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SECTION 5 - WATER DISTRIBUTION SYSTEM DESIGN CRITERIA

5.01 SCOPE

.1 Waterworks design shall follow accepted engineering principles, the Provincial Health Branch requirements, the Fire Underwriters Survey Guidelines and the following design criteria:

5.01A WATER DEMAND

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

(a) Residential:

Average daily per capita	455 L
Maximum daily per capita	1135 L
Maximum peak per capita	1820 L

(b) Commercial and Industrial:

Commercial and other non-residential water demands are normally included in the per capita design consumptions for the overall Community. Heavy industrial, industry parks, and shopping centers must be accounted for separately in any proposed development which includes such zoning.

(c) Fire:

Watermains servicing fire hydrants shall be sized to provide Fire Flows in accordance with the recommendations of the Fire Underwriters Survey publication 'Water Supply for Public Fire Protection' 1999 edition. Calculations supporting the theoretical fire flow available are to be submitted with the design drawings. ***(REVISED NOVEMBER 2016)***

Fire flow requirements for a development with a sprinklered building under the Building Code shall be determined in accordance with the water supply requirements in National Fire Protection Association (NFPA) 13. ***(REVISED NOVEMBER 2016)***

All fire hydrants shall be installed on a looped water system unless otherwise approved by the City Engineer. Water distribution systems shall also be designed to ensure that fire flow, as required by the Insurers' Advisory Organization (IAO), is available for the required duration. ***(REVISED NOVEMBER 2016)***

The maximum allowable reduction to a calculated fire flow for a sprinkler system, as determined in Part 3 of Appendix H3 - Fire Flow Calculation Sheet shall be fifty percent (50%).

Design for fire flows shall consider present available flow and anticipated ultimate available fire flow from the City of Nanaimo's water system.

New water distribution piping shall be capable of delivering the required fire flows with a minimum of 75l/s during Maximum Day Demand and a residual pressure at all flowing hydrants of 150kPa. The hydrant fire flow for new piping shall be the value in Table W-1 “Hydrant Fire Flows by Land Use Zone” for all properties served by the new piping.

For new developments, a balance of pipe size, water quality and existing fire flows at the main will be considered. If the fire flow requirements, as calculated above, cannot be supplied by the existing water distribution system at time of development, available fire flows shall be reviewed with the City Engineer. The developer will be required to either upgrade portions of the system at their own cost or modify the proposed development to match existing fire flows at the main.

SECTION 5 - WATER DISTRIBUTION SYSTEM
DESIGN CRITERIA

TABLE W-1: HYDRANT FIRE FLOWS BY LAND USE ZONE

LAND USE ZONE (BYLAW 4500)		Hydrant Flows at main (ℓ/s)
R1 - 3	Single Dwelling Residential	75
R4	Duplex Residential (not sprinklered)	150
R5	Three & Four Unit Residential	110
R6	Townhouse Residential	130
R7	Row House Residential ((s) for larger buildings)	90
R8	Medium Density Residential	240
R9 *	High Density (High Rise) Residential	300
R10	Steep Slope Residential (SFD / (s) for Multi)	75 / 175
R11	Recreational Vehicle Park	120
R12	Mobile Home Park Residential	120
R13	Old City Duplex Residential	180
R14	Old City Low Density (Four plex) Residential	115
R15	Old City Medium Density Residential	140
AR1	Rural Resource	75
AR2	Urban Reserve	75
COR1	Residential Corridor	230
COR2 *	Mixed Use Corridor	300
COR3 *	Community Corridor	300
CC1	Local Service Centre	105
CC2	Neighbourhood Centre	200
CC3 *	City Commercial Centre	300
CC4 *	North Nanaimo Urban Centre	300
CC5	Hospital Urban Centre	240
CC6	Commercial Recreation Centre (s)	----
DT1	Core ((s) for high rise)	230
DT2	Fitzwilliam	300
DT3 *	Wallace	300
DT4	Terminal Avenue	210
DT5	Chapel ((s) for high rise)	240
DT6 *	Port Place ((s) for high rise)	300
DT7	Quennell Square	225
DT8	Old City Mixed Use	140
DT9	Old City Central	150
DT10	Old City Infill Business Commercial	170
DT11	Old City Infill Service Commercial	170
DT12	Gateway	215
PRC1/2/3	Parks, Recreation and Culture One, Two, Three (s)	----
I1	Highway Industrial	225
I2 *	Light Industrial	300
I3 *	High Tech Industrial	300
I4 *	Industrial	300
CS1/2/3	Community Service One, Two, Three (s)	----
W1	Waterfront	75
W2 *	Harbour Waterfront	300
W3	Newcastle Waterfront	285
W4 *	Industrial Waterfront	300
CD1 - CD6	Comprehensive Development (s)	----

Land uses marked * require limitation to 300 ℓ/s

Land uses marked (s), and all high rises require site specific calculations

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5.02 WATER PRESSURE

.1 Minimum design distribution pressure in all areas at peak hour demand is 275kPa based on design low reservoir level. With the combination of maximum daily demand and the specified fire flow, the minimum residual water pressure at the fire hydrant is 138kPa. Where these minimum design pressures cannot be maintained due to an increase in elevation or distance from the point of connection, a booster pump station and/or emergency storage shall be provided as part of the distribution system. ***(REVISED NOVEMBER 2016)***

.2 The maximum allowable distribution line pressure is 860kPa static, except where individual connections are permitted directly from trunk mains and where special precautions are taken. Otherwise, where distribution pressures will exceed 860kPa static due to a drop in elevation, a pressure reducing station shall be installed as part of the distribution system. Where distribution pressures exceed 550kPa, occupants of existing houses in the area shall be advised to install individual pressure reducing valves.

5.02A VELOCITY

.1 The maximum desirable velocity at maximum peak hour flow shall not exceed 2.0m/s. ***(REVISED NOVEMBER 2016)***

.2 The maximum desirable velocity during fire flow conditions *plus* the maximum day rate shall not exceed 3.0m/s. ***(REVISED NOVEMBER 2016)***

5.03 DESIGN POPULATION

.1 Design populations used in calculating water demands shall be computed in accordance with the City of Nanaimo's 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.

Land Use	Population Density
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

5.04 HYDRAULIC NETWORK

.1 Depending on the complexity and extent of the proposed distribution system, the City may require, for new developments, a hydraulic network analysis diagram showing maximum design flows and pressures. If this information is required, it shall be stated at the time of the feasibility review and shall be submitted by the applicant with the detailed design application. The hydraulic network shall be designed to distribute the maximum design flows in accordance with Section 5.02 – Water Pressure and Section 5.02A – Velocity.

.2 Field testing of design flows and existing network capacity may be required by the City Engineer.

5.05 WATER DISTRIBUTION PIPING

.1 The general requirements for the distribution piping are as follows:

(a) Numerous trunk lines and secondary feeders shall be installed throughout the system. Mains must be adequate to deliver consumption and fire flow demands for the area served, and should be spaced not more than 1000m apart and looped. For extensions to the distribution network, all water distribution piping shall be looped. When looping is not feasible, temporary or permanent dead ends shall be approved at the discretion of the City Engineer.

(b) Pipes on a grid system in residential areas shall be a minimum of 200mm diameter, except that 150mm diameter may be allowed for short interconnecting streets, or short dead ends not over 100m long. Where dead ends or poor grids are likely to last over two years, greater pipe diameters may be required and shall be evaluated for peak hour and fire flow requirements.

(c) Lines furnishing domestic supply only, and not serving hydrants, may be 100mm in diameter. Where a watermain ends in a dead-end or a valve is normally closed, a fire hydrant or flushout shall be provided for flushing purposes. No flushout shall be connected to a sewer.

(d) The distribution piping and all the ancillary components of the water system work together to provide the service. The longevity and reliability of this overall system is critical to the sustainability of the service. To ensure longevity of the systems, including all of the components from the pipe and fittings to curb stop, there are two options: ***(REVISED NOVEMBER 2016)***

(i) Provide a soils corrosivity report prepared by a professional engineer based on field samples covering the entire alignment with spacing no greater than 150m apart, a minimum of 2 samples shall be provided. The report must outline the required protective measures for all buried metallic components from pipe and fittings, to appurtenances. This report is to be prepared based on the methodology outlined in AWWA C105 Appendix A. ***(REVISED NOVEMBER 2016)***

(ii) Material selection and corrosion protection measures that assume the soils are corrosive (corrosive is defined as a soil exceeding 10 points based on AWWA C105 Appendix A) shall be provided. For all buried metallic components, specific measures may include cathodic protection, petroleum tape application, or non corrosive material choice such as stainless steel. ***(REVISED NOVEMBER 2016)***

(e) All pipes shall be designed for the maximum pressures and earth loading to which the pipe will be exposed. For PVC pipe, in no case shall the design working pressure or Dimension Ratio be less than DR18 and 1030kPa. In areas where static pressures are greater than 860kPa, the Dimension Ratio shall be DR14.

(f) Design criteria for any watermain piping 350mm or greater in diameter requires City Engineer approval. ***(REVISED NOVEMBER 2016)***

5.06 SERVICE CONNECTIONS

.1 Design drawings shall show the arrangement for water service connections. The minimum size of service connection to be specified is 25mm diameter for polyethylene service tubing and 19mm diameter for copper. All components shall be the same size as the service pipe to which they are connected, except for 25mm diameter polyethylene service tubing, the

corporation stop, curb stop and water meter shall be 19mm diameter. All lots shall be provided with their own water service. ***(REVISED NOVEMBER 2016)***

.2 The maximum length of water service connections from the watermain to the property line shall be 30m unless otherwise approved by the City Engineer.

