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7 WATER DISTRIBUTION SYSTEM DESIGN AND LAYOUT OF WATERMAINS AND WATER SERVICES

7.1 DEFINITION AND PURPOSE

These specifications shall apply to all water services and to all water mains up to 450 mm diameter including appurtenances which are located within the City road allowance, or on property which will be transferred to City ownership. These specifications shall also apply to all water meter placements.

The designer shall design to City Specifications and also make reference to the Ministry of the Environment “Design Guidelines for Drinking-Water Systems” and to the Ministry of the Environment “Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit”. If there is a discrepancy between the City Specifications and the MOE Guidelines then the Water Engineering Division shall be contacted to resolve the issue.

Any deviation from these specifications must be submitted in writing to the Water Engineering Division, Environmental Services Engineer for approval.

For water mains larger than 400 mm diameter and for any other water system installation, special specifications must be prepared for and approved by the Water Engineering Division, Environmental Services Engineer. These specifications are to be used as a supplement to all other specifications approved by the Water Engineering Division, Environmental Services Engineer for water system installation.

The water distribution system is for the purpose of supplying and distributing water, but does not include plumbing or other works to which the Ontario Building Code applies.

“Water Distribution System” means watermains with connections to feeder watermains, feed watermains within subdivision lands, private watermains, water services, fire hydrants, and shut-off valves and all other appurtenances thereto.

A water distribution system may exist for the purpose of distributing potable or non-potable water, however water distribution systems for potable and non-potable water may not be intermixed or cross-connected. Private supplies of potable water may not be cross-connected to the municipal or public water distribution system.

Watermain Classifications
- Trunk Main - Large diameter watermain (over 600mm diameter)
- Feeder Main - Large diameter watermain (400mm, 450mm and 600mm)
- Distribution Main – Watermain diameters of 300m and smaller
7.2 **PERMITTED USES**

Permitted and non-permitted uses of water are identified by By-law W-1 - A by-law to provide for the REGULATION OF WATER SUPPLY IN THE CITY OF LONDON.

7.3 **WATERMAIN DESIGN**

7.3.1 **Pressure and Flow Requirements**

Watermains shall be sized to maintain the greater of:

i) maximum day demand plus fire flow at a pressure not less than 140 kPa (20 psi) at any hydrant lateral or potential fire service connection. Pressures to be taken at the most critical locations.

ii) maximum hourly demand at a pressure not less than 275 kPa (40 psi).

iii) average day demand at a pressure not less than 275 kPa (40 psi).

iv) maximum residual pressure should not exceed 550 kPa (80 psi) and a minimum residual pressure shall not be below 275 kPa (40 psi).

v) All pressures shall be calculated/determined assuming minimum hydraulic grade line conditions apply. Refer to section 7.3.7 of this document and confirm with the Water Engineering Division, Environmental Services Engineer.

7.3.2 **Design Water Demands**

7.3.2.1 **Total Water Demands**

Gross water consumption rate recorded for the City is 470 to 600 L/d (121 IGPD to 132 IGPD) average per capita.

7.3.2.2 **Domestic Water Demands**

Average day domestic (residential) unit demand for design shall be 255 litres per capita per day.

Peaking factors of 3.5 for maximum day and 7.8 for maximum hour are to be used for design for the purposes of subdivisions and site plans unless written authorization from the Water Engineering Division, Environmental Services Engineer is received.
For design purposes, the following densities shall be used:

<table>
<thead>
<tr>
<th>Type Of Use</th>
<th>People / Unit</th>
</tr>
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<tbody>
<tr>
<td>Low density residential</td>
<td>3 people per unit</td>
</tr>
<tr>
<td>Medium density residential</td>
<td>2.4 people per unit</td>
</tr>
<tr>
<td>High density residential</td>
<td>1.6 people per unit</td>
</tr>
</tbody>
</table>

7.3.2.3 Commercial, Institutional and Industrial Water Demands

These demands vary greatly with the type of water using facilities or process present in the development. If the Owner (designer) does not know the required demand they should refer to Ontario Ministry of the Environment “Guidelines for the Design of Water Distribution Systems” or find other suitable references and justification for selecting water demands. The designer can also provide typical demand and peaking factor data. For industrial demands the Owner (designer) shall discuss water requirements with the Water Engineering Division, Environmental Services Engineer.

7.3.2.4 Friction Factors

The following Hazen-Williams “C” values shall be used for design, regardless of material:

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>C-Factor</th>
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<tr>
<td>100 and 150 mm</td>
<td>100</td>
</tr>
<tr>
<td>200 and 250 mm</td>
<td>110</td>
</tr>
<tr>
<td>300 to 600 mm</td>
<td>120</td>
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<tr>
<td>Over 600 mm</td>
<td>130</td>
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7.3.3 Fire Demands

To estimate the fire flow requirements for an area of the Municipality, the designer should refer to the guide “Water Supply for Public Fire Protection - A Guide to Recommended Practice” (latest revision) prepared by Fire Underwriters Survey, Insurers’ Advisory Organization. For single family detached low density residential areas, a minimum fire demand of 76 l/s is to be used.

On private property, adequate water for firefighting shall be determined in accordance with the Ontario Building Code.
7.3.4 Minimum Pipe Sizes/Acceptable Pipe Sizes

The minimum size for watermains shall be 150 mm diameter except beyond the last hydrant on cul-de-sacs where smaller diameter pipe shall be used which is designed for domestic and maximum hour demands only.

Accepted pipe sizes are 50mm and 100 mm (see above), 150mm, 200mm, 250mm, 300mm, 400mm, 450mm, 600 mm. For larger pipe sizes, the designer should consult with the Water Engineering Division, Environmental Services Engineer.

7.3.5 Water Quality

Watermains and watermain networks shall be designed so that water shall not remain unused in the watermain for more than three (3) days under average day demand.

To demonstrate a three (3) day turnover, the designer shall provide a hydraulic analysis as outlined in 7.14 of this document. The hydraulic analysis shall also provide calculations to determine if and where automatic flushing devices are required and determine the appropriate size of the automatic flushing device (25mm or 50mm).

The City of London has primary responsibility to ensure that the minimum chlorine residuals are maintained in the distribution system and therefore reserves the right to require watermain looping and/or automatic flushing devices and/or blow-offs to facilitate the maintenance of the required chlorine residual under the Safe Drinking Water Act. Refer to W-CS-2 sht.1, 2, 3 and W-CS-5.

On private property, where there is a concern that there may be degradation of the water quality (when a three (3) day water turn-over cannot be achieved), the City reserves the right to require perimeter isolation. This shall consist of a testable device (DCVA) on the water service and shall be installed at the property line and at the owners expense.

It will be a requirement that a testable device (DCVA) be installed at property line for all site plans with a private watermain connected to the municipal water supply system which services more than one commercial building. The testable devices (DCVA) are to be maintained in accordance with the manufacturer’s suggested requirements at the owner’s expense.

7.3.6 Maximum Velocities

The watermain shall be sized so that the maximum velocity in the pipe shall not exceed 1.5 meters per second during maximum hour domestic flow conditions or 2.4 meters per second during fire flow conditions unless otherwise approved by the Engineer.
7.3.7 Boundary Conditions

For the purposes of hydraulic analysis the designer shall contact the Water Engineering Division, Environmental Services Engineer for appropriate boundary conditions rather than using information from fire flow test directly. This is because operating pressures and flows are subject to fluctuation.

