DISTRICT OF LAKE COUNTRY

BYLAW 1121, 2020

CONSOLIDATED VERSION

(Includes amendment as of January 21, 2025)

This is a consolidated copy to be used for convenience only. Users are asked to refer to the Subdivision and Development Servicing Bylaw as amended from time to time to verify accuracy and completeness.

Amending Bylaw	Summary of Amendments	Adoption
1161	Delete & replace sec B.1, F.1, N.9, S.1.3, & T.2 Add figures B-1 & B-2 Add sec B.9, B.10 & Q.1.4 Delete sec Q.2	July 20, 2021
1193	Delete sec H.2, H.2.1 & Q.3.1 (r)	October 4, 2022
1228	Delete and replace sec 9.2. In the entire Bylaw, replacing the words “his”, “her”, or “his or her” with the word “their. Delete and replace the words “direct”, “directed” or “direction” with “require”, “required” or “requirement”, in the following sections: • G.3.1 • H.1.2 • H.1.3 (b) • H.1.3 (c) • I.6.7 • I.7.3 • 1.12.1(a)(iii) • M.18.4.(a). Delete definition of “Preliminary Layout Review”. Delete sec B.2. Delete and Replace sec B.6.2. Add sec B.6.4. Delete and replace sec G.1.5. Delete sec G.1.6. Delete subsection G.3.1 (m). Amened title of Table G-1 Delete texts of footnotes 1, 2, 6, and 7. Delete and replace section G.3.2. Delete and replace G.3.4.	May 21, 2024
1241	Delete and replace Schedule M	September 3, 2024
1262	Delete and replace subsection T.1.4 Cash in Lieu	January 21, 2025

DISTRICT OF LAKE COUNTRY
SUBDIVISION AND DEVELOPMENT SERVICING BYLAW 1121, 2020

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DISTRICT OF LAKE COUNTRY

BYLAW 1121

A BYLAW TO REGULATE THE PROVISION OF WORKS FOR SUBDIVISION AND DEVELOPMENT OF LAND

The **Council** of the **District** of Lake Country, in open meeting, enacts as follows:

1. **APPLICATION OF BYLAW**

1.1. This Bylaw applies to all land, buildings and structures within the geographical area incorporated as the **District** of Lake Country.

1.2. All works required in this bylaw apply to all **Owners** who make an application for **Subdivision** or **Development** unless the **District** determines that the proposed Subdivision or **Development** does not require works.

1.3. All works required in this Bylaw shall be designed and constructed in accordance with the provisions of this Bylaw.

2. **GRAMMATICAL**

2.1. In this Bylaw the singular shall also include the plural, and the masculine shall also include the feminine.

3. **SEVERABILITY**

3.1. If any part of this Bylaw is for any reason held invalid by any court of competent jurisdiction, the invalid portion shall be severed and the severance shall not affect the validity of the remainder of this Bylaw.

4. **ENACTMENT**

4.1. Any enactment referred to herein is a reference to an enactment of British Columbia and regulations thereto, as amended, revised, consolidated or replaced from time to time.

4.2. Any Bylaw referred to herein is a reference to an enactment of the **Council** of the **District** of Lake Country, as amended, revised, consolidated or replaced from time to time.

5. **SCHEDULES**

5.1. Schedules A through T are attached to and form part of this bylaw and are enforceable in the same manner as this bylaw.

6. **COSTS BORNE BY OWNER**

6.1. The **Owner** shall bear sole responsibility for all costs related to documentation, design, provision of works and fees or charges required under this Bylaw.

7. DELEGATION

7.1. The **District Engineer** is hereby delegated the powers to execute and amend all forms related to this Bylaw, including:

(a) Statutory Right of Way;
(b) Subdivision and **Development** Servicing Agreement;
(c) Maintenance Agreement;
(d) Section 219 Covenant for Onsite Water Treatment;
(e) Section 219 Covenant for Onsite Sewerage system;
(f) Drawing Standards Policy; and
(g) Latecomer Agreements.

7.2. Delegation contained with this Bylaw includes the successor, lawful deputy, and any person designated to act in their place.

8. APPLICATION PROCEDURES

8.1. Under the procedures set out in this Bylaw, if an Owner of land intends:
(a) to subdivide a parcel of land; or
to develop a parcel of land the **Owner** must make application to the **District** for **subdivision** or **development**.

8.2. An application must:
(a) be signed by the Owner of each parcel of land that is the subject of the application or by a person authorized in writing by the Owner to act as their agent for the purpose of making the application;
(b) be made in writing on the application forms prescribed by the **District**;
(c) include the information required under this Bylaw; and
(d) be accompanied by the applicable fees.

9. OWNER'S ENGINEER

9.1. Unless exempted by the **District Engineer** the **Owner** must retain, at the **Owner's** sole expense, a Professional Engineer who shall:
(a) prepare engineering design drawings in accordance with the provision of this bylaw.
(b) be responsible for the design, layout, approval of materials, field reviews of installation, information for and certification of as-built drawings and documents, for all services that are the responsibility of the **Owner** under this Bylaw;
(c) be responsible for coordinating communication between the **District** and the **Owner**, the **Owner's Engineer**, and the **Contractor**.
(d) ensure that the work is performed in accordance with all applicable laws, ordinances, rules, regulations, codes, Bylaws, and orders of the **District** or other authorities having jurisdiction.
(e) ensure all permits, licenses, approvals and certificates required for the performance of the work are obtained

Deleted and replaced by Bylaw 1228, 2024

9.2 If the Owner's Engineer can demonstrate and certifies that an alternative solution meets the intended safety, operational and functional objectives set out in the provisions of this bylaw, then, the District Engineer may permit the alternative solution. Notwithstanding permission granted by the District Engineer in this section, the Owner and Owner's Engineer retain full responsibility for the alternative

solution. The District Engineer may require third-party consulting engineer to evaluate the alternative solution, at the Owner's Expense."

10. **MMCD**

10.1. **MMCD** Specifications are hereby incorporated by reference into and form part of this Bylaw.

10.2. **MMCD** Specification provisions shall apply to all works constructed within the **District**. Where the provisions contained in this Bylaw are in conflict with the **MMCD** Specifications, this Bylaw shall supplement or supersede the **MMCD** Specifications.

11. **DUTY OF CARE**

11.1. This Bylaw does not create any duty at law on the part of the **District**, its **Council**, **District Engineer**, officers, employees or other representatives concerning anything contained in this Bylaw. All works, services, improvements and all matters required pursuant to this Bylaw are the responsibility of the **Owner** and **Applicant** and all persons acting on their behalf. No approval of any kind, certificate, permit, review, inspection, or other act or omission by the **District** or any of its representatives, including any enforcement, or lack of enforcement of the provisions of this Bylaw shall relieve the **Owner** and **Applicant** and all persons acting on their behalf from this duty pursuant to this Bylaw and shall not create any cause of action in favour of any person against the **District**, its **Council, District Engineer**, officers, employees or other representatives concerning anything contained in this Bylaw.

12. **COMPLIANCE**

12.1. No parcel may be subdivided or **developed** unless the subdivision or **development** conforms to the provisions set out in this Bylaw.

12.2. The **District Engineer** or the **Building Inspector** may issue a compliance order to the **Owner** or any other person found to be in contravention of this Bylaw, which may:

(a) require a person who contravenes this Bylaw to comply with the Bylaw within a time limit specified in the order;
(b) include an order to Stop Work or otherwise cease construction or **development** of works;
(c) require tests and evidence of proof of materials, equipment devices, construction methods, assemblies or soil conditions meet the requirements of this Bylaw;

12.3. If a compliance order is issued, approval may not proceed until the **District Engineer** or **Building Inspector** is satisfied that the required actions or repairs and any required fees or charges have been paid;

12.4. All costs associated with rectifying non-compliance issues shall be the sole responsibility of the Owner.

12.5. If the required actions or repairs, or any part thereof, are not completed in accordance with the provisions of this Bylaw the **District** may draw funds from the Letter of Credit and may complete the works at the expense of the Owner. If there is insufficient security, then the **Owner** will pay such deficiency to the **District** immediately upon receipt of an invoice from the **District**. The **District** may do such work either by itself, or by **contractor**s employed by the **District**.

13. **OFFENCE AND PENALTY**

13.1. Any person who violates any provision of this Bylaw or who suffers or permits any act or thing to be done in contravention or in violation of any of the provisions of this Bylaw or who neglects to do or refrains from doing anything required to be done by any of the provisions of this Bylaw, commits an offence and is liable on summary conviction to a penalty not exceeding Fifty Thousand Dollars ($50,000.00) plus the cost of prosecution.

13.2. Each day that the violation continues to exist shall constitute a separate offence

14. **RIGHT TO ENTER**

14.1. The **District Engineer**, **Approving Officer**, and the **Building Inspector** or their designates shall have the right to enter upon the property of any **Owner** or occupier at all reasonable times and in a reasonable manner for the purposes of inspecting property and declaring whether the property is otherwise not in compliance with the provisions of this Bylaw

15. **REPEALS**

15.1. Subdivision and Development Servicing Bylaw 985, 2016, and all amendments thereto, are hereby repealed in their entirety.

16. **CITATION**

16.1. This bylaw may be cited as “Subdivision and Development Servicing Bylaw 1121, 2020".

READ A FIRST TIME this 5th day of May, 2020.
READ A SECOND TIME this 5th day of May, 2020.

READ A THIRD TIME this day of, 2020.

ADOPTED this 20th day of October, 2020.

Original signed by James Baker
Mayor

Original signed by Reyna Seabrook
Corporate Officer

I hereby certify the foregoing to be a true and correct copy of the Bylaw cited as “Subdivision and Development Servicing Bylaw 1121, 2020”, as adopted by the Municipal Council on the 20th day of October, 2020.

Dated at Lake Country, B. C.

Corporate Officer

SCHEDULE A DEFINITIONS

A.1.1 Unless otherwise defined in this Bylaw, a word or expression in this Bylaw has the meaning assigned to it in the *Local Government Act, Interpretation Act, Community Charter, Transportation Act* or *Land Title Act* or any of successor legislation.

(a) In this Bylaw:

"Applicant" means an **Owner** of land or their agent duly authorized in writing, who applies for approval to subdivide or develop that land.

"Approving Officer" means the person appointed as the Approving Officer of the District of Lake Country, or their designate, appointed pursuant to the provisions of the *Land Title Act*.

"arterial highway" means a highway where the primary use is to provide connection from collector highways to other collector highways with limited access from local highways.

"boulevard" means that portion of highway between:
(a) the curb and the adjoining property,
(b) the curb and a separate sidewalk,
(c) the road boundary and the adjoining property, and
(d) the curb lines on the median strips or islands.
does not include curbs, sidewalks, ditches, or driveways.

"Building Inspector" means the person appointed by the District as the Chief Building Inspector or their designate.

"Certificate of Total Performance" means documentation signed by the District Engineer indicating that total performance has been achieved and approved in accordance with this Bylaw.

"collector highway" means a highway where the primary use is to provide connection from local highways to other collector highways and arterial highways while providing limited access to properties.

"community sewer system" means a system of works for the collection, treatment, and disposal of sewage that is owned, operated, and maintained by the District.

"community water system" means a system of works for the distribution of water and connection to a system of water works as referred to in Part 2 of the *Drinking Water Protection Act* which is owned, operated, and maintained by the District, or a private water utility.

"contractor" means the person, firm or corporation retained by the Owner, directly or indirectly to construct, erect, or install the works.

"Council" means the elected Council of the District of Lake Country.

"cul-de-sac" means a highway which has only one point of intersection with another highway except for access by way of emergency access, and that terminates in a vehicle turning area that is to be permanently closed.

"**designated integrator"** means the company or individual designated by the **District** to carryout PLC, HMI, and SCADA programming.

"development" or **"developed"** means the construction, alteration, or extension of buildings and/or structures for any use authorized by the Zoning Bylaw that requires issuance of a Building Permit or through an approved Development Permit, but does not include internal alterations of a building and/or structure where the principal use of the building and/or structure, or part thereof, is not changing. The altering of land for any use authorized under the Zoning Bylaw or through an approved Development Permit is considered to be Development.

"District" means the municipality of the District of Lake Country.

"District Engineer" means the Director of Engineering and Environmental Services for the District of Lake Country or their designate.

"engineer" means a person who is registered, or duly licensed as such, under the provisions of the *Engineers and Geoscientists Act of British Columbia*.

***"*field reviews"** mean such reviews of the *works*:

(a) at the site of subdivision or development to which the subdivision application or building permit relates, and
(b) where applicable, at the fabrication site where components of the required works are fabricated,

that the Owner's Engineer, in their professional discretion, considers to be necessary in order to ascertain that the *work* conforms in all material respects to the design drawings and supporting documents prepared by the Owner's Engineer and marked, "Reviewed for Construction" by the District Engineer. This will include keeping record of all site visits and any corrective actions taken as a result thereof.

"final approval" with respect to subdivision, means approval of a subdivision pursuant the *Land Title Act* and; with respect to development, means issuance of a Certificate of **Substantial Completion**.

"frontage" means the width of a parcel measured along the shortest parcel boundary which immediately adjoins a highway other than a lane or a walkway.

"geoscientist" means a person who is registered, or duly licensed as such, under the provisions of the *Engineers and Geoscientists Act of British Columbia*.

"highway" means a public street, road, trail, lane, bridge, trestle, tunnel any other public way or any other land or improvement that becomes or has become a highway by any of the following:

(a) deposit of a subdivision, reference or explanatory plan in a land title office under section 107 of the Land Title Act;
(b) a public expenditure to which section 42 applies;
(c) a common law dedication made by the government or any other person;
(d) declaration, by notice in the Gazette, made before December 24, 1987;
(e) in the case of a road, colouring, outlining or designating the road on a record in such a way that section 13 or 57 of the Land Act applies to that road;
(f) an order under section 56 (2) of this Act;
(g) any other prescribed means;

"local highway" means a highway where the primary use is to provide access to properties while providing limited access to other local highways and collector highways.
"lane" means a highway intended to provide secondary access to parcels of land.

"minimum building elevation" means the elevation of the underside of the lowest floor in a building or if lower, the lowest floor elevation in a crawl space.

"MMCD" means the Master Municipal Construction Specifications, 2009 Platinum Edition Volume II, prepared by the Master Municipal Construction Document Association as amended from time to time.

"offsite" means located on public highway, public land, or statutory right-of-way at final approval of the subdivision or development as the case maybe.

"onsite" means located on private property during development at final approval but prior to substantial completion of the subdivision or development.

"**Overhead wiring"** means the installation of above ground electrical and communication wiring usually installed from pole to pole.

"**Owner**" means, in respect of real property, the person registered as an Owner of an estate in fee simple, the tenant for life under a registered life estate, or the registered holder of the last registered agreement for sale, and includes their agent duly authorized in writing.

"Owner's Engineer" means the engineer or firm of engineers engaged by the Owner to design and prepare engineering drawings for a subdivision or development and to co-ordinate all design work and quality assurance/quality control required for the works under the provisions of this Bylaw.

"parcel" means any lot, block, or other area in which land is held or into which land is subdivided but does not include a highway.

Preliminary Layout Review definition deleted by Bylaw 1228, 2024.

"private water utility" means a water utility operated under the authority of the Comptroller of Water Rights.

"repair(s)" means restore to original or new condition.

"reviewed for construction" means documents, including construction drawings that have been reviewed by the District and stamped as such.

"road" means the portion of the highway that is improved, designed, or ordinarily used for vehicular traffic and excludes the road shoulder.

"sewerage system" means a system for treating domestic sewage that uses one or more treatment methods and a discharge area, an area used to receive effluent discharged from a treatment method, but does not include a holding tank or a privy.

"sidewalk" means a concrete-surfaced pedestrian walkway.

"**steep slopes**" means lands in their natural state that have a slope angle of 20% or greater for a minimum horizontal distance of 10 meters, or adjacent areas where existing or potential sloughing or stability warrants

concern. The definition applies to all properties which are 0.5 hectares or greater in size, and where 10% or greater of the parent property contains slope of more than 20%.

"storm drainage system" means a system of works designed and constructed for the collection, direction, storage, treatment and disposal of **stormwater**, snow melt and/or ground water.

"**stormwater**" means water resulting from natural precipitation, groundwater that has surfaced, and water from street cleaning.

"street lighting" means single or double davit or ornamental streetlights serviced by underground or overhead wiring.

"subdivision" means a subdivision as described in the *Land Title Act*.

"substantial performance" means the stage of completion of works, certified by the Owner's Engineer when:
(a) all portions of the works are ready for use or are being used for the intended purpose; and
(b) the total of the incomplete, defective and deficient works can be completed at an estimated cost of no more than 3% of the total value of the works.

"surveyor" means a person entitled to practise as a land surveyor under the *Land Surveyors Act* in the province of British Columbia.

"total performance" means the stage of completion of the works, certified by the District Engineer when all works including deficiencies have been completed in accordance with this Bylaw.

"Transportation for Tomorrow" means the District's Transportation for Tomorrow Plan as adopted by Council and amended from time to time.

"underground wiring" means electrical and communications wiring installed underground in ducts or by direct bury with an alignment approved by the service provider.

"walkway" means a highway intended for pedestrian and non-motor traffic save and except for maintenance vehicles, emergency vehicles, and conveyances used by persons with disabilities.

"water distribution system" means a domestic water distribution system and includes allowance for fire flows and storage as required in this Bylaw.

"water source" means a water supply located on each parcel or connection to a community water system.

"water supply" means a supply of water that conforms to the provisions of Schedule I and that at the time of subdivision or development, is available from an onsite groundwater source, a surface source requiring a domestic water license issued pursuant to the *Water Sustainability Act*, or a community water system.

"work(s)" means infrastructure and services and includes highways, sidewalks, boulevard, boulevard crossings, transit bays, street lighting, wiring, water distribution systems, walkways, roads, sewage collection and disposal systems, drainage collection and disposal systems, paving, curbs and gutters, and such other infrastructure, systems and any other improvements required to be constructed, erected, or installed, both onsite and offsite, under the provisions of this Bylaw.

"zone" means an area created by the District Zoning Bylaw.

SCHEDULE B APPLICATION REQUIREMENTS

B.1 **General**

Section B.1 deleted and replaced by Bylaw 1161, 2021

B.1.1 An **Applicant** for a **subdivision** or **development** may request a pre-application meeting prior to submitting an application under this Bylaw.

B.1.2 The **Owner's Engineer** shall ensure that all inspections and testing are carried out in accordance with the provisions of this Bylaw.

B.1.3 Figures B-1 and B-2 summarize the steps for completing the works and services required under this Bylaw.

B.1.4 It is the **Applicant**'s responsibility to ensure that the requirements, regulations, and approval procedures of all agencies are met. Where the standards and specifications of other agencies having jurisdiction conflict with this Bylaw, the more stringent standards and specifications shall apply.

Figures B-1 and B-2 added by Bylaw 1161, 2021

FIGURE B-1 Subdivision and Development Servicing Process

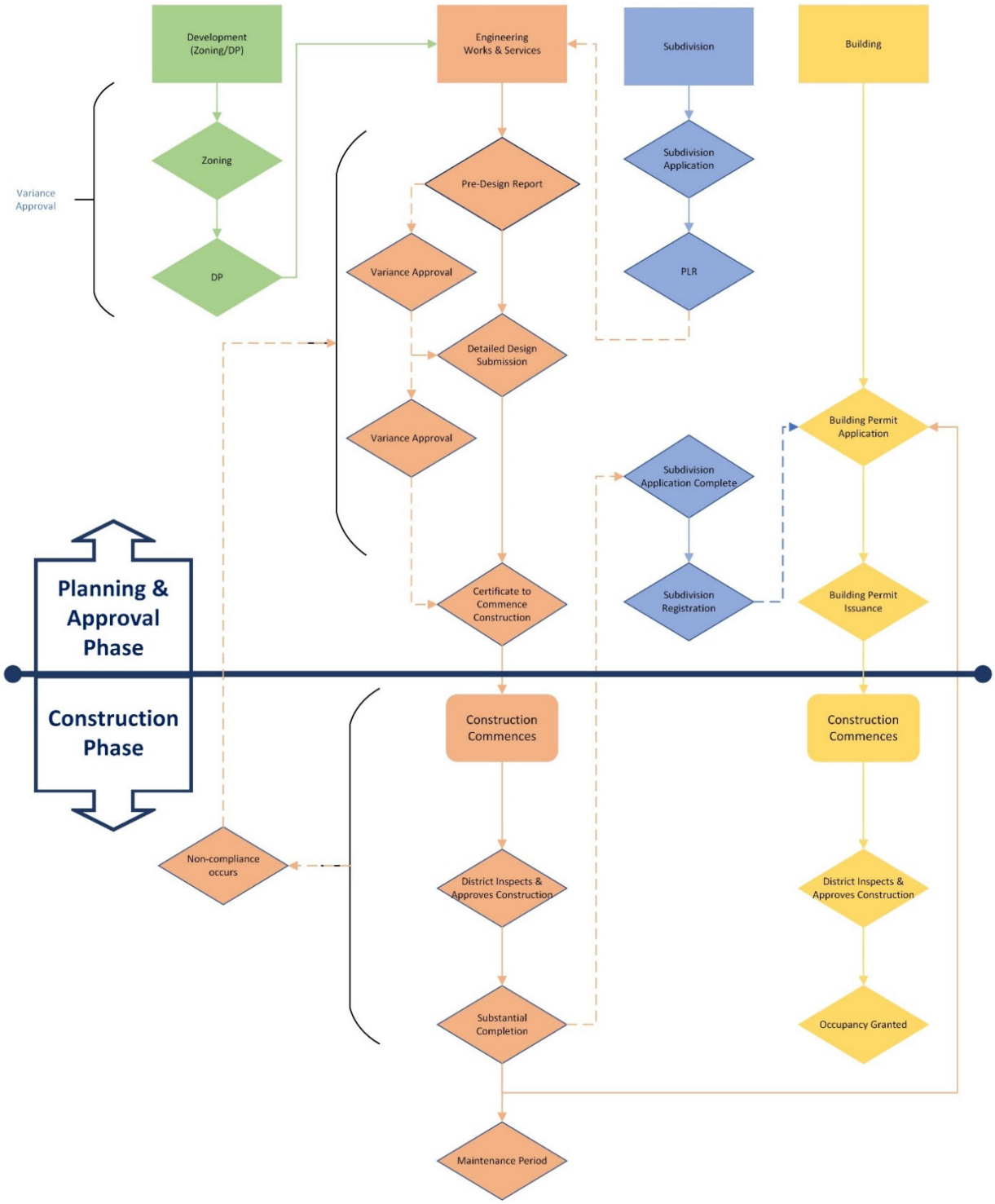


FIGURE B-2 Works and Services Application Process

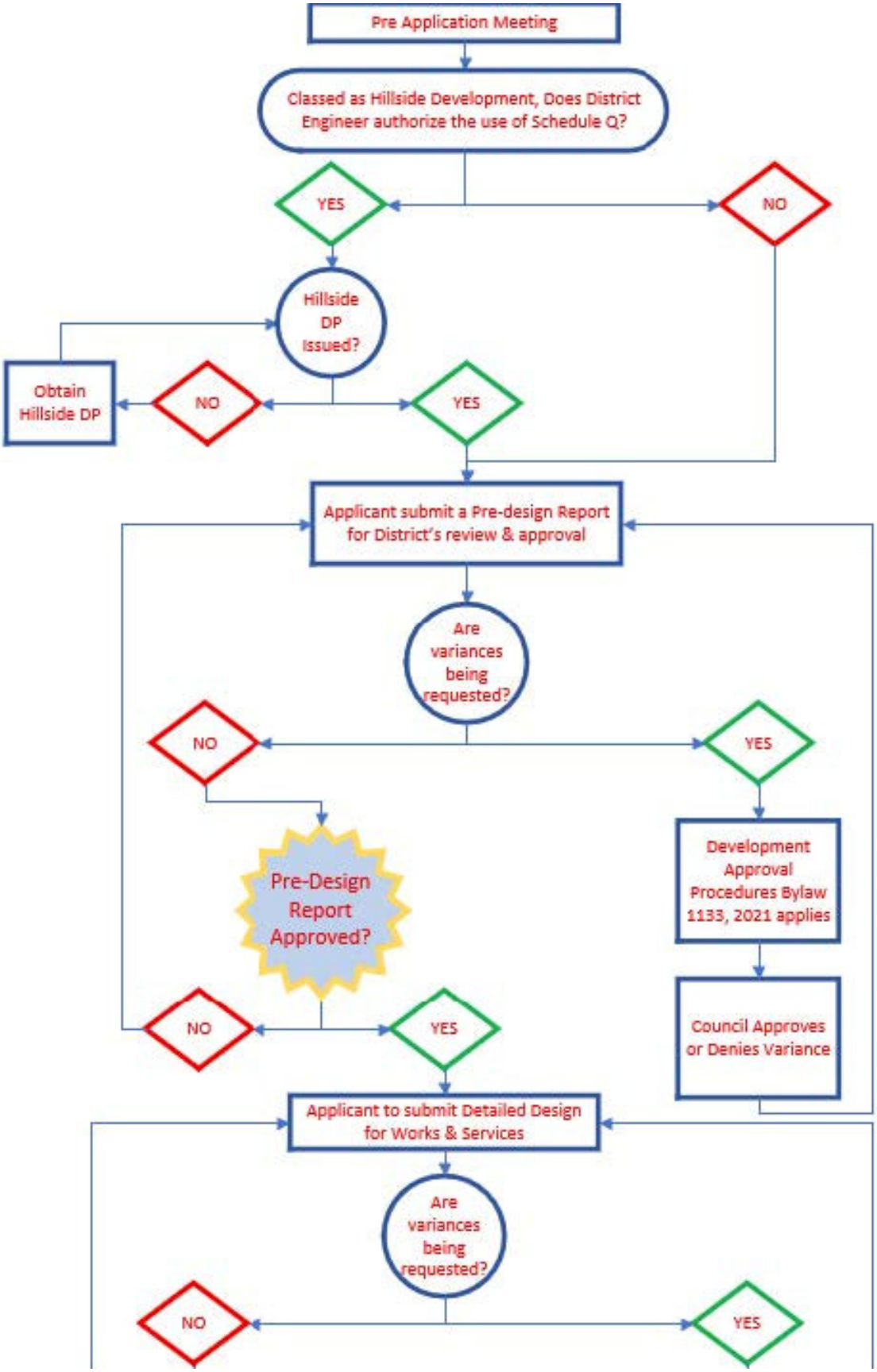
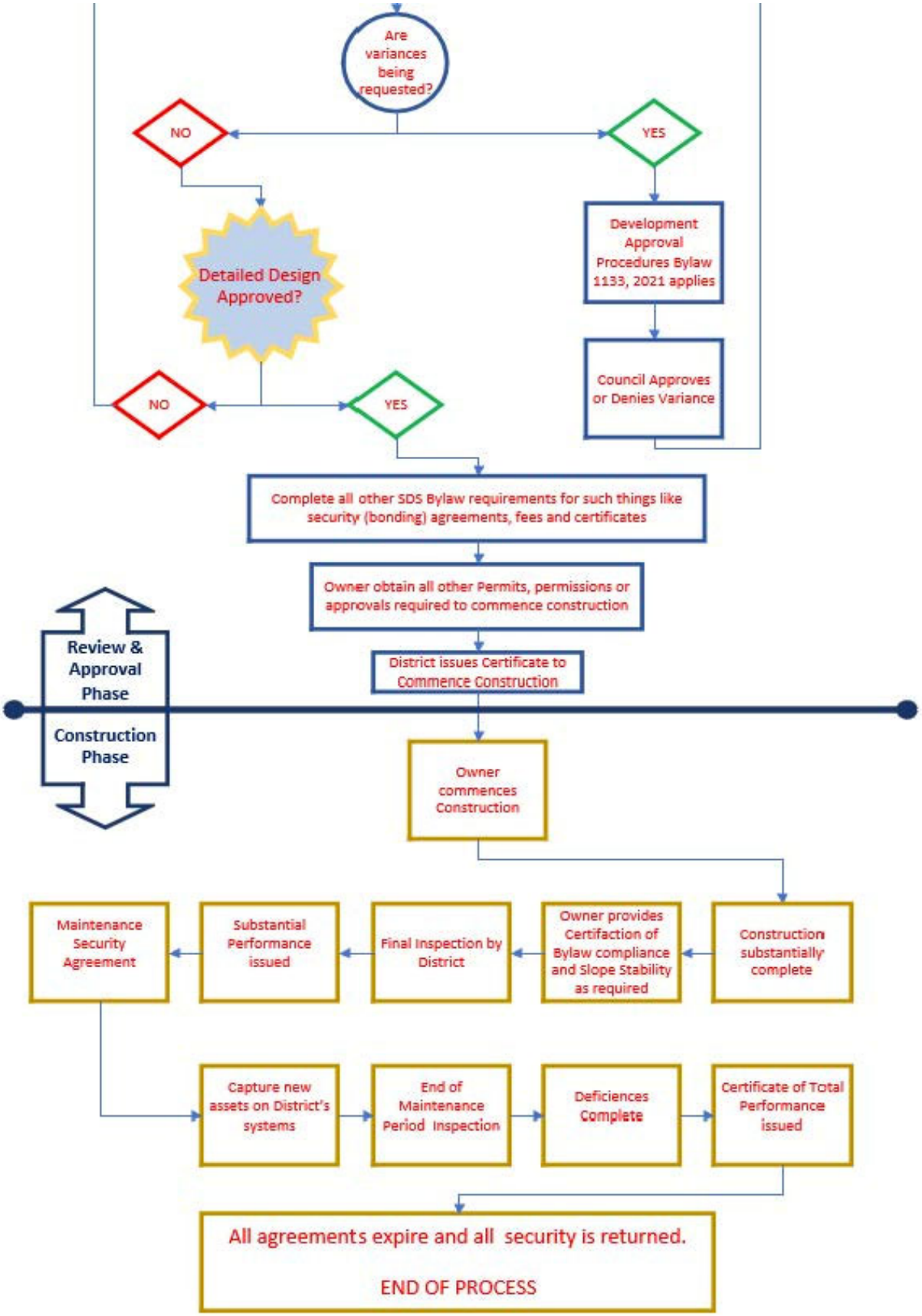


FIGURE B-2 Works and Services Application Process continued



B.2 *Section deleted by Bylaw 1228, 2024*

B.3 **Phased Strata or Strata Conversion**

B.3.1 Applications for approval of a phased strata plan declaration or strata conversion must be accompanied by applicable fees in accordance with **District** Bylaw**s**.

B.4 **Building Permit**

B.4.1 An **Owner** of a **parcel** who applies to develop land must submit a Building Permit application in accordance with the Building Bylaw.

B.4.2 The **Building Inspector** may impose conditions on the approval of a Building Permit required in connection with the **development**, including, but not limited to a **Subdivision and Development Servicing Agreement.**

B.4.3 If **works** are required for a Building Permit application:

(a) on a **highway** immediately adjacent to any **parcel** being **developed** up to the centre line of the **highway** and

(b) on the **parcel** itself,

the **Owner** must provide the **works** that are required to be provided under this Bylaw.

B.4.4 If required, a grant or charge over land on which the **works** are located shall be provided to the **District** in a form required, in priority over liens, charges and encumbrances, and executed in registerable form. The grant or charge may include a **highway** dedication, statutory right of way, **highway** reservation, permit or license, as required by the **District.**

B.4.5 The **District Engineer**, in their sole discretion, may approve the issuance of a building permit in advance of the **offsite work** having been completed provided that a valid servicing agreement, with security for **works**, is in place and that the signatories to the servicing agreement and building permit are one and the same.

B.4.6 For a partial or phased **development,** the **Owner** shall:

(a) construct a percentage of the **offsite work** proportional to the percentage of the site being **developed**, or

(b) provide cash in lieu in accordance with this Bylaw

B.4.7 In addition to design drawings required by the Building Bylaw, the **Owner** must submit design drawings prepared by an **engineer** to the **District Engineer** for approval, identifying:

(a) the **works** to be constructed on the **parcel** being **developed**; and on the **highway** abutting the **parcel**; and

(b) the intended connection of **onsite works** to **offsite works**.

B.4.8 The construction, installation, and connection of all **works** must conform to:

(a) the design drawings marked, “Reviewed for Construction”, and initialed by the **District Engineer**; and

(b) the provisions of this Bylaw and all other Bylaw**s** of the **District**.

B.5 **Subdivision**

B.5.1 An **Owner** of a **parcel** who applies for **subdivision**:
- (a) on a **highway** immediately adjacent to the **parcel** up to the centre line of the **highway**, and
- (b) on the **parcel** itself,

must provide the **works** that are required to be provided under this Bylaw.

B.5.2 No **works** shall be required on **highways** immediately adjacent to the **frontage** of a proposed remainder **parcel** that has potential for further **subdivision** under the existing **zoning** designation.

B.5.3 The construction, installation, and connection of all **works** must conform to:
- (a) the design drawings marked, "Reviewed for Construction" and initialed by the **District Engineer**, and
- (b) the provisions of this and all other **District** Bylaws.

B.6 **Exemptions**

B.6.1 Boundary Adjustment Subdivisions involving lands that have been:
- (a) **developed** with a permitted use;
- (b) appropriately serviced; and
- (c) do not create additional **parcels**,

shall not be subject to the requirements of this Bylaw except:
- (i) unprotected or existing services shall be protected by way of easement or statutory right-of-way, or relocated as required by the **District Engineer**;
- (ii) **parcels** currently serviced with on-site sewage disposal shall provide confirmation from a qualified professional that the existing system is satisfactory for its intended purpose;
- (iii) lots served by other than a **water distribution system** shall adhere to the applicable **water source** design and construction requirements of this Bylaw;
- (iv) where connection to a community sanitary sewer, storm sewer, and/or **water distribution system**, which in the **District Engineer's** opinion can be achieved cost effectively without a main extension, each adjusted **parcel** shall be connected to the applicable system.

Deleted and replaced by Bylaw 1228, 2024

B.6.2 Where a Building Permit has been issued for:
- (a) the construction, renovation or addition to a single-family or two-family building, or for an associated accessory building, the **Owner** shall not be required to:
  - (i) construct, install or pay monies in lieu of **highways**, **walkways**, curb, gutter, **sidewalk**, **street lighting**, and **underground wiring**;
  - (ii) connect to a **water distribution system** unless, in the opinion of the **District Engineer,** the connection can be achieved with a cost-effective main extension.
  - (iii) connect to the **District**'s **community sewer system** unless:
    - A. in the opinion of the **District Engineer** the connection can be achieved with a cost-effective main extension or;
    - B. the construction, renovation or addition complies with the **onsite sewerage system** requirements of this bylaw. For clarity, where the construction, renovation or addition does not comply with onsite sewerage system requirements, a connection to the District's Community Sewer System is required.
- (b) A renovation of a building where there is no increase to the floor area, the **Owner** shall not be required to construct, install or pay monies in lieu of **highways**, **walkways**, curb, gutter,

sidewalk, **street lighting**, and **underground wiring**, unless there is a significant change of use that warrants any or all of these improvements, in the opinion of the District Engineer.

B.6.3 In simple servicing cases where a standard drawing contained in **District** policy is deemed by the **District Engineer** to be sufficient for construction purposes, the **District Engineer** may, in their sole discretion, where a **District** approved **contractor** is being used, waive the requirement for engineering design drawings.

Added by Bylaw 1228, 2024

B.6.4 Subdivision or Building Permit applications where the District is the owner or agent are exempted from the Works and Services requirements of this Bylaw, unless Council passes as resolution imposing such requirements.

B.7 **Statutory Rights of Way**

B.7.1 **Works** under this Bylaw must be located within dedicated **highway**s or statutory rights of way in favour of the **District**.

B.7.2 Where the **District Engineer** requires rights of way to allow for eventual construction or installation of a system of water, sewer, or drainage ***works*** constructed and installed under this Bylaw must be located within dedicated ***highway***s or within statutory rights of way granted by the ***Owner*** in favour of the ***District*** or other agencies having jurisdiction.

B.7.3 Where **works** are not required to be constructed or installed under this Bylaw, the **District** may require rights of way to be granted by the **Owner,** in favour of the **District,** to allow for the eventual construction or installation of a system of water, sewer, or drainage **works.**

B.7.4 Where the **Owner** is required to grant rights of way in favour of the **District**, the **Owner** must enter into and register in the Land Title Office a Statutory Right of Way pursuant to Section 218 of the *Land Title Act* in a form acceptable to the **District Engineer** registered in priority to all financial and other charges as required by the **District**. All right of way agreements and plans must be signed by the **District**.

B.7.5 Upon registration of the rights of way and before release of any security being held by the **District**, the **Owner** must submit a copy of the registered right of way plan and agreement to the **District**.

B.7.6 All costs pertaining to the acquisition, surveying, and registration of all rights of ways shall be at the expense of the **Owner**.

B.7.7 For **District works,** the minimum width for a statutory right of way shall be 4.5 m for the first system of **works**, plus 1.5 m for each additional system of **works**. For deep sewers, the **Owner** may be required to provide additional width in order to comply with WorkSafeBC regulations and additional right of way may be required to accommodate appurtenances.

B.7.8 At **substantial performance**, **works** installed under this Bylaw in public rights of way or in a statutory right of way in favour of the **District** become the property of the **District** or if in favour of another agency having jurisdiction become the property of that agency subject to no encumbrances.

