

16.2 Geotechnical Hazard Development Permit Area No.1

Purpose

The Geotechnical Hazard Development Permit Area is designated under Section 919.1(1)(b) of the Local Government Act for protection of development from hazardous conditions.

Area

The Geotechnical Hazard Development Permit Area is shown as Development Permit Area No. 1 on Schedule C: Geotechnical Hazards. The Development Permit Area guidelines apply to all parcels either partially or entirely within the Development Permit Area No. 1. The hazard area designations should not be interpreted as prohibitions on all development activity, but as an identification of areas where professional geotechnical assessment and specific development standards are required.

Justification

The objective of this Development Permit Area is to protect development from geotechnical hazards. Research and analysis supporting the identification of the Geotechnical Hazard Development Permit Area as a hazardous area was conducted by Thurber Engineering Ltd. in the report entitled: Town of Gibsons Official Community Plan Reconnaissance Study of Geotechnical Hazards and Biophysical Environment (1991). Geotechnical hazards identified in that report include soil land sliding and wave erosion along beachfront slopes, potential soil landslides and adverse stream erosion and deposition on steep ravine slopes and potential rock fall.

Significant Hazard Areas

The most significant geotechnical hazards are those with relatively high estimated probabilities of occurrence (i.e. 1:25 to about 1:100 annually). These are indicated on Schedule C and include the significant soil landslide and related stream-flood and debris-flood hazards in the ravines of Charman and Gibson Creeks. The flood hazards extend through the community along Charman Creek below Stewart Road. There is also a relatively high probability of soil landslides along the Shoal Channel shoreline south of Franklin Road and adjacent Gower Point Road. These areas have the highest risks of property damage, injury or worse due to natural phenomena or incautious building practice. For these reasons, the Town will require geotechnical or other engineering approval for works in these high-risk areas.

Moderate Hazard Areas

Other areas have relatively lower estimated probabilities of hazard occurrence (i.e. 1:100 to about 1:500 annually). These include the recommended setback areas from crests of ravine slopes, shoreline landslides areas and the ocean shore (measured from the "natural boundary" or mean high tide line). The low medium hazard areas are indicated on Schedule C. Steep bedrock with potential rockfall and conditional construction hazards, several headwater stream areas and areas of existing development on shoreline slopes are included as areas of geotechnical caution which also require engineering review and approval before development.

Guidelines

Development permits issues in these areas for hazardous conditions shall be in accordance with the following guidelines:

Geotechnical Report Requirements

Development or alteration of land within the hazard areas defined on Schedule C shall require a geotechnical report, prepared by a BC registered professional engineer with experience in geotechnical engineering and preferably also with experience in hydraulic engineering.

The geotechnical report will determine the conditions and requirements of the Development Permit, and shall certify that the land may be used safely for the use intended.

The report shall include field definition of land located in the following areas:

- *15 horizontal metres back from the crest of ravine slopes; of Gibson Creek, Charman Creek, and the two small ravines at the south-western boundary of the Town as shown on Schedule C.*
- *The area within 1.5metres elevation of 15metres horizontal distance of headwater streams shown on Schedule C.*
- *15 horizontal metres back from the ocean shoreline.*
- *Both 15 horizontal metres and 30 horizontal metres back from the crest of the shoreline slope.*
- *The existing lower Charman Creek stream channel and possible over flow areas, as well as the area within 15 horizontal metres of the stream channel and overflow areas.*
- *Any other water courses, tributaries, steep slopes and ravines with the Development Permit Areas.*
- *The crest of the slope should be determined with conservative field criteria such as the perceived location of ground fractures, and other suspect features which may indicate an imminent landslide.*
- *The signature and seal of a B.C. registered professional engineer with experience in geotechnical engineering.*
- *The geotechnical report must take into consideration provincial requirements and the Guidelines for Legislated Landslide for Proposed Residential Development in BC, from APEGBC, 2010.*

