

**DESIGN CRITERIA**  
**SECTION W – WATER**

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## SECTION W - WATER

### W1 WATER SYSTEMS

#### W1.1 Community Water Supply

Water systems shall be designed to conform to the requirements of the Provincial Ministry of Health and this Schedule.

The system shall be designed to provide peak domestic requirements and also shall provide adequate flows for fire protection. The required flows shall be the sum of the max daily domestic flow plus required fire flow.

#### W1.2 Private Wells

When private wells are required for land development:

1. each lot must have its own well;
2. each well must be tested and proven to comply with Guidelines for Canadian Drinking Water Quality, latest edition.
3. proof of compliance for each well shall be submitted to the *Approving Officer* prior to final approval of the *subdivision*.

### W2 DOMESTIC DEMANDS

Average daily domestic flow	675 liters/capita/day
Peak Day Demand	1575 liters/capita/day
Peak Hour Demand	2500 liters/capita/day

Design populations used in calculating water demand shall be computed in accordance with the *Municipality's* population predictions or with the planned *development* in the area to be served, whichever is larger.

In the absence of any data on existing or proposed uses, the following design demands for commercial and industrial areas shall be used:

Average Flow (during an 8 hour day)	0.7 l/s/ha
Peak Day Demand (PDD)	1.1 l/s/ha
Peak Hour Demand (PH)	2.0 l/s/ha

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When information exists about the anticipated uses, flows shall be calculated for the actual use, or be based upon the equivalent population projection, but in no case shall be flows be less than the preceding criteria.

Hydraulic design computations shall be based on the Hazen-Williams formula:

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

Where: Q = Rate of flow in l/s  
C = Roughness coefficient (125 for all mains)  
D = Internal pipe diameter in mm  
S = Slope of hydraulic grade line in m/m

### W3 FIRE FLOW DEMANDS

#### W3.1 Fire Flows

Fire Flows shall be designed and calculated to meet current industry standards. Standards recognized in British Columbia for acceptable fire flows include but are not limited to:

- Insurance Services Office (ISO) “Needed Fire Flow Guide”;
- NFPA 1231 “Standard for Water Supply for Suburban and Rural Fire Fighting”;
- American Water Works Association “Distribution Requirements for Fire Protection”; and,
- Other standards as approved by the Fire Chief.

These flows shall be available at the farthest distance within the site from the service location and at the point of highest elevation.

The *Developer’s Engineer* must determine whether the fire flow required for the proposed *development* will exceed these minimum required flows.

#### W3.2 Sprinkler Fire Flows

Where each existing and future building on a lot is or will be constructed with an automatic fire sprinkler system protecting the entire building, the minimum fire flow provided to that lot may be reduced to the minimum flow required to support the automatic fire sprinkler systems and all other water requirements for fire fighting purposes on the lot.

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### W3.3 Interim Fire Flows

At the discretion of the *Approving Officer* an interim fire flow of 75% of the minimum ultimate fire flow may be accepted at the limits of dead-end mains if the main will be extended to connect back to the main system within five years.

### W3.4 Servicing of Existing Lots

Where a water main is extended, each existing lot along this extension must be serviced in accordance with W3.1, W3.2, or W3.3 as applicable based upon the type of *development* permitted by the current zoning on each lot.

### W3.5 Minimum Water Main Sizing

Notwithstanding W3.1, W3.2, W3.3, and W3.4, each water main extension shall be sized in accordance with Municipal requirements for its water main network as determined by the *Approving Officer* taking into account both domestic and fire flow requirements for the area.

## W4 WATER PRESSURES

Maximum allowable pressure 900 kPa.

Minimum press anywhere in the system during design fire flow (FF) plus Peak Day Demand (PDD) 150 kPa.

Minimum pressure at Peak Hour Demand (PH) 300 kPa

All service connections where the service pressure exceeds 517 kPa shall be individually protected by pressure reducing valves in the dwelling.

## W5 HYDRAULIC NETWORKS

Designs shall accommodate the ultimate *development* projection using either the Peak Day Demand plus Fire Flow or the Peak Hour Demand, whichever has the greater effect on pressure and flow.

Depending on the complexity and extent of the proposed distribution system, the *Municipality* may require a hydraulic analysis design showing minimum flows and pressures.

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Pipe segments shall not be designed to have velocities exceeding 2.0 m/s or head loss exceeding 1 m per 100 m of length under Peak Day or Peak Hour design conditions, whichever is the greater.