In general, the minimum hydraulic grade lines (HGL) for each of the various service areas of the City are:

- 301.8m for the low level system
- 335.0m for the Springbank / Westmount / Pond Mills / Wickerson Pumping Station high level system
- 317.0m for Hyde Park Pumping Station and Uplands Pumping Station
- 322.0m for the Southeast Pumping Station System

The designer shall assume a reservoir with the appropriate HGL for water supply to the area being designed.

7.4 LAYOUT OF WATERMAIN

7.4.1 Watermain Location within Road Allowance

a) Watermains are to be located in standard location as indicated on the City of London Standard Utility Locations for all streets, U.C.C.-1M (UCC1), on straight streets, unless otherwise approved. Deviation from the standard location must be approved by the Utilities Coordinating Committee.

b) Window Street Right-of-ways - all watermains to be located in a window street right-of-way are to be located in accordance with UCC-2M. Refer to Section 1.1.3 b) for additional details.

On watermain bends, the watermain may deviate from the standard location by up to 1.0 m, provided that the deviation is towards, or closer to the street line.

7.4.2 Watermain Pipe Depth

Curb and Gutter Roads - Watermains shall have no less than 1.7m nor more than 1.9m of cover from final surface grade. Variations from this cover may be made only if approved on plans or in writing by the Engineer.

Open ditch and unimproved roads - Watermains shall be laid 2.1m minimum below road grade or 1.1m below the bottom of the ditch, whichever is greater. On unimproved roads within the City, the designer should also review the vertical alignment of the road so that, where possible, future road improvements will not result in an unacceptable watermain depth, as defined in this specification.
7.4.2.1 **Pipe Insulation**

Where joint deflections or offsets require the pipe to be laid with less than 1.7m of cover, insulation shall be placed to prevent freezing. Refer to City of London W-CS-68 for insulation requirements.

Where storm drains or culverts cross over or under a watermain, insulation is required per City of London W-CS-68 unless there is a minimum 1.7m separation.

7.4.3 **Pipe Offsets/Bends/Deflection**

Offsets must be made according to City of London W-CS-12. Use of offsets must be indicated on the approved plans or in the case of unforeseen obstructions found after approval of the watermain design, written approval of the Engineer must be obtained.

For watermain diameter up to 400 mm, a maximum bury depth of 2.3 m should be utilized. Situations deviating from this should be approved by the Engineer.

If using joint deflection, full lengths of pipe must be used. Maximum deflection for various pipe materials to be in accordance with half (1/2) the pipe manufactures specifications. Where it is not possible to lay pipes to the required radius to utilize allowable joint deflection, manufactured pipe bends must be used. Axial deflection (bending of the pipe barrel) is prohibited for P.V.C. pipe. Any change in the direction of the watermain in excess of the pipe joint deflection tolerance shall be made using an appropriate fitting. Thrust or joint restraint shall be provided as in 7.4.6.

7.4.4 **Termination of Watermains**

Watermains shall be terminated opposite street lines or property lines.

Where caps and plugs are installed without a blow-off to provide for future watermain extension, a 20 mm watermain stop shall be tapped into the watermain no further than 0.5 m from the cap or plug to release trapped air/pressure from the watermain prior to removal of the cap or plug.

7.4.5 **Blow-Offs /Automatic Flushing Devices/Addressing Water Quality**

1. The design of the watermain shall be undertaken to ensure adequate water quality requirements are met. Refer to Section 7.14 for requirements relating to Hydraulic Modelling.

2. Dead end watermain which are part of an interim phase of a subdivision build-out shall meet water quality requirements by:
   i. demonstrating adequate turnover by use; or
   
   ii. installation of an automatic flushing device.

   iii. Alternately, consideration can be given to building watermain systems in smaller phases or stages to meet development needs, but reduce the amount of watermain for which water quality must be maintained.
3. Where an automatic flushing device is used to maintain water quality, a water meter (in a meter pit) shall be installed to measure the volume of water discharge. The owner will be charged for the water used. The designer shall provide calculations which indicate the volume of water to be discharged by the automatic flushing device and the sizing of the automatic flushing device as well as indicate the timer settings to be used. This information shall be clearly indicated on the drawings. The Owner’s contractor shall initially set up the automatic flushing device to the indicated settings.

4. Where an automatic flushing device is not required to maintain water quality a standard 50mm blow-off will be required to allow flushing to take place.

5. On cul-de-sac or similar streets, blow-offs, when required, shall terminate in the boulevard. Blow-offs must be operable without the necessity of excavating.


7. Automatic Flushing Devices – Notes for Designers with Respect to Limitations on Locations Where Automatic Flushing Devices Can be Used

i) Automatic flushing devices may not be used to discharge directly to a ditch or to the natural environment as municipal water contains chlorine.

ii) Any water discharged from an automatic flushing device must have a total chlorine residual less than 1.0 mg/L in accordance with the Waste Discharge By-Law for discharges to storm sewers.

iii) Normal Conditions for the use of an automatic flushing device it is assumed that the device discharges to a storm sewer which in turn discharges to a storm water management pond where the remaining chlorine can be dissipated before being released or discharged to the natural environment. In any situation where there are large volumes of water potentially being discharged from an automatic flushing device, or where the receiving storm system is a sensitive system, further consultation must take place to confirm if the use of an automatic flushing device is appropriate in the situation. Consultation should be with Development Services, Water Engineering and the Storm Water Management Division.

Exception – temporary connections for automatic flushing devices (150mm) may be made directly to a storm maintenance hole or to a storm catchbasin. If into a maintenance hole, the drainage pipe must outlet just above the benching, at the bottom of the structure. To remove the flushing device, the drainage pipe to the storm sewer should be fully grouted and properly bricked and mortared at the catchbasin, maintenance hole or storm sewer.
7.4.6 Thrust Restraint

Refer to section 441.07.23 Thrust Restraints of the City of London Standard Contract Documents

7.4.7 Watermain and Other Utilities Separation

Designers should refer to Ontario Ministry of the Environment Guidelines for the Design of Water Distribution Systems (latest revision) and the Ontario Plumbing Code (latest revision) regarding the location of watermains and water services relative to sewers and to the Public Utilities Act of Ontario regarding the location of watermains relative to other utilities.

Encroachment of utilities, structures, sewers and/or any utility appurtenances, which may impact the watermain, the integrity of its bedding, and/or structural capabilities, shall have design consideration(s) applied to adequately protect the watermain.

7.4.7.1 Parallel Installations of Watermains and Sewers

Sewers and watermains located parallel to each other should be constructed in separate trenches maintaining the maximum practical horizontal separation.

Under Normal conditions, watermains shall be laid with at least 2.5m horizontal separation from any sewer, sewer manhole, catch basin, or other sewer appurtenances.

7.4.7.2 Crossings of Watermains and Sewers

The designer shall refer to the Ministry of the Environment Procedure F-6-1, Procedures to Govern the Separation of Sewers and Watermains.

Watermain up to and including 450 mm diameter (New Construction)

Watermains shall cross above sewers and Private Drain Connections (PDC’s) with sufficient vertical separation to allow for proper bedding and structural support of the watermain, sewer or PDC. If the watermain is less than 1.7 meters below grade at the crossing, the watermain shall be insulated per section 441.07.14 of the City of London Standard Contract Documents for Municipal Construction Projects.