.3 For all services greater than 50mm diameter, a gate valve c/w valve box shall be provided at the watermain tee. There shall also be a gate valve at the property line. ***(REVISED NOVEMBER 2016)***

.4 Water service connection locations shall be coordinated with gas, cable, hydro and telephone utilities to avoid any conflict with their installations at the property lines of lots.

.5 Each lot shall be serviced by one only service connection for domestic water.

.6 Domestic and fire services shall be separate. The domestic water meter shall be downstream from the separation point. Combined lines may be considered with the approval of the City Engineer. ***(REVISED NOVEMBER 2016)***

.7 The City of Nanaimo Water Meter Sizing Calculation Sheet in Appendix H4 shall be used for sizing of water meters. ***(REVISED NOVEMBER 2016)***

5.07 HYDRANTS

.1 The minimum hydrant connection size shall be 150mm.
The minimum depth of cover shall be 1.20m.
Drain outlets shall be provided.

.2 Hydrants shall be constructed in accordance with Standard Drawing No. W-5 - Hydrant Connection. The bottom flange of the hydrant shall be located between 150mm to 200mm above final grade. ***(REVISED NOVEMBER 2016)***

.3 Hydrant spacing shall be the most conservative of the following:

(a) B.C. Building Code requirements for sprinkler systems and the Fire Underwriters Survey Guide.
(b) The maximum lineal distance between hydrants shall be 140m in single family and duplex land use zones where sprinklers are not required.
(c) The maximum spacing of hydrants in commercial, industrial, institutional and multi-family residential zones shall be 90m. ***(REVISED NOVEMBER 2016)***

.4 Two gate valves shall be provided at a hydrant assembly:

(a) A gate valve, flanged to a flanged tee on the hydrant lead. Hydrants shall not be flanged to the main or gate valve.
(b) A gate valve flanged to the flanged tee at the main. The location of this valve shall be on the upstream side of a dead-end main. ***(REVISED NOVEMBER 2016)***

.5 Hydrant access crossings shall be provided for hydrant installations adjacent to open ditches as per Standard Drawing No. W-7.

.6 Hydrants shall be located as per the offsets shown on the Standard Drawings in Section 9 - Streets, Traffic Signs and Markings, and where possible at property corners. Hydrants shall

be located 2.0m (minimum) from the edge of present and future vehicular traveled areas; a minimum of 3.0m from lamp standards, hydro poles, or other obstructions; and shall not be constructed closer than 1.0m from front property line. ***(REVISED NOVEMBER 2016)***

.7 The maximum design flow per hydrant shall be 100l/s. Where greater flows are required, additional hydrants shall be provided within a distance approved by the Fire Department.

.8 Preferably, hydrants shall be located on low points in the pipe system in conjunction with hydrant spacing for fire control.

5.08 VALVES

.1 In general, valves shall be located as follows: ***(REVISED NOVEMBER 2016)***

(a) In intersections either in a cluster at the pipe intersection or at projected property lines to avoid conflicts with curbs, gutters and sidewalks. Normally, 3 valves will be required at an "X" intersection of mains, and 2 valves at a "T" intersection of mains. ***(REVISED NOVEMBER 2016)***
(b) Distance between valves shall not be more than 150m. ***(REVISED NOVEMBER 2016)***

.2 Unless otherwise permitted, valves shall be the same size and class as the pipe in which they are installed. Resilient seat gate valves shall be used up to and including 300mm diameter. Valves may be rubber seated butterfly valves if approved by the City Engineer. ***(REVISED NOVEMBER 2016)***

.3 Thrust blocking or other restraints shall be provided on valves.

.4 Use of butterfly valves requires approval by the City Engineer. Butterfly valves shall not be direct buried. Chambers shall be provided for all butterfly valves.

5.09 THRUST BLOCKS AND JOINT RESTRAINTS (***REVISED NOVEMBER 2016)***

.1 Provide concrete thrust/reaction blocks or restraints on all tees, bends (>5 degrees), valves, caps and fittings. For pipes equal to or less than 300mm nominal diameter, refer to Standard Drawing No. W-8 for the minimum thrust/reaction block dimensions. Thrust/reaction and restraint calculations shall be completed by the Design Engineer and details shall be shown on the design drawings in the following cases: ***(REVISED NOVEMBER 2016)***

(a) For sizes larger than 300mm diameter.
(b) Where pressures exceed 1034kPa.
(c) Where allowable soil bearing is less than 96kPa.
(d) Where vertical thrust/reaction blocking is required. ***(REVISED NOVEMBER 2016)***
(e) Where joint restraints are used.

.2 Thrust calculations for joint restraints shall be done in accordance with the manufacturer's specifications. The type of joint restraint and length of pipe to be restrained shall be clearly indicated on the design drawings. All tie rods and joint restraints shall be protected with an approved petrolatum protection coating meeting AWWA Standards. ***(REVISED NOVEMBER 2016)***

.3 Tie rods and joint restraints shall be provided, as a minimum for the following locations: ***(REVISED NOVEMBER 2016)***

(a) Hydrants
(b) Blow-offs
(c) Temporary caps
(d) Fittings or pipes larger than 300mm
(e) Carrier pipe in casings
(f) Connections to valves outside PRVs and other chambers
(g) Any other location required by the Design Engineer or City Engineer.

(REVISED NOVEMBER 2016)

5.10 WATERMAIN LOCATION, DEPTH AND GRADE

.1 The minimum depth of cover shall be 1.20m unless otherwise permitted by the City Engineer. Minimum cover over watermain pipe crossings under ditches shall be 0.5m. ***(REVISED NOVEMBER 2016)***

.2 Unless otherwise approved by the Engineer, tolerances for pipe alignment and grade shall be:

Alignment	±50mm
Grade	±25mm

(REVISED NOVEMBER 2016)

.3 Watermains shall be located not less than 3.0m clear distance horizontally and 0.45m clear distance vertically from all sewer lines, unless otherwise permitted by the City Engineer and the Provincial Health Department. Normal watermain offsets are shown in the standard drawings for roadways**.** ***(REVISED NOVEMBER 2016)***

.4 If pipe alignment is not feasible as a means of establishing required separations due to conflict with existing services, crossings shall be arranged such that the crossover occurs on nominal pipe length centers and all joints within 3m of the crossing shall be secured with concrete encasement (as per Standard Drawing No. T-5), petrolatum tape, shrink wrap or approved equivalent in accordance with the Ministry of Health permit requirements.

.5 Watermains shall be designed with a rising grade (minimum 0.1%) wherever possible, to minimize high points in the main. Where a high point is unavoidable, an air release valve shall be installed in accordance with Section 5.14. ***(REVISED NOVEMBER 2016)***

.6 For trench dam design, refer to Section 4.18 - Trench Dams. ***(REVISED NOVEMBER 2016)***

5.10A UTILITES IN PRIVATE LANDS

The following shall be considered in the design of utilities crossing private lands:

.1 The design of utilities shall avoid crossing private lands as much as possible.

.2 Utilities following property boundaries across private lands shall generally be offset a minimum 2.0m from the property boundary. ***(REVISED NOVEMBER 2016)***

.3 Appurtenances such as valves, etc., shall not be located on property boundaries**.**

.4 Utilities shall not cross private parcels in such a manner that they render the property unusable. Special consideration must be given to ensure the location of the utility crossing minimizes the limitations on the future use of the property.

.5 For minimum widths of statutory right-of-way and working widths refer to Appendix D.

.6 For a sample statutory right-of-way condition sheet, refer to Appendix C, Standard Drawing No. RW-2.

.7 For an Easement Release and Inspection Form Following the Construction of the Utility, refer to Appendix C.

5.11 PRESSURE REDUCING STATIONS

.1 A pressure reducing station shall be required where the static pressure in the proposed distribution system will exceed 860kPa. In general, the pressure reducing station shall be located at the elevation where the static pressure initially exceeds 860kPa.

.2 General requirements for pressure reducing stations shall be as follows:

(a) A valved bypass shall be provided.
(b) A downstream surge relief valve shall be provided to release pressure in the event of a failure of the pressure reducing valve(s). The surge relief valve may be incorporated into the pressure reducing station or may be located at some other suitable location within the distribution system. The surge relief valve shall drain to an adequate storm drainage facility, as approved by the City Engineer. Upstream surge relief valves shall be provided as required.
(c) Pressure reducing valves shall be sized to provide adequate pressure control through all ranges of design flows. If necessary, two or more pressure reducing valves of varying sizes shall be provided in the one station. Pressure reducing valves shall be equipped with valve stem position indicators.
(d) Each pressure reducing and surge relief valve shall be provided with isolating valves and shall be installed so that individual components may be easily removed for repair or replacement.
(e) The pressure reducing station equipment shall be enclosed in a watertight reinforced concrete vault designed to CS600 loading with a standard manhole cover or other opening large enough to remove the largest single piece of equipment in the station. Station floors shall be sloped at 2.0% towards a floor drain assembly in accordance with Section 5.16 – Floor Drain Assembly Chamber Design.
(f) Pressure gauges complete with snubbers and isolating valves shall be installed to register both upstream and downstream pressure. Gauges shall be mounted so they may be read from the manhole access lid without entering the chamber.
(g) Adequate strainers shall be supplied on the water used for controlling the regulating valves and on the main intake.
(h) Pressure reducing stations shall be located outside of the travelled portion of any street and must be vented to promote air circulation.
(i) Inside walls, floors and ceilings of stations to be painted with a white water soluble cement base paint manufactured for the purpose of sealing concrete.
(j) Exterior walls below grade shall be black damp-proofed (tar coated) to prevent leakage.

