Development Bylaw, 2022

Bylaw No. 3260-2022

Contents

The Council of the City of Abbotsford, in open meeting assembled, enacts as follows:

Interpretation

1 (1) The *Interpretation Bylaw* applies to this bylaw.

(2) A reference to a form in this bylaw includes a document substantially in the form of the referenced form.

Definitions

2 The definitions set out in Schedule "A" apply to this bylaw.

PART 1- DEVELOPMENT APPROVALS

Application Forms

3 Every Applicant for approval of Subdivision or issuance of a Building Permit shall apply in the manner and on the forms prescribed by the City for that purpose and in respect of that application.

Compliance with all applicable requirements

4 (1) Every Applicant for approval of a Development shall comply with all applicable requirements of this bylaw and all other Applicable Laws and obtain all necessary approvals of government ministries and agencies having jurisdiction.

(2) Nothing in this Bylaw shall relieve Applicants for Subdivision or Development from the responsibility to seek out and comply with any other applicable legislation associated with the Subdivision or Development of their property.

Acceptance of application

5 (1) The acceptance for review of any application for a proposed Subdivision shall not be construed as Preliminary Layout Approval or Final Approval of a Subdivision for *Land Title Act* purposes.

(2) The approval of an application for Subdivision or Building Permit does not in any way constitute a representation or assurance that the City will expend public funds on Works and Services in support of such application.

Minimum highway frontage

6 Council hereby delegates to the Approving Officer the power to exempt a Parcel from the statutory or bylaw minimum frontage provided for in section 512 of the *Local Government Act.*

Highway access

7 (1) Every Developer of lands to be developed shall provide each Parcel of land within the proposed Development with access to a Highway.

(2) Where a Development borders on a natural body of water, access to the water shall be given by a Highway in accordance with the requirements of the *Land Title Act*.

Right-of-Way dedication

8 (1) Every Highway, required in respect to a proposed Development, shall be dedicated, designed, constructed and installed in accordance with the minimum requirements, standards and specifications contained in Schedule "E", "H", and "M" of this Bylaw.

(2) Where the Approving Officer believes that due to terrain and soil conditions, the proposed Works and Services cannot be adequately constructed in accordance with the minimum requirements, standards and specifications of this Bylaw, they may require that the Developer provide, without compensation, land of a width or dimension that, in the Approving Officer's opinion, would permit the Works and Services to be adequately and appropriately designed, constructed and installed.

PART 2 - CONNECTION TO EXISTING COMMUNITY SYSTEMS

Division 1 – Community Water System

Requirement to connect to water distribution system

9 All water distribution systems and fire hydrant systems shall be connected, in accordance with the standards established under this bylaw, to an existing adequate Water Distribution System.

Groundwater outside Urban Development Boundary

10 Despite section 9, each Parcel created outside the Urban Development Boundary where an existing Water Distribution System is not available for extension or connection, shall be provided with a proven source of potable groundwater having stability, quality and quantity characteristics in accordance with the minimum requirements, standards and specifications contained in Schedule "E" of this Bylaw.

Subdivision parcels without dwellings

11 Where a proposed Subdivision creates a Parcel outside the Urban Development Boundary of the City greater in size than two (2) hectares and no dwelling unit is to be constructed on the new Parcel, the requirements of section 10 shall not apply to that Parcel provided that the Developer grants to the City and registers a Section 219 covenant against title to the new Parcel prohibiting the construction of a dwelling unit until the requirements of section 10 are fulfilled to the satisfaction of the Engineer.

Development adjacent to water distribution system

12 Where a proposed Development is adjacent to an existing Water Distribution System, and the minimum requirements, standards and specifications contained in Schedule "B" of this Bylaw for either domestic flows or fire flows cannot be achieved using the existing Water

Distribution System, then the Developer or Applicant shall upgrade and extend the existing Water Distribution System to meet domestic and fire flow demand requirements to service the proposed Development in accordance with the minimum requirements, standards and specifications contained in Schedule "E" of this Bylaw.

Compliance with Waterworks Regulations Bylaw

13 All water distribution systems shall be completed in accordance with the City's *Waterworks Regulations Bylaw*.

Division 2 - Community Sewer System

Requirement to connect to sanitary sewer system

14 All sanitary sewage collection systems shall be connected, in accordance with the standards established under this bylaw, to an existing adequate Sanitary Sewer System.

Domestic sewage outside Urban Development Boundary

15 Despite section 14, where a Developer makes application for a Development on lands outside the Urban Development Boundary where an existing Sanitary Sewer System is not available for extension or connection, the Developer shall ensure that all domestic sewage originating from the Development on the lands is discharged into:

(a) a Holding Tank that is constructed and maintained in accordance with the *Holding Tank Bylaw* and the *Sewerage System Regulation*; or

(b) a Sewage System that is constructed and maintained in accordance with the *Sewerage System Regulation*.

Compliance with Sewer Regulations Bylaw

16 All sanitary sewage collection systems shall be completed in accordance with the City's *Sewer Regulations Bylaw*.

Division 3 - Community Drainage System

Requirement to connect to drainage system

17 All drainage collection systems shall be connected, in accordance with the standards established under this bylaw, to an existing adequate Drainage System.

Exception for on site infiltration

18 Despite section 17, where infiltration of the runoff from a 1:100-year rainfall event is provided on site in accordance with the minimum standards required in Schedule "E", and the Developer satisfies the Engineer that there is no risk of groundwater contamination, a direct connection into any adjacent storm sewer is not permitted.

Division 4 - Power and Telecommunications Distribution

Requirement to provide underground power and telecommunication distribution system

19 (1) Subject to section 22, every Developer of lands to be developed or developed within the Urban Development Boundary shall provide each Parcel of land within the proposed Subdivision or Development with an underground power, and Telecommunication distribution system.

(2) Service connections to the distribution required under this section shall be by an underground dip service.

Overhead or underground connections outside urban development boundary

20 Every Developer of lands to be subdivided or Developed outside the Urban Development Boundary of the City, shall provide each Parcel of land within the proposed Subdivision or Development with an overhead or underground power and Telecommunications distribution system capable of providing supporting the expected land use.

Overhead conversion requirement within urban development boundary

21 Every Developer of lands to be subdivided or developed within the Urban Development Boundary shall convert to an underground distribution system any existing overhead power and Telecommunications distribution systems located on that portion of Highway immediately adjacent to the site being subdivided or developed up to the centre line of the Highway.

Streetscape contribution option for target streets

22 (1) Despite the requirement under section 21 to convert existing overhead distribution systems to underground distribution systems, a Developer of lands to be subdivided or Developed may pay a fee as set out in the *Fees and Charges Bylaw* as described in Schedule "D" if the lands to be subdivided or developed front a Target Street as listed in Schedule "D".

(2) A Developer of lands to be subdivided or Developed and fronting a Target Street as listed in Schedule "D" that elects to pay the fee, must provide, on the portion of Highway immediately adjacent to the site being subdivided or developed, the underground civil infrastructure necessary to allow for the future overhead conversion to occur.

(3) The cost of the infrastructure works required under this subsection (2) shall be deducted from the fee payable in the *Fees and Charges Bylaw* to a maximum deduction of the fee payable.

PART 3 - SERVICING REQUIREMENTS

Servicing requirements within a subdivision

23 The Developer of every Parcel being subdivided shall, as a condition of approval of the Subdivision by the Approving Officer, provide Works and Services within the Subdivision in accordance with Schedules "B" and "C" of this bylaw.

Servicing requirements on an adjacent existing highway

24 The Engineer may, in accordance with section 506(8) of the *Local Government Act*, require that, prior to Subdivision approval by the Approving Officer or issuance of a Building Permit by the City, the Developer shall provide Works and Services, in accordance with Schedule "B" of this bylaw, on that portion of every Highway immediately adjacent to the Parcel being subdivided or Developed up to the centre line of the Highway.

Servicing requirements on a building site

25 The Engineer may, in accordance with section 506(9) of the *Local Government Act*, require that the Developer shall, as a condition of the issuance by the City of a Building Permit, provide Works and Services on the site being Developed in accordance with Schedule "B" of this bylaw.

Requirements must be directly attributable to development

26 For clarity, the Engineer shall exercise the powers delegated under sections 24 and 25 in accordance with section 506(10) of the *Local Government Act*.

Required standards and construction specifications

27 All Works and Services required to be provided under this bylaw shall be designed, constructed and installed to the minimum requirements, standards and specifications prescribed in Schedules "E" through Schedule "M" of this Bylaw.

Variation of requirements

28 The City recognizes that site conditions may necessitate minor variations to location and dimensions of the Works and Services, but not the elimination of any elements or features.

Owner's expense

29 The Developer shall be responsible for the design, construction and installation of such Works and Services meeting or exceeding the minimum requirements, standards and specifications contained in Schedules "E", "F", "H", "I", "J", "K", "L" and "M" of this bylaw all at the Developer's own expense.

Payment in lieu

30 (1) Where the physical construction of part or all of the Works and Services is considered by the Engineer to be premature, the Developer may provide such Works and Services by means of a cash payment in lieu of design, construction and installation.

(2) A cash payment under subsection (1) shall be in an amount equal to that estimated by the Consulting Engineer plus 25% and to the satisfaction of the Engineer, plus the applicable administration and inspection fees prescribed by the *Fees and Charges Bylaw*.

(3) Every cash payment required under this section shall be paid before Final Approval of a Subdivision plan or issuance of a Building Permit.

Exceptions

31 The requirements under this Part shall not apply

(a) to a Subdivision under the *Strata Property Act, or*

(b) if

(i) the Subdivision or Development creates only parkland or natural areas, or a Parcel for the installation of utilities and related structures and equipment, and

(ii) a covenant restricting the use of the Parcel to one of those uses has been registered on title under section 219 of the *Land Title Act* in favour of the City.

PART 4 - WORKS AND SERVICES AGREEMENTS

Agreement and security deposit required for subdivision or development

32 Despite sections 23, 24, and 25, no final Subdivision approval or Building Permit shall be issued until the Developer of the Parcel being subdivided or Developed:

(a) deposits to the City a Security Deposit in the amount prescribed in section 38, and

(b) enters into an agreement with the City in a form acceptable to the Engineer to construct and install the required Works and Services by a specified date or forfeit to the City the amounts secured under paragraph (a).

Delegation of authority to enter into agreements

33 (1) The Engineer may approve agreements under section 32(b) on behalf of the City and on such terms and conditions that the Engineer considers desirable.

(2) Agreement authorized under this section may be jointly executed on behalf of the City by the Engineer and corporate officer.

Excess or extended services

34 (1) Prior to Subdivision approval or issuance of a Building Permit, the Developer may be required to provide excess or extended services as described in section 507 of the *Local Government Act.*

(2) The Engineer may, in accordance with section 507 of the *Local Government Act*:

(a) determine what excess or extended services are required in connection with a Subdivision or Development,

(b) determine whether the cost of such excess or extended services is excessive such that the owner must pay the costs,

(c) identify the benefiting properties in relation to excess or extended services, and

(d) determine what proportion of the costs associated with the excess or extended services is associated with each benefiting property.

(3) For the purpose of charges payable for latecomer connections or use under section 508 of the *Local Government Act,* interest shall be calculated annually at a rate established by the *Excess and Extended Services Interest Bylaw*.

PART 5 – RAINWATER SOURCE CONTROL

Application of rainwater source control requirements

35 This Part applies to the control, management, treatment and disposal of rainwater runoff from all Development where source controls are required for volume reduction or treatment under this bylaw.

Discharge of rainwater

36 A person must not discharge, or cause or permit the discharge of rainwater into or off of any lands except by means of an approved Rainwater Management System installed in accordance with this bylaw.

Inspection and maintenance

37 Every property owner is responsible for initial and ongoing inspection and maintenance of a Rainwater Management System, including all on-lot source control facilities, in accordance with the terms, conditions and requirements of an applicable Section 219 (Land Title Act) Covenant and Statutory Right of Way.

PART 6 - FEES AND SECURITY

Security deposit for works and services

38 (1) The Security Deposit related to rezoning of a development site shall be equal to 150% of the estimated cost of construction (including Landscaping and trail development costs) accepted by the Engineer.

(2) Despite subsection (1), once all engineering drawings for required Works and Services are provided by the Developer and accepted by the Engineer, then the Security Deposit shall be:

(a) 110% of construction costs for all required Works and Services, plus

(b) 5% of the construction costs for all required Works and Services or $15,000, whichever is greater, for Record Drawings.

(3) All cost estimates provided in relation to the Security Deposit shall be:

(a) Provided by the Developer's Consulting Engineer and Landscape Architect, and

(b) Provided in the Master Municipal Construction Document Form of Tender, estimated quantities and prices format that includes the related Master Municipal Construction Document section, quantities, unit prices and extension. In addition, the Master Municipal Construction Document costs shall be summarized by asset type in the City of Abbotsford Construction Cost Allocation Form.

Security deposit reductions before certification of substantial completion

39 (1) As the Works and Services progress and prior to the issuance of a Certificate of Substantial Completion, the Developer may request a reduction in the Security Deposit up to a maximum of 75% of the Works and Services completed.

(2) The Developer's Consulting Engineer shall prepare and submit to the Engineer a Security Deposit reduction request, signed and sealed, setting forth an estimate of the quantity, value and percentage of the work constructed to the end of the month for which the security reduction is being requested.

(3) Despite any provision of this Bylaw, the Engineer may, in the Engineer's sole discretion, deny reductions to the Security Deposit where, in the Engineer's opinion, the amount of Security Deposit remaining is required to cover any portion of the remainder of the Works and Services or repair to damage to City property.

(4) Security Deposit reductions under this section are for the convenience of the Developer and must not be construed as acceptance on behalf of the City of the material plant or workmanship of stipulated Works and Services.

(5) Following issuance of the Certificate of Substantial Completion, the Engineer may reduce the Security Deposit to the Warranty Deposit.

Certificate of substantial completion – other than landscape and trails

40 (1) The Consulting Engineer shall notify the Engineer when construction of the Works and Services are substantially complete by submitting the 'Certificate of Inspection – Request for Substantial Completion' form.

(2) The Engineer shall, if necessary, issue a list of deficiencies that must be corrected prior to issuance of a Certificate of Substantial Completion.

(3) All deficiencies are to be rectified and Record Drawings submitted within 60 days of the Substantial Completion inspection unless an alternative schedule is specifically requested and approved by the Engineer.

(4) A Certificate of Substantial Completion shall be issued by the Engineer when all of the following conditions are met:

(a) all deficiencies are rectified;

(b) Record Drawings of the required Works and Services have been accepted by the Engineer and all inspection testing reports outlined in this Bylaw are received and accepted;

(c) Service Record Cards have been accepted by the Engineer;

(d) all legal encumbrances have been registered or released accordingly;

(e) a Certificate of Inspection and Request for Substantial Completion from the Consulting Engineer has been received stating that all Works and Services have been supplied, designed, constructed and installed in substantial conformance with the accepted design drawings and the requirements, standards and specifications of this Bylaw and all other applicable City enactments;

(f) Warranty Security has been provided to the City in accordance with the requirements of this Bylaw.

Certificate of substantial completion – landscape and trails

41 (1) Upon completion of Landscape and trail works, the Consulting Landscape Architect shall inspect the work and, if necessary, issue to the Contractor a list of deficiencies that shall be corrected.

(2) Upon adequate correction of all deficiencies identified under subsection (1), the Consulting Landscape Architect shall submit BCSLA Schedule C-L to the Engineer.

(3) Following receipt of this Schedule, a Certificate of Substantial Completion (Landscape and Trails) shall be issued by the Engineer.

(4) Upon issuance of the Certificate of Substantial Completion (Landscape and Trails), the City may release that portion of the Security Deposit held for Landscaping, less a warranty holdback of 20%.

(5) The warranty holdback under subsection (4) shall be held for the Warranty Period in section 50.

Building permit issuance

42 (1) No Building Permit for any building-other than a Show Home-will be issued without the Developer providing proof acceptable to the Engineer, in writing or on plans, that the building is serviced to the standards and specifications of this Bylaw.

(2) No single-family Building Permit will be issued until a Certificate of Substantial Completion for the required Works and Services under the Servicing Agreement has been issued by the Engineer.

(3) Despite subsection (2), a Building Permit for a Show Home may be issued in accordance with the requirements of the City's *Show Home Building Permit Policy* A001-09.

Warranty deposit

43 (1) Upon issuance of the Certificate of Substantial Completion, the Engineer may release the Security Deposit less a Warranty Deposit of 5% of the estimated cost of the Works and Services or $25,000, whichever is the greater, to secure the maintenance or repair to the Works and Services during the Warranty Period referred to in Part 8 *[Warranty Period]*.

(2) An updated cost estimate must be included for the final top lift of asphalt or other works deferred to the maintenance period.

(3) Any deficiencies that are to be corrected prior to Final Acceptance must be secured in addition to the Warranty Deposit in the amount of 200% of the estimated cost provided by the Developer's Consulting Engineer and accepted by the Engineer.

(4) The Warranty Deposit shall not be applied to the maintenance or repair of BC Hydro, Telecommunications or Fortis BC Gas equipment and plant installations but may be applied to the maintenance or repair of excavations and soil settlement areas on City property arising from such installations.

Certificate of final acceptance

44 (1) The Consulting Engineer shall notify the Engineer of the end of the eleventh (11th) month of the Warranty Period by submitting the 'Request for Final Inspection – Final Acceptance' form.

(2) The Engineer shall, if necessary, issue a list of deficiencies that must be corrected prior to the issuance of a Certificate of Final Acceptance.

(3) A Certificate of Final Acceptance will be issued by the Engineer upon expiration of the Warranty Period for the required Works and Services provided that

(a) all deficiencies have been corrected, and

(b) the 'Request for Final Inspection – Final Acceptance' form has been completed, submitted to the City, and signed and sealed by the Consulting Engineer.

(4) Portions of the Works and Services that the City deems to be of public safety or interest that are eligible for a Certificate of Final Acceptance that have not been completed in the time frame as indicated in the Servicing Agreement or elsewhere in this Bylaw may be reviewed by the City for execution of Works and Services that provide for public safety or interest.

(5) If the City performs or causes to be performed the inspection and construction, the Developer must pay the corresponding charges set out in the *Fees and Charges Bylaw*.

PART 7 - INSPECTIONS

Inspections - general

45 (1) The Engineer may, but is not obligated to, examine any part of the Works and Services including workshops or other places where material is being prepared or stored.

(2) A Developer shall provide access and all information requested to enable the Engineer to conduct an examination under this section.

(3) A Contractor shall open for inspection any part of Works and Services that have been covered up without inspection by the Engineer.

(4) A Consulting Engineer shall supply representative samples of materials as requested by the Engineer.

(5) A Consulting Engineer shall provide on-site survey, measurements, inspection and testing of the Works and Services.

(6) A testing and geotechnical firm shall immediately forward results, reports or recommendations relevant to an examination under this section to the Consulting Engineer and the Engineer.

(7) Examination by the Engineer under this section shall not constitute inspection, supervision or co-ordination of the Works and Services, and must not be construed as a substitute for a formal engineering inspection and supervision of the Works and Services by the Developer's Consulting Engineer.

Inspections – landscape and trails

46 (1) The Developer shall, at its sole cost and expense, supply representative samples of materials and plants as requested by the Engineer.

(2) No payment, reimbursement or remuneration shall be made to the Developer by the City for the cost of labour, plant, material, work or any delay occasioned by the requirements of this section.

(3) A Consulting Landscape Architect must conduct onsite inspections to ensure that the Landscape and trial works are in compliance with the requirements, standards and specifications of this bylaw and are in general conformance with the intent of the accepted plans and are in a condition acceptable to the City.

Inspections by consulting engineer

47 The Consulting Engineer shall be responsible for the following:

(a) carrying out on-site engineering inspection of the Works and Services to ensure that they comply with the requirements, standards and specifications of this Bylaw and that the design, construction and installation of the Works and Services are carried out according to sound engineering practices and standards and conform to the intent of the accepted designs and this Bylaw;

(b) engaging the services of qualified testing and geotechnical firms to provide quality control inspections, recommendations and testing of the Works and Services, as required by the Engineer;

(c) ensuring that all other requirements of the City are performed and completed to a satisfactory conclusion.

Testing or confirmation of completed works and services

48 (1) The City may conduct independent testing of any or all Works and Services.

(2) Tests under this section will ordinarily be conducted on a random basis and are for the purpose of ensuring that the Works and Services being accepted by the City meet the minimum requirements, standards and specifications of this Bylaw.

(3) In addition to ensuring that the City has proper and accurate records of the Works and Services constructed by the Developer, survey spot checks may be conducted from time-to-time to verify authenticity of the as constructed information.

(4) Subject to subsection (5), the costs of random testing or surveying under this section shall be borne by the City.

(5) If Works and Services do not comply with this Bylaw, the Developer shall bear the costs under subsection (4), plus all costs for repairs, replacement, reconstruction and re-certification of any Works and Services disturbed, exposed, removed or affected by the random checks.

PART 8 - WARRANTY PERIOD

Warranty period – other than landscape and trails

49 (1) The Warranty Period for Works and Services, excluding Landscaping, designed, constructed and installed under this Bylaw, shall be for a minimum of 1 year following the date of issuance of the Engineer's Certificate of Substantial Completion and shall expire upon issuance of the Certificate of Final Acceptance.

(2) During the Warranty Period, the Developer shall guarantee the stability and sufficiency of the materials and workmanship of the Works and Services, excluding Landscaping, and shall make good, correct and repair all defects, imperfections, damage, settlements and acts of vandalism which may arise or occur in relation to the Works and Services, excluding Landscaping.

(3) The Developer shall ensure that the Roadways, including Sidewalks, Walkways, erosion and sediment control facilities comply with the *Erosion and Sediment Control Bylaw* and are kept clean and free of dirt and debris during the Warranty Period or any additional period as required by the Engineer.

Warranty period for landscape and trails

50 (1) Upon completion of Landscape and trail works as required under this Bylaw, the Developer shall notify the Engineer who shall issue a Certificate of Substantial Completion (Landscape and Trails) upon satisfactory inspection of the work to determine conformance with the requirements, standards and specifications of this Bylaw.

(2) The Warranty Period for Landscaping shall be for a minimum of 1 year from issuance of the Certificate of Substantial Completion (Landscape) as issued by the Engineer, which may include 1 dormant period followed by one growing season.

(3) In the case of Trails and Associated works, the warranty shall be for a minimum of 1 full calendar year.

(4) During the Warranty Period for Landscape and trails, the Developer shall replace any plant material that dies, is damaged or that fails to grow satisfactorily as determined by the Engineer.

(5) All replacements required under subsection (4) shall be with plant material of the same kind and size as the original Plantings unless otherwise specified by the Engineer.

(6) Trails and associated works shall be repaired and rehabilitated to conform to the requirements, standards and specifications of this bylaw.

(7) The Developer shall warrant all replacement plant material and trail repairs for a period equal to the original Warranty Period.

(8) Should the Developer fail to make good and repair any defects, imperfections, vandalism acts, settlements or clean-up after being given at least 7 calendar days' written notice during the Landscape Warranty Period, the City shall make, or cause to be made, all necessary repairs at the cost of the Developer.

(9) The Engineer may extend the Developer's warranty responsibilities for an additional time period, not to exceed 1 year if at the end of the initial Warranty Period, leaf Development, plant growth or overall vigor is not sufficient to ensure future survival, or, in the case of trails and associated works, deficiencies are not sufficiently addressed to ensure public safety and ease of use.

Parkland dedication

51 (1) The subdivider shall dedicate, without compensation, up to five percent (5%) of the land proposed for Subdivision for neighbourhood parkland at the locations required by the Approving Officer in accordance with the maps and policies in an Official Community Plan, Neighbourhood Plan or Master Plan.

(2) Where parkland dedication is not required as determined by the Approving Officer in accordance with the parkland dedication policies contained in an Official Community Plan, Neighbourhood Plan or Master Plan, the subdivider shall pay cash-in-lieu of

parkland dedication in an amount equivalent to 5% of the average market value of all the land proposed for Subdivision as assessed on the date of preliminary approval of the Subdivision.

(3) Subsections (1) and (2) do not apply:

(a) to Subdivisions of less than three additional lots; or

(b) to Subdivisions where the smallest lot being created is larger than 2 hectares; or

(c) to the consolidation of existing Parcels.

(4) Where parkland dedication is required, the subdivider shall provide City services including water, drainage and sanitary connections and hydro service to the park.

Repeal

52 The following bylaws are repealed:

(a) *Development Bylaw, 2011*;

(b) *Storm Water Source Control Bylaw, 2011*.

READ A FIRST TIME on June 13, 2022,
READ A SECOND TIME on June 13, 2022,
READ A THIRD TIME on June 13, 2022,
ADOPTED on June 27, 2022,

SCHEDULE "A"

DEFINITIONS

1 In this bylaw,

"**Agricultural**" has the meaning as defined as "Agricultural Use" in the Zoning Bylaw;

"Applicable Law" means an applicable City enactment, provincial enactment and federal enactment;

"**Applicant**" means a person applying for approval to develop lands either as the Developer or as a duly authorized agent of a Developer;

"**Approved Products List**" means the list of preferred products and materials approved by the City as amended from time to time by City staff. The list will be posted on the City of Abbotsford website;

"**Approving Officer**" means the person appointed to that position for the City in accordance with the *Land Title Act*;

"Arterial Road" means a Highway with the primary function to carry traffic from one area to another with as little interference as possible from adjacent land uses and having limited direct access;

"Bicycle Facility" means the improved area of a Highway adjacent to or within the Roadway or Boulevard which is intended for the use of bicycle traffic. Examples include on-street protected bike lanes, on-street unprotected bike lanes, shared Roadways and Multi-use Pathways;

"Boulevard" means the portion of a Highway not occupied by the Roadway or Sidewalk and includes Plantings, surface finishing or treatment;

"Building Permit" means an authorization by the Chief Building Official as defined in the *Building Bylaw* on a prescribed form for the construction, alteration, renovation, or demolition of a Building or Structure or other work specified in the permit;

"Certificate of Final Acceptance" means the acceptance of the construction and installation of the required Works and Services completed to the standards and specifications set out in this Bylaw as evidenced by the issuance of a Certificate of Final Acceptance;

"Certificate of Inspection and Request for Certificate of Substantial Completion" means when the Consulting Engineer submits to the City a written statement that all the Works and Services have been supplied, designed, constructed and installed in substantial conformance with the accepted design drawings and the requirements, standards and specifications of this Bylaw and that a request is made for the issuance of a Certificate of Substantial Completion, contained in Schedule "E" of this Bylaw;

"Certificate of Substantial Completion" means the form issued by the City once the Engineer is satisfied that the conditions of the Servicing Agreement have been fulfilled;

"City in the Country Plan" or **"CICP"** means the lands within the Clearbrook, Peardonville and Abbotsford Airport CICP lands, as identified in Schedule "J", that are situated above the Abbotsford-Sumas Aquifer, which the predominant use of the lands is for Industrial purposes;

"Collector Road" means a Highway with the primary function to distribute traffic between Arterial Roads, other Collector Roads and Local Roads within an area, and may also provide full direct access to adjacent Parcels;

"Commercial" has the meaning as defined in the City's *Zoning Bylaw*;

“Construction Cost Allocation Form” means a form developed by the City for the capture of municipal infrastructure asset data which includes asset category, quantity, design life and estimated cost of construction;

“Consulting Engineer” means a Professional Engineer licensed under the provisions of the *Professional Governance Act*;

“Consulting Geoscientist” means a Professional Geoscientist licensed under the provisions of the *Professional Governance Act;*

“Consulting Landscape Architect” means a Landscape Architect licensed under the provisions of the *Architects (Landscape) Act*;

“Contaminant” means any hazardous, corrosive or toxic substance, waste or other pollutant which is prohibited, controlled or regulated under any Applicable Law;

“Contractor” means the person or firm that will construct the Works and Services to the requirements, standards and specifications of this bylaw;

“Crawlspace” means a space between the underside of any floor system and the underlying surface having a maximum height of 1.2 metres to the underside of the joists;

“Developer” means an Owner or Owners of land being developed, or the holder(s) of a bona fide interim agreement or option to purchase land, or an Applicant who has made application to the City for, or is engaged in undertaking the Development of such land, and shall include their duly authorized representative;

“Development” means the improvement of, or the carrying out of work on, land, including but not limited to building, clearing and grubbing, grading, tree removal and demolition and includes the improvement or re-development of land and the construction of improvements on land requiring the issuance of a building permit but excludes the word required to install an approved System;

“Development Agreement” means a document registered in the Land Title Office that covenants limitations and requirements to the use of the lands;

"Ditch" means Streams that are typically characterized as being manmade and straight with no significant headwaters or springs. Ditches can be wet or dry. They were constructed to drain property and Roadways or impound water for irrigation, and they often form property boundaries. While connected to natural Streams, Ditches are not part of the natural historic drainage pattern;

“Driveway” means an access providing a private Parcel with connection to a public Roadway;

“Engineer” means the City’s General Manager, Engineering and Regional Utilities, or delegate;

“Erosion and Sediment Control Bylaw” or **“ESC”** means the City’s *Erosion and Sediment Control Bylaw*;

“Final Acceptance” means the acceptance of the construction and installation of the required Works and Services completed to the standards and specifications set out in this bylaw, as evidenced by the issuance of a Certificate of Final Acceptance signed by the Engineer;

“Final Approval” means approval of a Subdivision plan by the Approving Officer when all applicable requirements of this bylaw, the *Local Government Act*, the *Community Charter*, the *Land Title Act*, the *Strata Property Act* and all other Applicable Laws have been fulfilled and when all conditions of Subdivision Preliminary Layout Approval have been fulfilled;

“Form of Tender” means a form used by the City to obtain tender prices;

"Front", **"Frontage"** and **"Fronting"** mean in respect to those lands located on that portion of a Highway immediately adjacent to the site being subdivided or developed, up to the center of the Highway;

"Garage Pad Elevation" or **"(GPE)"** means the elevation of the garage floor of any building;

"Growing Medium" means imported growing media as defined in the Canadian Landscape Standard (CLS) (Section 6.2.3) and shall be specified, regarding CLS type designation, by the Consulting Landscape Architect or as specified by the Engineer for an identified application;

"Highway" includes a public street, path, Walkway, bridge, road, thoroughfare, and any other public way, as defined in the *Land Title Act*, but does not include a private road over private lands;

"Highway Excavation Permit" means a permit issued by the Engineer permitting Works and Services for the construction, installation or repair on any City Highway or Walkway where such work is not governed by a Servicing Agreement or Development Agreement;

"Holding Tank" means a watertight container for holding domestic sewage until the domestic sewage is removed for treatment;

"Industrial" has the meaning as defined in the *Zoning Bylaw*;

"Institutional" has the meaning as defined in the *Zoning Bylaw*;

"Landscape", **"Landscaped"** and **"Landscaping"** mean any combination of trees, shrubs, groundcovers, grasses, lawn, mulch, decorative boulders, planters, sculptures, trails, pathways, fencing, decorative paving, and the like, installed, and maintained to improve the environmental function and enhance and embellish the appearance of a property, or where necessary to screen, or buffer and can be located on Highways, Boulevards and medians;

"Lane" means a Highway that provides primary or secondary vehicular access to any abutting Parcel;

"Letter of Credit" means a guaranteed and irrevocable financial instrument issued by a Canadian Chartered Bank or Credit Union registered in British Columbia for the purposes of providing security to the City for a Developer's obligations for the design, construction and installation of the required Works and Services and Landscaping to the requirements, standards and specifications of this bylaw;

"Local Road" means a Highway, including a cul-de-sac, which provides direct access to abutting Parcels and provides circulation of traffic within a Subdivision;

"Minimum Building Elevation" or **"MBE"** means the elevation of the lowest floor slab in a building or the underside of the floor joists where the lowest floor is constructed over a Crawlspace;

"MMCD" means the Master Municipal Construction Documents Association (Platinum Edition – Volume II printed in 2009);

"Modular Suspended Pavement System" means the structural system that can support the weight of hard-surfaced area while creating a void space underneath for Growing Medium, tree root development and storm water management, and includes Structural Soil cells;

"MOTI" means the Ministry of Transportation and Infrastructure of British Columbia as renamed or replaced from time to time;

"Multi-family" means Residential development in the form of Townhouses, Row Housing, or Apartments, as defined in the *Zoning Bylaw*;

"Multi-use Pathway" means the improved area of a Highway adjacent to the Roadway or Boulevard which is intended for the use of pedestrians and cyclists, and are typically used on one side of the Highway in place of Sidewalk and Bicycle facilities;

"Notice to Proceed" means a written notice issued by the City to a Developer or Contractor, that authorizes the commencement of the construction of the Works and Services associated to a Development in accordance with this bylaw or an agreement executed by the City;

"Invasive Plant" means Noxious Weed as defined in the *Weed Control Regulation*, and includes the seeds off the Noxious Weed;

"Owner", in respect of real property, has the meaning attributed to it in the Community Charter;

"Parcel" means any lot, strata lot, block or other area as defined by the *Land Title Act* in which land is held or developed or into which land is subdivided, but does not include a Highway;

"Preliminary Layout Approval" or **"PLA"** means the written conditional approval by the Approving Officer of a proposed Subdivision plan;

"Rain Garden" means a surface, rainwater runoff management and treatment system utilizing a constructed soil/organic media with vegetated plantings to remove rainwater pollutants by filtering rainwater runoff substantially in accordance with the requirements and specifications contained in this bylaw;

"Qualified Professional" means an applied scientist or technologist who practices in a relevant applied science or technology field including, without limitation, the field of agrology, forestry, biology, engineering, geomorphology, geology, hydrology, hydrogeology or landscape architecture, whether acting alone or together with another Qualified Professional, as listed in the *Streamside Protection Bylaw*;

"Rainwater Management System" means any system designed, constructed or installed for the express purpose of containing or conveying rainwater to an outlet destination whether such system is located on public or private lands, protected by registered Statutory Right of Way, in place historically, or previously accepted by the City and includes, without limitation, storm sewer mains, Ditches, swales, creeks, ravines conveying or capable of conveying rainwater or runoff, watercourses, Streams, detention and infiltration systems and rain gardens;

"Rainwater Management Plan" means a plan that is an ecologically and holistically based approach that considers the full rainfall spectrum for all the rainfall days of the year and takes a systems- based approach to rainfall capture and retention, runoff control and detention, water quality treatment and flood mitigation;

"Record Drawings" means the drawings produced at the completion of construction with information contained as outlined in this bylaw;

"Residential" has the meaning as defined in the *Zoning Bylaw*;

"Roadway" means the paved, constructed or traveled portion of a Highway that is used for vehicular or bicycle movement;

"Sanitary Sewer System" means a system designed and constructed for the collection, treatment and disposal of sanitary sewage;

"Security Deposit" means cash or an irrevocable automatically renewing Letter(s) of Credit deposited with the City by the Developer in accordance with the requirements of this bylaw, to secure the design, construction and installation of the required Works and Services and Landscaping to the requirements, standards and specifications of this bylaw;

"Service Record Card" means a document prepared by the Consulting Engineer to record the details of a water, sanitary sewer or drainage service and horizontal and vertical location at each Development site;

"Servicing Agreement" means an agreement substantially in the form of Schedule "G" to this bylaw between the City and a Developer for the design, construction and installation of Works and Services in accordance with the specifications and standards of this bylaw, that are required prior to use of lands to be developed;

"Sewage System" means a system for treating domestic sewage that uses one or more treatment methods and a discharge area, but does not include a Holding Tank or an outhouse;

"Sidewalk" means the improved area of a Highway adjacent to the Roadway or Boulevard which is intended for the use of pedestrians;

"Spill Containment Plan" means an emergency spill containment and clean-up plan, prepared by a Consulting Engineer or Qualified Professional, to be implemented upon the spill or deposit of any Contaminant on Industrial Lands or other Lands as determined by the Engineer, whether or not such Contaminant has entered the System;

"Standard Drawing" means those drawings that are included in Schedule "H" *[Supplementary Specifications, Standards and Detail Drawings]*;

"Statutory Right of Way" means an easement without a designated dominant tenement registerable under section 218 of the *Land Title Act*;

"Statutory Right of Way Plan" means a plan prepared by a British Columbia land Surveyor and deposited under section 113 of the *Land Title Act*;

"Stream" means a natural watercourse or a natural body of water, whether or not the channel of the Stream has been modified, or a natural source of water supply, including without limitation, a lake, pond, river, creek, spring, ravine, gulch, or wetland, whether or not usually containing water, but does not include an aquifer;

"Streamside Protection and Enhancement Area" means an area adjacent to a Stream that links aquatic to terrestrial ecosystem and including both existing and potential riparian vegetation and existing and potential adjacent upland vegetation that exerts an influence on the Stream, the width of which is determined in accordance with the S*treamside Protection Bylaw;*

"Structural Soil" means a designed soil of gap-graded aggregate, imported Growing Media, and stabilizing agent in a uniform mixture that meets the requirements as outlined in this bylaw and functions to provide load bearing support for paved surfaces and growing medium filled voids to facilitate tree root development;

"Subdivision" means

(a) a Subdivision as defined in the *Land Title Act*; and

(b) a Subdivision under the *Strata Property Act*;

"Substantial Completion" means the acceptance of the construction and installation of the required Works and Services completed to the standards and specifications set out in this bylaw as evidenced by the issuance of a Certificate of Substantial Completion, the form of which is included in Schedule "E" of this bylaw;

"Suburban Residential" means as defined in the *Zoning Bylaw*;

"Surveyor" means a BC Land Surveyor (BCLS) currently licensed and registered in the Province of British Columbia;

"Target Street" means a street identified in Schedule "D" of this bylaw where the overhead power and telecommunication lines are to be converted to an underground installation;

“Telecommunications” means telephone, internet and television infrastructure services installed underground or overhead within a Highway to serve Development;

“Urban Area” means the Urban Development Area as outlined within the *Official Community Plan*;

“Urban Development Boundary” means the area depicted in the *Official Community Plan*;

“Urban Residential” as defined in the *Zoning Bylaw*;

“Walkway” means a public Statutory Right of Way or dedication, with or without improvements for the predominant use of pedestrians, not including a Sidewalk on a Highway;

“Warranty Deposit” means the reduced value of the Security Deposit or a separate irrevocable, automatically renewing Letter of Credit to be deposited with the City for the duration of the Warranty Period, as required in Schedule “E” and Schedule “G”, attached to and forming part of this bylaw, as a guarantee for the stability and sufficiency of the Works and Services completed by the Developer;

“Warranty Period” means a period immediately following the issuance of a Certificate of Substantial Completion during which the Developer is required to correct, reconstruct, replace or repair at their cost any deficiencies in the Works and Services installed for that Developer;

“Water Distribution System” means a system of waterworks within the meaning of the *Health Act* to provide potable water for human consumption and fire protection;

“Works and Services” means any public service, facility or utility which is required by this bylaw, including: the supply and distribution of water for domestic use and firefighting; collection and disposal of sanitary sewage; collection and disposal of rainwater and other waters; grading, erosion and sediment control; street lighting; Highways; Roadways; retaining walls; curbs; gutters; Sidewalks; traffic control signs and devices; Roadway markings; Landscaping.

