4	3	1
Extension	5	4	3	1
New Building	5	4	3	1
Subdivision (infill/extend)	5	5	4*	1
Rezoning (for new community)	5	5	5*	1

* Where land is located in areas of potential snow avalanche risk, an assessment prepared by a qualified Professional Engineer and avalanche professional (or one person that meets both qualifications by virtue of education and experience) may be required to confirm which CAA zone the property is located within and if the property is located within a white zone, that it is safe for the use intended.

Rock Fall - Small Scale Detachment

Rock falls are free falls of loose rock from cliff faces. Sustained rock fall activity may build talus (an accumulation of rock fall debris) at the base of slopes. Rock falls are different from landslides on the basis of their much more frequent occurence and more localized effects.

Table 7

	1:100	1:100-1:500	1:500-1:1,000	1:1,00-1:10,000	<1:10,000
Minor Repair (<25%)	5	2	1	1	1
Major Repair (>25%)	5	4	2	1	1
Reconstruction	5	4	2	1	1
Extension	5	5	4	1	1
New Building	5	5	4	1	1
Subdivision (infill/extend)	5	5	5	4	1
Rezoning (for new community)	5	5	5	5	1

Major Catastrophic Landslide

Larger scale landslides are likewise caused by the de-stabilization of slopes that result in the movement of earth and debris downwards. However, massive landslides post a destructive and life-threatening risk to those living below the slide area. Of the surficial hazards, large landslides are the least common, least predictable and most destructive.

Table 8

	1:200	1:200-1:500	1:500-1:1,000	1:1,00-1:10,000	<1:10,000
Minor Repair (<25%)	5	2	1	1	1
Major Repair (>25%)	5	5	2	1	1
Reconstruction	5	5	5	1	1
Extension	5	5	5	1	1
New Building	5	5	5	1	1
Subdivision (infill/extend)	5	5	5	5	1
Rezoning (for new community)	5	5	5	5	1

Chilliwack River Valley Erosion or Avulsion

Erosion involves the gradual destruction of a stream or river bank. When erosion is rapid, it is known as "avulsion" and becomes unpredictable and potentially dangerous due to the speed at which floodwaters can move. During avulsion, sudden changes in creek alignment can occur due to flood flows. The erosion or avulsion of the Chilliwack River Valley could have devastating effects on multiple downstream communities.

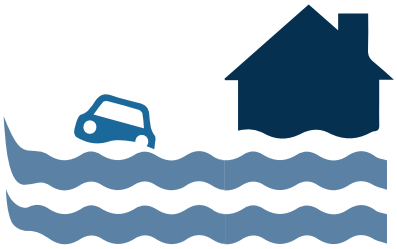


Table 9

	Setback within the "erosion setback line"	Setback between the "100 year erosion limit line" and "erosion setback line"	Setback greater than "100 year erosion limit line"
Minor Repair (<25%)	2[2]	2[3]	1
Major Repair (>25%)	4[4]	2[3]	1
Reconstruction	4[4]	2[3]	1
Extension	4[4]	2[3]	1
New Building	4[6]	2[3]	1
Subdivision (infill/extend)	5	4[5]	1
Rezoning (for new community)	5	4[6]	1

Table revised 1993 10 27.

[1] The terms "erosion setback line" and "100 year erosion line" are explained and defined in the Official Settlement Plan, and in the Hay Co. reports on river hazard management in the Chilliwack River Valley.

[2] Where the threat or river avulsion or erosion is deemed to be immediate and extreme, a building permit may not be available until approved bank protection is provided.

[3] A save harmless covenant to acknowledge potential future erosion hazard is implied in this approval.

[4] Where the property cannot be protected by on-site works, a building permit may not be available until the community protection scheme outlined in the Hazard Management Plan has been implemented.

[5] "Approved Bank Protection" may mean on-site protection on an individual lot, or where it is not possible to protect the property with on-site works, it may mean installation of works recommended in the community protection scheme outlined in the Hazard Management Plan, which are administered by a Local Service Area.

[6] Same as above.