

BYLAW NO. 1170

A bylaw to regulate and require the provisions of works and services.

“**WHEREAS** Council may, by bylaw, regulate and require the provisions of works and services in respect to any subdivision of land within the Town of Creston.

AND WHEREAS the Council of the Town of Creston requires the provisions of works and services as a condition of issuing a building permit;” BL #1420

NOW THEREFORE the Council of the Town of Creston, in open meeting assembled, enacts as follows:

1. TITLE

This bylaw may be cited as the “Town of Creston Works and Services Bylaw No. 1170, 1990”.

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2. REPEAL

The "Subdivision Bylaw of the Municipality of Creston, No. 647, 1974 all amendments thereto, is hereby repealed.

3. SCHEDULES

3.1 Schedule "A" - Design Criteria, Specifications and Standard Drawings - is attached hereto and forms a part of this bylaw.

3.2 The following is a list of Appendices attached hereto for the purpose of providing information only and which do not form a part of this Bylaw:

Appendix "A" - Drawing Submissions - Acceptable Standards
Appendix "B" - Typical Servicing Agreement

BL #1287

4. DEFINITIONS

In this bylaw, unless the context otherwise requires:

"Accepted" means as accepted by the Approving Officer or Building Inspector.

"Approval" means written approval of a subdivision by the Approving Officer or issuance of a building permit by the Building Inspector.

"Approving Officer" means a person appointed as an Approving Officer for the Town of Creston.

"Building Inspector" means a person appointed as a Building Inspector for the Town of Creston.

"Community Drainage System" means a system of works owned, operated and maintained by the municipality, designed and constructed to control the collection, conveyance and disposal of surface and other water.

"Community Sanitary Sewage System" means a system owned, operated and maintained by the Municipality for the collection and disposal of sanitary sewage.

"Community Water System" means a system of waterworks, within the meaning of the Health Act, which is owned, operated and maintained by the Municipality.

"Considered" means considered for acceptance by the Approving Officer or Building Inspector.

"Contractor" means the person or persons or the company undertaking the construction of works in a subdivision or development and/or on municipal property, or their employees, subcontractors or other duly authorized representative.

“Developer” means the owner of land or the holder of a bona-fide interim agreement or option to purchase land, who has made application to the municipality for or is engaged in undertaking the development of such land and shall include his duly authorized representative.

“Developer’s Engineer” means the Professional Engineer engaged by the Developer to design and/or prepare drawings for the construction of works in a subdivision, development, and/or on municipal property, or his duly authorized representative.

“Highway” means and includes any street, road, lane, sidewalk, walkway, bridge, viaduct and any other way open to the use of the public, but does not include a private right-of-way on private property.

“Lane” means a narrow highway which provides vehicular access to any abutting parcel, so that the parcel may be serviced or accessed by vehicles using that highway.

“Medical Health Officer” means the official appointed under the Health Act who has jurisdiction over the area in which the subdivision is located.

“Municipality” means the Town of Creston.

“Owner” means a person registered in the Land Titles Office as owner of land or a charge on land, whether entitled to it in his own right or in a representative capacity or otherwise, and includes “registered owner”.

“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 or portion thereof.

“Potable Water” means water which is accepted for drinking purposes by the Medical Health Officer.

“Professional Engineer” means a person who is registered or duly licensed as such, under the provisions of the “Engineering Profession Act” of the Province of British Columbia.

“Road” shall have the same meaning as highway.

“Sanitary Sewer” - see Community Sewer System.

“Sidewalk” means a narrow portion of a highway designed specifically for pedestrian traffic, and which may or may not be separated by a boulevard from that portion of the highway designed for vehicular traffic.

“Subdivision” means the division of land into two or more parcels, whether by plan, apt descriptive words, or otherwise.

“Walkway” means a narrow pathway for the predominant use of pedestrian traffic.

“Water System” - see Community Water System.

“Works and Services” means any public service, facility or utility which is required or regulated by this Bylaw and without restricting the generality of the foregoing includes: the supply and distribution of water; collection and disposal of sanitary sewage and drainage water; street lighting; highways; curbs, gutters, and sidewalks; and natural gas, power, telephone and cable vision services.

“Works Superintendent” means the Works Superintendent of the Town of Creston or a duly authorized representative of the municipality.

“The Work” means and includes anything and everything to be done for the setting out, the execution and fulfilment of the Specifications in this bylaw.

“Zone” means a zone as provided for in the Zoning Bylaw of the Town of Creston and amendments thereto.

All other words or expressions used in this bylaw shall have the same meaning assigned to them as like words or expressions contained in the Land Title Act and the Municipal Act.

5. GENERAL PROVISIONS

5.1 Severability

The provisions of this bylaw are severable. If any provision is for any reason held to be invalid by the decision of any court of competent jurisdiction, such decision shall not affect the validity of the remaining provisions of this bylaw.

5.2 Administration

This bylaw shall be administered by:

- (a) The Approving Officer of the Town of Creston where works and services are to be provided because of subdivision of land; or
- (b) The Building Inspector of the Town of Creston where works and services are to be provided pursuant to Section 989(4), (5) or (6) because of an application for a building permit; or
- (c) Some other officer appointed by Council.

5.3 Record Kept

- (a) The Approving Officer shall maintain a record of all applications submitted under this bylaw with respect to subdivisions, which record shall indicate the final disposition of all such applications thereon.
- (b) The Building Inspector shall maintain a record of all occasions when the provisions of this bylaw are used under Section 989(4), (5) or (6) of the Municipal Act to require the provision of works and services in accordance with the standards of this bylaw, and this record will show what works and services were provided and where.

5.4 Authorization for Entry

Employees of the municipality are hereby authorized to enter at all reasonable times upon any property or premises to inspect the same in connection with their duties under this bylaw and to ascertain whether the provisions of this bylaw are being complied with.

5.5 Measurements

All measurements in this Bylaw are expressed in the Metric System.

5.6 Compliance with Other Regulations

- (a) Applications for subdivision will be reviewed for compliance with the requirements of this bylaw and other Municipal and Provincial legislation. However, nothing contained in this Bylaw shall relieve the owner of a subdivision from the responsibility to seek out and comply with legislation applicable to his undertaking.
- (b) No subdivision shall be approved which would cause any existing building or structure, sewage disposal installation or used source of potable water to contravene any setback established by a zoning, building or other regulation in force, except where the setback is in respect of a highway.

6. REQUIRED WORKS AND SERVICES

6.1 Dedication of Land for Highways

Throughout the municipality, the subdivider or developer shall provide land for highways without compensation as set out below. Additional width may be required pursuant to Section 995(2) of the Municipal Act.

- (a) for motor vehicle use, land not exceeding 20 metres in width; or
- (b) to widen an existing local highway that borders on or is within the subdivision or development,

- (i) 10 metres in width; or
 - (ii) the difference between the current width of an existing highway and 20 metre, whichever is less.
- (c) for motor vehicle use, lanes not exceeding 6 metres in width, where lanes are deemed necessary pursuant to Section 75(1)(d) of the Land Title Act.
- (d) for walkways, land not exceeding a width of 3 metres.

6.2 Roads

Highways and boulevards, and sidewalks and walkways as required by the Approving Officer, shall be provided in all subdivisions and developments, and they shall be constructed in accordance with and otherwise meet the standards set in the Schedules to this bylaw.

6.3 Water

All subdivisions and developments shall have a water system and fire hydrant system connected to the community water system, except where the Approving Officer deems such connection to be unavailable, in which case each newly created parcel within the subdivision or development shall be provided with a source of potable water which meets the standards set in the Schedules to this bylaw.

6.4 Sewage

All subdivisions and developments shall have a sewage collection system connected to the community sanitary sewer system except where the Approving Officer deems such connection to be unavailable, in which case each newly-created parcel within the subdivision or development shall be provided with suitable soil and a sewage disposal system which meets the standards set in the Schedules to this bylaw.

6.5 Drainage

In all subdivisions and developments where a drainage system is required, such system shall be constructed in accordance with and otherwise meet the standards set in the Schedules to this bylaw.

6.6 Street Lighting

In all subdivisions and developments where a street lighting system is required, said street lighting shall be constructed in accordance with and otherwise meet the standards set in the Schedules to this bylaw.

6.7 Underground Wiring

Underground wiring shall be provided in all subdivisions and developments and constructed in accordance with and otherwise meet the standards set in the Schedules to this bylaw.

6.8 Overhead Wiring

Overhead wiring may be considered at the discretion of the Approving Officer for some subdivisions; and, where such overhead wiring is accepted, it shall be constructed in accordance with and otherwise meet the standards set out in the Schedules to this bylaw.

6.9 Natural Gas

Natural gas service may, at the owner's option, be provided for some subdivisions; and, where such natural gas service is to be provided, it shall be constructed in accordance with and otherwise meet the standards set in the Schedules to this bylaw.

7. SECURITY

7.1 Building Permit

Where all works and services required to be constructed or installed at the expense of the subdivider are not constructed or installed, security in the form of a cash deposit or an irrevocable letter of credit from a financial institution acceptable to the municipality, in the amount of 120% of the estimated construction cost as estimated by the Approving Officer shall be deposited with the municipality prior to the Building Inspector's issuance of the building permit.

7.2 Subdivision

Where all works and services required to be constructed or installed at the expense of the developer pursuant to Section 989(4), (5) or (6) of the Municipal Act are not constructed or installed, security in the form of a cash deposit or an irrevocable letter of credit from a financial institution acceptable to the municipality, in the amount of 120% of the estimated construction cost as estimated by the Approving Officer, shall be deposited with the municipality prior to the Approving Officer granting approval for the subdivision.

8. FEES

8.1 Pursuant to Section 988(4) of the Municipal Act, a fee of Twenty-five Dollars (\$25.00) for the first parcel created by subdivision and Ten Dollars (\$10.00) for each additional parcel is payable to the municipality.

9. PENALTY

9.1 Any person who is deemed upon summary conviction to be in contravention of this bylaw shall be liable to a penalty of not more than Two Thousand Dollars (\$2,000.00).

10. ADOPTION

READ A FIRST TIME THIS 5th day of November, 1990.

READ A SECOND TIME THIS 5th day of November, 1990.

READ A THIRD TIME THIS 5th day of November, 1990.

RECONSIDERED AND ADOPTED THIS 19th day of November, 1990.

Lela Irvine
Mayor

Wm. F. Hutchinson
Clerk

TOWN OF CRESTON WORKS AND SERVICES BYLAW NO. 1170
SCHEDULE "A"

BL #1644

Design Criteria, Specifications and Standard Drawings

A.1 REQUIREMENT

- 1(1) Schedule "A" to the Town of Creston Works and Services Bylaw identifies the Design Criteria, Specifications and Standard Drawings acceptable to the municipality and is to be referred to BL #1644
- in the design;
 - incorporated in the construction;
 - and is a condition of the acceptance of the Engineering Works
- in subdivisions, developments, and on municipal properties or rights-of-way within the municipality.

A.2 NON-MUNICIPAL CODES AND STANDARDS

- 2(1) Where non-municipal codes and standards, such as A.S.T.M., C.S.A., A.W.W.A., etc., are referred to in this Schedule, the latest adopted revision, including amendments, of these codes and standards at the date of commencement of construction shall apply, except that the Approving Officer may vary requirements under certain circumstances in the interest of public health or safety.
- 2(2) When references to the following capitalized abbreviations are made, they refer to Specifications, Standards or Methods of the respective Association.

