Peterborough Utilities Commission

UTILITIES
PETERBOROUGH
COMMISSION

WATER
RIVERVIEW PARK AND ZOO

WATER SUBDIVISION and DEVELOPMENT REQUIREMENTS

Revised November 2017

LIST OF REVISION NOTICE DATES

Rev. #	Rev. Date	COMMENTS
0	Nov. 2006	
1	Mar. 2007	Complete copy issued March 21, 2007
2	Jan. 2012	Complete copy issued January 2012
3	June 2013	Compete copy issued June 2013
4	Dec. 2015	Revised Drawing Index Added Section 6.1.5.6 and renumbered the remainder of Section 6.1.5 Revised Section 6.1.5.18 (Hydrant Installation) Revised Section 6.1.6.6 Revised Section 6.1.6.8 Added Section 6.6 Water Meter Specifications Revised Section 8.0
5	Jan. 2016	Revised Section 3.1 b) ii) Revised Section 7.0 (Revised A2000) Revised Section 6.1.3.14 Revised Section 8.0
6	Feb. 2016	Revised Section 6.1.6.8 Revised Section 8.0
7	Nov. 2017	Revised Section 6.1.2.1 Revised Section 6.1.5.3 Revised Section 7.0 (Revised A1636, Deleted A1973, Added D3073)

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NOTE: In conversion of measures to/from metric equivalents both exact and nominal conversions have been used in this specification as and where deemed appropriate.

1.0 GENERAL CONDITIONS OF SUPPLY - WATER

This section outlines the Peterborough Utilities Commission's (PUC), otherwise known as the Commission, general policy for water servicing of subdivisions and developments, other than developments that will ultimately be operated privately.

Peterborough Utilities Services Inc. (PUSI) shall act as the Peterborough Utilities Commission's agent regarding matters related to the water distribution system.

1.1 WATER DISTRIBUTION SYSTEMS

The Developer shall enter into an agreement to provide water mains, hydrants, water service pipes and the connecting mains from the existing system to the subdivision including the necessary looping as well as pay Development Charges towards the cost of system facilities including trunk mains, reservoirs, major pressure zones, pumping stations and treatment plant facilities.

The Developer shall design, supply and construct at their own expense, a complete water system, including water mains, valves, hydrants and water service connections from the water main to the property line to service the land in the subdivision, according to the specifications of the Commission and the subdivision agreement. The Developer shall design and construct a water system of sufficient size as approved by the Commission, to serve the subdivision's water mains as feeder mains.

1.2 OVERSIZING

The Commission shall pay for the oversizing of a water main in low density residential subdivisions, based on the difference in the cost of water mains over 200 mm in diameter, where oversizing is required by the Commission.

For medium and high density residential and industrial and commercial subdivisions, the Commission shall pay for the cost of oversizing based on the difference in cost of water mains over 300 mm in diameter where oversizing is required by the Commission.

1.3 SUBDIVISION PHASING

The minimum size of a phase shall not to be less than ten (10) lots. Phasing of smaller numbers of lots does not allow the proper spacing of hydrant and valves in the water distribution system.

1.4 MOE APPROVAL REQUIREMENTS

Under the new Ministry of the Environment (MOE) Municipal Drinking Water License process the Peterborough Utilities Commission was issued its Drinking

Water Works Permit (DWWP) on June 21, 2011, part of the replacement for the Certificate of Approval (CofA) that the Ministry use to issue.

With the new DWWP the MOE CofA application process and the MOE Transfer of Review Program no longer exist. Most alterations of the Peterborough Drinking Water System by addition, modification, replacement or extension now must satisfy the requirements of the PUC's Drinking Water Works Permit (#145-201). Therefore, most submissions are made directly to the PUC.

There are limited conditions which would require an application directly to the Ministry of the Environment to amend Peterborough's Drinking Water Works Permit (DWWP). Those conditions are addition, modification, replacement, or extension of a water main that:

- Has a nominal diameter greater than 750mm;
- Passes under or through a surface water (except if trenchless construction method is to be used);
- Connects to another drinking water system; or
- Results in fragmentation of the drinking water system.

If in doubt the Developer should contact the PUC Water Utility Engineer at the design stage to determine if a DWWP amendment application to the MOE is required.

Generally however, a DWWP Amendment will not be required. In that case the water works design is submitted to and must receive the consent of the PUC and meet MOE design requirements. The Developer shall be required to submit engineering drawings, prepared by a Professional Engineer, to the PUC Water Utility Engineer for review and approval in accordance with PUC's Drinking Water Works Permit for water works projects within the City of Peterborough.

The design must satisfy the design criteria set out in the Ministry of the Environment publication "Water Main Design Criteria for Future Alterations Authorized under a Drinking Water Permit – March 2009", as amended from time to time, and the design objectives contained within the Ministry of the Environment publication "Design Guidelines for Drinking Water Systems, 2008", as amended from time to time. Both documents are available on the Ministry's website.

Furthermore, the design must also satisfy the requirements of the PUC, as further defined in this document.

The above only deals with water mains within the boundaries of the City of Peterborough. Other facilities such as water intake pipes, water supply, and treatment works, high and low lift pumping stations, water storage facilities at

water treatment plants and chemical feeding equipment will require an amendment of the DWWP, submissions being made directly to the MOE.

PUC's set fee for the review of any submission is to be submitted along the Developer's application for PUC approval, with all cheques to be made payable to Peterborough Utilities Commission. For current fee rates, contact PUC Water Utility Engineer. All correspondence is to be addressed to the Peterborough Utilities Commission, not to the City of Peterborough as this will cause a delay in processing the application.

The application form "Application for Approval of Modifications to Peterborough's Municipal Drinking-Water Distribution System" along with supporting documents and applicable fee are to be submitted in duplicate to:

Peterborough Utilities Services Inc.
1867 Ashburnham Dr.
Peterborough ON K9J 6Z5
Attn: Water Utility Engineer, Engineering Department

1.5 INSPECTION OF WATERWORKS MATERIALS

Prior to construction of water mains, water services, or any other underground water facilities, PUC shall inspect and approve the materials to be used. Any materials installed that are unacceptable for use shall be removed and replaced at the Developer's cost. If PUC has not approved the material prior to installation, PUC retains the right to order excavation of installed material, at the Developer's cost, for inspection.

PUC may order excavation of approved material if there is reason for concern regarding the material or installation. If, upon excavation, the concerns are unfounded, PUC shall pay for the costs of the excavation. If installation or materials are found to be not as specified the Developer shall pay all costs for excavation and replacement of unacceptable materials.

2.0 SUBDIVISION AGREEMENT REQUIREMENTS

2.1 AGREEMENT REQUIREMENTS

A Developer shall enter into an agreement with the Peterborough Utilities Commission prior to any water main construction associated with the subdivision as outlined in Section 1.1. Pursuant to the requirements of the City of Peterborough's Subdivision Requirement, a letter stating that the appropriate arrangements have been made with the Commission must be submitted to the City Engineer. The Water Subdivision Agreements shall be approved and signed by the Commission prior to the submission of this letter.

2.2 PERFORMANCE SECURITY

A performance security shall be posted by the Developer prior to construction. Performance security shall amount to 100% of the cost of the water distribution system associated with the new development as determined by the consultant and approved by PUC and may be in one of the following forms:

i) An irrevocable, automatically renewable Letter of Credit, drawn on a Schedule I Canadian chartered bank with a branch in Ontario
ii) Bank Draft
iii) Canada Savings Bonds

An approved form of a letter of credit is provided in Section 2.5.

2.3 INSURANCE REQUIREMENTS

A Comprehensive Liability Insurance policy to the extent of $5,000,000 shall be provided and remain in effect during the period from the commencement of the water main construction until the one (1) year warranty expires.

Peterborough Utilities Services Inc., including its officers, employees and agents while performing their duties on behalf of the Commission, and the Peterborough Utilities Commission shall both be named as additional insured parties on this Liability Insurance policy.

2.4 WATER CAPITAL AND DEVELOPMENT CHARGES AND DEPOSITS

a) Development Charges

The Developer shall be required to pay the Water Capital and Development Charges as established by the Commission, prior to the start of any water main construction associated with the subdivision. The Development Charges

are for the construction of trunk water mains, oversizing water mains reservoirs, pumping stations and water treatment facilities. The charges are based on a residential unit and depend on the type of unit (i.e. single family, apartment). The commercial/institutional/industrial charge is based on a square metre of gross building area.

The Water Capital and Development rates are reviewed periodically and therefore the charges in effect at the time of payment will apply. Contact the PUC Engineering Department to obtain the current rates.

Payments required for material to be procured by PUC are due prior to PUC ordering the material.

b) Inspection Charge

The Developer shall be required to pay an inspection charge per lot, prior to starting any work. The inspection charge is a cursory spot inspection charge on a per lot basis. The Developer is expected to provide continuous resident inspection by their Consultant that oversees the design and installation of the subdivision or development.

c) Water Frontage and Water Service Connection Charges on Existing Streets

Where a new subdivision has frontage on a street(s) with existing water main facilities, there may be additional Water Main Frontage Charges on a per metre of frontage basis and water service connection charges due. The Developer should contact PUC as some exemptions may apply.

2.5 TYPICAL LETTER OF CREDIT REQUIRED FOR SUBDIVISION AGREEMENT

TO: PETERBOROUGH UTILITIES COMMISSION

Pursuant to the request of our customer, _____

WE, _____

hereby establish an irrevocable Letter of Credit in your favour in the total amount of _____($_____) which may be drawn on by you at any time and from time to time to the extent required to perform the obligations of our said customer under an agreement dated _____ between the Peterborough Utilities Commission and our said customer relating to the subdivision of _____ in the City of Peterborough, as shown on the plan attached to said subdivision agreement as Schedule 'A'.

Drawings under this Letter of Credit shall be in the form of a written demand for payment made by the President of Peterborough Utilities Commission and any such demand shall be honoured without inquiring whether you have a right as between yourself and our said customer to make the demand and without recognizing any claim of our said customer or of this bank.

The amount of this credit may be reduced from time to time by notice in writing given to this Bank by the Peterborough Utilities Commission.

This Letter of Credit shall continue for a period of one year from this date and shall be deemed to be automatically renewed and extended from year to year thereafter unless we notify you in writing, at least thirty days prior to any expiration date that we elect not to renew or extend this Letter of Credit.

Upon receipt by you of any such notice, you may draw hereunder to the extent you consider necessary to provide adequate security for the due performance of the obligations of our said customer under the said Agreement.

This standby Letter of Credit is subject to the most current version of the International Chamber of Commerce “Uniform Customs and Practice for Documentary Credits” ICC Publication No. 500 and engages us in accordance with the terms thereof.

3.0 INSPECTION AND LOCATE PROCEDURES

3.1 INSPECTION - SUBDIVISIONS

a) Initial Inspection

PUC will carry out cursory spot inspections during the installation of the water distribution systems. The Developer is required to provide continuous resident inspection by their Consultant, during the initial installation and testing.

b) Additional Inspections

After the initial installation and prior to Acceptance, PUC will carry out additional inspections for the Developer or their Consultant, under the following conditions:

i) Sufficient advance notice is provided and the work is carried out during regular working hours. (The extent of the advance notice will depend on the size of the subdivision and the time required to inspect the work.)

ii) The inspection is carried out during the normal construction season (i.e. between April 1st and October 31st), unless approved in writing by the Water Utility Engineer.

iii) The Developer or their agent, prior to inspection, will carry out the necessary preparatory work in locating the various facilities not readily visible (It is the Developer's responsibility to search for, dig up and locate individual water valves and services so that the waterworks facilities can be easily and effectively checked). PUC will expect this preparatory work to be carried out prior to being asked to carry out an inspection.

iv) The Developer or their agent shall accompany PUC Inspectors to aid them in the inspection so that the extent and nature of any problems uncovered can be viewed first hand and recorded on a deficiency list created by the Developer or their consultant. A copy of this list shall be provided to PUC and its content approved by PUC. All additional inspections deemed necessary by the circumstances will be carried out at the cost of the Developer.

In the case of the water distribution system, the inspection will generally consist of checking the location, condition and operation of the hydrants, services, valves and valve boxes, depth of valves and services, cursory investigation for leaks and condition of hydrants. A tracer wire continuity test shall be carried out on the water system as outlined in Section 6.1.5.14. The first and last inspection of the water distribution system will be carried out at no additional cost.

3.2 ENGINEER/INSPECTOR

The Developer shall employ the services of a professional engineer, licensed to practice engineering in the Province of Ontario, to design the water distribution system and stamp the drawings.

The Developer shall supply a full time qualified Inspector who is well experienced in water main and subdivision construction.

The water works inspector is required to ensure material meets PUC requirements, ensure the water main and water services are installed correctly and at the proper locations as illustrated on the plans, both horizontal and vertical alignments.

3.3 LOCATES IN SUBDIVISIONS PRIOR TO ACCEPTANCE

Prior to Acceptance, PUC reserves the right to apply the normal utility locate requirements prior to excavation, where applicable. PUC's normal utility locate requirements shall generally apply after Acceptance of the water distribution facilities in the subdivision.

Generally, PUC will, on provision of adequate advanced notice, for individual builders or plumbers in new subdivisions during regular work hours at no additional cost to the builder or plumber, stake from locations provided from the Consultant's "as constructed" information the location of individual water service shut-offs. PUC, however, will not dig up or search for the water service shut-off box if it is not readily found at the staked location and does not take responsibility for the accuracy of the Consultant's "as built" information.

4.0 DOCUMENTATION AND DRAWING REQUIREMENTS

4.1 SUBMISSION OF PLANS

The Developer, sufficiently in advance to the anticipated start of the work, shall provide acceptable engineering plans, profiles and working drawings at their own expense, prior to any work being carried out, as outlined in this section for PUC review and approval.

Two (2) copies of the survey draft plan of subdivision are required for the water subdivision agreements. One signed copy of the agreement is ultimately returned to the Developer with a copy of the survey plan included.

All photo copying, white print sets, vellum plots and mylar plots supplied during the design drafting and as-built stages are to be provided to PUC at the Developer's expense.

4.2 DIGITAL DRAWINGS

Subdivision projects require digital copies of drawings to be supplied on final acceptance to a standard acceptable to the PUC. Prior to preparation of drawings for the subdivision, the Developer's Consultant should request a typical standard of acceptance from the PUC.

4.3 WATER PLAN REQUIREMENTS

4.3.1 Plans

Sufficient location dimensions, calculations and pre-planning are required when designing water distribution systems to achieve the desired offset and not conflict with standard locations allotted to other utilities. This pre-planning and detailing shall be carried out by the designer and NOT left to the field layout people who may not be aware of the other design constraints. Water mains shall be laid to a designed grade so that a proper record is obtained of its vertical position.

The layout design for steel and reinforced concrete pipe shall be more rigorous due to the fact that pipe fittings and closure pieces are pre-manufactured to suit a specific installation.

In general, a plan and profile, together with certain other details are necessary for construction of any water pipeline. These shall show:

a) All pertinent existing water mains, hydrants, valves, fittings and other existing utilities.

b) Horizontal and vertical distances, either directly or by survey station and elevation.
c) Location of deflections or bends, both horizontal and vertical (point of intersection preferred).
d) Degree of bends, degree or radius of curves, tangent distances for curves, or external distances if clearance is required.
e) Points of intersection with pipe centreline for tees, wyes, crosses or other branches, together with direction - right or left hand, up or down or angle of flow, viewed from inlet end.
f) Location and overall length of all valves, pumps, or other inserted fittings not supplied by the pipe manufacturer.
g) Location of adjacent or interfering installations or structures.
h) Occasional tie-ins with property lines, curb lines, road or street centre lines, and other pertinent features necessary to design right-of-way and locate pipe centre-line clearly.
i) Details and descriptions of all specials, together with data required to supplement AWWA Standards.
j) Details, dimensions, and class designation or other descriptions of all flanges and mechanical field joints.
k) Any special requirements affecting the manufacturer of the pipe or any installation procedures.

The overall layout plan shall show the location of the water mains, valves and hydrants and the size and type of pipe. The overall layout plan shall also show the location of the proposed sanitary and storm sewers, manholes, catch basin and any other major sewer or drainage facilities, ROW, driveways, curb line, etc.

The plan and profile drawing shall show the relevant location and elevation information in plan and profile for all water mains, fittings, valves, hydrants, services, locations of bends with deflection angles, and details of other facilities etc. Where it is necessary for the water main to cross under other facilities using bends, a special detail of the arrangement shall be provided.

4.3.2 Composite Utility Plan Requirements for MC Approval Submissions

In addition to other design plans submitted the following are the Criteria required for any proposed subdivision submission to Peterborough Utilities requesting Municipal Consent (MC) Approval. The applicant is to provide a Composite Utility Plan as further herein defined in addition to other subdivision plans and their request for MC Approval. A composite utility plan, in addition to any other detail plans provided, will assist all service/utility providers in ensuring there are no conflicts during their review of an MC submission. (Any deviation will be at the Utilities' discretion alone.)

