

## City of Chilliwack

### Bylaw No. 4519

#### **A bylaw to designate land as Floodplain and make provisions in relation to flood control, flood hazard management and development of land that is subject to flooding or erosion.**

---

WHEREAS Council is authorized under the *Local Government Act* (Section 524) to enact a bylaw to designate land as Floodplain and to make regulations in relation to flood control, flood hazard management and development of land that is subject to flooding;

AND WHEREAS Council has considered the Flood Hazard Area Land Use Management Guidelines published by the Province of British Columbia in May 2004, as amended, under authority of the *Environmental Management Act*;

AND WHEREAS Council has considered the Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC, commissioned by the Ministry of Forests, Lands and Natural Resource Operations and adopted in June 2012 by Engineers and Geoscientists British Columbia Council under authority of the *Engineers and Geoscientists Act*;

AND WHEREAS the requirements of this bylaw were established with the assistance of Qualified Professionals.

NOW THEREFORE the Council of the City of Chilliwack enacts as follows:

1. This bylaw may be cited as “**Floodplain Regulation Bylaw 2018, No. 4519**”.
2. “Floodplain Regulation Bylaw 2004, No. 3080” and amendments thereto are hereby repealed.

#### **BYLAW OUTLINE AND SCHEDULES**

3. This bylaw covers:
  - Definitions (Section 4)
  - Designation of Floodplain Areas (Section 5)
  - Flood Protection Requirements (Sections 6 to 17)
  - General Exemptions (Sections 18 to 20)
  - Building Size Exemptions (Section 21)
  - Residential and Institutional Uses Permitted Below a FCL (Section 22)
  - Site Specific Application (Section 23)
  - Inspections, Offences, Penalties and Severability (Sections 24 to 27)

The following Schedules constitute part of the Bylaw:

Schedule A – Map of Floodplain Areas

Schedule B – Guidelines for Site Specific Application by a Qualified Professional

## DEFINITIONS

4. In this Bylaw:

“Alluvial Fan” means an accumulation of sediment where a steep stream channel flows out onto a valley floor of reduced gradient, often fan-like in shape, subject to further additions of sediment;

“Approving Officer” means the official who is appointed under the *Land Title Act*;

“Covenant” means a Covenant registered on title of land under the *Land Title Act*, absolving the City of Chilliwack of any liability with respect to the flooding of the property or flood damage to land, structures and contents thereof;

“Crawl Space” means an area located in part or entirely below the Flood Construction Level having a maximum height from floor to ceiling of 1.5 m;

“Debris Flow” means the rapid downslope movement descending steep pre-existing drainage channels of water-saturated soil and debris;

“Design Flood” means a flood equal in magnitude to the 1894 flood of record with respect to the Fraser River OR 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 frequency analysis of unregulated historic flood records with respect to the Chilliwack River, Vedder River and Vedder Canal;

“Design Flood Level” means the observed or calculated elevation for the Design Flood and is used in the calculation of the Flood Construction Level;

“EGBC” means Engineers and Geoscientists British Columbia;

“Flood Construction Level (FCL)” means the Flood Construction Levels as indicated on Schedule “A”, attached hereto and forming part of this Bylaw;

“Floodplain” means the area shown on Schedule “A”, attached hereto and forming part of this Bylaw;

“Floodproofing” means the alteration of land or buildings to reduce flood damage and includes the use of building setbacks from water bodies to maintain a floodway and to allow for potential erosion. Floodproofing may be achieved by either, or a combination of the following:

- building on structural fill, provided such fill does not interfere with flood flows of the watercourse, and is adequately protected against floodwater erosion and scour;
- building raised by foundation walls, columns or piles;

“Freeboard” means a vertical distance added to the actual calculated flood level to accommodate uncertainties (hydraulic and hydrologic variable), potential for waves, surges, and other natural phenomena;

“Geodetic Survey of Canada (GSC)” means the measurement of height in reference to the coastal mean sea level for North America pursuant to an agreement between the United States of America and Canada.