5.12 -NOT USED- ***(REVISED NOVEMBER 2016)***

5.13 METER CHAMBERS

.1 All water services must be metered and all meters must be contained in an approved chamber or meter box normally located in:

(a) the road right-of-way at the property line of the lot served for services 50mm in diameter or less.
(b) a statutory right-of-way on private property for services larger than 50mm in diameter. Chamber shall be as close to property line as possible.
(c) Alternate locations may be considered with the approval of City Engineer. ***(REVISED NOVEMBER 2016)***

.2 Larger strata developments are to have a single meter at the property line with a privately owned watermain. A City owned watermain with individually metered units may be considered for small strata developments with the approval of the City Engineer. ***(REVISED NOVEMBER 2016)***

.3 For small services, 50mm in diameter or less, manufactured meter service boxes in accordance with Section 5.30 – Water Service Connections, clause 5.30.4 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 and shall be in accordance with Section 5.34.

.4 The meter shall be installed in a horizontal plane.

(a) Avoid locating meter boxes, Hydro, telephone, cable vaults and junction boxes in sidewalks.
(b) If sidewalk location unavoidable, situate box to maximize unobstructed walking corridor.

.5 Isolation valves shall be provided on both sides of meters 50mm diameter and larger. Valves for fire line services shall be in accordance with NFPA regulations.

.6 The following requirements are to be applied in the design of meter chambers.

(a) The chamber shall be sized so that the meter and associated piping are accessible for meter reading, servicing and inspecting. A minimum of 600mm clearance shall be provided between the walls and the meter including associated piping. At least 600mm 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 450mm of clearance provided above the chamber floor. Overall inside height of the chamber shall not be less than 1.8m.
(b) The meter shall be protected against freezing, mechanical damage and tampering.
(c) Bypass and isolation valves may be located in approved valve boxes outside the chamber to minimize chamber size.
(d) 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.
(e) The meter chamber shall be designed as a vault in accordance with Standard Drawing No. W-11. The meter chamber can be designed as a manhole with a precast circular manhole barrel only when the meter and associated piping can be

installed allowing for the required clearances to the chamber wall and approved by the City Engineer.

(f) Chambers, either vaults or manholes, that contain valves, flushouts, meters or other appurtenances shall allow for adequate room for maintenance including headroom and side room. Access openings must be suitable for removing valves and equipment.

(g) The chamber shall not be located or constructed such that it is an obstacle or hazard to the customer or public safety.

(h) 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.

(i) An adequate floor drain assembly shall be provided and designed in accordance with Section 5.16 – Floor Drain Assembly Chamber Design.

(j) A safe permanent access ladder shall be provided which meets the WorkSafe BC requirements for fixed ladders.

(k) Exterior walls below grade shall be watertight.

(l) Interior surfaces of chambers for meters 50mm diameter and larger to be painted with white, waterproof masonry wall coating that penetrates and seals pores in masonry surface.

.7 A valved bypass shall be provided for meters 38mm diameter and larger to avoid service shutdown during meter maintenance. For combination fire service and domestic meters, the bypass shall be sized for the largest flow rate. In the absence of the flow rate, the bypass shall be the same diameter as the service. ***(REVISED NOVEMBER 2016)***

.8 The City has a Cross Connection Control program that requires all new developments to install Premise Isolation. The Premise Isolation will be privately owned. Refer to CSA B64.10, BC Building Code and appropriate City of Nanaimo bylaws. ***(REVISED NOVEMBER 2016)***

5.14 AIR VALVES

.1 Combination air valves shall be provided at all high points of the watermain or where a closed valve creates a high point (i.e. closed valve to isolate pressure zone) and located off the travelled portion of the road. ***(REVISED NOVEMBER 2016)***

.2 Combination air valves shall be a minimum of 25mm diameter. ***(REVISED NOVEMBER 2016)***

.3 For mains 300mm diameter and larger, the air valve type, (combination, release or vacuum) and size shall be determined by the Design Engineer and the details shall be on the design drawings. ***(REVISED NOVEMBER 2016)***

.4 Combination air valve chambers shall be drained to ensure that the chamber does not flood. ***(REVISED NOVEMBER 2016)***

.5 Combination air valves must be vented to an appropriate above-grade location to eliminate potential cross-connection in a flooded or contaminated chamber. ***(REVISED NOVEMBER 2016)***

5.15 FLUSHOUTS

.1 Flushouts shall be provided at the ends of all dead end mains whether permanent or temporary. ***(REVISED NOVEMBER 2016)***

.2 On all mains greater than 350mm diameter, flushouts shall be installed at the lowest points in the watermain network. ***(REVISED NOVEMBER 2016)***

.3 Above-ground flushouts shall only be installed in areas where high ground water tables prohibit the installation of below-grade flushouts.

.4 Above-ground flushouts shall be located as per the offsets shown for hydrants on the Standard Drawings in Section 9 - Streets, Traffic Signs and Markings. Flushouts shall be located 2.0m (minimum) from the edge of present and future vehicular traveled areas and shall not be constructed closer than 0.6m from front property line.

.5 Where practical, and with the approval of the City Engineer, hydrants may also be used in a secondary role as a flushout. ***(REVISED NOVEMBER 2016)***

5.16 FLOOR DRAIN ASSEMBLY CHAMBER DESIGN

.1 Chambers are to be designed to include a drain to a storm sewer or ditch.

.2 Floor drain assemblies shall be designed in accordance with Section 7 – Stormwater Management System with adequate capacity to keep the chamber dry at all times.

.3 Floor drain systems shall provide no risk of flooding of the chamber.

.4 Sumps shall be provided at the low point of the meter chamber for all floor drain assemblies.

.5 The design of floor drain assemblies shall consider the following options in the order presented:

(a) Sump drain to an adequately sized and normally dry rock pit or gravity flow to daylight. ***(REVISED NOVEMBER 2016)***
(b) Where ground water tables permit, a perimeter drain around the base of the meter chamber with gravity connection to storm sewer mains. The City Engineer may approve raising the perimeter drain to the bottom of the water pipe to provide sufficient grade for a gravity connection.
(c) Alternatives require approval by City Engineer. ***(REVISED NOVEMBER 2016)***

SECTION 5 - WATER DISTRIBUTION SYSTEM SPECIFICATIONS

5.20 SCOPE

.1 This specification refers to pressure pipe and appurtenant fittings for water distribution piping and water service connections. Only those products approved by the City Engineer and listed in the City of Nanaimo Approved Products List will be accepted for installation.

5.21 MATERIALS TESTING

.1 If, in the opinion of the Engineer, testing is required, the Engineer will arrange for a testing firm to carry out tests to determine whether the applicable standards and specifications have been met. Where initial testing indicates inadequacies, additional testing may be required by the Engineer.

.2 The Contractor as directed by the Engineer shall supply specimens or samples for testing.

5.22 WATERMAIN PIPE

.1 The sizes and types of pipe to be used shall be shown on the drawings. ***(REVISED NOVEMBER 2016)***

.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:

Pipe Size	Class
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.

Polyethylene Encasement to ANSI/AWWA C1054/A21.5 and ASTM A674 where warranted by soil conditions. **(*REVISED NOVEMBER 2016*)**

.3 STEEL PIPE

(a) Standard Specifications:

Steel pipe, fittings and specials, shall conform to the following standard specifications:

ASTM A36 – Standard Specification for Carbon Structural Steel
AWWA C200 - Standard for Steel Water Pipe 150mm and larger ASTM A36
AWWA C205 – Standard for Cement – Mortar Protective Lining and Coating for Steel Water Pipe 4 in. (100mm) and Larger-Shop Applied ***(REVISED NOVEMBER 2016)***
AWWA C207 – Standard for Steel Pipe Flanges for Waterworks Service Sizes 4 in. through 144 in. (100mm through 3,600mm) ***(REVISED NOVEMBER 2016)***
AWWA C208 - Standard for dimensions for Steel Water Pipe Fittings
AWWA C606 – Standard for Grooved and Shouldered Joints ***(REVISED NOVEMBER 2016)***

(b) Supplementary Data:

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

Hydrostatic mill test reports for each length of pipe shall be submitted from the supplier.

Wall thicknesses shall be determined in accordance with AWWA Manual M11 Steel Pipe Design and Installation and the following criteria:

Minimum wall thickness shall be 6.3mm.

Pipe shall be electric resistance welded or fusion welded, with spiral or longitudinal seams. Pipe shall have 1 or 2 longitudinal seams with no girth seam, or one longitudinal seam with girth seams 1.5m - 2.75m apart, or spiral seams. If girth seams are used, adjacent cans within a pipe length shall be arranged so that their longitudinal seams do not form a continuous line. Seams shall be staggered on alternate cans on each side of top centreline so that each seam is approximately 100mm from the top centreline.

Pipes, fittings and special sections shall be complete with all materials necessary to complete a watertight joint by methods other than welding equipment, or coal-tar enamel.

The joints shall be plain ends for mechanical couplings.

(c) Protective Coatings:

The interior surface of the steel pipe fittings and specials shall be cleaned and lined with an epoxy paint, in conformance with AWWA C210 or C213 and ANSI/NSF61. Epoxy paint shall be applied such that there is a minimum thickness of 406 micro-meters. The maximum coating thickness shall be of 508 micro-meters built up after two or more coats, or as recommended by the individual product supplier. Note, for 100% solids, chemically cured epoxies, the maximum thickness may be increased

above 508 micro-meters. This coating shall also apply to the interior of steel reservoirs.

