

7.0 WATER DISTRIBUTION SYSTEM

7.1 General

Water distribution systems shall be designed as a network system to meet the water demand for each area or subdivision under consideration. Oversizing of watermains will be required to provide for adjacent areas where service is expected to be extended. Long dead end mains and single supply systems are to be avoided.

Communal water supply systems will be considered on an individual basis. The system must be designed to the satisfaction of the Town and MOE.

All watermains, appurtenances and service connections shall be located at the minimum covers specified in this section. In areas where the minimum cover cannot be achieved, special provisions shall be considered to protect the pipe from live loading and freezing.

7.2 Service Area

Systems shall be designed to service all areas within the subdivision to their maximum future development in accordance with the Official Plan.

Allowance shall be made for external lands within the pressure district boundaries as established by the Town.

Allowance shall be made for connection to appropriate mains to the approval by the Town.

7.3 Reporting Requirements

7.3.1 Design Report

A hydraulic network analysis and design report of the proposed water distribution system will be required with every new development, duly stamped and signed by a licensed professional engineer.

The Hazen-Williams equation shall be used for computing friction losses. Computer-based hydraulic network analysis programs shall be used where the proposed system is too complex for desktop methods of analysis. The network analysis be conducted using WaterCAD such that the model shall be submitted for purposes of updating the Town-wide model.

Boundary conditions shall be determined through hydrant flow tests. Field confirmation of system performance using hydrant flow tests will be required prior to the release of building and/or occupancy permits.

The design report shall consist of the following elements, at a minimum:

- A clear list of all assumptions and modeling parameters.
- Demand calculations.
- Hydrant flow test results and boundary condition assumptions.
- Schematic diagram of the system with fire flow locations, pipe information and ground elevations.
- Summary of results to include residual pressures and flow velocities for each scenario considered.
- Response Curves (i.e. plots or tables of Residual Head vs. Flow Rate) at critical hydrant locations, to be used as a basis for comparison after construction.
- Digital file of hydraulic model (if WaterCAD used for analysis).

7.3.2 Verification Report

Upon completion of construction, flow tests are to be conducted at critical locations within the development for comparison with modeled results presented in the design report.

The results of the flow test should reasonably agree with the modeled results, with satisfactory explanations for any significant discrepancies. The hydrant flow test results shall be shown on the as-constructed drawings.

Results and analysis to be submitted in letter report form, duly stamped and signed by a Licensed Professional Engineer.

7.4 Water Demand

7.4.1 Design Conditions

Watermains shall be designed to carry the greater of:

- Maximum Daily Demand plus Fire Flow; and
- Maximum Hourly Demand.

The following peaking factors shall be applied to the average daily demand:

- Minimum Hourly Demand Peaking Factor: 0.40 or from MOE Guidelines
- Maximum Daily Demand Peaking Factor: 2.75 or from MOE Guidelines
- Maximum Hourly Demand Peaking Factor: 4.13 or from MOE Guidelines

7.4.2 Residential Demand

Average Daily Demand: 450 L/c/d

For local watermains, the following population densities are to be used to estimate residential water demands:

- Single Family and Semi-Detached 4.0 ppu
- Townhouse 3.5 ppu
- Apartment 3.0 ppu

In the absence of sufficiently detailed development concepts, the following unit densities shall be used, unless otherwise specified in the Official and/or Secondary Plans:

- Single Family and Semi-Detached 24 units per site hectare
- Townhouses 40 units per site hectare
- Apartments 75 units per site hectare

For the design of trunk watermains, population estimates may be based upon census data or other reliable means of estimation.

7.4.3 Industrial/Commercial/Institutional (ICI) Demands

The following average daily demand rates shall be used (based on gross areas):

- Commercial: 0.29 L/s/ha
- Schools: 0.50 L/s/ha
- Light Industrial: 0.41 L/s/ha
- Heavy Industrial: 0.64 L/s/ha

The Town reserves the rights to allow or impose alternative standards or require site-specific studies.

7.4.4 Fire Flow

Fire flows shall be determined from the latest publication of "Water Supply for Public Fire Protection" prepared by Fire Underwriters Survey.

Alternatively, the following minimum fire flow demands may be used for residential areas:

- Single Family and Semi-Detached Residential Dwellings 6,000 L/min (100 L/s)
- Townhouses (maximum 2.5 storey) 8,000 L/min (133 L/s)

For Industrial, Commercial and Institutional (ICI) land uses, the following fire flow rates may be used in the absence of sufficient information relating to floor areas and construction types.

