

PART 1 - GENERAL

- 1.1 WORK INCLUDED .1 This section specifies the requirements for construction water mains and service connections. Work includes supply, installation and testing of pipe, fittings and related appurtenances.
- 1.2 RELATED SECTIONS .1 Cast-in-Place Concrete: Section 03 30 00
.2 Metal Fabrications: Section 05 50 00
.3 Excavation, Trenching and Backfilling: Section 31 23 10
.4 Reinstatement: Section 32 98 00
- 1.3 SYSTEM REQUIREMENTS .1 Maintain water service throughout the duration of the Work.
- 1.4 APPROVALS .1 Approval of modifications to design requires approval of the Departmental Representative and Halifax Water (HW).
- 1.5 OPERATIONS PLAN .1 Submit a detailed Water System Operations Plan to the Departmental Representative for review and approval. This plan must incorporate the Commissioning Plan, refer to 3.7 of this Section. The Water System Operations Plan to include the following:
.1 A listing of all tenant services affected.
.2 A detailed schedule showing when the various sections of water main will be installed and when each of the various connections to the existing water system will be completed.
.3 A plan of which valves are to be utilized during the connections to the existing system.
.4 A list of any sections of the project for which water service will be interrupted and the anticipated duration of the interruption.
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- 1.5 OPERATIONS PLAN .1 (Cont'd)
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- .5 A description of methods to be used to accomplish the maintenance of service.
- .6 A description of contingency plans that can be implemented to provide water service to affected tenants should service be disrupted longer than anticipated.
- .7 Certification that System Operations Plan has been coordinated with Halifax Water.
- .2 Deviation or amendment of the Water System Operations Plan requires approval by the Departmental Representative. Requests must be submitted in writing 72 hours prior to any change being authorized.
- 1.6 REFERENCES .1 ANSI/ASME B16.1-2010, Fittings, Flanges and Valves.
- .2 AWWA B300-2010, Hypochlorites.
- .3 AWWA B301-2010, Liquid Chlorine.
- .4 ANSI/AWWA C104/A21.4-08, Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water.
- .5 ANSI/AWWA C105/A21.5-2010, Polyethylene Encasement for Ductile Iron Pipe System.
- .6 ANSI/AWWA C110/A21.10-2012, Ductile Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm) for Water and Other Liquids.
- .7 ANSI/AWWA C111/A21.11-2012, Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings.
- .8 ANSI/AWWA C151/A21.51-09, Ductile Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
- .9 ANSI/AWWA C153/A21.53-2011, Ductile Iron Compact Fittings 3 in. through 24 in. (76mm through 610mm) and 54 in through 64 in. (1,400mm through 1,600mm), for Water Service.
- .10 ANSI/AWWA C502-05, Dry-Barrel Fire Hydrants.
- .11 ANSI/AWWA C504-2010, Rubber-Seated Butterfly Valves.
- .12 ANSI/AWWA C509-09, Resilient Seated Gate Valves, for Water and Sewerage Systems.
- .13 ANSI/AWWA C600-2010, Installation of Ductile Iron Water Mains and Their Appurtenances.
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1.6 REFERENCES
(Cont'd)

- .14 ANSI/AWWA C606-2011, Grooved and Shoulder Joints.
- .15 ANSI/AWWA C651-05, Disinfecting Water Mains.
- .16 ANSI/AWWA C800-05, Underground Service Line Valves and Fittings.
- .17 ASSE 1060-2006, Performance Requirements for Outdoor Enclosures for Backflow Prevention Assemblies.
- .18 ASTM A183-03(R2009), Carbon Steel Track Bolts and Nuts.
- .19 ASTM A240-2010b, Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
- .20 ASTM A276-2010, Stainless and Heat- Resisting Steel Bars and Shapes.
- .21 ASTM B62-2009, Composition Bronze or Ounce Metal Castings.
- .22 ASTM B88-2009, Seamless Copper Water Tube.
- .23 ASTM B418-09, Cast and Wrought Galvanic Zinc Anodes.
- .24 AWWA C115-2011, Flanged Ductile Iron Pipe and Ductile Iron or Gray Iron Threaded Flanges.
- .25 AWWA C500-09, Gate Valves for Water and Sewage Systems.
- .26 CAN/CSA B64.10M-2011, Selection, Installation, Maintenance and Field Testing of Backflow Prevention Devices.
- .27 CAN/ULC S701-2011, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .28 Halifax Water Design and Construction Specification, latest edition.

1.7 SHOP DRAWINGS

- .1 Submit shop drawings in accordance with Section 01 33 00 for all pipe, fittings, valves and all other items necessary for a complete water main installation.
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- 1.8 CERTIFICATES .1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section in accordance with Section 01 33 00.
- 1.9 HANDLING AND STORAGE .1 Handle and store pipe, valves and fittings, in such manner as to avoid shock and damage. Do not use chains or cables passing through pipe bore. Do not damage coatings or linings.
- .2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.
- .3 Store hydrants and valves to prevent retention of water and damage by freezing.
- 1.10 SCHEDULING OF WORK .1 Coordinate schedule in accordance with Water System Operations Plan.
- .2 Coordinate and organize work to minimize interruptions to existing services.
- .3 Notify the Departmental Representative, Halifax Water and building tenants and occupants a minimum of 48 hours in advance of planned interruptions in service.
- .4 Do not interrupt water service between 0800 hours and 1800 hours, unless otherwise authorized.
- .5 Notify Fire Department of any planned or accidental interruption to water service.

PART 2 - PRODUCTS

- 2.1 GENERAL .1 Diameter, material and strength class of pipe and fittings: as indicated.
- .2 All water main pipe to be Class 52 Ductile Iron pipe.
- .3 Provide lateral service extensions from old to new connection points in accordance with this section's requirements.
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2.2 DUCTILE IRON
PIPE AND FITTINGS

- .1 Pipe: Special Class 52, to AWWA C151 latest revision.
- .2 Fittings: to AWWA C110 or C153, cement mortar lined, minimum pressure rating 1035 kPa for cast-iron, 1720 kPa for ductile-iron.
- .3 Hydrant Tee: to AWWA C153 and AWWA C111 c/w ductile-iron rotatable mechanical joint gland on plain end branch.
- .4 Pipe Coatings:
 - .1 Interior: cement mortar lining with asphaltic seal coat to AWWA C104.
 - .2 Exterior: manufacturer's standard coating.
- .5 Joints: mechanical or push-on to AWWA C111; flanged where indicated, to AWWA C110 or C153 with Class 125 flanged ends to ANSI B16.1 (grooved type coupling joint with malleable iron couplings and gaskets).

