

## **PART 1 GENERAL**

### **1.01 WORK INCLUDED**

- .1 This Section specifies requirements for construction of domestic water service laterals. Work includes supply, installation, and related appurtenances.

### **1.02 REFERENCES**

- .1 AWWA B300-10, Hypochlorites
- .2 AWWA C800-14, Underground Service Line Valves and Fittings.
- .3 AWWA C901-08, Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service.
- .4 AWWA C904-2016, Cross-Linked Polyethylene (PEX) Pressure Pipe, 1/2 In. (13mm) Through 3 In. (76 mm), for Water Service.
- .5 ASTM B62-2015, Standard Specification for Compositon Bronze or Ounce Metal Castings.
- .6 ASTM B88-2014, Standard Specification for Seamless Copper Water Tube.
- .7 ASTM F876-15a1, Standard Specification for Polyethylene Crosslinked (PEX) Tubing.
- .8 ASTM F877-11a, Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems.
- .9 ASTM F1282-10, Standard Specification for Polyethylene/Aluminum/Polethylene (PE-AL-PE) Composite Pressure Pipe.
- .10 ASTM F2023-15, Standard Test Method for Evaluating the Oxidative Resistance of Crosslinked Polyethylene (PEX) Pipe, Tubing and Systems to Hot Chlorinated Water.
- .11 Health Canada:
  - .1 Guidelines for Canadian Drinking Water Quality.
- .12 CAN/CSA B137-Series 13, Thermoplastic Pressure Piping Compendium.

### **1.03 SHOP DRAWINGS**

- .1 Provide shop drawings in accordance with Section 01 33 00 for all pipe, fittings, valves, thrust restraint and all other items necessary for a complete installation. Include details showing dimensions and tolerances of pipe and joint proposed.

### **1.04 CERTIFICATES**

- .1 Submit manufacturer's test data and certification that products and materials meet requirements of this Section and the latest Guidelines for Canadian Drinking Water Quality as published by Health Canada.

### **1.05 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 passed 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 valves to prevent retention of water and damage by freezing.

### **1.06 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL**

- .1 Diameter, material and strength class of pipe and fittings: as indicated.
- .2 Any material that comes in contact with drinking water must comply with NSF 61.

### **2.02 SERVICE PIPE AND FITTINGS**

- .1 Copper tubing: to ASTM B 88, type K annealed, and minimum pressure rating 1035 kPa.

- .2 Polyethylene pipe: to CAN/CSA B137, AWWA C901, NSF 61, type PE, Series 160 or 200.
- .3 Cross-linked polyethylene tubing: to CAN/CSA B137 .5 and AWWA C904, NSF 14, NSF 61, ASTM F2023, ASTM F876 and ASTM F877, type PEX.
- .4 Joints: compression type, minimum pressure rating 1035 kPa. For polyethylene pipe, to CAN/CSA B137, with stainless steel liner.
- .5 Corporation stop: brass to ASTM B62 and NSF 61-G, compression type, inlet threads to AWWA C800.
- .6 Curb stop and drain: brass to ASTM B62 and NSF 61-G, compression type joints and O-ring seal.
- .7 Service clamp: bronze body, confined O-ring seal cemented in place and straps suitable for connecting main. Outlet tapped and threaded to AWWA C800.
- .8 Service box: adjustable type, cast-iron bottom section, cast-iron lid with recessed pentagon nut and internal stem to suit depth of bury. Service box to have appropriate foot piece.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION**

- .1 Clean pipes, fittings, valves 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 execution of the work. Take every precaution to prevent foreign material from entering the pipe.

#### **3.02 TRENCHING, BEDDING AND BACKFILLING**

- .1 Do trenching, bedding and backfilling to Section 31 23 10 and as specified on the drawings.

