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SECTION 4A

WATER - DESIGN4A.1 SCOPE

This section shall cover design standards and material specifications for municipal water systems.

4A.2 WATER DEMANDS

The water distribution system shall be designed according to the following minimum demands:

4A.2.1 Residential

Values for:

- Average Daily Demand Per Capita (ADD)
- Maximum Daily Demand Per Capita (MDD)
- Peak Hour Demand Per Capita (PHD)

Shall be obtained from the current figures of the Town of Ladysmith Water System Analysis, available at the Public Works office.

4A.2.2 Commercial and Industrial

Commercial and industrial demands shall be determined on an individual basis.

4A.2.3 Fire

Required fire flows shall be in accordance with the latest release of "Water Supply for Public Fire Protection" as published by the Fire Underwriter's Survey.

During a fire situation, the system shall be designed to supply an adequate volume of water at a minimum residual pressure of 140 kPa (20 psi).

4A.3 WATER PRESSURES

Maximum and minimum design pressures are:

- | | |
|------------------------------------|-------------------|
| - maximum desirable static | 700 kPa (100 psi) |
| - minimum, PHD | 275 kPa (40 psi) |
| - minimum, MDD + Fire at Hydrant | 140 kPa (20 psi) |
| - minimum, static at building site | 275 kPa (40 psi) |

Where distribution pressures will exceed 700 kPa (100 psi) due to a drop in elevation a pressure reducing station shall be installed as part of the distribution system.

4A.4 DESIGN POPULATION

Design populations used in calculating water demands shall be computed in accordance with the Town of Ladysmith population predictions or with the planned development in the area to be served, whichever is larger. In the absence of detailed design population information, the following minimum design population densities shall be used.

| <u>Land Use</u> | <u>Population Density</u> |
|---------------------------|---------------------------|
| Single family | 36 persons per hectare |
| Low density multi-family | 48 persons per hectare |
| High density multi-family | 120 persons per hectare |
| Industrial & Commercial | 36 persons per hectare |

4A.5 HYDRAULIC NETWORK

Depending upon the complexity and extent of the proposed distribution system the Municipality may require a hydraulic network analysis diagram showing design flows and pressures. The hydraulic network shall be designed to distribute the design flows at the pressure specified. A standard grid main network is required throughout a residential subdivision. **Except in cul-de-sacs of less than 150 metres length, all watermains shall be looped.**

4A.6 DISTRIBUTION SYSTEMS

4A.6.1 Piping

(a) Location

Unless otherwise approved by the Engineer, watermains shall be located in the road right-of-way in accordance with Section 7, Street Typical Section Standard Drawings.

In accordance with the 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".

(b) Depth

All watermains shall have at least 1.2 m of cover to finished grade.

(c) Size

Watermains shall be sized as determined by the network analysis to provide design flows and pressures. No watermain shall be less than 150 mm diameter.

(d) Curvature

Radius of curvature shall be uniform throughout the curve and shall not be less than 60 metres; in no case shall the deflection required to achieve the design curvature exceed the

manufacturer's recommended deflection for the material being used.

4A.6.2 Valves

In general, valves shall be located at intersections and at a spacing not exceeding 150 m.

Valves shall also be provided between hydrants so they may be isolated in case of a line break. Valves shall be located to avoid any conflict with curb and gutter on sidewalks.

Valves shall be the same size as the pipe in which they are installed. Thrust blocking or other restraints shall be provided on valves.

4A.6.3 Hydrants

The minimum hydrant connection size shall be 150 mm.

The minimum depth of cover shall be 1.20 m.

Drain outlets shall be provided.

The maximum lineal distance between hydrants shall be 140m unless otherwise approved by the Engineer or as required to meet the B.C. Building Code requirements for sprinkler systems, whichever is less.

A gate valve, flanged to a flanged tee in the main, shall be provided on all connections between a hydrant and main. Hydrants shall not be flanged to the main or gate valve.

Hydrants shall be located as per the offsets shown on the Standard Drawings in Section 7 and where possible at property corners. Hydrants shall not be constructed closer than 0.6 m from the front property line.

4A.6.4 Flushouts

Where a water main ends in a dead end a flushout shall be provided for flushing purposes. If there is no possibility of future extension, a permanent flushout shall be used as shown in Standard Drawings W2 and W3.

