

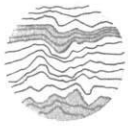
DISTRICT OF SQUAMISH



FLOOD HAZARD MANAGEMENT PLAN

PB 6166 01

MAY 1994



KLOHN LEONOFF

Our File: PB 6166 0101
940511

May 11, 1994

District of Squamish
37955 2nd Avenue
P.O. Box 310
Squamish, British Columbia
V0N 3G0

Mr. R. A. Miles
Clerk-Administrator

Flood Hazard Management Plan

Dear Sir:

I am pleased to enclose our report on the Flood Hazard Management Plan for the District of Squamish.

The report includes an implementation program for the Flood Hazard Management Plan, a draft Official Community Plan amendment bylaw and a draft 969 bylaw for Floodplain Management Provisions. Also included are revised copies of the Flood Hazard Maps and Flood Hazard Management Planning Maps.

We have appreciated the contributions of the staff of the District of Squamish and B.C. Environment in developing the Flood Hazard Management Plan. Thank you for your assistance and support.

Yours very truly,

KLOHN LEONOFF LTD.

C. David Sellars, P. Eng.
Project Manager

CDS:ds



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1. BACKGROUND

The District of Squamish is located at the head of Howe Sound, where five mountain rivers converge. Industrial, commercial and residential development has taken place largely in the floor of the valley and it is estimated that about 75% of the population of over 12,000 occupy flood hazard areas.

As part of the preparation of the Squamish Flood Hazard Management Plan, a Background Report, dated February 18, 1994 was prepared by Klohn Leonoff Ltd. and Graham Farstad Associates Ltd. The principal flood hazards in Squamish were identified in the Background Report as follows:

SOURCE	POTENTIAL FLOOD HAZARD
• Squamish River	Flooding in Brackendale, North Yards, Dentville and downtown Squamish.
• Mamquam River	Flooding in Garibaldi Estates, North Yards, Dentville and downtown Squamish.
• Cheakamus River	Flooding and erosion in the Cheakamus Valley.
• Cheekye River	Debris flows and flooding on the Cheekye Fan.
• Stawamus River	Flooding in Valleycliffe.
• Howe Sound high tides	Flooding in downtown Squamish.

Dykes are only a partial solution for flood protection. The major dykes in Squamish are designed to provide protection for flood events that occur on average once every 200 years. When a greater flood than the 200-year event occurs, the dykes would be overtopped. Overtopping of dykes is possible even during a more frequently occurring flood event. All the rivers in the Squamish area transport large volumes of sediments, particularly during floods. Sediment deposition results in higher river bed levels which can cause increased water levels for the same flow. In addition, the rivers in the study area carry large organic debris including logs during major flood events. These can result in log jams and increased water levels. Other potential dyke failure mechanisms

include erosion of the riverside of the dyke and piping failure as a result of seepage through and under the dyke. Both modes of failure could occur more frequently than once in 200 years.

No flood hazard management plan for Squamish will be able to eliminate all of these flood hazards due to the existing settlement pattern. However, it is possible to manage future development to reduce both the likelihood of flooding and the extent of damages should flooding occur.

With these objects in mind, the Background Report for the Squamish Flood Hazard Management Plan:

- identified and assessed flood hazards;
- documented existing flood mitigation works;
- prepared flood hazard maps and flood hazard planning management maps. (These maps have been revised in the Squamish Industrial Area to account for recent fill placement);
- reviewed historical development and existing land use patterns;
- examined growth projections and land use changes;
- documented current flood hazard management procedures; and
- proposed a new regulatory framework to better manage the flood hazards.

The Background Report concluded that the following general approach to development should be used to manage flood hazards in Squamish:

- Residential uses should be encouraged outside flood hazard areas.
- Infill residential development should be accommodated in existing neighbourhoods where flood hazards are judged to be low and required mitigation measures modest.

- More intensive residential development should be accommodated where flood hazards are judged to be low and all required mitigation measures are met.
- More intensive residential development should be avoided in existing neighbourhoods where flood hazards require major mitigation (i.e., large amounts of fill or structural support required to elevate a floor system to FCLs plus erosion protection).
- Residential development should be avoided in new areas or extensions of existing neighbourhoods where flood hazards require major mitigation (i.e., large amounts of fill or structural support required to elevate a floor system to FCLs plus erosion protection).
- Institutional, commercial and light industrial development should be floodproofed to withstand the same level of protection as residential development.
- Floodproofing for heavy industrial development protected by dykes is recommended but should be left to the discretion of the developer except for electrical equipment and accessory offices.
- The unique circumstances in the downtown must be recognized in responding to the need for floodproofing there.

Prior to preparation of the Background Report, the Cheekye River Terrain Hazard and Land Use Study was completed in March 1993 by Thurber Engineering Ltd. in association with Golder Associates Ltd. The report concluded that for the existing situation, the hazard probability approach indicated that new construction on existing lots would only be permitted in Zone 4 (Area C4 in Background Report). Approval of subdivisions would require prior mitigation of the flood hazard.

The most appropriate mitigation options were considered to be land use zoning, diversion dykes and warning systems. Diversion dykes could increase the extent of Areas C3 and C4, thus permitting greater development on the fan. The report noted that mitigation strategies need to be evaluated on the basis of costs and benefits and that some options will result in the transfer of risk from one part of the fan to another.

The management of flood hazards in Squamish requires a coordinated, comprehensive response by the District of Squamish and the provincial government. This response should consist of the following five elements:

- public education;
- policy development;
- regulatory requirements;
- emergency procedures;
- dyking and other structural improvements.

Details of these five components of the Squamish Flood Hazard Management Plan are contained in Sections 2, 3, 4, 5, and 6 of this report.

2. PUBLIC EDUCATION

Public education is a critically important part of the Flood Hazard Management Plan. Its effectiveness will clearly be greater if flood hazards are publicly recognized and accepted rather than ignored and denied. Similarly, public cooperation and support for managing flood hazards will be more effective than if floodproofing measures are imposed by government edict. Landowners, realtors, the development industry and related professionals are all key to the success of the Flood Hazard Management Plan.

One of the key objectives of this study has been to raise public awareness about the reality of flood hazards in Squamish. Three four-page bulletins have been distributed to all Squamish residents and businesses. The history of flooding in Squamish and the experiences of its pioneers have been noted prominently. Total circulation for each bulletin has approached 5,000 copies.

Two open houses have also been held. The first open house focused on background information about flood hazards and included a questionnaire designed to encourage persons with information about past flooding to come forward and to gauge public reaction about the importance of the subject. Graphic displays were featured. Over 110 persons attended the first two open houses. One additional open house and bulletin are planned at the conclusion of the study.

Media co-operation from the Squamish Chief newspaper and Mountain FM radio station conveying information about the importance of flood hazard management has been excellent.

With an annual population increase approaching 3% and a population turnover (i.e., persons moving into and away from Squamish) much higher than that, there is a need to continually educate people about the need to manage flood hazards and floodproof within flood hazard areas.

There are two main elements of public education proposed. These extend beyond the significant raising of public awareness of flood hazards which occurred throughout the course of the Flood Hazard Management Study.

The first is the preparation of a Flood Hazard Brochure. This brochure should convey basic information about flood hazards in Squamish in an easily read, visually attractive format. Such a brochure should be made available at the municipal office and in other suitable locations such as the Chamber of Commerce and real estate offices. The proposed concept for such a brochure is contained in Appendix I.

The second proposed element of public education is through the Squamish Official Community Plan. The O.C.P. is the key policy document affecting land use in Squamish. As such, it provides an excellent opportunity to serve a public education function. Since the O.C.P. is primarily a policy document, its proposed policies concerning flood hazard management are discussed in the following section.

The use of 215 covenants also plays an indirect education role by informing property owners and their successors in title of the existence of flood hazards.

3. POLICY DEVELOPMENT

Official Community Plan policies will establish a context for decision making concerning future land use proposals, provide a framework for regulatory procedures including bylaw changes and serve to inform the public about flood hazards in Squamish.

The following policies are proposed to be incorporated in the Squamish Official Community Plan through a separate amending bylaw:

- manage future development in accordance with the Flood Hazard and Flood Hazard Management Planning maps (thereby replacing Schedule 3, which identifies Environmentally Sensitive and Hazardous Areas, with the new maps);
- establish new O.C.P. category and Development Permit area where the natural environment should be left essentially untouched [Municipal Act Section 945.(4)(a)];
- include river floodways, the environmentally sensitive fishery resources in Schedule 3 of the existing O.C.P. and Baynes Island Ecological Reserve in new O.C.P. category where preservation of the natural environment is the overriding goal;
- acquire isolated private lots within areas where protection of the natural environment is the long term community objective;
- establish public pathways on top of or along dykes to improve access to, visibility of, and appreciation of natural areas in Squamish including rivers and estuary;
- designate the Cheekye Fan as a Development Permit area in order to provide protection of development from hazardous conditions [Section 945.(4)(b)];
- allow for overland flow paths within developments in areas subject to flood hazards;
- maintain a corridor east of Highway 99 where building construction and fill placement are minimized in order for the area to serve as an emergency floodway and thereby enable reduced Flood Construction Levels to occur in the Dentville and downtown areas;

- encourage residential development in designated growth areas not subject to flood hazards such as north of Garibaldi Highlands and Valleycliffe;
- review zoning in Flood Hazard Areas and initiate zoning amendments to minimize more intensive development in areas where over 2.5 m of elevation is required to meet Flood Construction Levels;
- obtain Section 215 covenants from property owners saving the District of Squamish and the Province of British Columbia harmless from liability or damage claims in the event of flooding prior to any subdivision or rezoning;
- initiate O.C.P. and zoning amendments as required to minimize more intensive development where high flood and debris flow hazards have been confirmed (i.e., primarily parts of Brackendale);
- encourage clustering of developments in new residential areas in order to enable sensitive natural areas and significant tree stands to remain;
- encourage open space and natural park uses in selected areas that are subject to flood hazards;
- solicit the cooperation of the Squamish Nation to manage flood hazards;
- encourage multiple family uses adjacent to the downtown where such uses are considered appropriate and provided that all floodproofing measures can be met;
- encourage multiple family above commercial uses in the downtown;
- acquire lots in cooperation with the Ministry of Environment, Lands & Parks with the object of cancelling subdivisions that are undevelopable due to changes in watercourses.

Policies encouraging infill (i.e., more intensive) development in areas with high flood hazards or over 2.5 m of elevation to reach FCLs should be deleted.

Proposed property acquisitions are identified in Appendix II.

4. REGULATORY REQUIREMENTS

Regulatory changes are proposed with the objective of responding in the most effective manner possible. A number of general as well as specific changes are proposed.

Regulatory changes include the Official Community Plan, the Zoning Bylaw, a Floodplain Bylaw and subdivision approval under the *Land Title Act*. Site grading and drainage plans will be required at the subdivision and building permit stages.

4.1 Official Community Plan

In addition to proposed policy changes to the O.C.P. identified in Section 3, three additional regulatory changes to the O.C.P. are proposed. They consist of the following:

ACTION	AFFECTED AREAS	RATIONALE
1. Create new O.C.P. category where conservation and protection of the natural environment are the primary and long-term goals.	Wilson Slough and adjacent area, creeks and other water bodies with fishery resources.	Would avoid the mixed messages of the present Limited Use O.C.P. designation which includes both long-term conservation areas and others where long-term future development is contemplated. Such a category would clearly not be a holding zone.
2. Designate as Development Permit areas those locations shown on O.C.P. for conservation and protection of the natural environment.	Wilson Slough, fish-bearing watercourses and Baynes Island.	Designation of areas where the protection of the natural environment will establish conservation as an end value and reduce the risk of alternate land uses being considered.
3. Create development permit designation to include Cheekye debris flow hazard area.	Cheekye Fan Zones C1 to C3.	Would clearly demonstrate the nature of the flood hazard and provide a clear indication of public concern. (Present regulatory policies would remain in force)

Deletion of references to floodproofing requirements being in the Zoning Bylaw would be a housekeeping measure as this represents neither current nor proposed procedures.