- “Habitable Area” means any room or space within a building or structure that is or can be used for human occupancy, assembly or Institutional Use, commercial sales, or storage of goods, possessions or equipment (including furnaces) which would be subject to damage if flooded;
- “Inspector of Dikes” means a provincial employee appointed under the *Dike Maintenance Act* with the statutory authority to oversee maintenance of dikes by diking authorities, set diking standards and approve changes to existing dikes and new dikes;
- “Institutional Use” means a use providing for public functions and includes federal, provincial, regional and municipal offices, schools, churches, colleges, hospitals, community centres, libraries, museums, jails, courts of law and similar facilities; and specifically excludes public storage and works yards, and public utility uses;
- “Manufactured Home” means a structure manufactured as a unit, intended to be occupied in a place other than at its manufacture, and designed as a dwelling unit, and includes mobile homes, and specifically excludes Recreation Vehicles;
- “Natural Boundary” means the visible high watermark of any lake, river, stream, or other body of water where the presence and action of the water are so common and usual and so long continued in all ordinary years as to mark upon the soil of the bed of the lake, river, stream or other body of water a character distinct from that of the banks thereof, in respect to vegetation, as well as in respect to the nature of the soil itself;
- “Natural Ground Elevation” means the average of the undisturbed ground elevations at the four corners of the proposed building site;
- “Non-Conforming” means any existing building located on flood prone land that does not meet Floodproofing requirements set out in any pertinent bylaw, regulation or Covenant;
- “Pad” means a compacted gravel, paved or concrete surface on which blocks, posts, runners or strip footings are placed for the purpose of supporting a Manufactured Home or unit;
- “Ponding Elevation” means the water surface elevation as controlled by the lowest ground or road elevation of the area, which would act as the outlet to that area, if a storm runoff exceeds the capacity of culverts or other in-ground drainage works;
- “Professional Engineer” means a person who is registered or licensed as a Professional Engineer under the provisions of the *Engineers and Geoscientists Act*;
- “Professional Geoscientist” means a person who is registered or licensed as a Professional Geoscientist under the provisions of the *Engineers and Geoscientists Act*;
- “Provincial Guidelines” means the *Flood Hazard Area Land Use Management Guidelines*, Ministry of Water, Land and Air Protection, dated May 2004 (updated August 17, 2011), in relation to flood control, flood hazard management and development of land that is subject to flooding in the Province of British Columbia, and *Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC* commissioned by the Ministry of Forests, Lands and Natural Resource Operations, dated June 2012, as amended from time to time;

“Qualified Professional” means a Professional Engineer, Professional Geoscientist, licensee, including limited licensees with the appropriate level of education, training and experience to conduct flood assessments and licensed to practice by EGBC;

“Recreation Use” means a use providing for indoor or outdoor recreation and includes parks, playgrounds, and sports facilities;

“Recreation Vehicle” means any structure, trailer or vehicle used or designed to be used for living or sleeping purposes and which is designed or intended to be mobile on land, whether or not self-propelled;

“Standard Dike” means a dike considered by the Inspector of Dikes to meet minimum provincial standards including: design and construction to contain the Design Flood; design and construction completed under the supervision of a Qualified Professional; an effective dike management and maintenance program by a local diking authority; and legal access;

“Training Works” means any wall, dike or protective structure used to prevent a stream from leaving its channel at a given location. This includes any Debris Flow training structures including basins, trash racks, or other works;

“Watercourse” means any natural or man-made depression with well-defined banks and a bed 0.6 m or more below the surrounding land serving to give direction to a current of water at least 6 months of the year or having a drainage area of 2 square kilometres or more upstream of the point of consideration.

## **DESIGNATION OF FLOODPLAIN AREAS**

- 5.** The following areas of the City of Chilliwack are designated as Floodplain:
- (1) the Floodplains of the Fraser River, Chilliwack River, Vedder River and Vedder Canal as shown on Schedule “A” attached hereto and forming part of this Bylaw; and,
  - (2) the Alluvial Fans and Floodplains of several creeks adjacent to the Fraser Valley as shown on Schedule “A”, attached hereto and forming part of this Bylaw.