B.8 **Construction Contractors**

B.8.1 The **Owner** shall demonstrate to the satisfaction of the **District Engineer** that the **Owner** has or shall retain the services of one or more qualified **contractors** to undertake the construction of the **works**. The **Owner** shall provide the **District** with the name and address of its **contractor**(s) together with a summary of the projects that the **contractor**(s) has undertaken that are similar in scope, nature, and value to the **works** prior to awarding the contract(s) to the **contractor**(s).

B.8.2 In the case where the **contractor** has not performed similar **works** within the Regional **District** of Central Okanagan, the **District** may require that the **Owner** provide a list of projects and references from other municipalities that demonstrates that the **contractor**(s) is qualified to undertake the **works**.

B.8.3 The **Owner** shall ensure that its **contractor**(s) constructs the **works** in accordance with the design, drawings, plans, and specifications reviewed for construction by the District Engineer and the provisions of this Bylaw**.**

Sections B.9 and B.10 added by Bylaw 1161, 2021

B.9 **Engineering Design Submissions**

B.9.1 Owners must submit engineering designs and associated information for review by the **District** as part of the process for obtaining a Certificate to Commence Construction.

B.9.2 All Engineering Design Submissions must meet the requirements of this Bylaw and be complete to the satisfaction of the **District Engineer**.

B.9.3 The **District** employs a two-part process for reviewing Engineering Design Submissions, these are:

(a) Pre-Design
(b) Detailed Design

B.9.4 The following is the minimum information required for a Pre-Design Report submission:

(a) Quality Assurance Plan
(b) Concept engineering drawings
(c) Class D construction cost estimate
(d) Summary design brief that includes;
    (i) safety, functional, operational and environmental aspects of the proposed design,
    (ii) servicing requirements,
    (iii) design constraints and assumptions,
    (iv) list of non-compliance specifications that will require variances to this bylaw,
    (v) assumed **Owner**ship of infrastructure upon completion.

B.9.5 Once the **Owner**'s Pre-Design Report has been reviewed and accepted by the **District Engineer**, the **Owner** will be invited to submit the Detailed Design to the **District** for review.

B.9.6 The following is the minimum information required for a Detailed Design Submission.

(a) Quality Assurance and Quality Control Plan; (in accordance with Schedule F)
(b) Detailed Design Drawings (in accordance with Schedule R)
(c) Detailed design calculations for all **works** and services covered by this Bylaw
(d) Drainage, Sediment and Erosion Control Plan (in accordance with Schedule N)
(e) Detailed Design Brief (in accordance with Schedule F)
(f) Letter of Commitment by **Owner** and **Owner**s Engineer (in accordance with Schedule S)
(g) Letter of Commitment to Design and field review (in accordance with Schedule S)
(h) If required, letters approving design from the Ministry of Transportation and Infrastructure, and other agencies having jurisdiction.

B.9.7 The **Owner** shall ensure that its contractor(s) constructs the works and services in accordance with the design drawings, plans, and specifications reviewed for construction by **the District Engineer** and the provisions of this Bylaw.

B.10 **Variances**

B.10.1 Variances to this Bylaw must be identified through the Engineering Design Submission process and resolved prior to proceeding to the next step in the process as shown in Figure B-1 and Figure B-2.

B.10.2 All variances are to follow the process contained within the Development Approval Procedures Bylaw 1133, 2021, as amended from time to time.

B.10.3 It is the responsibility of the Owner and the Owner's Engineer to identify any variances required and to formally request variances as part of the Pre-Design and the Engineering Design Submission.

SCHEDULE C SERVICING REQUIREMENTS

C.1.1 **Works** required for a **subdivision** or **development** is based on the **zone** in which the land is located.

C.1.2 The **work**s indicated by a checkmark (✓) in the corresponding column must be constructed and installed in accordance with the provisions set out in this Bylaw.

C.1.3 The required **work**s must be constructed and installed prior to obtaining **final approval**.

TABLE C-1 SERVICING REQUIREMENTS

TYPE OF WORKS		**Highways** and **Walkways**	**Sidewalks**	Curb & Gutter	**Boulevard** & Landscaping[3]	**Water Distribution System**	**Water Source**	Community Sewer[2]	**Onsite Sewerage system**	Storm Drain System	Drainage, Sediment & Erosion Control	**Street lighting**	**Overhead wiring**	**Underground Utilities**
See Schedule		**G**	**H**	**H**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**P**
Zone														
C	ALL COMMERCIAL ZONES	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
DC	(Direct Control) **zone**s	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
DC10	Pixie Beach Resort	✓				✓			✓		✓		✓	
I-1	General Industrial	✓	✓	✓		✓		✓		✓	✓	✓		✓
I-3	Heavy Industrial	✓	✓	✓		✓		✓		✓	✓	✓		✓
I-5	Gravel/Soil Extraction	✓	✓			✓			✓	✓	✓		✓	
P-1	Public Park/Open Space	✓	✓	✓	✓	✓		✓			✓	✓		✓
P-2	Administration, Public Service and Assembly	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
P-3[1]	Minor Utilities													
P-4[1]	Utilities	✓	✓	✓		✓		✓		✓	✓	✓		✓
RU	ALL RU ZONING	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
RM	ALL RM ZONING	✓	✓	✓	✓	✓		✓		✓	✓	✓		✓
A	ALL A ZONING	✓					✓		✓	✓	✓		✓	
RLP	ALL RLP ZONING	✓					✓		✓	✓	✓		✓	
RR1	Rural Residential	✓					✓		✓		✓		✓	
RR2	Rural Residential	✓				✓			✓		✓		✓	
RR3	Rural Residential	✓				✓		✓		✓	✓		✓	

[1] The **District Engineer** may recommend **Council** vary the servicing standard, having regard to the **development** proposed.

[2] **Community sewer system** is required for new lots or on new secondary suites in detached buildings on lots that are less than 1.0 hectare (2.47acres) in area.

[3] **Boulevard** and landscaping required where included in design submission.

SCHEDULE D GENERAL REQUIREMENTS

D.1 Geotechnical Requirements

D.1.1 The **Owner** shall engage a qualified geotechnical **Engineer** to investigate and provide a pre- and post-construction report on surface and subsurface conditions within the proposed **subdivision** or **development.** The geotechnical **Engineer** shall prepare a report outlining their findings and shall provide clear, definitive recommendations on the geometry and placement of fill sections, compaction requirements unique to the project, cut slope geometry and recommendations for surface treatments (in consultation with the **Owner's** Qualified Landscape Professional) required to prevent erosion, pavement structures for **roads**, and any other geotechnical issues affecting construction within the proposed **subdivision** or **development**.

D.1.2 Pursuant to Section 86 of the Land Title Act, the **Approving Officer** may at their sole discretion, require a report certified by a professional **engineer** or **geoscientist** experienced in geotechnical engineering stating that the land may be used safely for the use intended; and/or require one or more covenants under Section 219 of the Land Title Act in respect to any of the parcels that are being created by the **subdivision**.

D.2 Removal of Accumulated Soils

D.2.1 Where soil accumulates on public **road**s, **sidewalk**s, or in drainage systems as a result of construction activity in the **subdivision** or **development**, the **Owner** must remove and dispose of the accumulated soil. The **District** may remove and dispose of the accumulated soil at the expense of the **Owner** if it has not been completed within 72 hours of notification from the **District Engineer**.

D.3 Systems Modelling

D.3.1 Where modelling of infrastructure systems including, but not limited to, water, sanitary sewer, storm water and transportation networks is required, the modelling will be done by the District at the **Owner's** expense.

D.4 Test Procedures

D.4.1 For the following test procedures:

(a) pressure testing,
(b) leakage testing,
(c) flushing and cleaning,
(d) video inspection,
(e) disinfection, and
(f) inspection chamber water test.

The following requirements must be adhered to.

(i) The **Owner's Engineer** must be present for the results to be accepted by the **District Engineer**.
(ii) The **Owner** must notify the **District Engineer** as specified in the District New Watermain Connection Policy or at least twenty-four (24) hours in advance of the procedure.
(iii) If 24 hours has elapsed since proper notification was provided, the **Owner's Engineer** may instruct the test procedure to proceed.

(iv) Proceeding without proper notification to the **District Engineer** may require the procedure to be performed again in the presence of the **District Engineer.**

D.5 **Existing Structure or Utility**

D.5.1 Where an existing structure or utility may be affected by the **works** the **Owner's Engineer** must provide sufficient advance notification to the **District Engineer** and the **Owner** of the structure or utility so that inspection and protective measures can be identified and implemented.

D.5.2 Where alignment of an existing structure or utility conflicts with the **wor**ks, the **Owner** must relocate the existing structure or utility in accordance with Standard Drawings at the **Owner's** sole expense and responsibility.

D.5.3 When existing water, sanitary sewer, or storm drainage alignments conflict with the offsets shown on Standard Drawings or when community sewer is not required pursuant to this Bylaw, alternative alignments may be submitted for approval.

D.6 **Obstructions and Repair**

D.6.1 Where an unforeseen or other obstruction is encountered and interferes with the **work**s, construction must cease until revised proposals are approved by the **District Engineer**. The **Owner** must **repair** all items damaged or destroyed.

D.6.2 The **Owner** is responsible for **repair**ing all **highway**s, **lane**s, driveways, **boulevard**s, other areas traversed by trenches or damaged during construction and any damage to unforeseen obstructions.

D.7 **Protection from Damage**

D.7.1 The **Owner** must ensure that due care is taken in order to protect the **work**, existing underground utilities and structures, and other person's property from damage. Any damage must be **repair**ed at the expense of the **Owner**.

D.7.2 The **Owner** must ensure the provision of the necessary safety devices and supervision to protect the public.

D.8 **Connection to or use of Existing Works**

D.8.1 The **Owner** must not use any of the existing **work**s until a Certificate of Substantial Performance has been issued by the **District Engineer**.

D.9 **Flushing**

D.9.1 No flushing water shall be discharged into any sanitary sewer or storm sewer without the approval of the **District Engineer**.

SCHEDULE E SUPPLEMENTALS TO THE MMCD SPECIFICATIONS

E.1 General

E.1.1 This Schedule provides supplemental requirements that are to be applied in conjunction with the **MMCD** Specifications. Where the provisions contained in this Bylaw are in conflict with the **MMCD** provisions, this Bylaw shall supplement or supersede the **MMCD**.

E.1.2 References to the following within the **MMCD** Specifications shall be as follows:

(a) Contract Administrator shall mean **Owner's Engineer**

(b) Contract Drawings shall mean Design Drawings marked "Reviewed for Construction" and signed by the **District Engineer.**

(c) **Contractor** shall mean **Owner**

TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS

MMCD SECTION	SUB SECTION	SUPPLEMENTARY SPECIFICATIONS
01 57 01 Environmental Protection	1.4 Environmental Protection .3 Pollution Control	Delete and replace .1 with Maintain drainage, sediment, and erosion control features in accordance with the Drainage, Sediment and Erosion Control Plan submitted to the **District**.
03 30 53 Cast-In-Place Concrete	1.6 Inspection and Testing	Delete and replace .1 with The **Owner** must retain an independent materials testing firm to carry out comprehensive testing of concrete which must include unit weight determination, slump test, air test, and casting of test cylinders. One test consisting of three test cylinders must be made for every 175 meters of curb, gutter, and **sidewalk**. In no case shall there be less than one test on any given day which concrete is poured.
31 05 17 Aggregates and Granular Materials	1.0 GENERAL	Add .2 Maximum aggregate particle size to be no more than 50% of total thickness of sub-base layer.
31 05 17 Aggregates and Granular Materials	2.1 Materials – General	Add .3 The physical properties of the materials for granular sub-base and crushed granular base course shall meet the specifications set out in TABLE **E-3**
31 05 17 Aggregates and Granular Materials	2.7 Granular Pipe Bedding and Surround Material	Delete and replace .2 with Pit run sand as specified in Section 31 05 17 (2.4) may also be used unless other specified by the **Owner's Engineer** Add .3 Other permissible materials: only where shown on Design Drawings Marked **reviewed for construction** or directed by the **Owner's Engineer** shall drain rock or approved native materials be used for bedding and pipe surround.
31 05 17 Aggregates and Granular Materials	2.8 Select Granular Sub-base	Delete and replace the table with **TABLE E-4**
31 05 17 Aggregates and Granular Materials	2.10 Granular Base	Delete and replace .1 with to be 25 mm crushed gravel conforming to the gradations referenced in TABLE **E-5**
31 05 17 Aggregates and Granular Materials	2.11 Recycle Aggregate Material	Amended .1 by deleting and replacing the third sentence with: Recycled material should consist only of crushed portland cement concrete and asphaltic pavements; other construction demolition materials such as bricks, plaster, etc. are not acceptable.

TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS		
MMCD SECTION	**SUB SECTION**	**SUPPLEMENTARY SPECIFICATIONS**
		Add .2 Material retained on the 4.75 mm sieve to be not more than 20% recycled material. Minimum size of processed recycled material is to be retained on the 4.75 mm sieve. Add .3 Recycled material and granular sub-base material is to be mechanically blended to produce a homogeneous mixture prior to delivery to site. Blending on site will not be permitted. Add .4 Acceptable recycled material to be used in sub-base material only.
31 22 01 Site Grading	3.2 Grading	Delete and replace .1 with Rough grade to levels, profiles and contours in accordance with the Sediment and Erosion Control Plan submitted to the **District**.
31 23 01 Excavating, Trenching and Backfilling	3.6 Surface Restoration .7 Permanent pavement restoration	Delete and replace .5, with the following new sections: .1 Restore pavement as detailed on District Standard Detail Drawing DLC R14. If thickness of existing permits, grind 50 mm depth along edge of pavement. Dry if necessary and paint clean, dry edge with asphalt emulsion (tack coat). .2 All asphalt shall be saw cut 500 mm wider and longer than the surface dimensions of the actual trench excavation. This saw cut must extend cleanly through the existing asphalt to the base material prior to asphalt removal. .3 If the thickness of the existing asphalt is greater than 75 mm, grind it to a depth of 50 mm and a width of 400 mm along the saw cut edge. This can be done just prior to the final asphalt restoration. .4 Where the edge of the saw cut or milled asphalt, whichever is wider, extends into the travel **lane or bike lane**, it must be extended to the full width of that **lane**. .5 Where the edge of the saw cut or milled asphalt, whichever is wider, is less than 1.5 m from the lip of gutter or edge of paved shoulder, it must be extended to the lip of gutter or edge of paved shoulder. .6 When an area of existing asphalt between two transverse trenches is less than 5 metres in width, the existing asphalt shall be removed and the area paved in conjunction with the paving of the two trenches. .7 Regardless of 7.5.5, if the longitudinal distance between two trenches is less than three (3) meters it shall be removed and the area paved in conjunction with the paving of the two trenches. .8 Longitudinal trenches must be paved with a paving machine. .9 Hot-mix paving shall meet the thickness of the existing pavement or that shown on the design drawings, whichever is greater. If the thickness of the hot-mix paving is 75 mm or less, it shall be placed in one

TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS		
MMCD SECTION	**SUB SECTION**	**SUPPLEMENTARY SPECIFICATIONS**
		lift. If the thickness of the hot-mix paving is greater than 75 mm it shall be placed in two lifts as shown on Drawing G5 .10 Vertical faces and the surface of the bottom lift of asphalt must be painted with bituminous material prior to hot mix paving.
31 24 13 Roadway Excavation, Embankment and Compaction	3.3 Inspection of Native Surface	Add .2 Top 150 mm of Native Surface to be scarified, moisture conditioned to optimum moisture content and compacted to a minimum of 95% of Modified Proctor density in compliance with ASTM D1557, before placing of embankment or sub-base material.
31 32 19 Geosynthetics	2.1 Geosynthetic	Add .6 Woven Geotextile Fabric Products providing plant and root barriers shall conform to the following Woven Geotextile Fabric Products providing plant and root barriers shall conform to the following: ● *Minimum Tensile Strength - 900 N /m ● *Maximum elongation at break - 22% ● *Minimum Tear Strength - 500 N /m ● *Minimum Bursting Strength (Mullen) - 2200 kPa ● *Maximum Equivalent opening size - 300 um
31 32 19 Geosynthetics	3.1 Installation	Add .5 Installation of geotextile fabric which provides plant and root barriers, shall conform to the following: ● *Geotextile fabric shall be installed in accordance with the manufacturer's recommendations. ● *Fabric shall be placed by unrolling into place and not by dragging across the subgrade. ● *The fabric shall be inspected for punctures or tears prior to any materials being placed upon it and any such defects shall be **repair**ed by overlapping new material or replacement. ● *The entire fabric roll shall be placed and rolled out as smoothly as possible. Wrinkles and folds in the fabric shall be removed by stretching and staking, as required. ● *Overlap at roll ends shall be a minimum of 1 meter and the overlaps shall be stapled or pinned to maintain them during construction activities. *No vehicles shall be permitted to pass over the fabric.
32 12 16 Hot-Mix Asphalt Concrete Paving	2.1 Materials	Delete and replace .2 with Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. See **TABLE E-6** Delete and replace .6 with Sand Equivalent: to ASTM D2419. Min: 50 (New Arterial), Min: 40 (All other street classifications). Delete and replace .10 with Lightweight particles: to ASTM C123. Maximum % by mass less than 1.95 relative density: Surface course: 1.0 % Lower course: 1.5% Delete and replace .11 Flat and elongated particles: (with length to thickness ratio greater than 5): Maximum % by mass: Coarse aggregate, surface course: 10% Coarse aggregate, lower course: 10% Delete and replace .12 Crushed Particles (fraction retained on 4.75 mm sieve), 2 faces, % minimum:

TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS		
MMCD SECTION	**SUB SECTION**	**SUPPLEMENTARY SPECIFICATIONS**
		New arterial streets: 85% All other street classifications: 70%
32 12 16 Hot-Mix Asphalt Concrete Paving	2.2 Mix Design	Delete and replace .1 The **Owner**, at their cost, must retain an independent testing consultant to perform trial mix designs and to submit the job mix formula. The trial mix design must be performed in accordance with ASTM D1559 (75 blows per face) and must include five (5) separate trial values of asphalt content. **Contractor** must pay for trial mix designs and submissions. Delete and replace .2 Mixes for construction of asphalt base course may contain up to 20% of RAP, provided that the properties of RAP material are considered in the trial mix design. Submissions for RAP mixes must contain all data relevant to RAP utilized in the mix design. Delete and replace .3 with Design of Mix: Include the following data with the trial mix design submission: • Aggregate bulk specific gravity and water absorption. • Sand equivalent values. • Asphalt cement properties including mixing and compaction temperatures, based on temperature viscosity properties of asphalt cement. • Aggregate gradations and blending proportions. • Maximum theoretical density of trial mixes. • Asphalt absorption values. Delete and replace .2 with Mix Physical requirements to meet **TABLE E-7**. Do not change job-mix without prior approval of **Owner's Engineer**. Should change in material source be proposed, new job-mix formula to be submitted to **Owner's Engineer** for review and approval.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.1 Plant and Mixing Requirements .1 Batch and continuous mixing plants	Delete and replace .3 with Before mixing, dry aggregates to a moisture content not greater than 1% by mass or to a lesser moisture content if required to meet mix design requirements.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.1 Plant and Mixing Requirements .9 Where RAP is to be incorporated into mix:	Delete and replace .3 with RAP must not be fed through the aggregate dryer system.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.1 Plant and Mixing Requirements .11 Mixing time:	Add .3 Mixing period and temperature to produce a uniform mixture in which particulates are thoroughly coated, and moisture content of material as it leaves mixer to be less than 0.2%.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.1 Plant and Mixing Requirements .4 Mixing Tolerances	Delete and replace .1 with Permissible variation in aggregate gradation from job mix (percent of total mass) see TABLE E-8
32 12 16 Hot-Mix Asphalt Concrete Paving	3.2 Equipment .1 Pavers	Add .1 Paving equipment must be capable of placing a standard mat width not less than 3 m and must be capable of paving wider widths in 150 mm and 300 mm increments by means of equipment supplied by the manufacturer of the equipment. The screed must include a tamping bar or strike-off device. Add .2 Control of the screed must be by automatic sensing devices. Longitudinal control must be by a sensor that follows a string-line, ski or other reference. The grade sensor must be movable and mounts provided so that grade control can be established on either side of the

TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS		
MMCD SECTION	**SUB SECTION**	**SUPPLEMENTARY SPECIFICATIONS**
		paver. A slope control sensor must be provided to maintain the proper transverse slope of the screed.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.6 Compaction .2 General	Delete and replace .1 with Provide sufficient compaction equipment to ensure that the compaction rate meets or exceeds the placement rate and to ensure that specified density is achieved before the temperature of the mat falls below 100 degrees C.
32 12 16 Hot-Mix Asphalt Concrete Paving	3.7 Joints .1 General	Add .4 When placing final pavement layer against concrete curbing, compacted pavement must meet the gutter at the same elevation or a maximum of 10 mm above and along the entire lip of the gutter.
33 01 30.1 CCTV Inspection of Pipelines	3.0 Execution	Delete and replace with Immediately upon completion of the **works,** including all backfilling and compaction and prior to paving, the **Owner** must video inspect a completed sewer. Prior to any video inspection, the sewer must be thoroughly flushed to remove all deleterious materials so that defects can be observed. Immediately prior to the video inspection, water must be introduced into all sewers with slopes of less than 1% in sufficient quantities to flow the entire length of the section being videoed. Once the water has been added, the water shall be turned off. Video inspection must not take place while the water is running. Picture quality shall be such to produce a continuous 500-line resolution picture showing the entire periphery of the pipe. Picture quality and definition shall be to the satisfaction of the **District Engineer.** Video inspection must be continuous between manholes. A measuring device shall be provided to measure depth of ponding and shall be continuously visible from the video camera. The measuring device must be capable of measuring ponding to a depth of 100 mm and to an accuracy of 10 mm increments. Upon completion of the video inspection, a report must be submitted to the **District Engineer**. The report must include the following information: (d) Title page with video company's name, address and phone number, **contractor**'s name, **engineer**'s name, location, date, and report number. (e) A schematic plan showing manholes, sewer mains, **road** names and manhole numbers. Manhole numbers must correspond to the as-constructed drawings. (f) Summary page with upstream and downstream manhole number and corresponding inspection report page number.

TABLE E-1 SUPPLEMENTAL MMCD SPECIFICATIONS		
MMCD SECTION	**SUB SECTION**	**SUPPLEMENTARY SPECIFICATIONS**
		(g) Individual inspection report for each pipe section with street name or location, upstream manhole number, downstream manhole number, direction of video, length of pipe section, type of material, pipe use, diameter of pipe, grade of pipe, technician's name, and a section for notes. In addition, the inspection report shall include: (i) A log of distances to pertinent information such as services, defects, ponding, and debris. (ii) A description of the pertinent information including length and depth of ponding. (iii) The tape count to each occurrence of pertinent information. Upon completion of the video inspection a video must be submitted to the **District Engineer.** The video must conform to the following: (h) Type of video must be digital in full colour. (i) Videos must be numbered and cross referenced to inspection report with labels located on all media. (j) Date and running distance in meters to an accuracy of two decimal places. The date and distance must be displayed continuously. (k) Direct voice communication at the start of each section identifying test section, manhole numbers, location, and any other information required to describe section being videoed. (l) Direct voice communication at all service locations, defects, ponding and deleterious materials. Communication shall be factual information only. (i.e. type of defect, depth of ponding, length of ponding, and type of obstruction).
33 11 01 Water**work**s	2.0 Products	Only materials listed in E -2 are approved for installation in any water systems owned and operated by the **District**.
33 30 01 Sanitary Sewers	2.2 Plastic Pipe, Mainline Smooth Profile	Add to .1 Ribbed piping shall not be permitted.
33 30 01 Sanitary Sewers	3.0 Execution	Add New Subsection 3.21 Inspection Chamber Water Test Add .1 Prior to paving, the **contractor** must introduce a minimum of 20 liters of water in each inspection chamber to visually inspect for ponding.

TABLE E-2-WATERWORKS APPROVED MATERIALS (MMCD 33 11 01 Section 2.0)			
MANUFACTURER	**MAKE/MODEL**	**SIZE**	**COMMENT**
Pipe			
Ipex, Royal Pipe	PVC to C900	100 mm-300 mm	Only SDR 18, class 150 or better as required
	PVC to C905	350 mm- 900 mm	
Canada Pipe	Ductile Iron	100 mm – 900 mm	Pressure Class 350
Service Pipe			
Wolverine	Type K Copper	min. 19 mm (3/4”)	Must conform to CSA HC.7.6 and ASTM B88
Poly Tubes/Ipex	Polyethylene	Min. 19 mm (3/4”) up to 50mm (2”)	Only series 200 conforming to CAN/CSA- B137.1-M
Fittings & Appurtenances			
Terminal City	Iron Fittings	100 mm- 600 mm	All fittings must be properly thrust blocked
Sigma	Iron Fittings	100 mm-600 mm	All fittings must be properly thrust blocked
Ipex	PVC Fittings	150 mm- 200 mm	Shall be AWWA C-907 approved
Restraining Joints			
Clow	Series 1200 & 1350	100 mm – 600 mm	Subject to Owner Engineer’s design and District Engineer’s approval
Smith Blair	Model 982	100 mm – 600 mm	Subject to Owner Engineer’s design and District Engineer’s approval
Uniflange	Series 1300, 1390 & 1400	100 mm – 600 mm	Subject to Owner Engineer’s design and District Engineer’s approval
Ebba	1500- 15PF	100 mm – 600 mm	Subject to Owner Engineer’s design and District Engineer’s approval
Service/Tapping Saddles			
Robar	2616 DS		Full stainless steel up to 25 mm (1”)
Robar	2506 DS		Double strap bronze body over 25 mm (1”)
Cambridge	812		38 mm to 50 mm (1.5” X 2”)
Canada Pipeline	SC-2 & CD-2		19 mm-25mm only (¾” – 1”)
Clamps & Couplers			
Robar	1506 & 1509R	100 mm-600 mm	Epoxy coated complete with stainless steel bolts
Hymax		100 mm – 600 mm	
Smith Blair	411, 413 415, 611, 525	100 mm-600 mm	Epoxy coated complete with stainless steel bolts
Smith Blair	Top Bolt 441		
Gate Valves			
Clow	Clow Resilient	50 mm – 300 mm	Resilient seat gate valves to C-509
Mueller	Super-Seal	50 mm – 300 mm	Resilient seat gate valves to C-509
Butterfly Valves-AWWA C504			

TABLE E-2-WATERWORKS APPROVED MATERIALS (MMCD 33 11 01 Section 2.0)			
MANUFACTURER	**MAKE/MODEL**	**SIZE**	**COMMENT**
Centerline	Series 200 350 mm+	350 mm +	For installation in chamber only
Pratt	Groundhop	350 mm +	For buried service
Mueller	Lineseal III	350 mm +	For buried service
Valmatic	Series 2000	350 mm +	
Kflow	Series 500 or 47	350 mm +	
Air Valves			
Apco	143C, 145C, 147C, 149C, 150C	25 mm-150 mm	
Valmatic	201C, 202C, 203C, 204C	25 mm- 150 mm	
Fire Hydrant			
Canada Valve	Century EM		2 ½ ports: BC Fire Thread Centre Ports – 100 mm (4”) Storz Cap Painted Black
Sampling Station			
Kupferle Foundry	Eclipse 88		
Service Brass			
Mueller	13 mm - 50 mm		
Cambridge	13 mm – 50 mm		
Service Boxes			
Trojan			Stainless Steel Rods and Pins

E.2 **Supplemental MMCD Tables**

TABLE E-3-PHYSICAL PROPERTIES FOR GRANULAR SUB-BASE AND CRUSHED GRANULAR BASE COURSE			
Physical Property	**Test Designation**	**Granular Sub-base**	**Granular Base**
$MgSO_4$ Loss %	ASTM C88	20	20
Course Ag (Max) Fine Ag (Max)	ASTM C88	25	25
Sand Equivalent % (Min)	ASTM D2419	25	35
Plasticity Index % (Max)	ASTM D4318	6.0	6.0
Crushed Particles (one face) % (Min)	MoT I-11 (A)		60
California Bearing Ratio (Soaked) % (Min)	ASTM D1883	20	80

TABLE E-4-SELECT GRANULAR SUB-BASE GRADATION	
Sieve Designation	**Percent Passing**
150 mm	100
100 mm	85 -100
50 mm	65 -100
19 mm	40 – 100
4.75 mm	20 – 70
0.150 mm	0 - 20
0.075 mm	0 - 8

TABLE E-5-GRANULAR BASE GRADUATIONS	
Sieve Designation	**Percent Passing**
25 mm	100
19 mm	80 – 100
9.5 mm	60 – 90
4.75mm	35 - 70
2.36 mm	25 – 50
1.18 mm	15 – 35
0.300 mm	5 – 20
0.075 mm	2 -8

TABLE E-6-HOT-MIX ASPHALT AGGREGATE GRADATION SPECIFICATION		
Sieve Designation	**Percent Passing**	
	Lower Course	**Surface Course**
25 mm	100	-
19 mm	80-100	100
12.5 mm	-	84-95
9.5 mm	50-84	73-90
4.75 mm	25-55	50-75
2.36 mm	20-45	35-57
1.18 mm	15-35	25-45
0.600 mm	-	18-34
0.300 mm	5-20	10-26
0.150 mm	-	6-17
0.075 mm	3-7	3-7

TABLE **E-7-SPECIFIED PHYSICAL REQUIREMENTS OF HOT-MIX ASPHALT**		
Property	**Mix Type**	
	Lower Course [1]	**Surface Course**
Stability @ 60^0 C, kN (min)	8.0	9.0
Flow Index, 0.25 mm units	8-14	8-14
Voids in Mineral Aggregate % (min)	12.0	14.0
Air Voids, % [2]	3-6	3-5
Index of Retained Stability after Immersion in Water for 24 hrs @ 60^0C, % (min)	75	85

[1] If lower course mix is used in staged construction, i.e. exposed for at least one winter, specified properties for surface course mix must apply.

[2] Percent air voids in compacted trial mixes must be determined in accordance with ASTM D3203, with asphalt cement absorbed into the aggregate compensated for in the calculation.

TABLE **E-8-MIXING TOLERANCES**	
4.75 mm and larger	± 4.5
2.36 and 1.18 mm	± 4.0
0.600 mm	± 3.5
0.300 mm	± 2.5
0.150 mm	± 1.5
0.075 mm	± 1.0”

SCHEDULE F QUALITY CONTROL AND QUALITY ASSURANCE

Section F.1 deleted and replaced by Bylaw 1161, 2021

F.1 Administration and Design Requirements

F.1.1 The Detailed Design Brief Submission Requirements are specified in this section.

F.1.2 Each design Detailed Design submission to the District Engineer shall include a project Detailed Design Brief which provides comprehensive information relating to the safety, functional, operational and environmental aspects of the proposed design, at. At a minimum the Detailed Design Brief, shall include the following elements where applicable:

(a) Title page
(b) Table of contents
(c) Introduction
(d) Objectives and Policies
(e) Description of the proposed subdivision or development
(f) List of non-compliant specifications that will require variances to Subdivision and Development Serving Bylaw
(g) Methodology /rationale for design solutions developed
(h) Design options considered
(i) Assumptions
(j) Description of Infrastructure requirements
(k) Constraints
(l) Operations and Maintenance (O & M) requirements
(m) Schedule
(n) Modelling and Analysis
(o) Geotechnical considerations
(p) Environmental considerations
(q) Risks/Benefits
(r) Planned Solutions
(s) Sketches
(t) Synopsis
(u) Conclusion/Summary

SCHEDULE G DESIGN AND CONSTRUCTION OF HIGHWAYS AND WALKWAYS

G.1 General

G.1.1 All **highway**s and **walkway**s must be constructed in accordance with this Bylaw. It is recommended that Local **highways** and **walkways** within strata **subdivisions** or **developments** shall be designed and constructed in accordance with this Bylaw.

G.1.2 A **highway** proposed to be dedicated by a plan of **subdivision** must not be shown on the plan of **subdivision**, dedicated, laid out, or constructed unless the dimensions, locations, alignment and gradient meet the requirements for **highway**s prescribed in this Bylaw.

G.1.3 **Development**s may require **frontage road**s, double **frontage** lots, deep lots with rear service **lane**s or such other treatment as may be necessary in the public interest for the separation of through and local traffic.

G.1.4 Where 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, he may determine that the **Owner** provide, at the **Owner**'s expense, land of a width that, in the **Approving Officer**'s opinion, would permit the **highway** to be supported, protected, or drained pursuant to the *Local Government Act*.

Deleted and replaced by Bylaw 1228, 2024

G.1.5 In the preparation of the Pre-Design Report submission for **highways**, the **Owner's Engineer** shall address the following general design considerations:

(a) the sufficiency and suitability of the proposed road system;
(b) the arrangement, width, grade, and location of all roads in relation to existing and planned roads;
(c) all District bylaws, plans, programs and policies;
(d) topographical features;
(e) public convenience and safety;
(f) the proposed uses of the land to be serviced by such roads.
(g) Operation and Maintenance (O&M) requirements
(h) Continuation of existing **roads**
    (i) The design and arrangement of **highways** within a **subdivision** shall provide for the continuation or projection of existing **roads** in the surrounding area. In no case shall the arrangement of **highways** within a proposed **subdivision** make impractical the extension of **roads** and the **subdivision** of adjoining **parcels.**
    (ii) The design and arrangement of **highways** must consider the impact of new development on the surrounding road network. Traffic calming measures must be implemented if the following conditions are expected:
        A. Potential for short-cutting due to the new connections having a shorter route to a main road;
        B. Geometric conditions that may facilitate speeding (e.g., high operating speeds and straight roadways; and
        C. Unsafe conditions due to geometric conditions.

G.1.6 *Section deleted by Bylaw 1228, 2024*

G.1.7 Driveways, retaining walls, vegetation and other private or municipal improvements on private or municipal property or **highway**s affected by the **road** construction shall be restored at minimum to the condition existing prior to construction and to the satisfaction of the **District Engineer**.

G.1.8 Paving shall not be undertaken until all underground utilities have been constructed in accordance with this Bylaw nor during snow, heavy rain, temperatures below 5 degrees C, or other unsuitable conditions. Asphaltic concrete shall not be placed on a frozen, muddy or rutted base.

G.1.9 Tie-ins to existing pavement shall be made in accordance with Standard Drawings. The existing pavement shall be cut back to produce a neat vertical face with a straight edge as described in Table E-1 Supplemental MMCD Specification 31 23 01.

G.1.10 The timing for the installation of the top lift of asphalt shall be at the **District Engineer's** discretion and dependent on District requirements with respect to ensuring **stormwater** is able to enter catch basins on steeper sections of road.

G.2 **Classification of Highways**

G.2.1 Prior to design of the **road** system, the **Owner's Engineer** shall consultant with the **District Engineer**, to classify each **road** proposed adjacent to and within the **subdivision**.

G.3 **Transportation Requirement Assessment**

G.3.1 The **District Engineer** may, in their sole discretion, require the **Owner's Engineer** to prepare a transportation requirement assessment that considers the following requirements and amenities:

(a) Criteria set out in **TABLE G-1**;
(b) traffic volumes and expected speeds;
(c) the need for and applicability of alternate intersection configurations, including roundabouts;
(d) the need to accommodate normal traffic, emergency vehicles, transit, pedestrians, cyclists, and parking;
(e) drainage constraints/options;
(f) street or intersection lighting;
(g) traffic calming;
(h) snow storage;
(i) hillside slope/width restrictions;
(j) right of way width availability;
(k) desire to encourage use of certain routes for varying types of traffic (e.g. truck, farm, and commercial traffic);
(l) minimize capital costs as well as future maintenance and rehabilitation costs; and
(m) *deleted by Bylaw 1228, 2024.*

Title amended by Bylaw 1228, 2024

TABLE G-1-TYPICAL HIGHWAY CROSS SECTION REQUIREMENTS AND AMENITIES										
	Lane		Urban-Undivided				Rural-Undivided			Urban Divided
	Residential	Commercial	Local Hillside	Local	Collector	Arterial	Local	Collector	Arterial	Arterial
Lane Width	6	7.5	3.2	3.2	3.5	3.5	3.2	3.5	3.5	3.5
Bike Lane [6]	n/a	n/a	1.5	1.5	1.5	1.8	1.5	1.5	1.8	1.8
Parking	No	No	2.4 [1]	2.4 [1]	2.4 [1]	2.4 [1]	None	None	None	2.4 [1]
Shoulder	n/a	n/a	n/a	n/a	n/a	n/a	1.5	1.5	2.0	n/a
Ditch	n/a	n/a	n/a	n/a	n/a	n/a	2.5	2.5	2.5	n/a
Curb & Gutter (type)	n/a [8]	n/a [8]	Barrier	Barrier	Barrier	Barrier	None	None	None	Barrier
Sidewalk	n/a	n/a	One side [2]	One side [2]	Two sides	Two sides	None	None	None	Two sides
Pathway [6]	n/a	n/a	None	None	None	None	None	2.0 [3]	2.0 [3]	None
# of Lanes	n/a	n/a	2	2	2-4	4	2	2	2-4	4
Pavement Width	5	7.5	9.4 [4, 5, 9]	9.4 [4, 5, 9]	12.4 [4, 5, 9,]	20 [9]	9.4	10	10-17 [9]	18 [9]
R/W width	6	7.5	18 20 [5]	18 [9]	22	30	20	20	28	25-35 [1, 7]
Standard Dwg #	DLC R2	DLC R3	DLC R4	DLC R5	DLC R6	DLC R7	DLC R8	DLC R9	DLC R10	DLC R11

1 *deleted by Bylaw 1228, 2024*
2 *deleted by Bylaw 1228, 2024*
3 Trail/bike path to be asphalt surface.
4 Pavement width is measured from back of curb to back of curb except for rural **roads** where it is measured to edge of asphalt.
5 Pavement is widened to accommodate parking where required. Alternate locations for parking that are not in the **road** carriage way may be considered by the **District Engineer** at a rate of one space per home where **road** right of way width is available.
6 *deleted by Bylaw 1228, 2024*
7 *deleted by Bylaw 1228, 2024*
8 Curb may be required for drainage.
9 Pavement width and right of way width may vary depending on configuration of driving, bike and parking **lanes**.

