



**CITY OF
SWIFT CURRENT**
where life makes sense

SECTION 08001
WATER MAINS

MARCH 2019

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1 GENERAL

1.1 DESCRIPTION

1.1.1 This section includes the supply and installation of water distribution systems within areas required by the City.

1.1.2 The Contractor shall provide all labour, products and equipment required for the work, including but not limited to:

- bedding under and over pipe
- watermains and appurtenances
- testing watermains
- flushing and disinfecting watermains
- connection to existing systems
- thrust blocks

1.2 RELATED SECTIONS

- 08000 Trenching and Backfilling for Utilities
- 08002 Sanitary Sewer Mains
- 08003 Lot Service Connections
- 08010 Storm Sewer Mains

1.3 INSPECTION AND TESTING

- 1.3.1 Products, workmanship and testing shall conform to standards specified in this section.
- 1.3.2 All products and workmanship may be subject to inspection by the City.
- 1.3.3 Perform all tests required by the specification and by authorities having jurisdiction.
- 1.3.4 Notify the City and authorities in ample time before testing to permit inspection and allow tests to be witnessed.
- 1.3.5 Do not cover any work before inspection and testing unless authorized by the City in writing.
- 1.3.6 Remove or repair defective products or work which fails to meet specified requirements as directed by the City, at no additional cost to City.
- 1.3.7 All bedding sand shall be loose, dry, non-compacting sand. A sample of the proposed bedding sand shall be submitted to the City for approval prior to the commencement of construction.
- 1.3.8 Watermain pressure testing shall be in accordance with the requirements in the Execution Section of this Construction Specification.
- 1.3.9 Upon completion of hydrant installation the fire department shall be notified to conduct a flow test on the new hydrant(s). Only city personnel will conduct flow testing of hydrants.

2 PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) AND POLYETHYLENE (PE) WATER PIPE

- 2.1.1 PVC or HDPE pipe shall be used in watermain installation.
- 2.1.2 PVC pipe shall be manufactured in accordance with the latest edition of CSA B137.3, or the latest standards issued by AWWA and CGSB (Canadian Standards Board).
- 2.1.3 HDPE pipe shall be manufactured in accordance with the latest edition of CSA B137.1, or the latest standards issued by AWWA and CGSB (Canadian Standards Board).
- 2.1.4 The expected internal pressures on the pipe will dictate the pipe strength requirements, but a minimum Series 160 or Class 100 or equivalent shall be used.
- 2.1.5 The maximum allowable working pressure is 62% of the series rating.
- 2.1.6 PVC pipe joints shall be integral gasketed bell ends. Couplings shall be permitted only for closures or special connections. Gaskets shall conform to AWWA C111. An affidavit of compliance shall be provided if requested.
- 2.1.7 HDPE pipe joints shall be butt-fused in accordance with the manufacturer's recommendations. Electrofusion joining methods may also be permitted.

2.2 WATER PIPE FITTING

- 2.2.1 Cast iron or ductile iron fittings shall meet the requirements of the latest edition of AWWA/ANSI C110.
- 2.2.2 Push on joints shall be fully compatible with the pipe being joined and having a working pressure rating of 1.74 MPa (25 psi).
- 2.2.3 Fittings shall be externally and internally coated with bituminous material approved by waterworks service.
- 2.2.4 PVC fittings shall be to CAN3-B.137.3, pressure Class 150, which are designed to accommodate the pipe for which they are used.
- 2.2.5 PVC fittings shall be gasketed bell end type similar to pipe except where adaptors are required in which case flanged or threaded joints may be permitted subject to approval by the City. Gaskets to conform to AWWA C111.
- 2.2.6 Cast ductile iron couplings to be robar couplings or approved equal complete with ANSI 303 stainless steel nuts & bolts compatible with outside diameters of pipes to be joined in locations approved or specified by the City.
- 2.2.7 Moulded HDPE manufactured in accordance with ASTM D2683 for socket type or ASTM D3261 for butt fusion type and all in accordance with ANSI/AWWA C906 Latest Edition.
- 2.2.8 HDPE fitting pressure must be rated at least equivalent to the pipe to which it is being attached.
- 2.2.9 Fabricated HDPE fittings are not acceptable.
- 2.2.10 Flexible couplers shall be required on discharge lines from buildings and shall conform to the requirements of ASTM C1173.

