

**Table of Contents**

<b>1.0</b>	<b>DEFINITIONS .....</b>	<b>4</b>
<b>2.0</b>	<b>DESIGN SUBMISSION REQUIREMENTS.....</b>	<b>5</b>
<b>3.0</b>	<b>DESIGN FLOWS .....</b>	<b>6</b>
	Watermain Capacities .....	6
	Residential and Domestic Water Demands.....	6
	Commercial, Institutional and Industrial Water Demands.....	6
<b>4.0</b>	<b>WATER SUPPLY SYSTEM PRESSURES.....</b>	<b>6</b>
<b>5.0</b>	<b>FRICTION FACTORS.....</b>	<b>7</b>
<b>6.0</b>	<b>WATERMAINS .....</b>	<b>7</b>
	Blocks .....	7
	Minimum Sizes of Pipe.....	8
	Minimum Depth of Pipe.....	8
	Dead Ends and Cul-De-Sacs .....	8
<b>7.0</b>	<b>MATERIALS .....</b>	<b>8</b>
<b>8.0</b>	<b>VALVES .....</b>	<b>9</b>
	Mainline Valves .....	9
	Valve Sizes .....	9
	Number, Location and Spacing.....	9
	Air Valves.....	10
	Drain Valves.....	10
	Valve Boxes .....	10
	Chambers .....	10
<b>9.0</b>	<b>HYDRANTS.....</b>	<b>10</b>
	Numbers, Spacing and Type.....	10
	Anti-tampering Devices .....	11
	1. Fire Hydrant Spacing and Colour.....	11
	2. Maintenance Hydrant (For Swabbing & Flushing) .....	12
	3. Blow-Off (For Flushing).....	12
	4. Yard Hydrant (For Sampling) .....	12
	5. Branch Valves and Boxes.....	12
<b>10.0</b>	<b>RESTRAINED JOINTS.....</b>	<b>12</b>
<b>11.0</b>	<b>CATHODIC PROTECTION .....</b>	<b>12</b>
	Tracer Wire .....	12

City of Kawartha Lakes Infrastructure Guidelines

Water

Copper Service Connections .....	13
Valves, Hydrants and Fittings on Non-Ferrous Watermains .....	13
Valves, Hydrants and Fittings on Existing Ferrous Watermains.....	13
Connecting Non-Ferrous Watermains to Ferrous Watermains .....	13
Exposed Ferrous Watermain .....	13
Thermite Weld Coating .....	13
Replacement and Testing of Anodes .....	13
<b>12.0    WATERMAIN INSULATION.....</b>	<b>14</b>
<b>13.0    CONNECTIONS TO EXISTING WATER SYSTEM.....</b>	<b>14</b>
<b>14.0    WATER SERVICES.....</b>	<b>14</b>
Minimum Sizes of Pipe.....	14
Location .....	15
Minimum Depth of Pipe.....	15
Mainstops.....	15
Valves, Curb Stops & Boxes .....	15
Materials .....	15
Cross Connection and Backflow Prevention .....	15
<b>15.0    WATER SERVICE METERS .....</b>	<b>16</b>

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**City of Kawartha Lakes Standard Details - Watermains**

<b>CKL-100</b>	<b>Cul-De-Sac Water Looping Detail</b>
<b>CKL-101</b>	<b>Gate Valve and Valve Box on PVC Watermains</b>
<b>CKL-102</b>	<b>Hydrant Installation</b>
<b>CKL-103</b>	<b>50 mm Self Draining Blow-Off</b>
<b>CKL-104</b>	<b>Minimum Restraining Length (L) for PVC Watermains</b>
<b>CKL-105</b>	<b>Support for Mechanical Joints for PVC Watermains- Valves and Dead Ends</b>
<b>CKL-106</b>	<b>Support for Mechanical Joints for PVC Watermains- Plugged Cross</b>
<b>CKL-107</b>	<b>Joint Restraining Length (In Combination with Granular Thrust Block) for PVC Pipe</b>
<b>CKL-108</b>	<b>Cathodic Protection / Bonding Cable / Tracer Wire for PVC and CPP Watermain Systems.</b>
<b>CKL 109</b>	<b>19 mm Yard Hydrant</b>

