

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 03 30 00 - Cast-in-Place Concrete.
- .2 Section 31 23 33.01 - Excavation, Trenching and Backfilling.
- .3 Section 33 41 00 - Storm Utility Drainage Piping.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A123/A123M-12 Standard Specification for zinc (hot-dip galvanized) coatings or iron and steel products.
 - .2 ASTM A48/A48M-03(2012), Standard Specification for Gray Iron Castings.
 - .3 ASTM C478M-12a, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
 - .4 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400ft-lbf/ft³) (600kN-m/m³).
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-08 including updates, Cementitious Materials Compendium. Includes:
 - .1 CSA-A3001-08, Cementitious Materials for Use in Concrete.
 - .2 CSA-A3002-08, Masonry and Mortar Cement.
 - .2 CAN/CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .3 CAN/CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.

1.3 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 35 43 – Environmental Procedures.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 Cast-in-place concrete: in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Precast manhole units: to ASTM C 478M, circular top sections, flat slab top type with opening offset for vertical ladder installation, as indicated on drawings.
- .3 Pre-cast catch basin sections: to ASTM C 478M, circular.
- .4 Joints: to be made watertight using rubber rings and butyl resin cord.
- .5 Pipe penetrations: to be made watertight by using cast-in-wall rubber gasket.
- .6 Mortar masonry cement: to CAN/CSA-A3002.
- .7 Adjusting rings: to ASTM C 478M.
- .8 Ladder:
 - .1 Rungs to CAN/CSA-G30.18, No. 25M carbon steel deformed bars, hot dipped galvanized to ASTM A123.
 - .1 Rungs to be safety pattern (drop step type).
- .9 Frames, gratings, and covers to dimensions as indicated and the following requirements:
 - .1 Metal gratings and covers to bear evenly on frames. A frame with grating or cover to constitute one unit. Assemble and mark unit components before shipment.
 - .2 Gray iron castings: to ASTM A 48/A 48M-03, strength class 30B.
 - .3 Castings: coated with two applications of asphalt varnish sand blasted or cleaned and ground to eliminate surface imperfections.
 - .4 Manhole frames and covers: heavy duty municipal type for road service. Cover cast without perforations and complete with two 25 mm square lifting holes.
 - .5 Catch basin frames and covers round, municipal type heavy-duty perforated grates.
 - .6 Access openings to all manholes and catch basin manholes shall be minimum 760 mm clear.
- .10 Granular bedding and backfill to Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .11 Concrete mixes and materials: in accordance with Section 03 30 00 – Cast-in-Place Concrete.

PART 3 - EXECUTION

3.1 MANUFACTURERER'S INSTRUCTIONS

- .1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions and datasheets.

3.2 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Departmental Representative before installing manholes or catch basins.
- .3 Bedding and backfill to type and extent indicated on drawings.

3.3 CONCRETE WORK

- .1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Place concrete reinforcement in accordance with Section 03 20 00 – Concrete Reinforcement.
- .3 Position metal inserts in accordance with dimensions and details as indicated.
- .4 Construct units in accordance with drawings, plumb and true to alignment and grade.

3.4 INSTALLATION

- .1 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.
 - .2 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.
 - .3 Set precast concrete base on 150 mm minimum of Type 1 fill compacted to 98% of the maximum dry density to ASTM D 698, in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.
 - .4 Precast units:
 - .1 Set bottom section of precast unit in bed of cement mortar and bond to
-

concrete slab or base. Make each successive joint watertight with Departmental Representative approved rubber ring gaskets.

.2 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.

.3 In addition to "O" ring gaskets, joints in the pre-cast sections shall be sealed with 25 mm butyl resin cord. The cord shall be placed on the upper inside ledge of the joint prior to the placement of the subsequent section.

.5 For sewers:

.1 Place stub outlets and bulkheads at elevations and in positions indicated.

.2 Bench to provide a smooth U-shaped channel. Side height of channel to be 0.75 times diameter of sewer. Slope adjacent floor at 1 in 20. Curve channels smoothly. Slope invert to establish sewer grade.

.6 Compact Type 1 Fill to 95% maximum dry density to ASTM D 698, in accordance with Section 31 23 33.01 – Excavating, Trenching and Backfilling.

.7 Place frame and cover on top section to elevation as indicated. If adjustment required use concrete ring.

.8 Installing units in existing systems:

.1 Where new unit is installed in existing run of pipe, ensure full support of existing pipe during installation, carefully remove that portion of existing pipe to dimensions required and install new unit as specified.

.2 Make joints watertight between new unit and existing pipe.

.3 Where deemed expedient to maintain service around existing pipes and when systems constructed under this project are ready for operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

.9 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

.10 Install safety platforms in manholes having depth of 5 m or greater, as indicated. Departmental Representative.

3.6 CLEANING

.1 On completion and verification of performance of installation, remove surplus materials excess materials, rubbish tools and equipment

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .4 Section 03 20 00 - Concrete Reinforcing.
- .5 Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B300-10, Hypochlorites.
 - .2 ANSI/AWWA B301-10, Liquid Chlorine.
 - .3 ANSI/AWWA B303-10, Sodium Chlorite.
 - .4 ANSI/AWWA C153/A21.53-11, Ductile-Iron Compact Fittings.
 - .5 ANSI/AWWA C509-09, Resilient-Seated Gate Valves for Water Supply Service.
 - .6 ANSI/AWWA C504-10, Rubber-Seated Butterfly Valves.
 - .7 ANSI/AWWA C651-05, Disinfecting Water Mains.
 - .8 ANSI/AWWA C800-05, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
 - .9 ANSI/AWWA C900-07, Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Distribution.
 - .10 ANSI/AWWA C110/A21.10-12, Ductile-Iron and Gray-Iron Fittings for Water.
 - .11 ANSI/AWWA C105/A21.5-10, Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM B 88M-05 (2011), Standard Specification for Seamless Copper Water Tube (Metric).
 - .2 ASTM C 117-04, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM C 136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .4 ASTM C 478M-12a, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.
 - .5 ASTM D 698-12, Standard Test Method for Laboratory Compaction
-

Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/mü)).