A draft Official Community Plan Amendment Bylaw that addresses all issues raised in Sections 3 and 4.1 is contained in Appendix III.

4.2 Floodplain Management Provisions

The designation of flood hazard areas by bylaw and specification of minimum setbacks from a watercourse, minimum construction elevations and required structural support is proposed under Section 969 of the *Municipal Act*. The foundation of such a bylaw would be the Flood Hazard Management Planning Maps. Revised Flood Construction Levels (FCLs) would be as specified in the three-map series. They would replace the 1983 and 1986 floodplain maps produced by the Ministry of Environment, Lands & Parks, except for the Cheakamus floodplain. Such a Bylaw would require the approval of the Ministry of Environment, Lands & Parks.

ACTION	AFFECTED AREAS	RATIONALE
Adopt Municipal Bylaw under Section 969 of the <i>Municipal Act</i>	Map areas 1 (Downtown), 2 (Dentville, North Yards, west of Garibaldi Estates, lower Brackendale), 3 (Valleycliffe, Garibaldi Estates, 4 (areas adjacent to existing dykes), 5 (river floodways), 6 (Squamish Estuary), and C4 (part of Brackendale).	<ul style="list-style-type: none">• 969 Bylaw would signify concurrence of municipal and provincial governments re: flood hazards in Squamish.• No other legislative provisions authorize minimum flood construction elevations.• A clearly stated floodplain management bylaw would respond effectively to most flood hazards. This bylaw would be administered locally.• The resulting procedural change will be less time consuming and need not require additional municipal staff.

Permitted uses below FCLs should be clearly defined and limited to garages, carports, accessory buildings, crawl spaces (under 1.5 m in height) and entrance foyers.

Relaxation of these provisions could only occur if approved by the Ministry of Environment, Lands & Parks. However, general exemptions would be specified thereby avoiding time consuming appeals over minor structures.

The bylaw regulating floodplain elevations and setbacks under Section 969 of the *Municipal Act* would be combined with the Zoning Bylaw as authorized by Section 943.1 of the *Municipal Act*. This offers the advantage of combining all regulatory requirements for floodproofing under a single bylaw.

A draft bylaw is contained in Appendix IV.

4.3 Zoning Bylaw

Amendments to Zoning Bylaw 751 should follow policy revisions to the Official Community Plan as stated in Section 3. Amendments are proposed in the following specific areas:

ACTION	RATIONALE
1. Replacement of Section 2.1.2 (Flood Plain Requirements) with 969 Bylaw.	Schedule B, which allows certain developments in historic urban areas to avoid floodproofing, would be eliminated. Revised flood construction levels would be incorporated. All floodproofing requirements would be combined with other land use regulations in a single bylaw.
2. Review of zoning in light of new flood hazard assessment.	Consideration should be given to maintaining existing parcel sizes in high flood hazard areas and encouraging limited uses in such areas. Particular attention should be given to restricting development potential to current uses in Areas 4, C1, C2, C3 and where FCLs are 2.5 m or more above existing grades.
3. Building areas below FCLs should be limited to entrance foyers, crawl spaces, garages and carports.	The potential to complete unfinished basements in flood hazard areas would be removed. Crawl spaces would be limited to a height of 1.5 m.

continued

ACTION	RATIONALE
4. A new zone where conservation of the natural area is desired should be created.	The Zoning Bylaw should reflect the desire to preserve certain lands in their natural state.
5. Lands acquired for permanent conservation purposes should be rezoned to reflect such intent.	A limited number of private properties are within proposed conservation areas or are in river channels due to changes in river locations. Acquisitions should be followed up by plans cancellation and rezoning for protection of the natural environment.
6. Provision for overland flow paths.	Overland flow paths can be effectively provided for through the Zoning Bylaw. The concept can be easily understood as a variation of site coverage limitations.

4.4 Land Title Act

Conditions respecting the approval of subdivisions should be established by the Ministry of Environment, Lands & Parks in those designated floodplain areas where the subdivision approval function may be transferred to the District of Squamish. The authority for local subdivision approval in floodplain areas where conditions satisfactory to the Ministry of Environment, Lands & Parks have been established comes under Section 82 of the Land Title Act. Regulations to adequately floodproof developments should be formulated that are clearly understood and easily implemented by District of Squamish staff.

In addition to establishing floodproofing conditions for subdivisions under Section 82, the Land Title Act should be used to take advantage of the opportunity to require covenants under Section 215 of the same statute. Such covenants should be used to require floodproofing requirements to be met, save governments harmless from liability in the event of flood damages and bind all successors in title to the conditions specified in the covenant.

Where a new development is proposed on a property with an existing 215 covenant on title which does not reflect current flood construction levels or legal requirements, the existing covenant should be discharged and replaced by an updated covenant that meets current requirements.

The cost of preparing or revising a 215 covenant should be borne by the applicant for development.

Although this provision of the *Land Title Act* has some similarity to Section 969 of the *Municipal Act*, action is required in both instances. This is because Section 82 of the *Land Title Act* regulates the creation of new lots while Section 969 of the *Municipal Act* regulates existing lots.

ACTION	AFFECTED AREAS	RATIONALE
<ul style="list-style-type: none">• Designation of floodplain areas by Ministry of Environment, Lands & Parks.• Establishment of conditions regulating subdivisions in floodplains.	<ul style="list-style-type: none">• Areas 1, 2, 3, 4 and 6 on Flood Hazard Management Planning Maps.• C-4 to be included once avulsion mitigation measures have been resolved.	Where subdivision requirements for certain flood hazard areas can be clearly established in advance, there is no need for a local approving officer to require provincial approval for each specific application.

The conditions established by the Ministry of Environment, Lands & Parks concerning Section 82 of the *Land Title Act* should apply equally to Section 3.3 of the Bare Land Strata Regulations of the *Condominium Act*.

The approval of subdivisions in Cheekye Fan Zone C4 and part of C3 in the vicinity of Ross Road will remain with the Ministry of Environment, Lands & Parks until adequate mitigation works to protect the area from an avulsion of the Cheekye River have been designed and an implementation program agreed upon.

No local subdivision approval authority is recommended for Cheekye Fan Zones C1, C2 and C3 (except in the vicinity of Ross Road) or subdivisions within the 200-year floodplain of the Cheakamus River. In these cases, the approval of subdivisions will remain with the Ministry of Environment, Lands & Parks. In the case of Cheekye Fan Zone C1, C2 and C3, this is due to the higher flood hazard and greater complexity. In the case of the Cheakamus River, the lack of continuous dyking is a major factor.

The use of a 215 covenant to protect the District of Squamish and the provincial government from damage claims in the event of flooding should also be included prior to rezoning and development permit approval in flood hazard areas. This would significantly broaden the range of development situations beyond subdivision applications where liability protection is provided. Such covenants also provide an indirect public education function.

Conditions respecting the approval of subdivisions in designated floodplain areas under Section 82 of the *Land Title Act* are outlined in Appendix V.

4.5 Geotechnical Engineering Report

Section 734 (2), (3) and (4) of the *Municipal Act* authorizes a building inspector to require the owner of land subject to flood hazards to provide him with a report certified by a professional engineer with experience in geotechnical engineering that the land may be used safely for the intended use. Without such a report, the building inspector shall refuse to issue a building permit, thereby preventing construction from taking place. If such a report is produced, the building inspector may issue a building permit subject to the registration of a covenant under Section 215 of the *Land Title Act* specifying the conditions under which the owner may safely use the land.

Although the requirement for such a report is a judgement call by the Building Inspector, it is the object of this study to limit the need for such a report.

Most sites identified in this study subject to flood hazards can be classified into a number of areas where similar floodproofing measures are appropriate. Consequently it is anticipated that Section 734 (2), (3) and (4) of the *Municipal Act* will be required primarily for those properties with special hazards (landslide, rockfalls, subsidence, avalanches) where the Building Inspector has concerns about the adequacy of the required floodproofing. This is consistent with the two page checklist of natural hazards currently used by the District of Squamish Building Inspector.

The current policy of the District of Squamish to require a geotechnical engineering report in Cheekye Zones C1, C2 and C3, except for minor repairs, will be continued.

4.6 Site Grading and Drainage Plans

The most appropriate time to address site drainage, erosion protection and overland flow paths is at the subdivision and building permit stages. For a subdivision, civil engineering design is required for roadworks and underground services. The inclusion of site or lot grading plans as a requirement of subdivision approval should also occur. This will require amendment of the District of Squamish Subdivision Bylaw No. 535, 1976. Extensive changes to the enabling legislation now authorized by Section 989 of the *Municipal Act* have taken place since 1976. Accordingly, the District of Squamish may consider a major rewriting of its bylaw concerning subdivision servicing requirements. The District should also continue preparation of Master Drainage Plans to ensure future adequacy of drainage networks and major outlets.

The following site grading matters should be addressed in a new or amended subdivision bylaw:

- connection to stormwater drainage facility to prevent flooding and erosion on adjacent properties;
- maximum allowable grades to property lines;
- general description of erosion protection measures to be used in flood hazard areas 2, 3 and 4;
- measures to be taken to ensure habitable building sites in flood hazard area 3 will be 1.0 m above the finished ground elevation or 0.6 m above the crest of the adjacent road, whichever is greater;
- measures to be taken to ensure habitable building sites in flood hazard areas 1, 2, 4 and 6 will be above the FCL; and
- provision for overland flow paths where new developments are within floodplains.

At the building permit stage, these site grading matters should be verified. More detailed plans of erosion protection measures for flood hazard areas 2, 3 and 4 and foundation protection measures for flood hazard area 4 should be submitted. If no site grading plans have been prepared at the subdivision stage (for older subdivisions which predate floodproofing requirements), all such information should be supplied as part of the building permit application.

In addition to site grading required for on-site drainage, site grading for floodproofing is required in Area 3 as described in the Background Report. In Area 3, the flood levels are defined as finished grade plus 1.0 m or nearest downslope embankment (for example a road) plus 0.6 m, whichever is higher. Figure 1 illustrates the concept. Similar site grading is required in Area 4 if the resulting elevation is higher than the designated FCL.

Various alternatives for scour protection of foundations in Area 4 were described in the Background Report. A simple method would involve construction of an apron of riprap 0.6 m thick and 3 m wide placed outside the perimeter wall as shown in Figure 2. The riprap would be placed in two layers using rock with a mean diameter of 0.3 m.

The regulation of building construction is authorized under Section 734(1) of the *Municipal Act*. As an alternative, or in addition, to providing site grading plans, an applicant could be required by a building inspector to provide a geotechnical report pursuant to Section 734(2). Site grading plans should be prepared and stamped by a qualified professional and approved by the District.

In order to regulate the placement of fill to meet FCLs, it may be necessary for Council to pass a bylaw to regulate the removal or deposit of soil. Authority for such regulation is given in Section 930.1 of the *Municipal Act*.