The Composite Utility Plan must adhere to Peterborough Utilities Services Inc. standards and provide the following information:

1. The lot layout and numbering is to be shown as per the draft plan, and municipal addresses if available.
2. All utility line locations including sanitary sewer, storm sewer, water main, catch basins including rear yard catch basins, manholes, hydrants and valves, are to be identified.
3. All utility service drop locations are to be shown including sewer and water service laterals.
4. The complete street lighting system is to be identified as well as disconnects.
5. Other street features are to be indicated/scaled i.e. sidewalks, communications pedestals, transformers, bus stop locations, shelters and pads, Canada Post Super Mailboxes, etc.
6. Location of all proposed trees and landscaping on the subdivision road allowance are to be shown.
7. All driveways are to be indicated at maximum allowable width and clear of water services, transformers, fire hydrants and streetlights.
8. A note stating that all utility boxes (i.e. pedestals and transformers) are to be installed in accordance with utility / telecom parties standards, within the road right-of-way.
9. For particular minimum clearance requirements, a reference to each individual utility's specifications and standards will be made.
10. The Plan scale ranges from 1:1000 or 1:1500 metric for some larger developments to 1:500 or 1:250 metric for particular areas of congestion such as cul-de-sacs, garden home/townhouses, etc. (Attached detail plans typically are 1:500 metric).
11. All easements must be clearly identified and registration number indicated if available.
12. Show maximum building footprint on each lot considering required minimum setbacks, or each house footprint if established.
13. Symbol Legend to conform to City standards.
14. North arrow is to be shown.
15. A Key Plan shall be provided.

<u>Some Details key to the above that need to be provided within a submission package are:</u>

1. A typical utility road cross-section is to be shown including road width, typical utility trench, utility depths, clearances between utilities and dimensions from utility plant to curbs and lot lines.
2. A typical lot servicing detail is to be shown for each type of proposed unit and the location of all utility services, driveways, and trees if standard shall be shown including dimensions for each from lot lines.
3. Typical utility trench details are to be shown including depth, layout and identification of each utility's ducts and cables within the trench when a joint use trench is used.

Peterborough Utilities approvals will be provided either independently or jointly by Engineering Dept. (Water) and Engineering Dept. (Electrical) commenting on their individual areas of responsibility.

Approval will be provided in writing on our own MC Approval Form. This Approval can then be used as confirmation to the City that the applicant has satisfied the requirements of the Water Utility and the Electrical Utility respecting MC Approval.

4.3.3 Preliminary Drawing Approval

For preliminary approval, the following plans shall be submitted:

a) Two (2) copies of the proposed layout plan.

b) Two (2) copies of the detailed plan and profile drawings to a scale of not less than 1:500 horizontally and not less than 1:50 vertically.

After examination of the preliminary plans, one copy shall be returned to the Developer's Consultant outlining and showing any changes that are required.

4.3.4 Final Drawing Approval

The final submission shall be made, once all requested revisions have been completed and shall consist of:

a) Four (4) copies of the survey plan of the subdivision.

b) Two (2) sets of the approved “stamped” Engineering “For Construction” drawings and construction specification.

c) Two (2) completed copies of the "Peterborough Utilities Application for the Approval of Waterworks" forms, including a certificate of compliance with the Environmental Assessment Act.

   The application form shall be submitted to the PUC Water Utility Engineer for review and final approval.

   One copy of the final approved drawing(s) shall be returned to the Developer or their Consultant.

   Once final drawing approval has been received from PUC, Ministry of the Environment, if required, and all other regulatory agencies, and all provisions of the subdivision agreement between the Commission and the Developer have been complied with, the Developer shall arrange a pre-construction meeting with PUC staff to review details of the project and to inspect materials forming part of the work. A start date shall be determined and the

Developer may then proceed with the installation of the water system. The Developer shall advise PUC at least one (1) week in advance of the start of the work, so that PUC can arrange for inspection during construction.

d) One (1) digital copy of the approved overall layout plan of the water distribution system; no activity related to final swabbing, pressure testing, leakage testing, nor disinfection shall be permitted without this overall layout plan.

4.3.5 Layout

The Developer shall, at their own expense, carry out all layout work necessary for complete construction of the work in accordance with the approved plans and specifications. The Developer's Engineer involved in the design of the waterworks facilities shall, unless otherwise approved, be responsible for the complete layout, inspection and resident supervision of the work.

4.3.6 "As Constructed" Information

a) General

"As Constructed" information of underground services is an essential requirement of any underground work.

The acquisition of "as constructed" information shall be obtained for two purposes:

i) Enable a service locater to quickly pin-point the water facilities in all kinds of weather conditions, summer or winter, from readily identifiable and normally visible surface or above-ground facilities.

ii) Provide a drawing showing all facilities in the "as constructed" locations relative to one another for accurate reference purposes.

b) "As Constructed" Plan Tie Points

"As Constructed" tie points shall allow the location of underground water facilities during any time of the year. Acceptable tie points include:

1) Hydrants;
2) Water valve boxes in roadway;
3) Sanitary or storm manhole covers located in the roadway;
4) Any easily identifiable existing permanent structures such as houses.

Tie points which are unacceptable include:

1) Hydro or Bell poles;

2) Storm catch basins along the gutter (EXCEPT as a temporary tie point);
3) Manhole covers located off the roadway;
4) Survey bars (except for occasional tie-ins for hydrants and curb stops).

Water services are tied down relative to each other and to valves and hydrants and NOT survey bars. The occasional tie point of a hydrant and water service curb stop to a survey bar is useful for field location and in identifying the exact location of hydrants and curb stops relative to the property line. Tie every 5th or 6th curb stop to property bars.

Where water services are installed on a bend, cul-de-sac or other locations where it is not possible to locate the water service at right angles to the main, the location of the main stop and the curb stop shall be shown on the "as constructed" drawing so that the exact line of the service can be accurately determined. End curb stops and every 5th or 6th curb stop to be tied to above grade features.

c) "As Constructed" Plans

Both preliminary and final "as constructed" information is required as follows:

i) Preliminary "As Constructed": Within one (1) month of the completed water system in the subdivision or any phase thereof being put into service and before the issuance of building permits, the Developer shall provide preliminary "As Constructed" information. This preliminary "As Constructed" information can be in any legible, comprehendible form that is convenient such as a marked copy of the overall plan or photocopies of pertinent "As Constructed" field notes. This information shall be sufficient so that valves and services can be readily located from above ground objects such as hydrants.

"As Constructed" information required on completion of the water main installation shall include the make, type, class and manufacturer of all water main pipe (PVC, Ductile Iron, Concrete Pressure Pipe) and is to be recorded on the drawings.

Preliminary "As Constructed" information shall include completing the node, main, hydrant, valve and chamber inventory record forms (supplied by PUC). One service card (supplied by PUC) is to be completed for each water service installed in the subdivision. Preliminary as-built ties to the water services are to be drawn in pencil on the water service cards. All other information on the cards is to be in pen.

It is the Consultant’s responsibility to provide an accurate description of the water services, valves and hydrants installed in the development. PUC shall be consulted for proper completion of the documents.

ii) Final "As Constructed"

Prior to the final acceptance of the waterworks system in the subdivision by PUC, one (1) complete final set of approved "As Constructed" original mylars in accordance with the general requirements for "As Constructed" information shall be provided.

In addition, PUC will require a digital copy of the final "As Constructed" plans. PUC should be contacted regarding any questions on the appropriate digital format. A CADD copy, plus a PDF copy, for each plan to be provided.

d) Tie Points

Water Distribution System Ties:

For swing tie measurements to plant features such as hydrants, valves, sanitary manholes, storm manholes, catch basins and double catch basins, etc. the plant ID numbers from the construction drawing are to be used. All measurements are to be metric.

SMH #	Sanitary Manhole
STMH #	Storm Manhole
CB #	Catch Basin
DCB #	Double Catch Basin
H #	Hydrant
V #	Valve

Where # represents the plant ID number on the construction drawing.

ie. 25.4 m SMH 15
19.5 m DCB 19

Building Ties:

For swing tie measurements to buildings the following convention applies. When standing on the road allowance facing the house or lot the left swing tie distance is your left side and the right swing tie distance is your right side. All measurements are to be metric. The municipal address and street name are to be used to reference the ties.

ie. 25.4 m L. 1582 Ravenwood Dr.
19.5 m R. 1582 Ravenwood Dr.

Generally the reference is to the two corners of the main building, although circumstances may dictate the use of other building reference points.

As Constructed Water Main Elevations:

The actual as constructed top of pipe water main elevations and station location are to be plotted on the construction profile drawing.

4.4 ACCEPTANCE

The Acceptance of the water distribution system in a subdivision is tied to the completion of all other services (i.e. paving, curbing, sodding of the boulevards and sidewalk installation). The maintenance guarantee period extends for one (1) year from the date of Acceptance of the water system.

Acceptance usually occurs after the substantial construction of the majority (approximately 66%) of the houses in the subdivision. The City of Peterborough's Subdivision Agreement requires that a substantial number of houses have roofs on before allowing the completion of the curb and gutter, paving, sidewalk construction and boulevard sod.

The Developer is responsible for rectifying damages to the water distribution systems facilities that occur prior to the completion of the one (1) year maintenance period.

The Developer shall provide a copy of the final registered subdivision plan complete with lot numbers before acceptance by PUC. The municipal address and lot numbers are to be on all “as-constructed” plan/profile drawings.

4.5 COST AND STATISTICAL DATA

The Developer shall provide the quantities and tendered unit prices for water mains, hydrants, services, etc. for the water system once they become available. Cost figures for water facilities and statistical information (i.e. trunk mains, water mains, number of water services, hydrants) shall be made available to PUC on a yearly basis and prior to final acceptance. (This information is required for the Commission’s financial and statistical records.) These values should be the actual amounts paid with the exception of monies paid directly to the Commission.

5.0 SECTION NOT USED IN THIS DOCUMENT

6.0 SPECIFICATIONS FOR WATER MAIN CONSTRUCTION

6.1 SPECIFICATION FOR WATER MAIN INSTALLATION / REPLACEMENT

6.1.1 SCOPE OF WORK

This specification covers the requirements for constructing and testing water mains, service connections and appurtenances.

Unless otherwise specified, the Engineer is the Commission's designate to review and approve design and construction of all water works appurtenances.

6.1.2 DESIGN

The purpose of the following information is to indicate for subdivision development, water main extension work and water servicing, for the various forms of residential, commercial and industrial construction, the specific requirements for the design and construction of water mains and services to be connected to the Peterborough Utilities Commission waterworks system.

This information is applicable to cement lined ductile iron pipe, from 150 mm diameter to 300 mm diameter inclusive, polyvinyl chloride pipe (PVC) from 150 mm to 300 mm inclusive, copper pipes for 20 mm diameter to 50 mm diameter inclusive, and all appurtenances such as valves and hydrants. For installation of water mains larger than 300 mm diameter and for any other waterworks installations, special specifications must be approved by the Engineer.

Basic Design Criteria:

Average Day Demand	450 litres per capita per day
Min. day Peaking Factor	0.70
Max. Day Peaking Factor	1.65
Peak Hour Peaking Factor	3.00
Demand:	Greater of ‘Max. day + Fire’ and ‘Peak Hour’
Water main diameter:	150 mm min., unless approved otherwise
Normal operating pressure:	350 to 480 kPa (50 – 70 psi) (objective) But not less than 275 kPa (40 psi)
Maximum operating pressure:	700 kPa (100 psi)
Minimum pressure (Fire):	140 kPa (20 psi) at Max. Day + Fire
Transient pressure:	Max. Operating Press. + surge press. created by stopping a 0.6m/s (2 ft/s) water column
Maximum Design velocity:	1.5m/s (5 ft/sec); 5.0 m/s during fire flow
Minimum velocity:	0.8 m/s flushing velocity
Head Losses:	< 1m/100m (10 ft/1000 ft)

Design for Fire in accordance with Fire Code (O.Reg. 388/97 or latest edition) under the FPPA, 1997 and the latest edition of Fire Underwriters Survey "Water Supply for Public Fire Protection" and to AWWA Manual of Water Supply Practices M31 – Distribution Requirements for Fire Protection. The desired minimum flow is 63 Lps @ 140 kPa (1,000 USgpm @ 20 psi; single family residential) although this may not be always available.

Designs must comply with the MOE's "Design Guidelines for Drinking Water Systems 2008", as amended from time to time, and MOE's publication "Water Main Design Criteria for Future Alterations Authorized under a Drinking Water Works Permit, March 2009, as amended from time to time.

With respect to Design Criteria the most rigid criteria will apply, and in no case should any criteria less than regulatory requirements be adopted.

Within a subdivision a second redundant feed will be required in order to minimize customer disruption during a water main repair. As a guide, but totally at the discretion of PUC on a case-by-case basis, no more than 50 units are to be constructed before a second feed is provided. The provision of looping may also be subject to a time limit and/or the requirement to post security equal to the cost of extending the water main.

6.1.2.1 Location

Water Mains:

Water mains shall be located in accordance with the City of Peterborough standard locations as per the drawing entitled "Standard Service Locations for Various Street Allowances". A 4.9 metre offset from the property line is most commonly used in residential subdivisions, however, the width of the proposed pavement and road allowance could affect the water main location. The water main location is normally on the side of the street opposite to that chosen by the City's Utility Services Department for the storm sewer.

The standard location must be followed on straight streets. On curved streets or bends, the water main may deviate from the standard location, but should not deviate from the standard location in either direction by more than 0.3 metres. Where the standard location is exceptionally tight, a 0.6 metre deviation from the standard location towards the centre of the roadway may be allowed, providing the deviation does not conflict with other facilities such as catch basins, gas mains, etc.

Water main pipe shall be laid to a designed grade, so that the proper record is obtained of its vertical position. All water mains shall have a depth of cover of at least 1.8 metres measured from the top of the pipe to the finished grade. For

water mains that are dead-ended, either temporarily or permanently, the depth of cover shall be 2.0 metres minimum for the final 30 metres of pipe. Unless specifically approved in writing, no water main shall be laid with more than 2.75 metres of cover. All temporary or permanent dead end water mains shall have the last five joints restrained.

Water main grades shall be set to minimize high and low points in the distribution system.

Water mains and sewers/sewage works located parallel to each other shall be constructed in separate trenches maintaining a minimum clear horizontal separation distance of 2.5 metres wherever possible. Sewers/sewage works include sanitary sewers and force mains, storm sewers and force mains and all appurtenances and fittings thereto. When conditions prevent a clear horizontal separation of 2.5 metres, a water main may be laid closer to a sewer providing that:

i) The elevation of the crown of the sewer is at least 0.5 metres below the invert of the water main. Such separation shall be of undisturbed or compacted earth.

ii) Where this vertical separation cannot be maintained, the sewer main is constructed of materials with joints equivalent to water main materials and is pressure tested at a pressure of 350 kPa (50 psi) without leakage, using OPSS 701 testing methodology.

Under normal conditions, water mains should cross above sewers with a minimum clear vertical separation of 500 mm to allow for proper bedding and structural support of the water main and sewer main.

When it is not possible for the water main to cross above the sewer, the water main passing under a sewer shall be protected by:

i) Providing a vertical separation of at least 500 mm between the bottom (external) of the sewer and the crown of the water main.

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

iii) Ensuring that the length of water pipe shall be centred at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

Where it is not practical or possible to maintain a 2.5 metre separation between the water main and a manhole or catch basin, the section of water pipe shall be centred opposite the structure such that the joints are at least 2.5 metres from

the nearest surface of the structure. All other factors relevant to design shall be considered, as outlined in The MOE Design Guidelines for Drinking-Water Systems.

No water main shall pass through or come into contact with any part of a sewer or sewer structure, septic tank, tile field, subsoil treatment system or other source of contamination under any circumstance.

Water mains shall, preferably, be terminated opposite the property lines.

Water mains shall be arranged in a looped pattern for mutual support and reliability. Dead ends shall be avoided wherever practicable. Water mains on permanent dead end streets where the water main length, exclusive of looping, would exceed approximately 150 metres (500') shall be looped, where practically possible.

Water main dead ends on permanent dead end streets, where unavoidable and approved by the PUC, generally shall be equipped with a suitably located hydrant at the dead end. Additionally, and at the discretion of the Engineer, a permanent automated flushing station shall be incorporated at the end of the water main. These shall be designed in a manner to alleviate as much as practically possible, the negative affects created by dead end facilities.

Flushing Stations:

The automated, metered flushing station will be direct buried and shall discharge to the sanitary sewer. Appropriate backflow prevention and air gap shall be provided to reduce the potential for a cross connection hazard. The flushing station shall be installed in accordance with PUC Standard Drawing A3073.

Temporary automated, metered flushing stations, if required, shall be installed at the phasing limits of a subdivision until such time as the next phase is connected and placed into service. Charges will be invoiced for all water discharged from flushing stations. Charges will be based on the current Water Utility rate schedule. Wastewater charges may be applicable at the discretion of the City of Peterborough.

Valves:

Valves are generally required at all intersections on the extension of all street lines. At an intersection valves shall be located opposite the property line. Four valves shall be required at each water main cross and three valves are required at a tee intersection. In the case where intersections create short blocks, consideration will be given to valving two of the three intersecting water mains.

Valves shall be distributed so that any section of water main serving approximately 50 dwelling units can be isolated by operating not more than four valves.

Where property lines are not involved or are indeterminate, the valves shall be located so they do not exceed a maximum spacing of 245 metres (800') for valves 150 mm (6") to 300 mm (12") inclusive in a residential area, and can be referenced with respect to certain obvious above-ground facilities. (For commercial and industrial districts the valve spacing shall not exceed 150 metres (500 ft.))

Hydrant valves shall be located 2.75 metres (9') from the hydrant as shown on PUC Standard Drawing A1633.

Hydrants:

Hydrants shall be installed at a spacing not exceeding 150 metres (492') in single family residential districts and not exceeding 75 metres (246') in congested areas, medium and high density areas and commercial or industrial districts.

Hydrants shall, where possible, be placed near street intersections. At street intersections, hydrants shall be installed at least 3.5 metres (12') back from the corner formed by the intersecting street lines and preferably on the flankage or short side of the lot, rather than the frontage or long side of the lot.

All hydrants shall be installed with an isolating valve on the 150 mm (6") branch connection and in accordance with PUC Standard Drawing A1633.

