# FLOOD HAZARD AREA LAND USE MANAGEMENT

## Guidance For

## Selection of Qualified Professionals
## and
## Preparation of Flood Hazard Assessment Reports

## Introduction

This document is intended to provide guidance for the selection of qualified professionals (QP) and the preparation of flood hazard assessment reports in relation to land use management in flood hazard areas.

These types of reports may be required under, but are not limited to, the following circumstances:

- By a building inspector under section 56 of the *Community Charter* (CC).
- By an approving officer under section 86 of the *Land Title Act* (LTA).
- By a local government under section 910 of the *Local Government Act* (LGA).
- By a land use manager under the "Flood Hazard Area Land Use Management Guidelines".
- And also at other points of land use decision making, such as by a land use decision maker under section 11 of the *Land Act* (LA).

## Qualified Professionals

The classes of QPs that may undertake this work are described as follows:

- Section 56 of the CC – a professional engineer or a professional geoscientist with experience or training in geotechnical study and geohazard assessments.
- Section 86 of the LTA – a professional engineer or geoscientist experienced in geotechnical engineering.
- Section 910 of the LGA – a professional engineer or geoscientist and experienced in geotechnical engineering, or
  a person in a class prescribed by the minister under subsection (7) [No class of persons has been prescribed to date.].
- Flood Hazard Area Land Use Management Guidelines - a professional engineer or geoscientist and experienced in geotechnical engineering, or
  a person in a class prescribed by the minister under subsection (7) [No class of persons has been prescribed to date.].
- Section 11 of the LA – not specified.

## Quality Assurance Statement

The land use decision maker requires high quality, trustworthy information to make a good decision. To help ensure that the study is of professional quality, the QP and any reviewers employed by the proponent must sign and stamp the work, and the report should include a Quality Assurance Statement.

The Quality Assurance Statement should assure the land use decision maker that:

- the QP has performed the evaluation of the area proposed for development or to be subject to a bylaw:
  - with due consideration of any applicable legislation, and
  - with due consideration of the "Flood Hazard Area Land Use Management Guidelines", and that
- the QP has the qualifications to carry out the flood hazard assessment.

## Guidance for Selection of Qualified Professionals to Undertake Flood Hazard Assessments

This information is intended to assist in the selection of a QP to undertake flood hazard assessments for land use management in flood prone areas. Hereafter, whenever the word "flood" is used in this document, it is intended to include alluvial fan, mud flow, debris flow, debris torrent, inundation, erosion from flood flows, and/or coastal flooding processes.

- Flood hazard assessments are to be performed by QPs with geotechnical engineering experience and expertise in river engineering and hydrology, and in appropriate cases, alluvial fan, mud flow, debris flow, debris torrent, erosion from flood flows, and/or coastal flooding processes.
- QPs should be requested to provide written proposals containing the following information:
  - resumes of key staff selected for the project
  - list of similar projects completed (with a short description) by the company and/or QPs selected for the project
  - outline of proposed study methodology and reporting format [Refer to the 'Terms of Reference for Preparation of Flood Hazard Assessment Reports' section for more detail.]
  - list of resources available to complete the assessment [For example, the capacity to undertake river surveys, computer modeling capability, etc.]
  - estimated costs and proposed terms of payment
  - project completion schedule
  - list of agencies which will be consulted as part of the assessment
  - list of reference documents that will be considered in the flood hazard assessment [The list must include the "Flood Hazard Area Land Use Management Guidelines".]
- **in some instances it may be prudent to first confirm the administrative and economic feasibility of a proposal by undertaking a preliminary overview flood hazard assessment and confirming with the land use decision maker prior to a more detailed and costly assessment**

## Guidance for Preparation of Flood Hazard Assessment Reports

### *Terms of Reference for Preparation of Flood Hazard Assessment Reports*

This information is intended to assist with the preparation and review of flood hazard assessment reports required for land use management in flood prone areas. It is recognized that some flood hazards are easier to identify and assess than others and that site conditions will vary. Consequently, reports will vary in size and complexity. Not all the items listed in this document may be required or expected in all cases. However, the list should serve as a useful checklist for the proponent, report author and land use manager.