In residential areas, water mains servicing fire hydrants shall be 200 mm diameter or larger. Water mains 100 mm in diameter may be permitted for domestic service on dead end roads where no further extension is planned, provided no fire hydrant is required. Whenever practical, water mains shall be looped. Dead-end mains shall not be promoted.

In commercial/industrial/institutional areas, the minimum water main size shall be 200 mm diameter.

### **W6 DEPTH OF COVER**

The minimum cover over any water main shall be 1.0 m with minimum 0.3m cover over valve stems. The maximum depth to a valve stem shall not exceed 1.5m. Valves larger than 400 mm may be installed sideways with a 90° stem adapter.

Where it is impractical to provide the minimum cover required, precast concrete slabs shall be used to protect the water main against excessive loadings. The *Developer's Engineer* shall submit a design to show that the precast concrete slab is adequate for its intended purposes. Such slab shall be provided with lifting hooks for subsequent access to the water main. The Engineer shall include insulation in his design that will provide the equivalent protection to the water main of 1.0 m depth of bury. The slab and insulation system must be able to support an H20 highway loading.

Concrete encasing will not be allowed.

### **W7 WATER MAIN GRADES**

The minimum grade for a main shall be 0.1%. The maximum grade shall be 8% unless provision is made to anchor the pipe to the bottom of the trench with concrete anchor blocks.

### **W8 CLEARANCE WITH SEWER PIPES**

All cross over points with sanitary or storm sewers shall be indicated on the drawings.

Where the water main is below a sewer, or has less than 0.5 m clearance above any sewer, a next higher class of pipe shall be used and a full pipe length shall be centered across the cross over point.

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The end joints of this pipe shall be wrapped with a petroleum tape product in accordance with the following standards.

ANSI/AWWA C214 (factory applied)

ANSI/AWWA C209 (field applied)

ANSI/AWWA C217 (petroleum tape)

All materials used are to have zero health hazard.

The minimum horizontal clearance between a water main and a sanitary or storm sewer shall be 3 m. Where it is impractical to provide this minimum clearance, all affected joints shall be similarly protected.

### W9 VALVES

#### W9.1 Valve Locations and Spacing

In general, valves shall be located as follows:

1. At intersections, in a cluster at the pipe intersection or at hydrant tees the minimum shall be:
  - a) 3 valves at “X” intersection
  - b) 2 valves at “T” intersectionso that specific sections of mains may be isolated.
2. Valves shall be provided in all legs of “X” or “T” intersections in industrial areas.
3. Spacing of valves in industrial areas shall isolate no more than 2 service connections.
4. Spacing of valves shall not be more than 200 m apart for single family residential areas or 150 m apart for commercial areas. All other zones shall require special designs.
5. Not more than 1 hydrant is to be isolated per valve.

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### W9.2 Valve Sizing

Valves shall be the same diameter as the main up to 300 mm diameter. For mains larger than 300 mm in diameter, valves shall be no more than one diameter size smaller.

### W9.3 Valve Types

All direct bury mainline valves shall be gate valves. Butterfly valves shall only be used in special circumstances where approved by the *Approving Officer* and where gate valves are not practical. Valves larger than 400 mm shall be provided with bypass valves. Gate valves shall be Terminal City valves or an approved equivalent.

### W9.4 Valve Boxes

Valve boxes shall be the Nelson type, or an approved equivalent, with the word “water” clearly cast into the cover.

## W10 HYDRANTS

Fire Hydrants shall be located in general at street intersections, and at a maximum spacing of 150 m in residential areas with no lot further than 75 m from a hydrant. In high density residential, commercial and industrial areas, hydrants shall be located at a maximum spacing of 90 m or as approved by the *Approving Officer*.

In mid-block locations, fire hydrants shall be located at the property lines. It shall be the *Engineer's* responsibility to ensure the design and proposed locations of the fire hydrants will not conflict with existing or proposed street lights, power poles, driveways, power kiosks, and other structures.

Fire hydrants shall be Terminal City TC-20P slide gate with a 100 mm diameter pumper port painted with Cloverdale paint marine enamel, bright red part No. 11187 or an approved equivalent.

## W11 AIR VALVES

Combination air valves shall be installed at the summit of all mains of 200 mm diameter and larger except where the difference in grade between the summit and valley is less than 600 mm.

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Combination air valves shall be sized as follows:

<u>Water Main Size</u>	<u>Valve Size</u>
Up to 300 mm	25 mm
Up to 600 mm	50 mm
Larger mains	Special design

Refer to Standard Drawings for air valve installations.