### **3.03 BURIED PIPE INSTALLATION**

- .1 Lay service pipe in a smooth trench bottom with gravel bedding 250mm below the pipe and a minimum 18 inches over the pipe.
- .2 Backfill with well graded select backfill.
- .3 Install new 11kg zinc anode on copper services.
- .4 Curb stop and box to be installed as indicated on the drawings.
- .5 Do not lay pipe and fitting when trench bottom is frozen, underwater or when trench conditions or weather are unsuitable.
- .6 Do not exceed maximum deflection recommended by manufacturer.
- .7 Prevent entry of bedding material, water or other foreign matter into pipe. Keep pipe joints free of mud, silt, gravel or other foreign materials.
- .8 Cut pipe as required for fittings or closure pieces, square to centreline, and as recommended by manufacturer. Do not damage pipe lining or coating and leave smooth bevelled edge.

### **3.04 FLUSHING**

- .1 Flush water service laterals with potable water through available outlets until foreign materials have been removed and water is clear.

**END OF SECTION**

## **1 GENERAL**

### **1.01 WORK INCLUDED**

- .1 This section specifies requirements for constructing gravity sanitary sewers. Work includes supply, installation, low pressure testing of pipe, fittings and service connections.

### **1.02 REFERENCE STANDARDS**

- .1 CAN/CSA A257 Series-14, Concrete Pipe and Manhole Sections.
- .2 CAN/CSA B1800-15, Thermoplastic Non-pressure Piping Compendium.
- .3 ASTM D4254-16, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

### **1.03 SHOP DRAWINGS**

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

### **1.04 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 - Submittal Procedures.
- .2 Ensure certification is marked on pipe.

### **1.05 HANDLING AND STORAGE**

- .1 Handle and store pipe and fittings in such manner as to avoid shock and damage. 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.

## **1.06 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 and City of Moncton 24 hours minimum in advance of any interruption in service.

## **2 PRODUCTS**

### **2.01 GENERAL**

- .1 Sanitary pipe: PVC DR-35, size as indicated on Drawings.

### **2.02 PLASTIC PIPE AND FITTINGS**

- .1 Type PSM Polyvinyl Chloride to CSA B1800.
- .2 Joints: bell and spigot with rubber gasket recommended by pipe manufacturer.
- .3 Bend: PVC DR35, same manufacturer as the pipe.

### **2.03 SERVICE SADDLES**

- .1 PVC main: PVC strap-on saddle, in- line tee or wye, with gasket, all stainless steel strap and O-ring in branch end.

### **2.04 PIPE BEDDING MATERIAL**

- .1 As specified in Section 31 23 10.

## **3 EXECUTION**

### **3.01 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

execution of the work.

- .4 Take every precaution to prevent foreign material from entering the pipe.

### **3.02 TRENCHING, BEDDING AND BACKFILLING**

- .1 Do trenching, bedding and backfilling to Section 31 23 10 and as specified on the Drawings.

### **3.03 PIPE INSTALLATION**

- .1 Lay and join pipe and fittings as specified herein and according to manufacturer's published instructions.
- .2 Carefully lower pipe into the trench. Do not drop or dump materials into trench.
- .3 Lay pipe and fittings on prepared bed, true to line and grade indicated, within following tolerances:
  - .1 Horizontal Alignment: 50mm.
  - .2 Vertical Alignment: the lesser of 12mm 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 watertight bulkheads when pipe laying is not in progress.
- .6 Do not lay pipe when the trench bottom is frozen or underwater or when trench conditions or weather are unsuitable.

### **3.04 PIPE JOINTING**

- .1 Install gaskets in accordance with manufacturers 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 Complete each joint before laying next length of pipe.
- .7 Where deflection at joints is permitted, deflect only after joint is completed. Do not exceed maximum joint deflection recommended by manufacturer.
- .8 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer.
- .9 Make watertight connections to manholes. Use non-shrink grout when suitable gaskets are not available.
- .10 At structures provide flexible joint not more than 300mm from outside face of structure, or otherwise indicated.

### **3.05 PIPE CLEANING**

- .1 Prior to testing, clean gravity sewer to remove foreign materials.

