

**THE CORPORATION OF
THE DISTRICT OF CENTRAL SAANICH**

SCHEDULE '4' OF LAND USE BY-LAW NO. 1309

ENGINEERING SPECIFICATIONS

AND

STANDARD DRAWINGS

**WORKS AND SERVICES
GENERAL PROVISIONS**

OF

**BY-LAW 1309
(LAND USE BY-LAW)**

ADOPTED June 28, 1999

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(Consolidated for Convenience)

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SECTION 1.A GENERAL CONDITIONS FOR THE INSTALLATION OF MUNICIPAL SERVICES.

1.0 Scope

- 1.01 These Specifications or the latest amendment thereto, shall apply to the design and installation of services within the Municipality of Central Saanich. No departure from these Specifications shall be permitted except with the written approval of the Municipality. The Municipality may give verbal approval to revisions, which they consider to be sufficiently minor. A record of these changes shall be kept by the Consulting Engineer who shall provide a copy to the works inspector.
- 1.02 These Specifications do not cover the design or installation of power, telephone or television services, but include the preparation of "as-built" drawings for these services.
- 1.03 The Standard Drawings as referred to in various sections shall form an integral part of these Specifications but the Specifications shall take precedence over both Standard Drawings and Design Drawings.

2.0 Definitions

2.01 In these Specifications, unless the context otherwise requires, the following words shall have the meaning hereinafter assigned to them.

- a) "**APPLICANT**" shall mean a person applying for the approval of a development whether as owner of the property proposed to be developed or as agent for the owner.
- b) "**CONSULTING ENGINEER**" shall mean the professional engineer retained by the Applicant to be responsible for the design, layout and supervision of installation, recording of "as-built" information and performing those duties in connection with the provision of Municipal services as set out in these Specifications and Conditions.
- c) "**CONTRACTOR**" shall mean any person, persons or corporation which shall undertake the installation of Municipal services on behalf of either the Applicant or the Municipality.
- d) "**MUNICIPALITY**" where used in these Specifications shall mean the Corporation of the District of Central Saanich or the area incorporated as the said Corporation.
- e) "**MUNICIPAL ENGINEER**" where used herein will mean Head of the Engineering Department. (This shall include any employee authorised to act on his behalf.)
- f) "**MUNICIPAL ENGINEERING DEPARTMENT**" shall mean the Municipal Engineering Department of the Corporation of the District of Central Saanich.
- g) "**WORKS INSPECTOR**" shall mean a Municipal employee authorised by the Municipal Engineer who shall from time to time make such inspections and tests of work being carried out as he considers necessary and shall co-ordinate works being carried out within the Municipality.

SECTION 1.B PROCEDURES FOR THE INSTALLATION OF MUNICIPAL SERVICES

1.0 Engineering Design

1.01 The Applicant shall retain a Consulting Engineer who shall be responsible for the design and preparation of Drawings and Specifications for all services (except telephone and electric power) as required within the Municipality. These services shall be designed in accordance with the Municipal Specifications, which are available from the Municipal Engineering Department.

2.0 Preliminary Engineering Design Submission

2.01 Upon completion of the Design Drawings, the Consulting Engineer shall submit two white prints of each to the Municipal Engineering Department for review, together with:

- a) Calculations of storm drain capacity, accompanied by a contour map showing the drainage basin;
- b) Sanitary sewer capacity calculations may be required if determined to be necessary by the Municipal Engineering Department;
- c) Pipe loading calculations may be required in certain circumstances if requested by the Municipal Engineering Department;
- d) A print of the registered plan of the subdivision, if not already supplied by the Applicant;
- e) Proof of application to the Provincial Ministry of Environment for watermain extension approval.

2.02 All streets to be created shall be named on the Drawings; names to have been approved by the Approving Officer prior to the submission of drawings.

2.03 Super mailbox location(s) shall be ascertained from the Post Office and shown on the Design Drawing. This location must be clearly staked on site prior to selling lots.

2.04 The Consulting Engineer shall bring to the attention of the Applicant and the Municipal Engineering Department, the need for any rights-of-way, outside the subdivision, which the Applicant may have to obtain.

3.0 Related Documentation

- 3.01 Where applicable, the following information shall be submitted to the Municipal Engineering Department for information and/or approval prior to final design submission:
- a) B.C. Hydro design drawings; (for approval)
 - b) B.C. Telephone design drawings; (for approval)
 - c) Street lighting design drawings (2 white prints) sealed by an Electrical Engineer registered in the Province of British Columbia; (for approval)
 - d) Health certificate from the Provincial Ministry of the Environment for the water system;
 - e) Ministry of Transportation and Highways approval.

4.0 Final Design Submission

- 4.01 Upon completion of all revisions, the Consulting Engineer shall submit the originals of his drawings, together with four (4) white prints, duly signed and sealed, to the Municipal Engineering Department along with cost estimates for the work.
- 4.02 Upon completion of all drawings and estimates, to the satisfaction of the Municipality, the Municipal Engineer or his delegate will sign the originals of all drawings and return the original drawings to the Consulting Engineer.
- 4.03 No work shall be commenced within any parcel of land on any of the services to be provided by the Applicant until approved by the Municipality of Central Saanich.
- 4.04 Approval of Design Drawings or any other communication by the Municipality does not constitute or relieve the Consulting Engineer of any responsibility, as to correctness, adequacy, omission, mistake or oversight.

5.0 Right-of-Way Documents

- 5.01 Where a right-of-way plan is deemed necessary a B.C. Land Surveyor at the Applicant's expense shall prepare it. Right-of-way and private easement documentation, together with a letter of "Intent to Register", will be required prior to registration of the subdivision plan.
- 5.02 Right-of-way documents for electric power, telephone and cablevision facilities shall be prepared and registered by the respective utility companies.

6.0 Approval to Construct

- 6.01 Upon receipt of Design Approval, the Applicant may proceed to install Municipal services subject to the following provisions:
- a) The work must be carried out by a contracting firm licensed to operate within the Municipality holding public liability insurance coverage of a minimum \$2,000,000. Proof of insurance shall be furnished to the Municipality prior to commencement of any construction.
 - b) A permit to construct any works within the public road allowance shall be obtained from the Municipal Engineering Department prior to the work being commenced.
 - c) Prior to the commencement of any work, the Consulting Engineer shall make arrangements to inspect the site of the work in company with the Works Inspector.
 - d) Erect and maintain all necessary barriers, signs, covers, fences, and all such safety devices to the satisfaction of the Municipality and in accordance with the Workers' Compensation Board.
 - e) Notify Workers' Compensation Board prior to commencement of any work.
 - f) Blasting will be permitted only after securing a permit from the Municipal Engineering Department, and only where proper precautions are taken for the protection of persons and property.
- 6.02 A copy of all approved Drawings and Specifications shall be maintained at the construction site during the installation of services.

7.0 Surety

- 7.01 Surety shall be required for all works carried out within the Municipal road allowance and as determined by the Approving Officer.
- 7.02 The Municipality may release, upon request from the Consulting Engineer, a portion of the Surety reflecting works completed to that date provided that:
- a) the estimated value of the total work exceeds \$25,000.00;
 - b) the Consulting Engineer certifies in writing the extent and value of work completed and that the said work meets the Specifications of the Municipality;
 - c) an amount equal to 15% of the total value is withheld until the acceptance by the Municipality of all "as-built" drawings.

- 7.03 Underground subdivision services shall not be permitted to operate as part of existing Municipal services until the respective subdivision services have been inspected, tested and approved by the Consulting Engineer with the results forwarded in writing to the Municipal Engineering Department.

8.0 Engineering Supervision

- 8.01 The Consulting Engineer shall be responsible for the layout, inspection and approval of materials and the supervision of installation of all services which are required to be installed by the Applicant.

- 8.02 In addition to the supervision carried out by the Consulting Engineer, the Works Inspector will periodically inspect the work and assist in coordinating the subdivision works with any related Municipal works.

The Works Inspector shall bring the use of any unacceptable materials or practices to the attention of the Consulting Engineer. If remedial action is not taken to the satisfaction of the Works Inspector, he shall advise the Consulting Engineer to have the work cease until the matter is resolved.

- 8.03 If the Consulting Engineer wishes to make any changes in design either before or during the execution of the work, he shall first submit a marked print showing proposed revisions to the Municipal Engineering Department. If approval is granted for revision, the original drawing shall be immediately revised, signed by the Municipality and new prints issued.

9.0 Testing

- 9.01 Testing shall be done in accordance with instructions contained in the section covering the appropriate service.

- 9.02 The Works Inspector shall be notified at least 24 hours prior to any tests being carried out.

- 9.03 The Consulting Engineer shall notify the Municipality in writing of the test results, complete with test data.

10.0 Site Restoration General

- 10.01 All sidewalks, curbs, pavement, etc. shall be restored to their original condition to the satisfaction of the Municipality. Where asphalt has been removed, the area shall be repaired with hot mix asphalt in accordance with Section 3.B.7 of these specifications. The thickness shall be at least equivalent to that of the surrounding area. The minimum acceptable thickness will be 50 mm.
- 10.02 Grassed areas shall be restored to their original state by replacement of turf or by re-seeding in 200 mm of topsoil and fertilizing with premium products.
- 10.03 Other landscaped areas to be restored as near to, or better than, their original condition.

11.0 Adjacent Structure and Properties

- 11.01 Prior to undertaking works of any kind, the Contractor shall consult and co-operate with owners of structures that could be endangered, or landscaped areas requiring protection or alteration in the course of construction. Sufficient records shall be established to avoid future dispute or litigation relative to the condition of private property before and after installation of the works.
- 11.02 Under no circumstances shall the Contractor permit his forces, materials, and/or equipment to encroach on private properties adjacent to the work, without the authorisation of the Consulting Engineer who shall be responsible for obtaining the written consent of the property owner of the said private property.

12.0 As-Built Drawings

- 12.01 Within two (2) weeks of completion of all services to be installed by the Applicant, the Consulting Engineer shall deliver "As-Built" Drawings, to the Municipality in accordance with Section 2.B of these Specifications. These drawings shall include the following statement signed and sealed by the Consulting Engineer:-

"I certify that the following services (name them) were inspected during construction and installed in accordance with Municipal Specifications and as shown on these Drawings."

13.0 Rectification, Repair and Maintenance

- 13.01 The Applicant shall be responsible for, at his own expense, executing all work, repair, alteration, reconstruction or replacement required to remedy any defect, fault or deficiency in or developing in the completed work., Not only up to the receipt and approval of the Consulting Engineer's "As-Built" Drawings but also during a period herein referred to as the Period of Maintenance of twelve (12) months after the date of approval of all the "As-Built" Drawings.