A temporary hydrant may be required for blow-off purposes at the end of the water main, which will be continued into a future phase of the subdivision. This temporary hydrant may be required where the end of the water main is more than approximately 90 metres (300') from the last permanent hydrant. This temporary hydrant may be located on the end of the water main, providing it does not conflict with the other facilities.

A permanent hydrant is required at the end of all permanent dead-end water mains in cul-de-sacs, etc.

As soon as possible after the hydrant has been installed and until the water distribution system is in service, the new hydrant shall be covered with a protective bag clearly marked "Hydrant Out of Service", as approved by the Engineer, and securely fastened to the hydrant, indicating to the public, and the Fire Department, that the hydrant is not in service.

Water Services:

Each individually owned building unit shall have a separate water service extending directly from the water main on public property to the property being serviced.

In locations where the normal water pressure in the water main, adjacent the service connection, is expected to be less than 350 kPa (50 psi), the minimum service size shall be increased to 25 mm (1inch) diameter. Larger services shall be designed by the Developer and the design notes shall be submitted to the Engineer for information.

The minimum diameter of copper water service pipe, assuming a total service pipe length of less than 30 m. (100') shall be:

Single family dwelling	20 mm (3/4") or 25 mm (1")
Semi-detached dwelling	20 mm (3/4") or 25 mm (1")
Duplex	20 mm (3/4") or 25 mm (1")
4-plex	20 mm (3/4") or 25 mm (1")
6-plex	30 mm (1 ½")
12 Unit apartment	50 mm (2")

Pipes on the Customer's property shall be the same or larger than the Commission's service pipe.

For Special Thickness Class 52 ductile iron pipe, the maximum allowable direct tap without a saddle is as follows:

150 mm (6") pipe:	32 mm (1 1/4")
200 - 250 mm pipe (8 to 10"):	38 mm (1 1/2")
300 mm (12") pipe and larger:	50 mm (2")

Any size of tap larger than what is listed above must have a saddle installed similar to that used on PVC pipe.

Wherever possible buried water services shall separated from any building drain or building sewer by not less than 2.5 metres of undisturbed or compacted earth, on the non-driveway side of the lot, preferably on the uphill side of the sewer service, as referenced from the direction of flow of the sewer. (This location is based on a standard sanitary sewer service location in the middle of the lot.) If the sewer service should be located other than the middle of the lot, the water service location shall be reviewed and approved by the Engineer.

The buried water service may be closer than 2.5 metres or be placed in the same trench with the building drain or building sewer if:

i) The bottom of the water service pipe at all points as at least 500 mm above the top of the building drain or building sewer and;
ii) When in a common trench with the building drain or building sewer, the water service pipe is placed on a shelf at one side of the common trench.
iii) The water service pipe is constructed of a single run of pipe with no joints or fittings between the mainstop and the curbstop, or;

iv) The building drain or building sewer is constructed of piping which is pressure tested with a pressure of 345 kPa (50 psi) without leakage, using OPSS 701 testing methodology.

Water services are to be located at least 500 mm away from any driveway unless absolutely unavoidable and approved by PUC. Any water service installed within the driveway location not approved by PUC shall be relocated at the Developer's expense.

Water services shall be installed at right angles to the water main. In the case where the main is not on the straight standard offset or is on a bend, the length of the water service pipe from the curb stop to the main should be noted during construction on the "As built" drawings and additional dimensional information recorded as appropriate for future location of the service.

All water service boxes shall be located on streetline unless otherwise specified. A maximum deviation of up to 300 mm towards curbline of road shall be acceptable. Water boxes shall not be located on private property.

Water boxes installed at non-standard locations shall be corrected at the Developer's expense prior to acceptance. Where a water box is located in excess of 300 mm towards the curb line, the entire water service shall be replaced and water service box installed in the appropriate location.

All water services shall be minimum depth of cover of 1.8 metres measured from the top of the pipe to the finished grade. The depth of the water service shall not exceed 2.4 metres.

New water services shall not have any unions installed between the mainstop and the curbstop. For long side water services on roadways in excess of 20 m (66'), 30 m (100') coils of copper tubing are to be used. If the use of a union is approved, the union shall not be installed under the paved portion of the road.

Upon completion of the installation of water services a 50 mm x 100 mm x 2400 mm wooden marker, 1200 mm in the ground, 1200 mm above ground, shall be placed behind the water service to indicate its location. The top portion of this

wooden marker shall be painted blue to indicate the water service. A sign shall be securely attached to this wooden stake near the top, and facing the street, indicating the municipal address and lot number for each lot or building block being serviced.

Permanent Water Quality Sampling Stations:

As specified by the Engineer, permanent water quality sampling stations shall be installed in a suitable location to allow easy access to the station by PUC staff during routine sampling. The sampling station assembly shall be installed plumb, with free draining material placed around its base, in accordance with PUC Standard Drawing A2421.

The sampling station shall be located on street line unless otherwise specified. A maximum deviation of up to 300 mm towards curb line of road shall be acceptable. Sampling stations shall not be located on private property.

The sampling and purge lines shall be protected by 100 mm PVC casing pipe, filled with sand, from the bottom of the trench to the underside of the sampling station housing. Heat tracing wire shall protect the sampling line and the purge line from the bottom of the trench to the sampling station box.

6.1.2.2 Alignment and Grade

All pipe, fittings, valves, hydrants, and water services, etc., shall be laid and maintained to the required location and grades at the proper location, with joints centred with spigots set according to the manufacturers' instructions and with all valve and hydrants stems plumb. Any variation from line and grade must be approved by the Engineer in writing.

Where it is necessary to raise or lower the pipe due to unforeseen obstructions or other causes, the Engineer may approve of changes to the alignment and/or the grade; changes shall be made by the deflection of joints or by the use of bends. No joints shall be displaced or offset any amount which, in the opinion of the Engineer, will be detrimental to the strength and water tightness of the finished joint.

Water service pipe laying shall not begin until stakes are provided to indicate grade and the centre line of the lot or the boundaries of the lot or the exact location of the service laying line. The location of the water service shall conform to approved drawings.

Errors in water service location and/or grade shall be corrected to the satisfaction of the Engineer at the expense of the Developer.

6.1.3 MATERIALS

PUC Approved Products: A complete current list of approved products and their manufacturers, makes and models is provided in Section 8.0, labeled 'Approved Manufacturer's Products for the Peterborough Water System'.

All water contacting materials used in construction and operation of drinking water systems shall meet all applicable quality standards set by AWWA, and shall meet the latest edition of the consumer safety standards NSF/ANSI Standard 60 and Standard 61. NSF/ANSI Standard 61 products are to be products manufactured after July 1, 2012 and be 'lead-free' as defined by that Standard (≤5ppb leached; ≤0.25% by weight).

6.1.3.1 Pipe

Water main pipe, 150 mm to 300 mm inclusive, shall either be:

Polyvinyl Chloride Pipe

Polyvinyl chloride (PVC) pipe shall be manufactured in accordance with ANSI/AWWA Specification C900-07, Class 150 (DR18) minimum (CSA B137.3-05) or the latest revision thereof. The pipe joint shall be Bell and Spigot slip on joint with rubber rings to ASTM D3139 or the latest revision thereof and shall be supplied in 6.1 m lengths. The pipe is to be supplied from the manufacturer certified to the above specification and also certified by CSA.

The pipe shall be colour coded blue and be marked sufficiently to indicate that it is a water carrying line.

Ductile Iron Pipe

New ductile iron cement-lined pipe, Special Thickness Class 52, manufactured in accordance with ANSI/AWWA Specifications C150/A21.50-08, C151/A21.51-09, C111/A21.11-07 or the latest revision thereof and cement lined in accordance with the ANSI/AWWA Specification C104/A21.4-08 or the latest revision thereof. The pipe joint shall be slip-on joint (Tyton joint) and shall be supplied in 5.5 metre lengths unless otherwise specified, complete with wedges. (min. 3 per joint).

Ductile iron pipe shall be provided with a road salt, sulphate and corrosion resistant protective cover which shall consist of a polyethylene encasement conforming to ANSI/AWWA Specification C105/A21.5-05 or the latest revision thereof. The polyethylene wrap shall be a minimum of 8 mil.

Any exposed metal surface not wrapped with polyethylene encasement shall be coated with two finishing coats of a suitable corrosion resistant mastic (i.e. Sterling Varnish No. 1756 Black Mastic) or wrapped with Denso Tape T-l.

Water main pipe larger than 300 mm diameter shall be concrete pressure pipe, or as approved by the Engineer.

6.1.3.2 Tracer Wire

Where plastic pipe is used, a tracer wire consisting of #14 AWG solid copper, TWU with plastic coat must be installed with the pipe. See Section 6.4.2.2 for sacrificial anodes (cathodic protection) regarding tracer wire.

6.1.3.3 Tracer Wire Connectors

All tracer wire connectors shall be Marr type connectors, brass split bolt connectors or soldered and wrapped with insulating tape.

6.1.3.4 Gate Valves

All gate valves 300 mm and smaller shall be iron body, resilient seated, non-rising stem type, with mechanical joint or flanged ends as required, suitable for a test pressure of 1035 kPa. Workmanship, design, materials and pressure ratings shall conform to the current standard specifications for resilient-seated gate valves (RSGV), ANSI/AWWA Standard Specification C509-09, or the latest revision thereof. Valves shall be supplied with all rings, rubbers/gaskets and hardware required for a complete installation.

Gate valves will be generally installed with a valve box, however, may on occasion be installed in a concrete chamber.

The line valve shall have a 50 mm square operating nut. Valves located in valve chambers shall have the chamber lid core drilled to accept a valve box top section for access. Only valves with O-ring stem seals shall be used.

All gate valves shall open by turning the valve stem in:
Peterborough: clockwise direction (open right) unless stated otherwise.
Lakefield: counter-clockwise direction (open left) unless stated otherwise.

6.1.3.5 Butterfly Valves

All butterfly valves shall be rubber-seated, tight-closing with a high strength cast iron short body to ASTM A-126 Class B, with mechanical joint or flanged ends as required, suitable for a test pressure of 1035 kPa. Workmanship, design, materials and pressure ratings shall conform to the current standard specifications for butterfly valves, ANSI/AWWA Standard Specification C504-06, or the latest revision thereof. Valves shall be supplied with all rings, rubbers/gaskets and hardware required for a complete installation.

All butterfly valves shall open by turning the valve stem in:
Peterborough: clockwise direction (open right) unless stated otherwise.
Lakefield: counter-clockwise direction (open left) unless stated otherwise.

Butterfly valves shall be located in valve chambers. Installation as per Section 6.1.3.6. If approved by PUC a butterfly valve may be direct buried and shall have a 50 mm square operating nut with a full class 150B "underground" operator suitable for direct bury.

The contractor shall supply the PUC with shop drawings of all valves supplied to the project.

6.1.3.6 Valve Chambers

Concrete valve chamber shall be as per OPSD 701 and sized as shown on PUC standard drawings B1682, B1969, B1970, B1810 or B2129. Frame and grate shall be closed cover "Type A" as per OPSD 401.01. Chambers shall have appropriate frost protection.

6.1.3.7 Air Valves

All air release, air and vacuum, and combination air release valves shall have high strength cast iron bodies conforming to ASTM A-126 Class B and ANSI/AWWA C512-07 or the latest revision thereof, designed to be used in service with potable water up to 1035 kPa (150 psi). The float, guide shafts and bushings shall be constructed of Type 304 stainless steel. The model shall be selected to match the application and approved by the Engineer prior to installation. Valves shall be supplied with all rings, rubbers/gaskets and hardware required for a complete installation.

Air valves shall be installed in precast concrete chambers as per OPSD 701 and shown on PUC standard drawing B1779. Frame and grate shall be closed cover "Type A" as per OPSD 401.01.

The contractor shall supply the PUC with shop drawings of all valves supplied to the project.

6.1.3.8 Valve Boxes

Valve boxes shall be cast iron with an inside screw configuration, sized appropriately for the valve and depth of bury. The shaft shall be 130 mm diameter with a No. 6 base. See standard drawing A1633, A2729 or A2733 for installation details.

6.1.3.9 Hydrants

Peterborough: All fire hydrants shall be the compression type fire hydrant manufactured to ANSI/AWWA Specification C502-05 or the latest revision. The size of hydrant shall be 114.3 mm (diameter of opening in main valves seat). The hydrant shall be the two-piece barrel type, complete with two (2) nozzles at 90°, (Peterborough pattern) suitable for standard 63.5 mm hose and one (1) 100 mm pumper connection. The hydrant boot shall have a mechanical joint end suitable for a 150 mm diameter pipe connection to the main. The hydrant shall open left and shall have an O-ring seal. All iron parts of the hydrant inside and outside below the ground line shall be coated with asphalt varnish. The Engineer retains the right to reject any fire hydrant that is not in good new condition.

Lakefield: Same requirements as above except as follows: The hydrant shall be the two-piece barrel type, complete with two (2) nozzles at 180°, suitable for standard 63.5 mm hose and one (1) 100 mm pumper connection.

Hydrants shall generally be self draining and therefore the drain tubes shall not be plugged, unless instructed otherwise.

The hydrant barrel installed below grade is to have a 6 mil (minimum) polyethylene encasement surrounding it from the base to the traffic flange.

6.1.3.10 Fittings

Fittings for 300 mm or smaller water main shall be new compact body ductile iron, cement lined mechanical joint and shall conform to ANSI/AWWA Specifications C153/A21.53-06, C111/A21.11-06 and C104/A21.4-08 or the latest revisions thereof. All fittings shall be supplied with rings, rubbers/gaskets and hardware required for a complete installation.

All fittings used on metal pipe shall be supplied with suitable means of providing electrical conductivity as recommended by the pipe manufacturer. Lead tipped gaskets shall not be used.

Where PVC pipe is used, PVC fittings conforming to ANSI/AWWA Specification C907-04, CSA B137.2 and NSF61 may be used. If PVC fittings are to be used only PVC injection moulded prefabricated fittings are accepted. However, pre-manufactured PVC service couplings are not approved for use.

6.1.3.11 Restrained Joints

Restrained joints may be achieved using appropriate tie rods, restrained harness and/or mechanical joint retainer gland rings, if approved by the Engineer.

Water main installed in areas of engineered fill, will require restrained joints and these can be used on ductile iron and PVC pipe and fittings. All temporary or permanent dead end water mains shall have the last five (5) joints restrained.

6.1.3.12 Tapping Sleeves

All tapping sleeves shall be two-piece type. The outlet half shall have either a recessed flat face flange to mate with a standard tapping valve, or a mechanical joint outlet to mate with a standard mechanical joint gate valve.

6.1.3.13 Couplings

Bolted couplings for water mains 100 mm through 600 mm shall be manufactured with ductile iron sleeves. All construction as per AWWA C219 & NSF61. Products as per approved products list. Only use new bolts.

6.1.3.14 Water Service Materials

Service Saddles (Mandatory use on PVC Pipe):

All service saddles, used on PVC pipe, shall be made of stainless steel band fastened with a double bolt mechanism. The saddles shall be supplied with stainless steel nuts, bolts and non-corrosive washers.

Service Pipe:

Water service pipes up to 50 mm diameter shall be type “K” soft copper tubing annealed, minimum pressure rating of 1035 kPa and shall be in accordance with ASTM Specification B-88 or the latest revision thereof.

Water service pipes over 50 mm diameter shall be ductile iron pipe or PVC pipe meeting the specifications required for water main pipe and fittings.

Service Fittings:

Fittings up to and including 50 mm shall be brass and have compression type joints. For fittings greater than 50 mm the material and joint type shall match that used on the main to which the service connects.

Corporation Main Stops*:*

Corporation main stops shall be manufactured in accordance with AWWA specification C-800-14 or the latest revision thereof. Corporation main stops shall be the ground key type with compression type connections and shall open left.

Curb Stops:

Curb stops shall be manufactured in accordance with AWWA specification C-800-14 or latest revision thereof with compression type connections, O-ring seals and shall open left.

Service Boxes:

Service boxes shall be slide type steel boxes, 1500 mm to 1800 mm length with an 875 mm operating rod.

Unions:

Unions, if acceptable, shall be compression type connection, with minimum pressure rating of 1035 kPa manufactured in accordance with AWWA specification C-800-14 or latest revision thereof.

6.1.3.15 Granulars

Granular A: Crushed rock composed of hard, uncoated, fractured fragments graded to conform to MTO Granular A designation.

Granular B: Select pit-run granular, not requiring crushing, composed of clean, hard, durable uncoated particles graded to conform to MTO Granular B type I designation.

Modified Granular B Type I: Crushed rock composed of hard, uncoated, fractured fragments graded to conform to the City of Peterborough's Modified Granular B Type I designation as follows:

MTO SIEVE DESIGNATION	PERCENT PASSING BY MASS
150 mm	100
37.5 mm	N/A
26.5 mm	N/A
19 mm	N/A
13.2 mm	N/A
9.5 mm	N/A
4.75 mm	25 – 50
1.18 mm	10 – 35
300 µm	5 - 20
150 µm	N/A
75 µm	3 - 8

Maximum particle size not to exceed 57 mm
Modified Granular B Type I shall be a crusher run material

Sand: Screened or pit-run sand composed of clean, hard, durable uncoated particles graded such that 100% passes the 6.7 mm MTO sieve designation and a maximum of 5% by dry weight is retained on the 75 µm MTO sieve designation.

Crushed Stone: 19 mm or 50 mm, as specified, open graded crushed clear stone consisting of sound, clean, durable limestone fragments.

Blended Stone – use, composition and gradation subject to approval of PUC.