Where it is not possible for the watermain to cross above the sewer or PDC, the watermain shall pass under a sewer or PDC and shall be protected by providing:

a) A vertical separation of at least 0.5 meters between the invert of the sewer or PDC and the crown of the watermain.

b) That a minimum 5.0 meter length of water pipe shall be centred at the point of crossing so that the watermain joints will be equidistant and as far as possible from the sewer or PDC.

c) Adequate structural support for the sewers to prevent excessive deflection of joints and settling.
Watermain Greater than 450 mm Diameter (New Construction)

Watermains shall cross above sewers and Private Drain Connections (PDC’s) with a minimum vertical separation of 0.60 meters to allow for proper bedding and structural support of the watermain, sewer or PDC. Joints for the watermain shall be located a minimum horizontal distance of 2.0 meters from the crown of the sewer pipe or PDC. If the watermain is less than 1.5 meters below grade at the crossing, the watermain shall be insulated as per section 441.07.14 of the City of London Standard Contract Documents for Municipal Construction Projects. Where it is not possible for the watermain to cross above the sewer or PDC, the watermain shall pass under a sewer or PDC and shall be protected by providing:

- a vertical separation of at least 0.60 meters between the invert of the sewer or PDC and the crown of the watermain; and adequate structural support for the sewers to prevent excessive deflection of joints or settling, and
- that a minimum 5.0 meter length of water pipe shall be centred at the point of crossing so that the watermain joints will be equidistant and as far as possible from the sewer or PDC.

7.4.7.3 Utility Crossings of Existing Watermains larger than 450 mm Diameter

It is desirable for new servicing, sewers or PDC to cross above existing trunk watermains wherever possible. The watermain shall be protected by providing:

i) vertical separation of at least 0.60 meters between the invert of the sewer or PDC and the crown of the watermain; and

ii) adequate structural support for the sewers to prevent excessive deflection of joints or settling, and

iii) that the crossing is not within 2.0 m of a joint in the watermain.

Where it is not possible to cross above the watermain, the sewer or PDC shall pass under the watermain, and the watermain shall be protected by providing:

i) a vertical separation of at least 0.60 meters between the crown of the sewer or PDC and the invert of the watermain; and

ii) adequate structural support for the watermain must be provided during construction, and post construction to support the structure and prevent excessive deflecting of the watermain or joints.

For either situation (crossing over or under an existing watermain) details of the crossing proposed and the method of reinstatement to be used must be approved prior to construction. Refer to W-CS-69.
7.4.8 Looping of Watermain/Supply Redundancy

Water distribution systems shall be designed to exclude any dead-ended pipe, unless meeting the requirements in 7.4.5. Water distribution systems shall be designed so that no more than eighty (80) units with individual water services and meters shall be serviced from a single source of supply. If the looped watermain is connected to a single watermain, a valve must be installed in the watermain to permit isolation of supplies.

For requirements for looping for private property, see section 7.9.3.

7.4.9 Connections between High Level and Low Level Water System (security of water Supply/Supply Redundancy in critical scenarios)

Areas which are serviced by high level water distribution systems shall have periodic and an appropriate number of interconnections between the high level and low level system, by means of the installation of a checked connection between the high and low level system. In general this would supply water from the low level system to the high level system. The purpose of this connection is to ensure redundancy of water supply. These interconnections shall be sized in order to provide adequate water supply under all situations including emergency scenarios.

The designer/modeler is encouraged to discuss critical scenarios with the City Engineer, and this will vary, however; as an example this might be a watermain break in a high level supply source under a max day plus fire scenario.

7.5 WATERMAIN PIPE MATERIAL

7.5.1 Reference Specifications

All waterworks material used shall be new and shall conform to those listed in the City of London Standard Contract Documents for Municipal Construction Projects and the latest revision of the Standards of the American Waterworks Association (AWWA).

Material other than that listed in the City of London Standard Contract Documents for Municipal Construction Projects may be used if it is approved in writing by the Water Engineering Division. The Water Engineering Division will designate the AWWA Standard and/or other specifications and conditions applicable for use of such approved material.

The City reserves the right to select any materials or product it deems appropriate for the application. The City also reserves the right to remove from the specifications any product previously approved but found inappropriate for the application. This includes but is not limited to pipe material, valves, or fittings. The designer shall clearly indicate on drawings and contract documents the materials which are acceptable for use in a particular application where the use of one or more of the approved materials list is not acceptable.
7.5.2 Transitions in Pipe Material - Watermains

Transitions from one pipe material to another must be made at a valve or tee. Where PVC pipe is used, a tracer wire must be provided along the entire pipe and CAD welded to the valve and terminated at grade elevation as per the Standard Contract Documents for Municipal Construction Projects Section SW 441.05.04 Polyvinyl Chloride Plastic Pipe Products.

7.6 SWABBING, FLUSHING, DISINFECTING AND BACTERIOLOGICAL TESTING OF WATERMAINS

For requirements regarding swabbing, flushing and disinfecting and bacteriological testing of watermains see section 441.07.25 of the City of London Standard Contract Documents for Municipal Construction Projects. The usual test pressure in the London water system is 1035 kPa (150 psi).

7.7 LOCATION AND SPACING OF VALVES

7.7.1 Location and Spacing of Watermain Valves

In accordance with the Ministry of the Environment, Watermain Design Criteria for Future Alterations Authorized Under a Drinking Watermain Works Permit, Table 2: Shut-Off Valves.

7.7.1.1 Residential Developments

In residential developments, valves shall be located so that any section of watermain serving up to a maximum of sixty (60) residential water services can be isolated by operating not more than four (4) valves. Phasing of developments should be considered and valving should be logical (i.e. at intersections). In residential areas, valves shall be spaced no more than 250 m apart.

7.7.1.2 High Density Residential, Commercial and Industrial Developments

In high density residential, industrial and commercial areas, valves shall be located to be no more than 150 m apart.

7.7.1.3 Feeder Watermains

Feeder watermains (400mm, 450mm and 600mm) should have valves at 400 m intervals.

7.7.1.4 Intersections of Watermains

At intersections where smaller watermains connect to larger feeder watermains, each smaller watermain shall be valved with an isolation valve whereas the larger watermain shall be valved as required above.
7.7.1.5 **Valves for Looped Services/Private Watermains**

Valves shall be installed on looped services or private watermains to isolate buildings or groups of buildings so that no more than eighty (80) individual water services or apartment complex containing 300 dwelling units or more are on any one valved section. The Owner shall install a valve on the street watermain between connections to a looped private watermain if there is not an existing valve, at no expense to the City.

7.7.1.6 **Crossings of Watermain, Rivers, Railway, Controlled Access Highways, Bridges**

Watermains crossing rivers, railways and controlled access highways shall be valved on each side of the crossing.

7.7.1.7 **Hydrant Laterals**

Valves shall be located on all hydrant laterals according to City of London W-CS-1.

7.7.1.7.1 **Maximum Length of Hydrant Laterals**

The maximum length of hydrant laterals shall be 10 m in order to address concerns of water quality. Where a hydrant lateral is longer than 10 m, a testable device (DCVA) shall be installed at property line on the private property side to protect the municipal water system.

Where the hydrant lateral is located on private property, the testable device (DCVA) shall be located as close as possible to the private main in order to protect the water quality in the private water system.