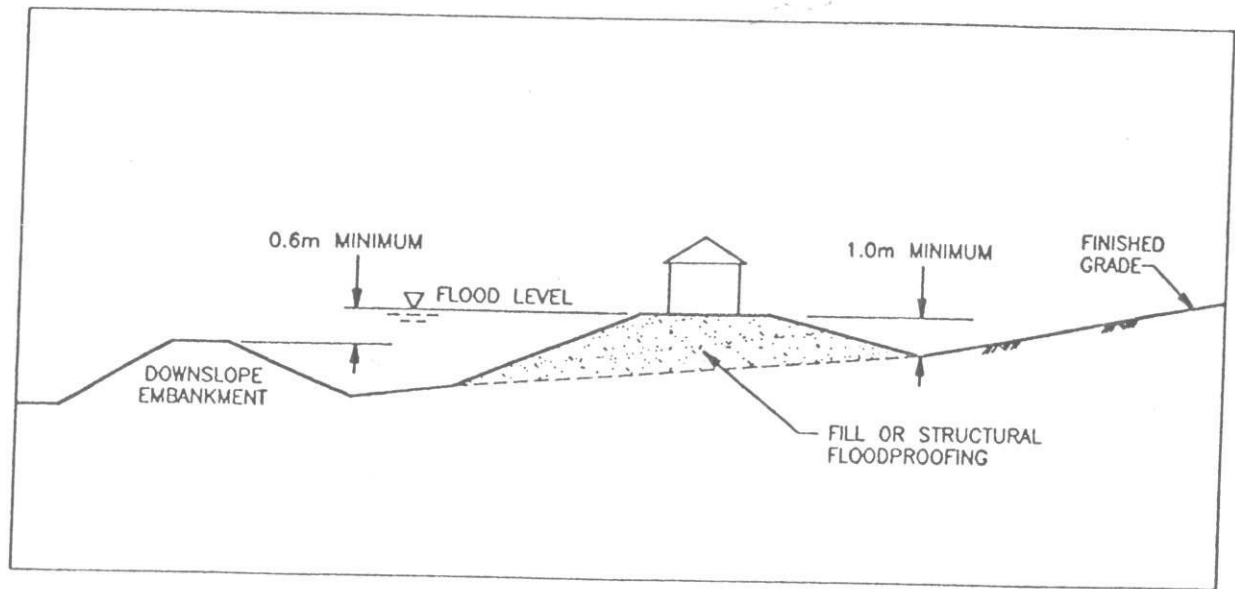


Figure 1 - Flood Level for Area 3

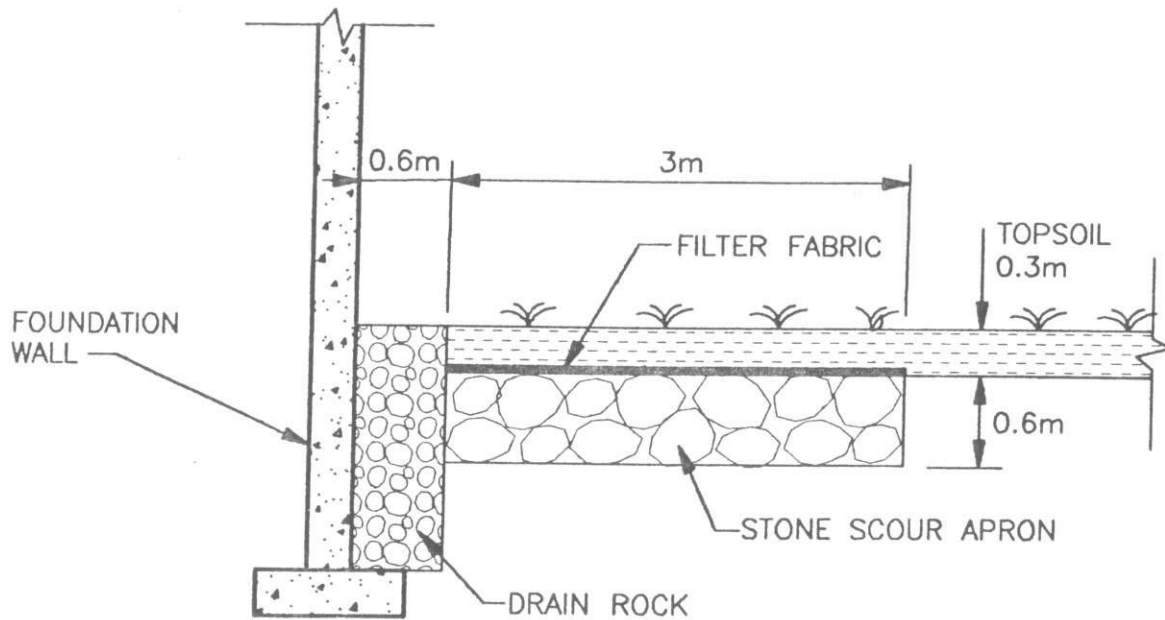


Figure 2 - Scour Apron for Flood Hazard Area 4

Provision should also be made in any new development in the floodplain, for overland flow. The Flood Hazard Maps indicate depths of flow and velocities in the flood corridors. These flow characteristics have allowed for future development conditions including the placement of fill in the floodplain. However, to avoid excessive blockage of overland flow and localized backwater, subdivision layout and building orientation should provide for continuous flow paths in the direction of overland flow. These overland flow areas would comprise roads, linear parks, playing fields and other open spaces below Flood Construction Levels. For new developments, provision for overland flow should be made by ensuring that a percentage of the development is below the FCL. Elevations for overland flow areas should remain at the natural ground elevation or a maximum of 25% of the difference between the natural ground elevation and the FCL, or 0.3 m above the nearest downstream road crown. The use of structural measures in Areas 2, 3, 4, C3 and C4 will facilitate this requirement. Areas available for the purposes of overland flow provisions include building setbacks, parking lots, access roads within a parcel and open space. Designated flow paths must extend to the property line on at least two sides of a site. In Area 1 (downtown), it will be necessary to maintain flow paths in developments along the waterfront of Mamquam Blind Channel. The maximum fill elevation in these flow paths should be 3.3 m GSC, the same crest elevation as the proposed sea dyke.

Implementation of overland flows as shown in Figure 3 can most effectively be accommodated through amendments to the Zoning Bylaw. This should not prove to be an onerous requirement as the maximum lot coverage for all buildings and other structures is 33% for most residential and commercial zones. In order to accommodate overland flows, the following zoning amendments should be made:

ZONES	MAXIMUM SITE COVERAGE BUILDINGS AND FLOODPROOFING FILL
All residential	65%
Commercial	50%
Industrial (other than heavy industrial)	60%

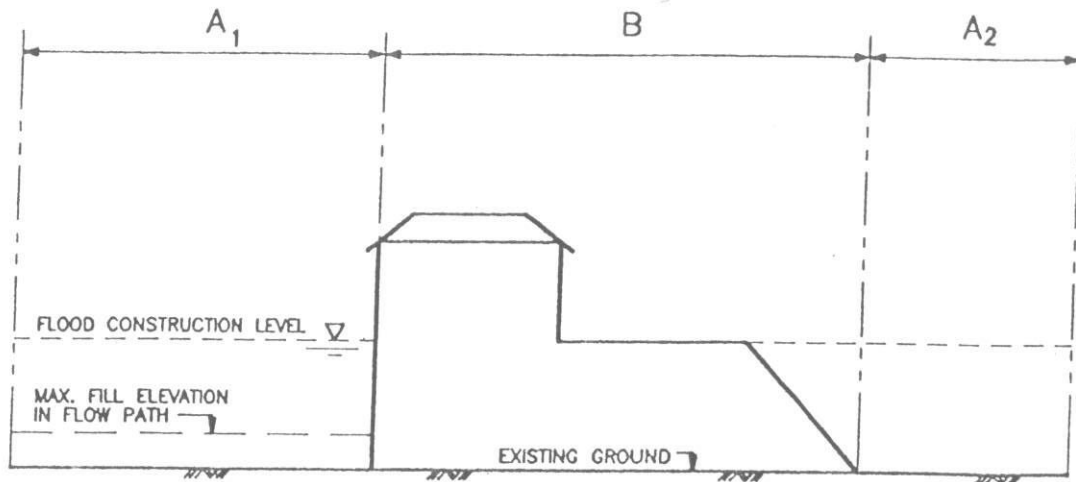


Figure 3 - Overland Flow Provision

- A - Designates overland flow paths ($A = A_1 + A_2 \dots$)
- B - Designates blockage due to floodproofing.

Land designated under 945.4(b) of the *Municipal Act* to protect development against hazardous conditions can be restricted from alteration, thereby restricting the use of fill on part of the site. In the Cheekye Fan Flood Hazard Areas, this provision will also reinforce the concept of overland flow provision.

A particular requirement for an approved site grading plan and provision for overland flow paths arises for Cheekye Hazard Area C4. This area is located at the toe of the Cheekye Fan and is subject to an avulsion hazard from the Cheekye River. The magnitude of the avulsion for design was not established in the Thurber-Golder report prepared for the Cheekye River Terrain Hazard and Land Use Study. Preparation of a Master Drainage Plan for this area should include estimation of the magnitude of the

avulsion hazard and design of measures which may include diversion dykes to divert overland flows into drainage ditches and other designated flow paths.

4.7 Floodplain Management Component of Subdivision Bylaw

District of Squamish Subdivision Bylaw No. 535, 1976 as amended regulates the subdivision of land in Squamish. The enabling legislation concerning the subdivision of land has undergone many changes over the past 18 years. Although several amendments to the District of Squamish Subdivision Bylaw have taken place, a more comprehensive rewriting of this important regulatory tool is currently underway.

The following requirements concerning the subdivision of land in flood hazard areas should be included in a revised subdivision bylaw:

- connection to stormwater drainage facility to prevent flooding and erosion on adjacent properties (included in Section 11 of the draft bylaw).

Floodproofing in Flood Hazard Areas

- general description of erosion protection measures to be used in flood hazard areas 2, 3 and C4;
- general description of foundation protection measures to be used in flood hazard area 4;
- measures to be taken to ensure habitable buildings sites in flood hazard area 3 will be 1.0 m above the finished ground elevation or 0.6 m above the crest of the adjacent road, whichever is greater;
- measures to be taken to ensure habitable building sites in flood hazard areas 1, 2, 4 and 6 will be above the FCL; and
- fill to be used for structural purposes to be certified by a Professional Engineer.

Site Grading

- provision for overland flow paths where new developments are within floodplains; and
- maximum allowable grades to property lines.

Consent to any subdivision in a flood hazard area will be subject to a covenant registrable under Section 215 of the *Land Title Act* which shall run with the land and have priority over any financial charges registered against the property. The covenant shall require any habitable area on the subdivided lands to be constructed at the flood construction level or higher except as authorized by the Ministry of Environment, Lands & Parks. The owner of such lands shall indemnify and save harmless the Province of British Columbia and the District of Squamish including their employees and agents resulting from any flood hazards.

A standard covenant should be included as an appendix to the subdivision bylaw.

4.8 Development Permits

The use of development permits is proposed pursuant to Section 945.(4)(a) and (b) of the *Municipal Act*. In the first instance, areas would be designated for the protection of the natural environment. In the second instance, areas would be designated for the protection of development from hazardous conditions.

In each instance, the objectives that justify the development permit designate must be described in the Official Community Plan as well as guidelines as to how the conditions will be alleviated. Both are contained in the draft Official Community Plan Amendment Bylaw in Appendix III.

Initial designations for both purposes are limited to core lands presently designated or agreed to by Council policy. Other areas can be added in conjunction with a zoning amendment or once all affected parties have agreed (i.e., Squamish Estuary Management Plan).