Geotechnical Report Recommendations

The items required in the report should be in sufficient detail and clarity to permit their inclusion in a Section 215 Covenant as required by the Land Title Act. At a minimum, the report should include the following types of analysis and information:

- *A topographic and geomorphic description of the site and a statement as to which type of natural hazards may affect it. A review of previous geotechnical studies affecting the site and/or engineering work in the vicinity.*
- *An assessment of the nature, extent, frequency (probability) and potential effect of the hazard including a description of the scientific methodology used to define these parameters. The methodology should be described in sufficient detail to facilitate a professional review of the study of necessary.*
- *Proposal mitigative works (if any, including construction and maintenance programs for such works) and/or actions designed to prevent hazardous occurrences. Certificates of approval are required on all constructed works for which the engineer is responsible.*
- *An assessment of the effect of the mitigative work in terms of its ability to reduce the potential impact of the hazard. Any other recommendations which the engineer believes appropriate.*

Location of Dwellings or Structures

Unless recommended otherwise by a professional engineer with experience in geotechnical engineering, no dwellings, structures or other use of land (such as the designation of new residential parcels) shall be permitted within the areas defined on Schedule C as high geotechnical hazard area.

Ocean Shoreline

The ocean shoreline is a very active geomorphic boundary, which may be affected by storm wave erosion and deposition, tidal change and possible future sea-level change. The Thurber Report generally recommends a

precautionary, minimum 15m horizontal setback from the mean high tide line along all marine shorelines.

There is active soil landsliding in the Franklin Road and adjacent Gower Point Road areas. Developed ground above the bedrock enclosed pocket beaches east of Gower Point Road is retreating northward. The local silty-sandy glaciomarine soil is highly susceptible to erosion, and groundwater seepage and rain may especially promote the movement of fill area. The following recommendations apply:

- *Horizontal setbacks of 30 m apply from the top of the shoreline slopes southward on bedrock controlled shoreline Franklin Road and Gower Point as outlined on Schedule C.*
- *Precautionary setbacks of 15m apply to other shoreline areas. At the north end of the Town, the limit of the Development Permit Area is 15 m back from the top of the local slope. At the south end of the Town, it follows west (up-slope) rights-of-way. In beach areas at the south end of Town, the relatively high risk zone extends 15 m horizontally from the crest of the shoreline slope. This setback also applies to the developed shoreline north to Seaview Road, where slopes have generally unknown geotechnical conditions directly above the shoreline.*

Charman Creek and Gibson Creek Ravines

These ravines have steep to very steep forested slopes eroded in glacial drift, which are susceptible to shallow soil landslides and erosion. The slopes average about 32° from the horizontal, but much steeper slopes along narrow upper stream channels indicate comparatively recent erosion. There are many areas of groundwater seepage, with widespread soil creep and slow downslope movement of the shallow soil mantle. This mantle is very susceptible to rapid landslide movement. Small slides may run out on the valley flows and form debris dams, resulting in water flows, mud flows or debris flood with severe downstream effects. The highly developed course of lower Charman Creek is particularly susceptible to damaging water or debris floods. The ravine slopes are very sensitive to incautious soil disturbance including excavation and filling.

The following guidelines apply:

- *The ravines identified on Schedule C are to be preserved as underdeveloped, natural landscape corridors to preserve and enhance the natural water courses.*
- *In these ravines; a 15 m hazard area setback applies from the top of the ravine slope. No site clearing or development activity shall occur within this setback unless otherwise recommended by a geotechnical engineer.*
- *Vegetation should be retained and, if deemed necessary through geotechnical study or the recommendations of Government Agencies, replanted in order to control erosion and to protect banks and the streamside habitats.*
- *No dumping of debris, including soil or vegetation is permitted.*

Headwater Stream

Hazard zones along headwater streams are outlined on Schedule C, and are subject to a 15 m horizontal setback distance and a 1.5 m minimum elevation requirement.

Flooding

Schedule C outlines the estimated extent of the high hazard (1:100 flood) and moderate hazard (1:150) areas subject to possible effects of ravine landslides, water floods and possible debris flows.