**Appendix**

<b>1</b>	<b>City of Kawartha Lakes Approved Manufacturers' List</b>
<b>2</b>	<b>Watermain Commissioning Checklist</b>
<b>3</b>	<b>Watermain Commissioning Standard Operating Procedure</b>
<b>4</b>	<b>City of Kawartha Lakes Final Measurement Service Card</b>

## City of Kawartha Lakes Infrastructure Guidelines Water

This document does not supersede, nor replace any legislation governing the design of Potable water systems. Designers, Consultants and Contractors must be fully familiar with legislation such as the Ontario Water Resources Act, Safe Water Drinking Act, Environmental Assessment Act, Environmental Protection Act, Ontario Building Codes when carrying out the design and construction of water infrastructure projects within the City of Kawartha Lakes.

Although this document is often referred to as policies, the design portion should be considered as minimum guidelines. This document provides the City's design preferences under normal circumstances. The Engineer however, should use their best judgment to find innovative solutions when abnormal design conditions are encountered. Deviation from these design guidelines requires written approval of Director of Engineering or designate. All watermain, appurtenances and components shall comply with all applicable current industry standards and specifications for design, installation, modification, quality management and quality control, such as:

- Ministry of the Environment (MOE): *Design Guidelines for Drinking Water Systems, 2008* (MOE Guidelines) <https://www.ontario.ca/document/design-guidelines-drinking-water-systems>
- Ministry of the Environment and Climate Change (MOECC): *Water Drinking Quality Management Standard (DWQMS)* <https://www.ontario.ca/page/ontarios-drinking-water-quality-management-standard-pocket-guide>
- Fire Underwriters Survey of the Insurance Bureau of Canada Water Supply for Fire Protection: *A Guide to Recommended Practice* (Fire Underwriters, the American Waterworks Association (AWWA))
- *Ontario Provincial Standards (OPS)*, their most recent editions or revisions thereof.
- City of Kawartha Lakes *Water and Wastewater Connection By-Law 2011-260* or as amended shall be adhered to.
- City of Kawartha Lakes Drinking Water Works Permit License
- The Canadian Standards Association (CSA)
- American Standard and Testing Materials (ASTM)
- Approved Manufacturer's Product List for Water Systems
- NSF International (NSF)

### **1.0 DEFINITIONS**

- a) **“Backflow Prevention”** means the prevention of a reversal of normal flow that could introduce Contamination to the potable water supply; accomplished by an Air gap or a CSA approved backflow preventer selected, installed and tested in accordance with CSA Standard B64.10:“Selection and Installation of Backflow Preventers”.
- b) **“CKL”, “City”, “City of Kawartha Lakes” or “Kawartha Lakes”** means The Corporation of the City of Kawartha Lakes, including its entire geographic area, and includes its Officers, Directors, employees and agents.
- c) **“Cross Connection”** means any actual or potential connection between the

waterworks and any source of pollution, contamination, or other material or substance that could change the quality of the water in the waterworks. This includes any bypass, jumper connection, removable section of pipe, swivel or changeover device, and any other temporary or permanent connecting arrangement through which backflow can occur. Individual protection would be installed on fixtures or appliances that have the potential of contributing to a cross connection.