Select Backfill Material: Select native material that is free of organics, frozen material, rock pieces that will not pass through a 200 mm diameter ring and other deleterious matter. The material must have a moisture content suitable to obtain the specified degree of compaction for backfill material.

Non-shrink Backfill: All unshrinkable fill shall be standard 28-day with maximum strength of 0.4 MPa as per OPSS 1359.

Thrust Block Concrete: Concrete for thrust blocks shall be ready mixed from a supplier who has an Approved Ready Mix Concrete Operation and shall have a minimum twenty-eight day compressive strength of 20 MPa.

Concrete for Pipe Bedding: Concrete for pipe bedding shall be ready mixed from a supplier who has an Approved Ready Mix Concrete Operation and shall have a minimum twenty-eight day compressive strength of 15 MPa.

6.1.4 EQUIPMENT

This section intentionally left blank.

6.1.5 INSTALLATION

6.1.5.1 Bedding Requirements - Ductile Iron and Concrete Pressure Pipe

Pipes shall be bedded in accordance with the details shown on the drawings or as ordered by the Engineer. Bedding material shall be granular, concrete or crushed stone where indicated, as specified or where directed by the Engineer.

The minimum bedding requirements for cement-lined ductile iron and concrete pressure pipe shall be Class C (ordinary bedding) consisting of laying the pipe on a careful excavated flat bottom trench and backfilling with clean, organic free, carefully selected excavated material. The bottom of the trench shall be excavated in such a manner that the barrel of the pipe shall have a bearing for its full length. The pipe shall be entirely surrounded by carefully selected excavated material, free from organic materials, lumps, stones, stumps, etc.. This material shall be carefully placed in maximum of 300 mm lifts around this pipe to fill the voids and thoroughly compacted to 98% maximum dry Standard Proctor density.

Where the native site material may be injurious to the pipe coating, the pipe shall be bedded on and encompassed by a minimum of 100 mm (4") of a granular backfill material.

Where polyethylene encasement is used, bedding shall be a minimum of Class 'B' unless the existing material is stone free and can be effectively placed and compacted without damaging the polyethylene encasement.

6.1.5.2 Bedding/Backfill Requirements - PVC

Pipes shall be bedded in accordance with the details shown on the drawings or as directed by the Engineer.

The minimum bedding requirements for polyvinyl chloride pipe shall conform to the following specifications:

i) Granular "A" bedding under the pipe to minimum 100 mm in depth and up to the pipe springline, compacted to 98% maximum dry Standard Proctor density;

ii) Sand or Granular “A” from springline to 300 mm above crown of the pipe compacted by a mechanical vibratory plate tamper to 98% maximum dry Standard Proctor density in 150 mm lifts;

iii) Balance of approved backfill shall contain no stones which are more than 200 mm in diameter, and shall be spread in uniform layers of 300 mm compacted to 98% maximum dry Standard Proctor density. Rolling equipment should not be used until a minimum of 1.0 metres of backfill material has been placed over the top of the pipe. If a hydro hammer is to be used to compact the backfill, a minimum of 1.5 metres of cover is required;

iv) Trench width shall be the same as for ductile iron which is shown in the trench reinstatement profiles of the manufacturer's recommendations for installation.

v) When using trench boxes or moveable sheeting, care shall be given not to disturb the pipe location or compacted backfill material up to springline of pipe.

6.1.5.3 Water Service Bedding

All copper service pipes shall be bedded and covered with screened sand to a minimum of 100 mm surrounding the pipe and compacted to 98% of Standard Proctor density.

6.1.5.4 Crushed Stone Bedding

Where directed by the Engineer, crushed stone shall be used for additional bedding under pipes for refilling the bottom of the trench where additional excavation has been made, due to unsatisfactory foundation conditions.

Crushed clear stone (19 mm) bedding, where required, shall be placed and wrapped in non-woven geotextile filter fabric, in the trench to form a bed for the pipe and shall be consolidated to a firm condition. After the stone is placed, the pipe shall be bedded as per bedding requirements for the type of pipe. See City of Peterborough drawing CPD410.02.

6.1.5.5 Handling Water Main Pipe and Fittings

General:

All materials shall be supplied, delivered, stockpiled and distributed at the site by the Contractor. Pipe, fittings, valves, hydrants and accessories shall be loaded by lifting with appropriate equipment so as to avoid shock or damage as recommended by the manufacturer of the material. Under no circumstances shall such materials be dropped.

Keep material safe and clean at stockpile location.

Stored pipe shall, at all times, be supported on sand bags or other nonabrasive support placed under the end of the pipe. Bags shall be of sufficient size to

prevent contact of the pipe coating with the ground or any obstruction. Rolling the pipe on coated surface will not be permitted.

In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pipe shall be handled so that the pipe, pipe coating or pipe lining will not be damaged. If, however, any part of the coating or lining is damaged, the repair shall be made by the Contractor to the satisfaction of the Engineer.

Ductile Iron Pipe, Polyvinyl Chloride Pipe and Fittings:

The pipe shall be handled, hauled and placed, using wide slings and padded cradles of canvas, leather or other suitable material so designed and constructed as to prevent damage to the pipe or pipe coating. The use of bare metal cables, chains, hooks or other equipment which might injure the pipe or pipe coating will not be permitted.

6.1.5.6 Depressurized Water Main Hazard

To be controlled by the Contractor: When the Contractor requires a water main to be depressurized PUC cannot guarantee a full shut down of the valve(s). Therefore the Contractor shall verify the depressurization of the pipe by providing an open point to atmosphere at all times.

A request for water main isolation shall be made as per the Valve Operating Report and signed by the Contractor and PUC's Operator.

Payment for work completed as part of this Special Provision will be assumed to be included in the unit prices provided. No extra claim will be entertained.

6.1.5.7 Pipe Installation

All pressure pipe and associated fittings, before being lowered into the trench shall be thoroughly cleaned of all materials which may have accumulated inside the pipe or in the joints. Pipe shall be carefully examined for cracks and flaws and no defective pipe or fittings shall be used in the work. Initial disinfection of the pipe as described in Section 6.1.6.5 shall be performed just prior to pipe installation.

Pipe shall be laid and all joints made in a manner approved by the Engineer and as recommended by the manufacturer of the material. All tees, bends, etc., shall be securely braced or stayed by the Contractor against draw or blow out and the Contractor shall be liable for any damage or repairs arising from any draw or blow out, etc, occurring in the mains he is laying, has laid or to which he is making connections. The means of providing electrical conductivity shall be installed as recommended by the manufacturer of the pipe.

6.1.5.8 Plugging Pipe

An easily removable water-tight stopper shall be inserted in the end of every pipe as it is being laid so as to prevent entry of foreign materials, contaminated trench water, rodents, etc.

During all phases of the pipe laying operation, the water main pipe in the trench shall be protected with a watertight plug or stopper. At the close of each day's work or when work ceases for any reason, special care shall be taken to protect the stopper so that it cannot be inadvertently removed.

6.1.5.9 Cleaning Pipes and Wiping Joints

Each pipe shall be kept clean at all times and care shall be taken by the Contractor to prevent any materials or debris from entering the pipe while stored at the site, during and after laying operations. The end of the pipe shall be plugged each time the laying operations are suspended and preventative measures in this connection shall be such as will meet the approval of the Engineer.

All pressure pipe, before being lowered into the trench shall be thoroughly cleaned of all materials which may have accumulated inside the pipe or in the joints. All pipes and castings shall be carefully swept and cleaned and all spigots and sockets shall be wiped so they are clean and dry. No joint shall be made unless these are perfectly dry and clean. All open branches and ends of the pipe shall be plugged at night and at lunch hours. A proper door or plug shall always be kept in front of the pipe to prevent any foreign substance from entering the pipe.

The Contractor shall ensure that each pipe and casting is clean and perfect in all respects and has no foreign substance in it when laid; they shall be held responsible for any neglect in this respect, as well as for any damage done to the pipe or other articles or material, until the completion of the contract, and from any damage of whatever nature, caused by their operations or neglect.

6.1.5.10 Laying and Jointing - Ductile Iron Pipe

Pipes shall be handled carefully by approved methods so as to avoid damage to the pipes, either by transit, unloading, storage or moving to the final location and placing. Pipe bedding and backfill shall be in accordance with PUC standard drawing A1769.

Special care shall be taken to ensure that the pipes are well bedded as per specification on a solid foundation and any defects due to settlement shall be made good by the Contractor at their own cost and expense. The bottom of the

trench shall be shaped so as to ensure the surface of the pipes have an even bearing throughout their entire length, without causing strain on the spigot.

Mechanical joints or their equivalent shall be made by the Contractor to the satisfaction of and under the supervision of the Engineer. All bolts, nuts, couplings, rubber rings and connecting pieces must be thoroughly cleaned and the ends of the connecting pieces coated with pipe soap, as supplied by the manufacturer, (the use of cup grease or machine oil is not permitted) so that the rubber rings will fit tightly and correctly in place when the couplings are bolted together.

At each joint, the spigot shall be centrally located in the bell. The surface with which the rubber gasket comes in contact shall be thoroughly cleaned to remove any loose rust or foreign material. The gasket may be rinsed in soapy water prior to being placed on the pipe end. The bolts shall be lubricated and the nuts shall be tightened alternately so that the gland is brought up evenly toward the pipe flange. The nuts shall be tightened in three or more stages and the final tightening shall be done by ratchet wrenches of the torque limiting type with indicators to apply a torque on each bolt of approximately 100 Newton-metres.

If any gaskets are damaged or gland rings broken, due to improper jointing procedures, they shall be replaced at the Contractor's expense.

"Tyton" joints shall be made in accordance with the pipe manufacturer's instructions. The Contractor shall assemble all joints carefully, as follows:

i) Clean bell, spigot and gasket. Flex the gasket and place in bell with bulb entering first.

ii) Locate the gasket groove on its retaining bead. Bed gasket heel firmly in seat.

iii) Ensure gasket seats snugly around whole circumference. Remove bulges that might interfere with proper entry of spigot end. In large diameters, this may be assisted by forming a second loop in the gasket, opposite the first. Press loops flat one after the other.

iv) Apply thin film of lubricant to surface of gasket which will come in contact with entering spigot. Lubricate outside surface of spigot for about 25.4 mm (1") from the end.

v) Align spigot end of pipe being jointed. Carefully enter spigot into bell until it just makes contact with the gasket.

vi) Complete entry of spigot into bell by pushing against bell end of entering pipe with a crowbar or a spade, until the second painted strip is approximately flush with bell face.

When the pipe is cut in the field, the cut end shall be conditioned as recommended by the manufacturer by filing or grinding a small taper at about 30° to remove any sharp, rough edges which might otherwise injure the gasket.

The pipe and fittings shall be supplied with suitable means of providing electrical current conductivity. The method used to obtain electrical continuity shall be as per the pipe manufacturer's recommendation.

Where serrated bronze wedges are used, the Contractor shall install three at each pipe joint. The method of producing electrical continuity shall be approved by the Engineer.

All phases of construction shall be in accordance with the current standards recommended by the pipe manufacturer, except as otherwise specified.

6.1.5.11 Laying and Jointing - Concrete Pressure Pipe

The Contractor shall install pipe to the manufacturer's specifications and as indicated by the manufacturer's approved shop drawings. The Contractor shall submit shop drawings to the Engineer for approval and shall not deviate from the drawings unless previously approved by the Engineer.

Joint deflection shall not exceed the manufacturer's allowable in any circumstance.

Special care shall be taken to ensure that the pipes are well bedded on a solid foundation and any defects due to settlement shall be made good by the Contractor at their own cost and expense. The bottom of the trench shall be shaped as detailed so as to ensure the surface of the pipes having an even bearing throughout their whole length.

Joints shall be prepared by the Contractor in accordance with the pipe manufacturer's requirements.

6.1.5.12 Laying and Jointing - PVC Pipe

The Contractor shall use proper handling procedures for PVC pipe and chains or cables shall not be used in lifting pipe. Special care in pipe handling shall be employed during freezing temperatures. Bedding and backfill shall be in accordance with PUC standard drawing A1769.

The trench bottom shall be prepared to provide firm, stable support throughout the full length of the pipe, as per specification, with no stones exceeding 20 mm in diameter present. Bell holes shall be provided to properly achieve this support. The Contractor shall keep the trench width at the pipe level to the minimum to achieve proper compaction adjacent to the pipe. Where possible, pipes shall be

laid with bell ends facing the direction of laying. Pipe lengths shall not be deflected in excess of manufacturer's recommendations.

For a bell and spigot joint, the pipes shall be joined to the depth indicated on the pipe or to manufacturer's requirements. The gasket shall be carefully fit into the bell groove and the spigot shall be lubricated using manufacturer supplied lubricant suitable for use in potable water applications. The Contractor shall ensure that the bell, spigot and gasket are clean and free of imperfections.

A wooden block shall be used when levering the pipe. The Contractor shall not pry directly against the PVC pipe. Mechanical equipment shall only be used for joint construction when recommended by the manufacturer and approved by the Engineer.

When pipe is field cut a bevel of approximately 15 degrees shall be put on the spigot end.

6.1.5.13 Polyethylene Encasement for Ductile Iron Pipe

The Contractor shall install polyethylene encasement as specified. Polyethylene encasement shall be in accordance with ANSI/AWWA C105/A21.5-93. Installation shall conform to either Method "A" or "B" as outlined in this section.

The polyethylene encasement shall prevent contact between the pipe and the surrounding backfill and bedding material but is not intended to be a completely air and watertight enclosure. Overlaps shall be secured by the use of adhesive tape, plastic string, or any other material capable of holding the polyethylene encasement in place until backfilling operations are completed.

Method "A"

i) Cut polyethylene tube to a length approximately 610 mm longer than that of the pipe section.

ii) Slip the tube around the pipe, centre it to provide a 305 mm overlap on each adjacent pipe section. Bunch it accordion-fashion (length-wise) until it clears the pipe ends.

iii) Lower the pipe into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at the joints to facilitate installation of the polyethylene tube.

iv) After assembling the pipe joint, make the overlap of the polyethylene tube. Pull the bunched polyethylene from the preceding length of pipe, slip it over the end of the new pipe section and secure the overlap. Pull the polyethylene from the new pipe section over the end of the first wrap until

it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack (width-wise) to make a snug, but not tight, fit around the circumference of the pipe along the barrel of the pipe, securing the fold at quarter points with appropriate ties, a minimum of 4 per 5.5 metre length.

v) Repair any rips, punctures, or other damage to the polyethylene with adhesive tape or with a short length of polyethylene tube to be cut open, wrapped around the pipe, and secured in place. Proceed with installation of the next section of pipe in the same manner.

Method "B"

i) Cut the polyethylene tube to a length approximately 300 mm shorter than that of the pipe section. Slip the tube around the pipe; centre it to provide 150 mm of bare pipe at each end. Make polyethylene snug around the circumference, but not tight; secure ends as described for Method "A".

ii) Before making up a joint, slip a 1.0 metre length of polyethylene tube over the end of the preceding pipe section bunching it (length-wise) accordion-fashion. After completing the joint, pull the 1.0 metre length of polyethylene over the joint, overlapping the polyethylene previously installed on each adjacent section of pipe by at least 300 mm.

iii) Make snug around the circumference and secure each end as described for Method "A".

iv) Repair any rips, punctures or other damage to the polyethylene as described for Method "A".

Pipe-Shaped Appurtenances

Cover bends, reducers, offsets and other pipe-shaped appurtenances with polyethylene in the same manner as the pipe.

Odd-Shaped Appurtenances

When valves, tees, crosses and other odd-shaped pieces cannot be wrapped practically in a tube, wrap with a flat sheet or split length of polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seam by bringing the edges together, folding over twice and taping down.

Make snug around the circumference and overlap at joints as described in Method "A". Tape polyethylene securely in place at valve stem and other penetrations.

Openings in Encasement

Provide openings for branches, service taps, blow-offs, air valves and similar appurtenances by making an X-shaped cut in the polyethylene and temporarily folding back the film. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene with tape.

Junctions between Wrapped and Unwrapped Pipe

Where polyethylene-wrapped pipe joins an adjacent pipe that is not wrapped, extend the polyethylene wrap to cover the adjacent pipe for a distance of at least 600 mm. Secure the end with several turns of tape around the circumference of the pipe.

Backfill for Polyethylene-Wrapped Pipe

Use the same backfill material as that specified for pipe without polyethylene wrapping, exercising care to prevent damage to the polyethylene wrapping when placing the backfill. Backfill material shall be free from cinders, refuse, boulders, rocks, stones or other material that could damage polyethylene.

6.1.5.14 Tracer Wire Installation

Tracer wire shall be installed on all plastic pipe installed, including all plastic services and hydrant leads.

The wire is to be laid along with the pipe in the trench and strapped to the top of the pipe with tape (Denso tape or equal) at intervals not exceeding 3.0 metres. The wire is to be brought to the surface at all hydrants through a 12 mm polyethylene or PVC pipe strapped to the outside of the hydrants and at all mainline valve boxes. The tracer wire shall be connected to the hydrant boot and ground flange as per PUC standard drawing A1633, A2729 or A2976. A continuous length of wire is to be used between surface points. The wire shall be taped to the outside of the valve box so as not to interfere with the operation of the valves. If the valve box does not have a pre-manufactured hole drilled in the top for tracer wire access then a groove shall be cut in the top of the valve box just under the lid to enter the tracer wire. Any wire joints made at tees etc., shall be made with Marr connectors, brass split-bolt connectors or solder and then wrapped with insulating tape to inhibit corrosion of the wire. Cad weld to fittings and DI pipe ends. Spray coat all exposed connections. Connect tracer wire under valve bolt nut. Do not remove epoxy coating.