2.3 GATE VALVES

- 2.3.1 Valves shall be iron body, bronze mounted, double disc or solid-wedge, with full 360 degree rubber to cast iron bond wedge seat gate valves approved for potable water use, meeting AWWA Specification C509-80 and the following:
 - Valves to be bronze mounted with a grade of bronze completely resistant to de-zincification by water having a pH of 9.0.
 - Valve ends shall be consistent with the type of joint used for pipe and fittings except where otherwise detailed.
 - Valves to be supplied with either bronze or type 304 stainless steel stems.
 - Working pressure of 1035 kPa.
 - Valve interior to be epoxy coated for corrosion protection.

- Valves shall close by turning clockwise and be a non-rising stem type and be equipped with a 50 mm square operating nut. Valve stem shall be equipped with "O-Ring" type seals.
- Exterior to be factory coated.
- All exterior bolts and nuts must be T304 or type 3145.5 stainless steel.

2.4 VALVE BOXES

- 2.4.1 Valve boxes shall be Trojan Industries Type C, or an approved equivalent and in accordance with standard drawing A-101.
- 2.4.2 Valve boxes shall be of suitable length for depth of bury specified for mains with possible adjustment of 300 mm up or down from this length.
- 2.4.3 Valve box extensions shall be cast iron suitable for use with the valve box to be installed.
- 2.4.4 All cast iron surfaces to have a bituminous coating for corrosion resistance.

2.5 HYDRANTS

- 2.5.1 Hydrants shall be of the same type and make as presently used in the City of Swift Current (McAvity M67 Brigadier).
- 2.5.2 Hydrants are to be of the post type, dry barrel hydrant with compression shut-off conforming to AWWA Specification C502-80, having the following features:
 - Working pressure of 1035 kPa.
 - Two hose connections at 180 deg., 65mm Western Canadian Thread.
 - One 125mm STORZ pumper connection.
 - 150 mm riser barrel, 125 mm bottom valve.
 - Minimum distance from flange to bonnet will be 600 mm.
 - Main connection to be 150 mm ductile iron size rubber gasketed bell end joint.
 - Self-Draining hydrants (or as determined by site condition)
 - Number 6 operating nut with five sides.
 - Hydrant to open counterclockwise.
 - All hydrants will be painted Red.
 - Ground line breakway system: 2.75 m from invert to flange, including an extension spool section with hydrant rod coupled at extension to meet the required elevations.
 - Minimum 710 mm from top of operating nut to bottom of base flange.
 - All exposed nuts and bolts to be T304 or type 3145.5 stainless steel.

- Interface between removable parts of main valve and hydrant body shall be bronze to bronze.
- Finishes on exterior surfaces below the hydrant flange to be asphaltic coated as recommended by the coating manufacturer.

2.6 WATERMAIN PLUGS

- 2.6.1 Watermain plugs shall be of standard manufacture to suit type of pipe and pipe joint specified.

2.7 AIR RELIEF VALVE AND FLUSHING CHAMBER

- 2.7.1 Valve and chamber shall conform to the detail drawing referenced or attached.

3 EXECUTION

3.1 MUNICIPAL WATER SYSTEM

- 3.1.1 The Contractor may be required to tie into a municipal water system or to shut off system valves to undertake the proposed Work. When this is required, the Contractor shall:
- Notify the City of the proposed Work and schedule.
 - Supply all water necessary for the Work and obtain written permission from the Infrastructure and Operations Department prior to using any hydrants.
 - The City may require their own personnel to operate their valves and/or hydrants. Contractor shall not operate valves and/or hydrants unless provided written permission by the City. The Contractor shall be held responsible for any damage done to the hydrants or surrounding area.
 - Contractors may not hook up to City hydrants for construction purposes, except for City operations.
 - Be responsible for the supply of all water necessary for the Work.
 - Provide minimum 24 hours' notice to any property owner affected by water service disruption, unless for Emergency situations.
 - Supply an alternative water service if the water disruption is longer than 8 hours.
 - For essential service establishments relying on an uninterrupted water source for their operations, an alternative water source shall be provided.
 - The above noted requirements shall be done at the Contractor's cost.