## **FLOOD PROTECTION REQUIREMENTS**

### Setback Requirements

- 6.** Unless specified elsewhere in this Bylaw, no building or part of a building for which Floodproofing is required shall be constructed, reconstructed, moved or extended, nor shall any Manufactured Home or unit be located within the minimum setback from a Watercourse, body of water or dike as specified below:
- (1) 60 m of the Natural Boundary of the Fraser River;
  - (2) 75 m of the Natural Boundary of the Vedder River;
  - (3) 30 m of the Natural Boundary of the Chilliwack River and Vedder Canal;

**FLOOD PROTECTION REQUIREMENTS (continued)**

Setback Requirements (continued)

- (4) 15 m of the Natural Boundary of any other Watercourse or the edge of a bluff, subject to erosion or 3 times the height of the bluff (as measured vertically from the toe to top of bluff), whichever is greater;
  - (5) 7.5 m of the Natural Boundary of a lake, swamp, pond or drainage ditch;
  - (6) 10 m of any structure for flood protection or seepage control or any dike right of way.
7. No landfill or structural support required to support a floor system or Pad, shall be constructed, reconstructed, moved, extended or located within the Floodplain setback specified in Section 6 of this Bylaw.

Elevation Requirements for Areas Protected by a Standard Dike

8. Within areas protected by a Standard Dike, unless specified elsewhere in this Bylaw, no building or any part of a building, Manufactured Home or unit, shall be constructed, reconstructed, moved or extended with the underside of a wooden floor system or top of a concrete foundation of any Habitable Area, nor shall any Pad be located lower than (whichever elevation is greater):
- (1) the applicable FCL for the Fraser River, Chilliwack River, Vedder River or Vedder Canal as indicated on Schedule “A”, attached hereto and forming part of this Bylaw, plus 0.6 m Freeboard;
  - (2) 1.5 m above the boundary of any other natural watercourse;
  - (3) 0.6 m above the top of bank of any drainage ditch;
  - (4) 0.3 m above the crown of the adjacent road.
- The 0.6 m Freeboard requirement may be waived on the condition that the owner registers a Covenant against the title and also provides a Qualified Professional’s report indicating that the property may be safely used for the intended purpose.
9. Within areas protected by a Standard Dike, a dwelling unit or other building thereon may be constructed with the underside of a wooden floor system or the top of the Pad of any Habitable Area no lower than 2.5 m above the Natural Ground Elevation, provided that:
- (1) the difference between the FCL and the ground exceeds 2.5 m;
  - (2) the owner has provided a report from a Qualified Professional that the land can be used safely for the intended purpose; and,
  - (3) the owner enters into a Covenant, absolving the City of Chilliwack of any liability with respect to the flooding of the property or flood damage to land, structures and contents thereof.
10. Structural support or compacted landfill or a combination of both may be used to elevate the underside of the floor system or the top of the Pad to the requirements specified in Section 8 and 9 of this Bylaw.

Flood Protection Requirements in Yarrow and Greendale

- 11.** Within the Yarrow Area and Greendale Areas shown on Schedule “A”, attached hereto and forming part of this Bylaw, a building may be constructed, reconstructed, moved or extended, or a Manufactured Home located with the underside of the lowest Habitable Area, at a minimum elevation of 1.2 m above the Natural Ground Elevation, or no less than 0.3 m above the crown of the adjacent road, whichever elevation is greater; provided that:
- (1) the owner has provided a report from a Qualified Professional that the land can be used safely for the intended purpose; and,
  - (2) the owner enters into a Covenant absolving the City of Chilliwack of any liability with respect to the flooding of the property or flood damage to land, structures and contents thereof.
- 12.** Structural support or compacted landfill or a combination of both may be used to elevate the underside of the floor system or the top of the Pad to the requirements specified in Section 11 of this Bylaw.