AASHTO	American Association of State Highway and Transportation Officials
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
AWS	American Welding Society
BCBC	British Columbia Building Code
CEC	Canadian Electrical Code
CEMA	Canadian Electrical Manufacturers Association
CGSB	Canadian General Standards Board
CSA	Canadian Standards Association
CSPI	Corrugated Steel Pipe Institute
IES	Illumination Engineering Society
LEMA	Lighting Equipment Manufacturers Association
NBC	National Building Code of Canada
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
RTAC	Road and Transportation Association of Canada
WCB	Workers' Compensation Board

PART B HIGHWAYS

B.1 INTRODUCTION

1(1) All roads in the municipality shall be designed in accordance with the recommended practice as outlined in "Geometric Design Standards for Canadian Roads and Streets" as published by the Canadian Roads and Transportation Association (RTAC) or as stated elsewhere in this Schedule, or as accepted.

1(2) List of Standard Drawings

The following drawings pertain to PART B - Highways:

<u>Title</u>	<u>No.</u>	<u>Title</u>	<u>No.</u>
Local urban Road	R-1	Culvert Installation	R-11
Cul-de-Sac	R-2	Paved Lane	R-12
Collector, Urban	R-3	Hydrant Access Path	R-13
Local Rural	R-7	Separate Sidewalk	R-14
Collector Rural	R-8	Sidewalk Crossing for	
Curb and Gutter	R-9	Barrier Curb	R-15
Paved Walkway	R-10	Transition Curb	R-16
		Wheelchair Ramp	R-17

B.2 HIGHWAY CLASSIFICATIONS

2(1) Roadway classification throughout the municipality shall be as determined by the Approving Officer. In determining classification and acceptability, the Approving Officer shall take into consideration the Community Plan and the local conditions in which the development is situated.

2(2) The following are the classifications of roadways within the municipality:

Arterial Canyon Street, Northwest Boulevard, Erickson Street, 16th Avenue and 17th Avenue.

Collector Collector streets provide traffic service functions. The traffic service function of this type of street is to carry traffic between local and arterial streets. Within the municipality, these roads form a "grid road" system. Collector roads are further subclassified into urban and rural.

Local The main function of a local street is to provide land access. Direct access is allowed to all abutting properties. Local streets are not intended to move large volumes of traffic; trip lengths are short, generally under 0.75 km in length. Local streets are further subclassified into major and minor, urban and rural.

Cul-de-sacs Cul-de-sacs shall be classified as local streets and none shall exceed a length of 150 metres unless otherwise accepted.

Lanes Lanes shall provide service access to commercial areas or as an extension of any existing system of lanes. Lanes shall not exceed a length of 150 m unless otherwise accepted.

Walkways Otherwise known as “leisure walkways”, these shall provide pedestrian access to parks and open public areas.

Sidewalks These are functional walkways to provide pedestrian access to transit, shopping and school sites.

Commercial, Industrial, Multi-Family Residential (etc.)

Where a road is located in or directs traffic to or through a commercial, industrial, multi-family residential area, additional standards may be required in accordance with the Schedule and as a condition of acceptance by the Approving Officer.

B.3 DESIGN PARAMETERS

3(1) Design Speed

- (a) Unless otherwise accepted, roads shall be designed to the following minimum standards as specified in the Roads and Transportation Association of Canada Geometric Design Standards for Canadian roads and Streets Manual:

Arterial	70 km/h
Collector	60 km/h
Local	50 km/h

3(2) Right-of-Way and Roadway Widths

BL #1287

- (a) Rights of way and roadway widths (pavement) shall be as follows: however, the Approving Officer has the authority to require more width if he deems that terrain, development or traffic flow will so warrant.

BL #1287

Collector

Urban:

Minimum Right of Way	20.0 metres
Pavement Width	14.0 metres

BL #1644

Local

Urban:

Minimum Right of Way	15.0 metres
Pavement Width	11.0 metres

BL #1644

Walkway

Minimum Right of Way	3.0 metres
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- (b) The developer shall dedicate sufficient right-of-way to cover all road embankments and comply with the provisions and outlined in Section 7 “Security” of the Works and Services Bylaw, or complete all road construction and site grading prior to registration of the subdivision plan.

3(3) Horizontal Alignment

(a) Curvature

The minimum required centerline radius for various superelevation rates for each classification of roadway are as follows. All designs are to be in accordance with RTAC Standards.

Minimum Horizontal Curb Radii:

Roadway Classification	No Superelevation	Horizontal Curve Radii Superelevation (m/m)		
		.02	.04	0.06
Arterial	as per Ministry of Transportation & Highways standards			
Collector	120	110	100	---
Local	65	---	---	---

- (i) Spiral transition curves and superelevation will be required for arterial roadway designs while collector and local streets may be designed using simple curves.
- (ii) The maximum superelevation rate for arterials shall be 0.06 m/m and collectors 0.04 m/m. No superelevation will be permitted on local streets.

(b) Curb Return Radii (in metres)

<u>Road Classification</u>	<u>Return Radii</u>
Arterial	9
Collector	8
Local (Major)	8
Local (Minor)	6
Cul-de-sac	8
Industrial	9

- (i) A cul-de-sac bulb shall have a curb-to-curb radius of 10.7 m.
- (ii) All roadways shall be constructed using a 2% centerline crown, except under adverse topographic conditions. Offset crowns may be permitted for local or collector streets at the discretion of the Approving Officer, in which case the location of the crown shall be approximately 2.5 metres from the high side curb with a minimum cross slope of 2% and a maximum cross slope of 4%.

- (iii) Overall curb-to-curb crossfalls will not be permitted except in cases where superelevation is required.
- (iv) Lanes shall be constructed using an inverted 2% crown.

3(4) Vertical Alignment (Roadway Grades)

- (a) Minimum grades for urban and rural roadways shall be 0.50%.
- (b) Maximum roadway grades:

<u>Roadway Classification</u>	<u>Maximum Grade</u>
Arterial	8%
Collector	9%
Local	9%
Cul-de-sac (uphill)	9%
Cul-de-sac (downhill)	8%
	6% through bulb
Industrial	9%
Lanes	9%

- (c) Consideration may be given to allowing increased grades where short sections of steeper grades can be utilized to improve the geometric design of intersections for increased safety. The Approving Officer may accept up to a maximum of 12% at his discretion.

3(5) Vertical Curvature

- (a) Vertical curves shall be designed to provide safe stopping sight distances and shall be provided where centerline grade change is in excess of 1%. Stopping sight distance is the distance separating a vehicle from an object, measured the instant that an object (for which the driver decides to stop) comes into view. Minimum stopping sight distance is the least distance required to bring the vehicle to a stop, under prevailing vehicle and climatic conditions. Vertical curve length is calculated by the equation $L=KA$:

Where

- L = length of the vertical curve
- K = a constant related to lines and geometry of a parabolic curve
- A = algebraic difference in grades in percent

- (b) All vertical curves are to be symmetrical.

(c) Minimum K Values for Vertical Curve Design:

Roadway Classification	Crest Curve		Sag Curve	
	Minimum	Desirable	With Street Lighting	Without Street Lighting
Collector	10 m	15 m	9 m	20 m
Local	7 m	10 m	6 m	9 m
Arterial	as per Ministry of Transportation & Highways Standards			

3(6) Intersections

(a) Design Standards

Unless indicated elsewhere herein, all intersection design standards shall conform to those outlined in the “Geometric Design Standards for Canadian Roads and Street” as published by the Roads and Transportation Association of Canada.

(b) Intersection Grades

- (i) Approach grades of minor roads at intersection to major streets shall not exceed 75% of the maximum allowable road grade for that street classification.
- (ii) Consideration may be given to increased approach grades where topographic or other conditions dictate the use of maximum or near maximum grades.
- (iii) Minimum K values for vertical curves on minor roads at intersections:

<u>Minor Intersecting Street</u>	<u>Minimum K Value</u>	
	<u>Crest Curve</u>	<u>Sag Curve</u>
Collector	7 m	6 m
Local	4 m	4 m

- (iv) Grades of major roads through intersecting minor approaches shall be constant and shall not exceed 75% of the maximum allowable grade for that street classification. Consideration may be given to allowing increased grades where topographic or other conditions dictate the use of maximum or near maximum grades.

3(7) Road Base

- (a) Minimum road base requirements:

<u>Road Classification</u>	<u>Sub-base Thickness</u>	<u>Base Thickness</u>	<u>Asphalt Thickness</u>
Arterial	450 mm	150 mm	100 mm
Collector	450 mm	150 mm	75 mm
Local	400 mm	150 mm	50 mm
Cul-de-sac	400 mm	150 mm	50 mm
Industrial	400 mm	150 mm	75 mm
Commercial	400 mm	150 mm	75 mm
Lane	400 mm	150 mm	50 mm

- (b) Road base requirements refer to both rural and urban road classifications.
- (c) Increases in sub-base thickness where poor soil conditions exist shall be at the discretion of the Approving Officer.

3(8) Sidewalks and Walkways

- (a) Minimum Sidewalk Requirements and Widths:

<u>Road Classification</u>	<u>Requirement</u>	<u>Width</u>	<u>Curb Type</u>
Arterial	One Side	1.8 m	non-mountable
Collector Urban	One Side	1.5 m	non-mountable
Local Urban	One Side	1.5 m	mountable
Cul-de-sa	One Side	1.5 m	mountable
Walkway	--	1.5 m	--

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- (i) Additional sidewalks shall be installed in areas deemed necessary by the Approving Officer. Such cases may include areas with multi-family, institutional and commercial development and proposed bus routes.
- (ii) Where a walkway exists on a cul-de-sac, a sidewalk 1.5 metres in width shall be extended to the walkway entrance.

BL #1644

- (b) Sidewalks shall at all times drain towards the gutter with a cross slope of 2 %.
- (c) Wheelchair ramps shall be installed at all intersections and at crosswalks.

- (d) Where non-mountable curbing is used, access to properties shall be in the form of Sidewalk crossings and shall conform to municipal standards. Breaks in the sidewalk and use of curb returns for access will not be permitted. Widths for crossings may vary depending on the development's requirements, minimum crossing width for residential driveways shall be 6 metres.
- (e) Where mountable curbing is used, sidewalk crossings will not be required and access shall be directly over the sidewalk. Transition from mountable to non-mountable curbing shall in all cases be made at the nearest wheelchair ramp.
- (f) Sidewalks and walkways shall be designed to provide an overall pedestrian traffic system throughout the area, and locations shall be subject to the acceptance of the Approving Officer.
- (g)
 - (i) Walkway patterns in newly-developed areas shall be designed on the basis of functional and leisure usage and shall be subject to the acceptance of the Approving Officer.
 - (ii) Leisure walkways for pedestrian access to and in parks and open public areas shall be constructed to municipal specifications to a full 1.5 metre width with a minimum of 100 mm pit-run gravel base and surfaced with a minimum of 50 mm compacted crushed shale or gravel.
 - (iii) Fencing of walkways shall be the responsibility of the developer in accordance with municipal standards.
 - (iv) Walkways shall be graded and constructed to the full width between property lines to provide proper access and drainage.
- (h)
 - (i) Sidewalks for pedestrian access to transit, shopping and school sites shall be constructed to municipal specifications to a full 3 metre width with a minimum of 100 mm pit-run gravel base and surfaced with a minimum of 50 mm asphaltic concrete.
 - (ii) Where sidewalk grades exceed 15%, the applicant shall construct steps to a standard acceptable to the Approving Officer.