13.02 All such works of rectification, repair and maintenance shall, during this Period of Maintenance, be executed as the need for them becomes apparent or upon the written request of the Municipality. Should the Applicant neglect or fail to commence the execution of such works within a space of one (1) week from the date of written request for their performance, the Municipality shall be entitled to obtain the remedy using the maintenance security.

13.03 In the event that emergency repairs are required, the Municipality will undertake to make such repairs as it deems necessary and will notify the Applicant as soon thereafter as possible. All costs for these repairs shall be borne by the Applicant. In some cases, it may be necessary for the Applicant to make final permanent repairs at his own cost. Should the cost of these repairs exceed the amount of the deposit the Applicant will be required to pay the outstanding balance.

14.0 Municipal Acceptance & Maintenance Security

14.01 Upon authorisation of the Municipality and after the Receipt of satisfactory "As-Built" drawings, maintenance security and the acceptance of the required works, any relevant deposits guaranteeing the satisfactory installation of the works shall be released and the twelve (12) month maintenance period shall commence.

14.02 Maintenance security shall be held by the Municipality in the form of a Deposit or approved Letter of Credit for the twelve (12) month Period of Maintenance. The deposit shall be ten percent (10%) of the cost of the works with a minimum of one thousand dollars.

15.0 Building Permits

15.01 No building permits shall be issued until the subdivision plan is registered and essential services provided as follows:

- a) Complete storm, sanitary sewer and watermain installation as per approved design drawings and submission of as-built drawings.
- b) A road to be constructed to gravel base that in the opinion of the Municipal Engineer is sufficient to accommodate emergency vehicles.

SECTION 2.A PREPARATION OF ENGINEERING DRAWINGS

1.0 Scope

- 1.01 This Specification shall govern preparation of Engineering Drawings for all Municipal Services.

2.0 Drawing Size, Material and Basic Layout

- 2.01 Standard sheet size is A 1 (594mm x 841mm).
- 2.02 Use transparent plan-profile sheet, Plate 1 (2mm x 10 mm) with profile at top of sheet.
- 2.03 The plans shall not extend onto the profile section of the Drawing. All profiles must be on the profile section of the Drawing.

3.0 Scales

- | | | | |
|------|---------------------|------------------|----------------|
| 3.01 | Plan-profile: | Horizontal 1:500 | Vertical 1:100 |
| | Cross-section: | Horizontal 1:100 | Vertical 1:100 |
| | Structural Details: | Horizontal 1:20 | |

4.0 Drawing Technique

- 4.01 Drawings shall be computer generated using AutoCAD, or hand drafted in ink with Leroy lettering. A variety of line widths shall be used so as to clearly identify services, lot lines, and dimension lines.

5.0 General Requirements for all Services

- 5.01 Elevations shall be relative to the Municipal datum. Bench mark numbers, locations and elevations can be obtained from the Municipal Engineering Department. The reference bench mark and elevation shall be shown on the Design Drawing.
- 5.02 All existing rights-of-way and their permitted uses must be checked through the Land Titles Office and lightly shaded on the Design Drawing. Proposed rights-of-way for new services are to be shown as a chain dotted line, together with their width, permitted uses, and the note "acquire".
- 5.03 Where there is more than one profile, clearly identify each.

- 5.04 A north arrow, adjacent lots and plan numbers, street names, and the legal description of the parcel being subdivided, shall be shown on the drawing. In general, the north arrow should be orientated towards the top or left side of the plan.
- 5.05 All services are generally shown on one (1) plan with curbs, sewers, drains, water and underground wiring and poles identified as C, S, D, W, and U/G, H or T respectively.
- 5.06 Existing services shall be indicated by a solid line and proposed new construction by a dashed line.
- 5.07 Show the elevation of any existing offsite basement floors which would have a critical effect on the design of services.

6.0 Requirements for Subdivision Key Plan

- 6.01 A key plan to scale 1:2500 shall be included on each set of Engineering Drawings and shall contain the following information:
 - a) Plan of all proposed streets and lot lines with streets named and lots numbered.
 - b) Existing streets and lots adjacent to proposed subdivision.
 - c) Indicate existing and proposed hydrants and street light standards.
 - d) Contours at 2 meter intervals except on very steeply sloping ground, where 4 metre intervals will be accepted.
 - e) If the subdivision is to be developed in stages, each proposed stage shall be clearly outlined and order of development indicated.

7.0 Requirements for Roads

- 7.01 Both plan and profile must be tied to an iron pin, preferably near or at 0 + 00 chainage. If the chainage exceeds 100 metres, a second tie shall be shown.
- 7.02 Show the road width and the curb offsets measured from the property line to the back of the gutter (curb face).
- 7.03 Chainages of the BC and EC of horizontal curves shall be shown together with the central angle, centerline radius, tangent length, and centerline arc length.
Curb radii are not required, except on curb returns at intersections, at the end of cul-de-sacs, and on any curbs where alignment is not directly related to the centerline radius.

- 7.04 The percent grade to two (2) decimal places shall be shown on the profile together with the following information on vertical curves:
- a) The chainage and elevations of BVC, EVC and PIVC.
 - b) The external value, e.
 - c) The length of vertical curve.
 - d) The elevation and chainage of the low spot of sag curves, or the high spot of crest curves.
 - e) The chainage and elevations at 10 metre intervals.
- 7.05 Road profiles shall show the top of curb elevations.
- 7.06 On super-elevated curves and crossfall sections, show a profile of each curb (no centerline profile).
- 7.07 Detailed plan of turn-arounds at a scale of 1:250 shall include top of curb elevations and crossfall grade information.
- 7.08 The profile shall be shown at true centerline length and projected above the plan in as close relationship as possible.
- 7.09 Locate catch basins - using road chainage - and show catch basin leads.
- 7.10 Existing driveways, drainage ditches, culverts, etc. adjacent to the works shall be shown on the drawings.

8.0 Requirements for Sewer and Drain

- 8.01 PROFILE - the following information shall be shown:
- a) Size, type and class of pipe, class of bedding and percent grade to two (2) decimal places.
 - b) Invert elevations at both inlet and outlet of manholes.
 - c) Information on vertical curves.

- 8.02 PLAN - the following information shall be shown:
- a) All survey pins and the ground elevations at each pin.
 - b) Information on horizontal curves.
 - c) Tie locations of manholes, cleanouts, and other appurtenances to survey pins.
 - d) Pipe offsets from property line.
 - e) Tie location of house connections at the property line to survey pin.
 - f) Ground and invert elevations of house connections at the property line or at the end of connection in a right-of-way.
- 8.03 ADDITIONAL INFORMATION - the following additional information shall also be shown where appropriate:
- a) Sanitary sewer manholes shall be lettered and storm drain manholes shall be numbered on plan and profile.
 - b) Structural details of all manholes not covered by the Standard Drawings.

9.0 Requirements for Water

- 9.01 A profile of the watermain is not required unless there is a possible conflict with other services or if the watermain varies from the standard one (1) metre cover.
- 9.02 Tie the location of hydrants and other appurtenances to the nearest survey pin.
- 9.03 Show the offset of the main from the property line and locate the end of the main to the nearest survey pin.
- 9.04 Indicate the size, type and class of pipe on the plan.

10.0 Requirements for Underground Hydro and Communication Services

- 10.01 Dimension of offset from property line to the underground conductors.
- 10.02 Refer to appropriate utilities for complete details of existing underground installations.

- 10.03 Dimension the location of all poles, both existing and proposed, from the pole road face to property line and/ or survey pins.

- 10.04 Show existing and proposed street lights.

SECTION 2.B PREPARATION OF "AS-BUILT" DRAWINGS

1.0 General

1.01 The Consulting Engineer shall submit the following "As-Built" drawings in compliance with Section 1.B.12:

- a) One complete set of paper print "As-Built" drawings, colour coded as follows to show the extend of constructed services:

Sanitary Sewer	Red
Storm Drains, Culverts	Green
Water -	Blue
Curb, Sidewalk and Pavement Edge	Orange

- b) One complete set of "As-Built" reproducible drawings with new services clearly delineated. These "As-Built" drawings shall clearly show the location of all services as installed using offsets from survey pins. The locations will be shown either by check marking the original dimensions on the drawing (if they are correct) or by showing the revised dimension.

1.02 The "As-Built" drawings are to be completed and certified in accordance with Section 1.B. subsection 12 of these Specifications.

1.03 In addition to the information required under Section 2.A the "As-Built" drawings shall include chainages from downstream manholes to sewer and drain house connecting points at the main.

2.0 Tolerances

2.01 All horizontal locations shall be to the nearest 150mm and all vertical locations to the nearest 3mm except that ground elevations and house connection inverts at property line shall be to the nearest 30mm and road vertical locations to the nearest 15mm.

SECTION 3.A DESIGN OF SANITARY SEWERS AND STORM DRAINS

1.0 General

- 1.01 Upstream drainage and sewerage areas, the Consulting Engineer must consider land use in accordance with the Official Community Plan and the Zoning by-law of the Municipality and other criteria required accommodating upstream drainage and sewerage.
- 1.02 It shall be the responsibility of the Consulting Engineer to summarise drainage and sewerage computations pertaining to that project and submit this data for approval together with a contour plan (scale 1:2500) showing the boundaries.
- 1.03 The Municipality reserves the right to restrict connections to existing storm drain and sanitary sewer systems.
- 1.04 The Municipality reserves the right to make all connections or alterations to existing systems at the expense of the Applicant where it can be demonstrated that such work is necessary to accommodate the Applicant's development.
- 1.05 Provisional crossings and/or connections for future development must be installed when requested by the Municipal Engineering Department.

