

REGION OF PEEL

PUBLIC WORKS DESIGN, SPECIFICATIONS & PROCEDURES MANUAL

LINEAR INFRASTRUCTURE

Watermain Design Criteria

REVISED June 2010

**PUBLIC WORKS
WATERMAIN DESIGN CRITERIA
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1. INTRODUCTION

The design of municipal services in the Region of Peel is to be based upon the current "Public Works (PW) Design, Specification & Procedures Manual". All plans are to be reviewed and cleared by the Region prior to the construction of services. Such review shall not relieve the engineer from primary responsibility for the design to meet all Federal, Provincial, Regional, and local government 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 requirements of the local municipal plumbing department and Region of Peel specifications. Where these conflict, clarification is to be received from the Region's PW Department.

The Region of Peel strives to maintain a minimum operation pressure of 40 psi and a maximum operating pressure of 100 psi.

Refer to the Environmental Assessment Process section of this manual for the steps required to fulfill the Class Environmental Assessment process.

1.1 Geotechnical Investigation

The Consultant shall determine the need for soils investigation. However, if Region staff requests a soils investigation, the Consultant is obligated to supply one.

The purpose of an investigation would be to determine the soil's composition, bearing strength, and type, and to verify that no contamination is present; which would be determined by the consultant. The consultant shall recommend the appropriate bedding requirements based on the findings of the Geotechnical Investigation and state them on the drawings.

Boreholes shall be taken to a minimum depth of one (1) metre below the anticipated depth of the watermain invert or the deepest utility.

1.2 General Specifications

All water distribution system components and lubricants are to be as stated on the Region's list of approved products for watermains and must meet applicable AWWA Standards, NSF/ANSI 60 and 61 Standards, or other appropriate standards for approved materials, coatings or linings for distribution system components or chemicals that come into contact with potable water.

Watermain construction to be as described in Region of Peel Volume 2 – Contract Documents, Specifications for Watermains Vol 2-2.

2. WATERMAINS – GENERAL

Where non-metallic pipe (e.g., PVC, concrete pressure pipe) is installed, a 12 – gauge TWU stranded copper, light coloured plastic coated tracer wire must be installed with and along the pipe and brought to the surface at each valve box/chamber and hydrant (around port). Tracer wire is to be attached to the pipe and outside of each valve box by means of tape.

All fittings shall be restrained where required by the design or by the Region. Drawings shall be supplied to the Region of Peel for review and approval prior to construction.

Stainless steel bolts and nuts are to be used on all fittings and joint restraints.

All metallic fittings, valves and joint restraints must be wrapped end to end with an approved corrosion protection system that includes petrolatum primer (paste), petrolatum moulding mastic, and low temperature petrolatum tape.

Shop Drawings shall be submitted for all watermains made of concrete pressure pipe.

2.1 Sizing

Sizing and looping of watermains will be discussed at the preliminary stage of the project. For major projects, consult with the Region's current hydraulic model. The following are the minimum pipe sizes required. Unless otherwise required, all watermains within the right-of-way shall be designed for 1,000 kPa (150 psi) test pressure.

250mm diameter watermain is no longer considered a standard size. A 300mm diameter watermain shall be used in lieu of any 250mm diameter watermain.

Residential Areas

- 150 mm minimum diameter for mainlines; 50 mm diameter will be allowed in cul-de-sac bulbs and shall be looped back to the 150 mm main, refer to STD DWG 1-7-4
- 300mm minimum diameter mainline servicing all schools.
- 300mm minimum diameter mainline servicing High Density Residential Areas.

Industrial/Commercial Areas

- 300mm minimum diameter for mainlines.

2.2 Classification

Transmission Mains

Larger diameter pipes dedicated to transfer water between pressure zones, from downstream pumping stations to upstream reservoirs. These should be routed as determined through the Environmental Assessment process.

Major Distribution Feeder mains

Large diameter pipes greater than 600mm diameter, used to distribute water throughout one pressure zone. They also should be located, where possible, along major arterial roads and avoid local residential streets.

Local Distribution Feeder mains

Pipes 400mm to less than 600mm diameter, used to supply water to subdivisions. They should be located, where possible, on main roads and not on local residential streets.