The exterior surface of buried steel pipe, fittings and specials shall be coated in accordance with AWWA C203 and AWWA C209 and finished with a coal tar epoxy or coal tar enamel and a Kraft paper outer wrap, or; the exterior surface of the pipe shall be coated with extruded polyethylene. Heat shrink sleeves shall be provided for all welded pipe joints. Special sections and fittings shall be coated with a primer and wrapped with polyethylene tape to provide a corrosion resistant coating equal to the extruded pipe coating.

The exterior protective coating for fittings and pipe inside underground chambers shall consist of 2 coats of coal tar epoxy, as per AWWA C210 and painted with marine enamel in colours approved by the City Engineer.

.4 POLYVINYL CHLORIDE (PVC) PIPE

(a) Standard Specifications:

100 to 300mm dia to AWWA C900 and CSA B137.3
350 to 1200mm dia to AWWA C905 and CSA B137.3 ***(REVISED NOVEMBER 2016)***

(b) Supplementary Data:

Unless otherwise stated in the drawings, all pipe shall be as stated in Section 5.05(e) – Water Distribution Piping. An affidavit of compliance with the standard specifications and supplementary data shall be submitted from the supplier. All pipe shall be ULC Listed and be CIP size equivalent. Joints for PVC pipe shall have a mechanical seal formed by a preformed rubber gasket in a bell or coupling. It is mandatory that the push-on integrally thickened bell and spigot type conform to ASTM D3139 Clause 6.2 with single elastomeric gasket to ASTM F477. Couplings shall be of a class and strength equivalent to the pipe. ***(REVISED NOVEMBER 2016)***

All PVC water pipe shall be blue in colour.

.5 HIGH DENSITY POLYETHYLENE (HDPE) PIPE

(a) Standard Specifications:

HDPE pipe to be used for watermains only, at the discretion and approval of the City Engineer. (HDPE pipe shall not be used for services.)

Projects in which HDPE pipe is proposed shall be accompanied by complete HDPE specifications for approval.

HDPE pressure pipe shall conform to AWWA C906 (Standard for Polyethylene Pressure Pipe & Fittings, 100mm through 1575mm for Water Distribution and Transmission). ***(REVISED NOVEMBER 2016)***

Iron pipe size equivalent outside diameter.

(b) Fittings:

Fabricated HDPE mitered fittings shall be AWWA C906 suitable for pressure rating as specified in Contract Documents.

Molded HDPE fittings shall be ASTM 3261 suitable for pressure rating specified and fusion to main pipe with dimensions as specified in Contract Documents.

(c) Supplementary Data:

An affidavit of compliance with the standard specifications and Section 5.05 – Water Distribution Piping shall be submitted from the supplier. All pipe shall bear the underwriters label.

Joints for HDPE pipe shall be heat butt fusion to ASTM D2657 and in accordance with manufacturer's recommendations.

Fittings to be compatible with approved mechanical joint fittings and valves without special adapters. See City of Nanaimo Approved Product List.

Couplings shall be of a pressure rating and strength equivalent to the pipe.

5.23 WATERMAIN FITTINGS

.1 All fittings for ductile iron and PVC pipe shall be:

(a) Cast iron fittings manufactured to AWWA C110 designed for a minimum working pressure of 1035kPa, and cement mortar lined to AWWA C104.
(b) Asphalt coated ductile iron compact fittings manufactured to AWWA C153, designed for a minimum working pressure of 2415kPa, and cement mortar lined to AWWA C104.
(c) Asphalt coated ductile iron fittings manufactured to AWWA C110, designed for a minimum working pressure of 2415kPa and cement mortar lined to AWWA C104.

.2 The design pressure rating of all fittings shall meet or exceed the pressure class of the pipes they are connected to.

.3 Mechanical seal joints on fittings to pipe shall be formed by a bell equipped with closed tie-rod lugs and preformed rubber gasket suitable for the pipe to which the joint is made.

.4 Flanged joints on fittings shall be flat faced conforming in dimension and drilling to ANSI B16.1.

.5 Ends shall be flanged or belled to suit pipe ends.

.6 Thrust blocks or joint restraints shall be provided as shown in the drawings.

.7 In areas where the static pressure exceeds 1380kPa, fittings shall be as approved by the City Engineer.

5.24 WATERMAIN VALVES

.1 Refer to Section 5.08 - Valves.

.2 Unless otherwise permitted, only valves conforming to the following specifications shall be installed in the distribution system:

(a) Gate Valves:

Gate valves shall be in accordance with AWWA C500 and the following supplementary data:

(i) Gate valves shall have a cast iron or ductile iron body, bronze mounted.
(ii) Gate valves shall be solid wedge gate or double-disc parallel seat, with a non-rising stem.
(iii) Valve ends shall be provided to fit the pipe.
(iv) The position of the valve in line shall be vertical.
(v) Stem seals shall be o-ring.
(vi) Valves shall open to the left (counter-clockwise).
(vii) Extension pieces complete with valve riser guide shall be used where valve bury is deeper than 1.2m below finished grade. Valve nut extension rods shall be a minimum 600mm below finished grade. Refer to Standard Drawing No. W-16.
(viii) Gears will be required on valves 400mm in diameter and larger. Gear cases shall be totally enclosed.
(ix) Valves shall be flanged to fittings.
(x) Bypasses will be provided on valves 510mm 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.
(xi) Valves shall have a 50mm square operating nut.

(b) Rubber Seated Butterfly Valves:

Butterfly valves for water service shall be short body flanged type or wafer body type conforming to AWWA C504, suitable for a maximum non-shock shut-off pressure of 1035kPa. Valve construction shall be as follows, or as approved.

(i) Body material shall be ductile or cast iron.
(ii) Disc material shall be ductile or cast iron.
(iii) Valve seats shall be of new natural or synthetic rubber.
(iv) Valve shaft material shall be 18-8 stainless steel type 304 or 316. Shaft shall be pinned to the disc. Shaft sizing shall be in accordance with AWWA C504.
(v) Body shall be complete with shaft bushing and locating lugs for flange bolts.
(vi) Valve operators shall be worm gear type totally enclosed and waterproofed and equipped with adjustable stops. All valves shall be equipped with a standard 50mm square operating nut and the operator shall be located on the side of the valve with the spindle in a vertical position.
(vii) Valve shall be designed for the extreme maximum flows for both opening and closing.
(viii) Valve ends shall suit the pipe.
(ix) Valves shall open to the left (counter-clockwise).
(x) Shaft seals shall be of the o-ring type.

(xi) A reinforced concrete chamber (designed to meet CS600 loading requirements) shall be provided for each butterfly valve as shown on the drawings. Valves shall not be direct buried.

(c) Resilient Wedge Gate Valves:

(i) Valves shall conform to the latest revision of AWWA Standard C509 Resilient Seated Gate valves and shall be UL listed and FM approved
(ii) Valves shall be non-rising stem, open left (counter-clockwise) and have a 50mm square operating nut.
(iii) The wedge shall be ductile or cast iron completely encapsulated with urethane rubber.
(iv) The rubber shall be permanently bonded to the wedge and meet ASTM D429 for test for rubber metal bond.
(v) Stems for non-rising assemblies shall be cast bronze with integral collars or stainless steel in full compliance with AWWA. The non-rising stem stuffing box shall be the O-ring seal type with two rings located above the thrust collar; the two rings shall be replaceable with the valve fully open and subjected to full rated working pressure.
(vi) There shall be two low torque thrust washers located above and below the stem collar. The stem nut shall be made of solid bronze. There shall be a smooth unobstructed waterway free of all pockets, cavities and depressions in the seat area.
(vii) The body and bonnet shall be coated with fusion bonded epoxy both interior and exterior. Each valve shall have the manufacturer's name, pressure rating and the year of manufacture cast on the body. Prior to shipment, each valve shall be tested by hydrostatic pressure equal to twice the specified working pressure.
(viii) Every valve will have a positive stop to prevent distortion to the wedge.
(ix) Valve operating nuts greater than 1.2m below finished grade require a valve nut extension rod complete with valve riser guide. Valve nut extension rods shall be a minimum 600mm below finished grade. Refer to Standard Drawing No. W-16.

5.25 WATERMAIN VALVE BOXES

.1 Where valves are located in the roadway, valve boxes shall be MR Type of cast iron and telescoping so that surface loads are not transmitted to the valve body or pipeline. A minimum of 450mm of adjustment shall be available on all valve boxes. PVC C900/C905 valve hoods shall be used on all 200mm and larger underground valve installations.

.2 Valve box lids shall have a non-rocking fit and extend 75mm into the valve box from the lid seat as shown on Standard Drawing W-16.

.3 Minimum requirements for valve box risers in traveled and untraveled areas shall be DR18 pipe.

5.26 WATERMAIN VALVE MARKERS

.1 Valve markers are required to indicate the locations of the valves.

.2 Where valve boxes are located outside the paved portion of a road, these markers shall be constructed of 50mm steel pipe painted blue and set in a concrete base. They shall extend one 1.0m above the ground surface. The markers shall be located on site at a location determined by the Engineer opposite the valve and the distance to the valve is to be painted in black figures on a flattened upper portion of the marker.