- .3 American Water Works Association (AWWA)/Manual of Practice
 - .1 AWWA M11, Steel Pipe - A Guide for Design and Installation.
 - .2 AWWA M17, Installation, Field Testing, and Maintenance of Fire Hydrants.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .5 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004, A3005). Includes Update No. 1 (2009), Update No. 2 (2010), Update No. 3 (2011).
 - .2 CSA B137 Series-09, Thermoplastic Pressure Piping Compendium, includes update No. 1 (2011).((Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
 - .1 CAN/CSA B137 SERIES-09, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
 - .3 CAN/CSA-G30.18-09 (2012), Billet Steel Bars for Concrete Reinforcement.
 - .4 CAN/CSA-G164-M92 (R2003) Hot Dip Galvanizing of Irregularly Shaped Articles.
- .6 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .7 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA)
- .8 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual.
- .9 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S520-07, Hydrants.
 - .2 CAN4-S543-09-AM1, Internal-Lug, Quick Connect Couplings for Fire Hose.
 - .3 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .10 Halifax Regional Water Commission, Design and Construction Specifications, 2012 edition.

1.3 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal

Procedures.

- .2 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.
- .3 Pipe certification to be on pipe.
- .4 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least 4 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Include top of pipe elevations, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

1.5 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to interruption schedule as approved by Departmental Representative.
- .3 Notify Departmental Representative minimum of 24 h in advance of interruption in service.
- .4 Do not interrupt water service for more than 3 h and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.
- .5 Notify base Fire Department of any planned or accidental interruption of water supply to hydrants.
- .6 Provide "Out of Service" sign on hydrant not in use.

PART 2 - PRODUCTS

2.1 PIPE, JOINTS AND FITTINGS

- .1 Polyvinyl chloride pressure pipe: to ANSI/AWWA C900-07, class 305, DR 14, 1 MPa gasket bell end.
 - .2 Fittings: to ANSI/AWWA C110 or C153, cement mortar lined, minimum pressure
-

rating 1035 kPa for cast-iron, 1720 kPa for ductile-iron.

- .3 Depth of bury: 1.6 m minimum to top of pipe.

2.2 PIPE PROTECTION

- .1 Provide means of protection in corrosive soils in accordance with local practices and to ANSI/AWWA C105/A21.5.

2.3 VALVES AND VALVE BOXES

- .1 Valves to open counter clockwise.
- .2 Gate valves: to ANSI/AWWA C509-09, standard iron body, resilient seated bronze mounted wedge valves with non-rising stems, suitable for 1 MPa with mechanical joints.
- .3 Valve Box: composite or cast iron; three piece sliding type adjustable over minimum of 450 mm complete with valve operating extension rod, 30 mm minimum diameter, 25 x 25 mm cross section, of such length that when set on valve operating nut top of rod will not be more than 150 mm below cover.
 - .1 Base to be large round type with minimum diameter of 300 mm.
 - .2 Top of box to be marked "WATER"/"EAU".

2.4 SERVICE CONNECTIONS

- .1 Service Pipe
 - .1 Copper tubing: to ASTM 388, type K annealed, minimum pressure rating 1035 kPa.
 - .2 Cross linked polyethylene (PEXa) tubing for pressure applications: to ANSI/AWWA C904, CAN/CSA B137.5, minimum pressure rating 1035 kPa. A stainless steel support liner shall be installed inside the pipe at each compression joint and at corporation stop connections.
 - .2 Copper tubing joints: compression type suitable for 1 MPa working pressure.
 - .3 Depth of bury: 1.6 m minimum to top of pipe.
 - .4 Brass inverted key-type curb stops: red brass to ASTM B 62-09, compression type with drains.
 - .1 Curb stops to have adjustable bituminous coated cast iron service box with stem to suit depth of bury. Service boxes to have stainless steel operating rods and cotter pins.
 - .2 Top of cast iron box marked "WATER"/"EAU".
 - .5 Service connections for PVC pipe:
 - .1 Service connections less than 100 mm: Corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service
-

- saddle to consist of double stainless steel strap circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets, with confined O-ring seal cemented in place.
- .2 Service connections 100 mm and over: Use tee fitting or tapping valve and sleeve.
- .6 Bronze type service clamps: for PVC pipe service connections.
 - .1 Service clamps to be of strap-type, with confined "O" ring seal cemented in place.
 - .2 Clamps to be tapped with threads to ANSI/AWWA C800-05.

2.5 PIPE BEDDING AND SURROUND MATERIAL

- .1 As indicated, Type 1 fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.

2.6 BACKFILL MATERIAL

- .1 As indicated, Type 4 fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.7 PIPE DISINFECTION

- .1 Liquid chlorine to ANSI/AWWA B303-05 to disinfect water mains or as required by local practices for procedure.
- .2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.

2.8 ANODE PACKS

- .1 Zinc anodes (ZN24-48) complete with clamps.