All air valves shall be installed off the traveled portion of the road.

### W12 BLOW-OFFS

Blow-offs are required at the ends of all water mains and at system low points. Blow-offs for water mains larger than 200 mm shall require special design. A gate valve is required for temporary blow-offs.

### W13 THRUST BLOCKING AND JOINT RESTRAINTS

Fire hydrants shall be terminal city T-20P slide gates with a 100 mm diameter pumper port painted with Cloverdale Paint Marine Enamel, Bright Red Part No. 11187 or approved equal.

Concrete thrust blocking shall be provided at valves, bends, tees, wyes, reducers, plugs, caps, and blow-offs. Thrust block sizes shall be indicated on the design drawings.

Thrust blocks shall be designed with sufficient bearing area to prevent movement of the water main or fitting for the greater of the peak system test pressure, or the working pressure plus an allowance for water surge, under the specific site conditions. In no case shall the area be less than the area specified in the standard drawings.

Joint restraining devices may be used with the approval of the *Approving Officer* in cases where conventional thrust blocking is not feasible, or to augment conventional thrust blocking where the possibility of disturbance exists. Design plans shall identify the type of restraining device to be used and clearly show the minimum required restrained pipe length.

### W14 SERVICE CONNECTIONS

Minimum 20 mm diameter service connections shall be required for all lots. Where the length of the service to the lot exceeds 30 m the minimum size shall be 25 mm diameter.

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These connections shall typically be located at the centerline of the lot and the curb stop located at 300 mm from the property line, or the road *right-of-way*.

The *Municipality* may require the installation of a water meter box, with or without a meter. In this instance the meter box shall be located 300 mm from the property lines or the road *right-of-way* and the curb stop shall be 300 mm from the box. Meters for commercial, industrial, or institutional uses shall be designed by an *Engineer* and shall be located within the property or within the building. Access shall be provided to the meter for a service vehical.

A corporation stop and a curb stop shall be installed for each connection 50 mm diameter in size or smaller.

### W15 WATER SYSTEM LOCATION / CORRIDORS

Water mains shall be located within the road *right-of-way* as noted in the applicable Standard Drawings for road cross-sections unless otherwise approved by the *Approving Officer*.

When the water main is required to cross private lands, the *right-of-way* shall be a minimum of 3.0 m wide and not less than two times the depth to the water main.

When a water main, manhole, valve chamber, or other appurtenance is located within the *right-of-way*, the *Developer* may be required to provide access from a *Municipal* road for maintenance vehicles. The maintenance access shall be constructed to be adequate to support the maintenance vehicles for which the access is intended.

### W16 PRIVATE WELLS

#### W16.1 Minimum Yield

Private wells must provide a quantity of not less than 2,500 liters per lot per day, provide a sustained yield of 9 liters per minute for a minimum of 4 hours.

#### W16.2 Well Certification

The certification required pursuant to clause 69 of this Bylaw shall be in accordance with the "Private Well Certification" form.

#### W16.3 Well Test Report

If there are two wells or less in the proposed development, a certification by a Professional Engineer based upon a water well contractor's report or well testing

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contractor's report will be sufficient. Where well yield is considered marginal ( $\nabla 10\%$ ) by the certifying engineer or where more than two wells are involved, a Hydrogeological Evaluation of the proposed development is required.

### W16.4 Well Testing Procedure

- Completed wells shall be pumped continuously at a constant rate for a minimum period of four hours. The tested rate must be at or greater than the required 13,000 l/d (9 liters per minute). While the test is running, the following measurements shall be made and recorded on the "Well Pump-Field Test" form.
  - water levels in the well;
  - pumping rate (must be constant);
  - time that all readings were made;
  - notes on colour, smell and taste of water pumped; and
  - notes on weather conditions at the time of testing.
- Recording of well testing data shall be in accordance with the following procedure:
  - Depths to water (or drawdown) during the pumping test and recovery after the pump is turned off are to be measured in the pumped well and in nearby observation wells. These measurements should be recorded to the nearest 0.01 m.
  - The time intervals for both drawdown and recovery readings should be short enough to adequately record any rapid drawdown during start of pumping and any rapid recovery immediately after pump shut down. The time interval after these initial periods can then be gradually lengthened between the readings.
  - The pumping rate is to be expressed in liters per minute (lpm). In the final "constant rate" test, the pumping rate is to remain constant throughout the period of pumping. This test will involve continuous pumping at a constant rate for four hours or longer, if necessary, to determine a reliable drawdown trend.