3.2 TRENCH EXCAVATION, PIPE BEDDING AND BACKFILL

- 3.2.1 Refer to Section 08000 and Standard Drawing C-100 for typical installation.
- 3.2.2 Excavate below bottom of trench at joints as required to provide working space.
- 3.2.3 If on-site material meets granular bedding specification requirements, it may be used to replace the top 200 mm of bedding sand.
- 3.2.4 For trench in rock, bed pipe on minimum of 150 mm of compacted sand.

3.3 LAYING AND JOINTING PIPE

- 3.3.1 Carefully lower pipe and specials into trench using proper equipment. While suspended, inspect for defects. Remove foreign materials from inside of pipe. Unless otherwise directed, lay pipe from lower end of line upward.
- 3.3.2 Lay pipe true to line and establish grading using laser level or measurement rod and sight rails.
- 3.3.3 Cut pipe accurately to bring valves, fittings and hydrants to correct position.
- 3.3.4 At all hydrants, plugs, tees, crosses, bends of more than 22 degrees and all other points of concentrated thrust, provide reaction blocking as detailed to prevent movement. Place reaction blocking against solid undisturbed ground. Details are based on soil load values of 7323 kg per square meter, or more. Where soil will not provide this load value, provide bands and clamps to take reaction. Refer also to special thrust block details. Place blocking to provide access to pipe and fittings for repairs or extensions of line.
- 3.3.5 Install turned wood or plastic plugs, properly sized, in pipe and fittings to prevent ingress of water, mud, dirt and debris at all times. Do not use rags, clothing or other means.
- 3.3.6 Install slip type rubber gasket joints to manufacturer's directions. If requested, provide copies of manufacturer's directions on site for reference and obtain technical assistance from manufacturer or representative.
- 3.3.7 Ensure that valve box can be adjusted up or down at least 300 mm. It is intended that valve boxes installed at this time to finished crushed gravel elevation, will be raised at the time of paving without having to supply a new upper extension.

3.4 SETTING AND JOINTING VALVES

- 3.4.1 Check and ensure stuffing glands on valves are properly packed before installation.
- 3.4.2 Set valves accurately in position, set valve box carefully over hood with shaft vertical and cap at proper level plus or minus 50 mm from elevations provided by the City.
- 3.4.3 Anchor valves to prevent movement under unbalanced pressure conditions when recommended by pipe manufacturer. Include cost of anchorage in unit price for valves.

3.4.4 All valves shall be installed with the operating box removed.

3.4.5 Check operation of valves in presence of the City before testing and after testing.

3.5 SETTING AND JOINTING HYDRANTS

3.5.1 Set hydrants and hydrant valves on concrete blocking as per the details.

3.5.2 Ensure hydrant stock and valve box are truly vertical.

3.5.3 Locate hydrants and valves as per the drawings within the following tolerances: 50 mm horizontal, 15 mm vertical.

3.5.4 Face pumper nozzles to roadway with hose nozzles parallel to roadway. No portion of the hydrant or nozzle cap shall be within 150 mm of the sidewalk.

3.5.5 Concrete thrust blocks will be required at hydrants and hydrant valves as detailed.

3.5.6 Ensure that regular maintenance of hydrants is carried out for the duration of the maintenance period. Pay all costs for maintenance such as repainting, draining prior to freeze-up, etc.

3.6 THRUST BLOCKS

3.6.1 Do concrete work in accordance with Section 06010 – Concrete Sidewalk, Curb and Gutter.

3.6.2 Cement to be sulfate resistant Portland cement.

3.6.3 Place concrete thrust blocks between undisturbed ground, tees, plugs, caps, bends, reducers, hydrants, and fittings.

3.6.4 Keep joints and couplings free of concrete.

3.6.5 Do not backfill over concrete within twenty-four (24) hours after placing.

3.7 MARKERS

3.7.1 A 50 mm by 100 mm stake, from 600 mm below ground to 600 mm above ground level shall be placed at each water valve, the top 600 mm to be painted blue.

3.8 HYDROSTATIC PRESSURE TESTING

3.8.1 Watermain testing may be carried out when all the following conditions have been met:

- The section has been carefully filled with water and allowed to sit for at least twenty-four (24) hours.
- Reaction or thrust blocking within the section has reached 25.0 MPa compressive strength.

- At least thirty-six (36) hours after the last concrete reaction or thrust block has been cast with high early strength cement, or at least seven days after the last concrete reaction or thrust block has been cast with sulfate resistant cement.