Flood Protection Requirements North and East of Shefford Slough, South of Cartmell Road and West of Young Road

- 13.** Within the area north and east of Shefford Slough, south of Cartmell Road and west of Young Road as shown on Schedule “A”, attached hereto and forming part of this Bylaw, a single family dwelling may be constructed provided that:
- (1) the underside of the lowest Habitable Area is above the applicable FCL;
  - (2) any entrance foyer or crawlspace shall be no lower than the applicable FCL minus 1.5 m;
  - (3) furnaces, hot water heaters and electrical panels shall be located above the FCL;
  - (4) any electric circuits extending below the FCL shall be equipped with ground fault circuit breakers; and,
  - (5) the owner enters into a Covenant absolving the City of Chilliwack of any liability with respect to the flooding of the property or flood damage to land, structures and contents thereof.
- 14.** Structural support or compacted landfill or a combination of both may be used to elevate the underside of the floor system or the top of the Pad to the requirements specified in Section 13 of this Bylaw. The structural support and landfill shall be adequately protected against erosion by floodwaters.

Flood Protection Requirements for Areas Not Protected by a Standard Dike

- 15.** No building or structure is permitted to be constructed in the Floodplain in an area not protected by a Standard Dike as depicted on Schedule “A”, attached hereto and forming part of this Bylaw, *except a renovation or addition to a building as specified in Section 21 of this Bylaw.* (AB#4557)

Flood Protection Requirements on an Alluvial Fan

- 16.** Construction on an Alluvial Fan as designated on Schedule “A”, attached hereto and forming part of this Bylaw, shall be in accordance with Provincial Guidelines and meet the following requirements:
- (1) a site specific assessment by a Qualified Professional is required to determine building setback and elevation requirements;
  - (2) an engineered concrete foundation shall extend to a minimum of 1.0 m above the grade at any point on the perimeter of the building on an Alluvial Fan;
  - (3) the design, construction, operation and maintenance of the protective works shall be certified by a Qualified Professional to ensure that structures are anchored to minimize the impact of flood, sediment and erosion damage;
  - (4) footings shall be extended below scour depth, erosion and flood flows;
  - (5) where protective works are required, an ongoing maintenance program shall be required as part of the covenant agreement between the City of Chilliwack and an owner, or a strata corporation;
  - (6) where works protect more than one property:
    - (a) easements or rights of way for the works and access to the works must be registered in favor of the City of Chilliwack;
    - (b) an Operation and Maintenance manual must be prepared for the City of Chilliwack with a copy to the Inspector of Dikes;
    - (c) Training Works or a dike protecting more than one property must be approved by the Inspector of Dikes; and may also require approval under the Provincial *Water Sustainability Act* and the Federal *Fisheries Act*.

Flood Protection Requirements in Debris Flow Hazard Areas

- 17.** A site specific assessment by a Qualified Professional is required to determine building setback and elevation requirements, and construction of protective works, in Debris Flow hazard areas, which are broadly included in Development Permit Area No. 2 - Hillside and Upland Areas.

**GENERAL EXEMPTIONS**

Agricultural Exemptions

- 18.** The elevation requirements above shall not apply to:
- (1) farm buildings and open-sided livestock housing (other than dwelling units and closed-sided livestock housing) protected by a Standard Dike;
  - (2) farm buildings and open-sided livestock housing (other than dwelling units and closed-sided livestock housing) not protected by a Standard Dike, on the condition that the owner provides a Qualified Professional’s report indicating that the property may be safely used for the intended purpose;

**GENERAL EXEMPTIONS** (continued)

Agricultural Exemptions (continued)

