SUBDIVISION AND DEVELOPMENT SERVICING MODEL BYLAW
April 29, 2013

[*Name of Local Government*]
Bylaw No. XXXX, 2013

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A bylaw to regulate the provision of *Works and Services*.

WHEREAS the Council of the [*Name of Local Government*] has the authority pursuant to sections 938 of the *Local Government Act* and 8(3)(l) of the *Community Charter* to regulate and require the provision of *Works and Services* in respect of the *Subdivision* of land and as a condition of issuing a building permit;

WHEREAS the Council of [*Name of Local Government*] desires to provide orderly and aesthetically pleasing *Development*, to preserve established amenities, and to ensure that *Subdivisions* and *Developments* are appropriately serviced and best suited to the use for which they are intended;

AND WHEREAS the Council desires to address the impacts of climate change;

NOW THEREFORE the Council of [*Name of Local Government*], in open meeting assembled, ENACTS AS FOLLOWS:

1. TITLE
This bylaw may be cited as "[*Name of Local Government*] Subdivision and Development Servicing Bylaw No. XXXX".

2. SCHEDULES
The following schedules are attached to and form part of this bylaw:

Schedule A	Levels of Works and Services [*Beyond scope of model bylaw*]
Schedule B	Engineering Design Standards and Construction Specifications
Schedule C	Subdivision Servicing Agreement [*Beyond scope of model bylaw*]
Schedule D	Standard Forms [*Beyond scope of model bylaw*]

3. REPEAL
Subdivision and Development Servicing Bylaw No. XXXX and all amendments thereto are hereby repealed.

4. INTERPRETATION
4.1. Unless otherwise defined in this bylaw, any word or expression in this bylaw has the meaning assigned to it in the *Local Government Act*, *Interpretation Act*, *Strata Property Act* or *Land Title Act*, and the [*Name of Local Government*] Zoning Bylaw. In the case of a conflict, the *Local Government Act* shall take precedence.

4.2. In this bylaw, whenever words are used to imply the *Subdivision* of land, those words shall be deemed to refer to the division of land into two or more *Parcels*, whether described by plan, metes and bounds, replotting scheme, or another means.

4.3. The standards for *Works and Services* described in this bylaw also apply to *Developments*, which may not involve the *Subdivision* of land.

Severability

5. If any section, subsection, clause, subclause or phrase of this bylaw is, for any reason, held to be invalid by the decision of a court of competent jurisdiction, such decision will not affect the validity of the remaining portions of this bylaw.

Standards of Measure

6. Metric units are the standard of measure in this bylaw.

7. Definitions

Applicant means a person applying for the approval of a *Subdivision* or building permit.

Approving Officer means a person appointed by the [*Name of Local Government*] Council to act as *Approving Officer* pursuant to the provisions of the *Land Title Act* and *Local Government Act*.

As-Built Drawings means the final engineering drawing submitted to the [*Name of Local Government*] and constitute the drawings that accurately portray the *Works and Services* as accepted by the [*Name of Local Government*] and constructed by the *Owner*, including any field design or construction changes accepted by the [*Name of Local Government*].

Certificate of Substantial Performance means a written certificate issued by the [*Name of Local Government*] indicating that the *Works and Services* have been substantially *Completed* subject to deficiencies identified in the certificate.

Chief Building Official means the person designated in or appointed to that position by the [*Name of Local Government*], and any person named by the Council to act in place of the *Chief Building Official*.

Completed/Completion means *Completion* of the *Works and Services* or a portion of them by the *Owner* to the standards and specifications set out in the bylaws of the [*Name of Local Government*] such that the *Works and Services* have been fully tested, are functional and can be used for their intended purpose.

Consulting Professional means a professional engineer pursuant to the *Engineers and Geoscientists Act* R.S.B.C. 1996 c.116, a professional landscape architect pursuant to the *Architects (Landscape) Act*, R.S.B.C. 1996 c.18, and a professional biologist pursuant to the *College of Applied Biology Act*, S.B.C. 2002 c.68. The *Approving Officer*, *Chief Building Official* or *Municipal Engineer* determines which professional designation is appropriate for work undertaken.

Developer means the party or contractor who has the authority to act on behalf of and represent the *Owner* in carrying out *Works and Services* under this Bylaw.

Develop or Development means an activity that requires a building permit under the [*Name of Local Government*] [*Name of building regulation bylaw*] No. XXXX.

Estimated Cost means the total cost of constructing *Works and Services* estimated by the *Owner's Consulting Professional* and approved by the *Approving Officer* or *Chief Building Official*.

Excess or Extended Services has the meaning prescribed by the *Local Government Act*.

Final Acceptance Certificate (FAC) means the written document as set out in Schedule C of this Bylaw by which the [*Name of Local Government*] confirms that the *Developer* has fulfilled the warranty obligations and all other requirements of this Bylaw in relation to *Works and Services*.

Highway has the meaning prescribed by the *Community Charter*.

MMCD means the most current edition of the Master Municipal Construction Document published by the Master Municipal Construction Documents Association.

Municipal Engineer means the person or company appointed from time to time by the [*Name of Local Government*] Council as the engineer for the [*Name of Local Government*] or their duly authorized representative.

Owner shall mean a person registered under the *Land Title Act* as the *Owner*, or any other person lawfully in possession or occupancy of buildings or property in the [*Name of Local Government*].

Parcel means a lot, block or other area in which land is held or into which land is *Subdivided*.

Security means a cash deposit or unconditional irrevocable letter of credit redeemable at site by the [*Name of Local Government*] within the boundaries of the [*Name of Local Government*], issued by a Canadian Chartered Bank or Credit Union, to ensure the *Completion* and warranty of *Works and Services* required by this bylaw.

Service Levels means the standard of *Works and Services* required under this bylaw for *Subdivision* or *Development*.

Servicing Agreement means the written agreement between the *Owner* and [*Name of Local Government*] contained in Schedule C.

Subdivide or Subdivision means the division of land into two or more *Parcels*, whether by plan, apt descriptive words or otherwise.

Works and Services includes *Highways*, sidewalks, boulevards, boulevard crossings, transit bays, street lighting, wiring, electrical distribution systems, water distribution systems, fire hydrant systems, sewage collection and disposal systems, drainage collection and disposal systems which includes landscaping, and such other infrastructure or systems required under this bylaw in connection with the *Subdivision* or *Development* of land.

Zone has the same meaning as defined in the [*Name of Local Government*] Zoning Bylaw.

WORKS AND SERVICES REQUIRED

Prohibition

8. No *Parcel* may be *Subdivided* or *Developed* unless that *Subdivision* or *Development* complies with the servicing standards and requirements set out in Schedule B, or is permitted through a development variance permit or development permit issued by Council.

On-Site and Off-Site *Works and Services*

9. An *Owner* of a *Parcel* who applies for a *Subdivision* or *Development* must provide, as a condition of *Subdivision* Approval or *Development*, as applicable

    9.1. on a *Highway* immediately adjacent to the land being *Subdivided* or *Developed* up to the centre line of the *Highway*, and

    9.2. on the *Parcel* itself

    the *Works and Services* that are required lawfully to be provided by the Council, the *Approving Officer*, or the *Chief Building Official*.

10. The minimum level of *Works and Services* required for *Subdivision* and *Development* in different *Zones* and for different circumstances is contained in Schedule A.

11. Standards for on-site *Works and Services* must conform to the provisions of this bylaw, except where otherwise specified in

    11.1. The Zoning Bylaw for parking space and parking lot design and specifications;

    11.2. The B.C. Building Code;

    11.3. [*Name of Local Government*] [*Name of Building Regulation Bylaw*] No. XXXX;

    11.4. Guidelines contained in the [*Name of Local Government*] Official Community Plan; and

    11.5. Any additional design requirements specified in a development permit or development variance permit.

Alternative Development Standards

12. Alternative *Service Level*s or specifications that address climate change adaptation, environmental, or technical solutions that provide more sustainable approaches for *Works and Services* will be considered where warranted by site-specific conditions.

13. The *Applicant* shall take into account best management practices when designing the *Subdivision* or *Development*, including the following documents:

    13.1. Stormwater Planning: A Guidebook for British Columbia (Ministry of Water Land and Air Protection 2002)
    13.2. Water Balance Model for British Columbia (waterbalance.ca)
    13.3. Green Bylaws Toolkit (Wetlands Stewardship Partnership 2007)
    13.4. Green Infrastructure Guide (West Coast Environmental Law 2007)
    13.5. Groundwater Bylaws Toolkit (Okanagan Basin Water Board 2009)
    13.6. Topsoil Bylaws Toolkit (Okanagan Basin Water Board 2012)
    13.7. Best Management Practices Guide for Stormwater (Greater Vancouver Sewage and Drainage District 1999)
    13.8. FireSmart Manual (BC Ministry of Forests, Lands and Natural Resource Operations 2003)
    13.9. Water Conservation Planning Guide for British Columbia Communities (The POLIS Project on Ecological Governance 2009)
    13.10. Land Development Guidelines for the Protection of Aquatic Habitat (Department of Fisheries and Oceans 1993)
    13.11. Code of Practice for the Use of Reclaimed Water (Ministry of Environment, Lands and Parks 2001)
    13.12. Planning for the Distribution of Reclaimed Water (AWWA Manual M24 2009)
    13.13. Passive Solar Design Strategies: Guidelines for Home Building (Passive Solar Industries Council undated)
    13.14. Climate Change, Impacts and Adaptation in the Canadian Columbia Basin: From Dialogue to Action (Columbia Basin Trust 2012)

Owner* Responsible for Construction of All *Works and Services

14. The *Owner* of a *Parcel* being *Subdivided* or *Developed* is responsible for the *Works and Services* required by this bylaw, the *Local Government Act*, the Council of the [*Name of Local Government*], the *Approving Officer* or the *Chief Building Official*.

Storm Drainage System

15. The *Owner* of a *Parcel* being *Subdivided* or *Developed* must:

    15.1. Provide the storm drainage *Works and Services*, including service connections, landscaping, and protection of natural watercourses and trees, designed and constructed in accordance with the requirements and standards prescribed in Schedule B;

    15.2. Except where the requirements of Schedule B and the *Approving Officer* or *Chief Building Official* require a drainage collection system to terminate in the ground, connect the drainage collection system required to be installed under this bylaw to

the storm drainage collection system of the [*Name of Local Government*] in accordance with the standards prescribed in Schedule B; and

15.3. Keep every storm drainage system separate from any sanitary sewer system.

Water Distribution System

16. The *Owner* of a *Parcel* being *Subdivided* or *Developed* must:

16.1. Provide the water distribution system and fire hydrant system, including service connections, designed and constructed in accordance with the requirements and standards prescribed in Schedule B; and

16.2. Connect the water distribution and fire hydrant system required to be installed under this bylaw by distribution mains to the [*Name of Local Government*] community water system, or, if required by the *Approving Officer* or *Chief Building Official*, to an alternative water system, in accordance with the standards set out in Schedule B, or in the case of an alternative system, to the satisfaction of the [*Name of Local Government*] and provincial authorities.

17. If the [*Name of Local Government*] does not operate the water distribution system and fire hydrant system, the *Owner* must also deliver to the [*Name of Local Government*] a written acceptance of the water distribution and fire hydrant systems executed by the applicable Health Region or provincial government authority indicating that the alternative water system and fire hydrant system meets or exceeds all applicable standards for water quality and quantity.

Sanitary Sewage Collection and Disposal System

18. The *Owner* of a *Parcel* being *Subdivided* or *Developed* must:

18.1. Provide every *Parcel* in the proposed *Subdivision*, or the land being *Developed*, with a sanitary sewage collection and disposal system, including service connections, designed and constructed in accordance with the requirements and standards prescribed in Schedule B; and

18.2. Subject to section 19, connect the sewage collection system required to be installed under this bylaw by trunk mains to the sewer system of the [*Name of Local Government*] in accordance with the standards prescribed in Schedule B.

19. If connection to the [*Name of Local Government*] sewage collection system is not possible, the *Municipal Engineer* may consider the use of septic disposal or an alternative sewage treatment system, subject to professional comprehensive suitability analysis for permanent onsite septic disposal, which analysis has been conducted at the *Owner's* sole cost, and subject to the alternative sanitary sewage collection, treatment or disposal system complying with all requirements of [*Name of Local Government*] bylaws, provincial health regulations and professional determination by the *Owner's Consulting Professional*s that the proposed system is scientifically and environmentally suitable according to the comprehensive suitability analysis.

20. Pumped sanitary sewer systems will only be considered if no other alternative is reasonably possible.

Connectivity, Highways and Active Transportation

21. The *Owner* of a *Parcel* being *Subdivided* or *Developed* must:

    21.1. Provide and construct all *Highways*, boulevards, sidewalks, crossings, street lighting, underground wiring, transit stops, traffic signals, bikeways, bicycle paths, trails and other connectivity and active transportation routes required by [*Name of Local Government*] bylaws, plans and Schedule B of this bylaw in accordance with the standards prescribed in Schedule B;

    21.2. Comply with the dimension, location, alignment and gradient requirements for *Highways* prescribed in Schedule B;

    21.3. Provide at no cost to the [*Name of Local Government*] land of a width that, in the *Approving Officer's* opinion, would permit the *Highway* to be supported, protected or drained, if the *Approving Officer* believes that, due to terrain and soil conditions, a *Highway* of a specified width under this bylaw cannot be supported, protected or drained.

22. The *Applicant* will consult with the *Approving Officer* to determine the road classification of the proposed *Highways* to facilitate their integration into the existing or proposed hierarchy of connectivity determined in relation to land use, configuration of the land, and the classification of existing *Highways*.

23. At minimum, all final dedicated *Highway* widths shall be sufficient to accommodate multimodal two-way traffic flow, which includes automobile turning movements at intersections, a sidewalk, underground utilities that includes a drainage collection system and street light on one side of the *Highway*.

24. Emergency access shall be provided in accordance with the standards prescribed by Schedule B and, where required by the *Approving Officer*, must be approved by the local Fire Department.

25. *Owner* Responsible for Cost of *Works and Services*

25.1. Every requirement for an *Owner* or *Developer* to provide *Works and Services* or to do or provide any related thing under this bylaw is at the sole cost of the *Owner*.

25.2. Any cost associated with the provision of *Works and Services*, including but not limited to, engineering design, construction costs, preparation of agreements or other required legal documents, administration fees and taxes associated with any requirement of this bylaw is at the sole cost of the *Owner*.

Compliance with Other Laws

26. The *Owner* must comply with all enactments, laws, statutes, regulations, and orders of any authority having jurisdiction, including the bylaws of the [*Name of Local Government*].

Environmental and Climate Adaptation Approvals

27. The *Owner* must comply with and obtain all federal, provincial, municipal, environmental and other licenses, permits and approvals required under applicable enactments.

28. Every *Subdivision* and *Development* must comply with the [*Name of Local Government*]'s climate adaptation and environmental management bylaws and policies, including provisions for sediment and erosion control, tree retention and protection, and site alteration.

29. The *Owner* must not alter, without the prior written approval of the [*Name of Local Government*], any natural watercourses in and around a *Parcel* that is subject to *Subdivision* or *Development*, and to incorporate such protection and conservation methods as required by the [*Name of Local Government*] or by any enactments.

Where *Works and Services* Exist

30. In circumstances where the *Works and Services* required by this Bylaw are already in existence, an *Applicant* may be required to alter them such that they comply with the standards set out in the Schedules.

Connection Fees and Connection by [*Name of Local Government*]

31. The *Owner* must pay to the [*Name of Local Government*] the cost of all tie-ins and other connections of the Works to existing storm and sanitary sewers, water mains, water meters, access improvements, and other municipal Services, and the cost of installing all necessary *Highway* name and traffic control signs in connection with the Works, with all such connections to be completed by the [*Name of Local Government*].

Off-Site *Works and Services* Become Property of the [*Name of Local Government*]

32. Off-site *Works and Services* constructed and installed under this bylaw, the *Local Government Act*, or as required by the *Approving Officer* or *Chief Building Official* become the property of the [*Name of Local Government*] free of encumbrances, on acceptance in writing of the *Works and Services* by the *Municipal Engineer*, and must be located within dedicated *Highways* or statutory rights of way granted by the *Owner* to the [*Name of Local Government*].

33. Any *Highways* or statutory rights of way or right of way agreements required for the *Works and Services* must be granted by the *Owner* to the [*Name of Local Government*] at the sole cost of the *Owner*.

Excess or Extended Services

34. An *Owner* of land being *Subdivided* or *Developed* may be required to provide *Excess or Extended Services* to land other than the land being *Developed* in accordance with section 939 of the *Local Government Act*.

STRATA DEVELOPMENT STANDARDS

[*Beyond scope of model bylaw*]

EXCEPTIONS TO *WORKS AND SERVICES* REQUIRED

Subdivisions for Specific Purpose

35. The *Works and Services* requirements of this Bylaw do not apply to a *Subdivision* that creates only:

    35.1. A *Highway* dedication;

    35.2. Parkland;

    35.3. A *Parcel* for the installation of public utilities and related structures and equipment; or

    35.4. A consolidation or a lot line adjustment, in which the number of lots having sufficient area to be built upon in accordance to the [*Name of Local Government*]'s Zoning Bylaw is not increased and the land use is single-family or two family only.

Works and Services Impractical to Build

36. Where, in the opinion of the *Approving Officer*

    36.1. it is not practical to build all or part of the required *Works and Services* until a project of greater scope can be arranged, and

    36.2. the Works or Services are not immediately required for the *Subdivision* or the building

    the *Applicant* may provide the [*Name of Local Government*] with *Security* in an amount that is acceptable to the [*Name of Local Government*]'s *Approving Officer* that equals the cost of designing, constructing and providing the *Works and Services*. The funds will be placed by the [*Name of Local Government*] in an interest bearing reserve until they are used to provide the contemplated *Works and Services*.

SECURITY AND *SERVICING AGREEMENT*

Servicing Agreement and *Security* Deposit Required

37. All *Works and Services* required to be constructed and installed at the sole cost of the *Owner* of the land being *Subdivided* or *Developed* must be constructed and installed to the standards prescribed in this bylaw before the *Approving Officer* approves the *Subdivision* or the *Chief Building Official* issues a Building Permit, unless the *Owner*:

    37.1. Deposits *Security* with the [*Name of Local Government*];

37.2. Enters into a *Servicing Agreement* accepting the terms and conditions in that agreement and undertaking to construct and install the required *Works and Services*, and to warrant the *Works and Services* or to forfeit the *Security* to the [*Name of Local Government*]; and

37.3. Completes all *Works and Services* within one year of the date of the agreement, unless otherwise stated in the *Servicing Agreement*.

38. *Subdivisions* that create only one new single-family residential *Parcel* are not required to enter into an agreement if *Security* is deposited as required in section 36.

39. The *Security* must be in the amount of 125 percent of the cost of constructing and installing the *Works and Services*, as estimated by the *Consulting Professional*, and as accepted by the *Municipal Engineer*.

Timing of *Security* Deposit

40. The *Owner* must deposit with the [*Name of Local Government*] the required *Security* referred to in sections 36 and 37 to secure *Completion* of the *Works and Services*

40.1. Before the [*Name of Local Government*] Council considers adoption of a zoning amendment bylaw for which the *Owner* has made an application to the [*Name of Local Government*];

40.2. In the case of *Subdivision*, before the *Subdivision* plans are submitted to the *Approving Officer* for final approval;

40.3. In the case of *Development* not requiring *Subdivision* approval or zoning amendment, prior to issuance of any building permit or *Development* permit where applicable, or

40.4. On the reference date of the *Servicing Agreement*,

and in any case, prior to commencement of construction of any *Works and Services*.

Renewal of *Security*

41. If any *Works and Services* are not *Completed* to the satisfaction of the [*Name of Local Government*] within the term of the *Security* that relates to the *Works and Services*, the *Owner* must renew the *Security* for a further one year period, and thereafter from year to year.

42. If in any year the *Security* is not so renewed at least thirty (30) days before its expiry, the [*Name of Local Government*] may draw down the full amount of the *Security* and hold the funds so drawn as *Security*.

[*Name of Local Government*] May *Complete* Works

43. If any of the *Works and Services* are not duly and properly *Completed* within one year or as otherwise specified in the *Servicing Agreement*, the [*Name of Local Government*] may draw

down the *Security* and may, through its employees or contractors, Complete those *Works and Services* at the cost of the *Owner* and deduct from the *Security* the costs of *Completion*. The balance of the *Security*, if any, must be returned to the *Owner* less any administrative costs incurred by the [*Name of Local Government*].

44. If the *Security* is insufficient to cover the actual cost of completing the *Works and Services*, the *Owner* must pay the deficiency to the [*Name of Local Government*] immediately on receipt of the [*Name of Local Government*]'s invoice for the cost.

APPLICATION AND APPROVAL

Design and Construction

45. The *Owner* must design, construct, install and complete the *Works and Services* in accordance with this bylaw.

Consulting Professionals

46. Works and Services designed by *Consulting Professionals* must be submitted for review and acceptance by [*Name of Local Government*].

47. The *Owner* must retain, at their sole cost, *Consulting Professionals* who are responsible for design, layout, acceptance of materials, field inspection of installation, certification, communication with the *Owner's* contractors, information for and certification of *As-Built Drawings*, and certification of *Completion* for all *Works and Services* that are the responsibility of the *Owner* in accordance with this bylaw.

48. The *Approving Officer* or *Chief Building Official* may require the *Owner* to submit plans and additional information prepared by *Consulting Professionals* with the appropriate qualifications given the characteristics, location, or climate vulnerability of the *Parcel*, including but not limited to:

    48.1. Climate adaptation;

    48.2. Total and effective imperviousness of the *Parcel*, as well as rainwater infiltration rates;

    48.3. Passive solar design;

    48.4. Integrated stormwater management;

    48.5. Wildfire interface; and

    48.6. Landscaping.

Integrated Design Meeting

49. *Applicants* will meet with planning staff, the *Approving Officer*, and/or the *Chief Building Official* to discuss the proposal.