Local Water mains

Pipes 300mm diameter and smaller, used to supply and distribute water within subdivisions. They should be located on local residential streets.



See paragraph 6.1 for connection protocol

2.3 Water Demands

Water demands are to be calculated as follows:

Table #1 – Typical Water Demand Criteria

| Population Type | Unit | Avg. Consumption Rate | Max Day Factor | Peak Hour Factor |
|------------------------|----------------|------------------------------|-----------------------|-------------------------|
| Residential | L/cap • d | 280 | 2.0 | 3.0 |
| ICI | L/Employee • d | 300 | 1.4 | 3.0 |

ICI = Industrial, Commercial or Institutional

Custom demands for larger volume consumers or those with exceptional peak demands require special considerations regarding flow calculations. Each case will be reviewed on an individual basis.

It has been noted that some new development can generate higher water demands during the first years of occupancy. Factors for this elevated water use include additional lawn watering for new sod and changes in water use patterns. Table #2 states the potential short term water demand criteria for new development. However, over the long term, it is estimated that water use would ultimately be reduced through water conservation programs and other potential factor including rates. As such, for the purpose of projecting long term water requirements, the water demand criteria in Table #1 should be used.

Table #2 – Potential short term water demand criteria for new development

| Population Type | Unit | Avg. Consumption Rate | Max Day Factor | Peak Hour Factor |
|------------------------|----------------|------------------------------|-----------------------|-------------------------|
| Residential | L/cap • d | 409 | 2.0 | 3.0 |
| ICI | L/Employee • d | 300 | 2.0 | 3.0 |

The Region may impose the higher short-term water demand criteria for new developments where water supply capacity or residual pressure may be marginal.

2.4 Locations

Watermains shall be located in accordance with the local municipality's standard locations and must have a minimum horizontal separation of 2.5 m (edge to edge) and a minimum vertical separation of 0.5 m (bottom of pipe to top of pipe) from any sewer as per MOE design criteria. All non-standard watermain locations will require individual approval by the Region and PUCC (Public Utilities Coordinating Committee). Any joint deflection shall be 50 percent of the manufacturer's specifications. Pipe barrel deflection is prohibited when using PVC pipe.

2.5 Depth

Curb and Gutter Roads

The top of watermain shall be constructed a minimum of 1.7 m below the finished grade.

Open Ditch and Unimproved Roads

The minimum cover over the top of watermains shall be 2.1 m below the existing centerline of the road, or 1.4 m below the bottom of the ditch or 1.7 m below grade if there is no ditch, whichever is greater. Where watermains within a ditch are crossed by driveways, the minimum depth of 1.7 m shall apply.

Where the above mentioned requirements can not be satisfied, refer to STD DWG 1-5-8 for insulation requirements.

2.6 Crossings

Where watermains cross under a creek, the minimum cover over the watermain below the creek bottom shall be as per Municipal Class Environmental Assessment and Conservation Authorities requirements.

Generally, where watermains cross over utilities, a 0.3 m minimum clearance shall be provided. Where watermains cross under utilities, the minimum clearance shall be 0.5 m.

For a watermain crossing a sanitary sewer, watermain joints are to be offset a minimum of 2.5 m horizontally from the centerline of the sanitary sewer.

2.7 Abandonment of Watermain

Watermains to be abandoned shall be removed or filled with grout.

2.8 Easements

No Regional infrastructure shall be installed in a trench whose lines of influence encroach on the foundation of any present or proposed permanent structure.

Line of influence – An imaginary line at a slope of 1:1 taken from the deepest point of the permanent structure towards the easement in question. The zone of influence would therefore be all areas underneath the lines(s) of influence.

Easements for Region of Peel watermains with a pipe invert between 1.7 m to 3.6 m depth require a total easement width of 8.0 m. The watermain should be offset within the easement as illustrated.