When a development permit area has been designated in an Official Community Plan, a Council resolution to issue a development permit is required. Until this occurs, lands within the development permit area cannot be subdivided and no construction, addition or alteration of a building or structure can be commenced.

The use of a 215 covenant is proposed as a development permit condition prior to the issuance of a building permit under Section 976.(2)(b) of the *Municipal Act*. This would enable the use of 215 covenants to be broadened to those designated areas where no subdivision of land is involved.

4.9 Matrix of Regulatory Responses

Three matrixes document proposed regulatory responses in Squamish's flood hazard areas. The first identifies overall regulatory responses to different land use proposals. The second outlines proposed procedures for subdivision applications in different flood hazard areas. The third outlines proposed procedures for building permit applications in each flood hazard area.

Table 1 - Regulatory Responses to Different Land Use Requests in All Flood Hazard Areas

LAND USE	REQUEST	RESPONSE**
Existing Single-family or Two-family dwelling (non-conforming as to floodproofing requirements).	Building permit for repairs or renovations and additions involving less than 25% of original ground floor area.	No floodproofing required.
Single-family dwelling.*	Building permit for new dwelling (construction on vacant lot, replacement of older dwelling, fire damage over 75%).	Floodproofing required as per Flood Hazard Management Planning Maps.
Single-family dwelling.	Subdivision under current residential zoning.	Floodproofing as per Flood Hazard Management Planning Maps and 215 covenant required.
Two-family dwelling.*	New construction under current zoning (each unit may be strata-titled).	Floodproofing required as per Flood Hazard Management Planning Maps.

Table 1 (continued) - Regulatory Responses to Different Land Use Requests in All Flood Hazard Areas

LAND USE	REQUEST	RESPONSE**
Single-family dwelling, Two-family dwelling or Multi-family dwelling.	Rezoning for higher density residential uses.	Floodproofing as per Flood Hazard Management Planning Maps and 215 covenant required.
Multi-family dwelling, Commercial, Industrial and Institutional.	Building permit for repairs and renovations or addition that would increase the original ground floor area by less than 25%.	No floodproofing required.
Multi-family dwelling, Commercial, Industrial and Institutional.	Building permit for new construction or major addition.	Floodproofing for new construction or addition as per Flood Hazard Management Planning Maps.
Multi-family dwelling, Commercial, Industrial and Institutional.	Subdivision, rezoning or development permit.	Floodproofing as per Flood Hazard Management Planning Maps plus 215 covenant required.
Heavy Industrial (excluding associated offices).	Subdivision rezoning or development permit.	Full floodproofing advisable but not required.

- * Historic exemption areas to be eliminated once FHMP is adopted.
 ** All new construction to contain stormwater drainage on-site or connect to municipal storm sewers.
- N.B. 1. General exemptions apply as per 969 Bylaw. Relaxation of floodproofing requirements may be considered by the Ministry of Environment, Lands & Parks.
 2. These regulatory responses should be also considered in the light of council policy relating to the Cheekye River Terrain Hazard & Land Use Study.

Table 2 - Subdivision Applications*

FLOOD HAZARD AREA	PROPOSED PROCEDURES	APPROVING AUTHORITY
1.	<ul style="list-style-type: none"> • Applicant inquiries about site specific subdivision potential. • Floodproofing requirements given to applicant including applicable FCL, site grading and drainage requirements, existing road elevations, erosion protection requirements, setbacks and overland flow provision. • Applicant submits preliminary plan of subdivision including site grading and drainage plan, proposed servicing, proposed elevations and method of achieving FCL. • Preliminary approval given after review by Planning & Engineering Departments subject to conditions established by Approving Officer including 215 covenant. • Detailed plans including servicing submitted and sealed by appropriate professional (e.g., P.Eng., BCLS). • 215 covenant approved and registered in Land Title Office. • Subdivision approved. 	Squamish**
2.	<ul style="list-style-type: none"> • Same as 1. except that erosion protection measures included in submission standards and required prior to preliminary subdivision approval. • 215 covenant to include erosion protection measures. 	Squamish**
3.	<ul style="list-style-type: none"> • Similar to 1. except that FCL defined as finished grade plus 1 m or downslope embankment plus 0.6 m, whichever is higher. 	Squamish**
4.	<ul style="list-style-type: none"> • Same as 2. and 3. except that the applicant will also be required to identify foundation protection measures. 	Squamish**
5.	<ul style="list-style-type: none"> • Subdivisions not to be approved except to correct historical anomalies. 	Environment, Lands and Parks
6.	<ul style="list-style-type: none"> • Same as 1. except that site specific wave/wind analysis required to determine flood construction levels. 	Squamish**
C1, C2, C3	<ul style="list-style-type: none"> • Applicant inquires about site specific subdivision potential. • Applicant given pertinent Council policy applicable to C1, C2, C3 or C4. • Applicant referred to Ministry of Environment office in Surrey if he/she wishes to proceed further. 	Environment, Lands and Parks
C4	<ul style="list-style-type: none"> • Same as 3. except that area-wide avulsion mitigation measures required where three or more lots are proposed. 	Squamish following approved plan for area-wide avulsion mitigation measures**
* Geotechnical engineering report may be required by Approving Officer if warranted by site specific conditions.		
** Ministry of Environment, Lands & Parks to receive copy of subdivision approval letter.		

Table 3 - Building Permit Applications*

FLOOD HAZARD AREA	PROPOSAL	PROPOSED REQUIREMENTS	APPROVING AUTHORITY
ALL	Repairs and renovations or addition involving less than 25% of original ground floor area.	<ul style="list-style-type: none"> No floodproofing required. 	Squamish
ALL	Major repairs, additions and new construction.	<ul style="list-style-type: none"> Generic floodproofing design options to be offered at inquiry stage (as shown in Background Report). 	N/A
1. Downtown	New construction (including fire damage over 75%) and additions involving more than 25% of original ground floor area.	<ul style="list-style-type: none"> Site grading and drainage plan required. 215 covenant required if in Development Permit area. All habitable space for residential purposes required to meet FCL (as verified by BCLS). All habitable space for commercial or institutional purposes in buildings of less than 300 m² required to: <ul style="list-style-type: none"> meet FCL or "tank" such uses to withstand flooding or use only specified flood resistant materials. All habitable space for commercial or institutional purposes in buildings greater than 300 m² required to: <ul style="list-style-type: none"> meet FCL or "tank" such uses to withstand flooding. 	Squamish
2, 3, C3 and C4	New construction (including fire damage over 75%) and additions involving more than 25% of original ground floor area.	<ul style="list-style-type: none"> Site grading and drainage plan required. 215 covenant required if in Development Permit area. All habitable space required to meet FCL (as verified by BCLS). Erosion protection measures required. 	Squamish

Table 3 (continued) - Building Permit Applications

FLOOD HAZARD AREA	PROPOSAL	PROPOSED REQUIREMENTS	APPROVING AUTHORITY
4.	New construction (including fire damage over 75%) and additions involving more than 25% of original ground floor area.	<ul style="list-style-type: none"> • Site grading and drainage plan required. • 215 covenant required if in Development Permit area. • All habitable space required to meet FCL (as verified by BCLS). • Erosion protection measures required. • Foundation protection measures required. 	Squamish
5. River Floodways	New construction (including fire damage over 75%).	<ul style="list-style-type: none"> • No building permits to be allowed in river floodway. 	Squamish
6. Squamish Estuary	New construction (including fire damage over 75%) and additions involving more than 25% of original ground floor area.	<ul style="list-style-type: none"> • Site grading and drainage plan required. • 215 covenant required if in Development Permit area. • All habitable space required to meet FCL as modified by wind/ wave analysis (elevation to be verified by BCLS). • Floodproofing of heavy industrial uses (excluding offices) not mandatory but to be strongly encouraged. 	Squamish
C1 and C2	New construction (including fire damage over 75%) and additions involving more than 25% of original ground floor area.	<ul style="list-style-type: none"> • Not approvable due to high debris flow risk. 	Squamish
* A geotechnical engineering report may be required by the Building Inspector if warranted by site specific conditions.			

NB: District of Squamish policies in C1, C2, C3 and C4 also to be addressed.

5. DYKING AND OTHER STRUCTURAL IMPROVEMENTS

The Background Report indicated that the existing dykes appeared to be in generally good condition, although geotechnical or hydraulic analysis was beyond the scope of this study. In several locations, improvements are recommended.

Due to erosion of the left bank along the Squamish River in the vicinity of the B.C. Rail North Yards, erosion protection works are recommended. The affected area totals approximately 1.0 km and the estimated construction cost for this bank protection is \$1.7 million.

Upgrading of the sea dykes in the downtown area of Squamish is also recommended in order to provide continuous protection to a dyke crest elevation of 3.3 m. The proposed sea dyke comprises the following sections.

- Section A Part of Loggers Lane and Highway 99 near the junction with Cleveland Avenue.
- Section B A waterfront dyke along the Mamquam Blind Channel.
- Section C A connected series of dykes and roads near Westminster Street and along the southerly extension of Third Avenue.
- Section D The B.C. Railway embankment on the west side of downtown Squamish. The old sea dyke on the west side of downtown, which is partly overgrown, would not form part of the sea dyke system.

Upgrading of the sea dykes will require the following improvements:

- Section A Raising Loggers Lane east of Highway 99 or installing tidal gates in the Highway 99 culverts at the north crossing of Mamquam Blind Channel.
- Section B Constructing a 0.2 m to 1.0 m high dyke along an existing right-of-way between Loggers Lane and Mamquam Blind Channel. Once the waterfront is fully developed, a continuous walkway along the channel could provide flood protection.
- Section C Raising of road elevations by about 0.1 m and placing fill (about 0.3 m) in the vicinity of Westminster Street and Third Avenue.
- Section D No improvements required.

The estimated cost is approximately \$500,000 as detailed in the Background Report.

A regular inspection program of existing dykes should be carried out. Such activity will also assist in identifying preventative maintenance requirements.

In order to maintain the existing channel capacity of Squamish's rivers and consequently their current dyking protection, periodic gravel removal should take place. Surveys of river cross sections should be undertaken to monitor changes in river bed elevations. The need for gravel removal should be confirmed by water surface profile analyses.

Such gravel removal must take place in accordance with the requirements of Fisheries and Oceans Canada and the provincial Ministry of Environment, Lands & Parks.

Gravel is also an economic resource. Aggregate removal near development locations will also assist in keeping floodproofing costs down as well as be of benefit for road and building construction purposes.

In order to fully document the existing dyking system in Squamish, as built drawings should be prepared. Such drawings should include precise locations of existing dykes, their crest elevations and profiles. Field surveys of the existing dyking system have been completed recently by Ministry of Environment, Lands & Parks staff. This information will be used by Ministry of Environment, Lands & Parks to prepare as-built drawings.

6. EMERGENCY PROCEDURES

The Background Report includes a review of emergency procedures in Squamish related to flood hazards.

The Squamish Emergency Plan includes detailed procedures concerning potential flooding and impacts and identifies responsive procedures. The establishment of detailed call-out procedures for each major flood corridor similar to those in the Cheakamus Valley is recommended based on the information available in the Flood Hazard Maps. An advance warning system for the Cheekye River is recommended based on two options identified in the Cheekye River Terrain Hazard and Land Use Study. The Squamish Emergency Plan should also be reviewed in the context of the Background Report to determine if any other procedural changes are needed.