2.9 THRUST RESTRAINTS

- .1 Thrust blocks and Anchors: 20 MPa concrete and 15 M, grade 400 reinforcing steel where indicated.
 - .2 Mechanical thrust restraints: to AWWA C111 and C153 for mechanical and push-on joints with multiple wedge or gripper ring restraining mechanism, minimum working pressure rating 240 kPa and minimum safety factor of 2:1.
 - .1 Acceptable products:
 - .1 EBAA Iron Megalug.
 - .2 Star.
 - .3 Muller Aquagrip.
 - .3 Restrained Flange Adapter: Shall be made of ductile iron conforming to ASTM
-

A536 and have flange bult circles that are compatible with ANSI/AWWA C110/A21.10. Pressure rating to be equal to piping (ANSI/AWWA C900-07, Class 305, DR14.

2.10 PIPE INSULATION

- .1 50 mm expanded polystyrene, to CAN/ULC-S701, Type 4.

2.11 TRACER WIRE

- .1 10 gauge copper tracer wire to be provided along entire length of watermain and brought to surface at hydrants and valves as determined by Departmental Representative. Contractor to provide conductivity test to Departmental Representative's satisfaction.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
 - .1 Inspect materials for defects to approval of Departmental Representative.
 - .2 Remove defective materials from site as directed by Departmental Representative.

3.2 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling.
- .2 Trench depth to provide cover over pipe of not less than 1.6 m from finished grade or where minimum cover is not possible, pipe is to be insulated.
- .3 Trench alignment and depth require Departmental Representative's prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
 - .2 Do not place material in frozen condition.
 - .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
 - .4 Shape transverse depressions in bedding as required to suit joints.
 - .5 Compact each layer full width of bed to at least 95% Maximum Dry Density to ASTM D 698.
-

- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling with compacted bedding material.

3.4 PIPE INSTALLATION

- .1 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.
 - .2 Join pipes in accordance with manufacturer's recommendations.
 - .3 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
 - .4 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3m.
 - .5 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
 - .6 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
 - .7 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .8 Position and join pipes with equipment and methods approved by Departmental Representative.
 - .9 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .10 Align pipes before jointing.
 - .11 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
 - .12 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
-

- .13 Complete each joint before laying next length of pipe.
- .14 Minimize deflection after joint has been made.
- .15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.
- .17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .19 Do not lay pipe on frozen bedding.
- .20 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.
- .21 Backfill remainder of trench.
- .22 Place watermain pipe so that mid-point of a full length of pipe is over any other pipe crossing at all times.
- .23 Where pipes cross with less than 150 mm clear vertical between them, place a 300 x 300 mm pad of 50 mm extruded polystyrene insulation between them.
- .24 Install zinc anodes on all valves, bends, hydrant bases and copper service connections.
- .25 Where a minimum pipe cover of 1.6 m cannot be achieved, water pipe is to be insulated as indicated.

3.5 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.
 - .2 Support valves located in valve boxes or valve chambers by means of bedding same as adjacent pipe. Maximum length of pipe on each end of valve shall be 1 m. Valves not to be supported by pipe.
 - .3 Thrust anchor required for PVC pipe greater than or equal to 150mm.
 - .4 Install zinc anodes on all valves.
-

3.6 SERVICE CONNECTIONS

- .1 Terminate building water service at wall as indicated.
 - .1 Install coupling necessary for connection to building plumbing.
 - .2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main are completed.
 - .3 Construct service connections at right angles to water main unless otherwise directed. Locate curb stops as indicated.
 - .4 Tappings on ductile iron, or PVC-C900 pipe, may be threaded without service clamps.
 - .1 Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used.
 - .5 Tappings for PVC-C900 pipe to conform to the following:

Pipe Diameter (mm)	Maximum Tap Without Clamp (mm)	Maximum Tap with Clamp (mm)
100	20	25
150	20	40
200	25	50
250	25	50
300	40	75
 - .6 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with "O" ring seal cemented in place.
 - .7 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
 - .8 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.
 - .9 Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m, whichever is greater.
 - .10 Leave corporation stop valves fully open.
 - .11 In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.
 - .12 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.
 - .13 Install curb stop with corporation box on services NPS 2 or less in diameter.
 - .1 Equip larger services with gate valve and cast iron box.
-

- .2 Set box plumb over stop and adjust top flush with final grade elevation.
- .3 Leave curb stop valves fully closed.
- .14 Place temporary location marker at ends of plugged or capped unconnected water lines.
 - .1 Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
 - .2 Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.

3.7 THRUST BLOCKS AND RESTRAINED JOINTS

- .1 For thrust blocks: do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.
- .2 Place concrete thrust blocks between valves, tees, plugs, tapping sleeves, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Departmental Representative. Use mechanical restraints in combination with thrust blocks.
- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.
- .5 Only use restrained joints approved by Departmental Representative.

3.8 HYDROSTATIC AND LEAKAGE TESTING

- .1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
 - .2 Notify Departmental Representative at least 24 hours in advance of proposed tests.
 - .1 Perform tests in presence of Departmental Representative.
 - .3 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
 - .4 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Departmental Representative.
 - .5 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.
 - .6 Leave hydrants, valves, joints and fittings exposed.
 - .7 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
-

- .8 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.
- .9 Open valves.
- .10 Expel air from main by slowly filling main with potable water.
 - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
 - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .11 Thoroughly examine exposed parts and correct for leakage as necessary.
- .12 Apply hydrostatic test pressure in accordance with applicable municipal regulations based on elevation of lowest point in main and corrected to elevation of test gauge, for time specified in applicable regulations.
- .13 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .14 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .15 Repeat hydrostatic test until defects have been corrected.
- .16 Apply leakage test pressure equivalent to design working pressure after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .17 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.
- .18 Do not exceed allowable leakage as per manufacturer's recommendations or as required by applicable municipal regulations.
- .19 Locate and repair defects if leakage is greater than amount specified.
- .20 Repeat test until leakage is within specified allowance for full length of water main.