2.0 Design Criteria for Sanitary Sewers

- 2.01 Design shall conform to the current "Guidelines for Assessing Sewerage Works" as prepared by the Ministry of Environment of the Province of British Columbia.
- 2.02 Pipes shall be designed to carry the required quantity when flowing full.
- 2.03 The following criteria shall be applied in the sizing of sanitary sewers in the Municipality of Central Saanich:-
- .1 Domestic Wastewater Flow:
60 igpd/capita (275 L/day/capita)
 - .2 Peaking Factor (Babbit Formula):
 $PF = 5p^{1/5}$
where: p = tributary population in thousands
 - .3 Infiltration Rate:
460 igpd/ac (0.061 L/s/ha)

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Cont'd

- .4 Design Flow = (Population x Domestic Wastewater Flow x Peaking Factor) +
(Infiltration Rate x Area)
- .5 Hydraulic Design for Trunk Sewers (Manning Formula):
n = 0.013 for all pipe.
- 2.04 The minimum grade of sanitary sewers shall be that which produces a minimum velocity of 0.75 metres per second in the pipe. However, a velocity of 1.0 metre per second must be attained in the pipe above the last manhole.
- 2.05 Service connections for single family dwellings shall be 100mm minimum diameter pipe laid at a grade not less than two (2) percent connected to the main with monolithic wyes or directional tees as shown on Municipal Standard Drawing No. 309.
- 2.06 Main sanitary sewers shall not be less than 200mm in diameter, except that sanitary sewers in the upper part of a non-extendable system as defined in "Guidelines for Assessing Sewerage Works" may be 150mm in diameter.
- 2.07 Local sewage lift stations shall be designed and sized to handle peak wastewater flows. Emergency facilities must be provided to prevent overflow in the event of loss of power. Rationale for emergency design criteria is to be submitted to the Municipal Engineering Department by the consultant.

A duplex, in-ground, F.R.P. pump chamber, having sufficient wet well capacity to ensure efficient pump operation, shall be installed. Chamber depth must be no more than five (5) metres unless otherwise approved the Municipality. Twin, lockable access hatches, of a size and location to facilitate removal of pumps via guide rails, are to be provided. Fittings to include chamber vent, bolting location for municipal hoist, approved access ladder and flat steel bar with hooks for floats.

A separate chamber is to be provided for operating valves. The valving will consist of individual check and plug valves for each pump. Check valves shall have external lever. In addition, a 1/2" i.p. with female end shall be installed in the force main for pressure testing. A valved drain shall discharge to the pump chamber.

All bolts, nuts, anchors, etc. to be Type 316 stainless steel. Other steel parts to be hot dipped galvanised.

Two (2) Flygt submersible sewage pumps with ductile iron discharge piping shall provide 100% standby. They will be equipped as follows:-

- Hydraulic flush valve (one pump only);
- Heat and moisture sensors;
- Galvanised lifting chains and shackles; and

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- Galvanised guide bars for easy installation and removal of pumps.

Five floats with continuous leads to control panel will control pump operation. These shall be wired, as follows:-

- (1) Low level alarm;
- (2) Stop all pumps;
- (3) Start lead pump;
- (4) Start lag pump; and
- (5) High level alarm.

Items (1), (4) and (5) will send alarms to Communications Centre.

Control unit shall be Flygt automatic, weatherproof unit in Cema 3 steel enclosure. Controls shall comply with the most recent standards of Municipal installations. Base of unit shall be an approved distance above the top of the pump chamber. Two (2) 150mm ducts shall connect the control unit to the chamber. A Crowse Hinds #AR 1048-S22 with male end No. 72 receptacle will be supplied for standby power use. Contronic 8-channel dialer with 20 hour auto rechargeable battery backup will be programmed to transmit the following:-

- High level alarm;
- Lag pump on;
- Low level alarm;
- Power failure alarm;
- Low battery; and
- Restored code.

Panel to be provided with a 100 volt duplex receptacle with ground fault interrupted, 100 watt heater with thermostat and explosion proof fan. Individual hour meters will monitor pump operation.

Upon acceptance, station shall be fully operational, including alarm system. A gravel parking pad will be provided for Municipal maintenance vehicles with protection bollards, if necessary. Station shall be provided with appropriate screening.

3.0 Design Criteria for Storm Drains

- 3.01 Storm drainage shall be discharged from the subdivision to an acceptable outlet within the Municipal drainage system in accordance with the Subdivision Bylaw.
- 3.02 Subject to the requirement and/or approval of the Municipal Engineer, the principles of storm water management - "zero increase in run-off" - may be incorporated into the design of storm drains.
- 3.03 The rational formula $Q = RAIN$, where Q is the peak runoff rate in m^3 per second, R is the runoff co-efficient, A is the area in hectares, I is the rain- fall intensity in millimetres per hour, and $N = 0.002778$; shall be used in the design of storm drains.
- 3.04 Unless otherwise required by the Municipal Engineering Department, the recurrence interval used in designing storm drains up to and including 900mm shall be ten years, and greater than 900mm shall be twenty-five years.
- 3.05 The intensity-duration curve to be used shall be that of the Victoria International Airport, as shown on the Standard Drawing No. 301.
- 3.06 The following minimum values shall be used for the inlet time to the upstream end of non-extendable storm drain lines and for the coefficient of runoff (R):
- a) Unimproved areas, parks playgrounds, cemeteries, etc. - inlet time to be determined using standard engineering practice acceptable to the Municipal Engineering Department and $R = 0.35$.
 - b) Residential areas - low-density, single-family dwelling neighbourhoods - inlet time = 10 minutes and $R = 0.60$.
 - c) High density and largely impervious areas - inlet time = 5.0 minutes and $0.90 < R < 1.0$.
- 3.07 Composite value based on percentages of different types of contributory areas may be established from the above figures. Care should be taken to incorporate future land use in the design. In areas subject to excessive overland flows, or in seepage areas, French drains, diversion ditches, catch basins, etc. as required shall be installed.
- 3.08 Pipes shall be designed to carry the required flow when flowing full.
- 3.09 Pipe capacity is to be determined by the Manning Formula using the following roughness coefficients:
n = 0.013 for concrete pipe
n = 0.011 for P.V.C. pipe

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- 3.10 The minimum grade for storm drains shall normally be that which produces a velocity of 1.0 metre per second in the pipe when flowing full.
- 3.11 Service connections for single family dwellings shall be 100 mm minimum diameter pipe laid at a grade not less than two (2) percent and connected to the main with monolithic wyes and directional tees. Hubs of design and material acceptable to the Municipality may be used when connecting to an existing system or on pipes over 250 mm diameter. For details of connections to concrete pipe, see Standard Drawing No. 310.
- 3.12 Main storm drains shall be not less than 200 mm in diameter.
- 3.13 Catch basin leads shall be minimum 150 mm diameter laid at a minimum grade of one percent.
- a) Not more than one catch basin shall be connected to a lead;
- b) Double catch basins shall be individually connected to the main.
- 3.14 Open ditches shall enter an enclosed storm drain system through a silt trap as shown on Standard Drawing No. 306. The pipe accepting the flow from the ditch shall be a minimum 250mm diameter.
- 3.15 Driveway culverts shall be a minimum 250mm diameter.

4.0 Materials

- 4.01 All pipes shall be free of defects and be of the size and class shown on the design drawings.
- 4.02 The following pipe is permitted for sewers and drains providing it is designated on the design drawing.

a) **200mm to 900mm**

Material:	Concrete - non-reinforced.
Class:	3
Use:	Main storm drains. Main sanitary sewers.
Current Standard:	ASTM C14

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b) **200mm to 3600 mm**

Material: Concrete - reinforced.
Use: Main storm drains.
Driveway culverts.
Main sanitary sewers.
Current Standard: ASTM C76

c) **250mm and up**

Material: CMP - galvanized.
Use: Driveway culverts.
Current Standard: CGSB 34GP-96

d) **150mm to 400mm**

Material: Ductile Iron - 1035 kPa
Use: For main storm drains or
catch basin leads.
Main sanitary sewer.
Current Standard: AWWAC151-76

e) **100mm and 150mm**

Material: PVC Gravity Sewer Pipe DR28, Pipe stiffness of not
less than 690 kPa with rubber gasket and integral
bell.
Use: 100mm and 150mm for service connections.
150mm for catch basin leads.
Current Standard: CSA B182.1; ASTM D2412-73

f) **200mm to 375mm**

Material: PVC Gravity Sewer Pipe DR 35, pipe stiffness of not
less than 320 kPa with rubber gasket and integral
bell.
Use: Main storm drains.
Main sanitary sewers.
Current Standard: ASTM D3034-77C; CSA B 182.2;
ASTM D2412-73

g) **Other**

Material & Class : As approved by the Municipal Engineer.

5.0 Field Supporting Strength

- 5.01 The class and type of pipe and fittings, together with required class of bedding and trench widths shall be so selected that the pipe will support the anticipated gravity earth and any surface dead and live loads with a safety factor of 1.5 for rigid and 1.9 for non-rigid pipe. Details of pipe bedding are shown on the Standard Drawing No. 302.
- 5.02 Minimum cover for mains shall be 0.75m. For installation in road allowances, minimum cover shall be 1.0m (except for catch basin leads).
- 5.03 Minimum cover for catch basin leads shall be 0.75m from main to within 2 metres of catch basin.
- 5.04 Minimum cover for house connections shall be 0.45m. For installation in road allowance, minimum cover shall be 0.75m.

6.0 Alignment and Grade

- 6.01 Pipelines shall be normally designed to follow a straight alignment and constant grade between manholes. Curves may be permitted when this is not feasible.
- 6.02 Any curve, whether horizontal or vertical, must be approved by the Municipal Engineering Department, and shall conform to the following:
- a) Only one curve, either horizontal or vertical may be permitted between manholes.
 - b) The radius of a horizontal curve shall be not less than 60m, or that radius recommended by the pipe manufacturer, whichever is greater.
 - c) A vertical curve must be not less than 30m in length. The curve must be designed so that the pipe deflection does not exceed the manufacturer's specifications.

7.0 Location of Services

- 7.01 Sanitary sewers and storm drains should be located within the road allowance where possible. Service connections shall be installed to each proposed lot, connected to the main, and where feasible, in a common trench.
- 7.02 The designer shall make provision for the installation of other services such as watermains, curbs, sidewalks, power and telephone facilities. Standard Drawing No. 502 shows typical location of services on residential streets or private easement.
- 7.03 Service connections shall be extended to the edge of any right-of-way and to the main body of the lot in a panhandle access or private easement.

8.0 Manholes and Cleanouts

8.01 The maximum distance between manholes may vary according to the pipe diameters as shown in the table below:

<u>Pipe Size</u>	<u>Maximum Spacing</u>
150mm up to and including 375mm	120 metres
Over 375mm up to and including 1200mm	180 metres
Over 1200mm	300 metres

8.02 Manholes shall be provided at the following additional locations:

- 1) At all changes of grade and/or alignment.
- 2) At all changes of pipe size and type.
- 3) At all pipe junctions other than service connections.
- 4) Where the service connection is the same size as the main, if required by the Municipal Engineering Department.

8.03 Drop manholes may be allowed only where particular circumstances preclude the use of normal manholes, and must be in accordance with details shown on Standard Drawing No. 304. Allowance must be made in the design for the effect of the resulting turbulence on hydraulic capacity of the system.