Permission to Construct

50. No land clearing, stripping of top soil, excavation, placement of fill, construction or installation of any kind may be undertaken on a *Subdivision* or *Development* until:

    50.1. The *Owner* has deposited all construction plans with the *Municipal Engineer*; and

    50.2. The *Municipal Engineer* has given the *Owner* or *Consulting Professional* permission to construct *Works and Services.*

Inspection and Monitoring by the *Consulting Professional*

51. The *Owner's Consulting Professional* must inspect the *Works and Services* for the *Subdivision* or *Development* during construction and installation for compliance with this bylaw.

52. The *Consulting Professional* must submit copies of their inspection reports to the [*Name of Local Government*].

Statutory Rights-of-Way

53. For the purpose of installing or maintaining *Works and Services*, the *Owner* shall provide statutory rights-of-way where *Works and Services* are not located in *Highways*, and shall be deposited in the Land Title Register and registered against the title to the *Parcel*.

54. The *Applicant* is responsible for negotiating and securing any rights-of-way or easements necessary to the Application, to prepare the legal documentation, to have it processed in the Land Titles Office, and to pay all direct or indirect costs, including:

    54.1. B.C. Land Surveyor costs;

    54.2. Legal fees; and

    54.3. Registration and other fees, including Land Title and Survey Authority fees.

55. The *Approving Officer* may require the *Applicant* to provide a lawyer or notary's undertaking satisfactory to the [*Name of Local Government*]'s solicitor prior to Final Approval to ensure registration of these documents.

COMPLETION OF *WORKS AND SERVICES*

Certificate of Substantial Performance

56. On *Completion* of the *Works and Services* the *Owner* may request, in writing, a *Certificate of Substantial Performance*. This request must be accompanied by a document prepared by the *Consulting Professional* that includes test results, a list of accepted changes and a list of project deficiencies and their cost estimates.

57. The *Municipal Engineer* shall issue a *Certificate of Substantial Performance* that contains a list of deficiencies that must be corrected, if the *Municipal Engineer* is of the opinion that the *Works and Services* have been substantially *Completed*.

Reductions in *Security* Deposit

58. The *Owner* may apply to the [*Name of Local Government*] for a reduction in the *Security* for a portion of the Works for which the *Municipal Engineer* has issued a *Certificate of Substantial Performance*.

59. The [*Name of Local Government*] may reduce the *Security* by the amount of the cost of the *Works and Services* for which a *Certificate of Substantial Performance* has been issued up to ninety (90) percent of the *Security* for Works that are not related to landscaping.

60. The [*Name of Local Government*] may reduce the *Security* provided for landscaping *Works and Services* to a maximum of eighty (80) percent for which the *Municipal Engineer* issues a *Certificate of Substantial Performance*.

61. The [*Name of Local Government*] will not pay interest on all or any portion of *Security* that is reduced or returned.

Two Year Warranty

62. The [*Name of Local Government*] will retain ten (10) percent of the *Security* for the *Works and Services*, except landscaping *Works and Services*, for two years after the *Municipal Engineer* issues the *Certificate of Substantial Performance*

63. The [*Name of Local Government*] will retain twenty (20) percent of the *Security* for landscaping *Works and Services* for two complete growing seasons, as directed by the *Municipal Engineer*, after the *Municipal Engineer* issues the *Certificate of Substantial Performance*.

64. If the *Owner* fails to maintain any of the *Works and Services*, remedy any defect, or pay for any damages resulting from the defects, the [*Name of Local Government*] may maintain the *Works and Services*, remedy the defect and pay the damages at the cost of the *Owner* by drawing down the *Security* and deducting the costs and damage from the *Security* funds.

65. The balance of the *Security*, less any administrative costs incurred by the [*Name of Local Government*], must be returned to the *Owner* at the end of two years after the issuance of the *Certificate of Substantial Performance*.

66. If the *Security* is insufficient to cover the actual costs incurred by the [*Name of Local Government*], the *Owner* must pay such deficiency to the [*Name of Local Government*] immediately on receipt of the [*Name of Local Government*]'s invoice.

Return of *Security* Deposit

67. If the *Works and Services* are maintained by the *Owner* as required under the *Servicing Agreement*, the [*Name of Local Government*] must return the *Security* to the *Owner* on receipt of the *Final Acceptance Certificate* from the *Municipal Engineer*.

Warranty Period

68. The *Owner* must:

68.1. Maintain the *Works and Services* in Complete repair for two years after issuance of the Certificate of Substantial *Completion*;

68.2. Remedy any defects or deficiencies appearing within the two year period; and

68.3. Pay for any damage to other *Works and Services* or property resulting from the defects, save and except for defects caused by reasonable wear and tear, negligence of the [*Name of Local Government*], or Acts of God.

Final Acceptance Certificate

69. The *Municipal Engineer* will only issue a *Final Acceptance Certificate* for the *Works and Services* when the requirements of this bylaw for the construction and installation of *Works and Services* have been fulfilled.

Monitoring

70. The *Approving Officer* or *Chief Building Official* may require the *Consulting Professional* to monitor or test the *Works and Services* for up to two (2) years after their installation and provide the results of that monitoring or testing to the [*Name of Local Government*].

INSPECTIONS AND ENTERING LANDS

Right to Enter Property

71. Subject to section 16 of the *Community Charter*, the *Municipal Engineer*, *Approving Officer*, *Chief Building Official*, Director of Engineering, Director of Planning, and all [*Name of Local Government*] officers and employees supervised by them may enter at all reasonable times and in a reasonable manner, after taking reasonable steps to advise the *Owner* before entering a *Parcel*, to inspect and determine whether all regulations, prohibitions and requirements under this bylaw are being met.

OFFENCES AND PENALTIES

72. No person may prevent or obstruct, or attempt to prevent or obstruct, the entry of authorized persons onto a *Parcel* as authorized by this bylaw.

73. Every person who violates a provision of this bylaw commits an offence and is liable on summary conviction to a penalty not exceeding ten thousand dollars ($10,000.00) and the costs of prosecution.

74. The penalties imposed under this subsection supplement and are not a substitute for any other remedy available for an infraction of this bylaw.

READ A FIRST TIME this th day of, 2013.
READ A SECOND TIME this th day of, 2013.
READ A THIRD TIME this th day of, 2013.

ADOPTED this th day of, 2013.

_____	_____
Mayor	Corporate Officer
[*Name*]	[*Name*]

I HEREBY CERTIFY that this is a true copy of
"No. ____, 2013"

_____
[*Name*], Corporate Officer

SCHEDULE B
TO THE SUBDIVISION AND DEVELOPMENT SERVICING MODEL BYLAW

DESIGN CRITERIA, SPECIFICATIONS AND STANDARD DRAWINGS

Disclaimer: This "model" Schedule B has been drawn together from the following sources:

The District of Elkford's draft SDS bylaw (2011)

The District of North Vancouver's Development Servicing Bylaw 7388 (2006)

The City of Kamloops Subdivision and Development Control Bylaw 4-33 (2012)

Inserts have also been made from other bylaws and ordinances from Canada and around the world. Intrinsically, this Schedule B contains specifications that promote infrastructure resiliency Provisions specifically relating to climate change resilience have been included throughout. By no means are these provisions considered to represent all possibilities for improving climate resilience.

The authors have also added textboxes where no provisions could be found or alternative considerations are possible. These areas can be researched in future and appropriate wording included, as needed, in an updated Schedule B for a particular local government. In various places the numeric values associated with a provision have been left blank. These omissions are intended as placeholders so local governments can use their own numbers when updating their SDS Bylaw which, by necessity, will vary based on local conditions. Further discussion and examples of ideas or types of infrastructure in Schedule B have been incorporated into an accompanying guidance document:

Nelitz, M., J. Cooke, D. Curran, and I. Glotze. 2013. Enhancing climate resilience of Subdivision and Development Servicing (SDS) Bylaws in the Columbia Basin: A guidance document. Prepared for the Columbia Basin Trust.

This "model" Schedule B provides a lot of detail taken from various sources. Ideally, an SDS Bylaw would be significantly shorter (see bylaws from the Cities of Richmond, Toronto, Auckland (New Zealand), and Canterbury (England)). Shorter SDS bylaws would make reference to an array of Guidelines, Design Criteria Manuals and the British Columbia Master Municipal Construction Documents (MMCD).

This Schedule B is therefore only intended to provide examples to be considered by local government staff en route to developing their own climate resilient bylaws in future. In other words, this model represents a first step in producing an SDS Bylaw Schedule B that will provide landowners and developers with a clear outline of the rules of development, especially when it comes to adapting to future climate change phenomena.

SCHEDULE B

GENERAL INDEX

SECTION 1

GENERAL INFORMATION

1.0 GENERAL INFORMATION

1.1. INTRODUCTION

Schedule B forms part of the [*Name of Local Government*] Subdivision and Development Servicing (SDS) Bylaw No. XXXX, 2013.

It sets out deliverables, criteria, specifications and performance standards and other provisions that must be adopted by *Developers*:

- in the preparation of engineering and other professional designs and drawings for, and
- in the execution of,

the *Subdivision* and/or *Development* of land.

1.2. INTEGRATED DESIGN AND SUSTAINABILITY

The criteria, specifications and performance standards for municipal infrastructure set out in this schedule are based on the following principles of sustainability and asset management:

- Enhancement of quality of life
- Environmental protection
- Minimizing construction costs where possible
- Preventive maintenance
- Life cycle costs

Some of the above principles involve conflicting priorities, for example undue concentration on financial economies can have adverse impacts on environmental protection and life cycle costs of infrastructure. A balanced approach to design of municipal infrastructure with consideration of all of the above principles is required.

1.3. APPLICATION

This bylaw applies to both new *Development* and re-*Development*. New *Development* refers to proposed *Development* in areas that are currently undeveloped. Re-*Development* refers to proposed *Development* in areas that have existing *Development*, including *Works and Services*.

Notwithstanding the criteria, specifications and performance standards in this schedule, the *Owners* and their *Consulting Professional*s remain fully responsible for the design and construction of municipal infrastructure utilities according to good engineering and other professional standards that are adequate to address their specific needs and site conditions of their project.

All design and construction details for municipal infrastructure services will be in accordance with this schedule, other [*Name of Local Government*] bylaws, and with the British Columbia Master Municipal Construction Documents (*MMCD*, Current Version).

Where conflicts or discrepancies may appear between similar drawings and/or specifications prepared by the [*Name of Local Government*] and those presented in the *MMCD*, the *Consulting Professional* will review the conflict or discrepancy with the *Municipal Engineer* of [*Name of Local Government*] and will obtain the [*Name of Local Government*]'s acceptance for the correct drawing and/or specification before proceeding.

1.4. ALTERNATIVE SOLUTIONS AND DESIGNS

The standards in this schedule are set out as minimum level requirements and will not be mandatory where variations acceptable to the [*Name of Local Government*] will achieve better technical, environmental or economical solutions.

Consulting Professionals are encouraged to seek innovative and superior solutions to subdivision layout, *Development* and servicing that address the sustainability and climate adaptation goals of [*Name of Local Government*]. Those who wish to adopt criteria not specifically included in or variant from this schedule will justify the proposed change in a letter or report prepared, signed and sealed by a Professional Engineer registered in the Province of British Columbia.

Submissions must demonstrate that the proposed alternative designs are equivalent to or better than the criteria in this schedule. The letter or report will be submitted to the [*Name of Local Government*] for review and acceptance, prior to acceptance of the proposed alternative design.

1.5. INDEPENDENT UTILITIES

Independent utilities are those not normally supplied by municipal or regional authorities and are not included in this schedule. Independent utilities include:

- Electrical power
- Communications (telephone and cable)
- Gas

Design of municipal infrastructure must include consideration of the above utilities. Design of these utilities is normally carried out by the Utility owner and coordinated by the *Consulting Professional* and/or the [*Name of Local Government*].

1.6. REVISIONS TO THIS SCHEDULE

The criteria and design parameters contained in this manual are subject to constant review and re-evaluation, and the [*Name of Local Government*] reserves the right to initiate revisions or additions to these criteria as and when it is deemed necessary to make such revisions.

The [*Name of Local Government*] encourages submissions from *Consulting Professionals* at large wishing to amend the [*Name of Local Government*]'s design criteria and standards. Such submissions will be in a report format, signed and sealed by a Professional Engineer,

and will include clear and succinct expressions of concern, suggestions for alternatives including their economic, engineering and environmental benefits, and, recommendations addressing improvements to the current design criteria.

The [*Name of Local Government*] may review, assess, accept, reject or adopt in whole or in part the submissions and/or the recommendations from a *Consulting Professional* for inclusion within this schedule at a future date.

1.7. INTERPRETATION OF CRITERIA

The [*Name of Local Government*] reserves the right to make the final decision in interpreting the intent of the design criteria and standards, and about the acceptability of changes from the standards, or of standards proposed by the *Consulting Professional*. Final decisions, interpretations and acceptances will be provided by the [*Name of Local Government*].

1.8. STATUATORY REQUIREMENTS BY OTHER AUTHORITIES

The *Consulting Professional* will remain responsible for compliance with all statutory requirements of other relevant authorities that regulate and approve *Works and Services* and will arrange for and secure all acceptances from the appropriate authorities.

Where conflicts or inconsistencies with this schedule arise due to statutory amendments, the *Consulting Professional* will be responsible for applying the most current requirement, and will refer the issue to the [*Name of Local Government*]. If there is more than one standard that may be applied the *Consulting Professional* will apply the more stringent standard.

1.9. OTHER GENERAL REQUIREMENTS

1.9.1. Information about existing services is available from the [*Name of Local Government*]. These records are made available on the understanding that the [*Name of Local Government*] cannot, and does not, guarantee their accuracy. The *Consulting Professional* or user of such information will undertake appropriate verification to ensure the accuracy of details.

1.9.2. Materials and products that are accepted for use in the [*Name of Local Government*] are listed on its website [*insert web address*]. If the appropriate use of certain materials or products is in doubt, confirm the acceptance of the material or product with the [*Name of Local Government*] prior to its design or use.

1.9.3. The units for all design and construction will be SI (International System of Units), and will conform to the Canadian Metric Practice Guide, CSA CAN3-Z234.1.

SECTION 2

DESIGN AND AS-BUILT DELIVERABLES

2.0 DESIGN AND AS-BUILT DELIVERABLES

2.1. INTRODUCTION

The purpose of this section is to outline the minimum standards and requirements the [*Name of Local Government*] will accept in the design and *As-Built Drawings* for *Subdivision* layout and engineering *Works and Services*.

It is the specific intent of the [*Name of Local Government*] to require quality submissions for design and *As-Built Drawings*. Whenever engineering works are required or proposed, the *Consulting Professional* will arrange for a pre-design meeting to ensure compliance with the latest [*Name of Local Government*] standards, specifications and policies.

Based on this meeting, it is highly desirable for the *Developer*, the *Consulting Professional*, and [*Name of Local Government*] Staff to develop a project implementation timeline.

Following the initial meeting, the *Developer* will receive a completed application checklist, which will confirm what relevant information and materials will be required by the [*Name of Local Government*] in the formal *Development* application. This step is important as smaller *Developments* may not require all the information requirements listed in Section 2.2 below.

Incomplete or substandard submissions will be returned to the *Consulting Professional* with a short letter of explanation as to why the design report(s) and drawings are being returned.

2.2. LIST OF APPLICATION REQUIREMENTS

The [*Name of Local Government*] may require the following planning and design information as part of the *Subdivision* application depending on the size, location and other qualities of the *Subdivision* being proposed:

2.2.1. Completed *Subdivision* application form

2.2.2. *Development Parcel* boundary or cadastral survey

2.2.3. *Development Parcel* topographical survey plan

2.2.4. Site profile (as per BC *Contaminated Sites Regulation 375/96*)

2.2.5. Environmental impact study

2.2.6. Climate impact study

2.2.7. Wildfire interface plan

2.2.8. Archaeological assessment

2.2.9. Heritage impact statement/conservation strategy

2.2.10. Tree preservation and fire management plan

2.2.11. Geotechnical study

2.2.12. Stormwater management plan

2.2.13. Sediment and erosion control plan

2.2.14. Planning rationale

2.2.15. Proposed neighbourhood layout plan

2.2.16. Urban design guidelines

2.2.17. Architectural control guidelines

2.2.18. Community service/facility study

2.2.19. Green development standards checklist (including climate change solutions and passive solar design)

2.2.20. Accessibility standards checklist

2.2.21. Traffic operations and transportation impact study

2.2.22. Noise impact study

2.2.23. Servicing report and drawings

a) Storm drainage

b) Domestic, irrigation and fire water systems

c) Sanitary sewer systems

d) Connectivity, highways and active transportation

e) Snow Removal

f) Landscaping and landscape irrigation water conservation solutions

g) Utilities (electricity, telephone, gas, cable, alternative energy solutions)

2.2.24. Earthworks plan

2.2.25. Construction implementation, review, inspection and enforcement plan

2.3. SURVEY INFORMATION

All boundary and topographical surveys shall be conducted in a safe manner so as not to create a nuisance to traffic or the public at large. The permission of the registered *Owner* is required before entering private property.

All elevations shall be from Geodetic Datum.

Originating benchmarks and integrated survey monuments shall be noted on all plans as well as those to be established in the work.

Copies of legible field notes shall be made available to the [*Name of Local Government*] upon request.

Centre lines (or offset lines) are to be marked and referenced in the field and all chainage shall be keyed to the legal posting.

All existing items such as manholes, catch basins, fire hydrants, poles, existing dwellings, fences, trees, hedges and unusual ground shall be noted as required.

Where applicable, cross sections will be required. The section shall include centreline, edge of pavement or gutter line, edge of shoulder, ditch invert, top of ditch, property line, and an existing ground elevation inside property line.

2.4. DRAWING SUBMISSION

All drawings shall be prepared in metric, on standard A1 sheets, in accordance with the requirements in this section and all other applicable requirements of this bylaw.

All drawings shall be signed and sealed by a Professional Engineer registered in British Columbia.

All drawings shall clearly identify the works in sufficient detail.

A complete set of engineering design drawings shall include:

2.4.1. The Cover Sheet shall note the *Consulting Professionals*' names, the *Applicant's* name, the [*Name of Local Government*] project number, if applicable, the legal description of the lands involved, a site plan at a 1:5000 scale, and an index.

The site plan shall note all proposed roads and the proposed *Subdivision* layout. The cover sheet may be utilized to show the larger drainage catchment area up and downstream of the proposed *Subdivision*.

2.4.2. The Key Plan shall be at a 1:500 scale and shall note all proposed services, including street lighting. If more than one sheet is required, note the westerly or southerly portion first and identify as Key Plan "A" with additional plans ("B" and "C", etc).

2.4.3. The Storm Water Management Plan shall be 1:500 scale and identified as per key plan system if more than one sheet is required.

2.4.4. Storm management facilities and sewers: plan and profile drawings shall show grades, inverts, manholes, catch basins, and other features. The scale shall be 1:500 for Plan and 1:50 for profile. Symbols to denote the service connection elevation at the property line shall be shown on the profile plan, as well as the minor and major system hydraulic grade lines. The full pipe shall be shown on the profile.

2.4.5. Water servicing: Plan and profile drawings shall show all grades, inverts, curves, radii, valves, hydrants, bends, and other features. The scale shall be 1:500 for plans and 1:50 for profile. The full pipe shall be shown for the watermain on the profile.

All cross over points with sewers shall be noted. Health risks should be noted and what mitigation is required where watermains are nearer than 3m horizontally or have less than 0.45m clearance vertically from any sanitary or storm sewer.

2.4.6. Sanitary Sewers

Plan and profile drawings shall show grades, inverts, manholes, and other features. The scale shall be 1:500 for plans and 1:50 for profile. Symbols to denote the service connection elevation at the property line shall be shown on the profile plan. The full pipe shall be shown on the profile.

2.4.7. Connectivity, Highways and Active Transportation: Plan and profile drawings shall show all driveways, alignments and grades. The scale shall be 1:500 for plans and 1:50 for profiles. Sidewalk, bike paths, trails and other low carbon impact infrastructure should also be shown on these drawings. Fire emergency evacuation routes should also be clearly marked.

2.4.8. Road cross-sections shall be scaled at 1:100 horizontal and 1:50 vertical and shall note the existing ground elevation, the proposed elevations of the road centreline, the curb and gutter (or road edge) and property lines. Cross-sections are required at 20.0m intervals. Additional sections may be required where excessive cuts or fills are involved.

2.4.9. Street lighting plans shall be a plan view (1:500) of the street lighting proposal designed, signed and sealed by a Professional Engineer. There shall be General Notes included on the Plan noting reference(s) to the [*Name of Local Government*] Standards and Specifications and the appropriate design criteria. Generally, street lights shall be located at all intersections and within 1 m of the property lines. Any street lighting plan(s) should be accompanied with the photometric calculations.

Some Local Governments' may wish to add in requirements regarding hydro-saving new lighting technologies (e.g. LED Lights).

2.4.10. A proposed construction earthworks and lot grading plan (1:500) must also be prepared. The plan must set out vegetation and soil retention specifics.

2.4.11. Construction details shall show a proposal for construction that are not covered or specifically detailed in the [*Name of Local Government*] and *MMCD* Standards and Specifications. Where there is a [*Name of Local Government*] Standard, it is expected to refer to the Drawing Number. It is not necessary to include or provide

drawings for work(s) for which there is a [*Name of Local Government*] Standard Drawing.

The *Consulting Professional's* seal and signature shall be noted on sheets of design submissions. Failure to do so will result in the Plans being returned without comment. The *Consulting Professional*'s seal and signature shall infer that the works as proposed are structurally sound, comply with the applicable design criteria of this bylaw, and good engineering practice.