Flushouts are to be placed in a location approved by the Engineer.

4A.6.5 Health Certificate

The design drawings for the distribution system shall be forwarded to the local Ministry of Health Public Health Engineer for approval in accordance with Section 21 of the Health Act. Construction shall not commence until a Final Certificate has been received.

4A.7 MATERIALS

All materials in the watermain installation shall conform to the following specifications, and shall be subject to inspection and testing at the discretion of the Engineer. Polyvinyl Chloride (P.V.C.) Pipe is to be used for standard applications. Alternate pipe (Ductile Iron) will only be used on special applications when approved by the Engineer.

4A.7.1.1 Watermain Pipe

The sizes and types of pipe to be used are on the drawings.

4A.7.1.2 Ductile Iron Pipe

(a) Standard Specifications

Ductile iron pipe shall conform to AWWA C151 and AWWA C150.

(b) Supplementary Data

Unless otherwise specified on the construction drawings, all pipe shall have a minimum pipe class as follows:

| <u>Pipe Size</u> | <u>Class</u> |
|------------------|--------------|
| 75 - 300 | 350 |
| 350 - 500 | 250 |

An affidavit of compliance with the standard specifications and supplementary data shall be submitted from the supplier.

All pipe supplied shall bear the underwriter's label.

Joints shall be a mechanical type conforming to AWWA C111 or shall be rubber gasket, bell and spigot, Tyton joint or as approved.

(c) Protective Coatings

Ductile iron pipe shall be cement-lined conforming to AWWA C104.

A cathodic protection system shall be provided where warranted by soil conditions.

4A.7.1.3 Polyvinyl Chloride (P.V.C.) Pipe

(a) Standard Specifications

P.V.C. pressure pipe shall conform to AWWA C900 and C.S.A. B137.3

(b) Supplementary Data

Unless otherwise stated in the drawings, all pipe shall be Class 150 (DR 18 minimum). In areas where the static pressure exceeds 860 kPa (125 psi), Class 200 pipe shall be used. An affidavit of compliance with the standard specifications and supplementary data shall be submitted from the supplier. All pipe shall bear the underwriter's label. Joints for P.V.C. pipe shall have a mechanical seal formed by a preformed rubber gasket in a bell or coupling. Couplings shall be of a class and strength equivalent to the pipe.

4A.7.2 Tracer Wire

Tracer wire is to be fastened to:

- The full length of all non copper water services
- The full length of the watermain where required by the Engineer.

Tracer wire is to be wrapped around and taped to the service or main to ensure the wire remains against the line as bedding material is placed.

Tracer wire is to be RW90 copper blue in color or approved equivalent.

Connections are to be made with a copper splice crimp wrapped with heat shrink or self vulcanizing rubber tape to ensure moisture does not enter the connection.

For non copper water services, wire leads are to be fastened to the water main at the point of service connection, ran along the service and ran up inside the water meter box and fastened to the side of the box.

For water mains, wire leads are to be fastened to the main line valves, ran up inside the PVC valve riser and fastened at the top of the riser.

Cut 50 mm of insulation away from tracer wire ends at all leads and connections.

4A.7.3 Fittings

All fittings for ductile iron and PVC pipe shall be:

- (a) Cast iron fittings manufactured to AWWA C110 designed for a working pressure of 1035 kPa. (150 psi) or as specified by engineer.
- (b) Asphalt coated ductile iron compact fittings manufactured to ANSI/AWWA C153/A21.53.84.
- (c) The design pressure rating of all fitting shall meet or exceed the pressure class of the pipes they are connected to.
- (d) Mechanical seal joints on fittings to pipe shall be formed by a bell and preformed rubber gasket suitable for the pipe to which the joint is made.
- (e) Flanged joints on fittings shall be flat faced conforming in dimension and drilling to ANSI B16.1. (125 lbs.)
- (f) Ends shall be flanged or belled to suit pipe ends.
- (g) Thrust blocks shall be provided as shown in the drawings.

4A.7.4 Valves

All valves used on pipe 50 mm to 300 mm diameter shall be gate valves of the same size as the pipe. Valves for pipe larger than 300 mm diameter shall be as specified by the Engineer.