### **3.06 TESTING**

- .1 Test each section of sewer. A section is the length of pipe between successive manholes or termination points, including service connections to the street line or termination point.
- .2 Provide labour, equipment and materials required to perform testing.
- .3 Notify Departmental Representative at least 24 hours in advance of all proposed tests. Perform tests in presence of Departmental Representative.
- .4 Flush sewers and related appurtenances to remove foreign materials.
- .5 Before testing, ensure that all relevant open ends are blanked off with watertight plugs or caps.
- .6 Low Pressure Air Testing

CAUTION:

FOR SAFETY OF PERSONNEL AND PUBLIC, OBSERVE PROPER PRECAUTIONS DURING AIR TESTING. USE TEST EQUIPMENT DESIGNED TO OPERATE ABOVE GROUND. DO NOT PERMIT PERSONNEL IN TRENCH DURING TESTING. DO NOT AIR TEST PIPE WITH DIAMETER GREATER THAN 600MM (24 INCHES).

- .1 Provide air testing equipment meeting the following requirements:
  - .1 Air Blower: 0.5 cfs, maximum pressure 10 psi continuous.
  - .2 Pressure Relief Valve: Sized to relieve full blower capacity at maximum blower pressure. Range 3-10 psi, adjustable.
  - .3 Pressure Gauges: Range 0 to 10 psi with accuracy +/- 0.04 psi.
- .2 Provide plugs at each end of section, with one plug equipped for air inlet connection.
- .3 Fill test section slowly until a constant pressure of 4 psi is reached. If ground water is above section being tested, Departmental Representative may recommend increase in air pressure.
- .4 Allow minimum 2 minutes for air temperature to stabilize, adding only amount of air required to maintain pressure.
- .5 After 2-minute period, shut off air supply.
- .6 Decrease pressure to 3.5 psi. Measure time required for pressure to reach 2.5 psi. Minimum time allowed for pressure drop is as follows:

<u>Pipe Diameter (mm)</u>	<u>Minimum time Min:Sec</u>
100	1:53
150	2:50
200	3:47
250	4:43
300	5:40
375	7:05
450	8:30
525	9:55
600	11:20

- .7 Locate and repair defects if test fails. Retest.
- .8 Repair visible leaks regardless of test results.

### 3.07 CLOSED CIRCUIT TELEVISION INSPECTION

- .1 Provide inspection of installed sanitary sewer by television camera; once at 30 days after substantial performance and again one (1) year after substantial performance.
- .2 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.
- .3 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.
- .4 Inspection:
  - .1 Perform inspection of pipe from manhole to manhole by passing TV camera through sewer in direction of flow.
- .5 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 centerline of reference manhole and position referenced to axis of pipe.
  - .3 Photograph fault from the television screen using a 35 mm camera. 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.
- .6 Reports:
- .1 Provide a composite report of CCTV 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 Inspection findings for each sewer main 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 each photograph to correspond with description number.
  - .5 Enclose all pages of report in transparent sheet protector.
- .7 Accuracy:
- .1 Maximum permissible error in accuracy to be within

following limits of fault location:

- .1 Up to 375mm pipe:  $\pm 75$ mm per 100m of length.
  - .2 450mm - 600mm pipe:  $\pm 150$ mm per 100m of length.
  - .3 750mm - 900mm pipe:  $\pm 225$ mm per 100m of length.
- .8 Records:
- .1 Supply a complete record of all inspections on DVD.
  - .2 Index all DVDs, listing sections of inspections.
- .9 Repeat Inspection: Repair faults detected during television inspection. Repeat television inspection for those sections repaired.

### **3.08 CLEAN-UP**

- .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.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED WORK**

- .1 Excavating, Trenching and Backfilling: Section 31 23 10

### **1.02 REFERENCES**

- .1 ASTM C478M-15a, Specification for Precast Reinforced Concrete Manhole Sections.
- .2 ASTM C858-2010e1, Standard Specification for Underground Precast Concrete Utility Structures.
- .3 CAN/CGSB 51.34-M86, Vapour Barrier, Polyethylene Sheet for use in Building construction.
- .4 CAN/CSA-A23.1-04/A23.2-2014, Concrete Materials and Methods for Concrete Construction.
- .5 CAN/CSA-A3000-2013, Cementitious Materials.