- d) **“Dwelling Unit”** means a unit that consists of a self-contained room or set of rooms located in a building or structure, is used or intended for use only as a residential premises, contains kitchen and bathroom facilities that are intended for the use only of the unit, is used as a single housekeeping unit in which no occupier has exclusive possession of any part of the unit, and has a means of egress to the outside of the building or structure in which it is located, which means of egress may be through another residential unit or common area.
- e) **“Guidelines”** means and is not limited to the Guidelines for the City of Kawartha Lakes, and/or Design Guidelines for Drinking-Water Systems 2008 by the Ministry of the Environment, and/or Design Guidelines for Sewage Work 2008 by the Ministry of the Environment, as applicable and as amended.
- f) **“Private Hydrants”** are situated within the limits of the property owned or occupied by the owner or occupier of the water, and/or installed at such locations to serve as exclusive fire protection for said buildings at such a site complex, i.e., institutions, condominiums, community centers, schools, etc.
- g) **“CKL WWW Staff”** means The City of Kawartha Lakes Water/Wastewater Distribution Chief Operator or designate, holding current MOECC Certification as per Ontario Regulation 128/04, as amended.
- h) **“Distribution System”** means a watermain system carrying potable water. The primary functions of the distribution main are to distribute water to customers through service connections, and to provide fire protection through hydrants with the adequate quality, quantity and pressure for the consumer.
- i) **“Feedermain”** is any watermain where the primary function of such main is for the transmission of potable water from a water supply plant to a reservoir for supply of water to the distribution mains.
- j) **“Cathodic Protection”** is a technique used to control the corrosion of a metal surface by making it the cathode of an electrochemical cell.

## **2.0 DESIGN SUBMISSION REQUIREMENTS**

- The Functional Servicing Report, shall include, but not necessarily be limited to;
  - ✓ Main sizing, location and looping
  - ✓ Pressure boundaries, booster stations
- Drawing size shall be A1 (594 mm x 841 mm)

## City of Kawartha Lakes Infrastructure Guidelines Water

- Plan and profile horizontal metric bar scale shall be 1:500 or 1:250 and the vertical scale shall be 1:50.
- All drawings shall be neat, legible and shall conform to CKL drawing standards.
- All watermains, hydrants, water valves, pipe diameter, material type, pipe class, pipe bedding and service connections shall be shown on all drawings.
- All engineering drawings must clearly identify services being removed, services being abandoned but not removed, existing services that will remain, proposed services and future services.

### **3.0 DESIGN FLOWS**

#### Watermain Capacities

Watermains shall be sized to carry the greater capacity of the maximum day plus fire flow or the peak hour demand. Fire flow shall be calculated as outlined in the current edition of *“Water Supply for Fire Protection, A Guide to Recommended Practice”* issued by the Fire Underwriters Survey of the Insurance Bureau of Canada, unless otherwise approved by the City of Kawartha Lakes

The minimum required fire flow for single family, detached dwellings is 4,500 L/min.

#### Residential and Domestic Water Demands

The values of 450 L/capita/day and 2.3 persons per unit shall be used when determining residential and domestic water demands. The information in the *MOE Guidelines* (Section 3.4.2, Table 3.1) shall be used to determine the minimum rate, maximum day and peak flow rates for the system.

#### Commercial, Institutional and Industrial Water Demands

When determining the commercial, institutional and industrial water demands the value of 0.4 L/ha shall be used.

### **4.0 WATER SUPPLY SYSTEM PRESSURES**

Refer to MOE 10.2.2.1 “Maximum & Minimum Operating Pressures” or latest revision.

The distribution system shall be sized to meet normal demands. The maximum sustained operating pressures shall not exceed 700 kPa (100 Psi). Under conditions of simultaneous maximum day and fire flow demands the pressure shall not drop below 140 kPa (20 Psi) in the CKL distribution system. Under normal operating conditions the pressure shall not drop below 275 kPa (40 Psi) in the CKL distribution system.

The Ontario Building Code requires, “where the static pressure exceeds 550 kPa (80 Psi) a pressure reducing valve shall be installed to limit the maximum static pressure to not more than 550 kPa (80 Psi) in areas that may be occupied.”

## **5.0 FRICTION FACTORS**

The following “C” values shall be used in the Hazen Williams equation for the design of water distribution systems, unless actual pipe materials and “C” factors are known:

<b>Pipe Diameter (mm)</b>	<b>“C” Factor</b>
Up to 150	100
200 to 300	110
350 to 600	120
Over 600	130

The Hazen Williams Equation is:

$$Q = 0.84918 \text{ CAR}^{0.63} \text{S}^{0.54}$$

C = Coefficient of Roughness

R = Hydraulic Radius (m)

S = Slope of the Energy Grade Line (m/m)

A = Cross-Sectional Flow Area (m<sup>3</sup>)

The above “C” factors represent long-term values. A “C” factor of 140 shall be used to calculate maximum velocities for transient pressure estimations, or for checking pump motor sizes for run out conditions.