Gate valves shall conform to the latest revision of AWWA Standard C509 Resilient Seated Gate Valves, shall be UL listed, FM approved and conform to the following supplementary data:

- (a) Valve pressure rating. The minimum design working pressure shall be 1380 kPa (200 psi) for 3-in (75 mm) through 12-in (300 mm) sizes, and 1034 kPa (150 psi) for sizes 16-in and 20-in (400 mm and 500 mm) sizes.
- (b) Gate valves shall have a cast iron body, bronze mounted.
- (c) Gate valves shall be resilient seat, with a non-rising stem.
- (d) Valve ends shall be provided to fit the pipe.
- (e) The position of the valve in line shall be vertical.
- (f) Stem seals shall be o-ring.
- (g) Valves shall open to the left (counter-clockwise).
- (h) Extension pieces complete with rock guard shall be used where valve operator nut bury is deeper than 1.2 m.
- (i) Gear operators will be required on valves 400 mm in diameter and larger. Gear cases shall be totally enclosed.
- (j) Valves shall be flanged to fittings.
- (k) Bypasses will be provided on valves 510 mm in diameter and larger. Ends shall be bell or mechanical at junctions with pipe. Joints shall be formed with a mechanical seal, which is the equivalent of that used in jointing the pipe.
- (l) Valves shall have a 50 mm square operating nut.

4A.7.5 Valve Boxes

Valve boxes shall be Nelson Type of cast iron and telescoping so that surface loads are not transmitted to the valve body or pipeline. Victoria Foundries No. 30-72 or approved equal shall be used. A minimum of 300 mm of adjustment shall be available on all valve boxes. Generally valve hoods acceptable to the Engineer shall be provided on all gate valves 250 mm in diameter or larger. In cases where the valve is smaller but the valve box extension will not fit over the valve stuffing box a valve hood shall be used.

Minimum requirements for valve box risers in all areas shall be Class 150 PVC pipe.

4A.7.6 Hydrants

Installed fire hydrants shall meet the following specifications:

- (a) Hydrants shall be compression type complying fully with AWWA standard C502. Hydrants shall be Model C7IP Terminal City Iron Works or Model A442 Mueller Modern Centurion or Clow.
- (b) Hydrants shall be counter clockwise opening and have a standard pentagonal operating nut.
- (c) The hydrant lead shall be minimum 150 mm diameter and made of the same material as the mainline piping.
- (d) Hydrants shall have two nominal 65 mm (2-1/2") diameter hose outlets without independent cut-off. The 65 mm diameter hose outlets shall conform to the BC Fire Hose Thread Standards.

There shall also be one nominal 100 mm diameter (120 mm OD) pumper outlet. The 100mm diameter pumper outlet shall conform to the B.C. Fire Hose thread Standards, nominal 100 mm IP, 117.5 mm OD (4.625") male, 6 threads per 25 mm (6 TPI).

- (e) Hydrant bodies shall be painted with red rust paint above the bury line to an average dry thickness of 65 um. Hydrant ports and bonnets shall be painted with a base coat of aluminum rust paint and a top coat of reflective yellow paint.
- (f) Drain outlets shall be provided.
- (g) A gate valve shall be provided between the hydrant and the main line, flanged to a flanged tee in the main. Installation shall be in general accordance with AWWA M17. Hydrants shall not be flanged to the main or gate valve.

4A.7.7 Air Valves

For water mains up to 300 mm in diameter, air valves shall be 25 mm diameter APCO Combination Air Release Valve Model 143-C or approved equivalent. Bushings, reducers and unions to be used in the valve connection shall be brass manufactured to CSA specification A 40.2 using ASTM B-62 Bronze. Nipples shall be standard brass and threaded at both ends.

Service valves for use in air valve assemblies shall have screw ends and shall be brass or bronze. Gate valves 100 mm or less in diameter shall be wedge disc type with non-rising stem, hand wheel and stuffing box glands, as specified for 1375 kPa water (860 kPa steam) service.

Air valves for watermains greater than 300 mm diameter shall be as approved by the Engineer.

4A.7.8 Flushouts

- (a) All piping and fittings shall be 65 mm diameter iron pipe thread, galvanized steel pipe except for a brass or SCH 80 PVC nipple between the water main cap and flushout valve.
- (b) Shutoff valve shall be a 65 mm cast iron gate valve meeting all specifications for main line valves.
- (c) Vertical section of flushout above ground shall be supported by a 100 x 100 mm cedar post,

painted white with a red top and extending 1.20 m above finished grade.