### **1.03 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.

## **2 PRODUCTS**

### **2.01 MATERIALS**

- .1 Manholes and Catch Basins:
  - .1 Precast manhole and catch basin sections: to ASTM C478M, circular. Manhole top sections to be eccentric cone type where identified on Drawings. Precast concrete bases to be approved by Engineer.
  - .2 HDPE Catch Basin: made from a polyethylene resin that complies with properties classification PE 334420C, as defined in standard ASTM D3350
- .3 Joints: to be made watertight using rubber O-rings.

- .4 Mortar:
  - .1 Cement: to CAN/CSA-A3000.
- .5 Adjusting rings: precast concrete, to ASTM C478.
- .6 Frames and grates: to dimensions as indicated and 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 A48.
  - .3 Bearing surfaces to be ground to eliminate surface imperfections.
  - .4 Catch basin frames and grates: heavy duty municipal type for road service and as indicated on the drawings.
    - .1 Acceptable product: IMP Group Ltd. Type R10.
- .7 Bedding material: Class A as specified in Section 32 11 23.

### **3 EXECUTION**

#### **3.01 EXCAVATION AND BACKFILLING**

- .1 Provide excavating and backfilling in accordance with Section 31 23 10.
- .2 Obtain approval of the Departmental Representative before installing, manholes or catch basins.
- .3 Inform Departmental Representative at least 24 hours prior to beginning excavation and installation. Departmental Representative must be on site during these operations.

#### **3.02 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 the 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 frames and grates on applicable top sections to elevation shown on Drawings or as directed.
- .9 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

### **3.03 SYSTEM CLEANLINESS**

- .1 Upon manhole adjustment, removal of catchment device and all works associated with restoration around the manhole, provide all testing equipment, labour, incidentals, traffic control, etc., required to undertake an inspection of the system to verify its cleanliness. Conduct inspection in the presence of the Departmental Representative.

**END OF SECTION**

## **1 GENERAL**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 31 23 10 - Excavating and Backfilling.
- .2 Section 07 21 13 - Board Insulation.

### **1.02 PRICE AND PAYMENT PROCEDURES**

- .1 Measurement procedures:
- .2 Measure excavation and backfill under Section 31 23 10 - Excavating, Trenching and Backfilling.
- .3 Measure supply and installation of storm sewer including testing and including excavation and backfilling and granular bedding and surround horizontally from manhole face to manhole face in metres of each pipe size and depth class installed.

### **1.03 REFERENCES**

- .1 ASTM D 3034-15e1, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

### **1.04 SCHEDULING**

- .1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.
- .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

### **1.05 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 pipes, and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Shop drawings to indicate proposed method for

installing carrier pipe for undercrossings.

- .4 Samples:
  - .1 Inform Departmental Representative at least 4 weeks prior to beginning Work, of 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 two (2) weeks prior to beginning Work.
- .7 Manufacturer's Instructions: submit to Departmental Representative one (1) copy of manufacturer's installation instructions.

#### **1.06 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance 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.

## **2 PRODUCTS**

### **2.01 PLASTIC PIPE**

- .1 Type PSM Poly Vinyl Chloride (PVC): to ASTM D 3034.
  - .1 Standard Dimensional Ratio (SDR): 35.
  - .2 Locked-in gasket and integral bell system.
  - .3 Nominal lengths: 4 m.

### **2.02 PIPE BEDDING AND SURROUND MATERIAL**

- .1 Bedding material to be Class A in accordance with Section 32 11 23.

### **3 EXECUTION**

#### **3.01 PREPARATION**

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

#### **3.02 TRENCHING**

- .1 Do trenching Work in accordance with Section 31 23 10 - Excavating, Trenching and Backfilling. EPO must be on site during trenching operations. Provide 24 hours notice in advance of trenching.
- .2 Protect trench from contents of sewer.
- .3 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.

#### **3.03 GRANULAR BEDDING**

- .1 Place 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.
  - .1 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 density to ASTM D 698.

#### **3.04 INSTALLATION**

- .1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of the Departmental Representative.
- .2 Handle pipe using methods approved by the Departmental Representative.
  - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.