## **6.0 WATERMAINS**

The design of the water system must ensure that all proposed municipal watermains are located on municipal property.

### Blocks

Where the watermain cannot be placed under a municipal right of way, a block of land will be conveyed to the City. The requirements are as follows

<b>Type of Service, Size &amp; Depth</b>	<b>Minimum Width of Block</b>
Single sewer or watermain less than 600 mm dia., and less than 3.7 m deep, centered on Block.	6.0 m
Single sewer in excess of 3.7 m depth or single watermain larger than 600 mm dia., centered on Block.	9.0 m
A combination of two mains, either sewer or water, less than 3.7 m deep centered on Block.**	9.0 m
A combination of two mains, either sewer or water, over 3.7 m deep, no closer than	12.0 m

## City of Kawartha Lakes Infrastructure Guidelines Water

3.0 m to Block limits.**	
Major trunk sewer.** (Possible future twinning)	20.0 m
Three or more mains, no closer than 3.0 m to Block limits.	Add 3.0 m to items with ** for each additional main.

### Minimum Sizes of Pipe

- Sizing and looping of watermains shall be determined at the preliminary stage of the development.
- Residential systems shall be designed with a minimum of 150 mm diameter watermain.
- Industrial, commercial and institutional systems shall be designed with a minimum of 300 mm diameter watermain, unless otherwise approved by the City.

### Minimum Depth of Pipe

- The watermain shall have a minimum cover of 1.80 m, measured from the top of pipe to finished center line road grade.

### Dead Ends and Cul-De-Sacs

The distribution system shall be designed to provide looping and to eliminate dead end sections. When avoiding dead ends is impossible, the contractor shall provide a fire hydrant for flushing purposes and a maximum of 20 houses shall be permitted.

A cul-de-sac detail is provided as *City of Kawartha Lakes Detail – Cul-De-Sac Water Looping Detail, CKL-100*.

## **7.0 MATERIALS**

For acceptable watermain products, refer to the *City of Kawartha Lakes Approved Manufacturers' Products List*.

A “distribution main” is watermain carrying potable water. The primary functions of the distribution main are to distribute water to customers through service connections, and to provide fire protection through hydrants. Distribution mains range in size from 150 mm to 300 mm. Distribution Mains shall be constructed of Polyvinyl Chloride (PVC) to AWWA C900, or approved equivalent.

A “feedermain” is any watermain where the primary function of such main is for the transmission of potable water from a water supply plant to a reservoir for supply of water to the distribution mains. Feeder mains shall not be tapped for individual service connections. Feeder mains shall be constructed of Concrete Pressure Pipe.

If watermain is being installed via horizontal directional drilling, then High Density Polyethylene (HDPE) Pressure Pipe shall be used providing a geotechnical survey indicates favourable conditions.

## **8.0 VALVES**

Valves shall be specified and supplied in accordance with the *City of Kawartha Lakes Approved Manufacturers' Products List*.

### **Mainline Valves**

Resilient seat gate valves shall be used on all watermains 300 mm in diameter or less in size.

If resilient seat gate valves are proposed on watermains 400 mm in diameter, approval of the City through the Director of Public Work or their designate must be granted. This approval shall be based on the location of the watermain, pipe material and whether the valve is to be installed on a new or existing watermain.

Gate valves with a by-pass system shall be used on all watermains 400 mm or greater in size.

A by-pass system is to consist of two flanged nozzles cast integrally with pipe body, flanged elbows and a flanged resilient seat gate valve. The by-pass system shall be suitable for the same working and test pressures as associated with the main valve.

All valves shall be of the approved type with non-rising stem and a 50 mm square operating nut, opening counter clockwise.

All in-line valves shall be restrained as per *City of Kawartha Lakes Detail – Gate Valve and Valve Box on PVC Watermains, CKL 101*.

### **Valve Sizes**

For watermains of 600 mm diameter or smaller, the size of the valve shall be the same size as the watermain. Valves on watermains 750 mm in diameter or larger, may be one size smaller than the watermain size.