Deleted and Replaced by Bylaw 1228, 2024

G.3.2 Where parts of a proposed subdivision or development front on an existing road, the configuration of the improvements will take into consideration the existing road setting and existing and proposed cross section improvements as shown in the District's Mobility Master Plan and Mobility Improvement Program, as amended from time to time

G.3.3 Where reasonably practical, driveway access will be from local **road**s rather than from collector and/or **arterial highway**s.

G.3.4 In determining the Highway Cross Section Requirements, the Owner's Engineer shall consider the following:

(a) Systems Modelling (Section D.3)

(b) The sufficiency and suitability of the proposed road (Section G.1.5)
(c) Transportation Requirement Assessment (Section G.3)
(d) Typical Highway Cross section Requirements and Amenities (Table G-1)
(e) Whether the proposed subdivision or development front an existing road (Section G.3.2).

G.4 **Consistency with Official Community Plan**

G.4.1 The location, classification, and standards all **highway**s proposed within a **subdivision** shall take into account the proposed use of the land and shall conform to the provisions of the **District** of Lake Country Official Community Plan.

G.5 **Local highways**

G.5.1 Local **highway**s within a proposed **subdivision** shall be arranged so that their use by through traffic will be discouraged.

G.6 **Culs-de-sac**

G.6.1 Cul-de-sac streets shall not exceed 300 metres in length and shall be provided with a turning area of not less than 12.5 m radius designed to permit safe and adequate space for the turning of emergency and motor vehicles at the terminus of the cul-de-sac.

G.6.2 Where circumstances are such that a cul-de-sac bulb is impractical, the **District Engineer** may, at their discretion, permit a hammerhead configuration in accordance with Standard Drawings.

G.6.3 Turning areas in all culs-de-sac shall be designated as no parking areas with signs and pavement markings in conformance with G.13.

G.6.4 For culs-de-sac greater than 200 metres and less than 300 metres, an emergency access route is required. The emergency access route must be within 50 metres of the terminus of the cul-de-sac and must provide connection to another public **highway**. The emergency access route shall be designed in accordance with Standard Drawing DLC R2 – Residential lane. The maximum grade of the emergency access shall be no greater than 12 %. The minimum width of the emergency access route shall be 6.0 metres with a 5.0 metre drive aisle. The emergency access route must be paved and closed to vehicle traffic with a suitable traffic control device approved by the **District Engineer**.

G.6.5 Where a cul-de-sac abuts adjacent developable lands, the Approving Officer may require that the cul-de-sac be configured such that it does not preclude future continuation of the road.

G.7 **Lanes**

G.7.1 Lanes, meeting the standards set out in this Bylaw, shall be provided where the **District Engineer** deems them to be necessary. Lanes are permitted for access, subject to approval by the **District Engineer**, where access from the street is not practical.

G.8 **Walkways**

G.8.1 Walkways shall be provided where the **District Engineer** deems them to be necessary to provide access through a **subdivision** to schools, parks, playgrounds, commercial areas or other community facilities, or for the safe and efficient circulation of pedestrian traffic.

G.8.2 Walkways shall be provided with chain link fencing in accordance with **MMCD** 32 31 13, on both sides of the **walkway**. The height shall be 1.0 m in the set back area of the adjacent property and 1.8 m for the remaining length.

G.9 **Transit Bays**

G.9.1 Transit bays shall be provided where the **District Engineer** deems them necessary.

G.10 **Intersections**

G.10.1 Intersections shall be designed as follows:

(a) intersecting **highway**s shall meet substantially at right angles (between 70 degrees and 110 degrees);

(b) jogs in **highway** alignment at intersections shall be avoided except where the distance between centrelines is sufficient to ensure traffic safety. The minimum spacing between tee intersections along a street shall be 60 m;

(c) intersections having more than four intersecting legs shall not be permitted;

(d) intersections shall provide adequate crossing sight distances and stopping sight distances, whichever is greater.

G.11 **Reverse Curves**

G.11.1 If reverse curves are required in a **highway** alignment, the **District Engineer** may require that they be separated by means of tangents of sufficient length to prevent superelevation rotation.

G.12 **Mailboxes**

G.12.1 Where required by Canada Post, the **Owner** shall indicate the Canada Post approved locations of the mailboxes on the engineering drawings. The **Owner** is referred to Canada Post for location guidelines and approval.

G.13 **Road Names, Traffic Signs, and Pavement Markings**

G.13.1 Road names shall be approved by the **District** in accordance with current policies and Bylaws. Road name signs, traffic signs, and pavement markings required as a result of constructing or improving **road**s shall be supplied and installed by the **Owner** at the **Owner**'s expense.

G.13.2 Road name signs (street blades) shall be produced using FHWA series C2001 CA font on engineering grade green background. Strata road name signs shall be on a blue background. Signs shall be produced on 2 mm. (0.08 inch) flat Aluminum stock.

G.13.3 Pavement markings and all traffic signs shall conform to the Transportation Association of Canada Manual of Uniform Traffic Devices for Canada.

G.13.4 Pavement marking layout must be inspected by the **District Engineer** prior to painting. 48 hours notice must be provided.

G.13.5 Thermoplastic markings shall be used at all stop bars and cross walks.

G.14 Appurtenances

G.14.1 The **Owner's Engineer** shall detail, on the design drawings, the location of all proposed traffic islands, retaining walls, guardrails, and permanent barricades. These structures shall be designed in accordance with Transportation Association of Canada Guidelines and with good engineering practice.

G.14.2 The design shall show the location of all traffic signs, street signs, pavement markings and other traffic control devices.

G.14.3 Drawings must show all utility poles, ducts, junction boxes, and pipelines. The **Owner's Engineer** shall indicate those utilities which require relocation prior to **road** construction and shall confirm with the utility the feasibility of their relocation prior to design completion. For underground systems, design drawings shall show the location of **underground wiring** and appurtenances including the connections to properties.

G.15 Vertical Alignment

G.15.1 The vertical alignment of **highway**s and **walkway**s shall be set so the grades of driveways to adjacent properties will comply with the **District** Highway Access Bylaw.

G.15.2 The minimum longitudinal gradient at the gutter line shall be 0.50% for all classifications of streets. The minimum longitudinal gradient around **culs-de-sac** and curb returns shall be 0.80%.

G.16 Design Speeds

G.16.1 The design speeds to be used for design of Highways shall be as per TABLE G-2

TABLE G-2-DESIGN SPEED	
Arterial (A)	70 km/h
Collector (C)	60 km/h
Local (L), Recommended for Bare Land Strata	50 km/h
Strata	30 km/h

G.17 Road Crossfall

G.17.1 Minimum **road** crossfall shall be 3%; maximum crossfall shall be 4%.

G.18 Road Grades

G.18.1 Minimum and maximum **road** centre line grades shall conform to TABLE G-3 based on the **road** classification.

G.18.2 Maximum grades are to be reduced by 1% for each (or part of each) 30 metres that the centre line radius is less than 150 metres.

TABLE G-3-HIGHWAY GRADES		
Road Classification	**Min Grade**	**Max Grade**
Arterial	0.5%	9%
Collector	0.5%	9%
Local and recommended for Bare Land Strata	0.5%	8%
Cul-de-sac, (entry downhill)	0.5%	8%

Cul-de-sac (entry uphill)	0.5%	8%
Cul-de-sac (bulbs)	0.5%	6%
Lane	0.5%	9%
Walkway	0.5%	12%

G.19 **Vertical Curves**

G.19.1 Vertical curves shall be designed to provide safe stopping sight distances. Minimum stopping sight distance is the least distance required to bring the vehicle to a stop under prevailing vehicle and climatic conditions. Vertical curves shall be provided at the following grade changes:

(a) Greater than 0.5% for Arterials
(b) Greater than 1.0% for Collectors
(c) Greater than 2.0% for Locals and **Lanes**
(d) Vertical curve length is calculated by the equation L = KA where:
L is the length of the vertical curve (Minimum L = 15 m)
K is a constant related to lines and geometry of the vertical curve
A is the algebraic difference in grades in percent

G.19.2 Minimum K values for vertical curve design shall be as set out in TABLE G-4

TABLE G-4-MINIMUM K VALUES FOR VERTICAL CURVE DESIGN (METRES)

Road Classification	**Crest Curve**	**Sag Curve**	
	Minimum	**Lighting**	**No Lighting**
Arterial	22	15	25
Collector	15	10	20
Local, Recommended for Bare Land Strata	7	6	11

G.20 **Horizontal Alignment**

G.20.1 Centre Line Radii

(a) The minimum required centreline radius for various super elevation rates for each classification of **road**ways are set out in TABLE G-5

TABLE G-5-MINIMUM CENTRE LINE RADIUS

Road Classification	**Horizontal Curve Centreline Radii (m)**			
Superelevation (m/m)	None	0.02	0.04	0.06
Arterial	n/a	230	200	190
Collector	160	140	130	n/a
Local, Recommended for Bare Land Strata [1]	95	n/a	n/a	n/a
Strata	12	n/a	n/a	n/a

[1] Radius may be reduced at the discretion of the **District Engineer**.

G.20.2 Curb Return Radii

(a) Curb return radii shall conform to TABLE G-6 and be based on the lesser classified **Highway**.

TABLE G-6-CURB RETURN RADII

Road Classification	
Arterial	11.0 m
Collector	11.0 m
Local, Recommended for Bare Land Strata	9.0 m

Cul-de-sac	11.5 m connecting radii to tangent =16.0 m
Industrial	11.0 m
Strata	6.0 m roadway – 9.0 m 7.3 m roadway -7.5 m

G.21 Intersection Design

G.21.1 Unless indicated elsewhere herein, all intersection design standards shall conform to those outlined in the latest edition of "Geometric Design Guide for Canadian Roads" as published by the Transportation Association of Canada (TAC).

G.22 Intersection Grades

G.22.1 Approach grades of minor streets at intersections to major streets shall not exceed 75% of the maximum grade allowed for that street classification. The minor street shall be designed to intersect the major street with a vertical curve of minimum length required for that street classification. The vertical curve shall terminate at the curb line using the K values set out in TABLE G-7.

TABLE G-7-INTERSECTION CURVES MINIMUM K VALUES

Intersecting Street	Minimum K Value	
	Crest Curve	Sag Curve
Arterial	17	15
Collector	7	6
Local, Recommended for Bare Land Strata	4	4

G.22.2 Under limited adverse access conditions, the **District Engineer** may allow the criteria listed in TABLE G-8 while considering factors such as length of grade, amount of lower grade approach, amount of direct **road** access, **road** width, and drainage requirements.

TABLE G-8-DESIGN CRITERIA FOR LIMITED ADVERSE TOPOGRAPHIC CONDITIONS

	COLLECTOR	LOCAL ROAD
Design Speed (km/h)	50	50
Curvature (m)	95	85
Grade (%)	11	12
K Sag Curve	6	4
K Crest Curve	6	4

G.22.3 Crossfalling a **road** at an intersection will be permitted where required because of topographical features in keeping with good engineering practices.

G.22.4 The transition length from a normal cross-sectioned **road** to a section of **road** where there is superelevation shall be calculated based on 15 m for every 1% change in grade. If these conditions are to be used the **Owner** must submit a preliminary design showing a centre line profile with existing ground line and the proposed grade for all streets and intersections affected for adverse topography. If prior approval has not been given by the **District Engineer,** then any design submitted will not be approved.

G.23 Subgrade Preparation

G.23.1 The **road** right of way shall be cleared of all trees, stumps, logs, roots, and any other objectionable material likely to cause settlement for the full width of the **highway,** and for such additional width as may be required to contain cut and fill slopes. In addition, buildings, fences, superfluous culverts, or any other structures within the **highway** shall also be removed. Trees may be left within the **highway** only where they do not conflict with utility services and where they are not deemed a hazard at the discretion of the **District Engineer**.

G.23.2 Prior to placing of any granular aggregate on the **highway**, all existing topsoil or other deleterious matter shall be removed from the full width of the **road** right of way and the **road** surface graded to the desired cross section. Those areas not supporting structural portions of the **road**, curb, gutter, or **sidewalk**s do not need to be stripped.

G.23.3 Embankments shall be constructed by placing, shaping, and compacting approved materials as classified in this Bylaw. All material placed in embankments shall be bladed smooth in level layers not exceeding 300 mm uncompacted depth over the entire embankment area and placed in successive uniform layers.

G.23.4 When embankments are to be made on hillsides or where a new fill is to be applied upon an existing embankment, the slopes of the original ground or embankment (except rock embankments) shall be terraced or stepped before filling is commenced.

G.23.5 Each layer shall be compacted to 95% Standard Proctor Density.

G.23.6 The embankment shall be constructed to provide adequate drainage. Should the embankment material become damaged or saturated by rain, flooding, or other effects, **repair**, scarification, or whatever other measures required to restore the embankment to the moisture and compaction requirements this Bylaw shall be undertaken. Unsuitable materials encountered in the excavation areas or at the subgrade elevation shall be excavated and wasted.

G.23.7 Over excavations shall be rebuilt to grade with an approved compacted material.

G.23.8 At transition sections where the profile grade changes from embankment to cut, the natural slope shall be excavated to a depth of 1 meter and replaced with suitable material for a distance of 15 meters in order to prevent abrupt future differential grade changes. These parameters may be varied on the recommendation of a geotechnical **engineer**.

G.23.9 The upper 300 mm of the subgrade shall be compacted to 100% of Standard Proctor density. Subgrade preparation shall extend a minimum of 600 mm out from back of curb, **sidewalk** or edge of asphalt on either side of the **road**.

G.23.10 Subgrade preparation shall be considered integral to the construction of new **road**s.

G.23.11 Frost Susceptible Soils (ML): The susceptibility of soils to frost heave is commonly classified using the US Corp of Army Engineers four categories, as shown in Table 15.2 of the "Canadian Foundation Engineering Manual", 3rd edition, 1992. All geotechnical reports shall address the frost susceptibility of the subgrade soil.

G.23.12 Swelling Soils (CH): Pockets of soils known to change volume with variation of moisture content are known to exist in several locations within the **District**. These soils are typically identified as highly plastic clays (CH) using the Unified Soil Classification System and Atterberg Limits index test

(ASTM D4318). Where these soils are encountered as subgrade, special subgrade preparation considerations are required, as outlined below.

G.23.13 Scarification should render the subgrade to cohesive pieces of a maximum size of 20 mm to allow adequate moisture conditioning of the soil. The soil should be moisture conditioned to achieve a homogeneous moisture content between 0 and 3% over optimum. Following moisture conditioning, the subgrade soil should be compacted to a minimum of 95% of Modified Proctor density, as determined by ASTM D1557. The subgrade should be covered with granular sub-base as soon as practical to minimize the variation of the moisture content in the subgrade. Additional moisture conditioning and compaction may be required, should the moisture content be allowed to vary significantly from optimum prior to placing the sub-base.

G.23.14 Proof Rolling

(a) Upon completion of the subgrade preparation, the subgrade shall be proof rolled with a loaded single axle truck with a minimum rear axle load of 8,000 Kg.

(b) Any areas found to be soft or wet shall be excavated and back filled with select granular sub base, granular material, and compacted to 100% Standard Proctor density.

G.24 **New Pavement Design**

G.24.1 The following four primary factors shall be considered in undertaking a specific design:

(a) Subgrade support quality (geotechnical report)
(b) Design life (20 years)
(c) Traffic loading (expressed in ESALs)
(d) Climate

G.24.2 New pavement structures shall be designed in accordance with the methodologies presented in "AASHTO Guide for Design of Pavement Structures", 1993. The pavement structure shall be designed for a twenty (20) year design life.

G.24.3 The American Association of State Highway and Transportation Officials (AASHTO) design method is based on a Structural Number (SN) for the entire pavement structure (i.e. hot mix asphalt, granular base and granular sub-base). The method incorporates the subgrade strength expressed as the Subgrade Resilient Modulus (Mr), and design loading measured in equivalent single axle loads (ESALs). Each component of the pavement structure is assigned a layer coefficient.

G.24.4 Subgrade strength is frequently characterized utilizing the California Bearing Ratio (CBR) test procedure (ASTM D1883). This test should be performed on soaked subgrade soil specimens compacted to 95% of Modified Proctor density as determined by ASTM D1557. The Resilient Modulus may be approximated from the soaked CBR test values using the following relationships:

Mr (MPa)	=	10.3 CBR, or
Mr (psi)	=	1500 CBR

G.24.5 The soaked CBR properties of subgrade soil should be determined for each major soil type encountered. Where more than one test is required, the tests should be evenly spaced, unless otherwise directed by the geotechnical **engineer**.

G.24.6 The required SN for the pavement structure is the sum of the product of the layer coefficient, the component thickness, and a drainage coefficient for each component:

eq'n (1) $SN = a_{ac}D_{ac} + a_bD_bM_b + a_{sb}D_{sb}M_{sb}$ where:

SN	=	structural number for pavement structure
a_{ac}	=	layer coefficient for hot mix asphalt (0.4)
a_b	=	layer coefficient for granular base (0.14)
a_{sb}	=	layer coefficient for granular sub-base (0.10)
D_{ac}	=	thickness of hot mix asphalt (mm)
D_b	=	thickness of granular base (mm)
D_{sb}	=	thickness of granular sub-base (mm)
M_b & M_{sb}	=	layer drainage coefficient (1.0 for Lake Country)

G.24.7 Road classifications, design traffic values and minimum depths of hot mix asphalt and granular base components of the total pavement structure are as per TABLE G-9.

TABLE G-9-MINIMUM ASPHALT AND GRANULAR BASE DEPTH VS DESIGN TRAFFIC

Road Classification	Design Traffic (ESALs) [1]	Minimum Depth of Hot Mix Asphalt (mm)	Minimum Depth of Granular Base (mm)
Walkways	n/a	50	75
Local, Lanes & Access Roads	2.8×10^4 (28,000)	50	75
Collector	2.8×10^5 (280,000)	100	100
Arterial [2]	1.0×10^6 (1,000,000)	100	100

[1] See Part 1 – Chapter 1 of AASHTO for definition of an Equivalent Single Axle Load (ESAL).

[2] Special design reviews may be requested by the **District Engineer**

G.25 Standard Pavement Structures

G.25.1 Standard pavement structures, including required SN values, are provided on in TABLE G-10 for three strengths of subgrade. The standard pavement structures incorporate the minimum depths of hot mix asphalt and granular base shown.

TABLE G-10-STANDARD PAVEMENT STRUCTURES				
Street Classification	**Structure Component**	**Thickness is mm for Soaked CBR [1] of**		
		3.0 [4] CBR 5	**5.0 CBR 10**	**CBR 10**
Walkways	Asphalt – Surface Course	50	50	50
	Granular Base	75	75	75
	Granular Sub-base [3]	150	150	150
	Required SN Value	n/a	n/a	n/a
Local, Lanes & Access Roads	Asphalt – Surface Course	50	50	50
	Granular Base	75	75	110 [2]
	Granular Sub-base [3]	275	165	0
	Required SN Value	58	47	35
Collector	Asphalt – Surface Course	40	40	40
	Asphalt – Base Course	60	60	60
	Granular Base	75	75	100 [2]
	Granular Sub-base	335	185 [3]	0
	Required SN Value	84	69	53
Arterial	Asphalt – Surface Course	40	40	40
	Asphalt – Base Course	60	60	60
	Granular Base	75	75	75
	Granular Sub-base	535	355	155(3)
	Required SN Value	104	86	66

[1] Soaked CBR value shall be at 95% of Modified Proctor maximum dry density and optimum moisture content, as determined by ASTM D1557.

[2] Placement of equivalent sub-base layer is not practical and shall be replaced with additional granular base.

[3] Maximum aggregate size of sub-base material to be no more than 50% of total depth of sub-base.

[4] Where the top 1 m of subgrade has a soaked CBR value of less than 3, then the subgrade strength should be supplemented with an additional thickness of granular sub-base material in order to achieve a soaked CBR value of 3 or greater. The thickness of the supplemental sub-base and the corresponding composite CBR value for the top 1 m of composite subgrade can be determined by the following formula:

$$CBR\ Composite = ((t_{ssb} \times CBR_{ssb}^{0.33} + (100-t_{ssb}) \times CBR_{sg}^{0.33})/100)^3$$

Where CBR Composite is 3 or greater.

t_{ssb} = thickness of supplemental sub-base (cm).

CBR_{ssb} = CBR value of supplemental sub-base.

CBR_{sg} = CBR value of subgrade soil.

G.25.2 Granular base and granular sub-base to have a minimum soaked CBR value of 80 and 20, respectively.

G.25.3 For design purposes, the maximum subgrade soaked CBR value shall not exceed 10.

G.25.4 Staged construction may be considered by the **District Engineer** when a **road** is to be constructed and to be widened at a later date.

TABLE G-10 provides standard pavement structures for **road**s constructed on only three strengths of subgrade. Alternate pavement structures may be designed based on the SN determined using

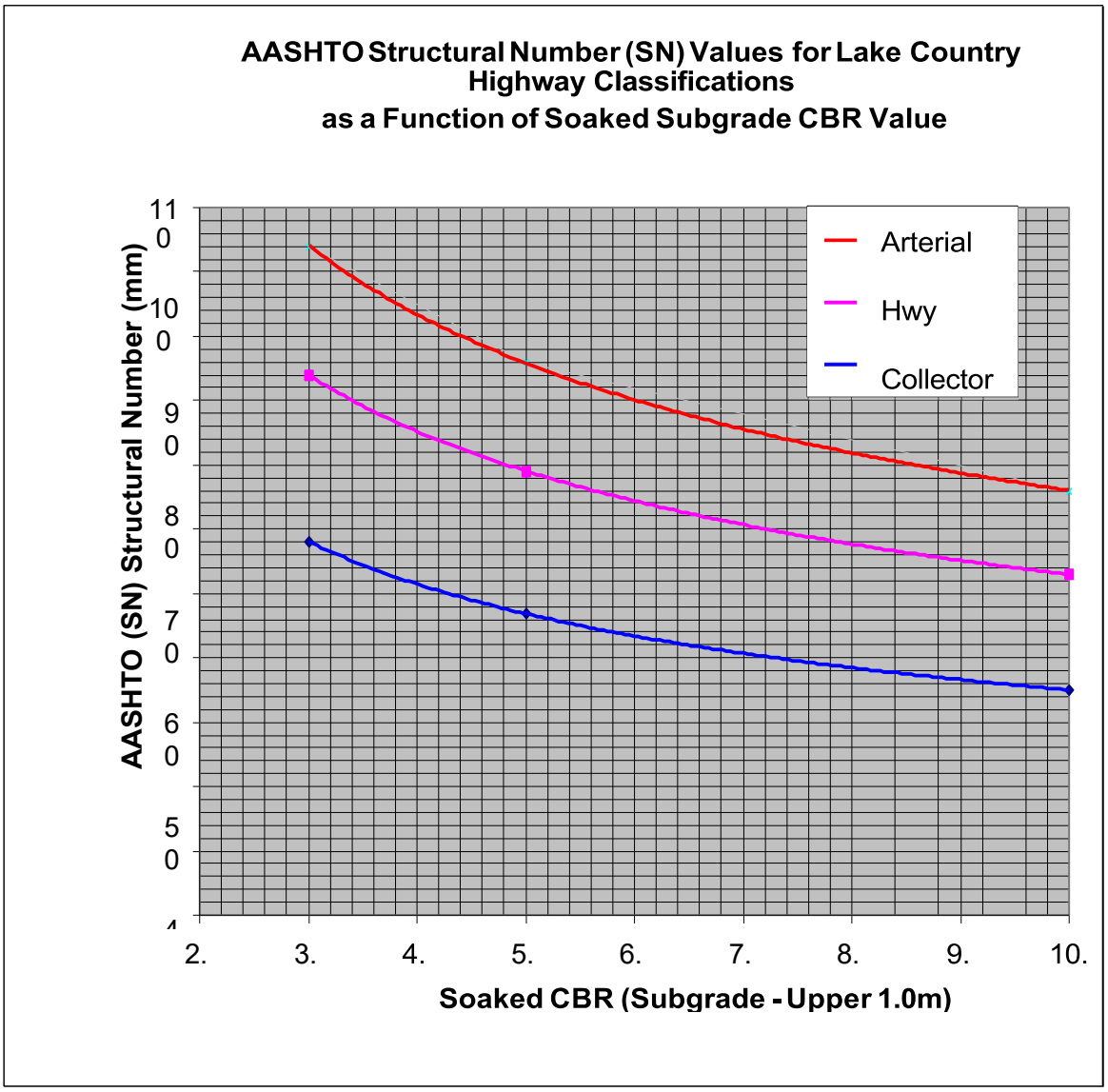
G.25.5 **FIGURE G-1**. For example, for a Collector Road with soaked subgrade CBR value of 4, then the corresponding pavement structure requires a SN of 75. Using eq'n (1), and the specified layer coefficients, a suitable pavement structure alternative may be determined as shown TABLE G-11.

TABLE G-11-EXAMPLE PAVEMENT STRUCTURE [1]			
Pavement Structure Component	**Thickness, D (mm)**	**Layer Coefficient, a**	**SN**
Hot Mix Asphalt	100	0.40	40
Granular Base	100	0.14	14
Granular Sub-base	210	0.10	21
Total SN			75

[1] The minimum depths of hot mix asphalt and granular base shown, and the required SN have been met.

FIGURE G-1

Curves shown are derived from the methodologies presented in AASHTO. A description of all variables used to derive the curves is presented in the Ministry of Transportation Technical Circular T - 9/95, "Pavement Design Standards".



G.26 **Design of Overlays for Existing Pavements**

G.26.1 Design criteria for overlays are based on the limiting Benkelman Beam deflections as per TABLE G-12

(a) The design Benkelman Beam rebound (x + 2σ) should be determined on the basis of at least 10 uniformly spaced readings per two-**lane** kilometre (one half in each **lane**).

(b) The summary rebound statistic for a pavement section should be seasonally adjusted to the spring peak rebound value.

TABLE G-12-BENKELMAN BEAM CRITERIA FOR OVERLAYS

Road Classification	**Maximum Deflection (mm)**
Arterial highways	1.00
Collector highways	1.25
All Other Highway Classifications	1.50

G.27 **Materials**

G.27.1 Subgrade Fill Material

(a) Subgrade fill material shall be free of rock detrimental to proper compaction and free of organic or other deleterious matter. Fill material shall be compacted to a minimum of 95% Standard Proctor density (ASTM 0698). Fill material shall be moisture conditioned to within 3% of its optimum moisture content, as determined by the Standard Test Methods for Moisture-Density Relations of Soils and Soils-Aggregate Mixtures ASTM D698 or ASTM D1557, at the time compaction is undertaken.

G.27.2 Rock Fill

(a) Rock, by definition, shall mean any material excepting hardpan or glacial till over 0.75 cu.m. in volume requiring continuous drilling and blasting. It shall mean masonry or concrete as well as natural boulders fitting this definition.

(b) Rock fill shall be any material containing more than 15% by volume of rock larger than 150 mm in size.

(c) It shall only be used in approved areas and by approved methods to provide maximum stability of the fill, as approved by the geotechnical **engineer**.

G.27.3 Granular Sub-base Course

(a) Granular sub-base shall be well-graded material conforming to the gradation limits as shown on Standard Drawings or suitable blast rock designed and installed under the supervision of a Geotechnical Engineer provided the maximum nominal size is less than or equal to 50 percent of the compacted sub-base layer thickness.

G.27.4 Crushed Granular Base Course

(a) Crushed base course shall be composed of inert, durable aggregate, reasonably uniform in quality, and free from soft or disintegrated pieces, wood wastes, roots, organic material or other deleterious materials.

(b) The gradation shall be within the limits set out in **TABLE G-13** when tested to ASTM C 136 and C 117, using the designated sieve sizes, and to have a smooth curve without sharp breaks when plotted on a semi log grading chart.

TABLE G-13-CRUSHED GRANULAR SUB-BASE LIMITS	
USBC Sieve Size	**Percent by Weight Passing**
25.00 mm (1")	100%
19.00 mm (3/4")	80-100%
9.50 mm (3/8")	50-80%
4.75 mm (# 4)	35-65%
2.36 mm (# 8)	25-50%
1.18 mm (# 16)	15-35%
0.300 mm (# 50)	5-20%
0.075 mm (#200)	3-8%

(c) A minimum of 60% of the material retained on 4.75 mm sieve shall have at least two fractured faces as determined by particle count.

G.27.5 Crushed Granular Aggregate for Asphaltic Concrete

(a) Crushed granular aggregate for asphaltic concrete shall be composed of hard, durable, crushed gravel free from shale, clay, silt, loose coatings, and other deleterious materials.

(b) The gradation of aggregates, when blended to meet the job mix formula shall be within the limits shown in **TABLE G-14** when tested to ASTM C 136 and C 117, using the designated sieve sizes, and to have a smooth curve without sharp breaks when plotted on a semi log grading chart.

TABLE G-14-GRADATION OF CRUSHED GRANULAR AGGREGATE FOR ASPHALTIC CONCRETE			
USBC Sieve Size	**Arterial, Industrial and Collector Streets**		**Residential, Lanes, walkways**
	Percent Passing by Weight		**Percent Passing by Weight**
	Lower Course	**Surface Course**	
25 mm (1")	100		
19 mm (3/4")	85 - 100	100	
12.5 mm (1/2")	65 - 85	85 - 95	100
9.5 mm (3/8")		70 - 85	70 - 90
4.75mm (#4)	40 - 65	50 - 70	45 - 80
2.36mm (#8)		38 - 55	32 - 64
1.18mm (#16)	20 - 38	28 - 44	24 - 51
0.600mm(#30)		20 - 34	17 - 40
0.300mm(#50)	10 - 20	12 - **26**	13 - 29
0.150mm(#100)	8 - 15	**8** - 16	7 - 18
0.075mm(#200)	3 - 8	3 - 7	3 - 8

(c) A minimum of 60% of the material retained on 4.75 mm to 25 mm sieve shall have at least two freshly fractured faces as determined by particle count.

G.27.6 Spreading and Compaction of Granular Aggregate

(a) Granular aggregate shall be placed in maximum 150 mm lifts and shall be spread in an approved manner such that the aggregate is neither segregated nor contaminated with foreign material. Segregated materials shall be remixed until uniform. Immediately following spreading, granular aggregate shall be compacted to 100% Standard Proctor density. The finished surfaces shall be within +/- 15 mm of the design grade and cross section.

(b) The tolerance limits are in relation to the design aggregate gradation submitted with the Marshall mix design. Aggregate short of material passing the 0.075 mm sieve shall have approved mineral filler added. Mineral filler shall be material passing the 0.075 mm sieve and shall be non-plastic when tested in accordance with ASTM D424. The moisture content of the aggregate after leaving the drier and before mixing shall be not more than 0.5% by weight.

TABLE G-15-TOLERANCE LIMITS	
Max Size	**Percent Passing by Weight**
4.75 mm	5.0%
2.36 mm	4.0%
1.18 mm	4.0%
0.600 mm	3.0%
0.300 mm	3.0%
0.150 mm	2.0%
0.075 mm	1.5%

G.27.7 Placing and Compacting Asphaltic Concrete

(a) A self-propelled mechanical paver shall be used to spread the mixture. Compaction shall commence immediately. Compaction methods shall be carried out as specified in the Asphalt Paving Manual published by the Asphalt Institute and the MMCD

G.27.8 Asphalt primer shall be:

(a) Anionic emulsified asphalt, slow setting (SS 1) and shall be diluted with clean water at two (2) parts emulsion to one (1) part water for application, and thoroughly mixed by pumping. The diluted asphalt emulsion shall be applied at a rate of 2 litres per square metre, or as approved by the **District Engineer**. The prepared granular base shall be clean and free of "float" prior to application of prime. Allow prime to absorb and cure for 24 hours prior to paving, unless otherwise approved by the **District Engineer**. Traffic shall not be permitted onto primed areas. Or;

(b) Cutback Asphalt Primer RM20 meeting the requirements, and to application rates, stipulated in the Standard Specifications for Highway Construction (latest edition) of the Province of British Columbia Ministry of Transportation and Infrastructure.

G.27.9 Tack coat:

(a) Bituminous tack coat shall be undiluted SS 1H or SS 1 asphalt emulsion and shall be applied at a rate not greater than 0.5 litres per square metre to a clean pavement surface and provide for adequate curing time prior to placing asphalt paving mixtures. The temperature of the material shall be maintained between 30^{o}C and 40^{o}C at the time of application.

G.27.10 Asphaltic cement:

(a) shall be homogenous, free from water, shall not foam when heated to 175 °C, and meet the requirement of TABLE G-16.

TABLE G-16-ASPHALTIC CEMENT		
REQUIREMENTS	**MIN.**	**MAX.**
Viscosity @ 60° (Pa/s)	65	
Min. Penetration @ 25°C	80	
% Ret. Pen. after T.F.O.T. @ 25°C - 100 g/5 s	55	
Solubility in Trichloroethylene (%)	99.0	
Flash Point, C.O.C. minimum (°C)	235	
Ductility at 25°C, 5 cm/min.cm	100	
Water (%)		0.5

G.27.11 Asphaltic concrete:

(a) shall conform to **TABLE G-17**

(b) The **Owner** shall supply the **District Engineer** with a current 5-point Marshall mix design, performed in accordance with ASTM D 1559, under the signature of a geotechnical **Engineer**. The design asphalt content shall be specified to comply with the requirements of this section.

(c) The asphalt content of hot mix asphalt which is produced in accordance with the approved Marshall design shall be maintained within plus or minus 0.3% of the approved design asphalt content.

TABLE G-17-ASPHALTIC CONCRETE			
Property	**Arterial & Collector Streets**		**Residential**
	Lower Course	**Surface Course**	**Surface Course**
Marshall blows per face	75	75	50
Marshall Stability @ 60°C (kN)	8 min.	8 min.	5.5 min.
Marshall Flow (0.25 mm units)	8 – 14	8 - 14	8 - 15
Voids in Mineral Aggregate (%)	13.0 – 16.5	14.0 - 17.0	14.0 - 17.5
Air Voids in Mixture (%) - at design A.C. - Allowable production range	4.0 + 0.2 3 - 5	4.0 + 0.2 3 - 5	3.5 + 0.3 3 - 5
Index of Retained Stability after water immersion for 24 hours @ 60°C	80% min.	80% min.	80% min.

(d) Density of Completed Asphaltic Concrete Pavement

(i) The minimum allowable density of the completed pavement shall be not less than 97% of the laboratory compacted Marshall Density.

(ii) Flaws in the pavement surface shall be corrected by removal of the complete area and the full lift involved. Pavement which is unsatisfactory in the opinion of the **District Engineer** by reason of faulty materials or methods of placement shall be **repaired,** to the original condition or better, removed, replaced, or otherwise corrected.

(e) Asphaltic concrete shall be constructed in lifts of compacted thickness as per TABLE G-18:

TABLE G-18-ASPHALTIC CONCRETE CONSTRUCTION		
Course	**Permissible Compacted Lift Thickness (mm)**	
	Minimum	**Maximum**
Lower Course	50	100
Surface Course	40	75

G.28 Testing

G.28.1 The **Owner** shall retain an independent materials testing firm to carry out comprehensive testing to frequencies defined below, for each stage of construction of **roads** and streets. The materials testing firm must employ a full time, qualified Engineer within the office from which the testing services are provided. He shall review all test data and provide to the **District**, on a daily basis and in summary form at the completion of each stage of the **work**, test data at the following minimum frequencies:

(a) For subgrade construction:
- (i) Moisture density relationship (Standard Proctor) – ASTM D698; - one test for each soil type incorporated into the subgrade.
- (ii) Moisture and density test
- (iii) Subgrade construction and preparation three tests per 150 lineal metres of **road** per lift, to include dry density and moisture content.

(b) For trench backfill
- (i) one test per lift per 50 lineal metres of trench and one test per lift around manholes, valves, catch basins, etc.

(c) For sub base and base course construction (including subgrade enhancement using sub-base material):
- (i) Gradation analysis - one test per 500 m3 or 1100 tonnes of material delivered to the site with a minimum of 1 test per day of placement.
- (ii) Moisture density relationship (Standard Proctor) ASTM D698; one test per class of material for each 5000 m3, or 11000 tonnes delivered to site.
- (iii) Compaction testing three tests per 150 lineal metres of **road** per lift, to include dry density and moisture content.