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- Optional step drawdown tests or “maximum drawdown” tests can be used initially to determine the ideal rate if the test is to be run at rates higher than the required 9 lpm rate. When the test has been run for 240 minutes, or sufficiently long enough to determine a reliable drawdown trend the test pump is turned off. Water levels in the well should also be recorded during the recovery period in the same manner as during the pumping test.
- The suggested schedule for readings both during and following the test is provided in the following:
  - Readings every minute from 1 to 10 minutes and then every five minutes from 10 to 60 minutes (first hour), then readings every 15 minutes thereafter.
  - A preferred method for ease in plotting the data, but one that is sometimes hard to comply with, is as follows:

Readings every 30 seconds from 1 to 5 minutes;  
Readings every minute from 5 to 10 minutes;  
Readings every 2 minutes from 10 to 20 minutes;  
Readings every 5 minutes from 20 to 50 minutes;  
Readings every 10 minutes from 50 to 100 minutes;  
Readings every 20 minutes from 100 to 200 minutes; and  
Readings every 60 minutes thereafter until the end of the test.
  - If the well level does not return to the pre-test level within 240 minutes, then one reading should be made on the next day following the test.
- Results of the well test shall be presented as follows:
  - Time and water level data shall be plotted on the “Well Pump-Drawdown Graph” form. Water levels may be expressed in depth to water or drawdown relative to the initial water level. Normally the graph will be a straight line. Bends in the line suggest that the water-bearing zone is not extensive and that boundary conditions exist. If the slope of the line increases by a factor of three during the test, a Professional Engineer with groundwater experience will be required to interpret the test data.
  - The drawdown at 10 minutes (Sh1) and at 240 minutes (Sh2) shall be determined using the attached “Well Pump-Drawdown Graph” form and the equivalent daily rate drawdown values, SL1 and SL2, calculated using

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the formulas provided at the bottom of “Well Pump-Drawdown Graph” form.

- The formulas are:

$$SL_1 = \frac{Q_L}{Q_h} \cdot Sh_1$$

$$SL_2 = \frac{Q_L}{Q_h} \cdot Sh_2$$

$Q_L$  = required minimum daily yield  
= 2500 liters/day  
= 1.74 liters/minute

$Q_h$  = pumped rate in liters per minute;  
=  $Q_h$  must equal or exceed 9 liters per minute.

- Plot the calculated values for SL1 and SL2 at each values appropriate time interval (10 minutes for SL1 and 240 minutes for SL2) on “Well Pump-Drawdown Graph” form. Draw a straight line between the two points and continue the line to the 30 day period on “Well Pump-Drawdown Graph” form. Read the long term drawdown value S30 from the vertical axis adjacent to the intersection of the drawn line at 30 days.
- Initial static water level depth (DTW) plus drawdown (S30) plus seasonal water level decline (D), plus safety factor (SF) must not exceed planned depth to pump suction (intake), as calculated on “Well Pump Drawdown Graph” form.
- All relevant data on the well and the testing program shall be summarized on “Well Pump-Test Summary” form.

### W16.5 Hydrogeological Evaluation

Where there are three or more wells proposed in a development, or where the yield is considered marginal pursuant to Clause 16.3, a Hydrogeological Evaluation of the proposed development shall be provided. Such evaluation shall include the following information:

- Geologic maps of the area and environs, showing regional surficial geologic units, location of known springs, seeps and existing wells or test holes,

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together with proposed subdivision layout, location of new or proposed wells and septic system tile fields.

- Hydrogeologic sections drawn through the area of the proposed subdivision showing inferred major hydrogeologic units (aquifers), water tables, piezometric lines and probable groundwater flow direction.
- Detailed logs of subdivision wells and summary information on existing wells on properties surrounding the subdivision.
- Constant rate pump test data on all subdivision wells.
- Summary and interpretation of chemical and biological test results on well water samples.
  - Summary of hydrogeologic impact assessment considering the following factors:
    - Impact of each proposed well on neighbours' wells, both within and adjacent to the proposed subdivision.
    - Potential for degradation of well water quality resulting from septic tanks, agricultural commercial operations.
    - Long term impact of the proposed wells on the source aquifer.
- A certification in the form of the "Private Well Certification" form is required in support of the Evaluation Report.

### W17 RESISTIVELY TESTING

Resistively testing may be required by the *Approving Officer* for proposed ductile iron or steel pipes to determine whether corrosion protection is required.