S E C T I O N 5A

SANITARY SEWER - DESIGN

STANDARD DRAWINGS

Sl	Manhole Benching Details
S2	Typical Manhole Details
S3	Typical Drop Manhole Details
S3A	Inside Drop Manhole
S4	Heavy Duty Manhole Cover and Frame
S4A	Utility Chamber Manhole Frame, Ring & Cover
S5	Sanitary and Storm Sewer Connection
S6	Driveway Service Box Installation
S7	Single Service Concrete Box
S8	Twin Service Concrete Box
S9	Cleanout Structure - Type l
Sl0	Cleanout Structure - Type 2
S13	Sanitary Sewer Flow Curves
S14	Sanitary Sewer Flow Analysis - Calculation Sheet

S E C T I O N 5A

SANITARY SEWER - DESIGN

5A.l SCOPE

This section covers design standards and material specifications for municipal sewer systems.

5A.2 SEWAGE FLOWS

5A.2.l Sanitary sewer systems shall be designed to accommodate peak sewage flows with an allowance for stormwater infiltration. The discharge of storm water into the sanitary sewer system will not be allowed. Adjacent contributory areas must be determined and included in the design and where required, design systems shall be proven capable of handling additional future upstream flows. The existing systems downstream of the design shall be proven capable of handling the additional flows.

5A.2.2 Design contributory populations shall be computed in accordance with the Town of Ladysmith population predictions or with the planned development in the tributary area, whichever is the larger.

5A.2.3 In the absence of detailed design population information, the following minimum design population densities shall be used:

Areas	Population Density
Single Family Dwellings	36 persons per hectare
Low Density Multiple Family Dwellings	48 persons per hectare
High Density Multiple Family Dwellings	l20 persons per hectare
Industrial & Commercial equivalent of	36 persons per hectare

5A.2.4 Peak sewage flow shall be established by multiplying the peak unit AWWF shown on Drawing Sl3 by the design contributory population except in confined industrial and commercial areas where other methods, approved by the Director of Engineering and Public Works shall be used.

5A.2.5 Peak stormwater infiltration shall be calculated on the basis of ll,200 L per hectare of design tributary area per day.

5A.2.6 Design sewage rates of flow shall be computed by adding peak sewage flow to peak stormwater infiltration.

5A.2.7 Sanitary sewage design calculations shall be prepared in a format in accordance with the calculation sheet shown on Drawing S14.

5A.3 SEWER HYDRAULICS

5A.3.1 No sewer main shall be less than 200 mm in diameter unless otherwise approved by the Engineer. Installation of l50 mm diameter mains will only be considered for the last section of non-extendible lines where the grade is 2 percent or greater.

Unless otherwise approved by the Engineer, downstream pipe diameter shall be greater than, or equal to, the upstream pipe diameter.

5A.3.2 No service connections shall be less than l00 mm in diameter. Service connections serving more than duplex family dwellings shall be minimum l50 mm in diameter and sized in accordance with design flows and available grades.

5A.3.3 The following shall be the minimum grades for each size of pipe:

SIZE	**GRADE**
l00	2.0%
l50	l.0%
200 & greater	0.5%

5A.3.4 All sewer mains shall be designed to provide a minimum velocity of 0.75 metres per second, and a maximum velocity of 4.5 metres per second. The minimum velocity for a horizontal curved sewer shall be l.0 metres per second.

5A.3.5 Manholes shall be designed so as not to impede the hydraulic flow. The design shall incorporate a minimum elevation differential of 30 mm, in addition to the normal grade of the sewer.

5A.4 DEPTHS

5A.4.1 Depths of all sewer mains shall be such that all basements in the area the sewer is intended to serve can be serviced by gravity.

5A.4.2 Minimum cover on sewer mains shall be l.5 metres in traveled areas and l.0 metres elsewhere unless otherwise approved by the Engineer.

5A.4.3 Where minimum cover cannot be provided, an explanation of the reasons and pipe loading calculations shall be submitted with the proposed method of pipe protection to the Engineer for approval.

5A.5 LOCATIONS

5A.5.1 (a) Unless otherwise approved by the Engineer, sanitary sewers shall be located in the road right-of-way in accordance with Section 7 Standard Drawings.

(b) Sanitary sewers may be installed in common trench with storm drains, provided the maximum invert elevation difference is 300 mm and the minimum lateral clearance between the walls of adjacent pipes is 300 mm.

(c) Where deflections are required to accommodate manholes and other works, only the storm drain shall be deflected from the design alignment.

(d) In accordance with Ministry of Health requirements, no storm or sanitary sewer shall be located less than 3.0 m horizontally and 0.45 m vertically from all water pipes, unless

otherwise approved by the Public Health Engineer / Drinking Water Officer "Vancouver Island Health Authority".

5A.5.2 Where topography makes placement of sanitary sewers in the road right-of-way unfeasible, sanitary sewers may be located in a statutory right-of-way (SRW) over private property, subject to the following conditions:

(a) Municipal service locations and SRW widths shall confirm to Standard Drawing R6.