(d) For hot mix asphalt pavement production and placement:
- (i) Asphalt content and gradation of extracted aggregate - one test per production period, where a production period is defined as that part of the working day either before or after 12:00 Noon local time. In a full working day, the times of test shall be not less than two hours apart.
- (ii) Marshall Analysis of hot mix asphalt - one per work week per mix type; additional tests shall be performed when any of the specified Marshall properties are not met in the initial analysis.
- (iii) Asphalt cement tests one complete analysis per project or one every two work weeks, whichever is the lesser in timing; plus one penetration (ASTM D5) test per work week from product obtained from the **contractor's** asphalt cement storage tanks.
- (iv) Density, air voids and pavement thickness tests 3 cores (100 mm dia.) per 1500 m2 of paved area per lift, with a minimum of 3 cores for each production day. Air void tests shall be performed in accordance with ASTM D3203.
- (v) Tests on prime and tack coat products - one test per product per project.

G.28.2 The **District** shall be provided with copies of all compaction test results pertaining to subgrade, granular base and pavement structure.

G.29 Notification

G.29.1 Prior to undertaking **roadwork**s, adequate notice shall be given to the **District Engineer** by the **Owner** in accordance with TABLE G-19. The **Owner** shall not proceed from one stage to another stage without the approval of the **District Engineer**.

TABLE G-19-CONSTRUCTION NOTIFICATION REQUIREMENTS

Stage	**Minimum Notice Required**
Prior to construction of fills or doing subgrade preparation	24 hours
Prior to placement of sub-base materials	24 hours
Prior to placement of concrete for curbs and **sidewalk**s	48 hours
Prior to placement of base course (19 mm crushed gravel)	24 hours
Prior to paving	48 hours
Prior to top soiling **boulevard**s	24 hours

G.30 Testing Frequency and Procedures

G.30.1 Aggregate Gradation and Asphalt Cement Content

One test per production period as defined in G.33.1 Asphalt content shall be determined in accordance with ASTM D2172 or D6307. Gradation analysis of extracted aggregate shall be performed in accordance with ASTM C136 and C117.

G.30.2 Thickness

(a) The actual pavement thickness, for each unit of **work** area, will be determined on the basis of the average thickness of three (3) cores. The cores shall be spaced at intervals of 150 m of paved **lane** width or less. If the deficiency of any individual core exceeds 10 mm, three (3) additional cores may be extracted in proximity to the location of the core of excessive deficiency, to identify the extremities of the pavement area to be removed and replaced. The **Owner** will initiate and pay for such additional coring.

(b) A unit of **work** area is defined as 1,500 m^2 or fraction thereof, representing pavement placed in an individual placement day.

(c) Sampling and testing for thickness determination shall be in accordance with ASTM D3549.

G.30.3 Density

(a) Density of compacted pavement shall be determined on the basis of tests on core samples taken at a maximum interval of 150 m of paved **lane** width. A test area shall be that area lying between longitudinal joints and between transverse lines located midway between test cores or between such transverse lines and the beginning or end of placement.

(b) With prior approval of the **District Engineer**, the in-situ density of a compacted layer of pavement may also be determined by nuclear methods in accordance with ASTM D 2950. Spacing of tests shall be as stated above, and tests shall be taken in the vicinity of the core samples extracted for testing of the thickness of the pavement layer. In a situation where the in-situ density of the lift does not meet specification, according to D 2950, then the density of the extracted cores shall be determined and will take precedent over the in-situ density. Where the specified compaction has not been met, as confirmed by the direct measurement of

the core, then an additional three cores shall be taken in the immediate area and the average of the three cores shall be used.

G.31 Non-Compliance with Specifications

G.31.1 General

G.31.2 If the **Owner** fails to ensure that their **contractor** complies with the paving and construction specifications as set out in this Bylaw, the following shall apply. Any penalty for deficiencies will be in the form of a reduction in the amount of security for **work**s returned to the **Owner**.

G.31.3 Hot Mix Asphalt Concrete

(a) A Marshall analysis will be performed from a sample obtained at the paving site on a frequency of one analysis per day, with at least one analysis required per project or 700 tonnes of asphalt.

(b) When analysis identifies non-conformance with specified properties, remedial measures must be immediately initiated. Evidence that compliance exists with the approved mix design must be provided. Failure to do so must result in suspension of paving operations.

G.31.4 Aggregate Gradation

(a) When the aggregate fails to comply with tolerances set forth in this Bylaw, the **Owner's Engineer** will initiate the following action:

(b) When two (2) consecutive gradation analyses identify non-compliance with the specified tolerances, the **contractor** must be served notice and a third test will be initiated.

(c) If continued non-compliance is indicated from the third test, the **Contractor**/**Owner** must suspend production. It must not commence construction again until it has demonstrated that corrective action has been taken and that the aggregate gradation is within the specified tolerance limits.

G.31.5 Asphalt Cement

TABLE G-20 -PAYMENT ADJUSTMENT FOR NON-COMPLIANCE WITH TOLERANCE	
Asphalt Content Deviation from Design %	Payment Adjustment Factor
0.30 OR LESS	0.00
0.31 TO 0.40	0.20
0.41 TO 0.50	0.75
0.50 OR GREATER	Remove and replace

G.31.6 Penalty will be applied for asphalt cement content non-compliance where the amount of penalty for Hot Mix Asphalt Paving equals the unit bid price times the payment adjustment factor times the quantity to which the factor is to be applied, i.e.:

$A_C = P (F_C) (Q_n)$

where:

A_C = Adjustment for asphalt cement content non-compliance

P = Unit bid price

FC = Payment adjustment factor for Asphalt Cement Content non-compliance

Q_n = Asphalt measured for payment which was produced during the production period to which a test applies

G.32 **Penalty for Non-Compliance**

G.32.1 Pavement Thickness

(a) Pavement of any type found to be deficient in thickness by more than 10 mm must be removed and replaced by pavement, of specified thickness, at the **Owner**'s expense.

(b) Pavement of any type found to be deficient by less than 10 percent of its specified compacted thickness will not be subject to payment adjustment for thickness non- compliance.

(c) Pavement of any type found to be deficient in thickness by more than 10 percent of its specified thickness but not more than 10 mm shall give rise to an adjustment in the amount of penalty. The penalty shall be calculated as follows:

$$A_t = \frac{T_d}{T_s} \times P \times Q_t$$

Where:

A_t = Adjustment for thickness deficiency

T_d = Deficiency in thickness measured in mm and being greater than 10% of specified thickness but not greater than 10 mm.

T_S = Specified thickness in mm.

Q_t = Asphalt measured for payment lying within a unit of **work** area defined in G.39.2 (b) where the thickness deficiency has been identified.

P = Unit Bid Price.

NOTE: No allowance will be made for the tolerance provided for in G.36.2

(d) The adjusted price will be applied to all asphalt measured for payment which lies within a unit of **work** area defined in G.39.2 (b) where the thickness deficiency had been identified, or to such lesser area as may be defined in accordance with the provisions G.39.2(b).

G.32.2 Density

(a) The minimum specified density for acceptance, without penalty adjustment, must be 97% of the 75 blow Marshall density as most recently determined by the appointed testing agency.

TABLE G-21-PAYMENT ADJUSTMENT FOR DENSITY NON-COMPLIANCE

Density (% of 75 blow Marshall)	Payment adjustment factor
97 and greater	0.0
95.0 to 96.9	As per Density Payment Adjustment Factor Chart (see Standard Drawing)
Less than 95.0	No payment (subject to removal and replacement after review by the Engineer)

(b) Adjustment for density specification non-compliance shall be determined as follows:

A_D = P (F_D) (Q_{nD})

where:

A_D = Adjustment for density non-compliance

P = Unit Bid Price for Hot Mix Asphalt Cement paving

F_D = Payment Adjustment Factor for density non-compliance

Q_{nD} = Asphalt measured for payment within a unit of test area as defined in G.39.3.

G.32.3 Adjusted Payments

(a) The total penalty arising from pavement deficiencies identified in the foregoing shall be determined as follows:

$A_r = A_c + A_t + A_D$

where:

A_r = Total Adjustment

A_c = Adjustment for asphalt cement content non-compliance

A_t = Adjustment for thickness deficiency

A_D = Adjustment for density non-compliance

The total adjustment (A_r) shall be paid by the **Owner** to the **District** and may be withheld by the **District** from any securities held for the **subdivision** or **development**.

SCHEDULE H DESIGN AND CONSTRUCTION OF SIDEWALKS, CURBS, GUTTERS, BOULEVARDS AND LANDSCAPING

H.1 General

H.1.1 All curbs, **sidewalk**s, gutter, **boulevard**, and landscaping must be designed and constructed in accordance with this Bylaw.

H.1.2 The minimum width of sidewalks shall be 1.5 metres. The **District Engineer** may in their sole discretion, require that a sidewalk width be increased.

H.1.3 The location of **sidewalk**s shall be as follows:

(a) **Arterial highways** - **sidewalk**s are required on both sides of **highway**;

(b) **Collector highways** - **sidewalk**s are required on one side of **highway** as required by the **District Engineer**;

(c) **Local highways** - **sidewalks** are required on one side of the **highway**, where the **highway** will be used to provide the public with safe and efficient access to educational facilities, government facilities, parks, recreation sites, hiking trails, pedestrian corridors, shopping centers, entertainment centers, health institutions, religious institutions, or where identified as per Standard Drawings for the **road** class. The location shall be as required by the **District Engineer**.

H.1.4 In accordance with **District** Bylaws and policies, upon completion of **highway**, curb, gutter, and **sidewalk** construction, **boulevards** must be shaped and graded to match and blend with surrounding areas.

H.1.5 Trees, shrubs, dry land grass as well as turf or mulch complete with irrigation must be in accordance with Schedule C-1 and **District** irrigation standards.

H.1.6 In areas of rural cross sections without curb, gutter, or **sidewalk**; **boulevard**s must be shaped and graded to match and blend with surrounding areas seeded with coarse grasses (Okanagan Dryland Grass Mix).

H.2 Driveway Access – *deleted by Bylaw 1193, 2022*

H.3 Wheelchair Ramps

H.3.1 Wheelchair ramps must be provided at all intersections on **road**ways that are being provided with **sidewalk**s and constructed in accordance with Standard Drawings.

H.4 Barrier Curb Crossing

H.4.1 Barrier Curb Crossings must be provided at all access locations and must be constructed in accordance with Standard Drawings.

H.5 **Landscaping**

H.5.1 Landscape Plan Requirements:

For landscape Works that will be owned and maintained by the District, a Qualified Professional with expertise in landscaping, engaged by the Owner, is required to submit landscape drawings for review by the District.

The following information shall be shown on the Landscape Drawings:

(a) property lines and easements.
(b) buildings, edge of pavement, curb lines and curbs, sidewalks, lighting fixture locations, surface utilities and related service boxes or other elements that would affect the landscape and street tree location.
(c) Location of all existing vegetation to remain.
(d) Location of retaining walls and existing or proposed slopes that exceed 3:1 vertical.
(e) Location of all proposed trees, shrubs, ground cover and lawn areas.
(f) Indication of which areas will be seeded grass vs sodded lawn.
(g) Plant list showing botanical name, common name, size at planting, quantity, typical spacing, and root zone volume of supplied growing medium for trees.
(h) Landscape features, if applicable.
(i) Type of mulch and application depth.
(j) Growing medium depths for each planting type.

H.5.2 Boulevard Landscaping:

Unless specified otherwise, boulevards shall be vegetated with sodded lawn or densely planted groundcover. Rough grass and/or wildflower seeding may be used on boulevards and side slopes that are visually backing onto natural or rural areas, or for temporary boulevard treatments, subject to the approval of the District Engineer.

(a) For the boulevards of arterial and collector roads within the Town Centre DP area, the treatment shall be as per the streetscape improvement plan for that area.
(b) For boulevards adjacent to commercial property and locations outside the Town Centre DP area, or where no plan is in place, subject to development permit requirements, the boulevard treatment shall generally be turf or hard-surfaced, and shall include street trees and irrigation, serviced and maintained by the **Owner** of the parcel with the boulevard frontage. Acceptable surface materials for the boulevard include:
    I. unit pavers
    II. exposed aggregate concrete;
    III. stamped and coloured concrete;
    IV. irrigated turf; or
    V. xeriscape or dryland landscaping
(c) For boulevards where the land use of the adjacent property is industrial, institutional or multi-family the boulevard treatment shall generally be street trees and turf or xeriscape landscaping, serviced and maintained by the **Owner** of the parcel with the boulevard frontage.
(d) For boulevards where the land use of the adjacent property is one, two or four-family residential, and where the boulevard is accessible for maintenance mowing and watering from the adjacent property, the boulevard treatment shall generally be street trees and turf or xeriscape landscaping, serviced and maintained by the Owner of the parcel with the boulevard frontage.
(e) For boulevards where it is unlikely that the adjacent property owner will be able to adequately maintain the boulevard due to geographical constraints, the **District** may accept ownership and maintenance of the boulevard, subject to the approval of the **District Engineer**.

H.5.3 Median and Roundabout Landscaping:

(a) Landscaped medians are generally discouraged within arterial or collector roads due to difficulty of service and maintenance.

(b) In locations approved by the **District Engineer**, medians shall be vegetated with sodded lawn or densely planted groundcover and irrigated street trees.

(c) The landscaping of roundabouts and cul-de-sac islands shall have a hard surface material or landscaping with low shrubs or groundcovers at the discretion of the **District Engineer**, and should feature:

(i) a single specimen tree;

(ii) a group of like trees; or

(iii) public art if the roundabout or cul-de-sac is in the Town Centre area. The selection, design and placement of public art shall be made in cooperation with the Public Art Advisory Commission.

H.5.4 Utilities Coordination:

(a) Placement of landscape features shall be coordinated with the location of underground utilities and shall be, as much as is practical, aligned and buried to provide a continuous 1.0m deep utility-free trench beneath tree planting locations.

(b) Planting and paving design shall be co-coordinated with the design and construction of surface utility boxes, such that boxes fall entirely within either a paved surface or entirely within a planted surface but not partly in paving and partly in planting and that grades and alignment of boxes match the final design and construction of all elements to create a co-coordinated and orderly appearance, free of trips and hazards.

H.5.5 Plant Materials:

(a) Plants shall have the ability to withstand adverse conditions such as airborne pollutants, maximum sun exposure and reflected heat from pavements, high winds and abrasive forces, occasional snow loading and exposure to salt from road clearing operations, and limited root zone soil volumes.

(b) Plant hardiness requirements vary by elevation. Plants shall be hardy to Canadian Plant Hardiness Zone 5A to 1A as site conditions dictate.

(c) Plants shall be capable of reduced water demand following a one-year establishment period.

(d) Plants shall have relatively low maintenance attributes including: fine to medium leaf size and canopy density; non-fruit bearing or having only berry-sized non-staining and non-toxic fruits; low susceptibility to disfiguring or fatal diseases and infestations; infrequent demands for pruning, fertilizing and other cultural requirements.

(e) Plants shall be of appropriate size and form at maturity to meet criteria listed in this bylaw.

H.5.6 Tree Planting:

(a) Street Tree plantings shall be required on streets and **highways** in all subdivisions where new roads (including culs-de-sac) or road extensions are required.

(b) Minimum number of boulevard trees shall be calculated as follows:

(i) Medium trees (± 10 - 20m ht. at maturity) greater of 1 per lot or 15m.

(ii) Small trees (Under 10m ht. at maturity) greater of 1 per lot or 10m.

(iii) Plantings of trees closer than 6m on centre shall require the written concurrence of the District Engineer.

(iv) Locate trees fronting on single family lots in locations that avoid all utility service alignments and driveways. Generally, this will lead to tree placement in the half of the lot frontage away from the driveway side, and not at either the lot centerline or at a lot line.

(c) Boulevard or 'street' trees shall be of a single species/cultivar on either side of the street within a given block. Centre median tree species may vary.

(d) Street tree species shall vary between intersecting streets. Street tree selection will be made with consideration of maintaining a diverse and varied street tree distribution across a neighbourhood to minimize disease risks.

(e) All street trees shall have:
   (i) A compact or upward branching structure.
   (ii) Ability to withstand pruning for pedestrian, vehicle and/or building clearance without compromise to tree health or form.
   (iii) Absence of species/varietal characteristics of structural weakness, susceptibility to wind damage, or thin, easily damaged bark.

(f) Trees shall be minimum 5 cm caliper measured at 300mm above the root ball at the time of planting, and of uniform size if planted in a boulevard row.

(g) Tree branch clearance requirements are 5m over the traveled portion of road and 2.25m over the sidewalk.

(h) Trees directly under electrical power lines must meet the following selection and soil volume requirements:
   i. Minimum allowable soil volume per tree is 4 cu.m. with 1m depth pit.
   ii. Mature height not greater than 7.5m.

(i) Trees beside hydro lines must meet the following selection and soil volume requirements:
   i. Minimum lateral distance from nearest line 2.75m.
   ii. Minimum allowable soil volume per tree is 4 cu.m. with 1m depth pit.
   iii. Mature spread not greater than 5m.

(j) Trees with limited available soil volume must meet the following selection and soil volume requirements:
   i. Minimum allowable soil volume per tree is 4 cu.m. with 1m depth pit.
   ii. Mature height not greater than 10m.

(k) Trees for available soil volumes of 9 cu. m. or greater must meet the following selection and soil volume requirements:
   i. 1m pit depth
   ii. Mature height not greater than 20m.

(l) Trees for a wide boulevard or wide median use only must meet the following selection and soil volume requirements:
   i. Minimum available root zone of 20 cu. m. per tree
   ii. Minimum boulevard or median width of 3.5m

(m) Minimum setbacks for trees to objects in new developments shall be as follows:

Underground streetlight conduit or irrigation main	0.6m
Other underground utilities	3.0m
Lamp standards	6.0m
Steel and wooden utility poles	3.0m
Driveways	1.5m
Catch basins	1.5m
Manholes, valve boxes, services	3.0m
Sewer service boxes	3.0m
Fire hydrants	2.0m
Road intersection	7.0m
Curb face (see SS-L3 for Root Barriers required)	0.5m

Sidewalk	0.85m
Curb face and sidewalk with root barrier	0.60m
Buildings - fastigiate (columnar) tree	2.0m
Buildings - regular crown tree	3.0-5.0m

The District Engineer may consider custom setbacks where trees are being installed in existing streets with established utilities.

(n) Lawns/Fine Grass, Rough Grass and Wildflowers:
Sod shall be used on all lawn/fine grass areas. Seeding, as an alternate, shall require approval of the **District Engineer**.

(o) Rough grass and wildflower areas shall be seeded. Seeding method shall be noted on drawings.

(p) Areas to be seeded with grades greater than 3:1 and/or highly erodible soils shall be hydroseeded with a nurse crop seed mix, a hydraulically applied erosion control mulch, or erosion control blanket. Erosion control method to be noted on drawings.

H.5.7 Landscape Maintenance

(a) All landscaping must be actively maintained by the **Owner** for the entire Landscape Maintenance Period as described below. The Landscape Maintenance Period for landscape establishment shall be one year from the date of **Substantial Performance** of the landscape components of the work. All landscape areas shall be provided establishment maintenance which shall include irrigation maintenance and watering, mowing, weeding, pruning and supplemental fertilization until the end of the Landscape Maintenance Period. The Landscape Maintenance Period shall continue until a Certificate of **Total Performance** of all Landscape **Works** is issued by the **District** upon the expiration of the Landscape Maintenance Period.

(b) The Owner's qualified professional shall submit a maintenance schedule with the **Certificate of Substantial Performance**. It shall include timing and arrangements for:
   i. Routine inspection
   ii. Aerating and dethatching turf areas
   iii. Replenishing mulch
   iv. Fertilizing
   v. Pruning
   vi. Weeding

(c) is encouraged to implement sustainable or environmentally-friendly practices for overall landscape maintenance.

H.6 **Irrigation**

H.6.1 Irrigation Plan Requirements

(a) For irrigation **Works** that will be owned and maintained by the **District**, a Qualified Professional with expertise in landscaping, engaged by the **Owner**, is required to submit landscape drawings for review by the **District**.
The following information shall be shown on the Irrigation Drawings:
   i. property lines and easements
   ii. buildings, edge of pavement, curb lines and curbs, sidewalks, lighting fixture locations, surface utilities and related service boxes or other elements that would affect the irrigation system.
   iii. Location of all existing vegetation to remain.
   iv. Location of retaining walls and slopes that exceed 3:1 vertical.

v. Designate the areas irrigated by each valve (irrigation zones) and assign a number to each valve.
vi. Clearly identify any 'temporary zones': those zones which are intended to operate for less than a two (2) year grow in period.
vii. Schematic layout showing all points of connection, backflow prevention, water meters, electrical supply and meters, winterization facilities, timeclocks, heads, valves, piping, sleeves, sensors and other elements critical to construction and maintenance of the irrigation system.
viii. Irrigation legend describing brand, model and size of timeclocks, heads, valves, piping, sleeves, sensors and all other elements shown on the irrigation plan.

H.6.2 General Irrigation Requirements

(a) A complete and working automatic irrigation system shall be provided for all landscaped areas within a **highway** boulevard, median or roundabout. Temporary watering provisions
(b) shall also be made for planted areas of a 'non-irrigated' variety – to allow for watering through a maximum 1-year establishment period or in severe drought.
(c) Urban trees in pavement shall be irrigated with an automatic irrigation system that may include bubblers or drip elements.
(d) Sleeves shall be provided under sidewalks and driveways, and to medians / islands, as required for installation and maintenance of the irrigation system without removing surface paving.
(e) Provide a flow sensor and master valve, both connected to the controller, that will stop flow to the system or irrigation circuit in cases of an irrigation water leak. Provide an isolation gate valve upstream of all automatic sprinkler valves.
(f) Design to water plant materials with different watering requirements (e.g. grass vs. shrub areas and high vs medium vs low water use shrub areas) on different valve circuits.
(g) Where surface sprinklers are used, ensure unobstructed sprinkler coverage to tree bases from at least two sides.
(h) Every drip system shall be designed with a filter, pressure regulator, flush valve and air relief valve. The drip component manufacturer's instructions for installation and maintenance shall be included in the project specifications.
(i) The irrigation system shall perform to within 15% of the targeted application efficiency standards for irrigation systems, as determined by the Irrigation Association and the Irrigation Industry Association of British Columbia, as follows:
    i. Spray Zones: 75% or higher;
    ii. Rotor Zones: 80% or higher;
    iii. Microjet Irrigation Zones: 85% or higher.
    iv. Drip Irrigation Zones: 90% or higher.
(j) Sprays and rotors shall be designed with head to head coverage to meet the application efficiency standards.
(k) It is the responsibility of the Certified Irrigation Designer to identify to the **Owner** and to the **District** any landscape impediments, existing or planned, that will impede reaching the targeted efficiencies. At the discretion of the **District**, irrigation system design audits may be performed to ensure design efficiency has been met.
(l) The irrigation system shall be designed with minimal pressure losses where possible. Pressure losses between any two sprinklers on the same zone shall be less than 10%.
(m) Pipes shall be sized to allow for a maximum flow of 1.5m/sec.
(n) The irrigation system shall be sized and designed to 80% of point of connection available flow and pressure; allowing for 20% growth of system or 20% reduction in operating pressure while retaining targeted operational efficiencies.

(o) Locate point of connection or pedestal to meet the following requirements:
   i. No pedestal or point of connection locations will be permitted with medians without the explicit written consent of the **District**.
   ii. No pedestal location shall be subject to application of irrigation watering.
   iii. No point of connections shall be placed within a sidewalk without the explicit written consent of the **District**.

(p) The irrigation design shall include voltage loss calculations to the electrical control valve furthest from the controller. The drawings are to include:
   i. A chart comparing the actual voltage drop to the allowable voltage drop on common and zone signal wires;
   ii. Voltage loss shall not exceed the maximum voltage loss as specified by the manufacturer of the irrigation controller;
   iii. Indicate wire locations, wire gauge required, spare wires and necessary splice box locations on the Contract Drawing.
   iv. Install one spare control wire for every five (5) electric control valves connected to the controller;

(q) Install one spare common wire for every ten (10) electric control valves connected to the controller.

(r) Irrigation sleeves shall be installed to route irrigation lines under hard surfaces and features. Non-metallic CSA approved electrical conduit shall be installed adjacent to irrigation sleeves.

(s) Electric control valves used in the design of the irrigation system are to remain consistent in size and manufacturer, where possible. Renovations or additions to the irrigation system shall use the same manufacturer, model and size that exist on site. It is permissible to use an electric control valve from a different manufacturer for specialized applications. In general:
   i. Electric control valves must be sized to the design flow;
   ii. Drip and micro irrigation zones must include filtration and pressure regulation to manufacturers' specifications. Drip and micro zones must have an isolation valve prior to zone valve for maintenance of filtration.
   iii. Unless it has deemed not possible, valves are to be located on the periphery of green spaces and where available, within planting beds.
   iv. Design approval will be required to insert valve locations within hardscape surfaces.

(t) Sprinklers specified for the irrigation system are to remain consistent in size, nozzling and manufacturer. Modifications or additions to the existing irrigation system shall use the same manufacturer, model and size that exist on site. Sprinkler choice is based upon:
   i. Available operating pressure at the base of the sprinkler;
   ii. Desired radius;
   iii. Type of landscape/plant material to be irrigated.
   iv. Preference will be given to sprinklers incorporating pressure compensating devices.
   v. Preference will be given to sprinklers incorporating check valves to reduce low head drainage.

(u) Sprinkler arcs, radius and alignment are to be designed and capable of adjustment to minimize overspray onto adjacent surfaces outside of landscape areas.

(v) Drip line and emitters must incorporate technology to limit root intrusion.

H.6.3 Irrigation Service Connections

Except as required otherwise all landscaped areas of a **highway** boulevard, median or roundabout shall be serviced with a metered water service (50mm diameter, and a metered electrical service (120/240 volts, 60 amps minimum). Provision of water and electrical services by the Owner shall include the establishment of service accounts with the utility providers, all necessary permits,

testing and certification, and all materials, labour, fees and utility costs necessary to provide the service until the end of the Landscape Maintenance Period.

SCHEDULE I DESIGN AND CONSTRUCTION OF WATER DISTRIBUTION SYSTEMS

I.1 General

I.1.1 If a **water distribution system** is required, **subdivision** or **development** must not be approved until:

(a) the **Owner** provides each **parcel** within the **subdivision** or **development** with a water service connected to a **water distribution system** that is connected by trunk water mains, to an existing **community water system**. All **works** must be installed in accordance with the standards set out in **District** Bylaws and the regulations of the local water authority; and

(b) the proposed **subdivision** or **development** is included within an established water system boundary which is either extended or established pursuant to the local improvement and local service provisions of the *Local Government Act* or *Community Charter*, as required by the authority having jurisdiction.

(c) where the **District** does not own or operate the **community water system,** the **Owner** of the **community water system** has provided the **District Engineer** with a Certificate of Public Convenience and Necessity issued by the Comptroller of Water Rights, together with written confirmation from the water utilities **engineer,** that the system meets the requirements of this Bylaw.

(d) new water mains must be installed and commissioned in accordance with the **District's** "Requirements for New Water Mains" policy.

I.1.2 Where the **District** does not own or operate the **community water system** and the proposed **work**s do not meet the design criteria set out in this Bylaw, the **subdivision** or **development** may be approved provided that:

(a) the **Owner** of the **community water system** has submitted a five-year capital plan prepared by an **engineer**;

(b) the **Owner** of the **community water system** has complied with the conditions set out in the five-year capital plan; and

(c) the subject property for the application is located within the boundaries of the capital improvement area as set out in the approved five-year capital plan submitted by the **Owner** of the **community water system**.

I.2 Capacity of System and Sizing of Water Mains

I.2.1 Water distribution systems must be designed to deliver water in adequate quantities and at adequate pressures for domestic use under peak consumption conditions and fire flows. Mains must be sized to carry whichever is the greater of:

(a) the peak hourly flow rate, OR;

(b) the maximum daily flow rate plus the fire flow rate.

I.2.2 Mains must be sized using the Hazen Williams formula with the coefficient "C" equal to 120. The maximum flow velocity for peak hourly demand rate must not exceed 2.0 m/s. For maximum daily flow rate plus the fire flow rate, the maximum flow velocity must not exceed 4.0 m/s.

I.3 **Domestic Demand Criteria**

I.3.1 For residential areas, the daily domestic demand criteria for the purposes of designing **water distribution system**s must be as follows:

TABLE I-I-1- DAILY DOMESTIC DEMAND CRITERIA	
Average Daily Flow	= 900 litres/capita/day
Peak Daily Flow	= 1800 litres/capita/day
Peak Hour Flow	= 4000 litres/capita/day

I.3.2 The demand criteria must be selected to suit the particular circumstances as approved by the **District Engineer**. Densities for specific **zone**s are indicated in TABLE I-2.

TABLE I-2-COMMUNITY WATER SYSTEM DENSITIES		
	People/Ha.	**People/Unit**
Single Family	24-30	3
Multi-family Low	85	2
Multi-family Medium	(3 storey) 120	2
Multi-family High	(4-12 storey) 320-960	2
Mobile Home	45	2
Industrial	50	-
Institutional	50	-
Commercial	75	-

I.4 **Fire Demand Criteria**

I.4.1 Water distribution systems must be designed to ensure that fire flows as required by the most recent Fire Underwriters Survey are available for required durations. Notwithstanding, the provisions of the Fire Underwriter's Survey, fire flows and shall not be less than:

TABLE I-3- REQUIRED FIRE FLOW	
Zone	**Required Fire Flow**
Single & Two Dwelling Housing	60 litres/sec
Modular/Mobile Home	60 litres/sec
Three & Four Plex Housing	90 litres/sec
Apartments & Row Housing	150 litres/sec
Commercial	150 litres/sec
Institutional	150 litres/sec
Industrial	225 litres/sec

I.4.2 Notwithstanding the above table, for all **subdivision** or **development**, with due consideration to anticipated building size, the **Owner's Engineer** must provide, detailed design calculations supporting the amount and duration of the design flows prior to final design.

I.5 **Design Pressures**

I.5.1 The **water distribution system**s must be designed to provide domestic water at the probable building main floor elevation on each **parcel** as follows:

Maximum static pressure	827 Kpa	120 psi
Minimum static pressure	275 Kpa	40 psi
Minimum residual pressure at peak hour	250 Kpa	36 psi
Minimum residual pressure at fire flow conditions	140 Kpa	20 psi

I.5.2 Hydraulic Net**work** Considerations

(a) Where there is an existing hydraulic net**work** model in place, the **District** will provide information for design calculations.

(b) Depending on the complexity and extent of the proposed **water distribution system**, the **District** may elect to carry out a hydraulic analysis showing minimum design flows and pressures. The **Owner** will be required to pay for this analysis.

(c) The maximum length of any permanent, non-interconnected water main must be less than 150 m. All mains exceeding 150 m, unless it is a temporary situation, must be looped.

(d) Where the water system network is deficient, installation of supplementary mains may be required and may necessitate the provision of rights of way in favour of the **District** or the agency having jurisdiction.

(e) The minimum pipe size for all water mains shall be 200 mm diameter. The **District Engineer** may require water mains larger than 200 mm diameter if on a distribution or transmission route. The minimum water main size for commercial or industrial areas shall be 200 mm.

(f) In residential areas, fire hydrant leads must be 150 mm diameter minimum. Water mains 100 mm in diameter may be permitted for domestic service on dead-end **roads** where no further extension is planned. Wherever practical, water mains must be looped. Dead-end mains must not be promoted.

I.6 **Location and Grade of Water Mains**

I.6.1 Water mains must be located in the **road** right of way as shown on Standard Drawing. (e.g. Statutory right of way).

I.6.2 A minimum horizontal clearance of 1 meter between a water main and underground utilities must be provided, except for sanitary and storm sewer mains.

I.6.3 A minimum three-meter clear horizontal distance between a water main and a sanitary or storm sewer main must be maintained.

I.6.4 In special cases such as installations in rock or hardpan and subject to any provincial regulations, the horizontal clearance may be reduced with the approval of the **District Engineer** and the Interior Health Authority, provided the invert of the water main is a minimum of 450 mm above the crown of the sanitary sewer. On side hill streets the water main must be located on the cut side of the centre line of the street.

I.6.5 Water mains must be designed to follow a straight alignment between intersections and at grades parallel to the **road** centerline unless otherwise approved by the **District Engineer**.

I.6.6 Curved alignments may be accepted provided the pipe alignment is at a parallel offset to an established boundary. In no case shall the radius of curvature be less than 300 times the outside diameter of the pipe barrel. The design drawings must indicate the method for achieving the curvature. In no case shall curvature be established in PVC pipelines using joint deflection.

I.6.7 Water mains must be designed at grades that minimize high points in the main. Where a high point is unavoidable, a hydrant, a service, or an air release valve must be installed at the high point as required by the **District Engineer**.

I.6.8 Where the slope of the water main exceeds 20%, anchorage is recommended. Slopes 30% or greater require anchorage and trench dams must be incorporated in the design.

I.6.9 Gas main, electric or telephone duct, or other utility lines may only be installed in the same trench with water mains when horizontal and vertical separation is maintained.

I.6.10 Where it is necessary for a water main to cross other underground services, the crossing must be made at an angle greater than 20 degrees and the vertical clearance between services at the crossing point must be not less than 150 mm except for sanitary sewers where clearance must be in accordance with the *Public Health Act*.

I.6.11 Design drawings must indicate whether the water main passes over or under other underground services which it is crossing.

I.7 **Services**

I.7.1 The diameter of water services must be approved by the **District Engineer**.

I.7.2 The diameter of water services shall be determined considering **water distribution system** pressures, requirements for sprinklers and building size (fixture counts). In no case shall the diameter be less than 19 mm.

I.7.3 The diameter of water services for **District** Parks shall be as required by the **District Engineer**, but in no case shall the diameter be less than 25 mm.

I.7.4 Separate water services installed in accordance with Standard Drawings must be provided to each **parcel** and installed on the same side of the **parcel** as the sanitary sewer service.

I.7.5 Tappings shall be made at an angle of < 30 and > 10 degrees above the horizontal centerline p**lane** of the pipe.

I.7.6 Curb stops must be located 2.0 meters from the property corner pin. Where such location will conflict with other services, alternate alignments may be submitted for approval.

I.7.7 19 mm diameter service connections may be tapped directly into mains 150 mm diameter and greater. 25 mm diameter service connections may be tapped directly into mains 200 mm diameter and greater, except in the use of PVC water mains where all service connections must be made with double strap service saddles. 40 mm and 50 mm diameter service connections must be made using double strap service saddles. Multiple corporation stops must be staggered.

I.8 **Blow Offs**

I.8.1 Blow offs are required at the end of all dead-end water mains and must be constructed and installed in accordance with Standard Drawings.

I.9 **Water Sampling Stations**

I.9.1 The **District Engineer** may require water sampling stations to be installed. Water sampling stations shall be Kupferle Foundry Eclipse 88.

I.10 Air Valves

I.10.1 The general application of the three types of air valves must be:
(a) air/vacuum valves for filling or discharging mains and preventing negative pressures,
(b) air release valves for small air release during normal operation, and
(c) combination valves for combination of air/vacuum and air release valves.

I.10.2 Air valves are not required on water mains 200 mm diameter and smaller, except as determined by the **Owner's Engineer** or as required by the **District Engineer**.

I.10.3 Combination air valves must be installed at the summit of all mains 250 mm diameter and larger, except where the difference in grade between the summit and valley is less than 600 mm. Where practical, with approval of the **District Engineer**, fire hydrants may be located to facilitate an air release.

I.11 Fire Hydrants

I.11.1 Fire hydrants must be located as specified in the most recent publication of the Fire Underwriter's Survey, "Water Supply for Public Fire Protection".

I.11.2 Where hydrants are located other than at intersections, they must be located on the projection of the property line dividing two lots. In selecting the location of a hydrant, the probable route of the firefighting equipment must be considered in consultation with the Fire Department.

I.11.3 A hydrant must not be located within 3 meters of a utility pole, pad mounted transformer, light standard, or any other obstructions.

I.11.4 Legal access and clearance of 1.3 m must be maintained around the fire hydrant.

I.11.5 Hydrants must be flow tested with results added to the hydrant service card.

I.11.6 All hydrants must be painted in a specific colour (team green) and be colour-coded according to the **District** Fire Department standards utilizing the NFPA standard regarding expected flow rates.

I.11.7 For hydrants located across a rural **road** ditch, provision for access, including a culvert and frost protection must be provided.

I.11.8 All hydrants must be bagged until **substantial performance** is achieved.

I.12 Valving

I.12.1 Valves must be located as follows:
(a) In a cluster at the pipe intersection or at the projected property line, when located in an intersection, to avoid conflicts with curbs and **sidewalks**:
  (i) 3 valves at "X" intersection,
  (ii) 2 valves at "T" intersection,
  (iii) or as required by the **District Engineer** so that specific sections of mains may be isolated.
(b) Not more than 200 m apart for single family residential. All other **zones** require special designs.
(c) Not more than two hydrants are isolated.

I.12.2 Valves must be the same diameter as the main. Gate valves must be used up to and including 300 mm diameter. Gear operated butterfly valves will be allowed in mains larger than 300 mm. Valves must be installed in accordance with Standard Drawings.

I.13 Thrust Blocking

I.13.1 Concrete thrust blocking and/or adequate joint restraining devices must be provided at bends, tees, wyes, reducers, plugs, caps, valves, hydrants and blow-offs.

I.13.2 Thrust blocking and/or adequate joint restraining devices are not required for bends at 5 degrees.

I.13.3 The restraining device system must take into account potential future excavations of the **road** in the vicinity of the water main.

I.13.4 The engineering calculations for the thrust block design, based on fitting type, water pressure and soil conditions shall be provided to the **District Engineer** if requested.