2.4.12. Notwithstanding the previously detailed requirements, the following additional information is to be noted in design submissions:

a) The size, grade, inverts, and type of material on profile sections.

b) The locations, off-sets, curvatures, size and identification of the mains noted on the Plan sections.

c) The clearance between mains at cross-over points.

d) All existing structures, including houses, sheds, fences, wells, septic tanks and fields, shall be shown on the appropriate drawings(s), with a notation indicating their fate (i.e. to be removed, filled, etc.).

e) In rural *Subdivisions*, with an open ditch drainage system, note the size of (future) driveway culverts required to conform to the design.

2.4.13. The first complete design submission shall consist of:

a) Three complete sets of drawings.

b) Soils report (to verify road structure design).

c) Photometries (lighting calculations) for street lighting plans if specifically requested by the [*Name of Local Government*] Engineer.

d) All applicable utility calculations (water, sanitary, storm sewer).

e) Any other relevant plans and reports as per the list provided in Section 2.2 above.

2.4.14. Subsequent design submissions requiring changes to the previous submission shall consist of:

a) Three complete sets of drawings.

b) A complete construction cost estimate.

c) highlighted changes made by the *Consulting Professional* that are in addition to "Red Line" changes required by the [*Name of Local Government*].Items 'Red Lined" must be addressed by the *Consulting Professional*. Failure to do so will result in submissions being returned.

2.4.15. The final submission for [*Name of Local Government*] acceptance shall consist of:

a) Three complete sets of drawings.

b) Digital copies of design drawings in pdf and AutoCAD (latest version) format.

Climate change: A local authority may want to include a "Tree Retention and Restitution Plan" that will be discussed in Section 7, Landscaping, of this schedule. The reason for this requirement is to improve energy efficiency created by tree shading, as well as to help reduce the heat sink added to an urban environment by paved surfaces. It may also contribute to the health (heat stroke) of the residents during more frequent summer heat waves.

Tree Retention or Restitution Plan (District of North Vancouver)

General requirements are:

i) The plan will be at a 1:500 scale showing the methods to be used for the retention or protection of trees in the immediate and surrounding area of the proposed *Development*. This plan generally accompanies an Arborist's Report.

ii) The Retention or Restitution Plan visually depicts any proposed methods or special consideration required to prevent damage to any trees marked for retention.

iii) The plan shows location of proposed work, including property lines, existing and proposed structures, utilities and other relevant topographic features;

iv) Shows species, location and size of tree(s) involved;

v) Identifies all District trees on the associated boulevard, or within 5 metres of proposed work;

vi) Shows trees to be removed or retained and method of protection (e.g. fencing).

Tree Retention or Restitution Plans will be *Completed* in accordance with Master Requirement List (MRL) Form #ENV106 and #ENV108A, which are available for viewing at the District of Vancouver's website at www.dnv.org.

Climate change: The role of tree and landscape planting forms an important part of adaptation planning.

Landscaping, Street Tree and Boulevard Planting Plan (District of North Vancouver)

Will be a 1:500 plan of the proposed landscape, street tree and boulevard treatment designed, signed and sealed by a British Columbia registered Landscape Architect (BCSLA). The plan will show:

i) The location of the plant material with respect to curbs, sidewalks, underground utilities, overhead utilities, driveway locations, mailbox locations, sign posts, bus stops, traffic signals and street lights;

ii) Planting detail as per District standard drawings and cross sections pertaining to street tree and boulevard plantings, and consistent with the Street and Traffic Bylaw No. 7125

District of North Vancouver.

iii) Plant list showing botanical name, common name, quantity and size of proposed plant material;

iv) Depth of native or imported topsoil should be indicated on the plans. Layers of soil and drainage material should be indicated to show groundwater infiltration and shallow soilwater storage strategies (see Section 3.8.3b for specifications);

v) Surface treatment of proposed boulevard strip;

vi) Notation on drawing that "Final location and species selection will be to the satisfaction of the District";

vii) All plans to include a written specification following the format of the BCSLA and BCLNA Landscape Standards;

viii) Note on the drawing that all work is to be *Completed* in accordance with the BCSLA and the BCLNA Landscape Standards;

ix) Plans to be submitted with detailed cost estimates for soft and hard landscape works. Separate cost estimates are required for on-site and off-site landscape works, and should include an itemized estimate for all materials, including quantity, size and price of plant material; a factor of 100% of supply for installation, a 10% contingency allowance, and all taxes.

x) Standard notes as required by the District: The submission is to include the "Assurance of Professional Design and Commitment for Field Review" form (BCSLA Schedule L-1), the "Summary of Design and Field Review Requirements" form (BCSLA Schedule L-2), and the "Assurance of Professional Field Review and Compliance" form (BCSLA Schedule L-3).

Climate change: Similarly, a local authority may want to include specifications for a sediment and erosion control plan:

Sediment and Erosion Control Plan (District of North Vancouver)

General requirements for Sediment and Erosion Control Plan are:

i) The plan will be at a scale of 1:500 showing the methods in which exposed or stockpiled soil, surface water and groundwater will be managed during a project that involves land disturbance or excavation;

ii) The plan will show the location, *Parcel* dimensions, legal description, street name and address of the project;

iii) Shows soil stockpile area, excavation area and proposed methods for stabilizing the soil;

iv) Illustrates any required sediment traps or filter mechanisms;

v) Shows perimeter ditching, silt fencing, hay bales or other methods used to intercept and control runoff.

2.5. CONSTRUCTION ESTIMATE CALCULATION

The construction estimate shall be broken down in a format as defined in *MMCD*. At the end of construction and before registration of the *Subdivision*, these construction numbers are used by the [*Name of Local Government*] to calculate the inspection fees and parkland dedication fees that must be levied.

Note: Hydro and telephone cost estimates are required and the *Estimated Costs* are to be included in the *Security* required under the *Servicing Agreement*. These items and costs will be reviewed and amended where or if necessary.

2.6. SERVICE CONNECTION CARDS

The *Consulting Professional* will provide service connection cards for each *Development* where available. These cards are to indicate clearly and accurately the location, depth, size, and material of construction of each [*Name of Local Government*] utility connection. The [*Name of Local Government*] project number shall be required on all cards. Service Connection Cards are considered part of the *As-Built Drawings*.

2.7. CONSTRUCTION INSPECTION REPORTS AND OTHER REQUIREMENTS

The [*Name of Local Government*] has construction inspection procedures for critical off site public infrastructure that is being tapped into or newly constructed. These checklists and forms may be obtained from [*Name of Local Government*] staff. All other construction inspection reports for onsite work shall be signed off by the *Consulting Professional* and provided to the [*Name of Local Government*] before finalizing the *Subdivision* approvals.

2.8. AS-BUILT SUBMISSIONS

The following procedures shall be followed in the submission of *As-Built Drawings* for [*Name of Local Government*] acceptance.

2.8.1. The *Consulting Professional* shall submit two complete sets of paper prints, including hydro, telephone and cable as-built, except for the road cross-section sheet(s), and a complete set of Service Connection Cards for [*Name of Local Government*] review.

2.8.2. One marked-up set of the as-built paper prints will be returned to the *Consulting Professional* for revision. If there are minor changes, the *Approving Officer*, *Municipal Engineer* or *Chief Building Official* may request that the prints with the revisions noted, be submitted for [*Name of Local Government*] acceptance. If there are numerous amendments, it is likely that the *Consulting Professional* will be requested to submit two sets of revised paper prints for a second review.

2.8.3. When the [*Name of Local Government*] is satisfied with the *As-Built Drawings*, the *Consulting Professional* will be requested to submit the following:

a) A digital copy of the CAD files containing the *As-Built Drawings*.

b) Digital pdf files containing *As-Built Drawings* signed and sealed by the Professional Engineer.

c) Two sets of paper prints with the following certification: The signature and seal by the Professional Engineer who supervised the required inspections.

2.8.4. One set of the paper prints will be returned to the *Consulting Professional* upon acceptance by the [*Name of Local Government*].

SECTION 3

STORM DRAINAGE SYSTEMS

3.0 STORM DRAINAGE SYSTEMS

3.1. GENERAL

The purpose of the drainage design criteria is to standardize the procedures for designing common drainage facilities in the [*Name of Local Government*]. All drainage works will be designed with considerations for public safety, regulatory requirements, and the natural environment. *Consulting Professionals* will consult with the (e.g. Environment, Parks and Engineering Department, [*Name of Local Government*]) to determine what existing information may be of assistance to them.

The presence of an existing municipal drainage system does not mean, or imply, that the system has adequate capacity to receive the proposed design flows, nor does it indicate that the existing system pattern is acceptable to the [*Name of Local Government*]. Existing facilities that are undersized or inadequate to accept additional drainage must be upgraded at the *Owner's* expense to accommodate the appropriate flows. Alternative drainage proposals may be considered.

3.2. OBJECTIVES

Three goals define the [*Name of Local Government*] objectives for stormwater management:

Goal #1 – Preserve and improve the environment and natural resources for present and future generations by:

- Minimizing the potential stormwater impacts of *Development*, such as increased or decreased streamflows, changes in groundwater regime, alteration of fish and wildlife habitat, increased pollution, and increased erosion and sediment transport.
- Where feasible, maintaining the shape and composition (geomorphology) of the natural stream channels or ravine geometry, natural biological indicator conditions and the flow conditions (hydrogeometric regime).
- Employing stream protection measures to prevent adverse hydrological and water quality impacts, for all recognized watercourses within the [*Name of Local Government*].
- Infiltrating rainwater to maintain and enhance the hydrological regime.
- Promoting sound *Development* that respects the natural environment.
- Where feasible and where opportunities allow, restoring watercourses that are currently enclosed, to open channels.

Goal #2 – Reduce the risk of health hazards, loss of life and property damage by:

- Providing both major and minor drainage protection for life, livelihood and property.

- Controlling the incidence of nuisance or damage related to surface ponding and flooding to within an acceptable frequency.
- Requiring infrastructure that will respond to climate change through adaptation.
- Protecting municipal infrastructure.

Goal #3 – Conserve social and financial resources by:

- Treating stormwater as a resource rather than a waste product, ensuring that stormwater facilities are functional and aesthetically pleasing, and integrating multi-use objectives where possible.
- Providing a system of infrastructure and services that enhances general public convenience and safety, enhances aesthetics, and allows *Development* to proceed according to the community plan.
- Sustaining future *Development*, supporting orderly and managed *Development* of resources and integration of land uses within the [*Name of Local Government*].
- Using best available technologies and management practices where feasible.
- Encouraging economic design of drainage systems. In other words, new drainage systems, as well as upgrades to existing systems, should be designed and built to ensure longevity and resilience to climate change and other impacts. This with the ultimate view of minimizing future operation and maintenance costs, and extending the lifespan of this infrastructure, so future tax burden on residents of [*Name of Local Government*] are minimized.
- Providing consistency and a basis of fairness for balanced and planned *Development* within the community.

3.3. DEFINITIONS (Preliminary list)

In a given storm drainage system:

3.1.1	Antecedent Moisture	is a term used in drainage modeling or hydrologic calculations where moisture from previous rainfalls may be accounted for in runoff calculations.
3.1.2	Design Frequency	is the average elapsed time between the occurrence of two events (storms, floods, etc.) equal to or exceeding a specified value (intensity, low, etc.).
3.1.3	Discharge	is the rate of flow of water flowing in a stream, usually expressed in cubic metres per second.
3.1.4	Drainage Basin	(1) is an area surrounded by a continuous height of land within which all runoff is expected to join into a single flow stream, and which extends to the point of junction of the flow stream with some predefined point of discharge at the lowest height of land in the

		drainage catchment area; or, (2) is the area served by a drainage system receiving storm and surface water, or by a watercourse.
3.1.5	Ecosystem	is any complex of living organisms together with all the other biotic and abiotic (non-living) factors that affect them. For example, a forest ecosystem is that part of a forest area that is uniform in climate, parent materials, physiography, vegetation, soils, animals and micro-organisms.
3.1.6	Floodplain	is the relatively flat or lowland area adjoining a river, stream, watercourse, ocean, lake or other body of standing water that has been or may be covered temporarily with floodwater. For administrative purposes, the floodplain may be defined as the area that would be inundated by the 1 in 200 year storm event.
3.1.7	Flood Proofing	is a combination of structural changes and adjustments to properties subject to flooding primarily for the reduction of flood damages.
3.1.8	Flood Construction Level (FCL)	is defined as the minimum elevation for main habitable floor areas in proposed buildings that are subject to flood hazards. The FCL applies to the underside of building wood floor systems or the top of concrete floor systems.
3.1.9	Hydrograph	is a graph showing the discharge of water with respect to time for a given point on a stream or conduit.
3.1.10	Hydrology	is the science of engineering that deals with the aspects of rainfall and the nature of its subsequent collection and discharge.
3.1.11	Hyetograph	is a graph showing rainfall, rainfall intensities or volume over specified areas with respect to time.
3.1.12	Impervious	is a term applied to a material through which water cannot pass, or through which water passes very slowly.
3.1.13	Imperviousness Coefficient	is the ratio of impervious surfaces to total surface area within a watershed or drainage area.
3.1.14	Infiltration	is (1) the entering of water through the interstices or pores of a soil or other porous medium; (2) the entrance of water from the ground into a

		sewer or drain through porous walls, breaks, or defective joints; or (3) the absorption of water by the soil either as it falls as precipitation, or from a stream flowing over the surface.
3.1.15	Integrated Stormwater Management Planning	is the process of setting goals, objectives, strategies and policies in a cooperative framework among all watershed resources and resource uses.
3.1.16	Intensity	is the rate at which precipitation falls in a given period, usually expressed in millimetres per hour or inches per hour.
3.1.17	Intermittent Stream	is a stream with a defined channel, but which is dry for periods of the year, usually the late summer and fall period of low precipitation and no snow melt.
3.1.18	Lag Time	is the time between two occurrences, such as between rainfall and runoff.
3.1.19	Major Drainage System	is the storm drainage system that carries the runoff from the major design storm, generally a 1 in 100 year event. It usually includes many features such as roads, ditches and overland flow paths.
3.1.20	Minor Drainage System	is the storm drainage system that is frequently used for collecting, transporting and disposing of minor flows, and storm runoff up to the capacity of the system; generally a 1 in 10 year event. The minor system may include many features ranging from storm sewer pipes, curbs and gutters, ditches and other open drainage ways.
3.1.21	New *Development*	refers to proposed *Development* in areas that are currently undeveloped.
3.1.22	Overland Flow	refers to the flow of water over the ground surface before it flows to channels, swales and ditches.
3.1.23	Pervious	applies to a material through which water passes relatively freely.
3.1.24	Planning	is the process of determining the goals and objectives of an enterprise, and the selection, through systematic consideration of alternatives, of the policies, programs and procedures for achieving them.
3.1.25	Precipitation	is any moisture that falls from the atmosphere, including snow, sleet, rain and hail.
3.1.26	Rainfall Mass Curve	is a plot of accumulated precipitation against time

		from the beginning of the storm.
3.1.27	Re-*Development*	refers to proposed *Development* in areas that have existing *Development* and *Works and Services* and are being redeveloped or changed to a new or higher density form of *Development*.
3.1.28	Runoff	is that part of the precipitation which results in surface flow and in turn reaches a stream, drain, sewer, etc., directly or indirectly.
3.1.29	Source Controls	refer to stormwater techniques and/or facilities for retaining and treating stormwater at its source to best preserve or mimic the natural hydrologic cycle for typically occurring storm events.
3.1.30	Storage, Detention, Retention	with respect to runoff analysis, is that water that is detained in a facility during a storm and is released at controlled rates.
3.1.31	Storm Drainage System	refers to all facilities used for conveying stormwater through and from a drainage area to a point of final outlet, consisting of any or all of the following: conduits and appurtenant features, canals, channels, ditches, streams, ravines, gullies, flumes, culverts and roads.
3.1.32	Stream	is a natural watercourse or source of water supply, whether usually containing water or not, and a lake, river, creek, spring, ravine, swamp and gulch.
3.1.33	Surcharge	is the flow condition occurring in closed conduits when the hydraulic grade line is above the conduit crown, or the transition from open channel to pressure flow.
3.1.34	Synthetic Unit Hydrograph	is a unit hydrograph developed for an ungauged drainage area, based on known physical characteristics of the basin.
3.1.35	Time of Concentration	is the time required for storm runoff to flow from the most remote point of a watershed or drainage area to the outlet or point under consideration. It is not a constant, but varies with depth of flow, grades, length and condition of conduit and/or channel.
3.1.36	Topography	is a general term that means the characteristics of the ground surface such as plains, hills and mountains, degree of relief, steepness of slopes, and other physiographic features.
3.1.37	Trash Rack	is a barrier constructed to catch debris and exclude it

		from a downstream conduit in a stream. An improperly maintained trash rack may render a conduit useless.
3.1.38	Unit Hydrograph	is a runoff hydrograph resulting from one inch (25.4mm) of excess rainfall applied to a given watershed over some specified time interval.
3.1.39	Watershed	See Drainage

3.4. DETERMINING STORMWATER RUNOFF UP AND DOWNSTREAM OF PROPOSED *SUBDIVISION*

3.4.1. General Approach

The design catchment area shall include the entire area tributary to the storm drainage system. The catchment area should be shown on the Catchment Area and Storm Drainage Plan and shall be in accordance with District or City-wide Master Stormwater Management Plans developed by the [*Name of Local Government*]. Detailed boundaries shall be established by the *Consulting Professional* in so far as they affect the proposed *Subdivision*.

3.4.2. Stormwater Runoff Generation (Hydrology)

This section describes the rationale, methodology and parameters for determining the hydrologic variables such as rate and amount of stormwater runoff above, through and downstream of the proposed *Development*.

a) The capacity of storm drainage systems through the *Developments* will be designed to accommodate post-*Development* flows above and in the *Development*. All calculations pertinent to the design of the drainage system will be signed and sealed by the Consulting Engineer and submitted to the [*Name of Local Government*].

   For *Developments* where the total tributary area is 10 hectares or less, the Rational Method will be used to compute the peak runoffs.

   For *Developments* where the total tributary area is greater than 10 hectares, the Runoff Hydrograph Method will be used to compute the peak runoff. The Runoff Hydrograph Method will also be used for the design of storage facilities with tributary areas greater than 10 hectares.

b) In all cases the *Consulting Professional* (in determining the critical design conditions) is to consider the impact of snowmelt on the drainage system.

c) Rational Method

   This method calculates the peak flow using the equation Q_T =RAIN

   Where Q_T = Flow in cubic m per second, for a return period T

   R = Runoff coefficient (see Table 3.1)

   A = Drainage area in hectares

I_T = Average rainfall intensity in mm/hr for the return period T, during that period of time equal to T_C (see IDF curves on Figure 3.1)

N = 0.00278

i) Runoff coefficients

Table 3.1 – Runoff Coefficients

Description of Area	% impervious	5/10-year coefficient	100-year coefficient
Commercial	90	0.80	0.85
Industrial	90	0.80	0.85
Suburban Residential (lots>0.4 ha)	20	0.35	0.40
Low Density Residential	40	0.50	0.55
Medium Density Residential	65	0.60	0.65
High Density Residential	78	0.70	0.75
Woodlands	5	0.10	0.30
Parks, Playgrounds, Cemeteries	20	0.25	0.30
Agricultural Land	30	0.30	0.40
Institution, School, Church	80	0.75	0.80

Note:

- The above table assumes conventional site drainage of directing all surface drainage overland into streets and catch basins. The runoff coefficients account for antecedent wet conditions.
- In the case of mixed land use, a composite runoff coefficient is to be determined.
- The *Consulting Professional* is to verify the above values meet site specific conditions and if higher values are required.

ii) Drainage (or catchment) area

The extent of the tributary drainage areas for the storm drainage system being evaluated shall be determined using the natural and/or the proposed contours of the land taking into account future land use in accordance with the OCP.

It is stressed that it is the *Consulting Professional's* responsibility to confirm the extent of the drainage areas with the *Municipal Engineer* prior to final design, and to incorporate the previously determined storm planning flows into the overall system.

Figure 3.1: Short Duration Intensity-Duration-Frequency Data: [*Name of Local Government*]

iii) Time of Concentration (Tc)

In *Developments* where substantial undeveloped areas remain, the contributing drainage area flows and corresponding Time of Concentration should be checked by trial and error to determine the maximum peak outflow rate. It is the cumulative sum of all flow times: overland, channel (swale or stream); and/or storm drain.

- Overland Flow Time:

  Several equations for overland flow time may be used such as; the kinematic wave equation, the airport method, etc. It may be appropriate in fully developed basins as determined by the *Consulting Professional*, to use the minimum inlet times in the following table:

Development Type	Minimum (minutes)	Maximum (minutes)
Single Family	10	15
Multi-family	8	15
Commercial/Industrial	5	10

  The minimum inlet times reflect roof leaders and parking lot drainage (hard surface) being discharged directly into a piped storm system. The maximum inlet times reflect roof leaders and parking lot drainage being discharged onto ground (grass, gravel, swales) and accounting for travel distances and other variables. It is the *Consulting Professional's* responsibility to verify that the above values are appropriate and provide recommendations to the City Engineer for approval where variations are appropriate.

- Channel Flow Time:

  When the channel characteristics and geometry are known, the preferred method of estimating channel flow time is to divide the channel length by the channel velocity obtained by using the Manning equation, assuming bank full conditions.

- Storm Drain Flow Time:

  When it is appropriate to separate flow time calculations, such as for urban storm drains, Manning's equation may be used to obtain flow velocities within pipes.

iv) Rainfall data

Data from the [*name of nearby Airport*] or other approved rainfall gauges will be used in evaluating and designing drainage infrastructure in the [*Name of Local Government*]. This data is compiled in the rainfall Intensity Duration Frequency (IDF) curves for 5 minutes to 24-hour durations contained in Figure 3.1.