The cost for the installation and maintenance of testable devices (DCVA) shall be the owner’s.

7.7.1.8 **Location of Valves at Street Intersections**

Valves shall be located on the extension of street lines or according to City of London W-CS-45.

7.7.1.9 **Location of Valves at Intersections with Roundabouts**

Water valves may be placed within the raised roundabout island where possible. However, if placement of the valves creates a potential conflict with the curb & gutter of the island, than the valves are to be placed in the boulevard clear of the curb and gutter of the approaching streets.

7.7.1.10 **Valve Boxes and Extensions Rods Required**

All valves shall be provided with valve boxes. Valve extension rods as detailed on City of London W-CS-6 shall be installed on every valve and are to be purchased from the City of London Purchasing & Supply Division.
7.7.2 Valve Locations - Phasing of Subdivision Developments

Valves shall be located to meet the requirements of 7.7.1. As well, location and number of valves shall take into consideration reducing shutdowns and inconvenience to customers during the construction of additional phases. Valves may be installed on a temporary basis and relocated in order to accomplish this.

7.7.3 Sizing of Valves

For watermain 400 mm in diameter and below, valves shall be sized to be the same size as the watermain on which the valve is installed. Restraints for pipe sizes greater than 300 mm is not addressed by the City of London Standards and Specifications and will have to be designed by the consultant/designer and/or provided by the pipe manufacturer as part of the drawing submissions.

7.8 FIRE HYDRANTS AND FIRE DEPARTMENT CONNECTIONS

All fire hydrants situated within the road allowance and on private property are the sole property of the City of London and shall be installed in accordance with The City of London Standard Contract Documents for Municipal Construction Projects, and shall be maintained by and operated only by the City of London.

The detail of hydrant and valve installations shall be according to The City of London Standard Contract Documents for Municipal Construction Projects (441.05.10) and drawing W-CS-1

Fire Hydrants and Fire Department Connections

All new PUBLIC hydrants installed are to be flow tested and colour coded in accordance with the requirements of NFPA 61. Colour coding is for the purpose of indicating available fire flows at 20psi residual pressure. Colour coding shall be by means of placing reflective markers on each of the two 65 mm hydrant outlets.

In new subdivisions and site plans, the designer shall create a table on the drawings for fire hydrants and their colour coding marker. The hydrant markers shall be installed by City staff.

<table>
<thead>
<tr>
<th>Class</th>
<th>Rated Capacity</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class AA</td>
<td>1500 usgpm (5680 L/min) or greater</td>
<td>Light Blue</td>
</tr>
<tr>
<td>Class A</td>
<td>1000-1499 usgpm (3785-5675 L/min)</td>
<td>Green</td>
</tr>
<tr>
<td>Class B</td>
<td>500-999 usgpm (1900-3780 L/min)</td>
<td>Orange</td>
</tr>
<tr>
<td>Class C</td>
<td>500 usgpm (1900 L/min) or less</td>
<td>Red</td>
</tr>
</tbody>
</table>
7.8.1 Location/Spacing of Hydrants on Public Streets

The location of hydrants is subject to the requirements and approval of the City Fire Department in accordance with the Ontario Building Code. As a general guide, hydrants must be located not more than 170 m apart along the length of the watermain and should be located at intersections where possible. Hydrants shall be installed a minimum of 1.5m from the edge of a driveway.


7.8.1.2 Location of Hydrants to Sprinkler or Standpipe Systems

For use with sprinkler or standpipe systems the hydrant must be located not more than 45 m from the Fire Department connection.

7.8.1.3 Hydrants on Dead-end Streets

Hydrants shall not be located on dead-end streets unless such streets exceed 90 m in length. Where located on dead-end street the hydrant shall be located at 90 m from the end and a smaller size watermain (minimum 50mm) shall be used beyond the hydrant so that water quality is maintained.

7.8.2 Addition or Relocation of Hydrants

Regardless of hydrant location shown on accepted subdivision plans, additional hydrants may be required or existing hydrants may have to be relocated due to circumstances unknown at the time of plan acceptance such as the position of a structure, Fire Department connection, driveway or landscaping feature.

Such addition and/or relocation shall be requested when the City approves the service plan and must be done at the expense of the Owner of the subdivision or, if the subdivision has been assumed, at the expense of the Owner of the property for which the additional or relocated hydrant is required.

7.8.3 Hydrants on Private Property

Hydrants shall be located on private property where required to meet spacing in accordance with the Ontario Building Code, subject to the approval of the Building Division.

Fire hydrants shall be installed at grades such that they are readily accessible to the fire department.

For average conditions, fire hydrants shall be placed at least 12.2m from the buildings being protected, in accordance with NFPA 24.

Exception: When hydrants cannot be placed at this distance, they shall be permitted to be located closer, or wall hydrants used, provided they are set in locations by blank walls where the possibility
of injury by falling walls is unlikely and from which people are not likely to be driven by smoke or heat. Usually, in crowded plant yards, they can be placed beside low buildings, near brick stair towers or at angles formed by substantial brick walls that are not likely to fall.

Fire hydrants shall be located a minimum distance of 3.0m from a fence or other such obstruction.

Fire hydrants shall not be placed near retaining walls where there is danger of frost through the wall, in accordance with NFPA 24.

Where municipal water is not available, and an on-site water supply is utilized for firefighting purposes, a fire hydrant shall not be installed, but instead a standpipe connection, meeting the requirements of the Building Division, Standard Practice Sheet B2.2, On-Site Water Supply for Fire Fighting shall be provided.

The cost for the supply and installation of hydrants located on private property must be paid by the Property Owner. The fire hydrant must meet the specification set out in section 441.05.10 Hydrants, of The City of London Standard Contract Documents for Municipal Construction Projects and drawing W-CS-1 since they become the property of the City of London and are maintained by the City.

7.8.4 Hydrants for Fire Department Connections

Requirements are given in the Ontario Building Code.

7.8.5 Protection of Hydrants

If the placement of a hydrant on public or private property is such that it will be susceptible to damage by vehicular traffic, bollards are to be installed, at the owners cost, in sufficient number to protect the hydrant. Minimum spacing between any bollard and a hydrant shall be 1.0 meter, and bollards shall be a minimum of 1.0 meter in height. Bollards shall be painted hydrant yellow as per section 441.05.10 of the Standard Contract Documents for Municipal Construction Projects. Bollard construction to be steel with concrete fill.

7.9 WATER SERVICES, FIRE SERVICES AND PRIVATE WATERMAINS

For the design and materials requirements all water service pipe and fire service mains on private property, the Ontario Building Code shall apply. It shall be noted that water quality requirements are not addressed in the Ontario Building Code. Where there is a concern that there may be a degradation of water quality in the private servicing that has the potential to enter the municipal water supply system, the Water Engineering Division reserves the right to require premise isolation. Premise isolation shall consist of appropriate backflow prevention measures to the risk posed, and shall be installed at the property line at the owners expense.

The following apply to the water services on public property up to the property line.
7.9.1.1 Water Service Size and Design

The Owner will be responsible for water service sizing. The Water Engineering Division, Environmental Services Engineer shall be consulted for available pressures and flows at the watermain under design conditions given in Section 7.3.1. If the results of hydrant flow tests are to be used, the Water Engineering Division, Environmental Services Engineer shall be consulted for necessary adjustments since flow tests are not usually done at design conditions.