Tracer wire used in conjunction with non-metallic water services (20 mm to 50 mm) shall be connected to the electrical grounding tail nut tracer wire terminal on the curb stop and main stop.

Upon completion of the water main and water services the tracer wire shall be tested for continuity by an independent consultant (approved by the PUC) at the Contractor's expense. The Contractor shall provide the Engineer with a continuity report. Any indication of a break in continuity shall be repaired at the Contractor's expense.

6.1.5.15 Changes in Line or Grade

Changes in line or grade of 11.25 degrees or more shall be made with specially fabricated bends. Deflections of less than 11.25 degrees shall be made by pipe joint deflections. Pipes shall not be deflected either vertically or horizontally in excess of that recommended by the manufacturer.

6.1.5.16 Setting Valves in Water Mains

All valves shall be furnished with mechanical joints or flanged ends. The valves and connecting piping shall be accurately aligned and supported to prevent subsequent movement and strain at the joints.

All bolts, nuts, couplings, rubber rings and connecting pieces shall be new and thoroughly cleaned. The valves shall be supported on the blocks as shown on the drawings.

6.1.5.17 Setting Air Relief Valves and Other Appurtenances

The Contractor shall install air relief valves and all other small appurtenances and jointing materials as detailed on the drawings or as required by the specifications.

6.1.5.18 Hydrant Installation

The Contractor shall install fire hydrants of the type and at the locations where shown on the drawings or as directed by the Engineer on a 150 mm diameter lead of pipe material similar to the main. The hydrants shall be valved with a 150 mm gate valve and box, as specified. Hydrants are to be installed in accordance with PUC standard drawing A1633, A2729 and A2976. The hydrant barrel installed below grade is to have a 6 mil polyethylene encasement surrounding it.

The work shall include all material including stone and concrete, excavation, backfilling, and all labour necessary to install the hydrant, valve, valve box, branch connecting pipe, concrete thrust blocks or restrained joints from tee to hydrant, all as specified herein. The hydrant shall be securely supported to prevent drawing off from the pipe, by blocking solidly between the hydrant and solid earth with concrete.

Where existing soil conditions are impervious, such as clay, the base of each hydrant shall be packed around with not less than 0.5 cubic metres of 19 mm crushed stone and to at least 100 mm in height. No drainage pit is required where the soil is free draining sand or gravel.

The hydrant shall be installed to a grade that the breakaway is 75 mm to 225 mm above the final surrounding grade. The Contractor shall install any hydrant and isolation valve box extensions required.

6.1.5.19 Installation of Service Connections

The Contractor shall install water services as indicated on the drawings or directed by the Engineer. The work shall include all excavating, bedding, pipe-laying, backfilling, compacting, installation of materials, anode supply and installation, etc., necessary to construct complete private water service connections from the main to the property line. Water services shall be installed in accordance with PUC standard drawing A1636 or A2269. As per pipe manufacturer's recommendations, all water service taps to be wet-tapped regardless of material.

The Contractor, unless otherwise directed by the Engineer, shall pressure (wet) tap the water main to receive the main stop at a point opposite the horizontal centre line of the main. Sufficient slack (a "horizontal gooseneck" of at least one (1) metre in length) shall be left in the service pipe to allow for any settlement of the backfilling material. Joints between the fittings and pipe shall be made watertight.

PVC pipe tapping shall be a pressure tap with line valves only cracked open to maintain line pressure but reduce the flow of water should a problem arise. All services installed on PVC pipe shall use a saddle designed for the application and a safety blanket shall be used during the tapping operation.

Care shall be taken to ensure the curb stop valve boxes are set vertical with the tops level with the ground. All services shall be laid at a depth of 1800 mm below the proposed ground surface unless otherwise directed. Refer to plan A2732 for anode connection detail.

Unions will not be permitted in new water services from main to property, without approval of the Engineer.

Contact the Water Division of Peterborough Utilities for requirements specific to the service extension from property line to and into the house, including water meter requirements and the activation or shut-off of a service.

Water service shut-offs at the property line are the property of the Commission and shall be operated only by PUC employees. The Public Utilities Act

specifically forbids the turning on or off of water service shut-offs without the approval of the PUC, except in the case of accident or for the protection of the building to prevent flooding.

6.1.5.20 Material for Backfilling

The excavations and trenches shall be backfilled with specified backfill materials, unless otherwise specified. Approved backfill materials as previously described to be used and compacted to City of Peterborough specifications.

6.1.5.21 Exposed Metal Surfaces

Any exposed metal surfaces not embedded in concrete or wrapped with polyethylene shall be painted with two (2) finishing coats of No. 1756 Black Mastic, from Sterling Varnish. The application rate with two coats shall be twenty (20) mils. The mastic shall be applied only to clean dry surfaces with temperatures of 45°F (7.2°C) or over and the Contractor shall warm areas to be painted if required. Suitable ventilation of the area shall be provided. During winter conditions, a comparable low temperature mastic shall be used.

6.1.5.22 Thrust Blocks/Restrained Joints

Concrete thrust blocks or approved restrained joints shall be required behind all bends 11.25 degrees and over, tees, hydrants, plugs, etc. The concrete shall be installed in such a way, that the concrete is placed behind the bends, etc., but not around or overtop of the glands, nuts and bolts. A polyethylene bond breaker shall be placed between the thrust block and fitting/hydrant, etc. The concrete shall be placed so as to transfer the thrust to solid undisturbed ground adjacent to the bend.

The surface area for the thrust blocks against solid undisturbed ground for the various piping shall be as follows:

Thrust Block Areas in Square Metres (Soil Bearing Pressure 50 kN/m2)

	150 mm	200 mm	300 mm	400 mm
Behind Hydrant	0.50 m2	0.50 m2	0.50 m2	0.50 m2
“T” or Plug	0.50 m2	0.86 m2	1.83 m2	3.18 m2
90° Bend	0.760 m2	1.214 m2	2.502 m2	3.18 m2
11.25° Bend Horizontal	0.097 m2	0.168 m2	0.358 m2	-----
22.5° Bend Horizontal	0.194 m2	0.335 m2	0.716 m2	0.716 m2
45° Bend Horizontal	0.382 m2	0.656 m2	1.400 m2	-----

All connections, caps, bends, etc., which are liable to "draw" or blow out, shall be securely stayed with concrete, as directed, to the satisfaction of the Engineer, and without any extra remuneration to the Contractor. The Contractor shall be liable for any damage caused by the drawings or blowing off of any such connection, caps, or bends or for any damage caused by blow outs, etc., of any pipe with which they are making the connection.

Restrained joints in lieu of concrete thrust blocks for hydrants and fittings will be considered, subject to Engineer's approval. When utilizing restrained joint devices, the water main joints shall also be restrained (2 joints either side of fitting being restrained).

6.1.5.23 Victaulic and Dresser Couplings

Victaulic and Dresser couplings, if required and approved by the Engineer, shall be supplied by the Contractor and installed in accordance with manufacturer's specifications.

The pipes shall be cleaned and dried and the rubber gaskets shall be lubricated with lubricants approved by the manufacturer. The coupling shall be carefully assembled. The bolts shall be tightened using a torsion wrench of the correct torsion as recommended by the manufacturer of the couplings.

6.1.5.24 Mechanical Joint Retaining Glands

Where mechanical joint retaining glands may be required on the water main, the Contractor shall supply and install the retaining gland rings in place of the regular gland rings.

6.1.5.25 Tie Rods, Steel Straps, Etc.

Where tie rods, steel straps, anchor rods and steel beams are required, as shown on the plans, or required by the specifications, the Contractor shall supply and install the tie rods, threaded as required, complete with nuts and shall supply and install the necessary steel straps, anchoring rods and steel beams required for thrust blocks. All materials to be stainless steel, unless approved otherwise by PUC's Engineer.

6.1.5.26 Connection to Existing Pipes

All connections to existing pipes must be made at times that have been agreed upon with the PUC's Water Department Superintendent and the tapping of all existing water mains shall be carried out by PUC Water Department personnel.

6.1.5.27 Locate Works for Tie-Ins

The Contractor shall be responsible, as part of the cost of the excavation and installation of the various works, to locate and uncover all existing utilities including existing water mains that they are to tie into, sufficiently in advance of the actual tie-in so that the alignment or grade of the new pipe being laid can be altered, if necessary, or other arrangements made, to accommodate the existing in place piping.

6.1.5.28 Customer Notification of Water Interruptions

All customers supplied by mains to be shut down shall be notified by the Contractor prior to the interruption of the water supply. Where the Contractor is allowed to have the water turned off in existing mains to make connections, they shall notify the Fire Department and the customers in the affected area at least 24 hours in advance of the water interruption and indicate the anticipated duration of the shut-off. The operation of the existing valves to shut off and/or charge water mains shall be carried out by PUC Water Department personnel.

6.1.5.29 Leakage from Existing Mains

The Contractor shall not hold PUC liable for leakage from existing mains or services.

6.1.5.30 Chlorination Lines

The Contractor shall provide the necessary chlorination lines to perform chlorination as specified. The Contractor shall remove the mainstop and plug the pipe orifice with a brass plug once the bacteriological results meet specification and there is no further need for the line.

6.1.5.31 Temporary Water Services

The Contractor shall provide temporary water services to adjacent properties affected by the Work. Short duration water shutdowns, where proper notice has been given, is acceptable where there are no major objections from the affected parties.

6.1.5.32 Bacteriological Sampling Line

The Contractor shall provide necessary bacteriological sampling lines as specified by the Engineer. The Contractor shall remove the mainstop and plug the pipe orifice once the bacteriological results meet specification and there is no further need for the line.

6.1.5.33 20 mm Chlorination/Bypass Test Point

The Contractor shall supply and install chlorination/bypass test points complete with a reduced pressure zone (RPZ) double check backflow preventer at all tie in locations or as directed by the Engineer. The work shall include all excavation bedding, pipe laying, backfilling, compaction, installation of materials necessary for a complete installation. The bypass arrangement shall be installed in accordance with PUC drawing A3004. During freezing conditions the by-pass shall be properly protected and insulated. The use of double curb stops may be required at the discretion of the Engineer. Once the bacteriological results meet specification the by-pass shall be removed and the pipe orifice plugged. The Contractor shall provide the Engineer with certification of testing of the back flow preventers prior to commissioning this bypass arrangement.

6.1.5.34 Water Quality Sampling Station

The Contractor shall install water sampling stations as indicated on the drawings or as directed by the Engineer. The work shall include all excavation, bedding, pipe laying, backfilling, compacting and installation of materials necessary for a compete installation. Sampling stations shall be installed as per PUC drawing A2421. All water main taps shall be as per section 6.1.5.19.

6.1.5.35 Water Main Construction Signs

Where required PUSI shall supply 6' (1.8 m) x 4' (1.2 m) water main construction signs. The Contractor shall install and remove these signs in locations designated by the Engineer. The installation shall be by free standing method utilizing sand bags or excavated in place or buried method using 4" (100 mm) x 4" posts. Installation method to be determined by the Engineer.

6.1.5.36 Insulation

The contractor shall supply and install insulation on all water main at tie in locations with less than 1.8 m of cover. The work shall include all excavation, bedding, high density rigid polyurethane foam half shell insulation complete with an outer urethane skin, backfilling, compaction and installation of materials necessary for a complete installation. The insulation shall be installed in accordance with PUC Drawing A3006.

6.1.6 QUALITY ASSURANCE

6.1.6.1 Defective Pipes or Castings, Etc.

No pipes, special castings, or valves shall be laid or installed which are known or may be found to be defective or which have been injured in handling. If any

defective pipe, valve or casting shall be found to have been installed, it shall be removed, and a good one put in its place, at the Contractor's expense. All pipes and specials shall be examined by the Contractor, prior to unloading.

6.1.6.2 Connections to Existing Activated Water Mains

PUC Water Department licensed operators shall, unless otherwise agreed to in writing, carry out the tapping of all existing activated water mains at the expense of the Contractor. This includes the actual tapping of the tapping sleeves and valves and the tapping for additional water services or water mains in active service. The Contractor will, however, be required to provide the materials and to excavate, backfill, compact, etc., and carry out all other work required in connection with the installation, except for the actual operation of the tapping machine itself (i.e. the Contractor is to clean and prepare the pipe and put the tapping sleeve and valve in place, ready for tapping). The tapping shall be carried out at the Contractor's expense for private developments.

The Contractor shall make arrangements for the tapping with the Water Department Superintendent at least 72 hours in advance of the time they propose to carry out the tapping of the water main.

6.1.6.3 Water Main Valve Operation

Once the new water system has been installed, pressure tested, disinfected, flushed, passed bacteriological testing and put into active service, the Contractor **shall not operate** existing or newly activated water main valves, hydrants and services.

If the Contractor requires a valve shut-off or turned on, which will affect the status of the water mains or hydrants that are charged, they shall request the PUC Water Department personnel to operate the water system. The Contractor shall make arrangements, 48 hours in advance of the pre-planned work with the PUC Water Department personnel. In the case of emergencies, the nature and extent of the emergency will govern the notification to customers. In all cases, the customers should be informed of the situation and given some information as to when they can expect service to be restored. At present, there is no charge by the PUC Water Department for this service during regular working hours, but PUC summer hour schedule may affect the availability of licensed operators.

6.1.6.4 Use of Water and Hydrants

Treated water for construction purposes shall be furnished under the provisions of this clause from the nearest appropriate hydrant. Water required for cleaning, testing, and chlorination purposes may be obtained free of charge from the Commission waterworks system. All water used shall be drawn only at times and in a manner approved by the Engineer.

Contractors will be allowed to obtain water from the fire hydrants provided they supply themselves with a reducer, a control valve, and an approved and tested reduced pressure zone backflow prevention device, which must be operated for this purpose. The valves must be maintained in perfect working order the whole time the work is under construction. If at any time during the construction of the work the Engineer finds that the control valves are out of order, and cannot be operated so as to turn on and off they must immediately close the hydrant valve, and keep it closed until the control valves have been repaired or a new valve in good order substituted.

A PUC Water Department licensed operator shall open the main valve of the hydrant in the morning and close it at night, removing the reducer from the hydrant at the same time. **On no account** shall the Contractor or their employees be allowed to open and shut the hydrant valve. Any infringement of this rule shall render the Contractor liable to charges being laid to the full extent of the law, as well as potential actions by the Ministry of the Environment.

Where the Contractor desires to use water from a Commission hydrant, they must first obtain a written permit from the Engineer. Any hydrant found damaged on the line of the works after they have been commenced, shall be made good by the PUC at the Contractor's expense.

6.1.6.5 Initial Swabbing and Disinfection

When the water pipe is installed, it shall be as free as possible of all foreign matter. The interior of the pipe shall be cleaned and swabbed with bactericidal solution, approved by the Engineer, immediately prior to laying. A 0.1% chlorine solution (1000 mg/L) shall be used for swabbing the pipe.

Swabbing shall be carried out using a suitable foam swab at least 300 mm long and at least 50 mm larger in diameter than the diameter of the water main. Care shall be taken to keep the swab free of exterior contamination by providing a proper support arrangement while the swab is not in use.

6.1.6.6 Final Swabbing

The entire pipeline shall be swabbed after installation, filling and water service tapping, in accordance with the latest revision of AWWA C651. The Contractor shall determine the swabbing protocol prior to pipe construction and it shall be approved by the Engineer. The swabs shall be strategically placed in the pipe at no more than 300 metre intervals to thoroughly swab the entire pipeline, not including hydrant branches, prior to disinfection. The foam swabs shall have a density between 1.33 and 1.44 lbs/ft^3 and be sized at least 50 mm (2") greater than the inside diameter of the largest sized pipe being cleaned. The swabs shall be passed through the entire length of the completed pipeline, with a potable water feed, at a rate not exceeding 0.5 metres per second (1.5 ft/s).

6.1.6.7 Hydrostatic Testing

Pressure Test:

After the pipe has been laid and backfilled and all services, hydrants, blow-offs, have been installed, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1034 kPa (150 psi) pressure at the point of testing. New water mains shall be pressure tested in sections of approximately 500 metres (1/3 mile) and between appropriately located valves and hydrants. Testing of any length greater than 500 metres is subject to PUC's approval.

Pressure tests shall:

- Not be less than 1034 kPa (150 psi).
- Not exceed pipe or thrust restraints design pressures.
- Be of at least three (3) hour duration.

Where any section of pipe is provided with concrete anchorage, the hydrostatic pressure tests shall not be made until at least five (5) days have elapsed after the concrete was installed. If high-early-strength cement is used in the concrete, the hydrostatic tests shall not be made until at least two (2) days have elapsed.

The Contractor shall test the new water main, where possible, in isolation from any existing mains and shall supply the filling supply hose and an approved and tested 50 mm backflow prevention device for use from a hydrant water supply point.

Each section of pipe shall be slowly filled with water, allowing the air to escape. After the pipe has been filled with water at normal system pressure, it shall be left at normal system pressure for a period of at least 24 hours prior to carrying out of the pressure and leakage tests. The specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. The testing equipment comprised of the pump, storage tank, pressure gauge, relief valve, check valve and pipe connection and all necessary apparatus shall be furnished by the Contractor, who shall carry out the tests at their expense. The Engineer reserves the right to check the Contractor's pressure gauge against a suitable test gauge.

The Contractor shall provide and install the necessary piping to connect to the main.

Before applying the specified test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks so that the air can be expelled as the line is filled with water. After the air has been expelled, the corporation cocks shall be closed and the test pressure applied.

The water supplied for these tests shall be potable water and all containers used to handle it must be clean and sterilized before use.

During the pressure test, the surface of the water main trenches shall be checked for visible leaks and any obvious leaks should be fixed before the leakage test is made.