SCHEDULE "B"

LEVELS OF WORKS AND SERVICES WITHIN THE URBAN DEVELOPMENT BOUNDARY

Land Use	Highways	Water Distribution	Rainwater Management and Detention/Infiltration			Sewage Collection and Disposal		Power/Telecommunications Distribution		Landscaping
		Domestic & Fire Fighting	Conveyance System	Detention – Infiltration	Treatment	Conveyance System		U/G	Conversion Policy	
						Gravity Mains	PS/FM			
Suburban Residential	Rural	WDS	Gravity Mains	Y	Y	Y	Y[1]	Y	Y	N
Urban Residential:- Fee Simple	Urban	WDS	Gravity Mains	Y	Y	Y	Y[1]	Y	Y	Y
Urban Residential: --Strata, Multi-Family	Urban	WDS	Gravity Mains	Y	Y	Y	Y	Y	Y	Y
Mixed Use Centres	Urban	WDS	Gravity Mains	Y	Y	Y	Y	Y	Y	Y
Commercial	Urban	WDS	Gravity Mains	Y	Y	Y	Y	Y	Y	Y
Industrial	Urban	WDS	Gravity Mains	Y	Y	Y	Y	Y	Y	Y
Institutional	Urban	WDS	Gravity Mains	Y	Y	Y	Y	Y	Y	Y

Notes

1. Will only be considered where conveyance via gravity sewer is not possible.

Glossary

WDS	Water Distribution System
PS/FM	pump station/forcemain
U/G	underground
N	No
Y	Yes

SCHEDULE "C"

LEVELS OF WORKS AND SERVICES OUTSIDE THE URBAN DEVELOPMENT BOUNDARY

Land Use	Highways	Water Distribution		Rainwater Management and Detention/ Infiltration			Sewage Collection and Disposal		Power/Telecommunications Distribution	
		Fire	Domestic	Conveyance System		Detention – Infiltration	Gravity Mains	Sewage System	O/H	Conversion Policy
				Gravity Mains	Open Ditch					
Agricultural	Rural	N	Private Well	N	Y	Y[1]	N	Y	Y	O/H
Suburban Residential	Rural	N	Private Well	Y	Y	N	N[2]	Y	Y	O/H
Commercial	Rural	WDS[2]	Private Well	Y[2]	Y	Y	N[2]	Y	Y	U/G dip
Industrial	Rural	WDS[2]	Private Well	Y[2]	Y	Y	N[2]	Y	Y	U/G dip
Institutional	Rural	WDS[2]	Private Well	Y[2]	Y	Y	N[2]	Y	Y	U/G dip

Notes

1. Detention/Infiltration is required if the proposed total impermeable surface area after Development, including building footprints, driveways, parking, storage and other impermeable surfaces, exceeds 3,700m^2 or covers more than 10% of the Parcel area.

2. For water, drainage and sewage disposal, the higher urban level takes precedence when available.

Glossary

MOH Ministry of Health
WDS Water Distribution System
O/H overhead
U/G underground
N No
Y Yes

SCHEDULE "D"

STREETSCAPE CONTRIBUTION LEVY & TARGET STREETS

The fees for the streetscape contribution levy for Residential (Single Family), Residential (Medium to High Density), Commercial, Institutional and Industrial developments are as set out in the *Fees and Charges Bylaw*.

TARGET STREETS

Street Component	Name	From	To
1	Mount Lehman	Automall Drive	Sandpiper Drive
2	Old Yale Road	Clearbrook Road	Parkview Street
3	South Fraser Way	Countess Street	James Street
4	South Fraser Way	Garden Street	McCallum Road
5	Allwood Street	End	South Fraser Way
6	Emerson Street	Simon Avenue	South Fraser Way
7	Gladwin Road	Garibaldi Drive	Ventura Ave
8	Essendene Avenue	McCallum Road	Cyril Street
9	South Fraser Way	Essendene Avenue	McDougall Avenue
10	Marshall Road	Gladwin Road	McCallum Road
11	McCallum Road	Gillis Avenue	McDougall Avenue
12	Sumas Way	Lonzo Road	Marshall Road
13	Pauline Street	George Ferguson Way	Laurel Street
14	Montrose Avenue	George Ferguson Way	McDougall Avenue
15	West Railway Street	George Ferguson Way	Laurel Street
16	Montvue Avenue	Essendene Avenue	South Fraser Way
17	King Road	McCallum Road	King Crescent
18	Salton Road	Highway 1	King Road

SCHEDULE "E"

ENGINEERING STANDARDS AND SPECIFICATIONS

SECTION NO. 1 – GENERAL INFORMATION

1. DEVELOPER PERFORMANCE RESPONSIBILITY

(a) Where Works and Services are to be designed, constructed and installed within the City, the Developer shall be aware of the areas and degrees of performance and responsibility required under this Schedule.

(b) The Engineer, or his duly authorized representative, shall be the City's representative during the design, construction, installation and maintenance of the Works and Services.

(c) Work Performance

The whole of the work, and the manner of performing the same, shall be done in accordance with the requirements, standards and specifications set out in this Bylaw to the satisfaction of the Engineer, whose decision shall be final and binding.

(d) Variation of Works and Services at Developer's Request

(i) Any variation to the Works and Services previously accepted shall be subject to review by the Engineer. All requests for variations to the Works and Services shall be designed and sealed by a Consulting Engineer on behalf of a Developer, and shall be made in writing to the Engineer and prior to the construction of the same works.

(ii) Any requests for variations shall include a signed and sealed revision to the previously accepted drawing(s). The Engineer's decision as to the acceptability of any revision(s) shall be final and binding.

(e) Unforeseen Conditions

(i) If, at any time after the drawings have been accepted for construction, unforeseen conditions or circumstances become known which make it necessary that changes in the design or extra Works and Services be done in order to complete the project to good engineering practice, the Engineer shall have the right to order such changes or extra Works and Services as he deems necessary to complete the Works and Services in an acceptable manner.

(ii) All costs of such extra Works and Services shall be borne by the Developer.

(f) Verbal Agreements

No verbal instruction, objection, claim or notice by any party to the other shall change or modify any of the terms or obligations contained in any of the requirements, standards or specifications, and none of the requirements, standards or specifications shall be held to be waived or modified by reason of such verbal instruction, objection, claim or notice.

(g) Service of Notices

Any notice, order, direction, request or other communication given by the City, shall be deemed to be well and sufficiently given if the same be left at any office used by the Developer or be delivered to the Developer's Consulting Engineer or Contractor.

(h) Pre-Construction Meeting

Prior to the commencement of any Works and Services to be constructed within the scope of Schedules "E" to "K", a pre-construction meeting shall be held. The Developer, Consulting Engineer, and Contractor, along with appropriate City representatives meet for the purposes including, but not necessarily limited to:

(i) the City releasing the accepted Works and Services drawings to the Developer;

(ii) the City receiving Insurance Policy submissions as required by this Bylaw;

(iii) providing the City with a WorkSafeBC "Notice of Project";

(iv) reviewing procedures for traffic control, tie-ins to City services, testing and documentation submissions;

(v) reviewing procedures for requests for reduction of Letters of Credit;

(vi) establishing conditions for the issuance of a Certificate of Substantial Completion and Certificate of Final Acceptance;

(vii) establishing lines of communication;

(viii) reviewing project coordination requirements with other Developers or Contractors engaged by the City;

(ix) providing the City with a full set of digital construction drawings on USB, or transfer from a FTP site or other online transfer solution provided that the file size can be accommodated. Other formats may be acceptable subject to the acceptance of the Engineer;

(x) securing written acknowledgement that the Developer or the Developer's Contractor is designated as the "Prime Contractor" in respect of all obligations by virtue of the Workers Compensation Act and Regulations;

(xi) review with all members of the construction and design team the location and sensitivity of environmentally sensitive areas and trees to be retained, construction phase best management practices, and communication protocols regarding environmental protection and management; and

(xii) where the construction of the Works and Services will impact environmentally sensitive areas, the Developer's Qualified Professional shall provide confirmation that all required approvals, and/or permits as may be required by other senior governmental agencies have been received and copies are provided to the Engineer and Contractor.

(i) Notice to Proceed

When all of the requirements of the pre-construction meeting have been met, the Engineer will issue a Notice to Proceed to the Contractor. Construction of any Works and Services associated shall not be undertaken prior to the issuance of a Notice to Proceed. This also includes any construction of Works and Services outside of regular working hours unless otherwise agreed to in writing by the City.

2. CONDUCT OF WORK

(a) Responsibility

(i) The Developer shall be held fully responsible to the City for the acts and omissions of his agents and of all persons directly or indirectly employed by him. The Developer agrees to bind all agents or employees to the requirements, standards and specifications of this Schedule.

(ii) Construction superintendents and supervisors directly or indirectly employed by the Developer must have adequate relevant experience for the proposed Works and Services. The Engineer can require the Developer to replace any construction staff determined not to have adequate experience or presents concerns regarding work site safety or quality of work.

(iii) The Developer shall not commence the construction of any Works and Services without written permission from the Engineer.

(b) Materials and Workmanship

The whole of the work shall be done in a substantial and workmanlike manner with materials, articles and workmanship of the best quality and description as required by, and in strict conformity with, this Schedule. Unless otherwise specified, all materials shall be new.

(c) Survey Monuments and Legal Postings

(i) All legal posts, stakes and integrated survey monuments within and outside the immediate area of the work, and on adjoining areas of work, shall be preserved, undisturbed and visible. The Consulting Engineer, in the presence of a city engineering staff member, shall inspect the survey

monuments prior to the Pre-Construction meeting and prior to the issuance of a Certificate of Substantial Completion. In the event any of the above are disturbed, lost or destroyed, they shall be replaced by the City, at the cost of the Developer, to the satisfaction of the Engineer. Costs for replacement of survey monuments are listed in the Fees and Charges Bylaw 1532-2006, as amended from time to time.

(ii) All surveys within integrated areas of the City shall be tied to the monument system based on the Surveyor General's instructions.

(d) Disposal of Excavated Materials – Soil Removal

(i) No person shall place material from excavation on private property within the Agricultural Land Reserve unless that person has obtained a permit issued by the City as required under the *Soil Conservation Act*.

(ii) No person shall place material from excavation on properties outside the Agricultural Land Reserve unless that person has obtained a permit issued by the City as required under the City's Soil Removal and Deposit Bylaw.

(e) Invasive Plant Management

(i) Due to the presence of Invasive Plants within the City of Abbotsford that could compromise the integrity of infrastructure, buildings and/or human health, and natural environment the City requires an Invasive Plant assessment to be conducted on any property proposed for rezoning and/or Subdivision or requiring a Development Permit or a Development Variance Permit. Specific target species are those designated by regulation to be a noxious weed pursuant to the BC Weed Control Act, such as wild chervil, tansy ragwort, knotweeds, giant hogweed and others listed under the Weed Control Regulation.

The Invasive Plant assessment and mapping must be carried out by a Qualified Professional or Consulting Landscape Architect with expertise in Invasive Plant identification and management. Other certified professionals may be approved by the Engineer on a case by case basis.

On sites where Invasive Plants are present, the Developer shall have a Qualified Professional with expertise in Invasive Plant management, prepare an Invasive Plant management plan and submit this strategy to the City for Review. The Invasive Plant management plan will specify how Invasive Plants will be eliminated or establishment greatly reduced such that the prescribed landscaping plan or natural area native plants are well established and free of competition from Invasive Plants. A cost estimate and Security Deposit for management plan implementation and Qualified Professional fees shall also be provided. A 3-year monitoring and maintenance period with annual monitoring and maintenance reports prepared by the Qualified Professional is required. Annual monitoring and maintenance reports will describe maintenance methods, Invasive Plant survivorship results and make recommendations for future maintenance.

The City may require unsuccessful management plans to be revised and the maintenance period extended.

(f) Work of Others

(i) The City, its officers, employees, agents and Contractors shall be at liberty to enter upon the site of the work with its workers and materials to do other work, and the Developer shall afford any such workmen all reasonable access and facilities.

(ii) The Developer shall arrange his work and dispose of his materials in such a manner as will not interfere with the work or storage of materials of others upon the site of the work. The Developer shall join his work to that of others, and perform his work in proper sequence in relation to that of others to the acceptance of the Engineer.

(g) Existing Structures and Utilities

(i) Plans or descriptions, verbal or otherwise, of existing piping or structures that are given to the Developer are intended only as an aid in the location of these items. Measurements and locations of the existing piping and structures are compiled from the most reliable information available. This information must be verified by the Developer prior to proceeding with construction.

(ii) The City does not check, review or maintain the accuracy of any plans, maps or elevations that are in its possession. The Developer, or its Consulting Engineer, must review any information received from the City, and verify its accuracy by field investigation.

(h) Drainage

(i) The City utilizes Streams and Ditches as part of the Drainage System. Accordingly, the Developer shall be responsible for complying with all Federal, Provincial and Municipal legislation with respect to protection of fish, fish habitat and watercourses.

(ii) The Developer shall keep all portions of the site efficiently drained during construction and until acceptance by the City. The Developer shall be responsible for all damage which may be caused from water backing up, flowing over, through, from or along any part of the work, or elsewhere.

(iii) Existing culverts, drains, Ditches and watercourses affected by the work shall be kept clear of excavated material at all times. When it is necessary to relocate, remove or alter an existing drainage structure, the Developer shall provide suitable alternative measures for handling the drainage.

(iv) The Developer shall clean streets, catch basins, manhole sumps, detention tanks, and maintain erosion and sediment control works (in accordance with City's Erosion and Sediment Control Bylaw) as often as the Engineer

deems necessary, or as deemed necessary by other City permits or bylaws.

(i) Work In and Around Streams and Ditches

(i) Streams and Ditches shall be assessed, classified, and mapped to clearly define locations of Streams as defined Provincial legislation and the City of Abbotsford's Streamside Protection Bylaw.

(ii) Streamside Protection and Enhancement Area setbacks shall be clearly illustrated on all drawings and plans.

(iii) No works shall be conducted in a Streamside Protection and Enhancement Area without a Development Permit or Development Variance Permit and, where applicable, senior government approvals.

(j) Work to Fit With Others

(i) The Developer shall do all cutting, fitting or patching of his work that may be required to properly fit or receive existing structures and utilities.

(ii) The Developer shall not connect his Works and Services to existing Works and Services without the prior written consent of the Engineer.

(k) Damage to Work

(i) The Developer shall bear the risk and all loss or damage which may occur on or to the Works and Services until accepted by the Engineer.

(ii) All repair, restoration or re-execution of the Works and Services shall be carried out to the satisfaction of the Engineer and at no cost to the City.

(l) Use of Completed Portions

The City shall have the right to take possession of any completed, or partially completed, portion of the Works and Services when considered necessary by the Engineer. Such possession shall not be deemed an acceptance of Works and Services. If prior use increases the cost of constructing uncompleted Works and Services, or causes refinishing of completed work beyond normal wear and tear, the Developer shall be entitled to such compensation as the Engineer may determine.

(m) City's Right to Repair, Restore or Re-Execute the Works and Services

(i) Should the Developer, within fourteen (14) calendar days of the City's written notice to do so, fail to perform the design, construction and installation of Works and Services, or fail to begin, repair, restore or re-execute the Works and Services, all to the satisfaction of the Engineer, or fail to comply with the provisions of this Bylaw, the City shall be hereby

empowered to repair, restore or re-execute the Works and Services at the cost of the Developer.

(ii) Despite any other provisions of this Bylaw, the City reserves the right to repair, restore or re-execute the Works and Services on an emergency basis without written notice.

(iii) The work performed by the City shall not relieve the Developer from the performance and fulfillment of any of his obligations and duties under this Bylaw.

(n) Payment of Accounts

(i) The Developer shall pay all accounts for labour, services and materials, incurred by the City as a result of the City performing any repair, restoration, execution or re-execution of the Works and Services, whether during the design, construction and installation of the Works and Services or during any Warranty Period as established herein. Should payment not be made upon invoice, and if the Works and Services performed relate to outstanding Works and Services secured for in the Security Deposit or Warranty Deposit, the City shall deduct the payment from the Security Deposit or Warranty Deposit, provided the remaining Security is adequate for the outstanding Works, plus 200%.

(ii) If the amount is greater than the Security Deposit or Warranty Deposit, as the case may be, the Developer shall pay the difference when invoiced.

(o) Arbitration

In the case of any dispute between the City and the Developer during the progress or afterwards of the design, construction or installation of the Works and Services, as to any matter arising there under, either party may at his option give to the other, notice of such dispute and the parties may, with respect to the particular matters then in dispute, agree to submit the same to arbitration in accordance with the laws of the Province of British Columbia; provided, however, that if arbitration has not been agreed upon, either party may elect to have such dispute determined by a Court of competent jurisdiction. Arbitration shall not be a cause for the stoppage of work.

(p) Employee and Plant Safety, Adequacy

(i) The Developer or the Developer's Contractor is designated as the Prime Contractor and shall be responsible for the safety of his employees and for the safety, adequacy and sufficiency of his plant, equipment and method of executing the design, construction and installation of Works and Services. The Developer shall advise the City in writing on who has been designated as the Prime Contractor for each work site.

(ii) The Contractor shall be responsible for notification of the proposed construction and installation of the Works and Services to WorkSafe BC, and shall conduct the delivery of all Works and Services in compliance with

the regulations of WorkSafe BC. A copy of the notification letter shall be forwarded to the Engineer prior to commencement of construction.

(q) Public Convenience, Access and Clean-Up

(i) In carrying out the work, the Developer shall always consider the convenience and safety of the public.

(ii) The Developer shall not obstruct any Roadway or Sidewalk longer than is necessary to complete the works.

(iii) The Developer shall provide for safe access to Sidewalks, Driveways, buildings and private property for vehicles, pedestrians and cyclists, where Bicycle Facilities exist, at all times.

(iv) The Developer shall allow for passing along and crossing of all Roadways and Sidewalks, where practical, during the execution of the construction and installation of the Works and Services.

(v) The Developer shall construct and maintain in good order suitable platforms, approaches, structures, bridges, crossings, signage or other Works and Services as required by the Engineer.

(vi) The Developer shall not deposit material upon a Roadway or other public or private property without the consent of the Engineer or private property Owner.

(vii) During all phases of the construction and installation of Works and Services, including the Warranty Period, the Developer shall take precautions to abate nuisance caused by mud, dust or erosion by clean-up, sweeping, sprinkling with water or other means, as necessary to accomplish results acceptable to the Engineer.

(viii) The Developer shall obtain written consent from the Engineer prior to any closure of a Roadway, access way or Statutory Right of Way.

(r) Traffic Control Barriers, Lights

(i) The Developer shall, at his own expense, provide, erect and maintain all required barriers, fences, warning flashers with amber globes, or other such proper protection including qualified flag persons if necessary, to ensure safety to the public as well as those engaged about the premises or with the construction and installation of the Works and Services.

(ii) The Developer shall also provide signs or notices in compliance with the most recent versions of the Ministry of Transportation’s Traffic Control Manual for Works on Roadways and Manual of Uniform Traffic Control Devices.

(s) Releases at Completion of Works and Services

(i) The Engineer may require that, upon completion of construction and installation of any portion of the Works and Services on private property, the Developer obtains from each affected property Owner, a formal release, in writing, verifying that the property has been restored by the Developer to the same condition it was in as before such construction or installation.

(ii) In the case of a dispute, the Engineer's decision shall be final.

3. AGREEMENTS, FEES, BONDING, INDEMNIFICATION, INSURANCE, PERMITS

(a) Servicing Agreement - Contents and Provisions

(b) Servicing Agreement Procedure

When entering into a Servicing Agreement the following procedure shall be followed:

Three (3) copies of the Servicing Agreement shall be obtained from the City. All copies of the Agreement shall be executed by the Developer and returned to the Engineer along with the following:

(i) Security Deposits in the amount and form specified;

(ii) a non-refundable administration and inspection fee in the amount calculated in accordance with the Fees and Charges Bylaw; and

(iii) any other connection fees, cash in lieu of Works and Services, latecomer fees, or similar charges levied by the City and required in the Servicing Agreement.

(c) Administration and Inspection Fee

The administration and inspection fee shall be based upon the estimated cost of construction including engineering and a contingency of 10% as provided in Fees and Charges Bylaw.

(d) Where Development Works and Services have been undertaken on private property prior to the issuance of a Notice to Proceed, the Engineer shall consider requiring the following terms and conditions to be met by the Developer prior to the issuance of a Certificate of Substantial Completion:

(i) deposit of Warranty Period security equal to 200% of the estimated cost as determined by the Consulting Engineer and accepted by the City;

(ii) Warranty Period extension of up to five (5) years;

(iii) relocation or reconstruction of any infrastructure (above or below ground) not conforming to this Bylaw;

(iv) flushing and CCTV inspection of all gravity mains and services each year up to the date of Issuance of a Certificate of Final Acceptance;

(v) pressure testing and disinfection of all sewage forcemains, water mains and service connections;

(vi) full exposure and/or spot-checking of infrastructure not inspected by the City to verify the horizontal and vertical locations of mains and services including pipe material and class;

(vii) independent electrical and mechanical commissioning of booster stations, pressure reducing valve installations, sewage pump stations, water retaining structures;

(viii) detailed geotechnical investigation confirming suitability and compaction of bedding and backfill, densities, beam testing, and/or any further testing as directed by the Engineer;

(ix) asphalt and concrete testing; and

(x) any other testing as may be required by the Engineer in order to ascertain acceptability for turnover of infrastructure to the City for ownership, operations and maintenance.

(e) Indemnity Clause

(i) The Developer shall indemnify and hold the City, its officers, employees, elected officials, agents and Contractors harmless from and against all actions and proceedings, costs, damages, expenses, claims and demands whatsoever and by whomsoever brought by reason of the construction, installation, maintenance or repair of the Works and Services, and for greater certainty, the indemnification shall be in accord with the provisions of the Servicing Agreement in Schedule “G” or a Development Agreement;

The Developer shall pay all expenses and costs which may be incurred by reason of the construction, installation, maintenance or repair of the Works and Services resulting in damage to any property owned in whole or in part by the City or which the City by duty or custom is obliged directly or indirectly, in any way or to any degree to construct, install, maintain or repair; and

(f) The Developer shall pay all expenses and costs which may be incurred by reason of liens for non-payment of labour or materials, Workers’ Compensation, Employment Insurance, all taxes, check-off or encroachments owing to mistakes in survey;

(g) Public Liability and Property Damage

(i) Prior to the commencement of any Works and Services, the Developer shall obtain and maintain a policy or policies of insurance acceptable to the Engineer and in accordance with the requirements of Subsection (j).

(ii) In all policies:

A. each Contractor engaged in the work and the City shall be named as an additional insured;

B. each policy shall contain a provision that the insurance shall apply as though a separate policy has been issued to each named insured; and

C. each policy shall provide that no expiry, cancellation or material change in the policy shall become effective until after 30 days notice of such cancellation or change. Notice of change shall be given to the City by registered mail.

(iii) The Developer shall maintain in good standing the insurance policy or policies until issuance of a Certificate of Final Acceptance by the Engineer.

(h) Insurance Policy Limits

The following are limits to be included:

(i) Comprehensive Public Liability Insurance and Property Damage Insurance providing coverage of at least $5,000,000, inclusive against liability for bodily injury or death and/or damage to property on an all risk occurrence basis;

(ii) Motor Vehicle Insurance for public liability and property damage providing coverage of at least $5,000,000, inclusive on owned, non-owned or hired vehicles; and

(iii) completed operations coverage on an all-risk occurrence basis of at least $5,000,000, inclusive against liability for bodily injury, death and/or damage to property of others arising out of the existence of any condition in the work when completed or any installation or repair operations during the period of 12 calendar months next ensuing after the issuance of a Certificate of Substantial Completion by the City.

(i) Insurance Policy Submission

(i) Prior to the pre-construction meeting, the Developer shall deliver, to the City, a copy of the policy or policies of insurance certificate signed by a licensed insurance agent, certifying as follows:

"I hereby certify that the attached insurance policy provides insurance coverage as required by Servicing Agreement number _____

between the City of Abbotsford and (the Developer), and that the attached Insurance Policy No.____ is valid for the period of the Servicing Agreement including the Warranty Period."

(ii) No construction may commence if this provision has not been satisfied.

(j) Patents and Copyrights

The Developer shall pay all royalties, patent and license fees, and hold and save the City, its officers, agents, servants and employees, harmless from liability of any nature or kind, including costs and expenses, for, or on account of, any copyrighted or un-copyrighted composition, secret process, patented or un-patented invention, articles or appliances manufactured or used in the execution of the Works and Services, including their use by the City.

(k) Permits

Where any work is undertaken on a Highway within the City and outside the area of the required Works and Services or any work is undertaken without the benefit of an executed Servicing Agreement or registered Development Agreement covenant where full or partial road closures are necessary or contemplated, the Developer shall obtain a Highway Excavation Permit from the Engineer.

SECTION NO. 2 – ENGINEERING STANDARDS FOR DRAWING SUBMISSIONS

1. INTRODUCTION

(a) The Developer and its' Consulting Engineer shall refer to the most current version of ENGINEERING STANDARDS FOR DRAWING SUBMISSIONS as posted on the City of Abbotsford website.

SECTION NO. 3 – WATER DISTRIBUTION – DOMESTIC AND FIRE FIGHTING

1. GENERAL

(a) The design of water systems in the City shall conform to the requirements of the Provincial Drinking Water Protection Act, the Health Act, and this bylaw.

(b) The design of the water systems shall provide fire flows supporting the proposed land use.

(c) Refer to Schedule "H" for procedures regarding de-chlorination and de-chloramination.

2. PRE-DESIGN REQUIREMENTS

(a) The adequacy and availability of the existing Water Distribution System shall be confirmed with the Engineer prior to any design, extension, or connection into City infrastructure. Where Developments are to be served by Clearbrook Waterworks District, the Developer shall provide the City with proof that water quality and

quantity are adequate and conform to the requirements of the Provincial Drinking Water Protection Act, the Health Act, Clearbrook Waterworks District standards, and this bylaw. Clearbrook Waterworks District shall be required to perform a computer modeling analysis of their system to determine and validate the available domestic and fire flows for the Development site – a sealed copy of this report shall be provided to the City under the signature and seal of the qualified Consulting Engineer.

(b) The proposed Water Distribution System shall be designed to provide domestic requirements and fire protection, as specified herein.

(c) Dead end water mains are to be avoided whenever possible. Water mains shall be looped at the direction of the Engineer

3. CONSTRUCTION SPECIFICATIONS

(a) All construction within the scope of this Schedule shall conform to the City approved edition of the Master Municipal Construction Documents (Platinum Edition – Volume II) and the requirements, standards and specifications prescribed by this Bylaw.

(b) Should any conflict exist or arise between these documents, this Bylaw shall take precedent over the Master Municipal Construction Documents.

4. PER CAPITA DEMAND

Average annual daily demand (ADD)	300 litres/capita/day
Maximum daily demand (MDD)	700 litres/capita/day
Peak hour demand (PHD)	1050 litres/capita/day

The following tables are provided for applying minimum density by land use to determine domestic flow:

For Urban Residential	Persons/Unit
Single Detached/Duplex Residential without secondary suite	3.3
Single Detached/Duplex Residential with secondary suite	6.6
Ground Oriented (Townhomes)	2.5
Midrise (Apartments)	1.8

Land Use Type	Equivalent Population/Hectare
Commercial/Mixed Use	90 people/ha
Institutional	50 people/ha
Industrial	90 people/ha

(a) Populations used in calculating water demand shall be computed in accordance with the City's population projections or with the planned Development in the area to be served, whichever is greater.

(b) The Consulting Engineer shall confirm projections with the Engineer prior to completing designs.

5. FIRE FLOW REQUIREMENTS

(a) Fire flow requirements in the City shall follow published criteria by the Fire Underwriters' Survey (FUS) entitled, "Water Supply for Public Fire Protection - A Guide for Recommended Practice" (latest edition). Fire flow calculations are to be submitted by the Consulting Engineer for all Developments except for Single Detached/Duplex Residential land uses. When fire flow calculations exceed the requirements below, the Developer must either upgrade the water system or reduce building requirements to comply.

(b) Accessory processing use buildings in Agricultural zones greater than 2000 metres square in building area shall have fire flows as per NFPA 1142, Standard on Water Supplies for Suburban and Rural Fire Fighting.

(c) Required fire flows for specified land uses are:

Land Use Type	Required Fire Flow
Single Detached/Duplex Residential	75 L/s
Ground Oriented (Townhomes)	150 L/s
Midrise (Apartments)	175 L/s
Commercial/Mixed Use/Highrise	200 L/s
Institutional	200 L/s
Industrial	220 L/s

(d) If available fire flows are less than the required fire flows as stated herein, or velocity exceeds 3.0 m/s, the Developer shall improve, upgrade or extend the existing Water Distribution System. Where necessary, the City may require the proposed extended Water Distribution System to be upsized. The Engineer may authorize payment for the cost of upsizing beyond sizes required by these standards and specifications.

6. DESIGN FLOWS

(a) Design flows are to be the greater of the following:
(iii) Maximum Daily Demand plus the Fire Flow (MDD + FF), or
(iv) Peak Hour Demand (PHD)

7. WATER PRESSURE

Minimum Peak Demand Pressure at 5.0 metres above Minimum Building Elevation (MBE)	300 KPa
Maximum Allowable Pressure	830 KPa
Minimum Fire Hydrant Pressure (residual)	150 Kpa

8. HYDRAULIC NETWORK CONSIDERATIONS

(a) The Consulting Engineer shall provide, at the discretion of the Engineer, a hydraulic analysis of the proposed water system showing minimum flows and pressures. All water mains shall be looped at every opportunity.

(b) Where there is an existing hydraulic network in place, the City may provide information for design calculations at a cost to the Developer.

(c) Design computations shall be based on Hazen-William's formula:

$$Q = \frac{CD^{2.63} S^{0.54}}{278{,}780}$$

Where: Q = rate of flow in l/s
D = internal pipe diameter in mm
S = slope of hydraulic grade line in m/m
C = roughness coefficient: for all mains within the City use a roughness coefficient of 130.

(d) The minimum pipe grade shall be 0.1%. Where the maximum grade is greater than 10%, the main shall be constructed with joint restraints plus anchoring designed as per MMCD Detail G8 with input from a geotechnical Consulting Engineer.

(e) Design velocities within new water mains shall not exceed 3.0 m/s.

9. WATER MAINS AND APPURTENANCES

(a) Water Main Pipe Sizes

Water main pipe sizes shall be the greater of the sizes shown in the table below or the size required to meet velocity or fire flow constraints as determined by the Consulting Engineer. Larger sizes may be required at the discretion of the Engineer.

Land Use Type	**Water Main Size (Minimum)**
Single Detached/Duplex Residential	200 mm diameter *
Ground Oriented (Townhomes)	250 mm diameter
Midrise (Apartments)	250 mm diameter
Commercial/Mixed Use/Highrise	250 mm diameter
Institutional	250 mm diameter
Industrial	250 mm diameter

*In all Single Detached/Duplex Residential (RS) Land Use, water mains may be reduced to 150 mm diameter provided that:

(i) they are at the terminus of a system that cannot be extended in the future;

(ii) minimum fire flow and water pressure requirements are met; and

(iii) the water main services ≤18 single-family homes.