3.9 PIPE SURROUND

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
 - .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 1 m of pipe.
 - .3 Place layers uniformly and simultaneously on each side of pipe.
-

- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95% Maximum Dry Density to ASTM D 698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95% Maximum Dry Density to ASTM D 698.

3.10 BACKFILL

- .1 Place backfill material above pipe surround, in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Compact each layer to at least 95% Maximum Dry Density to ASTM D 698 within 300 mm of sub-base and base gravels of sidewalks and pavement areas, compact each layer to at least 98% maximum dry density to ASTM D 698.

3.11 FLUSHING AND DISINFECTING

- .1 In the case of conflict between flushing and disinfection instructions contained within this specification and applicable municipal or provincial guidelines, the more stringent shall apply.
- .2 Flushing and disinfecting operations: witnessed by Departmental Representative.
 - .1 Notify Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.
- .3 Two (2) swabs to be launched and propelled through watermain.
- .4 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.

- .5 Flushing flows in accordance with NFPA-24 Standards.

<u>Pipe Size NPS</u>	<u>Flow (L/s) Minimum</u>
150 and below	56
200	99
250	154
<u>300</u>	<u>222</u>
- .6 Provide connections and pumps for flushing as required.

- .7 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .8 When flushing has been completed to Departmental Representative approval, introduce strong solution of chlorine as approved by Departmental Representative into water main and ensure that it is distributed throughout entire system.
- .9 Rate of chlorine application to be proportional to rate of water entering pipe.
- .10 Chlorine application to be close to point of filling water main and to occur at same time.
- .11 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .12 Flush line to remove chlorine solution after 24 hours.
- .13 Measure chlorine residuals at extreme end of pipe-line being tested.
- .14 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
 - .1 Take samples daily for minimum of two days.
 - .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
- .15 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .16 After adequate chlorine residual not less than 50 ppm has been obtained leave system charged with chlorine solution for 24 hours.
 - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

3.12 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition, as indicated or as directed by Departmental Representative.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.

1.2 REFERENCES

- .1 Drawing R.070629.001- C01 - EXISTING SITE PLAN
- .2 Drawing R.070629.001- C02 - PROPOSED SITE PLAN
- .3 Drawing R.070629.001- C04 - NEW SALT WATER INTAKE PLAN & PROFILE
- .4 Drawing R.070629.001- C05 - CIVIL DETAILS
- .5 Drawing R.070629.001- S03 - INTAKE STRUCTURE PLAN, SECTIONS, & DETAILS

1.3 STANDARDS

- .1 Perform all installations to current CSA standards, with particular attention to CSA B137 Series-09, Thermoplastic Pressure Piping Compendium, including all updates.
 - .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C906-07, Polyethylene (PE) Pressure Pipe and Fittings 4 In. (100 mm) Through 63 In. (1,600 mm) for Water Distribution and Transmission.
 - .2 ANSI/AWWA C800-05, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).
 - .3 American Society for Testing and Materials International, (ASTM)
 - .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
 - .5 Halifax Regional Water Commission, Design and Construction Specifications,
-

2012 edition.

- .6 Transport Canada, TP 14591 – Navigable Waters Protection Act – Water Intakes.
- .7 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C 117-04, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .2 ASTM C 136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .3 ASTM D 698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/mü)).
- .8 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

1.4 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.
- .3 Pipe certification to be on pipe.
- .4 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least 4 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.5 CLOSEOUT SUBMITTALS

- .1 Provide record drawings, including directions for operating valves and maintenance and operating instructions in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Include top of pipe elevations and horizontal location of fittings and type.

1.6 SCHEDULING OF WORK

- .1 Schedule Work to minimize interruptions to existing services.
 - .2 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to interruption schedule as approved by Departmental Representative.
 - .3 Notify Departmental Representative minimum of 24 h in advance of interruption
-

in service.

- .4 Do not interrupt water service for more than 3 h and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.
- .5 Provide "Out of Service" sign on existing wave tank feeds when not in use.
- .6 Advise base Police Department of anticipated interference with movement of traffic.

1.7 QUALIFICATIONS OF SALT WATER INTAKE PROVIDERS

- .1 Salt water intake structure, fittings, and weights shall be customarily manufactured by companies regularly engaged in manufacturing this type of equipment and who maintain services and parts departments from which service, repairs, and replacements may be obtained quickly at all times.
- .2 All components of the salt water intake structure, fittings, and weights will be built for the highest class service. Each intake and intake line shall be complete in every respect and shall include every part necessary for the highest degree of stability against tidal forces in the Bedford Basin. Materials of construction shall be selected because of their suitability for the particular duty outlined below.
- .3 Maintenance schedules for regular maintenance and cleaning of intake structures should be specified and approved by the Departmental Representative prior to selection.

1.8 SCOPE OF WORK

- .1 Must supply, install, and commission two identical salt water intakes and lines, supporting structures, and weights to supply salt water to the existing BIO Wave Tank. Raw water is to be taken from the Bedford Basin to fill the Wave Tank.