3(9) Boulevards and Restoration

- (a) Unless otherwise accepted, all boulevards shall be graded to drain to the curb at a minimum slope of 2% and a maximum slope of 10%.
- (b) The top 100 mm of soil shall be good quality topsoil raked free of any debris which is not conducive to the growing of grass.
- (c) Quantities and combinations of landscaping materials shall be submitted to and accepted by the Approving Officer prior to installing such materials.

3(10) Geotechnical Requirements

- (a) The developer's engineer shall ensure that the structural integrity of the on-site soils are adequate to accommodate the expected loading by providing a geotechnical evaluation prepared by a qualified geotechnical engineer.
- (b) Modifications to the municipality's road base requirements shall be as outlined in Section B.3(7) "Road Base".

3(11) Street Names

Street names for new streets shall be designated by the Town of Creston, which shall have absolute discretion in this regard.

B.4 MATERIALS

4(1) Roadway Embankment Materials

Earthfill for roadway embankment shall be native material with the exception of overburden topsoil and rockfill. Earth fill shall be capable of being compacted to form a stable embankment, and shall be free of organic or deleterious material.

4(2) Select Granular Sub-Base Material

- (a) Select granular sub-base material shall be a pit-run gravel or crushed gravel, screened if necessary, composed of inert, durable aggregate, uniform in quality and free from soft or disintegrating particles, clay or silt balls, organic material or other deleterious material, and shall be well-graded from coarse to fine particles within the following gradation limits:

<u>Screen Size</u>	<u>Percent Passing</u>
75 mm	100
25 mm	60 - 85
No. 4	30 - 60
No. 200	2 - 10

- (b) That portion of the aggregate which passes the No. 40 sieve shall have a liquid limit of not more than 25 and a plasticity limit of not more than 6.

4(3) Crushed Granular Base Material

- (a) Crushed granular base material shall be screened if necessary, and composed of inert, durable aggregate, uniform in quality and free from soft or disintegrating particles, clay or silt balls, organic material or other deleterious material, and shall be well graded from coarse to fine particles within the following gradation limits:

<u>Screen Size</u>	<u>Percent Passing</u>
19 mm	100
12.5 mm	70 - 100
No. 4	40 - 80
No. 8	30 - 60
No. 16	20 - 45
No. 50	8 - 20
No. 200	2 - 8

- (b) Not less than 60% of the material retained on the No. 4 sieve shall be crushed particles with at least one fractured face. That portion of the material which passes the No. 40 sieve shall have a liquid limit of not more than 25 and a plasticity limit of not more than 6.

4(4) Hot Mix Asphaltic Concrete

- (a) Hot mix asphaltic concrete design mix shall be prepared by a Professional Engineer and satisfy the following criteria, in accordance with ASTM D-1559, Marshall Test Procedure:
- | | |
|---------------------------------|---------|
| - Blows per face | 50 |
| -Marshall stability, kg at 60°C | 450 |
| -Flow index, mm | 8-14 |
| -% voids in mineral aggregate - | |
| - 20 mm max. | 14 min. |
| - 12.5 mm max. | 14 min. |
| -% voids in total mix | 3-5 |
| -% voids filled with asphalt | 78-85 |
- (b) Prime coat shall be MC-O (MC-30) or as accepted.
- (c) Asphalt cement shall be prepared by refining petroleum, uniform in character. It shall not foam if heated to 177°C, and shall conform to grade 120-150 penetration when tested in accordance with ASTM-D5.
- (d) Tack coat shall be RC-0 (RC-30) or as accepted.
- (e) (i) Coarse mineral aggregate shall consist of hard, clean, durable, crushed aggregate, in conformance with ASTM D692.
- (ii) Fine mineral aggregate shall consist of natural sand or hard, clean, durable crushed aggregate.
- (f) Gradation of mineral aggregate, graded in accordance with ASTM C136 shall conform to the following and shall form a smooth concave-shaped curve when plotted on a semi-log chart:

<u>Sieve Size</u>	<u>% Passing Base Course</u>	<u>Surface Course</u>
19.0 mm	100	---
12.5 mm	75-90	100
9.5 mm	62-82	78-94
No. 4	44-63	58-60
No. 8	---	52-74
No. 10	31-50	42-64
No. 20	23-41	28-48
No. 40	17-34	19-38
No. 100	10-20	10-24
No. 200	3-10	5-14

4(5) Concrete

- (a) The design of concrete mixes shall be prepared by a Professional Engineer and shall suit the local site conditions.
- (b) Cement shall be normal Portland Cement Type 10 or sulphate resistant Portland Cement Type 50, conforming to CSA A.5.
- (c) Water and aggregates shall conform to CSA A.23.1 Air entraining admixtures shall conform to CSA A.266.1 Chemical admixtures shall conform to CSA A.266.2 and shall be used only if accepted.
- (d) Concrete for curb and gutter and sidewalks shall be ready mix concrete designed to achieve a 28-day compressive strength of 25 mPa, with a maximum aggregate size of 25 mm, air entrainment 5-7%, water/cement ration 0.50 maximum and slump of 25-75 mm. Pre-molded expansion joint filler material shall be minimum 13 mm thick, cut to suit.

B.5 INSTALLATION

5(1) General

- (a) Copies of compaction test results, granular materials, sieve analyses, asphaltic concrete and concrete design mixes, asphaltic concrete and concrete test results shall be submitted.
- (b)
 - (i) The working area and haul roads shall be maintained in an orderly fashion and shall not be encumbered with equipment, materials or debris.
 - (ii) Dust control shall be maintained at all times by watering or other accepted means.
 - (iii) The work shall be scheduled such that disruption of normal traffic and inconvenience to residents shall be kept to a minimum.

- (c) Proof rolling of the sub-grade, sub-base or base course may be required by the Approving Officer.

5(2) Clearing and Grubbing

The roadway right-of-way shall be cleared and grubbed of all standing or fallen trees, brush, timber, stumps or other debris and organic materials and these materials shall be disposed of by burning or other accepted means. Burning shall be done in accordance with the BC Forest Act and Municipal Bylaws. Topsoil and overburden shall be stripped to a minimum depth of 300 mm.

5(3) Grading

The entire roadway right-of-way width shall be graded to the approved profile and cross-section, and uniformly compacted to a minimum 98% Standard Proctor. The complete profile and cross-section shall be accurate to a tolerance of 30 mm, with no soft, spongy or unstable areas, and free from ruts, waves and undulations.

5(4) Select Granular Sub-base

Select granular sub-base material shall be placed on dry, firm sub-grade, and compacted in uniform layers not exceeding 150 mm in un-compacted thickness, to a minimum 100% Standard Proctor. The completed profile and cross-section shall be accurate to a tolerance of 15 mm, free from ruts, waves and undulations.

5(5) Crushed Granular Base

Crushed granular base course material shall be placed on dry, firm sub-grade, and compacted in uniform layers to a minimum 100% Standard Proctor. The completed profile and cross-section shall be accurate to a tolerance of 12 mm, free from ruts, waves and undulations.

5(6) Culverts

- (a) Culverts shall be concrete or galvanized corrugated steel pipe designed for H20 loading for local roads and HS25 loading for arterial and collector roads in accordance with A.A.S.H.O.
- (b) Culvert sizes shall be designed for the anticipated run-off, 25 year return, and shall be minimum 375 mm diameter. Driveway culverts shall be a minimum 7 metres long.
- (c) Culverts shall be installed to true line and grade, with a minimum 300 mm bury. End walls shall be riprapped.

5(7) Boulevards

Boulevard areas lying between the curb and property line of the road right-of-way shall be graded to drain to the curb, and fill sections shall be compacted. The topsoil shall be raked free of roots and other debris.

5(8) Curb and Gutter, Sidewalks

- (a) (i) All concrete work shall conform to the applicable CSA Standards. All curb and gutter and sidewalk shall be plant mixed Portland Cement concrete installed to true line and grade, placed on dry, firm, granular base course. Alternative materials and methods of construction such as extruded curb and gutter may be considered.
- (ii) Concrete placed in forms shall be consolidated using mechanical vibration to achieve the required strength.
- (b) Expansion joint material shall:
 - (i) be placed at each expansion joint, construction joint, at the beginning and end of a curve, around all structures such as poles, valve boxes, and hydrants, and adjacent to any building or structure;
 - (ii) have a radius of less than 15 metres.
- (c) (i) Sidewalk crossings for private residential driveways shall be 150 mm thick.
- (ii) Sidewalk crossings for lanes shall be 180 mm thick.
- (iii) Sidewalk crossings in industrial, commercial or multiple dwelling developments shall be 180 mm thick.
- (iv) Curing compound and sealing compound shall be applied according to the manufacturer's recommendations
- (d) Cold weather installation of concrete shall conform to CSA A23.1.19. Hot weather installation of concrete shall conform to CSA A23.1.20.

5(9) Hot-Mix Asphaltic Concrete

- (a) Priming and paving shall be carried out only on dry, smooth, compacted base course. Granular base courses and asphaltic concrete base courses shall be kept clean and uncontaminated until covered. Priming shall include granular and asphaltic base courses, edges of buildings, structures, gutters and pavement, and shall not be carried out when the ambient temperature is less than 10°C.

- (b) Hot-mix asphaltic concrete shall be produced in a batch plant capable of drying and heating the mineral aggregate, heating the asphalt cement and accurately proportioning all materials to produce an asphaltic concrete possessing the required characteristics and within designated tolerances in accordance with ASTM D-99.
- (c) Hauling of asphaltic concrete shall be done in a manner such that the hot-mix material is delivered to the site at the specified temperature and that no damage to surface of roadways occurs.
- (d) Hot-mix asphaltic concrete shall be placed, spread and compacted to produce a true profile and cross section, of the specified thickness and density and with a uniform textured surface, free from roller marks. Minimum final densities shall be:
 - Prior to October 15 - 97% of laboratory design density
 - After October 15 - 98% of laboratory design density
- (e) Test results indicating conformance with the approved detailed design drawings and specifications shall be submitted.

PART C WATER

C.1 INTRODUCTION

- 1(1) Water distribution design and construction shall conform to the requirements of the Provincial Ministry of Health and this Schedule.
- 1(2) The system shall be designed to provide day-to-day domestic requirements and also shall provide adequate flows for fire protection. The required flow shall be the sum of the maximum daily domestic flow plus the required fire flow.
- 1(3) When a private water source is required for land development, the water must be tested and proven safe for human consumption. The Building Inspector will require a copy of the certificate prior to final inspection of any residence building within the development.