### **Number, Location and Spacing**

Three valves are required at a tee intersection and four valves are required at a cross intersection. The valves shall be located at the point where the projection of the street line intersects the watermain. Valve boxes and chambers shall be located in boulevards whenever possible. When not possible all valve boxes located in the travelled portion of the roadway shall be set to base course asphalt grade and shall be screw type. Valve boxes located outside the travelled portion of the roadway shall be set to finished grade.

## City of Kawartha Lakes Infrastructure Guidelines Water

Line valves shall be located such that no more than approximately 20 houses can be shut-off and isolated from the system at a time. The line valve spacing shall not exceed 240 m between valves.

### Air Valves

Air valves shall be placed at all significant high points on feeder mains.

### Drain Valves

Drain valves shall be located at the low points of all water mains that are 600 mm diameter or greater and shall be constructed in a chamber.

### Valve Boxes

All valves 400 mm diameter or smaller shall have valve boxes and specified direct bury operators shall be used.

All valves larger than 400 mm diameter shall be installed in valve chambers. All valves in chambers are to be installed with extension stems.

The tops of valve boxes and valve chamber maintenance hole covers shall be set flush with finished grade.

### Chambers

The use of chambers shall be minimized or eliminated whenever possible. All watermain valve, drain valve and air valve chambers shall be provided with a drain pipe connection to the storm sewer if feasible. No connections are permitted to the sanitary sewer. Storm sewer connections shall include a backflow preventer in an accessible location. The location of the storm sewer connection shall be shown on the contract drawings.

## **9.0 HYDRANTS**

### Numbers, Spacing and Type

For Fire Hydrant specifications refer to *City of Kawartha Lakes Approved Manufacturers' Product List*. For construction, *City of Kawartha Lakes Detail – Hydrant Installation*, **CKL 102** shall be used.

All hydrants supplied shall include two 63 mm diameter ports and a 100 mm diameter Storz pumper nozzle and shall conform in all respects to the standards of the City of Kawartha Lakes. Drain holes shall be left open for drainage of the hydrant barrel. Drain holes shall be plugged in high groundwater areas or when deemed necessary to CKL.

City of Kawartha Lakes Infrastructure Guidelines  
Water

Hydrants shall be installed such that the breakaway flange is 100 to 150 mm above the surrounding ground surface. Hydrant extensions, when required, shall be installed at the bottom of the hydrant barrel. No flanges on the hydrant barrel shall be permitted within 1.5 meters of the ground surface.

Anti-tampering Devices

Anti-tampering devices shall be installed on hydrants designated by the City of Kawartha Lakes. The device shall be installed by the City and shall remain in place until the final acceptance certificate is issued or until building construction is complete.

A fee shall be charged to the developer to cover the cost of supply, installation and removal of the device.

1. Fire Hydrant Spacing and Colour

Hydrants shall be installed on all watermains 150 mm diameter and larger, in a fire rated system, with the following maximum allowable spacing:

- 150 m in residential areas, (to provide for a maximum hose length of 75 m)
- 75 m in industrial, commercial and institutional areas (to provide for a maximum hose length of 37.5 m)

All hydrants shall be placed in an obstruction free zone of 1.5 m diameter to ensure hydrant is visible and accessible. All hydrant bonnets and port caps shall be painted as per the associated fire flow rating.

Hydrant Class	Colour	Flow
AA	Blue	5,680 L/min or greater (1500 usgpm)
A	Green	3,785 L/min – 5,675 L/min (1000-1499 usgpm)
B	Orange	1,900 L/min – 3,780 L/min (500-999 usgpm)
C	Red	Less than 1,900 L/min (500 usgpm)

- Hydrants with a Black Stortz Fitting do not get painted.
- Private hydrant barrels must be painted Red.

All proposed hydrant flange elevations shall be identified on the engineering design drawings.