1.9 INSPECTION

- .1 The Departmental Representative reserves the right to inspect and test any material supplied under this Specification at the Manufactures plant, before shipment or installation. Any substantial deviation in material from that specified, or any unsuitable performance, may result in the material being rejected.
-

PART 2 – PRODUCTS

2.1 INTAKE

- .1 The intake screen will be installed approximately 1.1 m off the seabed according to Drawing R.070629.001- S03 - INTAKE STRUCTURE PLAN, SECTIONS, & DETAILS. It will stretch approximately 25 m from the shore at Low Normal Tide (LNT). The new salt water lines will run north of the existing Energy Centre salt water lines. The screen must be fabricated to resist corrosion and the formation of biofilm and the entrainment and entrapment of aquatic life found in the Bedford Basin. It must have a flow capacity ranging from 470 to 650 L/min. Flow through the screen must be passive in nature. There may be no moving parts in the intake screen. Mounting of the intake screen is to follow suggestions of the manufacturer.
- .2 Raw water will flow from the intake screen through an HDPE (DR 17) pipe to the proposed pump house. From here, lines will connect to the existing Wave Tank fill lines.
- .3 Intake screens will be machined of HDPE into T-shaped structures. Maximum hole diameter of 25 mm (1 In.). Refer to Drawing R.070629.001 – S03 – INTAKE STRUCTURE PLAN, SECTIONS, & DETAILS for other details, including flange and connections.

2.2 PIPE BEDDING AND SURROUND MATERIAL

- .1 As indicated, Type 1 fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Concrete mixes and materials required for bedding mattress, supports, and weights: to Section 03 30 00 - Cast-in-Place Concrete.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Clean pipes, intake structure, and valves of accumulated debris and water before installation.
 - .1 Inspect materials for defects to approval of Departmental Representative.
 - .2 Remove defective materials from site as directed by Departmental Representative.

3.2 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 33.01 - Excavating
-

Trenching and Backfilling.

- .2 Trench depth to provide cover over pipe of not less than 1.6 m from finished grade or where minimum cover is not possible, pipe is to be insulated.
- .3 Trench alignment and depth require Departmental Representative's prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.
- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% Maximum Dry Density to ASTM D 698.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling with compacted bedding material.

3.4 PIPE INSTALLATION

- .1 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.
 - .2 The allowed spacing for each salt water intake and line is shown in Drawings R.070629.001- C02, C05, and S03.
 - .3 All bolts and fasteners should be made of corrosion resistant material.
 - .4 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
 - .5 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .6 Position and join pipes with equipment and methods approved by Departmental Representative.
-

- .7 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .8 Align pipes before jointing.
- .9 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .10 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
- .11 Complete each joint before laying next length of pipe.
- .12 Minimize deflection after joint has been made.
- .13 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .14 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Departmental Representative.
- .15 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .16 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .17 Do not lay pipe on frozen bedding.
- .18 Do hydrostatic and leakage test and have results approved by Departmental Representative before surrounding and covering joints and fittings with granular material.
- .19 Backfill remainder of trench.

3.5 HYDROSTATIC AND LEAKAGE TESTING

- .1 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
 - .2 Notify Departmental Representative at least 24 hours in advance of proposed tests.
 - .1 Perform tests in presence of Departmental Representative.
-

- .3 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
 - .4 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Departmental Representative.
 - .5 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.
 - .6 Open valves.
 - .7 Thoroughly examine exposed parts and correct for leakage as necessary.
 - .8 Apply hydrostatic test pressure in accordance with applicable municipal regulations based on elevation of lowest point in main and corrected to elevation of test gauge, for time specified in applicable regulations.
 - .9 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
 - .10 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
 - .11 Repeat hydrostatic test until defects have been corrected.
 - .12 Apply leakage test pressure equivalent to design working pressure after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
 - .13 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.
 - .14 Do not exceed allowable leakage as per manufacturer's recommendations or as required by applicable municipal regulations.
 - .15 Locate and repair defects if leakage is greater than amount specified.
 - .16 Repeat test until leakage is within specified allowance for full length of water main.
-

3.6 PIPE SURROUND

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 1 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95% Maximum Dry Density to ASTM D 698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95% Maximum Dry Density to ASTM D 698.

3.7 BACKFILL

- .1 Place backfill material above pipe surround, in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Compact each layer to at least 95% Maximum Dry Density to ASTM D 698 within 300 mm of sub-base.

3.8 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition, as indicated or as directed by Departmental Representative

PART 1 – GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 78 00 – Closeout Submittals.
- .3 Section 31 23 33.01 – Excavating, Trenching and Backfilling.

1.2 MEASUREMENT AND PAYMENT

- .1 Measure trenching and backfilling under Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Measure supply and installation of sewage force main including excavating and backfilling and granular bedding and surround in metres of each type and size of pipe installed.
 - .1 Measurement will be made of actual length in place, through valves and fittings, after work has been completed.
- .3 Measure granular bedding and surround material in cubic metres compacted in place.
- .4 Measure concrete for thrust blocks in cubic metres in place concrete thrust blocks in units in place.

1.3 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C104/A21.4-08, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - .2 ANSI/AWWA C111/A21.11-06, Standard for Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - .3 ANSI/AWWA C151/A21.51-09, Standard for Ductile-Iron Pipe, Centrifugally Cast.
 - .4 ASTM D3035, AWWA C901, NSF-07, Standard for High Density Polyethylene Pressure Pipe and Fabricated Fittings, 1/2 Inch Through-36 Inch (50 mm-900 mm), for Water Transmission and Distribution.
 - .2 ASTM International
 - .1 ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .2 ASTM C 117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .3 ASTM D 698-07e1, Standard Test Method for Laboratory Compaction
-

Characteristics of Soil Using Standard Effort ((12,400 ft-lbf/ftü)
(600kN-m/m3)).