1(4) List of Standard Drawings

The following drawings form part of PART C:

<u>Title</u>	<u>No.</u>	<u>Title</u>	<u>No.</u>
Hydrant Access Path	R-13	Water Service Connection	
Encasement Pipe Detail	S-5	Detail	W-4
Trench Details in Gravelled Areas	S-7	Extension Service Box Detail	W-5
Trench Bedding Detail	S-8	Standpipe Detail	W-6
Thrust Blocks	W-1	Watermain Relocation	W-7
Fire Hydrant Assembly	W-2	Butterfly Valve Chamber	W-8
Sewer and Water Services	W-3	Air Release Valve Chamber	W-9

C.2 DESIGN FLOWS

2(1) Per Capita Flows, Fire Flow Demands

- (a) (i) Minimum design flows for domestic demand shall be:
 - Average daily domestic flow - 700 litres/capita/day
 - Maximum daily domestic flow - 2,000 litres/capita/day
 - Peak hour domestic flow - 3,000 litres/capita/day
- (ii) Additional design flows may be required for industrial, institutional or commercial development.
- (b) (i) Fire flows shall be in accordance with the criteria outlined in *Water Supply for Public Fire Protection - A Guide to Recommended Practice* published by Public Fire Protection Survey Services.
- (ii) The following minimum Fire Flows shall be met for the noted development zones:

<u>Zone</u>	<u>Required Fire Flow</u>
Single Family Residential	60 litres/sec
Apartment, Multi-Family	90 litres/sec
Commercial	150 litres/sec
Institutional	150 litres/sec
Industrial	225 litres/sec

- (c) Design populations used in calculating water demand shall be computed in accordance with the municipality's population predictions or with the planned development in the area to be serviced, whichever is larger.

2(2) Pressure and Hydraulic Network Considerations

(a) Water Pressure and Demand

- (i) Unless otherwise accepted, the following standards shall be used:

Minimum pressure at peak demand:	300 kPa
Maximum allowable pressure:	690 kPa
Minimum fire protection residual (At hydrant):	140 kPa

- (ii) As a basic guideline the following criteria may be used:

Design for maximum of (a) fire flows plus maximum day or (b) peak hour.
Hazen-Williams formula to be used.

- (iii) Demand requirements shall be based on the municipality's present water consumption records and the project trends. Demand may vary for different locations within the municipality.
 - (iv) Where there is an existing hydraulic network in place, the municipality will provide information for design calculations.
 - (v) Depending on the complexity and extent of the proposed distribution system, the Approving Officer may require a hydraulic analysis design showing minimum flows and pressures.
- (b)
 - (i) The maximum desirable length of any permanent, non-interconnected watermain shall be 150 metres. Unless otherwise accepted, all mains exceeding 150 metres (unless it is a temporary situation) shall be looped.
 - (ii) In residential areas, watermains servicing fire hydrants shall be 150 mm diameter or larger. Watermains of 100 mm in diameter may be permitted for domestic service on dead-end roads where no further extension is planned. Wherever practical, watermains shall be looped. Dead-end mains are not encouraged.
 - (iii) In commercial, industrial, and institutional areas, the minimum watermain size shall be 200 mm diameter, or as accepted.
 - (c) Watermains shall generally be located in the road right-of-way, 3 metres from centreline, and on the opposite side from the sanitary sewer. When watermains must cross private property, a registered utility right-of-way, of a minimum of 6 meters in width, shall be provided.

- (d) Design of pumping stations and control valving such as pressure reducing valves requires the acceptance of the Approving Officer.

2(3) Cover, Grades, Clearances

- (a) The minimum cover over any watermain shall be 1.8 meters.
- (b) The minimum grade for a main shall be 0.1%. The maximum grade shall be 8.0% unless provisions are made to anchor the pipe to the bottom of the trench with concrete poured in place. Watermain grades shall generally be consistent with the roadway grade.
- (c)
 - (i) The minimum vertical clearance between a watermain and any sewer shall be 500 mm unless the watermain is adequately encased with concrete encasement.
 - (ii) The minimum horizontal clearance between a watermain and any sewer shall be 3 meters unless the watermain is concrete encased or installed in a carrier pipe.

2(4) Valving

- (a) In general, valves shall be located
 - (i) in intersections, in a cluster at the pipe intersection or at the project property lines, to avoid conflicts with curbs and sidewalks:
 - 3 valves at "X" intersection
 - 2 valves at "T" intersectionso that specific sections of mains may be isolated.
 - (ii) not more than 200 meters apart for single family residential. All other zones shall require special designs.
 - (iii) having not more than one hydrant isolated.
- (b) Valves shall be the same diameter as the main. **BL #1420**

2(5) Hydrants

- (a) Fire hydrants shall generally be located at street intersections and shall be installed at a 600 mm off-set from the centre of corner cuts. Where hydrants are required at mid-block locations, they shall be installed opposite property pins at a 600 mm off-set. In no case shall fire hydrant spacing exceed a distance of 100 meters, nor should any residence be more than 100 meters from a hydrant.
- (b) In high density residential, commercial and industrial areas, hydrants shall be spaced at a maximum of 75 meters, or as accepted.

- (c) It shall be the Developer's responsibility to ensure the design and proposed location of the fire hydrants will not conflict with existing or proposed street lights, power poles, etc.
- (d) All hydrants shall be installed with the pumper port facing the street, and in no case shall the port be less than 450 mm above ground level.
- (e) Gate valves shall be installed with a flanged connection at the main to isolate all hydrants.
- (f) Hydrant access paths shall be installed in accordance with municipal standards on all roads with ditches.

2(6) Air Valves, Blow-offs, Chamber Drainage

- (a) Air release valves shall be installed at the summit of all mains of 200 mm diameter and larger except where the difference in grade between the summit and valley is less than 600 mm. Chamber insulation and drainage shall conform to that specified for butterfly valve chambers.
- (b) A 50 mm diameter standpipe shall be installed on all dead-end mains. Standpipes shall be installed at a height of 750 mm above ground.

2(7) Thrust Blocking

Concrete thrust blocking shall be provided at bends, tees, wyes, reducers, plugs, caps and blow-offs. The area of thrust block bearing on pipe and ground shall be as shown on the standard drawings, or as accepted.

2(8) Service Connections

- (a) In addition to the municipal requirements, service connections shall be subject to the requirements of the National Plumbing Code.
- (b) A Corporation Stop and a Curb Stop shall be installed for each connection up to 50 mm diameter. Service connections larger than 50 mm diameter may be installed using a gate valve flanged to the tee at the main, and a gate valve, temporary cap and thrust block at property line.
- (c) The minimum size water service connections shall be as follows:

Residential	20 mm diameter
Other	20 mm diameter

(d) Connections shall be installed up to the property line at a minimum depth of 1.8 meters. All services shall be marked with a 40 x 90 mm stake at the property line with the top 150 mm painted blue. Curb stops shall be located at a 300 mm off-set from property line and shall be extended to ground level.

2(9) Private Water Sources

Where a private water source is required, the water provided must be potable water certified for drinking purposes by the Medical Health Officer. Certification must clearly state whether or not the water tested meets the Provincial standards on both chemical analysis and coliform count.

C.3 MATERIALS

3(1) Pipe

The materials outlined below shall be considered acceptable for installation throughout the municipality. Consideration may be given to the use of alternate materials for major trunk mains.

<u>Material</u>	<u>Range Size (mm)</u>	<u>Specification</u>	<u>Use</u>
soft copper	19-50	ASTM, B88, Type K	service connection
*ductile iron	150 +	AWWA C151 Class 50 minimum, cement-lined	distribution and trunk mains
polyvinyl chloride	100 - 450	AWWA C900 (bell & spigot joints)	distribution mains and service connections

*When D.I. pipe is specified, it shall be installed utilizing adequate corrosion protection techniques.

3(2) Pipe Joints

- (a) Jointing of pipe shall be in accordance with the manufacturer's recommendations.
- (b) A flexible joint shall be provided at locations where the pipe is held in a fixed position by a rigid structure or support.
- (c) Unless otherwise accepted, the amount of pipe deflection at joints and couplings shall not exceed 3 degrees, or one-half the limit specified by the manufacturer, whichever is less.

3(3) Valves, Valve Boxes and Fittings

- (a)
 - (i) Solid wedge or double disc gate valves manufactured in Canada with non-rising stems, conforming to AWWA C500 specifications combined with extension spindles and valve boxes shall be installed on all watermains up to and including 300 mm in diameter.
 - (ii) Where air release valves are required, they shall be double-acting, vacuum type, with cast iron bodies and 0.86 Mpa flanges. A butterfly valve shall be installed beneath each air valve assembly. All air release valves shall be protected from frost by insulating the valve chambers.

- (b) Valve boxes shall be Robar, or as accepted, and shall be locking unless otherwise accepted. Valve box risers shall be ductile iron, PVC or fibre pipe as accepted, suitable for the valve and valve box.
- (c) (i) Fittings for ductile iron or PVC pipe shall be:
 - cast iron fittings manufactured to AWWA c110 designed for a working pressure of 1035 kPa, or
 - asphalt coated ductile iron compact fittings manufactured to ANSI/AWWA C153/A21.53-84.
 - polyvinyl chloride (PVC) pressure fittings AWWA C907 **BL #1420**
- (ii) Mechanical seal joints on fittings to pipe shall be formed by a bell and preformed rubber gasket suitable for the pipe to which the joint is made.
- (iii) Flanged joints on fittings shall be flat faced conforming in dimension and drilling to ANSI B16.1.
- (iv) Ends shall be flanged or belled to suit pipe ends.

3(4) Hydrants

- (a) Compression type Hydrants shall conform with AWWA Specification C502 and shall be flanged at 50 mm above the ground line. Hydrants shall have two 65 mm nominal diameter hose ports and one 100 mm nominal diameter pumper port with quick connect STORZ fitting. All ports to be complete with caps. Nozzle threads shall conform with British Columbia Fire Hose Thread Specification.
- (b) Hydrant stems shall be turned counterclockwise to open. Stem seals shall be resilient "O-Ring".
- (c) Hydrant extensions shall be supplied complete with nuts, bolts, flange gaskets, operator extension and coupling.
- (d) Hydrants shall be installed using flanged joints and shall be held in place by thrust blocks. Tie rods may be permitted for thrust restraint in situations where existing utilities limit the available space for concrete thrust blocks.
- (e) Approved standard 150 mm Hydrants include Canada Valve or Century. **BL#1698**

3(5) Service Connections

- (a) Corporation stops shall be in accordance with AWWA C800, with fitting ends suitable for use with compression fittings unless otherwise accepted.

- (b) Curb stops up to 25 mm diameter shall be inverted key, stop type, as accepted. Curb stops 30 mm diameter and larger shall have an “O-Ring” seal for the inlet port and top of the valve plug as accepted. All curb stops shall have solid tie heads with 13 mm hold for attaching stationary rod, open counterclockwise, have a quarter turn check and be suitable for 1035 kPa working pressure.
- (c) Corporation couplings shall be in accordance with AWWA C800.
- (d) Curb boxes shall be cast iron, and adjustable top, with 1.8 metre stationary rod for 2.5 metre service.
- (e) Copper pipe with flare **or compression** type fittings shall be used for all connections up to 50 mm diameter and polyvinyl chloride or ductile iron for connections 100 mm diameter and larger. Connections of 50 mm diameter may be silver soldered. Service connections between 50 mm and 100 mm in diameter shall not be permitted.

BL #1420

3(6) Pipe Bedding

Pipe bedding specifications shall conform to municipal standards for Class “A”, Class “B” and Class “C” bedding. Pipe bedding selection may vary for different material installed and for different locations within the municipality.