The Fire Chief shall have the final authority on the location of structures or other items, which might interfere with the view or the accessibility of hydrants

2. Maintenance Hydrant (For Swabbing & Flushing)

Maintenance hydrants are required in non-fire rated systems to facilitate flushing and swabbing. Maintenance hydrants will be located at dead ends and within the system as required by Public Works, Water and Wastewater. The hydrants must be painted black.

3. Blow-Off (For Flushing)

Blow-off set up for water service connections 100 mm to 300 mm in size shall be 50 mm in size. Refer to *City of Kawartha Lakes Detail – 50mm Self Draining Blow-Off*, **CKL 103** and the *City of Kawartha Lakes Approved Manufacturers' Products List*.

4. Yard Hydrant (For Sampling)

Yard hydrant sampling stations shall be installed at locations as directed by the City of Kawartha Lakes. For sampling station specifications and installation requirements refer to the *City of Kawartha Lakes Detail – 19 mm Yard Hydrant*, **CKL 109**.

5. Branch Valves and Boxes

All hydrants installed on watermains shall be installed with a 150 mm diameter branch valve and box, attached with an anchor tee.

## **10.0 RESTRAINED JOINTS**

Joint restrainers and granular thrust blocks shall be used on all fittings and connections as per City of Kawartha Lakes Details; *Minimum Restraining Length (L) for PVC Watermains*, **CKL-104**, *Support for Mechanical Joints for PVC Watermains, Valves and Dead Ends*, **CKL - 105**, *Support for Mechanical Joints for PVC Watermains, Plugged Cross*, **CKL – 106**, *Joint Restraining Length for PVC Pipe*, **CKL 107**.

Joints to be restrained in all opposing directions of thrust forces. All joints encountered within the specified restraining length as indicated on the appropriate Standard Drawings, must be restrained.

## **11.0 CATHODIC PROTECTION**

Refer to the *OPS* and the *City of Kawartha Lakes Approved Manufacturers' List*, for location and sizing. Cathodic protection to be installed in accordance with *City of Kawartha Lakes Detail – Cathodic Protection / Bonding Cable / Tracer Wire for PVC and CPP Watermain Systems*, **CKL 108**. For a Metallic Watermain System cathodic protection is to be installed in accordance with OPSD 1109.010 or as amended.

### Tracer Wire

Cathodic protection shall be provided for all tracer wires on PVC and Concrete Pressure Pipe (CPP) watermains. One 5.4 kg zinc anode shall be installed for every 1000 m of tracer wire. The location of anodes shall be shown on the construction drawings.

## City of Kawartha Lakes Infrastructure Guidelines Water

On open cut installations, provide one tracer wire in accordance with *the City of Kawartha Lakes Detail – Cathodic Protection / Bonding Cable / Tracer Wire for PVC and CPP Watermain Systems, CKL 108*.

On all Horizontal Directional Drilling (HDD) installations, provide two tracer wires, positioned on opposite sides of the pipe.

Tracer wire shall be installed on all feeder mains. Tracer wire shall be brought to the surface using 50 mm diameter valve boxes, spaced at 300 m intervals along the feeder main for locating purposes.

### Copper Service Connections

One 5.4 kg zinc anode shall be installed on all new copper service connections and all existing copper service connections that are exposed during any type of road reconstruction work.

### Valves, Hydrants and Fittings on Non-Ferrous Watermains

One 5.4 kg zinc anode shall be installed on every valve and fitting connected to a non-ferrous watermain.

Fittings include bends, tees, crosses, sleeves, reducers, plugs, caps, joint restrainers and couplings.

### Valves, Hydrants and Fittings on Existing Ferrous Watermains

All valves and fittings installed on existing ferrous watermains shall be cathodically protected by a 14.5 kg magnesium anode. Bonding cables shall be provided on each side of the fitting to the existing watermain. Bonding cables shall be No. 6, seven strand coated copper wire connected to the fittings and watermain by a thermite weld (Cadweld).

### Connecting Non-Ferrous Watermains to Ferrous Watermains

When connecting a non-ferrous watermain to a ferrous watermain, the ferrous watermain shall be cathodically protected by a 14.5 kg magnesium anode.