On private property, adequate water required for fire protection shall be determined in accordance with the Ontario Building Code. Fire flow and hydraulic calculations shall be reviewed by the Building Division.

It is a requirement to provide fire flow information (i.e. hydrants on private property and fire sprinkler requirements) in conjunction with site plan submissions for water servicing in order to determine the correct water service sizing.

7.9.1.1.1 Minimum Service Size for Single Family Residential Homes

<table>
<thead>
<tr>
<th>Pressure Area</th>
<th>Ground Elevation</th>
<th>Minimum Water Service Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low level</td>
<td>Above 267m</td>
<td>25mm</td>
</tr>
<tr>
<td>Upland / Hyde Park</td>
<td>Above 278m</td>
<td>25mm</td>
</tr>
<tr>
<td>Springbank / Westmount / Pondmills / Wickerson</td>
<td>Above 300m</td>
<td>25mm</td>
</tr>
<tr>
<td>Southeast</td>
<td>Above 286m</td>
<td>25mm</td>
</tr>
</tbody>
</table>

In general, these pressure areas are where water pressures are between 275m (40psi) and 345kpa (50psi). Location of pressure areas can be obtained from the Water Engineering Division, Environmental Services Engineer.

It is recommended that the designer determine the water service sizing based on flow requirements for water services which service single family homes which are estate lots, larger homes, have deep setbacks or where automatic lawn sprinkler systems or fire sprinkler systems are to be used.

As required by the Ontario Building Code on private property, the minimum size for fire service mains and water service pipes, combined with fire service mains, shall be 150mm, in accordance with NFPA 24.

Exception: For mains that do not supply hydrants, sizes smaller that 150mm may be used, subject to:

- the main supplies only automatic sprinkler systems, open sprinkler systems, water spray fixed systems, foam systems or Class II standpipe systems;

- hydraulic calculations show that the main will supply the total demand at the appropriate pressure. Systems that are not hydraulically calculated shall have a main at least as large as the riser.
7.9.1.2 Accepted Water Service Sizes

Acceptable water service sizes are 25 mm, 40 mm, 50 mm, 100 mm, 150 mm, 200 mm, 250 mm, and 300 mm diameter.

7.9.1.3 Pressure Reducing Valves Recommended Where Water Pressure Exceeds 550 kpa (80 PSI)

In some lower elevation areas of the City, water distribution pressures may exceed 690 kPa (100 psi) and it is recommended that when pressures in the municipal water distribution system exceed 550 kPa (80 psi) that owners provide pressure reducing valves, at no cost to the City. System pressures available at points of supply should be obtained from the Water Engineering, Environmental Services Engineer.

7.9.1.4 Cathodic Protection

Cathodic protection to be provided where connection made to steel mains in accordance with W-CS-24 or W-CS-25.

7.9.2 General Requirements - Water Services

Water service shall mean the pipe, fittings and shut off valve that convey potable water from a connection on a watermain or private watermain to the meter location.

a) Water Services to Residential Dwelling Units
   (Detached, Semi-detached, Townhouses, Row-housing).

   Each dwelling unit in a detached, semi-detached, townhouse or row house block, must be serviced with a separate water service connected to a watermain or private watermain. Water services must front the dwelling unit they service unless otherwise approved in writing by the Water Engineering Division.

b) Water Services to Commercial/Industrial Malls

   Each structure in a commercial or industrial mall shall have one water service connected to a watermain or private watermain. Units in such a mall may have an individual water service connected to a watermain or private watermain outside the unit.

c) Water Services to Swimming Pools/Lawn Sprinkler Systems

   Swimming pool facilities and lawn sprinkler systems must be serviced by connecting to the metered side of a water service that is within a heated structure.

   Connections to lawn sprinkler systems are to have backflow prevention devices in accordance with CAN CSA B64 and are subject to the approval of the Building Department Direct Pool Makeup Water Connections are to have backflow prevention devices in accordance with CAN CSA B64 and are subject to the approval of the Building Department.
d) **Water Services to Other Structures**

Unless otherwise approved in writing by the Water Engineering Division, all structures not covered in (a), (b), and (c) including commercial, industrial and institutional shall have one water service connected to a watermain or private watermain.

e) **Water Engineering Division to Designate Watermain to Provide Service**

When there are two (2) watermains on a road allowance, the water service shall be laid from the structure to the watermain which, in the opinion of the Water Engineering Division, Environmental Services Engineer, provides adequate flow and/or pressure. Water services shall not be tapped off transmission Watermains 24” (600 mm) and larger where an alternate source is available.

f) **Water Services to Residential Apartment Buildings (5 dwelling units or more)**

Apartment buildings (5 dwelling units or more), shall have one metered water service connected to a watermain or private watermain.

i) **Water Services to Residential Dwelling Units in Townhouse/Condominium Blocks**

Each dwelling unit in a private block must be serviced with a separate water service connected to a watermain or private watermain. Water services must front the dwelling unit they service unless otherwise approved in writing by the Water Engineering Division.

Where it is proposed that servicing of individual dwelling units is not in accordance with the standard above, bulk metering of the site at the point(s) where the water service enters the property will be required. Individual metering of dwelling units by the City of London will not be provided in this circumstance.

g) **Water Services to Multi Family Residential Buildings**

This section will describe the requirements for individually servicing/metering new or converted multi-family (4 residential units or less) residential buildings. This may include but is not limited to the following configurations:

1. An existing single family home that has been converted to a multi-family residence such as a duplex, triplex or a fourplex. The newly created units may have several different layouts such as side by side, upstairs/downstairs units, front/back, etc.

   - In this case, the building must be supplied by a water service pipe from the municipal watermain in the street to the property line that is
adequately sized for the intended use of the building. The City of London minimum water service pipe sizing is 25mm PEX.

- The internal plumbing of the building must be arranged in such a manner that each residential unit must have a separate hot and cold water supply that can be isolated by a main valve and not interfere with the water supply of the other units.

- The City of London allows one water service pipe from the municipal watermain to the property line with a shut off valve located 300mm from the property line on the City right-of-way. Once the water service pipe crosses the property line it can be branched off in to two - four separate water services, one for each new customer. Each branch is to have a shut off valve located at 300mm from the property line on private property. A meter pit will have to be installed for each unit which will house the City of London water meter. From this point the water service pipes will enter the building and be connected to the building plumbing system.

2. Similar to item 1 above but newly constructed building purpose built multi-family residence.

- As described above, each dwelling unit may be serviced by a meter pit located at the front of each unit.

3. Other multi-family (that may or not be stacked) residential condominium or rental units that cannot be serviced as described in the previous sections (7.9.2 a – f).

Each residential unit may be individually serviced by a meter pit located in front of the residential unit it is servicing. The developer is to ensure that there is adequate space to locate the meter pits and associated valving in the front and that the meter pit is accessible for maintenance. Regardless of the configuration of the building, it is important to understand that each metered water service consists of a water service pipe, an isolation valve and a water meter. The meter pits are to be located in the front of the residential unit being serviced and the must be accessible for maintenance.
7.9.3 **Looped Water Servicing Required**

A looped water service connected to a public or private watermain or watermains must be installed:

a) when one water service will not supply the required flow for domestic use and fire protection or,

b) for an apartment complex containing one or more structure and more than 300 dwelling units or,

c) for a townhouse, condominium or similar complex having more than eighty (80) units with individual water services and meters.

d) for buildings over 84 m in height, 2 water service connections will be required in accordance with the OBC. These 2 water services shall be able to be isolated from each other by a valve in the municipal water distribution system.