I.14 Reservoirs

I.14.1 All reservoirs require a pre-design report prior to commencing detailed design.

I.14.2 Reservoirs must be designed to suit particular circumstances.

I.14.3 Reservoir designs must include:

(a) structures to be below ground and covered unless specifically approved otherwise;
(b) material must be reinforced concrete designed in accordance with the American Concrete Institute's manual on Environmental Engineering Concrete Structures - ACI 350 R-Current Version;
(c) 2 cells, each containing one half of total required volume and capable of being isolated and drained and filled independently;
(d) two lockable access openings in roof for cleaning and maintenance with easy access to any ladders. Minimum dimension to be 1-meter x 1 meter each. Overflow pipe must be visible from the access hatch;
(e) At all access hatches, a survey mark inlaid inside showing the geodetic elevation is to be provided;
(f) Access hatch(s) to have the following:
  (i) Aluminum cover ¼" tread plate – 300lb/ft^2 ,
  (ii) perimeter drain,
  (iii)perimeter sealing gasket,
  (iv)slam lock with aluminum removable sealing plug and opening tool,
  (v) flush lift handle,
  (vi)gas spring assist cylinder,
  (vii) 90-degree hard open arm;
(g) ventilation pipes or openings sized to handle appropriate intake and exhausting volumes of air for filling and drawing the reservoir;
(h) floor to be sloped to the sump;
(i) sub drain under floor to collect and drain any leakage, connected to overflow pipe;
(j) interior stainless steel wall ladder from roof access to floor. Any exterior ladders must be vandal proof and prohibit unauthorized access;

(k) inlet and outlet pipes to be designed to disperse water throughout the reservoir;
(l) overflow drain to be provided and sized to transmit the maximum reservoir design inflow. The overflow drain must be connected to an acceptable point of discharge; approved by the **District Engineer**;
(m) All entrance doors must be equipped with electric strike and fob reader system as supplied by Chubb Edwards in accordance with **District** standards;
(n) A PLC based control system, instrumentation, and process and SCADA telemetry in accordance with **District** standards, including;
(i) Continuous level measurement of each reservoir cell
(ii) Back up high-level float alarm signals for each reservoir cell;
(iii)Intrusion alarming for each hatch;
(iv)Intrusion alarming for the reservoir valve chamber;
(v) Room temperature monitoring in the valve chamber;
(vi)Flood monitoring in the valve chamber;
(vii) HMI for local monitoring;
(viii) UPS power supply;
(ix)Chlorine residual or other analytical monitoring shall be included.

I.14.4 PLC, HMI, and SCADA programming shall be done by the **District's designated integrator**, in accordance with District standards at the Owner's expense.
(a) equipment and operations manuals;
(b) security against vandalism and theft;
(c) landscaping acceptable to the **District** is to be provided including irrigation; and
(d) a minimum 30 amp, 120 VAC power service

I.14.5 Reservoir capacity must be calculated by the following equation:
Total Storage Requirement = A + B + C
Where: A = Fire Storage
B = Equalization Storage (25% of maximum day demand)
C = Emergency Storage (25% of A + B)

I.14.6 Reservoir capacity must not be less than the greater of the following:
(a) One day average annual consumption for the service area.
(b) The sum of the peak hourly demand flow rate sustained for 6 hours plus the fire flow required to meet Fire Underwriters Survey Guidelines for the specified period of time, less the pump station capacity with the largest capacity pump out of service.

I.14.7 Reservoir valve chamber design must incorporate:
(a) all valves associated with the reservoir;
(b) sump in valve chamber floor, connected to overflow pipe through a check valve;
(c) 50 mm valved outlet off supply line within valve chamber for **water supply** for cleaning reservoir; and
(d) valves must be outside stem and yolk.

I.15 Pump Stations

I.15.1 Pump stations must be designed to meet maximum daily demands with the largest pump out of service with balanced storage online. If equalization storage is not online, pump station capacity must meet peak hour demand with the largest pump out of service.

I.15.2 Pump station design must assess, and where appropriate incorporate, the following features:

(a) ability to handle the ultimate flow requirements;
(b) type of station and impact on neighbours;
(c) construction dewatering requirements;
(d) access for construction;
(e) access for maintenance;
(f) aesthetics, noise, and landscaping acceptable to the **District** is to be provided, including irrigation;
(g) security against vandalism and theft;
(h) proximity and adequacy of power supply;
(i) minimizing energy requirements;
(j) equipment and maintenance requirements (access, lifting equipment, etc.);
(k) standby power and its compatibility;
(l) soil suitability for intended purpose;
(m) convenience of operation and maintenance.
(n) safety for operators and public; and
(o) capital, operation, and maintenance costs.

I.15.3 Pump Station design must include:

(a) A PLC based control system, instrumentation, and process and SCADA telemetry in accordance with **District** standards, including:
    (i) Feedback signals from and control signals to each motor starter;
    (ii) Feedback signals from and control signals to chlorination system (if required);
    (iii) Lead pump selection, including the option to alternate;
    (iv) Continuous Suction Pressure monitoring and alarming;
    (v) Continuous Discharge Pressure monitoring and alarming;
    (vi) Continuous Flow monitoring and alarming;
    (vii) Continuous Room Temperature monitoring and alarming;
    (viii) Flood monitoring;
    (ix) Intrusion monitoring;
    (x) All entrance doors must be equipped with electric strike and fob reader system as supplied by Chubb Edwards in accordance with **District** standards
    (xi) HMI for local monitoring; and
    (xii) UPS power supply
(b) full duplex pump sequencing;
(c) VFDs or electronic soft starters, with ramping, to minimize starting and stopping surges;
(d) starters in individual enclosures for each pump motor in accordance with District standards, including:
    (i) Hand-Off-Auto selectors; Hand-Off-Auto selectors;
    (ii) ii. Keypads mounted in the starter door for VFD's and Soft Starters;
    (iii) iii. Hour Meters;
    (iv) iv. Ammeters (may be part of keypad display);
    (v) v. Phase Loss Protection; and
    (vi) vi. Power Factor Correction to meet electrical supply utility requirements.
(e) low discharge pressure override-start plus alarm;
(f) low pressure or no flow override-start plus alarm;
(g) alarms to be both audible and visible;
(h) control valves to minimize starting and stopping surges;
(i) duplicate control cables, without splices, between pump stations and reservoirs;
(j) security against vandalism and theft;

(k) energy efficient motors;
(l) hour meters, recording flow meter and recording suction and discharge pressure gauges at each pump;
(m) flow metering equipment;
(n) automatic heating, ventilating and dehumidifying systems;
(o) in-station lighting;
(p) telemetry alarm system;
(q) wireless (radio) telemetry between pump station and reservoir;
(r) drainage to be provided for all areas of pump station;
(s) chlorine injection requirements, including safety, storage and handling;
(t) chlorine alert detection;
(u) chlorine weigh scale;
(v) electrical phase loss protection;
(w) electrical drawing schematics for control panel;
(x) reduced pressure backflow preventer;
(y) a minimum 347/600V electrical service; and
(z) pump motors shall operate at 575V, three-phase for motors five horsepower or greater.

I.15.4 For each design submission to the **District**, an extra set of drawings and manuals pertaining to the design of the pump station, key plan, and location plan must be submitted to the **District Engineer**.

I.15.5 PLC, HMI, and SCADA programming shall be done by the **District's designated integrator**, in accordance with District standards at the Owner's expense.

I.15.6 The **Owner** must provide three sealed sets of mechanical shop drawings, three sealed sets of electrical line diagrams, two sealed copies of design calculations for review by the **District Engineer**.

I.15.7 Factory certified pump head/capacity curves must be submitted to the District for review and pumps must not be shipped until the District has reviewed and marked the head/capacity curves as having been reviewed.

I.15.8 The **Owner** must provide two copies of an Operation and Maintenance Manual in a three-ring binder with the name of the facility embossed on the cover, prior to issuance of a **Certificate of Total Performance**. The manual must contain:
(a) Table of contents;
(b) Identified, plasticized, labeled section dividers;
(c) As-constructed shop drawings;
(d) equipment layout drawings;
(e) electrical, control, and alarm wiring diagrams;
(f) operating instructions for all equipment;
(g) maintenance instructions for all equipment, including frequency of maintenance tasks
(h) equipment data sheets;
(i) spare circuit cards for critical components;
(j) certified head/capacity curves for pumps;
(k) equipment part lists; and
(l) emergency operating procedures.

I.16 Pressure reducing valve (PRV) Stations

I.16.1 PRV stations must be designed as above ground facilities in order to avoid "confined space entry" requirements. PRV stations shall be provided with a minimum 30 amp, 120 VAC power service.

(a) PRV station design must include:
- (i) Forced air ventilation, heat and light;
- (ii) External kiosk and antenna;
- (iii) All entrance doors must be equipped with electric strike and fob reader system as supplied by Chubb Edwards in accordance with **District** standards
- (iv) Parallel pressure reducing valves;
- (v) Air release valves;
- (vi) Water quality sample points;
- (vii) Sump drain to storm;
- (viii) Off road vehicle parking;
- (ix) Manuals as per "manual" section;
- (x) landscaping acceptable to the District Engineer; and

(b) A PLC based control system, instrumentation, and process and SCADA telemetry in accordance with **District** standards, including:
- A. Security switches
- B. Discharge and suction pressure transmitters
- C. temperature sensor;
- D. flowmeter;
- E. uninterruptable power supply;
- F. radio or hard wire modem;
- G. external antenna;
- H. operator interface panel.

Where necessary, in the opinion of the **District Engineer**, the criteria of this section may be modified.

I.17 Facility Access

I.17.1 Paved vehicular access with turnaround and parking for up to two vehicles must be provided to all reservoirs and pump stations. The minimum standard shall be shown in the Standard Drawings, for a residential lane with curb, gutter, and drainage provisions to match surrounding neighbourhood.

I.18 Waterworks Approved Materials

I.18.1 Only the materials listed in the approved products list in Schedule E unless otherwise approved by the District Engineer are approved for installation in water systems owned and operated by the **District.**

SCHEDULE J DESIGN AND CONSTRUCTION OF A WATER SOURCE

J.1 General

J.1.1 If Schedule C permits a **water source**, **subdivision** or **development** must not be approved until each **parcel** in the **subdivision** or **development** is provided with its own **water source** located on said **parcel**.

J.1.2 All **work**s must be installed in accordance with the standards set out in this Bylaw and applicable provincial legislation and regulations.

J.1.3 Notwithstanding J.1.2, if connection to a **community water system** can be achieved without a trunk main extension, the **community water system** must be used as the **water source**, unless the **subdivision** or **development** is within the Agricultural Land Reserve and the land or **development** is to be used for agricultural purposes.

J.1.4 If the **water source** is not from a **community water system**, the **Owner** must register a Covenant pursuant to Section 219 of the *Land Title Act* in a form acceptable to the **District Engineer** in priority to all financial charges and other charges as required by the **District** against the existing land title pursuant to the *Land Title Act* confirming that the water is not from a **community water system** and verifying all quantity and quality testing meets the requirements of this bylaw.

J.1.5 **A Water source**s must be capable of delivering water at a rate of not less than 20 liters per minute per well over a one-hour period to a minimum of 2,275 liters per day per dwelling unit.

J.1.6 A water sample taken from the water source must be tested using a "**comprehensive test**" to determine conformity to potable drinking water standards. The comprehensive test must as a minimum include the following: Total Coliforms, E. Coli, Alkalinity, Aluminum, Antimony, Arsenic, Barium, Boron, Cadmium, Calcium, Chloride, Chromium, Copper, Conductivity, Cyanide, Fluoride, Hardness (total), Iron, Lead, Magnesium, Manganese, Mercury, Nitrate, Nitrite, pH, Potassium, Selenium, Sodium, Sulfate, Total Dissolved Solids, Turbidity, Uranium, and Zinc. The test results must be submitted to the **District Engineer**. The test results are to be registered in Land Title Office against the title of the **parcel** as a restrictive covenant, prior to issuance of a Building Permit. Any changes to the wording of the restrictive covenant are subject to the written approval of the **District Engineer**

J.1.7 Notwithstanding J.1.4, where the **District** does not own or operate the **community water system** and the proposed **work**s do not meet the requirements set out in this Bylaw the proposed **subdivision** or **development** may be approved provided that:

(a) the **Owner** of the **community water system** has submitted a five-year capital plan acceptable to the **District**;

(b) the **Applicant** seeking approval of the proposed **subdivision** or **development** has complied with the conditions set out in the five-year capital plan; and

(c) the property that is subject to the **subdivision** or **development** application is located within the boundaries of the capital improvement area as set out in the approved five-year capital plan as submitted by the **Owner** of the appropriate **community water system**.

J.2 **Water source**

J.2.1 The required **water source** may be a well or a surface **water source** provided that the **water source** complies with the provision of this Bylaw.

J.3 **Requirements for Wells**

J.3.1 All wells must be drilled, cased, and flood proofed in accordance with the BC Drinking Water Protection Act.

J.3.2 All wells must be capable of delivering water at a rate of not less than 20 liters per minute per well over a one-hour period to a minimum of 2,275 liters per day per dwelling unit.

J.3.3 Each **parcel** must have its own well. Where the well is not located on the **parcel** for which the well is the **water source**, the well, water mains, and all other appurtenances must be protected by an easement, in favour of the **parcel** being supplied with water, registered with Land Title Office. A legal survey plan prepared by a **surveyor** must be provided indicating the location of all wells, water mains, and appurtenances.

J.3.4 A water sample taken from the well must be J.3.4 tested using a comprehensive test to determine conformity to potable drinking water standards. The test results must be submitted to the District Engineer. The test results are to be registered in Land Title Office against the title of the parcel as a restrictive covenant as prescribed in District Policy 09.103. Any changes to the wording of the restrictive covenant is subject to the written approval of the District Engineer

J.3.5 A report must be submitted to the **District Engineer** by a qualified professional specializing in groundwater hydrology verifying all quantity and quality testing. The report must include a plan showing the location of all wells, water mains and appurtenances.

J.4 **Requirements for Surface Water sources**

J.4.1 A domestic water license must be obtained from the Provincial Water Stewardship Branch of the Ministry of Environment. A copy of the water license must be submitted to the **District Engineer**.

J.4.2 The quantity of water authorized to be used under the water license shall be as determined by the Comptroller of Water Rights, but shall not be less than 20 liters per minute over a one hour period to a minimum of 2,275 liters per day per dwelling unit.

J.4.3 A water sample taken from the surface water source must be tested using a comprehensive test to determine conformity to potable drinking water standards. The test results must be submitted to the District Engineer. The test results are to be registered in Land Title Office against the title of the lot as a restrictive covenant as prescribed in District Policy 09.103. Any changes to the wording of the restrictive covenant are subject to the written approval of the District Engineer.

J.4.4 All quantity and quality must be verified by a qualified professional specializing in surface water hydrology verifying all quality and quantity testing. A report must be submitted to the **District Engineer**.

SCHEDULE K DESIGN AND CONSTRUCTION SANITARY SEWER SYSTEMS

K.1 General

K.1.1 If community sewer is required in accordance with this Bylaw, a **subdivision** or **development** must not be approved unless the **Owner** of the **parcel** being subdivided or **developed**, provides each **parcel** in the **subdivision** or **development** with a sanitary sewer service connected to the **District** Sanitary Sewer System. All **work**s must be constructed and installed in accordance with the standards as set out in this Bylaw.

K.2 Design Flows

K.2.1 Sanitary sewer facilities constructed in or for a **subdivision** or **development** must be designed to provide sufficient capacity to carry the required quantity of sewage flow from the full contributing area as determined by the **Owner's Engineer** and as approved by the **District Engineer**.

K.2.2 All **parcel**s must be serviced by gravity flow unless otherwise approved by the **District Engineer**.

K.2.3 The sanitary sewer system must be designed based on the following criteria:

(a) Domestic Flow Rate = 350 litres/capita/day, plus;

(b) Infiltration rates for:

(i) New pipes not in water table	=	5,000 l/ha/day
(ii) New pipes in water table	=	8,000 l/ha/day
(iii) Old pipes	=	10,000 l/ha/day

(c) Densities per **TABLE K-1**

TABLE K-1-SANITARY SEWER SYSTEM DENSITIES

	People/Ha.	People/Unit
Single Family	24-30	3
Multi-family Low	85	2
Multi-family Medium	(3 storey) 120	2
Multi-family High	(4-12 storey) 320-960	2
Mobile Home	45	2
Industrial	50	-
Institutional	50	-
Commercial	75	-

(d) A peaking factor must be applied to the average flow. With this factor being modified to suit the areas served as follows:

Peaking Factor = $f\ (1 + \frac{14}{4 + \sqrt{P}})$

Where: P = Population in thousands
f = Reduction factor, applied as follows:

New residential areas	= 0.75
Old residential areas	= 0.85
Commercial and Industrial area	= 1.00

(e) Peak design flows must be determined by applying the peaking factor to the average daily flow, and adding inflow and infiltration (I & I) flows.

(f) Pipes shall be designed so that the sewer flow does not exceed d/D=0.67 for pipes 250 mm diameter and less, or d/D=0.75 for pipes greater than 250 mm diameter. {d=flow depth and D=pipe diameter.}

K.3 **Pipe Flow Formulas**

K.3.1 Gravity Sewers

(a) Manning's formula must be used for gravity sewers. The roughness coefficients must be:

Concrete	=	0.013
PVC	=	0.011

K.3.2 Force Main Sewers

(a) Hazen-Williams formula must be used. Friction coefficient must be C = 120.

K.3.3 Velocities

(a) The minimum velocity must be 0.6 m/sec. There is no maximum velocity, however, consideration must be given to scour problems where flow exceeds 3.0 m/sec.

K.4 **Minimum Grade**

K.4.1 The grade of any sewer is governed by the minimum velocity required (0.6 m/sec). However, the last section of a main that will not be extended in the future must have a minimum grade of 1.0% where 150 mm diameter pipe is proposed. Notwithstanding the above, the minimum grade for all pipes must be 1.0% unless restricted by topography or other factors approved by the **District Engineer**. There must be no change in grade between manholes.

K.4.2 Where the slope of the sewer main exceeds 20%, anchorage shall be considered by the **Owner's Engineer**. Where slope is 30% or greater, anchorage must be incorporated in the design. Anchorage must be constructed in accordance with Standard Drawings.

K.5 **Alignment of Sewer Mains**

K.5.1 Sewer mains must be designed to follow a straight alignment between manholes unless approved by the **District Engineer**. Where permitted, horizontal curves will require a constant offset and must be uniform throughout the curve. In no case shall the radius of curvature be less than 300 times the outside diameter of the pipe barrel. The design velocity must exceed 0.90 m/sec., the minimum grade must be 1.0%, and the curve midpoint and two l/4 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.

K.5.2 Routing of the sewers must be approved by the **District Engineer**.

K.6 **Service Connections**

K.6.1 Separate service connections installed in accordance with Standard Drawings must be provided to each **parcel** and must be installed, wherever possible, in a common trench with the water service. All services must enter the main at a point just above the springline.

K.6.2 Only single connections will be permitted.

K.6.3 Connections to new mains must be made using standard wye fittings; connections to existing mains shall be made using wye saddles or other pre-approved methods.

K.6.4 The minimum grade from the main to the property line shall be 2.0% for a 100 mm service and 1.0% for a 150 mm service.

K.6.5 The diameter of sewer services must be as determined by the **Owner's Engineer** but in no case shall the diameter be less than 100 mm.

K.6.6 The minimum depth of a service at the property line must be 1.2 m within a **highway** right of way and 1.0 m within a statutory right of way.

K.6.7 Inspection chambers are required for all connections and shall be installed in accordance with Standard Drawings.

K.6.8 Service connections must be installed at the downstream corner of the **parcel** at an offset of 3.0 m from the property pin.

K.6.9 Service connections may be permitted into manholes provided that:

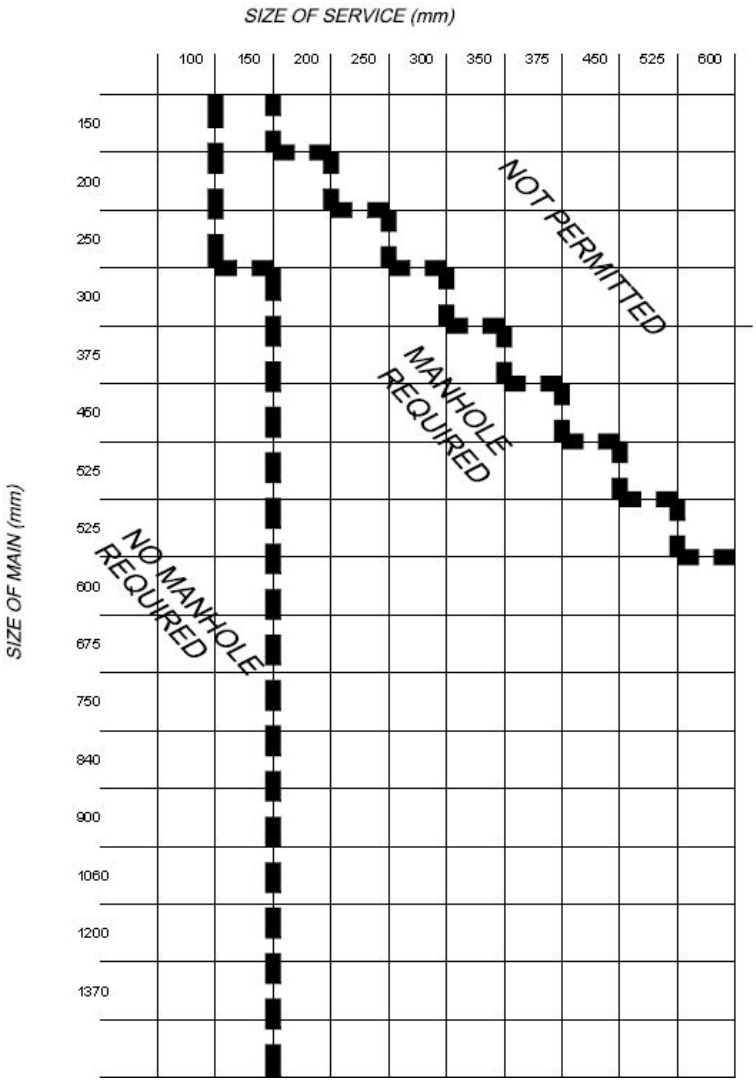
(a) the connection is not in an adverse direction to the flow in the sewer main and
(b) the connection enters the manhole so the service crown matches the sewer main crown.

K.6.10 Manholes are required for services relative to the size of the main as shown in **TABLE K.1**.

K.6.11 Following final grading, Brooks Boxes are to be installed on every inspection chamber.

K.6.12 Manholes are required to be installed at the intersection of the main and the service for non-residential services 150 mm and larger as shown in TABLE K-1.

TABLE K-1



K.7 **Minimum Sewer Main Diameter**

K.7.1 The minimum permitted size of pipe is 200 mm diameter.

K.7.2 Where no further extension is anticipated, the minimum pipe diameter may be reduced to:

(a) For residential lands - 150 mm diameter with minimum 1.0% grade

(b) For commercial and industrial - 200 mm diameter with minimum 0.60% grade

K.8 **Depth of Cover**

K.8.1 The depth of the sewer main must be sufficient to provide “gravity flow” service connections to both sides of the **highway** and must allow for future extension(s) to properly service all of the upstream tributary lands.

K.8.2 The minimum depth of cover shall be 1.2 m.

K.8.3 The maximum depth of cover is 4.5 m unless approved by the **District Engineer**.

K.9 **Manholes**

K.9.1 Manholes must be installed at all:
- (a) changes in grade,
- (b) changes in direction, except for curvilinear sewers,
- (c) changes in pipe sizes,
- (d) intersecting sewers,
- (e) terminal sections, and
- (f) upstream and downstream end of curvilinear sewers.

K.9.2 Manholes must be placed at all locations where future extensions are anticipated and must be spaced no further than 150 m apart.

K.9.3 For sanitary manholes not located within the **road**, the rim elevation must be designed to be above:
- (a) the adjacent storm manhole rim elevation,
- (b) the surrounding ground so that infiltration from ponding will not occur, and
- (c) the 100-year return runoff event.

K.9.4 Manholes must be constructed and installed in accordance with Standard Drawings.

K.9.5 All manhole lids are to be clearly labelled Lake Country Sewer.

K.10 **Hydraulic Losses Across Manholes**

K.10.1 The following criteria must be used:
- (a) The crown of the downstream pipe must not be higher than that of the upstream pipe.
- (b) Minimum drop in invert levels across manholes:
  - (i) Straight run - no extra drop required other than slope of pipe.
  - (ii) Deflections up to 45 degrees- 25 mm drop
  - (iii) Deflections 45 degrees to 90 degrees - 50 mm drop

K.10.2 Drop manholes and outside ramps must be installed in accordance with Standard Drawings. Where provisions are required for a future drop manhole connection, the manhole must be constructed and installed in accordance with Standard Drawings.

K.10.3 Inside ramps will only be permitted where the proposed alignment conflicts with existing utilities or where an inside ramp is required to match upstream and downstream pipe slopes. Inside ramps must not exceed 450 mm.

K.11 **Clean-Outs**

K.11.1 Clean-outs may be provided at terminal sections of a main in lieu of a manhole where:
- (a) future extension of the main is anticipated.
- (b) the length of sewer to the downstream manhole does not exceed 45.0 m.
- (c) the depth of the pipe does not exceed 2.0 meters of cover at the terminal point.
- (d) design of the anticipated extension is completed to the next manhole to ensure the **works** will not require realignment when extended.

K.12 **Sanitary Lift Stations**

K.12.1 The use of sanitary lift stations is discouraged. Any proposed use of lift stations must receive prior approval from the **District Engineer**. Sanitary sewer lift stations should be located within a right of way outside the required **highway** dedication. Siting of lift station must be approved by the **District Engineer**.

K.12.2 The following criteria cover both dry well and submersible sewage lift stations. Larger capacity sewage lift stations or lift stations with special design or siting requirements may require additional assessment and review of criteria including but not limited to:

(a) Pre-design Report

(i) Prior to commencing detailed design of a lift station, the **Owner's Engineer** must submit to the **District Engineer** for approval a pre-design report that addresses all pertinent design considerations, including:

A. The lift station must be designed to handle the ultimate flows of the designated catchment
B. Type of station and impact on neighbours.
C. Access for maintenance.
D. Aesthetics, noise, odour control and landscaping requirements.
E. Security against vandalism and theft.
F. Proximity of receiving sewers, water mains and adequacy of power supply.
G. Soils. Sub-surface investigations must be undertaken prior to site approval.
H. Capital costs and operation and maintenance costs.
I. Corrosion and odour control.

(b) Design Report

(i)The **Owner's Engineer** must provide three sealed sets of mechanical drawings and three sealed sets of electrical line diagrams for review by the **District Engineer**. Two sealed copies of design calculations shall be provided for documentation.

(ii) Lift station design must address the following:

A. Construction dewatering requirements.
B. Access for construction.
C. Station uplift design must be based on minimum load level and maximum flood elevations.
D. Minimizing energy requirements.
E. Standby power and its compatibility.
F. Convenience of operation and maintenance.
G. Safety for operators and public.
H. All entrance doors must be equipped with electric strike and fob reader system as supplied by Chubb Edwards in accordance with **District** standards

K.12.3 Pumps must be:

(a) Gorman-Rupp or pre- approved equivalent
(b) capable of passing solids up to 75 mm in size
(c) equipped with hour meters
(d) easily removed for maintenance
(e) operate on a 347/600 volt electrical source (pump motors over 5 H.P. are to be 600 volt 3 phase type)
(f) able to operate alternately and independently of each other
(g) able to meet maximum flow condition with one pump in failure mode

K.12.4 Factory certified pump head/capacity curves must be submitted to the District for review and pumps must not be shipped until the District has reviewed and marked the head/capacity curves as having been reviewed.

K.12.5 Motor cables, power cables, etc., must be continuous from within the pump station to within the kiosk. In no instance shall a cable be spliced.

K.12.6 The lift station shall include a PLC based control system, instrumentation, SCADA telemetry in accordance with **District** standards, including:

(a) Feedback signals from and control signals to each motor starter;
(b) Lead pump selection, including the option to alternate;
(c) VFDs or electronic soft starters, with ramping, to minimize starting and stopping surges;
(d) Continuous level monitoring for pump control;
(e) Emergency high and low-level switches for back up control, independent of the PLC control system;
(f) Magnetic flow meter, with flood monitoring in flow meter chamber;
(g) Flood monitoring in valve chamber;
(h) Kiosk temperature monitoring;
(i) Power supply status from the automatic transfer switch;
(j) Running and fault feedback signals from the standby generator;
(k) HMI for local monitoring; and
(l) UPS power supply.

K.12.7 Electrical and control equipment must be mounted in a three-compartment kiosk adjacent to the station, in accordance with **District** standards. The kiosk must be located a minimum of 3.0 m from the station lid as follows:

(a) Control Panel, telemetry equipment, instrument displays, and motor starters are to be in the kiosk compartment facing the wet well;
(b) Electrical service and distribution equipment are to be located in the kiosk compartment facing away from the wet well;
(c) All cable entries into the kiosk are to be made through a sealed end compartment; and
(d) The kiosk shall be aluminum, insulated, heated, ventilated, with a powder-coat finish;

K.12.8 Each pump motor shall have a starter in an individual enclosure, in accordance with **District** standards, including:

(a) Hand-Off-Auto selectors;
(b) Keypads mounted in the starter door for VFD's and Soft Starters;
(c) Hour Meters;
(d) Ammeters (may be part of keypad display);
(e) Over temperature and seal leak monitoring relays, to pump manufacturer requirements;
(f) Phase Loss Protection; and
(g) Power Factor Correction to meet electrical supply utility requirements.

K.12.9 Check valves must be ball lift type.

K.12.10 All stations must be equipped with an explosion-proof exhaust fan which can be activated by a manual switch and be of sufficient capacity to exchange the total volume of air inside the station

with fresh air within 3 minutes of activation to meet WorkSafeBC requirements for ventilation in a confined space.

K.12.11 The entrances to all stations must be waterproof and be provided with a suitable lock. The access must be a minimum 900 mm x 900 mm in size. The access hatch must have:

(a) an aluminum 6.4 mm tread plate
(b) a perimeter drain
(c) a perimeter sealing gasket
(d) a slam lock with an aluminum removable sealing plug and opening tool
(e) a flush lift handle
(f) a gas spring assist cylinder
(g) a 90 degree hold open arm
(h) a flush fitting padlock tang
(i) be reinforced for 1465 kgs/m^2. All fasteners to be made of 316 stainless steel.

K.12.12 The entrance must be at ground level where feasible but, in no case, more than 300 mm above the ground. An explosion-proof light with a protective cover should be located in a suitable location in the station and the light should be activated by the entrance cover.

K.12.13 Access into the stations must be by an aluminum ladder. The location of the ladder must not interfere with the removal and installation of the pumps, etc. The ladder must be designed to extend and lock at least 600 mm above the station entrance. A platform is to be provided above the high-water level float to permit wet well access. The platform is to be a fibreglass grating.

All wiring in classified areas, including the wet well, area around the wet well, and the kiosk end compartment, must meet the Canadian Electrical Code requirements for that area classification. Sealing between classified and unclassified areas shall meet the requirements of the Canadian Electrical Code. The electrical design and installation is subject to the acceptance of Technical Safety BC.

K.12.14 All equipment must be CSA approved and have at least a one-year warranty for parts and labour. All pumps must be factory tested prior to installation.

K.12.15 A gate valve is required on the influent line and a plug valve on each pump discharge. The valves must be outside the station and be complete with square operating nut and nelson box.

K.12.16 A 38 mm diameter water connection for cleaning purposes must be provided. A backflow preventer is required for connections in the station.

K.12.17 The roof and cover of the lift station should be designed to withstand a loading of H-20 (Highways Standard).

K.12.18 The lift station electrical system shall include an automatic transfer switch and stationary standby generator set, in accordance with **District** standards.

K.12.19 Subject to the findings of the pre-design report regarding access and landscaping, the area around the station and all associated equipment or building must be asphalted. The size of the area is to be determined by the requirements for maintenance.

K.12.20 A receptacle compatible with the **District**'s removable lifting arm must be incorporated into the design of the pump station to facilitate the removal and installation of the pump(s).

K.12.21 The interior surfaces of all fibreglass stations must receive at least two coats of two component white epoxy enamel.

K.12.22 The wet well bottom must be benched to direct all solids into the pump suction. The influent line must be located tangent to the wet well to encourage scouring of the wet well.

K.12.23 Minimum storage between the high-level alarm and the start of overflow under the more critical of:

(a) Minimum 2 hour in wet well at average wet weather flow.
(b) Minimum 1 hour in wet well and influent pipes at peak wet weather flow.

K.12.24 Station to allow removal of pumps using a hoist truck with a 1.8 m boom.

K.12.25 Security lighting and perimeter fencing is to be provided. The fence must be made of black chain link.

K.12.26 Landscaping acceptable to the **District** is to be provided including irrigation.

K.12.27 Minimum barrel size must be 2440 mm in diameter.

K.12.28 PLC, HMI, and SCADA programming shall be done by the **District**'s **designated integrator**, in accordance with District standards, at the Owner's expense.

K.13 Operation and Maintenance Manual

K.13.1 Before acceptance by the **District** of the completed station, the **Owner** must provide three copies of an Operation and Maintenance Manual to the **District**. The manual must contain:

(a) as constructed shop drawings;
(b) equipment layout drawings;
(c) electrical, control, and alarm wiring diagrams;
(d) operating instructions for all equipment;
(e) maintenance instructions for all equipment, including frequency of maintenance tasks;
(f) equipment data sheets;
(g) spare circuit cards for critical components;
(h) certified head/capacity curves for pumps;
(i) equipment part lists;
(j) emergency operating procedures.

K.13.2 The maintenance manuals must be bound documents with the name of the facility on the cover. Manuals must contain a table of contents with each section identified by a plasticized, labelled divider.

K.14 **Sanitary Force Mains**

K.14.1 In conjunction with sanitary pumping facilities, the following criteria must be noted in the design of force main systems:

(a) At the lowest pump delivery rate anticipated to occur at least once per day, a cleansing velocity of 1.0 m/sec should be maintained. Maximum velocity should not exceed 3.5 m/s.
(b) An automatic air relief valve must be placed at high points in the force main to prevent air locking.
(c) The minimum size for force mains shall be 100 mm diameter.
(d) The material for force mains must be HDPE (high density polyethylene) designed to suit the conditions of use.
(e) All force mains must be designed to prevent damage from transient conditions.

K.15 **Noise Control Criteria**

K.15.1 Noise levels for facilities must not exceed 65 dB at property line or 20 m away whichever is closer.

K.16 **Corrosion and Odour Criteria**

K.16.1 Corrosion and Odour controls must be considered in all design.

K.16.2 Analysis for potential odour and sulfides is required.

K.16.3 Odour Criteria:

(a) at 10 m from any gravity main, force main, manhole and lift station or other sewer facility (summer conditions, winds between 2-10 km/h), 1.0 odour units.
(b) where sewer facilities are close to houses, parks or **walkways**, 0.0 odour units.
(c) Dissolved sulfide maximum limit at any point in the system is to be 0.5 mg/l. However, for new tie-ins to **District** system, the maximum limit is 0.3 mg/l.
(d) Wet well size, force main diameter and length, as well as other pertinent factors must be considered in optimizing system operations to avoid odours.

SCHEDULE L DESIGN AND CONSTRUCTION ONSITE SEWERAGE SYSTEMS

L.1 General

L.1.1 Where the provisions of this Bylaw allow an **onsite sewerage system**, the **Owner** must design and construct such services in accordance with the provisions of this Bylaw.

L.1.2 On-site disposal systems must be designed and constructed in accordance with the Sewerage System Regulation of the *BC Public Health Act*.

L.1.3 If connection to a **community sewer system** can be achieved without a main extension, the **community sewer system** must be used as the method of sewage disposal, unless the **subdivision** or **development** is within the Agricultural Land Reserve and the land or **development** is to be used for agricultural purposes.

L.1.4 If an **onsite sewerage system** is permitted under this Bylaw, for the **subdivision** or **development**, the subdivision must not be approved until the **Owner's Engineer** has demonstrated that each individual **parcel** has sufficient area for a septic disposal field suitable for effluent disposal including sufficient area for a backup septic disposal field.

L.1.5 The septic disposal field area for an initial and replacement field must be surveyed and registered as a covenant preserving the land for use as a septic field on each individual lot.

L.1.6 Onsite disposal is permitted on existing **parcel**s less than 1.0 ha in size. However, **subdivision** into **parcel**s less than one hectare in size, is not permitted in cases where a connection to a sanitary sewer is not available.

SCHEDULE M DESIGN AND CONSTRUCTION OF STORM DRAINAGE SYSTEMS

M.1 General

M.1.1 Overview

The purpose of Schedule M is to standardize the procedures for designing common drainage facilities in the District. All drainage works will be designed with considerations for public safety, regulatory requirements, and the natural environment. The Owner's Engineer will consult with the District Engineer to determine what existing information may be of assistance to them.

The determination of the primary method for the management and disposal of stormwater will be at the discretion of the District Engineer. To aid in this determination, the Owner may be required to commission a study by a Qualified Professional to determine the viability of ground disposal for storm water.

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 District of Lake Country. 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.