.3 Where valve boxes are located in the paved portion of the road, valve tag markers shall be installed in a nearby reasonable location. ***(REVISED NOVEMBER 2016)***

5.27 HYDRANTS

.1 Installed fire hydrants shall meet the following specifications:

(a) Hydrants shall be compression type complying fully with AWWA standard C502.
(b) Hydrants shall be clockwise opening and have a standard pentagonal operating nut with a circle diameter of 44.5mm.
(c) The inlet connection shall be 150mm diameter and made of the same material as the mainline piping. The hydrant shall have a bell and preformed rubber gasket suitable for connection to the pipe being used.
(d) Hydrants shall have two nominal 65mm diameter hose outlets without independent cut-off. The 65mm diameter hose outlets shall conform to the B.C. Fire Hose Thread Standards, nominal 65mm I.P., 75mm O.D. male, 8 threads per 25mm, tapering from 75.72mm minimum O.D. to 82.63mm maximum O.D.

There shall also be one nominal 100mm diameter (120mm O.D.) pumper outlet. The 100mm diameter pumper outlet shall conform to the B.C. Fire Hose Thread Standards, nominal 100mm I.P., 117.5 mm O.D. male, 6 threads per 25mm.

(e) Hydrant bodies shall be painted with red rust paint above the bury line. Hydrant ports and bonnets shall be painted with a base coat of aluminum rust paint and a top coat of bright yellow rust paint.
(f) Drain outlets shall be provided.
(g) Depth of bury shall be as required to provide the specified minimum cover on the connecting pipe and the required position of the hydrant flange relative to the finished ground elevation.
(h) For new installations, fire hydrant extensions will require approval from the Engineer.
(i) Subject to the discretion of the City Engineer, hydrant flow test on all new hydrants, in accordance with NFPA 291, may be required. ***(REVISED NOVEMBER 2016)***

.2 Tie Rods and Nuts:

(a) Tie rods to be continuous threaded, quenched and tempered alloyed steel to ASTM A354, Grade BC. To be zinc plated to ASTM B766. Tie rod sizes to be minimum 19mm diameter or greater as shown on the Contract Drawings.
(b) Nuts and internally threaded couplings to be heavy hex finish to ASTM A563. Washers to be flat hardened steel to ASTM F436. All to be zinc plated to ASTM B633 or cadmium plated to ASTM B766.
(c) All tie rods, nuts and washers shall be coated with approved petrolatum corrosion protection. ***(REVISED NOVEMBER 2016)***

.3 Hydrant Access Crossings:

(a) Culvert headwalls shall be as specified in Section 7.35B - Culvert Headwalls.
(b) Culverts shall be as specified in Section 7.35A - Culverts.
(c) Gravel surfacing shall be as specified in Section 9.30 – Road Base Gravel Course.

5.28 FLUSHOUT

.1 All piping and fittings shall be 65mm diameter iron pipe thread, galvanized steel pipe.

.2 Shutoff valve shall be a 65mm cast iron gate valve meeting all specifications for main line valves.

.3 Vertical section of flushout above ground shall be supported by a 100 x 100mm cedar post, painted white with a red top and extending 1.20m above finished grade.

.4 Above ground flushout bodies shall be painted with red rust paint above the grade line. Flushout caps shall be painted with a base coat of aluminum rust paint and a top coat of bright yellow rust paint.

.5 The valve box shall be a MR type of cast iron and telescoping so that surface loads are not transmitted to the valve body or piping. A minimum of 300mm of adjustment shall be available. The 65mm diameter fire hose connection and cap shall meet standard B.C. Fire Hose Thread Requirements.

.6 Below grade flushouts shall conform to Standard Drawing No. W-2B.

5.29 AIR VALVES AND FITTINGS

.1 All air valves shall be combination air release valves. Bushings, reducers and unions to be used in the valve connection shall be brass manufactured to ASA specification A 40.2 using ASTM B62 bronze. Nipples shall be standard brass and threaded at both ends.

.2 Service valves for use in air valve assemblies shall have screw ends and shall be brass or bronze. All packing shall have each ring cut to fit, with staggered joints. Continuous (spiraled) packing shall not be used. Gate valves 100mm or less in diameter shall be wedge disc type with non-rising stem, hand wheel and stuffing box glands, as specified for 1375kPa water (860kPa steam) service.

.3 All air valves shall have two 12mm ball-type drain valves as shown on Standard Drawing No. W-4.

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

5.30 WATER SERVICE CONNECTIONS

.1 Pipe:

(a) Tubing for underground services 75mm diameter and smaller shall be:

(i) type K annealed copper conforming to ASTM B88M or

(ii) class 200 Polyethylene tubing to AWWA C901.

(b) Service supply lines larger than 75mm diameter shall be as specified for the watermain pipe.
(c) Tracer wire shall be installed with polyethylene tubing and shall be blue in colour and be 14 gauge wire.

(REVISED NOVEMBER 2016)

.2 Corporation Stops:

(a) Corporation stops shall be bronze conforming to ASTM B62 and conform to AWWA C800 with AWWA standard threaded inlet and compression copper outlet.
(b) Shutoff head shall be solid tee head type.
(c) All pipe for installation inside the meter chamber up to 75mm diameter shall be copper or brass. Only compression, or threaded joints shall be permitted.
(d) All pipe for installation inside the meter chamber over 75mm diameter shall be ductile iron or epoxy coated steel pipe. ***(REVISED NOVEMBER 2016)***

.3 Curb Stops:

(a) Curb stops shall be bronze conforming to ASTM B62 and be supplied with compression and female iron pipe thread outlets***. (REVISED NOVEMBER 2016)***
(b) Shutoff head shall be solid tee head type.

.4 Meter Service Boxes, Box Extensions and Lids:

(a) Service boxes for water services 25mm diameter and smaller shall be 300mm x 500mm concrete meter boxes complete with cast iron traffic cover marked "water". Where approved by the City Engineer, plastic meter service boxes may be used in existing landscape areas. They are not to be used in existing, proposed or future driveway locations. ***(REVISED NOVEMBER 2016)***
(b) Service boxes for 38 - 50mm diameter water services shall be 425 x 750mm concrete boxes complete with steel traffic covers marked "Water". ***(REVISED NOVEMBER 2016)***
(c) Service boxes or chambers for water services larger than 50mm diameter shall be specified as per Section 5.34 - Meter Chambers.
(d) Meter box lid shall be suitable for mounting of a “touch pit read” register unit. ***(REVISED NOVEMBER 2016)***

.5 Couplings and Joints:

(a) Couplings for jointing copper shall be compression type. Sweated joints shall not be permitted. ***(REVISED NOVEMBER 2016)***

.6 Pipe Saddles:

(a) Tapping threads to be tapered to AWWA C800. ***(REVISED NOVEMBER 2016)***
(b) Saddles shall be compliant with NSF61. ***(REVISED NOVEMBER 2016)***
(c) Gasket shall be styrene butadiene rubber (SBR) to ASTM D2000 specifications or other approved gasket material. The Design Engineer shall specify the appropriate gasket material. ***(REVISED NOVEMBER 2016)***
(d) Saddles for ductile iron pipe: ***(REVISED NOVEMBER 2016)***

(i) Saddles for 19mm to 50mm services to have a ductile iron body to ASTM A536. ***(REVISED NOVEMBER 2016)***

(ii) Anti-corrosive coating to AWWA C219, AWWA C210, or AWWA C213. ***(REVISED NOVEMBER 2016)***

(iii) Two high strength low alloy steel straps to AWWA C111, or Type 304 stainless steel U-bolt straps, with minimum width per strap of 50mm. ***(REVISED NOVEMBER 2016)***

(e) Saddles for PVC pipe to AWWA C900/905:

(i) To provide full support around circumference of pipe, saddles with lugs or U-bolt straps that may gouge or deform the pipe are not allowed. ***(REVISED NOVEMBER 2016)***

(ii) Saddles for 19mm to 50mm services shall be:

1. Bronze body to ASTM B62 and two stainless steel straps to ANSI T304 with minimum width per strap of 50mm.
2. All-stainless steel broadband saddle to ANSI T304; for services less than 37mm diameter, saddle shell must be a minimum of 125mm wide and have double bolts; for services 37mm to 50mm, saddle shell must be a minimum of 190mm wide and have double bolts. Saddles to come with donut style gasket and stainless steel shell must be minimum 18 gauge thickness. All stainless steel to be fully passivated to ASTM A240. ***(REVISED NOVEMBER 2016)***

(f) Pipe saddles shall be installed on all PVC pipe service junctions. ***(REVISED NOVEMBER 2016)***

.7 Meters:

(a) Meters shall be compatible with "Sensus Touch Read" automated meter reading and billing system. Meters installed in meter chambers shall be equipped with a Touch Read Pit Lid register mounted on a bracket as per Standard Drawing No. W-12.

(b) All meters shall be equipped with encoder type remote – registers and provide at least 8 digit visual and encoded registration. ***(REVISED NOVEMBER 2016)***

(c) For single family servicing, meters shall be 19mm minimum positive displacement meters.

(d) For duplex servicing, meters shall be 25mm positive displacement meters.

(e) All meters larger than 25mm require approval from the City Engineer.

(f) All meters 100mm and larger shall be equipped with a test port or test tee and be plumbed with the appropriate isolation valves and bypass to facilitate in-situ testing of the meter. ***(REVISED NOVEMBER 2016)***

(g) All meters used for a fire line service shall be UL listed and FM approved. ***(REVISED NOVEMBER 2016)***

(h) All meters shall read in cubic meters.