2.3 HYDRANTS

- .1 Dry barrel type: to AWWA C502 and as follows:
 - .1 Depth of bury: as per pipe specification.
 - .2 Barrel: two-piece with safety break-away flange stem.
 - .3 Main valve: compression type, 134 mm minimum diameter.
 - .4 Inlet connection: mechanical joint, 150 mm diameter.
 - .5 Nozzles: two hose and one pumper. Match nozzles to those currently installed at BIO. Note: For further clarification, refer to HW Standard Drawing No. 1110.
 - .6 Direction of opening: counterclockwise.
 - .7 Operating nut: 32 mm square.
 - .8 Body colour: Fire Engine Red. Hydrant tops and caps to be colour coded Safety Yellow
 - .1 Note: For further clarification, refer to Halifax Water Standard Drawing No. 1140. Confirm hydrant top colour requirements with HW prior to painting.
 - .9 Acceptable products:
 - .1 Clow Brigadier "M67"
 - .2 Canada Valve "Century"
 - .3 Mueller "Centurion"
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- 2.4 GATE VALVES .1 Standard buried type: to AWWA C509 up to and including 300 mm, minimum working pressure rating 1380 kPa and as follows:
- .1 Body: cast-iron with mechanical joint ends.
 - .2 Mechanism: solid resilient wedge, epoxy coated, bonnet, S.S., packing gland nuts and bolts, non-rising spindle, and O-ring seals.
 - .3 Direction to close: clockwise.
 - .4 Operating nut: 50 mm square.
 - .5 Acceptable products:
 - .1 Clow McAvity F-6100 Resilient Seat Valve
 - .2 Mueller A2360-23 Resilient Wedge Valve
 - .3 AVK Series 25/00 Resilient Seat
- .2 Epoxy coat all gate valves with minimum 150 microns coating.
- 2.5 VALVE BOXES .1 To AWWA C500 and as follows:
- .1 Cast iron, slide type, adjustable for depth of pipe below finished grade. Maintain minimum of 125mm between the top of the lower and flange of the upper.
 - .2 Covers marked "Water", "Sprinkler", "Service" or "Hydrant", as applicable.
 - .3 Lugged to prevent turning and rolling of cover, and cover notched to suit.
 - .4 Have clear opening of 135 mm.
 - .5 Bonnet on the bottom section which is capable of enclosing the packing gland section of the gate valve.
 - .6 Acceptable products:
 - .1 IMP Model V.1
- 2.6 BOLTS FOR BURIED SERVICE .1 T-head bolts and nuts:
- .1 Low alloy Corten steel
- 2.7 COUPLINGS .1 Mechanical joint sleeve type: to AWWA C110; use on new ductile iron pipe. Provide spacer ring between pipe ends. Where gap between pipe ends is less than 10 mm, spacer not required.
- 2.8 THRUST RESTRAINT .1 Thrust blocks and anchors: Mix design to Section 03 30 00 - Cast-in-Place Concrete. Use 15 M Grade 400 reinforcing steel where indicated.
- .2 Joint restraint device: 100 mm to 600 mm joint restraint device to AWWA C111 and C153 for mechanical
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- 2.8 THRUST RESTRAINT (Cont'd) .2 Joint restraint device:(Cont'd)
or push-on joints with multiple wedge or gripper ring restraining mechanism, minimum working pressure rating 2410 KPa and minimum safety factor of 2:1. No special tools will be required for installation.
- .1 Acceptable products:
- .1 Ebba Iron Megalug
- .2 Ford
- .3 Star
- .3 Mechanical joint restraint devices are to be used in combination with concrete thrust blocks. No pipe joints are permitted within the "minimum pipe length" as denoted in Standard Drawing No. 1090.
- .4 Thrust block design requirements are outlined in HW Standard Drawing No. 1070 for pipe up to 300mm diameter.
- 2.9 DISINFECTANT .1 Sodium hypochlorite or calcium hypochlorite: to AWWA B300.
- .2 Liquid chlorine: to AWWA B301.
- 2.10 REDUCING AGENT .1 Hydrogen peroxide, 35% by mass commercial grade.
- 2.11 INSULATION .1 To Section 07 20 00.
- 2.12 GEOSYNTHETIC .1 Synthetic fibre, rot proof, unaffected by action of oil or salt water and not subject to attack by insects or rodents. Non-woven construction, with minimum thickness of 2 mm and minimum density of 200 g/m2.
- 2.13 ANODE PACKS .1 Zinc anodes (ZN24-48), complete with clamps, as directed.
- 2.14 POLYETHYLENE ENCASEMENT .1 Encasement to be single application of 200 micron polyethylene tubes or sheets conforming to AWWA C105.
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2.15 PROTECTIVE
COATING

- .1 Anti-corrosion petrolatum paste, tape and mastic.
 - .1 Acceptable products:
 - .1 Winn & Coates (Denso) Ltd.
 - .2 Trenton
 - .3 Petro
 - .4 Tapecoat
 - .5 STAC

PART 3 - EXECUTION

3.1 PREPARATION

- .1 Carefully inspect products for defects and remove defective products from site.
- .2 Confirm that pipe, fittings, valves and hydrants are clean before installation.

3.2 TRENCHING,
BEDDING AND
BACKFILLING

- .1 Provide trenching, bedding and backfilling to Section 31 23 10.
- .2 Use Type 1 gravel for pipe bedding and protection unless otherwise specified.
- .3 Clear stone may be used in wet or freezing conditions only where specified or with the prior approval of the Departmental Representative.
- .4 Break rock 3m beyond end of watermain and lateral(s) for full trench width.

3.3 BURIED PIPE
INSTALLATION

- .1 Lay and join pipe, fittings, and valves, as specified herein and according to manufacturer's published instructions.
- .2 Do not lay pipe and fittings when trench bottom is frozen, under water or when trench conditions or weather are unsuitable.
- .3 Lay pipe and fittings on prepared bed, true to line and grade indicated, within the following tolerances:
 - .1 Horizontal Alignment: 150 mm
 - .2 Vertical Alignment: 75 mm
- .4 Face bell ends in direction of laying. On grades of 5% or greater, lay pipe up grade. For grades exceeding 16%, install appropriately designed gradient thrust restraint.

3.3 BURIED PIPE
INSTALLATION
(Cont'd)

- .5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.
- .6 Do not use excessive force to join pipe sections.
- .7 Install gaskets in accordance with manufacturer's published instructions. Use only lubricant approved for potable water. During cold weather, store gaskets in heated area to assure that gaskets remain flexible.
- .8 Align pipes carefully before joining.
- .9 Support pipes as required to assure concentricity until joint is properly completed.
- .10 Keep pipe joints free from mud, silt, gravel or other foreign materials.
- .11 Avoid displacing gasket or contaminating with dirt, or other foreign material. Remove, clean, re-install and lubricate gaskets so disturbed. Do not reuse a gasket that has been contaminated with petroleum products.
- .12 Complete each joint before laying next length of pipe.
- .13 Restrain all joints with a mechanical joint restraint device.
- .14 Provide thrust blocks and joint restraint devices at all tees, bends and where indicated.
- .15 Where deflection at joints is permitted by the Departmental Representative, deflect only after spigot is fully inserted in bell. Do not exceed joint deflection recommended by manufacturer.
- .16 At structures, provide flexible joint not more than 300 mm from outside face of structure. Support pipe between structure wall and first joint with concrete.
- .17 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer. Do not damage pipe lining or coating. Leave smooth bevelled edge.
- .18 For corrosion protection, install polyethylene on ductile-iron pipe and fittings, as detailed on HW Standard Drawing No. 1020. Install zinc anodes on valves, hydrant bases, and copper service connections, as detailed on HW Standard Drawing No.

3.3 BURIED PIPE
INSTALLATION
(Cont'd)

- .18 (Cont'd)
1040. Take care when handling poly wrapped pipe. Any damage to the polyethylene must be repaired to the Departmental Representative's satisfaction.
- .19 Give sufficient notice so that appropriate inspection and approval of pipe installation can be undertaken.

3.4 HYDRANT
INSTALLATION

- .1 Install hydrants at locations indicated or where directed.
- .2 Install 150 mm gate valve and cast-iron valve box on hydrant anchor tee, or as indicated.
- .3 Set hydrant plumb, with hose outlets parallel to roadway, pumper connection facing roadway and breakaway flange, as indicated on HW Standard Drawing No. 1110
- .4 Provide mechanical joint restraint on all joints from the hydrant tee to the hydrant. In addition to joint restraint, provide concrete thrust blocks on all hydrants. Do not obstruct drain holes.
- .5 Provide drainage not less than 0.5 m³ in volume and backfill with clear stone to a level 150 mm above top of hydrant lead from hydrant to main.
- .6 Place geosynthetic over clear stone from hydrant to main.
- .7 Where water table is above drain holes, notify Departmental Representative. Where hydrant cannot be appropriately relocated, plug drain holes and advise Departmental Representative.
- .8 Set back hydrants a minimum of 700 mm from face of curb to center of hydrant on local streets, 850 mm on all other urban streets, as per HW Standard Drawing No. 1120.
- .9 Immediately upon installation of hydrants, place a 300 mm x 300 mm blue "hydrant out of service" marker on each hydrant pumper nozzle. Maintain markers on hydrants and remove when system is activated.