Stormwater management designs must conform to local government bylaws, regulations, and policies plus federal and provincial statutes and guidelines. These include, but are not limited to, the following:

- District of Lake Country Stormwater Management Design Guidelines
- Existing Master Drainage Plans, Watershed Plans, or Integrated Stormwater Management Plans
- Local Government Act
- Fisheries Act
- Water Sustainability Act
- Canadian Navigable Waters Act
- Canada Wildlife Act
- Migratory Birds Convention Act
- Dike Maintenance Act
- Land Development Guidelines for the Protection of Aquatic Habitat (Canada/B.C.)
- National Guide to Sustainable Municipal Infrastructure (Canada)
- Best Practices for Protection of Groundwater Resources in British Columbia (BC)
- Standards and Best Practices for Instream Works (Canada/BC)
- Riparian Areas Protection Regulation (BC)
- Canadian Dam Association Dam Safety Guidelines
- Applicable Professional Practice Guidelines provided by Engineers and Geoscientist British Columbia
- MMCD Green Design Guideline Manual

Where there is a discrepancy between this Schedule and any of the above-referenced documents, the more stringent requirements or guideline shall govern. Also note that the design standards in this Schedule set minimum acceptable standards.

M.1.2 Storm Drainage System Triggers

If a storm drainage system is required pursuant to this Bylaw, the Owner of the parcel being subdivided or developed must provide the proposed subdivision or the parcel being developed with a storm drainage system constructed and installed in accordance with the provisions of this Bylaw, as amended from time to time.

In addition to the requirements of Schedule C Servicing Requirements, a storm drainage system is required where the subdivision or development is located in an area where drainage studies adopted by Council indicate that drainage work should be constructed.

In addition to the requirements of Schedule C Servicing Requirements, a storm drainage system is required where the development includes or is solely for the alteration of land.

M.1.3 Georeferenced Data

It is the Owner's Engineer's responsibility to ensure they obtain true and accurate elevations for the development of the site and to confirm the accuracy of any mapping or information that may be provided by the District.

M.2 Design Overview

M.2.1 General Requirements

a) The Owner's Engineer must design the storm drainage system so that all downstream drainage facilities are capable of handling the determined, controlled post development flows.

b) All stormwater runoff that is discharged to a receiving water, whether directly or indirectly, must be treated using approved methods and to an approved standard.

c) A Stormwater Management Plan must be prepared by the Owner's Engineer for District review for all phases of the proposed development to ensure required drainage routes and facilities are adequately identified, protected, and sized for ultimate development conditions. The level of detail required is contingent on the size and type of development proposed.

M.2.2 Dual Drainage System

Each storm drainage system must consist of a minor and a major drainage system as defined below:

M.2.2.1 Minor Drainage System

The minor drainage system is comprised of storm sewers, swales, channels, culverts and flow control facilities designed to prevent flooding and property damage and to minimize public inconvenience caused by frequent storm events. Runoff from the minor storm is referred to as the Minor Flow.

M.2.2.2 Major Drainage System

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. A major drainage system shall be designed to protect the public and prevent significant property damage due to flooding caused by

these rare and significant storm events. Runoff from these storm events is referred to as the Major Flow.

M.2.3 **Service Levels**

The service level for each of the drainage systems is defined by the capacity required to convey or control runoff from design storm events with return periods specified in Table M-1.

Table M-1: System Service Level Return Periods

Drainage System	Design Return Period
Minor	10 years
Major	100 years
Culverts & Bridges on Streams	200 years

M.2.4 **Control Criteria**

Stormwater discharge generated by the subdivision or development shall be controlled to reduce downstream impacts and to mimic the pre-development conditions as much as possible. The following level of runoff control shall be provided:

Table M-2: Control Criteria

Control Objective	Criteria
Water Quality Control	Treat 70% of the 2-year/24-hour post-development runoff volume or 90% of the average annual post-development runoff volume, depending on whether the design is based on single-event analysis or continuous simulation. See Section M.3.7
Runoff Rate Reduction	Store runoff from the critical minor-system design rainfall event and release it at a rate that approximates the natural pre-development Minor Flow. See Section M.3.3.
Peak Flow Conveyance	Ensure that the Major Drainage system is able to convey post-development runoff from extreme storm events (up to and including the Major Flow) in accordance with good engineering practice as determined by the District Engineer. If the District Engineer determines that this is not feasible, then Control Criteria for discharge to the Major System shall be provided as specified by the District Engineer.

Offsite discharge rates not based on the above criteria may be allowed at the discretion of the District Engineer based on downstream system capacity and/or ability to convey flows without causing erosion, negative impacts to the Receiving Water, flooding, damage to flood protection works or degraded water quality.

M.3 **Runoff Analysis**

M.3.1 **General**

This section describes the rationale, methodology, and parameters for determining the design runoff rates and volumes corresponding to the proposed Development or Subdivision. This includes runoff generated within catchments both tributary to and within the Development or

Subdivision. Where analysis of downstream conveyance systems by the Owner is required, runoff rates and volumes from catchments tributary to these works shall also be determined.

M.3.2 **Upstream Catchments**

The Design shall be sized to safely convey runoff from upstream catchments tributary to the Development or Sub-Division. Design runoff values from upstream catchments shall be determined in consultation with the District Engineer to reflect anticipated future land uses within these drainage catchments.

M.3.3 **Pre-Development Runoff**

In general, and for the purposes of this Schedule, "pre-development" refers to natural land cover prior to any disturbances or alterations by humans – including roads, clearings, agriculture, and buildings. The pre-development flow shall be calculated using Equation M-1.

Equation M-1: $Q_T = A \times URR_T$

Where: Q_T = pre-development runoff rate for a specified return period "T" [m^3/s]

A = drainage area [ha]

URR_T = Unit Runoff Rate for the return period "T" [Lps/ha], as found in the District's *Stormwater Management Design Guidelines*

Alternatively, pre-development runoff may be determined using the Hydrograph Method. In this case, the model must reasonably reflect field hydrology conditions based on flow measurements and/or reliable anecdotal evidence. Modelling results are subject to approval by the District Engineer.

M.3.4 **Climate Change**

To account for a changing climate, the rainfall IDF values presented in the District's Stormwater Management Design Guidelines have been adjusted to reflect projected rainfall intensities to the year 2100. This accommodation is adequate for single-event design storms. However, should continuous modelling be required, appropriate continuous climate values projected to 2100 must be used. These continuous data sets shall be obtained from the District.

M.3.5 **Acceptable Methods**

Storm drainage design shall be carried out using one or more of the following methods.

M.3.5.1. **Rational Method**

The Rational Method is applicable for preliminary design, for detailed design of minor drainage systems in urban areas and for the purposes of computing peak flow rates where no retention or detention features are included. Use of the Rational Method shall be limited to hydrologically simple and uniform catchments with a combined area less than 10 hectares. Its application shall also be limited to sizing conveyance systems only. It shall not be used to establish pre-development hydrology.

M.3.5.2 **Hydrograph Method**

Computer models that generate hydrographs shall be used for hydrologic and hydraulic analysis for all instances where the combined drainage catchment area is larger than 10 hectares, where drainage catchments are hydrologically complex and/or where stormwater management systems require more than basic conveyance (systems include green infrastructure, detention or retention storage, infiltration systems, and/or pump stations for example). This method is also acceptable for developing pre-development runoff rates provided that the model adequately reflects anecdotal or recorded flows using historical rainfall events.

M.3.5.3 **Continuous Simulation**

A continuous simulation model shall be used to design infrastructure where system capacity is based on runoff volumes that must be stored and/or released over extended time periods. Climate data time series may have a duration as short as several days (multi-day storms) or as long as several years or decades – the duration required shall be determined by the District Engineer. The maximum time interval for the rainfall time series shall be 1 hour. Digital files of hourly rainfall and temperature data can be obtained from the District.

M.3.6 **Rational Method**

M.3.6.1. **Formula**

The Rational Formula is expressed as: **Equation M-02:** $Q = CIA/360$

Where: Q_T = peak runoff for a specified return period "T", m^3/s

C = runoff coefficient

A = drainage area, hectares

I_T = rainfall intensity for the return period "T" and storm duration equal to the Time-of-Concentration (T_C), mm/hr

M.3.6.2. **Runoff Coefficients**

Runoff Coefficient (C) values shall be established based on the proposed land uses, proposed **developments,** soils, catchment slopes, and hydrogeological information. Runoff calculations and rationale for the C values selected shall be included in the stormwater management section of the Detailed Design Brief that is part of the Detailed Design Submission.

"Default" C values, as shown on Table M-3 may also be used.

Table M-3: Rational Method Design Runoff Coefficients

Land Use	Minor Storm	Major Storm
Commercial	0.85	0.90
Industrial	0.75	0.80
Institutional	[1]	[1]
Residential - Single-Family areas	0.40	0.50
Residential - Multi-units, detached	0.50	0.60
Residential - Multi-units, attached	0.60	0.70
Apartments	0.75	0.80
Parks / Cemeteries	0.20	0.25
Streets – Asphaltic	0.85	0.95

Streets – Concrete	0.85	0.95
Drives and Walks	0.80	0.90
Roofs	0.80	0.90
Green Space (Lawn)	0.15	0.20
Landscaped (Trees / Shrubs)	0.10	0.15
Orchards / Vineyards (Mature)	0.12	0.18
Natural Areas [2]		
Slope < 2%	0.04	0.09
3% < Slope < 6%	0.09	0.14
Slope > 6%	0.13	0.18

[1] Calculate weighted average value based on site land use composition as per Equation M-03.

[2] Adjust to reflect amount, type, and density of vegetation - subject to approval by District Engineer.

Note: The above table assumes conventional site drainage of directing all surface drainage overland into streets and catch basins. The runoff coefficients account for "wet" antecedent conditions. In a case of applying the Rational Method to a mixed land use in a drainage area, a weighted average C value shall be used and can be calculated from the following equation:

Equation M-03: $C_{avg} = \sum \frac{A_i C_i}{A}$

Where: C_{avg} = the average runoff coefficient for the catchment

A_i = the area of land within the catchment correlated to runoff coefficient C_i, and

A = the total catchment area

M.3.6.3 **Time of the Concentration**

The value of the design rainfall intensity (I_T) for the Rational Method is selected from the appropriate Intensity Duration Frequency (IDF) curve, with a duration chosen to coincide with the Time-of-Concentration (T_C). T_C is the time required for run-off to become established and reach the catchment outlet from the furthest point within the contributing drainage catchment. T_C is the sum of two components, the "inlet time" and the "travel time".

M.3.6.4. **Inlet Time**

The inlet time is the time it takes for overland flow to enter the conveyance system. It varies with size of the catchment area and surface imperviousness. In developed urban areas where paved surfaces drain directly to catch basins, the inlet times provided in Table M-4 shall be used. The minimum inlet times reflect roof leaders and parking lot drainage (hard surface) being discharged directly into a piped storm system. Longer inlet times may be appropriate to reflect roof leaders and parking lot drainage being discharged onto ground (grass, gravel, swales) and to account for travel distances and other variables. When Inlet Times other than those presented in Table M-4 are proposed, it is the Owner's Engineer's responsibility to verify that the selected values are appropriate and provide recommendations to the District Engineer for approval.

Table M–4: Inlet Times for T_C Calculations

Lot Type	Minimum Inlet time	
	10-Year	**100-Year**
Single Family Residential	15	10
Multi Family Residential	10	5
Commercial/Industrial/Institutional	10	5

For inlet times in rural areas, the overland flow time must be calculated using one of the following methodologies.

M.3.6.5. **Travel Time**

The travel time is the length of time required for flow to travel within the conveyance system from the point of inflow to the location being analyzed – typically the catchment or system outfall. When the channel or pipe characteristics and geometry are known, the preferred method of estimating channel flow time is to divide the travel length by the average travel velocity obtained by using the Manning equation. This may require one or two iterations since the flow rate used to calculate the velocity must first be estimated, then calculated using the results based on the initial assumption. Default roughness coefficients for different types of open channel linings and pipe materials are found in Sections M.5.2.1 and M.6.3.2.

M.3.6.5.1. **Developed Areas – Use FAA Airport Equation**

Common time of concentration calculations include the FAA, Kirpich, and Kerby equations. The FAA (U.S. Federal Aviation Administration) equation is the most commonly used of the three because it uses the widely recognized Rational Coefficient to describe watershed ground cover.

Equation M-05: $T_c = 3.26\ (1.1 - C)\ L^{0.5} / (S)^{1/3}$

Where: T_c = Time of concentration (minutes)C = Rational method runoff coefficient
L = Longest watercourse length in the watershed (m)
S = Average slope of the watercourse (m/m)

M.3.6.5.2. **Rural / Undeveloped Areas – Use BC Water Management Method**

This method was developed by the BC Ministry of Environment, Water Management Division, Hydrology Section. It is limited to drainage areas up to 1000 ha and is dependent on the catchment's characteristics. Equation M-06 and corresponding coefficients in Table M-6 reflects curves fitted to the graphical method presented in the BC Supplement to TAC Geometric Design Guide.

Equation M-06: $T_C = aA + bA^{0.5} + c$

Where: T_c = Time of concentration (hours)
A = Catchment area (ha)

Table M-5: Water Management Method Coefficients

Catchment Slope	Coefficients		
	a	b	c
Flat (slope ≈ 0%)	-0.0416	4.5609	0.4984
Rolling (slope ≈ 1%)	0.0488	3.0973	0.3041
Moderate (slope ≈ 2.5% slope)	-0.0113	2.2271	0.0642
Steep (slope > 10%)	0.0233	0.9075	0.0832

Note that for agricultural and rural basins, the curves labeled Flat or Rolling should be used. For forested watersheds, the curves labeled Rolling, Moderate, or Steep should be used.

M.3.6.6. **Rainfall Intensity**

Rainfall intensities shall be determined from the IDF data presented in the most recent version of the District's Stormwater Management Design Guidelines. Values obtained from the Guidelines shall be included in the Owner's Engineer's Design Brief accompanying the Stormwater Management Plan (SWMP).

M.3.7 **Hydrograph Method**

M.3.7.1 **General**

Analysis using the Hydrograph Method requires computer software capable of modelling the hydrologic characteristics of the watershed and generating runoff hydrographs from rainfall hyetographs. The hydrographs are typically routed through a network of open channels, conduits, storage facilities, and other stormwater management infrastructure or components. Hydrographs my be generated from single-event storms as well as from continuous time series covering multiple rainfall events or even years-worth of historical rainfall and climate data. The Hydrograph Method shall be used to analyze non-homogeneous drainage catchments, complex combinations of infrastructure and runoff controls, and/or the effects of timing due to flow routing through the system. Analyses and reporting shall be completed as per the District's Stormwater Management Design Guidelines.

M.4 **Site Design**

M.4.1 **Site and Lot Grading**

A comprehensive lot grading plan shall be prepared by the Owner's Engineer. The plan shall retain as many natural surface drainage features as possible while meeting the grading requirements of all the proposed lots within the Development area. The grading plan shall also mitigate or at least minimize impacts on existing adjacent Development areas.

Grading shall comply with the B.C. Building Code and be prepared as per the District's Stormwater Management Design Guidelines.

M.4.2 **Driveway Rough-In**

Driveways for lots fronting a road serviced by a rural road section (ditches and culverts) shall be roughed-in at the direction of the District Engineer. This shall include a driveway culvert, sized and installed as per Section M.5.8 of this Schedule.

M.4.3 **Minimum Building Elevation (MBE)**

The MBE applies to the elevation of the lowest floor slab in a building or the underside of the floor joists where the lowest floor is constructed over a crawl space. Crawl space is defined as the space between a floor and the underlying ground having a maximum height of 1.2 m to the underside of the joists and is not used for the storage of goods or equipment damageable by flood waters.

The MBE shall be at least 0.60 m above the storm sewer service connection invert and 0.30 m above the Major Drainage System hydraulic grade line (HGL), whichever requires the greater MBE. Establishment of the MBE shall also consider the influence of the groundwater table at its annual peak.

For sites near a watercourse for which a floodplain elevation has been established, the MBE shall be a minimum of 0.30 m above the instantaneous 200-year return period flood elevation or 0.60 m above the maximum daily 200-year return period flood elevation. Where a flood elevation has not been established, setbacks should be as per current Provincial guidelines. Where more than one setback is applicable, the greater distance shall be applied.

M.5 **Minor System**

M.5.1 **Service Level**

The Minor System is considered as a “convenience” system. It is intended to capture and convey runoff from frequent rainfall and typical snowmelt events. For roads with an urban cross section, the minor system may include curbs, gutters, catch-basin inlets, catch-basins, catch-basin leads, maintenance holes, storm sewers, flow-control structures, detention storage, infiltration systems, stormwater quality treatment, and outfalls. For roads with rural cross sections, the Minor System may include ditches, culverts, and vegetated swales. The Minor System may also include green infrastructure and Low Impact Development (LID) Best Management Practices (BMPs).

M.5.2 **Storm Mains**

M.5.2.1 **Sizing**

Storm sewers shall be designed to provide the required capacity in free flow (not surcharged) conditions using Manning's formula. The following Manning’s roughness coefficients shall be used:

- 0.011 for smooth-walled PVC or HDPE pipes
- 0.013 for smooth-walled concrete pipes
- 0.024 for corrugated metal pipes

The minimum storm sewer diameter shall be:

- 250 mm for mains within all residential/single family zones
- 300mm for mains within all industrial/commercial/multi-family zones

Downstream pipe sizes shall not to be reduced unless the downstream pipe is 600 mm diameter or larger and increased grade provides adequate hydraulic capacity without exceeding velocity limits. Detailed hydraulic analysis and the District Engineer’s approval is required. The maximum reduction is two pipe sizes.

Storm sewers may be sized according to the required capacity taking 50% of the capacity of any upstream infiltration facilities into consideration. The infiltration capacity must be calculated and justified by a Qualified Professional experienced in this field. In no case shall main diameters be less than the specified minimums.

M.5.2.2. **Surcharged Storm Sewers**

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

M.5.2.3. **Grades and Velocities**

Minimum grades of storm mains, flowing full or half-full, are required to obtain the minimum velocity of 0.6 m/s. Where velocity exceeds 4.5 m/s, or when super-critical flow occurs on steeper slopes, flow throttling or energy dissipation measures to prevent scour or to accommodate the transition back to subcritical flow may be required. Where the slope of the storm sewer main exceeds 10%, but is less than 20%, anchorage shall be considered by the Owner's Engineer. Justification for not including anchorage in the design under these slope conditions shall be included in the Design Brief.

Where slope is 20% or greater, anchorage must be incorporated into the design. Anchorage must be constructed in accordance with Standard Drawings. At the discretion of the District Engineer, the Owner's Engineer shall also determine if special provisions are required to protect against displacement of sewers by erosion or shock. These provisions shall be incorporated into the design and adequately detailed in the design drawings and specifications.

M.5.2.4. **Discharge to Natural Watercourses**

Runoff from developments near Okanagan Lake, Ellison Lake, Kalamalka Lake, and Wood Lake may be discharged directly to the lake provided that the required minor and major systems exist, stormwater quality is addressed, and approval from the appropriate provincial authority is obtained. Developments within the remaining areas of the District are required to attenuate offsite discharge to the appropriate pre-development runoff rate via on-site controls.

Where drainage discharge enters a natural watercourse, maximum discharge velocities shall be less than 1.0 m/s. All proposals for works affecting natural watercourses must be forwarded by the Owner to the appropriate provincial and/or federal authorities for review and approval.

Should siltation or erosion controls be required by the above agencies, details of the proposed works must be included in the engineering drawings and must be installed as part of the works.

M.5.2.5 **Location**

M.5.2.5.1 **Public ROWs**

Storm sewers shall 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 Owner's Engineer shall provide rationale and analysis for consideration by the District Engineer. Works to be owned by the District, and which are on private property, shall be located within a Statutory Right of Way (SROW).

M.5.2.5.2. **Statutory ROW Through Private Land**

The District Engineer may require a statutory right-of-way over a drainage course that crosses private land to allow for future maintenance by the District and to prevent structures in a location where they could be damaged by stormwater. When a storm main is located within a statutory right-of-way (SROW) across private land, and appurtenances which require maintenance are located within the right-of-way, the Property Owner must ensure that maintenance access is available. For large structures or structures requiring an enhanced maintenance level such as oil/sediment chambers, control structures and pond inlet/outlet chambers, an access route adequate to support the maintenance vehicles shall be provided. The surface of the route may be gravel, concrete pavers, or asphalt depending on the location and the context of the site at the discretion of the District Engineer.

SROW requirements are further defined in Schedule B.7 of this bylaw.

M.5.2.6 **Depth and Cover**

Storm sewers should be of sufficient depth to:

- Permit gravity service to all tributary areas, including both sides of the roadway if feasible,
- Prevent freezing,
- Clear other underground utilities, and
- Prevent damage from surface loading.

Storm sewers shall be designed with cover ranging from a minimum of 1.2 m to a maximum of 4.5 m above the crown of the pipe, subject to approval by the District Engineer.

M.5.2.7. **Alignment**

Except as indicated for Curved Sewers, horizontal and vertical alignments shall be straight lines between maintenance holes unless approved by the District Engineer.

M.5.2.8. **Curved Storm Sewers**

Where permitted by the District Engineer, horizontal and vertical curves may be formed using pipe joint deflections as follows:

- Minimum radius shall be 300 times the outside diameter of the pipe barrel (300 x D) or 1.5 times the manufacturer's recommended minimum radius of curvature – whichever is greater.
- Constant radius throughout curve.
- Joint deflection not to exceed 50% of maximum recommended by pipe manufacturer.
- Minimum design velocity = 0.9 m/s.
- Minimum grade = 1.0% (0.01 m/m).

The curve midpoint and two quarter-points shall be located by survey and shown on the as-constructed drawings with corresponding invert elevations and offsets.

Subject to approval by the District Engineer, sewers larger than 600 mm diameter may include deflections formed by mitred bends to a maximum mitre of 45 degrees.

M.5.2.9 **Ditch Inlets**

The minimum pipe diameter for ditch inlets to the storm sewer system shall be 400 mm. All ditch inlets shall be connected to a maintenance hole. All ditch inlets to storm sewers shall be equipped with a headwall, and for large pipes (>600 mm diameter), debris screens. If directed by the District Engineer, the ditch inlet shall include a sedimentation basin or trap.

M.5.2.10. **Temporary Cleanouts**

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

a) Future extension of the main is proposed or anticipated,
b) The length of storm drain to the downstream maintenance hole does not exceed 45.0 m, and
c) The depth of the pipe does not exceed 2.0 m at the terminal point.

M.5.2.11. **Pipe Joints**

Watertight joints are preferred, but open joints may be used subject to approval by the District Engineer to support groundwater recharge. However, since open joints can increase the risk of erosion within pipe bedding, their use shall be limited to grades less than 5%. Where the use of open joints is approved, clear 19mm crush gravel rather than sand bedding shall be used.

M.5.3 Maintenance Holes

M.5.3.1. **Where Required**

Maintenance holes are required at the following locations:

- Every change of pipe size.
- Every change in grade, except as indicated for curved sewers.
- Every change in direction, except as indicated for curved sewers.
- Upstream end of every sewer line.
- Downstream end of curved sewers.
- Every pipe intersection except for service connections as per **Error! Reference source not found.**
- Every catch basin connection.
- Outfalls to the major system (i.e., creeks, channels, lake) in order to isolate the upstream main to facilitate cleaning. The maintenance hole shall be located as close as possible to the point of discharge.

M.5.3.2. **Spacing**

The maximum distance between maintence holes shall be:

- 150 m for pipes with diameters less than 900 mm, or
- 250 m for pipes with diameters 900 mm and larger.

M.5.3.3. **Hydraulic Considerations**

The crown of the downstream pipe must not be higher than the crown elevation(s) of the upstream pipe(s).

Minimum drop in invert elevations across maintenance holes:

- Straight runs: 5 mm drop

- Deflection up to 45 degrees: 20 mm drop
- Deflection 45 to 90 degrees: 50 mm drop

M.5.3.4. **Hydraulic Losses**

Hydraulic losses shall be calculated for maintenance holes with significant change of grade or alignment. For high velocity flows, particularly for pipes with diameters 600 mm or larger, detailed analysis using the Froude number, or utilizing appropriate computer models is required. The Manning's equation should not be relied on for pipe slopes above 10%. For low to moderate velocities and smaller pipes, use following equation:

Equation M-08: $H_L = k V^2 / 2g$

Where: H_L = head loss (m)
V = flow velocity entering junction (m/s)
g = gravitational acceleration (9.81 m/s2)
k = head loss coefficient (1.0 for channelled 90 degree bends and tees to 1.5 without channelized benching)

Where benching is used, the minimum drops listed in Section M.5.3.3 are applicable for velocities below 1 m/s. Where flows exceed 1 m/s, H_L should be specifically computed - the greater of the two values shall be used as the drop across the junction.

M.5.3.5 **Drop Maintenance Holes**

Drop maintenance holes and outside ramp structures should be avoided where possible by steepening inlet sewers. Where necessary, drop maintenance holes or outside ramps shall be installed as per Table M-6:

Table M-6: Drop Maintenance Holes and Ramps Criteria

Invert Difference	Structure
Up to 0.25 m	Inside Ramp
0.25 to 0.90 m	Outside Ramp
Greater than 0.90 m	Outside Drop*

* Inside ramps may be permitted, but only where the proposed alignment conflicts with existing utilities or where an inside ramp is required to match upstream and downstream pipe slopes. Inside ramps must not exceed 450 mm and must be approved by the District Engineer.

M.5.3.6. **Lid Markings**

All maintenance hole lids shall be clearly labelled Lake Country Storm Sewer.

M.5.4 **Catch Basins**

M.5.4.1. **General**

a) Catch basins are required at regular intervals along roadways, at intersections, and at low points.

b) Side-inlet catch basins are required for all curbed roads. Lawn basins are required on boulevards and private properties where necessary to prevent ponding or flooding of sidewalks, boulevards, driveways, buildings, and yards.

c) Catch basin grates shall be installed as specified in the District's Standard Detail Drawings. Alternate grates may be allowed providing that corresponding rating curves are submitted to and approved by the District Engineer.

d) All catch basins shall discharge to a storm sewer system or approved infiltration system. Direct discharge from catch basins to natural streams or receiving waters shall not be allowed.

M.5.4.2. **Spacing**

Catch basin spacing shall provide sufficient inlet capacity to collect the entire minor flow, or major flow if required as per Section M.6.1 of this Schedule, into the pipe system. To ensure that the capture or inlet capacity matches the storm main capacity, the spacing of catch basins on streets shall, at the minimum, meet the following criteria:

a) Road grades less than or equal to 3% shall have a maximum spacing of 150 m or 675 m2 of paved area, whichever is more stringent.

b) Road grades greater than 3% shall have a maximum spacing of 100 m or 450 m2 of total area.

c) Catch basis will be spaced to ensure no overflows to driveways, boulevards, sidewalks, or private property.

d) Catch basis will be spaced at intersections so as not to interfere with crosswalks.

The Owner's Engineer shall provide confirmation that the above-listed maximums have not been exceeded by the design.

M.5.4.3. **At Low Point**

Double, side-inlet catch basins are required at all low points on a road, including cul-de-sacs. Double catch basins are required on both sides of the road if it is crowned, and only on the lower side of the road if it is cross-falled or super-elevated.

M.5.4.4. **Sediment Trap**

All catch basins shall be equipped with a minimum 0.5 m sump to capture and hold sediment.

M.5.4.5 **CB Leads**

M.5.4.5.1. **Minimum Diameters**

All catch basin leads shall be sized to convey the design inlet capacity, subject to the following minimum diameters:

a) from single, top-inlet catch basin – 200 mm

b) from double top-inlet or side-inlet catch basins – 250 mm

M.5.4.5.2. **Minimum Slope**

The minimum slope of the lead shall be 2.0% unless otherwise specified by the District Engineer.

M.5.4.5.3. **Connections**

All catch basin leads shall discharge into a maintenance hole.

M.5.4.5.4. **Cover**

Catch basin leads shall have a minimum cover of 0.9 m. If this is not feasible, the design shall include traffic load and frost protection. Design calculations must be provided.

M.5.5. **Service Connections**

M.5.5.1. **General**

Every legal lot shall be provided with a separate service connection where disposal to ground of discharge from foundation perimeter drains and/or roof drains is not recommended by a Qualified Professional or at the discretion of the District Engineer. Connections shall drain away from building foundations by gravity, but pumped connections may be permitted if requested prior to design, approved by the District Engineer, and appropriate covenants are provided.

M.5.5.2. **Foundation Drains**

Foundation perimeter drains for buildings are required as per the British Columbia Building Code. Where a hydrogeological study justifies their use, and subject to approval by the District Engineer, dry wells or ground infiltration systems may be used as the storm water disposal method for connection of perimeter drains. These systems shall be designed and supervised by a Qualified Professional.

Foundation perimeter drains are not permitted to be directed to any infiltration device or soak away pit that impacts an engineered retaining wall or reinforced earth structure.

Where infiltration systems are not recommended in the hydrogeological study, foundation perimeter drains may be connected by gravity via a storm service to the storm main provided that:

a) the elevation of the basement/crawlspace floor is at least 600 mm above the elevation of the storm main obvert, or

b) 600 mm above the anticipated or known high ground water table, or

c) 600 mm above the 100 year hydraulic grade line within the main at that point, whichever is higher.

M.5.5.3. **Roof Leaders**

Roof drainage leaders shall be connected to the storm service connection unless geotechnical conditions support use of splash pads for dispersal to the ground. The evaluation of this requirement shall be included in the scope of the study referenced in Section M.1.1. Use of ground disposal for roof leader discharge is subject to approval by the District Engineer.

Roof leaders shall not be directed onto driveways which drain directly onto District right-of-way, including roads, or to areas draining directly onto neighboring properties.

M.5.5.4. **Size**

Service connections shall be sized to accommodate peak design flow, subject to the following minimum pipe diameters:

- from Single Family or Low Density Multi-Family lots – 100 mm
- from Medium or High Density Multi-Family lots – 150 mm
- from Commercial, Industrial, or Institutional lots – 150 mm

M.5.5.5. **Location and Depth**

As a general rule service connections shall be located at the lowest corner of the property and installed at an offset of 4.0 m from the property pin.

Minimum depth will depend on the frost depth, but should be at least 0.9 m where subsurface building floor space is not required. Where basements are proposed, the depths of the storm sewers and services shall be increased to suit.

M.5.5.6. **Grade**

Service connections shall have the following minimum grades:

- 100 mm diameter pipe: 2%
- 150 mm diameter pipe: 1.00%
- Larger sizes: Grade based on minimum velocity of 0.75 m/s.

M.5.5.7. **Connections to Mains**

a) For connections to new mains, use standard wye fittings.

b) For connections to existing mains, use wye saddles or, if approved, insertable tees.

c) Service connections may be permitted into maintenance holes if

d) the connection is not oriented against the flow in the main and

e) maintenance hole hydraulic requirements are met.

f) Storm services to properties shall not be permitted from storm drains located in rights-of-way unless a clean-out is provided and the nature of the development will permit access to the right-of way for inspection, maintenance, and repair.

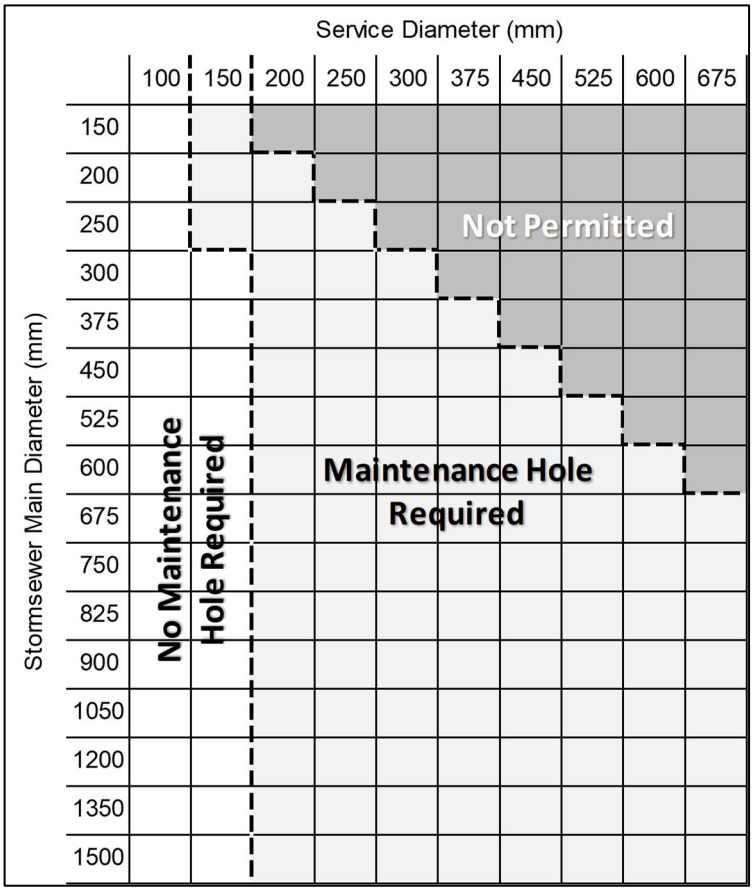
g) Must Include an inspection chamber unless service is less than 2.5 m long and connects to a maintenance hole.

h) Service connections shall be designed as mains if they exceed 30 m in length.

M.5.5.8. **Maintenance Access**

Maintenance holes are required for services relative to the size of the main as shown in **Error! Reference source not found.**

FIGURE M-1



M.5.6. **Sub-Surface Disposal / Infiltration Facilities**

M.5.6.1 **General**

Infiltration facilities are intended to reduce offsite-discharge volumes and rates, and to promote groundwater recharge. They are suitable for high permeability soils with low groundwater elevation, but must be supported by an appropriate study prepared by a Qualified Professional for confirmation and design guidance.

Design details should be in accordance with current technologies as outlined in Infiltration Systems guidelines in Land Development Guidelines for the Protection of Aquatic Habitat (Canada/B.C.), and related documents such as the MMCD Green Design Guideline Manual.

The Owner's Engineer shall submit all sizing assumptions and calculations for review and approval by the District Engineer.

Under no circumstances shall these systems or controls be used in the following conditions:

- Areas within 30 m of a slope that is steeper than 3.0 (horizontal) to 1.0 (vertical) and higher than 6.0 m, or a slope that has been assessed to be unstable or potentially unstable by a Qualified Professional.
- Areas where the post-development wet season groundwater table is less than 0.6 m below the base of proposed infiltration system or infiltrating surface.
- Areas where existing dwellings do not have foundation drains.
- Bedrock or other impermeable layer is located within 1.2 meters of the infiltrating surface.
- The infiltrating surface is located on top of fill material.
- The adjacent or underlying soils have a fully saturated percolation rate of less than 10 mm/hr.
- Site is sensitive to potential groundwater contamination.

M.5.6.2. **Infiltration Rate Correction Factor**

A correction factor, or factor of safety, is commonly applied to measured infiltration rates for design purposes. These correction factors are intended to mitigate the following:

- Long-term silting or "blinding" of the facility.
- Potential variability in the subsurface conditions.
- Type and size of infiltration facility.
- Whether it is public or private.

The correction factor is applied as follows:

Equation M-01: $K_{Design} = K_{Field} / SF$

Where: K_{Design} = the design infiltration rate (mm/hr)
K_{Field} = the infiltration rate as determined by field tests (mm/hr)
SF = the Safety Factor

The Safety Factor shall be recommended by the Qualified Professional, but shall not be less than 2.0.

M.5.6.3 **Drywells**

Where drywalls are deemed suitable by the District Engineer as part of an on-site storm water management plan for the minor system, the minimum number of dry wells must be determined by considering the flow generated from the site in relation to the infiltration capacity of the site soil. Sufficient temporary storage (within the drywell, surrounding drain rock, and potentially on the surface) shall be constructed with sufficient volume to temporarily store generated flows

until such time as they infiltrate into the subsurface. Design shall be in accordance with Standard Detail Drawings.

M.5.6.4. **Perforated Pipes**

Perforated pipes within infiltration trenches are only suitable for undisturbed ground where water can move horizontally out of the trench and where drainage water is free from silts. The system must be designed to function under surcharged conditions, and is therefore more suitable to locations with flatter slopes. Where necessary, this type of infiltration system shall include internal overflows within each maintenance hole. Design shall be subject to approval by the District Engineer.

M.5.6.5. **Infiltration Basins / Manufactured Systems**

Surface infiltration basins shall be designed in accordance with the criteria specified in Section M.5.6. Pre-manufactured modular infiltration chambers shall be designed as per manufacturer's recommendations. Shop drawings for such systems shall be provided, and shall reflect site conditions, including invert elevations and layout dimensions. Details regarding inspection and maintenance access shall also be provided.

The design shall include provision for system failure and overflow under Major Storm conditions.

The design shall include an operations and maintenance manual, along with an estimate of annual O&M costs.

M.5.6.6. **Pre-Treatment**

Particularly in multi-family, commercial, institutional, and industrial developments, all infiltration systems shall include pre-treatment measures to remove sediments, suspended solids, and oils and greases prior to entering the infiltration zone. This is especially a concern in areas with new development until landscape vegetation has matured. Pre-treatment design shall be in accordance with Section M.9 of this Schedule.

M.5.7. **Outfalls**

Outfalls of a storm sewer system into watercourses shall be designed recognizing aesthetics and erosion control. All new all storm water outfalls to natural watercourses or water bodies must be approved by the appropriate provincial and federal authorities. In cases where the receiving water is classified as a navigable water way, approval may also be required from the Canadian Coast Guard.