7. SUMMARY

The following elements are proposed for the Squamish Flood Hazard Management Plan:

7.1 Public Education

7.1.1 Flood Hazard Brochure -- 8-page colour brochure to interested public

7.1.2 Official Community Plan (overall document)

7.2 Policies in Official Community Plan

- manage future development in accordance with the Flood Hazard and Flood Hazard Management Planning maps (thereby replacing Schedule 3, which identifies Environmentally Sensitive and Hazardous Areas, with the new maps);
- establish new O.C.P. category and Development Permit area where the natural environment should be left essentially untouched [Municipal Act Section 945.(4)(a)];
- include the environmentally sensitive fishery resources and Baynes Island & Wilson Slough in Schedule 3 of the O.C.P. where preservation of the natural environment is the overriding goal;
- acquire isolated private lots within areas where protection of the natural environment is the long term community objective;
- establish public pathways on top of or along dykes to improve access to, visibility of, and appreciation of natural areas in Squamish including rivers and estuary;
- designate the Cheekye Fan as a Development Permit area in order to provide protection of development from hazardous conditions [Section 945.(4)(b)];
- allow for overland flow paths within developments in areas subject to flood hazards;
- maintain a corridor east of Highway 99 where building construction and fill placement are minimized in order for the area to serve as an emergency floodway and thereby enable reduced Flood Construction Levels to occur in the Dentville and downtown areas;

- encourage residential development in designated growth areas not subject to flood hazards such as north of Garibaldi Highlands and Valleycliffe;
- review zoning in Flood Hazard Areas and initiate zoning amendments to minimize more intensive development in areas where over 2.5 m of elevation is required to meet Flood Construction Levels;
- obtain Section 215 covenants from property owners saving the District of Squamish and the Province of British Columbia harmless from liability or damage claims in the event of flooding prior to any subdivision or rezoning;
- initiate O.C.P. and zoning amendments as required to minimize more intensive development where high flood and debris flow hazards have been confirmed (i.e., primarily parts of Brackendale);
- encourage clustering of developments in new residential areas in order to enable sensitive natural areas and significant tree stands to remain;
- encourage open space and natural park uses in selected areas that are subject to flood hazards;
- solicit the cooperation of the Squamish Nation to manage flood hazards;
- encourage multiple family uses adjacent to the downtown where such uses are considered appropriate and provided that all floodproofing measures can be met;
- encourage multiple family above commercial uses in the downtown;
- acquire lots in cooperation with the Ministry of Environment, Lands & Parks with the object of cancelling subdivisions that are undevelopable due to changes in watercourses.

7.3 Regulatory Requirements

7.3.1 Official Community Plan

- new O.C.P. category re: conservation and protection of the natural environment

- Development Permit designation for conservation and protection of the natural environment.
- Development Permit designation for debris flow hazard areas.

7.3.2 Floodplain Management Provisions (969 Bylaw)

- specify minimum flood construction levels and building setbacks.
- specify areas requiring erosion and foundation protection.
- adopt Flood Hazard Management Planning Maps.
- limit uses and areas below FCLs.
- local regulation of most flood hazard areas.
- specify general exemptions
- combine with Zoning Bylaw for convenience and ease of administration.

7.3.3 Zoning Bylaw

- replace existing Section 2.1.2. (Floodplain Requirements) with Floodplain Management Provisions (969 Bylaw).
- review zoning in light of findings of Background Report.
- create new zone where conservation of the natural area is the long term objective.

7.3.4 Land Title Act

- Ministry of Environment to establish conditions and areas where local subdivision approvals within flood hazard areas can occur.
- designation of floodplain areas by Ministry of Environment, Lands & Parks.
- use of 215 covenant to provide protection from future flood liability.

7.3.5 Geotechnical Engineering Report

- use of Section 734(2), (3), (4) where specific site conditions warrant special analysis of and response to flood hazards including Cheekye Zones C1, C2 and C3 and the Cheakamus floodplain.

7.3.6 Site Grading and Drainage Plans

- include site grading requirements in subdivision Bylaw.
- provide final site grading details with building permit application.
- include drainage and provision for overland flow.

7.3.7 Emergency Procedure

- establish detailed call-out procedures for each major flood corridor.
- add advance warning system for Cheekye River.

7.4 Dyking and Other Structural Improvements

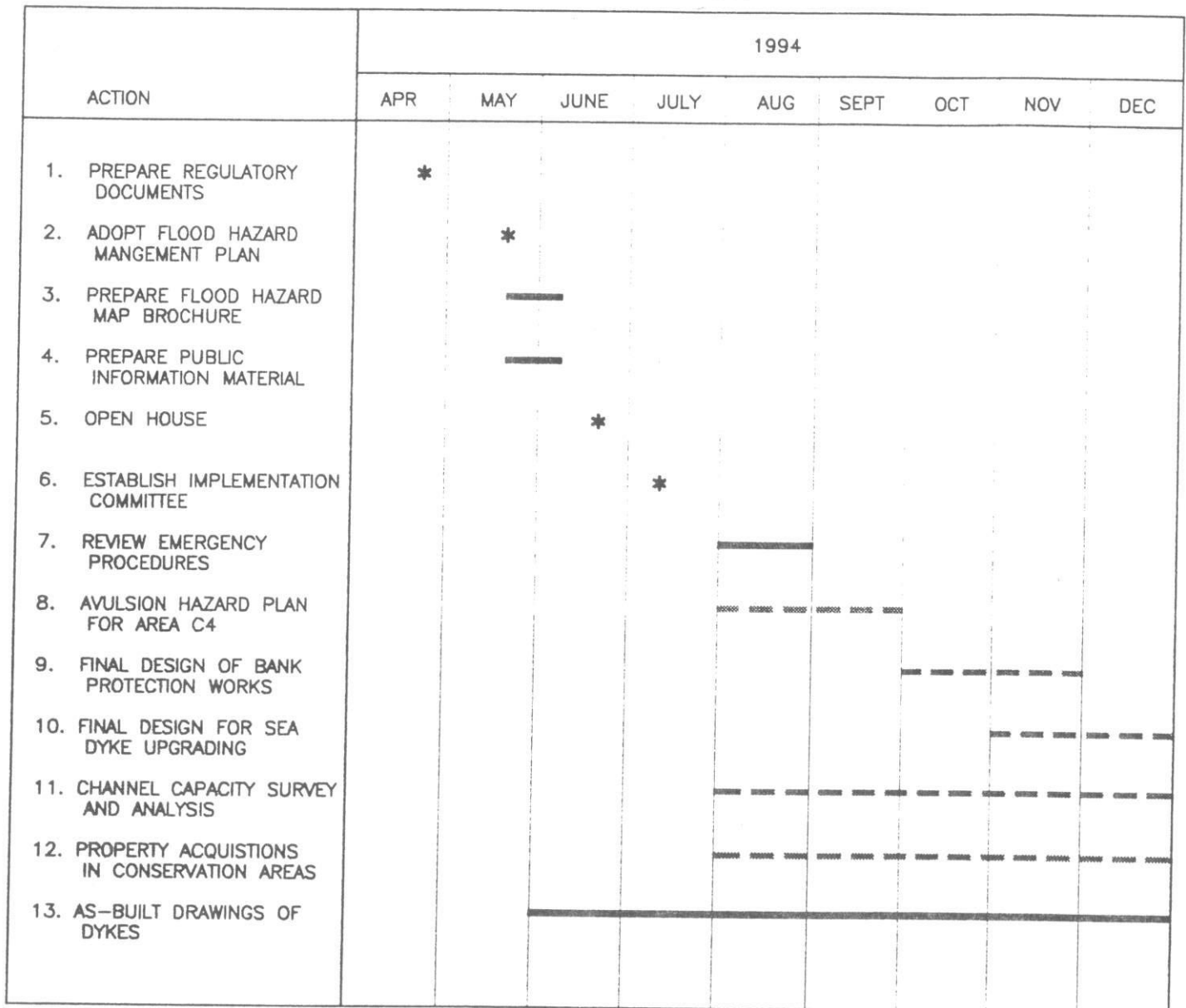
- 7.4.1 Strengthened bank protection along 1.0 km section of the Squamish River dyke west of BC Rail North Yards.
- 7.4.2 Upgrading of sea dykes.
- 7.4.3 Regular inspection and preventative maintenance of existing dykes.
- 7.4.4 Periodic gravel removal to maintain existing channel capacity and dyke protection.
- 7.4.5 Prepare as-built drawings of dyke locations, crest elevations and profiles.

8. IMPLEMENTATION PROGRAM

8.1 Schedule

Although it is desirable for the entire Floodplain Management Plan to be implemented as a comprehensive package, it is not possible for this to occur. Factors affecting different components involve further studies, funding, bylaw preparation, approval processes between different levels of government and scheduling. A proposed schedule is shown on the attached Figure 4 up to the end of 1994. Responsibility for draft and final documentation for the first four action items are listed as follows:

<u>ACTION</u>		<u>DRAFT DOCUMENTATION</u>	<u>FINAL DOCUMENTATION</u>	<u>FINAL APPROVAL</u>
1a	Prepare O.C.P. Amendment Bylaw	Klohn Leonoff/ Graham Farstad	District of Squamish	Council
1b	Prepare 969 Bylaw	Klohn Leonoff/ Graham Farstad	District of Squamish	Council and Ministry of Environment, Lands & Parks
1c	Prepare floodplain management components to enable amendment of subdivision bylaw	Klohn Leonoff/ Graham Farstad	District of Squamish	Council and Ministry of Environment, Lands & Parks
1d	Prepare terms for subdivision approval transfer	Klohn Leonoff/ Graham Farstad	District of Squamish	Council and Ministry of Environment, Lands & Parks
2	Adopt flood hazard management plan	Klohn Leonoff/ Graham Farstad	Klohn Leonoff/ Graham Farstad	Council
3	Prepare flood hazard map brochure	Klohn Leonoff/ Graham Farstad	Klohn Leonoff/ Graham Farstad	Steering Committee
4	Prepare public information material	Klohn Leonoff/ Graham Farstad	Klohn Leonoff/ Graham Farstad	Steering Committee



— — — — — SUBJECT TO FUNDING

FIGURE 4 — SCHEDULE FOR IMPLEMENTATION PROGRAM

The remaining action items on Figure 4 are as follows:

ACTION	COMMENTS
5 Open House	The Open House will be organized by Klohn Leonoff/Graham Farstad and will complete the current contract between the consultants and the District of Squamish.
6 Establish Implementation Committee	An Implementation Committee is required to ensure that the process is continued particularly the transfer of regulatory authority.
7 Review Emergency Procedures	The items identified and recommended in the Background Report should be reviewed by the District of Squamish and incorporated as appropriate into the District Emergency Procedures.
*8 Avulsion Hazard Plan	As discussed in Section 4.6, a plan for mitigating the avulsion hazard in Area C4 is required before transfer of regulatory authority. The Terms of Reference should be prepared by the Ministry of Environment, Lands & Parks in conjunction with the District. A proposed scope of work is attached in Appendix VI.
*9 Final Design of Bank Protection Works	Terms of Reference for an engineering design contract should be prepared by the District and BC Environment.
*10 Final Design of Sea Dyke Upgrading	Terms of Reference for engineering work for the sea dyke upgrading should be prepared by the District and the Ministry of Environment, Lands & Parks.
*11 Channel Capacity Survey and Analysis	Surveys of the major river channels and channel capacity analyses should be carried out under the direction of the District and the Ministry of Environment, Lands & Parks.
*12 Property Acquisitions in Conservation Area	The District of Squamish & Ministry of Environment Lands & Parks should proceed with this activity in 1994 though it could be delayed.
13 As-built Drawings of Dykes	The Ministry of Environment, Lands & Parks, has started this activity and will complete it in 1995.
* subject to funding	

In addition, it should be noted that the Ministry of Environment, Lands & Parks has a statutory obligation on an ongoing basis to consider appeals of floodproofing requirements.