3.5 VALVES AND
VALVE BOXES

- .1 Install valves at locations indicated. Joints and bedding as specified for pipe and fittings.
- .2 On direct buried valves, install valve boxes plumb and centered over operating nut, and true to line and grade.
- .3 Install zinc anodes on all valves as detailed on HW Standard Drawing No. 1040.
- .4 Place select backfill material, maximum size 50 mm around valve box to subgrade.
- .5 When valves are installed with cover in excess of 2.0 m, provide a valve stem extension in accordance with HW standards.
- .6 Where details of road construction do not dictate asphalt paving at valves an asphalt pad is required around the valve box as indicated on Standard Drawing No. 1050.

3.6 THRUST
RESTRAINT

- .1 Provide formed thrust blocks to undisturbed ground on all tees, bends, plugs and caps. Keep joints and couplings free of concrete and construct, so as to avoid conflict with manholes in dual pipe trenches.
- .2 Backfill over thrust blocks when concrete has sufficient strength and can withstand earth pressure.
- .3 Mechanical joint restraint alone is permitted on 11, 22 and 45 Deg. horizontal bends of 300 mm diameter or smaller.
- .4 Where mechanical joint restraint is used alone, provide a single length of pipe within the "minimum pipe length" denoted in Standard Drawing No. 1090.
- .5 Reaction backing for plugs and caps shall be of timber blocking (hardwood sized to withstand thrust restraint against undisturbed earth or against a concrete thrust block). Install blocking to allow future removal without disturbing pipe, cap or bedding.
- .6 Place double polyethylene on bend before pouring concrete thrust block.

3.7 COMMISSIONING
PLAN

- .1 Provide a Water System Commissioning Plan outlining the measures that will be taken for the hydrostatic testing, chlorination and disinfection of the water system. Coordinate plan with the Water Systems Operation Plan. This plan is to indicate the areas to be tested, the sequence of testing and the sample locations for bacteriological tests. Follow all requirements set forth in this specification and be provided to and approved by the Departmental Representative and HW's representative prior to any testing taking place. Unless otherwise approved, the maximum length of water main that can be tested will be limited to 450m.

3.8 HYDROSTATIC
TESTING

- .1 Provide labour, equipment and materials required to perform hydrostatic test.
- .2 The operation of any existing valve not part of the new construction, shall be by Departmental Representative. 24 hours notice is required by the HW for all filling, flushing or chlorination operations for new construction.
- .3 Include services, hydrants, mains and other appurtenances in the system test.
- .4 Do not carry out testing until the street base course (first lift of gravel) has been placed and compacted. Pipework located outside of the street right of way (R.O.W.) (ie easements) must be at finished grade prior to testing.
- .5 Perform tests in presence of the Departmental Representative and a representative of the HW. Provide HW representative with at least 24 hours notice prior to conducting any tests. Provide a 1/4 inch NPT connection at an appropriate location for the HW's pressure gauge.
- .6 Pressure test valves, including hydrant valves.
- .7 Where hydrant extensions are required, install extensions prior to testing.
- .8 Open all valves in test section.
- .9 Expel air from main by slowly filling with potable water. Install corporation stops at high points where no air-vacuum release valves are installed.
- .10 Conduct test at a minimum pressure of the greater of 1035 kPa or one and one-half (1.5) times the

3.8 HYDROSTATIC
TESTING
(Cont'd)

- .10 (Cont'd)
operating pressure at the lowest point of elevation of the system being tested. In any case, the test pressure must not exceed 1205 kPa. Do pressure testing in sections where necessary to meet testing requirements. Testing to be in accordance to AWWA C600.
- .11 Conduct test over a full two (2) hour period, maintaining a constant test pressure. No leakage is permitted during the test period.
- .12 Locate and repair defects if test fails. Retest until results show remedial measures have been successful.
- .13 All water used for pipe testing including pressure testing, chlorination, flushing and dechlorination will be the responsibility of the Contractor, and will be chlorinated potable water.
- .14 Following acceptance of field tests, HW may order a second test. Cost of retesting will be paid by HW providing the test is satisfactory.

3.9 FLUSHING AND
DISINFECTION

- .1 Chlorination of any water system can proceed only after system has been successfully pressure tested. Have chlorination test witnessed by the Departmental Representative and HW.
- .2 Flush and disinfect water mains to AWWA C651 and as herein specified. Notify HW 24 hours in advance of flushing and disinfection.
- .3 Flush water mains with potable water through available outlets until foreign materials have been removed and water is clear. The size and number of taps should conform to Table 3 of AWWA C651.

3.9 FLUSHING AND .3 (Cont'd)
DISINFECTION
(Cont'd)

Pipe Diameter	Flow Required to Produce 2.5 ft/s (approx.) Velocity in Main	Size of Tap, In. (mm)	Number of 2½" (64mm) Hydrant Outlets
In. (mm)	Gpm (L/s)	1(25) 1½(38) 2(51)	
4 (100)	100 (6.3)	1 - -	1
6 (150)	200 (12.6)	- 1 -	1
8 (200)	400 (25.2)	- 2 1	1
10 (250)	600 (37.9)	- 3 2	1
12 (300)	900 (56.8)	- - 2	2

- .4 Slowly open and close valves and hydrants to ensure thorough flushing.
- .5 If satisfactory results cannot be achieved by flushing, swab pipe by approved methods and re-flush.
- .6 Disinfect water main upon completion of flushing using chlorine solution distributed throughout entire system.
- .7 Inject 1% chlorine solution through a corporation stop in the top of newly laid pipe, at point close to where main is being filled and at rate proportioned to filling rate. Prepare stock chlorine with concentration of 1% free chlorine by volume as follows:

<u>Product</u>	<u>Amount Of Compound</u>	<u>Quantity of Water (litre)</u>
high test calcium hypochlorite (67-70%Cl)	1.0 kg	60 litres
liquid laundry bleach (5.25% Cl)	1.0 litre	3.5 litres
3.5 litres (10.5% Cl)	1.0 litre	7.0 litres

- .8 Calcium hypochlorite is not to be used when water temperature is less than 5 degrees C.
- .9 The following table indicates the quantity of 1% chlorine stock solution required per 100 metre length of pipe.

3.9 FLUSHING AND .9 (Cont'd)
DISINFECTION
(Cont'd)

1% Hydrogen Peroxide

<u>Pipe Diameter (mm)</u>	<u>Solution (litres)</u>
100	4.9
150	10.9
200	19.4
250	30.4
300	42.9

- .10 Operate valves, hydrants, and appurtenances while main contains chlorine solution.
- .11 Take water samples at all hydrants and termination points, in suitable sequence, to test chlorine residual. When tests indicate minimum chlorine residual of 50 mg/L, leave system charged with disinfectant solution for 24 hours. At the end of this 24-hour period, the treated water in all portions of the main must have a residual of not less than 25 mg/L. Rechlorinate if the residual has fallen below 25 mg/L the system.
- .12 Flush disinfectant solution from line after 24 hours. Under no circumstances shall disinfectant solution remain in the line longer than 48 hours. Add 1.0% hydrogen peroxide reducing agent to the disinfectant solution at point of discharge or within a retention facility such that the solution is disposed to the environment with a total chlorine residual no greater than 0.0 mg/L in accordance with the requirements of Nova Scotia Environment. Check chlorine residuals before disposal and at regular intervals during disposal to ensure compliance. This de-chlorination requirement can only be excluded with the written consent of Nova Scotia Environment.
- .13 Dispose of de-chlorinated disinfectant solution. Where disposing to the environment, disposal of the de-chlorinated solution must be at least 100 meters from the nearest watercourse.
- .14 Where disinfectant solution is de-chlorinated at point of discharge, inject stock reducing agent at a rate proportioned to discharge rate. Injection and discharge rates must be monitored continuously to ensure proper proportioning.