8.04 The relative elevations entering and leaving a manhole are to be such as to ensure that the manhole does not reduce the hydraulic capacity of the system. Allowances for energy losses or changes in velocity are to be determined in accordance with sound hydraulic principles.

8.05 Manholes are normally constructed in accordance with the details as shown on Standard Drawing No. 303. In cases where these details will not suffice, the Municipal Engineering Department must approve a detailed design drawing. All manholes with pipes 450mm or larger must be individually designed. All situations involving a pipe flowing into a small pipe on a steeper grade shall require special treatment.

8.06 Stubs shall be placed in manholes to allow for future extensions. The length of stubs shall be 0.060m maximum from the outside of the manhole unless otherwise requested, and the end shall be securely capped.

8.07 Cleanouts shall be installed at the end of all mains as shown on Standard Drawing No. 305.

9.0 Rights-of-Way and Easements

- 9.01 Where topographic or other circumstances render it necessary to locate services on private property, the services shall be installed in a Municipal right-of-way.
- 9.02 Right-of-way widths shall be:
- 3.0 metres (minimum) for a single service.
 - 3.6 metres (minimum) for twin services.
 - 4.5 metres (minimum) for services in excess of 2 metres in depth.
- 9.03 It is preferable that rights-of-way are located within a single property adjacent and parallel to property boundaries.
- 9.04 Where sanitary sewer and/or storm drain facilities are not yet available, rights-of-way shall be provided by the applicant for the eventual installation of the sanitary sewer and/or storm drain as required by the Municipality.
- 9.05 Service connections through private property shall be placed within a private easement, a minimum of 3 metres wide.

SECTION 3.B INSTALLATION OF SANITARY SEWERS AND STORM DRAINS

1.0 General

- 1.01 This Specification shall cover the installation of the pipes, manholes and other appurtenances used in the construction and installation of storm drains and sanitary sewers throughout the Municipality.
- 1.02 Provision shall be made to maintain the flow of all sewers, drains, house or inlet connections and all watercourses and ditches which may be encountered during the progress of the work. the contents of any sewer, drain, house or inlet connection shall not be allowed to flow into the trench or into the mains except where permission is given by the Municipal Engineer. All offensive matter shall be immediately removed from the proximity of the work, using such precautions in doing so as directed by the Consulting Engineer.

2.0 Alignment and Grade

- 2.01 Line and grade stakes shall be set out at not more than 15 metre intervals on a straight line and constant grade, at 7.5 metre intervals on horizontal or vertical curves, and at maximum 7.5 metre intervals where the grade is one percent (1%) or less.
- 2.02 At each stake position grade boards shall be erected to enable the pipe to be laid to a constant grade between the boards. At least three grade boards shall be in place at the location of the open trench. In vertical curves, the pipe shall be laid to grade by using the two grade boards on either side of the joint being set to grade.
- 2.03 When laser or other instruments are to be used to set alignment and grade the procedure shall be approved by the Consulting Engineer.

3.0 Excavation

- 3.01 Where the sewer or drain location is not to be under any pavement, driveway or gravel shoulder, top soil to a maximum depth of 300mm shall be removed and stockpiled for eventual replacement.
- 3.02 Where trenches are excavated on the travelled portion of a road or future road, all excavated material shall be removed from the site, except in such cases where approval is given by the Works Inspector and Consulting Engineer for the use of this material for back filling.
- 3.03 If the clear width trench at the top of the pipe is greater than that specified on the Design Drawings, reference must be made to the Consulting Engineer who shall obtain the approval of the Municipal Engineering Department before further construction may continue.

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- 3.04 If the bottom of the trench is organic or contains other unsuitable material, the trench shall be excavated to firm ground or such other remedial measures taken as required by the Consulting Engineer, subject to the approval of the Municipal Engineering Department.
- 3.05 Any excavation carried out below pipe invert elevation shall be backfilled with pit run gravel or crushed rock overlaid with sufficient sand or gravel for bedding the pipe, compacted in a maximum of 150mm lifts.
- 3.06 All water, soft silt or other disturbed material shall be removed from the bottom of the trench prior to placement of bedding.
- 3.07 All solid rock, boulders and large stones shall be removed to provide a minimum clearance of 150mm around the pipe.
- 3.08 When the end of the service connection is in solid rock, the rock must be blasted 1.2 metres past the end of the connection.
- 3.09 No blasting may proceed without securing a Municipal Blasting Permit in accordance with Section 1.B Sub- section 6.01(f) of these specifications.
- 3.10 Where an existing structure or underground installation may be affected by the works, it is the responsibility of the Consulting Engineer to ensure that the owner of such utility has sufficient time in which to specify what protective measures must be taken.
- 3.11 Where an unforeseen obstruction is encountered which interferes with the designed alignment, the Consulting Engineer shall have construction stopped and not proceed until such time as the Municipal Engineering Department approves revised proposals.

4.0 Bedding Material

- 4.01 Bedding material shall be that material from a depth of 150mm below the pipe to 150mm above the top of pipe.
- 4.02 The bedding details will be as indicated on Standard Drawing No. 302.
- 4.03 Imported machine placed granular material shall be 10mm maximum size.
- 4.04 Hand tamping bars or equal shall be used for tamping all material below springline of pipes.

5.0 Installation of Pipe

- 5.01 Pipes shall be handled, stored and laid in accordance with the recommendations of the manufacturer.
- 5.02 All pipe must be laid to the designed horizontal and vertical alignment and be within the following tolerances:
- a) Horizontal Deviation from the true alignment shall not be greater than 60mm from the designated location and the rate of deviation shall not exceed 40mm in 10 metres.
 - b) Vertical Deviation from true grade varies with the grades and shall not exceed the limitations as detailed in the table below:

<u>Grade</u>	<u>Max. Departure from Design Grade</u>	<u>Max Rate of Deviation</u>
Over 5%	30 mm	6mm in 3 metres
2% to 5%	15 mm	3mm in 3 metres
Less than 2%	6 mm	3mm in 3 metres

6.0 Manholes, Cleanouts, Silt Traps and Catch Basins

- 6.01 Standard manholes shall be constructed as shown on Standard Drawing No. 303.
- 6.02 Drop manholes if approved by the Municipal Engineering Department will be constructed as shown on Standard Drawing No. 304.
- 6.03 Manholes other than standard or drop manholes will be constructed as shown on the approved Design Drawing.
- 6.04 Cast-in-place manholes will be allowed provided that the following criteria is observed:-
- a) Concrete shall attain a minimum strength of 20 Mpa at 28 days;
 - b) Structural details will be in accordance with the approved Design Drawing.
- 6.05 The manhole frame shall sit on a minimum of one (1) and a maximum of three (3) courses of mortared concrete brick which shall be parged on both sides with a mortar paste composed of one part cement and three parts of sand and only sufficient water for workability.
- 6.06 Heavy-duty 200mm frames and covers as per Standard Drawing No. 308 shall be installed on manholes and cleanouts within the travelled portion of existing and future roadways.
- 6.07 Light duty 100mm frame and covers as per Standard Drawing No. 307 shall be installed on manholes and cleanouts in non-travelled areas.

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- 6.08 All sanitary sewer manholes shall be constructed so as to be watertight.
- 6.09 Catch basins, silt traps and cleanouts shall be constructed as shown on Standard Drawings: 305, 306, 311, 312, and 313.
- 6.10 The Contractor shall take precautions to prevent mortar and other debris from entering any part of the system.

7.0 Back filling of Trenches

- 7.01 Where a pipe is installed beneath an existing or foreseeable future pavement, driveway, sidewalk or gravel shoulder, the backfill shall be pit run gravel machine compacted in maximum 300mm lifts such that the compaction achieved shall be not less than 95% Standard Proctor Density. The gravel backfill at all depths shall extend at least one (1) metre beyond the curb, driveway or future edge of pavement.
- 7.02 Suitable native material may be used as backfill where the pipe is installed in non-travelled areas. Backfill in these cases shall be free of stones over 150mm in size, frozen material, organic, or other perishable or objectionable material that would prevent proper consolidation or that might cause subsequent settlement.
- 7.03 Where it is required to replace topsoil, it shall be placed in the upper 200mm of the trench and shall be heaped on top to allow for settlement. If the installation is under a developed lawn, the soil shall be fine raked at the appropriate season, sown with a top quality grass seed, at the rate of 150 grams of seed per square metre and rolled.
- 7.04 Where the trench is on the shoulder or under the paved portion of the street or driveway, the surface material shall be cut in neat straight lines. Where the edges of an area requiring repaving extend outside the straight lines cut, further cuts shall be made so that the final patch will have a neat appearance. All gravel-filled cuts must be maintained to the original travelled surface until final paving is installed in accordance with Section 1.B subsection 10.01 of these specifications.
- 7.05 If weather conditions do not permit hot-mix asphalt at the time of installation, a temporary cold-mix asphalt patch must be placed within a 3 day period, and be replaced with hot-mix as soon as weather permits. All cuts paved as specified shall be maintained by the Applicant to the level of the original travelled surface for a period of one year after the date of acceptance of the work. Should excessive settlements occur during the year's maintenance period, the Municipality will require the Applicant to excavate and restore the trench.

8.0 Testing of Sanitary Sewers - Gravity Mains

- 8.01 After the gravity sections of sewers have been back filled and all house connections installed, the Contractor shall air test the pipe in the presence of the Consulting Engineer.

- 8.02 The sewer line shall be tested at an internal air pressure of 35 kPa (5 psi) for a duration of five (5) minutes. If the pressure at the end of this period is 28 kPa (4 psi) or greater, the section of pipeline under test will be considered acceptable.

9.0 Testing of Sanitary Sewers - Pressure Mains

- 9.01 Pressure sewer mains shall be tested at 2 times the working pressure and not less than 345 kPa (50 psi) for a period of one (1) hour. The procedure to be followed shall be the same as outlined in the section for testing of watermains.
- 9.02 Should any test disclose a defect, the Applicant shall have the defect located and repaired. The affected length will be re-tested and not accepted until found satisfactory.

10.0 Clean-Up

- 10.01 All pipelines, manholes and other appurtenances shall be thoroughly cleaned to the satisfaction of the Works Inspector.
- 10.02 The Contractor shall remove excess materials and clean up the area within two weeks of completing the installation of any section of pipe.