Other data that may become available is to be used or considered by the *Consulting Professional.*

v) Presentation of Rational Method Computations

The *Consulting Professional* shall tabulate the design calculations based on Manning's formula using a tabular format for submission with the Stormwater Management Plan.

d) Runoff Hydrograph Method

For basins larger than 10 hectares, hydrologic programs will be used for runoff analyses. The Consulting Engineer will obtain acceptance from the [*Name of Local Government*] on the selection of the proposed computer program. In view of very limited site specific calibration data available, the selection and proper application of appropriate computer programs should include a comprehensive review of the program's historical usage/application in other similar urban/urbanizing watersheds. This is primarily the responsibility of the Consulting Engineer. It is necessary to use computer models that have the capability to adequately represent the hydrologic characteristics of the watershed.

3.5. STORMWATER MANAGEMENT PLAN

3.5.1. Introduction

Stormwater management is the planning, analysis and control of storm runoff. Stormwater management involves the planning and design necessary to mitigate the hydrological impacts of land development or land use changes. Adverse hydrological impacts include increased peak storm flows and frequency of flows, erosion, sedimentation, flooding, reduced surface infiltration, reduced minimum groundwater levels and reduced stream base flows, water quality deterioration and degradation of aquatic and wildlife habitats.

The [*Name of Local Government*] is committed to the application of the latest drainage and engineering practices to maintain or improve biodiversity in watercourses, to create adaptable stormwater infrastructure, and to meet objectives of overall improvement to watershed health.

The design of storm drainage systems will incorporate:

- *Development* site and individual lot grading planning
- Source controls such as infiltration facilities, rain gardens, swales, absorbent landscapes and green roofs
- Subsurface disposal
- Detention storage (including roof storage)
- Erosion control and sediment removal
- Flood routing through minor and major drainage systems
- Other acceptable methods to mitigate the runoff impacts due to changes in land use and the severity of storm events

Consulting Professionals will consult with the [*Name of Local Government*]'s (Environment, Parks and Engineering Department) to determine what existing [*Name of Local Government*]'s stormwater master planning and record information may be of assistance to them in order to properly complete the drainage system design.

3.5.2. General Approach

A Stormwater Management Plan (SMP), which is required as part of the *Subdivision* application, describes in detail how the proposed *Development* will impact the existing drainage system and how the proposed major and minor drainage infrastructure meets the [*Name of Local Government*]'s drainage policies, masterplanning and design criteria.

The SMP must be provided for all *Developments* that alter the existing drainage characteristics.

A SMP of the proposed *Subdivision* or *Development* must be developed in two phases at the expense of the *Owner*. The Stormwater Management Plan must be developed or overseen by a Professional Engineer who is registered in the Province of British Columbia and is experienced in hydrologic analysis. The SMP should be conservative in calculation, coupled with sound engineering judgment. The economic aspects of the design must not be overlooked. Low maintenance and operational simplicity are preferred. Criteria and proposed solutions will be reviewed by the [*Name of Local Government*].

The *Owner's* Consulting Engineer will provide the [*Name of Local Government*] with the technical information, and the [*Name of Local Government*] may at its discretion undertake the hydrologic analyses by computer model to verify the suitability of the *Consulting Professional's* design.

It is also the *Consulting Professional's* responsibility to confirm the extent of the drainage catchments, and the required level of SMP detail, with the *Municipal Engineer* prior to design work commencing.

3.5.3. Minor and Major Drainage Systems

The minor drainage system comprises storm sewers, swales, channels and flow control facilities designed to collect and carry runoff from frequent storm events.

Flow control facilities include detention/retention ponds, exfiltration trenches, dry wells, and other acceptable methods suitable for reducing the rate of runoff into the downstream drainage system. In most *Subdivisions*, with the exception of sensitive hillsides and areas were aquifers can be contaminated, infiltration should be the preferred initial stormwater treatment in new *Subdivisions*.

The minor drainage system will be designed to prevent flooding and property damage and minimize public inconvenience caused by the frequent storm events up to the 10-year return period event. The runoff from the minor storm is referred to as the minor flow.

The major drainage system comprises surface flood paths, drainage outlets (i.e. designated storm sewers that convey the major flow), ditches, roadways, watercourses and flow control facilities designed to accommodate the runoff from rare and intense storms.

The major drainage system will be designed to protect the public and prevent significant property damage due to flooding caused by the rare storm events with the 100-year return period event.

The calculation of peak design flows used for the design of the major and minor drainage system will represent the unobstructed flow from the upstream hydrology and will not include attenuated flow from undersized culverts/bridges, retention ponds or similar facilities.

Roadways, overland flow paths, channels and watercourses will be designed to ensure that the maximum hydraulic grade line is below the lowest existing or proposed flood construction level (FCL) of adjacent buildings. Surcharging at the inlet under the major flow is acceptable provided the headwater profile does not rise above the proposed flood construction levels. Adequate erosion protection will be required where surcharging is proposed.

In the event that surface flow is not feasible or that the inlet facility is likely to be blocked or restricted, consideration will be given to sizing the storm sewer system to accommodate the major flow (i.e. creation of a drainage outlet).

3.5.4. The *Consulting Professional* will ensure that all downstream drainage infrastructure for a distance of 1.5 km (or to a distance where the contribution is insignificant) are capable of handling the projected increase in runoff created by the proposed new *Development* or redevelopment.

Some Local Governments may wish to only specify Performance Standards and refer the *Consulting Professional* to BC and other Stormwater Management Guidelines. The District of Elkford has proposed the following provision in its draft SDS Bylaw. Some additions have been made from other bylaws.

3.6 STORMWATER MANAGEMENT SYSTEMS: PERFORMANCE STANDARDS

3.6.1. General Approach - Performance Standards adopted by the [*Name of Local Government*] may be utilized as a starting point by qualified storm drainage professionals to determine the methods to develop the stormwater systems for the proposed *Development*, subject to the written approval of the [*Name of Local Government*].

3.6.2. Performance Standards:

a) No discharge from impervious surface areas for storm events with rainfall depths up to one half the 24-hour Mean Annual Rainfall (MAR).

b) Post-development runoff for the 2-year recurrence 24-hour storm shall be 50% of the pre-development runoff and the post-development runoff of the 5-year recurrence 24-hour storm shall not exceed the pre-development runoff.

c) For storm events exceed the 5-year recurrence, safe conveyance of runoff.

d) Proposals for Stormwater Management Systems using the Performance Approach shall be in report form, sealed by the responsible professional, and shall include information on the following to the satisfaction of the [*Name of Local Government*]:

i. Consideration of impact on the total watershed and recommendations in the [*Name of Local Government*]'s Master Stormwater Management Plan, Official Community Plan (OCP), or Neighbourhood Plan (NP) if applicable.

ii. Tributary areas to the *Development* including existing and ultimate land use in accordance with the OCP.

iii. The *Development* area within the drainage catchment including all features such as roads, natural watercourses, watercourse crossing structures, and low or poorly drained areas.

iv. Contour plan with 1.0 m elevation interval. Five metre contours may be considered for areas of steep terrain outside the developing lands to depict general drainage patterns. All contours must be labeled and easily discernible.

v. Existing watercourses including environmental classifications and/ or fish presence information.

vi. Continuous-flow modeling using currently accepted hydrologic and

hydraulic modeling software and practices. Selection of computer programs requires review of the historical application of each program in watersheds similar to those under consideration. [*Name of Local Government*] approval of computer program selection should be obtained before design is commenced.

vii. Layouts of existing and proposed drainage systems.

viii. Major and minor conveyance capacity.

ix. Impervious or runoff coefficient values for each catchment area based on future OCP land use.

x. Hydrologic calculations summarized in table form and supporting parameters to a point downstream of the discharge into an existing trunk storm sewer or as identified in the *Subdivision* Preliminary Letter of Approval or by the [*Name of Local Government*] Engineer.

xi. 1:100 year flow routing internal and external to the *Development.*

xii. Conceptual lot grading patterns.

xiii. Design of proposed infiltration facilities, if appropriate, including location, sizing, detail cross sections and typical profiles. Results of on-site infiltration testing of soils at the elevation of the proposed infiltration.

xiv. Locations, sizes and hydraulic grade line (HGL) elevations of proposed detention facilities, if appropriate.

xv. Other proposed mitigation measures, if appropriate.

xvi. Proposed Minimum Building Elevations (MBE) and 100 year HGL of major flowpath (100 year storm).

xvii. Pre and post-development flows, with and without the impact mitigation measures.

xviii. Current and future upstream and downstream flows and system capacities.

xix. Plan for erosion and sediment control during all phases of construction.

xx. Plan for monitoring of performance by qualified professionals during construction and maintenance periods.

xxi. Plan for maintenance during the maintenance period.

xxii. Plan for maintenance of oil/water separators.

e) The proposed system shall be "equivalent" or better to the Prescriptive Standards.

3.6.3. Required Professional Qualifications for *Applicants* using the Performance Standards approach for Stormwater Management System Design:

a) Professional Engineer with a minimum of 5 years' experience in Stormwater Management Engineering.

b) Landscape Architect (BCSLA) with experience in Stormwater Management landscapes for soil / planting / irrigation design.

c) Professional Engineer with experience in Soil Hydraulics and/or Hydrogeology for soil infiltration capacity assessments.

3.7. STORMWATER VOLUME ANALYSIS

Stormwater management systems such as source controls for rainfall capture and detention facilities for runoff rate control will be designed using the following methodologies:

3.7.1. The *Consulting Professional* shall provide the [*Name of Local Government*] with a written report as to how source controls such as rain gardens, absorbent landscapes, swales, infiltration facilities and green roofs were designed and sized.

3.7.2. Detention facilities will be designed to retain the greater volume between the 2-year and 10-year requirements, whichever governs. The 10-year volume is defined as the volume required to control the 10-year post development flow to a maximum rate to be accommodated in the existing downstream minor drainage system. The 2-year volume is defined differently for each *Development* or redevelopment as outlined under each subheading. Volume calculations and release rates are outlined in subsection 3.8.

- **For New *Development*:**

  In order to meet the stormwater capture criteria for new *Development* source controls, the runoff volume targets and drainflow output should not exceed 10% of the overall runoff.

  The 2-year volume is defined as the volume required to control 2-year, 24 hour post development flows to predevelopment levels or 3.5 litres per second per hectare (l/s/ha), whichever is less.

- **For Redevelopment with Existing *Development* <50% Imperviousness:**

  In order to meet the stormwater criteria for redevelopment (less than 50% imperviousness) source controls, the runoff volume target and drainflow output should not exceed existing conditions output.

  The 2-year volume is defined as the volume required to control 2-year, 24-hour post development flows to existing condition levels.

- **For Redevelopment with Existing *Development* >50% Imperviousness:**

In order to meet the stormwater criteria for redevelopment (greater than 50% imperviousness) source controls, the post development runoff volume target and drainflow output should not exceed 50% of the overall runoff.

The 2-year volume is defined as the volume required to control 2-year, 24-hour post development flows to 50% imperviousness condition levels.

3.8. STORMWATER MANAGEMENT FACILITIES

To meet the stormwater management principles outlined above, the following methodology will be applied:

- Maintain natural features such as riparian corridors, streams, ponds, wetlands, surface depressions, soils and vegetation that are integral to the hydrologic cycle.
- Artificially capture rainfall on-site and infiltrate, evaporate, transpire, or reuse it. Implement low impact development standards and source controls (rain gardens, absorbent landscaping, infiltration facilities, dry wells, infiltration trenches, swales, porous pavements, green roofs, rainwater reuse, etc).
- Detain runoff and release at rates that approximate natural watershed conditions. Implement stormwater management facilities (i.e. storage facilities, detention ponds or tanks or diversions). Divert excess flows only (flows above 3.5 litres/second/hectare) directly to a large water body, if feasible. Base flows and natural forested watershed flows (3.5 l/s/ha) to the creek system will be maintained.

  The Consulting Engineer should consult with the [*Name of Local Government*] to determine appropriateness of the proposed storm water management measure.

  For new *Development* and redevelopment areas that do not drain to a creek or river system but discharge directly to a large water body, storm water management facilities may not be required for hydrological control, but may be required for water quality treatment.

3.8.1. Upstream detention and routing through or around *Development*

As part of the SMP, the *Consulting Professional* will provide the rationale as to whether or not upstream stormwater detention and or treatment should be adopted. In some cases upstream *Development* may have additional capacity in dry detentions ponds.

Similarly, the rationale for routing flows through the site utilizing natural or man-made surface corridors must be presented as part of the drainage design philosophy adopted for the proposed *Development*.

3.8.2. Lot Grading Plan

A comprehensive lot grading plan prepared by the *Consulting Professional* is required. This requirement may be waived by the *Municipal Engineer* if fewer than three new lots are created and there is no apparent impact on adjacent properties.

The first principle is to retain as many natural storm drainage features as possible.

Regardless of the size of *Development* the *Municipal Engineer* may require a report or grading plan prepared by the *Consulting Professional* analyzing the existing *Development* and impact on adjacent properties. This plan must illustrate a strategy that addresses both the compatibility of the grading on all lots within the *Development* area and the impact of these strategies on the existing adjacent *Development* area.

Items to be addressed are:

a) Pre- and post-development contours.

b) Identification of cut and fill areas. Areas of greater than 1 m of fill are to be identified and the Geotechnical Engineer is to provide comments on these areas pertaining to suitability for building construction.

c) Building envelopes within the proposed lots.

d) Grade elevations at property corners and any other change in grade.

e) A typical grading detail identifying general conditions and any special conditions for construction.

f) Minimum and maximum main floor elevations for buildings.

g) Directional arrows showing proposed drainage flow routes on each lot. Cumulative drainage of two or more properties is to be avoided and where necessary the *Consulting Professional* is to provide the rationale for this condition as well as propose a means of directing the flows to prevent impact on adjacent lots. This condition may require installation of special *Works and Services* by the *Applicant* and encumbrances registered on the lands.

h) The *Consulting Professional* will document any low impact development and source control solutions proposed.

i) Existing drainage patterns adjacent to the site.

j) Legend identifying all notations.

k) Lot numbering as per the final registered plan.

Confirmation of final elevations will be required prior to acceptance of *Works and Services*. The final grading plan submitted to provide guidance for the *Development* of buildings on the lots may omit pre-development contours and cut/fill notations. Covenants may be registered on lots to ensure compliance with the approved plan.

3.8.3. Stormwater source control

a) Stormwater source control shall be incorporated into *Subdivision* and lot *Development* to meet the requirements of stormwater management plans developed by the [*Name of Local Government*] or *Developer* (in the absence of a [*Name of Local Government*] Plan) for various watershed areas, and the requirements below.

b) Selection of stormwater source controls shall be made with regard to the topography, water table, soil or rock infiltration capacity, and downstream slope stability hazards. Stormwater source control use and sizing shall be customized by the *Consulting Professional* for each *Development*, subject to the following general guidelines and the approval of the [*Name of Local Government*]:

i. As a guideline all unpaved landscape areas shall have the following criteria (the Landscape *Consulting Professional* may motivate differently based on vegetation species. The final decision regarding these values will remain with [*Name of Local Government*]).

1. organic matter content of 15% dry weight in planting beds and 8% in turf areas;
2. depth of 300 mm for turf;
3. depth of 450 mm for shrubs/trees;
4. depth of 300 mm around and below the root ball of all trees;
5. pH from 6.0 to 8.0 or matching that of the original undisturbed soil;
6. subsoils scarified to a depth of minimum 100 mm with some topsoil being incorporated into the subsoil;
7. planting beds mulched with a minimum of 50 mm of organic material. The surface shall be vegetated or re-vegetated. Immediately before seeding or planting, the surface shall be cultivated to remove surface crusting, and compacted areas that do not exhibit free drainage shall be scarified; and
8. landscape irrigation requirements as described in Section 7.

ii. Narrow paved areas, such as streets, driveways or walkways, shall be sloped to drain onto adjacent unpaved landscape areas designed as infiltration facilities in accordance with the guidelines below, to encourage runoff from these areas to infiltrate into the soil.

iii. Maximum ponding depth of infiltration areas shall be 150mm. All infiltration areas shall drain away from buildings, and shall have a provision for draining within 48 hours to the 5 year return period drainage system, and shall have an overflow to the 100 return period year flow path.

iv. The surface of unpaved landscape areas shall be designed for positive drainage away from pavements and buildings. Slopes of 1% to 3% are desirable to encourage infiltration of small rainfalls while facilitating drainage of large storms.

v. Infiltration-based stormwater source controls shall not be used in the following conditions:

- Areas within 30m of a slope that is steeper than 3 (horizontal) to 1 (vertical) and higher than 6m, or other unstable slopes.
- Areas where the post-development wet season groundwater table is less than 0.6m below the base of infiltration trenches.
- Areas where existing dwellings do not have foundation drains.

vi. In all *Developments* other than those listed in Section 3.8.3b(v), infiltration-based stormwater source controls with an overflow to the [*Name of Local Government*] storm drain system are required, except when a Professional Engineer with experience in geotechnical engineering identifies conditions that would preclude the use of infiltration practices, with written recommendations to the approval of the [*Name of Local Government*]. Required practices are:

- Infiltration Swales and/or Rain Gardens with reservoir and underdrain shall be installed where appropriate and with [*Name of Local Government*] approval.
- Whereas the reservoir and underdrain are generally required, the underdrain and/or reservoir may be deleted in cases where a report by a professional engineer with experience in geotechnical engineering provides on-site infiltration test results that indicate that subsurface infiltration rates are adequate to allow absorption of one half the Mean Annual Rainfall (MAR) within the drainage area of the stormwater source control. In such cases the geotechnical engineering report shall recommend the appropriate detail.
- All utility crossings of infiltration-based stormwater source controls shall have trench dam installed as necessary to stop infiltration water from flowing down the utility trench to downstream basements or crawl spaces.

vii. Permeable pavers shall be allowed with the [*Name of Local Government*]'s approval in appropriate areas.

The following extract from the District of Elkford's draft SDS Bylaw may also be utilized.

A. Infiltration Swales shall meet the following design guidelines:

a) The swale infiltration area should be approximately 10-20% of the upstream impervious area that it serves, with its sizing preferably calculated by continuous flow modeling.

b) Flow to the swale should be distributed sheet flow, travelling through a grassy filter area at the swale verges (500 mm min., >3000 mm desirable). Provide pretreatment erosion control to avoid sedimentation in the swale. Provide non-erodible material, sediment cleanout basins, and weir flow spreaders at point source inlets.

c) Provide vegetated erosion control along all sides of weir and at drainage inlets.

d) Pavement edge at the swale may be wheel stop, flush curb, drop curb or side inlet curb.

Provide a 25mm drop at the edge of paving to the swale soil surface, to allow for positive drainage and buildup of road sanding/organic materials at this edge. Ensure positive drainage from curb into the swale invert.

e) Swale planting is typically sodded lawn. Low volume swales can be finished with a combination of grasses, shrub, groundcover and tree planting to provide a 100% vegetated cover within 2 years of planting. Meet the requirements in Section 7, Landscaping, for growing medium depth / volume where shrub and groundcover is used, and at planted trees.

f) Swale longitudinal slope should be 1-2%, or dished between weirs.

g) Swale bottom width - 600mm minimum, 2400mm maximum, flat in cross section.

h) Swale surface side slopes - 3(horizontal):1(vertical) maximum, 4:1 preferred for maintenance. Minimum sideslope shall exceed the slope of the road edge profile.

i) Weirs to have level top to spread flows and avoid channelization, keyed in 100mm minimum. Integrated mowing strip at the weir is desirable in lawn areas.

j) Design stormwater conveyance using Manning's formula, with attention to erosion and channel stability during maximum flows.

k) Maximum ponded level: 150mm.

l) Drawdown time for the maximum surface ponded volume – 48 hours maximum.

m) Minimum freeboard to adjacent paving: 100mm or in accordance with swale conveyance design.

n) Treatment soil depth: 350mm depth of growing medium is desirable, 150mm depth of growing medium is the minimum required. Both of these over 100 mm minimum depth of washed sand.

o) Drain rock reservoir bottom shall be level.

p) Underground weirs of undisturbed native material or constructed ditch blocks shall be provided to create underground pooling in the reservoir sufficient for infiltration performance.

q) A non-erodible outlet or spillway must be established to discharge overflow.

B. Rain Gardens shall meet the following design guidelines:

a) The Rain Garden area should be 10-20% of the upstream impervious area that it serves, preferably sized by continuous flow modeling. Common rain garden size is about $50m^2$ draining $250m^2$ of impervious area, although this sizing and proportion will vary by rainfall and soil characteristics. Smaller, distributed Rain Gardens are better than single large-scale facilities.

b) Siting of Rain Gardens should be similar to other infiltration facilities.

c) Minimum of 30m from wells or unstable slopes, minimum 3 m downslope of building foundations, and only in areas where foundations have footing drains.

d) Provide pretreatment erosion control to avoid sedimentation in the garden.

e) Provide non-erodible material, sediment cleanout basins, and weir flow spreaders at point-source inlets. Flow to the swale should be distributed sheet flow, travelling through a grassy filter area or grass swale prior to entering the Rain Garden (500 mm minimum, greater than 3000 mm is a desirable grassy pretreatment swale length).

f) Rain Garden bottom flat cross section, with a longitudinal slope of 1 to 2%. Provide a 50mm – 75mm layer of organic mulch – well aged compost, bark mulch or similar weed free material. The mulch is important for both erosion control and maintaining infiltration capacity.

g) Rain Garden bottom width: 600mm minimum, 3000mm desirable, length:width ratio of 2:1 desirable.

h) Rain Garden side slopes: 2 horizontal: 1 vertical maximum, 4:1 desirable for maintenance. Provide organic mulch on side slopes similar to bottom of garden.

i) Maximum ponded level: 150mm.

j) Drawdown time for the maximum surface ponded volume: 48 hours.

k) Treatment soil depth: 450mm minimum, 1200mm desirable. Treatment soil should have a minimum infiltration rate of 13mm/hr, with 6mm/hr used for design. If a filter cloth is used over drain rock reservoir, provide clean washed sand over the filter cloth as a replacement for the lower 100mm of growing medium.

l) Slope of the drain rock reservoir bottom shall be level.

m) A non-erodible outlet or spillway must be established to discharge overflow.

n) Avoid utility or other crossings of the Rain Garden. Where utility trenches must be constructed crossing below the garden, install trench dams to avoid infiltration water following the utility trench.

o) Rain gardens can be constructed in a variety of shapes. Gain a letter of approval from a professional engineer with experience in geotechnical engineering prior to siting rain gardens closer than 3m to building foundations.