(b) All water mains greater than 400 mm diameter are to be ductile iron or welded steel.

(c) Testing of the soil and surrounding environment shall be conducted for all new or replacement mains. The results are to be used to predict the deterioration rate of the main and appurtenances shall be of a suitable material and thickness, or supplemented by a corrosion mitigation technique, to ensure at least 50 years of service prior to a leak or failure. Soil analysis shall be conducted by a corrosion engineering firm or certified personnel in accordance with a standardized evaluation procedure such as ANSI/AWWA Standard C105, Appendix A (10-point system) or 25-point system Developed by William Spickelmire. Evaluation of the surrounding environment shall include sources of stray current, fluctuating water table, leak records (if available) and soil condition changes along the alignment. A copy of the corrosion analysis report and recommendations shall be provided to the City.

(d) Water mains designated by the Engineer to provide “lifeline watermains” in the case of disaster shall be designed to be seismically resilient in in accordance with the American Lifelines Alliance Seismic Guidelines for Water Pipelines. The seismic design event is to be provided by the Engineer. The Consulting Engineer will provide a design brief that outlines the pipeline function class, expected horizontal and vertical movement associated with the design event and outline how the design accommodates this.

(e) Designs showing water mains or service connections being installed under a retaining wall shall be avoided. When extraordinary circumstances exist, the Engineer may give consideration to designs that incorporatecarrier pipes which allow the main or service connection to be removed and replaced without impacting the long-term stability of the retaining walls.

(f) Design consideration must be given to the horizontal alignment of utilities such that any water mains shall run parallel to any Streamside Protection and Enhancement Area or environmentally sensitive area(s). The horizontal alignment of the utility is to be offset such that excavation works are beyond the drip line of trees or other native or new plantings. Design consideration is to be given to long term integrity in order to avoid pipe breakage or blow out which could lead to a release of chlorinated water to a Stream or Ditch.

(g) Valves

(i) Valves shall be located as follows:

A. at intersections;

B. in a cluster at the pipe intersections;

C. at hydrant tees (an additional valve is required on Arterials and Collectors as determined by the Engineer);

D. every 150.0 metres within the Urban Development Boundary;

E. every 300.0 metres in rural areas; and

F. outside of curbs and gutters.

(ii) The minimum number of valves at intersections shall be:

A. three (3) where mains “Cross”; and

B. two (2) where mains “Tee”.

(iii) All valves shall be the same diameter as the main

(iv) All direct bury mainline valves shall be resilient seat gate valves. Bypasses are to be reviewed on a case by case basis.

(h) Pressure Reducing Valves/Stations

Pressure reducing valves are required where water systems cross pressure zones. The Consulting Engineer shall refer to latest standards and specifications for design and installation of PRV stations from the Engineer.

(i) Air and Vacuum Release Valves

(i) Accepted air and vacuum release valves shall be installed at all summit points including temporary dead ends and other locations as determined by the Consulting Engineer.

(ii) The Consulting Engineer shall size air and vacuum release valves based on manufactures specifications.

(j) Valve and Meter Chambers

(i) Chambers or manholes containing valves, air valves, blow-offs, meters or other appurtenances shall be connected directly to the Drainage System complete with appropriate back flow protection. Chambers or manholes may be drained to the surface or to absorption pits, subject to adequate soil conditions and the approval of the Engineer. Mechanical or automated

systems for de-chloramination of expelled or leaking water shall be incorporated at the discretion of the Engineer.

(ii) Meter chambers shall be located within the road right of way outside the traveled portion of the roads (including Driveways) or in a right of way on private property. Whenever possible, the chambers shall be located in Landscaped areas not subject to vehicular traffic. Chambers in Landscaped areas within 1.5 metres of a Driveway shall be considered to be subject to vehicular traffic unless they are protected by bollards or barrier curb.

(iii) Chambers installed in Landscaped areas not subject to vehicular traffic may have an alternative lid assembly acceptable to the Engineer. Where it is necessary to install a chamber in a Landscaped area subject to vehicular traffic or parking lot, the chamber lid shall be designed to withstand a "dynamic" H-20 loading. This dynamic loading includes a 30% impact allowance to the H-20 wheel load identified in the American Association of State Highway and Transportation Officials (AASHTO) standard specification for Highway bridges. For these applications the hatch must be made of steel with lift assists incorporated into the hatch. Maximum force required to open the lid shall not exceed 16 kilograms (35 pounds). Manhole frame and covers shall not be used for chamber lids in any circumstances.

(iv) Locking mechanisms for the meter chamber lid shall be recessed and of a design accepted by the Engineer.

(k) Blow-offs

Blow-offs shall be provided on all dead-end mains. For mains 200 mm diameter and greater, the blow-off shall be 100 mm diameter. For mains smaller than 200 mm diameter, the blow-off shall be 50 mm diameter.

(l) Mechanical Joint Restraints

(i) Mechanical joint restraints shall be provided at all fittings (bends, tees, wyes, reducers, plugs, caps, hydrants and blow-offs) requiring thrust restraint. The Consulting Engineer shall show calculations and the number of joint restraints required to resist the thrust at the fittings.

10. HYDRANTS

(a) Fire hydrants shall be:

(i) located within a Statutory Right of Way for Highway purposes in Urban Areas, where City ownership is confirmed by the Engineer, at a maximum spacing of 150.0 metres and, where possible, within 75.0 metres of all possible building Parcels;

(ii) located so that there is a clear radius of a minimum 1.5 metres around the hydrant at all times measured from center of hydrant; and

(iii) if within a private Parcel, shall comply with Fire Service Bylaw and the BC Building Code.

(iv) located in accordance with the appropriate Standard Drawing or as designated by the Engineer;

(v) at the EC/BC of curb returns in Highway intersections where possible;

(vi) at least 1.5 metres away from an ornamental lamp standard, utility pole, street tree or Driveway;

(vii) opposite a property line between two (2) Parcels or at the beginning of the radius of truncation for a corner Parcel; and

(viii) in rural areas: within a Statutory Right of Way for Highway purposes at a maximum spacing of 300 metres, unless otherwise directed by the Engineer.

11. SERVICE CONNECTIONS AND WATER METERS

(a) The standard Single Detached/Duplex Residential connection in the City is 25 mm and shall be located at the property line as per Standard Drawing ES-G-1. For non-standard Single Detached/Duplex and other land uses the Consulting Engineer shall calculate the size of service required and submit a request for the service connection complete with demand calculations (both domestic and fire flow requirements). The Engineer shall review the application to confirm the service size requirement, alignment, and determine if it can be accommodated by the City's infrastructure.

(b) For all land uses other than Single Detached/Duplex Residential applications domestic and fire services shall be separate.

(i) The fire service shall incorporate a double check valve back flow preventer which includes a flow detector feature ("tattle tale" meter) complete with wiring to outside of building for the installation of a meter interface unit. The preferred location for the backflow preventer shall be at the entry point into the building, preferably in a designated mechanical room. Alternate locations and configurations must be submitted to the Engineer for approval prior to execution of the Servicing Agreement or issuance of Building Permits.

(ii) The Domestic service shall have the Domestic meter located at PL in a meter box as per the applicable standard in this Bylaw.

(iii) Use of the fire service is to be for fire sprinkler systems only. Any other use is prohibited and subject to fines and penalties contained in the Waterworks Rates and Regulations Bylaw.

(c) All water meters must be designed and installed as per the City's Water Meter Design Criteria Manual as available on the City Website.

(d) Bareland and townhouse strata units (excluding apartment style condominiums) shall have a bulk meter at property line and be individually serviced. The meter shall be located outdoors in a meter box in such a way as to protect the service from freezing or damage from vehicular traffic. Meter boxes shall be easily accessible to accommodate meter maintenance and an access covenant must be registered on the property.

12. WATER DISTRIBUTION SYSTEM LOCATION/CORRIDORS

(a) All proposed Water Distribution Systems within a Statutory Right of Way for Highway purposes shall be located as shown on the typical cross-sections or as designated by the Engineer. Where a Water Distribution System crosses private property it shall be protected by a Statutory Right of Way. The width of the Statutory Right of Way shall be the maximum of the two following criteria:

(i) 3.0 m; or,

(ii) 2 x (Depth $_{\text{surface to crown of pipe}}$) + Trench Width.

Note: For any mains deeper than 2 m, the SROW will be confirmed by the Engineer.

(b) When a Water Distribution System is within a Statutory Right of Way on private property, a restrictive covenant may also be required at the discretion of the Engineer to restrict the depth and location of any proposed footings, buildings, overhangs etc. in the vicinity of the water main.

(c) When a Water Distribution System is located within a Statutory Right of Way, the Developer will be required to provide access for maintenance vehicles. The maintenance access shall be constructed to withstand H-20 loading.

(d) When a Water Distribution System is within Private property and not within a Right of Way, it and all appurtenances, with exception of the water meter, shall be the property and responsibility of the property owner, unless otherwise determined at the discretion of the Engineer.

(e) A new Water Distribution System by a Developer shall not be connected to a City System until:

(ii) pressure testing and bacteriological testing have been completed, passed and accepted by the Engineer; and

(iii) the City receives a legal document and Statutory Right of Way plan, in a registerable form, complete with a letter of undertaking from the Developer's solicitor.

13. COVER

(a) Minimum cover over the crown of ductile iron (D.I.) water mains shall be 1.0 metre and minimum 600 mm over appurtenances. For all other types of mains, the minimum cover shall be 1.2 metres.

(b) At high points in the water system, adequate cover must be maintained to facilitate installation of an air release valve complete with chamber as per City drawings CS-W-7, CS-W-17 and CS-W-18.

(c) Special consideration and specific permission from the Engineer is required for frost and mechanical protection in cases where minimum depths cannot be attained. Where approved the Consulting Engineer shall provide details for insulation or alternative methods of protection.

14. SEPARATION FROM OTHER UTILITIES

(a) Water Distribution Systems constructed in proximity to other utilities shall conform to the criteria of the Provincial Drinking Water Protection Act and Regulations and the Fraser Health Authority Waterworks Construction Permit.

(b) When crossing Asbestos Cement (AC) pipe, a minimum 3.0 metres length of the AC pipe (1.5 metres each side of the crossing point) shall be removed and an equal length of ductile iron (DI) or PVC pipe shall be inserted as per Drawing CS-W-22. Such work must be carried out by or under the direct supervision of City forces.

(c) Horizontal Separation

At least 3.0 metres horizontal separation shall be maintained between a water main and either a sanitary or storm sewer. The separation shall be measured from the outside diameter of the water main to the outside diameter of the sewer.

In special circumstances, specifically in rock or where the soils are demonstrated by a geotechnical engineer to the satisfaction of the Engineer to be impermeable, lesser separation than 3.0 metres may be permitted provided that:

(i) the sewer main and water main are installed in separate trenches and the water main invert is at least 0.5 metres above the crown of the sewer and the water main joints are wrapped with heat shrink plastic or packed with compound and wrapped with petrolatum tape in accordance with the latest version of AWWA Standards C217, C214 or C209; or

(ii) the pipes are installed in the same trench with the water main located at one side on a bench of undisturbed soil at least 0.5 metres above the crown of the sewer and the joints of the water main are wrapped with heat shrink plastic or packed with compound and wrapped with petrolatum tape in accordance with the latest version of AWWA Standards C217, C214 or C209.

(iii) horizontal separation of greater than 1.0 m is achieved.

(iv) pipe wrapping to be used only for non-welded pipe connections.

(v) specific approval is obtained from the Fraser Health Authority.

(d) Vertical Separation

Where a sanitary sewer or storm sewer crosses a water main, the sewer should be below the water main with a minimum clearance of 0.5 metres and the joints of the water main, over a length extending 3.0 metres either side of the sewer main are to be wrapped with heat shrink plastic or packed with compound and wrapped with petrolatum tape in accordance with the latest version of AWWA Standards C217, C214 or C209.

Where it is not possible to obtain the vertical separation above, and subject to the satisfaction of the Engineer and the Fraser Health Authority, the following details may be used:

(i) the water main joints shall be wrapped as indicated above; and

(ii) between upstream and downstream manholes, the sewer shall be constructed of pressure pipe such as high density polyethylene (HDPE) or PVC with fused joints and pressure tested to assure it is water tight. Applicable to new sewer installations only.

15. PRIVATE WATER SYSTEMS

(a) Where no City water system exists, the Developer shall provide potable water from a proven ground water source as per the Provincial Drinking Water Protection Act and Regulations and this Bylaw. Private water systems will only be considered for fee simple and bare land strata single family lots.

(b) The water quality shall meet or exceed the latest edition of “Guidelines for Canadian Drinking Water Quality”, as published by Health Canada. A certified laboratory that is under the direction of the Standards Council of Canada or the Canadian Association of Environmental and Analytical Laboratories shall complete testing and supply all testing results to the Engineer and Consulting Engineer.

(c) For each single-family dwelling created or proposed there must be a dedicated well capable of providing 2500 litres per day and a peak flow of 9.0 litres per minute for a four (4) hour period.

(d) Each lot or proposed lot must have its own self-contained well. Community or shared wells will not be permitted. The Owner of each lot will be responsible for all operational, maintenance and replacement costs of the associated well.

(e) All water well drilling, construction and well abandonment shall conform to Groundwater Protection Regulation and Fraser Health Authority requirements. The well driller must be certified as a water well driller in British Columbia.

(f) A Consulting Engineer or Consulting Geoscientist shall submit well test information and certification that the well meets or exceeds the above standards. See Form E8 for certification requirements.

(g) If there are two (2) wells or less in the proposed Development a certification by a Consulting Engineer based on a Water Well Contractor's Report or Well Testing Contractor's Report will be sufficient. Where well yield is considered marginal, ±10% by the Consulting Engineer or where more than two (2) wells are involved, a hydro-geotechnical evaluation of the proposed water source is required.

(h) Well Testing Procedure

Completed wells shall be tested by pumping continuously at a constant rate for a minimum period of four hours. The tested rate must be at or greater than the required 9.0 litres per minute. See appropriate forms and appendices for recording of information and data. While the test is running, the following measurements shall be made:

(i) water levels in the well at specific time intervals;

(ii) pumping rate must be constant;

(iii) times that all readings were made;

(iv) notes on colour, smell and taste of the water pumped; and

(v) notes on weather conditions during and up to 48 hours prior to the time of testing.

SECTION NO. 4 – RAINWATER MANAGEMENT

1. GENERAL

(a) The Rainwater Management design criterion standardizes the procedures for designing rainwater collection, management and conveyance facilities in the City. All Rainwater Management Systems shall be designed with consideration for water quality and quantity, public safety, regulatory requirements, maintenance, economic benefits and the natural environment.

(b) A comprehensive Rainwater Management Plan is required for all Developments of greater than 0.5 Ha in size except Developments classified as rural or agricultural unless otherwise directed by the Engineer. The Rainwater Management Plan consistent with the requirements outlined in Section 2 of Schedule “E” and will be subject to the approval of the Engineer.

(c) Drainage System to be compliant with Part 5 *[Rainwater Source Control]* of this bylaw.

(d) Works and Services shall be compliant with the *Erosion and Sediment Control Bylaw*.

(e) All construction within the scope of this Section shall conform to the City approved version of the MMCD (Platinum Edition – Volume II) and the requirements, standards and specifications prescribed in this Bylaw.

(f) Should any conflict exist or arise between these documents, this Bylaw shall take precedent over the Master Municipal Construction Documents.

2. MINOR SYSTEM

(a) The minor system shall be designed to prevent flooding and property damage and minimize public inconvenience caused by rainfall events with a return period of 1:10 years. The runoff from a 1:10-year rainfall event is referred to as the “Minor Flow”.

(b) Refer to Subsections 6, 7 and 8 within Section 4 of this Schedule for further design criteria for the minor system.

3. MAJOR SYSTEM

(a) The major system shall be designed to protect the public and prevent significant property damage due to flooding caused by the rainfall events with a return period of up to 1:100 years.

(b) The major system shall comprise surface flood paths, swales, channels, watercourses, Roadways, Walkways, pathways, flow control facilities or other City owned facilities at the discretion of the Engineer, designed to accommodate the major 1:100 year flow.

(c) The maximum hydraulic grade line for the major flow shall be 150 mm below the proposed MBE of adjacent buildings.

(d) Surcharging at an inlet (e.g. manhole, catch basin, lawn basin) under major flow is acceptable provided that the hydraulic profile in the storm sewer main line does not come within 150 mm of the MBE of adjacent properties. The maximum depth of ponded water at inlets shall not be greater than 300 mm, and provided that the water is sufficiently contained and does not spill to adjacent properties. Adequate erosion protection shall be required where surcharging is evident.

(e) Where surface flood paths cannot be established, pipes and culverts of the existing or proposed minor system shall be enlarged to accommodate the conveyance of the major flow (1:100 year). Emergency overflow routes may be required by the Engineer.

4. RAINWATER MANAGEMENT SYSTEMS

(a) All proposed Rainwater Management Systems shall drain to existing, adequate drainage systems.

(i) Where there is no storm sewer in an existing Subdivision, a Single Family Residential infill Development, or replacement / reconstruction of an existing home, may apply retention / infiltration facilities for rainwater management.

(b) The presence of existing Rainwater Management Systems does not imply that there is adequate capacity to receive flow from proposed Development, nor does it imply that the existing system is adequate.

(c) As required by the Engineer, the Consulting Engineer shall analyze all downstream piped Rainwater Management Systems to determine if they are adequate for the projected increase in runoff created by any Development.

(d) Existing Rainwater Management Systems which are inadequate to accept additional rainwater flow shall be upgraded to accommodate the proposed flows at the Developer’s expense.

(e) All Rainwater Management Systems shall be located within a Statutory Right of Way for Highway purposes or registered Statutory Right of Way. When a proposed Rainwater Management System is to be connected to an existing, adequate Rainwater Management System that is not protected as above, efforts by the Developer may be required to acquire necessary Statutory Right of Way at the discretion of the Engineer. The cost for securing this protection shall be borne by the Developer.

5. DESIGN METHODS

(a) Hydrology

(i) Rainwater Management Systems shall be designed to accommodate post-Development flows using the Rational Method or a Runoff Hydrograph Method at the discretion of the Engineer.

(ii) The Rational Method is acceptable for computing design flows for catchments up to 10 hectares in total area:

Q=RAIN

Where:

Q = Flow in (m^3/s)
R = Runoff Coefficient
A = Drainage area in hectares (Ha)
I = Rainfall intensity in mm/hr
N = 0.00278

Q: is the resulting flow from the catchment or sub-catchment area

R: For designs not incorporating alternate rainwater management strategies, the Runoff Coefficient for the minor system shall be not less than:

0.6 for single family land use
0.7 for Multi-family land use
0.9 for Commercial land use
0.9 for Industrial land use
0.95 for Roadways and rooftops

A: The catchment areas shall be determined using the natural contours of the land. The Consulting Engineer shall confirm the extent of catchment areas with the Engineer. City data on existing contour mapping and aerial photographs may not be accurate enough for design purposes and the Consulting Engineer shall confirm true and accurate surface elevations and contours for his design.

I: Rainfall Intensity can be derived by using the rainfall intensity duration frequency (IDF) curve shown on ES-D-1. The IDF curve includes the anticipated impact of climate change.

N: 0.00278 - a fixed constant

(b) Time of Concentration

(i) The time of concentration is the time required for water to flow from the most remote part of the catchment area to the rainwater element under design, computed by the following formula:

(Note: actual velocities in storm sewers shall be used to calculate T_c values.)

$T_c = T_i + T_t$

Where:

T_c = time of concentration (minutes)
T_i = inlet or overland flow time (minutes)
T_t = travel time in sewers, Ditches, channels or watercourses (minutes)

(ii) A composite value for T_c is calculated where the type of flow along the longest flow path varies or the slope changes.

(iii) Overland Sheet Flow in Undeveloped Basins

The maximum sheet flow path length in any undeveloped basin shall be 300 metres. The overland sheet flow time shall not exceed 15 minutes.

(iv) Inlet Time for Developed Areas

A. For low density Residential Development, assume an inlet time of 10 minutes;

B. For all other uses and undeveloped areas, inlet times shall be calculated as follows:

$$T_t = \frac{C_t \, L \, n}{12 \, s^{0.5}}$$

Where:
T_t = travel time (minutes)
C_t = flow travel coefficient (0.5)
L = length of flow path (m)
n = roughness coefficient:
0.050 natural channels
0.030 excavated Ditches
0.013 concrete lined channels
0.013 concrete pipe
0.011 PVC pipe
S = slope in m/m

(c) Presentations of Rational Method Calculations

The Consulting Engineer shall tabulate all Rational Method calculations for submission along with appropriate plans and other relevant information as directed by the Engineer.

(d) Runoff Hydrograph Method

(i) For basins larger than 10.0 hectares, or for computing detention storage requirements, dynamic hydrologic programs shall be used for runoff analyses. Standard runoff simulations shall be modeled using programs acceptable to the Engineer.

(ii) The model used shall be based on the post-development conditions using the most current planning information. Conservative parameters shall be selected if calibration data is not available. For assessment of existing systems, the drainage model shall be based on the existing conditions if no future land use changes are anticipated. The total Developed tributary area should not deviate from the total natural drainage area.

(iii) It is incumbent upon the Consulting Engineer to use the rainfall data within this bylaw for the analysis and receive approval from the Engineer of the system and process to use.

(iv) Presentation of Modeling Results

The Consulting Engineer shall submit a rainwater management report including the following:

A. name and version of modeling program;

B. calibration data and results;

C. assumptions and estimates

D. design storms

E. table of all design parameters;

F. schematic diagram of the model;

G. drainage map showing the catchment and sub-catchment boundaries, slopes, land uses, soil conditions, etc.; and

H. digital model files as part of final submission.

(v) Design Rainfall Distributions

A. The design rainfall distributions listed below are to be used for the 2, 5, 10, 25 and 100-year storms. The Consulting Engineer shall run all storm durations and design for the critical event.

1 Hour (AES)		12 Hour (AES)		24 Hour (SCS)	
Time (minutes)	Cumulative Rainfall (%)	Time (hours)	Cumulative Rainfall (%)	Time (hours)[1]	Cumulative Rainfall (%)
0	0	0	0	0	0
5	1	1	6	0.5	1.0
10	4	2	13	1.0	2.0
15	10	3	22	1.5	3.5
20	20	4	30	2.0	5.0
25	35	5	38	2.5	6.6
30	56	6	50	3.0	8.2
35	72	7	59	3.5	9.8
40	84	8	68	4.0	11.6
45	92	9	77	4.5	13.5
50	97	10	85	5	15.6
55	99	11	93	5.5	18.0
60	100	12	100	6.0	20.6
				6.5	23.7
				7.0	26.8
				7.5	31.0
				8.0	42.5
				8.5	48.0
				9.0	52.0
				9.5	55.0
				10.0	57.7
				10.5	60.1
				11.0	62.4
				11.5	64.5
				12.0	66.4
				12.5	68.3
				13.0	70.1
				13.5	71.9
				14.0	73.6
				14.5	75.3
				15.0	76.9
				15.5	78.5
				16.0	80.1
				16.5	81.6
				17.0	83.1
				17.5	84.6
				18.0	86.0
				18.5	87.4
				19.0	88.7
				19.5	90.0

1 Hour (AES)		12 Hour (AES)		24 Hour (SCS)	
				20.0	91.3
				20.5	92.5
				21.0	93.7
				21.5	94.8
				22.0	95.9
				22.5	97.0
				23.0	98.0
				23.5	99.0
				24.0	100

[1] The timesteps have been aggregated for the purposes of facilitating the display with this Bylaw. The original curve that the NCRS provides must be followed and can be obtained from the Engineer.

6. PIPE DESIGN

(a) Hydraulics

(i) Hydraulics shall be calculated using Manning's Formula:

$$Q = \frac{A R^{0.667} S^{0.5}}{N}$$

Where:

Q = flow capacity (m^3/s)
A = cross-sectional area (m^2)
R = hydraulic radius (m)
S = slope of hydraulic grade line (m/m)
N = coefficient of roughness
0.011 for all smooth walled plastic pipes
0.013 for concrete pipes
0.024 for corrugated pipes.

(ii) Downsizing of storm sewers on steeper grades is not permitted for mains 750 mm diameter or less. Downsizing of a maximum of one nominal pipe sizes for mains larger than 750 mm diameter may be considered at the discretion of the Engineer.

(iii) Velocity

A. Minimum = 0.6 m/s flowing half full

B. Maximum = there is no maximum velocity. However, if the design velocity exceeds 3 m/s and super-critical flow occurs, provisions for structural stability of the main and durability of the pipe shall be addressed by the Consulting Engineer.

C. Despite the above, where the slope of the proposed main exceeds

15%, scouring protection and anchor blocking shall be incorporated. A geotechnical Engineer may be required to provide design details, monitor construction and provide construction reports at the discretion of the Engineer.

(b) Strength – "Class"

Where cover on any main is less than 600 mm or exceeds 2.5 metres, the Consulting Engineer shall submit calculations proving the class of pipe specified is adequate for the expected loading.

(c) Pipe Joints

All storm sewer systems shall be designed for closed joint construction unless otherwise accepted by the Engineer.

(d) Design consideration must be given to the horizontal alignment of utilities such that any storm sewer mains shall run parallel to any Streamside Protection and Enhancement Area or environmentally sensitive area(s). The horizontal alignment of the utility is to be offset such that excavation works are beyond the drip line of trees or other native or new plantings. Design consideration is to be given to long term integrity to avoid pipe breakage which could lead to a release of rainwater discharge to a Stream or Ditch.

(e) No reduction in pipe sizing for flow reductions due to the presence of upstream detention facilities is permitted unless otherwise authorized by the Engineer.

7. STORM SEWER MAINS AND APPURTENANCES

(a) Minimum Pipe Sizes

(ii) Mains shall not be <300 mm in diameter.

(iii) Single CB leads shall not be < 200 mm in diameter.

(iv) Double CB leads shall not be < 250 mm in diameter.

(b) Depth

(i) The depth at crown of proposed Drainage Systems should be enough to provide gravity service connections for all Parcels adjacent the main. The elevation at the upstream terminus of any main shall be sufficient to service all upstream tributary lands beyond the Development and within the accepted design catchment area.

(ii) Standard minimum depth of cover above pipe crown is 1.2 metres. Only in unique circumstances, and at the discretion of the Engineer, may the cover depth be less than 1.2 metres.

(iii) Storm sewers and service connections under or adjacent to retaining walls should be avoided. When extraordinary circumstances exist, the Engineer

may consider steel casing pipes which allow the main or service connection to be removed and replaced without impacting the stability of the retaining wall.

(c) Manholes

(i) Manholes are required:

A. maximum every 120.0 metres for pipes ≤ 900 mm in diameter;

B. maximum every 200.0 metres for pipes > 900 mm in diameter;

C. at all changes in pipe size, grade, or alignment;

D. at the upstream terminus of all mains; and

E. at all intersecting sewers.

(ii) In manholes, the crown of the inlet pipe shall be at or above the crown of the outlet pipe.

(iii) Manholes shall include a minimum 600 mm sump where Ditches discharge to storm sewers.

(iv) The drop through all manholes shall be a minimum of 30 mm unless otherwise accepted by the Engineer.

(v) All manholes shall be accessible for maintenance.

(vi) Manholes shall be minimum 1200 mm diameter.

(vii) Manhole rim elevations within the Roadway or asphalt shall be set at the elevation of the first lift of asphalt and adjusted to be flush with final lift of asphalt when placed, to conform to the slope and contour of the Roadway.

(viii) Use of shims, wedges or any material that will induce point loading to the concrete lid or concrete grade rings is not permitted. Use of pre-manufactured, sloped rings are approved.

(ix) Use of HDPE levelling rings may be considered at the discretion of the Engineer.

(x) Manhole frames to be TR18 on all Collector/Arterial roads, or where continuous truck traffic is anticipated.

(d) Cleanouts

Cleanouts shall be minimum 200 mm diameter and shall be provided on terminal sections of mains when:

(i) the distance to the nearest downstream manhole < 45.0 metres; and

(ii) the depth of the sewer at the terminal point < 2.0 metres.

(e) Catch basins

(i) Locations:

A. at regular intervals along Roadways;

B. at intersections and curb returns wherever practical. Rainwater should be drained into CBs on the upstream side of curb returns and wheelchair letdowns;

C. CB's are not to be placed within a crosswalk or driveway letdowns. Side inlet CB's are required on all Arterial and Collector Roads;

D. at any trapped low points where double side inlet CBs are required; and

E. at end of curb points unless a hard-surface flow path to a Ditch is provided.

(ii) Design:

A. CB's shall collect up to a maximum of 800.0 m^2 of pavement runoff per CB where gutter grades are less than or equal to 3% and up to a maximum of 500.0 m^2 of pavement runoff where gutter grades exceed 3%; and

B. the Consulting Engineer shall specify the appropriate type of catch basin to be used in swales and shallow Ditches to the satisfaction of the Engineer.

C. the Engineer shall require the use of side inlet CB's and/or narrow gutter pan barrier curb on Roadways where on-street Bicycle Facilities have been identified per CS-D-19.

(f) Service Connections

(i) See Standard Detail Drawing ES-G-1 for typical location. An Inspection Chamber (IC) is required for all connections to City mains. ICs shall be installed at the property line or Statutory Right of Way line in a concrete meter box with a cast steel lid and labeled "storm" (see Standard Detail Drawings No. ES-G-1, ES-G-2, ES-G-3 and CS-D-22).

(ii) Diameter:

A. minimum 150 mm for single family Residential; and

B. minimum 200 mm for all other applications.

(iii) Minimum slope from main to property line shall be 2%.

(iv) All Parcels abutting a proposed Drainage System shall be provided with a service connection except where existing service from another Drainage System is adequate and acceptable to the Engineer, or closed infiltration system is provided onsite.

(v) The Drainage System and all service connections shall be at a depth to permit gravity flow from existing or proposed building(s) to the main.

(vi) Connections to the drainage system shall be provided only where the MBE is at a minimum of 150 mm above the major system hydraulic grade line or 150 mm above the center line of adjacent Roadways that are designed to convey major system flow at the discretion of the Engineer.

(vii) Each Parcel shall have one service connection unless otherwise permitted by the Engineer.

(viii) When infilling an existing Ditch, all existing service connections from existing properties to the Ditch or where any type of Rainwater Management System is provided by the existing Ditch, provision shall be made to maintain or replace the service. Works of this nature must be compliant with senior government regulations and may require senior government approvals.

(ix) When there is a PVC service connection to a concrete storm main, a long radius pipe shall be used to connect to the main, connection to be made via core using core bell or sanded hub.

(g) Inlet/Outlet Structures

(i) New inlet or outlet structures or modifications to an existing structure may require senior government approvals.

(ii) All storm mains shall require inlet and outlet structures as per the Standard Drawings (CS-D-17 and MMCD equivalent).

(iii) All mains discharging to Streams and Ditches require energy dissipation downstream of the outlet to prevent erosion of the channel. The Consulting Engineer, in consultation with a Qualified Professional, shall design protective measures to mitigate channel erosion.

(iv) Where the design velocity of flow in the main is ≥ 1.0 m/s, an outlet structure is required, complete with energy dissipation as per CS-D-17.

(v) Structures exceeding 1.0 metre in height shall include a railing.

(h) Culverts

(i) New culverts or modifications to an existing culvert may require senior government approvals.

(ii) Minimum culvert diameter shall be:

A. 300 mm for Driveway crossings; and

B. 600 mm for Roadway crossings.

(iii) The minimum diameter shall be greater than or equal to the depth of headwater at the inlet, unless otherwise accepted the Engineer.

(iv) Culverts located in Streams or all culverts crossing Roadways shall be designed to convey the flow resulting from a minimum 1:100-year rainfall event unless otherwise specified by the Engineer. All culverts crossing Roadways classified as Arterials or Collectors or located within a major creek or river as identified by the Engineer shall be designed to convey a 1:200 year rainfall event unless otherwise specified by the Engineer. The Consulting Engineer shall provide calculations and recommendations if the culvert will be operating under inlet or outlet control conditions.

(v) Reinforced concrete culverts and smooth inner wall corrugated High Density Polyethylene (HDPE) are preferred for general uses. Other materials may be considered at the discretion of the Engineer.

(vi) The minimum depth of cover is 0.3 metres subject to adequate pipe loading design parameters.

(vii) Inlet and outlet structures are required on all culverts designed to convey the major flow. Energy dissipation and scouring protection or erosion control shall be included in the design of any culvert installation.

(viii) Driveway culverts may be part of the minor system at the discretion of the Engineer and shall have the capacity for the 1 in 10-year rainfall event.

(ix) If a Stream or Ditch has been classified as fish-bearing or has the potential to be fish-bearing, fish friendly design shall be required for all new culvert installations and upgrades. If no watercourse classification has been made, a Qualified Professional shall determine if there is the potential for fish and if so, fish friendly design shall be required.

(i) Ditches

(i) Open Ditches for rainwater management are not acceptable for permanent servicing of land within the Urban Development Boundary of the City unless otherwise accepted by the Engineer. Ditches shall be used for rainwater management in rural areas.

(ii) Constructed Ditches shall be connected to an adequate drainage system with appropriate connections per standards and specifications within this Bylaw and shall be used where interception of natural groundwater or seepage contributions from adjacent lands cannot be reasonably managed in a swale.

(iii) Ditches require explicit consideration of SPEA setbacks pursuant to the Streamside Protection Bylaw No. 1465-2005.

(iv) Elimination or alterations of existing Ditches may be subject to senior government regulatory authority and require compliance with provincial and federal legislation

(v) Ditches adjacent to Roadways shall conform to the following:

A. maximum depth shall be 1.5 metres;

B. minimum bottom width shall be 0.5 metres;

C. maximum side slopes 1.5H:1V; subject to geotechnical stability assessment.

D. minimum grade shall be 0.5%; and

E. design flow velocities more than 0.6 m/s shall include design details to prevent scouring, erosion and under-cutting:

i. where poor and erosive soil conditions exist or where erosion protection is impossible to be provided, Ditch enclosure may be required at the discretion of the Engineer; and

ii. the minimum Statutory Right of Way width for an existing or proposed Ditch crossing private property shall be 6.0 metres wider than the top width of the Ditch. The Ditch shall be offset in the Statutory Right of Way to permit access for maintenance vehicles. The top of a Ditch adjacent to a property line shall be a minimum 0.5 metres away from that property line.

(j) French Drains

French drains shall be provided where the presence of groundwater may affect the stability of the existing or proposed road structure, or if ground water has the possibility of crossing roadways and sidewalks. French drains are required where indicated by investigation and soils report(s) prepared by a qualified geotechnical engineer and at the discretion of the Engineer.

(k) Swales

(i) Swales shall be used:

A. in conjunction with lot grading to provide rear, front and side yard rainwater management as required or directed by the Engineer;

B. to convey overland major flows at the discretion of the Engineer;

and

C. on a rural Highway for road rainwater management at the discretion of the Engineer.

(ii) The Engineer may under exceptional circumstances allow swales to convey flow through multiple properties, provided there is a Statutory Right of Way or restrictive covenants placed on each property.