- .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 Joint deflection permitted within limits recommended by pipe manufacturer.
- .6 Water to flow through pipes during construction only as 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 CAN/CSA-B1800.
- .9 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.
- .10 Make watertight connections to manholes and catch basins.
  - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .11 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.
  - .1 Joint to be structurally sound and watertight.
- .12 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

### **3.05 PIPE SURROUND**

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after the 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 100% maximum density to ASTM D 698.

**3.06 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 100% maximum density to ASTM D 698. In other areas, compact backfill to at least 90% maximum density to ASTM D 698.

**END OF SECTION**

## **1 General**

### **1.01 RELATED REQUIREMENTS**

- .1 Section 03 30 00 - Cast-in-Place Concrete.

### **1.02 REFERENCES**

- .1 ASTM International (ASTM)
  - .1 ASTM C4-04(2014), Standard Specification for Clay Drain Tile and Perforated Clay Drain Tile.
  - .2 ASTM C136/C136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM C444M-03(2009), Standard Specification for Perforated Concrete Pipe (Metric).
  - .4 ASTM C654M-15, Standard Specification for Porous Concrete Pipe (Metric).
  - .5 ASTM D698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN m/m<sup>3</sup>)).
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB 8.1 88, Sieves, Testing, Woven Wire, Inch Series.
  - .2 CAN/CGSB 8.2 M88, Sieves, Testing, Woven Wire, Metric.
- .3 CSA International (CSA)
  - .1 CSA A23.1-14/A23.2-14, Concrete materials and methods of concrete construction / Test methods and standard practices for concrete.
  - .2 CSA B1800-15, Thermoplastic Nonpressure Piping Compendium, Update No. 1 (2015), Update No. 2 (2015).
  - .3 CSA G401-14, Corrugated Steel Pipe Products.

### **1.03 SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's product literature for each product listed including manufacturer's recommended installation procedures and any modifications required to suit installation conditions.

- .3 Samples:
  - .1 Drainage Pipe: Provide a 300 mm length of perforated pipe and end connection.
  - .2 Filter Fabric: Provide 600 mm x 600 mm filter cloth sample for review and acceptance.
- .4 Certificates:
  - .1 Submit manufacturer's test data and certification that drain pipe materials meet requirements of this Section at least 2 weeks prior to beginning Work.
  - .2 Submit proposed source of granular bedding and filter materials a minimum of 2 weeks before beginning work of this Section, indicate gradation and certification of expected flow rate of granular materials.
  - .3 Certification to be marked on pipe.

#### **1.04 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Project General Requirements: Common Product Requirements.
- .2 Store materials in accordance with manufacturer's written instructions.

## **2 Products**

### **2.01 MATERIALS**

- .1 Corrugated Plastic Drainage Tubing: PVC DR 35 to CSA B1800, perforated, tapered ends, sizes as indicated on drawings. Unperforated matching pipe leads.
- .2 Other pipe as indicated on Drawings and as required for a complete installation.
- .3 Drainage Aggregate: Coarse aggregates to CSA A23.1, Table 3, Group 1, 20 mm to 5 mm nominal size of aggregate.
- .4 Filter Cloth: Tensile strength minimum 400 N, equivalent opening size 70 microns or less.
- .5 Other aggregate: refer to Drawings .
- .6 Accessories:
  - .1 Provide accessories as required for a complete system.
  - .2 Drainage pipe couplings (where pipe does not have bell connectors), end caps, clean-outs, and access covers.

### **3 Execution**

#### **3.01 TRENCHING**

- .1 Do excavating, trenching and backfilling in accordance with Section 31 23 10.
- .2 Trim and compact trench bottom to provide firm uniform support throughout length of pipe.
- .3 Allow 150 mm clearance underneath and on both sides of pipe for drainage aggregate.

#### **3.02 BEDDING**

- .1 Place at trench bottom geotextile fabric of sufficient width to completely wrap around drainage aggregate and pipe with minimum 300 mm overlap.
- .2 Place 150 mm layer of drainage aggregate over geotextile fabric, as indicated, and compact to minimum 95% of maximum density to ASTM D698.