- (3) closed-sided livestock housing protected by a Standard Dike if elevated to 0.6 m above the Ponding Elevation;
  - (4) closed-sided livestock housing, not protected by a Standard Dike, if elevated to 1.0 m above Natural Ground Elevation or 0.6 m above the Ponding Elevation or the FCL minus 1.5 m, whichever is greater on the condition that the owner provides a Qualified Professional’s report indicating that the property may be safely used for the intended purpose.
- 19.** Where a lot is within the Agricultural Land Reserve, a dwelling unit thereon may be constructed with the underside of a wooden floor system or the top of the Pad of any Habitable Area no lower than 1.2 m above the Natural Ground Elevation or 0.3 m above the crown of the adjacent road, whichever elevation is greater, provided that:
- (1) the property is protected by a Standard Dike; and,
  - (2) the owner enters into a Covenant, absolving the City of Chilliwack of any liability with respect to the flooding of the property or flood damage to land, structures and contents thereof.

Other Land Use Exemptions

- 20.** The elevation requirements in this Bylaw shall not apply to:
- (1) industrial uses within areas designated for industrial use in the City of Chilliwack “Official Community Plan”, as amended from time to time, or occupied by an industrial use and which are protected by a Standard Dike, provided that:
    - (a) the underside of the lowest floor system or surface of the floor slab is no lower than 0.15 m above the crown of the nearest road where water may pond; *and*, (AB#4557)
    - (b) fixed equipment susceptible to damage by floodwaters is no lower than the FCL.
  - (2) on-loading and off-loading facilities associated with water oriented industry and portable sawmills provided the main electrical switchgear is placed above the FCL;
  - (3) commercial uses within the Downtown Land Use Plan Area as indicated in the Chilliwack “Official Community Plan”, as amended from time to time, and which are protected by a Standard Dike, provided the underside of the lowest floor system or surface of the floor slab is no lower than 0.15 m above the crown of the nearest road where water may pond;
  - (4) commercial uses not within the Downtown Land Use Plan Area as indicated in the “Chilliwack Official Community”, as amended from time to time, other than tourist accommodation units, and which are protected by a Standard Dike, provided the underside of the lowest floor system or surface of the floor slab is no lower than 0.30 m above the crown of the nearest road where water may pond;
  - (5) an ancillary building such as a garage or workshop;



**GENERAL EXEMPTIONS (continued)**

Other Land Use Exemptions (continued)

- (6) that portion of a building or structure to be used as a carport, garage, entrance foyer and mechanical room including hot water tanks and furnaces in buildings protected by a Standard Dike; and,
- (7) recreation shelters and washrooms.

**BUILDING SIZE EXEMPTIONS**

- 21.** The elevation requirements in this Bylaw do not apply to:
  - (1) a renovation or addition to a building or structure that would increase the size of the building or structure, at the original Non-Conforming floor elevation, by less than 25 percent of the floor area existing at the date of the adoption of “Floodplain Management Bylaw 1996, No. 2395” (March 3, 1997); and,
  - (2) that portion of a building consisting of crawl space.

**RESIDENTIAL AND INSTITUTIONAL USES PERMITTED BELOW A FCL**

- 22.** The area below the FCL as applied to a residential or Institutional Use may be used for entrance foyer, utility room, workshop or indoor Recreation Uses provided that:
  - (1) the floor level of all of these areas is at least 0.30 m above the crown of the nearest road where water may pond; *and*, (AB#4557)
  - (2) the owner enters into a Covenant absolving the City of Chilliwack of any liability with respect to the flooding of the property or flood damage to land, structures and contents thereof.

**SITE SPECIFIC APPLICATION**

- 23.** Notwithstanding the above, Council may grant a site specific exemption with respect to the setback requirements or elevation requirements elsewhere in this Bylaw where:
  - (1) a Qualified Professional has submitted an application in accordance with the City of Chilliwack “Guidelines for Site Specific Application”, attached hereto as Schedule “B”, and forming part of this Bylaw;
  - (2) a Qualified Professional has submitted a site specific report, consistent with Provincial Guidelines and EGBC Professional Practice Guidelines, and supplemented with a flood hazard and risk assurance statement as specified in Appendix J of EGBC Professional Practice Guidelines, that certifies that the property can be safely used for the intended use and that protection from a 1 in 200 year flood on the Chilliwack River, Vedder River and Vedder Canal or from the 1894 flood on the Fraser River can be achieved through an engineered design without reliance on a Standard Dike; and,
  - (3) the owner enters into a Covenant absolving the City of Chilliwack of any liability with respect to the flooding of the property or flood damage to land, structures and contents thereof.