3.8.2 Ensure all water service connections are turned off at curb stops to avoid damage to private plumbing.

3.8.3 The duration of each test shall be two (2) hours. Test pressure will be 692 kPa (100psi), whichever is greater. Test pipeline in sections not exceeding 365 meters in length.

3.8.4 Conduct leakage tests after completion of pressure testing. Conduct leakage tests in accordance with AWWA C605-13 procedures. Allowable leakage will be calculated using the following formula:

$$\text{Allowable leakage} = N \times D \times P^{0.5} \div 128320 = \text{Litres per hour}$$

Where N = Number of joints; D = nominal diameter of pipes (mm);
and P = average test pressure (kPa).

3.8.5 If test leakage in any section is greater than permitted by AWWA Standards, locate and repair defective pipe joints at no additional cost until leakage is within permitted allowance. Test pipelines in sections not exceeding 365 m in length.

3.8.6 Provide all equipment and labour for tests and include costs in prices for watermains.

3.9 TEMPORARY WATER SUPPLY DURING CONSTRUCTION

3.9.1 Temporary water supplied during construction shall be from a source approved by the City.

3.9.2 Temporary water shall be supplied where service is disrupted for longer than 8 hours or if an essential service establishment relying on an uninterrupted water source for their operations is affected.

3.9.3 Temporary watermains shall be sized to provide adequate water supply.

3.9.4 A backflow preventer shall be installed at any connection of a temporary watermain to the existing water distribution system.

3.9.5 Temporary water services shall be connected to the temporary watermain for each single residential unit or other building. Each temporary water service shall have its own valved connection to the temporary water main.

3.9.6 Temporary services shall not be installed or operated during freezing weather.

4 FLUSHING AND DISINFECTING WATERMAINS

Section 30(4) of the *Regulations* state "No permittee shall cause the operation of a distribution system, or portion of a distribution system, that is new, altered, extended or repaired to commence operation until it has been disinfected".

Any new, modified or depressurized watermain must be disinfected, flushed and bacteriologically tested before it may be put into service or return to service. The following sections provide an overview of the requirements stipulated by Saskatchewan Environment pursuant to *The Waterworks Regulations* and the American Water Works Association.

4.1 GENERAL

- 4.1.1 Pipes and appurtenances shall be kept free of foreign material during construction.
- 4.1.2 Prior to flushing of any water mains, the City of Swift Currents Infrastructure and Operations Department will receive a minimum of two (2) working days' notice. Only City personnel will operate existing valves.
- 4.1.3 Disinfection during, or after construction shall be in accordance with one of the three disinfection methods (tablet, continuous feed, or slug) described in AWWA Standard C651 – Disinfecting Water Mains.
- 4.1.4 Do not use calcium hypochlorite in powder form in PVC pipe as an explosive reaction may occur. Use of this chemical in tablet or solution form is safe for PVC piping.
- 4.1.5 Dechlorination of the chlorinated water may be required in some circumstances before discharging the water to the environment in order to meet the regulatory requirements of The City of Swift Current or Saskatchewan Environment. Dechlorination, if required, is to be performed by adding neutralizing chemicals (AWWA C651-86, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

4.2 TABLET METHOD

- 4.2.1 The *Tablet Method* described in AWWA C651 may be used in pipes up to 600mm diameter. The "continuous feed" or "slug" method shall be used for pipes larger than 600mm.
- 4.2.2 Preliminary flushing cannot be done for the *Tablet Method*.
- 4.2.3 Upon completion of installation slowly fill main to be disinfected with water. Velocity should be limited to less than 0.3 m/s.
- 4.2.4 Once the line is full of water leave the main in static conditions for at least one hour if the water temperature is over 5°C and two hours if the water temperature is below 5°C.
- 4.2.5 Following this time obtain a sample of the water close to where the water was introduced to the new pipe and at an end location furthest from that point. The chlorine concentration must be a minimum of 25 mg/l at both locations.
- 4.2.6 Maintain the high strength solution in the main for a minimum contact time of 24hrs.

- 4.2.7 With higher chlorine dosage shorter contact times may be accepted by the engineer and the Water Security Agency where conditions make the 24hr contact time impractical. Alternate dosage/contact time options are described in AWWA C651.
- 4.2.8 At the end of the contact period obtain a sample at each of the previously sampled locations. A minimum 10 mg/l residual must be present at both locations or the disinfection must be repeated.
- 4.2.9 After successful disinfection, flush the main to waste until the chlorine residual reading is less than 1.0 mg/l. The chlorinated water shall be discharged in a manner approved by the City.