8.2 Funding

Possible funding sources for the implementation program include the following:

- general taxation in the District of Squamish;
- establishment of a local improvement program under Section 651 of the *Municipal Act* for dyking and drainage improvement within the floodplain;
- development cost charge for constructing, altering or expanding drainage facilities as authorized by Section 983 of the *Municipal Act*;
- Provincial Emergency Program (PEP) funding for the bank protection works on the basis of avoiding future costs with possible dyke failure;
- a gravel management plan including royalties on excavated gravel to pay for dyking improvements;
- grant or cost sharing assistance from the Ministry of Environment, Lands & Parks; and
- infrastructure funding from the Provincial and Federal Governments.

APPENDIX I

FLOOD HAZARD MAP BROCHURE

APPENDIX I

FLOOD HAZARD MAP BROCHURE

The preparation of a Flood Hazard Map Brochure is proposed to convey basic information about flood hazards in Squamish. An eight page brochure is planned to be made available to interested persons such as landowners, realtors, prospective homeowners, lending agencies and developers. The concept of the Flood Hazard Brochure is as follows:

Contents:

- | | |
|--------------|---|
| Page 1 | Introduction and Rationale for Flood Hazard Management Plan.
Identify different flood hazards in Squamish. |
| Page 2 | Historical Photos.
Historical Flood Experience.
Costs of Flooding to individuals and governments (i.e., taxpayers). |
| (Map insert) | Full page map of Squamish will show general location of flood hazards at a scale of 1:65,000. This includes the entire District. |
| (Map insert) | Reverse page will show three detailed map inserts on key hazard areas between downtown and Brackendale. Proposed areas at a scale of 1:20,000 include Brackendale, Garibaldi-Mamquam fan and downtown Squamish (including Squamish Terminals and key parts of the Squamish Estuary and Valleycliffe areas). |
| Page 7 | Describe major elements of Flood Hazard Management Plan. Provide definitions and explanation of key technical terms commonly used in flood hazard management. |
| Page 8 | Illustrate floodproofing showing FCLs, erosion protection and setbacks. Include flow chart of typical development in flood hazard area. Include reference for further assistance. |

Key floodproofing requirements will be noted but the reader will be encouraged to refer to regulatory bylaws for details.

This format will enable a full page map of Squamish or one of three detailed map segments to be reviewed as desired in context with different descriptive elements of the Flood Hazard Management Plan. The maps will be an insert and can be removed so particular text and map elements can be reviewed together.

APPENDIX II

PROPOSED PROPERTY ACQUISITIONS

APPENDIX II

PROPOSED PROPERTY ACQUISITIONS

The following proposed property acquisitions involve lands that are in a river floodway or are within long term conservation areas where development is not appropriate:

1. **Lots 1-7 of Block 10 and Lots 1-24 of Block 11, all of Plan 4709, DL 609.**
This subdivision became non-viable after the Squamish River shifted course in 1921. These privately owned "lots" are either inaccessible or in the main stem of the Squamish River. The other 237 lots in this "paper" subdivision are all owned by the provincial Crown. The properties should be acquired, title conveyed to the Ministry of Environment, and cancellation of the plan under Section 134.2 of the *Land Title Act* requested.
2. **Plan 4580 north-west of the Squamish Airport** should also be cancelled. This 225-lot subdivision extends west from the BCR line across the Cheakamus River.
3. **Lots 10 and 11, Block 4, Plan 4727, DL 760.**
These two lots are located in the middle of Wilson Slough, a designated environmentally sensitive area. All other remaining lands in this area are owned by the District of Squamish or the provincial Crown. Their acquisition as public lands would prevent development incompatible with their current O.C.P. designation.
4. **Lands outside the dyke west of the existing downtown sea dyke alignment** should be consolidated or replotted under Part 28, Division (2) of the *Municipal Act*. The current subdivision pattern implies a potential development pattern in conflict with the O.C.P.

APPENDIX III

DRAFT OFFICIAL COMMUNITY PLAN AMENDMENT BYLAW

APPENDIX III
DRAFT O.C.P. AMENDMENT BYLAW NO. _____, 1994

A Bylaw to Amend the District of Squamish Official Community Plan Bylaw 1034, 1989.

WHEREAS pursuant to Section 944 of the *Municipal Act*, a local government may adopt or amend an official community plan;

AND WHEREAS the District of Squamish desires to amend the existing Official Community Plan with respect to flood hazards and environmentally sensitive areas;

NOW THEREFORE the Council of the District of Squamish in open meeting assembled, enacts as follows:

1.0 This bylaw may be cited as the "District of Squamish Official Community Plan Amendment Bylaw No. _____, 1994".

2.0 Section 2.3.2 (d) is repealed and the following substituted:

"The Environment:

This key element of the Strategy concerns the management of environmental hazards and the protection of environmentally sensitive areas.

The District of Squamish is located at the head of Howe Sound where five mountain rivers converge. Industrial, commercial and residential development has taken place largely in the floor of the valley and it is estimated that about 75% of the population of over 12,000 occupy flood hazard areas.

The District of Squamish Flood Hazard Management Plan Background Report prepared by Klohn Leonoff Ltd. in association with Graham Farstad Associates Ltd.

in February, 1994 identified the flood hazards in Squamish and prepared a comprehensive plan to manage these risks.

The principal flood hazards consist of the following:

SOURCE	POTENTIAL FLOOD HAZARD
• Squamish River	Flooding in Brackendale, North Yards, Dentville and downtown Squamish.
• Mamquam River	Flooding in Garibaldi Estates, North Yards, Dentville and downtown Squamish.
• Cheakamus River	Flooding and erosion in the Cheakamus Valley.
• Cheekye River	Debris flows and flooding on the Cheekye Fan.
• Stawamus River	Flooding in Valleycliffe.
• Howe Sound high tides	Flooding in downtown Squamish.

Although the existing dykes provide a significant measure of protection, they are only a partial solution for flood protection. The major dykes in Squamish are designed to provide protection for flood events that occur on average once every 200 years. If a greater flood than the 200-year event occurs, the dykes could fail by overtopping. Overtopping is possible even during a more frequently occurring flood event. All the rivers in the Squamish area transport large volumes of sediment, particularly during floods. Sediment deposition results in higher river bed levels which can cause increased water levels for the same flow. In addition, the rivers in the study area carry large organic debris, including logs, during major flood events. These can result in log jams and increased water levels. Other potential dyke failure mechanisms include erosion of the riverside of the dyke and piping failure as a result of seepage through and under the dyke. Both modes of failure could occur more frequently than once in 200 years.

To respond to the flood hazards in Squamish, the following general objectives are adopted:

- Residential uses should be encouraged outside flood hazard areas.
- Infill residential development should be accommodated in existing neighbourhoods where flood hazards are judged to be low and required mitigation measures modest.
- More intensive residential development should be accommodated where flood hazards are judged to be low and all required mitigation measures are met.
- More intensive residential development should be avoided in existing neighbourhoods where flood hazards require major mitigation (i.e. large amounts of fill or structural support required to elevate a floor system to FCLs plus erosion protection).
- Residential development should be avoided in new areas or extensions of existing neighbourhoods where flood hazards require major mitigation (i.e. large amounts of fill or structural support required to elevate a floor system to FCLs plus erosion protection).
- Institutional, commercial and light industrial development should be floodproofed to withstand the same level of protection as residential development.
- Floodproofing for heavy industrial development protected by dykes is recommended but should be left to the discretion of the developer.
- The unique circumstances in the downtown must be recognized in responding to the need for floodproofing there.

The following policies to manage these flood hazards are also adopted:

- Future development should be managed in accordance with the Flood Hazard

and Flood Hazard Management Planning maps;

- Isolated private lots should be acquired within areas where protection of the natural environment is the long term community objective;
- Public pathways should be established on top of or along dykes to improve access to, visibility of, and appreciation of natural areas in Squamish including rivers and estuary;
- Allowance for overland flow paths should be made within developments in areas subject to flood hazards;
- A corridor east of Highway 99 as shown on Sheet 1 of the Flood Hazard Management Planning Map should be maintained where building construction and fill placement are minimized in order for the area to serve as an emergency floodway and thereby enable reduced Flood Construction Levels to occur in the Dentville and downtown areas;
- Residential development should be encouraged in designated growth areas not subject to flood hazards such as north of Garibaldi Highlands and Valleycliffe;
- Zoning in Flood Hazard Areas should be reviewed and zoning amendments initiated to minimize more intensive development in areas where over 2.5 m of elevation is required to meet Flood Construction Levels;
- Zoning amendments should be initiated to minimize more intensive development where high flood and debris flow hazards have been confirmed (e.g. primarily parts of Brackendale);
- Section 215 covenants shall be obtained from property owners saving the District of Squamish and the Province of British Columbia harmless from liability or damage claims in the event of flooding prior to any subdivision or rezoning;

- Clustering of developments should be encouraged in new residential areas in order to enable sensitive natural areas and significant tree stands to remain;
- Open space and natural park uses in accordance with the Squamish Parks and Recreation Masterplan should be encouraged in selected areas that are subject to flood hazards;
- The co-operation of the Squamish Nation should be solicited to manage flood hazards;
- Multiple family uses should be encouraged adjacent to the downtown where such uses are considered appropriate and provided that all floodproofing measures can be met;
- Multiple family should be encouraged above commercial uses in the downtown;
- Lots should be acquired in co-operation with the Ministry of Environment, Lands and Parks with the object of cancelling subdivisions that are undevelopable due to changes in watercourses.

Environmentally sensitive lands have been identified in co-operation with the provincial Ministry of Environment, Lands and Parks and the federal Department of Fisheries and Oceans. The protection of fish-bearing waters is of critical importance. Any development adjacent to such creeks and waterways must therefore be vetted through the appropriate senior government agencies.

The following maps identify environmentally hazardous and sensitive conditions in the District of Squamish:

Schedule 3A — Overview Hazards Map

Schedule 3B — Flood Hazard Maps (three map sheets)

Schedule 3C — Environmentally Sensitive Lands"

3.0 Section 3.2.1 is repealed and the following substituted:

3.2.1 Land Use:

Brackendale functions as one of Squamish's five residential neighbourhoods, consisting of a variety of housing types, local commercial outlets, schools, churches and parks. Over the next 5 - 10 year period the following land use changes are anticipated for Brackendale:

- a) development of vacant single family residential lots within existing subdivisions;
- b) subdivision of acreage parcels that have subdivision potential based upon existing zoning, where the natural ground elevation is less than 2.5 metres below the Flood Construction Level and mitigation measures to protect against an avulsion of the Cheekye River approved by the Ministry of Environment, Lands and Parks;
- c) subdivision of the land on either side of Ross Road for low density residential purposes subject to compliance with approved floodproofing measures including mitigation to protect against an avulsion of the Cheekye River; and
- d) minor expansion of the local commercial area subject to compliance with approved floodproofing measures.

- 4.0 The first two paragraphs of Section 3.2.4 are repealed and the following substituted:

"Environmentally Sensitive and Hazardous Conditions:

Brackendale is located within a flood hazard area as determined by the Flood Hazard Management Plan Background Report. In order for subdivision of land to proceed and building construction to take place, floodproofing measures will be required. Floodproofing measures on individual sites will include erosion protection measures, construction of Habitable Areas above the Flood Construction Level, provision for overland flow paths, watercourse and dyke setbacks and the registration of covenants under Section 215 of the *Land Title Act* to notify property owners of flood hazards and save the District of Squamish and the Province of British Columbia harmless in the event of flood damages.