- (d) Above ground flushout bodies shall be painted with red rust paint above the grade line to an average dry thickness of 65 um. Flushout caps shall be painted with a base coat of aluminum rust paint and a top coat of reflective yellow paint.

4A.7.9 Water Services

- (a) Size

Single Family Residential service connections shall be 19mm diameter unless otherwise designated by the Engineer. All components, eg., corporation stop, meter setter, shall be the same size as the service pipe to which they are connected.

- (b) Pipe

Unless otherwise approved by the Engineer pipe for underground service 50 mm diameter and smaller shall be:

PE3406 CTS Series 160 Municipal Polyethylene Tubing for pressure rates up to 150 psi, and use Copper Tubing for pressure greater than 150 psi.

Pipe for underground service greater than 50 mm and less than 100 mm diameter will not be allowed.

Pipe for services 100 mm and greater diameter shall be as specified for the distribution piping.

- (c) Corporation Stops

Corporation stops shall be bronze conforming to ATM B62 and conform to AWWA C800 with AWWA standard threaded inlet and compression outlet.

Shutoff head shall be solid tee head type.

Corporation stops shall be "Ford Q Style" or "Mueller" unless otherwise approved by the Engineer.

- (d) Couplings and Joints

Couplings for jointing polyethylene shall be compression type with stainless steel inserts.

Couplings shall be "Ford Q Style" or "Mueller" unless otherwise approved by the Engineer.

- (e) Service Saddles

Listed below are the required service saddles for each type of pipe:

PVC pipe - Canada Pipeline SC2 or equivalent

Steel or Ductile Iron pipe
AC pipe

- Rockwell 313 or equivalent
- Rockwell 264 or equivalent

4A.7.10 Meters(a) General

All water meters shall:

- Comply with AWWA C700.
- Read unit of measurement in cubic metres
- Have 6 digits (3 board) registration
- Be equipped with a Touch Read register
- Have hermetically sealed lense.

All water meters are to be supplied and installed by the Developer's Contractor.

Multifamily, Commercial, and Industrial water meters shall be installed by the Developer's Contractor at the Developer's expense.

(b) Residential

Meters used for 19 mm diameter residential services shall be 16 mm x 19 mm positive displacement meters Sensus (SR, SR11, or ICE) or ABB Model C700 or approved equivalent

(c) Multifamily/Commercial/Industrial

(i) Domestic Only

Meters used with services ranging in size from 19 mm to 50 mm diameter shall be Sensus (SR, SR11, or ICE), or ABB Model C-700 or approved equivalent. Applications requiring meters greater than 50 mm shall be approved by the Engineer.

Bypasses shall be provided on all meters 50 mm diameter and larger.

(ii) Combined Domestic and Fire

For applications where domestic and fire demands are supplied from the same internal system, a Sensus Fireline Fire Service Assembly as shown in Standard Drawing W15 may be submitted to the Engineer for approval.

(iii) Separate Domestic and Fire

For applications where the domestic and fire demands are supplied from separate systems, assemblies as shown on Standard Drawings W16 and W17 may be submitted to the Engineer for approval. The domestic line is connected into the fireline upstream of the fire line assembly.

4A.7.11 Meter Setters

Meter setters shall be "Mueller" or "Ford Q Style" unless otherwise approved by the Engineer. All

meter setters shall have the same dimensions and configuration so as to be interchangeable.

Meter setters shall have ASSE approved dual check valves.

Combination meter box/ meter setter configuration such as the Ford Long Yokebox may be used subject to approval by the Engineer.

Typical meter setter assembly for a single family residential service is shown on Standard drawing No. W1.