(l) Major Flow Path Swales

(i) Major flow path swales shall be:

A. designed for the capacity of the expected flows;

B. designed with scour protection and energy dissipation;

C. secured and protected by a Statutory Right of Way; and

D. designed with suitable access for continuous maintenance and inspection by the City.

(m) Roadside Drainage Swales

(i) Roadside drainage swales shall be connected to an adequate drainage system with an appropriate connection per standards and specifications and shall be used where the road rainwater is minimal and can be contained safely and practically in a swale rather than a Ditch.

(ii) Roadside drainage swales shall be:

A. maximum 2.0 metres wide;

B. maximum 0.3 metres deep;

C. designed with the roadside edge of the swale at least 2.0 metres from the edge of pavement;

D. designed with a maximum velocity of 1.0 m/s; and

E. lined with sod on minimum 300 mm Growing Medium or erosion blanket or accepted alternative.

(n) Curvilinear Sewers

Curvilinear sewers shall not be permitted.

(o) Location/Corridors

(i) Mains located within the Statutory Right of Way for Highway purposes shall conform to the standard typical cross-sections.

(ii) Where a Rainwater Management System is designed to convey rainwater for more than two (2) Parcels across private property, it shall be secured within a Statutory Right of Way as per the tables below however it shall not be owned or maintained by the City unless the system is conveying runoff from City owned lands.

Properties that are designated as Urban 3 – Infill as per the 2016 OCP shall use the following table to determine the appropriate Statutory Right of Way:

Depth of Main (ground to invert)	Width of SROW with one (1) pipe	Width of SROW with two (2) pipes
≤ 3.0 m	3.0 m	4.5 m
> 3.0 m & ≤4.0 m	4.0 m	5.5 m
> 4.0 m	6.0 m	8.0 m

Properties designated other than Urban 3 - Infill in the 2016 OCP shall provide the following Statutory Right of Way widths:

No. of Sewer Mains within SROW	SROW Width Required	Minimum SROW Width Required
Single main	2 x (Depth $_{\text{surface to crown of pipe}}$) + Trench Width	4.5 m
Two mains (same trench)	2 x (Depth $_{\text{surface to crown of pipe}}$) + Trench Width	5.0 m
Two or more mains (separate adjacent trenches)	Sum of SROW required for each single main + separation between trenches	6.0 m

(iii) Storm mains in Statutory Right of Way shall require access for maintenance and replacement at the discretion of the Engineer. The access-way shall be a minimum 5.0 metres wide and designed for 9.1 tonne vehicle loading. The access route shall be clearly shown on the drawings and registered by Statutory Right of Way.

(iv) Each SROW shall be accompanied by a cross sectional drawing showing the depth, trench width and SROW width calculation

(p) Groundwater Pumping - Underground Parkades

(i) All internal underground parking structure drainage is to be directed to the sanitary sewer whether it is by gravity or by a pumped system.

(ii) Pumping systems for external drainage of footings of underground parkades may be permitted, at the discretion of the Engineer, if the following are provided:

A. a building and hydrogeological assessment of the need and impacts of pumping. This assessment shall also consider aquifer depletion, reduction of base flow to creeks, water quality and expected annual

discharge pattern, with pertinent recommendations;

B. backup power sources;

C. high water level alarms;

D. the pumped water is directed to onsite rainwater detention facility; and

E. the footing system is isolated from other systems to prevent backup.

(iii) A restrictive covenant shall be registered on the property with an underground parkade drainage pumping system. The covenant shall indemnify and hold the City harmless from any damage, loss or act resulting from the failure of the pumping system for any reason. In addition, the covenant shall describe maintenance procedures.

8. ENVIRONMENTAL CONSIDERATIONS

(a) Streams

(i) Works in setback areas and discharge to Streams and Ditches are subject to City, federal and provincial authority approvals. Works must be compliant with the City's Streamside Protection Bylaw No. 1465-2005. The Developer shall retain the services of a Qualified Professional to complete required studies and obtain any necessary permits and approvals prior to construction.

(b) Erosion and Sediment Control

(i) Any Development of lands shall be completed in such a way that prevents erosion either by wind, rainfall, sediment, or other deleterious substances from entering the aquifer, City Rainwater Management Systems, and Streams in accordance with the Erosion and Sediment Control Bylaw.

(ii) Additional specific requirements may be required by the Engineer, to ensure adequate design, especially in sensitive areas.

(c) Protection of Aquifer

(i) Rainwater infiltration in High Impact Industrial areas is not permitted within the 150-day capture zone of potable water well heads as presented in Schedule "L".

(d) Protection of Habitat

(i) Any Development of lands shall comply with senior government legislation about nesting birds and species at risk.

(e) Absorbent Soils

(i) A minimum 300 mm thick layer of absorbent soil – a Growing Medium that balances water storage capacity, saturated hydraulic conductivity and nutrient and organic components – is required for all lawn and soft-Landscape areas for all Developments within the Urban Development Boundary.

(ii) Absorbent soils shall conform to Canadian Landscape Standard (CLS) specification for imported Growing Medium (Section 6.2.3) Type 2L with the following:

A. Sand content: 60 – 75% with a minimum of 55% coarse (0.5 mm to 1.0 mm and medium (0.25 mm to 0.5 mm) sand;

B. Clay and silt combined: maximum 5% as a percent of the mineral aggregate in the mix;

C. Organic content: 8-15% by weight; and

D. Saturated Hydraulic Conductivity: < 300 mm/hour @ 85% compaction (per ASTM 2434) with no loss in organics from pre- to post-test (per ASTM D2974, test for organic matter).

(iii) Native soil may be used, provided it meets the standards for absorbent soils or can be amended to meet all the requirements for use as a Growing Medium and is approved by the Engineer.

(iv) Expertise from other sources such as Consulting Landscape Architect may be necessary, at the discretion of the Engineer, to ensure the Growing Medium meets the requirements for absorbent soils.

(f) Spill Containment

(i) A Spill Containment Plan for the emergency containment and clean-up of spills of contaminants on the lands is required to be prepared by a Qualified Professional and registered in a Section 219 covenant.

SECTION NO. 5 - RAINWATER SOURCE CONTROLS, INFILTRATION & DETENTION

1. GENERAL

The goal of the City in managing rainwater is to provide sustainable hydrologic systems that mimic natural systems, protect groundwater resources and minimize downstream flooding and erosion. The City shall require, unless exempt, volume reduction strategies and reduction of peak runoff rates through the use of storm detention facilities.

(a) Post Development rainwater runoff from all Developments is required to be controlled to prevent or mitigate flooding or environmental impacts to the satisfaction of the Engineer. These controls shall be in the form of:

(i) Detention storage in surface ponds, underground chambers or tanks; and

(ii) Infiltration systems designed to reduce runoff volume and augment or reduce detention storage.

(b) Systems are to be compliant with the Part 5 *[Rainwater Source Control]* of this bylaw.

(c) Stormwater outfall connections must be designed and constructed in compliance with Provincial and Federal legislation, and subject to applicable terms and conditions.

(d) In areas where the City has completed Integrated Stormwater Management Plans (ISMPs), the Consulting Engineer shall confirm with the Engineer if the design criteria in the ISMP will govern over the criteria stated in this Bylaw.

(e) All source controls, infiltration systems and/or detention facilities will require the development of an Operations, Inspection and Maintenance Plan.

2. RAINWATER SOURCE CONTROLS

(a) General

(iv) The City shall require, unless exempt by the Engineer, the implementation of onsite rainwater source controls to assist in the management, control, treatment and disposal of rainwater runoff.

A. Source Controls are onsite features and facilities used to provide water quality treatment, rate control, and volume reduction of rainwater runoff.

B. Water quality treatment source controls remove rainwater pollutants by filtering runoff through vegetation and soil media. They consist of on-site absorbent soil layers, bio-infiltration and bio

C. -filtration facilities such as vegetated swales, rain gardens, swales and basins or equivalent systems.

(v) Source controls shall be located upstream of other rainwater or drainage facilities, such as infiltration trenches and detention ponds, but can also be managed within a private site.

(b) Source Control Requirements

(i) There are two goals through the use of source controls: volume reduction (to retain rainwater through infiltration, evapotranspiration, or reuse) and water quality (rainwater treatment).

The design storm that shall be used to size source controls is the 6-month, 24-hour return period storm, which results in the retention and/or treatment of 90% of the average annual rainfall or 72% of the 2-year 24 event rainfall depth, unless otherwise stated elsewhere in this Bylaw.

A. The Rainwater volume reduction and water quality criteria listed above shall be applicable to all Developments except Urban 3 – Infill Single Detached/Duplex Residential Developments. All Urban 3 – Infill Single Detached/Duplex Developments shall apply a minimum 300 mm of absorbent soil and construct infiltration/detention facilities for 1:100 year events; these objectives will achieve both the volume reduction and water quality objectives for these Developments.

B. The list of areas that are exempt or have limited requirements from the volume reduction and water quality targets are listed below

a. Lands that will remain undeveloped and are protected by a Section 219 restrictive covenant from future development are exempt from both the volume reduction and water quality targets listed in this Bylaw.

b. Lands designated as the Historic Centre land use as a part of the Historic Downtown Neighborhood Plan will be exempt from the volume reduction target; however, the water quality target will still apply.

(ii) All the criteria listed above shall be confirmed with the Engineer prior to design.

(iii) Metro Vancouver's Stormwater Source Control Guidelines 2012, as updated from time to time, may be referenced for design of source controls; however, any guidelines stated within this Bylaw will govern.

(iv) No persons shall carry out Development on any lands without first obtaining written approval for a Rainwater Management Plan for the lands, installing a system and granting the City a Section 219 (Land Title Act) Covenant and Statutory Right of Way, providing assurances as to the continued operation, performance, maintenance and monitoring of the System and approval of a Spill Containment Plan for the emergency containment and clean-up of spills of contaminants on the lands.

(v) Prior to infiltration of any kind, all wells within the site shall be decommissioned or converted to non-potable uses only except for Agriculture developments without cross-connection.

3. SOURCE CONTROL DESIGN

(a) Types of Source Controls

(i) The following table provides examples of possible source controls for various types of Developments. All source controls shall be suitable for the given soil type/infiltration in the area of the Development and the types of the proposed source controls are subject to the approval of the Engineer.

Table 5.1: Examples of Source Controls for Different Land Uses

Slope & Soil Type		Land Use					
		Multi-Family Residential	Single Detached/Duplex	Commercial, Institutional & Industrial	Suburban/Rural Residential	Park & Agricultural	Roadways
Slope < 10%	Good Infiltration (>50mm/hr)	• 300mm absorbent soil • Swales or rain gardens • Roof leaders to infiltration facilities • Pervious surfaces for pedestrian areas	• 300mm absorbent soil • Disconnect roof leaders • Infiltration trench or rain gardens and rock pits • Pervious surfaces for pedestrian areas	• 300mm absorbent soil • Swales or rain gardens • Roof leaders to infiltration facilities • Pervious surfaces for pedestrian areas	• 300mm absorbent soil • Disconnect roof leaders	• 300mm absorbent soil • Disconnect roof leaders	• 300mm absorbent soil • Rain gardens • Swales and ditches in rural areas • Weirs to limit longitudinal slope to 2%
	Moderate Infiltration (10-50mm/hr)	• 300mm absorbent soil • Swales or rain gardens • Roof leaders to infiltration or re-use facilities • Regional detention for uplands • Pervious surfaces for pedestrian areas		• 300mm absorbent soil • Swales or rain gardens • Roof leaders to infiltration or re-use facilities • Regional detention for uplands • Pervious surfaces for pedestrian areas • Green roofs			
	Limited Infiltration (0-10mm/hr)		• 300mm absorbent soil • Disconnect roof leaders • Regional detention for uplands • Pervious surfaces for pedestrian areas				• Curb & gutter, storm sewer in non rural areas • Swales and Ditches in rural areas • Regional retention/bio-retention
Slopes between 10% and 20%	Good and Moderate (10>mm/hr)	• Terrace cleared lot area • 300mm absorbent soil terraced slopes • Rain gardens and rock pits	• 300mm absorbent soil terraced slopes • Disconnect roof leaders • Terrace cleared lot area • Rain gardens and rock pits	• Terrace cleared lot area • 300mm absorbent soil terraced slopes • Rainwater reuse for roof water • Rain gardens and rock pits • Green roof	• Terrace cleared lot area • 300mm absorbent soil terraced slopes • Disconnect roof leaders • Rain gardens and rock pits	• Terrace lawn/open landscape • 300mm absorbent soil on lawn or open landscape • Disconnect roof leaders	• Curb & gutter, storm sewer in non rural areas • Perforated storm sewers in infiltration trench • Armoured Ditches in rural areas • Underground infiltration/retention
	Limited Infiltration (0-10mm/hr)	• Terrace cleared lot area • 300mm absorbent soil terraced slopes • Underground retention • Regional retention or onsite retention	• 300mm absorbent soil terraced slopes • Disconnect roof leaders • Terrace cleared lot area • Regional retention or onsite retention	• Terrace cleared lot area • 300mm absorbent soil terraced slopes • Rainwater reuse for roof water • Green roof • Underground retention • Regional retention or onsite retention	• Terrace cleared lot area • 300mm absorbent soil terraced slopes • Disconnect roof leaders • Retention or bio-retention		• Curb & gutter, storm sewer in non rural areas • Armoured Ditches in rural areas • Bio-retention/regional retention • or onsite retention • • Underground retention •

(b) Absorbent Soils for Pervious Areas

(i) Absorbent soil shall meet the specification in Section 4. 8 (e) of this Schedule.

(c) Sizing Considerations for Water Quality Treatment Source Control

(i) Water quality treatment is typically provided by vegetation, mulch and soil media in a swale, rain garden or basin. The vegetated soil layer shall be sized to meet the rainfall events as outlined in Section 5. 2 (b) (i) of this Schedule.

(ii) The vegetation soil layer in the facility has a limited infiltration rate regardless of the subsurface infiltration. A maximum facility infiltration rate of 30 mm/hr shall be used.

(iii) Raised inlets within the facility shall be provided to allow flows greater than the treatment volume to be conveyed directly to an underlying rock trench with perforated pipe for dispersion for infiltration or retention for Volume Reduction providing that suitable ground conditions exist (as confirmed by a professional hydrogeologist). During frozen ground conditions when infiltration through the treatment facility is hindered or blocked, the inlets allow flows to be conveyed underground to be infiltration or retained. Design requirements for inlets shall:

A. include a sump and perforated pipe into underlying rock trench; and

B. be raised 150 mm above the swale invert to promote ponding and infiltration of small storm event runoff into the absorbent soil before overtopping.

C. Raised inlet to be below curb inlet height to prevent ponding on the road surface, if applicable

(iv) Runoff into the facility shall be distributed to avoid concentrating flows and locally overwhelming the treatment capacity. This can be accomplished by utilizing smaller, distributed or linear facilities rather than large, centralized facilities.

A. Flat panel curbs adjacent to the swales shall be used instead of curb cuts or piping flows into the swale.

B. The maximum ratio of tributary pavement area to facility plan invert area shall be 15:1 to avoid overwhelming the treatment capacity.

(v) Refer to Figures 1, 2 and 3 of Schedule “K” attached to and forming part of this bylaw.

(d) Design Considerations for Water Quality Treatment Swales

(i) The minimum depth of the swale shall be 300 mm.

(ii) The minimum bottom width shall be 0.5 m.

(iii) The maximum side slopes shall be 2H:1V.

(iv) The maximum longitudinal slope shall be 2%.

(v) The minimum absorbent soil depth in the swale shall be 500 mm.

(vi) The absorbent soil specification is as listed in Section 4. 8 (e) (ii) of this Schedule.

(vii) A perforated pipe underdrain is required to prevent the Growing Medium from becoming saturated in areas of poorly draining soils.

(viii) A 30 mm drop is required at the edge of paving or panel curb to finished ground surface, to allow for positive drainage and compensate for buildup of sediment at this edge.

(ix) Swale plantings to be selected by Qualified Professional to achieve water quality improvements. All vegetation will be non-aggressive, with a preference for native plants. Deciduous trees should be selected to manage leaf drop from clogging facility.

(x) Refer to Figures 1, 2 and 3 of Schedule “K”, attached to and forming part of this Bylaw.

(e) Design Considerations in Low Permeability Soil Area

(i) In areas with low permeability soils where infiltration is not a viable option, retention and bio-filtration facilities shall be used. Pollutant generating surfaces will require bio-filtration facilities with vegetated soil layers underlain by retention rock trenches.

A. Bio-filtration treatment: Bio-filtration treatment removes rainwater pollutants by percolation of flows through a vegetation and soil media. They can be swales, rain gardens and basins. Pollutant removal mechanisms include filtration, pollutant sorption to soil and uptake in vegetative root zones. Depending on the site location, refer to Figure 1 or 2 of Schedule “K”, attached to and forming part of this Bylaw.

B. Retention facility: Retention facilities retain frequently occurring runoff on-site and slowly exfiltrate over time and/or evapotranspire it. These facilities are used to meet the Volume Reduction criterion in areas with poorly-draining soils that drain to watercourses. Refer to Figures 3 and 4 of Schedule “K”, attached to and forming part of this bylaw.

(ii) Retention facilities can include a bio-filtration surface to provide water quality treatment and underlying rock trench for volume reduction.

(iii) The bio-filtration and retention facility calculated volume is to be retained in the void spaces of the Growing Medium layer and underlying retention trench assuming dry initial conditions.

(iv) The rock trench shall be capable of draining from full to empty within four (4) days after the end of a storm. To ensure this, the maximum depth of the rock trench shall be the smaller of:

A. 2.0 m; or

B. infiltration rate (mm/hr) x 24 hr/day x 4 days / (1,000 mm/m x porosity).

(v) The infiltration rate of the trench shall be the saturated infiltration rate of the soil at the design depth of the trench. Rates may be determined using standard percolation tests but they shall be performed and monitored by qualified geotechnical testing personnel. No safety factor is required for retention facilities in poorly-draining soils because the surrounding drainage system is sized for adequate flood conveyance and life and property is not at risk.

(vi) The porosity of a rock trench shall be 0.35 minimum.

(vii) The water holding capacity of the Growing Medium is calculated by multiplying the swale area by 0.2 times (the difference between the soils field capacity and wilting point) the swale Growing Medium depth. This volume can be subtracted from the total catchment runoff volume to calculate the required retention trench capacity.

(viii) The retention trench capacity shall be calculated as the sum of the trench porosity volume and the infiltration volume during the 24-hour storm.

(ix) Trench porosity volume = trench bottom area x trench depth x porosity.

(x) 24-hour infiltration volume = trench bottom area x infiltration rate x 24 hours.

(xi) The water balance can be expressed as follows:

$$\frac{Ac \times R}{1000} = (0.20 \times As \times Ds) + (At \times Dt \times P) + \frac{24 \times At \times f}{1000}$$

Where:

Ac = catchment area (m^2)
R = 6-month, 24-hour rainfall (mm)
As = swale area (m^2)
Ds = swale Growing Medium depth (m)
At = bottom area of retention trench (m^2)
Dt = retention trench depth (m)
P = retention trench porosity fraction (unitless)
f = infiltration rate (mm/hr)

(xii) An overflow is required to convey excess flows to drainage system.

(xiii) Refer to Figures 2, 3 and 4 of Schedule “K”, attached to and forming part of this Bylaw.

(f) Design Considerations for Underlying Rock Trenches

(i) This section applies to areas with low permeability soils draining to watercourses and without regional infiltration facilities.

(ii) The retention trench shall be wrapped with filter fabric to prevent fines from migrating in from the sides of the trench and from the Growing Medium above.

(iii) A perforated pipe underdrain is required at the top of the retention trench to prevent the Growing Medium from becoming saturated in poorly draining soils areas. A sump is required between the inlet and perforated pipe. See Figures 3 and 4 of Schedule “K”, attached to and forming part of this Bylaw.

(iv) Incorporate inlets from the swale into the storm sewer system raised 150 mm above the swale invert to promote ponding and infiltration of runoff from small storm events into the Growing Medium.

(v) Inlets shall be sized for the minor system peak flow (10-year).

(vi) Incorporate safe overflow path from the swale towards a major municipal drainage system or failsafe conveyance route for flows in excess of the 10-year return period.

(vii) Refer to Figures 2 and 4 of Schedule “K”, attached to and forming part of this Bylaw.

4. INFILTRATION SYSTEMS

(a) Design Considerations for Infiltration Systems

(i) An infiltration system must be at least 1.2 metres above bedrock, clay or other impervious soils.

(ii) An infiltration system must be at least 1.2 metres above the maximum seasonal water table.

(iii) Minimum distances from an infiltration system to proposed or existing foundation walls shall be 5.0 metres or as recommended by a professional geotechnical engineer and setbacks from property lines shall be 1.2 metres.

(iv) To mitigate potential negative effects on slope stability, groundwater infiltration and recharge systems to be located within 200 m of the top of a steep slope (i.e. greater than 20%) or ravine shall have design input provided by a geotechnical Consulting Engineer.

(v) The design of an infiltration system shall be based on the saturated infiltration rate of the soil at the design depth of the trench. Rates may be determined using standard percolation tests but they shall be performed and monitored by qualified geotechnical testing personnel. A safety factor of three (3) shall be applied to the results.

(vi) Only the base area of the linear trench shall be considered as permeable.

(vii) The maximum allowable storage time is 24 hours.

(viii) A “Rainwater Analysis Sheet”, ES-D-3 and ES-D-4 shall be submitted to the Engineer. The Engineer may request calculations based on the information supplied.

(ix) Rainwater storage medium shall be resistant to chemicals found in urban runoff.

(b) Design Considerations for Infiltration Trenches Underlying Treatment Swales

(i) The infiltration trench media shall be wrapped with non-woven geotextile fabric or equivalent to prevent fines from migrating in from the sides of the trench and from the Growing Medium above.

Above-ground inlets in the treatment system shall connect to the subsurface system for flows in excess of the rate that can soak into the Growing Medium (at 30 mm/hr maximum) and for all flows during frozen ground surface conditions. Refer to Figure 1 of Schedule “K” attached to and forming part of this Schedule.

(ii) The depth of the trench shall be governed by the groundwater table or bedrock elevation and also by the allowable drain time.

(iii) An infiltration system may not be used where bedrock or impervious ground or maximum seasonal water table is within 1.2 m of the base of the infiltration system or where a professional hydrogeologist recommends one not be used.

(iv) The minimum distance from an infiltration system to property lines – except the front property line – shall be the greater of either 3.0 m or City’s Zoning Bylaw setback requirement to minimize potential impacts to adjacent properties.

(v) The minimum distance from an infiltration system to proposed or existing foundation walls shall be 5.0 m or as recommended by a professional geotechnical engineer.

(vi) Avoid utility or other crossings of the infiltration system. Where utilities must cross the infiltration system, construct impermeable trench dams to avoid conveying infiltration water along the utility trench.

(vii) The design of an infiltration system shall be based on the saturated infiltration rate of the native soil at the design depth of the trench. Rates may be determined using standard percolation tests performed and monitored by qualified geotechnical testing personnel. The measured rate will be divided by a safety factor of 3.0 for design calculations of 100-year infiltration facilities. The maximum infiltration rate allowed in facility sizing calculations shall be 1,000 mm/hr.

(viii) A groundwater table mounding calculation shall be performed by a qualified hydrogeologist when sizing infiltration systems in areas where the maximum seasonal water table is within 5.0 m of the ground surface.

(ix) The base area only of the infiltration system shall be considered as permeable for infiltration.

(x) The base of the infiltration system shall be level to maximize the infiltration area.

(xi) The maximum allowable storage time is 24 hours.

(xii) A “Drainage Analysis Sheet”, as contained in this bylaw, shall be submitted to the Engineer. The City may provide calculations based on the information supplied.

(xiii) Refer to Figure 1 of Schedule “K” attached to and forming part of this Bylaw.

5. RAINWATER TREATMENT

(a) All Developments within the City must incorporate water quality treatment provisions into design to meet the following targets:

(i) Basic Control - Basic treatment focuses on removal of TSS along with associated pollutants attached to those sediments, including low levels of petroleum hydrocarbons (oil, grease and polycyclic aromatic hydrocarbons (PAHs)). Basic control is applicable to all non-agricultural lands. The performance target is:

A. 80% removal of TSS for influent event mean concentration (EMC)[1] greater than 100 mg/L but less than 200 mg/L. For influent EMCs less than 100 mg/L, meet a goal of 20 mg/L effluent TSS. For sites generating TSS greater than 200 mg/L, provide Enhanced Control (see below); and,

B. Treatment should be applied to the water quality control volume as described in Section 5., 2. (b) (i) of this Schedule; runoff above this volume may bypass the treatment system(s). For facilities requiring the use of a flow rate for design, use the rainfall distribution described in Section 4. 5. (d) (v) of this Schedule. However, the system must be sized to overflow the 1 in 100 year or have a system bypass for the 1 in 100 year storm.

(ii) Oil Control – Oil removal is specifically required for sites where there is significant likelihood that higher concentrations of petroleum will be released; in general, this includes sites with significant presence or use of vehicles. The performance target is:

A. No on-going or recurring visible sheen in receiving watercourse(s), and 24-hour average Total Petroleum Hydrocarbon (TPH) concentration no greater than 10 mg/L with a maximum discrete (grab sample) concentration no greater than 15 mg/L; and,

B. Treatment should be applied to all runoff up to and including the 1 in 10 year storm event, with no bypass allowed, and the catchment area to the treatment system may be restricted to drives, roads, parking areas and outdoor storage areas, as applicable. Depending on site specific uses, treatment may be applied to runoff up to and including the 1% annual exceedance frequency storm event, with no bypass allowed, at the discretion of the Engineer.

(iii) Enhanced Control – Enhanced control is intended to achieve a higher level of dissolved metals removal and applies to sites experiencing intense vehicle usage, for example, industrial sites, or other activities likely to yield higher levels of pollutants. The performance target is:

A. Exceed basic removal of TSS;

B. Greater than 50% removal of the dissolved fractions of copper and zinc; and,

[1] EMC is the total mass pollutant in runoff from a storm event divided by the total volume of runoff from the same storm event.

C. Treatment should be applied to the water quality control volume as described in Section 5. 2. (b) (i) of this Schedule; runoff above this volume may bypass the treatment system(s). For facilities requiring the use of a flow rate for design, use the rainfall distribution described in Section 4. 5. (d) (v) of this Schedule.

(iv) Table 5.2 demonstrates how these performance targets are to be applied for various land uses. As well, the table lists rainwater best management practices (BMPs) presumed to achieve the performance targets, if properly designed, installed and maintained, and are accepted for use on properties within the City.

Table 5.2 Water Quality Performance Targets by Development Type

Development Type	Water Quality Pollutants of Concern	Typical Influent EMCs	Performance Targets	Acceptable BMPs to Achieve Performance Targets[2] [3]
Multi-family Residential	TSS TPH	≥ 100 mg/L and < 200 mg/L	Basic Oil Control	Absorbent Landscaping Rain Gardens Bioswales Porous Asphalt drives, sidewalks and parking areas Filter Strips Stormwater Treatment Wet Ponds Stormwater Treatment Wetlands Manufactured Filter Systems Oil/water Separator (API or coalescing plate type)
Commercial/Mixed Use	TSS TPH	≥ 100 mg/L and < 200 mg/L	Basic Oil Control	
Institutional	TSS TPH	≥ 100 mg/L and < 200 mg/L	Basic Oil Control	
Industrial [4] [5] • General Industrial	TSS TPH	≥ 100 mg/L and < 200 mg/L	Basic Oil Control	
Parks and Open Space	TSS	< 100 mg/L	Basic	
Industrial • High Impact Industrial • CICP Lands [6]	TSS TPH Metals Other (based on materials being handles on site)	≥ 200 mg/L	Basic Oil Control Enhanced	Oil/water Separator (API or coalescing plate type) plus: Stormwater Treatment Wetlands Stormwater Treatment Wet Ponds Media Filters Subsurface Infiltration Absorbent Landscaping
Roads: • low intensity use (<15,000 ADT) (e.g. Local roads, Lanes)	TSS	≥ 100 mg/L and < 200 mg/L	Basic	Follow the same list under "Ground Oriented (Townhomes) & Midrise (Apartments)" except the use of Porous Asphalt drives
Roads: • high intensity use (>15,000 ADT) (e.g. Highways, Arterials, Collectors, high use intersections where >15,000 ADT on main road and >10,000 ADT on intersecting road)	TSS TPH Metals	≥ 200 mg/L	Basic Oil Control Enhanced	Oil/water Separator (API or coalescing plate type) plus: Stormwater Treatment Wetlands Stormwater Treatment Wet Ponds Media Filters Subsurface Infiltration
Agricultural	TSS Nutrients Coliforms		Follow Applicable Provincial Rules and Guidelines for Agricultural Lands	

[2] Manufactured treatment devices that have been vetted through a recognized, formal certification or verification protocol and shown able to meet the targets described in Section 5 (A) (i) through (iii) will

accepted as BMPs. Recognized protocols are the Canadian Environmental Technology Verification (ETV) Program and the Technology Assessment Protocol – Ecology (TAPE) of the State of Washington (USA) Department of Ecology. The Engineer will maintain a list of acceptable treatment technologies based on these protocols in their Approved Products List.

[3] Trash removal facilities, oil-grit separators, hydrodynamic separators, baffle boxes and other proprietary manufactured treatment devices primarily intended to remove trash, grit and sand will not be accepted as stand-alone treatment sufficient to meet the targets described in Section 5 (A) (i) through (iii), but may be accepted when used in series with other BMPs as pre-treatment devices.

[4] Agri-Industrial Developments shall meet the requirements listed for General Industrial. Additional treatment requirements may be required for contaminants for site specific uses at the discretion of the Engineer.

[5] If a Development occurs within the I2 zone, the performance targets for the Development shall be confirmed with the Engineer.

[6] The lands within the Mt Lehman, Clearbrook, Peardonville and Abbotsford Airport CICP lands are situated above the Abbotsford-Sumas Aquifer; as such, they shall follow the same source control and water quality treatment measures as identified for High Impact Industrial. These areas are identified in the map presented in Schedule "J".

(b) Location and Maintenance of Runoff Controls

(i) Subject to any specific requirements contained in relevant bylaws, the location and maintenance for control facilities include:

A. Onsite: For all land uses except Single Detached/Duplex, Rainwater Management Systems and treatment facilities shall be met onsite. Restrictive covenants are required to ensure appropriate maintenance by the property owners.

B. Offsite: For Highways, rainwater management and treatment objectives shall be met on public lands, commonly road Statutory Right of Ways. Maintenance is to be carried out by the City.

(c) Pre-treatment for Roof Runoff Prior to Infiltration

(i) Roofs that are subjected to atmospheric deposition and normal heating and venting do not require treatment of roof runoff. However, to minimize clogging and maximize the life of downstream infiltration facilities, the roof runoff infiltration design shall incorporate a manhole sump between building and infiltration facility.

(ii) See Standard Drawing CS-D-4 for typical roof runoff infiltration trench.

6. STORAGE FACILITY REQUIREMENTS

(a) Storage facilities shall be sized to detain the volume of runoff from incoming flows generated by a 1 in 10-year rainfall event from the contributing developed area and discharge it at the allowable release rate. Where the Modified Rational Method is used to calculate storage, a safety factor of 1.5 shall be applied to the calculated storage volume.

(b) The allowable release rate from all detention facilities is 5.0 litres per second per hectare (L/s/ha) of the net developed area (i.e. all disturbed land), or as otherwise directed by the Engineer.

(c) Storage facilities require a flow restrictor device as per detail CS-D-2 or CS-D-3 to limit the outflow to the allowable release rate at the design head, an emergency release valve, and/or an overflow directed to a major flow path.

(d) Where existing drainage system or overland flow routes are inadequate to convey the runoff from a 1 in 100-year rainfall event, the Consulting Engineer shall design the storage facility to detain the 100-year rainfall event and release at a maximum rate of 5 L/s/Ha.

(e) Storage facilities for Developments discharging to Clayburn Creek upstream of Wright Street shall be designed to detain the 1:100-year rainfall event and release at a maximum rate of 5 L/s/ha.

(f) A Drainage Analysis Sheet ES-D-2 and detention storage calculations shall be submitted to the Engineer.

(g) The location of all detention facilities shall be accepted by the Engineer prior to design.

(i) Detention facilities are not permitted within Highway corridors, on Agricultural Land Reserve, or in Streamside Protection and Enhancement Areas or in parks unless otherwise accepted by pertinent regulatory agencies and the City.

7. STORAGE FACILITY TYPES

(a) Surface Dry Type – Grassed/landscaped open pond(s) shall be designed with a maximum ponding depth of 2.5 metres for a 1:10-year rainfall event and 3.0 metres depth for a 1:100-year rainfall event.

(b) Surface Wet Type – Grassed/landscaped open ponds shall be designed to permanently retain water even during extended periods of no rainfall with a minimum pond depth of 1.0 metres at the deepest point, a maximum pond depth of 3.5 metres for a 1:10-year rainfall event, or 4.0 metres for a 1:100-year rainfall event. The Consulting Engineer shall confirm approval and specific design requirements of this type including planting, weed and stagnation controls prior to design and construction.

(c) Underground storage – To be on private property unless otherwise accepted by the Engineer. It shall be designed to permit regular cleaning and maintenance, or designed to minimize the need for cleaning through the use of runoff screening and filtering devices. Systems are to be designed for a life expectancy of 75 years.

(i) Underground concrete tanks require WorkSafeBC confined entry design guidelines and regulations to be incorporated in the tank design. A Building Permit is required for construction.

(ii) Proprietary systems may be accepted by the Engineer provided that it is designed by a Consulting Engineer and that the component materials are resistant to chemicals found in urban runoff, has a life expectancy of 75 years, a design report, and has only one (1) direct connection into the same system complete with a minimum 600 mm sump. Post construction, a letter from a Consulting Engineer is to be provided certifying the installation was done in

accordance with the design and manufacturers recommendations, along with an operations and maintenance manual. These documents must be submitted to the City prior to the issuance of a Certificate of Substantial Completion.

(iii) The Consulting Engineer shall design underground storage facilities to provide access for cleaning and maintenance.

(d) Linear detention Ditches - Are acceptable on private lands zoned for Industrial use only. They must be fully accessible for maintenance at all times and be protected from public trespass by appropriate fencing and signage. The Engineer may require impermeable liners or water quality treatment measures for runoff upstream.

(i) Design Considerations:

A. the maximum ponding depth is 2.5 metres;

B. the minimum freeboard is 0.3 metres above the peak 1:100 year water level;

C. the maximum side slopes shall be 1.5H:1V;

D. the bottom width shall be no less than 0.5 metres and no more than 2.0 metres; and

E. the minimum base slope is 0.5%.

8. MAINTENANCE

(a) The Developer is responsible for inspection and maintenance of any storage facility or system up to the end of the Warranty Period. A maintenance plan shall be submitted specifying how the system will be inspected and cleaned throughout the Warranty Period in a manner that prevents sediment and other deleterious substances from entering the downstream drainage system. The system shall be clean at the end of the Warranty Period.

(b) The following describes maintenance responsibilities for detention facilities following the end of the Warranty Period:

Table 5.3 Maintenance Responsibilities

Type	Servicing	Maintained By
Community facilities in Statutory Right of Way or on City property	Servicing a number of Developments or larger catchment area	City
All types	Commercial, Industrial, Institutional, strata and Multi-family Developments	Property Owner
On-lot Facilities	Fee simple Single Detached, Row house and Multiplex residential Developments	Property Owner

(c) Only one detention facility is permitted per Development if future maintenance is the City's responsibility, unless otherwise accepted by the Engineer.