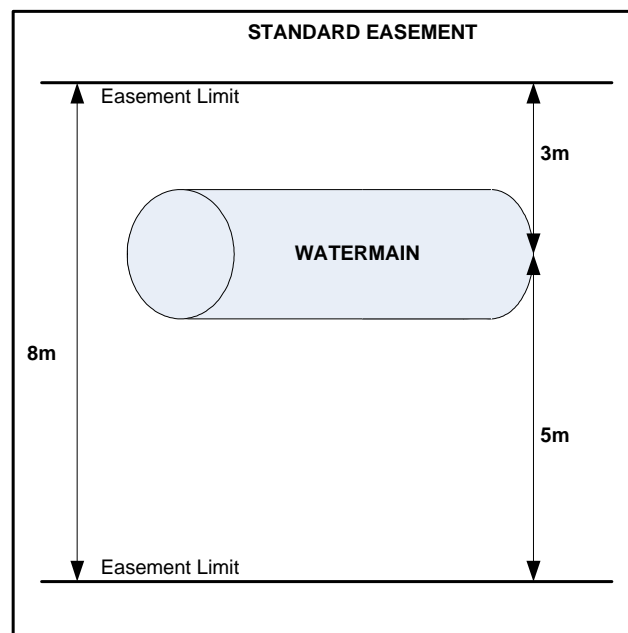


Figure # 1

Note: Concrete encasement within the easement is not considered an acceptable substitution to easement width requirements.

Certain restrictions apply with respect to easements as per the documents registered on title. The applicant must keep the easement clear of buildings, structures or obstructions. The permitted uses of the easement lands are restricted to lawn, flowerbed, roadway, driveway or parking area which can not be paved with a hard concrete surface.

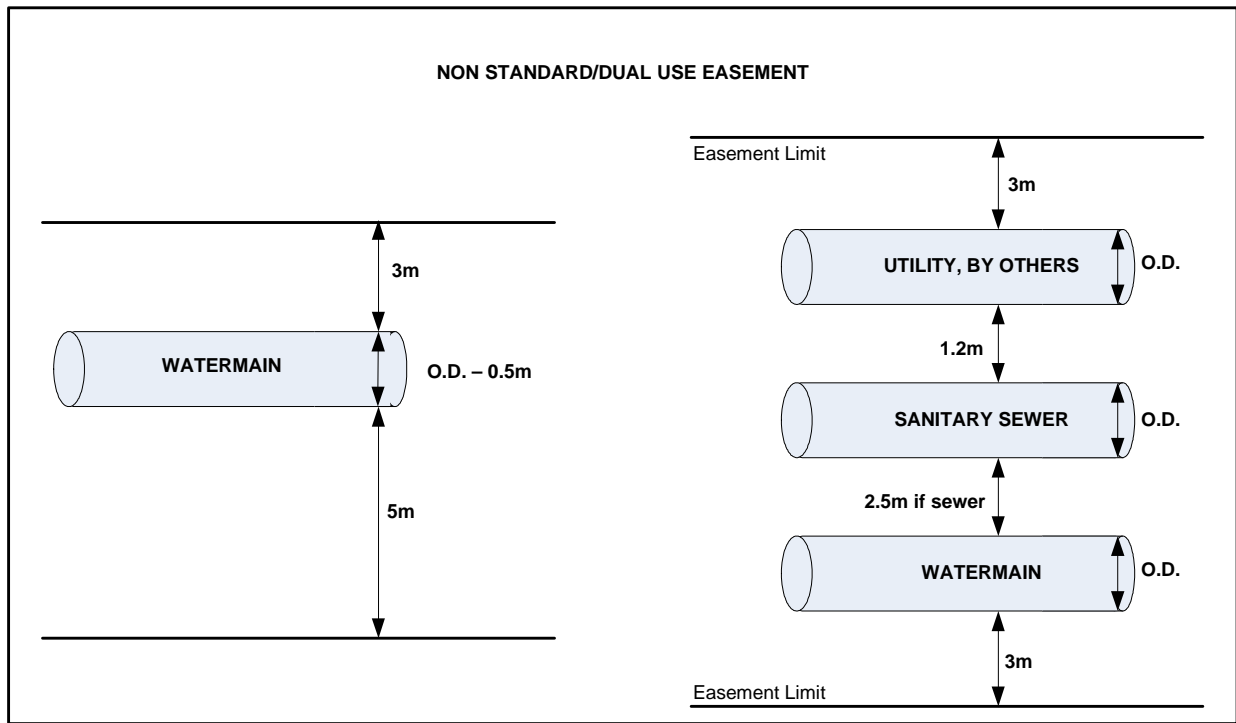


Figure #2

A width adjustment is required for infrastructure with an outside diameter (O.D.) greater than 500 mm. Required easement width is directly related to pipes outside diameter. Example: for pipe with an outside diameter of 800 mm, assuming standard depth of bury, the minimum easement width shall be 8.3 m (3 m + 5 m + (800 mm – 500 mm))