4A.7.12 Meter Service Boxes, Box Extension and Lids

- (a) All meter box lids must be able to accommodate the specified meter reading register.
- (b) Designation of traveled areas and untravelled areas shall be determined by the Engineer.
- (c) In untravelled areas, meter service boxes for 19 mm and 25 mm diameter services shall be plastic with standard lids and 150 mm meter box extensions. Plastic shall have a minimum tensile strength of 450 kPa as measure according to ASTM D638 and shall be unaffected by moisture, light, corrosion and extreme temperatures. Water box sizes shall be as follows:

| | |
|------------------------|---|
| 19 mm diameter service | - 250 mm x 400 mm meter box see Standard Drawing W10 |
| 25 mm diameter service | - 355 mm x 510 mm meter box |
| 37 mm diameter service | - same as traveled areas specifications see Standard Drawing W12 |

- (d) In traveled areas (roads, driveways and sidewalks), service boxes shall be concrete with cast iron or steel traffic cover marked "WATER METER" and concrete extension sections as required. The traffic cover is to be pre drilled to accommodate the water meter touch read pad.
- (e) Meter box sizes shall be as follows:

| | |
|------------------------|----------------------------|
| 19 mm diameter service | - see Standard Drawing W11 |
| 25 mm diameter service | - see Standard Drawing W12 |
| 37 mm diameter service | - see Standard Drawing W12 |
- (f) Combination meter box/ meter setter configuration such as the Ford Long Yokebox may be used subject to approval by the Engineer.
- (f) Service boxes or chambers for water services larger than 37mm in diameter shall be specified as per Section 4A.7.13 Meter Chamber and Standard Drawing W13.

4A.7.13 Meter Chambers

- (a) Meter chamber covers must be able to accommodate the specified meter reading register.
- (b) All water services must be metered and all meters must be contained in an approved chamber

or meter box normally located in the road right-of-way at the property line of the lot service.

- (c) For small services, 37 mm in diameter or less, manufactured meter service boxes are adequate. For larger services the meter shall be contained in a chamber designed to accommodate the meter arrangement including associated piping, isolation valves and bypasses.
- (d) The following requirements are to be applied in the design of meter chambers and associated piping:
 - (i) If required by the Engineer, a valved bypass shall be provided to avoid service shutdown during meter maintenance. For combination fire service and domestic meters, the bypass shall be sized for the largest flow rate.
 - (ii) The meter shall be installed in a horizontal plane.
 - (iii) Isolation valves shall be provided on both sides of the meter.
 - (iv) The chamber shall be sized so that the meter and associated piping are accessible for meter reading, servicing and inspecting. A minimum of 600 mm clearance shall be provided between the walls and the meter including associated piping. At least 600 mm of head space shall be provided from the highest point on the meter including associated piping to the bottom of the vault cover, and a minimum of 450 mm of clearance provided above the chamber floor. Overall inside height of the chamber shall not be less than 1.8 metres.
 - (v) The meter shall be protected against freezing, mechanical damage and tampering.
 - (vi) Bypass and isolation valves may be located in approved valve boxes outside the chamber to minimize chamber size.
 - (vii) The chamber shall be constructed of reinforced concrete designed to withstand CS600 loading with a standard manhole cover or other approved opening large enough to remove the largest single piece of equipment.
 - (viii) A precast circular manholes barrel may be used for the meter chamber where the meter and associated piping can be installed allowing for the required clearances to chamber wall. If the meter and associated piping will not fit in a precast circular manhole barrel, an alternate meter chamber design shall be submitted to the Engineer.
 - (ix) The chamber shall not be located or constructed such that it is an obstacle or hazard to the customer or public safety.
 - (x) The lid of the chamber shall be flush with the surrounding grade and the ground surface shall be graded to direct drainage away from the chamber.
 - (xi) An adequate floor drain assembly connected to the storm sewer system shall be

provided and designed in accordance with Section 4A.7.14.

- (xii) A safe permanent access ladder shall be provided which meets the worker compensation board requirements for fixed ladders.
- (xiii) Exterior walls below grade shall be water tight.

4A.7.14 Floor Drain Assemblies

- (a) Floor drain assemblies shall be designed in accordance with Section 7. Storm Sewer System with adequate capacity to keep the chamber dry at all times.
- (b) Connections to existing storm mains or surface drainage structures shall provide no risk of flooding of the chamber.
- (c) Sumps shall be provided at the low point of the meter chamber for all floor drain assemblies.
- (d) For floor drain assemblies connected by gravity to a storm sewer system, the floor drain inlet shall be designed so that the drain assembly can be blanked or blinded off from outside the chamber in accordance with the WCB Regulations Section 13.19 and shall be approved by the Director of Engineering and Public Works.
- (e) Where a gravity connection cannot be provided, hydraulically operated sump pumps shall be installed.