C.4 INSTALLATION

4(1) Excavation, Bedding, Backfill, Restoration

- (a) The trench shall be excavated so that pipe can be laid to the specified alignment and depth with allowance for the specified wall clearances and bedding. Wall clearances shall be minimum 150 mm, maximum 400 mm, from the bottom of the trench to 100 mm above the top of the pipe.
- (b) Bracing, sheeting and trench side slopes shall be in accordance with WCB safety requirements. Dewatering may be required to control trench water.
- (c) Bedding material shall be crushed gravel, sand, select native material or concrete. Bedding shall be compacted to 95% Standard Proctor Density.
- (d)
 - (i) Backfill material shall be select native material or pit-run gravel and shall be placed in such a manner as to prevent damage to the pipe.
 - (ii) Backfill materials in travelled surfaces shall be compacted to 98% Standard Proctor Density, except for the upper 750 mm, which shall be compacted in accordance with the adjacent travelled surface design requirements.
- (e) Surface restoration shall conform to the original condition or as accepted.

4(2) Pipe Laying

- (a) (i) Pipe shall be installed in accordance with the applicable AWWA specifications, the manufacturer's recommendations, and the requirements of this Schedule.
- (ii) Pipes shall be handled with the greatest care and with equipment designed so that no damage occurs to the pipe or fittings.
- (b) Batter boards shall be erected over the trench or trench line at intervals of not more than 20 metres. The centre line of the required pipe line shall be marked on these boards and string or wire stretched between the boards and on this centerline. The pipe shall be kept to proper line by plumbing down from this string line. Each pipe shall be laid to grade by means of batter boards and a boning rod with a shoe which will enter the pipe and stand on the invert. A minimum of 3 batter boards shall be in place at all times during excavation and pipe laying. Sufficient batter boards shall be placed so that sighting is possible along these boards from one manhole to the next. Alternate methods of grading and aligning the pipe may be considered.
- (c) (i) All pipes shall be laid
 - to horizontal line with a tolerance of plus or minus 10 mm of the design line;
 - and grade, with a tolerance of plus or minus 25 mm for water mains and services;
 - with the spigot end pointed in the direction of the flow.
- (ii) The pipes shall be joined in accordance with the manufacturer's recommendations except that joint deflections shall be allowed only up to one-half of the manufacturer's recommended tolerances. Particular care must be taken to see that the ends of the pipes are kept clean. Care shall be taken to properly align the pipe once the joints are forced home. Movement of the pipe once the joint is made shall be kept to an absolute minimum. Jumping or dropping of pipe to obtain grade shall not be permitted.
- (d) Care shall be taken to prevent the entrance of trench water or other material into the pipe during installation.

4(3) Valves, Hydrants and Appurtenances

- (a) Valves shall be installed at the specified locations, in the vertical position. Valve boxes shall be installed plumb, centred over the valve, and such that traffic loads are not transmitted to the valve.
- (b) Hydrants shall be installed at the specified locations, set plumb and such that the pumper port faces, and is at right angles to, the road centerline, unless otherwise accepted. Drain outlets with drain rock shall be provided and kept free of obstructions.

- (c) Fittings shall be installed at the specified locations in accordance with the manufacturer's recommendations.

4(4) Thrust Blocking

- (a) Thrust block bearing areas shall be to municipal standards. Concrete shall be 25 Mpa at 28 days minimum.
- (b) Care shall be taken to ensure that concrete does not interfere with the operation of flange bolts and nuts or prevent proper operation of hydrant drains.

4(5) Service Connections

- (a) Service connections shall be installed at the specified locations and depths with the same tolerances as specified for pipe laying.
- (b) Curb stop boxes shall be set plumb and adjusted to finished grade.

4(6) Testing

- (a) Prior to testing, all new water mains are to be cleaned of debris by passing a line-sized "pig" through the main, or alternatively the main shall be video inspected. Immediately afterwards the pipe ends shall be capped in preparation for testing and disinfection.
- (b) All water mains shall be tested in accordance with the appropriate AWWA specifications and the following criteria:
 - (i) The test pressure shall be 1035 kPa or 1.5 times the operating pressure, whichever is greater. The pressure test shall be maintained for a minimum of two hours.
 - (ii) The allowable leakage shall be determined by the AWWA formulas:

$$L = \frac{N D P}{131,000}^{0.5}$$

L = allowable leakage in litres per hour
N = number of joints in test section
D = inside diameter of pipe in millimetres
P = test pressure in kilopascals

- (c) Service connections shall be tested with the watermain.
- (d) The Approving Officer shall be notified 24 hours in advance of the leakage testing and may elect to witness the test. All test data and leakage calculations are to be submitted to the Approving Officer.

4(7) Flushing and Disinfection

- (a) All water mains shall be disinfected by chlorination after the system has been flushed of dirt and other debris. Chlorination methods shall conform to AWWA C601 and all disinfection shall be acceptable to the Approving Officer and Medical Health Officer.
- (b) Upon completion of disinfection, the entire piping system shall be thoroughly flushed, filled with water, and left in a condition ready for use.

PART D - SANITARY SEWER

D.1 INTRODUCTION

1(1) Sanitary sewer systems shall be designed and installed in accordance with the requirements of the Ministry of Environment, Waste Management Branch, *Guidelines for Assessing Sewage Collection Facilities*, and the requirements noted in this Schedule.

1(2) List of Standard Drawings

The following form part of PART D:

<u>Title</u>	<u>No.</u>	<u>Title</u>	<u>No.</u>
Standard Manhole	S-1	Trench Details in Gravelled	
Exterior Drop Manhole	S-2	Areas	S-7
Manhole Benching	S-3	Trench Bedding Details	S-8
Standard Sewer		Manhole Cover Insulation	
Connections	S-4	Detail	S-10
Encasement Pipe Detail	S-5	Thrust Blocks	W-1
Trench Details in Paved		Sewer and Water Services	W-3
Areas	S-6		

D.2 DESIGN PARAMETERS

2(1) Design Flows

- (a) The sanitary sewer system shall be designed using the following average daily flows for the zone noted:

Residential/Institutional - 450 litres/capita/day
Industrial/Commercial - 22,500 litres/day/hectare
- (b) An infiltration rate of 0.1 litres/sec/hectare shall be added to the above flows.

- (c) The design flows shall be calculated using the average daily flows plus the infiltration rate.
- (d) Peak flows shall be 5 times the average daily flow for contributing areas with populations less than 1,000; and 4 times the average daily flow for contributing areas with populations between 1,000 and 3,000.
- (e) Design populations used in calculating average daily flows shall be computed in accordance with the municipality's population predictions or with the planned development in the area to be served, whichever is larger.

2(2) Pipe Flow Formulas

- (a) Capacities of gravity sanitary sewer mains shall be determined using Mannings' Formula:

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

Where:

Q = Design Flow in M3/sec

A = Cross Sectional Area in m²

R = Hydraulic Radius in m

S = Slope of hydraulic grade line in m/m

N = Roughness coefficient

= 0.013 for A.C., Conc. And P.V.C. Pipe

- (b) Calculations for capacities of sanitary sewer force mains shall use the Hazen-Williams Formula:

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

Where:

Q = Rate of flow in litres/sec

D = Internal pipe diameter in mm

S = slope of hydraulic grade line in m/m

C = Friction coefficient

= 120 for all pipe

2(3) Manholes and Hydraulic Losses

- (a) Manholes shall be required at:
 - all changes in grade
 - all changes in direction
 - all changes in pipe sizes
 - all intersecting sewers
 - all terminal sections
 - downstream end of curvilinear sewers
- (b) Manholes shall be placed where future extensions are anticipated and shall be spaced no greater than 150 metres apart.
- (c) Pipe intersections in manholes shall utilize smooth, hand-formed concrete channels to maintain uniform flows.
- (d) The invert of the downstream pipe shall not be higher than that of the upstream pipe. However, both pipes may be placed at the same elevation.
- (e) The springline of the downstream pipe shall not be higher than that of the upstream pipe.
- (f) (i) Minimum drop in invert levels across manholes:
 - Straight run - no drop required
 - Deflections up to 45° - 25 mm drop
 - Deflections 45° to 90° - 30 mm drop
- (ii) A drop pipe shall be installed when the drop between inverts exceeds 0.6 metre.
- (g) Inside ramps will be permitted up to 450 mm from invert to channel bed.
- (h) Where a small pipe joins a larger pipe, the energy gradient shall be maintained through the transition.

2(3) Temporary Clean-outs

- (a) Temporary clean-outs may be provided at terminal sections of a main provided that:
 - (i) future extension of the main is proposed or anticipated;
 - (ii) the length of sewer to the downstream manhole does not exceed 45 metres.
 - (iii) The depth of the pipe does not exceed 2 metres at the terminal point.
- (b) Clean-outs shall not be considered a permanent structure.

2(5) Minimum Pipe Diameter, Velocity, Grades and Cover

- (a) The minimum diameter for sanitary sewer installations shall be as follows:

Sanitary Sewer Mains = 200 mm

(except last upstream portion which cannot be extended in the future, which may be 150 mm.)

Sanitary Sewer Connections = 100 mm

Sanitary Sewer Force mains = 100 mm

- (b) The minimum velocity shall be 0.6 m/sec. There is no maximum velocity; however, consideration must be given to scour problems where flow exceeds 2.5 m/sec, and anchoring should be incorporated where the grade(s) of the sewer are 15% or greater.
- (c) The grade of any sewer shall be governed by the minimum velocity required. However, the last section of a main that will not be extended in the future shall have a minimum grade of 1.0% where 150 mm diameter pipe is proposed.
- (d) The minimum cover over any main shall be 1.5 metres. The desired cover over any sewer forcemain is 1.5 metres.
- (e) The depth of the sewer must be sufficient to provide "gravity flow" service connections to both sides of the roadway and must allow for future extension(s) to properly service all of the upstream tributary lands for ultimate development.
- (f) Where it is not feasible to service by gravity connection, a rear yard sewer may be required.
- (g) Where permitted, horizontal curves will require a constant off-set and/or shall be uniform throughout the curve. The radius of the curve shall not be less than 60 metres. The design velocity must exceed 0.91 m/sec; the minimum grade shall be 1.0%; and each joint is to be located by survey.
- (h) (i) Sanitary sewers shall generally be located in the road right-of-way, 3 metres from centerline on the opposite side from the watermain.
- (ii) Where sanitary sewers must cross private property, a registered utility right-of-way, a minimum of 6 metres in width, shall be provided.

2(6) Service Connections

- (a) In addition to the municipal requirements, service connections shall be subject to the requirements of the National Plumbing Code. A backflow preventer shall be installed on all sanitary sewer service connections, where required. **BL #1420**
- (b) Service connections shall be provided to each lot fronting the main. All services shall enter the main at a point just above the springline.

- (c) Separate service connections shall be installed for each dwelling unit of a duplex, townhouse or row-housing development for individual ownership.
- (d) Connections to new mains shall be made using wye fittings; connections to existing mains shall be made using saddles.
- (e) The minimum size for sanitary sewer service connections shall be 100 mm.
- (f) The minimum grade of 100 mm diameter service connections from the main to the property line shall be 2%. Where this grade cannot be met, a 150 mm diameter service connection at a minimum grade of 1% may be installed.
- (g) Depth shall be 2.5 metres at the property line, or as accepted.
- (h) Service connections may be permitted into manholes provided that:
 - (i) The connection is not in an adverse direction to the flow in the sewer main.
 - (ii) The provisions noted in Section D.2(3) "Manholes and Hydraulic Losses" are met.
- (i) All services shall be marked with a 40 x 90 mm stake at the property line. The top 150 mm of the stake shall be painted red.