3.9 FLUSHING AND
DISINFECTION
(Cont'd)

- .15 Prepare stock reducing agent with concentration of 1% Hydrogen Peroxide (H₂O₂) by volume, as follows:

<u>Liquid Reducing Agent</u>	<u>Amount of Agent (litres)</u>	<u>Quantity of Water (litres)</u>
Hydrogen Peroxide (35% H ₂ O ₂ by mass) 34.0	1.0	34.0

- .16 The following table indicates quantity of 1% Hydrogen Peroxide required to reduce total chlorine residual of disinfectant solution contained per 100 metre length of pipe, from 50 mg/L to 0.0 mg/L.

<u>1% Hydrogen Peroxide</u>	
<u>Pipe Diameter (mm)</u>	<u>Stock Solution (litres)</u>
100	4.5
150	10.2
200	18.1
250	28.2
300	40.6

- .17 Where total chlorine residual of disinfectant solution exceeds 50 mg/L, quantity of stock reducing agent for de-chlorination can be increased in direct proportion to the quantity indicated in the above table.
- .18 After disinfectant solution is flushed from water main, assist HW representative in obtaining two (2) water samples on each of two consecutive days (at least 24 hours apart) for bacteriological tests. Hydrants shall not be used as sampling points. Repeat disinfection procedure if bacteriological tests fail.
- .19 Obtain bacteriological samples from a test sampling tap or a copper service lateral if available. Take samples from every 366m (1200 ft) of new water main, plus one set from the end of the line and from every branch (See AWWA C651, Section 5.1). If service laterals are not available, a hydrant lead may be tapped to provide the required sampling location.
- .20 Collect samples in accordance with Appendix A of Nova Scotia Environment "Guidelines for Monitoring Public Drinking Water Supplies". Have analysis done

- 3.9 FLUSHING AND DISINFECTION
(Cont'd)
- .20 (Cont'd)
by an independent lab in accordance with Section 410 of the Guidelines.
- .21 Should any of the test results be positive, repeat disinfection, flushing, sampling and analysis.
- .22 After testing and submission of the written results for the passing of the bacteriological tests, remove corporation stops and install plugs. Check visually for leakage after plugs are installed with water main under normal operating pressure.
- 3.10 CONNECTIONS TO EXISTING MAIN
- .1 Connect new mains to existing mains as indicated.
- .2 Do not make a connection to an existing main within 1.0 m of a fitting, pipe joint or another service.
- .3 Departmental Representative and HW do not guarantee leak tight operation of existing valves.
- .4 No Work will be performed on existing main until all items required to complete the connection are on site and the outside diameter and type of pipe have been confirmed.
- .5 Departmental Representative will operate valves in the exiting system.
- .6 When a connection is made to an exiting main (ie. inserting a new tee) an inspection of the joints for leakage must be made by the HW, while the main is under operating pressure, prior to backfilling.
- 3.11 PROTECTIVE COATING
- .1 Apply where alternative corrosion protection measures (polywrap, epoxy coating, cathodic protection) are not employed unless otherwise directed by the Departmental Representative.
- .2 Protective coating:
- .1 Coat all valves, steel flanges, couplings and make-up pieces, restrained joint mechanisms, and other areas indicated on Drawings and specified with protective coating, in accordance with manufacturer's instruction.
- .2 Transport and store coating materials at temperatures between 5°C and 30°C.
- .3 Confirm surfaces to be coated are free of loose coating, soil and other foreign matter.
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3.11 PROTECTIVE
COATING
(Cont'd)

- .2 Protective coating:(Cont'd)
 - .4 Apply priming paste to all areas after surface preparation is completed.
 - .5 Apply mastic to all irregular surfaces to ensure smooth surfaces and no air pockets.
 - .6 Apply tape spirally to all areas receiving paste or mastic using a 25% overlap wrapping technique.
 - .7 Wrap protected area with 150 micron polyethylene sheet prior to backfilling.
- .3 Utilize primer, mastic and tape in accordance with manufacturer's instructions.

PART 1 - GENERAL

- 1.1 RELATED WORK .1 Excavating, Trenching, and Backfilling: Section 31 23 10
- 1.2 REFERENCES .1 CAN/CSA-B1800-2011, Thermoplastic Nonpressure Piping Compendium.
- 1.3 SHOP DRAWINGS .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Submit shop drawings for all pipe, fittings, valves, and all other items necessary for a complete installation. Include details showing dimensions and tolerance of pipe and joint proposed.
- 1.4 MATERIAL CERTIFICATIONS .1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section.
- .2 Confirm certification is marked on pipe.
- 1.5 DELIVERY, STORAGE AND HANDLING .1 Handle and store pipe, valves, fittings, in such a manner as to avoid shock and damage and as per manufacturer's recommendations. Do not use chains or cables passed through pipe bore.
- .2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.
- 1.6 SCHEDULING OF WORK .1 Schedule Work to minimize interruptions to existing services and maintain existing flows during construction.
- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
- .3 Notify Departmental Representative 24 hours minimum in advance of any interruption in service.
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PART 2 - PRODUCTS

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|---|----|---|
| <u>2.1 SEWER PIPE</u> | .1 | PVC pipe and fittings: type PSM polyvinyl chloride, to CAN/CSA-B1800, DR35, complete with bell and spigot joints with locked in rubber gaskets. |
| | .2 | Sewer laterals of 150mm diameter or less shall be type PSM polyvinyl chloride, to CAN/CSA-B1800, DR28 (white), complete with bell and spigot joints with locked in rubber gaskets from the main to the building. |
| <u>2.2 THREE-WAY VALVE</u> | .1 | Vertical stem, horizontal full port, corrosion-proof ball valve: <ul style="list-style-type: none">.1 Minimum Class 150, ANSI flanges..2 150mm diameter ports..3 316 stainless steel or B61 bronze body, 316 stainless steel trim and stem..4 Operational configuration: refer to drawings..5 Standard of acceptance:<ul style="list-style-type: none">.1 Montreal Bronze, Series B3A..2 KTM, E3900..3 Valtorc, Series 280. |
| <u>2.3 ADJUSTABLE VERTICAL INDICATOR POST</u> | .1 | Telescoping stem, adapted to suit three-way ball valve stem connection requirements. |
| | .2 | Standard left hand opening. |
| | .3 | Window with encased "OPEN" (sanitary open position) and "SHUT" (sanitary shut, storm open position) target plates. |
| | .4 | Non-supervisory. |
| | .5 | Lockable using standard size corrosion-proof padlocks (supplied by Departmental Representative). |
| | .6 | Head and bell: cast iron. |
| | .7 | Weldable schedule 80 steel indicator post barrel. |
| | .8 | Canada Underwriters Laboratory (C-UL) certified. |
| | .9 | Acceptable product: <ul style="list-style-type: none">.1 Mueller A-20806.2 Kennedy Valve.3 United Water Products, Model 5400. |
-

- 2.4 PIPE BEDDING MATERIAL .1 Granular bedding material: as specified in Section 31 23 10.
- 2.5 GROUT .1 Shrinkage compensating to Section 03 30 00.
- 2.6 COUPLINGS .1 Collar-type: steel with minimum pressure rating 1035 kPa, appropriate to the type and size of pipe being joined, epoxy coated with type 316 stainless steel bolts and nuts.
- 2.7 PROTECTIVE COATINGS .1 Anti-corrosion petrolatum mastic, paste and tape.
 .1 Acceptable products:
 .1 Winn & Coales (Denso) Ltd.
 .2 Trenton
 .3 Petro.