**INSPECTION**

24. No person shall interfere with or obstruct the entry of any authorized representative of the City of Chilliwack, on the land or into any structure, with respect to the administration or enforcement of this Bylaw.

**OFFENCE**

25. No person shall contravene, cause, or permit a contravention of this Bylaw.

**PENALTY**

26. Any person contravening any provision of this Bylaw is liable on summary conviction to a fine under the *Offence Act* of not more than \$2,000. Each day that the offence occurs constitutes a separate offence.

**SEVERABILITY**

27. If any part of this Bylaw is for any reason held to be invalid by the decision of any Court of competent jurisdiction, the part of the Bylaw held to be invalid shall be struck from the Bylaw and the decision shall not affect the validity of the remainder of the Bylaw.

Received first and second reading on the 17<sup>th</sup> day of April, 2018.

Received third reading on the 17<sup>th</sup> day of April, 2018.

Received adoption on the 1<sup>st</sup> day of May, 2018.

Amendment Bylaw No. 4557 adopted on the 17<sup>th</sup> day of July, 2018.

“Chris Kloot”

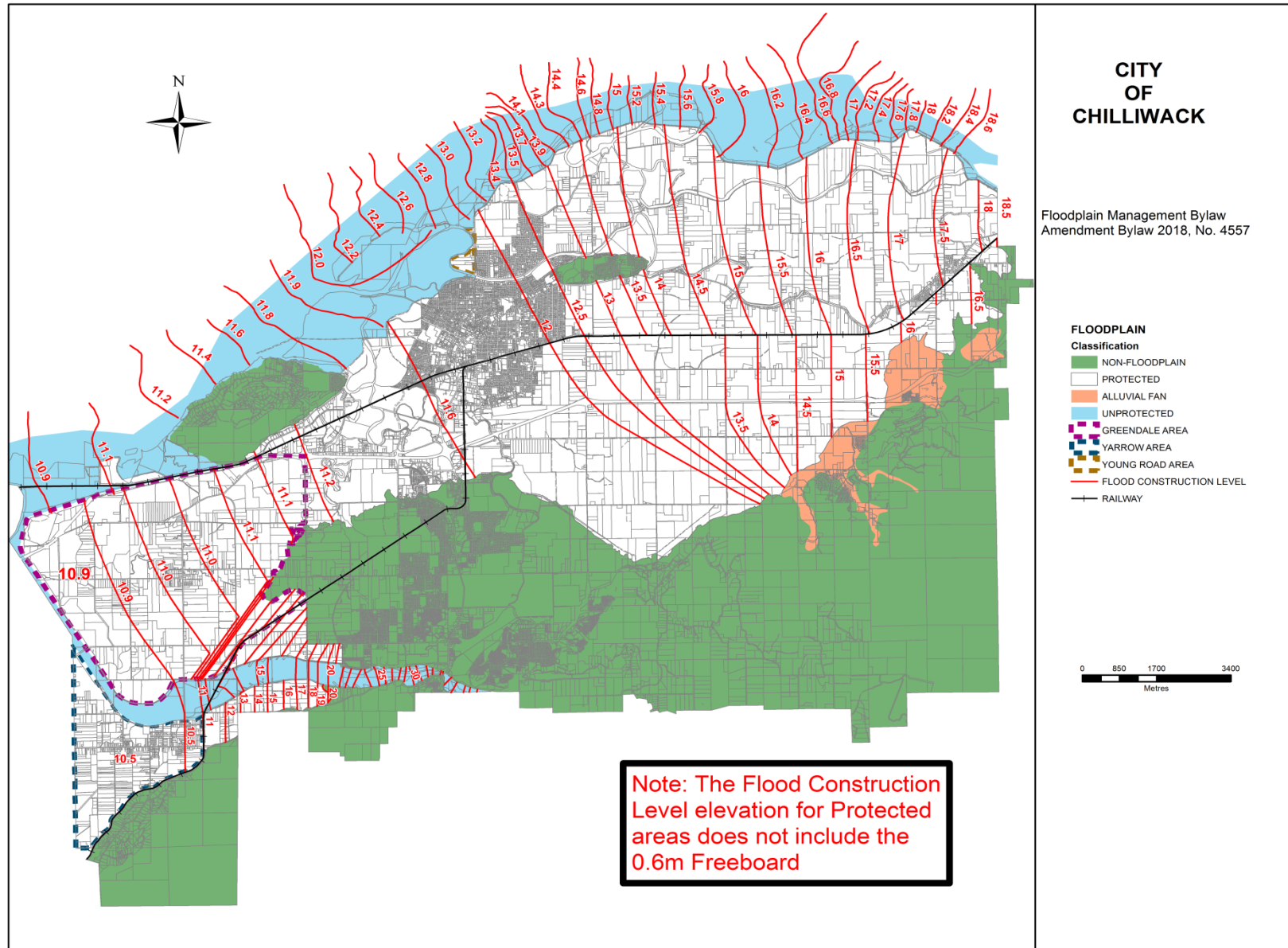
.....  
A/Mayor

“Jacqueline Morgan”

.....  
Corporate Officer

“Floodplain Regulation Bylaw 2018, No. 4519” – Schedule “A”

SCHEDULE “A”



CITY OF CHILLIWACK

Floodplain Management Bylaw  
Amendment Bylaw 2018, No. 4557

- FLOODPLAIN Classification**
- NON-FLOODPLAIN
  - PROTECTED
  - ALLUVIAL FAN
  - UNPROTECTED
  - GREENDALE AREA
  - YARROW AREA
  - YOUNG ROAD AREA
  - FLOOD CONSTRUCTION LEVEL
  - RAILWAY

0 850 1700 3400  
Metres

Note: The Flood Construction Level elevation for Protected areas does not include the 0.6m Freeboard