2(7) Pumping Stations and Force Mains

- (a) If at all possible, the use of sanitary pump stations is to be avoided. Any proposed use of pump stations must receive prior acceptance. Any sanitary pump station must be located within a right-of-way outside the road dedication.
- (b) The size, capacity and type of these stations will be dependent upon the development and catchment area involved.
- (c) All pumping station and forcemain design and installation shall be as accepted for the specific installation.
- (d) In conjunction with sanitary pumping facilities, the following criteria shall be noted in the design of forcemain systems:

- (i) Velocity

At the lowest pump delivery rate anticipated to occur at least once per day, a cleansing velocity of at least 0.9 m/sec should be maintained. Maximum velocity should not exceed 3.5 m/sec.

- (ii) Air Relief Valve

An automatic air relief valve shall be placed at high points in the forcemain to prevent air locking.

(iii) Termination

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

(iv) Size

The minimum size for force mains shall be 100 mm diameter. All force mains shall be designed to prevent damage from superimposed loads, or from water hammer or column separation phenomena.

2(8) On-Site Sewage Disposal

- (a) Where a parcel is not required to be served by a community sewer system, such parcel shall be served by individual on-site sewage disposal.
- (b) An area, suitable for construction of on-site sewage disposal facilities and certified by the Medical Health Officer, shall be located on each parcel.
- (c) The area of soil required for sewage disposal shall be capable of meeting the siting and setback requirements for absorption fields in the Sewage Disposal Regulations, BC Reg. 411/85.
- (d) Percolation tests are subject to the certification of the Medical Health Officer, who will make a recommendation to the Approving Officer.

D.3 MATERIALS

3(1) Gravity Sewer Pipe Materials and Specifications

Material for Gravity Sewers	Size Range (mm)	Minimum Specification	Use
Polyvinyl Chloride	100-150 200-375	CSA B182.1, SDR 28 ASTM D3034, SDR 35	minor collection mains service connections
Asbestos Cement	100-150 200-300	ASTM C-644 ASTM C428 Type II Class 2400 min.	minor collection mains and service connections

*Non-Reinforced

Concrete	300-900	ASTM C14, Class III	major trunk mains
Reinforced Concrete	300 - up	ASTM C76, Class III	major trunk mains

* Use of non-reinforced concrete pipe shall be at the sole discretion of the Approving Officer.

3(2) Forcemain Sewer Pipe Materials and Specifications

Material for Forcemains	Size Range (mm)	Minimum Specification	Use
Polyvinyl Chloride	100-up	AWWA C900	minor forcemains
*Ductile Iron	100-up	AWWA C151, Class 50 min. cement mortar lined	minor forcemains

* When D.I. pipe is specified, it shall be installed utilizing acceptable corrosion protection techniques.

3(3) Pipe Joints

- (a) All gravity sewer pipe shall be jointed using rubber gaskets or gasketed fittings and couplings.
- (b) All sewer forcemain piping shall be jointed as specified below:
 - (i) Jointing of pipe shall be in accordance with the manufacturer's recommendations.
 - (ii) A flexible joint shall be provided at locations where the pipe is held in a fixed position by a rigid structure or support.
 - (iii) Unless otherwise accepted, the amount of pipe deflection at joints and couplings shall not exceed 3 degrees, or one-half the limit specified by the manufacturer, whichever is less.

3(4) Manholes

- (a) All manholes shall be precast concrete, 1,050 mm inside diameter and shall conform to ASTM C478.

Manhole slabs shall be precast or cast in place on compacted material to municipal standards using 20 MPA concrete and shall be 1,600 mm square.

- (b) Precast concrete lids shall be designed to withstand H-20 loading conditions. Cast iron frames and covers and manhole ladder rungs shall conform to municipal standards.

3(5) Temporary Clean-outs

Temporary clean-out barrels, covers, bases and lids shall conform to standards for manholes, or as accepted.

3(6) Service Connections

Polyvinyl chloride pipe and fittings shall be used for all service connections. **BL #1420**

3(7) Pipe Bedding

Pipe bedding classifications shall conform to municipal standards for Class "A", Class "B" and Class "C" bedding. Pipe bedding selection may vary for different materials installed and for different locations within the municipality.

D.4 INSTALLATION

4(1) Excavation, Bedding, Backfill, Restoration

- (a) The trench shall be excavated so that pipe can be laid to the specified alignment and depth with allowance for the specified wall clearances and bedding. Wall clearances shall be minimum 150 mm, maximum 400 mm, from the bottom of the trench to 100 mm above the top of the pipe.
- (b) Bracing, sheeting and trench side slopes shall be in accordance with WCB safety requirements. Dewatering may be required to control trench water.
- (c) Bedding material shall be crushed gravel, sand, select native material or concrete. Bedding shall be compacted to 95% Standard Proctor Density.
- (d)
 - (i) Backfill material shall be select native material or pit-run gravel and shall be placed in such a manner as to prevent damage to the pipe.
 - (ii) Backfill materials in travelled surfaces shall be compacted to 98% Standard Proctor Density, except for the upper 750 mm, which shall be compacted in accordance with the adjacent travelled surface design requirements.
- (e) Surface restoration shall conform to the original condition or as accepted.

4(2) Pipe Laying

- (a) (i) Pipe shall be installed in accordance with the applicable AWWA specifications, the manufacturer's recommendation and the requirements of this Schedule.
- (ii) Pipes shall be handled with the greatest care and with equipment designed so that no damage occurs to the pipe or fittings.
- (b) Batter boards shall be erected over the trench or trench line at intervals of not more than 20 metres. The centre line of the required pipe line shall be marked on these boards and string or wire stretched between the boards and on this centerline. The pipe shall be kept to proper line by plumbing down from this string line. Each pipe shall be laid to grade by means of batter boards and a boning rod with a shoe which will enter the pipe and stand on the invert. A minimum of 3 batter boards shall be in place at all times during excavation and pipe laying. Sufficient batter boards shall be placed so that sighting is possible along these boards from one manhole to the next. Alternate methods of grading and aligning the pipe may be considered.
- (c) (i) All pipes shall be laid
 - to horizontal line with a tolerance of plus or minus 10 mm of the design line;
 - and grade, with a tolerance of plus or minus 25 mm for water mains and services;
 - with the spigot end pointed in the direction of the flow.
- (ii) The pipes shall be joined in accordance with the manufacturer's recommendations except that joint deflections shall be allowed only up to one-half of the manufacturer's recommended tolerances. Particular care must be taken to see that the ends of the pipes are kept clean. Care shall be taken to properly align the pipe once the joints are forced home. Movement of the pipe once the joint is made shall be kept to an absolute minimum. Jumping or dropping of pipe to obtain grade shall not be permitted.
- (d) Care shall be taken to prevent the entrance of trench water or other material into the pipe during installation.

4(3) Manholes, Clean-outs, and Appurtenances

- (a) Manholes, clean-outs and appurtenances shall be installed at the locations shown on the approved design drawings and in accordance with the Standard Drawings.
- (b) Manholes shall be set plumb and shall be constructed concurrently with the laying of the pipe. Manholes shall be constructed so as to be free from both ground water infiltration and exfiltration of sewage. All joints shall be butter mortared, including base, barrel, cover, bricking and frame.
- (c) Inlet and outlet elevations shall be as shown on the approved design drawings with tolerances as specified for pipe laying.

4(4) Service Connections

Service connections shall be installed at the locations and depths shown on the approved drawings with the same tolerances as specified in Section D.4(2) for pipe laying.

4(5) Flushing and Testing

- (a) Prior to flushing and testing, all new mains are to be cleaned of debris by passing a line-sized “pig” through the main, and immediately afterwards capping the pipe ends in preparation for testing. This procedure will help to identify any misalignments on curved mains.
- (b) All sanitary sewers shall be visually inspected and flushed to determine that they are straight and free from silt, sand, earth or other debris. Exfiltration tests shall be carried out on gravity sewers with either air or water as outlined below.
- (c) Testing for sanitary sewer forcemains shall conform to the testing criteria for watermains, but need not include disinfection.

(d) Exfiltration Test:

- (i) The allowable exfiltration (water method) shall be 10 litres per millimetre of pipe diameter per kilometre per day.
- (ii) The allowable exfiltration (air method) shall be determined by filling the test section with air to a constant pressure of 25 kPa and maintaining a pressure above 20 kPa for a minimum of 5 minutes. After the stabilization period, the air supply shall be cut off and the pressure allowed to drop to 20 kPa. Timing shall commence at 20 kPa and shall continue until the pressure reaches 15 kPa. The minimum acceptable time period shall be determined by the formula:

$$\text{Minimum Time in min.} = 0.040 \times \text{pipe diameter in millimetres}$$

Where the prevailing groundwater is above the sewer line being tested, the test pressure shall be increased 10 kPa for each metre of groundwater above the pipe.

- (iii) An infiltration test may be required in areas of high groundwater, at the discretion of the Approving Officer.
- (e) The Approving Officer shall be notified 24 hours in advance of the leakage testing and may elect to witness the test. All test data and leakage calculations are to be submitted to the Approving Officer.

PART E - STORM DRAINAGE

E.1 INTRODUCTION

1(1) All storm drainage facilities shall be designed and installed as stated in this schedule or as accepted, and shall be in conformance with the latest edition of the municipality's Master Drainage Plan.

1(2) List of Standard Drawings

The following drawings form part of PART E:

<u>Title</u>	<u>No.</u>	<u>Title</u>	<u>No.</u>
Standard Manhole Exterior Drop	S-1	Trench Details in Gravelled Areas	S-7
Manhole	S-2	Trench Bedding Details	S-8
Manhole Benching	S-3	Catch Basin Assembly	S-9
Standard Sewer Connections	S-4	Manhole Cover Insulation Detail	S-10
Encasement Pipe Detail	S-5	Catch Basin Adjustment	S-11
Trench Details in Paved Areas	S-6		

E.2 DESIGN PARAMETERS

2(1) Design Methods and Flows

Design flows shall be based on the concept of the major and minor drainage systems and must attempt to maintain zero increase in peak flows over the pre-development flows.

(a) Minor System

- (i) The minor system consists of localized areas of development serviced by a localized piping system which discharges to the major component.
- (ii) This system shall be designed to accommodate a five year storm event. However, in doing so, it is mandatory that a comprehensive flood routing plan be developed which analyses the impact of surcharging flows on adjacent services and property.

(b) Major System

- (i) The major component of the system consists of trunk mains which intercept flows from the minor system, natural drainage channels, overland flood routes and retention or detention facilities designed to reduce peaks. Overland flow through easements on private property is to be discouraged.
- (ii) This system shall be designed for a 100-year storm, based on an approved computer model simulation. It shall further conform to the storm water management plan established by the municipality for each particular basin. Amendments to this program may only be permitted upon consultation with and detailed analysis by the municipality.
- (iii) In areas of potential flood plain, the major system hydraulic grade line shall be identified and, to prevent flooding, minimum basement elevations shall be identified and established by covenant.