- Institutional 13,500 L/min (225 L/s)
- Industrial/Commercial 22,000 L/min (367 L/s)

7.5 Minimum Sizes

7.5.1 Mains

- Residential: 150mm Ø
- Industrial/Commercial/Institutional: 300mm Ø
- Mainline Fronting/Serviceing a School: 300mm Ø

7.5.2 Residential Service Connections

Single residential service connections shall be 25mm in diameter, unless located in areas of low pressures where larger connections sizes may be used to minimize losses. Larger sizes shall be specified:

- where the static water pressure under peak hour demand conditions is expected to be 310 kPa or less; or
- where water service connections are greater than 30 m in length (measured from main to building envelope; or
- where lot sizes are greater than 500 m².

Where these areas of low pressures cannot be compensated for with increased service connection sizes alone, individual booster pumps may be specified in addition thereto, to provide the required pressures.

In all cases, the measures described in this section shall only be considered in very unusual circumstances when the network infrastructure cannot be improved to provide the required pressures and flows, and only with the written permission of the Town.

In all cases, watermain sizing must satisfy fire flow requirements.

7.5.3 Industrial/Commercial/Institutional (ICI) Service Connections

A separate fire connection to the municipal watermain with a minimum size of 150mm Ø is required. A second separate minimum 50mm Ø service line for domestic use, in accordance with TNT.SD 405.

7.5.4 Park Service Connections

The Town's Parks department will identify the location for water services to each park. The service shall be a minimum 50mm Ø line complete with curb stop located at the park street line shall be provided.

7.6 Hazen-Williams Roughness Coefficients

Pipe Diameter (mm)	150	200 – 250	300 – 600	> 600
Hazen-Williams Roughness Coefficient (C)	100	110	120	130

7.7 Permissible Pressures

Demand Condition	Minimum Pressure (kPa)	Maximum Pressure (kPa)
Maximum Day	350	550
Minimum Hour	-	700
Maximum Hour	275	-
Maximum Day plus Fire	140	-

7.8 Velocity Considerations

Pipe velocities should not result in excessive head losses. Velocities in excess of 3.0 m/s should be avoided wherever possible, and justification for exceedance of this threshold must be justified.

Booster
 Pump
 Stations

7.9 Reliability

A minimum of two supply sources shall be provided wherever possible.

7.10 Permanent Sampling and Flushing Stations

Sampling/flushing stations shall be required in locations determined by the Town, based on the distribution system model.

Stations to be installed in accordance with TNT.SD 303 and TNT.SD 304. Locations to be shown on engineering drawings.

The Town requires sampling and flushing programs for watermain infrastructure. The Consulting Engineer shall prepare and submit to the Water Supervisor or their designate a proposed flushing and sampling program.

The Developer shall undertake the program to ensure the watermain system remains potable. The program is required to be implemented no later than 30 days following the system being found potable.

The Developer is to perform a flushing and bacteriological sampling program by a certified third party MOECC licensed Class 1 Water Operator at their cost until such time as 50% occupancy has been achieved along each street.

Flushing and chlorine residual testing are to be performed by the Developer bi-weekly; chlorine residual results and water consumption to be submitted on the Chlorine Residual Report Form to the Water Supervisor. Bacteriological samples to be coordinated and collected by the Town shall be taken every four weeks.

Failure to execute this program on a pre-determined schedule will result in the program being carried out by the Town or sub-contractor at the expense of the Developer.

Any expenses incurred by the Town for water loss, laboratory and courier fees will be the responsibility of the Developer.

7.11 System Layout

7.11.1 Watermains

Watermains shall generally be located in accordance with the Town's standard road cross-sections and shall be installed at a minimum cover of 1.7 m or 1.9 m below the road centerline, whichever is deeper.

At the discretion of the Town, the layout of the watermain may be altered to avoid conflicts with sidewalks, utilities and services.

When watermains are located within easements, the easement width shall be a minimum of 3.0 m when installed at the minimum cover. The easement size is to be increased sufficiently where the depth or diameter of the watermain requires greater working room.

Minimum clearances between other types of services shall be in accordance with MOE guidelines and procedures.

Location and placement of restrained joints for watermains (i.e. at tees, bends, etc.) shall conform to the latest Ontario Provincial Standards and pipe / restrainer manufacturer requirements. No poured concrete thrust protection is permitted. All bends, tees, valves, end caps etc. to be mechanically restrained as per pipe manufacturer including bell & spigot joints immediately adjacent to valves. Contractor to provide a Restrainer Plan indicating all mechanical restrainers and fittings for approval

Watermain bedding shall be as per TNT.SD 305, unless otherwise recommended by geotechnical engineer.