- .4 ASTM D 2241-09, Standard Specification for Poly(Vinyl Chloride) (PVC)
Pressure-Rated Pipe (SDR Series).
- .5 ASTM F2619/F2619M-13, Standard Specification for High Density
Polyethylene (PE) Line Pipe.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Scheduling:
 - .1 Schedule Work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions and adhere to schedule
approved by Departmental Representative.
- .3 Notify Departmental Representative and building manager superintendent
a minimum of 24 hours in advance of interruption in service.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data
sheets for for pipes and backfill and include product characteristics,
performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered
or licensed in Nova Scotia, Canada.
 - .2 Submit shop drawings showing proposed method of installation for
sewage force main in undercrossing.
- .4 Samples:
 - .1 Submit 4 weeks minimum before beginning Work, with proposed source
of bedding materials and provide access for sampling.
- .5 Certification to be marked on pipe.
- .6 Test and Evaluation Reports: submit manufacturer's test data and certification at
least 2 weeks prior to beginning Work.
- .7 Manufacturer's Instructions: submit to Departmental Representative 1 copy of
manufacturer's installation instructions.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 -
Common Product Requirements and with manufacturer's written instructions.
 - .2 Delivery and Acceptance Requirements: deliver materials to site in original
-

factory packaging, labelled with manufacturer's name and address.

- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 MATERIALS

- .1 High density Polyethylene pressure pipes: to CSA B317.1, ASTM F714, and CGSB 41-GP-25M:
 - .1 Type: DR 11
 - .2 Joints: to ANSI/AWWA C207, and thermal butt fusion to manufacturer's specifications.
 - .4 High density Polyethylene fittings: to CSA B317.1, for pipe sizes 4" and less.

2.2 PIPE BEDDING AND SURROUND MATERIALS

- .1 Granular material to Section 31 05 16 - Aggregate Materials and following requirements:
 - .1 Crushed or screened stone, gravel or sand.
 - .2 Gradations within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1 CAN/CGSB-8.2.
- .2 Concrete mixes and materials for cradles for undercrossing and thrust blocks to Section 03 30 00 - Cast-in-Place Concrete.

2.3 BACKFILL MATERIAL

- .1 As indicated.
- .2 Type 3, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Unshrinkable fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe installation in accordance with manufacturer's written instructions.
-

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction sediment and erosion control drawings sediment and erosion control plan, specific to site, that complies with EPA 832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- .2 Pipes and fittings to be clean and dry.
- .3 Prior to installation, obtain Departmental Representative's approval of pipes and fittings.

3.3 TRENCHING

- .1 Do trenching Work, in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Trench alignment and depth require approval from Departmental Representative prior to placing bedding material or pipe.

3.4 GRANULAR BEDDING

- .1 Place granular bedding in unfrozen condition.
 - .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
 - .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
 - .4 Shape transverse depressions as required to suit joints.
 - .5 Compact each layer full width of bed to at least 95% maximum density to ASTM D 698.
-

3.5 INSTALLATION

- .1 Lay pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .2 Join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .3 Avoid damage to machined ends of pipes in handling and moving pipe.
- .4 Maintain grade and alignment of pipes.
- .5 Align pipes carefully before jointing.
- .6 Joint deflection permitted within limits in accordance with pipe manufacturer's written recommendations.
- .7 Support pipe firmly over entire length, except for clearance necessary at couplings.
 - .1 Do not use blocks to support pipe.
- .8 Keep pipe and pipe joints free from foreign material.
- .9 Avoid bumping gasket and knocking it out of position, or contaminating with dirt or other foreign material. Remove disturbed gaskets clean, lubricate and replace before jointing is attempted.
- .10 Support pipes using hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
- .11 Apply sufficient pressure in making joint to ensure that joint is complete to manufacturer's recommendations.
- .12 Apply restraint to pipe to ensure that joints when completed are held in place, by tamping fill material under and alongside pipe, or otherwise as approved by Departmental Representative.
- .13 When stoppage of Work occurs, block pipe as directed by Departmental Representative to prevent creep during downtime.

3.6 THRUST BLOCKS

- .1 Restrain bends, tees and fittings using concrete thrust blocks as indicated.
- .2 Keep pipe couplings free of concrete.
- .3 Bearing area of thrust blocks to be as indicated.

3.7 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
-

- .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers simultaneously on each side of pipe not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 0.25 m of pipe.
- .4 Compact each layer from pipe invert to depth as indicated of pipe to at least 95% maximum density to ASTM D 698.
- .5 Compact each layer from mid height of pipe to underside of backfill to at least 90% maximum density to ASTM D 698.
- .6 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.8 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 95 % maximum density to ASTM D 698. In other areas, compact to at least 90 % maximum density to ASTM D 698.
- .4 Place unshrinkable fill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.9 UNDERCROSSING

- .1 Excavate working pit to dimensions indicated, outside right-of-way to be crossed.
 - .2 Excavate working pit to minimum of 0.5 m below lowest invert of encasing pipe.
 - .3 Dewater excavation.
 - .4 Dewater area of undercrossing.
 - .5 Ensure encasing pipe is not in tension.
 - .6 Use mechanical or welded type joints for encasing pipe.
 - .7 Place concrete grout levelling pad in encasing pipe.
 - .1 Carefully control level of grout during placing.
 - .8 Insert sewage force main into encasement pipe, in end with largest opening after placement of leveling pad.
-

- .9 Use approved blocking method to guide sewage force main in true alignment.
- .10 Clearance between blocks and encasement pipe: maximum 12 mm when sewage force main is in position.
- .11 Couplings of sewage force main: not to rest on levelling pad when sanitary sewer pipe is in position.
- .12 Place 20 MPa concrete cradle around sewage force main after it is positioned. Cradle to be minimum of 225 mm and maximum of 300 mm above levelling pad.
- .13 Pressure grout remaining void with grout consisting of one part Portland cement and two parts clean washed sand with only sufficient amount of water added to allow placement. Do not install pressure grout until sewage force main is secure against flotation. Do not use additives.
- .14 Do field testing before placing concrete cradle and grouting.