Any cracked or defective pipe, fittings, valves, or hydrants discovered in consequence of this pressure shall be removed and replaced by the Contractor with sound material and the test shall be repeated until satisfactory to the Engineer.

Leakage Test:

After the pipe has been laid and backfilled and all services, hydrants, blow-offs, etc., have been installed, all newly laid pipe or valved sections thereof, shall be leakage tested in sections of approximately 500 meters (1/3 mile) between appropriately located valves and hydrants.

The Contractor shall notify the Engineer at least 48 hours prior to the execution of the leakage tests. Testing shall be carried out during the PUC's regular working hours.

The leakage test may be conducted with the pressure test or after the pressure test has been satisfactorily completed.

The leakage test shall be applied for a minimum period of three (3) hours and during the test, the pipe shall be subjected to a test pressure of 1034 kPA (150 psi).

Leakage shall be defined as the quantity of water measured in litres that must be supplied into the newly laid pipe to maintain 1034 (150 psi) test pressure within 35 kPa (5 psi) after the air in the pipeline has been expelled and the pipe has been filled with water. The allowable leakage is defined by the formula:

$$L = \frac{N \times D \times \sqrt{P}}{130{,}400}$$ where $\sqrt{P}$ = the square root of P

WHERE: L is the allowable leakage in litres per hour
N is the number of joints in the length of the pipeline being tested
D is the nominal diameter of the pipe in millimetres
P is the average test pressure in kilopascals

During the leakage test, the amount of water pumped into the main shall be measured by the reduction in volume in the storage tank or by a water meter.

Readings shall be taken by the Engineer at 30 minute intervals over a period of 3 hours.

When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0014 L/mm/hr (0.0078 gal/hr/in) of nominal valve size shall be allowed. No allowable leakage shall be allowed for closed resilient seated gate valves.

When hydrants are in the test section, the test shall be made against the closed hydrant. Acceptance shall be determined on the basis of allowable leakage.

If the actual leakage for the 3 hour period exceeds calculated allowable leakage, the Contractor shall, at their own expense, locate and repair the defective joints, retest, etc., until the leakage is within the specified allowance. All visible leaks are to be repaired regardless of the amount of leakage.

6.1.6.8 Flushing and Disinfection of New Water Mains

When the Contractor has completed the installation of the water mains and has carried out satisfactorily, the specified pressure and leakage tests thereon, they shall thoroughly flush and disinfect the system in sections of approximately 500 metres and between the valves or plugs in a manner approved by the Engineer, at their own expense, as follows:

Initial Flushing:

The main shall be thoroughly flushed prior to disinfection at a flushing velocity of not less than 0.75 m/s (2.5 ft/s). The rate of flow required to produce this velocity in various diameters of water main is shown on the following table:

REQUIRED OPENINGS TO FLUSH PIPELINES (275 KPA – (40 PSI) RESIDUAL PRESSURE					
Pipe Size (mm)	Flow Required to Produce 0.75 m/s (2.5 fps) Velocity Litres/Second	Cubic Metres/ Minute	Orifice Size (mm)	Hydrant Outlet Nozzles	
				Number	Size (mm)
100 (4”)	7 (100 USGPM)	0.38	24 (15/16”)	1	62.5 (2 ½”)
150 (6”)	14 (220 USGPM)	0.83	35 (1 3/8”)	1	62.5 (2 ½”)
200 (8”)	25 (390 USGPM)	1.48	48 (1 7/8”)	1	62.5 (2 ½”)
250 (10”)	39 (610 USGPM)	2.31	59 (2 2/16”)	1	62.5 (2 ½”)
300 (12”)	56 (880 USGPM)	3.33	71 (2 13/16”)	1	62.5 (2 ½”)
350 (14”)	76 (1200 USGPM)	4.54	83 (3 ¼”)	2	62.5 (2 ½”)
400 (16”)	99 (1565 USGPM)	5.92	92 (3 5/8”)	2	62.5 (2 ½”)
600 (24”)	222 (3515 USGPM)	13.30	141 (5 5/8”)	1 1	62.5 (2 ½”) 100.0 (4”)

The flushing shall be carried out in accordance with a procedure approved by or as stipulated by the Engineer. At the discretion of the Engineer, the flushing may be permitted or required to be carried out in stages as parts of the system are completed.

Disposal of flushing water shall be such as to cause the least disruption to the area surrounding the point of flushing. Suitable hose for appropriate discharge of water flushed from the hydrant shall be provided by the Contractor.

When the required initial flushing has been completed satisfactorily, the Contractor may proceed with chlorination of the system.

Chlorination:

New water main pipe shall be disinfected by the continuous feed method in accordance with the latest revision of AWWA Standard C651, Disinfecting Water Mains and any Ministry of the Environment and Climate Change water main disinfection procedures in effect.

The Contractor shall give the Engineer at least two (2) working days notice of the date when they intend to commence the chlorination of the water main.

The Contractor shall arrange for water from the existing system to flow at a measured rate into the newly laid pipeline. The Contractor shall then introduce chlorine at a measured rate. The two rates shall be proportioned so that the chlorine concentration in the water throughout the length of this pipe is maintained at not less than 25 mg/L and not more than 200 mg/L. The chlorine solution to be used shall be a concentrated solution of known strength. Powdered chlorine shall not be used. All surfaces shall be in contact for a period of at least 24 hours. Following the 24 hour period, the allowable chlorine drop shall be no more than the percentage stated in the following table of the initial concentration.

WATER MAIN DISINFECTION CONCENTRATION AND CONTACT DURATION FOR NEW, LINED WATER MAINS AND TEMPORARY WATER MAINS		
Contact Duration (Hours)	Initial Disinfectant Concentration Range (ppm)	Maximum Allowable Decrease in Chlorine Concentration
24	25-200 ppm	40% of initial concentration to a maximum reduction of 50 mg/L

Failure to introduce and maintain a concentration within the limits stated above will require the water main to be flushed and re-chlorinated.

The duration of the disinfection as well as the initial doses and remaining residual at the end of the contact time are to be recorded.

The taking of bacteriological samples and testing for chlorine residual shall be observed by the Engineer.

At all locations where water is required to feed the new water distribution system from the existing water distribution system, a chlorination and bacteriological test point by-pass shall be installed in accordance with PUC Standard Drawing A3004.

All materials, equipment and labour shall be supplied by the Contractor at their expense, except the supply of water from an existing hydrant and the use of water meters required to carry out the chlorination of the main.

Disposal of Super-Chlorinated Water:

Flushing shall be carried out by discharging the super-chlorinated water to a suitable sanitary sewer.

The Contractor shall provide for the safe disposal of all super-chlorinated water used for testing, flushing, or disinfection. The Contractor shall note that if

approval is given to discharge to a watercourse or storm system, the chlorine residual shall be 0 mg/l.

Methods employed for disposal of all super-chlorinated water shall be approved by the Engineer.

Permission to discharge to the sanitary sewer must be obtained from the City of Peterborough Environmental Protection Division. The capacity of the sewer must be checked with the City of Peterborough Environmental Protection Division and the discharge flow rate kept under this value. The Contractor shall continuously monitor discharge into the sewers for surcharging or operational problems. The supply of all de-chlorination agents shall be the responsibility of the contractor.

The Contractor shall be responsible for satisfactory disposal of all water used in flushing, including problems associated with sewer system or premises connected to the sewers. Flushing shall be continued until the water tests at no more than 1.5 mg/L total chlorine residual and the turbidity does not exceed 1.0 NTU in the newly installed water main.

Bacteriological Sampling and Testing:

Following flushing, bacteriological sampling shall be carried out in accordance with a procedure as approved by the Engineer. A copy of the procedure may be obtained from PUC.

The water main shall not be considered disinfected nor be put into service until three successive tests meeting the bacteriological requirements of the Ontario Drinking Water Standards, Objectives and Guidelines and the section titled “Water Quality Parameters” on the following page have been obtained. All bacteriological samples shall be tested by a CAEAL accredited testing agency.

The Contractor is responsible for contacting the PUC Water Department a minimum of 24 hours prior to when staff are required to operate a water supply valve for bacteriological sampling. At present, there is no charge for this service during PUC's normal working hours. Appropriate charges may apply for valve operation after normal working hours. (Please note the PUC Water Department may be on summer hours, which may affect the availability of staff.)

Sampling Bottles:

Sterile bacteriological bottles can be obtained from a CAEAL accredited testing laboratory and shall contain sodium thiosulfate in them, so as to neutralize the chlorine in the water sample. These bottles shall not be rinsed out. Bottles for chlorine and turbidity sampling are to be standard Ministry of Environment PET 500 type, as supplied by PUC, and shall not contain sodium thiosulfate; as this will neutralize the chlorine and defeat the purpose of the test sample. All sample

bottles shall have a white adhesive Avery label indicating specific site of sample, type of sample and sample number.

Sampling Locations:

The locations for sampling points shall be provided by the Contractor and be such as to provide at least one test location for water mains less than 200 metres in total length, two test locations for water mains between 200 metres and 400 metres in total length and one additional test location for each additional 300 metre section of new water main.

All bacteriological test locations shall be either copper chlorination lines extending from the end of the water service or a specially tapped bacteriological test station on the hydrant branch at a location approved by the Engineer. The bacteriological test line shall be a minimum of 1200 mm above the existing ground so as to ensure the end of the line does not become contaminated. Hydrant ports are not acceptable locations for bacteriological sampling.

One of the sampling locations shall be representative of the source water that is entering the newly installed or rehabilitated water main. On the existing source water mains a chlorination/bypass test point, as per PUC standard drawing A3004, shall be installed to facilitate the sampling of the existing water quality conditions for day 1 of testing.

Water Quality Parameters:

All samples are acquired by the Contractor and must be witnessed by the PUC inspector. Any samples that are not witnessed by the PUC inspector shall be rejected and re-sampling shall be completed.

Three consecutive sample sets at each of the sampling locations, shall be taken at least 24 hours apart (one at time of flushing and one every 24 hours for two days after the flushing - 0, 24, 48 hours).

Sample set taken on Day 1 **only** shall include chlorine/turbidity test samples. The same sampling locations are to be used for all three sets of tests. A two-day sampling procedure is acceptable for the installation of temporary by-pass water mains.

The chlorine and turbidity samples must meet the following conditions, prior to the start of bacteriological testing:

- Free chlorine must exceed 0.20 mg/l
- Total chlorine must NOT exceed 1.5 mg/l
- Turbidity objective is less than or equal to 1.0 NTU. Any permitted exceedance must be approved by PUSI's Water Utility Engineer.

Any samples that do not meet these standards shall be rejected and re-sampling shall be completed at the Contractor's expense.

All bacteriological samples must meet the Ontario Drinking Water Quality Standards (Amended O. Reg. 169/03) as follows:

- Total Coliform must be 'Not Detectable',
- E-coli must be 'Not Detectable',

Furthermore, general background bacteriological samples must meet the following limits:

- Heterotrophic Plate Count (HPC) must be < 500 CFU/1mL

Any samples that do not meet these standards, shall require the water main system to be flushed, re-chlorinated and re-sampled and shall be completed at the Contractor's expense.

The bacteriological results shall be sent from the CAEAL approved testing laboratory to the Engineer for review and acceptance prior to activating the water distribution system. The Engineer will issue a letter, which will acknowledge the receipt of water quality test results and whether the water main installation has met the requirements of Ontario Drinking Water Standards (ODWS).

After the water quality results have been deemed acceptable by the PUC, the contractor shall remove all test lines within three (3) working days after the receipt of the acceptance letter. All new system valves and hydrants shall be verified for proper operation by the contractor and witnessed by PUC prior to activating the system. The system will then be final flushed by the contractor under the supervision of PUC Water Works personnel and put into service.

The flushing shall be carried out in accordance with a procedure approved by or as stipulated by the Engineer. At the discretion of the Engineer, the flushing may be permitted or required to be carried out in stages as parts of the system are completed.

Disposal of flushing water shall be such as to cause the least disruption to the area surrounding the point of flushing. Suitable hose and hydrant control valve for appropriate discharge of water flushed from the hydrant shall be provided by the Contractor.

Flushing, Re-Disinfecting Previously Tested Water Mains:

Where new water mains, after installation and initial successful testing, incurs little or no water usage, and water quality testing indicates that the water is not meeting current Ontario Drinking Water Standards; the Engineer may require the Contractor to flush and re-disinfect the water mains at their expense. As well, the

Contractor would be required to provide potable water to all customers in the affected area at their expense.

The Contractor shall flush the new water mains in a satisfactory manner and the Contractor will be responsible for satisfactory disposal of all water used in flushing.

6.2 SECTION NOT USED IN THIS DOCUMENT

6.3 SECTION NOT USED IN THIS DOCUMENT

6.4 SPECIFICATION FOR CATHODIC PROTECTION OF WATER MAINS

6.4.1 SCOPE OF WORK

This specification outlines the work to be undertaken to cathodically protect existing and newly installed ductile iron water mains, services and appurtenances. This specification also covers the cathodic protection of metallic fittings installed on non-metallic water mains and includes:

a) Installation of magnesium and zinc anodes
b) Fabrication and installation of bond straps
c) Installation of test leads and test stations

6.4.2 DESIGN

6.4.2.1 Cathodic Protection for Newly Installed Ductile Iron Water Mains

The packaged magnesium anode shall be placed on newly installed ductile iron water mains at the following spacing:

i) On the first joint of pipe installed in the Subdivision or Contract,

ii) Thereafter at the following spacing:

Water Main Diameter (mm)	Anode Spacing	
	Without Polyethylene Wrap (metres)	With Polyethylene Wrap (metres)
100	34.5	69
150	22.5	45
200	16.5	33
250	13.5	27
300 (industrial)	12.0	36
300 (residential)	12.0	20

iii) An additional 32 lb. magnesium anode shall be installed at each hydrant, and at each connection to an existing ductile or cast iron water main.

The packaged magnesium anode may be connected to a copper service using an approved brass grounding clamp but in no case shall the anode be moved more than 2.0 metres in order to facilitate the connection of the anode to the copper service piping.

Tests leads and test stations, where applicable, shall be installed as close as practical to the start of the water main installation, but in no event more than 300 metres from the start of the installation and, therefore, at not more than 300 metre intervals.

6.4.2.2 Cathodic Protection for Metallic Fittings on Non-metallic Water Mains

Anodes to be Used on Metallic Valves, Hydrants and Fittings:

One magnesium anode, with minimum casting weight of 7.2 kg (17 lbs) and length of 300 mm, shall be used on each ductile or cast iron valve, hydrant and fitting.

Anodes to be Used on Copper Services and Copper Tracer Wire:

One zinc anode, with minimum casting weight of 5.4 kg (12 lbs), shall be installed on each copper service and on the copper tracer wire for every 1000 metres of tracer wire (see Dwg A2732) with an approved brass clamp.

6.4.3 MATERIALS

6.4.3.1 General

The Contractor shall supply all materials necessary to complete the work in its entirety.

6.4.3.2 Handling & Storage

Material shall be stored so as to prevent injury to persons and to prevent the delay of work by others.

All material, which can be damaged by exposure to the elements, must be stored in a clean and dry enclosure.

Anodes shall not be handled by their lead wires.

6.4.3.3 Zinc Anodes (for Copper Water Services) and Copper Tracer Wire

Packaged zinc anodes shall have a 5.4 kg (12 lb) zinc alloy casting, have a length of 610 mm, of an alloy composition as per ASTM B-418-09 Type II or equal.

The zinc casting and its backfill shall be contained in a cardboard container 100 mm dia. X 760 mm long of sufficient durability to permit normal handling without appreciable damage.

The zinc casting within the container shall be supplied surrounded with a special backfill material having an electrical resistivity of less than 45 ohm-cm wet and the following approximate composition by volume:

Gypsum	75 - 77% +/- 2%
Sodium Sulphate	5 - 8% +/- 1%
Bentonite	15 - 20% +/- 1%

The packaged zinc anode shall be supplied with minimum 1.8 metres of #10/7 strand AWG copper cable having orange TWH insulation.

Anodes shall carry an identifying label indicating the manufacturer's name, type of anode, weight and composition, etc.

6.4.3.4 Magnesium Anodes

Packaged magnesium anodes shall have an alloy composition as per ASTM Specification B107/107M-07 (or latest revision) and the metallurgical analysis of each packaged anode shall conform to ASTM B843-07 (or latest revision) for

Grade M1C High Potential Magnesium anodes. Each anode shall be individually identified by appropriate Heat Number for cross-reference verification, traceable to the manufacturers and/or suppliers “Certificate of Conformance.”

High Potential Magnesium Anodes shall provide an open circuit potential with a minimum of 1.70 volts DC as measured with respect to the Copper/Copper Sulphate Reference Electrode, in accordance with ASTM G97. The magnesium anode shall have an average current efficiency exceeding 45 % when tested in accordance with ASTM G97. The anode shall be vibrated during packaging of backfill to eliminate air pockets which may have occurred to ensure that the packaged weight standards are maintained.

The magnesium anodes shall be contained in a cardboard container of sufficient durability to permit normal handling without appreciable damage and shall be of the following dimensions and weight:

Minimum Anode Casting Weight		Minimum Anode Casting Length	Minimum Anode Packaged Weight (Gross)	Minimum Container Dimensions	
kg	lbs	mm	lbs	Diameter (mm)	Length (mm)
7.2	17	300	35	125	750
14.5	32	560	80	200	700

The magnesium casting within the cardboard container shall be supplied surrounded with a selected chemical backfill material having electrical resistivity of less than 45 ohm/cm3 when wet and the following composition by volume as per OPSS 702:

Gypsum	77% +/- 2%
Sodium Sulphate	8% +/- 1%
Bentonite	15 % +/- 1%

The backfill shall have a grain size allowing 100% of it to pass through the #20 (850 µm) screen and 50% being retained by the #100 (150 µm) screen.