For Region of Peel watermains with a pipe depth of greater than 3.6 m, the easement width shall be designed such that the infrastructure can be installed by conventional excavation methods with the operation totally contained within the easement limits. Furthermore, the pipe location within the easement should not be within the zone of influence of any existing or proposed permanent structure. Considerations need to be made to accommodate 1:1 slope above the shoring box (3.6 m). For each meter of depth below 3.6 m, the width of the easement will need to increase by 2 m.

2.9 Liners

When installing watermains within steel liners, the following shall apply:

- 1) All casing spacers are to be made of grade 304 stainless steel;
- 2) Bearing surfaces (runners) shall be ultra high molecular weight polymer or equivalent;
- 3) Positioning of spacers along the watermain is to be as per the manufacturer's specifications;
- 4) Position of pipe within liner to be centered and restrained, sufficient enough to provide no less than 19 mm ($\frac{3}{4}$ inch) clearance between the casing pipe and the outside diameter of the bell;

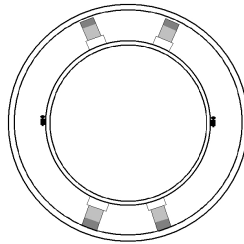


Figure #3 - Centered & Restrained

- 5) The watermain shall be restrained laterally for the entire length of the liner;
- 6) Liner to be sealed using wrap around rubber ends complete with stainless steel (grade 304) banding.

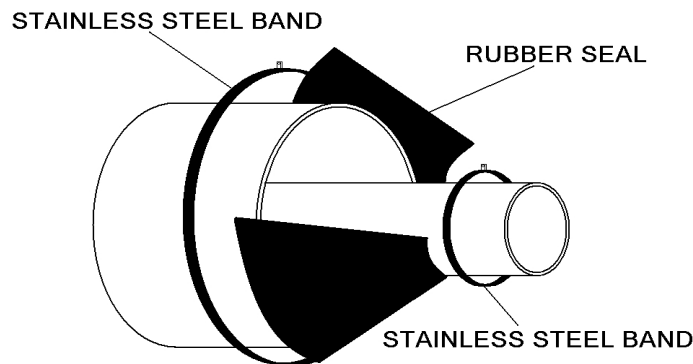


Figure #4

Where the Contract, Project Manager or designate specifies, supply material and grout the watermain pipe inside the casing. Assure that grout fills all spaces between the watermain pipe and the casing shown on the contract drawings.

2.10 Looping

Watermain design shall eliminate dead-ends by looping the mainline back to the system creating a network or, where this is not possible, by creating looping at a cul-de-sac as per STD. DWG. 1-7-4.

2.11 Construction in Fill Areas

The following notes are to be included on all drawings where watermain construction will take place in fill:

“No watermain shall be laid on fill until the density test reports have been submitted to and approved by the consultant or Region. Fill shall be placed to 0.6 m minimum above the top of the watermain grades and compacted to the minimum of 100% Standard Proctor Maximum Dry Density (SPMDD) in 0.3 m lifts. Tests shall be taken along the centerline of the proposed watermain. All fittings and branch valves in fill areas shall be tied with tie rods in addition to concrete blocking according to the following:

Thrust Blocking

Concrete thrust blocks shall be installed at all tees, horizontal bends, hydrants, end of mains and connections 100 mm to 300 mm diameter as per Region Standards. All 400 mm diameter watermains and larger shall have restrained joints. Calculations will be required from the consultant to determine the number of joints to be restrained beyond the bend.

At all thrust block locations, where compacted fill rather than undisturbed ground exists behind the thrust block, the following additional procedure shall be followed:

All segments of the fitting and the watermain at the thrust block location shall be tied using approved restraining devices installed in accordance with the manufacturer’s instructions (tie rods and clamps shall be protected using cathodic protection and corrosion prevention tape).