7.11.2 Valves

7.11.2.1 Location and Number

Valves shall generally be located along the projection of side lot lines, at intersections, and as required for spacing. The following number of valves are required at intersections:

- Cross Intersections: 4
- Tee Intersections: 3

7.11.2.2 Maximum Spacing

- Distribution Mains: 200m or 40 units
- Trunk Supply Mains: 400m

7.11.2.3 Valve Boxes and Chambers

Valve boxes are permitted on 150mm Ø to 300mm Ø watermains except at high points, where a chamber is required complete with an air release valve, respectively. The top of the valve box is to be set at the finished grade elevation. All valve stems must be within 1.6m of finished grade. A valve stem extension will be required where necessary to meet this criterion.

As an alternative to air release valves, hydrants may be located at or near high points in the watermain system to achieve the same purpose.

On watermains 350mm Ø and greater, drain valves in chambers are required.

Valve chambers are required for all other watermain sizes and shall be as per OPSD 1101.010, the tops of which are to be set to finished grade. Wherever possible, valve chambers are to be equipped with 100mm Ø drains to the storm sewer.

7.11.3 Hydrants

Hydrants shall be installed in accordance with OPSD 1105.010 and should generally be located as follows:

- Residential Areas: along the projection of lot lines
- Industrial areas: centrally along lot frontages
- A minimum of 1.5 m from driveways
- At the end of dead-end mains, either temporary or permanent
- At high points in the watermain system, in lieu of air release valves
- All joints shall be mechanically restrained.

The following are the maximum spacing requirements for hydrants on roadways:

- Residential: 90m
- Commercial, Industrial, Institutional and Multi-Family Residential: 90m

The spacing and location of hydrants on private property is governed by the Ontario Building Code.

The Developer shall install anti-tampering devices on all new hydrants and maintain until the beginning of the maintenance period. The Developer shall remove the anti-tampering devices at the beginning of the maintenance period unless the Fire Department requests their removal at an earlier date.

7.11.4 Service Connections

For residential dwellings, water service connections (curb stops), must not be located in driveways. With acceptance of the Town, where unavoidable, frost collars will be required on any curb stops located in driveways. All curb stops are to be installed flush with the finished grade on each individual residential lot.

Service connections shall be located at a depth of cover of 1.9m

It is the Town's Policy to allow one water service and one water meter per property.

Disconnection of abandoned/ decommissioned water services shall be at the main stop valve at the main unless otherwise approved by the Town.

7.11.5 Blow Offs

Blow-offs shall be installed at the end of watermains where hydrants are not practical, and shall be installed as per OPSD 1104.030.

7.12 Material Specifications

7.12.1 General Requirements

- Where watermains are to be used for fire protection purposes on private property they must satisfy the requirements of the Underwriters Laboratories of Canada in addition to the Town's Specifications.
- All PVC and concrete pressure pipe to be installed with white plastic coated 12 gauge, solid copper (TW75, TWU75, RW90XLPE) tracer wire, rated at minus 40 degrees C, which shall be brought to the surface at each main-line valve and each fire hydrant secondary valve.
- Tracer wire shall be brought to the surface adjacent to the valve box through a pre-drilled hole.

7.12.2 Pipe

- Polyvinyl Chloride (PVC):
 - Class 150, for pipe diameters less than or equal to 450mm, conforming to the latest A.W.W.A C900-75, A.W.W.A C901-78, CSA B137.3, and CSA B137.6 (SDR 18).
 - 450mm diameter watermains are to be site specific at the Town's discretion conforming to A.W.W.A C905 and A.W.W.A C907.
 - rubber gasketed bell & spigot for a 700 kPa rated working pressure
- Ductile Iron Pipe:
 - Class 52 (or Pressure Class 350) conforming to the latest A.W.W.A. C104 (A.N.S.I. A21.4), C111 (A21.11), C150 (A21.50), C151 (A21.51), C153 (A21.53).
 - Cement mortar lined conforming to the latest A.W.W.A. C104 (A.N.S.I. A21.4) or CSA B131.10.
 - Push-on TYTON joints for a 700 kPa rated working pressure.
 - Polyethylene encasement conforming to A.W.W.A C105 (A21.50).
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- Concrete Pressure Pipe:
 - For pipe diameters greater than or equal to 450mm, conforming to the latest A.W.W.A. C301, C303 and C304.
 - Joints to satisfy a 700 kPa rated working pressure.
- High Density Polyethylene (HDPE) Pipe:
 - For pipe diameters less than or equal to 300mm, conforming to the latest A.W.W.A. C906.