The packaged magnesium anode shall be supplied with a 3.5 m length of AWG #10/7 stranded copper cable having RW90, blue insulation.

Anodes shall carry an identifying label indicating the manufacturer's name, type of anode, manufacturer’s product ID number, net weight and composition on the outside of the cardboard tube.

6.4.3.5 Bonding Cables

Bond cables shall be fabricated using Erico Products Inc. #CAS05F copper sleeve and a #CAD-05 hammer die or equal.

Bonding cables shall be #1/0 AWG, 19 strand copper TW insulated cable having a minimum length of 450 mm.

6.4.3.6 Service Clamps

Anodes shall be attached to copper services using a brass ground clamp, properly sized for the copper service and the conductor size. The clamp shall be designated for direct burial applications and have brass screws. Refer to Section 8.0 for a list of Approved Manufacturer's Products for the Peterborough Water System.

6.4.3.7 Test Stations

Test station shall consist of a "Flush Fink" test station head as manufactured by Cott Manufacturing Company, mounted on a 100 mm dia. X 1.5 metre long ultraviolet stabilized polyethylene pipe having a minimum wall thickness of 6.25 mm. Test station colour shall be blue.

Test stations shall be supplied with three (3) nickel plated brass terminals, two (2) nickel plated copper bond straps and stainless steel locking devices.

Test stations shall be supplied with stainless steel locking devices.

6.4.4 EQUIPMENT

The cadweld equipment shall be specially designed for the purpose intended and shall be operated by a person trained in its proper and safe use.

6.4.5 CONSTRUCTION

6.4.5.1 Cathodic Protection for Newly Installed Ductile Iron Water Mains

Electrical Bonding:

All water main pipe joints and water main fittings shall be electrically bonded. Water main pipe joints and water main fittings on the new water main shall NOT be bonded to the existing water mains.

Electrical bonding of joints and fittings shall be accomplished according to the pipe manufacturer's recommendations. Electrical bonding of joints and fittings may be accomplished by any of the following methods:

i) Conductivity straps. Where piping is supplied with bonding strap tabs, the tabs shall be connected with a copper strap which shall be 180 mm long bolted to the tabs with 8 mm x 26 mm silicon bronze bolts tightened to a minimum of 20 N.m torque.

ii) Conductivity screws. Where piping is supplied with conductivity screws, each joint shall have two 26 mm long special alloy set screws inserted into tab lugs projecting from the face of the bell. After insertion of the spigot into the bell and after final settlement of the main, the set screws shall be tightened alternately against the spigot with a minimum of 20 N.m torque.

iii) Conductivity wedges. Where conductivity wedges are supplied, three wedges shall be installed at each joint. These wedges shall be driven with a hammer and connected to the bell with nails supplied with the wedges.

iv) Bonding Cables. Where fittings or piping are not supplied with the foregoing continuity facilities, the joint and fittings shall be made electrically continuous with a bond cable across each joint and fitting. Bond cables after fabrication shall be thermite welded to the pipe and/or fitting.

Anode Installation:

Packaged magnesium anodes shall be installed on the ductile iron water main in accordance with the Design Section. The magnesium anode shall not be lowered into the ditch by their lead wire and shall be backfilled with native soil.

The radial clearance between the anode and the pipe shall be not less than two (2) times the pipe diameter with an absolute minimum of 300 mm. The entire anode shall be installed horizontally below the pipe by at least 300 mm, but in no case above the springline of the pipe.

The anode lead shall be wrapped around the pipe and knotted prior to connecting the copper conductor to the ductile iron water main. The anode lead shall be thermite welded to the water main, except at test station locations, using a Erico Products Inc. #CAHH-1G welder and a #CA-15F-33 alloy cartridge. The thermite weld connections shall be tapped with a hammer to ensure that a strong connection has been accomplished.

If approved by the Engineer or his representative, the anode lead wire may be connected to the ductile iron or cast iron fitting or laterals by stripping a minimum of 150 mm of insulation from the anode lead and wrapping the lead wire a

minimum of twice around a bolt under the head prior to final tightening of the fitting bolts.

Test Stations:

The test station assembly shall be installed in a suitable location at the nearest property line. The test station shall be installed plumb, to a minimum depth of 1.0 metre and shall not interfere with vehicular or pedestrian traffic.

The test station shall contain an anode lead and a test lead from the ductile iron water main. The test lead from the ductile iron water main shall be #10 AWG, 7 Strand copper with TWU -40°C white insulation.

The test lead and the anode lead wire shall be connected together in the test station. The anode lead wire may be extended with an identical cable by crimping a copper conductor. This splice shall be soldered and taped with polyethylene tape.

6.4.5.2 Cathodic Protection for Metallic Fittings on Non-metallic Water Mains

Anode Installation on Ductile and Cast Iron Valves and Fittings:

Packaged magnesium anodes shall be installed on all metallic water main fittings. Anode shall be installed at pipe depth a minimum of 300 mm from the pipe.

The anode shall not be lowered into the trench by the anode cable. The protective outer wrap shall be removed prior to backfilling with native soil.

The anode may be connected to the hydrant boot, iron fitting or valve by the cadweld process using approved equipment and qualified operators. The weld area shall be coated with mastic upon completion of the weld.

The anode lead wire may be connected to the hydrant boot, iron valve or fitting by stripping a minimum of 150 mm of insulation from the anode lead and wrapping the lead wire a minimum of twice around a bolt under the head prior to final tightening of the fitting bolts.

Sufficient slack shall be left in the wire to prevent any stress on either the anode or fitting connection during backfilling and subsequent soil settlement.

Anode Installation on Copper Service Piping:

A zinc anode, with a minimum casting weight of 5.4 kg, shall be installed on every copper service attached to a non-metallic water main.

Anode conductor shall be connected to copper water service by the use of an approved brass ground clamp.

6.5 SECTION NOT USED IN THIS DOCUMENT

6.6 WATER METER SPECIFICATION

6.6.1 SCOPE OF WORK

6.6.1.1 Metering Applications

This specification covers requirements for the installation of water meters. The owner shall provide all labour, equipment and materials not specified as being supplied by the Commission for a complete installation.

Water meters will be installed in the following applications:

All new residential buildings;
All commercial, institutional and industrial services;
In any other location as required by the Commission.

6.6.2 WATER METER INSTALLATION SPECIFICATIONS

6.6.2.1 Definitions

“Building” shall have the same meaning as set out in the Ontario Building Code Act, S.O. 1992, chap. 23, as amended, or any successor thereof.

“Commission” means the Peterborough Utilities Commission and includes its employees, servants and agents.

“CSA Standard" means the document entitled CAN/CSA B64-10-11, Manual for the Selection and Installation of Backflow Prevention Devices.

“Enclosure” means an above or below ground structure, designed to accommodate a water meter and premise isolation backflow preventer, that incorporates positive drainage to prevent submergence of the water meter and backflow preventer, provide security, increase accessibility for testing and repair or replacement, and provide freeze protection.

“Ontario Building Code” means Ontario Regulation 350/06 or any successor thereof made under the Ontario Building Code Act.

"Owner" means any person, firm or corporation having control over property to which this policy applies and includes the owner registered on title of the property and any occupant of any building or enclosure located on such property.

"Person" means any person, firm or corporation having control over property to which this policy applies and includes the owner registered on title of the property and any occupant of any building or enclosure located on such property

"Water-cooled System" means any individual unit, group or combination or collection of units of apparatus or equipment supplied with water for cooling purposes.

"Water Meter" means the water meter supplied and owned by the Commission, installed within a building or enclosure to record the amount of water supplied to such building by the Commission and includes all remote readout equipment supplied and installed with the water meter.

6.6.2.2 Water Meter Location

Water meters shall be readily accessible at all times.

The water meter shall be located where the water service pipe enters a building or in another area of a building or location approved by the Commission.

No branch connection shall be made between the building control valve and the water meter.

Where the water meter is installed in an enclosure, the location and design of the enclosure shall be approved by the Commission.

Enclosures are privately owned and shall be designed in accordance with the Ontario Building Code and the CSA Standard if a premise isolation backflow device is required.

If the entrance to the enclosure is to be locked, a key shall be provided to the Commission for meter service work.

Water meters and premise isolation double check valve assembly backflow prevention devices shall not be located in a below-grade pit or vault unless approved by the Commission and/or their approved contractor.

Water meters shall not be located in ceilings or any overhead structures.

Water meters shall be located where they can be easily replaced, repaired and maintained.

Water meters shall be protected against freezing. Owners shall be responsible for any damage to a water meter due to freezing.

No electronic, electrical, mechanical, water sensitive equipment or machinery shall be placed or installed under or adjacent to the water meter installation or in an area where splash or flow from the meter settings or pipes could occur during servicing of the water meter.

6.6.2.3 Installation of Water Meters

Water meters shall be installed or relocated by a certified plumber, an apprentice plumber under the Trades Qualification and Apprenticeship Act or a water meter installer holding a Completion Certificate from the Ministry of Training, Colleges and Universities.

A residential property owner residing in his or her own property may do the installation provided a building permit is obtained from the City of Peterborough. The permit must be obtained before commencing the work. The Commission will require verification of the permit before a water meter will be issued. The meter installation must be completed and inspected within 5 days of meter issuance from the Commission.

Water meters shall be provided, sealed, replaced, maintained, repaired, tested, inspected or removed only by the Commission.

Owners shall, at their own expense, provide easy access to the Commission at all reasonable times to perform any of the above noted functions.

Owners shall be responsible for all expenses incurred for installing a water meter.

6.6.2.4 Water Meter Installation

All material used to install the water meter shall comply with the Ontario Building Code.

Water meters up to and including 25 mm shall be installed horizontally with register facings plumb and facing upwards or vertically with register facings facing outwards.

Water meters 38 mm and larger shall be installed horizontally with register facings plumb and facing upwards.

Water meters shall be supported independent of the water service pipe and the water distribution system.

Water service pipe and water distribution system pipe shall be supported sufficiently and in compliance with the Ontario Building Code so that removal of the water meter by the Commission shall not affect the integrity of the service pipe or the distribution system.

Water meter supports shall be steel support stands or other permanent means acceptable to the Commission. The water meter shall be protected from dissimilar metal corrosion.

Bricks, concrete or wood blocking shall not be acceptable means of supporting a water meter unless they are permanently installed.

Other support or restraint for piping, valves, joints or water meters shall be provided as required by the Ontario Building Code.

The person installing the water meter shall be responsible for all piping, joints, supports and valves required to install the meter.

Water meter type shall be determined by the Commission.

For non-typical water meter installations and water meters 38 mm or larger, or a metered fire safety system, the owner must provide detailed drawings, designed and reviewed by an architect or professional engineer, of the installation and relevant calculations of water use to show that the water meter size specified will provide an adequate water supply for the intended use.

Provisions shall be made for the disposal of water used for in place testing either through a floor drain or other means approved by the Commission.

The Commission shall inspect all water meter installations prior to turn on of water.

Water supplied to fire safety systems are not required to be metered.

6.6.2.5 Clearances

Unless otherwise approved by the Commission, water meters up to and including 50 mm shall be installed with the following clearances;

a) Not less than 300 mm and not more than 900 mm to centre line above floor level;
b) Not less than 300 mm from the foundation or exterior wall;
c) Not less than 600 mm clearance above the top of the meter;
d) Not less than 500 mm from any partition or obstruction;
e) Not less than 1m from any internal structure (ie: furnace, water heater, etc.).

Clearance specifications for water meters larger than 75 mm shall be submitted to the Commission for approval.

Where a premise isolation backflow prevention device is installed, minimum clearances for the device shall be according to the CSA Standard.

No backflow preventer shall be installed directly above a water meter.

6.6.2.6 Meter Valving and By-pass

Water meters shall be installed downstream of a building control valve and a shut off valve and drain port shall be provided downstream of the water meter.

Water meters up to and including 25 mm shall be installed within 300 mm of the building control valve.

Unless otherwise approved by the Commission, for water meters greater than 25 mm, a straight run of pipe of a minimum length of five times the diameter of the water supply pipe shall be installed between the building control valve and the water meter and a straight run of pipe of a minimum of two times the diameter shall be installed between the water meter and the downstream shut off valve.

No other connections are permitted between the building control valve and the downstream shut off valve.

Water meters larger than 25 mm shall be provided with a by-pass, complete with shut off valve, arranged so that the water meter may be removed without interrupting the water supply.

If a by-pass is installed directly over the water meter there shall be a minimum clearance of 500 mm.

A by-pass shall not be installed so as to obstruct access to the water meter for the purposes of repairing, replacing or maintaining the water meter.

A by-pass shall be the same size as the supply pipe connected to the water meter.

The by-pass valve shall be closed, locked out and tagged by the Commission.

No person other than the Commission shall operate the by-pass valve.

Owners shall ensure that all valves are visible, accessible and maintained in good working order at all times.

Full port valves, gate or ball type, shall be used for all water meter installations.

6.6.2.7 Protection of Meters

It is the owner's responsibility to protect water meters from frost and all other damage when received from the Commission.

Owners shall protect water service pipe, the water distribution system, supports or connections appurtenant thereto on their premises leading to or connected with the water meter from frost or any other injury so that the water meter will not be damaged.

Owners are responsible for the loss of or damage to water meters.

Grounding wires of any type are not permitted to be affixed to a water meter.

No person shall tamper with, modify, remove or by-pass a water meter.

No person shall relocate a water meter unless prior approval is obtained from the Commission.

Owners shall be responsible for all expenses to relocate a water meter.

6.6.2.8 Cooling

The Commission does not recommend the use of water for cooling of refrigeration equipment or for air conditioning purposes.

Water used for cooling purposes will be charged on a metered basis.

Water-cooled systems used directly or indirectly shall utilize approved conservation equipment wherever possible.

7.0 WATER WORKS STANDARD DRAWINGS

Title	Drawing Number	Last Updated
Standard Hydrant and Valve Installation	A1633	Jan. 9, 2014
Standard Residential Water Service	A1636	June 21, 2017
Concrete Thrust Blocks for Tees, Plugs & Horizontal Bends	A1719	May 5, 2000
Concrete Thrust Blocks for 500 & 600 mm dia. 45 & 90 Degree Bends	A1738	May 4, 2000
Hydrant Branch Bacteriological Water Test Line	A1754	Aug. 31, 2005
Water Main Bedding & Cover Details - Class "A", "B", "C"	A1769	May 2, 2000
Flush Mounted test Station and Anode Installation	A1821	March 2009
Recommended Method of Support for Water main Railway Crossing	A1997	April 29, 2009
Lowering & securing of new or existing water main crossing new or existing culvert, storm sewer or ditch	A2000	Jan. 25, 2016
Typical Service Connection Locations for Single Family Dwelling	A2061	Nov. 28, 2011
Concrete Thrust Blocks for Vertical Bends	A2200	May 4, 2000
Residential Water Service 38mm and 50mm	A2269	May 17, 2005
Detail for Connecting Anodes to Ductile Iron Water mains	A2370	April 19, 2011
Insulation of Water main Pipe	A2371	Feb. 22, 2002
Typical Detail for Supporting Water main Pipe - 300mm and smaller	A2372	Apr. 25, 2000
Typical Detail for Supporting Water main Pipe - Larger than 300mm diameter	A2373	May 11, 2000
Pipe Bedding Details	A2390	May 11, 2000
Water Sampling Station	A2421	Jan. 16, 2001
Typical Bollard Installation – Hydrant	A2599	June 18, 2003
Standard Hydrant and Valve Installation with Mechanical Restrained Joints	A2729	Jan. 9, 2014
Restrained Joint Detail for PVC Pipe	A2730	Mar. 29, 2011
Joint Restraining Length for PVC Pipe (in combination with granular thrust block)	A2731	July 23, 2008
Cathodic Protection / Bonding Cable / Tracer Wire for Non-Metallic Water Mains	A2732	May 24, 2011
Cathodic Protection for Valves & Fittings on Non-Metallic Pipe	A2733	Apr. 19, 2011
Thrust Blocks and Restrained Joints for PVC Water Mains, Tees, Crosses and Dead Ends	A2734	July 23, 2008
Supports for Water Mains at sewer, piping and conduit crossing	A2778	Mar. 4, 2008
Partial Relay of Water Services (Typical)	A2779	Feb. 27, 2008
20mm and 25mm Water Service Detail for Non-Metallic Services	A2820	Nov. 13, 2008
38 mm and 50 mm Water Service Detail for Non-Metallic Services	A2865	Apr. 16, 2010
Standard Hydrant, Anchor Tee and Valve Installation with Mechanical Restrained Joints	A2976	Jan. 9, 2014

Title	Drawing Number	Last Updated
Potable Water Supply for Testing New, Replaced and Lined Water Main. Chlorination and Bacteriological Test Point Bypass.	A3004	Jan. 13, 2015
Hydro Guard HG4 Automated Flushing Station Installation	A3073	Nov. 9, 2017
Pre-cast Circular Valve Chamber (300mm/350mm)	B1682	Aug. 31, 2005
Air Release Valve Chamber	B1779	Jan. 29, 2013
Pre-cast 2400mm x 1800mm Rectangular Butterfly Valve Chamber (400mm to 600mm)	B1810	Aug. 31, 2005
Water main Layout for Cul-de-Sacs	B1917	Apr. 16, 2010
Air Release Valve Arrangement in Pre-cast 2400 mm x 1600 mm Rectangular Chamber	B1936	Aug. 31, 2005
Typical Pressure Reducing Valve Installation	B1969	Mar. 15, 2004
Typical Installation for Check Valve at Pressure Zone Boundary	B2129	Aug. 23, 2007
Access to Hydrant Across Ditch	OPSD 217.050	Nov. 2011