PART 3 - EXECUTION

- 3.1 PREPARATION .1 Clean pipes and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.
- .2 Obtain Departmental Representative's approval of pipes and fittings prior to installation.
- .3 Provide proper implements, tools and facilities approved by the Departmental Representative, for the safe and convenient prosecution of the Work.
- .4 Take every precaution to prevent foreign material from entering the pipe.
- 3.2 TRENCHING AND BACKFILLING .1 Provide trenching, excavating and backfilling to Section 31 23 10.
- 3.3 GRANULAR BEDDING .1 Provide granular bedding to Section 31 23 10.
-

3.4 SPECIAL TIES .1 Three-way valve manhole: install indicator post assembly and three-way valve in accordance with manufacturer's recommendations and as indicated on drawings.

3.5 PIPE LAYING .1 Carefully lower pipe into the trench. Do not drop or dump materials into the trench.

.2 Lay and join pipes, fittings and valves as specified herein and according to manufacturer's published instructions.

.3 Lay pipe and fittings on prepared bed, true to line and grade indicated, within following tolerances:

.1 Horizontal Alignment: 50 mm.

.2 Vertical Alignment: the lesser of 12 mm or one half the rise per pipe length.

.4 Commence laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.

.5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary water-tight bulkheads when pipe laying is not in progress.

.6 Do not lay pipe when the trench bottom is frozen, underwater or when trench conditions or weather are unsuitable.

3.6 PIPE JOINTING .1 Install gaskets in accordance with manufacturer's published instructions. During cold weather store gaskets in heated area to assure flexibility.

.2 Align pipe carefully before joining. Do not use excessive force to join pipe sections.

.3 Support pipes as required to assure concentricity until joint is properly completed.

.4 Keep pipe joints free from mud, silt, gravel or other foreign material.

.5 Avoid displacing gasket or contaminating with dirt, petroleum products, or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.

.6 Where deflection at joints is permitted, deflect only after joint is completed. Do not exceed maximum joint deflection recommended by manufacturer.

- 3.6 PIPE JOINTING (Cont'd)
- .7 Cut pipe as required for fittings or closure pieces, square to centreline, and as recommended by manufacturer.
 - .8 Make watertight connections to manholes and structures.
 - .9 At structures provide flexible joint not more than 300 mm from outside face of structure, or as otherwise indicated.
- 3.7 PROTECTIVE COATING FOR FITTINGS AND VALVES
- .1 Coat collar type couplings and bolts and other areas indicated on drawings with protective coating, in accordance with manufacturer's instructions.
 - .2 Transport and store coating materials between 5°C and 30°C.
 - .3 Confirm surface to be coated is free of loose coating, soil or other foreign matter.
 - .4 Apply priming paste to areas after surface preparation is completed.
 - .5 Apply mastic to irregular surfaces to ensure smooth surfaces and no air pockets.
- 3.8 PIPE BACKFILL
- .1 As specified in Section 31 23 10.
- 3.9 PIPE CLEANING
- .1 Prior to testing, clean gravity sewer to remove foreign materials.
- 3.10 WATER-TIGHT TESTING
- .1 Test all sanitary gravity sewers for watertightness. Do all tests in the presence of the Departmental Representative.
 - .2 Continuously separate water used for flushing or testing obtained from a potable water supply from the service being flushed or tested by an air gap of a level of protection equal to or greater than that provided by a double check valve backflow prevention device. Confirm that no back-splash or particulate matter transfer possibility exists between the sanitary sewer and the water supply.
-

3.10 WATER-TIGHT
TESTING
(Cont'd)

- .3 Provide all labour, equipment and materials required to perform hydrostatic and leakage tests.
- .4 Before testing confirm that all relevant open ends are blanked off with watertight plugs or caps.
- .5 Discharge test water through newly laid pipeline if a suitable outfall exists, or otherwise in accordance with the Contract and applicable environmental regulations.
- .6 Exfiltration test:
 - .1 Fill section with water to displace air from main and service connections. Fill and maintain nominal head on concrete pipe 24 hours before testing to allow absorption of water by pipe material.
 - .2 Add water to establish test head of 3 m over either crown of pipe, measured at highest point of section, or level of static ground water, whichever is greater. Do not exceed net internal head of 8.13 m.
 - .3 Maintain test head for one (1) hour.
 - .4 Measure and record volume of water required to maintain head during test period.
- .7 Infiltration test:
 - .1 Conduct infiltration test instead of exfiltration test where level of static ground water is 760 mm or more above crown of pipe measured at highest point of section. No increase in infiltration rate will be allowed if head exceeds 760 mm.
 - .2 Install watertight plug at upstream end of section.
 - .3 Discontinue dewatering minimum of three (3) days before taking test measurements.
 - .4 Place 90° V-notch weir, in invert of main at downstream end of section. Add water until flow is observed through notch.
 - .5 Measure and record total volume of flow for one hour.
- .8 Allowable leakage: determined by the following formula:

$$L = F \times D \times \frac{S}{100}$$

where:

L = allowable leakage in litres per hour
D = Diameter in mm
S = Length of section, in metres
F = leakage factor, (litres per hour per
per mm of diameter per 100 metres of

3.10 WATER-TIGHT .8 Allowable leakage:(Cont'd)
TESTING
(Cont'd)

sewer)
= 0.02 (Non-Porous Pipe)
= 0.12 (Porous Pipe - Exfiltration
Test)
= 0.10 (Porous Pipe - Infiltration
Test)

- 3.11 DEFLECTION .1 Measure deflection by pulling a deflection gauge
TESTING - PVC PIPE through each pipe from manhole to manhole after
backfilling.
- .2 Provide deflection gauges to measure a 5% and 7-1/2%
deflection. Gauges to be a "Go-No-Go" device.
- .3 Thirty days after installation, pull a deflection
gauge measuring 5% deflection through the installed
section of pipeline. If this test fails proceed with
7-1/2% deflection test.
- .4 Thirty days prior to completion of Warranty Period
Maintenance, pull a deflection gauge measuring 7-1/2%
deflection through the installed section of pipeline.
- .5 If 7-1/2% deflection test fails, locate defect and
repair. Retest to satisfaction of Departmental
Representative.