(d) The Statutory Right of Way for underground facilities shall be sized to allow for future replacement of the facility without adversely affecting adjacent structures, Highways or utilities, and to provide maintenance access for maintenance equipment.

9. OFFLINE VS. ONLINE DETENTION

(a) Offline detention (where the incoming flow is directed into the control manhole that splits the flow between the base flow route and a detention facility) shall be provided as this reduces cleaning and maintenance activities.

(b) Where online detention is the only alternative, the Consulting Engineer shall provide the following:

(i) a low flow channel through the detention system utilizing a half section of pipe in the bottom of the detention facility equal in diameter to the largest incoming pipe with adequate capacity to carry flows less than 5.0 L/s/ha. Gradients on the low flow channel shall be a minimum of 0.5 %; and

(c) A sump which shall be accessible to truck mounted vacuum equipment. Maximum length of suction hose available from a truck mounted vacuum to the bottom of the sump is typically 6.0 metres.

10. OTHER DESIGN CONSIDERATIONS FOR DETENTION

(a) Where berms or dykes are used, the design shall be reviewed and sealed by a geotechnical Consulting Engineer.

(b) For open ponds, where native material in the floor of the pond percolates at a rate ≤25 mm per minute, a system of perforated under drains may be required in areas within proximity to steep slopes. A geotechnical report signed by a geotechnical engineer shall advise on risk impacts of seepage and if the need for pond lining or interception drains may be required.

(c) An emergency overflow spillway with capacity to convey the uncontrolled major flow is required for all storage facilities. The spillway surface shall be finished with erosion resistant materials such as concrete, turf stone or other accepted equal. The maximum slope of the spillway shall be 4V:1H. The design of the spillway or overflow shall consider the possibility of blockages in the outlet structure and the consequences of extreme storm events.

(d) An overflow is permitted at the control structure or from the detention facility directly to the drainage system for emergency situations.

(e) Fencing is required around permanent wet detention ponds as directed by the Engineer. All linear detention Ditches in Industrial areas shall be fenced. Fencing shall consist of 1.5 metres high chain link fencing or as approved by the Engineer.

(f) A surface dry type facility shall be covered with a minimum 300 mm Growing Medium, seeded or planted with a vegetative cover that requires little or no maintenance, provides protection from erosion and is unaffected by frequent flooding. Maximum interior side slopes of 4H:1V and to drain completely during periods of no rainfall.

(g) Wet type detention ponds interior side slopes above and below the active storage zone shall be 4:1. The slopes shall be covered with minimum 300 mm Growing Medium and seeded or planted with a vegetative cover that requires little or no maintenance. Interior side slopes in the active storage zone may be increased to 1:1 provided the active storage depth does not exceed 2.0 metres and are certified by a geotechnical Engineer, and the slope is covered with riprap (200 mm to 300 mm diameter). Wet ponds shall be fenced as directed by the Engineer but shall also include ability to access for maintenance and cleaning as necessary. Other features required in wet detention ponds include:

    (i) Plantings selected by the Consulting Landscape Architect to achieve a reduction in water temperature and to improve water quality, with a preference towards native plants, all aggressive and Invasive Plants will be avoided. All plantings must be compliant with the Landscaping specifications in Section 10 within this Schedule;

    (ii) length to width ratio of 2:1;

    (iii) other security measures may be required at the discretion of the Engineer; and,

    (iv) minimum freeboard of 0.3 metres above the 1:100 year peak water level.

(h) Signs which read “Warning - This Area is Subject to Flooding During Heavy Rainfall” shall be strategically placed on any surface detention pond.

(i) The flow control structure shall be in accordance with Standard Detail Drawing CS-D-2 or CS-D-3.

(j) The invert of proposed detention facilities shall be located a minimum of 0.5 metres above the maximum seasonal water table. The Engineer may request groundwater monitoring studies to confirm this.

(k) Detention tanks may be located within a parkade structure, provided that:

(i) the tank is designed for the 1 in 10-year rainfall event and any major storm overflows are directly connected to a City storm system capable of conveying a 1 in 100-year rainfall event;

(ii) a waterproof tank wall shall be required in order to ensure that seepage from the tank will not flow into the parkade structure or undermine the foundation or floor slabs of the parkade structure. Certification of the design and installation of the waterproofing system will be required from a Consulting Engineer and shall be submitted prior to occupancy;

(iii) access to the control manhole will be from the surface, outside the building and in a location where unrestricted access is available for maintenance personnel and equipment at all times;

(iv) a Statutory Right of Way in favour of the City is required over the detention tank and shall provide unobstructed access to the detention tank for inspection purposes. The City may request regular inspections of the tank; and

(v) a covenant is to be registered against the title to the land to indemnify and hold harmless the City against any claims due to leakage from the detention tank into the building or failure of the pumping system or backup of the City storm system which may have resulted in leakage into the building.

SECTION NO. 6 – SEWAGE COLLECTION AND CONVEYANCE

1. GENERAL

The design of Sanitary Sewer Systems in the City shall conform to Ministry of Environment, Waste Management Branch, Guidelines for Assessing Sewage Collection Facilities, latest edition, and these Engineering Standards.

2. PRE-DESIGN REQUIREMENTS

(a) The adequacy of the existing downstream Sanitary Sewer System shall be confirmed with the Engineer, prior to design of the proposed system.

(b) The Consulting Engineer shall confirm with the Engineer the peaking factor and ultimate density of the population expected in the catchment area.

3. CONSTRUCTION SPECIFICATIONS

(c) All construction within the scope of this Schedule shall conform to the City approved edition of the Master Municipal Construction Documents (Platinum Edition – Volume II) and the requirements, standards and specifications prescribed by this Bylaw.

(d) Should any conflict exist or arise between these documents, this Bylaw shall take precedent over the Master Municipal Construction Documents.

4. DESIGN FLOW

(a) Design Flow = average daily flow x peak factor + Infiltration

(b) Variables are derived from the following:

Average dry weather flow	=	350 litres/day/capita (l/d/c)
Peaking factor	=	Babbitt Curve shown on ES-S-2
Infiltration allowance	=	12,300 litres/ hectare/day * (l/ha/d)

*Infiltration allowance has been increased by 10% from previous value of 11,200 litres/ha/day in order to account for future climate change.

(c) The peaking factor is applied to the sanitary sewage contribution only.

(d) The following table 6.1 is a guideline for applying minimum density by land use to determine flow:

Table 6.1

For Residential	Persons/Unit
Single Detached/Duplex Residential without secondary suite	3.3
Single Detached/Duplex Residential with secondary suite	6.6
Ground Oriented (Townhomes)	2.5
Midrise (Apartments)	1.8

For Non-Residential	Persons/Hectare
Commercial (General)	90
Commercial (Mixed-Use)	90
Commercial (with Car Wash)	250
Industrial	50*
Institutional	50
Agricultural	3.3**

* Wet Industrial (processing use) minimum density used for Wet Industrial (processing use) will be at the discretion of the Engineer.
** Any increase to this density requirement shall be at the discretion of the Engineer.

5. PIPE DESIGN

(a) Hydraulics

Refer to Hydraulic Element chart (ES-S-1).

(b) Gravity Sewers

(i) Use Manning's formula:

$$Q = \frac{AR^{0.667} S^{0.5}}{n}$$

Where

Q = design flow in m^3/s
A = cross-sectional area in m^2
R = hydraulic radius (area/wetted perimeter) in m
S = slope of hydraulic grade line in m/m
n = roughness coefficient = 0.013

(ii) Terminal sections of mains serving 10 homes or less shall have a minimum grade of 1.0%.

(c) Force Main Sewers

Use Hazen-William's formula:

$$Q = \frac{CD^{2.63} S^{0.54}}{278{,}780}$$

Where

Q = rate of flow in l/s
D = internal pipe diameter in mm

S = slope of hydraulic grade line in m/m
C = friction coefficient = 120

(d) Velocities

(i) Gravity Sewer = 0.6 m/s (minimum)

(ii) Force Main = 0.9 m/s (minimum) = 3.5 m/s (maximum)

(iii) Gravity sewers with velocities > 4.5 m/s shall be anchored.

(e) Sewer mains designated by the Engineer to provide “lifeline sewer” in the case of disaster shall be designed to be seismically resilient. The seismic design event is to be provided by Engineer. The Consulting Engineer will provide a design brief that outlines the expected horizontal and vertical movement associated with the design event and outline how the design accommodates this.

(f) Depth of Mains

(i) The depth at crown shall be designed to allow service connections for all existing or proposed Parcels abutting the main. All mains shall have a minimum 1.2 m cover.

(ii) The Engineer may approve construction of mains with less than 1.2 m cover, provided that specific details of pipe material, backfill, and bedding design are submitted for review and acceptance prior to construction.

(iii) Mains shall be designed to service all upstream lands in the appropriate sewer catchment area as directed by the Engineer.

(iv) Design consideration must be given to the horizontal alignment of utilities such that any sewer mains shall run parallel to any Streamside Protection and Enhancement Area or environmentally sensitive area(s). The horizontal alignment of the utility is to be offset such that excavation works are beyond the drip line of trees or other native or new plantings. Design consideration is to be given to long term integrity in order to avoid pipe breakage which could lead to a release of sewerage discharge to a Stream or Ditch.

6. SANITARY SEWER MAINS AND APPURTENANCES

(a) Pipe

Minimum pipe sizes shall be:

(i) Mains: 200 mm; and,

(ii) Terminal Mains: 150 mm (serving 10 homes or less or equivalent flow).

(b) Manholes

Locations:

(i) at all changes in grade, direction and pipe size;

(ii) at all intersecting sewers;

(iii) at all terminal sections;

(iv) at the downstream end of curvilinear sewers;

(v) every 120.0 metres (maximum spacing); and,

(vi) where possible, shall be installed so that the lid is not in the wheel path of typical traffic flow or under potential fence lines.

(c) Rim Elevations

(i) Manhole rim elevations in off-road areas shall be set 50 mm above adjacent storm manhole rim elevation and 150 mm above adjacent ground to prevent infiltration from surface ponding.

(ii) Manhole rim elevations within the Roadway or asphalt shall be set at the elevation of the first lift of asphalt and adjusted to be flush with final lift of asphalt when required, to conform to the slope and contour of the Roadway.

(iii) Use of shims, wedges or any material that will induce point loading to the concrete lid or concrete grade rings is not permitted. Use of pre-manufactured, sloped, concrete rings are approved.

(iv) Use of HDPE levelling rings may be considered at the discretion of the Engineer.

(v) Manhole frames to be TR18 on all Collector/Arterial Roads or where continuous truck traffic is anticipated.

(d) Types

(i) Outside drop structures shall be used wherever possible to minimize the depth of the main.

(ii) Drop structures, the minimum difference in grade between the inlet and outlet shall be 0.6 metres.

(iii) Inside drop structures shall not be used for new construction.

(iv) Where the invert-to-invert change in grade through a manhole is >200 mm and ≤450 mm, a ramp shall be constructed in the manhole.

(v) Ramps in manholes for mains ≥200 mm will be considered only when the manholes are ≥1200 mm in diameter.

(vi) Manholes shall be minimum 1200 mm in diameter or sized to fit the main.

(vii) Designs showing sanitary sewer mains or service connections being installed under a retaining wall shall be avoided. When extraordinary circumstances exist, the Engineer may give consideration to designs that incorporate steel carrier pipes which allow the main or service line to be removed and replaced without

impacting the long-term stability of the retaining wall.

(viii) Manholes at the downstream end of a force main system to be made of corrosion resistant materials as per the discretion of the Engineer

7. HYDRAULIC CONSIDERATIONS

(a) The crown of the inlet pipe shall be at or above the crown of the outlet pipe.

(b) Minimum drop in elevation through manholes:

At:	Drop:
Deflections up to 22.5°	Use upstream design grade
Deflections up to 45°	15 mm
Deflections up to 90°	30 mm

Note: There shall be no horizontal change of direction > 90° (degrees) through any manhole.

8. CLEAN-OUTS

(a) Clean-outs shall be 200 mm diameter and may be provided on terminal sections when the distance to the nearest downstream manhole is <45 metres, and the depth of the sewer at the terminal point is ≤2.0 metres.

9. SERVICE CONNECTIONS

(a) All legal properties and each unit of a Residential duplex abutting a sanitary sewer main and within the Sewer Boundary shall be provided with a connection.

(b) Unless otherwise accepted by the Engineer, connections are to serve all plumbing by gravity. Minimum Building Elevations (MBEs) should be established accordingly.

(i) The MBE shall be established at least 0.9 metres above the sanitary service connection invert and a minimum of 150 mm above the 100-year hydraulic grade line.

(ii) Where hillside lots are Developed with the MBE lower than the invert of the sanitary connection, as approved by the Engineer, gravity flow for the first floor plumbing above the MBE shall be required.

(c) Minimum diameter shall be 100 mm.

(d) Minimum slopes from spring line of main to property line or Statutory Right of Way line shall be 2%.

(e) An inspection chamber (IC) is required for all connections to City mains. ICs shall be installed at the property line or Statutory Right of Way line in a concrete meter box with a cast steel lid and labeled “sewer” (see Standard Drawing No. ES-G-1, ES-G-2 and CS-S-2).

(f) The typical location of service connections shall be at the downstream side of the Parcel, wherever possible, avoid other utilities (Gas, Tel, etc.)

(g) The minimum cover from finished surface at the property or Statutory Right of Way line to top of connection shall be 1.0 metres. The maximum cover from finished surface design grade at Statutory Right of Way line to top of connection shall be 2.5 metres if the main is located within a Statutory Right of Way. If the main is located on municipal Roadway or laneway, the maximum cover from finished surface design grade at PL to top of connection shall be 3.5 metres. Where depth of basement exceeds service depth, upper floors that can drain by gravity shall not be pumped. Lower floors may be pumped.

(h) The invert elevation at the property line shall be above any design surcharge level in the Sewage System adjacent to the lands or Parcel.

(i) All service connections shall enter the main at or above the spring-line.

(j) The minimum elevation difference between the MBE and the invert of the service connection at the inspection chamber at PL shall be 0.9m.

(k) Only one connection per property is permitted unless otherwise accepted by the Engineer. Multiplex residential shall have one service connection per dwelling unit.

(l) Connections to new mains shall be made using wye fittings only. Service connections greater than 150 mm diameter shall be made at a manhole.

(m) A standard manhole and kiosk pad complete with all appurtenances is required at or near the property line for all Commercial and Industrial zoned properties, suitable for sampling purposes. The location and design of this manhole and kiosk pad shall be accepted by the Engineer prior to construction.

(n) The Developer shall apply for a wastewater discharge permit prior to commencing discharge from any Commercial, Institutional or Industrial zoned properties. This wastewater discharge permit shall be applied for in accordance with the Sewer Rates and Regulation Bylaw, 2009, Bylaw No. 1862-2009.

10. CURVILINEAR SEWERS

Curvilinear sewers are not permitted.

11. SEWER LOCATION/CORRIDORS

(a) Mains within the Statutory Right of Way (SROW) for Highway purposes shall be located as per the standard typical cross-sections.

(b) Where sanitary sewer mains cross private property, they shall be within a registered Statutory Right of Way as per the tables below.

Table 6.2 Statutory Right of Way widths:

Properties designated Urban 3 - Infill in the 2016 OCP shall provide the following

Depth of Main (ground to invert)	Width of SROW with one (1) pipe	Width of SROW with two (2) pipes
≤2.5 m	3.0 m	4.5 m
>2.5 m & ≤4.0 m	4.0 m	5.5 m
>4.0 m	6.0 m	8.0 m

Table 6.3 Statutory Right of Way widths:

Properties with a land use designation other than Urban 3 - Infill in the 2016 OCP shall provide the following Statutory Right of Way widths:

No. of Sewer Mains within SROW	SROW Width Required	Minimum SROW Width Required
Single main	2 x Depth + Trench Width	4.5m
Two mains (same trench)	2 x Depth + Trench Width	5.0m
Two or more mains (separate adjacent trenches)	Sum of SROW required for each single main + separation between trenches	6.0m

(c) Sanitary sewer mains in Statutory Right of Way shall require access for maintenance and replacement. The access-way shall be a minimum 5.0 metres wide and designed for 9.1 tonne loading. The access route shall be clearly shown on the drawings and registered by Statutory Right of Way.

(d) Each SROW shall be accompanied by a cross sectional drawing showing the depth, trench width and SROW width calculation

12. SANITARY PUMP STATIONS

The use of sanitary pump stations is discouraged. Where the only alternative is the use of pump stations, the Consulting Engineer shall receive prior approval from the Engineer. Interim/temporary pump stations are not permitted unless approved by the Engineer.

(h) The design and construction shall conform to “Standard for Design of Sanitary Pump Stations”, attached as Schedule “F”.

(i) Odour control may be required by the Engineer.

(j) Individual lot private pump stations will be allowed only if they discharge into City owned gravity systems.

(k) Low-pressure systems will not be permitted.

(l) Commissioning protocols for pump stations shall be provided to the Consulting Engineer by the Engineer.

13. PRIVATE SEWERAGE SYSTEMS

(a) Excluding community sewer systems owned, operated and maintained by the City of Abbotsford, no other community sewer collection, treatment and disposal system shall be accepted.

Where no community Sewer System exists or can be extended due to grade, soil conditions, existing building interference or conformance to an adequate, pre-design alignment, the Developer shall provide an accepted alternate sewerage system for each Parcel. The accepted alternate system shall be engineered by a Consulting Engineer or certified professional per standards and specifications of the *Health Act* and *Sewage Disposal Regulation* and filed with Ministry per *Health Act* requirements. Proof of filing shall be submitted to the City prior to Final Approval of a Development by the Approving Officer or issuance of a Building Permit. Systems that exceed the size threshold of the Health Act will not be permitted unless authorized by the Engineer. When authorized these shall be designed in accordance with the *Environmental Management Act* and *Municipal Wastewater Regulation*.

Treatment and disposal of multiple Parcels (i.e. private community systems) including strata Developments are not permitted.

(b) Prior to Final Inspection of a Building Permit or prior to Final Acceptance from the Engineer and Approving Officer, whichever is required per standards of this Bylaw or the Building Bylaw, 2018, Bylaw No. 2883-2018, proof of final filing with Ministry of Health per requirements of the *Health Act*, shall be submitted by the Consulting Engineer or certified professional.

SECTION NO. 7 – HIGHWAYS

1. GENERAL REQUIREMENTS

Roadway design shall conform to these Engineering Standards or as otherwise accepted by the Engineer. Principles of design shall also conform to standards and practices developed by the Transportation Association of Canada (TAC) and described in their manual “Geometric Design Standards for Canadian Roads”, as well as the Institute of Transportation Engineers (ITE) Traffic Engineering Handbook in its most current version. Principles established in the BC Active Transportation (BCAT) Guide may also be employed at the discretion of the Engineer.

2. CONSTRUCTION SPECIFICATIONS

(e) All construction within the scope of this Schedule shall conform to the City approved edition of the Master Municipal Construction Documents (Platinum Edition – Volume II) and the requirements, standards and specifications prescribed by this Bylaw.

(f) Should any conflict exist or arise between these documents, this Bylaw shall take precedent over the Master Municipal Construction Documents.

3. HIGHWAY CLASSIFICATIONS

(a) The appropriate Highway classification shall be consistent with the Official Community Plan (OCP).

(b) The Developer and/or his Consulting Engineer shall confirm with the Engineer the appropriate Highway classification within or adjacent to the proposed Development in order to establish appropriate road allowance widths and Roadway design.

(c) Where a Highway passes through more than one land uses, the land use having the most impact on the Roadway shall dictate the appropriate classification to be used.

(d) Dedications by the Developer shall be dependent on the ultimate design of the Roadway within each Highway classification and the ability to provide Works and Service, as defined by the Engineer and this Bylaw. As a general guide, Schedule “M” Highway Right-of-Way Width Map shall be used to determine the width of right-of-way required on a corridor absent of site specific constraints or other required improvements including but not limited to transportation network improvements deemed necessary by a transportation impact assessment.

(e) Standard offsets for utilities and other services are shown on the Typical Standard Cross-Sections. When existing utilities do not match the typical cross-section off-sets, or will not permit the use of a typical cross-section, the Consulting Engineer shall confirm an alternate design with the Engineer at a pre-design meeting and prior to submission of design drawings. The Developer may be required to provide further Dedication or provide Statutory Right of Way in order to accommodate ultimate designs that include Landscaping and franchise utilities.

4. DESIGN ELEMENTS

(a) Once an appropriate Highway classification has been established, the Developer and their Consulting Engineer shall confirm the Roadway design, either by using the applicable standard cross-sections, or by preparing and submitting a specific design for review.

(b) See Table 7.1 to determine an appropriate design cross section for all roads associated with the Development. Dedication and Statutory Right of Way requirements for all Highways within and adjacent to a Development shall be accepted by the Engineer prior to design.

Table 7.1: Typical Urban Highway Classifications

Classification	Section [a]	Min. Right-of-Way (m) [b]	Min. Pavement Width (m) [f g]
Arterial	Signature Corridor (South Fraser Way)	34.0	13.2
	Urban Regional Road (Fraser Highway)	30.6	18.9
	Urban Arterial Divided	27.0	16.5
	Urban Arterial Undivided	24.5	17.0
Collector	Urban Collector Divided	27.0	16.2
	Urban Collector Undivided	24.5	16.7
Local	Industrial Local [c d]	20.0	11.4
	Multi-Family Local [e]	20.0	12.8
	Single-Family Local	17.0	8.8
	Single-Family Single Loaded Local	13.5	8.5
Rural	Rural Regional Road (Fraser Highway)	30.5	22.8
	Rural Collector (4 Lane)	25.0	18.5
	Rural Collector (2 Lane with Left Turn)	20.0	10.8
	Rural Local (2 Lane)	20.0	7.5
Cul-de-sac	Commercial (including Institutional)	35.2	28.0
	Industrial	38.2	31.0
	Urban Residential	27.3	24.0

[a] For detailed cross sectional dimensions, refer to Engineering Standard – Roadway Drawings (ES-R series) of Schedule "H".

[b] Right of Way requirements are representative of mid-block section and an additional Right of Way of 5.0 m may be required at intersections or as directed by the Engineer.

[c] For Industrial Local Roads within the City-in-the-Country Plan Lands, see Drawings ES-R-17, ES-R-18 and ES-R-19.

[d] For Peardonville Road, between Simpson Road and Marshall Road, the curb face to curb face width shall be 12.0 metres. The Boulevard width, as shown on Drawings ES-R-17, ES-R-18 and ES-R-19, shall be modified to suit.

[e] Where Multi-Family and Single-Family occur on the same Local Road, the Multi-Family Local Right of Way will govern unless otherwise approved by the Engineer.

[f] Enhanced Sidewalks for Commercial and Institutional land use zones require additional land or Statutory Right of Way on private property at the discretion of the Engineer.

[g] Cul-de-sac Right of Way and curb to curb width requirements can be found in drawing ES-R-1 and ES-R-2.

(c) Dedication and Statutory Right of Way requirements specified in one of the City's neighbourhood plans will govern over information in Table 7.1.

(d) Dedication and Statutory Right of Way

(i) The Developer shall dedicate and provide sufficient road allowance to accommodate all Works and Services required to service the proposed Development.

(ii) Highway cross sections shall be designed to accommodate all relevant features including appropriate pavement width for the classification of the road, bicycle facilities, bus-stop shelters, fire hydrants, gas mains, inspection chambers, multi-use pathways, postal kiosks, street trees, soil cells, sidewalks, street lights, street/traffic signs, traffic signals, water meter boxes, overhead or underground power and Telecommunications plant including service boxes, junction boxes and kiosks. The location of utility and Roadway elements are shown in Drawings ES-R-6, ES-R-7, ES-R-8, ES-R-9, ES-R-10, ES-R-11 and ES-R-12. Extended Statutory Right of Way may be required if all relevant features do not fit within the designated Statutory Right of Way noted in Table 7.1, or as required by the Engineer to accommodate traffic growth.

(iii) The Developer shall provide all Statutory Right of Ways over the Development property where necessary to accommodate City and third party services, such as gas, hydro and Telecommunications.

(iv) Where Statutory Rights of Ways are needed over private property for City utilities or public access, the Developer will negotiate and acquire such, together with sufficient clear working space necessary for the install and ongoing maintenance.

(e) Design Standards

TABLE 7.2: Design Standards

Classification	**Min. design speed** (Kph)	**Max. Super-elev** (%)	**Grade** (%)		**K-Value**		**Minimum Sight Distance** (m)	
					Crest Curves	**Sag Curves**		
			Min	Max [2,3]	Min	Min	Stopping	Decision
Arterial Road (Urban)	60	6[1]	0.5	10	11	18	85	95-235
Arterial Road (Rural)	80	6[1]	0.5	8	26	30	130	155-315
Collector Road (Urban)	60	6[1]	0.5	10	11	18	85	95-235
Collector Road (Rural)	70	6[1]	0.5	10	17	23	105	125-275
Local Road	50	3	0.5	12	7	13	65	140-190
Lane	30	0	1.0	12	2	13	35	110-160
Alternate Access	30		1.0	15				
Walkway			1.0	12				
Cul-de-sac			1.0	8				
Multi-use Pathway	20		1.0	8				

[1] Maximum super-elevation reduced to 4% where there are intersecting roads or private accesses.

[2] Maximum grades approaching intersections are 2% less than indicated. Reduction applies for length equal to stopping sight distance.

[3] Reduced maximum grades are recommended for hillside Developments where frost or icy conditions may occur. The maximum grade for cul-de-sacs is at the discretion of the Engineer and may be limited to 6% for hillside Developments.

(i) Unless otherwise accepted by the Engineer, the standard design speed to be used for the design of Roadways in the City is the 85th percentile speed of the traffic, which typically can be assumed to be as shown in Table 7.2.

(ii) Prior to planning and design, the Consulting Engineer shall verify with the Engineer the design speed and design vehicle to be used.

(f) Gradients

(i) Maximum and minimum gradients for Roadways shall be as shown in Table 7.2.

(ii) The Engineer may approve a gradient of 12% on Local and Collector Roads. The Consulting Engineer may be required to supply to the Engineer all information pertinent to their request including traffic studies, sight line and stopping distance calculations, proposed design restrictions, etc.

(g) Cross Slopes and Super-Elevation

(i) Cross slopes for all Roadways shall not be less than 2% nor more than 4%. The crown of the road shall be at the centreline of the Statutory Right of Way unless otherwise accepted by the Engineer. Super-elevation for any Highway shall be accepted by the Engineer prior to design.

(h) Horizontal Curves

(i) Horizontal curves shall be governed by the design speed of the road. Radii shall be derived from the equation:

$$R = \frac{V^2}{127\,(e+f)}$$

Where:

R = radius of curve in metres
V = vehicle speed in kilometres per hour
e = Roadway superelevation in metres per metre
f = side lateral friction force factor

Values for f:

80 Kph	= 0.14
70 Kph	= 0.15
60 Kph	= 0.18
50 Kph	= 0.21
40 Kph	= 0.25
30 Kph	= 0.31

(ii) The following examples are derived from this equation, and shall be typical unless otherwise accepted by the Engineer:

Classification	Design Speed (Kph)	Min. Radius (m)
Local Roads	50 Kph with 2% Cross-fall	103.0
	50 Kph with 2% Super elevation	85.0
Collector Roads	60 Kph with 2% Cross-fall	177.0
	60 Kph with 2% Super elevation	142.0
	60 Kph with 4% Super elevation	129.0

(i) Vertical Curves

(i) Vertical curves shall be governed by the design speed and the design vehicle of the road. Typically, the numerical value for the length of a vertical curve should not be less than the numerical value of the design speed in Kph.

(ii) Vertical curves are required for all changes in grade greater than 1.5%.

(iii) Crest Curves

A. See Table 7.2.

(iv) Sag Curves

A. See Table 7.2.

(j) Curb Returns

The Consulting Engineer shall take special care in the design of curb returns on hillside Development. The maximum gradient around curb returns from one street to another shall not exceed 12%, or 1.5 times the grade of the major street, whichever is less.

(k) Pavement Tapers

(i) Pavement tapers are used to connect the end of new road construction to the existing Roadway.

(ii) Unless otherwise specified by the Engineer, tapers shall be:

Highway Classification	Direction of Taper	Taper (length : width)
Local Roads	Widening in direction of Travel	10:1
	Narrowing in direction of Travel	20:1
Collector Roads (Urban)	Widening in direction of Travel	30:1
	Narrowing in direction of Travel	30:1
Arterial Roads (Urban)	Widening in direction of Travel	30:1
	Narrowing in direction of Travel	30:1
Collector Roads (Rural)	Widening in direction of Travel	40:1
	Narrowing in direction of Travel	40:1
Arterial Roads (Rural)	Widening in direction of Travel	40:1
	Narrowing in direction of Travel	40:1

5. INTERSECTIONS

(a) Dedications

(i) Curb Returns and Property Corner Truncations

A. Contact Engineering for design vehicle and design speed for required for intersection design. All curb returns shall typically conform to the following table:

Pavement Width	Radius
8 m – 9 m	8 m
9 m - 12 m	8 m
12 m – 15 m	10 m
≥15 m	11 m
At rural road intersections [A]	8 m

[A] To be confirmed with the Engineer for rural road intersections for Collectors and Arterials as a larger radius may be required.

B. For intersections at angles other than 90°, traffic movement shall suit the appropriate design vehicle turning radius, as determined by the Consulting Engineer and confirmed by the Engineer.

C. Notwithstanding Subsection (ii) A, curb returns at major intersections shall be designed by the Consulting Engineer and accepted by the Engineer. It shall take into consideration site specific constraints (both horizontally & vertically), projected traffic volumes, turning movements, truck traffic, and dedicated turning lanes.

D. Property corner truncations shall be provided at all street corners and are subject to the approval of the Engineer. The minimum truncations shall typically conform to the following:

Intersecting Road	Truncation
Arterial and Collector Road to any Roadway or Lane	5.0 m x 5.0 m
Local Road to Local Road	3.0 m x 3.0 m
Local Road to Lane	1.5 m x 1.5 m
Lane to Lane [A]	5.5 m x 5.5 m

[A] Lane to lane corner cuts are required for garbage truck and fire truck access.

(ii) Centreline Crossing Maximum Meeting Grades

Predominant Roadway	**At Intersection With**					
	Arterial Roads		**Collector Roads**		**Local Roads**	
	Max. Grade	**Distance**	**Max. Grade**	**Distance**	**Max. Grade**	**Distance**
Arterial Roads	Site specific		Site specific		n/a	n/a
Collector Roads	5%	60.0 m	6%	30.0 m	*	*
Local Roads	n/a	n/a	6%	30.0 m	*	*

* as per Engineer requirements

Note: Distances are measured along the predominant Roadway from the end of the approach vertical curve (EVC) to the beginning of the departure vertical curve (BVC).

Non-predominant Highway Classification	**At Intersection With**					
	Arterial Roads		**Collector Roads**		**Local Roads**	
	Max. Grade	**Distance**	**Max. Grade**	**Distance**	**Max. Grade**	**Distance**
Collector Roads	2%	30.0 m	2%	25.0 m	n/a	n/a
Local Roads	2%	25.0 m	2%	20.0 m	2%	10.0 m

Note: Distances are measured along the non-dominant road from the ultimate near curb line of the major road to the beginning of the vertical curve (BVC).

(b) Spacing and Location

(i) Intersecting roads shall meet as close to 90° as possible.

(ii) Intersection approach and departure sight distances shall be as outlined by Transportation Association of Canada standards (TAC).

(iii) The location of intersections near curves and hills shall be governed by guidelines established by TAC, including road classification, intersection and access controls, and sight and stopping distance references.

(iv) The minimum intersection spacings between them shall be:

A. 200 metres for Arterial Roads as measured between the centerlines of the intersecting street. A 100 metres minimum is acceptable on divided Arterials with a right-in, right-out intersection.;

B. 80 metres for Collector Roads as measured between the centrelines of the intersecting streets; and,

C. 60 metres for Local as measured between the centerlines of the intersecting streets. Where the adjacent intersections are three-legged, a minimum spacing of 40m is acceptable.

(c) Sight distance at intersections must be done in consideration of the proposed lane use.

6. HIGHWAY LENGTHS

Cul-de-sacs

(a) The maximum centre-line length of permanent dead-end Highways shall be:

Type of Land Use	Maximum Centreline Length
Residential	275.0 m
Industrial, Commercial	110.0 m
Institutional	110.0 m
Agricultural (rural)	400.0 m
P-loop *	400.0 m

*Note: The entrance leg of a P-loop shall not exceed 110.0 metres.

(b) The centreline length shall be measured from the centreline of the intersecting Roadway to the 'throat' of the cul-de-sac bulb or the end of the turnaround.

(c) Topographic or traffic generation considerations may warrant a decrease in the maximum length at the discretion of the Engineer.

(d) Future Through Road/Temporary Dead-End

(i) The maximum centreline length of a cul-de-sac in a Residential Development may be extended to 400.0 metres provided that the road is intended to be extended in the future as part of an advanced street plan and provided that alternate access for emergency vehicle use is dedicated and constructed.

(ii) Temporary dead-end roads shall use radial or hammerhead type turnarounds as per Standard Detail Drawing ES-R-42. The turnaround shall be within the dedicated road or on a registered Statutory Right of Way, as required.

7. ALTERNATE ACCESS

(a) Alternate access is constructed for the use of emergency vehicles or for other vehicles under emergency conditions only. It shall not be open to traffic other than pedestrians unless conditions warrant its use under emergency situations. Where alternate access, whether temporary or permanent, is required, it shall:

(i) be a minimum 6.0 metres wide and conform to the appropriate Standard Drawing;

(ii) be designed for 9.1 tonne axle loading (20,020 lbs);

(iii) be within a registered Statutory Right of Way or dedicated road Statutory Right of Way; and

(iv) be barricaded per Standard Detail Drawing CS-R-7.

(b) Where alternate access is permanent; it shall be as above and also:

(i) be fenced complete with appropriate barricades (e.g. bollards in an Urban context

or a gate in Rural contexts); and

(ii) have a streetlight at the entrance and exit to the intersecting streets and may require intermediate streetlights if the access is longer than 40 m.

8. STRUCTURAL CONSIDERATIONS

(a) Cuts and Fills

(i) Cut and fill slopes shall be a minimum of 2% and a maximum of 10% within 2.0 metres of the proposed curbs and back of Sidewalk.

(ii) Cut and fill slopes greater than 2%, to a maximum slope of 2H:1V as accepted by a geotechnical engineer, may begin at 2.0 metres from back of proposed curbs or Sidewalks and shall project to meet existing slopes.

(iii) At the discretion of the Engineer, cut and fill slopes outside the dedicated road allowance shall be protected by registered Statutory Right of Way.

(iv) Where rock cuts are anticipated the slope of the rock face shall be as designated by a geotechnical engineer. The surface shall be treated as required by the geotechnical engineer. At the base of all rock cuts or slopes stabilized with rock, a suitable ‘rock fall’ zone shall be provided to protect pedestrian and vehicle traffic from incidental rock or debris falls. The width of the ‘rock fall’ zone shall be as indicated by a geotechnical engineer. Additional separation between the "rock fall" zone and pedestrian facilities may be required at the discretion of the Engineer.