The following guidelines apply:

- *Lots, any portion of which are located within areas along Charman Creek or Gibson Creek designated as having "High Probability of Geotechnical Hazard Occurrence" on Schedule C of the Official Community Plan,, and any lots abutting the sea shore, are designated as a "Floodplain", for purposes of subsections (1.1) and (2) of Section 910 of the Local Government Act.*

- *All buildings or structures or parts thereof, except for public service uses providing flood control, must not be located within 15.0 m (49.2 ft) of the natural boundary of the sea, a swamp or pond, or any watercourse, provided that on those portions of sea shore in the Franklin Road and Gower Point areas shown as having "High Probability of Geotechnical Occurrence" on Schedule C of the Official Community Plan, the setback from the natural boundary of the sea must be 30.0 m (98.4 ft).*
- *A geotechnical report is required if the lot is located on land designated as "Floodplain" under subsection (1) above. The geotechnical report must take into consideration provincial requirements and the Professional Practice Guidelines for Legislated Flood Assessments in a Changing Climate in BC, from APEGBC, 2012.*
- *All buildings or structures must be sited or constructed such that the underside of any floor system of habitable space, business floor area, or floor area used for the storage of goods, is at an elevation not less than 2.5 m (8.2 ft) above the current natural boundary of the sea in anticipation of the expected sea level rise of 1 metre by 2100, or 1.5 m for a watercourse, as applicable. Nor less than 0.6 m (2.0 ft) above the level of a flood at that location, having a magnitude equal to a two-hundred year occurrence interval, as determined by a professional engineer or geo-scientist experienced in geotechnical engineering, or a person in a class prescribed by the Minister by regulations under Section 910(7) of the Local Government Act.*
- *The floor level elevation required under subsection (4) above, may be achieved by landfill or structural elevation, but where landfill is used, it must comply with the setbacks prescribed under subsection (2) above, and the face of such landfill must be adequately protected against erosion.*
- *No Development Permit for development within the "Floodplain" defined in subsection (1) above shall be issued without prior registration in the Land Title Office against the Certificate of Title to the subject property of a Restrictive Covenant in perpetuity under Section 219 of the Land Title Act, to the following effect:*
 - *"The owner agrees that the Land shall not be used, developed, or buildings or structures erected thereon, except in compliance with the conditions herein. The owner acknowledges that the Town of Gibsons does not represent to the owner or any other person that any building constructed or mobile home located in accordance with the conditions herein will not be damaged by flooding or erosion and the owner covenants and agrees not to claim damages from the Town or hold the Town responsible for damages caused by flooding or erosion to the land or to said lands and to any contents thereof."*
- *The requirement for a 2.5m elevation above the current high water mark can be varied in the following situations:*
 - *A report from a qualified professional has been provided, outlining that a different elevation is suitable for a specific location given the site characteristics and / or exposure to wave action.*
 - *Proposed uses located below the required elevation don't pose a risk to people or the environment in case of occasional flooding.*
 - *The life span of the proposed development is less than 100 years and justifies a lower elevation, as specified by a qualified professional.*
 - *In relation to existing adjacent structures or existing elevations of the surrounding terrain, the required elevation is considered unreasonable.*

Gospel Rock Area

Gospel Rock is an area with steep to very steep east-facing and shoreline rock and includes many areas of loose rock as well as steep slopes. These factors are geotechnical concerns which may be overcome with careful subdivision design and construction.

The following guidelines apply to the Gospel Rock area identified on Schedule C:

- *A detailed geotechnical assessment and development management plan shall be prepared as part of any future development application to determine rock slope design, scaling of loose rock, road and driveway design to reduce potential hazards.*
- *The generalized limits of the recommended Development Permit Area are the top of slopes greater than 2H:1V, a variable rockfall "shadow zone": at the base of these slopes and areas of loose rocks as indicated on Schedule C. These areas merge with a shoreline setback along the ocean below Gower Point Road.*