Outfalls into lakes shall be submerged, extended from shore, and constructed according to the following:

- soft bottom, 0.6 metres minimum bury to allow for seasonal sand erosion and deposition
- rock bottom, criteria to be confirmed by Canadian Coast Guard
- exposed pipes must be a minimum of 2.4 metres deep during lake "low water" level

Where a storm sewer discharges into a natural watercourse or open channel, riprap bank protection will be provided and, if necessary, energy dissipation facilities. Discharge perpendicular to stream flow will be avoided.

M.5.8. **Culverts**

M.5.8.1. **General**

Culvert design shall be in accordance with the procedures outlined in the most current edition of a generally accepted design manual including, but not limited to:

- American Concrete Pipe Association – Concrete Pipe Design Manual
- Corrugated Steel Pipe Institute – Handbook of Steel Drainage and Highway Construction Products
- BC Supplement to TAC Geometric Design Guide.

Where the design guideline referenced above in section M.5.8.1 contradicts the requirements of this Schedule, the more conservative requirement shall govern.

M.5.8.2. **Minimum Diameters**

The minimum diameter for culverts will be:

- crossing residential driveways – 400 mm
- crossing commercial, industrial, or institutional driveways – 450 mm
- crossing public roads – 600 mm
- on a stream, regardless of road or driveway classification – 600 mm

M.5.8.3. **Hydraulic Design**

Culverts shall be sized to convey the design flow with a maximum headwater depth to culvert diameter ratio (Hw/D) of 1.0 measured from the culvert invert at the inlet. Analysis shall consider both inlet and outlet control and the design shall be based on the condition requiring the larger diameter.

- The following Manning's roughness coefficients shall be used for circular culverts:
  - 0.011 for smooth-walled PVC or HDPE
  - 0.013 for smooth-walled concrete
  - 0.023 for corrugated HDPE
  - 0.024 for corrugated metal
- Manufacturer's recommended roughness coefficients shall be used for non-circular culverts.
- Driveway culverts that form part of the Minor system shall be designed to convey runoff from the Minor Storm with a maximum headwater to diameter ratio (Hw/D) of 0.5 – measured from the culvert invert at the inlet.
- Culverts crossing roads shall be sized to convey the design flow with a maximum headwater to diameter ratio (Hw/D) of 1.0 measured from the culvert invert at the inlet.
- The design shall consider both inlet and outlet control and shall be based on the condition requiring the larger diameter.
- All culverts shall be constructed with inlet and outlet structures approved by the District Engineer. Exceptions may be granted at the discretion of the District Engineer.

- When culverts or storm pipes are greater than 600 mm, the outfall pipe or structure shall be protected against entry by a free swinging, lockable, weighted grating which will allow passage of materials on discharge.
- Energy dissipation and erosion control at culvert outfalls shall be considered in the design.

M.5.8.4 **Depth and Cover**

- The minimum depth of cover over culverts is 0.3 metres, subject to the manufacturer's loading criteria.
- Culvert invert elevations shall be no lower than the corresponding design elevation of the ditch bottom. Where there is insufficient depth to maintain minimum cover, two or more culvert barrels may be installed to convey the design flow.

M.6 **Major System**

M.6.1 **General**

Storm runoff generated by less frequent, higher intensity rainstorms may exceed the capacity of the Minor System. Runoff from these events will pond in depressions and follow whatever overflow route is available. This network of ponding and overland flows is called the "Major System." It may be comprised of some, or all, of the components found in the Minor System but sized to convey or otherwise accommodate the Major Flow. The Major System may also include road surfaces, overland drainage routes, and surface ponding. If the Major System is properly planned, it can minimize or even eliminate the potential inconvenience and property damage caused by large rainfall events or when inlets to the minor system become blocked by debris.

Even though storm sewers can function as part of the Major System, this is not encouraged. Using pipes to convey Major Flows may be implemented in special circumstances, but only with the approval of the District Engineer.

M.6.2 **Surface Flow Routing**

Roadways with curbs and gutters may be designed as wide channels to convey major surface flow. In this case, the Owner's 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. Use of barrier curbs for major surface flows on roads is preferred, but rollover curbs may be used with approval of the District Engineer.

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.

Calculations to verify that the surface flow is maintained within the road right-of-way and that the water elevation at maximum ponding/flow is at least 0.30 metres below the lowest Minimum Building Elevation (MBE) of adjacent buildings shall be provided with the design.

The following criteria for routing major design flows on road surfaces with an urban cross section shall be met:

- For all classes of roads, the flow/ponding depth shall not exceed 0.150 m above gutter line nor overtop the curb, whichever governs.
- Flow velocities greater than 2.5 m/s must be approved by the District Engineer.
- On local roads, the flow may spread to the crown.
- On collector roads, the flow spread must leave one lane or a road surface equivalent free of water to ensure access for emergency vehicles (fire, ambulance).
- On arterial roads, the flow spread must leave one lane in each direction free of water.
- Flooding is not permitted on private property except in flow channels within dedicated rights-of-way.

M.6.3 **Ditches**

M.6.3.1. **General**

Roads with rural cross-sections shall be constructed with ditches that ensure adequate road subgrade drainage (in compliance with standard road design). Ditch design shall conform to the criteria specified below. Variations may be implemented with appropriate justification by the Owner's Engineer and approval of the District Engineer.

- Minimum slope: 0.5% (0.005 m/m)
- Minimum depth: 0.3 m below road sub-grade
- Minimum freeboard: 0.3 m
- Maximum flow depth: 0.6 m
- Minimum bottom width: 1 m
- Maximum side slopes: 2:1 (H:V)

M.6.3.2. **Sizing**

Table M-7 provides acceptable Manning's "n" values for road surfaces, ditches, and swales, which shall be used with the Manning Formula for design and assessment of these structures.

Table M-7: Open Channel Roughness Coefficients

Condition	Manning's "n"	
	Minimum	Maximum
Concrete curb and gutter	0.012	0.016
Asphalt roadway	0.013	0.018
Grassed boulevards and swales	0.035	0.050
Ditches – gravel / small cobbles	0.025	0.030
Ditches – vegetated	0.030	0.035
Ditches - Rip-Rap (Class 10 kg / D_{50} 200mm)	0.068	0.072
Ditches - Rip-Rap (Class 25 kg / D_{50} 300mm)	0.071	0.076
Ditches - Rip-Rap (Class 50 kg / D_{50} 350mm)	0.073	0.078
Ditches - Rip-Rap (Class 100 kg / D_{50} 450mm)	0.075	0.080

Roughness coefficients for conditions not listed in Table M-9 shall be determined by the Owner's Engineer and submitted for approval by the District Engineer.

M.6.4. **Swales**

Swales shall be lined with turf on a minimum of 100mm of topsoil or lined with an erosion protection system approved by the District Engineer. All such swales serving two or more parcels of property shall be sized to accommodate the Major Design flow, and shall meet the following criteria:

- Minimum slope: 1.0% (0.01 m/m)
- Minimum freeboard: 0.15 m
- Maximum flow depth: 0.3 m
- Maximum side slopes: 4:1 (H:V)

All swales that are to be owned and operated by the District shall be located within a Statutory Right of Way (SROW).

M.6.5. **Culverts**

M.6.5.1. General

In addition to the design requirements presented in Section M.5.8, Major System culverts shall also be designed according to the following:

All culverts shall be installed with inlet and outlet structures.

Trash racks and/or debris barriers may be required upstream of culvert installations, as directed by the District Engineer.

M.6.5.2. **On Streams**

In addition to the design requirements presented in Section M.5.8, culverts on streams shall also be designed according to the following:

- All culverts shall be designed to convey the instantaneous 200-year return period flow or greater.
- Inlet and outlet structures are required for all culverts on streams, unless otherwise directed by the District Engineer.
- Culverts on fish-bearing streams shall meet conditions as specified by municipal, provincial, and federal authorities. Such culverts will be required to allow safe fish passage, and habitat restoration works will generally be required. The Owner's Engineer shall confirm and implement these requirements with the appropriate agencies.

M.6.6. **Piped Systems**

In special circumstances, or to accommodate lower building elevations, Minor System storm sewers may be enlarged or supplemented to accommodate major flows. System details shall be indicated in the Storm Water Management Plan and approved by the District Engineer. Design shall include:

- Provision of adequate inlets to accommodate major flows – including flows carrying suspended sediment and debris
- Surface overflow routes at potential surface ponding locations
- Compliance with minor drainage system guidelines.

M.6.7. **Overflow Routes**

Sags or low points in roads and cul-de-sacs must be designed with a safe overflow route to an approved receiving water or to adequately sized drainage infrastructure. These overflow routes may be ditches or swales and shall be designed as per Sections M.6.3 and M.6.4 respectively. The overflow route shall also be located within a right-of-way in favour of the District, with a minimum width of 4.5 m.

Where a ditch crosses private property, the ditch shall be offset in the right-of-way to permit a 3.0-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 shall be a minimum 0.5 metres away from that property line, and the design HGL shall be at least 0.6 m below the MBE of adjacent buildings. Ditches shall be designed to maximize infiltration where infiltration is appropriate as per Section M.5.6.

M.6.8. **Discharge to Natural Watercourses**

Storm discharge rates and volumes to natural watercourses shall be controlled to prevent damage to the natural channel and harm to the ecological system. Consideration must be given to fish bearing streams and to streams presently at capacity.

Designs must conform to all applicable federal, provincial, and municipal laws and regulations. The Owner shall submit the designs to, and obtain comments and approvals from, the appropriate provincial and/or federal agencies.

M.6.9. **Surface Disposal / Infiltration Systems**

If the study referenced in Section M.1.1 indicates that soil conditions are suitable to support infiltration-based disposal of Major System flows, then the system shall be designed in accordance with Section M.5.6.

M.7 **Detention Facilities**

M.7.1 **General**

It is usual to provide detention storage facilities in conjunction with flow control. Such facilities temporarily store the volume of runoff corresponding to the condition where the inflow rate exceeds the controlled discharge rate.

Storage facilities may be surface or underground and may be “online” or “offline”. Storage facility selection shall be subject to approval by the District Engineer and shall include

consideration of ownership and operation & maintenance requirements. The number of storage facilities shall be minimized.

Design details, other than discharge rates, should be in accordance with current technologies as outlined in Land Development Guidelines for Protection of Aquatic Habitat (Canada/B.C.), and related documents. Design for specific types of detention storage shall also reflect the following requirements.

M.7.1.1. **Parking Lot Storage**

a) Requires detailed lot grading design to ensure proper drainage, pedestrian safety and convenience, and major flow paths.
b) Maximum ponding depth: 300 mm outside vehicle stalls, 150 mm within vehicle stalls, however, also with consideration to frequency of ponding and impact to users of the parking lot.

M.7.1.2. **Underground Storage**

a) Facilities include tanks and oversized pipes, with outlet controls.
b) Cross sections and inlet and outlet locations shall be designed to minimize maintenance requirements.
c) Structural design to accommodate traffic loads and groundwater pressure.
d) Maintenance access provisions required.

M.7.1.3. **Dry Detention Ponds**

a) An off-line pond is preferred, but an on-line facility may be considered at the discretion of the District Engineer.
b) Fencing and graded slopes required as per referenced design guidelines.
c) May accommodate active recreational uses.
d) Overflow elevations to be coordinated with MBEs.
e) Provide warning signage indicating facility is a stormwater detention structure subject to flooding or rapid water level changes. Signs to be posted at all public access points or road frontages.

M.7.1.4. **Wet Detention Ponds**

a) Intention is to provide on-line detention storage and maintain a permanent minimum water levels.
b) Catchment area must be large enough to provide sufficient base flow to ensure wet storage and is sustained without becoming stagnant (based on local hydrologic characteristics).
c) Fencing and graded slopes required as per referenced design guidelines.
d) Can provide a public amenity within a passive park.

e) Overflow elevations to be coordinated with MBEs.

f) Provide warning signage indicating facility is a stormwater detention structure subject to flooding or rapid water level changes. Signs to be posted at all public access points or road frontages.

M.7.2 **Flow Controls**

Control structures shall be used to provide consistent flow control as specified in Section M.2.4. These structures shall be designed to include multi-stage controls. For example, two or more orifices located vertically on a control structure can be designed to provide increasing discharge rates as the water level rises. Safe overflow must be provided for conditions that exceed the maximum design flows.

Flow controls may be designed using the standard orifice and weir equations:

Equation M-09: Orifice Equation: $Q = CA(2gh)^{0.5}$

Where: Q = release rate (m^3/s)
C = orifice coefficient (0.62 for sharp or square edge)
A = area of orifice (m^2)
g = gravitational acceleration (9.81 m/s^2)
h = net head on orifice (m)

Equation M-10: Weir Equation: $Q = CLH^{1.5}$

Where: Q = release rate (m^3/s)
C = weir coefficient (to be determined by the Owner's Engineer, subject to approval)
L = effective length of weir crest (m)
H = net head on weir crest (m)

Release rates which do not reflect the criteria specified in Section M.2.4 may be allowed or required by the District Engineer, depending on downstream conveyance system capacity, stream protection, flood protection, and/or water quality issues.

M.7.3 **Sizing**

The design volume for detention facilities shall be determined using the Hydrograph Method and shall be the largest peak storage volume required to control flows as per the criteria specified in Section M.2.4. The District Engineer may require a 10% volumetric safety factor be applied to the calculated maximum volume. Rooftop or parking lot storage may be included in storage sizing calculations with the approval of the District Engineer. All sizing assumptions and results shall be provided as part of the design submission.

M.7.4 **Inlet /Outlet Considerations**

Design of inlet and outlet structures shall include consideration of energy dissipation and erosion control. Safety grates are required over all inlet and outlet openings larger than 500 mm diameter. Locks for access hatches are required.

M.7.5 Geotechnical Considerations

Geotechnical investigations by a Qualified Professional to address issues related to the design of all stormwater detention facilities shall be completed as part of the planning and design studies, and are a prerequisite to the final design of such facilities.
Wherever possible, the stormwater storage facility shall be excavated in natural, stable ground. Should topography dictate that a berm be constructed along one or more sides of a surface facility (dry or wet pond), the berm shall be designed by a Qualified Professional.

When the storm main is required to cross private land(s), the right-of-way must be a minimum of 4.5 m wide, however, the width must be suitable to accommodate excavations based on WorkSafeBC regulations for trench side slopes.

M.7.6 Ownership

For storage not under private ownership, all accesses to inlets/outlets, any structures and maintenance access routes to the facility shall be dedicated to the District. Land that is adjacent to a storage facility which is subject to flooding as per the design standard established, but which is part of the privately-owned parcel being developed, will be required to dedicate rights-of-way, to allow for encroachment of water onto the affected land. The right-of-way documents shall be prepared by the Owner, naming the District as grantee.

A restrictive covenant shall be placed on lots abutting the facility to control lot development so as not to compromise design requirements at the high-water level for major runoff events. This is to ensure an adequate freeboard is maintained.

The Owner shall confirm the need for an operational license for any wetland style storage or treatment facility with the appropriate municipal, provincial, or federal agency, and shall apply for and secure such license.

M.7.7 Operations & Maintenance

An Operations & Maintenance Manual for each type of detention storage facility shall be provided to the District. This shall include details of the system components and inspection and maintenance requirements in terms of tasks and frequencies.

For detention facilities that will be owned and operated by the District, suitable maintenance vehicle access from a public road to the detention facility shall be provided and protected by a right-of-way in favour of the District.

- For surface facilities (dry ponds), access shall include provisions for maintenance vehicles to access the pond.
- For buried facilities, access shall include adequate provisions to inspect and maintain the facility as per the required Operations & Maintenance Manual.

M.7.8 Emergency Overflow Provisions

If overflow is not provided as part of the flow control structure, then an adequate emergency overflow must be provided as part of the detention facility design. An adequate surface flow

route from the overflow structure to the designated Major Drainage route must be provided and must be located within a public or District-owned right-of-way.

M.7.9 Rapid Drawdown

The ability to discharge from storage facilities at the maximum flowrate that the downstream system can accommodate after storm runoff peak flows have passed, and the flows from other contributing areas have decreased or ended, shall be provided. The discharge rate for drawdown purposes shall be sufficient to restore available storage capacity in the facility to sufficiently control runoff from subsequent storm events within a reasonable time frame as per TABLE M-1.

TABLE M-1: Drawdown Provisions

Time After Commencing Drawdown From Full Level	Available Volume Required Below Design Full Level
24 hours	Volume equivalent of 1 in 10-year, 24-hour run-off
72 hours	100% of total storage volume

M.7.10 Temporary Conditions

Where land developments occur in advance of permanent detention facilities, the District may consider temporary storage facilities on an individual basis. Maintenance charges and responsibility for temporary storage facilities will be borne by the developer.

M.8 Erosions Control

M.8.1 General

Erosion and sediment control shall be incorporated into the design of all open channel conveyance routes and at all outfall / discharge locations. Typical erosion control methods include, but are not limited to vegetation, root-reinforced vegetation, manufactured materials and systems, rip rap, and velocity control.

M.8.2 Open Channels

Earthen open channels such as ditches and swales shall be designed to prevent incising, erosion, and movement of sediment. Such design is dependent on soil characteristics, channel lining, channel slope, flow depth, and flow velocity. Generally, open channels shall be designed to meet the maximum velocities specified in Table M-8.

Table M-8: Permissible Open Channel Velocities (Fully Vegetated / Grass-Lined)

Earth – Soil Type	Permissible Velocity (m/sec)		
Longitudinal Channel Slope	<0.5%	5-10%	>10%
Erosion Resistant Soils	1.2	0.9	0.7
Highly Erodible Soils	0.9	0.7	0.5

- Highly erodible soils include Fine Sand (non-colloidal), Sandy Loam (non-colloidal), Silt Loam (non-colloidal), and Ordinary Firm Loam.
- Erosion resistant soils include Fine Gravel, Stiff Clay (very Colloidal), Graded Loam to Cobbles (non-colloidal), Graded, Silt to Cobbles (colloidal), Alluvial Silts (non-colloidal), Alluvial Sites (colloidal), Coarse Gravel (non-colloidal), Cobbles, and Shales and Hard Pans.

At the discretion of the District Engineer, a more rigorous analysis using shear stress and soil characteristics supported by a study by a Qualified Professional, based on field investigation, may be required to establish the safe discharge rate for an open channel.

Bare-earth open channels will not be permitted, and must be vegetated or otherwise protected from erosion using rip-rap lined bottoms and sides, erosion control structures, geo-fabrics, or other methods approved by the District Engineer.

Erosion control calculations shall be submitted with the design. Rip rap design shall be conducted using methods presented in the most current edition of the BC Supplement to TAC Geometric Design Guide.

M.8.3 **Sediment and Erosion Control**

Given that disturbed soils are highly vulnerable to erosion and subsequent sediment transport during rainfall events, sediment and erosion control (SEC) measures as specified in Schedule N of this bylaw shall be implemented to protect stormwater management facilities and receiving waters. This applies, but is not limited to, areas that are cleared and grubbed, slope cuts, fills, and stockpiled materials such as sand, gravel, native soils, and topsoil.

M.9 **Stormwater Quality**

M.9.1 **General**

Several potential organic and inorganic substances can be found in rainwater runoff and are referred to as “non-point source” (NPS) pollution because the sources tend to be highly dispersed across the landscape. The ones of greatest relevance and which are targeted for treatment are:

- Total suspended solids (TSS)
- Oil and grease (O&G)
- Trace metals, typically represented by copper and zinc

Focusing on the removal of these constituents is expected to yield adequate removal of other associated constituents.

M.9.2 **Sizing**

All developments shall incorporate water quality treatment provisions into the design to meet the performance targets provided in this section. The targets are expected to be met for every new development and redevelopment site by implementing Best Management Practices (BMPs). Facilities shall be sized to adequately treat the following:

- 70% of the 2-year/24-hour post-development runoff volume when using a single-event design approach, or

- 90% of the average annual post-development runoff volume when using continuous simulation for design.

M.9.3 **Performance Targets**

The performance targets are classified as “Basic Control”, which address suspended solids, and “Hydrocarbon Control”, which addresses oils and grease. These targets shall apply to all stormwater discharges from the subdivision or development, including offsite discharges and discharges to a receiving water.

M.9.3.1. **Basic Control**

Basic treatment focuses on removal of TSS along with associated pollutants attached to those sediments, including low levels of petroleum hydrocarbons (oil and grease). Basic control is applicable to all non-agricultural lands within the District and must provide treatment for:

- 80% removal of TSS.

Discharge from the treatment system must meet the BC Recreational Water Quality Guidelines for turbidity.

M.9.3.2. **Hydrocarbon Control**

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

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

The catchment area to the treatment system may be restricted to drives, roads, and parking areas.

M.9.4 **Best Management Practices**

Table M-9 shows how the performance targets are to be applied to various land uses. Best Management Practices (BMPs) presumed to achieve the performance targets if properly designed, installed, and maintained are presented as follows:

M.9.4.1. **Basic Control**

- Rain Gardens / Vegetated Bioswales
- Porous Asphalt Drives, Sidewalks, Parking Areas
- Sand Filters / Filter Strips
- Stormwater Treatment Wet Ponds / Wetlands
- Manufactured TSS Removal Systems[1]

M.9.4.2. **Hydrocarbon Control – Level 1**

- Oil/water separator (API or coalescing plate type)[2]

M.9.4.3. **Hydrocarbon Control – Level 2**

- Stormwater Treatment Wetlands / Wet Ponds
- Subsurface Infiltration (requires pre-treatment)
- Sand Filters / Amended Sand Filters

Rainwater source controls and landscape-based, surface-oriented BMPs are encouraged over below-ground, manufactured (or engineered) devices. This list is not exhaustive, and alternative BMPs may be used subject to approval by the District Engineer.

Proposed use of manufactured devices must be accompanied by documentation of performance from a reputable testing or certification program[3]. Performance testing and/or monitoring may be required during the Maintenance Period at the discretion of the District Engineer.

[1] Including media filter and membrane filter systems as well as manufactured biofiltration systems, at the District's discretion.

[2] Requirement for an oil/water separator at multi-family residential sites may be waived at the discretion of the District Engineer if a development or redevelopment proponent can show that the site design has minimized impermeable surfaces and arranged buildings, roads, and parking elements in a manner similar to single-family residential areas. Typically, this will mean that total impermeable surfaces constitute less than 50% of the site and, more specifically, that large open parking lot areas must not be present. For purposes of rainwater management, impermeable surfaces includes all buildings, patios, decks, driveways, sidewalks, and parking areas on a single property; note that this is different than "parcel coverage" as defined in the District's Zoning Bylaw.

[3] These programs include, in order of preference, (1) Canadian Environmental Technology (ETV) Program; (2) State of Washington (USA) Technology Assessment Protocol – Ecology (TAPE) program; and (3) Technology Acceptance and Reciprocity Partnership (TARP) Protocol for Stormwater Best Management Practice Demonstrations. Other testing or certification programs administered by third parties, such a universities or independent testing labs, may also be acceptable, at the discretion of the District Engineer.

M.9.5 **Additional Requirements**

All stormwater quality installations shall:

a) Provide a high flow bypass that regulates the flow rate into the treatment unit and conveys high flows directly to the outlet such that scour and re-suspension of material previously collected does not occur.

b) Provide maintenance access both to the structure and within the structure so that accumulated debris, oils, and sediments can be readily removed with a vacuum truck.

c) Meet H-20 loading criteria when located where vehicles can pass over the structure.

d) Joints and fittings shall be oil resistant and watertight.

M.10 **Pumping Systems**

M.10.1 **Lift Stations**

Where possible, drainage pump stations are not to be used within the District and gravity systems utilized instead. Where drainage pumping is required, however, the Owner's Engineer must review the proposed concept and design criteria with the District Engineer, submit a pre-design report, and obtain approval from the District Engineer before proceeding with design. At a minimum, the pre-design report should include the following:

a) Delineated catchment area map

b) Estimated flows and operating head / HGL

c) Pump station location

d) Connection point to existing infrastructure.

Stormwater lift stations shall be designed as per the requirements for sanitary lift stations (except where not applicable to stormwater) as presented in Schedule K of this bylaw.

M.10.2 **Sump Pumps**

In general, design that allows for the potential of ongoing ground water issues should be avoided. In special cases, where groundwater seepage is seasonal, the District Engineer may allow a sump pump system inside the building which will discharge to the storm main via a storm service. A backwater or check valve and a siphon break must be installed in the sump pump discharge line to prevent backflow into the building. Discharge may be to the surface or a soak away pit, if geotechnical conditions, reviewed by a Qualified Professional, permit.

Note that permanent groundwater pumping is not permitted to District storm sewers.

SCHEDULE N DESIGN AND CONSTRUCTION OF SEDIMENT AND EROSION CONTROL SYSTEMS

N.1 General

N.1.1 Where the provisions of this Bylaw require a sedimentation and erosion control system, the design and construction of such services must be in accordance with the provisions of this Bylaw.

N.2 Design Criteria

N.2.1 The **Owner** must ensure that no silt, gravel or debris resulting from construction activity in the **subdivision** or **development** is allowed to discharge into existing drainage systems, natural drainage courses, water courses, or onto **highway**s or adjoining properties.

N.2.2 All proposed **subdivision** or **development** projects must provide erosion and sedimentation controls to prevent the displacement of soil and the transport of sediment from the project site resulting from land disturbing activities. In order to prevent the displacement of soil and the sediment transport during land disturbing activities, erosion and sedimentation control measures are required and shall be performed as described below. Both temporary and permanent erosion and sedimentation controls both during construction and post-construction shall be implemented.

N.2.3 The objective of erosion and sedimentation control is to prevent the displacement of soil and the transport of sediment to streams, wetlands, lakes, drainage systems, **highway**s and adjacent properties. Erosion on construction sites can result in excessive sediment transport to adjacent properties and to surface waters. Sediment transport can result in adverse impacts such as flooding due to obstructed drainage systems, smothering of aquatic habitat and the creation of algae blooms in lakes, among others.

N.3 Clearing Limits

N.3.1 Prior to any site clearing or grading, areas to remain undisturbed during project construction shall be delineated and marked on-site by flagging or other method. At a minimum, clearing limit delineation shall be installed at the edges of all sensitive area buffers. Retain existing vegetation, where possible.

N.4 Cover Measures

N.4.1 Temporary and permanent cover measures shall be provided when necessary to protect disturbed areas as detailed in the erosion and sedimentation control documents.

N.5 Perimeter Protection

N.5.1 Perimeter protection to contain sediment from sheet flow shall be provided downslope of all disturbed areas where necessary as detailed in the erosion and sedimentation control documents. Such protection shall be installed prior to upslope grading. Perimeter protection includes the use of vegetated strips, as well as more conventional constructed measures such as silt fences.

N.6 **Traffic Area Stabilization**

N.6.1 Unsurfaced entrances, **road**s, and parking areas used by construction traffic shall be stabilized to minimize erosion and tracking of sediment off site as detailed in the erosion and sedimentation control documents.

N.7 **Sediment Retention**

N.7.1 Surface water collected from disturbed areas of the site shall be routed through a sediment pond or trap prior to release from the site as detailed in the erosion and sedimentation control documents, except areas at the perimeter of the site small enough to be treated solely with perimeter protection. Sediment retention facilities shall be installed prior to grading of any contributing area.

N.8 **Surface Water Controls**

N.8.1 Surface water controls shall be installed to intercept and convey all surface water from disturbed areas to a sediment pond or trap and discharge it downslope of any disturbed areas as detailed in the erosion control documents, except areas at the perimeter of the site small enough to be treated solely with perimeter protection. Significant sources of upslope surface water that drain onto disturbed areas shall be intercepted and conveyed to a stabilized discharge point downslope of the disturbed areas.

N.9 **Drainage, Sediment and Erosion Control Plan**

Section N.9 deleted and replaced by Bylaw 1161, 2021

N.9.1 The **Owner's Engineer** must submit Drainage, Sediment and Erosion Control Plan detailing drainage, erosion and sedimentation control measures. All drainage, erosion and sedimentation control measures shall conform to the details and specifications in District Bylaws and policies unless an alternative is approved by the District.

N.10 **Construction within sensitive areas and buffers**

N.10.1 Unless a higher standard is required by a senior level of government, any construction that will result in disturbed areas on or within a stream or associated buffer, within a wetland or associated buffer, or within 15 metres of a lake or other water way shall be subject to "best management practices" including but not limited to "Urban Runoff Quality Control Guidelines for the Province of British Columbia from the Municipal Waste Branch Environmental Protection Division BC Environment" (June 1992) for erosion and sediment control. These provisions include phasing the project whenever possible so that construction in these areas is limited to the dry season.

N.11 **Maintenance**

N.11.1 All erosion and sedimentation control measures shall be maintained as per the erosion and sedimentation control plans submitted by the **Owner's Engineer**. The **Owner's Engineer** shall be responsible for ensuring maintenance and review of erosion and sedimentation control and for compliance with all conditions relating to erosion and sedimentation control.

N.12 **Final Stabilization**

N.12.1 Prior to obtaining **total performance**, the site shall be stabilized and the structural erosion and sedimentation control measures (such as silt fences and sediment traps) shall be removed and drainage facilities cleaned as specified.

SCHEDULE O DESIGN AND CONSTRUCTION OF STREET LIGHTING

O.1 General

O.1.1 The **Owner** must provide **street lighting** designed and constructed in accordance with this Bylaw.

O.1.2 The **District Engineer** may require additional **street lighting** be installed in locations where **street lighting** will improve public safety.

O.2 Design Criteria

O.2.1 Lighting is generally required in all urban and suburban areas. In other areas, lighting requirements shall be in accordance with warrants as indicated in the Transportation Association of Canada Guide for the Design of Roadway Lighting.

O.3 Decorative Street lighting

O.3.1 Additional requirements for decorative **street lighting** shall apply to areas identified in the Town Centre Road and Bottom Wood Lake/Woodsdale Roads areas.

FIGURE O-1 Bottom Wood Lake/Woodsdale Roads

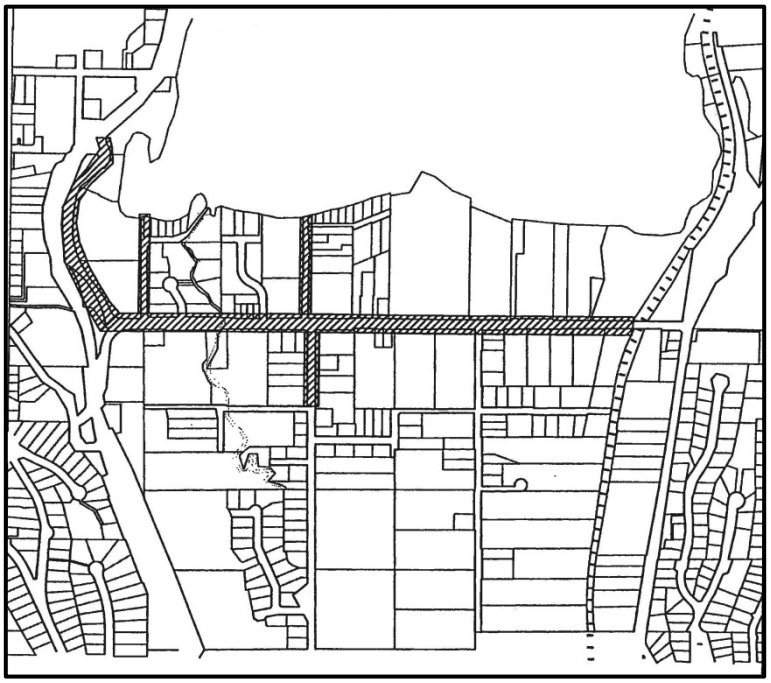
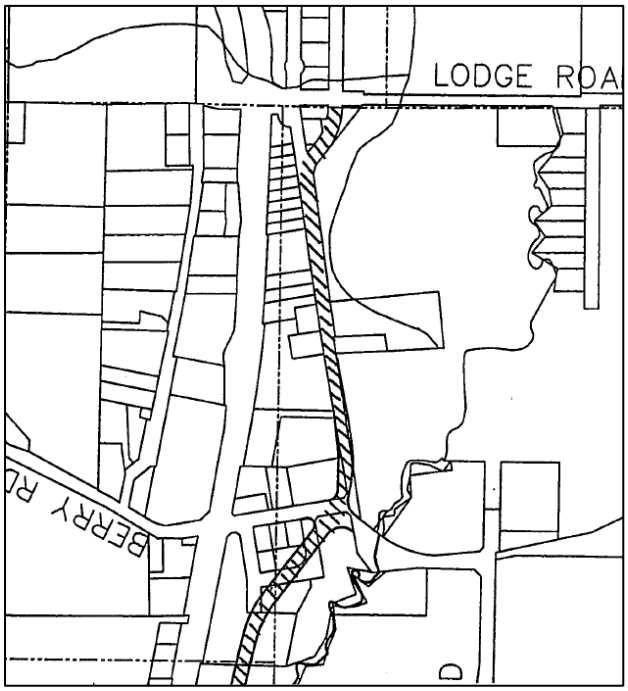


FIGURE O-2 Town Centre Road



O.3.2 Where decorative lighting is required, the following shall apply:

Decorative Luminaire
– King Luminaire K124 Paragon Series

Decorative |Pole
– West Coast Engineering #23300-15FT-Rayleigh Series7

Pole Shall include:
– 15 Foot tapered steel shaft;
- Baseplate on pole shall be supplied with a 297 mm. bolt circle diameter (197 mm. bolt square) that will accept 1”’ diameter galvanized bolts;
– Handhole cover shall be 102 mm. x 178 mm. mounted 222 mm. up from the pole baseplate; and
– Decorative cast aluminum base shall be the two-piece wraparound Raleigh Series.

O.3.3 Fixtures shall be approved by the **District Engineer.**

O.4 **Codes and Standards**

O.4.1 Streetlight designs shall be performed to the latest edition of:

(a) IRDMA/AMSO RP-8 Design Guidelines for Roadway Lighting
(b) IESNA DG-19-08 Design Guidelines for Roadway Lighting
(c) IESNA DG-5 Recommendations for Walkways and Class 1 Bikeways
(d) CSA C653 Energy Efficiency
(e) **MMCD**, Specifications, and Standard Drawings
(f) BC Electrical Code
(g) Transportation Association of Canada Guide for the Design of Roadway Lighting
(h) WorkSafe BC
(i) BC Hydro and FortisBC Design Guidelines

O.5 **Permits**

O.5.1 It is the **Owner**s sole responsibility to obtain all required electrical permits and inspections. A copy of the permits shall be submitted to the **District** upon application for **final approval**.

O.6 **Levels of Illumination**

O.6.1 The average levels of illumination in lux must be as shown in TABLE O-1

TABLE O-1 LEVELS OF ILLUMINATION		
ROAD CLASSIFICATION	**RESIDENTIAL AREAS**	**COMMERCIAL AND INDUSTRIAL AREAS**
Arterial **Highway**	9.0 lx	17.0 lx
Collector **Highway**	6.0 lx	12.0 lx
Local **Highway**	4.0 lx	9.0 lx
Walkways	5.0 lx	5.0 lx

Note: The maximum uniformity ratio for local residential **roads** and **walkways** shall be 5:1 and for all other **roads**, be 3:1. The uniformity ratio is expressed as the average horizontal lux divided by the minimum horizontal lux.

O.7 **Light Loss Factor**

O.7.1 Designs shall be performed using a light loss factor (LLF) per **MMCD** and IESNA design guidelines. The light loss factor shall take into account both lamp lumen depreciation (LLD), lamp dirt depreciation (LDD), and ballast factor (BF).

O.8 **Pole Specifications**

O.8.1 In general, poles must be installed as follows:

(a) **Arterial highways** - staggered spacing.

(b) **Collector highways** - staggered spacing.

(c) **Local highways** - spaced one side of street behind **sidewalk** if **sidewalk** required, otherwise staggered spacing.

(d) **Walkways** - one at every entrance to a **walkway** and additional lighting where required to meeting illumination requirements. Design of the light distribution pattern must minimize light spill into adjoining properties.

O.8.2 Poles must be located within 0.6 metres of the property corners and must not conflict with driveways, underground services and fire hydrants. Street lighting poles shall be installed in accordance with Standard Drawings.

O.8.3 Pole heights shall be 6.7 metres for **local highways** and 9.0 metres for **collector highways**.

O.8.4 Luminaire poles shall be per MMCD standard drawings E4.1 and E.4.2. Concrete bases shall be Type C trapezoidal concrete per MMCD standard drawing CE1.3.

O.8.5 Poles shall black powder coat finish.

O.9 **Products**

O.9.1 Unless otherwise approved by the **District Engineer**, LED fixtures shall be used for the streetlights. Fixtures shall be full cut-off fixtures with the exception of some decorative lighting fixtures for the purpose of matching decorative styles in existing areas. For every 10 fixtures, 1 spare luminaire and pole shall be provided.

O.9.2 All luminaires shall be Phillips Roadstar series or equivalent as approved by the **District Engineer**.

O.10 **Scheduling**

O.10.1 Scheduling of **work** with the governing electrical authority is the **Owner**'s responsibility. Where costs are incurred with B.C. Hydro or FortisBC in installing the light system, these costs shall be considered as part of the cost of the system and shall be at the expense of the **Owner**.

O.11 **Approval**

O.11.1 Prior to issuance of a **Certificate of Total Performance**:

(a) the **Owner** must submit a copy of the Certificate of Inspection by the governing electrical authority showing that the installation is unconditionally approved.