C. Pavers shall meet the following design guidelines and designs may be one of three types:

a) Full Infiltration – where all inflow is intended to infiltrate into the underlying subsoil.

b) Partial Infiltration – designed so that some water may infiltrate into the underlying soil while the remainder is drained by perforated pipes.

c) Partial Infiltration with Flow Restrictor – designed with a perforated pipe and flow restrictor located at the bottom of the drain rock reservoir. A small orifice in the flow restrictor allows the gradual decanting of water above the perforated pipe, with infiltration occurring as much as possible. These systems are essentially underground detention systems, and are used in cases where the underlying soil has low permeability or there is high water table.

D. Pavers shall meet the following design guidelines and designs may be one of three types:

a) Soil subgrade sampling and analysis should be provided by a professional engineer knowledgeable in the local soils. Testing of soil cores taken at the proposed area to be paved should include soil texture classification, sampled moisture content, 96 hour soaked California Bearing Ratio (CBR) with a target of at least 5% for light vehicular traffic, 15% for heavy vehicles, and on-site infiltration tests using a Double-Ring Infiltrometer taken at the elevation of the proposed base of the reservoir.

b) Minimum recommended tested infiltration rate for a full infiltration pavement design is 12.5 mm/hr. Sites with lower rates will require partial infiltration solutions with drain pipes, and care must be taken that the sub base will remain stable while saturated.

c) Where it is proposed to drain impermeable surfaces onto pervious pavement surfaces, it is recommended that a maximum ratio of 2:1 impermeable to permeable is used. This may vary by rainfall and soil characteristics as determined by modeling.

d) Permeable Unit Pavers should be selected and designed based on a manufacturer's tests that the installed unit paving system can maintain a minimum 28mm/hr infiltration rate over the pavement life (usually 20 years). This rate includes a factor of safety of 10 – the initial infiltration rate should be >280mm/hr.

e) Permeable unit pavers are usually 80mm depth. Provide edge restraint to contain the pavers, similar to standard unit paving. Edgers that use spikes are not recommended.

f) Permeable unit paving surface slope should be 1% minimum to avoid ponding on the surface, and related settlement of clay sized particles.

g) Provision of vegetated joints, and overhanging trees which drop needles onto the pavement have, in research studies, helped to maintain high infiltration capabilities of pervious unit paving. Vegetated joints are not suitable in heavily shaded areas such as under long-term parking.

h) Paver bedding material shall be wrapped with geotextile filter cloth on bottom and all sides. This is critical to the water quality performance of the pavement, and also keeps any intrusion of fines near the surface, where localized clogging could be repaired by replacing only the aggregate above the filter cloth and patching the cloth, reusing the pavers.

i) Bottom of reservoir: flat in full infiltration designs, minimum 0.1% slope to drain in piped systems.

j) If the pavement is being designed for heavy loads, optional reinforcing grids may be included in the pavement sub-base.

k) With infiltration designs, the bottom and sides of all reservoir base and subbase courses shall be contained by a geotextile filter cloth. Geotextile shall be adhered to the drains.

l) Design reservoir water levels and stormwater detention using a continuous modelling program. Drawdown time for the reservoir: 96 hours maximum, 72 hours desirable.

m) If the design is for partial infiltration with a flow restrictor assembly, size the orifice for a design flow that meets local requirements or replicates base flow from the drainage area.

n) Provide a secondary overflow inlet and inspection chamber (catch basin or manhole) at the flow control assembly. If no secondary overflow inlet is installed, provide a non-erodible outlet or spillway to the major storm flow path.

o) Underground weirs of undisturbed native material or constructed ditch blocks shall be provided to create underground pooling in the reservoir sufficient for infiltration performance.

p) Avoid utility or other crossings of the pervious pavement area. Where utility trenches must be constructed crossing below the reservoir, install trench dams at exits to avoid infiltration water following the utility trench.

E. Infiltration Trench systems shall meet the following design guidelines:

a) Locate Infiltration Trench at least 3m from any building, 1.5m from property lines, and 6m from adjacent infiltration facilities (or as recommended by a geotechnical engineer).

b) If any surface water is to enter the system, provide pre-treatment erosion control to avoid sedimentation in the Infiltration Trench. Provide non-erodible material and sediment cleanout basins at point-source inlets. Do not allow drainage from land uses with a high risk for water pollution (e.g. refueling stations) to enter an infiltration trench.

c) Provide vegetated erosion control along any surface water conveyance swales (e.g. between rain water leader and sump inlet). Swale planting is typically sodded lawn. Low volume swales can be finished with a combination of grasses, shrub, groundcover and tree planting to provide a 100% vegetated cover within 2 years of planting.

d) Sump: Concrete, plastic, or other non-degradable box with strength suitable to withstand surface loads. Provide a lid for periodic inspection and cleanout. Include a T-inlet pipe to trap oils, sediments and debris. Provide weep holes to dewater the sump, for mosquito management. In high volume situations, an oil/grit separator will be required by the [*Name of Local Government*].

e) Infiltration Trench: installation of perforated distribution pipe and bottom of drain rock to be level. If more than one section of infiltration trench is required, design so that underground water is temporarily "ponded" in each infiltration section, using underground weirs of undisturbed native material or constructed ditch blocks designed to create underground pooling in the reservoir sufficient for infiltration performance.

f) Infiltration Trench bottom width - 600mm minimum, 2400mm maximum.

g) Install the Infiltration Trench in native ground, and avoid over-compaction of the trench sides and bottom, which reduces infiltration.

h) Install an observation well for each Infiltration Trench (optional): vertical standpipe, with perforated sides, and locking lid, to allow the monitoring of water depth.

i) Size the Infiltration Trench system by continuous flow modelling to provide rainfall capture of the design target.

j) A non-erodible outlet or spillway must be established to discharge overflow.

k) Avoid utility or other crossings of the Infiltration Trench. Where utility trenches must be

constructed crossing below the Infiltration Trench, install trench dams to avoid infiltration water following the utility trench.

F. Additional stormwater source controls are described in the publication Stormwater Source Control Design Guidelines 2005 (GVSDD / GVRD). The following stormwater source controls are encouraged for use when appropriate, and shall require a custom design and specification document to be submitted for the approval by the [*Name of Local Government*]:

a) Soakaway Manhole, with design supported by a hydrogeotechnical engineering report concerning groundwater quality.

G. Oil / Grit Separators shall meet the following requirements:

a) Treat a minimum of 90% of the annual runoff volume of the catchment area.

b) Provide an internal high flow bypass that regulates the flow rate into the treatment chamber and conveys high flows (10% or more of the annual runoff volume) directly to the outlet such that scour and re-suspension of material previously collected does not occur.

c) Be capable of removing 50% to 80% of the total suspended sediment load (TSS, including fine and clay particles) and 60% to 95% of the floatable free oil. Design calculations for sizing the structure shall be based on the drainage area, historic rainfall data, and shall meet the upper range of the removal targets (80% of TSS and 95% of oil). Average performance of the installation shall meet the lower range of the removal targets as a minimum (50% of TSS and 60% of oil).

d) Maintenance access both to the structure and within the structure shall be provided so that accumulated oils and sediments can be readily removed with a vacuum truck.

e) The oil/grit separator shall be enclosed in a concrete manhole or vault structure. The structure and lid shall meet H20 loading. Concrete joints shall be oil resistant and water tight.

H. **Stormwater Source Control practices** are intended to infiltrate the frequent minor storm events to provide recharge of ground water for stream base flows, and also to improve water quality. Unless proven by a Performance Standard calculation, stormwater source controls shall be assumed to not substantially reduce the quantity of storm runoff in events exceeding one half of the Mean Annual Rainfall (MAR) depth.

I. Sediment Control Plan (City of Kamloops)

A Sediment Control Plan is a requirement of all *Development* projects and must clearly outline the measures to be taken to reduce sediment discharges from the site during the full construction period, which includes both City works and building construction. It is the *Consulting Professional's* responsibility to give consideration to the impact of sediment on existing infrastructure as well as watercourses. Some forms of sediment control may include:

a) Siltation ponds;

b) Bioswale filtration;

c) Point source control; and

d) Prefabricated sediment control systems.

J. Groundwater Interactions (City of Kamloops)

Where groundwater emergence can reasonably be expected, the *Consulting Professional* (or Geotechnical Engineer) must ensure this is addressed. Control of groundwater emergence and protection of City and private infrastructure from the negative impacts of groundwater must become part of the overall servicing strategy for a *Development.* Groundwater management must be accounted for in a site's infrastructure design. The use of cut-off drains or connecting servicing trenches to the storm sewer system are two possible solutions to this problem.

3.8.4. Detention of storm runoff

a) All *Developments* which are within the study boundary of a [*Name of Local Government*] approved stormwater or drainage plan must conform to the objectives and recommendations of the approved plan.

b) Where possible, stormwater runoff is to be directed to a regional detention system (whether existing or proposed) in an effort to maximize the tributary area of the regional detention systems. Where an engineering investigation concludes that connection to a regional system is not practical in the long term, independent drainage systems with direct drainage discharge to creek systems may be permitted, provided in all cases that water quality protection measures are provided to the approval of the [*Name of Local Government*]. Local stormwater detention will generally be required in such cases.

c) Wet Detention Ponds

i. Wet detention ponds, complete with a permanent low level pool, are the preferred method of stormwater detention, however, for small *Development Parcels*, where engineering studies have determined that wet detention ponds are not feasible, dry detention ponds, pipe-based, stormwater detention systems may be considered, but only if approved by the [*Name of Local Government*].

ii. In general, wet detention pond designs should maximize habitat and structural complexity in order to fully utilize the benefits offered by the wet detention pond while avoiding undesirable habitats with few species resulting from simple wet detention pond designs. Aesthetics and multiple-use aspects should be emphasized throughout the design.

iii. All vegetation within the low level pool, pond and surrounding buffer shall conform to the detention pond landscaping criteria set out in this section.

iv. The surface area of the permanent low level pool should represent at least 1% of the total developed area.

v. The wet detention pond and outlet structure shall be designed such that the designed post-development discharge rate of the pond outflow does not exceed runoff levels generated by a pre-development 2 year storm event. If *Development* is located within the boundary of a [*Name of Local Government*] approved stormwater or drainage plan, refer to the appropriate plan for approved discharge rates.

vi. Primary spillway shall be designed to accommodate the post-development run-off generated by a 1:10 year storm event and an emergency spillway shall be designed to accommodate the post-development run-off generated by a 1:100 year storm event. The discharge path from the wet detention pond to the receiving environment shall be adequately protected from erosion.

vii. The depth of the permanent low level pool shall be maintained between 0.6 m and 1.2 m.

viii. The maximum depth of water during storm events shall not exceed 2.5 m.

ix. A minimum freeboard of 0.6 m shall be provided above the designed maximum water level.

x. The wet detention pond shape combined with meandering channels in the permanent low level pool shall maximize the distance between the inlet and the outlet.

xi. The wet detention pond walls shall be constructed with a minimum interior side slope of 4 (horizontal) to 1 (vertical) and a minimum exterior side slope of 3 (horizontal) to 1 (vertical).

xii. The top of the wet detention pond bank should be a minimum width of 3.0 m.

xiii. A pretreatment sump is to be provided at the inlet to the wet detention pond.

xiv. An oil/water separator structure or equivalent source control treatment set of best management practices such as infiltration swales, pervious pavements, or rain gardens is to be installed upstream of the pond inlet.

xv. The flow control structure is to be constructed with a removable orifice plate sized to restrict flows to the pre-development 1:2 year storm event, and a riser sized to handle the post-development 1:100 year storm event.

xvi. The flow control structure shall be located within a lockable manhole positioned within the embankment for purpose of maintenance, access, safety and aesthetics. The design of the outfall structure shall be

determined based on the exit velocity of stormwater runoff from the wet detention pond.

xvii. Safety is to be provided by managing the contours of the wet detention pond to eliminate drop-offs and other hazards and by discouraging access to the permanent low level pool with appropriate vegetation on the safety bench in accordance with the detention pond landscaping criteria and Section 7. The safety bench, located at the toe of the side-slopes leading to the permanent low level pool, is to be 2 m wide with a maximum slope of 3% and is required around the entire perimeter of the wet detention pond. Where safety benches cannot be accommodated, fencing may be considered, subject to the approval of the [*Name of Local Government*].

xviii. A minimum of 4 signs shall be installed around the perimeter of the wet detention pond with the following wording:

xix.

DANGER! Water levels are subject to sudden change Please KEEP OUT For information, call the [*Name of Local Government*], Operations Department

xx. A buffer strip of at least 7.5 m measured from the inside of the top bank is to be provided around the entire perimeter of the wet detention pond.

xxi. A minimum distance of 12 m shall be maintained between the inside of the top bank and any structure.

xxii. Where possible, the wet detention pond's perimeter should be maintained as a forested buffer. In cases where retention of forest is not feasible, the buffer is to be landscaped in accordance with the detention pond landscaping criteria below with preference to native species.

xxiii. An access tract or road sufficient to accommodate maintenance vehicles shall be provided from the public right-of-way to the outlet structure.

xxiv. Pedestrian trails constructed to [*Name of Local Government*] standards may be included where applicable and desired, subject to [*Name of Local Government*] approval.

d) Detention Pond Landscaping Criteria

i. Where feasible, plantings should consist of native plants.

ii. All planting areas that are above permanent wetland pool shall be supplied with an automatic irrigation system. Planting and soils design shall anticipate that the irrigation system will be shut off approximately 3 years after planting, once the plants are established.

iii. Upon *Completion* of basic excavation of the wet detention pond, topsoil / wetland mulch amendments are to be incorporated. 0.30 m - 0.15 m of topsoil and/or wetland mulch is to be added to all depth zones.

iv. Grade to final elevations - after mulch and/or topsoil has been placed. All areas surrounding pond should be hydro seeded using a wet mix or other similar seed mix.

v. Provide standing time for wet pond - leave pond area for six to nine months to allow pond to experience storm flows. Details of the aquatic portion of the detention pond landscaping plan can be finalized using data collected during this time.

vi. All landscape/re-vegetation work in pond and surrounding areas must be performed by a competent landscape contractor, preferably experienced in aquatic/wetland re-vegetation.

3.8.5. Major flood routing and flood control

a) Major Flow Routing

Unless the storm sewer system is oversized to accommodate the major flow (i.e. 100 year return period storm), provision for surface flow is required wherever the overland flows in excess of 0.05 cubic metres per second (m3/s) are anticipated. Major flow routing is generally accommodated along roadways, swales and watercourses. These designated flow paths will be protected by restrictive covenants or rights-of-ways and clearly identified in the Stormwater Management Plan.

The quantity of flow to be conveyed by the surface flow path is the total major flow less the capacity of the minor system. The design of the major flow routing will ensure to the satisfaction of the [*Name of Local Government*] that no endangering of public safety nor any substantial property damage will occur under the major flow conditions.

b) Roadway Surface Drainage

Roadways with barrier curbs and gutters can be designed as wide channels to convey major surface flow. The required freeboard between the water elevation at maximum ponding/flow and the lowest minimum building elevation of the adjacent buildings is specified in subsection 3.8.2. The maximum depths of flow will not exceed 150 mm above the gutter line. Flow velocities greater than 2.5 m/s must be acceptable to the [*Name of Local Government*].

The Consulting Engineer will consider the impact of surface routing on the major flow hydraulic grade line (HGL) of adjacent lateral roads. Existing lateral roads designed with the major HGL below surface may preclude using surface flow routing on the road being designed.

Routing of major surface flow on roads with rollover curbs is discouraged.

The Consulting Engineer will submit calculations to verify that the surface flow is maintained within the road right-of-way and the water elevation at maximum ponding/flow is at least 0.35 metres below the lowest flood construction level (FCL) of adjacent buildings.

The design of the intersections will ensure that the surface flow can continue along the designated path crossing over lateral roads. Similar considerations are required if a change of surface flow direction is required at an intersection.

c) Ditches

Properly engineered ditches may be acceptable for permanent servicing of land *Development* projects in urban areas of the [*Name of Local Government*] to reduce the storage required for stormwater management. As a guide, ditches adjacent to roadways should conform to the criteria indicated below. In the case where the *Consulting Professional* wishes to adopt variations, these changes should be noted and the approval of the *Municipal Engineer* sought.

i. maximum depth [*insert value*]m

ii. minimum bottom width [*insert value*]m

iii. maximum side slope [*insert value*](H): [*insert value*](V)

iv. minimum grade [*insert value*]%

v. maximum velocity (Unlined ditch) [*insert value*]m/s

Where soil conditions are suitable or where erosion protection is provided, higher velocities may be permitted. If grades are excessive, rip-rap lined bottoms and sides of ditches, erosion control structures or complete ditch enclosure may be required.

The minimum right-of-way width for a ditch will be [*insert value*] metres where the ditch crosses private property. The ditch will be offset in the right-of-way to permit a 3 metre wide access for maintenance vehicles. Additional right-of-way may be required to facilitate the ditch construction and access. The top of the ditch adjacent to the property line will be a minimum 0.5 metres away from that property line. Ditches will be designed to maximize infiltration.

d) Creeks

Natural creeks are integral components of the drainage system and the ecological system. If the process of *Development* or drainage design involves in-stream works, the Consulting Engineer will refer to the latest version of the "Land Development Guidelines for the Protection of Aquatic Habitat"

prepared by the Department of Fisheries and Oceans (DFO) & the B.C. Ministry of Environment (MOE), and Section 9 of the *Water Act*.

Any activity within a creek corridor or wetland is subject to the provisions of the [*Name of Local Government*]'s Environmental Protection and Preservation Bylaw # [*insert bylaw number*].

All proposals for works within a creek corridor must be forwarded (by the *Consulting Professional*) to the [*Name of Local Government*]'s Sustainability, Planning and Building Services Division, who will liaise with the Federal and Provincial Government agencies.

e) Culverts

Culverts on creeks will be designed to convey the major flow (200-year return period instantaneous flow) or greater with the design headwater not exceeding the top of the culvert. The Consulting Engineer will determine whether the culvert will operate under inlet or outlet control at design conditions.

Concrete culverts are preferred for general uses. Corrugated steel culverts may be considered under special circumstances when their use can be justified.

The minimum diameter of culverts on creeks is 450 mm. The minimum diameter of driveway culverts that form part of the minor system is 300 mm. The average water velocity in culverts should not exceed:

- 1.2 m/s for lengths up to 24.4 metres
- 0.9 m/s for lengths greater than 24.4 metres

The minimum depth of cover over culverts is 0.3 metres, subject to the correct pipe loading criteria.

Inlet and outlet structures are required for all culverts designed for the 200-year return period instantaneous flow. Considerations for the installation of energy dissipation and erosion control will be included in the design.

Culverts on fish-bearing creeks must meet special conditions as specified by the [*Name of Local Government*]'s Environment, Parks and Engineering Department, Fisheries and Oceans Canada, and the BC Ministry of Environment (MOE). Such culverts will be required to be passable to fish. Habitat restoration works will generally be required. The Consulting Engineer will consult the [*Name of Local Government*] to determine the requirement for individual projects.

Driveway culverts that form part of the minor system will have capacity for the runoff from the 10-year return period storm with the design headwater not

to exceed the top of the culvert. All new driveway culverts will be sized to ensure that there is no adverse impact on adjacent properties under the 100-year return period runoff conditions.

Trash racks and/or debris barriers are required upstream of culvert installations. Refer to the Supplementary Standard Drawings.

f) Inlet and Outlet Structures

Refer to Supplementary Standard Drawings for the design of inlet and outlet structures for pipes up to 1200 mm diameter. Pipes larger than 1200 mm diameter and non-circular culverts require specially designed inlet and outlet structures. Outlets having discharge velocities in excess of 1 m/s require riprap and/or energy dissipating structures for erosion control.

Trash racks are required at the inlets and outlets of all pipes over 450 mm in diameter and exceeding 30 m in length (except large culverts in major watercourses). Trash racks may also be required on smaller diameter storm sewers at the discretion of the [*Name of Local Government*]. See Supplementary Standard Drawings for trash rack details.

g) Flood Control and Debris Flow Hazards

Flood control provisions apply to *Development* on sites subject to flood-related hazards.

The need for site specific provisions will be determined by the [*Name of Local Government*] in consultation with the B.C. Ministry of Environment (MOE), and/or the [*Name of Local Government*]'s *Chief Building Official*. *Owners* and Consulting Engineers are directed to [*Name of Local Government*] Creek Hazard Report, with respect to flood hazard reports which may need to be submitted in the case of properties located within identified flood and debris hazardous areas.

Steep creeks within the [*Name of Local Government*] may be subject to debris flow or debris flood hazards, which are generally defined in the Overview Report on Debris Flow Hazards, prepared by [*insert name*], dated [*insert date*]. *Development* in such areas will require satisfactory mitigation of the respective hazards.

Creeks and rivers may also give rise to flood and erosion hazards which must be mitigated through implementation of flood construction levels (FCLs') and building setbacks as follows:

i. Proposed buildings that are subject to flood hazards require a specified FCL, which is the minimum elevation for main habitable floor areas. The FCL ensures that buildings are elevated sufficiently high that flood inundation will not occur up to the design flood condition. The FCL

applies to the underside of wood floor systems, or the top of the concrete floor systems.

ii. FCLs are to be determined for any of the following conditions:

- 200-year return period flow for creeks and rivers (including 0.6 m freeboard).
- 100-year flow plus hydraulic gradeline (normally 0.3 metres unless acceptable to the [*Name of Local Government*]).
- The Seymour River FCLs as shown on the floodplain map produced by MOE.

iii. The need for creek setbacks over and above the environmental protection requirements (in order to ensure safe building sites) will be determined on a site specific basis.