- 3.12 CLOSED .1 Arrange and pay for television camera inspection of
CIRCUIT TELEVISION installed pipeline.
INSPECTIONS
- .2 Scheduling:
.1 Perform first video inspection when the
sanitary sewer has been cleaned and all manhole
adjustments and street reinstatement have been
completed.
.2 The entire system must also be video inspected
a second time eleven months after substantial
completion.
- .3 Equipment:
.1 Provide equipment meeting following
requirements:
.1 Self-contained monitoring unit and camera
with remotely controlled lighting system capable
of varying the illumination.
-

3.12 CLOSED
CIRCUIT TELEVISION
INSPECTIONS
(Cont'd)

- .3 Equipment:(Cont'd)
 - .1 (Cont'd)
 - .2 Picture quality shall produce continuous 600-line resolution picture, showing entire periphery of pipe.
 - .3 A meter device with readings above ground or marking on cable to clearly identify exact location of camera.
- .4 Definition of fault:
 - .1 Any pipe joint which displays a gap or spread, offset, gasket, or signs of infiltration.
 - .2 Any section of pipeline which is crushed, broken or displays cracks.
 - .3 Any variance in grade of pipeline.
 - .4 Any gravel, roots, or foreign material which may impede flow.
 - .5 Any deformation in shape of pipe.
- .5 Inspection:
 - .1 Perform inspection of pipe by passing TV camera through pipeline in direction of flow.
- .6 Records:
 - .1 Maintain inspection record in log form, during television inspection.
 - .2 Log to include location of each fault.
 - .3 Photograph fault from the television screen using a digital camera or provide hard copy stills directly from system if possible. All photographs to be clear and precise with distinct definition of fault.
 - .4 Include detailed technical description with photographs as supporting data for each fault.
 - .5 Provide all photos and videos in colour.
- .7 Reports:
 - .1 Provide a composite report of TV inspection. Enclose report in binder on letter size paper. Include following pages and information:
 - .1 Title page identifying project, camera operator and dates of inspection.
 - .2 Index page identifying pipeline, page number or numbers where information for section is contained.
 - .2 Report on each pipeline to contain:
 - .1 Heading:
 - .1 Street name.
 - .2 Manhole numbers applicable to section.
 - .3 Reference drawing number, if applicable.
 - .4 Weather on the day of inspection.

3.12 CLOSED
CIRCUIT TELEVISION
INSPECTIONS
(Cont'd)

- .7 Reports:(Cont'd)
 - .2 (Cont'd)
 - .1 Heading:(Cont'd)
 - .5 Statement of soil condition in area of inspection, i.e., dry, damp, wet, frozen.
 - .6 Date of inspection.
 - .2 Key Plan showing magnetic north, horizontal distance, pipe and material and direction of flow.
 - .3 Inspection findings for each pipeline to include:
 - .1 Location of all faults.
 - .2 One photograph each of typical joint and flanged connection.
 - .4 Mount photographs on left-hand page and place corresponding description on right- hand page. Number all photographs in order. Number beside photograph to correspond with description number.
 - .5 Enclose all pages of report in transparent sheet protector.
 - .6 Provide copy of DVD to Departmental Representative.

3.13 TESTS TO BE
REPEATED

- .1 Should testing or inspection disclose non-conformance, locate and repair defective pipe or joint to the approval of the Departmental Representative.
- .2 Re-test to determine success or otherwise of remedial measures applied to pipework. These re-tests are to be repeated at no extra cost to Contract until results show that remedial measures have been successful.
- .3 In the event the Departmental Representative suspects the sanitary gravity sewer no longer complies with requirement of the test, the Departmental Representative may order additional testing. Should the length of pipeline prove defective, repair or make good the defect at no extra cost to Contract.
- .4 Cost of additional testing to be at no extra cost to Contract if test proves a defect. However, if this testing shows pipe to be satisfactory, cost of second test will be borne by Departmental Representative.

3.14 CLEANUP .1 Upon completion of testing of each section remove all ancillary equipment and plug holes. Do not backfill around test plugs until inspected by Departmental Representative.

PART 1 - GENERAL

1.1 RELATED WORK .1 Cast-in-Place Concrete: Section 03 30 00

.2 Exterior Waterproofing: Section 07 11 00

.3 Excavating, Trenching and Backfilling:
Section 31 23 10

1.2 REFERENCES

.1 ASTM A48/A48M-2003 (R2012), Specification for Gray Iron Castings.

.2 ASTM A123-2012, Standard Specification for Zinc-Dipped (Hot-Dipped Galvanized) coatings on Iron and Steel Products.

.3 ASTM C478M-2012a, Specification for Precast Reinforced Concrete Manhole Sections.

.4 ASTM C858-2010, Standard Specification for Underground Precast Concrete Utility Structures.

.5 CAN/CGSB 51.34-M86, Vapour Barrier, Polyethylene Sheet for use in Building construction.

.6 CAN/CSA-A23.1-04/A23.2-09, Concrete Materials and Methods for Concrete Construction.

.7 CAN/CSA-A257 Series - 2009, Standards for Concrete Pipe.

.8 CAN/CSA-A3000-2008, Cementitious Materials.

.9 CAN/ULC S701-2011, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.10 CSA G40.20/G40.21-04 (R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steels.

1.3 SHOP DRAWINGS

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

.2 Submit manufacturer's test data and certification that materials meet requirements of this section. Include manufacturer's drawings, information, size of components, dimensions and details where pertinent.

PART 2 - PRODUCTS

- 2.1 MATERIALS
- .1 Precast manhole and catch basin sections: to ASTM C478M, circular. Manhole top sections flat slab top type with opening offset for vertical ladder installation. Precast concrete bases to be approved by Departmental Representative.
 - .2 Joints: to be made watertight using rubber O-rings.
 - .3 Mortar:
 - .1 Cement: to CAN/CSA-A3000.
 - .4 Oil/water separator: Stormceptor Model STC 1000 as supplied by Stormceptor Canada Inc. meeting the following characteristics:
 - .1 Circular and constructed from pre-cast concrete circular sections.
 - .2 Concrete separator to include a fiberglass insert bolted and sealed watertight inside the concrete chamber. The fiberglass insert must provide a lining for oil storage as a secondary containment system.
 - .3 Only profile neoprene or nitrile rubber gaskets will be accepted, manufactured in accordance to CSA A257. Mastic sealants are not acceptable.
 - .4 Provide frame and covers clearly embossed with "Stormceptor".
 - .5 The oil/sediment separator must remove oil and sediment from stormwater.
 - .6 Equip with a bypass that regulates the flow rate into the treatment chamber and conveys high flow directly to the outlet such that scour and re-suspension of material previously collected in the separator does not occur.
 - .7 Construct, transport, install and backfill as per all of the manufacturer's written instructions.
 - .8 A trained representative of the supplier must be on site at all times during the installation of the Stormceptor.
 - .9 The supplier representative will provide a written report to the Departmental Representative stating that the unit meets the requirements of these specifications.
 - .5 Adjusting rings: precast concrete, to ASTM C478.
 - .6 Frames and covers: to dimensions as indicated and following requirements:
 - .1 Bear metal gratings and covers evenly on frames. A frame with grating or cover to constitute
-

- 2.1 MATERIALS
(Cont'd)
- .6 Frames and covers:(Cont'd)
- .1 (Cont'd)
one unit. Assemble and mark unit components before shipment.
- .2 Gray iron castings: to ASTM A48.
- .3 Bearing surfaces to be ground to eliminate surface imperfections.
- .4 Manhole frames and covers: heavy duty municipal type for road service and as indicated on the drawings. Cover cast with perforations for storm sewer application. Cover cast without perforations and complete with single 25mm square lifting hole for sanitary sewer and other applications.
- .1 Acceptable product: IMP Group Ltd. Slotted (Perforated) Type R91, IMP Group Ltd. Vented (Non-perforated) Type R90 - single hole.
- .7 Granular bedding material: as specified in Section 31 23 10.
- .8 Concrete: for adjustment and benching, as specified in Section 03 30 00.
- .9 Waterproofing (sanitary manholes only):
- .1 Refer to Section 07 11 00.
- .10 Frost barrier (sanitary manholes only):
- .1 Rigid insulation: to Section 07 20 00.