11.0 Video Camera Inspection

- 11.01 Prior to acceptance of any sewer or drain line, the Consulting Engineer shall arrange for a video camera inspection of the line. The recording tape shall be provided to the Municipal Engineering Department complete with camera operator's written report.
- 11.02 During video camera inspection, a constant flow of water from a municipal watermain shall flow through the inspected section at around five litres per second.
- 11.03 If any deviations from standards are noted, during camera work, the work shall be repaired, re-tested and, at the discretion of the Municipal Engineer, subjected to a further video camera inspection.
- 11.04 Where blasting is required in proximity to existing mains, a video camera inspection of the existing main shall be required as detailed for new mains.

SECTION 4.A DESIGN OF WATERMAINS

1.0 General

- 1.01 This specification shall govern the design of all water pipe and waterworks appurtenances within the Municipality.
- 1.02 The Municipality shall make all connections or alterations to existing systems at the expense of the applicant. The contractor engaged by the applicant for this purpose shall carry out all other work.

2.0 Materials

- 2.01 The following materials shall be used for all waterworks construction within the Municipality:
- a) Pipe
All pipe shall be PVC class 150, DR18, AWWA C-900, as approved by the Municipal Engineering Department.
 - b) Fittings
Fittings shall be cast iron, ASTM A126, AWWA C110-77, Terminal City tyton or other as approved by the Municipal Engineering Department.
Sceptre Class 150 AWWA C-900 P.V.C. bends - 4" diameter through 8" diameter, 11 1/4 degrees through 90 degrees - or other as approved by the Municipal Engineering Department are also approved for use.
 - c) Gate Valves
All line valves shall be gate valves - 860 kPa (125 pound) iron body, bronze mounted, solid wedge or double disc, resilient seat type with non-rising stem, turning clockwise to open, with 32mm (1 1/4") square operating nut - Terminal City or other as approved by the Municipal Engineering Department.
 - d) Air Release Valves
Air release valves shall be 25mm double acting, Terminal City or other as approved by the Municipal Engineering Department.
 - e) Hydrants
Fire hydrants shall be 150mm (6"), tested for a working pressure of 1725 kPa (250 psi) and having one (1) 148mm (5.825") O.D. pumper port, threaded 8 T.P.I., and two (2) diagonally set 65mm (2 1/2") hose ports, threaded to B.C. Standard, Terminal City Model C71-P or other as approved by the Municipal Engineering Department. Ports are to be provided with caps. The operating nut is to be pentagon shape with 25mm (1") sides turning clockwise to open. Port caps shall have matching nuts. A drain valve shall be incorporated in the base of the hydrant.

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- f) Bolts and Tie Rods
All bolts and nuts used on underground fittings or appurtenances shall be cadmium plated. Hydrant tie rods to be stainless steel.
- g) Service Connections
Materials for water services shall be as shown on Standard Drawing No. 407. Service tubing shall be of one continuous piece between the main stop and the curb stop. Service connections shall be extended to the main body of the lot in a panhandle access.

3.0 Pipe Size

- 3.01 The size of the pipe to be used shall be 150mm diameter unless otherwise required by the Municipal Engineering Department, except that in a cul-de-sac with ultimate length not over 90 metres, the pipe size shall be 100mm diameter.
- 3.02 The size of the pipe used for water services shall be 19mm unless otherwise required by the Municipal Engineering Department.

4.0 Pipe Location

- 4.01 Watermains shall be located such that each lot to be served has at least one (1) side fronting thereon. The watermain shall be extended to the most convenience existing watermain that will provide an adequate supply of water.
- 4.02 The pipe shall extend at least one (1) metre beyond the curb line at the extreme end of a designed cul-de-sac, or to the property line at the end of the road which can be further extended.
- 4.03 The pipeline shall be located within a road allowance unless otherwise approved by the Municipal Engineering Department. Standard Drawing No. 502 shows preferred locations within the road allowance.
- 4.04 In locating the watermain, the Consulting Engineer shall make provision for the installation of other services such as drains, sewers, curbs, sidewalks, power and telephone facilities.
 - a) Where it is necessary for the watermain to cross other underground services the crossing shall be made at an angle greater than 20 degrees and the vertical clearance between services at the crossing point shall be not less than 75mm.
 - b) At any location, there shall be a minimum linear horizontal clearance of one (1) metre between the watermain and other existing or proposed underground services or open ditches, except sanitary sewers, unless an approved construction technique is employed. A minimum linear horizontal clearance of 3 metres shall be maintained

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between the watermain and a sanitary sewer with the exception that in rock or hardpan the watermain may be located on a bench of undisturbed material providing continuous support and having a horizontal separation of 300mm minimum and the invert of the watermain a minimum of 300mm above the crown of the sanitary sewer.

- 4.05 At all intersections, the pipe shall connect to existing mains. Where the final road pattern creates a weak watermain network, a supplementary connection of a minimum of 150mm diameter to an existing main shall be required at the discretion of the Municipality and may necessitate the provision of a right-of-way in favour of the Municipality.
- 4.06 Provision shall be made for expelling air by the installation of air valves where required by the Municipal Engineering Department.
- 4.07 Where a watermain extension creates a dead-end, the Municipality may require that the main be looped to another live system.

5.0 Fire Hydrants

- 5.01 Fire hydrants shall be installed as detailed on Standard Drawing No. 401. Hydrants shall be located so that every home is within 120 metres taking into consideration the locations of existing hydrants.
- 5.02 Hydrants shall be in the boulevard and preferably at or near a street intersection; otherwise they may be located on the projection of the property line dividing two lots. In selecting the location for a hydrant, the probable route of the fire engine shall be considered.
- 5.03 A hydrant shall not be located within 3 metres of a utility pole or light standard, within one (1) metre horizontally of underground service pipes or open ditches, within 0.75 metres of a property line or within 2.25 metres of the curb line. The Municipality may require additional hydrants at school, apartment, commercial or other high value properties.

6.0 Gate Valves

- 6.01 Line valves shall be not more than 365 metres apart. For convenience of operation, line valves should be located adjacent to a hydrant if there are no connecting mains within 120 metres. Line valves or hydrant valves shall not be located within 600mm of a curb line, in a ditch, or above another service.
- 6.02 There shall be a line valve of the same diameter as the pipe on each branch of all 'tee' and 'cross' fittings or as approved by the Municipal Engineering Department.

7.0 Flush Valves

- 7.01 Plans shall show flush valves at all dead ends in accordance with Standard Drawing Nos. 402 and 403.

SECTION 4.B INSTALLATION OF WATERMAINS AND SERVICES

1.0 General

- 1.01 This specification shall cover the installation of pipes and other appurtenances used in the construction of waterworks facilities throughout the Municipality.
- 1.02 Water services shall include that portion of the installation from, and including, the main stop up to and including the curb stop. Water services shall be installed in accordance with Standard Drawing No. 407 and shall conform to this specification.
- 1.03 The installation, including excavation, jointing, and backfill of all water pipe shall be in accordance with the current A.W.W.A. Standards and shall conform to this specification. Every reasonable precaution against contamination of pipe and fittings must be taken during execution of the works. Control of all existing valves shall rest with the Municipality. Valves and hydrants shall not be opened or closed by an unauthorised person.

2.0 Location

- 2.01 All pipe shall be laid to designed alignment and grade with the following tolerances:
- a) Horizontal tolerance shall not be greater than 60mm from designed location. The rate of deviation from the required alignment shall not exceed 30mm in 7.5 metres.
 - b) Vertical tolerance shall not be greater than 10mm from designed grades, where required.
- 2.02 The curb stop shall be not more than 0.4 metres outside of the front property line. The last metre of water service shall run parallel to the property line. Water services shall be installed from the watermain to the property line at 90 degrees.
- 2.03 Water services shall be located adjacent to survey pins of adjoining properties or at the centre of lot frontages at the discretion of the Municipality.
- 2.04 The ditch excavation shall be deep enough to allow a minimum of one (1) metre of cover material to be placed over the watermain. When the watermain is within the road allowance, it shall in all cases be at least one (1) metre below the final road grade. The Municipality may require the watermain to be laid deeper in certain areas.
- 2.05 Thrust blocking to be in accordance with Standard Drawing No. 406.
- 3.01 Where the watermain location is not to be under any pavement, driveway or gravel shoulder, topsoil shall be removed and stockpiled for eventual replacement.

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- 3.02 Where trenches are excavated on the travelled portion of the road or future road, all excavated material shall be removed from the site, except in such cases where approval is given by the Works Inspector and Consulting Engineer for the use of this material for backfilling.
- 3.03 If the clear width of trench at the top of the pipe is greater than that specified on the Design Drawings, reference must be made to the Consulting Engineer who shall obtain the approval of the Municipal Engineering Department before further construction may continue.
- 3.04 If the bottom of the trench is organic or contains other unsuitable material, the trench shall be excavated to firm ground or such other remedial measures taken as required by the Consulting Engineer, subject to the approval of the Municipal Engineering Department.
- 3.05 Any excavation carried out below pipe invert elevation shall be back-filled with pit run gravel or crushed rock overlaid with sufficient sand or gravel for bedding the pipe, compacted in a maximum of 150mm lifts.
- 3.06 All water, soft silt or other disturbed material shall be removed from the bottom of the trench prior to placement of bedding.
- 3.07 All solid rock, boulders and large stones shall be removed to provide a minimum clearance of 150mm around the pipe.
- 3.08 No blasting may proceed without securing a Municipal Blasting Permit in accordance with Section 1.B subsection 6.01(f) of these specifications.
- 3.09 Where an existing structure or underground installation may be affected by the works, it is the responsibility of the Consulting Engineer to ensure that the owner of such utility has sufficient time in which to specify what protective measures must be taken.

4.0 Bedding Material

- 4.01 The bedding details will be as indicated on the Standard Drawing No. 302.
- 4.02 Bedding material shall be imported machine placed granular material of 10mm maximum size.
- 4.03 Hand tamping bars or equal shall be used for tamping all material below springline of pipes.
- 4.04 The pipe shall not be covered until it has been inspected, approved and the horizontal and vertical alignment recorded by the Consulting Engineer.
- 4.05 All fittings, valves and service connections shall not be covered until inspected by the Works Inspector and recorded by the Consulting Engineer.