A gravity connection to the [*Name of Local Government*]'s storm drainage system may be made only where the habitable portion of a dwelling is above the major system hydraulic grade line.

h) Limitations and Precautions to Implementing Source Controls in Hazardous Areas with Potential Slope Instability

The implementation of source controls is prohibited in potential slope instability areas. Source controls encourage infiltration that saturate soils and further reduces the stability of these hazardous slopes. Adequate setbacks from the top of these slopes must be delineated by a qualified Professional Geotechnical Engineer.

i) Groundwater Downslope Impact

A Hydrogeologist must be retained to assess the fate of infiltrated water to confirm that it does not pose an increased saturation/flooding risk to down slope areas and/or adjacent *Developed* or undeveloped sites.

j) Overflows

As with all drainage works, source controls must be designed to ensure that facility overflows and interflows drain to the municipal minor/major drainage system or natural drainage path, and do not discharge to, or through, adjacent sites. Emergency overflows must be designed into all source controls.

3.8.6. Storm sewers and appurtenances (minor drainage system)

a) Scope

The emphasis of this section is on those criteria which determine the size and grade profiles of minor conveyance storm sewers and certain elements of the system arrangements, such as inlet requirements.

b) Level of service

The minor drainage system will be designed to convey the 5-year return period rainfall event runoff.

c) Storm Sewers

i. Sizing of Storm Sewers

Storm sewers shall be designed as open channels sized to provide the required capacity in free flow (not surcharged) conditions using Manning's formula. Manning's n of 0.013 shall be used for smooth wall plastic and concrete pipe, and 0.024 for corrugated pipes.

The minimum storm sewer size will be 200 mm inside diameter. Where ditches discharge directly into a storm sewer, the minimum pipe diameter will be 300 mm subject to the approval of the *Municipal Engineer*.

Downstream pipe sizes are not to be reduced unless the downstream pipe is 600 mm diameter or larger and increased grade provides adequate capacity. The maximum reduction is two pipe sizes and the system must be a closed pipe network or be protected with approved inlet structures. The *Municipal Engineer* must give approval to this condition.

ii. Surcharged Sewers

Surcharged sewers to convey the design flows are permitted only as exceptions and with completion of a report by the *Consulting Professional* and approval of the *Municipal Engineer*. In all such cases, it must be clearly demonstrated that the projected highest hydraulic grade line has no impact on downstream properties.

iii. Storm Sewer Slope Requirements

All storm sewers shall be designed and constructed to give mean velocities, when flowing full, of 0.60 m/s or greater based on Manning's formula except that the minimum slope shall be 0.4% for the most upstream leg of any storm system (between the terminal manhole and the first manhole downstream there from) unless approved by the *Municipal Engineer*.

On steeper slopes the *Consulting Professional* is to consider if special provisions are required to protect against displacement of sewers by erosion or shock. No upper limit to flow velocities in storm sewers is defined, however, when supercritical flow does occur, (where steep grades are utilized), the *Consulting Professional* shall provide appropriate analysis and justification and make provisions in the design to ensure that structural stability and durability concerns are addressed. Flow throttling or energy dissipation measures to prevent scour may be

required to control the flow velocity or to accommodate the transition back to subcritical flow.

For pipes on steep grades an approved anchoring system shall be provided in accordance with the Standard Drawings and Specifications.

iv. Location

Storm sewers are to be located as shown on the Standard Drawings within a *Subdivision* road right-of-way (ROW) or open lane. Where this is technically impractical and it is proposed to place storm sewers within private property the *Consulting Professional* is to provide rationale and analysis for consideration by the [*Name of Local Government*] Engineer. A minimum ROW width of 3.0 m will be required for maintenance purposes. Where storm and sanitary sewers are located in the same ROW, a minimum width of the ROW will be 5.0 m.

v. Depth

Where the catchment is on both sides of a roadway, storm sewers shall be installed at a depth capable of servicing properties on both sides by gravity where economically feasible. Elevation of storm sewers at upstream tributary points must be of sufficient depth to service all of the tributary lands.

Sewers shall not be designed with pipe cover less than [*insert value*] m above the crown of the pipe nor with depths in excess of [*insert value*] m (varies from city to city), unless there is justification by the *Consulting Professional* and approval is given by the *Municipal Engineer*.

vi. Groundwater

Storm sewer connections to other utility trenches shall be provided where there is a possibility of groundwater infiltration. The Geotechnical Engineer is to provide a report and recommendations for review by the *Municipal Engineer*.

d) Manholes

Manholes are required at the following locations and as outlined in *MMCD*:

i. Every change in pipe size.

ii. Every change in grade, except as indicated in the Curved Pipes section.

iii. Every change in direction, except as indicated in the Curved Pipes section.

iv. Every pipe intersection except for 100mm and 150mm service connections, catch basin connections and junctions with trunk sewers 900mm diameter and larger.

v. Upstream end of every sewer line.

vi. 150m maximum spacing for pipes smaller than 900mm diameter.

vii. 250m maximum spacing for pipes 900mm diameter and larger.

e) Sump Manholes

Where ditches, swales or other open channels discharge into a storm sewer system, the initial connecting manhole shall be of a sump type unless this provision is provided by the receiving inlet structure.

f) Catch Basins

Catch basin design criteria are defined in *MMCD*.

g) Service connections

Each and every legal lot and each unit of a residential duplex shall be provided with a separate service connection.

Unless otherwise approved by the [*Name of Local Government*], connections are to serve the perimeter (foundation) drains of all buildings by gravity. Building elevations should be established accordingly. Pumped connections may be permitted if requested prior to sewer design and if appropriate covenants are provided.

i. Size

- Pipe size to accommodate peak design flow.
- Minimum pipe size diameters for service connections are 100mm except for industrial/commercial connections which shall have minimum diameter of 150mm.

ii. Location and Depth

- Connections to large lots are to be located at the lower portion of each lot. For urban *Developments*, location of connection to follow the standard drawings.
- The connection elevation at the property line is to be above the minor system HGL.
- Other depth requirements are as indicated for storm sewer mains.

iii. Grade

Minimum grade from property line to storm sewer main:

- 100mm diameter pipe: 1.5%
- 150mm diameter pipe: 1.0%
- Larger sizes: Grade based on minimum velocity of 0.75 m/s

iv. Details

Use standard wye fittings for connections to new mains. For connections to existing mains, use wye saddles or insertable tees.

Connections exceeding 30m in length will be treated as mains.

- Service connections may be permitted into manholes if:
  - The connection is not oriented against the flow in the main.
  - Manhole hydraulic requirements are met.
  - Manholes are required on service connections larger than 250mm diameter.
- Inspection chambers are required on residential connections unless the service is less than 2.5m long and connect to a manhole.
- Inspection chambers to *MMCD* standards. Stormwater inspection chamber lids to be green in colour.

h) Temporary clean outs

Temporary clean outs may be provided at terminal sections of a main provided that:

- Future extension of the main is designed as an overall phased development.
- Clean outs are not considered a permanent structure.

i) French drains

The use of French drains shall only be permitted where the topography and soil conditions are proven adequate to the acceptance of the [*Name of Local Government*]. A soils report will be required to support the design.

j) Erosion and sediment control

i. The *Consulting Professional* will be required to demonstrate how work will be undertaken and *Completed* so as to prevent the release of silt, raw concrete and concrete leachate, and other deleterious substances into any ditch, storm drain, watercourse or ravine. Construction and excavation wastes, overburden soil or other deleterious substances must be disposed of or placed in such a manner as to prevent their entry into

any water course, ravine, storm drain system, or restrictive covenant area.

ii. Should siltation or erosion controls be required, details of the proposed works are to be included in the approved drawings and must be installed as part of the works.

iii. All siltation control devices must be situated to provide ready access for cleaning and maintenance.

iv. Proposed siltation control structures must be maintained throughout the course of construction and to the end of the maintenance period (final acceptance). Changes in the design of the structure will be required if the proposed structure is found to be inadequate.

REFERENCE TO *MMCD* AND [*NAME OF LOCAL GOVERNMENT*]'s STANDARD DRAWINGS WOULD BE ADDED HERE WHEN PREPARING INDIVIDUAL BYLAWS

SECTION 4

WATER DISTRIBUTION SYSTEMS

4.0 WATER DISTRIBUTION SYSTEMS

4.1. GENERAL

4.1.1. The water distribution system design should be prepared under the direction of a design professional who has the appropriate experience and is registered with the Association of Professional Engineers and Geoscientists of British Columbia.

4.1.2. Depending on the size of the *Subdivision*, water distribution system modifications may require approval of the Regional Health Authority prior to construction (http://www.interiorhealth.ca/YourEnvironment/DrinkingWater/Pages/default.aspx).

4.2. DEFINITIONS

[*Beyond scope of model bylaw*]

4.3. WATER RESOURCE AVAILABILITY AND QUALITY

4.3.1. The *Consulting Professional* will work closely with the *Municipal Engineer* to determine the current status and availability of water resources in the [*Name of Local Government*]. Water treatment, conveyance and storage reservoir capacities need to be confirmed to see if any [*Name of Local Government*] infrastructure upgrades are required.

4.3.2. In the case where multiple new *Developments* will benefit from an offsite infrastructure upgrade, Development Costs Charges (DCC) may be allocated to these projects. If DCC funds are not available, it is possible that the [*Name of Local Government*] may approve that the *Applicant* pay for the upgrades, and then claim back infrastructure DCC credits from the [*Name of Local Government*].

4.3.3. If the offsite upgrades benefit only one *Applicant* or *Owner*, these upgrades will be to the sole account of the *Applicant* or *Owner*. The *Applicant* or *Owner* may in this case wish to register a Latecomers Agreement, whereby the *Applicant* or *Owner* is entitled to claim part compensation for letting other adjacent future *Developments* to tap into this system that the *Applicant* or *Owner* has paid for.

4.4. WATER DEMANDS

4.4.1. General Residential Potable Water Demand Requirements

- Average annual daily demand (A) [*insert value*] litres/capita/day (L/c/d)
- Maximum day demand (D) [*insert value*] L/c/d
- Peak hour demand (H) [*insert value*] L/c/d
- Minimum hour demand [*insert value*] L/c/d

The above are considered design minimums. Where reliable water consumption data is available and exceed these minimums, actual demands are to be considered by the *Consulting Professional*.

Major system elements such as pumping stations, pressure reducing valves, etc. shall be designed to serve the full saturation population anticipated in the [*Name of Local Government*]'s current OCP for the service area. Actual construction can be phased depending on the expected rate of build-out.

4.4.2. Residential Demand

Where there are a known or projected number of lots or units to be *Developed*, the *Consulting Professional* shall estimate population based on equivalents of 2.7 capita/unit for single family and two family *Developments* and 2.5 capita/unit for multiple family *Developments*.

4.4.3. Non-Residential Demands

Commercial, industrial and institutional demands should be determined using specific reliable water consumption data related to the type of zoning or for identified facilities, the average annual daily demand (A), with analysis and rationale prepared by the *Consulting Professional*, subject to approval by the *Municipal Engineer*. In the absence of such data, use the above General Potable Water Demand Requirements and the following equivalent population factors.

- Commercial: 90 people/ha
- Institutional: 50 people/ha
- Industrial: 90 people/ha

4.4.4. Fire Protection Flow:

Fire flows are subject to the following minimum requirements for land use in each *Zone* not protected with sprinkler systems:

- Mobile Home 75 L/s
- Single and Two Family (Fee Simple) 85 L/s
- Three and Four Plex Housing 115 L/s
- Apartment and Row Housing 150 L/s
- Commercial 150 L/s
- Institutional 150 L/s
- Industrial 225 L/s

Single and two family residential *Developments* creating four or more new units in existing *Developed* areas are to achieve the above minimum fire flows where minor improvements to the existing system would provide those flows. Where the required flows are not available with minor improvements the *Consulting Professional* is to provide a report outlining conditions and recommendations for consideration by the *Municipal Engineer*. Residential sprinklers may be considered as an alternative to provide fire protection with recommendation from the *Consulting Professional* and at the sole discretion of the *Municipal Engineer*.

Infill single and two family residential *Developments* (3 new units or less upon ultimate buildout) that cannot achieve fire flows of 65 L/s may be required to utilize residential sprinklers as determined by the *Municipal Engineer*.

Fire flows for all land use other than single and two family residential *Developments* are to be determined in accordance with the requirements of the current edition of Fire Underwriters Survey - "Water Supply for Public Fire Protection - A Guide to Recommended Practice" (FUS). Regardless, it is the responsibility of the *Consulting Professional* to provide an analysis and recommendations for design fire flows taking into account requirements at the building permit stage.

A reduction in the above flows will be considered by the *Municipal Engineer* under special circumstances with provision of a report from the *Consulting Professional* outlining conditions for consideration. A reduction in flows utilizing mandatory sprinklers will be considered by the *Municipal Engineer* where the area serviced by the proposed system cannot be extended in the future in accordance with the OCP, topographic constraints or where mandatory sprinkler requirements are registered against all properties within the service area.

4.4.5. Design Flows:

The total demand [Q_{design}] shall be the greater of the following:

Q_{design} = D + F Maximum Day Demand (MDD) for the population or 'equivalent population' (D), plus the fire flow requirement (F);

or,

Q_{design} = H Peak Hour Demand for the population or 'equivalent population' (H):

System design flows shall be based on the ultimate population anticipated for the service area based on the [*Name of Local Government*]'s most current Zoning, OCP or Neighbourhood Land Use Plan.

4.4.6. Where, in the opinion of the *Approving Officer*, the flow characteristics of the *Development* area are substantially different, the above-mentioned criteria may be modified.

4.5. WATER NETWORK ANALYSIS

4.5.1. The water system design is to be conducted utilizing a calibrated water model acceptable to the [*Name of Local Government*] unless the system design, as determined by the *Approving Officer*, is not complex.

4.5.2. Discussions will need to be held with the *Municipal Engineer* to determine the status of the [*Name of Local Government*]'s potable water supply network and its water storage capacities. Some [*Name of Local Government*] sector-wide water system modeling may be required to feed into the *Subdivision* water network analysis.

4.5.3. The system shall be designed to provide day to day domestic supply and demand flows for fire protection.

4.5.4. Design computations for water distribution systems will be based on the Hazen-Williams' equation, unless otherwise approved by the [*Name of Local Government*].

4.5.5. The following values of the Hazen-Williams' coefficient are to be used.

- C =125 for all watermains 250mm internal diameter or larger
- C=100 for watermains 200mm internal diameter or smaller.

4.5.6. The reservoir in the appropriate pressure zone is to be used as the source node for analysis of the network system. The available head shall be 1m or less below the normal high water level for calculation of minimum pressures, and at normal high water level for calculation of maximum pressures or as determined by the *Municipal Engineer*.

4.6. WATER PRESSURE

4.6.1. The water pressure design criteria noted in this subsection must be used except where, in the opinion of the *Approving Officer*, the flow characteristics of the *Development* area are substantially different, the criteria may be modified to take into account the differences.

4.6.2. The water system must be designed to provide gravity flow domestic water at the design building main floor elevation on each *Parcel* in accordance with the following design pressure specifications.

- Minimum pressure at peak demand kPa ([*insert value*]psi)
- Maximum allowable pressure kPa ([*insert value*]psi)

- Minimum fire hydrant pressure kPa ([*insert value*]psi)

4.7. RESERVOIR, PUMPING STATIONS, AND PRESSURE REDUCING VALVE STATIONS

In the case where the *Applicant* or *Owner* is solely responsible for installing these larger system components for the specific *Subdivision*, design criteria and specific requirements shall be obtained from the *Municipal Engineer*. Design criteria have also been defined in *MMCD*.

4.8. WATER MAINS

4.8.1. Pipes and fittings should be designed in accordance with AWWA, ANSI and CSA standards so as to withstand all stresses, internal as well as external, whether caused by static pressures, dynamic pressures, transient pressures, thermal stresses, or stresses induced by vertical loads and impact of traffic.

4.8.2. The minimum size of a new water main that services a fire hydrant shall be 200 mm diameter, except:

The minimum size of a single feed reservoir supply main shall be 300 mm diameter from the reservoir to the first tee and 250 mm from the source to the first tee from the reservoir.

For looped water mains with lengths less than 500 m in single family *Subdivisions*, the minimum diameter may be reduced to 150 mm providing that under design flows maximum allowable velocities are not exceeded.

On residential dead-end roads and cul-de-sacs, where no further extension of the distribution system is possible and no fire hydrants are required, the minimum pipe diameter may be reduced to 100 mm diameter for the last length not exceeding 120 m.

4.8.3. Water mains must be looped wherever possible. Where dead ends are unavoidable, and approved by the local authority, blow-offs or blow-downs should be provided. In no instance shall a permanent dead end exceed 150m in length. Blow-off and blow-down sizes are:

- 50mm dia. for 100mm and 150mm dia. watermains
- 100mm dia. for 200mm dia. and larger watermains

4.8.4. Where practical, and approved by the [*Name of Local Government*], a hydrant may serve a secondary role as a blow-off.

4.8.5. Where the water system network is inadequate, installation of supplementary mains may be required and may necessitate the provision of rights-of-way in favor of the [*Name of Local Government*].

4.8.6. The maximum allowable design velocity shall not exceed the following:

- Pump supply, reservoir trunk mains is [*insert value*] m/sec.
- Distribution lines at Peak Hour Demand (H) is [*insert value*] m/sec.
- Fire flow conditions is [*insert value*] m/sec.

4.8.7. The minimum allowable design velocity is 0.15 m/sec.

4.8.8. All water mains shall be located within the road allowance unless approved by the *Municipal Engineer,* and should be designed to be parallel to the road centerline.

If water mains are constructed within private property and will become part of the [*Name of Local Government*]'s infrastructure, statutory rights-of-way (SRW) or dedicated easement will be required. When the utility crosses private land, the SRW or easement must be sufficient to replace the utility line and be a minimum of 6 m wide.

Water main extensions shall extend to and terminate at the furthest property line of the last lot it services.

Water mains shall be provided on both sides of Provincial *Highways* or railways, to minimize the number of service connection crossings. When water mains cross provincial *Highways* or railways, a steel casing pipe shall be provided and must be designed to meet the applicable requirements of the authority having jurisdiction. The size of the casing pipe must be at least 25% larger than the outside diameter of the water main pipe bell. Valves are to be installed on each side of the crossing to isolate that section of main.

4.8.9. Vertical and horizontal curves may be formed using pipe joint deflections as follows:

- Minimum radius and joint deflection in accordance with pipe manufacturers standards and specifications
- Constant radius throughout curve
- Only one horizontal defined curve is permitted between any two fittings
- The centre line alignment installed on a curve shall run parallel to curb or street centre line
- Minimum one pipe length between consecutive 5° bends.

  Sufficient data is to be provided on design drawings for setting out of horizontal curves and detailing as-built construction record information.

Water mains must be designed to minimize high points in the main. Where a high point is unavoidable, either a hydrant or air release valve shall be installed at this point.

A fire hydrant or blow down must be installed at low points in the water main.

4.8.10. Water mains and services must be installed at sufficient depth to prevent freezing.

Soil type and groundwater levels should be considered when determining the minimum depth of installations. The depth to the water main shall be sufficient to provide all services with a minimum cover of [*insert value*] m to the top of service anywhere within the right-of-way. There shall be a minimum cover of …m on any dead end main.

Alternatively, after discussion with the *Municipal Engineer,* the [*Name of Local Government*] may consider reduced depth of cover and insulation protection subject to the submission of an engineered design.

4.8.11. At all locations, there must be a minimum lineal horizontal clearance of 1m between the water main and other existing or proposed underground services or open ditches, except sanitary sewer and storm drains.

A minimum horizontal clearance of 3m and vertical separation of 0.45m must be maintained between the water main and a sanitary sewer or storm drain. Where this is not possible, mitigation solutions will need to be approved by the local Ministry of Health water quality representative.

Where it is necessary for the water main to cross other underground services, the crossing must be made at an angle greater than 20 degrees horizontal.

The design drawings must indicate whether the water main passes over or under other underground services it is crossing**.**

4.8.12. Where possible, minimum water main grades shall be 0.1%. Grading shall be designed to minimize the number of high points.

Grades shall be straight lines between defined deflection points conforming to specifications. Elevations shall be recorded at all points of deflection and appurtenances except service connections 50 mm or smaller.

For pipes on steep grades an approved anchoring system shall be provided in accordance with the [*Name of Local Government*] or *MMCD* Standard Drawings and Specifications.

4.8.13. A corrosive soils investigation is to be provided with the design submission. It is to be prepared by a *Consulting Professional* currently working in the corrosion abatement field to confirm the suitability of the soils for the proposed works.

The *Consulting Professional* is to submit a signed and sealed report which addresses the life expectancy of the various metallic components of the work. This report shall include projected time to perforation of unprotected components based on soil corrosivity and shall recommend protective measures to achieve a minimum life expectancy of 50 years.

The corrosive soils investigation shall include but not be limited to determining the following:

- Chlorine content (ppm);
- Sulphate content (ppm);
- Electrical resistivity (ohm-cm);
- Electrical conductivity (ms/cm);
- Moisture content (%);
- Soil pH; and
- Soil classification (% sand, silt, clay).

Samples are to be taken at a maximum of 200 m intervals along the length of the proposed works with a minimum of two samples taken.

Where corrosive soils are identified, the methods of protection of metallic components shall be sacrificial anodes. Water trunk main components shall be protected with anodes connected to approved test stations. Copper water services (if used) shall be provided with test leads. All installations are to conform to the [*Name of Local Government*] or *MMCD* Standard Drawings and Specifications.

The *Consulting Professional* is to inspect the installation of the cathodic protection components and provide certification of same. The *Consulting Professional's* final report shall summarize testing of all components including all relevant field testing data. This data shall contain locations of each test site and structure to soil potentials noting applicable testing methods.

All corrosion abatement components are to be functioning to the satisfaction of the *Consulting Professional* and the *Municipal Engineer* prior to acceptance of the works and prior to paving.