(b) Retaining Walls

(i) The use of treated wood timber or railway ties is prohibited both on private and City property. Lock blocks may be used at the discretion of the Engineer (as headwalls for culverts in ravines for example). Lock blocks shall not be used if open to public view.

(ii) The use of retaining walls to contain road cuts and fills is permitted subject to:

A. the approval of the Engineer;

B. any wall(s) and associated tieback/geogrid works on private property being within a registered Statutory Right of Way;

C. submission of geotechnical reports detailing soil analysis to support designs and type of construction, base, backfill and drainage;

D. aesthetic treatment of retaining walls that are open to public view shall be provided and as accepted by the Engineer;

E. a Building Permit being issued prior to construction (requirements of the Building Bylaw, 2018, Bylaw No. 2883-2018 shall be met, including railings and fencing as necessary), and

F. the provision of temporary and permanent, secure safety fencing along the top of retaining walls and adjacent Sidewalks.

(c) Road Base and Pavement Design

(i) Roadway structural design shall be designed for an expected life of 25 years under the expected traffic conditions for the specified Highway classification. The Consulting Engineer shall specify road base and depth of asphalt to be used for all Roadway designs in the City.

(ii) A geotechnical report shall be submitted with any Roadway design, confirming the structural adequacy of any existing Roadway and/or new Roadway being constructed by the Developer.

A. Regardless of the method used for design:

i. the minimum granular base course thickness = 75 mm;

ii. the minimum asphaltic concrete thickness = 76 mm (laid in two separate lifts); and

iii. the minimum sub-base course thickness = 450 mm (300 mm for Residential Local Roads, 200 mm for Lanes,350 mm Collectors and 450 mm Arterials).

(iii) Test holes and soil analyses shall be undertaken by a qualified soils testing company. All reports shall be signed and sealed by the geotechnical engineer.

(iv) Falling weight deflectometer (FWD) testing can be conducted to confirm that the pavement meets the structural requirements specified by the Engineer.

Classification	**Road Base**	**Asphalt**
Arterial Roads	1.5 mm	1.0 mm
Collector Roads	2.0 mm	1.3 mm
Local Roads	2.6 mm	1.5 mm
Lane	3.1 mm	1.5 mm
Industrial Roads	2.0 mm	1.3 mm

9. EXISTING ROADWAY UPGRADING

Existing Roadway re-construction designs, including asphalt overlays, shall be based on recommendations of a geotechnical engineer. A report shall be submitted including the results of pavement testing (i.e. Falling Weight Deflectometer (FWD) tests) and evaluation of test holes to establish design parameters.

10. PAVING

(a) Paving Materials

(i) The standard paving material in the City is hot-mixed, machine laid, asphaltic concrete, and it shall conform to the appropriate Standards and Specifications.

(ii) Gravel, surface-treated, or flush-coat treatments are not acceptable for new Roadway construction.

(iii) Special paving treatments may be required at the discretion of the Engineer.

(b) Paving Procedure

(i) All paving shall be done in two (2) lifts. Thickness shall be as designated by the accepted design.

(ii) The first lift shall be laid on an accepted base.

(iii) The final lift of pavement shall be placed at the end of the Warranty Period or earlier at the discretion of the Engineer.

(iv) As a guideline, the final paving shall be completed when 80% of the lots are built out.

(v) In any case, the final paving shall be placed within three (3) years of Substantial Completion of the Subdivision.

11. BICYCLE FACILITIES

(a) Bicycle Facilities are a part of the Roadway design as identified in the Transportation & Transit Master Plan and in consultation with the Engineer.

(b) Design requirements for the Bicycle Facilities will substantially comply with TAC, BCAT and in consultation with the Engineer.

(c) Drawing ES-R-44 shall be used as a reference for intersections with protected Bike Facilities, or as directed by the Engineer.

12. SIDEWALKS, CURBS AND GUTTERS

(a) Curbs and Gutters

(i) All urban Roadways shall be constructed with concrete curb and gutter on both sides unless otherwise specified by the Engineer.

(ii) Barrier curbs and gutters shall be used Fronting all Development and uses unless otherwise directed by the Engineer.

(iii) Road support structure shall be constructed a minimum 300 mm beyond the edge of any surface design feature.

(iv) All curbs shall be barrier style and constructed to Master Municipal Construction Document C4 standard unless otherwise directed by the Engineer except Lane access where rollover curb may be used.

(b) Wheelchair Ramps

(i) Wheelchair ramps are required at all intersections and as directed by the Engineer. The wheelchair ramps shall conform to Standard Detail Drawing CS-R-1.

(ii) A catch basin shall be located to intercept road drainage at the upstream side of wheelchair ramps.

(iii) Cast-in-place detectable warning surfaces to be installed at all Arterial and Collector intersections, or as directed by the Engineer.

(c) Sidewalks

(i) Sidewalks shall be constructed as per the applicable Highway classification and typical standard cross-section, or as otherwise directed by the Engineer. Typically:

Zoning	Width
Single Family Residential	1.8 m
Multi-Family Residential	1.8 m
Commercial	1.8 m or 3.0 m as directed by the Engineer
Industrial	1.8 m or 3.0m as directed by the Engineer
Institutional	1.8 m or 2.5 m in front of schools[A] [B]

[A] It is to the discretion of the Engineer if the Sidewalk shall be wider in front of schools.

[B] Statutory Right of Way may be required in situations where the existing road dedication does not accommodate the required width.

(ii) Sidewalks shall be constructed on both sides of the Roadway.

A. On urban Roadways with Sidewalk and street lighting designed for one (1) side only, such as in hillside Developments, the street lighting shall be on the same side as the Sidewalk.

B. Cul-de-sacs and dead-ended Roadways in single family areas shall have a Sidewalk constructed up to the throat of the cul-de-sac or the beginning of the turnaround complete with wheelchair letdown.

C. Where a Walkway or permanent alternate access is proposed from a cul-de-sac, the Sidewalk shall be extended to connect with them and a street light is required at the connection point.

D. The grade of the Sidewalk adjacent to Roadways shall be consistent with the grade of the Roadway. Where the elevation difference behind a Sidewalk exceeds 0.6 m with a slope greater than 2:1, a handrail or a fence is required.

E. Base and sub-base preparation shall extend a minimum of 600 mm beyond the width of the Sidewalk or Walkway.

F. The cross-fall of the Sidewalk through a driveway letdown shall be 2% for roads with a tree strip. The sidewalk pattern shall be maintained across the driveway letdown, except in industrial areas where by the driveway may pass through the sidewalk to accommodate grades and larger vehicles.

G. Along the frontage of all parks, leading into the adjacent neighbourhoods

and connecting nearby schools, community centres, other community amenities and other parks and trails.

13. DRIVEWAYS

(a) Single Detached/Duplex Residential Driveway access to an urban Arterial Road is not permitted unless approved by the Engineer.

(b) The maximum grade of any Driveway from the edge of pavement, back of curb or back of Sidewalk to the property line shall not exceed 2%.

(c) Driveway grades in excess of 14% may be accepted at the discretion of the Engineer and shall be designed by a Consulting Engineer to ensure that vehicles will not “bottom-out” or “hang-up” throughout the entire length of Driveway.

(d) Where a Parcel adjoins roads of different classifications, access is only permitted to the lower classification Roadway unless otherwise approved by the Engineer.

(e) Only one (1) Driveway access is permitted to a Single Detached/Duplex Residential lot unless an accessory dwelling unit is permitted, in which case an additional driveway may be considered at the discretion of the Engineer

(f) No Driveway shall be constructed within 1.5 metres of a streetlight, fire hydrant, utility pole or kiosk, above ground control panel or street tree.

(g) Consulting Engineers shall consider sight line constraints at horizontal and vertical curves when setting Driveway locations. A Driveway Sight Distance Plan shall be required for all Commercial, Industrial and Institutional Developments in any of the following circumstances:

(i) The property is a corner lot.

(ii) Vertical crest k values are at a minimum according to TAC guidelines.

(iii) The Development entails the horizontal realignment of a new or existing public road, or

(iv) The Development is on the inside of an existing horizontal road curvature. Driveways on the inside of horizontal curves and near the crest of vertical curves should be avoided unless supported by verification of a Driveway Sight Distance plan with the appropriate design vehicle.

(h) Driveways shall not be located within a corner truncation or within 5.0 m of the end of a corner truncation. Where a corner is without a truncation, the minimum distance from the corner shall be 12.5 m unless otherwise approved by the Engineer.

(i) Driveways shall not infringe on to the Frontage of adjacent properties.

(j) Driveway widths shall be designed in accordance with the following:

Zone or Land Use	Driveway Widths
Single Detached/Duplex Residential	Maximum 6.0 metres, minimum 3.0 metres
Multi-Family Residential	Maximum 9.0 metres
Commercial, Institutional	Single D/W:- Maximum 9.0 metres unless otherwise accepted the Engineer.
Industrial, Agricultural	Single D/W:- Maximum 12.0 metres unless otherwise accepted the Engineer unless turning template for the design vehicle indicates that a wider driveway access is necessary. More than one D/W:- Maximum 9.0 metres unless otherwise accepted by the Engineer. Single Detached Driveways in Agricultural land uses shall be a maximum of 6m as per ALC regulations.

(k) All Driveway access points shall be by curb/Sidewalk letdown unless accepted by the Engineer.

(l) Acceleration/deceleration Lanes in Rural areas or left hand/right hand Lanes in Urban Areas may be required for access or egress to Collector or Arterial Roads. Further Dedication may be required to accommodate the extra width of the auxiliary lanes.

(m) Agricultural properties shall be permitted one (1) driveway to the residence and one (1) to the farm operation, where applicable. Additional driveways may be considered at the discretion of the Engineer.

(n) All Driveways shall be finished with:

(i) Asphalt (minimum 50 mm thick) in areas without curb and gutter.

(ii) Concrete (minimum 120 mm thick) in areas with curb and gutter. Concrete shall be broom finished. Stamped and/or coloured concrete is not permitted.

14. BOULEVARDS

(a) Boulevards shall be hardscaped where development fronts retail commercial development with street parking or as directed by the Engineer

(b) All Boulevards are to be designed and constructed in accordance with Schedule “E”, Section 10 – Landscape, of this Bylaw.

(c) Boulevards shall be finished with 300 mm of Absorbent Soil per Section No. 4, 8 (e) and seeding or sod. Other surface finishes are not permitted, including artificial turf, asphalt or landscape rock.

15. MEDIANS

(a) All medians shall be finished with a hard surface or landscaped and shall conform with specifications established in Schedule “E”, Section 10.

16. TRAFFIC SIGNAGE AND PAVEMENT MARKINGS

Pavement markings, street signage, traffic advisory signs etc. shall be installed by the City at the Developer’s expense. When a Development proposes a change to a Roadway or Highway, such as adding a travel Lane or a Bicycle Facility, a Pavement Marking and Signage Plan is required as part of the design submission by the Consulting Engineer.

17. WALKWAYS

(a) Walkways with an overall grade of 5% or less shall have a uniform gradient (where possible). Walkways with a gradient between 5% and 12% shall be designed and constructed with stepped ramps per Standard Detail Drawing CS-R-10. Where the gradient exceeds 12%, a stairway shall be constructed in accordance with the Standard Detail Drawing CS-R-11.

(b) The maximum length of any ramp shall be 9 metres including a flat landing area at both ends. Ramps may ‘switchback’ but a flat landing area shall be constructed at the ‘switchback’ step. Where stepped ramps are constructed in combination with stairs, the ramps shall alternate from one (1) side of the stair to the other. Each transition landing area shall be flat. The Developer shall ensure sufficient Statutory Right of Way is provided for adequate construction to these standards.

(c) Walkways shall have pedestrian-oriented decorative lighting at:

(i) the entrance and exit;

(ii) all changes in direction greater than 30^{o} along its length;

(iii) every 40.0 m; and

(iv) the designer shall consider the issue of maintenance access and design to luminaires.

(d) Walkways shall be adequately drained and in Urban Areas shall be concrete with chain link fencing on both sides and bicycle bollards at both ends per standard detail drawings.

(e) Walkways with a grade of less than 8% shall be constructed with removable posts per Standard Detail Drawings CS-R-4. Where the walkway grade exceeds 8%, bicycle baffles shall be used per Standard Detail Drawing CS-R-5.

18. HANDRAILS

(a) Handrails shall be constructed in accordance with the Standard Detail Drawings where grades are in excess of 12%, where steps are constructed, or where grade separation between the back or edge of Walkways and Sidewalks exceeds slopes of 2.5V:1H.

(b) Handrails may be required on storm sewer inlet/outlet structures, along Walkways and

Sidewalks where steep or excessive side slopes are encountered, or in any location as deemed necessary by the Engineer where in their opinion the safety of the public or maintenance worker is a concern.

(c) Handrails shall be required in accordance with 12 (c) (ii) D. of this section of Schedule "E".

19. COMMUNITY MAILBOXES

(a) The Engineer shall approve the location of all community mailboxes.

(b) Community mailboxes shall typically be located along the designated side yard property line of corner Parcels and behind the Sidewalk as far from any intersection as possible.

(c) Proposed community mailboxes to be located on Arterial or Collector Roads are strongly discouraged. At intersections controlled by a traffic light, community mailboxes within the Statutory Right of Way for Highway purposes shall be at least 30.0 m from the beginning of curve and end of curve (BC/EC) of the corner truncation property line. At the intersection of Local Roads, they shall be at least 30.0 m from the intersecting sight lines and shall not be located within the intersection.

(d) Community mailboxes shall be at least 30.0 m from crosswalks and major Driveways (e.g., schools, Commercial Developments, etc.).

(e) Community mailboxes shall have a minimum clearance of 5.0 m to fire hydrants and 2.0 m to exposed municipal, power, Telecommunications or gas utility fixtures.

(f) Where pullouts are provided to community mailboxes, pullouts to be a minimum width of 2.8 m from the fog line or edge of pavement

20. BUS STOPS

Where Development occurs near or adjacent to a bus route, provisions shall be made for bus stops as either extra road allowance or by way of a registered Statutory Right of Way. Specific requirements for each Development shall be determined by the Engineer and are subject to transit needs for that area. The minimum dimension for a bus stop area shall be 3.0 m wide and 9.0 m long. Typical improvements of designated bus stop locations may include:

(a) Concrete Sidewalk to the curb to provide an all-weather access to each door of the bus. A minimum of 1.5m from the front of curb to the bus shelter is required to ensure sufficient accessibility to the bus;

(b) Sufficient road allowance to provide enough space for a bus stop as per ES-R-45. Specific bus stop requirements to be confirmed with the Engineer. Base preparation for any bus stop furniture shall be treated as an extension of the Sidewalk. Bus stop furniture pad to be concrete;

(c) Any bus stop furniture or structure(s) shall be clear of the designated Sidewalk for enhanced accessibility along any Sidewalk or Walkway. A minimum of 3.0m on either side of the bus shelter shall be clear for bus riders to allow for easy access to the bus;

(d) Appropriate street lighting to illuminate the bus stop, landing pad, and shelter; and

(e) Bus stop signage to be installed by the City at the Developer's expense.

(f) ID post location to be determined by the City, typically outside of the sidewalk space where possible ;

(g) Power from the nearest street light; and,

(h) Bus stops pullouts shall be designed in accordance with BC Transit Guidelines, or otherwise approved by the Engineer.

Standard Detail Drawing ES-R-45 demonstrates a typical bus stop adjacent to a protected Bicycle Facility. Any variations must be discussed and approved by the Engineer.

21. TRAFFIC ACCESS AND IMPACT STUDIES

The Developer shall comply with the City's Transportation Impact Assessment - Terms of Reference Guidelines document. All submissions will be subject to the review and approval of the Engineer. The Terms of Reference Guideline document is available upon request.

22. MOUNTAINOUS TERRAIN DESIGN ALTERNATIVES

(a) Where the average slope of the land in an area exceeds 15%, the design of Roadways in the Development may employ the following criteria at the discretion of the Engineer. The Consulting Engineer shall verify with the Engineer the use of these criteria prior to commencement of planning and design of a Development:

(i) Design Speeds;

Highway Classification	Design Speed (Kph)	Posted Speed (Kph)
Collector Roads	50	40
Local Roads (Residential)	40	30

(ii) and the Engineer may approve a maximum gradient of 12% on Collector Roads.

(b) Intersections

At intersections a flat continuous grade through the intersection is required. The through grade of the major Roadway shall be predominant. The maximum grade and minimum length of the flat section through the intersection shall be as noted below:

Predominant Roadway	At Intersection With			
	Collector Roads		Local Roads	
	Max. Grade	Distance (m)	Max. Grade	Distance (m)
Arterial Roads	6%	60.0	n/a	n/a
Collector Roads	8%	60.0	8%	30.0
Local Roads	n/a		8%	30.0

Note: Distances are measured along the predominant Roadway from the end of the approach vertical curve (EVC) to the beginning of the departure vertical curve (BVC).

Non-predominant Roadway	**At Intersection with**:					
	Arterial Roads		**Collector Roads**		**Local Roads**	
	Max. Grade	**Distance (m)**	**Max. Grade**	**Distance (m)**	**Max. Grade**	**Distance (m)**
Collector Roads	4%	15.0	4%	15.0	n/a	n/a
Local Roads	4%	15.0	4%	10.0	4%	10.0

Note: Distances are measured along the non-predominant Roadway from the ultimate near curb line of the predominant Roadway to the beginning of the vertical curve (BVC).

23. ROUNDABOUTS

(a) Roundabouts may be considered as a design alternative to Intersections at the discretion of the Engineer with recognition of future traffic growth.

(b) All design shall be complaint with the criteria established in the guidelines established by TAC and the Ministry of Transportation and Infrastructure's BC Supplement to TAC Geometric Guide for Canadian Roads.

24. TRAFFIC CALMING

(a) Traffic Calming may be considered for design within the Roadway at the discretion of the Engineer.

(b) All design shall be compliant with the City's most current Traffic Calming Policy and criteria established in TAC's current version of "Canadian Guide to Traffic Calming".

(c) New Roadways to a design speed of 30 km/h shall not be used as a traffic calming measure. Instead, Roadways must be designed to the design speed stated in Table 7.2 and have traffic calming measures introduced to lower the travel speed of vehicles.

25. FIBRE OPTICS CONDUIT

(a) Fiber optics conduit and associated infrastructure may be required as a part of Highway design and construction at the discretion of the Engineer. If required, the Engineer will provide the design criteria to the Consulting Engineer.

(b) All fiber optic conduit shall be buried at a minimum depth of 900 mm.

26. RAINWATER SOURCE CONTROL

(a) Rainwater source controls that are compliant with this Bylaw may be included as a requirement for projects within Highway, at the discretion of the Engineer.

27. MULTI-USE PATHWAYS

(a) At the discretion of the Engineer, Multi-Use Pathways (MUP) may be required in lieu of on-street active transportation facilities. MUP's shall be a minimum 3.0 m wide, surfaced with asphalt and be designed as per TAC Guidelines. Additional design criteria is in Table 7.2.

SECTION NO. 8 - STREET LIGHTING

1. GENERAL

(a) Street lighting generally refers to lighting of streets including Sidewalks, crosswalks, intersections, rail crossings, roundabouts and Multi-use Pathways. The main purpose of street lighting is to enhance visibility at night. For a pedestrian, this may mean better visibility of the surrounds and the Sidewalk, while for the driver of a motor vehicle, it will mean increased time to stop or to safely maneuver around an obstacle or a pedestrian.

(b) Street lighting design shall comply with the most current edition of ANSI/IESNA RP-8, MMCD Specifications and this Bylaw.

These standards are not intended to be a substitute for sound engineering knowledge and experience in street lighting design and the Canadian Electrical Code. Street lighting and traffic signal designs shall be prepared under the direction of a Consulting Engineer.

(c) Where a Developer converts overhead utilities, street lighting shall be provided by the Developer and the BC Hydro pole mounted lease streetlights shall be removed by BC Hydro once notification has been received from the City.

(d) Street lighting and traffic signal plans shall be signed and sealed by a professional electrical engineer responsible for the design of the Street Lighting and Traffic Signal Works and Services.

2. CONSTRUCTION SPECIFICATIONS

(g) All construction within the scope of this Schedule shall conform to the City approved edition of the Master Municipal Construction Documents (Platinum Edition – Volume II) and the requirements, standards and specifications prescribed by this Bylaw.

(h) Should any conflict exist or arise between these documents, this Bylaw shall take precedence over the Master Municipal Construction Documents.

3. LIGHTING CRITERIA

Table 8.1 – Based on the "Luminance Method":

Street Classification	Zone	Average Luminance Lavg	Pole Height (m)	Pole Layout	Average Uniformity Ratio Lavg/Lmin	Maximum Uniformity Ratio Lmax/Lmin	Maximum Veiling Luminance Ratio Lvmax/Lavg
ARTERIAL	Residential Industrial	0.9	9.0 or 11	staggered/ opposing	3:1	5:1	0.3:1
	Commercial Institutional	1.2	9.0 or 11	staggered/ opposing	3:1	5:1	0.3:1
COLLECTOR	Residential	0.6	9.0	staggered	3.5:1	6:1	0.4:1
	Industrial	0.6	9.0	staggered	3.5:1	6:1	0.4:1
	Commercial Institutional	0.8	9.0 or 11	staggered	3:1	5:1	0.4:1
LOCAL	Residential	0.3	7.5	one side	6:1	10:1	0.4:1
		0.3	6	one side	6:1	10:1	0.4:1
	Commercial Institutional	0.6	9.0	one side or staggered	6:1	10:1	0.4:1
	Industrial	0.5	9.0	one side or staggered	6:1	10:1	0.4:1

Note: Luminance Levels, Uniformities and Veiling Luminance are extracted from IESNA RP-8-18 Table 11-1 Light Design Criteria for Streets and adapted to City Zones.

(a) Lighting for Sidewalks and Walkways shall be as follows:

(i) Maintained Average Horizontal Illuminance: 5 Lux or greater; and

(ii) Maximum to Minimum Uniformity Ratio: 10:1 or less.

For major streets with high pedestrian activity levels, apply pedestrian lighting levels defined in IESNA RP-8-18.

(b) The illumination levels at all signalized intersections shall be as per IESNA RP-8-18 Table 12.1 Pavement Illuminance for Full Intersection Lighting. Pedestrian activity levels shall always be medium or high. Where lighting is being considered for a non-signalized intersection a lighting warrant (defined in the Transportation Association of Canada Guide for the Design of Roadway Lighting Chapter 10.4) shall be undertaken to determine the requirements and the amount of lighting (ie; full, partial or delineation lighting). Where warrants are undertaken, they shall be submitted to the Engineer for approval.

(c) When undertaking lighting calculations on single-lane or two-lane Roadways, and the maximum lane width is over the 4m, the width used in the calculation shall be 4m and shall be applied in the travel portion of the Roadway starting at the road centre line. This scenario will be most common for Residential or Industrial areas.

(d) Where time limited parking lanes exist or are proposed, the lighting shall be calculated as if the parking lanes are travel lanes. Full time on-street angled, or parallel parking areas shall not be included in the luminance calculations. Bicycle Facilities shall be calculated in luminance as part of the Roadway.

(e) Where only half the road width is being constructed, the lighting shall be designed

utilizing the ultimate pole arrangement to meet the road classification lighting design criteria. Lighting for half roads where a staggered or opposite pole spacing is required for the ultimate will not typically meet lighting levels in the interim and shall be designed to meet ultimate lighting level by showing future poles on the undeveloped side.

(f) Curved Roadway sections (less than 600 m radius) or roads with steep and variable grades (6% or greater) can be calculated using the horizontal illuminance method.

(i) For determining what horizontal illuminance level should be used as an equivalent to the recommended luminance level, a ratio of 1 cd/m^2 equal to 15 lux can be used. For the calculations a 2 m grid should be placed across the entire travel portion of the lanes.

(g) On Roadways connecting Residential areas to Commercial areas, the spacing of luminaires shall change gradually to suit the change in levels of illumination. In the case where luminaire output or type changes, the spacing in the transition zone may not have to change significantly. In any case, the spacing changes in the transition area shall not be abrupt or irregular.

(h) Where required by the Engineer, the Consulting Engineer shall provide street lighting on laneways where the lane is the primary access to the properties.

4. UNDERGROUND DUCTS

(a) Underground wiring for street lighting shall be designed in accordance with the MMCD Standard Details and this Bylaw, BC Hydro Specifications and shall conform to the rules and regulations of the *Canadian Electrical Code (Part 1)*, the Provincial Electrical Inspection amendments and any City codes or Bylaws and other authorities having jurisdiction.

(b) The standard offset for the location of the underground street lighting ducts within Statutory Right of Way for Highway purposes shall conform to the typical cross-sections.

(c) The minimum depth for the underground ducts shall be 0.6 metres in unpaved areas and 0.9 metres in paved areas.

(d) It is the Consulting Engineer's responsibility to ensure that the service connection point for street lighting systems is accepted by BC Hydro prior to construction.

5. CLEARANCES TO HYDRO LINES

The requirements of BC Hydro, *Canadian Electrical Code*, Technical Safety BC - Electrical, and WorkSafeBC, shall be followed with respect to clearances between streetlight poles, luminaires, high voltage and other conductors.

Where BC Hydro clearances to poles and luminaires cannot be met, BC Hydro Lease Lighting may be considered only when the Consulting Engineer can prove no viable City owned lighting options exist. This shall include shorter than standard poles or locating poles on the opposite side of the road than the overhead power lines. BC Hydro Lease lights shall meet the required light levels defined unless approved by the City.

6. LUMINAIRES

(a) The Developer shall install LED luminaires for any new or replacement lighting installations. The Consulting Engineer shall refer to the City's Approved Products List for products pre-approved by the Engineer. As the style, shape and appearance of LED luminaires vary greatly from supplier to supplier, the luminaire(s) selected by the Consulting Engineer for use on a project shall be reviewed with the Engineer prior to commencing design.

(b) Where directed by the Engineer, decorative street lighting is to be utilized to enhance the streetscape. The Engineer may provide the Developer with generic details of the decorative lighting requirements and a list of approved suppliers for use in producing design drawings. However, if there are no approved luminaire suppliers for the area, the Consulting Engineer shall select a LED luminaire(s) that resembles the generic details for approval by the Engineer.

(c) Absolute photometric files in accordance with IESNA LM79-08 shall be used for each luminaire type, wattage, operating current and photometric distribution.

(d) Where converting existing luminaires to LED and the required light levels can't be achieved, the Consulting Engineering shall confirm existing lighting levels and meet or exceed those.

7. POLES AND CONCRETE BASES

(a) Unless special decorative pole style is defined by the City, approved poles shall be davit.

(i) Davit pole heights shall be 7.5 m, 9.0 m or 11.0 m; and

(ii) Decorative pole heights shall be 5.0 m, 6.0 m or 7.5 m high.

(b) Decorative poles maybe defined for various areas as noted under luminaires above. Decorative poles may have specific shapes, colour and styles along with banners and flower basket hangers. Where decorative poles are required the poles, brackets, and anchor bolts shall meet all applicable codes and standards and shall be designed by a Consulting Engineer registered with the EGBC.

(c) The exact offset of the pole (behind curb, edge of pavement or Sidewalk) is defined in the City Engineering Standard Cross-section drawings ES-R-6 to ES-R-12. Poles shall be located to accommodate intersections, property corners and pedestrian Pathways and Walkways. Spacing shall be governed by Roadway width, road configuration and intersecting property lines. Locate pole at curb returns, at property lines and a minimum of 1.5 m clear of wheelchair ramps. Poles shall be located within 1.0m of adjacent property corners, and shall not conflict with proposed Driveway and/or underground services. Minimum offset from Driveways shall be 1.5 m.

(d) Where Sidewalk but no planting strip/Boulevard is present, poles shall be located behind the Sidewalk.

(e) Street light poles may require receptacles where dictated in an Official Community Plan or as directed by the Engineer.

(f) The MMCD standard drawings and specifications define typical bases to go with standard lighting poles. Where custom foundations are required, they shall be designed

by the Consulting Engineer. Custom foundations shall be based on the pole base reaction forces and soils conditions present.

8. POWER SUPPLY AND DISTRIBUTION

(a) Power is generally supplied by BC Hydro through an un-metered service when servicing only streetlights and traffic signals. Where tree lights, irrigation controllers and pole receptacles are included, BC Hydro may require a metered service. This shall be confirmed with the City and BC Hydro.

(b) The Consulting Engineer shall confirm voltage and locations of suitable power sources for the proposed lighting system. The Consulting Engineer shall confirm if a new service is required or an existing lighting system in the area is suitable for extension. Lighting systems are typically serviced from a 120/240 Volt single phase 3 wire system. Use of other voltages must be approved by the Engineer.

(c) Services are to be “Underground Dip” type or will tie into a service box. The Consulting Engineer shall select a suitable service location based on availability and what meets the City and BC Hydro standards.

(d) The BC Hydro power supply needs to feed into a service base which shall contain panel boards, breakers, lighting contactor(s), switch and surge protector. The lighting is controlled by a single photocell located on a luminaire. The service base shall be located:

(i) Off the Roadway where not likely to be impacted by motor vehicles;

(ii) Where it will not be a hazard or obstruction to pedestrians;

(iii) Where it can be accessed for easy servicing; and

(iv) To accommodate extension to future lights within the road Dedication and not on private property.

The service base shall have a concrete service pad (minimum 1 m x 1 m x 100 mm thick) at the access.

Service conduit shall be minimum 53 mm RPVC.

(e) Power distribution requirements include:

(i) Wiring to be installed in minimum 35 mm Rigid PVC conduit;

(ii) Wiring to be stranded copper with RW90 insulation;

(iii) Wiring to be colour coded per Canadian Electrical Code (CEC); and

(iv) Conduit burial depth to be minimum 900 mm

(f) Conduit alignments shall be designed to avoid tree roots wherever possible.

9. DESIGN

(a) Lighting design requires computer lighting calculations using AGI32 and lighting supplier photometric files in the IESNA format.

(b) The Consulting Engineer shall select luminaires with optical systems which efficiently light the interned area and properly illuminate the Roadway and Sidewalks as well as provide maximum spill light control beyond the Sidewalk in order to reduce spill light and glare impacts on residents.

(c) The Consulting Engineer shall apply Light Loss Factor of 0.81 to the lighting design.

(d) Electrical design requirements include:

(i) Maximum voltage drop for branch circuits: 3%;

(ii) Allow for possibility of future expansion. Stub out conduit(s) at the last streetlight pole and / or into a temporary junction box at end of the Development.

(iii) Junction boxes shall be installed where required and shall not be installed within the Sidewalk.

(iv) Conductor sizes: #6 RW90 in conduit and #12 RW90 in the poles from luminaire to the pole handhole.

(v) Circuit load not to exceed 80% of feeder breaker rating (as per CEC).

(e) The Consulting Engineer shall submit lighting and voltage drop calculation with their design. Voltage drop and lighting calculations shall be submitted in PDF and shall be signed and sealed by the Consulting Engineer.

(f) A completed lighting Design Criteria Table (see example Table 8.1 below) for each road, Walkway, intersection or roundabout will be required all Street Lighting Plans as per Section 2 of Schedule “E”.

TABLE 8.1: Lighting Design Criteria Table Example

LIGHTING DESIGN CRITERIA TABLE				
ITEM	**REQUIRED VALUES**	**CALCULATED VALUES**	**REQUIRED VALUES**	**CALCULATED VALUES**
STREET NAME(S)	McLean Ave		Intersection of McLean Ave and Caspers St	
LAND USE CLASSIFICATION	Residential		Residential	
ROADWAY CLASSIFICATION & WIDTH	8.6m Local		8.6m Local/12.2m Collector	
PEDESTRIAN ACTIVITY LEVEL	Low		Medium	
LUMINAIRE DESCRIPTION, MANUFACTURER & MODEL	LED Roadway Lighting Ltd. SAT-48S		LED Roadway Lighting Ltd. SAT-48S/SAT-96M	
PHOTOMETRIC FILE NUMBER	SAT-48S-350mA-T2.ies		SAT-48S-350mA-T2.ies SAT-48S-450mA-T2.ies	
LUMINAIRE WATTAGE, LIGHT SOURCE and COLOUR TEMP.	55W, LED, 3000k		55W/143W, LED, 3000k	
LIGHT LOSS FACTOR	0.72		0.72	
LUMINAIRE DISTRIBUTION CLASSIFICATION AND BUG RATING	Type II, B1-U1-G1		Type II, B1-U1-G1 Type III, B2-U0-G2	
POLE HEIGHT (m)	7.5m		7.5m/9.0m	
POLE ARRANGEMENT	one sided		n/a	
POLE SPACING (WORST CASE)	48m		n/a	
INTERSECTION ILLUMINANCE LEVEL (Eavg)	n/a	n/a	16 Lux	18 Lux
INTERSECTION UNIFORMITY RATIO (Eavg:Emin)	n/a	n/a	4.0:1	3.8:1
ROADWAY LUMINANCE LEVEL (Lavg)	0.3 cd/m2	0.4 cd/m2	n/a	n/a
ROADWAY UNIFORMITY RATIO (Lavg:Lmin)	6.0:1	5.1:1	n/a	n/a
ROADWAY UNIFORMITY RATIO (Lmax:Lmin)	10.0:1	9.1:1	n/a	n/a
ROADWAY VEILING LUMINANCE RATIO (Lvmax:Lavg)	0.4:1	0.37:1	n/a	n/a
SIDEWALK HORIZONTAL ILLUMINANCE LEVEL (Eavg)	3 Lux	4 Lux	n/a	n/a

SECTION NO. 9 - TRAFFIC SIGNAL DESIGN

1. GENERAL

(a) Traffic signal systems are to be designed in general conformance with:

(i) BC Motor Vehicle Act and Regulations;

(ii) Canadian Electrical Code, latest edition;

(iii) City of Abbotsford Supplementary Specifications;

(iv) BC Ministry of Transportation Electrical and Traffic Engineering Manual;

(v) Canadian Manual of Uniform Traffic Control Devices (MUTCD); and

(vi) Master Municipal Construction Document (MMCD) Specifications and Design Guidelines.

(b) Detail drawings and specifications for traffic signal systems shall be prepared by a Consulting Engineer experienced in traffic signal design

(c) Before proceeding with traffic signal system designs or designs that may impact existing traffic signal systems, the Consulting Engineer shall contact the Engineer to confirm the scope of work and ensure the requirements of the project are fully understood. This is particularly important for Developer derived work where the City is not directly responsible for engaging the design firm.

(d) The Consulting Engineer shall be knowledgeable in traffic signal design and specific City requirements. The Consulting Engineer shall contact the Engineer prior to starting the design to confirm materials and specifics as well as signal phasing.

(e) The Engineer will provide list of specific products to be used. The Engineer will also review signal phasing and signal timings with the Consulting Engineer.

City supplied materials at the Developers cost typically include:

(i) Traffic controller and cabinet;

(ii) Street name signs; and

(iii) Padlocks.