#### **3.03 INSTALLATION OF SUBGRADE DRAINAGE**

- .1 Lay pipe drains on prepared bed, true to line and grade with inverts smooth and free of sags or high points.
- .2 Place at trench bottom the geotextile fabric of sufficient width to completely wrap around filter aggregate and pipe with minimum 300 mm overlap. Alternatively, a sock of approved geotextile fabric may be slipped over the pipe.
- .3 Ensure barrel of each pipe is in contact with bed throughout full length.
- .4 Begin laying at outlet and proceed in upstream direction.
- .5 Lay perforated pipes on fabric with perforations 2/3 down.
- .6 Lay bell and spigot pipe with bell ends facing upstream. Do not mortar joints.
- .7 Make joints tight in accordance with manufacturer's instructions.
- .8 Make watertight connections to existing drains, new or existing manholes and catch basins, or to drainage swales where indicated or as directed by Departmental Representative. Seal joints with approved sealant.
- .9 Plug open upstream ends of pipes with watertight concrete, steel or wood bulkheads.

- .10 Surround and cover drain with filter material in uniform 75 mm layers to an elevation of at least 150 mm above top of drain and compact to at least 95% maximum density to ASTM D698. Level aggregate surface and overlap the fabric
- .11 Backfill remainder of trench to Section 31 23 10.
- .12 Do not place bedding surround and backfill materials in frozen condition.
- .13 Protect sub-drains against flotation during installation.
- .14 Install "Y" connections to surface for flushing.

### **3.04 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 and Disposal.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.

### **3.05 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by rough carpentry installation.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 WORK INCLUDED**

- .1 The Work consists of furnishing and installing drain tile and necessary fittings and appurtenances.

### **1.2 REFERENCES**

- .1 ASTM D1056-14, Flexible Cellular Materials - Sponge or Expanded Rubber.
- .2 CAN/CSA B1800-15, Thermoplastic Non-pressure Piping Compendium.
- .3 CAN/CSA A257-Series 14, Standards for Concrete Pipe and Manhole Sections.
- .4 ASTM D4533-15, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
- .5 ASTM D4632-15a, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
- .6 ASTM D4751-16, Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
- .7 ASTM D4491-16, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.

### **1.3 CERTIFICATES**

- .1 Submit manufacturers' test data and certification that products and materials meet requirements of this Section in accordance with Section 01 33 00 - Submittal Procedures.

### **1.4 HANDLING AND STORAGE**

- .1 Handle and store pipe and fittings in such manner as to avoid shock and damage. 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.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- .1 PVC pipe and appurtenances: DR 35 conforming to CAN/CSA B182.2 and perforated as per CAN/CSA B1800.
- .2 Geotextile: Filter fabric: non-woven, needle-punched synthetic filter fabric composed of minimum of 85% of mass of polyester with inhibitors to resist deterioration and must conform to the following:
  - .1 Tearing strength: 250N to ASTM D4533.
  - .2 Grab Tensile strength: 600N to ASTM D4632.
  - .3 Elongation at break: 50% to ASTM D4632.
  - .4 Apparent opening size: 50 to 250µm to ASTM D4751.
  - .5 Permittivity: 1.25 to 2.75/sec to ASTM D4491.
- .3 Supply 25mm Clear stone backfill in accordance with Section 31 23 10 item 2.1.3.1.

## **PART 3 EXECUTION**

### **3.1 EXCAVATION**

- .1 Unless otherwise specified, conduct excavation for the drain tile concurrently with the wall footing excavation.
- .2 Construct trench or excavation for the pipe to the depths and cross-sections shown on the drawings. The trench width may be increased at the option of the Contractor.

### **3.2 INSTALLATION**

- .1 Line 300mm trench, from the edge of footing to the wall of the excavation, with geotextile of a width sufficient to fit the bottom and sides and, after backfilling, the top of the free draining backfill with a minimum overlap of 200 mm.
- .2 Install drain tile as per the drawings.
- .3 Install drain tile pipe as a continuous line with all joints being constructed with couplers compatible with the pipe supplied and in accordance with the manufacturer's recommendations.
  - .1 Cut and fit pipes in the Work.