3.10 FIELD TESTING OF FORCE MAIN

- .1 Testing of force main to be carried out under supervision of Departmental Representative.
 - .2 Strut and brace caps, bends and tees, to prevent movement when test pressure is applied.
 - .3 Expel air from force main, by slowly filling main with water.
 - .1 Drill and tap high points and install suitable cocks to vent air and to be shut when pressure is applied.
 - .2 Remove cocks after satisfactory completion of test and seal holes with tight fitting plugs.
 - .4 Apply pressure for 1 hour for pressure test and 2 hours for leakage test.
 - .5 Examine exposed pipe, joints and fittings while system is under pressure.
 - .6 Remove defective joints, pipe and fittings and replace with new sound material.
 - .7 Do not exceed allowable leakage as defined in ANSI/AWWA C600.
 - .8 Locate and repair defects if leakage is greater than amount specified.
 - .9 Repeat test until leakage is within specified allowance for full length of force main.
 - .10 Complete backfill.
 - .11 Repeat test after completing backfill. Locate and repair defects and backfill.
-

Repeat tests, repairs and backfills as needed until leakage is less than amount specified.

3.11 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.
- .3 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management.
 - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .3 Section 03 30 00 - Cast-in-Place Concrete.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D 698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12.400 ft-lbf/ft (600 KN-m/m³)).
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B1800-11, Thermo-Plastic Non-Pressure Pipe Compendium - B1800 Series.
 - .2 CSA B182.2-11, PVC Sewer Pipe and Fitting (PSM Type).
 - .3 CSA B182.11-06, Recommended Practice for the Installation of Thermoplastic Drain, Storm and Sewer Pipe and Fittings.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .4 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA)

1.3 DEFINITIONS

- .1 A pipe section is defined as length of pipe between successive catchbasins and/or manholes.

1.4 SUBMITTALS

- .1 Submit shop drawings Manufacturer's information data sheets and instructions in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work.
- .3 Certification to be marked on pipe.

1.5 SCHEDULING

- .1 Schedule Work to minimize interruptions to existing services and to maintain
-

existing flow during construction.

- .2 Submit schedule of expected interruptions to Departmental Representative for approval and adhere to approved schedule.

PART 2 - PRODUCTS

2.1 PLASTIC PIPE

- .1 Type PSM Poly Vinyl Chloride (PVC): to CSA-B 182.2, DR 28 for pipe sizes 150mm and smaller; DR 35 for pipe sizes greater than 150mm.
- .2 Locked-in gasket and integrated bell system.
- .3 Nominal length: 3.5 m.

2.2 CONCRETE PIPE

- .1 Type Reinforced Concrete Pipe: to ASTM C-76-08a, C`4-07, C655-07, and will meet the CSA 275.1 and CSA 257.2 specifications.
- .2 Normal length: 20 m.

2.3 PIPE BEDDING AND SURROUND MATERIAL

- .1 As indicated, Type 1 fill in accordance with Section 31 23 33.01 - Excavating, trenching and backfilling.
- .2 Concrete mixes and materials for bedding, cradles, encasement, supports: in accordance with Section 03 30 00 - Cast-in-Place Concrete.

2.4 BACKFILL MATERIAL

- .1 As indicated, Type 4 fill in accordance to Section 31 23 33.01 - Excavating Trenching and Backfilling.

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Departmental Representative.

3.2 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
-

- .2 Do not allow contents of sewer or sewer connection to flow into trench.
- .3 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 95 % maximum dry density to ASTM D698.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted bedding material.

3.4 PIPE INSTALLATION

- .1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.
 - .2 Handle pipe using methods approved by Departmental Representative.
 - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon ends.
 - .3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points in accordance with manufacturer's recommendations.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
 - .5 Do not exceed maximum joint deflection recommended by pipe manufacturer.
 - .6 Do not allow water to flow through pipes during construction except as may be permitted by Departmental Representative.
 - .7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
 - .8 Install plastic pipe and fittings in accordance with CSA B182.11.
-

- .9 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.
- .10 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .11 Make watertight connections to manholes and catch basins.
 - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .12 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.
 - .1 Joint to be structurally sound and watertight.
- .13 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
 - .1 Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % of maximum dry density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95 % of maximum dry density - to ASTM D698.
- .7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.6 OUTFALL

- .1 Outfall to be positioned as shown in drawings R.070629.001-C02 PROPOSED SITE PLAN, R.070629.001-C03 WATER AND STORM WATER LINES
-

PLANS AND PROFILES, and Detail 10/C06 located on drawing
R.070629.001-C06 CIVIL DETAILS SHEET 2.

3.7 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround, in uniform layers not exceeding 300 mm compacted thickness up to grades as indicated.
- .3 Compact backfill to 95 % of maximum dry density to ASTM D698. Within 300 mm of sub-base and base gravels of sidewalks and pavement areas, compact each layer to at least 98% maximum dry density to ASTM D 698.