.8 Gate Valves Domestic Service:

(a) Gate valves shall be as per Section 5.24 – Watermain Valves, clause 5.24.2(a) and (c). ***(REVISED NOVEMBER 2016)***

.9 Gate Valves Fire Line Service:

(a) All valves shall be in conformance with NFPA regulations.
(b) Solid wedge and parallel seat valves shall be in conformance with Section 5.24 – Watermain Valves, clause 5.24.2(a) and shall be UL listed and FM approved.
(c) Resilient wedge valves shall be in conformance with Section 5.24 – Watermain Valves, clause 5.24.2(c). ***(REVISED NOVEMBER 2016)***
(d) Valves installed in chambers shall be OS&Y type or shall be supplied with indicator posts.

5.31 PRESSURE REDUCING STATIONS

.1 Valves:

(a) Pressure reducing valves shall be hydraulically operated, pilot controlled diaphragm-type globe or angle valves.
(b) The main valve shall have a resilient disc and a removable seat ring.
(c) The main valve trim shall be stainless steel.
(d) The valve stem on 50mm and larger valves shall be guided at both ends.
(e) All repairs shall be possible without removing valve from main line.
(f) All wetted surfaces on main valve shall be coated with an epoxy protective coating.
(g) All PR valves shall have a position indicator.
(h) All PR valves shall have Y strainers or basket strainers installed upstream of the main valve and upstream of the control pilot.
(i) All PR valves shall have speed controls between pilot and main valve body.
(j) All PR valves used for fire line service shall be UL Listed and FM approved ***(REVISED NOVEMBER 2016)***

.2 Gauges, pressure snubbers, isolation valves for gauges:

(a) All pressure gauges shall have a 90mm minimum dial size with a 6.5mm NPT bottom connection.
(b) All gauges shall be installed with a piston-type snubber.
(c) All gauges shall be installed with a brass gate valve for isolation.
(d) All gauges in pressure reducing chambers shall be mounted so they can be read from the manhole lid access.
(e) Small diameter piping up to 60mm shall be copper, or brass.
(f) Piping over 75mm shall be flanged steel pipe.

5.32 FLANGE ADAPTERS AND JOINT RESTRAINTS

.1 Flange adapters and joint restraints shall conform to AWWA C219 and be UL listed and/or FM approved. Flanged joints shall conform to AWWA C110 and ANSI B16.1, Class 125.

.2 Flange adapters and joint restraints shall be ductile iron conforming to ASTM A536 with an anti-corrosion coating on the interior and exterior rings conforming to AWWA C219.

.3 Bolts and nuts shall be high strength low alloy steel conforming to AWWA C111, or stainless steel conforming to ASTM F593 and F594. Rolled threads, fit and dimensions shall be to AWWA C111. ***(REVISED NOVEMBER 2016)***

.4 Tie rods shall be continuous threaded, quenched and alloyed steel conforming to ASTM A354, Grade BC and hot-dipped galvanized in accordance with ASTM A153. Coarse threads shall have Class 2A tolerance before galvanizing.

.5 Compression gaskets shall conform to AWWA C219.

.6 Flange adapters and joint restraints shall be designed to be suitable for the type pipe for which they are installed.

5.33 FLOOR DRAIN ASSEMBLIES

.1 Pipe and fittings for gravity connections shall conform to Section 7.22A – Piping, Fittings and Services, clause 7.22A.5.

.2 Pipe and fittings for 19mm to 100mm diameter sump pump connections shall conform to Section 5.30 – Water Service Connections.

.3 Services junctions at the storm main, where permitted, shall conform to Section 7.23 – Service Junctions.

.4 Sump drainer assemblies, if required, shall consist of a backflow preventer, ejector pump, foot valve, strainer and float assembly connected to the watermain with a saddle and corporation stop conforming to Section 5.30 – Water Service Connections.

.5 Sumps shall have minimum dimensions of 300 x 300 x 150mm.

.6 Perimeter drains shall consist of:

(a) 100mm diameter PVC certified to CSA B182.1. Includes drain rock and geotextile wrap. ***(REVISED NOVEMBER 2016)***

5.34 METER CHAMBERS

.1 Precast Manhole Sections

(a) Unless otherwise approved, all manholes sections shall be precast reinforced concrete conforming to ASTM C478.
(b) All precast sections shall be complete with ladder rungs.
(c) O-ring rubber gaskets shall conform to ASTM C443.

.2 Precast Manhole Bases

(a) Precast manhole bases shall be reinforced concrete in accordance with ASTM C76 Class III or better.

.3 Manhole Tops

(a) Manhole tops shall be flat slab, precast concrete. Tops shall be reinforced to meet CS600 loading requirements. Precast tops shall conform to ASTM C478 with approved offset opening for frame and cover.

.4 Manhole Covers and Frames

(a) Covers and frames shall be cast iron and certified to meet CS600 loading requirements with the bearing faces of the cover to be frame machined for a non – rocking fit.
(b) Patterns, dimensions and weights shall be in accordance with the Standard Drawings. Covers shall have "CITY OF NANAIMO WATER" permanently embossed on the covers.
(c) Standard manhole frame and cover shall conform to Standard Drawing No. W-19 –Manhole Frame and Cover.
(d) Utility chamber manhole frame and cover shall conform to Standard Drawing No. W-20 – Utility Chamber, Manhole, Frame, Ring and Cover.
(e) A watertight manhole frame and cover, if required, shall conform to Standard Drawing No. W-21 - Watertight Manhole Frame and Cover.
(f) Covers located in statutory rights-of-way shall be permanently embossed with the additional wording "DO NOT COVER".
(g) Refer to Section 5.58 for frame and cover installation.

.5 Manhole Steps

(a) Steps shall conform to ASTM C478 for manhole steps and ladders and shall be a 19mm diameter aluminum alloy conforming to CSA S157.
(b) All steps shall be complete with approved polyethylene anchor insulating sleeves and installed in 25mm to 26mm diameter precast or drilled holes in a manhole section.
(c) Refer to Section 5.58 for manhole steps installation.

.6 Concrete

(a) The compressive field strength of concrete for manhole bases shall be not less than 20MPa at 28 days.
(b) All concrete work shall conform to Section 11 – Reinforced and Plain Concrete Works.

.7 Precast Concrete Grade Ring

(a) A precast concrete grade ring conforming to ASTM C478 shall be used.

.8 Touch Read Meter Bracket

(a) Touch read meter bracket shall conform to Standard Drawing No. W-12.

5.35 -NOT USED-

(REVISED NOVEMBER 2016)

5.40 TRENCH EXCAVATION, BEDDING AND BACKFILL

.1 Refer to Section 4 - Trench Excavation, Bedding and Backfill for installation requirements.

5.41 PIPE ALIGNMENT ***(REVISED NOVEMBER 2016)***

.1 The pipe shall be laid on line and grade in accordance with the construction drawings. Each pipe shall be checked for line and grade as it is installed. Methods to maintain pipe alignment and grade shall be approved by the Engineer. ***(REVISED NOVEMBER 2016)***

.2 The following methods shall be used when a main is to be installed on a curve to maintain a constant offset within the road allowance:

(a) Deflection of Joints as per Section 5.46 – Deflection.

For: Ductile Iron Pipe, as per AWWA C600/82
For: PVC Pipe, as specified in the Uni-Bell Handbook of PVC Pipe

(b) Manufactured 5° PVC bends.

Arcing or bending of the pipe is not permitted.

.3 Refer to Section 5.10 – Watermain Location, Depth and Grade for design criteria.

5.42 PIPE CUTTING

.1 Pipe cutting shall be done in the manner recommended by the pipe manufacturer employing tools designed for this purpose.

.2 Cutting of asbestos cement pipe shall conform to WorkSafe BC requirements.

5.43 PIPE INSTALLATION

.1 Pipe shall be installed in strict accordance with the manufacturer's recommended practice.

.2 Pipe shall be checked before being lowered into the trench to ensure that no foreign material, manufacturer's defects, or cracks exist that might prevent the proper jointing of the pipe or its operation.

.3 The open end of the pipe in the trench shall be suitably covered to prevent entrance of trench water and other material during periods when pipe is not being installed.

.4 Precautions shall be taken to ensure that displacement of the pipe in the trench does not occur through soil displacement or floatation due to the presence of trench water. Pipe that has been displaced shall be removed from the trench and re-laid.

5.44 JOINTS AT RIGID STRUCTURES

.1 A flexible joint shall be provided at locations where the pipe is held in fixed position by a rigid support or structure. The distance from the support or structure shall depend on the diameter and type of pipe being installed and shall be in accordance with the pipe manufacturer's recommended practice. The purpose of the flexible joint is to prevent pipe failure due to uneven support under the pipe. Approved flexible joints include rubber gasket bell and spigot connections and dresser couplings.

5.45 HORIZONTAL AND VERTICAL CURVES

.1 Pipe on horizontal and vertical curves shall be laid true to the curve of the radius shown on the drawings and in accordance with field lines and grades for each curve supplied by the Engineer. Variations in vertical curves and grades within the allowable joint deflection may be allowed where approved by the Engineer.

5.46 DEFLECTION

.1 Unless otherwise specified, the amount of pipe deflection at joints and couplings shall not exceed the limit as specified by the manufacturer. ***(REVISED NOVEMBER 2016)***

5.47 PIPE RESTRAINT

.1 All fittings shall be restrained either by concrete thrust blocks as per Standard Drawing W-8 or joint restraints as indicated on the construction drawings, as directed by the Engineer.

.2 Concrete thrust blocking shall be placed between undisturbed ground and the fitting to be anchored. The area of thrust block bearing on pipe and on ground shall be as shown on the Standard Drawings or as otherwise indicated on the construction drawings. Concrete shall be so placed that pipe and fitting joints are accessible for repair. Bolts on flanged fittings shall not be encased in concrete. A polyethylene plastic barrier shall be provided between all fittings and concrete for thrust blocking. Concrete specifications shall be as per Section 11 – Reinforced and Plain Concrete Works.