7.12.3 Fittings

- Ductile / Cast Iron:
 - Class 52 (or Pressure Class 350) conforming to the latest A.W.W.A. C104 (A.N.S.I. A21.4), C110 (A21.10), C111 (A21.11), C150 (A21.50), C153 (A21.53).
 - Cement mortar lined conforming to the latest A.W.W.A. C104 (A.N.S.I. A21.4) or CSA B131.10.
 - Mechanical, flanged, or push-on TYTON joints.
- Polyvinyl Chloride (PVC):
 - Class 150, for pipe diameters less than or equal to 300mm, conforming to the latest A.W.W.A C900, A.W.W.A C901-78, A.W.W.A C908, CSA B137.2, and CSA B137.3 (SDR 18).
 - 400mm-900mm diameter fittings are to be site specific at the Town's discretion conforming to A.W.W.A C905 and A.W.W.A C907.
- Concrete:
 - For pipe diameters greater than or equal to 450mm, conforming to the latest A.W.W.A. C301, C303 and C304.
- Copper:
 - For pipe diameters between 25mm - 50mm, conforming to the latest A.W.W.A. C800 (compression joint).
- Polyethylene: High Density
 - For pipe diameters between 400mm - 900mm, conforming to the latest A.W.W.A. C906 (butt fusion joint).

7.12.4 Couplings

- Standard Adaptors:

- Ford Uni-flange 900C
- Ford Uni-flange 1500 Circle-Lock for PVC pipes
- Sigma One-Lok series mechanical restrainers for PVC pipes
- Flanged Adaptors:
 - Ford Uni-flange adaptor

7.12.5 Hydrants

- All Hydrants must:
 - Must be Century 6'0" 2H, 12B CSA, Storz (1,0-L), and shall come complete with hydrant valves and anchor tees and shall conform with A.W.W.A. C502
 - have two (2) 63.5mm dia. I.D. (73.4mm O.D.) hose nozzles at 180 deg., with CSA standard thread 5.T.P.I., designated 12B.
 - have one (1) 100mm Storz pumper nozzle as per ULC #S-520.
 - have operating nut "open left" (counter-clockwise).
 - have 150mm mechanical joint base/boot.
 - be self-draining, unless otherwise specified.
 - Hydrant colors are to be as follows:

<i>Class</i>	<i>Capacity</i>	<i>Colour</i>	<i>Colour Code</i>	<i>Colour Name</i>
Class C	Less than 500 gpm (1900L/min)	Red	F75RC7	International Red
Class AA	1500 gpm (5680 L/min) or greater	Blue	F75LC14	Equipment Blue
		Yellow	B54TF204	Primrose Yellow
Class A	1000-1499 gpm (3785-5675 L/min)	Green	B54TF204	Dark Green A/D
Class B	500-999 gpm (1900-3780 L/min)	Orange	F75EC9	Implement Orange
		Black	F75BC14	Raven Black

- The depth of Bury to be 1.83m for watermains 250mm in dia. or less, and 2.13m for 300mm dia. or greater.
- Hydrant barrel extensions to be obtained from the same manufacturer as the hydrant and installed at base of hydrant flange.
- Hydrants shall be painted in accordance with the National Fire Prevention Association (NFPA) Fire Hydrant Marking/Identification Standard.
- Two signs to be installed on each hydrant perpendicular to the roadway.

7.12.6 Valves

- Resilient Seat Gate Valves:
 - For pipe diameters less than or equal to 300mm, conforming to the latest A.W.W.A. C500 and A.W.W.A. C509.
 - mechanical joint retainer ends.
 - 50mm square operating nut to "open left" (counter clockwise) c/w non-rising stem.
 - Stainless steel nuts & bolts.
- Butterfly Valves:
 - For pipe diameters greater than 300mm, conforming to the latest A.W.W.A. C504.
 - 50mm square operating nut to "open left" (counter clockwise).
 - Seat to rest on body, not on disk.
 - To be installed in a valve chamber.
- Air Release Valves:
 - For pipe diameters greater than 400mm, conforming to the latest A.W.W.A. C512.
- Drain Valves:
 - For pipe diameters greater than 400mm.
- Detector Check Valves:
 - Conforming to the latest A.W.W.A. C508

7.12.7 Valve Boxes / Extensions

- To be installed in accordance with OPSD 1101.020.

- 135mm slide type (125mm min inside dia.), 750mm upper section, c/w 6mm predrilled round hole with grommet for tracer wire, 1200mm lower bell section.
- The cross head (handle) on a standard valve key shall be between 600mm and 1500mm above finished grade when placed on the top valve nut or extension.