Imported granular fill (OPS granular “B” or equivalent) is to be used behind the thrust block and for a minimum distance of 2 m each side of the thrust block. This imported granular fill shall be compacted to a minimum of 100% Standard Proctor Density. Prior to constructing the thrust blocks, the Contractor shall obtain written approval for backfill from a licensed Geotechnical Engineer.”

3. LINE VALVES

3.1 Sizing

Line valves shall be the same size as the watermain except on mains 750 mm diameter and larger, where the valve size shall be one size smaller than the main, as per STD. DWG. 1-1-3.

3.2 Number, Location and Spacing

Two valves are required to isolate a tee intersection and three valves are required to isolate a cross intersection. These valves are to be located at the day lighting corners and maintain a minimum horizontal clearance of 2 metres from any catch basin.

Line valves shall be provided at a maximum spacing of 300 metres for mains up to and including 400 mm diameter. For mains larger than 400 mm diameter, spacing shall be approved on a per project basis by the Region (typically 600 metre maximum spacing).

When mainline (non service) connections are made to watermains 400 mm diameter or larger, a by-pass connection is required. The need for additional valves at by-pass connections is at the discretion of the Region.

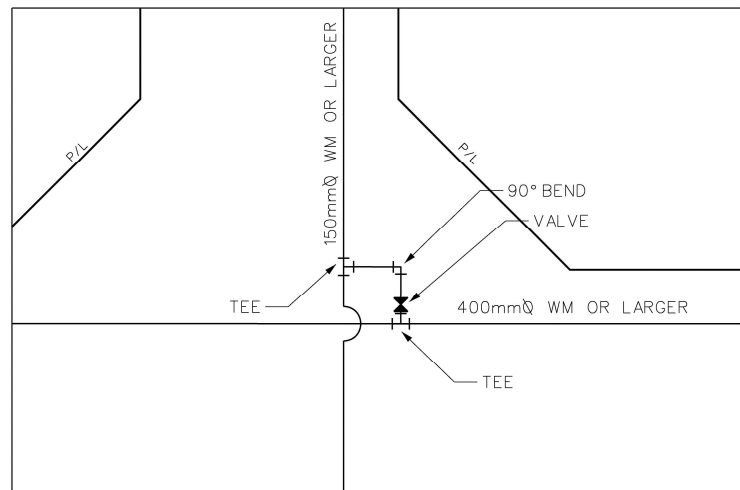


Figure #5 - Typical By-Pass Connection

3.3 Valve Boxes and Chambers

All valves 300mm diameter and smaller shall be equipped with valve boxes and restrained as per STD. DWG. 1-3-3A and valve and fittings wrapped in corrosion protection tape.

Larger openings on valve chambers to accommodate pump equipment and hoses. Chamber size and location shall be shown on both the plan and profile drawings. Details of the chamber shall be provided as required. Refer to standard drawings for specifications. Corrosion protection tape and zinc anode caps shall be applied to all valves located within chambers.

The top of valve boxes and chamber covers shall be set flush with finished grade and remain accessible at all times. A 12 - gauge TWU stranded copper, light coloured plastic coated tracer wire must be installed with and along the pipe and brought to the surface at each valve box/chamber. Tracer wire is to be attached to the pipe and outside of each valve box by means of tape. Tracer wire to be looped through a hole in the side of the valve box as per STD. DWG. 1-3-11.

3.4 Valve Box Protection

All line valve boxes and hydrant branch valve boxes are to be protected during construction and during the maintenance period as per STD. DWG. 1-3-11 Valve boxes are to be brought flush with grade level prior to final approval.

Watertight bolt down covers shall be provided on chambers located in all easements and in areas where chambers are susceptible to flooding or vandalism. Each chamber will require extended vents. The elevation of the vents shall be above Regional flood lines as determined by the appropriate Conservation Authority as indicated on the plan and profile drawings. Chamber vents are to be accessible to maintenance vehicles and equipment and be positioned in a suitable location to allow for venting.

4. HYDRANTS

Hydrants are to adhere to the specifications as described in the Region's list of approved products.