2. TRAFFIC SIGNALS AND CONTROL

(a) Traffic signal details are standardized throughout British Columbia to avoid potential confusion of the travelling public, both local and visiting. They are defined in the *BC Motor Vehicle Act*. Items standardized include:

(i) Vertical mounted signal heads;

(ii) Left side secondary heads; and

(iii) Order of signal indication.

(b) The Standard Construction documents shall be used in conjunction with the *BC Motor Vehicle Act* Regulations - Division (23) Traffic Control Devices and the *BC Motor Vehicle Act* R.S.B.C. 1996, Chapter 318.

(c) Refer to Part B, Traffic Signals, of the most current edition of the Manual of Uniform Traffic Control Devices for Canada (MUTCD) for information on traffic signal specifications, concepts and terminology.

3. SIGNAL HEADS

(a) General locations of signal heads are as follows:

(i) Primary: Mounted over the Roadway which a vehicle is to enter

(ii) Secondary: Mounted to the left of the Roadway which a vehicle is to enter

(iii) Auxiliary: Mounted to the right of the primary head, or other location to enhance visibility

(iv) Pedestrian: Mounted on the far side of the intersection in line with the painted crosswalk.

(b) Signal visibility distance is defined as the distance in advance of the stop line from which a signal must be continuously visible for approach speeds varying between 40 and 80 km/h. For speeds exceeding 80 km/h, the minimum visibility distance must equal or exceed the minimum stopping sight distance. Visibility distance guidelines are shown in Table 9.1.

TABLE 9.1: Signal Head Visibility Distance Guidelines

85th Percentile Speed (km/h)	Minimum Visibility (m)	Desirable Visibility (m)	Add For % Downgrade (m)		Subtract For % Upgrade (m)	
			5%	10%	5%	10%
40	65	100	3	6	3	5
50	85	125	5	9	3	6
60	110	160	7	16	5	9
70	135	195	11	23	8	13
80	165	235	15	37	11	20

(c) Visibility of a signal head is influenced by three factors:

(i) Vertical, horizontal and longitudinal position of the signal head;

(ii) Height of driver's eye; and

(iii) Windshield area

(d) Lateral vision is excellent within 5° degrees of either side of the centreline of the eye position (10° cone) and adequate within 20° (40° cone). Horizontal signal position should therefore be as follows:

(i) Primary heads within the 10° cone; and

(ii) Secondary heads within the 40° cone.

(e) Vertical vision is limited by the top of the windshield. Signal heads should be placed within a 15° vertical sight line. Overhead signals should be located a minimum of 15 m beyond the stop line.

(f) Signal head sizes are to be as indicated in the Table 9.2.

TABLE 9.2: Signal Head Sizes

Signal Head Type	Area Classification and Lens Size and Shape
Primary	300 mm round
Secondary and Auxiliary	300 mm round
	300 mm round
Pedestrian	300 mm square combination walk/don't walk indication 300 mm square countdown timer

(g) Each approach to an intersection requires a minimum of one primary and one secondary

signal head. Requirements for additional signal heads are to be determined based on visibility issues. Signal head placement are to be as indicated in the Table 9.3.

TABLE 9.3: Signal Head Placement

Straight Through Lines		
No. of Lanes	**No. of Primary Heads**	**Placement of Primary Heads**
One	One	Centred over through lane
Two	Two	Centred over through lane
Three	Two	Centred over lane lines
Left Turn Lanes		
Left Turn Type	**Primary Head Type**	**Placement of Primary Heads**
Protected/Permissive	4 Sections with Flashing Green Arrow and Steady Yellow Arrow	Centred over left-most through lane
Protected – Single Left Turn Lane	3 Sections with Steady Green Arrow	Centred on the left turn lane, either post mounted in median 2.5 m above Roadway or mast-arm mounted
Protected – Dual Left Turn Lanes	3 Sections with Steady Green Arrow	Centred on the left turn lane, either post mounted in median 5.5 m above Roadway or mast-arm mounted.

4. SIGNAL POLES

(a) Signal poles shall be Type L; however, type 4A poles, street lights poles and type S poles can be used for mounting signals and type 3 poles with breakaway bases for advance warning signs. The Consulting Engineer shall undertake pole capacity calculations using MOTI's Pole Capacity Program to verify pole loading with pole supplier. The Consulting Engineer is responsible for determining the suitability of these standard foundations for the given soil conditions. Where soils are in question a geotechnical engineer should be consulted to define the suitability of the foundations for the given soil conditions. Where foundations are not suitable, custom foundations will be required.

(b) The following shall be taken into consideration for signal pole locations:

(i) Signal poles should be placed so the top of the concrete base is between 1.5m and 2.5m from the face of curb or edge of pavement, preferably behind the Sidewalk. 1m of concrete Sidewalk shall be placed around the pole base. A pushbutton post shall be added if signal post is located more than 2.3m from curb portion of front edge of wheelchair let down

(ii) Pole arms should be oriented at 90° to the centreline of the road, except where

the intersection is skewed. When laying out a skewed intersection, ensure the arms do not block the view of the signal heads for other approaches.

(iii) Signal head tunnel visors shall be considered where signal heads are visible from conflicting movements.

(iv) Advance warning signals shall be considered where warranted.

(v) Other key considerations for pole placement are:

A. Ease of access to pushbutton for pedestrians, disabled and the visually impaired;

B. Maintaining wheelchair access around poles and from pushbuttons to wheelchair ramps;

C. Minimizing the number of poles required;

D. Locating poles and signal heads outside vehicle turning radius to avoid damage. This is particularly important in industrial areas;

E. Underground and overhead utility conflicts; and

F. For better visibility of vehicle and pedestrian heads.

5. LEFT TURN PHASING

(a) Left turns at signalized phasing options are as follows:

(i) Permissive – Green ball display. A Permissive left turn has no signal indication other than a green ball, which permits a left turn when opposing traffic is clear.

(ii) Protected – Green arrow display. A Protected left turn presents a continuous green arrow indication while all opposing traffic is held by a red ball. A Protected Left Turn is always terminated with a yellow ball.

(iii) Protected/Permissive – Yellow/Flashing Green arrow display. A Protected/Permissive left turn presents a flashing green arrow followed by a green ball. During the flashing phase (advanced movement), opposing through traffic is held by a red ball. After the advance has timed out, left turn traffic is presented with a green ball permitting the movement when conflicting traffic is clear. The protected phase of this movement is always terminated with a non-flashing yellow arrow indication.

(b) Protected/Permissive left turns phasing shall be used however protected left turn phasing can be considered for: dual left turn lanes; lack of sight distance to oncoming vehicle; high speeds; and left turn phase in a lead-lag operation.

6. SIGNAL PRE-EMPTION

(a) Traffic signals near rail crossings require interconnection with the rail crossing controls to ensure maximum driver safety.

(b) The Consulting Engineer shall confirm with the Engineer if there is a requirement for

emergency vehicle pre-emption to override normal signal operation and provide continuous green signals for emergency vehicles such as fire department equipment.

7. AUDIBLE PEDESTRIAN SIGNALS

Audible pedestrian signals are required unless stated otherwise. The audible signal is interconnected with the walk signal and produces a “cuckoo” or “peep” sound, depending on the direction of crossing. The cuckoo sound is used for north-south crossings and the peep is used for east-west crossings. Where the streets are not oriented north-south and east-west, maintain consistency with adjacent signals.

8. CONTROLLERS AND CABINETS

(a) Controller cabinets are available in various sizes and styles depending on equipment requirements. The Consulting Engineer shall confirm with the Engineer the approved specifications for cabinet and base sizes. Cabinets should be located entirely within the road right-of-way, including maintenance pad and door swing. Location should be behind the Sidewalk, with access door on the side away from the Sidewalk and the signals visible from the access.

(b) Traffic signal controller cabinet shall typically be NEMA P-44DD complete with extension base supplied by the City at the Developers cost.

9. POWER SUPPLY AND DISTRIBUTION

(a) General and Conduit

(i) The Consulting Engineer shall confirm voltage and locations of suitable power sources for the proposed signal system. Signals systems are typically serviced from a 120/240 Volt single phase 3 wire system.

(ii) Signal wiring and conduit shall include a minimum of 1 – 53 mm RPVC conduits and 3 – 78 mm RPVC around to all four corners of the intersection (1 – 78 mm for signal cables, 1 – 78 mm for loops and 1 – 53 mm for lighting and power conductors and 1 – 78 mm for communications).

(iii) Large concrete junction boxes shall be provided at each corner of the intersection (one for communications and one for power/signal) except for the power/signal conduits at the controller corner. At the corner nearest the controller a small concrete vault shall be used for power / signal conduits that is in accordance with BC MOTI Standard Specifications for Highway Construction.

(b) Surge Suppression

(i) The design shall define surge protection in the main service panel.

(c) Uninterruptible Power Supplies (UPS’s)

(i) UPS’s shall be used at all traffic signals. UPS’s shall typically be piggy-back style located on the traffic signal controller cabinet. The duration of operation flash period during a power failure will define the UPS size and number of batteries required. The use of UPS shall be confirmed with the Engineer.

(d) Service Connection

(i) The Consulting Engineer shall confirm service location with BC Hydro.

SECTION NO. 10 - LANDSCAPE

1. GENERAL

(a) Landscape design shall comply with the Canadian Landscape Standard (CLS), published by the Canadian Society of Landscape Architects and by the Canadian Nursery Landscape Association, current edition. A Consulting Landscape Architect shall prepare drawings and specifications for street trees, Boulevards, medians, curb extensions, and any other works as directed by the Engineer.

(a) The landscape design shall comply with the Urban Forest Strategy, current edition. Should any conflict arise this Bylaw shall take precedence.

(b) Tree Preservations and new tree planting shall be considered at the early states of development design with structure(s), driveways, rock pits, drainage features, retaining walls, street design etc. being arranged, sized and oriented to accommodate existing trees and new trees, including street trees.

(c) The landscape drawings including the landscape plan and details shall be prepared by a Consulting Landscape Architect and submitted to the Engineer for approval prior to any Works and Services being done. With the addition of the following:

(i) Include dimensioned widths of boulevards sidewalks pathways and trails.

(ii) Include the extent of stormwater management features such as rock trenches or pits, swales, underground tanks, ponds and retaining walls, indicating how they are coordinated with the tree retention, replanting and street tree requirements

(iii) Include (faded layer) all underground and overhead servicing infrastructure.

(iv) Include significant spot elevations in particular along pathways, trails and retaining walls.

(v) The planting schedule table shall include for each tree type specified, required soil volume and estimate of canopy diameter in 15 years.

(d) The Landscape drawings shall be prepared in conformance with the Engineering Design Drawings requirements contained in this Bylaw.

2. STANDARDS & SPECIFICATIONS

(a) All construction within the scope of this Schedule shall conform to the Canadian Landscape Standard and the requirements, standards and specifications prescribed by this Bylaw.

(b) Should any conflict exist or arise between these documents, this Bylaw shall take precedence.

3. PLANTING REQUIREMENTS

(a) Highways

(i) Street trees shall be required on all Highway at the discretion of the Engineer.

(ii) Consulting Landscape Architect shall coordinate plant species, spacing and location with the Engineer in consultation with Parks, Recreation and Culture (PRC) and in consideration of policies regarding street tree priorities.

(iii) The cost is per street tree and shall be paid for by the Developer. The amount to be paid per tree is established in the Fees and Charges Bylaw. These funds will be used by the City to purchase, install and maintain the street trees. The payment of this fee does not include the supply and installation of tree grates, Structural Soil, Growing Medium, mulch, Soil cells, drainage, lighting or irrigation systems.

(b) Boulevard*s*

(i) All softscape Boulevards without street trees, as approved shall be finished with 300 mm Absorbent Soil per Section No. 4, 8 (e) and seeding or sod. Seed mix shall be as specified by the Consulting Landscape Architect and approved by the Engineer.

(ii) All softscape Boulevards to be planted with street trees shall be finished with 750 mm Growing Medium in a continuous trench followed by seeding or sod as applicable in (i) Above

(iii) All hardscape Boulevards shall use soil cells to obtain the applicable soil volume as required in Section 4. (b).

(iv) The Developer shall be responsible for maintaining the Boulevards until the end of the Warranty Period.

(v) Additional Landscaping may be required in certain areas and on certain classifications of Highways at the discretion of the Engineer.

(c) Medians

(i) Medians shall be Landscaped according to a plan prepared by a Consulting Landscape Architect and approved by the Engineer in consultation with PRC.

(ii) Irrigation systems shall be installed at the discretion of the Engineer.

(iii) All medians shall be designed and constructed in accordance with Standard Detail Drawing CS-TP-4.

(iv) All medians shall be constructed with signage and lighting at the discretion of the Engineer. Flashing warning beacons may be used at locations where illumination levels are inadequate, at the approach end of a median island where a median transition is required to accommodate the median island, or where crash history warrants the installation of the flashing beacon (as per the MUTCD recommendations).

(d) Curb Extensions

(i) Curb Extensions shall be Landscaped at the discretion of the Engineer in consultation with PRC.

(e) Plant Material and Species Selection

(i) All plant material shall conform to the Canadian Landscape Standard and the Canadian Nursery Stock Standard, current edition. The plant size at time of planting shall be #1 pot size for ground covers and #2 pot size or greater for shrubs.

(ii) All plant material shall be selected based on the premise of the right plant for the right location. Plant selection shall be appropriate for the site's light and moisture availability, as well as context and aesthetic.

(iii) All plant material shall be located such that their mature height does not conflict with sight line requirements.

(iv) Street Trees

All street tree plantings shall:

(i) Conform to the Canadian Landscape Standard and the Canadian Standard for Nursery Stock, current edition;

(ii) Be nursery field grown unless approved otherwise by the Engineer;

(iii) Be locally hardened and acclimatized;

(iv) Be 60 mm caliper or greater if deciduous;

(v) Be 3.0 m height or greater if coniferous.

All exceptions to the above must be pre-approved by the Engineer.

(f) Single Family Residential Parcels

A "yard" tree shall be provided for each newly created single-family Residential parcel in a Development.

Yard trees shall be a minimum height of 2.0 m for conifers and a minimum trunk diameter of 60 mm measured at 1.2 m above the root crown for deciduous.

4. PLANT SPACING AND LOCATION

(a) Street tree spacing shall be varied to accommodate species diversity, maximize the number of trees to achieve crown closure, allow for full crown Development, and accommodate site lines, utilities, and other site features.

(b) The following table sets out recommended tree spacing based on the described size classes and required soil volume, for reference:

Tree Type	Mature Height	Spacing on Centre	Soil Volume

		(o/c)*	
Large	> 15 m	9.0 m (max)	20 m^3
Medium	10 m to 15 m	9.0 m (max)	16 m^3
Small	< 10 m	6.0 m (max)	10 m^3
Columnar Trees	Narrow habit & < 8 m	6.0 m or less	10 m^3

*Final tree spacing and location shall be approved by the City.

(c) Tree spacing should be consistent with existing tree spacing within the same block, on both sides of the street. Individual cases are subject to offset due to constraints shall be as directed by the Engineer.

(d) Tree spacing shall be adjusted to accommodate clearances set out in this Section.

(e) Landscape shrub and groundcover plantings shall be designed to fill in, such that there is no exposed soil within three (3) years of installation.

(f) Street tree planting shall not be required within the cul-de-sac bulb area.

5. MINIMUM TREE PLANTING CLEARANCES

(a) Listed below is the minimum distance trees should be planted from street feature or furniture:

Street Feature/Furniture	Minimum Separation to Tree
Lamp Standards	5.0 m
Steel/wooden poles, posts & bollards	3.0 m
Hydrants	3.0 m
Catch Basins	3.0 m
Manholes, Valve Boxes, Service Boxes	3.0 m
Water, Drainage & Sewer Service and Connection locations	2.0 m
Driveways	2.0 m
Intersection sight lines	8.0 m

6. DRAINAGE

(a) Drainage systems connected to the municipal storm sewer system shall be provided under hard surfaced street tree planting areas with soil cells subsoils are poorly draining and where tree pits, soil cells and planting beds are at risk of holding water, at the discretion of the Engineer.

7. IRRIGATION

(a) Drip irrigation and controllers meeting City standards shall be provided in medians, curb extensions, and where street trees are planted in hard surfaced street tree planting areas with soil cells.

(b) All irrigation systems shall be metered.

8. LANDSCAPE LIGHTING

(a) At the discretion of the Engineer, conduit from the nearest City electrical outlet to each

tree pit shall be provided for all trees planted in hard surfaced street tree planting areas. Lighting systems acceptable to the Engineer may be required. Conduit and outlet shall be located to avoid conflict with the growing tree trunk and root collar and not pose a hazard to pedestrian traffic.

(b) These service connection shall have a separate BC Hydro Meter

9. GROWING MEDIUM

(a) Growing Medium as defined in this Bylaw shall be installed at the following minimum depths prior to planting in non-hard surfaced areas:

(i) sod areas 300 mm (measured from top of sod thatch).
(ii) groundcover and shrub areas 450 mm.
(iii) street tree areas 750 mm.

(b) Each tree planting location shall be provided with a volume of Growing Medium per subsection 4. (b) of this section. The Consulting Landscape Architect or Consulting Engineer shall provide the planting plan showing the planting bed, and soil cell areas and associated Growing Medium volume calculations for each tree to the City for approval.

(i) The Growing Medium volume calculations shall account for the functional volume of Growing Medium achievable using planting beds and soil cells.

(c) In areas where the required Growing Medium volume per tree is not achievable due to specific site or project constraints, such as the presence of surface bedrock, the volume of Growing Medium may be adjusted in coordination with tree species selection and at the discretion of the Engineer.

(d) On-site topsoil or amended topsoil shall only be used if it meets the requirements for the specified Growing Medium and is approved by the Engineer.

(e) For each Growing Medium source and type used, soil tests confirming that the texture, organic matter, and nutrient levels meet the specifications shall be conducted conforming to the CLS (section 6.1.6) and provided to the Consulting Landscape Architect for approval prior to delivery and use. A copy of which shall be provided to the Engineer.

10. MULCH

(a) Non-composted bark mulch shall be used in all Highway, Boulevard, median, and curb extension planting beds and street tree plantings unless otherwise specified by the Consulting Landscape Architect and approved by the Engineer.

(b) Non-composted bark mulch shall be placed at a minimum 75 mm settled depth unless otherwise specified by the Consulting Landscape Architect and approved by the Engineer.

11. SOIL CELLS

(a) Soil cells shall be used in areas of hard surface planting where tree grates are used. Or where the softscape boulevard width is less than 1.65 m from face of curb to sidewalk or 1.5 m of clear width of growing medium to supplement the minimum volume of growing medium.

(b) Irrigation and drainage systems shall be installed in all soil cells areas.

(c) Refer to construction detail drawing CS-TP-3.

(d) Soil cells shall be filled with Growing Medium as specified by the Consulting Landscape Architect and approved by the Engineer.

(e) Soil cells shall be installed according to the manufacturers specifications and recommendations.

12. MAINTENANCE

(a) During the Warranty Period maintenance and watering activities shall be specified by the Consulting Landscape Architect, approved by the Engineer, and carried out by the Developer.

(b) After the expiry of the Warranty Period the City will be responsible for the maintenance of street trees.

13. RECREATIONAL TRAILS

Trails in the City of Abbotsford are classified according to intended access and recreation uses and type of construction materials. The intended access and recreation uses, along with site characteristics, will dictate the type of trails to be developed including trail layout, width, construction specification, landscaping and maintenance levels.

Trail types, layouts, design details and materials must be approved by the City of Abbotsford prior to initiation of the trail development process.

Trails are to be developed for the use of the general public and the most common trail types are:

(a) Multi-use Trail

Multi-Use Trails are 3 – 5 m wide with a smoothly paved surface to accommodate high usage and wherever possible universal accessibility with a maximum grade of 5%. They shall be designed and constructed in accordance with Standard Detail Drawing CS-TR-1.

The primary focus is recreation for both pedestrian and cycling but Multi-Use Trails may also be planned for community connectivity. They can accommodate maintenance vehicle access. An example of this type of trail is the “Discovery Trail”.

(b) Main Trail

Main Trails are 3 – 5 m wide with a compacted granular surface for medium use and an intermediate level of accessibility. They shall be designed and constructed in accordance with Standard Detail Drawing CS-TR-2. Where the gradient exceeds 15%, a stairway may be required at the discretion of the Engineer.

The primary focus is recreation for both pedestrian and cycling but Main Trails may also be planned for community connectivity. They may accommodate maintenance vehicle access at the discretion of the Engineer. Usage types and universal accessibility may

be reduced if constructed in areas with steep slopes. This type of trail can be planned as the main trail where there is a hierarchy of trails, where there is a requirement for vehicular maintenance access, or in place of a Multi-Use Trail where a hard surface is not recommended due to environmental or safety concerns.

(c) Secondary Trail

Secondary Trails are 1.5 – 3 m wide with a compacted granular surface for moderate use and an intermediate level of accessibility. They shall be designed and constructed in accordance with Standard Detail Drawing CS-TR-3. Where the gradient exceeds 25% a stairway shall be constructed with materials and design that are approved by the Engineer.

The primary focus of a Secondary Trail is recreation. Usage types and universal accessibility may be reduced if constructed in areas with steep slopes. This type of trail may lead off a Main Trail where there is a hierarchy of trails or may be the only type of trail in a moderately used park or greenspace.

(d) Nature Trail

Nature Trails are 1 – 2 m wide with a surface of native soil, wood mulch or compacted granular material for lower levels of use and accessibility. They shall be designed and constructed in accordance with Standard Detail Drawing CS-TR-4. Where the gradient exceeds 30% a stairway shall be constructed with materials and design that are approved by the Engineer.

The primary focus of a Nature Trail is for specific types of recreation, typically hiking or mountain biking.

(e) Planning, Design and Construction of All Trails:

(i) Recreational trails often traverse natural parkland or open space areas. Designs must accommodate all environmental requirements.

(ii) Trees, other plantings and landscaping should be included along the trail corridor to support policies in OCP section 3 'Make Walking, Biking + Transit Delightful', and to improve the local climate and environment, hence making trails more inviting for daily activity.

(iii) Trail types and widths are at the discretion and approval of the Engineer.

(iv) Associated works may be required such as, but not limited to: trail-head amenities, parking, creek crossings, slope stabilization measures, boardwalks, fencing, signage, viewpoints, drinking fountain, seating areas, stairs and access controls.

(v) Where trails are to be included in a development, they must be shown on all associated plans, such as grading, servicing, landscape, tree preservation, and storm water management plans.

(vi) For narrow trails, maintenance and emergency access must be considered and only small-sized specialized construction equipment will be allowed.

(vii) Layout plans must be confirmed with City staff, with on-site confirmation prior to

any tree pruning or removals or other works occurring on site.

(viii) Trail requirements and specialized trail construction details are available from the PRC Office upon request on a case-by-case basis.

SECTION NO. 11 – FORMS

1. The following forms are attached to, and form part of, these Engineering Standards and Specifications. They may typically be required, referred to and included with pre-design information and design drawing Submissions.

2. All references to these forms shall, in each instance, be understood to refer to the latest dated revision as issued by the City of Abbotsford's Engineering and Regional Utilities department.

Form E1 INSPECTION SUMMARY AND REQUEST FOR DEFICIENCY INSPECTION

In accordance with section 40(4)(e) of Development Bylaw, 2022, I hereby certify that all engineering and construction services, required under the Development Bylaw, 2022 for the Development of:

LEGAL DESCRIPTION: _____

BP/PROJECT NO: _____ SUB NO: _____

which Works and Services were designed by:

NAME OF FIRM: _____

Address: _____

and accepted for construction on Drawings numbered:

Drawing No.	Date	Drawing No.	Date

have been completed and have been inspected by or under the direction of:

_____

_____

I further certify that the record drawings hereby submitted reasonably represent the Works and Services as installed for the aforementioned Subdivision or Development. These Works and Services were installed with sufficient field reviews to ascertain that the work substantially complied in all material respects with the accepted design drawings, Development Bylaw, 2022 and as required by the *Engineer and Geoscientist Act* Code of Ethics.

I further acknowledge that the following documentation has been provided to the City of Abbotsford Works Inspector:

Civil Consultant:

Summary letter including of scope of work completed, list of testing and all supporting data signed and sealed by the Civil Consulting Engineer to confirm that all works and their construction meet the City specifications and standards.

1. draft record drawings, service record cards and hydrant cards submitted in digital format including shop drawings;

2. inspection reports;

3. water main certification package including Forms, pressure tests, chlorination tests, bacteriological tests and velocity flush report;

4. all water main test points have been removed and all pre-existing services have been disconnected at the main under City waterworks supervision;

5. sewer main inspection video in digital format and written inspection report;

6. sanitary sewer leakage test results;

7. all required pre-existing storm/sanitary services have been capped;

8. all legal pins have been replaced and any monument(s) replacement by the City have been paid

for;

9. all Statutory Right of Ways have been registered;

10. cast-in-place concrete detention/infiltration facility certification letter including associated record drawings;

11. summary letter signed and sealed by a professional engineer certifying proprietary storm water management systems were installed in accordance with manufacturer's specifications and City specifications Schedule "E", Section No. 5, 7 (c) (ii).

12. lot grading has been completed in accordance with Rainwater Management/Lot Grading Plan. All final grades on said plans have been adhered to within a tolerance of ± 150 mm and in no case alters from the effective function of the accepted Rainwater Management/Lot Grading Plan;

13. all developer's swales, lawn basins, catch basins, and/or interim drainage works and associated pipework have been installed in accordance with the certified lot grading and storm sewer drawings; and

14. all franchise utility works have been constructed to the satisfaction of the appropriate franchise utility agency and record acceptance letters attached;

Geotechnical Consultant:

1. summary letter of testing and all supporting data signed and sealed by the geotechnical engineer to confirm that all works met the City specifications and standards;

2. road and utility main sub grade inspection acceptance memo;

3. curb base and sub base materials density test;

4. road base and sub base materials density test;

5. curb Benkelman beam test results;

6. road Benkelman beam test results;

7. utility trench density test results;

8. sidewalk base and sub base compaction test results;

9. sidewalk proof roll acceptance memo;

10. pavement Marshall tests results and core data;

11. curb concrete test results;

12. infiltration and/or detention facility sub grade review;

13. sidewalk concrete test results;

14. retaining walls and slopes construction memo;

15. retaining wall certification with record drawings; and

16. building lot compaction test results (as appropriate).

Electrical Consultant:
Summary letter signed and sealed by the Electrical Engineering Consultant stating that all traffic signal and street light works have been inspected and meet City specifications and standards.
Erosion and Sediment Control Supervisor:
Summary letter from the Erosion and Sediment Control Supervisor stating that all required erosion and sediment control measures are in place, the Development site is stable, and all silt bags and temporary the ESC measures may now safely be removed.
A request for Substantial Completion deficiency inspection is hereby submitted:

Engineer's Seal

_____
Printed Name of the Consulting Engineer

Form E2 CERTIFICATE OF INSPECTION AND REQUEST FOR SUBSTANTIAL COMPLETION

In accordance with section 40(4)(e) of Development Bylaw, 2022, I hereby certify that all engineering and construction services, required under the Development Bylaw, 2022 for the Development of:

LEGAL DESCRIPTION: _____

BP/PROJECT NO: _____ SUB NO: _____

which Works and Services were designed by:

NAME OF FIRM: _____

Address: _____

and accepted for construction on Drawings numbered:

Drawing No.	Date	Drawing No.	Date
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

have been completed and have been inspected by or under the direction of:

_____

_____

I certify that all construction deficiencies have been rectified to the satisfaction of the City Works Inspector.

I further acknowledge that Form E1 and all supporting documentation has been provided to the City of Abbotsford Works Inspector.

A request for Substantial Completion is hereby submitted:

Engineer's Seal

_____

Printed Name of the Consulting Engineer

Form E3 CERTIFICATE OF INSPECTION AND REQUEST FOR FINAL ACCEPTANCE

In accordance with section 40(4)(e) of Development Bylaw, 2022, I hereby certify that all engineering and construction services, required under the Development Bylaw, 2022 for the Development of

LEGAL DESCRIPTION: _____

BP/PROJECT NO: _____ SUB NO: _____

which Works and Services were designed by:

NAME OF FIRM: _____

Address: _____

and accepted for construction on Drawings numbered:

Drawing No.	Date	Drawing No.	Date

have completed the warranty phase and have been inspected by or under the direction of:

_____

_____

I certify that all warranty phase construction deficiencies have been rectified, the drainage system (infiltration/detention systems, catch basins, flow controls, water quality treatment systems, sumps and mains) has been cleaned and all erosion and sediment control measures have been removed to the satisfaction of the City Works Inspector.

A request for Final Acceptance is hereby submitted:

Engineer's Seal

_____

Printed Name of the Consulting Engineer

Form E4 CERTIFICATE OF SUBSTANTIAL COMPLETION (LANDSCAPE & TRAILS)

FILE NO./SUB NO.: _____
PROJECT: _____
DEVELOPER: _____
ADDRESS: _____
_____
_____

LANDSCAPE ARCHITECT: _____
ADDRESS: _____
_____
_____

This Certificate of Substantial Completion (Landscape & Trails) is issued pursuant City of Abbotsford's Development Bylaw, 2022.
The WARRANTY PERIOD for the works shall **begin** on: _____
The WARRANTY PERIOD for the works shall **expire** on: _____
The Certificate of Final Acceptance (Landscape & Trails) will be issued:

(i) following the expiration of the Warranty Period;
(ii) when all deficiencies have been cleared; and
(iii) when the Engineer is satisfied that all conditions of the Subdivision have been fulfilled.

The Landscape Certificate of Substantial Completion does not constitute acceptance of any of the Works and Services supplied, constructed, or installed by the Contractor.
Deficiency List attached: ____ Yes
____ No

_____
Engineer

_____
Date

cc: Developer/Consulting Landscape Architect
Administrative Manager
Manager, Parks Planning, PRC
Director, Planning & Business Services, PRC

Form E5 CERTIFICATE OF FINAL ACCEPTANCE (LANDSCAPE & TRAILS)

FILE NO./SUB NO.: _____
PROJECT: _____
DEVELOPER: _____
ADDRESS: _____
_____
_____

LANDSCAPE ARCHITECT: _____
ADDRESS: _____
_____
_____

This Certificate of Final Acceptance (Landscape & Trails) is issued pursuant to the City of Abbotsford's Development Bylaw, 2022.
The WARRANTY PERIOD for the works **began** on: _____
The WARRANTY PERIOD for the works **expired** on: _____
The Certificate of Final Acceptance (Landscape & Trails) constitutes the acceptance of the landscape and trail Works and Services supplied, constructed, or installed by the Contractor and that all landscape conditions of the Subdivision have been fulfilled.
TAKE NOTICE THAT the Warranty Period for the above works is satisfactorily complete and that the Engineer has accepted these works as of:

_____
Date

_____
Engineer

cc: Developer/Consulting Landscape Architect
Administrative Manager
Manager, Parks Planning, PRC
Director, Planning & Business Services, PRC

Form E6 CERTIFICATE OF SUBSTANTIAL COMPLETION

FILE NO./SUB NO.: _____
PROJECT: _____
DEVELOPER: _____
ADDRESS: _____
_____
_____

CONSULTING ENGINEER: _____
ADDRESS: _____
_____
_____

This Certificate of Substantial Completion is issued pursuant to the City of Abbotsford's Development Bylaw, 2022.

The WARRANTY PERIOD for the works shall **begin** on: _____

The WARRANTY PERIOD for the works shall **expire** on: _____

The Certificate of Final Acceptance will be issued:

- following the expiration of the Warranty Period;
- when all deficiencies have been cleared; and
- when the Engineer is satisfied that all conditions of the Servicing Agreement have been fulfilled.

The Certificate of Substantial Completion does not constitute the acceptance of any of the Works and Services supplied, constructed or installed by the Contractors.

_____
Rob Isaac, P.L. Eng. Date
General Manager, Engineering and Regional Utilities

Development Technologist _____

Deficiency List Attached: _____Yes _____No

Form E7 CERTIFICATE OF FINAL ACCEPTANCE

FILE NO./SUB NO.: _____
PROJECT: _____
DEVELOPER: _____
ADDRESS: _____
_____
_____

CONSULTING ENGINEER: _____
ADDRESS: _____
_____
_____

This Certificate of Final Acceptance is issued pursuant to the City of Abbotsford's Development Bylaw, 2022.

The WARRANTY PERIOD for the works **began** on: _____

The WARRANTY PERIOD for the works **expired** on: _____

The Certificate of Final Acceptance constitutes the acceptance of the Works and Services supplied, constructed or installed by the Contractor and that all conditions of the Servicing Agreement have been fulfilled.

TAKE NOTICE THAT the Warranty Period for the above works is satisfactorily complete and that the Engineer has accepted these works as of:

_____

_____

Rob Isaac, P.L. Eng. Date
General Manager, Engineering and Regional Utilities

Development Technologist _____

Form E8 PRIVATE WELL CERTIFICATION

Pursuant to Schedule “E” of the Development Bylaw, 2022, which requires that each Parcel to be created and/or each existing Parcel forming part of the proposed Development shall be serviced with potable water in accordance with the requirements of the Bylaw for the Development of:

LEGAL DESCRIPTION: _____

PROJECT NO.: _____

I certify that a quantity of not less than 2,500 litres per day has been proven for each existing or proposed Parcel in the Development.

I certify that each well within the Development has been tested and is capable of continuously providing water at a rate of 9 litres per minute for a four-hour period.

I certify that water quality tests have been conducted and that the “Canadian Drinking Water Standards, (latest edition)” can be met for each existing or proposed Parcel in the Development.

Certified by:

_____

_____

Signature and Name of Consulting Engineer

_____

Company Name

_____

_____

Address

_____

Date

Engineer’s Seal

Form E9 WELL PUMP - FIELD TEST SHEET

OWNER'S NAME _____ WELL NO. _____
PROJECT NO. _____ DATE _____
LOCATION _____ SHEET _____ OF _____
TEST NO. _____

□ Drawdown □ Recovery

Reading No.	Time from start	Depth to water	Draw down	Flow Measurement Data			Comments
	min	M	m	min	l	lpm	

Form E10 CERTIFICATE OF WATERMAIN TESTING AND COMMISSIONING

Project:_____
Location:_____
City Drawing Number:_____
Test section(s): *(attach drawing markup with tested sections highlighted)*
Sample Locations: *(attach drawing location sketch with test point label eg. TP1)*

I hereby certify that the watermain(s) installed in this project has been installed according to MMCD and City of Abbotsford Development Bylaw Supplementary Specifications and that:

- All watermain(s) passed pressure tests *(attach test showing actual and allowed loss)*;
- All watermain(s) met 24 hour chlorine residual requirements *(attach results)*;
- All water mains were flushed of chlorine to level of City water. Chlorinated water was infiltrated or neutralized prior to entering storm system *(attach flushing report)*;
- A sealed bacteriological test certificate has been provided, including all passed and failed results.
- The test sample(s) identified above have been collected in accordance with AWWA standard C651 and delivered to a certified laboratory for testing.
- Chain of custody of the sample(s) was observed from the time of collection to the time of delivery at the laboratory.
- All test results provided by the laboratory were within the limits set forth in AWWA standard C651.
- Velocity flush plan (attached) to AWWA C651 (most recent version) or NFPA 13 *(select one)*

Engineer's Seal

_____
Printed Name of Consulting Engineer

SCHEDULE "F"

STANDARD FOR DESIGN OF SANITARY PUMP STATIONS

1. GENERAL

The use of sanitary pump stations is discouraged. Where the only alternative is the use of pump stations, the Consulting Engineer must receive prior approval from the Engineer. *Underlined and italicized text in the various subsections of this Schedule shall apply only to City owned and operated pump stations.*

2. PRE-DESIGN REPORT

(a) Prior to beginning the detailed design of the pump station, the Consulting Engineer shall submit two (2) signed and sealed copies of a pre-design report for the City's review and comment.