4.8.14. The *Consulting Professional* shall ensure that the choice of pipe material is appropriate its purpose and the surrounding soil conditions and in accordance with [*Name of Local Government*]’s list of approved materials and manufacturers to be

found at (Local Government's website) or *MMCD* Specifications and Standard Drawings.

4.9. VALVES

4.9.1. In general, valves must be located as follows:

- In intersections, in a cluster at the pipe intersection or at the project property lines, to avoid conflicts with curbs and sidewalks;
- 3 valves at "X" intersection
- 2 valves at "T" intersection
- Not more than 200m apart for single family residential areas;
- Must be at both ends of a utility right-of-way;
- It is possible to isolate a section of water main by operating no more than 4 valves;
- In locations and at a frequency so that not more than one hydrant is out of service when a section of the main line is turned off;
- Additional valving may be required due to phasing of *Subdivision Development* and as determined by the [*Name of Local Government*].

4.9.2. Valves must be the same diameter as the main up to 300mm diameter and may be reduced by one size less than the pipe size for mains greater than 300mm in diameter. Gate valves must be used up to and including 300mm diameter.

4.9.3. Butterfly valves with gear operators will be allowed in mains larger than 300mm.

4.10. HYDRANTS

4.10.1. The *Consulting Professional* must consider the existing and intended use in the area, and ensure that adequate spacing is provided in accordance with the Standard Hydrant Distribution Table in the "Water Supply for Public Fire Protection 1999", published by FUS. Preferred locations at intersection corner cuts.

4.10.2. Hydrants must be located so that the spacing is never greater than 150m in single family residential areas and 100m in multi-family density residential, commercial, institutional and industrial areas.

4.10.3. The design and location of the hydrants must not conflict with existing or proposed street lights, power poles, transformers or driveways, etc.

4.10.4. In mid-block locations, fire hydrants shall be located just outside of property lines.

4.10.5. Hydrant access provisions may be required and shall be reviewed and approved by the Fire Department.

4.10.6. Hydrants shall be to *MMCD* standards and shall be two 65mm (2 ½ ") outlet and one 100mm (4") Storz type pumper outlet with caps on each outlet. All hydrant assemblies to be approved by the *Approving Officer*.

4.10.7. Hydrant barrel colour to be [*insert colour*]

4.11. AIR VALVES

4.11.1. The general application of the three types of air valves must be:

- Air/vacuum valves for filling or discharging mains and preventing negative pressures.
- Air release valves at high points for small air release during normal operation.
- Combination valves for combination air/vacuum and air release valves.

4.11.2. Combination air valves must be installed at the summit of all mains 250mm diameter and larger, except where the difference in grade between the summit and valley is less than 600mm.

4.12. THRUST AND JOINT RESTRAINTS

4.12.1. Provide thrust restraint on all tees, valves, wyes, reducers, plugs, caps, hydrants, blow-offs and bends (>5 degrees). A minimum of one full pipe length between each 5 degree bend is required. The restraint system must take into account potential future excavations in the vicinity of the fitting.

4.12.2. The *Consulting Professional* is to provide the size of restraints on design drawings taking into account fitting type, water pressure (including test pressures, pressure transients) and soil conditions.

4.12.3. Joint restraint assemblies in chambers shall be designed for tension and compression. Mechanical restraints will be allowed if required.

4.13. CHAMBERS (INCLUDING MANHOLES)

4.13.1. Chambers containing valves, blow-offs, meters, or other appurtenances should allow adequate room for maintenance, including headroom and side room, and conform to Standard Drawings and Specifications. Access openings must be suitable for removing valves and equipment. The chamber is to be provided with a drain to a storm sewer or ditch complete with backflow prevention, to prevent flooding of the chamber.

4.13.2. Adequate ventilation should be provided. The *Municipal Engineer* may require provision of forced ventilation, lighting, heating and dehumidification. Access and ventilation details must comply with WorkSafeBC Regulations.

4.14. SERVICE CONNECTIONS

4.14.1. 20mm diameter is the minimum service connection size and requires a corporation stop prior to being tapped into water mains, unless the main is curvilinear per *MMCD* standard drawings.

4.14.2. 50mm diameter service connections must be made using service saddles, and a corporation stop, per *MMCD* standard drawings.

4.14.3. Main stops must be staggered and not less than 1m apart, along the main line.

4.14.4. The preferred location of the curb stop at the end of each service pipe is located 0.3m offset from the property line, on the road right-of-way, and at the center of each lot. Where such location will conflict with other services, the location may be revised with the approval of the [*Name of Local Government*].

4.14.5. Services and curb stops must have a minimum cover of [*insert value*] m and curb stops must be deeper than [*insert value*] m.

4.14.6. The *Municipal Engineer* may require that thaw wires be installed from the water main to property line parallel to the copper service connection. Thaw wires shall be 2/0 coated copper wire, seven strand or better.

4.14.7. The *Municipal Engineer* may require insulated water service lines and/or insulated trench boxes to counteract freeze up of services.

4.15. WATER METERS

4.15.1. All *Developments* shall require water meters for domestic and irrigation connection flows. Each lot or strata unit shall be metered individually.

4.15.2. All meters shall be supplied and installed by the *Applicant* or *Owner* under the direct supervision of the [*Name of Local Government*] Staff. The meters specified in the [*Name of Local Government*] list of approved materials and manufacturers to be found at [*insert Local Government's website*].

4.15.3. Meters shall be installed indoors or in an outdoor enclosure at the *Applicant* or *Owner's* expense. Location and type of enclosure shall be as approved by the [*Name of Local Government*].

4.15.4. All meters shall be easily accessible to the [*Name of Local Government*] at all times for the purposes of emergency, reading and/or maintenance activities.

4.15.5. Outside meter chambers, vaults or enclosures shall include:

- watertight underground structures
- drainage and ventilation
- protection against freezing
- adequate access and interior space for maintenance and equipment removal
- minimum headroom of 2.0m
- permanent ladder to WorkSafeBC regulations
- piping primed and painted with a rust-inhibiting paint
- metering and readout

4.16. PRIVATE WELLS

The District of Elkford's SDS Bylaw contains an extensive section on standards that are required when servicing lots or whole Subdivisions from private wells. For the sake of completeness, this section has been included below.

4.16.1 Private wells shall provide a quantity of not less than 2,500 litres per lot per day, provide a sustained yield of 9 litres per minute for a minimum of 4 hours.

4.16.2 The well certification required shall be in accordance with Form A (see Elkford Draft Bylaw)

4.16.3 If there are two wells or less in the proposed *Development*, a certification by a Professional Engineer based upon a water well contractor's report or well testing contractor's report will be sufficient. Where well yield is considered marginal (10%) by the certifying engineer or where more than two wells are involved, a Hydrogeological Evaluation of the proposed *Development* is required.

4.16.4 Well Testing Procedure

a) *Completed* wells shall be pumped continuously at a constant rate for a minimum period of four hours. The tested rate shall be at or greater than the required13,000 l/d (9 litres per minute). While the test is running, the following measurements shall be made and recorded on Form B.

i. Water levels in the well;

ii. Pumping rate (shall be constant);

iii. Time that all readings were made;

iv. Notes on colour, smell and taste of water pumped; and

v. Notes on weather conditions at the time of testing.

b) Recording of well testing data shall be in accordance with the following procedure:

i. Depths to water (or drawdown) during the pumping test and recovery after the pump is turned off are to be measured in the pumped well and in nearby observation wells. These measurements should be recorded to the nearest 0.01 m.

ii. The time intervals for both drawdown and recovery readings should be short enough to adequately record any rapid drawdown during start of pumping and any rapid recovery immediately after pump shut down. The time interval after these initial periods can then be gradually lengthened between the readings.

iii. The pumping rate is to be expressed in litres per minute (lpm). In the final "constant rate" test, the pumping rate is to remain constant throughout the period of pumping. This test will involve continuous pumping at a constant rate for four hours or longer, if necessary, to determine a reliable drawdown trend.

iv. Optional step drawdown tests or "maximum drawdown" tests can be used initially to determine the ideal rate if the test is to be run at rates higher than the required 9 lpm rate. When the test has been run for 240 minutes or sufficiently long enough to determine a reliable drawdown trend the test pump is turned off. Water levels in the well should also be recorded during the recovery period in the same manner as during the pumping test.

v. The suggested schedule for readings both during and following the test is provided in the following:

- Readings every minute from 1 to 10 minutes and then every five minutes from 10 to 60 minutes (one hour), then readings every 15 minutes thereafter.
- A preferred method for ease in plotting the data, but one that is sometimes hard to comply with, is as follows:
  - Readings every 30 seconds from 1 to 5 minutes;
  - Readings every minute from 5 to 10 minutes;
  - Readings every 2 minutes from 10 to 20 minutes;
  - Readings every 5 minutes from 20 to 50 minutes;
  - Readings every 10 minutes from 50 to 100 minutes;
  - Readings every 20 minutes from 100 to 200 minutes; and
  - Readings every 60 minutes thereafter until the end of the test.
  - If the well level does not return to the pre-test level within 240 minutes, then one reading should be made on the next day following the test.

c) Results of the well test shall be presented as follows:

i. Time and water level data shall be plotted on Form C. Water levels may be expressed in depth to water or drawdown relative to the initial water level. Normally the graph will be a straight line. Bends in the line suggest that the water-bearing stratigraphy is not extensive and that boundary conditions exist. If the slope of the line increases by a factor of three during the test, a Professional Engineer with groundwater experience will be required to interpret the test data.

ii. The drawdown at 10 minutes (SH1) and at 240 minutes (SH2) shall be determined using the attached Form C and the equivalent daily rate drawdown values, SL1 and SL2,

calculated using the formulas provided at the bottom of Form C.

iii. The formulas are:

SL1 = (QL / QH) * SH1

SL2 = (QL / QH) * SH2

QL = required minimum daily yield = 2500 litres per day = 1.74 litres per minute.

QH = pumped rate in litres per minute; = Qh shall equal or exceed 9 litres per minute.

iv. Plot the calculated values for SL1 and SL2 at each values appropriate time interval (10 minutes for SL1 and 240 minutes for SL2) on Form C. Draw a straight line between the two points and continue the line to the 30 day period on Form C. Read the long term drawdown value S30 from the vertical axis adjacent to the intersection of the drawn line at 30 days.

v. Initial static water level depth (DTW) plus drawdown (S30) plus seasonal water level decline (D), plus safety factor (SF) shall not exceed planned depth to pump suction (intake), as calculated on Form C.

d) All relevant data on the well and the testing program shall be summarized on Form D.

4.16.5 Hydrogeological Evaluation

a) Where there are three or more wells proposed in a *Development*, or where the yield is considered marginal pursuant to Clause 3.20.3, a Hydrogeological Evaluation of the proposed *Development* shall be provided. Such evaluation shall include the following information:

i. Geologic maps of the area and environs, showing regional surficial geologic units, location of known springs, seeps and existing wells or test holes, together with proposed *Subdivision* layout, location of new or proposed wells and septic system tile fields.

ii. Hydrogeologic sections drawn through the area of the proposed *Subdivision* showing inferred major hydrogeologic units (aquifers), water tables, piezometric lines and probable groundwater flow direction.

iii. Detailed logs of *Subdivision* wells and summary information on existing wells on properties surrounding the *Subdivision*.

iv. Constant rate pump test data on all *Subdivision* wells.

v. Summary and interpretation of chemical and biological test results on well water samples.

vi. Summary of hydrogeologic impact assessment considering the following factors:

- Impact of each proposed well on neighbours' wells, both within and adjacent to the proposed *Subdivision*.
- Potential for degradation of well water quality resulting from septic tanks, agricultural commercial operations.

- Long term impact of the proposed wells on the source aquifer.

vii. A certification in the form of Form A is required in support of the Evaluation Report.

4.17. CROSS CONNECTION AND BACKFLOW CONTROLS

4.17.1. All *Developments* shall conform to the [*Name of Local Government*]'s Cross Connection Bylaw. In the absence of this Bylaw, the *Development* should meet the recommendations set out AWWA Canadian Cross Connection Control Manual (latest edition) regarding the prevention of cross connections.

4.17.2. Similarly stormwater and sanitary backflow and back siphoning protection must be addressed by the *Consulting Professional* in the *Subdivision* application.

REFERENCE TO *MMCD* AND [*NAME OF LOCAL GOVERNMENT*]'s STANDARD DRAWINGS WOULD BE ADDED HERE WHEN PREPARING INDIVIDUAL BYLAWS

SECTION 5

SANITARY SEWAGE COLLECTION AND DISPOSAL SYSTEMS

5.0 SANITARY SEWAGE COLLECTION AND DISPOSAL SYSTEMS

5.1. GENERAL

5.1.1. Where a sanitary sewage collection and disposal system is required, sanitary sewer facilities including gravity sewer mains, pump stations and force mains (if required), manholes, service connections and all related appurtenances shall be provided.

5.1.2. The sanitary sewage collection system design should be prepared under the direction of a *Consulting Professional* who has the appropriate experience and is registered with the Association of Professional Engineers and Geoscientists of British Columbia.

5.1.3. A sewer service lateral shall be installed where required to provide a connection to each *Parcel* to be created by the *Subdivision* and to any other existing or possible future *Parcel* which can be serviced from mains installed by or for the *Subdivision*. The routing of sewers shall be in accordance with the directions of the *Municipal Engineer*.

5.1.4. Where sanitary sewer facilities are not required, rights-of-way may be required to be provided by the *Applicant* to allow for the eventual installation of this facility. Such rights-of-way shall be registered in favour of the [*Name of Local Government*] at the *Applicant's* expense.

5.1.5. Where a *Subdivision* is located in a *Service Level* area where on site disposal is permitted, the individual treatment systems (e.g. septic tanks) shall be designed to facilitate connection of the individual service lines to a future sanitary sewer system, should it become available.

5.1.6. On-site disposal systems shall be designed, constructed and inspected in accordance with current provincial government regulations and standards as set out in the *Health Act*.

5.1.7. Engineering drawings showing detailed design of the necessary works shall be submitted to the *Municipal Engineer* for approval. No construction of sanitary sewers shall commence until the drawings have been approved by the *Municipal Engineer*. These drawings shall show alignment and size of pipes, proposed grades, distances between manholes, manhole invert elevations, existing ground line and proposed final ground line over pipe, location of all service connections to the property line, all easements, lift stations, force mains, pipe bedding requirements and all other details which may be required by the *Municipal Engineer*.

5.1.8. Construction drawings must also be filed with Regional Health Authority and a construction permit obtained before sanitary sewers are installed. This

construction permit shall be submitted to prior to final approval of a *Development* by the *Approving Officer* or issuance of a building permit.

5.1.9. The *Consulting Professional* shall confirm downstream system capacity requirements with the *Municipal Engineer*. If required, adequacy of the existing system, downstream of the proposed catchment area, shall be determined using the analytical methods given in the following sections. Where available, modelling information will be supplied by the [*Name of Local Government*].

5.2. DEFINITIONS

[*Beyond scope of model bylaw*]

5.3. DESIGN FLOWS

5.3.1. The sanitary system must be designed based on the following criteria:

- Residential Average Domestic Flow Rate = [*insert value*] litres/capita/day
- Commercial Average Flow Rate = [*insert value*] litres/day/hectare
- Infiltration rates for pipes not in the water table = [*insert value*] I/ha/d
- Infiltration rates for pipe in the water table = [*insert value*] l/ha/d
- The design flows shall be calculated using the average daily flows plus the infiltration rate.
- Peak flows use the Harmon Formula.

5.4. PIPE FLOW EQUATIONS

5.4.1. Gravity Sewers:

The hydraulic analysis of sewer pipes shall be carried out assuming steady state flow conditions and using the Manning equation.

Flow Rate $\mathbf{Q} = \frac{\mathbf{1}}{\mathbf{N}} \times \mathbf{A} \times \mathbf{R}^{\mathbf{0.66}} \times \mathbf{S}^{\mathbf{0.5}}$

where: Q = design flow in cubic metres per second
A = cross-sectional area in square metres
R = hydraulic radius in m, A/wetted perimeter
S = slope of energy grade line in m/metre
n = roughness coefficient = 0.013 for all pipe

5.4.2. Force Mains:

The analysis of the system shall be carried out using the Hazen Williams equation:

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

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, 110 all pipes*

*A higher value for "C" may be appropriate for the pipe alone, if head loss calculations are used accounting for losses at all valves and fittings separately.

Maintain a minimum velocity of [*insert value*] m/s and a maximum velocity of [*insert value*] m/s.

Other formulas and methods may be used subject to the approval of the *Municipal Engineer*.

5.4.3. Peaking Factor to be used:

A 'peaking factor' is the ratio of peak dry weather flow to the average dry weather flow (ADWF). The calculation of sewage flows shall have a 'peaking factor' applied to the ADWF components of the sewage based on the population, or 'population equivalent', of the subject catchment area. The peaking factor shall be calculated using the Harman equation.

Peaking Factor $$\boldsymbol{PF_{Harman} = 1 + \frac{14}{4+\sqrt{\frac{Population}{1000}}}}$$

5.5. GRAVITY SEWERS

5.5.1. The minimum permitted size of pipe is:

- 200mm diameter mains – residential.
- 250mm diameter mains – industrial.
- 100mm diameter – services and force mains.

5.5.2. The minimum flow velocity in the sewer pipes must be [*insert value*] m/s. There is no maximum velocity; however, consideration must be given to scour problems and the dynamic loading on manholes where flow exceeds [*insert value*] m/s.

5.5.3. The grade of any sewer is governed by the minimum velocity requirement of [*insert value*] m/s. The last end section of a main that will not be extended in the future must have a minimum grade of 1.0% where 200mm diameter pipe is proposed. Anchoring must be incorporated where the grade of the sewer is 15% or greater in accordance with *MMCD* Drawing G8.

5.5.4. The minimum depth of the sewer main (from the finished surface of the road or grade to the top of the pipe) must be suitable to service the basement(s) of adjacent properties are required in the "Service Connection" section.

The absolute minimum cover over a pipe must be [*insert value*] m (measured from the finished surface to the top of pipe) or comply with manufacturer's recommendations.

The depth of the sewer must be sufficient to provide "gravity flow" service connections to both sides of the roadway and must allow for future extension(s) to properly service all of the upstream tributary lands for ultimate *Development*.

5.6. ALIGNMENT AND CORRIDORS

5.6.1. Sanitary sewers must be located within the road right-of-way as noted in the applicable Standard Drawing Typical Cross Section for that roadway.

5.6.2. When the utility is required to cross private land(s), the right-of-way shall have a minimum width of 3.0m. Where both storm and sanitary sewers are located within a single right-of-way, the minimum width shall be 5.0m.

5.6.3. Sewer main extensions shall extend to and terminate at the furthest property line of the last lot is services.

5.7. CURVED SEWERS

5.7.1. Subject to meeting manufacturer's specifications, horizontal and vertical curves are permitted and will require a constant offset and/or must be uniform throughout the curve.

5.7.2. The design velocity must exceed 0.9m/s and the curve midpoint and two ¼ points are to be located by survey and shown on the as-constructed drawings with an elevation and offset of the invert at each point.

5.8. MANHOLES

5.8.1. Manholes are required at:

- Every change of pipe size
- Every change in grade, except as indicated in the Curved Sewers section
- Every change in direction, except as indicated in the Curved Sewers section
- Downstream end of curved sewers
- Every pipe intersection except for 100mm and 150mm service connections and junctions with trunk sewers 900mm diameter and larger

- Upstream end of every sewer line
- Every future pipe intersection
- At least every 150m.

5.8.2. In all cases a manhole is required at the upper end of a sewer for flushing and cleaning.

5.8.3. Sanitary manhole rim elevations in off road areas must be designed to be:

- Above the adjacent storm manhole rim elevation.
- Above the surrounding ground so that infiltration from ponding will not occur.

5.9. HYDRAULIC LOSSES ACROSS MANHOLES

5.9.1. The following criteria must be used:

- The crown of the downstream pipe must not be higher than the crown of the upstream pipe.
- Minimum drop in invert levels across manholes:
  - Straight run – 5mm drop
  - Deflections up to 45 - 20mm drop max.
  - Deflection 45 to 90 - 30mm drop min.
- Drop manhole and ramp structures to follow *MMCD* standard.
- All benching shall be designed to prevent any solid deposition or flow disruption.

5.10. SERVICE CONNECTIONS

5.10.1. Each and every legal lot and each unit of a residential duplex shall be provided with a separate service connection and shall confirm to *MMCD* standards.

5.10.2. Unless otherwise approved by the [*Name of Local Government*], connections are to serve all plumbing by gravity. Building elevations should be established accordingly. Pumped connections may be permitted if requested prior to sewer design and if appropriate covenants are provided.

5.10.3. Size pipe to accommodate peak design flow. Minimum pipe sizes is 100 mm.

5.10.4. Connections to large lots are to be located at the lower portion of each lot. For urban *Developments*, location of connection to follow the standard drawings. Other depth requirements are as indicated for sanitary sewer mains.

5.10.5. Minimum grade from property line to storm sewer main:

- 100mm diameter pipe: 1.5%
- 150mm diameter pipe: 1.0%
- Larger sizes: Grade based on minimum velocity of 0.75 m/s

5.10.6. Details

Use standard wye fittings for connections to new mains. For connections to existing mains, use wye saddles or insertable tees.

Connections exceeding 30m in length will be treated as mains.

- Service connections may be permitted into manholes if:
  - The connection is not oriented against the flow in the main.
  - Manhole hydraulic requirements are met.
  - Manholes are required on service connections larger than 250mm diameter.
- Inspection chambers are required on residential connections unless the service is less than 2.5m long and connect to a manhole.
- Inspection chambers to *MMCD* standards and shall be include a backflow prevention device such as the Le-Ron Inspection Chamber Add-a-Flap or approved equivalent. Sanitary inspection chamber lids to be red in colour.
- Have a minimum diameter of 100mm except for industrial/commercial which shall have minimum diameter of 150mm.