8.0 APPROVED MANUFACTURERS' PRODUCTS FOR THE PETERBOROUGH WATER SYSTEM

SPECIFICATIONS	MANUFACTURER/MODEL
STANDARDS – GENERAL *The materials used in all structures shall comply with the requirements of the Building by-laws of the City of Peterborough and the National Building Code of Canada, except where a higher standard is specified herein.* *Materials and products used in Commission contracts must meet the most current version of NSF/ANSI Standard 61, "Drinking Water System Components – Health Effects". NSF/ANSI Standard 61 products are to have been manufactured after July 1, 2012 and be 'lead-free' as defined by the Standard (≤5ppb leached; ≤0.25% by weight).*	
ACCESS VAULT LEAK PROTECTION	
Manhole Seal	• CCI Pipeline Systems – Wrapid Seal Manhole Encapsulation System (engineered primer and wrap around heat-shrinkable sleeve)
ANODES	
Magnesium: Alloy as per ASTM B107, 1961 M-1c or equal B843-13 ***7.2 kg*** (300mm+ long)(125x750 mm container) *(for fittings, valves, hydrants)* ***14.5 kg*** (560mm+long) (200x700mm container) *(for DI & CI mains)* Anode Composition: Backfill wt > alloy wt x 1.75 & having elect. Resistivity <45 ohm-cm wet; backfill composition: gypsum 75-77%, NaSO4 5-8%, Bentonite 15-20%; c/w min. 1.8m of #10/7 strand AWG copper c/w orange TWH insul'n	• ICCC (Interprovincial Corrosion Control) - MaxMag HP model 32D5GG • CorrPro Canada Inc. - Model BC-81-3220 (32 lb, 14.5 kg) • Bren Technologies Inc. – MA-5, MA-9, MA-17, MA-32

SPECIFICATIONS	MANUFACTURER/MODEL
Zinc *(for copper services)*: 5.4 kg zinc alloy casting ASTM B418-12 Type II or equal alloy; min. 610mm+ long) (200 x 700mm+ container) Anode Composition: Contained in cardboard container; backfill having elect. Resistivity <45 ohm-cm wet; backfill composition: gypsum 75-77%, NaSO4 5-8%, Bentonite 15-20%; c/w min. 1.8m of #10/7 strand AWG copper c/w orange TWH insul'n	• ICCC - 12S1-4ZP • Exothermal Industries Inc. - ANZ12.01, ANZ05.01, ANZ06.01, ANZ14.01 • Maple Agencies – ANM05.01, ANM09.01, ANM17.01, ANM32.01 • Bren Technologies Inc. – ZA-6, ZA-12, ZA-24
Anode Bonding Cables: #1/0 AWG, 19 strand copper TW insul. Cable; min. length 450mm Fabricated using Erico Products Inc. #CAS05F copper sleeve & a #CAD-05 hammer die or equal.	• North Flex (welding cable) – E91935 600 Volt
Anode Service Clamps: Brass, designated for direct bury, c/w brass screws	• Thomas & Bett - Cat.# JD • Iberville Mfg. (Emco Supply) - #3110-U • Illsco of Canada Ltd - BGC-1DB
Anode Test Stations: 100mm x 1.5m UV stabilized polyethylene pipe; 3 nickel-plated brass terminals + 2 nickel plated copper bond straps; stainless steel locking devices	• Cott Manufacturing Co. (for station head) - "Flush Fink" test station head; blue cap
BACKFLOW PREVENTION DEVICES	
Reduced Pressure Zone (PRZ) assemblies – for use on the temporary water main connection to hydrants, chlorination & bacteriological test point bypass (PUC plan A3004), and on water trucks. Note that a manufacturer's equivalent or better unit to those models specified herein will be considered.	• Apollo/Conbraco Model RP4A • Watts Model 009 • Zurn Wilkins Model 375 or Model 975XL
Double Check Valve Assembly units – for use on temporary bleeder lines and may be considered for use on temporary water main connections to hydrants in specific locations if approved by PUC.	• Apollo/Conbraco Model DC4A • Watts Model 007 ½" - 2" • Zurn/Wilkins Model 350 or Model 950XL

SPECIFICATIONS	MANUFACTURER/MODEL
BACKWATER VALVES	
For use on discharge pipes to sewers at flush stations, air valve chambers, etc. CSA/CAN or approved equal.	• Canplas backwater valves • Royal backwater valves
CASING SPACERS	
#304 stainless steel Type Injection molded high-density polyethylene Type	• CCI Pipeline Systems model CSPB12-2.50-EXT-2.00 (for 12" spacers)
CORPORATION MAIN STOPS	
AWWA C800-14 or latest revision; open left; tracer wire (TW) terminals where required. Q = Quick Joint TW = Tracer Wire Lead content of materials in contact with drinking water must meet latest NSF/ANSI Standard 61 of ≤0.25% by weight.	• Mueller 300 – B25008 N – Cc x 110 Comp. • Cambridge Brass – 301 NL, AWWA x CB Comp • Ford – FB1000 – # – NL; AWWA x QJ • Mueller H15008N • ≥50 mm Mueller H9968
CORROSION PROTECTION	
	• Denso – Prevention & Sealing products – paste, molding compound, tape • Sterling Varnish - Black Mastic
COUPLINGS	
Bolted couplings for 100 – 600mm WM	• Smith-Blair – Type 441 • Robar – Style 1507 • Viking Johnson - MaxiFit • Ford – Ultra-flex FC2W • Powerseal 3501, 3506 • Straub Grip, Metal Grip • Straub Flex
Two (2) Bolt Coupling System 100 – 300 mm	• Smith-Blair – 421 top bolt

SPECIFICATIONS	MANUFACTURER/MODEL
CURB STOPS	
AWWA C800-14 or latest revision; O-ring seals; left open; tracer wire (TW) terminals where required. Lead content of materials in contact with drinking water must meet latest NSF/ANSI Standard 61 of ≤0.25% by weight.	• Mueller 300 – B25209N – 110 Comp x 110 Comp • Mueller Oriseal H15209N • Cambridge Brass 202NL - CB comp.x CB comp • Ford (with Quick Joint) - B44-###-Q or B44-###-TW-Q - NL
FITTINGS	
Ductile: ANSI/AWWA C153/A21.53-06, C111/A21.11-12 & C104/A21.4-13 Cement-lined; MJ ends	• Star • Bibby • Sigma • RCT Flex Tite (new installations only)
PVC: ANSI/AWWA C907-12, CSA B137.2, & NSF61; injection molded	• IPEX – Blue Brute • Harco
FLANGES	
Adaptor Flange	• Clow - Series 90S/90C – joins plain end PVC or DIC to equipment, valves, etc that are flanged (Not a restraint device!) • UNI-Flange • EBAA Iron
GRANULAR	
Granular A: Crushed rock composed of hard, uncoated, fractured fragments graded to MTO Gran. A	To be approved prior to construction.
Granular B: Select pit-run granular, not requiring crushing; clean, hard, durable uncoated particles – MTO Gran. B	To be approved prior to construction.
Modified Granular B Type 1: Crushed rock composed of hard, uncoated, fractured fragments graded to COP Modified Granular B Type 1 designation. Max size <57mm	To be approved prior to construction.

SPECIFICATIONS	MANUFACTURER/MODEL
Sand: Screened or pitrun sand of clean, hard, durable , uncoated particles (100% pass 6.7mm sieve, max. 5% retained on 75micrometer sieve	To be approved prior to construction.
Crushed Stone: 19mm or 50mm open graded crushed clear stone of sound, clean, durable limestone fragments	To be approved prior to construction.
Select Backfill: Select native material free of deleterious matter and rock pieces that will not pass 200mm dia. Ring; suitable moisture content	To be approved prior to construction.
Unshrinkable Backfill: Standard 28-day with max strength of 0.4 MPA – OPSS 1359	To be approved prior to construction.
Thrust Block Concrete: From an approved Ready Mix Operation; 28-day comp. strength of 20Mpa	To be approved prior to construction.
Pipe Bedding Concrete: From an approved Ready Mix Operation; 28-day comp. strength of 15Mpa	To be approved prior to construction.
Engineered Fill: Must meet OPSS1010 and PUC's written approval	To be approved prior to construction.
HYDRANTS	
Peterborough ANSI/AWWA C502-14; 114mm main valve size; two pc barrel c/w **2 – 63.5mm nozzles @ 90 deg. (Ptbo. Pattern) & 100mm pumper nozzle**; open left; yellow	• Mueller Canada Valve – Century 4.5in175psi 2H90 12B43B 1L MJ Y (Peterborough Pattern)
Lakefield ANSI/AWWA C502-14; 114mm valve size; two pc barrel c/w **2 - 63.5mm nozzles @ 180 deg. & 114mm pumper nozzle**; open left; yellow	• Mueller Canada Valve – Century 4.5in175psi 2H180 12B43B 1L MJ Y

SPECIFICATIONS	MANUFACTURER/MODEL
INFLOW PREVENTION	
Water security item NSF61 Epoxy coating in & out; 316 SS float checks Size – 1, 2, 3, 4, 6 & 8”	• Val-Matic Flood Safe Inflow Preventer (used on vault installed air valves & reservoir vents) – Model SPK-130X where X = size
JOINT RESTRAINTS	
Restraints for DI Pipe JRs can be tie rods, restrained harness and/or mechanical joint retainer gland rings	• Ford Uni-flange Series 1300 & 1390 • EBAA Iron 1100 Megalug Series • Star 9000C, 9100C • Ford Uni-flange – Series 1400 • EBAA Iron – 1000 Series • Sigma One-Lok • Stargrip 3000 • Tyler – MJ Field Lok kit (gasket/gland/nuts & bolts) • Tyler Union – TufGrip TGD
Restraints for PVC Pipe JRs can be tie rods, restrained harness and/or mechanical joint retainer gland rings	• Ford Uni-flange Series 1300, 1350 & 1360 • EBAA Iron Series 1500, 2500 & 6500 • Sigma PV-Lok • Star Model 1100G2 • Uni-flange – Series 1500 • EBAA Iron – 2000 Series • Sigma One-Lok • Stargrip 4000/4000 G2 • Tyler Union – TufGrip TGP • Clow – Series 300/350/360/390
PVCO Mechanical Joint Restraints	• Stargrip 4000/4000 G2 • Star 1000G2, 1100G2, 1200G2
PIPE INSULATION	
Urethane Half Shell Pipe Insulation Systems	• Urecon UIP kits; nominal 50mm thick rigid polyurethane foam; 0.305mm (*12 mil*) PE hand-roll tape jacket spirally applied with a 50% overlap

SPECIFICATIONS	MANUFACTURER/MODEL
PIPE - MAINS	
150mm to 300mm: *Ductile DIC* – Class 52, ANSI/AWWA C150/A21.50-14, C151/A21.51-09, c111/A21.11-12 Cement – C104/A21.4-13 Slip-on Tyton joint; poly wrapped ANSI/AWWA C105/A21.5-10; min. 8mil	• Canada Pipe Co. Exposed metal surfaces not wrapped to be coated with 2 coats corrosion resistant mastic (Sterling Varnish #1756 Black Mastic) or wrapped in Denso Tape T-1.
PVC – Class 150 (DR18): ANSI/AWWA C900-07 (CSA B137.3M) Bell & spigot slip on joint ASTM D3139 rubber rings Blue and marked	• IPEX – Blue Brute • Royal • Rehau • Diamond Plastics • National Pipe
Oriented PVC - ANSI/AWWA C909, ASTM F1483 biaxially oriented PVC pipe CIOD 100mm – 300mm Use approved restraints for C909 PVC pipe	• IPEX – Bionax PVCO
Fusible PVC Pipe for Trenchless Applications 100mm to 900mm (CIOD); CSA B137.3; AWWA C900 &C905; NSF-61; ASTM cell class 12454	• IPEX Inc. – Fusible Brute - Available in 12.2m lengths; DR 14 (305psi), DR 18 (235psi) acceptable although lower pressure classes available (25, 32.5, 41)
HDPE trenchless applications	• To be approved by PUC prior to use
CPP - Concrete Pressure Pipe (for >300 mm diameter pipe)	• Forterra CPP unless approved otherwise by engineer
PVC PIPE C/W INTEGRAL JOINT RESTRAINT "RESTRICTED USE"	
PVC C900 pipe w. coupling and locking splines; 100 – 300mm	• Royal Pipe Systems – Cobra Lock Pipe System - Class 150 (DR18) and Class 200 (DR14) "Use permitted by PUSI Approval only" • Royal Pipe complete with Bulldog integral joint restrained system

SPECIFICATIONS	MANUFACTURER/MODEL
PIPE - SERVICES	
Insulated Pipe – Services 50 mm or less, poly tubing	• Rehau Municipex PI Water Service Tubing **Approved in Principle**, Use permitted by PUSI approval only on a case by case basis.
50mm or less: Type K soft copper Soft copper tubing annealed, min. pressure rating 1035; ASTM B88 – Meets water main specs >50mm: DIC or PVC as per "mains". Poly Tubing: 50mm or less – subject to approval on a case by case basis; not to be used with ex. copper services	• Rehau Municipex Service Tube (19mm - 261056; 25mm – 261076)
REPAIR CLAMPS (Operations Only)	
Bell joint repair clamp for DI, CI, AC pipe Circle repair clamps	• Powerseal – Model 3232 • Straub Clamp (stainless steel) • Powerseal – Models 3121, 3122, 3123, 3131
SERVICE BOXES	
Steel boxes 1500x1800mm long; 875mm operating rod	• Mueller – A-726 • Clow • Bibby • Sigma - CBA160 or cb-196 • Mueller – A-753 for 38 & 50 mm, no operator rod • Star Pipe – Model SB#8DI
SERVICE FITTINGS	
50 mm or less: brass c/w compression type joints >50 mm service - meets water main specs AWWA C800-14 or latest revision. Lead content of material in contact with drinking water must meet latest NSF/ANSI Standard 61 of ≤0.25% by weight.	

SPECIFICATIONS	MANUFACTURER/MODEL
SERVICE SADDLES	
Mandatory for use on PVC pipe; stainless steel band; double bolt; SS nuts & bolts and non-corrosive washer	• Teck – Cambridge Brass Series 8403 • Ford – Model FS303 • Robar – Model 2616 • Robar – Model 2706 (for air valve applications) • Powerseal – Model 3412AS • Smith-Blair – Model 375
TAPPING SLEEVES	
Two piece; recessed flat face flange on outlet half; mechanical joint outlet also acceptable.	• Smith-Blair – Type 622 • Mueller – Type H304MJ • Ford – Complete with MJ Outlet; FTSS or FTSC (SS or carbon steel) • Power – 3460 CS MJ
TRACER WIRE (FOR PLASTIC PIPE)	
#14 (min.) AWG solid copper TWU c/w plastic coat	• Copperhead High Strength1230B-HS, blue coating
TRACER WIRE CONNECTORS	
#6 AWG type; Marr-type, brass split bolt; or soldered and wrapped with insulating tape <u>Slice Service Lines w/o cutting main line</u>: for low voltage tracers < 50V	• Marr • Dryconn - #10666 • Thomas & Betts – 6AWG-6H3 • King Innovation – DryConn Waterproof Direct Bury Lug; waterproof, corrosion proof; #14 to #10 AWG wire range; silicone filled • Copperhead Snakebite Connectors LSC 1230
TRACER WIRE TEST STATIONS	
Insulated direct connect point for attach of locate transmitter that attaches easily to the tracer wire	• Copperhead Snake Pit Magnetized Test Station LDXL36B TP Lite Duty Box; Blue colour coded

SPECIFICATIONS	MANUFACTURER/MODEL
UNIONS	
Compression type; min. press. rating 1035kPa; AWWA C-800-14 Lead content of materials in contact with drinking water must meet latest NSF/ANSI Standard 61 of ≤0.25% by weight.	• Mueller – H-15403 c/w bottom ridge • Cambridge Brass – CB x CB series 118 • Ford – "Quick Joint"
VALVES	
Air Valves: Air release, vacuum, combination valves: ASTM A-126 Class B & ANSI/AWWA C512-07; use up to 150psi	• APCO • Empire • Valmatic • ARI (50mm or less) – D-040-C ARI Combination • ARI (>50mm) – D-060-C HF ARI Comb'n • Vent-O-Mat – Series RBX Anti-shock
Butterfly Valves: ANSI/AWWAC504-94; **Peterborough** - open right (clockwise) **Lakefield** – open left (counterclockwise)	• Mueller • Clow • Pratt • Valmatic • VSI Series BFII (BFII(XX)(M)-DDSES-PS2 wh. XX=dia; M = Mech Jt)
Gate Valves: ANSI/AWWA C509-09; or ANSI/AWWA C515; latest versions; **Peterborough** - open right (clockwise) **Lakefield** – open left (counterclockwise)	• Mueller model 2361 • Clow • J&S Valves Mod. 6900 • VSI Series GV1 (GVI(XX)(M)N-DDSE-PS1 wh. XX=dia; M = Mech Jt)
VALVE BOXES	
Cast iron c/w inside screw config., 130mm dia. Shaft with No. 6 base	• Bibby complete with VB 825 cover • Star
Valve box aligner	• Powerseal Model 5000
VALVE CHAMBERS	
Concrete chambers as per OPSD 701; sized as per dwgs B-1682 & B-1810;	• Brooklin Concrete • Oaks
VALVE CHAMBER FRAME & COVER	
Closed cover frame & grate Type A – OPSD 401.01; frost protection	• Sigma – Model 401.01 • Bibby • Mueller • McCoy