For Cheekye Fan Zone C1 and that part of C2 within 350 metres of the Cheekye River, as shown on Schedule 3B, the high debris flow risk from the Cheekye River requires that those lands remain in a natural state as a buffer or stream corridor. New building construction and any rezoning or subdivision that increases the intensity of land use will not be approved.

For the remainder of Cheekye Fan Zone C2 (excluding the area within 350 metres of the Cheekye River), and Zone C3 except in the vicinity of Ross Road, as shown on Schedule 3B, rezoning and subdivision changes will be restricted to open space recreational uses such as a golf course or other non-residential uses. A monitoring and warning system to give advance notice of an impending debris flow, a 215 covenant, and a geotechnical report pursuant to Section 734(2) of the *Municipal Act* will all be required prior to any development approval in these flood hazard areas.

For Cheekye Fan Zone C4 and the remainder of C3, area-wide mitigation to reduce the risk of a flood avulsion hazard to less than one event in 200 years to the satisfaction of the District of Squamish and the Ministry of Environment, Lands and

Parks will be required for all development except for non-residential uses, a subdivision creating no more than one additional single family lot and the development of existing lots where a single family dwelling is permitted. A 215 covenant will be required prior to any rezoning or subdivision.

Part of Brackendale is situated within the Cheekye Fan area. For Cheekye Fan Zone C4, as shown on Schedule 3B, subdivision and development of three or more lots will not be permitted unless provision is made to mitigate the risk of a flood avulsion from the Cheekye River to not more than 1 in 200 years.

- 5.0 The first paragraph of Section 3.3.4 is repealed and the following substituted:

"Environmentally Sensitive and Hazardous Areas:

The Garibaldi Estates area and surrounding lands to the south and west are subject to flood hazards from both the Squamish and Mamquam Rivers as determined by the Flood Hazard Management Plan Background Report and Schedule 3B of this Bylaw. The existing dykes will provide a significant degree of off-site protection. Further on-site protective works will be required to mitigate the risk of flood damages.

Floodproofing requirements on individual sites in Flood Hazard Areas 2 and 3 will include erosion protection measures, provision for overland flow paths, construction of Habitable Areas above the Flood Construction Level and the registration of covenants under Section 215 of the *Land Title Act* to notify property owners of flood hazards and save the District of Squamish and the Province of British Columbia harmless in the event of flood damages.

In addition to the above provisions, foundation protection measures will also be required for developments in Flood Hazard Area 4.

6.0 to

13.0 Similar provisions will be required for all other sub-areas in Section 3, namely:

North Yards	Section 3.4.4
Industrial Area	Section 3.5.4
Squamish East	Section 3.6.4
Dentville/Wilson Crescent	Section 3.7.4
Valleycliffe/Hospital Hill	Section 3.8.4
Mamquam Blind Channel	Section 3.9.4
Downtown	Section 3.10.4
Harbour/Estuary	Section 3.11.4"

14.0 Section 3.12.4 is repealed and the following substituted:

"Environmentally Hazardous Areas:

Environmentally hazardous areas are broadly identified in Schedule 3A — Overview Hazard Map. Floodproofing requirements are identified in the District of Squamish Zoning and Floodplain Management Bylaw.

Additional requirements as a condition of subdivision may be necessary as determined by the Ministry of Environment, Lands and Parks. As well, the District of Squamish Building Inspector may require a geotechnical report prior to the issuance of a building permit as authorized by Section 734 (2) of the *Municipal Act*."

15.0 Section 3.13.4 is repealed and the following substituted:

"Environmentally Hazardous Areas:

Environmentally hazardous areas are broadly identified in Schedule 3A — Overview Hazard Map. Floodproofing requirements are identified in the District of Squamish

Zoning and Floodplain Management Bylaw.

Additional requirements as a condition of subdivision may be necessary as determined by the Ministry of Environment, Lands and Parks. As well, the District of Squamish Building Inspector may require a geotechnical report prior to the issuance of a building permit as authorized by Section 734 (2) of the *Municipal Act*."

- 16.0 Section 4.5 Development Permit Area 4 is repealed and the following substituted:

"Development Permit Area 4 — District Watercourses

Designation Category (Section 945 (4) (a) of the *Municipal Act*)

a) **Designation**

Schedule 3C is hereby designated a Development Permit Area for the protection of the natural environment.

Schedule 3C consists of fish-bearing creeks and back channels and the upper reaches of the Mamquam Blind Channel known as Wilson Slough.

b) **Objectives**

The objective of this designation is to protect environmentally unique watercourses in order to retain special physical features of the District, to protect sensitive wetlands, and to provide additional open space. A number of these watercourses provide fish-bearing habitats and are considered important by the Ministry of the Environment, Lands and Parks.

c) **Guidelines**

- i) Watercourses shall have a minimum undisturbed setback from the top of bank of 6 metres (19.69 ft.). Within this setback generally no works are to be completed except for the possible provision of walkways or other non-intense recreation use;
- ii) Where works are provided, then the area within the 6 metre (19.69 ft.) setback shall be returned to the general appearance of its original condition;
- iii) The development of unobtrusive trails and observation areas for wildlife and waterfowl may be considered provided they do not conflict with the object of environmental protection;
- iv) The construction of additional roads on dedicated rights-of-way should be avoided if possible in order to protect the sensitive nature of the wetlands; and
- v) Site rehabilitation measures to restore previously disturbed or altered areas shall be considered in conjunction with the senior governmental agencies, where appropriate.

17.0 Section 4.9 is added as follows:

"4.9 Development Permit Area 8 — Hazardous Areas

Designation Category: Designation of areas for protection of development from hazardous conditions and specification of objectives and guidelines to alleviate these hazards. (Section 945 (4) (b) of the *Municipal Act*.)

Justification and Objectives:

Hazard Areas C1, C2 and C3 as shown on Schedule 3B are hereby designated Development Permit Areas.

The Cheekye River Terrain Hazard and Land Use Study undertaken by Thurber Engineering Ltd. in association with Golder Associates Ltd. prepared in March, 1993 investigated the natural hazards in the Cheekye Fan area. The report recommended a series of mitigation works and development and land use controls in response to these risks.

The justification for these Development Permit areas is provided by the Thurber/Golder report.

Hazard Area C1

"This area appears to be a high risk location for any habitable uses, even if mitigation works were constructed. Development and land use in this area should clearly be extremely limited."

Hazard Area C2

"This is a relatively large area of mostly Crown Land that appears to be, in all cases, not suitable for habitable uses but potentially suitable for outdoor recreation such as golf, horse-riding or tennis, based on the PDI (i.e. probability of death and injury) approach."

Hazard Area C3

"In response to these risks, the objectives are to restrict development to those deemed acceptable. Approval of any mitigation works and any subdivision in these areas will remain with the Ministry of Environment, Lands and Parks."

Guidelines

- i) Minor repairs to any structure in Hazard Areas C1, C2 and C3 will be approved by the District of Squamish subject to a 215 covenant pursuant to the *Land Title Act* to save the District and the Province of British Columbia harmless in the event of any flood or debris flow damages.
- ii) Major repairs to any structure in Hazard Areas C1, C2 and C3 will require a geotechnical report pursuant to Section 734 (2) of the *Municipal Act* and a 215 covenant pursuant to the *Land Title Act*;
- iii) New building construction and any rezoning or subdivision that would increase the intensity of land use in Hazard Area C1 and that part of C2 within 350 metres of the Cheekye River will not be approved;
- iv) For the remainder of Hazard Zones C2 and C3, except in the vicinity of Ross Road, rezoning and subdivision changes will be restricted to open space recreational or other non-residential uses. A monitoring and warning system to give advance notice of an impending debris flow, a 215 flood covenant and a geotechnical report pursuant to Section 734(2) of the *Municipal Act* will all be required prior to any development approval in these flood hazard areas;
- v) For the remainder of Hazard Zones C3 and C4, area-wide mitigation to reduce the risk of a flood avulsion hazard to less than one event in 200 years to the satisfaction of the District of Squamish and the Ministry of Environment, Lands and Parks will be required for all development except for non-residential uses, a subdivision creating not more than one additional single family lot and the development of existing lots where a single family dwelling is permitted. A 215 covenant will be required prior to any rezoning or subdivision.

Section C A connected series of dykes and roads near Westminster Street and along the southerly extension of Third Avenue.

Section D The B.C. Railway embankment on the west side of downtown Squamish. The old sea dyke on the west side of downtown, which is partly overgrown, would not form part of the sea dyke system.

The District of Squamish will pursue these needed protective works in conjunction with senior governments and other benefitting parties."

May 2, 1994

READ A FIRST TIME this ____ day of _____, 1994.

READ A SECOND TIME this ____ day of _____, 1994.

A Public Hearing was held pursuant to Section 956 of the *Municipal Act*
this ____ day of _____, 1994.

READ A THIRD TIME this ____ day of _____, 1994.

RECONSIDERED and finally adopted this ____ day of
_____, 1994.

Mayor

Clerk

THIS IS CERTIFIED to be a true and correct copy.

Clerk

DATED at Squamish, British Columbia, this ____ day of _____, 1994.

APPENDIX IV

DRAFT 969 BYLAW FLOODPLAIN MANAGEMENT PROVISIONS

APPENDIX IV
DRAFT 969 BYLAW (FLOODPLAIN MANAGEMENT PROVISIONS)

DISTRICT OF SQUAMISH FLOODPLAIN MANAGEMENT BYLAW NO. _____, 1994

WHEREAS a local government, pursuant to Section 969 of the *Municipal Act*, may enact a bylaw, where it considers that flooding may occur on land;

AND WHEREAS the purpose of this bylaw is to reduce the risk of injury, loss of life, and damage to buildings and other structures due to flooding, notwithstanding that neither the District of Squamish, nor the Province of British Columbia represent to any person that any building or other structure used, constructed, or located in accordance with the following provisions will not be damaged by flooding;

AND WHEREAS the provisions contained in this bylaw are based on the recommendations of the Water Management Branch of the Ministry of Environment, the Ministry of Municipal Affairs, Recreation and Housing and reports entitled "District of Squamish Flood Hazard Management Study Background Report" dated February 1994 and "District of Squamish Flood Hazard Management Plan" dated April 1994, both prepared by Klohn Leonoff Ltd. in association with Graham Farstad Associates Ltd.;

AND WHEREAS a local government may enact a single bylaw, pursuant to Section 943.1 of the *Municipal Act*, combining the floodplain management provisions of this bylaw with those of the District of Squamish Zoning Bylaw No. 751, 1981, as amended;

NOW THEREFORE the District of Squamish enacts as follows:

1.0 Title

This bylaw may be cited as the "District of Squamish Floodplain Management Bylaw No. _____, 1994".

2.0 Definitions

CRAWL SPACE means an area below a Flood Construction Level not exceeding a height of 1.5 metres.

DESIGNATED FLOOD means a flood, which may occur in any given year, of such magnitude as to equal a flood having a 200 year recurrence interval, based on a frequency analysis of unregulated historic flood records or by regional analysis where there is inadequate streamflow data available;

DESIGNATED FLOOD LEVEL means the observed or calculated elevation for the Designated Flood, which is used in the calculation of the Flood Construction Level;

DYKE means an embankment built to a minimum crest elevation equal to the Flood Construction Level and meeting standards of design and construction approved by the Ministry of Environment, Lands and Parks and maintained by the District of Squamish.