4.1 Numbers and Spacing

Hydrants are to be installed on 150mm diameter and larger watermains with the following being the maximum allowable spacing measured **along the right-of-way**:

- 150 m in Residential Areas (detached and semi-detached)
- 100 m in Industrial, Commercial and Institutional Areas
- 70 m in Townhouse Areas

The above maximums may be reduced at the Fire Department's request.

Verify adequate fire protection for large buildings (i.e., distance to siamese connection).

When replacing existing hydrants use the same location if possible. If a new location is required, notify the homeowner in writing prior to engineering approval and provide proof of notification to the Region of Peel. Where an existing hydrant does not meet current spacing standards, the current standard shall apply.

Across undeveloped land, river valleys and non buildable lands, install one hydrant between valves to facilitate testing and flushing.

A 12 - gauge TWU stranded copper, light coloured plastic coated tracer wire must be installed and brought to the surface at each hydrant. Tracer wire is to be attached to the pipe by means of tape and looped around the base of the hydrant.

4.2 Branch Valves and Boxes

All hydrants shall have 150mm branch valves and boxes. Hydrant branch tees from watermains 400mm diameter and larger shall be flanged (STD. DWG. 1-6-2). Hydrant branches from watermains 300mm diameter and smaller shall be anchor tees (STD. DWG. 1-6-1).

4.3 Locations

The location of the hydrants in relation to the street line shall be in accordance with the local municipality's approved relevant cross-section. (Copies are available at the local municipality's office). Valves shall be installed on the flanged outlet or the anchor tee as applicable. Any non-standard location will require individual approval.

All hydrants shall have 1.2 m minimum horizontal clearance from all other utilities and 1.2 m minimum horizontal clearance from structures measured from the nearest point of the structure. Hydrants near driveways shall be located a minimum of 1.25 m clear from the projected garage (or edge of driveway, whichever is greater) in residential applications and 2.5 m separation in ICI areas. In subdivisions, hydrants are to be relocated at the Developer's / Builder's expense if the above minimum requirements are not met.

If subsequent changes are made to the property or design during construction (i.e. driveway widened, entrance feature, etc.), all costs associated with the relocation shall be borne by Developer, Builder or property owner.

4.4 Depth of Bury

- 1.83 metres (6 feet) for less than 300mm diameter watermain;
- 2.13 metres (7 feet) for 300mm diameter and larger diameter watermain.

The hydrant safety breakaway flange must be located 50 mm to 150 mm above the finished grade and field adjusted if required. Hydrant extension to adjust the length of a hydrant barrel, if necessary, shall be obtained from the manufacturer supplying the hydrant and installed as per the manufacturer's directions.

4.5 Drinking Water Sampling Hydrant

Drinking water sampling hydrants shall be installed as per STD DWG 1-7-6 with locations and requirements determined by Regional staff.

Generally, drinking water sampling hydrants are to be located in an accessible location, within a municipal right-of-way, preferably along side lot boulevards or buffer blocks, as directed by Regional staff. Installation along lot/block frontage is discouraged.

5. AIR VALVES AND DRAIN VALVES

For watermains 400 mm diameter and larger, provision for air release and drainage is required at the high and low points respectively. This provision may be incorporated with the line valve chamber or in separate chambers. Refer to STD. DWG 1-3-5 (Air Valve), STD. DWG 1-3-6 (Drain Valve) and STD. DWG. 1-3-7 (Valve Setting).

For watermains up to and including 300 mm diameter, hydrants shall be located at high and low points to function as manual air release and drain points.

6.0 WATER SERVICES

All water services shall be single service connections and be supplied as described:

All unutilized water services shall be removed or abandoned, plugged at the main with the valve or service box removed.

Installation of watermain “stubs” or pre-servicing for future development should be avoided unless confirmation can be made stating that these undeveloped lands will be developed in the near future, complete with an approved site plan.

Note: Where non-metallic or composite pipe is installed, a 12-gauge TWU stranded copper, light coloured, plastic coated tracer wire must be installed with and along the pipe and brought to the surface at each service box. Tracer wire is to be attached to the pipe and outside of each service box by means of tape or rubber grommet.