2(2) Flow Capacities for Storm Sewers and Open Channels

Capacities of storm sewer mains and open channels shall be determined using Mannings' Formula:

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

Q = Design Flow in m³/sec

A = Cross Section Area in m²

R = Hydraulic Radius in metres

S = Slope of hydraulic grade line in m/m

N = Roughness coefficient

= 0.013 for A.C., Conc. and P.V.C. pipe

= 0.024 for unpaved corrugated steel pipe

= 0.013 for concrete and asphalt lined channels

= 0.02 for gravel lined channels

= 0.05 for natural and grassed channels

2(3) Minimum Pipe Diameters, Velocities and Cover

- (a) The minimum diameter for storm sewer installations shall be as follows:

Storm Sewer Mains = 200 mm

Catch Basin Leads = 150 mm

Storm Sewer Service

Connections = 150 mm (Single Family Residential)

= 200 mm (all others)

Driveway Culverts = 300 mm

- (b) Storm sewer mains shall be installed with a minimum clear cover above the pipe crown of 1.5 metres.
- (c) Unless otherwise accepted, the minimum velocity for pipes flowing full or half-full shall be 0.75 m/s. BL #1420
- (d) Where grades for storm sewers are excessive, pipe anchors shall be installed.
- (e) Offsets for storm sewer mains shall be on the road centerline. Offsets may be changed where existing services require otherwise.

2(4) Manholes and Catch Basins

- (a) Manholes shall be installed at all vertical grade changes and on horizontal alignment changes where no curves are used. The maximum allowable spacing between storm sewer manholes shall be 150 meters. Increased spacing on sewers larger than 375 mm may be considered.
- (b) Catch basins shall be placed at regular intervals along roadways, at intersections and at low points. Wherever possible the leads should be connected directly to a storm manhole. Saddle or wye connections shall be used where leads tie directly to the main.
- (c) The maximum allowable spacing for catch basins shall be 120 meters.

2(5) Inlet and Outlet Structures

- (a) Inlet and outlet structures shall be designed to meet the requirements of each particular installation; however, the following guidelines shall be used as a basis for the minimum design requirements:
 - (i) End wall - Used to retain embankment fill over pipe. End walls shall be designed with a minimum height of 300 mm above the pipe crown and a minimum width of 300 mm on either side of the pipe.
 - (ii) Wing walls - used to transition outlet and inlet to existing channel shape. Wing wall heights shall match the end wall height; however, sloping may be used depending on the installation requirements. Wing wall lengths shall be a minimum of 1.5 times the end wall width. Wing walls shall be installed on a 30 or 45 angle from a perpendicular to the end wall.
 - (iii) Aprons or Spillways - Used to prevent erosion of channel bottoms at inlet and outlet structures and shall be located to meet the requirements of each particular installation.
 - (iv) Energy Dissipators - Used to reduce intake or discharge velocities. Energy dissipators shall be installed as required.

- (v) Trash Grate - to be bolted and removable with a normal maximum 150 mm spacing of vertical bars.
- (vi) Sedimentation devices shall be installed on all outlets to a creek.
- (b) All designs for inlet and outlet structures shall be subject to acceptance by the Approving Officer.

2(6) Ditches

- (a) Where ditching has been approved either alone or in conjunction with an underground system, all ditching shall be constructed to municipal standards for each particular road classification and shall be hydro-seeded in the following manner:
 - (i) A grass mixture containing the following shall be applied at a rate of 170 kg/ha:
 - 55% crested wheat grass
 - 20% Kentucky Blue grass blend
 - 20% Creeping Red Fescue
 - 5% Norlea Perennial Ryegrass
 - (ii) Fertilizer (10-55-0) or approved formula at a rate of 170 kg/ha.
 - (iii) The hydro-seeding solution should contain a mulch of wood cellulose fibre, free of growth and germination inhibiting ingredients, and dyed green for visual metering during application. This mixture shall be applied at a rate of 2,250 kg/ha.
 - (iv) Energy dissipators may be required if deemed necessary to prevent erosion. Sediment control devices may be required.
 - (v) Erosion protection may be required by the Works Superintendent in fill area ditching.

2(7) Sewer Connections

- (a) Storm sewer connections to single family residential lots are required unless indicated otherwise by the Approving Officer.
- (b) Storm sewer connections for multi-family, commercial, institutional or industrial lots shall be a minimum 200 mm diameter and shall be installed up to property line at a minimum depth of 1.2 meters. All services shall be marked with a 40 x 90 mm stake at the property line. The top 100 mm of the stake shall be painted green.

- (c) Whenever possible, service connections shall be located 3 meters from joint property lines on the lower side of the lot.

2(8) Trench Drains and Rock Pits

Trench drains and rock pits may be permitted in certain circumstances.

2(8) Natural Watercourses

Natural watercourses shall be protected as directed in the applicable municipal bylaws and the Town of Creston Master Drainage Plan.

E.3 MATERIALS

3(1) Pipe Materials and Specifications

Material	Size Range (mm)	Minimum Specification	Use
Reinforced Concrete	300 & Larger	ASTM C76, Class III	major trunk mains, culverts
aNon-Reinforced Concrete	300 - 900	ASTM C14, Class III	major trunk mains
Asbestos Cement	200 - 300	ASTM C428 Type II Class 2400 min.	minor collection mains & service connections
bPolyvinyl Chloride	200 - 375 450 - 600	ASTM D3034, SDR 35 ASTM F679, SDR 35 Equiv. Or ASTM F794	minor collection mains & service connections
cCorrugated Steel Pipe	300 & Larger		culverts

BL #1420

aConsideration may be given to use of asphalt coated corrugated steel pipe, on major trunk mains.

bUse of non-reinforced concrete pipe may be considered.

cUse of ribbed PVC pipe, ASTM F794 may be considered.

3(2) Pipe Joints

All pipe shall be jointed with rubber gaskets or gasketed fittings and couplings.

3(3) Manholes

- (a) Manhole barrels shall be precast concrete, 1050 mm minimum inside diameter, and shall conform to ASTM C478 for all mains up to 380 mm in diameter. Cast in place structures combined with precast sections shall be utilized.
- (b) Manhole slabs shall be precast or cast in place on compacted material to municipal standards using 20 Mpa concrete and shall be 1600 mm square.
- (c) Pipe intersections in manholes shall utilize smooth, hand-formed concrete channels to maintain uniform flows. Minimum invert drops shall be as follows:

Straight run = no drop required

Deflections to 45° = 20 mm drop

Deflections to 45° to 90° = 30 mm drop

BL #1420

3(4) Catch Basins

- (a) All catch basins shall be precast concrete 750 mm inside diameter. Precast barrels shall conform to ASTM C478. **“or as approved by the Town Engineer”**
BL #1420
- (b) Catch basin slabs shall be precast or cast in place on compacted material to municipal standards.
- (c) Catch basin slabs shall be 150 mm diameter and shall be installed a minimum of 460 mm from the upper side of the precast slab to allow for sediment collections. Catch basin leads shall be installed at a minimum 2% slope from the catch basin to the main.
BL #1420

3(5) Inlet and Outlet Structures

End walls and wing walls shall be constructed using concrete-filled sandbags, reinforced concrete or prefabricated sections. Aprons and spillways shall be constructed of reinforced concrete or rip-rap.

3(6) Service Connections

Polyvinyl chloride pipe shall be used for all service connections.

BL #1420

E.4 INSTALLATION

4(1) Excavation, Bedding, Backfill, Restoration

- (a) The trench shall be excavated so that pipe can be laid to the specified alignment and depth with allowance for the specified wall clearances and bedding. Wall clearances shall be minimum 150 mm, maximum 400 mm, from the bottom of the trench to 100 mm above the top of the pipe.

- (b) Bracing, sheeting and trench side slopes shall be in accordance with WCB safety requirements. Dewatering may be required to control trench water.
- (c) Bedding material shall be crushed gravel, sand, select native material or concrete. Bedding shall be compacted to 95% Standard Proctor Density.
- (d)
 - (i) Backfill material shall be select native material or pit-run gravel and shall be placed in such a manner as to prevent damage to the pipe.
 - (ii) Backfill materials in traveled surfaces shall be compacted to 98% Standard Proctor Density, except for the upper 750 mm, which shall be compacted in accordance with the adjacent traveled surface design requirements.
- (e) Surface restoration shall conform to the original condition or as accepted.

4(2) Pipe Laying

- (a)
 - (i) Pipe shall be installed in accordance with the applicable AWWA specifications, the manufacturer's recommendations, and the requirements of this Schedule.
 - (ii) Pipes shall be handled with the greatest care and with equipment designed so that no damage occurs to the pipe or fittings.
- (b) Batter boards shall be erected over the trench or trench line at intervals of not more than 20 meters. The centre line of the required pipe line shall be marked on these boards and string or wire stretched between the boards and on this centre-line. The pipe shall be kept to proper line by plumbing down from this string line. Each pipe shall be laid to grade by means of batter boards and a boning rod with a shoe which will enter the pipe and stand on the invert. A minimum of 3 batter boards shall be in place at all times during excavation and pipe laying. Sufficient batter boards shall be placed so that sighting is possible along these boards from one manhole to the next. Alternate methods of grading and aligning the pipe may be considered.
- (c) Vertical tolerances shall be 7 mm, plus or minus, for storm sewer gravity mains.
- (d) The pipes shall be joined in accordance with the manufacturer's recommendations except that joint deflections shall be allowed only up to one-half of the manufacturer's recommended tolerances. Particular care must be taken to see that the ends of the pipes are kept clean. Care shall be taken to properly align the pipe once the joints are forced home. Movement of the pipe once the joint is made shall be kept to an absolute minimum. Jumping or dropping of pipe to obtain grade shall not be permitted.
- (e) Care shall be taken to prevent the entrance of trench water or other material into the pipe during installation.

4(3) Manholes, Catch Basins and Appurtenances

- (a) Manholes, catch basins and appurtenances shall be installed at the locations shown on the approved design drawings and in accordance with the Standard Drawings.
- (b) Manholes shall be set plumb and shall be constructed concurrently with the laying of the pipe. Manholes shall be constructed so as to be free from both ground water infiltration and exfiltration of storm drainage. All joints shall be butter mortared, including base, barrel, cover, bricking and frame.
- (c) Inlet and outlet elevations shall be as shown on the approved design drawings with tolerances as specified for pipe laying (Section E.4 (2)).

4(4) Service Connections

Service connections shall be installed at the locations and grades shown on the approved drawings with the same tolerances as specified for pipe laying (Section E.4 (2)).

4(5) Flushing and Testing

- (a) Prior to flushing and testing, all new mains are to be cleaned of debris by passing a line-sized “pig” through the main, and immediately afterwards capping the pipe ends in preparation for testing. This procedure will help to identify any misalignments on curved mains.
- (b) All storm sewers shall be visually inspected and flushed to determine that they are straight and free from silt, sand, earth or other debris. Exfiltration tests shall be carried out with either air or water.
- (c) Exfiltration Test:
 - (i) The allowable exfiltration (water method) shall be 10 litres per millimetre of pipe diameter per kilometre per day.
 - (ii) The allowable exfiltration (air method) shall be determined by filling the test section with air to a constant pressure of 25 kPa and maintaining a pressure above 20 kPa for a minimum of 5 minutes. After the stabilization period, the air supply shall be cut off and the pressure allowed to drop to 20 kPa. Timing shall commence at 20 kPa and shall continue until the pressure reaches 15 kPa. The minimum acceptable time period shall be determined by the formula:

$$\text{Minimum Time in min.} = 0.040 \times \text{pipe diameter in millimetres}$$

Where the prevailing groundwater is above the sewer line being tested, the test pressure shall be increased 10 kPa for each metre of groundwater above the pipe.

- (iii) An infiltration test may be required in areas of high groundwater, at the discretion of the Approving Officer.
- (c) An infiltration test may be required in areas of high groundwater at the discretion of the Approving Officer.
- (d) The Approving Officer shall be notified 24 hours in advance of the leakage testing and may elect to witness the test. All test data and leakage calculations are to be submitted to the Approving Officer.