The looped water servicing must be installed to service the private development from two sources. If the looped watermain is connected to one public watermain, an isolating splitter valve must be installed in the public watermain to permit isolation of supplies, at no cost to the City.

Where a private water system is connected to the municipal water system by two (2) or more connections, the municipal water system shall be protected by perimeter isolation of the private system. This shall mean the installation of testable device (DCVA) at the property line. These devices shall be owned and maintained by the owner.

7.9.4 **Material Type**

Material type shall be an approved material type as indicated in the City of London Standard Contract Documents for Municipal Construction Projects to the property line. On private property, material for water service pipes and fire service mains shall comply with Part 7 of the Ontario Building Code.

7.9.5 **Location and Layout of Water Services**

Single Family and Semi-Detached Lots:
The standard residential water service will be located as per City of London SW-7.0, and W-CS-8.

Street Townhouse Blocks;
At this time no standards exist. Approval will be on a case by case basis. Approval is to be given by the Water Engineering Division.

The water service pipe must be installed at right angles to the watermain and in a straight line from the watermain to the water meter.

Water services connected to a private watermain are subject to the same requirements as water services connected to a public watermain.
7.9.5.1 **Water Service Pipe Depth**

Water services shall have no less than 1.7m nor more than 1.9m of cover from final surface grade. Variations from this cover may be made only if approved on plans or in writing by the Water Engineering Division.

The Owner must ensure that water services and private watermains are located so that “berm” or “mound” type landscaping will not cause excessive cover over water services.

7.9.6 **Approved Deviations in Location of Water Services**

Deviations from the above may be approved by the Water Engineering Division for the following conditions:

a) **Cul-de-sacs, Street Curves and Bends**

On cul-de-sac streets and on street curves and bends the water service stubs may be installed at other than right angles to the watermain and not necessarily through the midpoint of the lot frontage. The water service must be in a straight line from the watermain to the meter.

b) **Water Service Cannot be Located in Accordance with SW-7.0**

Where the water service cannot be located in line with the centre of the lot, the water service stub may be installed at any point on the front of the lot but must be at right angles to the watermain and in a straight line from the watermain to the meter and must maintain the appropriate separation distances from other utilities.

c) **Water Service Cannot Extend in a Straight Line from the Watermain to the Water Meter**

In (a) and (b), if the water service stub has been installed on the lot frontage but the water service cannot be in a straight line from watermain to water meter then the water service extension may be installed in a straight line from the curb stop to the meter provided the meter is inside the front wall of the structure.

d) **Water Meter to be Located at the Side of a Structure**

Where the water service entrance must be located at the side of a structure, the water service stub must be located on the front of the lot such that the water service extension can be installed in a straight line from the watermain to a point outside the structure adjacent to the meter. Such a water service shall be a minimum of 1.5 m from the structure and centered about a 3.0 m clear space.

e) **Cold Cellar on Front of Building**

Where there exists a cold cellar on the front of the building and the water service stub has been installed in the standard location on the lot frontage, the
water service extension may be installed under the porch or cold cellar in a straight line from the watermain to inside the first heated wall. A maximum distance of 2 metres of water service pipe may be located under the porch or cold cellar floor slab.

The water service shall be continuous between the curb stop and the water meter, with no coupling permitted.

The water meter shall not be located within the cold cellar as this is subject to freezing.

7.9.7 Nonconforming Installation of Water Service or Private Watermain

a) Water Service does not Conform with Location Requirements

If the water service stub is to be extended and it is found that the water service will not conform to the above location requirements in Section 7.9, the water service stub shall be disconnected from the watermain and a new stub installed which will conform with the requirements.

b) Water Service or Private Watermain not in Accordance with Specifications or with Approved Service Drawing

If a water service stub, a water service or a private watermain is installed that is not in accordance with these specifications or with the service drawing approved by the City, such installation will be required to be removed and relocated to conform with the specifications or approved drawings.

c) Existing Water Service to Relocated, Rebuilt or Replaced Structures

If an existing water service cannot conform to the above location requirements, or is of lead or other unsuitable material, a new water service must be installed which will conform to the requirements. If a Demolition Permit was issued for an existing structure on the lot, then the existing water service must be abandoned at the watermain and a new water service installed to service the structure.

d) Relocation to be at Owner or Contractor’s Expense

All relocation work required in (a), (b) or (c) shall be at the expense of the Owner or Contractor. The Owner will be responsible, upon approval of the demolition permit, to cut and cap the existing water service(s) at the watermain to City of London standards and at no cost to the City of London.
7.9.8 Fire Service Design

The determination of fire service requirements and the sizing of supply piping shall be the responsibility of the Owner. If a domestic water service is combined with a fire supply service, the Owner is responsible to ensure that the supply pipe is large enough to carry the combined demand. Design and installation of sprinkler and standpipe systems and their supply services shall conform to the requirements of the Ontario Building Code, Section 3.2, and the Fire Code. The design of Fire Services must be approved by the Chief Official (Fire Prevention Office) of the City. The designer should obtain information from the Engineer regarding flows and pressures available for fire systems. If the flows and pressures required are in excess of the minimum design standards given in Section 7.3.1 and in excess of the actual capacity of the system the Owner shall install booster pumps and/or storage to satisfy the required demand.

7.9.8.1 Separated Water and Fire Services

Domestic water, sprinkler and standpipe services may be installed as a separated services from the watermain to the structure. Sprinkler and standpipe services may be combined. The Owner is advised to consult with the Insurance Underwriter before combining these services.

7.9.8.2 Combined Water and Fire Services

A domestic water service may be combined with a sprinkler or standpipe service or with a combined sprinkler/standpipe service. The Owner is advised to consult with the Insurance Underwriter before combining these services.

The owner/designer is advised that water quality should be considered; domestic water demands may not achieve a sufficient turnover rate (see 7.3.5) to prevent poor water quality.

7.9.9 Water Service Size or Location not Determined

Where water service stub size and/or location for any block cannot be determined prior to street construction the Water Engineering Division will not approve installation of the water service stub.

7.9.10 Water Services Valves

All water services shall be equipped with a corporation stop and a curb stop. The curb stop shall be provided with a curb box.

All water service valves and curb stops shall be installed with valve boxes and operating rods. All in accordance with the City of London Standard Contract Documents for Municipal Construction Projects.
7.9.10.1 Location of Water Service Valves

7.9.10.1.1 Valves for Water Services up to 50 mm Diameter

On water services of 50 mm diameter and smaller, a main stop or corporation stop shall be installed at the watermain and a curb stop shall be installed 0.3 m from, and on the street side of, the property line in accordance with City of London W-CS-8 and W-CS-22.

7.9.10.1.2 Valves for Water Services 100 mm Diameter and Larger

For water services of 100 mm diameter and larger, water service valves shall be placed in accordance with City of London W-CS-31.

Where the watermain cannot be closed off for the water service connection, a tapping sleeve and valve will be required at the watermain. It should be noted that size on size taps (eg; 150mm x 150mm tap) is not allowed and a tee will have to be cut in.