### Exposed Ferrous Watermain

When a ferrous watermain is exposed during construction of underground utilities, a 14.5 kg magnesium anode shall be installed at each location.

### Thermite Weld Coating

All thermite weld connections shall be coated with an approved coating material.

### Replacement and Testing of Anodes

The City of Kawartha Lakes may reject any anode for any reason and request a suitable replacement.

The City may have any anode(s) tested to guarantee the authenticity of its composition. The Contractor shall supply the anode(s) for testing at no expense to the City.

## **12.0 WATERMAIN INSULATION**

All watermain and water service connections that do not meet the required minimum cover of 1.80 m shall be insulated in accordance with OPSD 1109.030 or amended unless otherwise approved by the City of Kawartha Lakes.

## **13.0 CONNECTIONS TO EXISTING WATER SYSTEM**

The Contractor shall make every possible effort to ensure that the final connection is no more than one pipe length.

## **14.0 WATER SERVICES**

All water service connections shall be in accordance with City of Kawartha Lakes Water and Wastewater Services By-Law 2011-260, as amended.

All water service connections for single family dwelling, semi-detached, and linear row housing building shall be individual service connections.

The Ontario Building Code requires, "where the static pressure exceeds 550 kPa (80 Psi) a pressure reducing valve shall be installed to limit the maximum static pressure to not more than 550 kPa (80 Psi) in areas that may be occupied."

Connections to the watermain shall be by pressure tap connection using a stainless steel service saddle. Piping shall be connected at 45° above horizontal for copper, or above the springline for municipex, including a vertical and/or horizontal gooseneck.

No service connection shall be made to feeder mains unless otherwise approved by the Director of Public Works.

For Commercial, Industrial and Multi-residential connections, separate domestic and fire water services must be installed in accordance with Water and Wastewater Services By-Law 2011-260, as amended. The water services shall not become operational until documentation, including acceptable laboratory test results from the accredited laboratory is provided to the City of Kawartha Lakes, verifying that all water system pipe on private property has been chlorinated, flushed and pressure tested according to the CKL, Ontario Building Code and Ministry of the Environment requirements.

### **Minimum Sizes of Pipe**

## City of Kawartha Lakes Infrastructure Guidelines Water

The minimum size for service connections shall be 19 mm diameter. The exception being when the length of the connection from the main to the building setback exceeds 30 m, then the minimum size shall then be 25 mm (1") diameter.

Service connections for multiple family dwellings shall be sized to provide capacity equivalent to a 19 mm (3/4") diameter connection to each dwelling unit.

Service connections for blocks, commercial, industrial and institutional areas shall be sized and installed according to the guidelines recommended by the Fire Insurance Advisory Organization and intended use.

### Location

Water service connections shall be installed at the mid-point of the frontage of a single family lot, terminating at property line on private property. The location of water service connections for semi-detached lots shall suit the house style and approved by the City. Where possible, the water service should not be installed under the driveway. The curb stop for the water service connections will not be permitted in the driveway.

### Minimum Depth of Pipe

The water service connection shall have a minimum cover of 1.80 m.

### Mainstops

All domestic water service connections shall have stainless steel service saddles and mainstops installed at the watermain equal in size to the water service connection diameter.

### Valves, Curb Stops & Boxes

All service connections 50 mm or less in diameter shall have curb stops and isolation valves installed at property line.

### Materials

For watermain service connection materials refer to Appendix F1 *The City of Kawartha Lakes Approved Manufacturers' Product List*.

### Cross Connection and Backflow Prevention

Refer to the City of Kawartha Lakes By-Law 2011-260, as amended, Section 17.00, for cross connection and backflow prevention.

**15.0 WATER SERVICE METERS**

Commercial, industrial, institutional and multi residential water meters shall be installed in a meter utility room or in a location within the building. Where it is not feasible to locate the water meter in a utility room or building, other means of housing the water meter will be considered on a site specific basis. The location, size and type of water meter to be installed shall be determined by the City of Kawartha Lakes and in accordance with the Water and Wastewater Connection By-Law 2011-260.

All proposed commercial, industrial, institutional and multi residential developments shall provide water flow demand rates.

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