PART 3 - EXECUTION

- 3.1 EXCAVATION AND BACKFILLING
- .1 Provide excavating and backfilling in accordance with Section 31 23 10.
- .2 Obtain approval of Departmental Representative before installing, manholes or catch basins.
- 3.2 CONCRETE WORK
- .1 Do concrete work in accordance with Section 03 30 00.
- .2 Position metal inserts in accordance with dimensions and details as indicated.
-

3.3 INSTALLATION

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
 - .2 Complete manholes and catch basins as pipe laying progresses.
 - .3 Dewater excavation as directed by Departmental Representative and remove soft and foreign material before placing concrete base.
 - .4 Set precast concrete base on 150 mm minimum of granular bedding compacted in accordance with Section 31 23 10.
 - .5 Set riser sections on precast base and make joint watertight with O-ring gaskets. Grout joints inside and out with non-shrink grout.
 - .6 Plug lifting holes with non-shrink grout.
 - .7 Place stub outlets at elevations and in position indicated. Provide type of gasket connection as indicated.
 - .8 Install manhole benching where shown on the Drawings using concrete Mix 2 in accordance with Section 03 30 00.
 - .9 Install STC 1000 Stormceptor in accordance with manufacture's instructions.
 - .10 Install frames and covers on applicable top sections to elevation shown on Drawings or as directed. Use cast-in-place concrete (min. 150 mm thickness) or cast-in-place concrete with 15 M reinforcing bar in centre (for adjustments between 75 mm and 150 mm) or "Rapid-Set" or "Set-45" epoxy mortar (between 20 mm and 75 mm). Cast-in-place concrete shall not exceed the outside edge of the capping ring.
 - .11 Install frames and covers integrally with concrete structures as indicated on drawings.
 - .12 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.
 - .13 Apply waterproofing for sanitary manholes as indicated and in accordance with Section 07 11 00.
-

3.4 SYSTEM CLEANLINESS .1 Upon manhole adjustment, removal of catchment device and all works associated with restoration around the manhole, the contractor shall provide all testing equipment, labour, incidentals, traffic control, etc., required to undertake an inspection of the system to verify its cleanliness. This inspection must be done in the presence of the Departmental Representative.

3.5 LEAKAGE TEST .1 Install watertight plugs or seals on inlets and outlets of each unit and fill with water. Allow 24 hours for absorption of water into concrete and top up before testing. Leakage not to exceed 0.3% per hour of volume of unit.

.2 If permissible leakage is exceeded, correct defects. Repeat until acceptable to Departmental Representative.

PART 1 - GENERAL

- 1.1 RELATED WORK
- .1 Excavating, Trenching, and Backfilling:
Section 31 23 10
 - .2 Manholes, Catchbasins
and Structures: Section 33 39 00
- 1.2 REFERENCES
- .1 ASTM C1433-10, Precast Reinforced Concrete
Monolithic Box Sections for Culverts, Storm Drains,
and Sewers.
 - .2 CSA B1800-2011, Thermoplastic Nonpressure Piping
Compendium.
 - .3 CAN/CSA A257 Series-09, Concrete Pipe and Manhole
Sections.

PART 2 - PRODUCTS

- 2.1 GENERAL
- .1 Use PVC pipe for storm sewers up to and including
300 mm nominal diameter.
 - .2 Use concrete pipe for all storm sewers greater than
300 mm nominal diameter.
- 2.2 PVC PIPE
- .1 Pipe and Fittings: Type PSM Polyvinyl Chloride to
CSA B1800, DR35.
 - .2 Catch Basin Leads: Type PSM Polyvinyl Chloride to
CSA B1800, DR35.
 - .3 Joints: bell and spigot with locked-in rubber
gasket.
- 2.3 CONCRETE PIPE
- .1 Reinforced concrete pipe to CAN/CSA-A257, diameter
as indicated, minimum strength classification as
follows:
 - .1 Up to 750mm nominal diameter: 65D
 - .2 Greater than 750mm nominal diameter: 100D
-

<u>2.4 PIPE BEDDING MATERIAL</u>	.1	Granular bedding material: as specified in Section 31 23 10.
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PART 3 - EXECUTION

<u>3.1 PREPARATION</u>	.1	Clean pipes and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.
	.2	Provide proper implements, tools and facilities approved by the Departmental Representative for the safe and convenient prosecution of the Work. Take every precaution to prevent foreign material from entering pipe.

<u>3.2 TRENCHING AND BACKFILLING</u>	.1	Provide trenching, excavating and backfilling to Section 31 23 10.
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<u>3.3 GRANULAR BEDDING</u>	.1	Provide granular bedding to Section 31 23 10.
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<u>3.4 PIPE LAYING</u>	.1	Carefully lower pipe into the trench. Do not drop or dump materials into the trench.
	.2	Firmly and accurately set pipe to line and elevation on bedding material to the depth shown on the Drawings.
	.3	Check profiles at the commencement of Work. Confirm grades and depths. Any variation will be made only at the order of the Departmental Representative. Set line of pipe and set elevation by a method approved by the Departmental Representative.
	.4	Start laying of the pipe at the lowest pipe and lay upgrade unless approved otherwise by the Departmental Representative.
	.5	Do not lay pipe when the trench bottom is frozen or underwater or when trench conditions or weather are unsuitable.
	.6	Temporarily support all pipe during assembly and install fittings in a manner to ensure pipe is not

3.4 PIPE LAYING
(Cont'd)

- .6 (Cont'd)
strained during jointing procedure. Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .7 Whenever it is necessary to cut pipe to fit into pipeline, do this work and provide materials at no extra cost to the Contract. No extra compensation will be considered for cutting of pipe or for placing cut pipe in the pipeline.

3.5 PIPE
JOINTING

- .1 Align pipes carefully before jointing.
- .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gaskets and maintain concentricity until gaskets are properly positioned.
- .3 Maintain pipe joints clean and free from foreign materials.
- .4 Complete each joint before laying next length of pipe.
- .5 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations. Minimize deflection after joint has been made to avoid damage.
- .6 Connections to manholes, catch basins and structures to be watertight and structurally sound, all as specified in Section 33 39 00.

3.6 PIPE
CLEANING

- .1 Leave internal parts of storm sewer in clean condition.
- .2 Remove debris by scraping, dragging, brushing, picking or flushing as required.

3.7 DEFLECTION
TESTING - PLASTIC
PIPE

- .1 Measure deflection by pulling deflection gauge through each pipe from manhole to manhole after backfilling.
- .2 Provide deflection gauges to measure a 5% and 7-1/2% deflection. Gauges to be a "Go-No-Go" device.
- .3 Thirty (30) days after installation, pull a deflection gauge measuring 5% deflection through the

- .1 Arrange and pay for television camera inspection of installed pipeline.
- .2 Scheduling:
 - .1 Perform first video inspection when the storm sewer has been cleaned and all manhole adjustments and street reinstatement have been completed.
 - .2 The entire system must also be video inspected a second time eleven months after substantial completion.
- .3 Equipment:
 - .1 Provide equipment meeting following requirements:
 - .1 Self-contained monitoring unit and camera with remotely controlled lighting system capable of varying the illumination.
 - .2 Picture quality shall produce continuous 600-line resolution picture, showing entire periphery of pipe.
 - .3 A meter device with readings above ground or marking on cable to clearly identify exact location of camera.
- .4 Definition of fault:
 - .1 Any sewer pipe joint which displays a gap or spread, offset, gasket, or signs of infiltration.
 - .2 Any service lateral which displays water infiltrating around service connection, or a steady flow through service lateral.
 - .3 Any service lateral exhibiting pronounced protrusion into the sewer main.
 - .4 Any section of sewer which is crushed, broken or displays cracks.
 - .5 Any variance in grade of sewer main section.
 - .6 Any gravel, roots, or foreign material which may impede flow.
 - .7 Any deformation in shape of pipe.
 - .8 Any ponding of water in pipe.