3.8 FIELD TESTING

- .1 In the case of conflict between this specification and applicable municipals or provincial guidelines, the more stringent shall apply.
- .2 Repair or replace pipe, pipe joint or bedding found defective.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Deflection Test:
 - .1 Measure deflection by pulling a deflection gauge through each pipe from manhole to manhole after backfilling.
 - .2 Provide deflection gauges to measure a 5% and 7 ½% deflection. Gauges to be a
 - .3 Within thirty (30) days after installation, pull a deflection gauge measuring 5% deflection through the installed section of pipeline. If this test fails proceed with 7 ½% deflection test. If 7 ½% deflection test fails, locate defect and repair. Retest using same methodology.
 - .4 Thirty (30) days prior to completion of warranty period, pull a deflection gauge measuring 7 ½% deflection through the installed section of pipeline. If 7 ½% deflection test fails, locate defect and repair. Retest using same methodology.
- .5 Television and photographic inspections: Carry out inspection of installed sewers by television camera and photographic camera. Camera to be complete with tilt and pan capability. Three (3) copies of inspection video and report to be submitted on DVD to Departmental Representative for review and acceptance.

PART 1 - GENERAL

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .3 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .4 Section 31 05 16 - Aggregate Materials.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D 698-12, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft² (600 kN-m/m²)).
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .2 CSA B1800-11, Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.8, B182.11 and B182.13).
 - .1 CSA B182.2-11, PVC Sewer Pipe and Fittings (PSM Type).
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA)
- .4 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA)
- .5 Nova Scotia Transportation and Infrastructure Renewal Standard Specification, Highway Construction and Maintenance, Latest Edition.

1.3 SUBMITTALS

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Inform Departmental Representative of proposed source of bedding and filter materials and provide access for sampling at least 4 weeks prior to commencing work.
 - .3 Submit manufacturer's test data and certification that drain pipe materials meet requirements of this Section at least 2 weeks prior to beginning Work.
 - .4 Certification to be marked on pipe.
-

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Divert unused concrete materials from landfill to local facility as approved by Departmental Representative.
- .5 Divert unused aggregate materials from landfill to on-site storage location as approved by Departmental Representative.
- .6 Divert unused metal materials from landfill to metal recycling facility for disposal approved by Departmental Representative.
- .7 Divert unused geotextiles from landfill to plastic recycling facility for disposal approved by Departmental Representative.
- .8 Place materials defined as hazardous or toxic in designated containers.
- .9 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

1.5 SITE CONDITIONS

- .1 Known underground utility lines and buried objects are as indicated on plans. Completeness and accuracy is not guaranteed.

PART 2 - PRODUCTS

2.1 PIPING

- .1 Perforated Poly Vinyl Chloride (PVC): to ASTM D3034 and CSA-B 182.2, size as indicated, complete with fittings.
 - .1 Standard Dimensional Ratio (SDR): 28 for pipe sizes 150mm or smaller; 35 for pipe sizes larger than 150mm.
 - .2 Strength: Minimum 320 kPa at 5% deflection rated
 - .3 Locked-in gasket and integral bell system.
 - .4 Nominal lengths: 6 m.

2.2 BEDDING AND SURROUND MATERIALS

- .1 Coarse aggregate: in accordance with Section 31 05 16 - Aggregate Materials.
-

Filter stone: clean, hard, durable particles, graded uniformly in size from 19 to 50 mm.

2.3 BACKFILL MATERIAL

- .1 Clear stone as indicated on the drawings and to NSTIR Standard Specification for Highway Construction and Maintenance.

PART 3 - EXECUTION

3.1 BEDDING PREPARATION

- .1 Cut trenches in subgrade and after trench approval by Departmental Representative, place geotextile, and course aggregate bedding in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .2 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
- .3 Shape transverse depressions, as required, to suit joints.
- .4 Fill excavation below design elevation of bottom of specified bedding with compacted bedding material.

3.2 FILTER FABRIC INSTALLATION

- .1 Wrap pipe filter stone with geotextile filter fabric as indicated on Contract Drawings using minimum 600 mm overlap both longitudinally and laterally.

3.3 PIPE INSTALLATION

- .1 Ensure pipe interior and coupling surfaces are clean before laying.
 - .2 Lay perforated pipe as indicated. For pipe face perforations and coupling slots downward.
 - .3 Lay non-perforated pipe as indicated from perforated pipe to disposal area. Make joints watertight.
 - .4 Grade bedding to establish pipe slope.
 - .5 Lay pipe drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points.
 - .6 Ensure barrel of each pipe is in contact with bed throughout full length.
 - .7 Begin laying at outlet and proceed in upstream direction.
 - .8 Lay perforated pipes with perforations downwards at 4 o'clock and 8 o'clock
-

positions.

- .9 Do not allow water to flow through pipes during construction except as approved by Departmental Representative. Install end plugs at ends of collector drains to protect pipe ends from damage and ingress of foreign material.
- .10 Provide flush cleanouts where directed by Departmental Representative.
- .11 Connect drainage system to storm sewer, as indicated.

3.4 PIPE SURROUND MATERIAL

- .1 Upon completion of pipe laying and after Departmental Representative has inspected Work in place, surround and cover pipe with course filter stone material as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness, as indicated. Do not drop material within 1 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Compact each layer from pipe invert to mid-height of pipe to at least 95% maximum density to ASTM D 698.
- .5 Compact each layer from mid-height of pipe to underside of backfill to at least 95% maximum density to ASTM D 698.

3.5 BACKFILL MATERIAL

- .1 Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Compact backfill to at least 95% maximum density to ASTM D 698.
- .3 Cover top of filter stone with filter fabric overlapped 600 mm.