**SCHEDULE “B”**

**DEFINITIONS<sup>1</sup>**

**GUIDELINES FOR SITE SPECIFIC APPLICATION BY A QUALIFIED PROFESSIONAL**

**1. Quality Assurance Statement**

I hereby certify:

I am a Professional Engineer or Professional Geoscientist, with experience in geotechnical engineering, geohazard assessment and river hydrology;

I am licensed in the Province of British Columbia; and,

I am qualified to carry out the following flood hazard assessment and that I have performed an evaluation of the area of the proposed development in accordance with the ‘Flood Hazard Area Land Use Management Guidelines’ of the Province of British Columbia and the ‘Professional Practice Guidelines – Legislated Flood Assessments in a Changing Climate in BC’ adopted by EGBC.

Name: \_\_\_\_\_ Signature \_\_\_\_\_

**2. General Requirements**

- (1) Legal Description of the property.
- (2) General Location map of the property.
- (3) Detailed map of the property showing property boundaries, safe areas for development, watercourses, topography and physical features.
- (4) Statement of conformance to “Floodplain Regulation Bylaw 2018, No. 4519”, in force from time to time, and Provincial Guidelines.
- (5) Review of all relevant Covenants registered on title (copies of Covenants, if relevant, should be attached to the report.)
- (6) Review of all relevant previous reports and flood hazard maps affecting the site and surrounding area.
- (7) Review of current and historical air photos.
- (8) Description of site visits and observations.
- (9) Review of historical flood information including stream flow data, climate data and local observations.

---

<sup>1</sup> Definitions from 2012 APEGBC Guidelines, 2004 Provincial Guidelines and City of Chilliwack “Floodplain Regulation Bylaw 2018, No. 4519”.