5.0 Backfilling of Trenches

- 5.01 Where a pipe is installed beneath an existing or foreseeable future pavement, driveway, sidewalk or gravel shoulder, the backfill shall be pit run gravel machine compacted in maximum 300mm lifts such that the compaction achieved shall be not less than 95% Standard Proctor Density. The gravel backfill at all depths shall extend at least one (1) metre beyond the curb, driveway or future edge of pavement.
- 5.02 Suitable native material may be used as backfill where the pipe is installed in non-travelled areas. Backfill in these cases shall be free of stones over 150mm in size, frozen material, organic, or other perishable or objectionable material that would prevent proper consolidation or that might cause subsequent settlement.
- 5.03 Where it is required to replace topsoil, it shall occupy the upper 200mm of the trench and shall be heaped on top to allow for settlement. If the installation is under a developed lawn, the soil shall be fine raked at the appropriate season, sown with a top quality grass seed at the rate of 150 grams of seed per square metre and rolled.
- 5.04 Where the trench is on the shoulder or under the paved portion of the street or driveway, the surface material shall be cut in neat, straight lines. Where the edges of an area requiring repaving extend outside the straight lines cut, further cuts shall be made so that the final patch will have a neat appearance. All gravel-filled cuts must be maintained to the original travelled surface until final paving is installed in accordance with Section 1.B subsection 10.01 of these specifications. If weather conditions do not permit hot-mix asphalt at the time of installation, a temporary cold-mix asphalt patch must be placed within a 3 day period, and be replaced with hot-mix when weather permits. The Applicant to the level of the original travelled surface shall maintain all cuts paved as specified for a period of one (1) year after the date of acceptance of the work. Should excessive settlements occur during the year's maintenance period, the Municipality will require the Applicant to excavate and restore the trench.

6.0 Testing

- 6.01 The installation shall be tested by the Contractor and witnessed by the Applicant's Consulting Engineer and shall meet the requirements for pressure and leakage in accordance with these specifications.
- 6.02 All water services shall be installed prior to pressure testing of the watermains.
- 6.03 After the pipe has been laid and partially back filled, all newly laid pipe and hydrants, or any valved section thereof, shall be subjected to the hydrostatic pressure of 1,030 kPa (150 psi). The duration of each pressure test shall be at least one (1) hour.
- 6.04 Each valve section of pipe shall be slowly filled with water and the specific pressure, based on the elevation of the lowest point of the line or section under test and corrected to the elevation

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of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Municipal Engineering Department. The Contractor shall furnish the pump, pipe connection - including any necessary taps - and all necessary apparatus.

- 6.05. Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install main stops at such points as to allow air to expel as the line is filled. After the air is expelled, the main stops shall be closed and the test pressure applied.

7.0 Allowable Leakage

- 7.01 Leakage allowed for all watermains installed as per these specifications would be 1.11 litres/mm diameter/ kilometre/24 hours based on one (1) hour duration (10 Imp. gallons/inch diameter/mile/24 hours). The method of measuring leakage shall be as follows:

- Bring pressure to 1,030 kPa (150 psi);
- Mark water level in water reservoir;
- After one (1) hour, recharge the system from the reservoir and mark water level;
- Calculate amounts of water used and compare with allowable leakage requirements.

- 7.02 If the actual leakage exceeds the allowable requirements, the Contractor shall repeat the test after correcting any deficiencies in the system.

8.0 Chlorinating and Flushing

- 8.01 After the installation, the new pipe line shall be chlorinated internally as an assembled unit; the chlorine solution shall remain in the pipe line for a period not less than 24 hours, when it shall be flushed out and refilled with water from a Municipal main.

- 8.02 The Contractor in a manner satisfactory to Regional Public Health officials shall carry out the chlorinating process. Samples shall be taken from the flushed out waterline and tested for potability. The Capital Regional District Health Branch or the Consultant for the development must take test samples. The installation shall not be accepted until such tests prove satisfactory to the Regional Health Department, and the appropriate certificate furnished to the Municipality.

9.0 Clean-up

- 9.01 The Contractor shall remove excess materials and clean up the area within two (2) weeks of completing the installation of any section of pipe.

SECTION 5.A DESIGN OF ROADS

1.0 General

1.01 This specification shall govern the design of all roads within the Municipality.

2.0 Classification and Width

2.01 Prior to design, the Municipal Engineering Department shall classify and stipulate widths for the particular road under consideration.

2.02

Road Classification	Minimum Right of Way (m)	of Road Width (m)	Design Speed (km/h)	Water Control	Shoulder
Local:					
Rural	20	6.7	50	Various	1 m
Urban	18*	8.5	50	Concrete curb and gutter	N/A
Collector:					
Rural	18	11	50	Concrete curb and gutter	N/A
Urban	20	13	50	Concrete curb and gutter	N/A

* Subject to the approval of the Approving Officer and where all services are placed underground, road allowances for cul-de-sacs or non-extendable roads not greater than 150 metres in length could be reduced to 16 metres in width.

3.0 Vertical Alignment

3.01 The vertical alignment of the road shall be set to serve adjacent properties with access driveways at a grade not steeper than 15%, conforming to the requirements as shown on the Standard Drawing No. 513.

3.02 The length of a vertical curve shall be calculated using Standard Drawing No. 501.

3.03 Vertical controls are as follows:

Maximum grade – Local	10%
- Collector	8%
Minimum Grade	0.5%
Maximum Grade on Turn-Around	5%
Maximum Grade at Intersection Approach	3%
Maximum Cross fall	3%

- a) Where it can be demonstrated that the above limits cannot be reasonably met, the Municipal Engineer may allow an increase (or decrease) of up to 50% of the above controls.
- b) At intersections, the crossfall and the grade through the intersection may exceed 3% to blend into the steeper road grade.

4.0 Cross fall

4.01 The Municipality will consider the practice of cross falling a road at intersections and through difficult side slopes.

5.0 Super-Elevation

5.01 Horizontal curves on Municipal roads are not to be super-elevated to achieve design speed.

6.0 Transition

6.01 The length of a transition from a normal cross-sectioned road to be a section of road where there is cross fall shall be not less than 45 metres. In selecting the length of the transition, care and consideration shall be given to drain the entire pavement.

7.0 Extensions

7.01 Evidence that vertical alignments are satisfactorily extendable will be required.

8.0 Horizontal Alignment

8.01 The horizontal alignment of the road shall be centred in the road allowance. Typical locations of services for residential streets are shown on Standard Drawing No. 502.

8.02 Centreline chainage stations shall be referenced and dimensioned from an identifiable survey pin.

8.02 Minimum radius of curve and maximum super-elevations:-

	Design Speed (km/h)	Minimum Centreline Radius (m)	Maximum Super-Elevation
Local	50	90 *	0
Collector	50	100	3%
Arterial		Special Design	

* Subject to the approval of the Municipal Engineer, radii in restricted areas may be reduced to 45 metres.

8.04 Non-mountable curb returns of 8 metre radius are required for residential roads. Curb returns located on roads within industrial and commercial district require a 10 metre or larger radius to facilitate trucks and trailer trucks. Property line returns to be 6m and 8m respectively.

8.05 When a new road with curbs intersects an existing road, the curb returns shall be constructed.

9.0 Cross-section

9.01 The cross-section of all roads shall be designed in accordance with the dimensions and requirements set out in Standard Drawing Nos. 503 to 506. Reference to, or details of, the cross-section dimensions and requirements must be shown on each design drawing submitted.

9.02 The sub-base in fill sections shall extend a minimum of 2.5 metres beyond the curb face and shall rest on a sub-grade with side slopes not steeper than 3:1.

9.03 The subgrade in cut sections shall extend a minimum of 2.5 metres beyond the curb face. The cut banks shall be sloped to a minimum of 2:1 in earth, 1/4 :1 in rock, or retained by some method approved by the Municipal Engineering Department.

9.04 Where either the bottom of a fill slope or the top of a cut slope would extend beyond the limits of the road allowance, either permission to construct the works on the adjoining property shall be obtained and an appropriate right-of-way acquired, or retaining walls shall be constructed to contain such slopes within the limits of the road allowance.

9.05 Where cut slopes are to be made into ground seepage zones or where the extent of the slope would generate noticeable surface runoff, curtain drains shall be required at the base of the slopes and connected to the road drainage system or other suitable points of discharge.

10.0 Geometric Layout of Turn-Arounds

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10.01 The design of the turn-around in areas with single family dwellings shall conform to Standard Drawing No. 507. The dimensions may be increased to meet traffic and vehicular requirements, or where the turn-around is skewed.

11.0 Curbs, Sidewalks and Walkways

11.01 Curbs shall conform to Standard Drawing No. 508.

11.02 Mountable curbs shall be specified for residential streets except at curb returns and non-mountable curbs elsewhere, except as required by the Municipal Engineering Department.

11.03 Sidewalks, where required, shall be located adjacent to the curb and shall be 1.5 metres wide. Sidewalks are normally cross falled towards the road at two (2) percent. When installed in conjunction with curb and gutter, sidewalks shall be monolithically constructed in accordance with Standard Drawing No. 508.

11.04 Access walkways to parks, schools, etc., where required, shall conform to Standard Drawing No. 509.

11.05 Roadside water control, where required will be in accordance with Standard Drawing No. 510.

12.0 Catch Basins

12.01 Catch basins shall be constructed as shown on Standard Drawings No. 311 to 313.

12.02 Double catch basins shall be installed at locations of high runoff, sag curbs, or as required by the Municipal Engineering Department.

12.03 Catch basins shall be located on the higher branches at the end of the curb returns of intersections, at the lowest point of the sag of vertical curves, and at a spacing not greater than the following:

<u>Road Width (m)</u>	<u>Catch Basin Spacing (m)</u>
<u>8.5</u>	<u>90</u>
<u>11</u>	<u>75</u>
<u>13</u>	<u>65</u>
<u>14</u>	<u>60</u>

12.04 On roads with crossfall the maximum spacing shall be one half (1/2) of the above figures.

13.0 Appurtenances

13.01 The Consulting Engineer shall detail on the design drawing the location of all retaining walls, guard-rails, barricades, handrails and fences. These structures shall be designed in accordance with the following Standard Drawings, where applicable, and in keeping with good engineering practices:

No. 501 - Vertical Curves
No. 514 - Concrete Gravity Retaining Wall
No. 518 - Sidewalk Handrails
No. 519 - Chain Link Fence
No. 520 - Barricades

13.02 It is the responsibility of the Consulting Engineer to ensure that wall design are suitable for the conditions involved.

14.0 Utility Poles

14.01 The Consulting Engineer shall indicate utility poles requiring relocation and obtain confirmation from the appropriate utility prior to design completion.

15.0 Underground Wiring

15.01 The Consulting Engineer shall indicate on his design drawing the B.C. Hydro/B.C. Telephone layouts for all underground wiring, existing or proposed, including connections to properties.

16.0 Ditches & Culverts

16.01 Roadside ditches may not be excavated to a depth greater than .45 metres below the travelled surface and in accordance with Standard Drawing No. 510. Deeper ditches shall be culverted unless permission to the contrary is received from the Municipal Engineering Department.