6.1. Connection Protocol



See paragraph 2.2 of this manual for definition of watermain types

Transmission Mains

- No connections permitted with feeder mains or water mains
- No service connections allowed

Major Distribution Feeder mains greater than 600mm

- Connections with other feeder mains and local water mains permitted
- No service connections allowed

Major Distribution Feeder mains 600mm or less

- Connections with other feeder mains and local water mains permitted
- Industrial connections may be considered under special circumstances when no other options are present
- No residential connections permitted

Local Distribution Feeder mains 400mm – 500mm

- Connections with other feeder mains and local water mains permitted
- Industrial, Commercial and Institutional connections permitted
- Residential connections may be considered under special circumstances

Local Water mains 300mm and smaller

- All types of service connections permitted



Refer to paragraph 2.1 for additional information.

6.2 Sizes - Residential

| Lot Size | Minimum Connection Size By Service Pipe Material | |
|--|---|------------------------------------|
| | <u>Copper</u> | <u>Other Approved Material</u> |
| a) Lots up to 500 m ² | 19 mm dia. | 25 mm dia. |
| b) Single lots greater than 500 m ² | 25 mm dia. | 30 mm dia. |
| c) Lots with static pressure less than 45 psi | 25 mm dia. | 30 mm dia. |

When determining water service size for a particular development, the majority sized service shall be applied for every connection. For example, if there are 35 x 19 mm diameter water service connections and 4 x 25 mm diameter water service connections (based on the above requirements), then all services for this development shall be 19 mm diameter.

6.3 Location

Residential service connection locations shall be in accordance with Region of Peel standard drawings and the service corridors of the local municipality. Copies of the standards are available at the respective municipal office.

All water services shall have 1.2 m minimum horizontal clearance from all other utilities and a 1.2 m minimum horizontal clearance from structures measured from the nearest point of the structure.

6.4 Depth



As per paragraph 2.5. of this manual

6.5 Mainstops

All water services shall have the same size mainstop as the service pipe. Mainstops are not required on water services off 50 mm diameter copper mains.

Any residential services that are installed on a PVC watermain will require the use of an approved wide-band service saddle or factory installed threaded fitting rather than direct tapping.

Service saddles are required for all services to concrete pressure pipe manufactured to the latest edition of AWWA C301 and AWWA C303 specifications for all tap sizes unless outlets were manufactured in pipes.

6.6 Curb Stops and Boxes

All services shall have curb stops and boxes installed at the street line, be flush with grade and accessible at all times. Reducing curb stops shall not be used.

For residential applications, all water service boxes (curb stops) shall be installed in grass areas with a minimum distance of 1.0 metre from the edge of the driveway.

6.7 Industrial and Commercial Water Services

Industrial and commercial water services may be installed with the subdivision servicing if the block is located on the opposite side of the watermain. If short water services are to be installed with the subdivision, an approved site plan will need to be submitted. Specific clauses are to be added to the agreement relating to conditions of removal of the services if not utilized.

Long services (including the blow-off) shall be removed or abandoned, capped at the mainstop with the valve box removed if not utilized prior to Final Approvals and Assumption of the Development.

All connections are to be as described in the Region of Peel's Standard Drawings (STD DWG 1-8-1 through 1-8-9).

6.8. Planting Blocks

Water services to buffer blocks, parkettes and median plantings shall be no larger than 25mm diameter and as per local municipality's standards.

Jurisdiction and maintenance agreements, including cost recoveries need to be clearly established when incorporating irrigation systems. All such connections need to be accurately represented in Peel's graphical infrastructure database and installed with a 12-gauge TWU stranded copper, light coloured and plastic coated tracer wire.

7. BLOW-OFFS

7.1 Temporary Dead-ended Watermains

All dead-ended 150mm diameter and larger watermains shall have a hydrant installed at their terminus instead of a blow-off for bleeding, charging and flushing of the main.

7.2 Dead-ended Industrial Water Services

50 mm diameter blow-offs are to be installed at the street line for all dead-ended long (greater than 10 m) industrial water services, unless other methods are available for bleeding off, charging and flushing of the service (STD. DWG. 1-7-2).

All blow-offs are to be clearly staked with a 2.4 m 100mm x 100mm marker, placed 1.3 m above the finished grade and painted blue.