PART F - STREET LIGHTING

F.1 INTRODUCTION

- 1(1) All street lighting systems shall be designed by a professional engineer competent in light design, and in accordance with the International Illuminating Society and municipal standards.
- 1(2) All materials, equipment and specifications shall be subject to the approval of the Provincial Electrical Inspector prior to submission to the Approving Officer for consideration.
- 1(3) The developer shall be responsible for obtaining all permits and for payment of any fees required by the Provincial Electrical Inspector or the power utility company prior to starting construction.
- 1(4) Upon completion, the consulting engineer or contractor shall make provision to energize the system for inspection purposes and shall notify the Approving Officer that the system is ready for inspection. After completion of such inspection by the Approving Officer (or his appointed agent) and correction of remaining deficiencies, the municipality will then make application to energize the system when service is required.
- 1(5) Special permission must be obtained from the Approving Officer for use of 347/600 street light services and distribution.

1(6) List of Standard Drawings

<u>Title</u>	<u>No.</u>	<u>Title</u>	<u>No.</u>
Davit Streetlights	E-1	Median Warning Light	
Post-Top Streetlights	E-2	Mounting Detail	E-7
Streetlight Anchor Base		Junction Box for	
for: Type A & C Poles	E-3	Traffic Signals	E-8
Type B & D Poles	E-4	Signal Head Patterns	E-9
Handhole Wiring Schematic		Underground Wiring	
120 v Streetlight	E-5	Trench Detail	E-10
Service Base Schematic			
120 v Streetlight	E-6		

F.2 DESIGN PARAMETERS

2(1) Minimum Levels of Illumination

- (a) The levels of average horizontal illumination, in lux for roadways and pedestrian walkways, shall not be less than those outlined below:

<u>Road Classification</u>	<u>Main Commercial Areas</u>	<u>Industrial & Intermediate Commercial Areas</u>	<u>Residential Areas</u>
Arterial	22	15	*11
Collector	13	10	* 6
Local	10	6	4
Pedestrian Walkways	6	6	4

* Average horizontal illumination shall apply only to arterial or collector roads abutting residential properties. Illumination for arterial or collector roads traversing a residential area but not abutting residential properties shall be designed to meet industrial and intermediate commercial area standards.

- (b) Differentiation between areas shall be at the discretion of the Approving Officer.

- (c) The maximum uniformity ratio of horizontal illumination for roadways and pedestrian walkways using a maintenance factor of 0.90 shall be as follows:

<u>Road Classification</u>	<u>Uniformity Average: Minimum</u>
Arterial	3:1
Collector	4:1
Local	5:1
Pedestrian Walkways	5:1

- (d) Where roads of different classifications meet, a transition area shall be incorporated wherein the road with the lower illumination level shall have a gradual increase in illumination level until the higher level is reached.

2(2) Pole Locations

- (a) In general, davit arm installations shall utilize a staggered arrangement and, where possible, be located on lot lines, away from driveways and underground services.
- (b) Post-top or davit arm installations on local roads shall utilize a one-side arrangement along the sidewalk side of the street, and shall be located 300 mm from the back of the sidewalk to the face of the pole base, in order to reduce conflicts with underground utilities located on the opposite side. A staggered arrangement will be considered provided that private utility companies are satisfied that no conflicts exist.
- (c) Where no sidewalks exist or are required, poles shall be located 300 mm from the back of the curb to the face of the pole base.
- (d) On curves, the luminaire spacing shall be reduced to ensure uniformity of illumination. Where poles are situated on the inside of bends, the spacing must be reduced to +/-55% of the spacing on straight sections. Where poles are situated on the outside of bends, the spacing must be reduced to +/-70% of the normal spacing. Reduction figures are general guidelines, and uniformity levels should dictate the required spacing.

2(3) Underground Ducting Locations

In general, conduit shall be placed on the same side of the road as the lights. However, where a staggered type lighting pattern is utilized, conduit shall be placed on both sides of the roadway.

2(4) Lamp Standards and Luminaires

The types of standards and luminaires for different road classifications shall be as set out below:

(a) Arterial and Collector Streets:

- (i) Standard: Davit Arm
Height: 8 meters
Luminaire: 150 watt high pressure sodium,
Powerlite LXBC2227S-150 c/w Sylvania
LU150/55/D deluxe coated lamp

OR

- (ii) Standard: Ornamental, as accepted
Height: varies with type accepted
Luminaire: varies with type accepted

(b) Local Street:

- (i) Standard: Davit Arm
Height: 8 meters
Luminaire: 100 watt high pressure sodium,
Powerlite LXBC2227S-100 c/w Sylvania
LU100/D deluxe coated lamp

OR

- (ii) Standard: Post-Top (with municipal approval in advance)
Height: 6.1 meters
Luminaire: 100 watt high pressure sodium,
Westinghouse Promenade c/w deluxe coated lamp and opaque shield on
house side

(c) Pedestrian Walkways:

Standard: ornamental, as accepted
Height: varies with type accepted
Luminaire: varies with type accepted

F.3 MATERIALS

3(1) All materials shall be C.S.A. approved.

3(2) Pipe

Poles shall be one-piece octagonal, tapered, hot-dipped galvanized steel to ASTM Standard A242 designed to withstand 160 km/h wind loading. All poles shall be refinished after installation with a cold galvanized compound to cover damaged areas. Street light poles shall be as detailed on standard drawings.

3(3) Pole Bases

Precast trapezoidal bases shall be installed on all pole installations. Under certain situations, cast-in-place trapezoidal bases may be considered.

3(4) Conduit

All conduit, couplings, adapters and bends shall be Scepter Manufacturing Co. Ltd. Or accepted equivalents, rigid non-plasticized polyvinyl chloride, minimum 50 mm diameter, Canadian Electrical Code, with maximum 30% conduit fill, unless otherwise accepted. Installation shall be in strict accordance with the manufacturer's recommendations using C.S.A. certified cement.

3(5) Grounding

Grounding of neutral wire to grounding plate or grounding rod at each service and installation of a continuous ground conductor in the conduit system shall be provided in accordance with the Provincial Electrical Code, #8 stranded green x-link.

3(6) Conductors

All conductors shall be type RW 90 x-link stranded copper. Minimum conductor size shall be #14. Conductor minimum for advance warning flashers shall be #12 AWG. High traffic heads shall be wired with cabtyer.

3(7) Connectors

Connectors shall be solderless insulated connectors of the Marrette type, taped with black P.V.C. tape.

3(8) Luminaires

- (a) All luminaires shall be acrylic type II, III, or IV with cut-off or semi-cut-off distributions.
- (b) Under special circumstances, the Approving Officer may require polycarbonate vandal-resistant refractors.

3(9) Lamps

All lamps shall be 150 watt/55 v or 100 watt high pressure sodium as applicable, colour corrected, deluxe coated.

3(10) Service Equipment and Junction Boxes

Service equipment and junction boxes shall be as accepted.

3(11) Conduit Bedding

Bedding for buried conduit shall be sand or crushed granular aggregate as specified for PVC water piping. Utility warning tape shall be installed above all buried conduit.

F.4 INSTALLATION

4(1) Layout and Positioning

Poles, pole bases, conduit and appurtenances shall be accurately located in accordance with the approved drawings. Conduit shall be installed parallel or perpendicular to the road centerline and routed so as to run in a direct line between adjacent poles or junction boxes.

4(2) Conduit Installation

- (a) Conduit shall be installed in accordance with the manufacturer's recommendation.
- (b) Empty conduits shall be provided with an insulated #12 AWG copper wire and capped immediately after installation of the pull wire.

4(3) Poles, Bases and Luminaires

- (a) Bases shall be set plumb and oriented such that one side of the bolt square layout is parallel to the road centerline.
- (b) Poles shall be set plumb with no more than 6 shims per pole.
- (c) Luminaires shall be securely fastened to the poles, leveled and cleaned after pole erection.

4(4) Wiring and Equipment

Wiring and equipment installation shall conform to the B.C. Electrical Code and manufacturer's recommendations.

4(5) Inspection and Testing

Inspection and testing shall conform to the provisions of the B.C. Electrical Code and the provisions of Section F.1 hereof.

PART G - NON-MUNICIPAL UTILITIES

G.1 INTRODUCTION

Non-Municipal utilities include natural gas, power, telephone and cablevision services.

G.2 NATURAL GAS

- 2(1) Natural gas services are not required as a condition of subdivision, but installation is encouraged where this service is available.
- 2(2) (a) Where the developer chooses that natural gas services are to be installed, the mains and service installations shall conform to the requirements of the utility owner.
- (b) Natural gas mains shall be installed on both sides of new or upgraded roads and located in accordance with the standard drawings.

G.3 POWER

Electrical power services are required by Sections 6.8 and 6.9 of this Bylaw. Where underground or overhead power services are to be installed, the installations shall conform to the requirements of the utility owner. Underground and overhead installations shall be located in accordance with the standard drawings.

G.4 TELEPHONE AND CABLEVISION

- 4(1) Telephone services are required. Cablevision services are not required as a condition of development; however, where cablevision service is available, installation is encouraged.
- 4(2) Where underground or overhead telephone and cablevision services are to be installed, the installations shall conform to the requirements of the respective utility owners and shall be located in accordance with the standard drawings.

PART H - STANDARD DRAWINGS

H.1 GENERAL NOTES

1(1) Standards

Where ASTM, AWWA or other non-municipal standard specifications are referred to, the most recent edition at the date of commencement of construction will apply.

1(2) Castings

- (a) All castings shall be true to pattern and free from cracks, gas holes, flaws, and excessive shrinkage. Surfaces of the castings shall be free from burnt-on sand and shall be reasonably smooth. Runners, risers, fins and other cast-on pieces shall be removed. In other respects, the castings shall conform to whatever points may be specially agreed upon between the manufacturer and the Approving Officer.
 - (i) Frame material specification: Cast Iron ASTM A48 - Class 20
 - (ii) Grate and cover material specification: Ductile Iron ASTM A445 or cast steel grade 60-90 (Table 11 ASTM A 148)

1(3) "As approved" means as accepted by the Approving Officer for the specific application.

1(4) All valve boxes, manholes and catch basin covers or grates are to be set 5 - 10 mm below finished road grade.

1(5) Standard Drawings

- (a) Standard drawings represent the preferred methodology under standard conditions and are to be used wherever practical. This does not rule out the development or use of other methods after appropriate approvals have been obtained from the Approving Officer. Any special conditions or deviations from standard drawings must be submitted as design details and will, after approval, take precedence over the standard drawing. Therefore, any standard drawing developed for a non-standard situation must specify on the drawing the specific use intended.
- (b) It is not the purpose of the standard drawings to detail a manufacturer's product but only the conditions of the municipality's use of such product.

INDEX OF AMENDING BYLAWS

Bylaw 1287.....	Adopted June 20, 1994
Bylaw 1420.....	Adopted November 3, 1997
Bylaw 1644.....	Adopted August 14, 2006
Bylaw 1698.....	Adopted April 14, 2009

NOTE TO USERS

"WHEREAS each bylaw consolidation shall be proof, in the absence of evidence to the contrary, of the original bylaw, of all bylaws amending it and of the fact of passage of the original and all amending bylaws", pursuant to 'Authority to Consolidate Municipal Bylaws No. 1533', which was adopted on the 11th day of June, 2001.