Where the watermain can be closed and a tee cut into it, or where a new watermain is being installed, a valve shall be installed 0.3 m from and on the street side of the property line.

The requirement to use a tapping sleeve and valve or to cut in a tee to make the service connection will be made at the discretion of the Water Engineering Division.

7.9.10.1.3 Valves for Water Services to be Connected to a Private Watermain

Water services to structures in a complex that are to be connected to a private watermain shall have the curb stop or valve placed 3 meters (10 feet) from the face of the building. If this distance locates the curb stop in the paved portion of the complex, a deviation in the curb box location may be requested. All deviations from standard location to be approved by the Water Engineering Division.

7.9.10.2 Locates for Curb Stops or Valves

The layout for water services must be such that the curb stop or valve can be easily found by referring to two directional dimensions from a plaque located on the building where the water service enters.

7.9.10.3 Water Service Control Valves Not to be Covered

The Owner shall ensure that water service control valves on his property are not covered by “mound” or “berm” type landscaping.
7.9.11 Water Service Entrances

Water services of all sizes shall enter through the building wall or under the wall footing into a heated area, leaving sufficient pipe and working space for meter installation.

A length of between 0.3 and 0.45 metres shall be exposed above the finished floor. The pipe shall enter the building not less than 0.15m and not more than 0.3m from the wall.

7.9.12 Protection from Contamination

Connections to the municipal potable water system shall be designed and installed so that non-potable water or substances that may render the water non-potable cannot enter the system. This shall be in accordance with the requirements of the Ontario Building Code, Part 7 Plumbing.

7.9.12.1 Backflow Prevention Devices Required on Water Services In High Elevation Areas of the City

In some high elevation areas of the City, the Owner may be required to install a check valve on the water service to prevent backflow into the watermain in the event of a loss of pressure in the system.

The Owner will be responsible for the supply, installation and maintenance of all check valves and protective devices, at no cost to the City.

7.9.13 Electrical Grounding

7.9.13.1 New Installations

Effective June 30, 1993 electrical systems of all new developments shall not be grounded to the water system. Refer to Ontario Hydro Electrical Safety Code (Section 10) for grounding requirements.

7.9.13.2 Upgrade of Existing Plant

Where an existing watermain is replaced or upgraded, the grounding of electrical systems to the water service may not be adequate. It will be the Owner's responsibility to ensure grounding is adequate after the watermain is installed.

7.10 CORROSION PROTECTION

Where ductile iron, steel or concrete watermain pipe are to be used, soil samples shall be taken on each street to identify soil class and resistivity for the purposes of designing corrosion protection systems for these pipe materials. The corrosion protection systems for the watermain shall be designed by a consulting engineer who is NACE (National Association of Corrosion Experts) Certified.
7.11 **EASEMENTS**

Easements are required for any publicly/City owned watermain which is located outside a road allowance on privately owned property.

The minimum width of easement shall be 6.0 m for a single watermain only. When the easement is 6.0m, the watermain will be installed 2.0m from one side of the easement to provide an adequate working area to access and repair infrastructure placed within the easement. Where there is more than one utility, adequate width of easement and separation of utilities for both construction and future access and maintenance shall be provided.

Where a watermain is installed on an easement which is located on private property or between private properties which have or may have a building(s) located on the property(ies) in the future, the watermain shall be installed in a casing.

7.12 **INSTRUMENTATION**

For design and installation standards related to instrumentation and control equipment, refer to “Scada and Instrumentation Standards”, (latest version from the City of London website: [http://www.london.ca/d.aspx?s=/Consultant_Resources/SCADA_index.htm](http://www.london.ca/d.aspx?s=/Consultant_Resources/SCADA_index.htm)

7.13 **WATER METERS**

7.13.1 **General Requirements**

Refer to Section 7.9.2 for acceptable servicing configurations.

a) **All Domestic Services to be Metered**
   All domestic water services must be metered.

b) **Fire Services Not Metered, Exception**
   Fire services are not metered with the exception of sprinkler systems located in individually metered dwelling units.

7.13.2 **Supply of Water Meters and Water Meter Remote Read Registers and Meter Strainers for Services 150 mm and Larger**

The City will supply and install all water consumption meters that are used for billing process. Water meters up to 20 mm size will be supplied at no charge.

Strainers for 75 mm and larger installations where required shall be supplied by the City.

7.13.3 **Location of Water Meter**

The water meter shall be installed on the water service immediately inside the point of entry of the water service into the building (see Section 7.9.11 Water Service Entrance). Any variation from this location must be approved in writing by the Engineer.
The Owner shall provide sufficient space for installation and maintenance of the meter. The water meter must be accessible for reading and maintenance and must be protected from freezing and other damage. In accordance with Section 7.9.6, water meters shall not be installed within a cold cellar.

The meter or piping shall be no closer than 1 metre to any electrical panel or above or below any electrical panel unless provided with a meter enclosure as outlined in 7.13.3.2.

7.13.3.1 Meter Pits will be Required

Meter pits will be allowed only with approval of the Water Engineering Division when no other suitable location is feasible. Meter pit design and installation must be submitted for approval as per section 7.9.2. All costs associated with the supply and installation of the meter pit will be the responsibility of the Owner.

7.13.3.2 Water Meter Enclosures

Water meters may be installed in electrical rooms provided a shield is installed between the water meter and any electrical panel located within one (1) meter. The shield must be of metal construction (or approved alternative) and affixed securely to the wall and must be of sufficient width to isolate the water meter from the electrical panel. It must not impede the maintenance of the water meter.

7.13.4 Installation of Water Meters

Water meters up to 20 mm size - single family residential units with individual water services. This applies to single family residential, semi-detached dwelling units and townhouses with individual services (constructed after 1985). Water meters up to 20 mm size shall be installed in accordance with City of London W-CS-7. Water meters larger than 20 mm in size shall be installed in accordance with AWWA C700, C701 or C702.

7.13.4.1 Water Meter Valving

All new and replacement installations shall require a valve on each side at the meter. The City will supply, install and maintain the valve on the inlet side of the meter for 16 mm and 20 mm meters for water service sizes up to and including 25 mm diameter.

The Owner must supply and install the outlet valving and bypass valve (when required) for all sizes of meters and the inlet valve when the water service piping is over 25mm diameter. The Owner will be responsible for maintaining and keeping the meter inlet and outlet valving operational and in good working order.

All meter setting valves must open left (counter clockwise).
7.13.4.2 **Meter Strainers**

Meter strainers shall be supplied and installed by the City on 75 mm size and larger meter installations in accordance with City of London W-CS-30. The Owner shall consult the Engineer regarding dimensions of supports required for the meter and strainer.

7.13.4.3 **Water Meter-by-pass Required**

The Owner shall install, at his expense, a meter bypass when any of the following conditions exist:

i) the water meter is 40 mm or larger in size.

ii) shutting the water supply off for approximately thirty (30) minutes during normal working hours of the City would create a production or other problem to the Owner.

iii) any water service which supplies coin-operated equipment cannot be shut down for thirty (30) minutes or longer during the normal working hours of the City.

Meter bypasses shall be installed according to City of London W-CS-30. Bypass valves shall be closed and sealed for use by the City only.