16.02 All culverting of ditches, creeks, etc. within Municipal road allowances or rights-of-way must be at the discretion of the Municipality and will be sized and installed by Municipal forces except where they are required servicing for a development or subdivision that is under the direction of a Professional Engineer.

16.03 All roads other than those with curbs shall be constructed with shoulders of a minimum of one (1) metre width.

17.0 Structural Design of Roads

17.01 The compacted gravel base and asphalt pavement thickness requirements for various road classifications are shown on the following Standard Drawings:

Classification	Standard Drawing
Local Rural	503
Local Urban	504
Minor Collector	505
Major Collector	506

SECTION 5.B CONSTRUCTION OF ROADS

1.0 Clearing

- 1.01 The full width of the roadway and shoulders will be cleared of timber and brush. Trees on existing road allowances will not be removed unless approved by the Municipal Engineer. All topsoil and turf will be removed from at least 2.5m clear of the curbs. Sufficient topsoil must be retained on site for 200mm of topsoil on the boulevard. In road allowances, all additional surplus topsoil shall become the property of the Municipality and shall be deposited at a stockpile site approved by the Works Inspector.
- 1.02 The remaining portion of road allowance will be cleared of stumps, rubble, loose rock and rough graded to the satisfaction of the Municipality. Finished grading and seeding of grass where required shall be done upon completion of all construction.

2.0 Road Grades

- 2.01 Grade hubs will be set at not more than 10m intervals on tangents and 5m intervals on curves on both sides of the road at the same chainage points. Hubs will be located so that the construction equipment does not disturb them.
- 2.02 On horizontal curves, the increased or decreased arc shall be calculated to compensate for the radius so that the hubs on both sides of the road will bear the same centerline chainage.
- 2.03 Alternate layout methods may be used providing the final grade and/or alignment is within the acceptable limits. Acceptable tolerances shall be:
- a) Vertical Alignment: $\pm 15\text{mm}$
 - b) Horizontal Alignment : $\pm 30\text{mm}$

3.0 Road Base Construction

- 3.01 Terms of reference used hereunder are defined on Standard Drawings:-
- 3.01 a) Subgrade: The subgrade is the original undisturbed non-organic material lying below the sub-base and/or base. No topsoil, trees, stumps or any organic matter will be present in the subgrade.
- b) Sub-base: The sub-base, if required, is considered to be the layer of material placed between the subgrade and base course.

The sub-base will be constructed of granular material or clay acceptable to a soils Consulting Engineer and placed in layers not exceeding 200mm and compacted to 95% of the laboratory density obtained by following A.S.T.M. 698 Method D, or latest revision thereof with exception of the top 200mm which shall be compacted to 100%. No topsoil, trees, stumps or any organic matter will be buried in the sub-base.

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- c) Base: The base is considered to be the layer of granular material placed between the subgrade and/or sub-base and levelling course. Pit run material conforming to the gradation requirements listed below when tested according to A.S.T.M. test procedure C136 shall be used for all base construction.

<u>Passing Sieve Size</u>		<u>% By Weight</u>
3 Inch	80 mm	100
1½ Inch	40 mm	60 – 100
¾ Inch	19 mm	40 - 80
⅜ Inch	9.5 mm	30 - 60
No. 4	4.75 mm	20 - 45
No. 8	2.36 mm	15 - 35
No. 16	1.18 mm	10 - 25
No. 50	300 µm	4 - 16
No. 200	75 µm	2 - 9

The pit run material shall be from an approved source and shall be composed of sound, durable particles free from lumps of clay, silt, decomposed rock, organic or other deleterious matter. Irrespective of source, the pit run shall be produced to yield a reasonably uniform product and any sand seams in the pit shall be blended with the natural gravel to achieve this uniformity.

- d) Levelling Course: The levelling course is the granular layer immediately under the wearing surface of the road and must meet the following specifications when tested by means of laboratory sieves according to A.S.T.M. Test Procedure C136 or the latest revision thereof:

<u>Passing Sieve Size</u>		<u>% By Weight</u>
¾ Inch	19 mm	100
⅜ Inch	9.5 mm	60 – 100
No. 4	4.75 mm	40 - 80
No. 8	2.36 mm	30 - 60
No. 16	1.18 mm	20 - 45
No. 50	300 µm	8 - 20
No. 200	75 µm	2 - 9

The levelling course material shall consist of crushed granular material from an approved source free from clay, silt and deleterious matter.

- e) Base and Levelling Course Construction: No base material shall be placed until all underground services have been installed, unless otherwise approved by the Municipality.

Base and levelling course material shall be spread uniformly in layers not greater than 300mm in depth, watered and compacted to 100% of the maximum density obtained in the laboratory following A.S.T.M. Test Procedure C698-66T Method D or the latest revision thereof.

Where the gravel does not contain sufficient moisture to ensure maximum compaction, water shall be applied in the quantity and manner required to ensure optimum density. No layer or course shall be placed until the previous course has been fully compacted in place.

A blade grader shall be used in conjunction with compaction equipment to maintain an even and uniform compacted surface, shaped to the required cross section.

- f) Compaction equipment shall be on an approved type and of sufficient capacity to efficiently handle the required construction of the base. At least one compaction unit on the project shall be of the vibrator type.

Prior to placing the 19mm minus crushed levelling course material, the pit run gravel base work shall be approved by the Consulting Engineer.

4.0 Testing

4.01 After the base has been compacted and prior to placing the levelling course material, the contractor shall proof roll the entire surface using a standard tandem truck loaded to normal capacity with granular material. Areas showing noticeable deflection, displacement, rutting or other signs of failure shall be rectified and re-tested.

4.02 The Municipality may require Proctor Density Tests to be carried out in any area where in the opinion of the Municipal Engineering Department insufficient compaction has been achieved. These tests shall be conducted by an independent testing agency at the expense of the applicant. Tests shall be performed in accordance with A.S.T.M. Specification 698 Method D or the latest amendments thereto. One copy of the test results shall be forwarded directly to the Municipal Engineering Department by the testing agency.

5.0 Concrete Construction - General

- 5.01 The Consulting Engineer shall ensure that property owners are warned prior to the pouring of concrete. He shall also ensure that pedestrian access is provided, and that adequate steps are taken to prevent vehicles crossing concrete work for a period of seven (7) days, unless high-strength concrete is used. With respect to commercial properties, access must be maintained as directed by the Municipality.
- 5.02 The Consulting Engineer shall program the work to keep the inconvenience to the public at a minimum.
- 5.03 Concrete work will be cured by wet burlap or approved type of membrane curing compound during hot weather. Any necessary precautions shall be taken to prevent vandalism to fresh concrete and should vandalism occur, it shall be rectified immediately.

6.0 Curb, Sidewalk and Catch Basin Materials

- 6.01 Concrete - compressive strength - 30 mPa @ 28 days maximum aggregate size - 20mm, slump not to exceed 80mm, air entrainment 4% - 6%.
- 6.02 Concrete shall be in accordance with C.S.A. Standard A23.1 or the latest revision thereof.
- 6.03 Concrete tests shall be performed as designated by the Municipality, on test cylinders by a qualified laboratory and reports shall be delivered to the Municipality within 35 days of concrete placement.
- 6.04 Should 10% of the test cylinders prove less than 17 mPa after 28 days, the Municipality will order the complete removal of all works. The expansion jointing material shall be manufactured, non-extruding, bituminous fiber material not less than 13mm thick and extend the full width and depth of the section.
- 6.05 Reinforcing steel shall be new billet stock, intermediate grade, in accordance with A.S.T.M. Specification A/15 or the latest revision thereof.

7.0 Curb and Catch Basin Construction

- 7.01 All forms shall be well staked and rigidly held to true line and grade. In all curbs, reinforcing steel shall be used as shown on Standard Drawing No. 508.
- 7.02 Concrete curb and gutter shall be placed in one course, to line and grade as staked on the ground and to the full cross-section as shown on Standard Drawing No. 508. The concrete shall be spread upon the prepared base, thoroughly tamped, rodded and screeded flush with the top of the forms.

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- 7.03 After the concrete is in place, it shall be floated with wooden floats, trowelled and finished in a workman-like manner with the property edging tools to conform to Standard Drawing No. 508. As soon as possible, the front form of the non-mountable curb face shall be removed and the concrete face shall be brushed to produce a uniform surface.
- 7.04 Provision shall be made in the curb for the construction of catch basins in the locations shown on the design drawings. Catch basins shall be constructed in accordance with Standard Drawing Nos. 311 and 312.
- 7.05 Expansion joints shall be at all curb returns and at 7.5 metre intervals, and excess material shall be trimmed off after the form work has been stripped.
- 7.06 Where the curb is constructed without a sidewalk, backfill will be placed behind the curbs, and shall be graded as shown on Standard Drawing Nos. 504, 505 and 506.

8.0 Sidewalk Construction

- 8.01 The sidewalk shall be constructed as shown on Standard Drawing No. 508.
- 8.02 Commercial driveway drops shall be a minimum of 150mm thick with 150 x 150 steel mesh reinforcing as per Standard Drawing No. 511.
- 8.03 The form work shall be of surfaced lumber free from warp, not less than 50mm in thickness, well staked and rigidly held to true line and grade.
- 8.04 The surface shall be finished with a wood float and steel edging tool at the joints. After floating, the surface shall be brushed.
- 8.05 Expansion jointing material extending the full depth and width of the section shall be placed at 7.5 metre intervals. These joints will coincide with curb and gutter expansion joints if abutting.
- 8.05 Expansion joints shall be required around all telephone or power poles, light standard bases and where work abuts existing building or other structures including existing sidewalks. Excess expansion joint material shall be trimmed flush after the form work as been stripped.
- 8.06 Dummy joints 25mm deep shall be inscribed at 1.5 metre intervals.
- 8.07 Where sidewalk and curb are constructed adjacent to each other and at the same time, they shall be of monolithic construction.

9.0 Combined Curb and Sidewalk Construction

- 9.01 The combined curb and sidewalk shall be constructed in accordance with these specifications, and the cross section will be detailed on Standard Drawing Nos. 508 and 511.

10.0 Bituminous Surfacing

- 10.01 Bituminous paving shall conform in all respects to Greater Victoria Asphalt Paving specifications.

11.0 Barricades and Railings

- 11.01 Barricades and railings shall be installed where shown on the design drawings and in accordance with Standard Drawing Nos. 518 and 520.

12.0 Traffic Control and Street Identification

- 12.01 The Municipality at the Developer's cost shall install all signs and pavement markings.