(b) If the **subdivision** or **development** is not located in an existing streetlight local service area, the **Owner** must submit a letter formally requesting that the local service area boundary be expanded to include the **subdivision** or **development**.

O.12 **Connection to Utility**

O.12.1 An allowance for a minimum of eight streetlights per electrical connection must be made and future extension of the **street lighting** system should be accommodated in this requirement.

O.12.2 Connection shall be made in accordance with Standard Drawings.

O.12.3 All **street lighting** in public right of ways must be provided with electrical metering equipment in accordance with standards of the appropriate electrical utility.

O.12.4 All **street lighting** kiosks must have a test switch.

O.12.5 Single service bases shall be per MMCD standard drawing E4.21. Where required, an aluminum single sided, single door, CSA type R3 rated kiosk may be used for meter installation.

SCHEDULE P DESIGN AND CONSTRUCTION OF ELECTRICAL AND COMMUNICATIONS WIRING AND GAS DISTRIBUTION SYSTEMS

P.1 General

P.1.1 Power supply, communication wiring, and gas service for each **parcel** must be designed and constructed in accordance with this Bylaw.

P.1.2 The **Owner** must obtain a letter of confirmation from the applicable utility that electrical, communication, and gas distribution infrastructure have been installed to their satisfaction.

P.1.3 Kiosks/Laminate Wrapping Requirements – All kiosks must be wrapped with anti-graffiti vinyl wrapping. Wrap material must be a cast vinyl with a high gloss laminated surface. The wrap is to be visually pleasing and compliment the area surrounding the installation location considering landscape, geography, and general theme of the area. Artwork must have a high degree of contrast so as to maximize resistance to graffiti vandalism. Artwork must not be for commercial advertising. All artwork must be approved by the **District Engineer** prior to installation.

P.2 Utility Locations

P.2.1 Systems of **work**s for electrical and communications wiring and gas distribution systems must be installed in accordance with the standards required by the particular utility and any applicable federal and provincial codes.

P.2.2 All utility **work** must be installed in alignments as generally indicated on Standard Drawings. It is the responsibility of the **Owner**s Engineer to coordinate with each utility the actual offsets required prior to a drawing submission to the **District**.

P.2.3 All systems must be designed and constructed so as to fully service all **parcel**s in a **subdivision** or **development**.

SCHEDULE Q DESIGN AND CONSTRUCTION OF HILLSIDE DEVELOPMENT AREAS

Q.1 General

Q.1.1 In steep slope areas where it is impractical to conform to technical requirements of this Bylaw and a Hillside **Development** permit has been issued by the **District**, the **District Engineer** may approve **work**s which comply with the criteria set out in this schedule.

Q.1.2 Use of this schedule is required in steep slope development areas. **Steep slopes** means lands in their natural state that have a slope angle of 20% or greater for a minimum horizontal distance of 10 meters, or adjacent areas where existing or potential sloughing or stability warrants concerns. The definition applies to all properties which are 0.5 hectares or greater in size, and where 10% or greater of the parent property contains slope of more than 20%.

Q.1.3 Before agreeing to the use of this Schedule, the District Engineer must be satisfied that use is warranted due to the topographical constraint involved and that the varied criteria are presented and accepted as good engineering practice and that the varied criteria are environmentally sound and do not adversely affect transportation or public safety.

Section Q.1.4 added by Bylaw 1161, 2021

Q.1.4 Engineering designs under this schedule shall conform to the specifications contained within TABLE Q-1 and Table Q-2.

Q.2 Pre-design Report – *deleted by Bylaw 1161, 2021*

Q.3 Detailed Design

Q.3.1 Detailed design must also consider the following:

(a) Underground infrastructure pipe bedding, trench backfill, and mechanical restraints.
(b) Road**work** structure, barrier curb, and the requirements for safety barriers.
(c) Driveway access concerns.
(d) Building code structural or foundation requirements.
(e) Environmental impact assessment.
(f) A list of requirements on a lot by lot basis pertaining to covenants that may be required.
(g) Each **parcel** created by **subdivision** must have a buildable site with building envelope setbacks and driveways shown on the design drawing.
(h) **Boulevard** grades in excess of 2% may be designed with the following conditions:
  (i) to a point 1.0 m from the back of **sidewalk** or curb (where no **sidewalk** present) where on street parking is provided and to a point 2.4 m back where parking is adjacent to the street, behind the curb, as long as it can be demonstrated that the depth of bury on underground utilities will not be negatively impacted and there is sufficient space for snow storage.
  (ii) In areas where the **boulevard** grade exceeds 2%, the **Approving Officer** may require the developer to undertake **boulevard** slope stabilization and planting.
(i) In no case shall the grade from the property line to back of **sidewalk**, back of curb, or back of ditch be less than 1%.
(j) Level access and clearance of 1.3m around fire hydrants, transformers, and vaults must be established.

(k) Centre median cross-section slope protection from erosion. Centre medians must be designed to be maintenance free.
(l) Alternate utility offsets.
(m) Down slope **road** section with storm mains and sanitary mains in common trench.
(n) Cut/fill slopes, vegetation planting, retaining wall structures, and parking and associated sight distances shall be designed to protect all site distances.
(o) Side yard and rear yard utility corridors shall only be approved if they are included in a right-of-way that restricts the construction of permanent structures (excluding fences).
(p) Utility service and transformer boxes, which need to be at **road** grade, require suitable grading and retaining structures.
(q) Disturbed areas within the **road** right-of-way or on disturbed areas of the site that are not within formal landscaped areas or building envelopes shall be restored to a natural condition or to a condition that will prevent erosion prior to **substantial performance** being issued or final occupancy in the case of a Building Permit application.
(r) *Deleted by Bylaw 1193, 2022*

TABLE Q-1 -HILLSIDE DEVELOPMENT STANDARDS									
STREET TYPE	**CONDITION [1]**	**DESIGN SPEED**	**MAX. GRADE**	**ROW WIDTH [5]**	**PAVEMENT WIDTH (M) [2]**	**PARKING [5, 6]**	**CURB & GUTTER**	**SIDEWALK [3, 4]**	**STREET TREES**
HILLSIDE LOCAL ROAD									
Development fronts both sides	A	40	12	14	6.4	Both sides	Barrier	1	Optional
Development fronts one side	B	40	12	12	6.0	Both sides	Barrier	1	Optional
No **Development** fronting	C	40	12	10	6.0	Where Required [8]	Barrier	1	Optional
HILLSIDE COLLECTOR ROAD									
Development fronts both sides	A	50	10 [7,9]	18	9.4	Above curb Both sides	Rollover[10]	2	2 Sides
Development fronts one side	B	50	10 [7,9]	15	9.4	Above curb Both sides	Rollover[10]	1	2 Sides
No **Development** fronting	C	50	10 [7,9]	14	9.4	Where Required [8]	Barrier	1	2 Sides
HILLSIDE EMERGENCY VEHICLE ACCESS									
		20	15	4.5	4.6				

1 Condition refers to Standard Drawings SD-HS1, SD-HS2 and SD-HS3.

2 Pavement width measured from back of curb.

3 **Sidewalks** shall terminate at a destination or connect with another **sidewalk** or pathway. The numbers indicate whether **sidewalk** is required on either one or both sides of the street.

4 **Sidewalks** are not required on local streets in steep slope areas unless they are required to provide connectivity to schools, parks, commercial areas or lands beyond.

5 Roadway cross sections may be further reduced in width if parking is to be established at strategic locations.

6 Split **road** section **lane** widths require 3.0 m traveled **lane** plus 2.5 m parking or cycling width.

7 Collector Streets maximum grades may be increased to 12% where necessary due to topographic constraints. Where approved, grades exceeding 10% shall be topographically surveyed at the developers' expense, to verify final **road** grades, prior to final **subdivision** approval.

8 Required adjacent to parks, green space and /or trail access points.

9 Except for the 100-metre portion of Chase Road intersecting with Glenmore Road as shown on Standard Drawing SD-HS4 attached to the Administrative Subdivision and Development Standard Forms Policy 155, 2017, as amended from time to time, and generally fronting portions of the following properties:

- 5000 Chase Road, Lot 2 Plan KAP81535, PID 026-759-900, Roll 02121.002
- 5474 Chase Road, Lot C Plan KAP87779, PID 027-694-968, Roll 02118.003; and
- 5235 Chase Road, Lot A Plan KAP35082, PID 002-897-687, Roll 02173.372,

maximum grades may be increased to 15% where necessary due to topographic constraints.

10 to act as gutter pan

TABLE Q-2-HILLSIDE ALIGNMENT DESIGN CRITERIA				
Criteria	**Design Speed**			
1. Horizontal Curve Radii				
Roadway	**60 km/h**	**50 km/h**	**40 km/h**	**30 km/h**
normal crown (-2%)	260m	165m	90m	45m
2% superelevation	205m	120m	65m	30m
4% superelevation	150m	80m	45m	22m
6% superelevation	120m	-	-	-
Through Intersections	200m	120m	70m	40m
2. Superelevation				
Maximum Superelevation	6%	4%	4%	4%
Maximum Superelevation at Intersection	4%	4%	4%	4%
3. Superelevation Transition Lengths				
Transition Lengths (2/4 lane roadways)[1]				
normal crown to +2%	24m/36m	22m/34m	20m	20m
normal crown to +4%	38m/54m	33m/50m	30m	30m
normal crown to + 6%	48m/72m	-	-	-
Min. Tangent Length between reversing				
2% superelevation (2/4 lane roadways)[2]	15m/22m	13m/20m	12m	12m
4% superelevation	28m/42m	26m/40m	24m	22m
6% superelevation	42m/64m			
4. Gradients				
Minimum Grade	0.50%	0.50%	0.50%	0.50%
Maximum Grades				
on horizontal tangents	8%[3]	10%[4]	12%	12%
on minimum radius horizontal curves[5]	8%	9%	10%	10%
Grades Through Intersections				
with design speed on major road	8%	8%	8%	-
approach distance for major road[6]	15/5m[7]	5m	0m	-
with design speed on minor road	5%[8]	5%	6%	6%
approach distance for minor road[9]	20m	15m	5m	5m
5. Vertical Curve K Values				
Criteria				
Minimum Crest	15	8	4	2
Minimum Sag	10	7	4	2
Crest/Sag on approach to stop condition	4	3	2	2
K values listed assume that new **road**ways will be illuminated				
6. Stopping Sight Distances				
Down grades: 12%	109m	78m	52m	34m
9%	101m	73m	50m	32m
6%	94m	69m	48m	31m
3%	89m	66m	46m	30m
0%	85m	63m	45m	30m
Up grades: 3%	81m	61m	44m	29m
6%	78m	59m	42m	29m
9%	76m	57m	41m	28m
12%	73m	56m	40m	28m
7. Decision Sight Distance				
Minimum decision sight distance for 60km/h: 175m-235m.				

[1] Values for transition lengths include tangent runout applied at the same rate as superelevation runoff.
[2] 60% of superelevation runoff occurs on the tangent approach and 40% on the curve, resulting in a minimum length of tangent between reversing curves of 120% of the superelevation length.
[3] Under special circumstances, grades up to 10% may be permitted.
[4] Under special circumstances, grades up to 12% may be permitted.
[5] Applies where radius is less than 1.5 times minimum allowable radius.
[6] Minimum distance back from the gutter line of the minor **road** that the specified grade may not be exceeded.
[7] Distances for design **road** approach to intersection with collector **road**/local **road**.
[8] 4% desirable.
[9] Minimum distance back from the gutter line of the major **road** that the specified grade may not be exceeded.
[10] Note that decision sight distance applies only to multi-**lane roads** at intersections.
[11] The range of values recognizes the variation in complexity that occurs at various sites. For less complex situation, values towards the lower end of the range are appropriate and for more complexity, values at the upper end are used.

SCHEDULE R DRAWINGS

R.1 General

R.1.1 Where **work**s are required to be constructed to service a **subdivision** or **development**, the **Owner's Engineer** must prepare engineering design drawings in accordance with the provisions of this Bylaw.

R.1.2 Drawings submitted to the District for review subsequent to the initial drawing submission, must clearly identify any revisions using a "revision cloud".

R.1.3 When required, the **District Engineer** may request that the **Owner's Engineer** provide 3-dimensional renderings of the proposed **subdivision** or **development**.

R.2 MMCD

R.2.1 **MMCD** Standard Detail Drawings must be referenced to and interpreted simultaneously with the pertinent sections of this Bylaw.

R.2.2 AutoCad Standard border and blocks shall be as per **MMCD**.

R.3 As-Constructed Drawings

R.3.1 Prior to the issuance of a **Certificate of Total Performance** the **Owner** must deposit with the **District**:

(a) one complete set of original as-constructed drawings; and
(b) electronic copies of the drawings in a format acceptable to the **District Engineer**.
(c) one set of Service Cards in the prescribed format for:
  (i) Water
  (ii) sanitary sewer
  (iii)storm sewer
  (iv)fire hydrants

R.3.2 As-constructed drawings must be prepared in accordance with the provisions set out in this Bylaw.

R.4 Design Drawings

R.4.1 In simple servicing cases where a standard drawing contained in this Bylaw is deemed by the **District Engineer** to be sufficient for construction purposes, the **District Engineer** may, in their sole discretion, waive the requirement for design drawings where a **District** approved **contractor** is being used

R.5 Standard Drawings

R.5.1 Existing **work**s refers to previously constructed **work**s.

R.5.2 Proposed **work**s refers to **work**s to be constructed and installed during the current **subdivision** or **development** phase.

R.5.3 Future **work**s refers to any **work**s that will be constructed or installed in future phases or as a part of a **District** construction project.

R.5.4 Where no standard is defined in this Bylaw for the preparation of a drawing to portray a particular service, structure, or other item, instructions and requirements shall be obtained from the **District Engineer**.

R.5.5 The drawings must include a title page, key plan, building envelope plan, composite utility plan, plan profile, details, cross sections, and any other related drawings.

R.6 **Preparation**

R.6.1 Drawings must be prepared:

(a) Using the **District** standard border, title block, drawing symbols and material symbols in accordance with **District** Standard Drawings. The drawings are available from the **District Engineer** in electronic format.

(b) using a cadastral base that matches the legal plan upon which a building permit application is based or on the legal plan which will be sent to the Land Titles Office for registration of the proposed **subdivision**.

(c) in accordance with the sample engineering drawings.

R.7 **Sheet Layout**

R.7.1 Sheet layout shall conform to the following standards:

(a) Sheet size to be A1.

(b) All information shall be completely contained with the drawing borders and shall not encroach on the title block.

(c) Place north arrow close to the top right-hand side of the sheet. For fragmented plan views, place north arrow at the top right-hand side of each fragment.

(d) North arrow must point towards the top of the page or towards the left-hand edge of the page.

(e) In all cases the title page, key plan, location plan and composite utility plan must be oriented in the same direction.

(f) Matchlines must be drawn and reference the appropriate sheet showing the continuation if the size of the **subdivision** or **development** makes it necessary to place the key plan or composite utility plan onto two or more sheets.

R.8 **Dimensions and Units**

R.8.1 The following conventions must be used:

(a) Dimensions and units must be shown in metric. No imperial units are permitted.

(b) Distances must be in meters and grade in percent to an accuracy of 2 decimal places.

(c) Elevations to an accuracy of 3 decimal places.

(d) Areas must be in square meters rounded to the nearest square meter.

(e) Pipe sizes must be in millimeters as per ASTM specifications using 1" = 25 mm.

(f) Existing imperial dimensions, except for pipe sizes, are to be soft converted using the factors of 1 inch = 25.4 millimeters or 1 foot = 0.3048 meters.

R.9 **Lettering**

R.9.1 Lettering must conform to the following:

(a) All lettering to be upper case AutoCAD - Romans.
(b) All lettering to maintain a 1:10 ratio between plotted text height and plotted pen thickness.
(c) The minimum plotted text height shall be 1.5 mm.
(d) The maximum plotted text height shall be 5.0 mm.
(e) Use black ink on all as-constructed drawings except that green ink may be used on the plan profile grid lines.

R.10 **Scales**

R.10.1 The following scales must be used:

(a) Plan View Drawings 1:500
(b) Plan and Profile Drawings Horizontal 1:500 Vertical 1:50
(c) Scales for location plans, key plans, cross-sections, and details shall be chosen as deemed suitable for the application.

R.11 **Title Page**

R.11.1 Title Pages shall contain the following information:

(a) Name of **development**
(b) Name and address of **development**
(c) Name and address of **Engineer**
(d) Site plan of **subdivision** or **development**
(e) Overall plan with lot numbers, plan numbers and street names for the subject **development** and adjoining properties.
(f) For phased **development** all phases must be shown with the current phase outlined darker than future or existing phases.
(g) File numbers of approving authorities, (i.e. **District** and the Ministry of Transportation and **Highways**).
(h) Complete list of drawings belonging to the set.
(i) Legal description of subject properties.
(j) North Arrow
(k) The lettering used on this page is not required to conform to R.9.1 in respect to text styles and text height.

R.12 **Key Plans**

R.12.1 Key Plans shall contain the following information:

(a) Lot numbers, plan numbers, and **road** names of the subject **development** and adjoining properties.
(b) Cross reference of the detailed drawings by outlining the area contained in each drawing and referencing that drawing by drawing number.
(c) North Arrow.

R.13 **Building Envelope Plan**

R.13.1 Building Envelope Plan shall contain the following information:

(a) Overall plan of current phase
(b) Lot numbers
(c) **Roads**, curbs, gutters and **sidewalks**
(d) Rights of way and easements
(e) Offset lines from all property boundaries indicating required building setbacks
(f) 10 meter by 10 meter square on each **parcel** indicating the required minimum building envelope
(g) Notes that indicate the required setbacks from all property boundaries pursuant to the Zoning Bylaw
(h) North arrow
(i) Minimum building elevation

R.14 **Composite Utility Plan**

R.14.1 Composite Utility Plans shall contain the following information:

(a) All existing and proposed utilities, **roads**, **walkways**, and **sidewalk**s.
(b) All rights of way and easements including widths.
(c) Control station monuments with identification number.
(d) All legal information, including bearings, dimensions, lot numbers, block numbers, legal plan numbers, and street names. All lots must be numbered.
(e) Show all BC and EC locations on curved lot lines.
(f) Dimensions for curved lot lines shall include radius and arc length.
(g) All **road**way dimensions including width of right of way, BOC to BOC and BOC to edge of right of way.
(h) Area of each **parcel**.
(i) Lots with curved **frontage** that do not meet the minimum **frontage** requirement, show arc length and radius at property line and at 6.0 meter offset.
(j) North Arrow.

R.15 **Plan and Profile Drawings**

R.15.1 The plan and profile drawings shall be prepared in accordance with this section and shall be divided into two parts: plan view on the top half of the page and profile view on the bottom half of the page.

R.15.2 For complex servicing with multiple utilities located within the same corridor or alignment, each utility shall be shown on a separate plan and profile drawing in addition to composite plan and profile drawings.

R.15.3 Plan Views must be divided into two views as follows:

(a) Above Ground View, must include the following:
  (i) All features and utility installations visible above ground
  (ii) Lot numbers
  (iii) Dimensions establishing location of all surface **works** constructed within statutory rights of way and easements.
  (iv) Horizontal curve data for **road** centerlines including radius, arc length, tangent length, and delta angle.

(v) Curb, gutter, and **sidewalk** information including type of curb, width of **sidewalk**, location of letdowns for driveways, wheelchair ramps, etc.

(b) Below Ground View, must include the following:
- (i) Lot numbers
- (ii) All underground utilities such as sanitary and storm sewers, water, electrical and communication wiring, gas and all applicable appurtenances.
- (iii) Utility alignment referenced to the nearest property line or right of way boundary.
- (iv) Size of all pipes and direction of flow for sewers.
- (v) Specifications for all fittings, valves, and hydrants.
- (vi) Geodetic invert elevations at property line for all sewer services connected directly into manhole.
- (vii) Lot services (sanitary, storm, water) referenced to the nearest legal pin.

R.15.4 Profile View

(a) Profiles shall be drawn on a grid that has horizontal lines with 2 mm spacing and vertical lines with 20 mm spacing. Horizontal lines must be accented every 20 mm. All vertical lines must be accented. All elevations shall be relative to a geodetic datum.

R.15.5 Plan and profile drawings must include the following:

(a) Continuous stationing on the accented vertical grid line.

(b) Pre-construction ground profile along the centerlines of proposed **roads**. In statutory rights of way or easements, show pre-construction ground profile for each utility. Include any related data or date surveyed.

(c) Profile shown at true centerline length and projected above to the plan view in as close a relationship as possible.

(d) **Road** centerline profile including the following information:
- (i) percent grade
- (ii) chainage and elevations of BVC, EVC, and PVI
- (iii) external "e" value
- (iv) “K” value
- (v) “A.D.” value
- (vi) length of vertical curve
- (vii) station and elevation of low point or high point vertical curves
- (viii) on super elevated curves and crossfall sections, show percent crossfall and transition length and crown

(e) Profiles of invert and crown of pipes for sanitary sewer, storm sewer, and water mains as well as length, size, type, grade, and class of pipe (i.e. 75 m 200 mm SAN SDR 35 PVC at 2.38 %).

(f) Manhole rim elevations and invert elevations at all inlets and outlets.

(g) Top and bottom inverts on manhole drop structures.

(h) Location type, and elevation of all crossing utilities.

(i) Gutterline and grate elevations for catch basins.

(j) Elevations at the right- and left-hand side of the profile and repeated at breaks in the profile.

(k) Elevations at every even metre graduation on the horizontal accented line.

R.16 **Electronic Drawings**

R.16.1 General Requirements

(a) The **Owner** must submit to the **District Engineer** a complete set of electronic drawings of the **subdivision** or **development** in DWG format compatible with the current version of AutoCAD being used by the **District**.

The electronic drawing must be prepared in accordance with this Bylaw.

R.16.2 Conventions

(a) Drawing symbols must be in accordance with Standard Drawings.

(b) Material symbols must be in accordance with Standard Drawings.

(c) No drawing shall be submitted that contains any external references (xrefs).

(d) All as-constructed drawings must be purged of all unnecessary information prior to submission to the **District**.

R.16.3 Prototype Drawings

(a) An electronic copy of the **District** prototype drawing is available from the **District.** The prototype drawing contains the **District** standard border, titleblock, layers, blocks and linetypes to be used in all submissions of design or as-constructed drawings.

Standard Detail Drawings are provided in Subdivision Standard Forms Policy 155, 2017. Where not superseded by a **District** drawing, the relevant **MMCD** Standard Detail Drawings must be referenced and interpreted simultaneously with this bylaw.

SCHEDULE S FORMS, AGREEMENTS, AND CERTIFICATES

S.1 Subdivision and Development Servicing Agreement

S.1.1 Prior to **work**s being carried out:

(a) on a **District highway** or

(b) in a statutory right of way in favour of the **District**

for the servicing of a **subdivision** or **development**, the **Owner** must:

(i) enter into a **subdivision** and **development** servicing agreement; and

(ii) provide a security deposit in accordance with this Bylaw.

S.1.2 Prior to entering into, and as a condition of a Servicing Agreement, the District Engineer may require the Owner's Engineer to provide a plan demonstrating constructability of the works.

Section S.1.3 deleted and replaced by Bylaw 1161, 2021

S.1.3 All **work**s required to be constructed and installed at the expense of the **Owner** of the land being subdivided or **developed** shall be constructed and installed in accordance with the provisions of the Bylaw before the **Approving Officer** approves the **subdivision** or the **Building Inspector** issues the building permit. At the District Engineer's discretion, the approval may be given or the permit issued if the owner of the land:

(a) Enters into a **Subdivision** and **Development** Servicing Agreement with the **District** accepting the terms and conditions in that agreement, and undertaking to construct and install the required **works** within one year from the date of executing the agreement; and

(b) The **Owner** deposits with the **District** security in the form of cash, a bank draft or an irrevocable letter of credit in a form acceptable to the Chief Financial Officer in the amount of:

(i) One hundred and twenty five percent (125%) of the awarded tender value for the construction and installation of the **work**s: plus

(ii) One hundred and twenty five percent (125%) of the **Owner's Engineer's** fee for the design and inspection of the **work**s as estimated by the **Owner's Engineer**; plus

(iii) enter into a Maintenance Security Agreement to warrant for the maintenance of the **work**s for a period of eighteen (18) months after the date of **substantial performance**; and

(iv) provide a Maintenance Security deposit in accordance with this Bylaw;

(c) The **Owner's Engineer** certifies that the tender has been awarded and that a contract has been executed between the **Owner** and the **contractor**; and

(d) The **Applicant** complies with the provisions of Schedule S, Section 4, Certificate to Commence Construction; and

(e) The **Applicant** provides written proof that all the requirements of the Ministry of Transportation and Infrastructure and other agencies having jurisdiction have been met, if applicable.

S.1.4 The **Owner** will not be required to enter into a Maintenance Security Agreement, nor be required to provide a security deposit when:

(a) There are no **works** required under the provisions of this Bylaw or

(b) Those **works** are not required as a result of a **development** variance permit granted by **Council**.

S.2 **Commitment by Owner and Engineer**

S.2.1 A Commitment by **Owner** and Engineer must be submitted to the **District Engineer** prior to review of design drawings.

S.2.2 A Commitment by **Owner** and Engineer shall be signed by the **Owner** and **Owner's Engineer** certifying that:
the **Owner's Engineer** has been contracted by the **Owner** for the design of all **works**, reviews and designs associated with the **subdivision** or **development**;

(a) the **Owner's Engineer** shall adhere to all Provincial Statute for their profession;
(b) the **Owner's Engineer** shall ensure that the **works** comply with the provisions of all **District** Bylaws, permits, policies, and applicable legislation and regulations;
(c) the **Owner's Engineer** shall ensure that only qualified personnel are retained to carry out tests, inspect or carry out design **work**, detailing, or **field reviews**;
(d) the **Owner's Engineer** has been given contractual mandate by the **Owner** for the purposes of **subdivision** or **development**;
(e) the **Owner's Engineer** shall submit summary reports to the **District Engineer** on request;
(f) the **Owner's Engineer** shall submit letters of Certification of Bylaw Compliance as required;
(g) the **Owner's Engineer** is licensed to practice as an **engineer** in the Province of British Columbia;
(h) the **Owner's Engineer** covenants that their firm presently carries, and will continue to carry for the duration of the project, liability insurance in the amount of five million dollars ($5,000,000).

S.2.3 Notification of termination of the **Owner's Engineer** shall be provided to the **District Engineer** in writing thirty (30) days prior to any intended termination;

S.2.4 Where the **Owner's Engineer** ceases to be retained at any time during construction of the **work**s, **work** on shall cease until:
a new **Engineer** has been retained; and

(a) an updated Commitment by **Owner** and **Engineer** and Commitment to Design and **Field review** have been submitted to the **District Engineer**.

S.3 **Commitment to Design and Field review**

S.3.1 A Commitment to Design and Field Review from the Engineer representing each engineering specialty shall be submitted to the **District Engineer** prior to issuance of a Certificate to Commence Construction.

S.3.2 A Commitment to Design and Field Review shall be signed by the **Owner's Engineer** and each Engineering Specialist certifying that:

(a) the **works** identified by the **Engineer**'s initial, will be designed, constructed and installed in accordance with all applicable **District** Bylaws, permits and policies and legislation and regulations;
(b) **Field reviews** shall be completed and provided to the **District Engineer** during construction.
(c) The **District** shall be notified immediately in writing if the contract for **field reviews** is terminated at any time during construction.
(d) the **Engineer** is licensed to practice as an **engineer** in the Province of British Columbia;
(e) the **Owner's Engineer** covenants that their firm presently carries, and will continue to carry for the duration of the project, liability insurance in the amount of five million dollars ($5,000,000).

S.4 **Certificate to Commence Construction**

S.4.1 No person shall excavate or fill land for the purpose of constructing **work**s, nor shall any person construct or install any of the **work**s until a Certificate to Commence Construction has been issued.

S.4.2 The **District Engineer** shall not issue a Certificate to Commence Construction until the **Owner** submits the following information:

(a) three complete paper copy sets and one electronic copy in pdf format of design drawings showing all pertinent information as required by this Bylaw and prepared in accordance with this Bylaw;
(b) detailed design calculations in support of the **street lighting** layout.
(c) detailed design calculations in support of the fire flows and storage required in the design of a **community water system**.
(d) detailed design calculations in support of a **storm drainage system**.
(e) detailed design calculations in support of a **community sewer system**.
(f) plans and documentation in support of a Drainage, Sediment and Erosion Control Plan.
(g) Letter of Commitment by **Owner** and **Engineer**;
(h) Quality assurance/quality control documentation
(i) Letter of Commitment to Design and **field review**;
(j) If required, letters approving design from the Ministry of Transportation and Infrastructure, and other agencies having jurisdiction.

S.5 Certification of Bylaw Compliance

S.5.1 A Certificate of Bylaw Compliance from each Engineer shall be submitted to the **District Engineer** prior to the issuance of a **Certificate of Total Performance**.

S.5.2 A Certificate of Bylaw Compliance may not be submitted until after Substantial Performance of the **work**s.

S.5.3 After submission of Certification of Bylaw Compliance, each Engineer must arrange and conduct a final inspection with the **District Engineer** to determine the acceptability of the Certification of Bylaw Compliance.

S.5.4 A Certification of Bylaw Compliance shall be signed by the **Owner's Engineer** and the **engineer** representing each engineering specialty certifying that:

(a) all obligations for **field reviews** pursuant to this Bylaw have been met;
(b) all obligations pursuant to the previously submitted Commitment to Design and Field Review have been met;
(c) **works** identified in the signed Commitment to Design and Field Review comply in all materials respects with the provisions of this Bylaw and the design drawings and supporting documentation submitted in support of the **subdivision** or **development** application;
(d) the final as-constructed drawings and supporting documents prepared have been submitted;
(e) the **Owner's Engineer** is licensed to practice as an **engineer** in the Province of British Columbia;
(f) the **Owner's Engineer** covenants that their firm presently carries, and will continue to carry for the duration of the project, comprehensive general liability insurance in the amount of two million dollars ($2,000,000);
(g) the **Owner's Engineer** covenants that their firm presently carries, and will continue to carry for the duration of the project, automobile liability insurance in the amount of two million dollars ($2,000,000);
(h) the **Owner's Engineer** covenants that their firm presently carries, and will continue to carry for the duration of the project, errors and omissions insurance in the amount of five hundred thousand dollars ($500,000)

S.6 **Certification of Slope Stability**

S.6.1 A Certification of Slope Stability from the geotechnical Engineer shall be submitted to the **District Engineer** prior to the issuance of **Certificate of Total Performance**.

S.6.2 A Certificate of Slope Stability may not be submitted until after Substantial performance of the **work**s.

S.6.3 A Certification of Slope Stability shall be submitted by a geotechnical Engineer certifying that:

(a) all obligations for slope stability review pursuant to this Bylaw have been met;
(b) all issues related to safety and slope stability have been addressed;
(c) In consideration of slope stability matters due consideration has been given to, "Guidelines for Legislated Landslide Assessments for Proposed Residential **Developments** in BC", Association of Professional Engineers of British Columbia, Revised May, 2010;
(d) **works** identified in the signed Commitment to Design and Field Review comply in all materials respects with the provisions of this Bylaw and the design drawings and supporting documentation submitted in support of the **subdivision** or **development** application;
(e) the final as-constructed drawings and supporting documents prepared have been submitted;
(f) the **Engineer** is licensed to practice as an **engineer** in the Province of British Columbia;
(g) A report confirming slope stability on the lots created as required in Schedule D of this Bylaw.

S.7 **Certification of Total Performance**

S.7.1 A **Certificate of Total Performance** will be issued by the **District Engineer** indicating that **total performance** of the **work**s has been achieved, once the **Owner** has complied with the provisions of this Bylaw.

S.7.2 The **District Engineer** must not issue a **Certificate of substantial performance** until the following has been submitted:

(a) as-constructed drawings;
(b) Utility Service Cards;
(c) Maintenance Security Agreement;
(d) Certification of Bylaw Compliance;
(e) three copies of the plan of **subdivision** which have been executed by all required parties and are ready for registration;
(f) executed copies of all Statutory Right of Way plans and agreements, if applicable and which are ready for registration;
(g) all applicable fees, charges and security deposits;
(h) video reports and air testing results;
(i) confirmation that a final inspection has been conducted by the **District Engineer** and **Owner's Engineer**;
(j) a letter from the governing electrical authority approving the **street lighting** installation;
(k) a letter from communication, gas, and electrical utilities as applicable and Ministry of Transportation and Infrastructure as applicable, confirming that their requirements have been met;
(l) a letter from the applicable **private water utility** approving the **water distribution system**; and
(m) confirmation that **substantial performance** of the **work** has been achieved.

S.8 **Maintenance Security Agreement**

S.8.1 Upon Substantial performance of the **subdivision** or **development** and prior to issuance of a **Certificate of Total Performance** the **Owner** must:

(a) Enter into a Maintenance Security Agreement to warrant for the maintenance of the **works** for a period of eighteen (18) months after the date of **Substantial performance;** and

(b) Provide a maintenance security deposit in accordance with this Bylaw.

S.8.2 The **Owner** will not be required to enter into a Maintenance Security Agreement, nor be required to provide a security deposit when:

(a) There are no **works** required under the provisions of this Bylaw or

(b) **Council** grants a **Development** Variance Permit exempting the **Owner** from some or all of the **works** required under this Bylaw.

SCHEDULE T FEES AND SECURITY

T.1 Fees and Deposits

(a) The **Owner** shall provide all security deposits and pay all fees required under any applicable **District** bylaws, including but not limited to, this bylaw and the **District**'s Fees Bylaw, as amended from time to time.

T.1.2 Security Deposits

(a) Security deposits must be provided to the **District** in the form of cash, bank draft, irrevocable letter of credit, or another form acceptable to the **District,** as follows:

(i) 125% of the awarded tender value (or the **Owner's Engineer**'s estimate if the project has not been tendered) for the engineering, design, quality assurance, contingency, construction and installation of the **work**s; plus

(ii) 150% of the **Owner's Engineer**'s fee for the design and inspection of the **work**s as estimated by the **Owner's Engineer**; plus

(iii) the value calculated and in a form acceptable to the **District** to warrant for the maintenance in accordance with **TABLE** T-1 Maintenance Security Table; plus

(iv) $2000 per sheet for drafting deficiencies.

T.1.3 Maintenance Security Deposit

(a) A maintenance security deposit must be provided to the **District** in the form of cash, bank draft, Irrevocable Letter of Credit or another form acceptable to the **District**, in accordance with the following table:

TABLE T-1-MAINTENANCE SECURITY TABLE [1]	
Description	**Maintenance Security**
Fee Simple Subdivisions (on site **work**s)	$580 per **parcel** or 5% of value of **work**s whichever is greater
Bare Land Strata **development**s	5% of the value of **offsite work**s 2
Offsite **work**s for **subdivision** or **development**	5% of value of capital costs [2]
Deficiencies and/or defects	200% of the estimated cost to **repair** [3]
Building Permits	5% of value of capital costs

[1] more than one of the items contained in the Maintenance Security Table may apply to any **subdivision** or **development**.

[2] five percent (5%) or one thousand dollars ($1,000.00), whichever is greater, of the cost of designing, constructing and installing the **works** required under this Bylaw, as submitted by the **Owner's Engineer** and as approved by the **District Engineer**.

[3] two hundred percent (200%) of the cost to **repair** deficiencies and defects as estimated by the **Owner's Engineer** and as approved by the **District Engineer**.

Deleted and replaced by Bylaw 1262, 2024

T.1.4 Cash in Lieu

(a) Notwithstanding Schedule S-Forms, Agreements and Certificates, subsection S.1.3 ,the District Engineer may require an Owner to provide a non-refundable payment in lieu (cash-in lieu) of constructing or installing all, or a portion of, works and services required under the provisions of this bylaw where, as determined by the District Engineer, such works may be undertaken at a future date or concurrently with other works and services in connection with the development of land.

(b) Cash-in-lieu payments:

(i) will be established through a Subdivision and Development Servicing Agreement between the Owner and District;

(ii) will be deposited into a reserve fund for the future construction or installation of works and services;

(iii) are due before the approving officer approves of the subdivision or the building inspector issues the building permit;

(iv) will not exceed an amount greater that 125% of the costs of design and construction at the time of entering into an agreement, plus any required land acquisition costs.

(v) will be determined by the District Engineer using sound engineering principles and will be based on cost estimates prepared by the Owners Engineer submitted to the District Engineer for acceptance.

T.1.5 Excess or Extended Capacity (Latecomer)

(a) Pursuant to the *Local Government Act*, the **District Engineer** may require the **Owner** to provide excess or extended services to provide access to or to service land other than the **parce**l being **subdivided** or **developed**. Where excess or extended services are required, the **Owner** shall provide additional documentation as requested by the **District Engineer** to assist in making a determination. Such information may include, but is not limited to, drawings that define catchment areas, design drawings, a traffic impact analysis and **onsite** utilities impact analysis.

(b) Where the **Owner** is required to provide excess or extended services, the **Owner** shall be entitled to receive latecomer payments in accordance with the **District's** Latecomer Policy.

Section T.2 deleted and replaced by Bylaw 1161, 2021

T.2 **Fees**

T.2.1 Fees shall be applicable as per the **District** Fees Bylaw as amended from time to time.