FINISHED GRADE means the final grade of a site after a site grading plan, approved by the District of Squamish, has been completed;

FLOOD CONSTRUCTION LEVEL means a Designated Flood Level at GSC datum including Freeboard, or where a Designated Flood Level cannot be determined, a specified height above a Natural Boundary, Natural Ground Elevation, or any obstruction that could cause ponding;

FLOODPLAIN means a flood hazard area which is designated in Section 3.0 of this bylaw;

FLOODPLAIN SETBACK means the required minimum distance from the Natural Boundary of a watercourse, lake, or other body of water to any landfill or structural

support required to elevate a floor system or pad above the Flood Construction Level, so as to maintain and allow for potential land erosion;

FLOOD RESISTANT MATERIALS shall consist of those construction materials that will sustain being submerged in water for a period of not less than 48 hours without damage, are impervious to water, and are easily repaired should damage occur.

HABITABLE AREA means any space or habitable room that is or can be used for dwelling purposes, business, or the storage of goods;

NATURAL GROUND ELEVATION means the undisturbed ground elevation prior to site preparation;

PAD means a paved surface on which blocks, posts, runner or strip footings are placed for the purpose of supporting a Mobile Home, a Modular Home or a concrete pad for supporting any other Habitable Area.

3.0 Application

- 3.1 This bylaw shall apply to Flood Hazard Areas 1, 2, 3, 4, 5, 6, C1, C2, C3 and C4 as shown on the District of Squamish Flood Hazard Maps (sheets 1, 2, and 3) prepared by Klohn Leonoff Ltd. in association with Graham Farstad Associates Ltd. dated February 1994 attached hereto as Schedule "A" and forming part of this bylaw.
- 3.2 This bylaw shall also apply to the Cheakamus River 200-year floodplain limit as issued by the Ministry of Environment in April, 1986 and shown on Drawing numbers 85-15-1, 85-15-2 and 85-15-3.

4.0 Floodplain Designation

- 4.1 Flood Hazard Areas 1, 2, 3, 4, 5, 6, C1, C2, C3 and C4, as shown on Schedule 'A', and the Cheakamus River floodplain as described in Section 3.2, are hereby designated as a floodplain.
- 4.2 The boundary of each Flood Hazard Area in Schedule 'A' is identified by a solid line, or a heavy dashed line where the boundary consists of a Dyke.
- 4.3 Where a property is partially within a designated floodplain, the entire property shall be deemed to be within the designated floodplain.

5.0 Flood Construction Levels

- 5.1 Flood Construction Levels in Flood Hazard Areas 1, 2 and 6 shall consist of those geodetic elevations surrounded by hexagons adjacent to solid lines that extend across Flood Hazard Areas on the District of Squamish Flood Hazard Management Planning Maps (sheets 1, 2, and 3) prepared by Klohn Leonoff Ltd. in association with Graham Farstad Associates Ltd. dated February 1994, attached hereto as Schedule 'B' and forming part of this bylaw.
- 5.2 The Flood Construction Level for any site not located on the solid lines with specified geodetic elevations shall be determined as a measure of the proportionate distance between the nearest higher and lower geodetic elevations.
- 5.3 Flood Construction Levels in Flood Hazard Areas 3, C3 and C4 shall consist of the Finished Grade plus 1.0 metre or downslope embankment plus 0.6 metre, whichever is higher.
- 5.4 Flood Construction Levels in Flood Hazard Area 4 shall consist of the:
- a) geodetic elevations in Schedule 'B',
 - b) Finished Grade plus 1.0 metre, or
 - c) downslope embankment plus 0.6 metre, whichever is highest.

6.0 Floodplain Setbacks

The following distances are specified as Floodplain Setbacks:

- a) 30 metres from the natural boundary of the Squamish, Mamquam or Stawamus Rivers except behind a Dyke in which case the floodplain setback shall be 7.5 metres from the inboard toe of a Dyke;
- b) 60 metres from the natural boundary of the Cheakamus or Cheekye Rivers;
- c) 15 metres from the natural boundary of any other watercourse; or
- d) 7.5 metres from the natural boundary of Howe Sound, a lake, pond or swamp.

7.0 Application of Floodplain Specifications

7.1 Pursuant to Section 969 (5) of the *Municipal Act*, after a bylaw has specified Flood Construction Levels and Floodplain Setbacks:

- a) the underside of any floor system containing a Habitable Area susceptible to damage by floodwater, including a Mobile Home or a Modular Home, shall be above the Flood Construction Level;
- b) the top of any Pad used to anchor a Mobile Home or a Modular Home shall be not more than 0.6 metres below the Flood Construction Level; and
- c) any landfill required to support a floor system or Pad shall not extend within any Floodplain Setback from a watercourse or body of water specified by this bylaw or the Minister of Environment, Lands and Parks.

7.2 In Flood Hazard Areas C1 and C2 adjacent to the Cheekye River, no building development shall take place in recognition of the high debris flow hazard.

- 7.3 In Flood Hazard Areas 2, 3, C3 and C4, erosion protection measures in the form of an engineered retaining wall, rip rap or cribbing shall be required to protect fill material against scour and erosion from flood flows.
- 7.4 In Flood Hazard Area 4, foundation protection measures prepared by a professional engineer shall be required to protect against scour and erosion from flood flows.
- 7.5 In Flood Hazard Area 5, which consists of the existing river floodways, no fill placement shall be allowed and no building development shall take place.
- 7.6 The Building Inspector, or such person appointed by the District of Squamish, may require that a British Columbia Land Surveyor's certificate be required to verify compliance with the Flood Construction Levels and Floodplain Setbacks specified in Sections 5.0 and 6.0. The cost of verification shall be assumed by the land owner.
- 7.7 Any Habitable Area in Flood Hazard Area 1 that is below the Flood Construction Level specified in Section 5.0, and is not used for dwelling purposes, shall be deemed to comply with the provisions of Section 5.0 if the entrances to and exits from the Habitable Area can be sealed against a Designated Flood and the building designed by a Professional Engineer to withstand the uplift pressures of a Designated Flood.
- 7.8 Where a property is within two or more Flood Hazard Areas of a designated floodplain, the more restrictive floodplain requirements shall apply.
- 8.0 General Exemptions**
- 8.1 The following types of development are exempted from the requirements of Section 969 (5) (a) of the *Municipal Act* unless precluded by a Section 215 flood covenant:
- 1) The repair or renovation of an existing building or structure, provided that 75 percent of its value above its foundations is not damaged or destroyed;

- 2) An addition to a building or structure at the original non-conforming floor elevation, that would increase the size of the building or structure by less than 25 percent of the original ground floor area (excluding carports or garages), provided that the degree of non-conformity regarding setback is not increased (i.e. no closer to the flood hazard area than existing);
- 3) That portion of a building or structure to be used as a carport or garage;
- 4) Accessory buildings as permitted in the Zoning Bylaw;
- 5) On-loading and off-loading facilities associated with water-oriented industry;
- 6) Crawl spaces;
- 7) Heavy Industrial uses behind a Dyke, other than main electrical switchgear and excluding accessory business and professional offices;
- 8) Entrance foyer to a Single Family, Two Family or Townhouse Dwelling not exceeding an area of 20 m²;
- 9) Hot water tanks and furnaces behind a Dyke;
- 10) One utility or laundry room not exceeding an area of 11 m² on a Parcel;
- 11) Swimming pools;
- 12) Any Habitable Area not used for dwelling purposes only in Flood Hazard Area 1 and only where such Habitable Area does not exceed 300 m² on any site; and
- 13) Existing mobile home parks provided there is no increase in the number of Mobile Homes or other Habitable Areas.

- 8.2 Section 8.1 (12) shall only apply if brick, stone, painted concrete, painted cement blocks, ceramic or porcelain tile, aluminum, galvanized steel, plastic laminate, waterproof backing board or other materials certified as Water Resistant by the Canadian Standards Association or the Underwriters' Laboratories of Canada are used for any construction below the Flood Construction Level. A list of such materials, specifications and drawings showing material assemblies sufficient to meet the above criteria shall be submitted to the Building Inspector.

9.0 Site-Specific Exemptions

An application by a property owner to the Minister of Environment, Lands and Parks for a site-specific exemption shall be completed on a form provided by the District of Squamish which is attached as Schedule 'C' and submitted in accordance with the instructions on the application.

10.0 Consequential Changes

- 10.1 Section 2.1.2 Flood Plain Regulations, of the District of Squamish Zoning Bylaw No. 751, 1981 is hereby repealed.
- 10.2 District of Squamish Zoning Bylaw No. 751, 1981 is hereby renamed the District of Squamish Zoning and Floodplain Management Bylaw No. _____, 1994.
- 10.3 District of Squamish Floodplain Management Bylaw No. _____, 1994 shall be included as Section 4 of District of Squamish Zoning and Floodplain Management Bylaw No. _____, 1994.

READ A FIRST TIME this _____ day of _____, 1994.

READ A SECOND TIME this _____ day of _____, 1994.

READ A THIRD TIME this _____ day of _____, 1994.

May 2, 1994

APPROVED by the Minister of Environment, Lands and Parks on this ____ day of _____, 1994.

Minister of Environment, Lands and Parks

RECONSIDERED and adopted the ____ day of _____, 1994.

Mayor

Clerk

I HEREBY CERTIFY the foregoing to be a true and correct copy of the District of Squamish Floodplain Management Bylaw No. ____, 1994.

DATED at Squamish, British Columbia, this ____ day of _____, 1994.

Clerk

APPENDIX V

CONDITIONS RESPECTING THE APPROVAL OF SUBDIVISIONS IN
DESIGNATED FLOODPLAIN AREAS UNDER THE LAND TITLE ACT

APPENDIX V
CONDITIONS RESPECTING THE APPROVAL OF
SUBDIVISIONS IN DESIGNATED FLOODPLAIN AREAS
UNDER THE LAND TITLE ACT

Section 82 of the *Land Title Act* concerns the subdivision of lands subject to flooding. Key regulatory provisions under this enabling legislation to meet the requirements by the Ministry of Environment, Lands & Parks should include the following:

1. Designation of areas 1 to 6 and C1 to C4* as shown on the Flood Hazard Maps as flood plain areas under Section 82(1).
2. Require that all subdivisions within these areas provide floodproofing as specified on the Flood Hazard Management Planning Maps.
3. Require the owner of land being subdivided within these areas to enter into a covenant under Section 215 of the *Land Title Act* to ensure floodproofing measures are met and save the District of Squamish and provincial government harmless in the event of flooding.
4. Authorize the approval of subdivisions by the Approving Officer appointed by the District of Squamish in Flood Hazard Areas 1, 2, 3, 4 and 6 subject to compliance with the conditions established by the Ministry of Environment, Lands & Parks.
5. Require the consent of the Ministry of Environment, Lands & Parks for any subdivision which does not comply with the required floodproofing measures.

* Area C4 approval subject to avulsion mitigation plan.

APPENDIX VI

PROPOSED SCOPE OF WORK FOR AVULSION HAZARD MITIGATION PLAN

APPENDIX VI

PROPOSED SCOPE OF WORK FOR AVULSION HAZARD MITIGATION PLAN

The scope of work for an engineering study to prepare an avulsion hazard mitigation plan for Area C4 should include the following:

- analysis of debris transport in the Cheekye River;
- estimate of the frequency and magnitude of debris blockage;
- estimate of the frequency and magnitude of avulsions;
- preliminary design and costing of mitigation works including diversion dykes and drainage systems for the 1 in 200-year event;
- assessment of risk transfer for larger events than 1 in 200 years.

The estimated cost for such a study is \$16,000.

APPENDIX VII

FLOOD HAZARD MAPS

APPENDIX VIII

FLOOD HAZARD MANAGEMENT PLANNING MAPS