7.13.5 **Meter Sizing**

The size of meters will generally be one size smaller than the water service. Owners should obtain advice from the Engineer on meter sizing. Meter ratings are as follows:

<table>
<thead>
<tr>
<th>METER SIZE</th>
<th>MAXIMUM RATING (L/MIN)</th>
<th>CONTINUOUS RATING (L/MIN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 mm</td>
<td>76</td>
<td>38</td>
</tr>
<tr>
<td>20 mm</td>
<td>114</td>
<td>57</td>
</tr>
<tr>
<td>25 mm</td>
<td>189</td>
<td>95</td>
</tr>
<tr>
<td>40 mm</td>
<td>378</td>
<td>189</td>
</tr>
<tr>
<td>50 mm</td>
<td>606</td>
<td>303</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMPOUND METERS</th>
<th>MAXIMUM RATING (L/MIN)</th>
<th>CONTINUOUS RATING (L/MIN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 mm</td>
<td>1136</td>
<td>568</td>
</tr>
<tr>
<td>100 mm</td>
<td>1893</td>
<td>946</td>
</tr>
<tr>
<td>150 mm</td>
<td>3785</td>
<td>1893</td>
</tr>
</tbody>
</table>
7.14 HYDRAULIC MODELING

7.14.1 General

Hydraulically model water distribution systems for all new developments, or as otherwise exempted by the City Engineer. Submit the results of the analyses to the City for review and provide an electronic version of the hydraulic model for incorporation in the City's overall hydraulic model.

Include all watermains 50mm diameter and larger, control valves (pressure reducing valves and flow regulating valves), reservoirs and pumping stations.

For phased developments, submit updated hydraulic models incorporating the distribution system for all phases at the first phase stage. It should be noted that phases will need to match with anticipated requests for conditional approval to be made. Where a submission is made at a later date for a phase which doesn’t match a phase considered during the design studies approval process, additional hydraulic modelling will be required. The City may require hydraulic analyses beyond the development boundaries in situations where the operation of water system facilities such as control valves, reservoirs and pumping stations, are influenced by changing demands in the new development.

The model shall also include calculations to ensure water quality in the subdivision during the buildout of the phases and ultimately as well as in any temporary dead-end watermains and specify the installation of automatic flushing devices as required.

The City has adopted InfoWater as its standard for hydraulic modelling. Other software packages may be used for analysis and reporting but all model input files provided to the City must be directly readable by InfoWater or EPANET without modification. The accuracy and readability of the input files are the sole responsibility of the developer.

As a minimum, conduct steady-state hydraulic analysis for each proposed development phase under the following demand conditions:

- Average day
- Peak hour
- Maximum day plus fire flow
- Water quality under buildout of the phase, and Water quality under zero buildout for the phase

All Hydraulic reports shall include detailed maps/layouts of the watermain system (valves, hydrants, etc.) and shall clearly show the pipe and node numbering.

Extended period simulations are not required unless specifically requested by the Water Engineering Division.
7.14.2 Information Provided by the City

The City of London Water Engineering Division will provide minimum steady-state pressures at the connection node(s). The designer is cautioned that only the pressures provided by the City will be acceptable for the model and that flow tests cannot be used for boundary conditions as they are not representative of design flow conditions.

7.14.3 Design Criteria

In accordance with Section 7.3 Watermain Design.

7.14.4 Hydraulic Model Input Standards

7.14.4.1 Units

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>elevation</td>
<td>metres</td>
<td>x.xx</td>
</tr>
<tr>
<td>length</td>
<td>metres</td>
<td>x.x</td>
</tr>
<tr>
<td>diameter</td>
<td>millimetres</td>
<td>x (hard conversion)</td>
</tr>
<tr>
<td>demand</td>
<td>litres per second</td>
<td>x.xxx</td>
</tr>
<tr>
<td>tank diameter</td>
<td>metres</td>
<td>x.</td>
</tr>
<tr>
<td>tank volume</td>
<td>cubic metres</td>
<td>x.xx</td>
</tr>
<tr>
<td>pressure</td>
<td>metres (of water)</td>
<td>x.xx</td>
</tr>
<tr>
<td>Power</td>
<td>kilowatts</td>
<td>x.xx</td>
</tr>
<tr>
<td>Time</td>
<td>hours</td>
<td>x.x</td>
</tr>
</tbody>
</table>

7.14.4.2 Node Elevations

In metres to geodetic datum and estimated final grading contours.

7.14.4.3 Node and Link Identification

Nodes and links are to be graphically identified on a map.

7.14.4.4 Demands

Use average day demands and global demand multipliers for demand patterns.

7.14.5 Submission Requirements

Submit electronic versions of the following files in EPANET format:

- model input file
- map or shape file

Submit a report, sealed by an Ontario Professional Engineer, including:

- summary of demand scenarios and points of connection to the City system
- network map (in colour) for each scenario which identifies node and link numbers

Note: Refer to Section 18 regarding additional design information for new subdivisions.
• node tables for all scenarios listing node numbers, elevation, demands, and pressures
• link tables for all scenarios listing link numbers (with up and downstream nodes indicated), diameters, lengths, roughness, velocities, flows, headlosses, and age of water calculations
• for multi-phase developments, provide model data and summaries for all phases as part of the first phase submission.

Reports containing results that indicate operating parameters outside the acceptable Design Criteria will be automatically rejected without further review and returned to the Owner for correction.

7.14.6 Review by the Water Engineering Division

The Water Engineering Division will review the report and advise on the need for any further analysis to be carried out at the Owner’s cost.

7.14.6 Submission Requirements for Interim Water Quality Reports – request to change settings of automatic flushing devices based on partial buildout of subdivision

The owner or their consultant may request changes to automatic flushing device settings based on partial buildout of a subdivision. This request should be submitted to the Development Services Compliance Group who will then circulate this request to the Water Engineering Division for review, and to Water Operations for the purposes of making the change to the automatic flushing device settings.

Where this water distribution system has been modelled fully, the submission can contain only water quality information.

Where this application is being made for a stage or phase of subdivision buildout that has not been fully modelled for fire flow, max day and peak hour, it will be necessary to submit hydraulic modelling for all demand scenarios as well as water quality.

7.15 Sediment & Erosion Control

The City of London requires an Erosion Sediment Control Plan (ESCP) be designed for most Capital Works, Operational and Development Projects. The complexity of the ESCP is determined by the sensitivity of the area that is to be protected.

For reconstruction or resurfacing of existing roads, or for infill sites less than 3.0 ha in land area within existing urbanized areas, that are not in close proximity to an open watercourse, woodlands, ESA’s, steep slopes or other natural area, an ESCP is not required, unless otherwise directed by the City Engineer. Where an ESCP is not required, all reasonable protective measures must be taken during construction to control sediment and prevent erosion from occurring.

For further information on the requirements of the ESCP, please refer to Section 10 – Sediment & Erosion Control, within this manual.
WATER DISTRIBUTION SYSTEM REFERENCES

Fire Underwriters Survey

Ontario Water Resources Act

Public Utilities Act

Ontario Building Code

Corporation of the City of London
Zoning By-Law, No. Z. - 1, March 1995

Water By-Law W-1
Regulation of Water Supply In The City of London

Ministry of the Environment

Design Guidelines for Drinking-Water Systems (Latest Revision)

Watermain Design Criteria for Future Alterations Authorized Under a Drinking Water Works Permit

Form 1 – Record of Watermains Authorized as a Future Alteration