Geo-exchange innovations: In BC, the alternative energy solution of collecting surplus heat by wrapping sanitary sewers in glycol pipes is becoming more popular in innovative ski hill and other building developments. If this is to be entertained in a local government's jurisdiction, then it may be wise to include some form of specification in this schedule.

5.11. SANITARY LIFT STATIONS

Lift Station Design Criteria are defined in the *MMCD* manuals.

5.12. FORCE MAINS

5.12.1. In conjunction with sanitary pumping facilities, the following criteria must be noted in the design of force main systems. Design computations for force mains must be made using a C value appropriate for the type of pipe. The Hazen Williams formula must be used.

5.12.2. At the lowest pump delivery rate anticipated to occur at least once per day, a minimum cleansing velocity of [*insert value*] m/sec ([*insert value*] m/s) should be

maintained. Maximum velocity should not exceed [*insert value*] m/sec ([*insert value*] m/s).

5.12.3. An automatic air relief valve must be placed at high points in the force main to prevent air locking.

5.12.4. Termination: Force mains should enter the gravity sewer system at a point not more than 600mm above the flow line of the receiving manhole. An outside drop pipe must be incorporated.

5.12.5. The minimum size for force mains is [*insert value*] mm in diameter.

5.12.6. Materials

- With the exception of valve, the material selected for force mains must meet the standards specified for water mains and must adapt to local conditions such as character of industrial wastes, soil characteristics, exceptionally heavy loadings, abrasion and similar problems.

- Valves used on force mains shall be plug valves sufficient for long term use in a corrosive environment.

5.12.7. Loads and Transient Pressures: All force mains must be designed to prevent damage from superimposed loads, or from water hammer or column separation phenomena.

5.13. ON-SITE SEWAGE DISPOSAL

Where permitted, site conditions and on-site sewage disposal systems shall be engineered by a *Consulting Professional* or certified professional per standards and specifications of the *Health Act* and filed with Ministry per *Health Act* requirements. Proof of filing shall be submitted to the [*Name of Local Government*] prior to final approval of a *Subdivision* by the *Approving Officer* or issuance of a building permit.

5.14. GREYWATER REUSE

No specific provisions could be sourced. Refer to Guidance Document for a discussion and examples of greywater reuse specifications.

REFERENCE TO *MMCD* AND [*NAME OF LOCAL GOVERNMENT*]'s STANDARD DRAWINGS WOULD BE ADDED HERE WHEN PREPARING INDIVIDUAL BYLAWS

SECTION 6

CONNECTIVITY, HIGHWAYS AND ACTIVE TRANSPORTATION

6.0 CONNECTIVITY, HIGHWAYS AND ACTIVE TRANSPORTATION

6.1. GENERAL

6.1.1. All *Highway* classifications and designations for vertical and horizontal alignment elements will be designed utilizing information contained in this section and in compliance with:

a) The current edition of the Transportation Association of Canada – Geometric Design Guide for Canadian Roads.

6.1.2. Consulting Engineers retained by the *Owner* to design the *Works and Services* must consult with the [*Name of Local Government*] to determine what existing information may be of assistance to them.

6.2. DEFINITIONS

[*Beyond the scope of model bylaw*]

6.3. ROAD CLASSIFICATIONS

6.3.1. Prior to commencing detailed design, the Consulting Engineer must liaise with the [*Name of Local Government*] with respect to classification, section, parking and bicycle lane requirements for all streets in or adjacent to the *Subdivision* or *Development* or other road improvements required.

6.3.2. Table 6.1 summarizes the general requirements for each road classification which shall be read in conjunction with the Standard Drawings.

Table 6.1 – Road Cross Section Elements

Road Classification	Minimum Right-of-Way Width (m)	Minimum Asphalt Width (m)
Arterial	[*insert value*]	[*insert value*]
Collector	[*insert value*]	[*insert value*]
Local Street	[*insert value*]	[*insert value*]
Limited Local Street	[*insert value*]	[*insert value*]
Cul-de-Sac - entrance	[*insert value*]	[*insert value*]
- terminus	[*insert value*]	[*insert value*]
Walkways	[*insert value*]	[*insert value*]

6.4. DESIGN PARAMETERS

6.4.1. Design Speed

Unless otherwise accepted, roadways shall be designed to the following minimum standards as specified in the Transportation Association of Canada, Geometric Design Guide for Canadian Road Manual:

Arterial Ministry of Transportation and Highways Standards

- Collector 50 km/hr.
- Local 50 km/hr.

6.4.2. Cross Section Elements (dimensions only used as an example)
The *Applicant* or *Owner* shall either dedicate sufficient right-of-way to cover road embankments. Where a cut or fill slope exceeds 1.5m in vertical height, additional right-of-way may be required at the discretion of the *Approving Officer*.

6.4.3. Road Cross Sections

- Roads shall be centre line crowned with a minimum slope of 2% (maximum 4%) to the gutter or edge of minimum shoulder.
- Offset from centre line crown may be considered where topography or property access grades are a factor.
- Super-elevation should be used as indicated in the TAC Geometric Design Guide.

6.5. ROAD WORKS STRUCTURE

6.5.1. The minimum road works structure is as shown in Table 6.2 below. Each road structure is to be designed based on site specific soil conditions and traffic loadings. The road works structure must be confirmed as acceptable during construction by a qualified Geotechnical Engineer.

Table 6.2 – Road Structure

Road Classification	Compacted Sub-Base Thickness (mm)	Compacted Base Thickness (mm)	Compacted Asphalt Thickness Lower/Upper Course (mm)
Arterial	[*insert value*]	[*insert value*]	[*insert value*]
Collector - Urban - Industrial	 [*insert value*] [*insert value*]	 [*insert value*] [*insert value*]	 [*insert value*] [*insert value*]
Local - Urban - Industrial	 [*insert value*] [*insert value*]	 [*insert value*] [*insert value*]	 [*insert value*] [*insert value*]
Limited Local	[*insert value*]	[*insert value*]	[*insert value*]

6.6. HORIZONTAL ALIGNMENT

6.6.1. All horizontal alignment elements shall be designed in accordance with the Alignment and Lane Section of the current edition of the Transportation Association of Canada Geometric Design Guide for Canadian Roads.

6.7. VERTICAL ALIGNMENT

6.7.1. All vertical alignment elements shall be designed in accordance with the Alignment and Lane Section of the current edition of the Transportation Association of Canada Geometric Guide for Canadian Roads.

6.7.2. Vertical curves shall be designed to provide safe stopping sight distances.

6.7.3. Vertical curves shall be provided at all grade changes greater than 1%.

6.7.4. Vertical curve length is calculated by the equation L = KA where:

L = the length of the vertical curve in metres.
K = a constant related to lines and geometry of a parabolic curve.
A = is the algebraic difference in grades in percent.

6.7.5. Minimum K values for vertical curve design shall be as shown in the current edition of the Transportation Association of Canada Geometric Guide for Canadian Roads

6.7.6. Maximum road grades shall conform to *MMCD* and are generally as shown in Table 6.3.

Table 6.3 – Maximum Roadway Grades

Roadway Classification	Maximum Grade
Collector	12%
Local	10%
Cul-de-sac (uphill)	10%
Cul-de-sac (downhill)	8%
Cul-de-sac (through bulb)	7%

6.8. CURB RETURN RADII

6.8.1. Minimum curb return radii to conform to *MMCD* standards and shall be provided at all intersections.

6.8.2. The minimum property corner cut shall follow the *MMCD* standard.

6.9. CUL-DE-SACS

6.9.1. Cul-de-sac bulbs shall be used to terminate “no exit” roads and shall have adequate pavement radii to ensure emergency or operations vehicle access.

6.9.2. Maximum length of cul-de-sac streets to be 150m as measured from the edge of the intersecting through road to the centre of the cul-de-sac bulb when there is no alternate access from the bulb, and 210m when there is alternate access (e.g. emergency access road) and a looped water main is provided.

6.9.3. Roads must be constructed to the end of the furthest property line of the last lot being built. If the road is to continue in the future then a temporary turn around complete with barrier posts must be constructed. The temporary turn around must be constructed to allow maintenance vehicles and garbage trucks to turn around.

6.10. INTERSECTIONS

6.10.1. Intersections are to be designed as close as possible to right angles with a maximum variation of 20 degrees.

6.10.2. Cross-slopes at intersections shall follow TAC Geometric Design Guide.

6.10.3. No through road grade exceeding 8% shall be permitted at intersections.

6.10.4. The minimum spacing between intersections is:

a) Along Collector Streets – 60m.

b) Along Local Streets, 4 Way Intersections – 60m.

c) Along Local Streets, 3 Way Intersections – 40m.

6.11. TRAFFIC CONTROL DEVICES

6.11.1. Traffic signs are to be designed in accordance with the current edition of the Transportation Association of Canada Manual of Uniform Traffic Control Devices for Canada.

6.11.2. Crosswalks to be designed in accordance with the current edition of the Province of British Columbia Ministry of Transportation and Infrastructure Pedestrian Crossing Control Manual.

6.11.3. Traffic Paint Markings to be design in accordance with the current edition of the BC Ministry of Transportation and Infrastructure – Pavement Markings Manual.

6.12. DRIVEWAYS/CROSSOVERS

6.12.1. All lots must be provided with a practical access driveway.

6.12.2. Driveway grades are to be set such that minimum cover over utilities within the boulevard is maintained.

6.12.3. Beyond the boulevard the maximum driveway grade is 15%. Where possible it is desirable to have the driveway sloping away from the house and towards the street or other stormwater drainage feature.

6.12.4. Number of Driveways

a) Urban Residential Areas:

i. One driveway per road frontage

ii. Second driveway permitted for corner lot if driveway not on an Arterial road

iii. Where residential lot abuts roads of different classifications, the principal driveway should access the road of the lower classification

b) Commercial, Industrial, Institutional, Comprehensive and Multifamily *Development*:

i. Upon demonstrated need, the [*Name of Local Government*] may approve more than one access.

6.12.5. Driveway Location and Widths

a) Urban Residential Areas
Driveways located on corner lots should be at least 5.0m from the lot corner nearest the intersection. Provision of adequate sight distance should be considered in accordance with TAC Geometric Design Guidelines.

Minimum and maximum widths of urban residential driveways are 4.0 and 7.5m respectively

b) Commercial, Industrial, Institutional, Comprehensive and Multifamily *Development*

Driveways to corner lots should be located no closer than 12.0m from the property line of the adjoining road. Provision of adequate sight distance should be considered in accordance with TAC Geometric Design Guidelines.

The minimum width of a driveway to a property having one or more accesses is 4.5m for one way access and 6.5m for two way access with a maximum of 11.0m. Where a corner lot adjoins roads of different classifications, the principal driveway should access from the road of the lower classification, except for commercial sites where access may be provided for both roads, subject to the [*Name of Local Government*] approval.

6.13. WALKWAYS/SIDEWALKS/BIKEPATHS

6.13.1. Concrete sidewalks must be provided at least on one side of the street adjacent to the roadway, or set back to separate pedestrian and bicycle movements from vehicular traffic.

6.13.2. The maximum gradient for walkways is 12%. Concrete stairs are to be installed where required to suit the terrain of the site, when the grade exceeds 12%.

6.13.3. Retaining walls shall be installed for walkways as required to suit the site topography. The design shall be specific to the situation and must be certified by a Professional Engineer.

6.13.4. Paved walkways shall be a minimum of [*insert value*] m wide and shall be designed to provide minimal elevation interference with adjacent lots.

6.13.5. Cycling facilities will be required as part of roadway design as identified in the Bicycle Master Plan and in consultation with the *Municipal Engineer*. Design requirements for cycling facilities will be determined in consultation with the *Municipal Engineer* and TAC Guidelines.

6.14. WHEELCHAIR RAMPS

6.14.1. Wheelchair ramps must be provided at all intersection curb returns as an integral part of the sidewalk or to link walkways and crosswalks.

6.14.2. All wheelchair and letdown ramps shall have a gutter lip that is flush with the gutterline to facilitate unobstructed movement of wheeled devices.

6.15. TRANSIT FACILITIES

6.15.1 The requirement for transit facilities will be established by the *Municipal Engineer*.

6.15.2 Bus bay locations should be established in co-operation with the *Municipal Engineer*. Bus bay details should be in accordance with the Pullouts section of the TAC Geometric Design Guidelines.

6.15.3 Additional guidelines are included in Canadian Urban Transit Association and TAC - Canadian Transit Handbook.

6.16. BOULEVARDS / STREETSCAPES

6.16.1. Boulevards shall be defined as the area between the face of curb, back of walk or the edge of pavement and the property line.

6.16.2. A minimum grade of 2% must be maintained from the property line to the back of curb, back of walk, or to the back side of a ditch.

6.16.3. The design of boulevards and streetscape improvements shall consider the items listed below. The determination of what is to be addressed rests with the *Approving Officer*. In determining which items are to be included, consideration will be given to the road classification of the street and the zoning of adjacent properties including:

a) Sidewalk.

b) Trees, shrubs and other plant materials.

c) Grass and other ground cover vegetation.

d) Paving stones in a variety of materials.

6.16.4. Street Trees:

a) Road design standards provide adequate room for tree planting and landscaping within the right-of-way.

b) The planting of trees on all new [*Name of Local Government*] residential roads shall be a requirement of all *Subdivisions*.

c) The *Developer* shall prepare and submit to the [*Name of Local Government*] a Landscaping Plan for review and approval. The Landscaping Plan shall show tree planting locations and species and be designed to achieve a tree cover of 40 percent upon maturity.

d) Trees to be planted along streets typically shall be:

i. Randomly spaced to provide one tree in front of each lot and a separation dependent upon the species but typically 7 to 12m apart.

e) Trees shall not be planted within:

ii. 6m from street intersections, and crosswalks – protect sight lines.

iii. 6m from street lighting – protect illumination.

iv. 3m from utility poles, junction boxes, vaults.

v. 2m from catch basins, driveways, utility services, hydrants and manholes.

vi. No underground utilities to pass directly under the rootball.

vii. When selecting tree species near overhead power lines, the designer shall ensure that the canopy of the mature tree will maintain the minimum distances as required by Electrical Regulations.

viii. Consideration should be given in locating trees within the boulevards to avoid obstructing traffic signs, driveways, and sight lines.

ix. The view corridor of main windows or patios.

6.17. STREET LIGHTING

[*Beyond the scope of model bylaw*]

6.18. HILLSIDE STANDARDS

6.18.1. General

a) Subject to prior approval by the [*Name of Local Government*], the previous design guidelines may be modified for hillside neighbourhoods as outlined below. Hillside areas are lands that in their natural state have a slope angle of 10% or greater for a minimum horizontal distance of 10 metres. The design objective of the Hillside Standards includes the following:

   i. Accommodation of hillside land *Development* while minimizing environmental impacts such as disturbance of natural slopes, vegetation and watercourses.

   ii. Protecting *Development* from hazardous conditions.

   iii. Encouragement of low speed traffic, particularly for local roads.

   iv. *Development* of site layouts compatible with the above objectives.

b) Modification to the following Hillside standards may be considered by the [*Name of Local Government*] for specific *Developments*, provided that the proposed modifications are supported by adequate research and detailed justification.

c) New Hillside *Development* should:

   i. Be in harmony with the surrounding community and the natural environment;

   ii. Protect wildlife habitat and environmentally sensitive areas;

   iii. Integrate or protect unique or special natural features of the site such as landforms, rock outcroppings, mature trees and vegetation, drainage courses, hilltops and ridgelines;

   iv. Avoid unstable or hazardous portions of the site and protect lives and property from hazardous conditions such as landslides, erosion, etc.

   v. Provide safe access for residents, visitors and service providers;

   vi. Maintain the aesthetic and scenic quality of the [*Name of Local Government*] of hillsides;

   vii. Be compatible with the natural features, building location and existing open spaces of neighbouring properties;

   viii. Respect the existing views, privacy, access to light and safety of neighbouring properties; and

   ix. Support economic and efficient construction and maintenance standards.

6.18.2. Roads

Subject to approval by the [*Name of Local Government*], maximum grades may be increased to 2% greater than those shown in Table 6.3.

6.18.3. Cul-de-Sac Streets and Hillside Emergency Accesses

Some of the Local streets within complex topographic areas will take the form of a cul-de-sac. Generally, cul-de-sac streets are used where street connectivity is not possible (i.e. steep terrain) or not warranted (i.e. serves very few homes). Although the appropriate Local street standard will also apply to cul-de-sac streets, there are two additional street specifications unique to this street form that must be addressed in relation to livability: permitted length and the design of the street turnaround.

In complex topographic areas long streets may be required to access *Developable* pockets within areas of steep terrain. Due to the complex topography it will often not be advisable, or even possible, for connectivity to be achieved at both ends of a street.

Longer cul-de-sac streets will result and systems of branching cul-de-sacs will be established to access some areas of extremely difficult terrain. In response to public safety issues, it is desirable that emergency access routes to such areas are available – Hillside Emergency Access standards are included below. This is considered more acceptable from a livability stance than requiring street connectivity in all situations as the lower standards required for an emergency access will result in a lesser impact to the hillside. Maintaining street connectivity wherever possible will remain a priority.

The radius of a cul-de-sac also plays a role in the livability of a street. Laying a cul-de-sac requires a relatively large flat area. The larger this area is, the greater the impact to the landscape, particularly in complex topographic areas. Large cul-de-sacs can also decrease the social quality of a street by terminating the public corridor with a large, barren paved surface. A reduction of the cul-de-sac radius is feasible if parking is restricted in the cul-de-sac, which will ensure a large enough circumference for car turning. It is noted that provision must be made on a case by case basis for emergency vehicle turning.

a) Cul-de-sac

   i. ROW: min 15.0m radius;

   ii. Radius to edge of paved surface: min 10.25m radius;

   iii. Alternative types of street turnarounds will be considered for use based on site;

iv. Specific topographic conditions. In certain circumstances; reduced cul-de-sac radii or hammer head type turnarounds will be permitted;

v. Cul-de-sac streets may exceed the maximum length as specified by the [*Name of Local Government*] - mid-block turnarounds should be considered in this situation;

vi. A secondary emergency access must be provided for all public cul-de-sac streets that are in excess of the maximum length as specified by the [*Name of Local Government*];

vii. Cul-de-sac Roads are designed to be permanent, must be provided at the closed end with an area designed to permit safe and adequate space for the turning of motor vehicles;

viii. At road intersections cul-de-sac must be constructed with an approach grade of not greater than 3% for a distance of not less than 15 m from the adjacent edge of asphalt of the major road;

ix. The draining grade around the outside curb of a cul-de-sac must be not less than 0.50% and not greater than 5.0%. Longitudinal gradients of cul-de-sac bulbs shall not exceed 5.0%;

x. When a cul-de-sac is at the bottom of a hill, the longitudinal gradient of the first 50m of roadway uphill from the cul-de-sac bulb shall not exceed 5.00%. The maximum longitudinal gradient for the rest of the hill shall not exceed 8.0%;

xi. When a cul-de-sac is at the top of a hill, the longitudinal gradient for the roadway downhill from the cul-de-sac must not exceed 12.0%;

xii. Gutter elevations on curb returns and cul-de-sacs must be shown on the drawings at the beginning, one-quarter points and end of curb returns and at 7.50 m intervals around cul-de-sacs;

xiii. A turn-around or a second point of access is required on roads longer than 100 m. The maximum length of a permanent cul-de-sac shall be 200 m. Where it is part of a temporary and/or staged *Development*, this maximum length may be 400 m. Cul-de-sac lengths greater than 200 m may be considered by the *Approving Officer*;

xiv. Major flood routes must be provided on down slope cul-de-sacs;

xv. Snow storage areas must be provided in close proximity;

b) Guidelines for emergency access roads at long cul-de-sacs include the following:

i. Maximum grade: 15%

ii. Minimum right-of-way and roadway width: 4.5m.

iii. Removable bollards to prevent access by non-emergency vehicles.

iv. Pavement structure equivalent to local road.

v. Shared use with pedestrian walkway or bikeway.

c) Refer to *MMCD* Design Guideline Manual – Hillside Road Cross-Section Elements.

d) Refer to *MMCD* Design Guideline Manual – Hillside Road Alignment Standards.

6.19. EMERGENCY ACCESS

6.19.1. Maximum grade is 10%

6.19.2. Right-of-way width to be a minimum of 6.0m

6.19.3. Minimum paved width to be 4.5

6.19.4. Restricted non-emergency vehicles‟ access through the use of removable restriction posts per *MMCD* standard drawing C12.

6.19.5. Additional requirements may be identified at the discretion of the *Approving Officer*

REFERENCE TO *MMCD* AND [*NAME OF LOCAL GOVERNMENT*]'s STANDARD DRAWINGS WOULD BE ADDED HERE WHEN PREPARING INDIVIDUAL BYLAWS

SECTION 7

LANDSCAPING

7.0 LANDSCAPING

Refer to the Guidance Document for input on this section.

REFERENCE TO *MMCD* AND [*NAME OF LOCAL GOVERNMENT*]'s STANDARD DRAWINGS WOULD BE ADDED HERE WHEN PREPARING INDIVIDUAL BYLAWS

SECTION 8

UTILITIES

8.0 UTILITIES

[*Beyond scope of model bylaw*]

Power company requirements and design

Power outages and future innovations such as electric vehicle recharging (capacity). Installation design criteria based on development type

Telephone utility requirements and design

Cablevision utility requirements and design

Natural Gas utility requirements and design

Mail delivery

SECTION 9

COMMUNICATIONS AND OPERATIONS

9.0 COMMUNICATIONS AND OPERATIONS

The aim of this section will be to make sure that the *Consulting Professional* consults the [*Name of Local Government*]'s Operations and Maintenance Personnel, as the Fire Chief and others to make sure that traditional designs, and climate change and other innovative solutions, suit the [*Name of Local Government*]'s operational policies and budgets.

Certain public works facilities may also be required on or near the *Development* to ensure future operation and maintenance of the proposed *Subdivision*.

Also to see that partnerships are built in the possible implementation of innovative neighbourhood development solutions.