**General Requirements**:

- legal description of the property and statement of local government jurisdiction
- location map depicting property location and any other regionally significant information used in the report, such as hydrometric and/or climate data
- regional and/or a site map and/or air photograph overlay depicting: the existing property boundaries (for a proposed subdivision show all proposed lots and remainder; for a proposed lease or sale of Crown land show all proposed lots; for a building permit application show the proposed building site); all water courses, alluvial fans and areas exposed to debris flow hazards; hydraulic structures, existing and proposed flood protection works; proposed safe building sites; and any other relevant regional or site specific information
- review of all relevant restrictive covenants registered on title for the subject property and any relevant nearby properties [Copies of covenants should be attached to the report.]
- review of all relevant local government land use policies, guidelines and regulations including; floodplain and other relevant bylaws, Official Community Plans, development permit area requirements and policy statements
- review of all relevant previous reports and flood hazard maps affecting the site and surrounding area and any scientifically relevant sites elsewhere
- description of site visits and/or overview flights, complete with documentation of observations
- review of current and historical air photographs
- review of historical flood information including; Water Survey of Canada hydrometric data (discharges, flow depths and velocities), Environment Canada climate data, local government and Ministry of Water Land and Air Protection reports, local newspapers archives and interviews with local residents
- assessment of the nature, extent, magnitude, frequency and potential effect of all flood hazards that may affect the property

- description of the scientific methodology(s) and assumptions used to undertake the assessment(s) [The methodology should be described in sufficient detail to facilitate a professional review.]
- location of all proposed safe building sites by specifying building setback distance(s) from the natural boundary of watercourse(s) and/or map notation [Areas depicted on maps must be delineated with sufficient accuracy and detail to allow the preparation of legal reference plan(s) for attachment to a restrictive covenant.]
- where applicable; Flood Construction Levels (see Appendix A of the "Flood Hazard Area Land Use Management Guidelines", hereafter sited as the Guidelines, for definition) by prescribing an elevation above the natural boundary of a watercourse or natural ground elevation at the building site, or by specifying a geodetic elevation, or by a combination of the above [Geodetic elevations should be referenced to Geodetic Survey of Canada datum or some other datum acceptable to the land use decision maker. Bench marks should be located on site and/or location plans.]
- recommendations to ensure safe use of a site should be clearly stated with sufficient detail and clarity to facilitate inclusion in a *Land Title Act* section 219 covenant [Recommendations should be accompanied with advice on how they can be practically implemented by the property owner and/or land use decision maker.]
- description of proposed mitigation works and/or actions designed to mitigate the hazard with a confirmation that the Guidelines, and specifically Section 5.7, have been considered
- where mitigation works and/or actions are proposed, an assessment of the effects that the proposed works and/or actions may have on other properties including public infrastructure
- **where mitigative works and/or actions designed to reduce hazards are contemplated, prior to completing the report and expending time and money on detailed design, the proponent should confirm that the works and/or actions proposed will be accepted by local government and that they would meet regulatory requirements** [For example, the construction of mitigative works may not be approved by the Inspector of Dikes in the absence of a commitment from the local government to assume the responsibility for the operation and maintenance of the works. Consequently, in some instances mitigative options may not be feasible.]
- preparation of a Quality Assurance Statement, as described above, with signature and seal of a QP(s) [Some assessment reports may require the involvement of one or more QPs and/or a peer review process. Flood protection measures recommended should be compared to the minimum requirements provided in the Guidelines. Where appropriate, cite relevant section of the Guidelines.]

**Hazard Specific Requirements:**

The following hazard specific requirements should be considered in the assessment report:

**For Lakes, Ponds, Marsh Areas and Reservoirs (Guidelines Section 3.1):**

- where an existing Flood Construction Level (FCL) is recommended, document the source of the information
- where an existing FCL is deemed inappropriate, or where there is no existing FCL, and a new FCL is recommended, provide details of the calculation and confirmation that the Guidelines were considered in the process
- where applicable provide shoreline profile(s) starting from below low water level to a point some distance above the safe building area(s), depicting the FCL, maximum wave run-up, existing and/or proposed mitigation works, natural boundary, safelines (if any) and any other relevant shoreline features
- where safeline(s) (Guidelines Section 3.1.4) have been established by a reservoir operator and accepted by local government, the safeline may be used to specify building setback requirements

**For Watercourses (Guidelines Section 3.2):**

- where floodplain maps (Guidelines Section 2.0) are used to recommend FCLs, document which map sheet(s) were used
- where an existing FCL shown on a floodplain map is deemed inappropriate, or where there is no existing FCL, and a new FCL is recommended, provide details of the calculation and confirmation that the Guidelines where considered in the process
- for property adjacent to or within a meandering and/or braided river floodplain, use air photographs, maps and other information to describe and assess relevant ongoing river processes (including ice and/or debris jamming) that may pose a hazard to the property
- when recommending the use of minimum setback and elevation guidelines for smaller streams (Guidelines Section 3.2.3) and/or a very small stream (Guidelines Section 3.2.4), provide a map of the stream watershed area used to determine drainage area
- when building setback distance(s) are established or modified in consultation with a dam owner and a Land and Water BC Dam Safety Officer (Guidelines Section 3.2.6), provide written confirmation from the dam owner and the Dam Safety Officer of their agreement with the setback distance(s)