4.3 CONTINUOUS FEED METHOD

- 4.3.1 Flush the section of main to be disinfected using potable city water at a flow rate of at least 0.75 m/s for at least the volume of pipe that is being disinfected.
- 4.3.2 Continuing to flush, slow the flow rate to less than 0.3 m/s and begin to introduce high strength disinfection solution into the main at the water inlet.
- 4.3.3 Continue the flow and injection until the chlorine residual reading is at least 25 mg/l.
- 4.3.4 Continue with the disinfection and flushing process described in Sections 4.2.6 to 4.2.9 of this specification.

4.4 SLUG METHOD

- 4.4.1 The Slug Method consists of placing calcium hypochlorite granules in the main during construction, completely filling the main with water, flushing the main to remove particulates and slowly flowing through the main a slug of water dosed with chlorine to a concentration of 100 mg/l.
- 4.4.2 The Slug Method is suitable for use in large diameter mains where the volume of water makes the Continuous-feed Method impractical and difficult to achieve.
- 4.4.3 The process shall be generally the same as for the Tablet and Continuous-feed Methods and in accordance with AWWA C651.

4.5 SAMPLING

- 4.5.1 After final flushing and before placing watermain in service, the City will collect samples in sterile bottles from an approved sampling point.
- 4.5.2 WSA requires a minimum of two (2) sets of three (3) bacteriological samples from the watermain.
- 4.5.3 Each set of three (3) samples must be taken and submitted a minimum of 24 hours apart. Where possible, samples are to be collected from different points along the watermain section.

- 4.5.4 Samples will be submitted to the Provincial Laboratory for testing and test results forwarded to Local Authorities.
- 4.5.5 If initial disinfection fails to produce satisfactory results, repeat disinfection processes until satisfactory samples are obtained.
- 4.5.6 Watermains shall not be placed into service until two consecutive sets of three samples have been analysed and all found to be acceptable.

5 MEASUREMENT AND PAYMENT

5.1 WATER MAIN PIPE

- 5.1.1 Payment will be made as per the unit price schedule per lineal meter of water main pipe installed. Price shall include the supply, installation, and jointing of water main pipe as well all labour, equipment, and materials required to complete the work.
- 5.1.2 Measurement will be field measured length of new watermain pipe installed.

5.2 WATER MAIN FITTINGS

- 5.2.1 Payment will be made as per the unit price schedule per each fitting installed. Price shall include the supply and installation of the fittings as well as all labour, equipment, and materials required to complete the work.

5.3 GATE VALVES

- 5.3.1 Payment will be made as per the unit price schedule per each gate valve installed. Price shall include the supply and installation of the gate valve and valve box as well as all labour, equipment and materials required to complete the work.

5.4 HYDRANTS

- 5.4.1 Payment will be made as per the unit price schedule per each hydrant installed. Price shall include the supply and installation of the hydrant as well as backfill and compaction, and all labour, equipment, and materials required to complete the work.

5.5 WATER MAIN PLUGS

- 5.5.1 There will be no direct payment for water main plugs. Price shall be included in alternation bid items.

5.6 THRUST BLOCKS

- 5.6.1 There will be no direct payment for thrust blocks. Price shall be included in alternation bid items.

5.7 PRESSURE TESTING, CHLORINATION, AND COMMISSIONING OF WATER MAINS

- 5.7.1 Payment will be made as per the unit price schedule lump sum price bid. Upon full completion of the testing, flushing, disinfecting and commissioning of the water line to the approval of the City of Swift Current and Engineer.
- 5.7.2 Include costs for flushing, disinfecting and testing, including any necessary repetitions, in the prices for watermains.

5.8 CONNECTION TO EXISTING WATER MAINS

- 5.8.1 Payment will be made at the contract unit per each connection to an existing water line. Price shall include all supply and installation of all necessary equipment required to facilitate the connection. Price shall also include all equipment, labour, and material required to complete the work.

5.9 PIPE BEDDING

- 5.9.1 Payment will be made at the contract unit price per lineal meter of pipe bedding completed. Price shall include supply and place of appropriate material as per this section and the drawings and specifications as well as all necessary equipment, labour and materials required to complete the work.

END OF SECTION