(b) The report should include and/or address the following design considerations:

(i) a drawing showing the proposed Development, complete with the catchment area and the location of the proposed pump station and force main;

(ii) calculations based on the proposed land use, including total population (Residential plus equivalent population for non-Residential uses), average dry weather and peak wet weather flows in accordance with Schedule "E" – Section 6. Calculations are to be in litres per second;

(iii) size, type, length and location of the proposed force main;

(iv) calculation of static or geodetic head;

(v) calculation of hydraulic system head loss using Hazen William's formula (Plot C = 120 & 140);

(vi) calculation of total dynamic head loss (i.e. geodetic head plus hydraulic system head loss);

(vii) a copy of pump manufacturer's pump curves, motor size and impeller number. Include power requirements, rated speed and pump efficiency. Plot the hydraulic system curve on to the pump curve;

(viii) calculation of velocity in the force main. *The volume of the force main shall be equal to or less than the design average dry weather flows. This is to ensure that the force main contents do not become septic. A transient surge analysis shall also be provided (minimum 75-year life cycle)*;

(ix) calculation of sump volume between pump cycles. Recommended pump start and stop and alarm levels are to be provided. The sump should be capable of accommodating peak day flow for a minimum of 15 minutes;

(x) calculation of the number of pump starts per hour during average dry weather and peak wet weather flows. Indicate the maximum number of pump starts per hour per the manufacturer's specifications. The minimum pump run time should

not be less than 2.5 minutes;

(xi) vessel buoyancy calculations (based upon maximum flood elevations);

(xii) the impact on neighbouring properties with respect to aesthetics, noise, odour and landscaping requirements;

(xiii) access for construction and maintenance. Assume minimum H-20 loading requirements and parking and turning of maintenance vehicles;

(xiv) a geotechnical report indicating existing ground conditions, de-watering requirements, blasting, and any other anomalies that may affect the design and construction of the proposed pump station and force main. *For City stations an assessment of long term settlement under normal conditions and also the 1:2,475-year seismic design event shall be provided.*;

(xv) access to a proposed or existing power supply. *For City stations the make, model and options must be accepted by the Engineer.* A review and recommendation of standby power requirements shall be included;

(xvi) a preliminary cost estimate of all associated Works and Services;

(xvii) *all sanitary pump stations that will be turned over to, serviced and/or maintained by the City must be located within a Statutory Right of Way and not within the road allowance*; and

(xviii) *New pump stations shall have a 600mm sump directly upStream of the pump station and will be accessible for maintenance*.

3. CONSTRUCTION SPECIFICATIONS

(c) All construction within the scope of this Schedule shall conform to the City approved edition of the Master Municipal Construction Documents (Platinum Edition – Volume II) and the requirements, standards and specifications prescribed by this Bylaw.

(d) Should any conflict exist or arise between these documents, this Bylaw shall take precedent over the Master Municipal Construction Documents.

4. GENERAL REQUIREMENTS

(a) Upon approval of the pre-design report the Consulting Engineer may proceed with detailed plan/profile construction drawings in accordance with this Bylaw.

(b) Drawings shall include:

(i) site plan;

(ii) plan of the station;

(iii) side view section of the station;

(iv) front view section of the station;

(v) pump/system curve;

(vi) pre-set pump levels;

(vii) relevant technical elevations;

(viii) *electrical schematic drawings*;

(ix) plan and profile of the force main; and

(x) generator shop drawings (as required).

(c) Every pump station shall be a wet well type with duplicate submersible sewage pumps (or accepted alternate). Pumps must be set up to operate automatically in alternating sequence. Pumps should be capable of handling raw, unscreened sewage.

(d) Only pumps specified in the City's Approved Products List shall be accepted.

5. PUMPS AND MOTORS

All pumps and motors must meet the following requirements:

(a) pumps shall be a submersible, constant speed, explosion proof, non-clog, solids-handling type, capable of passing spherical solids up to 75 mm in size;

(b) pump suction and discharge openings shall be a minimum of 100 mm diameter;

(c) pump impeller, volute, motor, discharge elbow and seal housing to be high quality cast iron;

(d) pumps shall have double mechanical seals, replaceable bronze wear rings and removable inspection ports;

(e) pumps must be capable of operating dry without damage;

(f) the motors must be capable of operating 10 spaced starts per hour and shall conform to Canadian Standards Act (CSA) and Electrical Equipment Manufacturers Association (EEMAC) standards;

(g) The current drawn by each sewage pump motor shall be monitored by the lift station RTU as follows;

1. Motor Controlled by Across the Line Starters: A current transformer (CT) and a 4-20mA signal converter shall be installed on one of the motor phase conductors downstream of the motor starter and power factor correction capacitors. The 4-20mA signal shall be connected to an RTU analog inpt for monitoring purposes. A 4-20mA signal isolator shall be installed between the signal converter and RTU input as needed if he convertor provides an "active' 4-20Ma output. The CT and signal converter shall either separate items or a combination unit.

2. Motors Controlled by Variable Frequency Drives (VFDs): A 4-20Ma VFD output signal representing motor current shall be connected to an RTU analog input for monitoring purposes. A 4-20Ma signal isolator shall be

installed between the VFD and RTU input as needed if he VFD provides an “active” 4-20 Ma output.

(h) motors shall have an automatically resetting, embedded temperature sensing device to protect against overheating;

(i) motors shall have a loss of seal sensor to protect the motor from damage due to loss of seal;

(j) pump motor shaft, all exposed bolts and motor information plate to be stainless steel;

(k) all relevant pump, motor and impeller information shall be stamped on the plate and permanently attached to the pump;

(l) bearings shall be factory lubricated with an operating life of not less than 70,000 hours;

(m) all rotating parts shall be balanced to provide minimum vibration under service conditions;

(n) power cables shall be fully weather proofed and sized to match the pumps supplied. Cables to be continuous from the vessel to the kiosk. In no instance shall a cable be spliced; and

6. VESSEL

All vessels shall meet the following requirements:

(a) filament wound reinforced fibreglass or steel reinforced concrete and completely watertight. *Concrete vessels shall be provided with PVC “T–Lock” liner. Liners that are welded together shall be subject to current industry standard welding test procedures (e.g. Puddy Knife Test, Spark Test, Soap-Vacuum Test) and must meet CSA or ASTM Standards*;

(b) fiberglass walls and floor shall be painted with two (2) coats of epoxy enamel (two (2) component), white in colour and should have a smooth glass-like finish;

(c) *intermediate platforms are required when the depth of the vessel exceeds 4.0 metres. Platforms shall consist of fiberglass grating with hinged opening sections above the pump units to facilitate pump removal. Platform support beams to be aluminum and mounting hardware to be stainless steel*;

(d) bottoms shall be sloped towards the pumps to prevent solid deposition;

(e) *an access ladder is required complete with “ladder-up” support mounted on both sides of the ladder (per Bilco style or an approved equivalent by the Engineer), shall extend to the platform*;

(f) there shall be individual aluminum watertight hatches for each pump. *Hatches shall be fitted with stainless steel hinges and capable of supporting 12.6 Kg per square metre (300 pounds per square foot). Each hatch must be secured with a standard 50 mm laminated Master padlock. A mechanism must be provided for securing hatch lids in the open position to prevent accidental closing. Lids to have a “safe hatch” or an approved equivalent by the Engineer*;

(g) the top shall be 250 mm above the final ground elevation;

(h) the vessel shall be tested for water tightness using infiltration/exfiltration methods (depending on water table level) prior to the installation of the pumps, pipe work and/or electrical works;

(i) all mounting hardware to be stainless steel; and

(j) *vessel shop drawings are to be sealed by a professional engineer*.

7. PIPING AND ACCESSORIES

The following piping and accessories are required:

(a) *piping shall be Schedule 40 steel to ASTM A53. All piping located in the wet well or in a chamber exposed to moisture is to be minimum Schedule 10 stainless steel to ASTM A312 or A778*;

(b) all fittings shall be either steel or cast-iron Class 125. Where fittings are in a corrosive environment they shall be same material as the pipe material;

(c) piping (except stainless steel) shall be coated inside and out with two (2) coats of coal tar epoxy;

(d) all mechanical fittings and couplings (excluding flanged joints) shall be located above the intermediate platform (where applicable);

(e) two (2) *stainless steel* guide bars shall be installed for each pump to facilitate removal and installation without disturbing the discharge piping. Each pump shall be supplied with stainless steel lifting chains;

(f) check valves and resilient seat gate valves shall be supplied for each pump. *Isolation valves to be located outside the vessel. Valve stems to be made of "everdure" or approved equivalent stainless steel*;

(g) *check valves shall be outside lever and weight, non-clog type, with cast iron body (Class 125), and shall be mounted in the vertical position*

(h) *check valves and isolation valves to be installed in a vault outside of wet well to avoid confined space entry into the wet well*;

(i) *explosion proof ventilation fan and ducting capable of providing a minimum of 30 air changes per hour at high speed and a minimum of six (6) air changes operating continuously at low speed is required. Air shall be forced into the wet well with adequate exhaust vents to allow displaced air to escape*;

(j) *vents shall be a minimum 150 mm diameter goose neck stack with bird screen*;

(k) *adjustable fans shall be located in a separate, isolated compartment in the kiosk and ducted to the wet well. There shall be no exchange of air between the fan compartment and the remaining portion of the kiosk. An adjustable fan switch shall be provided on the control panel*;

(l) there shall be a minimum 25 mm diameter water service for City owned and operated lift stations and a 19 mm diameter water service for private lift stations complete with water meter, backflow preventer inside separate meter box and yard hydrant. Backflow preventers are to be registered in the City's cross connection control database and tested accordingly. Backflow preventer and meter shall be protected sufficiently to prevent freezing;

(m) *a standard concrete meter box shall be located outside the vessel complete with a meter setter, valve, double check valve backflow preventer (Clayton Model D2 or equivalent) and water meter equivalent in size to the service connection*;

(n) provision(s) shall be made for standby pumping from an external source. Connection shall be an adaptor flange with 100 mm minimum (or sized to suit) diameter female Kamlock quick coupling and lockable lid complete with gate valve for isolation;

(o) *a davit compatible with the City's portable "DBI Sala" system shall be incorporated in the design of the pump station lid to facilitate maintenance access. The davit shall be flush with the top of the vessel. Davit is to be 75mm*;

(p) *for proposed City-owned and operated pump stations, a 1.8-metre-high chain link fence complete with two (2) strands of barbed wire and privacy slats shall be installed around the pump station site*;

(q) *City-owned pump stations shall include an asphalt Driveway constructed up to and beside the pump station to allow service vehicles to park off the street while conducting maintenance, repairs, alterations etc*;

(r) *the area adjacent to and to a minimum of 1.5 metres surrounding the kiosk and vessel shall be free draining and covered with a 300 mm layer of 19 mm clear crush gravel and 50 mm asphalt*;

(s) steel bollards or concrete no-post barriers shall be installed around the pump station to prevent vehicles from driving over top of the vessel; and

(t) inlet to the vessel shall be by gravity to avoid creating turbulence within vessel and shall also be located to direct flows away from level controls.

8. ELECTRICAL SUPPLY AND CONTROLS

All electrical components shall meet the following requirements:

(i) the power supply to the kiosk shall be by underground dip from the nearest convenient source. *Pumps larger than 5 hp shall be 600 volt, three (3) phase power;*

(j) the control kiosk shall be a factory built enclosure manufactured to National Electrical Manufacturers Association 3R standards and shall be pre-wired and bare a CSA label;

(k) the kiosk shall be constructed of 10-gauge steel and have hinged doors for the control and service entry sections. Rain gutters are to be provided on all sides;

(l) the kiosk shall be factory primed and painted with two (2) coats of enamel (white). For City-maintained pump stations, the doors shall be secured by means of a standard City 50 mm laminated padlock supplied by the City at cost to the Developer;

(m) *the kiosk shall be bolted onto a concrete pad. Install a closed cell neoprene gasket between the kiosk and the concrete pad. The concrete pad shall not be placed over top of the water service, force main or gravity sewer main;*

(n) *the level controls shall be ultrasonic type. Ultrasonic level control sensors (6-degree beam) shall be mounted near the top of the vessel inside a stilling well;*

(o) the level controls shall be set to **START** the **LEAD PUMP** upon rise in liquid level to a pre-set elevation as accepted by the manufacturer;

(p) the level controls shall be set to **STOP** the **LEAD PUMP** at a pre-determined low-level elevation as accepted by the manufacturer or the City;

(q) the **LAG PUMP** shall set to **START** when the liquid level rises to the second pre-set elevation, as accepted by the manufacturer and both pumps shall operate until the pre-determined low level elevation as accepted by the manufacturer is reached, where both pumps would stop simultaneously;

(r) an alarm level shall be set at a pre-determined level above the start level of the lag pump. There shall be a minimum of 150 mm between pre-set elevations and the alarm level should be below the invert of the inflow pipe. *The pre-determined alarm level shall be accepted by the City if this is a City operated lift station;*

(s) the pumps shall alternate starting sequence following each full pump cycle. *Alarms shall be telemetered to the City SCADA monitoring system;*

(t) *a ball float shall be installed as a back up for high level alarm;*

(u) the operator should be able to start either pump manually if necessary;

(v) electrical equipment inside the kiosk shall include a main breaker panel, hydro metering equipment, automatic transfer switch, emergency power receptacle as applicable, overload switch between the receptacle transfer switch (depending upon amperage), pump control panel, *smart remote telemetry unit (RTU), radio modem*, across-the-line magnetic starters, *control transformers, 120 volt receptacle, on-off switch for ventilation fan*, elapsed time totalizer for each pump, current-limiting motor protection, *surge and lightning protection, ammeter for each pump*, HOA selector switches and run lights for each pump, *ventilation system with thermostat controlled heater and fan. The entire cabinet shall be tested and base a CSA label*;

(w) Current transformer to be Crompton “Model 2” series, Cat. #DRL-xxx- or approved equal.

(x) *RTU shall be compatible with the City’s SCADA System complete with intelligent protocol mounted within a cabinet located adjacent to the control panel. Alarm contacts for power failure (as detected by a phase monitor and auxiliary relay), high-level and low-level overload for each pump, seal leak alarm or indicator for each pump, motor high-temperature for each pump and starter auxiliary contact for each pump;*

(y) *the radio modem shall be compatible with the City’s SCADA System and shall be confirmed by a radio propagation study that is to be conducted by the City. A radio antenna shall be mounted on a streetlight pole adjacent to the kiosk. The size of the streetlight pole and antenna will be dependent upon each individual location and as directed by the Engineer;*

(z) all work shall conform to the latest edition of the *Canadian Electrical Code including BC amendments*;

(aa) private pump stations which will never be maintained by the City may delete the requirement for the ultrasonic level control, RTU, radio modem and antenna. The level control shall then be by four Flygt (or accepted alternate) ball floats. All pump operation may be controlled by a standard relay system or programmable logic controller;

(bb) *VFD motor controls shall be included on all pumps 5 hp or larger, Refer to Approved products list;*

(cc) permanent standby generators with an automatic transfer switches (Asco or Thompson Technologies) shall be provided for all pump stations servicing Residential (single and Multi-family) Developments. Standby generators used for other back up power requirements, may also be used for the sewage pump station; and

(dd) *Generators to be mounted on a concrete base complete with fabricated cage constructed of 50 mm diameter Schedule 40 galvanized steel tubular members mounted around the generator to prevent theft.* Where the generator is adjacent to Residential Development, the generator's overall operating noise level shall be less than 65 dbA when measured at a distance of 6.0 metres from any side of the enclosure and 1.0 metre above ground. Otherwise, the generator's overall operating noise level shall be less than 68 dbA when measured at a distance of 6 metres from any side of the enclosure and 1.0 metre above ground. Please refer to City's Approved Product list

9. FORCE MAINS

In conjunction with sanitary pump stations, the following criteria shall be used in the design of force mains:

(a) the lowest pump delivery rate anticipated shall occur at least once per day, a scouring velocity of at least 0.9 metres per second shall be maintained and maximum velocity of flow in the main shall not exceed 3.5 metres per second;

(b) an automatic air-vacuum relief valve shall be placed at high points in the force main to prevent air locks and negative pressures. 50 mm saddle followed by ¼ turn isolation ball valve and then an air-vaccuum valve assembly is required;

(c) discharge into the gravity sewer system shall be ramped to avoid turbulence;

(d) *the minimum size of force mains shall be 100 mm diameter unless otherwise accepted by the Engineer;*

(e) cleanouts and valves shall be at maximum intervals of 1,000.0 metres or at points where the force main makes abrupt changed in profile (i.e. creek crossings); and

(f) line valves shall be located as directed by the Engineer and on both sides of railway crossings and creek crossings.

10. COMMISSIONING OF EQUIPMENT

When all mechanical and electrical equipment has been completed, adjusted and tested, the Consulting Engineer shall verify the proper operation of the pumping station over a minimum of three (3) pumping cycles (for each pump). The test shall include a normal pumping cycle,

combination lead and lag pump cycle, and high-level alarm situation. The pump capacities for each situation shall be measured and recorded. The Consulting Engineer shall co-ordinate an inspection and supervision of start-up by the equipment supplier. The measured pump capacities shall be noted on the mechanical record drawing. A separate test shall be performed with the BC Hydro power switched off and the controls connected to a standby generator unit. The full list of requirements for the commissioning protocol will be provided to the Consulting Engineer by the Engineer as described in Schedule “E” – Section 6.

11. DOCUMENTATION

(a) Prior to construction, the Consulting Engineer shall submit three (3) sets of signed and sealed mechanical drawings and one PDF set to the City for review and comment.

(b) Prior to requesting Final Acceptance, the Consulting Engineer shall submit an Operations and Maintenance manual and manuals for the generator in a PDF format on a flash drive which contains the following:

(i) title page with project name, date, Contractor and Consulting Engineer;

(ii) Table of Contents;

(iii) descriptive and technical data;

(iv) maintenance and operating instructions for all mechanical and electrical equipment;

(v) manufacturer’s catalogues for all mechanical and electrical equipment;

(vi) electrical wiring and generator schematics and coding;

(vii) list of parts for all equipment including part numbers, addresses of sales, service representatives and suppliers;

(viii) motor list detailing motor number, name, horsepower, pump name plate, current rating, current being drawn;

(ix) heater size and type;

(x) sealed shop drawings of all vessels;

(xi) copy of written certification by the supplier that the equipment is installed and operating in accordance with the manufacturer’s standards;

(xii) signed and sealed mechanical and electrical Record Drawings;

(xiii) emergency operating procedures; and

(xiv) commissioning report complete with measured pump capacities during the commissioning of the equipment.

SCHEDULE "G"

SERVICING AGREEMENT

SUB NO. _____ / FILE NO. _____

THIS AGREEMENT made the _____ day of _____, 20__.

BETWEEN:

_____

(the "Developer")

AND:

THE CITY OF ABBOTSFORD (a City under the *Local Government Act* of the Province of British Columbia) 32315 South Fraser Way, Abbotsford, British Columbia V2T 1W7

(the "City")

WHEREAS:

1. the Developer proposes to develop certain lands and premises located within the City of Abbotsford, in the Province of British Columbia, legally described as:

   _____

   (the "Lands");

2. the Developer wishes to develop the Lands (the "Development") and has requested approval of the Development by the City prior to the completion of all Works and Services required to be constructed and installed by the Developer in connection with the Development;

3. the City has determined that the cost to the City of providing necessary services to the proposed Development would be excessive and the City does not have sufficient funds to pay for the cost of the Works and Services;

4. a portion of the Works and Services required to be installed by the Developer to serve the proposed Development may provide access to or serve land other than the Lands, and thus may be eligible for a contribution toward the cost of such Works and Services from the City or from the Owners of other lands who may connect to or use the Works and Services; and

5. the Developer has voluntarily agreed to install such Works and Services which are necessary to serve the proposed Development and to waive any right the Developer may have to a contribution toward the cost of Works and Services, and has requested that the City enter into this agreement with the Developer.

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the premises and the mutual covenants and agreement contained herein and the sum of ten dollars ($10.00) now paid to

the Developer by the City (the receipt and sufficiency whereof is hereby acknowledged), the parties hereto covenant and agree each with the other as follows:

1. THE DEVELOPER COVENANTS AND AGREES with the City:

(c) to construct and install all Works and Services shown on the engineering drawings numbered _____, prepared by _____, dated _____, and accepted for construction by the Engineer on _____, which drawings are hereby incorporated in and shall form part of this agreement (hereinafter called the " Works and Services"), within one year from the date of this agreement;

(d) that the Works and Services shall be constructed and installed in accordance with the aforesaid drawings and the specifications and standards for the design and construction of Works and Services contained in the City's Development Bylaw, 2022;

(e) to grant to the City all necessary road dedications, Statutory Rights of Way and easements over the Lands to accommodate the Works and Services, and where the Works and Services are located upon or under privately owned lands other than the Lands, to obtain, at the Developer's expense, all necessary road dedications, Statutory Rights of Way and easements over such lands, in favour of the City, to accommodate the Works and Services;

(f) to construct and install fully completed Works and Services to the City's standards and to the satisfaction of the City's General Manager, Engineering and Regional Utilities (the "Engineer") and which, in the sole and unfettered discretion of the Engineer, may be varied because of conditions at the site, so that the Works and Services function and operate to the satisfaction of the Engineer and, should the Works and Services as constructed prove to be in any way defective or should they not operate to the satisfaction of the Engineer, then the Developer shall, at the Developer's expense, modify or reconstruct the Works and Services so that the Works and Services shall be fully operative and function to the satisfaction of the Engineer, such satisfaction to be indicated by a Certificate of Substantial Completion signed by the Engineer;

(g) to pay to the City, upon execution of this agreement, the sum of _____ ($_____) in payment of all engineering and administration costs, associated with the construction of the Works and Services incurred by the City in connection with the Lands;

(h) to pay to the City, upon execution of this agreement, the sum of _____ ($_____) in payment of street name signs, energizing of street light circuits, water meters and other City service in connection with the Lands;

(i) to pay to the City, upon receipt of an invoice for same, the cost of all tie-ins of the Works and Services to existing water mains, storm and sanitary sewers and street name signs, lease street lights, energizing of street lighting circuits and other City services in connection with the Lands;

(j) to assign, transfer and convey to the City upon issuance of the Certificate of Final Acceptance all of the Developer's right, title and interest in the Works and Services, and the Developer shall, from time-to-time and at all times so long as the Developer exercises any rights of Ownership in the Lands, upon the request of the City, make, do and execute or cause or procure to be made, done and executed, all such further acts, deeds, Statutory Right of Way, easements and assurances required by the City for the effectual carrying out of this agreement;

(k) that as security for the due and proper completion of the construction and installation of the Works and Services, and any other obligation of the Developer in connection with the development of the Lands, the Developer shall deposit with the City, upon execution of this agreement, an automatically renewing, irrevocable automatically renewing Letter(s) of Credit or cash in the sum of _____ ($_____) (the "Security Deposit");

(l) that if the Works and Services are not duly and properly completed within the time specified in Subsection (a) hereof, the City may draw upon the Security Deposit and may complete the Works and Services at the cost of the Developer and deduct from the Security Deposit the cost of such completion, and the balance of the Security Deposit shall be returned to the Developer, less any administration costs incurred by the City. If the Security Deposit is insufficient to cover the actual cost of completing the Works and Services, then the Developer shall pay such deficiency to the City immediately upon receipt of the City's bill for same. Should the Developer fail to pay such costs forwith, the City may recover such outstanding costs by any means, including adding the costs to the Lands, as taxes in arrears. It is understood that the City may do such work either by itself or by Contractors employed by the City. If:

(i) the Works and Services are completed by the Developer as herein required;

(ii) the final as-built drawing of the Works and Services are provided to the City;

(iii) landscaping and trails are completed; and

(iv) all repairs have been made to damaged City property,

then the Security Deposit shall be returned to the Developer on receipt of the Engineer's Certificate of Substantial Completion. Despite the preceding sentence, the Developer agrees that the Engineer may, in the Engineer's sole discretion, hold back on the release or reduction of any Security Deposit in connection with the development of the Lands, or any portion of a Security Deposit related to one or more portion of the Works and Services, to ensure that there is sufficient security to complete all remaining Works and Services, landscaping and trails, and repairs to damaged City property;

(m) for a Building Permit Servicing Agreement, to submit to the City the final record drawings of the Works and Services as constructed and as accepted by the Engineer prior to the release by the City of the Security Deposit less 5% of the value of the Works and Services or $15,000 whichever is greater and the Warranty Deposit amount;

(n) for a Subdivision Servicing Agreement, to submit to the City the final record drawings of the Works and Services as constructed and as accepted by the Engineer prior to the issuance of a Certificate of Substantial Completion;

(o) to pay to the City, prior to the approval of the proposed Development of the Lands:

(i) all arrears of taxes outstanding against the Lands; and

(ii) all current taxes levied or to be levied upon the Lands on the basis and in accordance with the assessment and collector's roll entries;

(p) to maintain the Works and Services in complete repair for a period of one year from the date of issuance of a Certificate of Substantial Completion;

(q) to remedy any defects or damage during the Warranty Period of one year from issuance of the Certificate of Substantial Completion, and to pay for any damage to other Works and Services or property resulting there from, save and except for defects caused by reasonable wear and tear, negligence of the City, its servants or agents, or acts of God;

(r) to deposit as security with the City, prior to the return of the Security Deposit, an automatically renewing, irrevocable Letter of Credit or cash in the sum of _____ ($_____) (the "Warranty Deposit"). Should the Developer fail to maintain the Works and Services or remedy any defect or pay for any damages resulting there from, the City may draw upon the Warranty Deposit and may maintain the Works and Services, remedy the defect or pay the damages at the cost of the Developer, and may deduct the cost of maintaining the Works and Services, remedying the defect or paying the damages from the Warranty Deposit, and the balance of the Warranty Deposit, less any administration costs incurred by the City, shall be returned to the Developer on receipt of the Engineer's Certificate of Final Acceptance. If the Warranty Deposit is insufficient to cover the actual costs incurred by the City, then the Developer shall pay such deficiency to the City immediately upon receipt of the City's invoice for same. If the Works and Services are maintained by the Developer as herein provided, then the Warranty Deposit shall be returned to the Developer on receipt of the Engineer's Certificate of Final Acceptance;

(s) that except as hereinafter specifically provided, the work done and payments made pursuant to this agreement are not payments or work to be applied in lieu of Development Cost Charges, and the Developer further covenants and agrees to pay to the City all applicable Development Cost Charges imposed upon the Development of the Lands by the Development Cost Charges Imposition Bylaw;

(t) to save harmless and indemnify the City against:

(ii) all actions and proceedings, costs, damages, expenses, claims and demands whatsoever and by whomsoever brought by reason of the provision, construction, installation, maintenance or repair of the Works and Services including, without limitation, loss or liability for any administrative fines, penalties or claims under the Workers Compensation Act and for injurious affection, whether such claims arise at law or under any statute, including, without limitation, the *Expropriation Act*, and any amendments, rules or regulations thereto, or otherwise whatsoever;

(iii) all expenses and costs which may be incurred by reason of the provision, construction, installation, maintenance or repair of the Works and Services resulting in damage to any property owned in whole or in part by the City or which the City by duty or custom is obliged, directly or indirectly, in any way or to any degree, to construct, install, maintain or repair; and

(iv) all expenses and costs which may be incurred by reason of liens for non-payment of labour or materials, Workers' Compensation, Employment Insurance, Federal or Provincial taxes, check-off or encroachments owing to mistakes in survey;

(u) to obtain and maintain until the date of issuance of the Certificate of Final Acceptance of the Works and Services, at the Developer's expense, with such company or companies and on such forms as are acceptable to the City, in the name of the Developer, Comprehensive General Liability Insurance coverage covering premises and operations liability, contingency liability with respect to the operations of Contractors and sub-Contractors, completed operations liability, contractual liability and automobile liability for

owned, non-owned and hired units. The limits of liability shall be not less than $5,000,000 for each occurrence for bodily injury and property damage. Each policy shall provide that it cannot be cancelled, lapsed or materially altered without at least 30 days' notice in writing to the City by registered mail, shall name the City as an additional insured and shall contain a cross-liability clause;

(v) to deliver a copy of each such insurance policy to the City prior to the commencement of any provision, construction, installation, maintenance or repair of the Works and Services; and

(w) that if the Developer fails to obtain and/or maintain the insurance or deliver the policy or policies to the City, then the City may obtain and/or maintain such insurance at the expense of the Developer, and the Developer hereby appoints the City as the Developer's lawful attorney to do all things necessary for that purpose.

2. THE DEVELOPER FURTHER COVENANTS AND AGREES with the City:

(a) In this section, "Extended Services" means:

(i) a portion of a Highway system that will provide access to land other than the land being subdivided or developed, land; and

(ii) a portion of a water, sewage or Drainage System that will serve land other than the land being subdivide or developed.

(b) The Developer and the City agree that, other than the Works and Services referred to in section 2(d) of this Agreement, none of the Works and Services provide by the Developer under this Agreement constitute Excess or Extended Services.

(c) The Developer and the City agree that:

(i) if a court of competent jurisdiction finds that, despite the parties' agreement set out in Subsection (b) above, all or part the Works and Services provided by the Developer under this Agreement other than the Works and Services referred to in section 1(a) constitute Extended Services, the City will collect charges payable for latecomer connections to or use of these Works and Services during the period beginning when a Certificate of Substantial Completion is issued with respect thereto (the "Completion Date") and ending one day after the Completion Date;

(ii) the Works and Services set out in section 1(a) of this Agreement constitute Extended Services, and the City agrees to collect charges payable for latecomer connections to or use of these Works and Services during the period beginning on the date the Certificate of Substantial Completion is issued with respect to these Works and Services and ending 15 years after the date the Certificate of Substantial Completion is issued.

3. The Developer hereby releases and forever discharges the City and its servants, agents, successors and assigns from all manner of actions, causes of action, suits, debts, dues, accounts, bonds, covenants, contracts, claims and demands whatsoever against the City which the Developer ever had, now has or hereafter may have by reason of the provision, construction or installation of the Works and Services by the Developer with no contribution toward the cost of the said Works and Services by the City or any other person and, without limiting the generality of the foregoing, by reason of the failure by the City to impose or collect

any latecomer charges from the Owners of the lands which may connect to or use the Works and Services.

3.1 The Developer covenants with the City that it shall, at its own expense, procure and carry, or cause to be procured, carried and paid for, full Workers Compensation Board coverage for itself and all workers, employees and others engaged in the provision, construction or installation of the Works and to comply with the provisions of the *Workers Compensation Act*.

3.2 The Developer covenants and agrees with the City that, while providing, constructing or installing the Works, the Developer is a licensee or occupier of the municipal property on which the Works are provided, constructed or installed and, as such, the Developer is an owner as defined in section 13 of the *Workers Compensation Act* in relation to such municipal property.

3.3 The Developer covenants and agrees with the City that as an owner, as defined in the *Workers Compensation Act*, of the municipal property on which the Works are provided, constructed or installed to either:

(a) assume the responsibilities of the Prime Contractor for purposes of section 24 of the *Workers Compensation Act* and the Occupational Health and Safety Regulation, B.C. Reg. 296/97 ("Occupational Health and Safety Regulation"), with respect to the provision, construction or installation of the Works, or

(b) to enter into a written agreement with a qualified third party to act as the Prime Contractor, for purposes of section 24 of the *Workers Compensation Act* and the Occupational Health and Safety Regulation, with respect to the provision, construction or installation of the Works.

3.4 The Developer covenants and agrees that it will provide, or will ensure that the third party Prime Contractor provides, the following completed documentation to the City prior to the commencement of the provision, construction or installation of the Works:

(a) the City's Developer's Designation of Contractor as Prime Contractor" form, as completed by the Developer and, where applicable by the third party Prime Contractor;

(b) a copy of the completed "Notice of Project" which has been filed with WorkSafe BC, pursuant to section 20.2 of the Occupational Health and Safety Regulation, as amended, by the Developer or the third party Prime Contractor, as the case may be;

(c) written confirmation of the name of the qualified coordinator appointed pursuant to section 20.3(2) of the Occupational Health and Safety Regulation, as amended, by the Developer or the third party Prime Contractor, as the case may be, for the purpose of ensuring the coordination of health and safety activities for the location where the provision, construction and installation of the Works will be performed; and

(d) if the construction of the Works involves exposure to asbestos containing materials, as determined by the Prime Contractor's review of contract drawings and the City of Abbotsford's online WebMap tool, both

(i) an Asbestos Exposure Control Plan; and
(ii) a WorkSafeBC Notice of Project (Hazardous Substances).

4. THE CITY COVENANTS AND AGREES with the Developer:

(a) to permit the Developer to perform all of the Works and Services upon the terms and conditions herein contained; and

(b) that upon satisfactory completion by the Developer of all of the covenants and conditions in this agreement, including the maintenance of the Works and Services in complete repair for a period of one year, the City shall provide the Developer with a Certificate of Final Acceptance of the Works and Services signed by the Engineer.

5. IT IS MUTUALLY UNDERSTOOD, agreed and declared by and between the parties hereto that:

(a) the City has made no representations, covenants, warranties, guarantees, promises or agreements (oral or otherwise) with the Developer other than those contained in this agreement;

(b) nothing contained or implied herein shall prejudice or affect the rights and powers of the City in the exercise of its functions under any public and private statutes, Bylaws, orders and regulations, all of which may be fully and effectively exercised in relation to the Lands as if this agreement had not been executed and delivered by the Developer;

(c) the Works and Services shall be and remain at the sole risk of the Developer until such time as they are accepted by the City as evidenced by the Engineer's Certificate of Final Acceptance;

(d) wherever the singular or masculine is used herein, the same shall be construed as meaning the plural, feminine or the body corporate or politic where the context or the parties so require and, where the Developer consists of more than one person, the term "Developer" shall mean all such persons jointly or severally;

(e) this agreement shall ensure to the benefit of and be binding upon the parties hereto and their respective heirs, executors, administrators, successors and assigns; and

(f) the parties hereto shall do and cause to be done all things and execute and cause to be executed all documents which may be necessary to give proper effect to the intention of this agreement.

IN WITNESS WHEREOF the parties hereto have hereunto affixed their respective Corporate Seals, attested by the hands of their respective officers duly authorized in that behalf, the day and year first above written.

The Corporate Seal of

_____

was hereunto affixed in the presence of:

_____
Authorized Signatory and printed name

_____
Authorized Signatory and printed name

SIGNED, SEALED AND DELIVERED by the above-named in the presence of:

Name:_____

Address:_____

_____

Occupation:_____

THE CORPORATE SEAL OF CITY OF ABBOTSFORD was hereunto affixed in the presence of:

_____
Mayor – Authorized Signatory

_____
City Clerk – Authorized Signatory