.3 Joint restraints shall be installed in accordance with the manufacturer's specifications. The length of pipe to be restrained shall be as shown on the construction drawings.

5.48 FITTINGS

.1 Fittings shall be installed at the locations shown on the drawings or as directed by the Engineer. Fittings shall be flanged to valves unless otherwise directed by the Engineer.

5.49 CONNECTIONS TO EXISTING PIPING

.1 All connections to existing piping services, and appurtenances shall be made by the City of Nanaimo forces unless otherwise authorized by the City Engineer.

.2 All connections to existing piping and services shall utilize a manufactured rubber gasket bell and spigot joint or dresser coupling designed for types of pipes to be connected.

5.50 VALVES

.1 All valves shall be set plumb directly on the centreline of the pipe and installed in accordance with Standard Drawing No. W-16.

.2 Valve boxes in unpaved areas shall have a 1.0m wide, 50mm thick asphalt apron around the valve box. ***(REVISED NOVEMBER 2016)***

.3 Abandoned Valve Box Removal

(a) Cut asphalt around valve box. Remove valve extension, mud and debris from valve riser box prior to filling with pea gravel. Valve box shall not be pulled prior to filling with pea gravel.
(b) Existing riser pipe must be minimum 300mm below final grade. Riser pipe shall be cut down where necessary so that the existing riser pipe is a minimum 300mm below finished grade.
(c) The minimum 300mm grade difference shall be backfilled with 25mm crush gravel and compacted to City of Nanaimo standards. Temporary cold mix asphalt to be used where necessary.

5.51 VALVES MARKERS

.1 All valve markers shall be installed in accordance with Standard Drawing No. W-9.

5.52 HYDRANTS

.1 All hydrants shall be installed in accordance with Standard Drawing No. W-5.

.2 Hydrant Installation:

(a) Hydrants shall be installed at the locations shown on the construction drawings and as specified in Section 5.07 - Hydrants, clause 5.07.6.
(b) Hydrant installation shall be in general accordance with AWWA manual M17.
(c) Tie rods shall be in accordance with Section 5.27 – Hydrants, clause 5.27.2.
(d) Hydrants shall be set plumb and such that the pumper nozzle faces, and is at right angles to, the road centreline unless otherwise directed by the Engineer.
(e) Hydrants shall be set with the ground flange 150 - 200mm above finished ground or sidewalk surface unless otherwise directed by the Engineer. ***(REVISED NOVEMBER 2016)***
(f) Care shall be taken in installing the connection pipe from the main to the hydrant to ensure that the hydrant is set at the specified level.
(g) Drain rock shall be placed as shown on the Standard Drawing for a hydrant connection to a level above the hydrant drain openings. The drain rock shall be covered with filter cloth before backfilling to prevent plugging up of the drainage pit.
(h) After installation, hydrants shall be covered with firmly secured black plastic bag until they are put into service. ***(REVISED NOVEMBER 2016)***

.3 Hydrant Thrust Blocking:

(a) Hydrant thrust blocking shall only be used in situations where installation of tie rods is not acceptable as determined by the Engineer.
(b) Care shall be taken to ensure that concrete for thrust blocking does not interfere with the operation of flange bolts and nuts or prevent proper operation of hydrant drains.
(c) Thrust block bearing areas shall be as shown on the drawings.

.4 Hydrant Access Crossings:

(a) Culverted hydrant access crossings shall be constructed as shown on the Standard Drawings.
(b) Culvert headwalls shall be constructed in accordance with Section 7.66 - Culvert Headwalls.
(c) Culverts shall be constructed in accordance with Section 7.65 - Culvert Installation.
(d) Gravel surfacing shall be constructed in accordance with Section 9.54 - Placing and Compacting Sub-base and Base Course.

5.53 FLUSHOUT INSTALLATION

.1 All flushouts shall be installed in accordance with Standard Drawing No's. W-2A and W-2B and located as directed by the Engineer.

.2 Flushouts shall be set plumb.

.3 Care shall be taken in installing the piping, drain hole and drain rock to ensure that the flushout will drain when the 65mm diameter gate valve is closed.

5.54 AIR VALVE INSTALLATION

1. All air valves shall be installed in accordance with Standard Drawing No. W-4 and located as directed by the Engineer.

5.55 FLOOR DRAIN ASSEMBLY INSTALLATION

.1 Drain assemblies shall be installed as shown on the construction drawings.

.2 Drain assembly connections to storm sewer mains, where approved by the City Engineer, shall be in accordance with Section 7.61 – Service Connection Installation.

5.56 WATER SERVICE CONNECTION INSTALLATION

.1 All water service connections up to and including 50mm diameter shall be installed in accordance with Standard Drawing No. W-1. ***(REVISED NOVEMBER 2016)***

.2 All water service connections greater than 50mm diameter shall be installed as shown on the drawings.

.3 Location of Water Service Connections:

(a) Install service connections to the locations and depths as shown on the drawings or as specified by the Engineer.

(b) Water service connections to each individual property shall have their own independent connection to the watermain.

.4 Water Service Connection Installation:

(a) Trenches shall be excavated where possible so that the pipe can be installed at right angles to, and in a direct line from, the main pipe to the terminus of the service.

(b) The trench shall be excavated to provide a minimum cover of 1.2m over the service connection pipe and raised for the curb stop as shown on Standard Drawing No. W-1 for services up to and including 50mm diameter in size. ***(REVISED NOVEMBER 2016)***

(c) In rock, the trench is to be extended 3.0m into the property to facilitate future extension of the service connection. ***(REVISED NOVEMBER 2016)***

(d) The trench bottom shall be graded to form a continuous support along the service pipe. All rocks or projections within 150mm of the service tubing shall be removed. ***(REVISED NOVEMBER 2016)***

(e) When the service box is to be installed in a driveway, a 150mm wide x 150mm deep concrete apron shall be installed around the concrete service box in addition to the 25mm minus crush gravel base structure. ***(REVISED NOVEMBER 2016)***

(f) For services up to and including 50mm diameter, the pipe shall be connected to the corporation stop and a gooseneck formed as shown on the drawings. ***(REVISED NOVEMBER 2016)***

(g) When polyethylene tubing is installed and squeezers are used, the area squeezed shall be marked with yellow electrical tape so that the location is not squeezed again to prevent damage. ***(REVISED NOVEMBER 2016)***

(h) Copper pipe shall be cut with square ends and reamed with the proper tools. Care shall be taken to prevent the pipe from kinking or buckling on short radius bends. Joints shall be made using the specified couplings. Sweated joints shall not be made. ***(REVISED NOVEMBER 2016)***

(i) Pipe installed in an augered hole shall be protected with a cap or plug to prevent the entrance of foreign material into the pipe.

(j) A gate valve c/w valve box shall be provided at the main on all services over 50mm diameter. ***(REVISED NOVEMBER 2016)***

(k) After installation, water service connection locations shall be marked with a 50 x 100mm pressure treated wood marker stake painted blue and located at the terminus of the water service next to the service box. The stake shall extend from a point approximately 600mm above ground to 600mm below ground except in locations where the extension of the stake above ground surface would be hazardous, in which case the stake shall be placed at a location satisfactory to the Engineer.

.5 Tapping Main Pipe:

(a) Taps shall be made in the main pipe by workmen using tools in good repair with the proper adapters for the size of main being tapped. Pipe shall be tapped while under internal water pressure unless otherwise approved by the Engineer. The minimum distance of a tapping shall be 1.0m from a pipe end or joint, or 2.0m from a pipe end equipped with a flushout and a minimum of 1.0m from an adjacent tapping unless a greater distance is specified by the pipe manufacturer.

(b) Service connections tapped to 100mm diameter main pipes and AC and PVC main pipes (all diameter) shall have approved pipe saddles for hot tapping. ***(REVISED NOVEMBER 2016)***

.6 Curb Stop and Service Box Installation:

(a) The curb stop shall be installed as shown on the drawings or in the locations directed by the Engineer and shall be provided with a plastic plug to prevent the entrance of foreign material.

(b) The service box shall be installed when the service is installed from the main to the property line. The service box shall be installed plumb with the center of the top of the lid 25mm above finished grade in untraveled areas and 0 - 6mm below finished grade in travelled areas as shown on Standard Drawing No. W-1. ***(REVISED NOVEMBER 2016)***

5.57 WATER METERS

.1 Water meters shall be installed by City of Nanaimo forces unless otherwise authorized by the City Engineer.

.2 Install meters in accordance with the manufacturer's recommendations.

5.58 METER CHAMBERS

.1 All meter chambers shall be constructed in accordance with Standard Drawing No. W-11 unless otherwise shown on the construction drawings.

.2 The floor drain system shall be installed in accordance with Section 5.55 – Floor Drain Assembly Installation.

.3 Install valves, fittings and meters according to the manufacturer's recommendations at the locations shown on the construction drawings.

.4 Support valves, fittings and meters by means of steel pipe supports.

.5 Install touch read meter bracket between the first and second ladder rung in accordance with Standard Drawing No. W-12.

.6 If required by the Engineer, meter chambers shall be tested for leakage after the installation of equipment by filling the chamber to the underside of the roof slab with water. The test duration shall be a minimum of three hours. No leakage will be allowed.