13.0 Cul-de-sac Island

- 13.01 The Cul-de-sac Island shall be constructed as detailed on Standard Drawing No. 507.
- 13.02 A minimum of 200mm of topsoil to be placed in the areas designated for landscaping and disease free, hardy, 5 gallon shrubs of the following varieties installed:-
- 6 - Junipers of 2 different varieties; and
 - 2 - Mugo pines.

Planting material to be fertilised, then mulched with a complete blanket of 6 ml black plastic, covered with 50mm of fine screened bark mulch.

14.0 Clean-up

- 14.01 All surplus material, tools and temporary structures shall be promptly removed on completion of the construction work. All debris, dirt and rubbish shall be promptly removed. The site shall be left clean and tidy and, where applicable, restored to equal or better than the original condition to the satisfaction of the Municipality. The roads leading to the site and used to convey construction vehicles and materials shall be kept in a clean condition.
- 14.02 All contractors shall cease work immediately when in the opinion of the Works Inspector excess dirt and or debris is deposited on Municipal roads.

15.0 Pavement Restoration

15.01 Road service cuts to be restored in accordance with Standard Drawing 521.

SECTION 6.A DESIGN OF STREET LIGHTING

1.0 Scope

1.01 This specification shall govern the design of all street lighting systems within the Municipality.

2.0 Codes, Rules and Permits

2.01 All work shall be carried out in accordance with the Canadian Electrical Code, C.S.A. Standard C22.1-1982 or latest amendment thereto as adopted by the Province of British Columbia. The applicant shall be responsible for ensuring that all permits and approvals are obtained from the Provincial Electrical Inspection Department. The Municipality shall not accept the street light system until approval has been obtained from the Provincial authority.

2.02 The applicant shall ensure that all necessary arrangements for the service connection are made with the B.C. Hydro and Power Authority.

3.0 Criteria for Selection and Placement of Luminaires

3.01 For industrial and commercial zones use luminaires on 'davit' style poles with 250 watt high pressure sodium lamps.

3.02 For civic areas, such as areas surrounding municipal buildings, community recreation centres, etc., and arterial roads use luminaires on 'davit' style poles with 150 or 200-watt high-pressure sodium lamps.

3.03 For residential roads use 'post top' style luminaires with 70-watt high-pressure sodium lamps.

3.04 Cul-de-sacs with a turn around area for motor vehicles shall be illuminated with a 'post top' luminaire.

3.05 On vertical and horizontal curves, the luminaire spacing may be reduced at the request of the Municipality.

3.06 The normal spacing for luminaires shall be:
a) 70 metres for 70 watt lamps
b) 45 metres for 150 watt lamps
c) 50 metres for 250 watt lamps

3.07 Poles shall be situated at the back of existing or future sidewalks or 2 metres behind face of curbs as shown on Standard Drawing No. 502. Davit arms to be perpendicular to the road centreline.

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- 3.08 Luminaires shall alternate to each side of the road.
- 3.09 Poles shall be located clear of all driveways and generally on property lines, not in front of houses.
- 3.10 Consideration shall be given to the relative positions of luminaires and trees so that a uniform light distribution is maintained on roadways and sidewalks.
- 3.11 In new areas where only one side of a road is to be developed, provision shall be made for future extension of the power distribution system to the opposite side of the roadway by providing ducts and fish wires across roadways, terminating in a junction box.

4.0 Materials

- 4.01 New materials, C.S.A. approved for the application, shall be used for all work covered by these specifications.

- 4.02 Materials shall be as follows:

a) Conduit

All conduit shall be the type classified as rigid PVC by Section 12 of the Canadian Electrical Code. PVC conduit shall be Scepter Manufacturing Company Ltd., or as approved. Couplings, adapters and bends shall be PVC, as manufactured by Scepter Manufacturing Company Ltd., or as approved. All ridges shall be removed and the conduit cleaned thoroughly before application of the solvent.

Size conduit correctly according to the size and number of conductors, but the minimum size shall be 25mm.

b) Poles, Distribution Boxes and Anchor Bolts

Poles for luminaires shall be one piece of minimum 11 gauge octagonal tapered hot dipped galvanised steel to ASTM A242, designed to withstand wind loads of 160Kph peak at the yield strength of the material, with a safety factor of 1.3 using the projected area of the luminaires to be installed. Steel anchor bases shall be secured to the poles with circumferential welds and shall be provided with a vee groove drain. All poles shall be listed as approved by the Canadian Standards Association testing laboratories.

The length of poles for davit style luminaires shall be as required to obtain a mounting height for the luminaire of 9.1 metres above the road. Where applicable, distribution bases will be Lincoln Standard base or equivalent as approved by the Municipal Engineering Department.

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Poles in residential areas shall be Lincoln Cat. No. LSP18B70A or equal as approved by the Municipal Engineering Department, tapered, octagonal, galvanised steel, 5.5 metres high with anchor bolt bases. Poles with distribution bases shall be Lincoln Cat. No. LSP16B70A complete with Lincoln mini distribution box or equal as approved by the Municipal Engineering Department.

Galvanised anchor bolts to be threaded for 300mm and provided with galvanised securing nuts and die cast or galvanised steel covers.

A grounding stud shall be welded to the pole on the inside adjacent to the hand hole.

Special combination poles shall be supplied for the installation of traffic signals when the Municipality so directs.

c) Luminaires

Luminaires shall be high pressure sodium type with integral ballasts rated at 120 volts.

Luminaires mounted on davit style poles shall be GTE Sylvania Powerlite LXB2227P or other as approved by the Municipal Engineering Department.

Post top luminaires shall be 70 watt high pressure sodium, 120 volt, Westinghouse Pinto, Catalogue No. PTA 07C12TL or other as approved by the Municipal Engineering Department complete with photo electric control and Type II refractors. Luminaires in turn around islands to have Type V refractors.

Luminaires having 150 watt lamps shall have refractor for medium range, semi-cutoff, type II distribution (MSII).

Luminaires having 250 watt lamp shall have refractor for short range, semi-cutoff, type III distribution (SSIII).

Slipfitter shall be adjustable and permit secure attachment to pole tenon.

d) Lamps

Provide colour corrected deluxe high pressure sodium lamps of 70 watt, 150 watt or 250 watt size as indicated on the plans.

e) Ballasts

Provide regulator type, high power factor, 120 volt ballasts installed integral with the luminaire.

f) Photoelectric Control

Photoelectric control shall be Tork Model 2003 or other as approved by the Municipal Engineering Department. Sunswitch, 1800 V.A. for vapour or reactive lamp load with built in lightning arrester. Provide photoelectric control for all luminaires.

g) Control Panel

Control panels shall be mounted in distribution bases. No more than four (4) luminaires shall be serviced from one breaker with a total of eight (8) luminaires per control panel. A photoelectric control override switch to be installed in each control panel.

4.03 The Municipality prior to purchase must approve the use of substitute equivalent materials.

SECTION 6.B **INSTALLATION OF STREET LIGHTING**

1.0 **Poles**

- 1.01 Poles shall be erected carefully to prevent damage to the finish on the pole or the anchor bolts.
- 1.02 The poles shall be plumbed so that they are vertical when viewed from all directions. Levelling shims shall be installed around the anchor bolts to achieve this.
- 1.03 Anchor bolt nuts shall be securely tightened and inspected by the Consulting Engineer before the nut covers are installed.
- 1.04 All poles shall be refinished after installation with a cold galvanizing compound to cover areas damaged due to transportation or erection. Before application, the surface to be refinished shall be thoroughly mechanically and chemically cleaned and the compound applied in complete accordance with the manufacturers recommendations.

2.0 **Pole Bases**

- 2.01 Concrete pedestals shall be poured to the dimensions shown on Standard Drawing No. 601.
- 2.02 The concrete shall have a minimum compressive strength at 28 days of 20 Mpa. A minimum curing time of seven days shall elapse before the standards are erected.
- 2.03 Anchor bolts shall be arranged to suit the poles and shall be held in place with an overhead template to ensure correct lateral positioning and correct thread exposure. After installation of the pole at least one thread of the anchor bolt shall be exposed on top of the nut.
- 2.04 Where possible the hole for the base shall be dug without disturbing the surrounding soil. If the soil remains firm and the hole dimensions conform to those specified, no form work need be used except for the top 200mm of the base (400mm at road side of base to provide for curb construction).
- 2.05 Before installing poles, all form work used for constructing the concrete base, except any tubular hardboard form, shall be removed. The excavation shall then be backfilled as specified in Section 4.B, subsection 5.
- 2.06 All grounding connections shall be made with approved compression lug connectors.

3.0 **Excavation and Back-fill of Conduit, etc.**

- 3.01 Where it is necessary to cut concrete driveways, sidewalks, or curbs for the installation of bases, conduits or junction boxes, a pavement saw shall be employed.

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- 3.02 Before commencing excavation, the contractor shall verify the location of other underground services with local utility companies and the Municipality. The Contractor shall bear the cost of any repairs required to any services damaged during excavation.
- 3.03 Conduits shall be laid on a 75mm bed of sand with a minimum cover of one (1) metre. the first 150mm over the conduit shall be sand and the remainder shall be back filled as specified in Section 4.B, subsection 5 of these specifications.
- 3.04 Where possible, conduits shall be drilled or pushed under paved areas to eliminate the necessity of excavation.
- 3.05 Factory bends for PVC conduit are preferred but field bends are permissible on a radius not less than ten (10) times the conduit diameter on conduits up to 50mm in diameter.
- 3.06 All sand used to encase conduits shall be fine granular devoid of debris, rocks or small stones.
- 3.07 When conduit installation is complete notify the Consulting Engineer and Inspection Authorities so that the installation may be inspected prior to backfilling. Do not backfill the trench without approval of the Consulting Engineer.
- 3.08 When required by the Municipality, the Applicant shall install underground conduit and wiring to existing traffic signals and conduit for future traffic signals.
- 3.09 Excavate by hand where in close proximity to existing underground utilities or structures.

4.0 Testing

- 4.01 In addition to normal electrical testing, the Contractor shall allow for a day and night inspection by the Consulting Engineer. Any units improperly mounted shall be adjusted at the Contractor's expense.

5.0 Dip Service

- 5.01 Where a dip service from a B.C. Hydro pole is made, all work shall comply with B.C. Hydro requirements.

SECTION 7.A INSTALLATION OF INTEGRATED SURVEY MONUMENTS

1.0 General

1.01 This specification shall cover the installation of integrated survey monuments throughout the Municipality.

2.0 Location

2.01 The Municipal Engineering Department shall determine all monument locations.

3.0 Installation

3.01 Survey monuments to be installed in accordance with Standard Drawing No. 7.01.