**2. General Requirements** (continued)

- (10) Assessment of the nature, extent, magnitude, frequency and potential effect of all flood or Debris Flow hazards that may affect the property.
- (11) Description of the scientific methodology(s) and assumptions used to undertake the assessment in sufficient detail to facilitate a professional review.
- (12) The location of all proposed building sites and specified setback distances from the Natural Boundary of watercourses. (Maps must be delineated with sufficient accuracy and detail to allow the preparation of a legal reference plan for attachment to a Covenant).
- (13) Recommendations to ensure safe use of a site. (These should be clearly stated with sufficient detail and clarity to facilitate inclusion in a Covenant).
- (14) Description of proposed mitigation works and/or actions designed to mitigate the hazard with confirmation that the Provincial Guidelines have been considered.
- (15) Where mitigation works and/or actions area proposed, an assessment of the effects that the proposed works and/or actions may have on other properties including public infrastructure.
- (16) Where mitigative works and/or actions designed to reduce hazards are contemplated, prior to completion the report and expending time and money on the detailed design, the proponent should confirm that the works and/or actions proposed will be accepted by the City of Chilliwack and that they would meet Provincial regulatory requirements and will be approved by the Inspector of Dikes.

**SPECIAL CASES**

**3. Watercourses**

- (1) Where Floodplain maps are used to recommend FCLs, document which map was used.
- (2) Where an existing FCL shown on a Floodplain map is deemed inappropriate, or where a new FCL is recommended, provide details of the calculation and confirmation that the Guidelines were considered in the process.
- (3) For property adjacent to or within a meandering and/or braided river Floodplain, use air photos, maps and other information to describe and assess relevant ongoing river processes that may pose a hazard to the property.
- (4) When recommending the use of minimum setback and elevation guidelines for smaller streams, provide a map of the stream watershed area to determine drainage area.

**5. Alluvial Fans**

- (1) Provide a suitably scaled topographic map depicting watershed area, fan boundaries, existing and abandoned channels, hydraulic structures, existing and proposed mitigation works, potential avulsion and overland flow paths for the 1 in 200 year flood event, features on the fan that would serve to give direction to and/or impede overland and/or channel avulsion flow paths and the property boundaries.
- (2) Provide channel cross-sections, stream profiles, and depths of flow and flow velocities used in the analysis.
- (3) Provide an assessment of the sensitivity of the watershed area, with respect to hydrology and sediment and debris loading.
- (4) Provide an assessment of the long-term channel bed load and debris maintenance requirements in relation to any recommended flood hazard mitigation measures.
- (5) Where existing channel capacity and topographic features on the fan are identified as features contributing to the safe use of the property, provide an assessment of the effects of any future changes to the channel or fan topography.
- (6) Provide plan, cross-sections and design specification for proposed building foundation treatments and to the site specific measures.

**6. Area Subject to Debris Flows**

- (1) Provide a suitably scaled topographic map and/or air photographic base map depicting watershed area, all existing and potential Debris Flow start, transport and run out zones, hydraulic structures, existing and proposed mitigation works, features on the Debris Flow transport path and/or run out area which could serve to give direction and/or impede Debris Flows, existing depositional features, cohorts, soil test pit locations, carbon dating and dendrochronology sample sites, and property boundaries.
- (2) Provide a statement of return periods considered in the hazard assessment and design of proposed mitigation works.
- (3) Provide a centerline profile from Debris Flow start zones to toe of run out zones.
- (4) Provide plans, cross-sections and design specifications for proposed mitigation works, event volume, depth and velocity of flow and impact forces used in the design of mitigation works.
- (5) Provide an assessment of the sensitivity of watershed area with respect to hydrology and sediment and debris loading.
- (6) Where existing channel capacity and topographic features on the fan are identified as features contributing to the safe use of the property, provide an assessment of the effects of any future changes to the channel or fan topography.