**For Alluvial Fans (Guidelines Section 3.3):**

- suitably scaled topographic map depicting watershed area, fan boundaries, existing and abandoned channels, hydraulic structures, existing and proposed mitigation works, potential avulsion and overland flow paths (thinking in terms of a one in two hundred year flood event), features on the fan that would serve to give direction to and/or impede overland and/or channel avulsion flow paths and the property boundaries
- channel cross-sections and stream profile(s)
- where applicable, depths of flow and velocities used in analysis
- assessment of the sensitivity of the watershed area, with respect to hydrology and sediment and debris loading [The assessment should include reference to pertinent Watershed Assessment Reports, Terrain Stability Maps and other reports which may be available from the Ministry of Forests and/or timber company tenure holder.]
- assessment of long term channel bed load and debris maintenance requirements in relation to any recommended flood hazard mitigation measures
- where existing channel capacity and topographic features on the fan are identified as features contributing to the safe use of the property, provide an assessment of the effects (if any) of any future changes to the channel or fan topographic [This information is required to identify land use and/or instream work measures that may be required for the land use decision maker to put in place to ensure the longevity of the features contributing to the safe use of the property. Examples of such measures include the maintenance of the channel discharge capacity and the operation and maintenance of protective structures.]
- plan, cross-sections and design specifications for proposed building foundation treatments and other site specific mitigation measures

**For Areas Subject to Debris Flows (Guidelines Section 3.4):**

- suitably scaled topographic map and/or air photographic base map depicting watershed area, all existing and potential debris flow start, transport and run out zones, hydraulic structures, existing and proposed mitigation works, features on the debris flow transport path and/or run out area which could serve to give direction and/or impede debris flows, existing depositional features, cohorts, soil test pit locations, carbon dating and dendrochronology sample sites, and property boundaries
- statement of return periods(s) considered in the hazard assessment and design of proposed mitigation works [Recurrence interval should be expressed in terms of annual probability, for example a 1 in 2,500 year debris flow event.]
- centreline profile(s) from debris flow start zone(s) to toe of run out zone(s)
- plans, cross-section(s) and design specifications for proposed mitigation works
- event volume, depth and velocity of flow and impact forces used in the design of mitigation works
- assessment of the sensitivity of the watershed area, with respect to hydrology and sediment and debris loading [The assessment should include reference to pertinent

Watershed Assessment Reports, Terrain Stability Maps and other reports which may be available from Ministry of Forests and/or timber company tenure holder.]

- where existing channel capacity and topographic features on the fan are identified as features contributing to the safe use of the property, provide an assessment of the effects (if any) of any future changes to the channel or fan topographic [This information is required to identify land use and/or instream work measures that may be required for the land use decision maker to put in place to ensure the longevity of the features contributing to the safe use of the property. Examples of such measures include the maintenance of the channel discharge capacity and the operation and maintenance of protective structures.]

**For The Sea (Guidelines Section 3.5):**

- plan and beach profile starting from below low water level to a point some distance above the proposed safe building site(s) depicting property lines, existing and proposed erosion protection works, high tide level, proposed FCL, proposed building sites and any other relevant shoreline features
- analysis of waves and water levels associated with high tides, storms, storm surges and/or tsunamis
- for areas affected by tsunamis, confirmation that the recommendations for safe building conditions were based on a review of a report entitled " Evaluation of Tsunami Levels Along the British Columbia Coast" by Seaconsult Marine Research Ltd dated March 1988 (Guidelines Section 3.5.2)

**Areas Protected by Standard Dikes (Guidelines Section 3.6):**

- map(s) depicting; existing and proposed dikes, dike right-of-ways, dike access routes and easements, areas protected by the dikes, and property boundaries
- a summary of all comments and concerns raised through consultation with the dike owner or diking authority and the Inspector of Dikes office complete with statements on how each comment or concern is addressed in the report

## *Review of QP Selection and Flood Hazard Assessment Reports*

To assist land use managers, local and provincial approving officers, building inspectors and proponents in the tasks of selecting Qualified Professionals and reviewing flood hazard assessment reports, the requirements described above can be used as a checklist to ensure that the action item has been met, or alternatively, is not applicable in those circumstances. Of course, the list may be modified to suit the particular circumstances.