3.8 CLOSED CIRCUIT
TELEVISION
INSPECTION
(Cont'd)

- .5 Inspection:
 - .1 Perform inspection of pipe from manhole to manhole by passing TV camera through sewer in direction of flow.
- .6 Records:
 - .1 Maintain inspection record in log form, during television inspection.
 - .2 Log to include location of each fault and service lateral distance measured from centreline of reference manhole and position referenced to axis of pipe.
 - .3 Photograph fault from the television screen using a digital camera or provide hard copy stills directly from TV system if possible. All photographs to be clear and precise with distinct definition of fault.
 - .4 Include detailed technical description with photographs as supporting data for each fault.
 - .5 Provide minimum of two photographs for each sewer main section televised, detailing typical joint, and typical building service lateral.
 - .6 All photos and videos to be in colour.
- .7 Reports:
 - .1 Provide a composite report of TV inspection. Enclose report in binder on letter size paper. Include following pages and information.
 - .1 Title page identifying project, camera operator and dates of inspection.
 - .2 Index page identifying street name, section from manhole to manhole, page number or numbers where information for section is contained.
 - .2 Organize inspection records in sequence from upstream manhole to downstream manhole.
 - .3 Report on each sewer main section to contain:
 - .1 Heading:
 - .1 Street name.
 - .2 Manhole numbers applicable to section.
 - .3 Reference drawing number, if applicable.
 - .4 Weather on the day of inspection.
 - .5 Statement of soil condition in area of inspection, i.e., dry, damp, wet, frozen.
 - .6 Date of inspection.
 - .2 Key Plan, showing corresponding manhole numbers, magnetic north, horizontal distance, pipe and material between manholes, and direction of flow.

- 3.8 CLOSED CIRCUIT .7 Reports:(Cont'd)
TELEVISION .3 (Cont'd)
INSPECTION .3 Inspection findings for each sewer main
(Cont'd) section to include:
.1 Location of all faults.
.2 Photographs of all faults.
.3 Location of all service laterals.
.4 One photograph each of typical joint
and typical when service laterals faults
are not found.
.4 Mount photographs on left-hand page and
place corresponding description on right-hand
page. Number all photographs in order. Number
beside photograph to correspond with description
number.
.5 Enclose all pages of report in transparent
sheet protector.
- .8 Accuracy:
.1 Maximum permissible error in accuracy to be
within following limits of fault location:
.1 Up to 375mm pipe: $\pm 75\text{mm}$ per 100m of
length.
.2 450mm - 600mm pipe: $\pm 150\text{mm}$ per 100 m of
length.
.3 750mm and greater pipe: $\pm 225\text{mm}$ per 100m
of length.
- .9 Video Tapes:
.1 Supply a complete record of all inspections on
DVD format.
.2 Index all tapes, listing sections of
inspections.
.3 Submit video tapes with written reports to
Departmental Representative.
- .10 Repeat Inspection:
.1 Repair faults detected during television
inspection. Repeat television inspection at no cost
to the Departmental Representative.

PART 1 - GENERAL

- | | | |
|-----------------------------|----|---|
| <u>1.1 RELATED SECTIONS</u> | .1 | Cast-in-Place Concrete: Section 03 30 00 |
| | .2 | Excavating, Trenching and Backfilling: Section 31 23 10 |
| <u>1.2 SHOP DRAWINGS</u> | .1 | Submit shop drawings in accordance with Section 01 33 00. |
| <u>1.3 REFERENCES</u> | .1 | CSA C22.2 No. 211.1-06(R2011), Rigid Types EB1 and DB2/ES2 PVC Conduit. |
| | .2 | CSA C22.3 No. 7-2010, Underground Systems. |

PART 2 - PRODUCTS

- | | | |
|------------------------------------|----|---|
| <u>2.1 PVC DUCTS</u> | .1 | PVC ducts, type DB2, encased in reinforced concrete. Concrete to Section 03 30 00, Mix 2. |
| <u>2.2 PVC DUCT FITTINGS</u> | .1 | Rigid PVC solvent welded and pushfit type couplings, bell end fittings, plugs, caps, adaptors as required to make complete installation. |
| | .2 | Expansion joints. |
| | .3 | Rigid PVC 5° angle couplings. |
| | .4 | PVC long radius bends, 5 ft. radius: 90° and 45°. |
| <u>2.3 CABLE PULLING EQUIPMENT</u> | .1 | Pull rope: 6mm stranded polypropylene, tensile strength 5 kN, continuous throughout each duct run with 3m spare rope at each end. |
| <u>2.4 MARKERS</u> | .1 | Concrete type cable markers: 600mm x 600mm x 100mm, with words: "cable", "joint" or "conduit" impressed in top surface, with arrows to indicate change in direction of duct runs. |
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PART 3 - EXECUTION

3.1 INSTALLATION
GENERAL

- .1 Install underground duct banks including formwork.
 - .2 Build duct bank on undisturbed soil or on well compacted Type 1 bedding not less than 150mm thick, compacted to 95% to ASTM D1557.
 - .3 Open trench completely before ducts are laid and ensure that no obstructions will necessitate change in grade of ducts.
 - .4 Where unstable soil (clay) is encountered, construct "mud slab" not less than 75mm thick prior to laying ducts.
 - .5 Install ducts at elevations and with slope as indicated and minimum slope of 1 to 400 away from building or manholes.
 - .6 Install spacers to provide duct spacing indicated, at maximum intervals of 1.5m levelled to grades indicated for bottom layer of ducts.
 - .7 Lay PVC ducts with configuration and reinforcing as indicated with intermediate spacers to maintain spacing between ducts as indicated. Stagger joints in adjacent layers at least 150mm and make joints watertight. Encase duct bank with concrete cover as indicated. Use galvanized steel conduit for sections extending above finished grade level unless otherwise indicated.
 - .8 Make transpositions, offsets and changes in direction using 5° bend sections, do not exceed a total of 20° with duct offset.
 - .9 Use bell ends at duct terminations in buildings and manholes. Comply with utility requirement for termination at poles.
 - .10 Use conduit to duct adapters when connecting to conduits.
 - .11 Terminate duct runs with duct coupling set flush with end of concrete envelope when dead ending duct bank for future extension, where indicated.
 - .12 Cut, ream and taper end of ducts in field in accordance with manufacturer's recommendations, so that duct ends are fully equal to factory-made ends.
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3.1 INSTALLATION
GENERAL
(Cont'd)

- .13 Allow concrete to attain 50% of its specified strength before backfilling.
- .14 Use anchors, ties and trench jacks as required to secure ducts and prevent moving during placing of concrete. Tie ducts to spacers with twine or other non-metallic material. Remove weights or wood braces before concrete has set and fill voids.
- .15 Clean ducts before laying. Cap ends of ducts during construction and after installation to prevent entrance of foreign materials.
- .16 Immediately after placing of concrete, pull through each duct a steel or wooden mandrel not less than 300mm long and of a diameter 8mm less than internal diameter of duct, followed by stiff bristle brush to remove sand, earth and other foreign matter. Avoid disturbing or damaging ducts where concrete has not set completely. Pull stiff bristle brush through each duct immediately before pulling-in cables.
- .17 In each duct install pull rope continuous throughout each duct run with 3m spare rope at each end.

3.2 MARKERS

- .1 Mark location of duct runs under hard surfaced areas not terminating in manhole with railway spike driven flush in edge of pavement, directly over run. Place concrete duct marker at ends of such duct runs. Construct markers and install flush with grade.
- .2 Mark ducts every 90m along straight runs and at all changes in direction.
- .3 Where markers are removed to permit installation of additional duct, reinstall existing markers.
- .4 Lay concrete markers flat and centered over duct with top 25mm above earth surface.
- .5 Provide drawings showing locations of markers.

3.3 INSPECTIONS

- .1 Inspection of duct will be carried out by Departmental Representative prior to placing. Placement of concrete and duct cleanout to be done when Departmental Representative present.
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3.4 CABLE <u>INSTALLATION</u>	.1	Supply and installation of cables in utility company ducts will be provided by the respective utilities.
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