(b) In general, manholes and cleanouts shall not be located in SRW's, however, where this cannot be avoided, only one manhole or cleanout, should be located in a SRW without making provision for direct vehicular access.

(c) Where vehicular access to manholes or cleanouts in a SRW is required an access lane approved by the engineer shall be provided.

5A.6 MANHOLES

5A.6.1 Distances between manholes shall not exceed l20 m, unless otherwise approved by the Engineer.

5A.6.2 Manholes shall be located at grade and alignment changes, at lateral size changes, at the upstream end of all lateral sewers, and at the junctions of all lateral sewers.

5A.6.3 Cleanouts may be substituted for manholes at the upstream end of lateral sewers where no further extension of the sewer main is anticipated and where otherwise approved by the Engineer.

5A.6.4 Where the difference in elevation between incoming and outgoing sewers exceeds 600 mm, standard drops for pipe sizes 375 mm or less shall be used as shown in the standard drawings. Inside drops between 250 mm and 600 mm shall be avoided.

5A.6.5 Precast manhole barrels shall be sized according to inside pipe diameter and depth as detailed below:

Pipe Size (Nominal)	Depth of Manhole (Top of Cover to Inv.)	Barrel Size (Inside Dia.)
l50 - 375 mm	0.0 - 5.9 m	l050 mm
l50 - 375 mm	6.0 - 9.0 m	l200 mm
l50 - 600 mm	9.0 m or greater	l500 mm
400 - 600 mm	0.0 - 8.9 m	l200 mm
675 - l050 mm	All Depths	l500 mm

5A.6.6 Where cast-in-place manholes are proposed, design and construction details shall be submitted to the Engineer for approval.

5A.6.7 Manholes shall be located to avoid any conflict with curb and gutter or sidewalks.

5A.7 CURVED SEWERS

5A.7.1 Horizontal curves will be permitted where the right-of-way requires curvature for a constant offset and where the design velocity exceeds 1.0 meters per second. Vertical curves will be permitted under special circumstances where excessive cuts are to be avoided and where energy dissipation is required. Horizontal and vertical curves may not be used in combination on the same section.

5A.7.2 Radius of horizontal curvatures shall be uniform throughout the curves and shall be not less than 60 metres; in no case shall the deflection required to achieve the design curvature exceed the manufacturer's recommended deflection for the particular material being installed.

5A.8. SANITARY SERVICE CONNECTIONS

5A.8.1 Connections shall be installed in accordance with Standard Drawing S5.

5A.8.2 Minimum grade for an l00 mm service shall be two percent; minimum grade for an l50 mm service shall be one percent.

5A.8.3 Minimum cover on services shall be l.0 m unless otherwise approved by the Engineer.

5A.8.4 Service shall be extended 2.0 m into the lot in order to prevent undermining of the boulevard and to protect cleanout when connecting to service.

5A.8.5 Cleanouts shall be installed at property line on all sanitary sewer connections. Cleanout riser, complete with rubber ring joint cap, shall be left 600 mm above ground at time of installation. Risers shall be adjusted by lot owner to suit finished grade.

5A.8.6 Where horizontal bends are required in the service pipe these shall be made with long radius bends.

5A.8.7 Where a horizontal bend greater than 45 degrees is required, a cleanout shall be constructed.

5A.9 PIPE MATERIALS

5A.9.1 The following materials may be used for sanitary sewer installations in the Municipality subject to the specifications and conditions listed below.

5A.9.2 Sanitary Sewer Mains

Polyvinyl Chloride (PVC) Pipe (Smooth Profile)

- Pipe and fittings up to 675 mm diameter shall be SDR-35. Pipe and fittings shall have a minimum pipe stiffness of 320 kPa at 5.0% deflection when tested in accordance with ASTM D2412.
- Pipe and fittings shall be manufactured to the following specifications:

  100 mm - 375 mm dia. to ASTM D3034 and CSA B182.2

  450 mm - 675 mm dia. to ASTM F679 and CSA B182.2

- Pipe and fittings shall include integral bell and spigot ends with stiffened wall section and formed groove for a rubber gasket conforming to ASTM F477.

5A.9.3 Sanitary Sewer Services

Polyvinyl Chloride (PVC) Service Pipe

- All sanitary service connection pipe and fittings shall be white in color.

- Sanitary service connections of 100 mm diameter shall be SDR-28 and conform to CSA B182.1. Pipe and fittings shall have elastomeric seal joints, locked in gasket and integral bell joint features.

- Sanitary service connections greater than 100 mm diameter shall be as specified for PVC (smooth profile) mainline pipe.

5A.9.4 Alternate Materials

Alternate materials will be considered in special circumstances such as inadequate cover, subject to the approval of the engineer.

5A.9.5 Pipe Selection

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 l.5.

5A.9.6 Testing of Pipe Materials

All pipes are subject to testing and inspection at the discretion of the Engineer. The basis of acceptance shall be confirmation with the applicable ASTM and CSA specification. The cost of all testing shall be borne by the Developer/Contractor.

5A.9.7 Appurtenances

All appurtenances shall be of a type and standard compatible with the pipe on which it is being installed.