7.12.8 Water Services

- Pipe (7 25mm; or 50mm):
 - Must conform to the latest Ontario Building Code (OBC), Canadian Standards Association (CSA) and American Society for Testing and Materials (ASTM) standards.
 - Copper soft Type “K” to ASTM B88-49, A.W.W.A. C800.
- Main Stops:
 - Ball valve, compression joint type to A.W.W.A. C800 and A.W.W.A. C202.
 - Installation to be direct “wet” tapped c/w Teflon tape on main.
- Curb Stops:
 - Ball valve, compression joint type to A.W.W.A. C800.
 - Valve to be stop only and non self-draining.
- Service Boxes:
 - Mueller MVB Composite valve box
 - Mueller A726
 - Emco D1, Clow D1
 - To be installed with stainless steel rods (use 1.14m long for 1.52m – 1.83m bury) and brass cotter pin, use extension if required.
- Service Saddles:
 - To be used on all PVC class 100 & series 160 pipe.
 - Rockwell 362 / 371 saddle with stainless steel nuts and bolts.
 - Tapered rubber gasket and 150mm min wide band.
 - If concrete pressure pipe, to conform to A.W.W.A. C301 & C303.
- Water Meters:
 - Residential - Sensus Omni c/w Sensus radioread AMR Model 510R transceiver unit
 - Industrial/ Commerical/ Institutional – Sensus Omni c/w Sensus radioread AMR Model 510R transceiver unit

7.12.9 Sampling Station

- Test Tap sampling station manufactured by Cromer Industries Corp. for 25mm copper piping

7.13 Corrosion Protection

All metallic components in the water distribution system shall be protected from corrosion. One, or any combination, of the following may be utilized to achieve the necessary protection:

- Cathodic Protection: (Preferred) All sacrificial anodes shall conform to ASTM B-418 Type II and shall be composed of high grade electrolytic zinc and sized at a minimum of 5.4 kg (12 lb). All metallic watermains, fittings, valves, hydrants, restrainers and copper service connections are to have one zinc anode installed per length of pipe.

All weld connections are to be coated with "TC Mastic" or approved equivalent.

For all anodes connected to new pipes, fittings, hydrants, restrainers or to existing metallic watermains, a Cadwelder and CA-15 or equivalent cartridge shall be used. Anode installation shall be performed in accordance with the manufacturer's specifications.
- Corrosion Prevention Tape: All direct buried valves and fittings, as well as those installed in chambers, must be wrapped with an approved corrosion prevention tape. Approved corrosion prevention tapes include: Denso Tape; Trenton Wax Tapes; and TC Envirotape.

7.14 Testing and Disinfection:

All watermain shall be tested by a qualified third party, approved by the Town prior to commencement of testing, and in accordance with the requirements of the appropriate OPSS. All watermain and service connections shall be disinfected and sampled by a qualified third party in accordance with the requirements of the appropriate OPSS.

The Consultant shall provide a written proposal of how the testing is to be conducted in keeping with current A.W.W.A Standards, M.O.E and Ontario Safe Water Drinking Act. Proposal is to be submitted seven (7) days prior to the start of testing for acceptance by the Town. The Consultant shall witness all testing and provide certification of compliance.

A pressure and leakage test shall be performed on the completed distribution system. The distribution system shall be tested in sections not exceeding 500m in length unless approved by the Town.

A pressure of 1 MPa (1,000 kPa) shall be applied to the section of pipe being tested and maintained for a period of one (1) hour.

Following the successful completion of the pressure test, a leakage test shall be performed. A pressure of 1 MPa (1,000 kPa) shall be applied to the main and the amount of water required to maintain this pressure for a period of two (2) hours shall be measured. Leakage shall not exceed 2.22 litres per mm of internal diameter of pipe per kilometer of pipe per day for any section. The Developer shall arrange to test each section of main and shall inform the Town for inspection 24 hours in advance.

Any sections of the watermain failing the pressure and/or the leakage tests shall be repaired and retested.

All valves and service connection curb stops shall be checked for operation following the testing.

Before being placed in service, the water system shall be foam swabbed and disinfected in accordance with the requirements of the Ministry of the Environment (MOE) for chlorination of potable water supplies and to the satisfaction of the Town. In addition, waste water shall be disposed of in accordance with the MOE Guidelines.

At no time during the construction or testing of the watermains will any participating party, except the Town, be permitted to open any valves connecting into the existing Town water distribution system in order to eliminate any risk of water contamination.