.7 Precast Manhole Sections

(a) Precast manhole barrel sections shall be placed plumb**.**

(b) Joints between the top riser and the cover slab shall be made watertight with cement mortar. Prior to placing sections, the mating faces shall be thoroughly soaked with water and a layer of cement mortar shall be spread on the lower face. After sections are placed, excess mortar which has been squeezed out shall be removed and the joint made flush inside and out.

(c) Joints between precast manhole barrels must utilize O-ring gaskets and shall conform to the manufacturer's specifications. The inside surface of the precast barrel at the O-ring joints shall be filled with cement grout to a smooth finish.

(d) Damaged O-ring manhole joints require removal and replacement of damaged manhole section. Mortar patching of damaged area if approved by the Engineer, shall require the removal of the O-ring gasket and installation as per Section 5.58.7(b).

(e) Refer to Section 5.34 for precast manhole section specifications.

.8 Manhole Concrete Bases

(a) All water shall be removed from the excavation prior to placing base concrete. The base shall be constructed such that the first section of a precast section can be set plumb with uniform bearing throughout its full circumference.
(b) If material in the bottom of the trench is unsuitable for support, the bottom shall be over excavated to firm base as determined by the Engineer and backfilled to the required grade with thoroughly compacted base gravel as specified for trench bottom stabilization under the applicable item included in Section 4 - Trench Excavation Backfill and Bedding.
(c) Where overexcavation and backfill with base gravel is not practical, special structural support shall be provided as specified for trench bottom stabilization under the applicable item included in Section 4 - Trench Excavation, Backfill and Bedding.
(d) Concrete manhole bases shall be constructed as shown on the drawings.
(e) Refer to Section 5.34 for precast manhole bases section specifications.

.9 Precast Manhole Bases

(a) Installation of precast manhole bases shall conform to 5.58.8.
(b) Precast manhole bases shall be placed on 150mm thick base of 40mm drain rock.
(c) Use of precast concrete bases requires approval by the Engineer.

.10 Concrete

(a) Concrete work shall be as specified under the Section 11 - Reinforced and Plain Concrete Works.

.11 Frames and Covers

(a) Frames shall be set on precast concrete grade rings to bring the cast iron manhole frame up to grade as shown on the Standard Drawings. Contractor to install a minimum of two (2) 62.5mm thick concrete grade rings to a maximum of four (4) 62.5mm thick grade rings. The concrete grade rings shall be laid in common bond with raked mortar joints and shall be mortared inside and outside of the manhole.

(i) Fine grade elevation adjustments of frames shall be done with a minimum of 3, steel only, shims equally spaced.

(b) Manhole covers shall be installed:

(i) for unpaved areas, covers shall have a 1.5m x 1.5m, 50mm thick asphalt apron. Covers shall be set flush with the asphalt surround.
(ii) for paved areas, covers shall be flush with finished pavement grade with a maximum allowed variance of 6mm lower than the finished pavement grade. Covers shall not protrude above the finished pavement.

(c) Steel manhole riser rings shall be used in easements only.
(d) Refer to Section 5.34 for manhole covers and frames specifications.

.12 Manhole Steps

(a) Manhole steps shall be installed in manhole sections by the manufacturer unless circumstance dictates otherwise, in which case approval must be received from the Engineer.
(b) The distance from the top of the chamber manhole, to the first manhole step shall conform to WorkSafe BC requirements.
(c) Refer to Section 5.34 for manhole step specifications.

5.59 -NOT USED-

5.60 PRESSURE REDUCING STATIONS

.1 Pressure reducing stations shall be installed in accordance with the construction drawings and supplementary specifications.

5.61 PRESSURE AND LEAKAGE TESTING

.1 Pressure and leakage tests shall be performed on all installed pipes, hydrants, valves, fittings and service connections.

.2 Pressure and leakage tests can be commenced upon completion of all underground utility installation. Prior to testing, concrete thrust blocking shall be sufficiently cured to restrain fittings, valves and hydrants.

.3 Testing procedures shall be submitted to the City Engineer for approval prior to commencement of testing. ***(REVISED NOVEMBER 2016)***

.4 Hydrant lead valves and service corporation stops shall be fully opened during the test. As a preliminary step, the entire system may be pressure and leakage tested at once. Pressure and leakage tests shall be carried out between valved sections of the installation such that every valve in the system is tested for leakage in the shut-off position.

.5 Pressure and leakage testing shall be conducted in the presence of the Design Engineer, and the City of Nanaimo Works Inspector. ***(REVISED NOVEMBER 2016)***

.6 Pressure and leakage tests for ductile iron piping shall be in accordance with AWWA C600.

.7 Testing of welded steel piping shall be in accordance with AWWA C206. No leakage shall be allowed.

.8 Pressure and leakage tests for PVC pipe shall be performed in the following manner:

(a) Fill the section to be tested slowly with water and expel all the air from the section.
(b) If air relief valves are not required at the high points of the test section, the pipe shall be tapped to release all air and approved plugs inserted upon completion of testing.
(c) Pump water into the test section until the static pressure reaches 1035kPa or 1.5 times the average system operating pressure at the point of test, whichever is greater.
(d) Maintain the test pressure in the pipe to $\pm$ 70kPa throughout the duration of the test by the addition of a measured quantity of water. The duration of the test shall be a minimum of one hour.

(e) The quantity of water required to maintain the test pressure shall be considered to be the leakage.

(f) The allowable leakage shall be determined from the following formula: ***(REVISED NOVEMBER 2016)***

$$L = \frac{SD \times \sqrt{P}}{715{,}317}$$ ***(REVISED NOVEMBER 2016)***

in which L = allowable leakage (liters/hour)
S = length of the test section, in meters
D = nominal diameter of the pipe run in mm
P = average test pressure during the leakage test in kPa
(REVISED NOVEMBER 2016)

(g) Should testing disclose leakage above the maximum allowable leakage, the contractor shall locate and repair or replace the defect and retest the section until test results are satisfactory.

(h) A copy of the leakage and test pressure report shall be forwarded to the City Works Inspector.

(i) Prior to accepting the work, all valves shall be checked to ensure they fully open.

5.62 FLUSHING, CHLORINATION AND BACTERIAL SAMPLING ***(REVISED NOVEMBER 2016)***

.1 Prior to chlorination, all piping and appurtenances shall be flushed with a minimum velocity of 1.0m/s. Dispose of flushing water only to drainage works capable of carrying the flows. When flushing the watermain into a sanitary sewer, the downstream capacity shall be reviewed with City of Nanaimo Operations staff.

.2 The Design Engineer shall arrange, undertake and ensure all piping and appurtenances are flushed, chlorinated, flushed of chlorinated water and tested for bacteria according to the latest edition of AWWA C651. ***(REVISED NOVEMBER 2016)***

On completion of chlorination, the entire piping system shall be thoroughly flushed and filled with potable water prior to bacterial sampling. ***(REVISED NOVEMBER 2016)***

Flushing chlorination and bacterial sampling shall be conducted in the presence of the Design Engineer and the City of Nanaimo Works Inspector. ***(REVISED NOVEMBER 2016)***

.3 Chlorinated water shall be disposed of in a way that will not cause harm or damage to vegetation or aquatic life in bodies of water or water courses. Points of discharge are to be approved by the Engineer.

5.63 NOTIFICATION TO ENGINEER - SYSTEM TESTS AND FINAL CONNECTION ***(REVISED NOVEMBER 2016)***

.1 The City Engineer and the City of Nanaimo Works Inspector shall be given 48 hours written notice in advance of all system tests and pipe chlorination by the Contractor.

.2 On new water systems no physical connection (tie-in) to the public system shall be made until the new system passes: ***(REVISED NOVEMBER 2016)***

(a) flushing, ***(REVISED NOVEMBER 2016)***
(b) pressure testing, ***(REVISED NOVEMBER 2016)***
(c) disinfection, ***(REVISED NOVEMBER 2016)***
(d) satisfactory bacterial testing results by an accredited certified lab. ***(REVISED NOVEMBER 2016)***

.3 Upon satisfactory passing, the Design Engineer shall submit copies of all the above noted test results to the City Engineer with their written recommendation on connection to the Public Water Supply. ***(REVISED NOVEMBER 2016)***

.4 The City Engineer will review the provided test results and recommendation from the Design Engineer and if acceptable may grant Approval to Connect to the Public Water Supply. Under no circumstances shall a connection to the Public Water Supply be undertaken without an Approval to Connect issued by the City Engineer. ***(REVISED NOVEMBER 2016)***

.5 Once Approval To Connect is granted, the time to connect (tie-in) to the Public Water Supply shall be no greater than 7 calendar days, otherwise bacterial testing results will be invalid and will need to be redone. The short spool pieces, fittings and couplers required to complete the connection shall be cleaned and disinfected to AWWA standards. All final connections (tie-ins) shall be reviewed by the Design Engineer. Once final tie-in is complete and the system is in operation, the tie-in shall be reviewed by the Design Engineer for water leaks prior to backfilling and covering up. ***(REVISED NOVEMBER 2016)***

.6 Tie-in and connection shall be conducted in the presence of the Design Engineer and the City of Nanaimo Works Inspector. ***(REVISED NOVEMBER 2016)***

.7 Final Connections: ***(REVISED NOVEMBER 2016)***

(a) If Connection is 1 pipe length or less (6m or less) spray or swab disinfect all parts just prior to connection. ***(REVISED NOVEMBER 2016)***
(b) If connection is greater than 1 pipe length (plus 6m), pipe must be set up above ground, disinfected and bacterial samples taken as described in AWWA C651 Section 5. Ends of pipe must be sealed watertight until installed. ***(REVISED NOVEMBER 2016)***