- .4 Backfill drain tile pipe with a minimum depth of 300mm of clear stone backfill.
- .5 Where the drain tile is to be connected to a precast catch basin, carefully make an opening in the catch basin at the required elevation, and make the connection as shown on the drawings
- .6 Backfill trench with suitable backfill material up to the finished grade.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.01 SECTION INCLUDES**

- .1 Materials and installation for electrical pole lines and hardware.

### **1.02 RELATED SECTIONS**

- .1 Section 01 33 00 - Submittal Procedures
- .2 Section 26 05 21 - Wires and Cables.
- .3 Section 26 05 22 - Connectors and Terminations.
- .4 Section 26 05 28 - Grounding - Secondary.

### **1.03 REFERENCES**

- .1 Where discrepancies exist, priority shall be given to the applicable CSA Standard, unless indicated otherwise.
- .2 Canadian Standards Association (CSA),
  - .1 CAN/CSA-G12-2014, Zinc-Coated Steel Wire Strand.
  - .2 CSA-C83-96 (R2011), Communication and Power Line Hardware.
  - .3 CAN/CSA-O80 Series-15, Wood Preservation.
  - .4 CAN/CSA-O15-2015, Wood Utility Poles and Reinforcing Stubs.
  - .5 CAN/CSA-C22.1-15, Canadian Electrical Code, Part I.
  - .6 CAN/CSA-C22.3 No. 1, Overhead Systems.
  - .7 CAN/CSA-Z462-15, Workplace Electrical Safety.
  - .8 CAN/CSA-C233.1-87(R2004), Gapless Metal Oxide Surge Arresters for Alternating Current Systems.
  - .9 CAN/CSA-C411.1-16, AC Suspension Insulators.
  - .10 CAN/CSA-C310-09(R2014), Distribution Class Polymeric Cutouts.
  - .11 CAN/CSA-C411.1, AC Suspension Insulators.
- .3 American National Standards Institute (ANSI)
  - .1 ANSI C29.5-2015, Wet-Processed Porcelain Insulators, Low and Medium Voltage Pin Type.

- .4 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
  - .1 EEMAC1B-1, Wet Process Porcelain Insulators (Strain Type).
  - .2 EEMAC2B-1, Wet Process Porcelain Insulators (Spool Type).

#### **1.04 PRODUCT DATA**

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

### **PART 2 PRODUCTS**

#### **2.01 MISCELLANEOUS MATERIALS**

- .1 Wood preservation: to CAN/CSA 080 Series.
- .2 Power line hardware: to CAN/CSA-C83.

#### **2.02 POLES**

- .1 Wood utility poles, if not otherwise noted: to CAN/CSA-015, wood species Red Pine, CCA wood preservative treated.
- .2 Wood utility poles located within 15 m of a well or high water mark: to CAN/CSA-015, wood species Western Red Cedar, untreated.
- .3 35 foot high, Class 4 poles.

#### **2.03 INSULATORS**

- .1 Secondary insulators:
  - .1 Spool type: to, ANSI C29.3.
- .2 Guy strain insulators:
  - .1 Strain type: to ANSI C29.4, nominal rating 34.5kV, one per guy wire.

#### **2.04 GUYS AND ANCHORS**

- .1 Guy wire: To CSA G12. Guy wire to be stranded galvanized steel 9.5 mm grade 160. Where guy attaches to pole, provide one guy hook and one performed guying deadend.

- .2 Guy clamps, preformed guying, deadend.
- .3 Eye bolt: 19mm thimble, length to suit, four hole guy straps and 16 mm machine bolt with square washer to attach guy wire to pole.
- .4 Anchor rod: 19mm diameter x 2.1m long, galvanized steel with thimble eye 16 mm HDG.
- .5 Anchor plate: To CSA C83. 406mm x 406mm with 19mm hole heavy duty HDG steel plate.
- .6 Guy guard: PVC or polyethylene, coloured yellow, 2.1 m long.

#### **2.05 SECONDARY CONDUCTORS**

- .1 In accordance with Section 26 05 21 - Wires and Cables.

#### **2.06 WIRE CONNECTORS**

- .1 In accordance with Section 26 05 22 - Connectors and Terminations.

#### **2.07 GROUND RODS, GROUND CONDUCTORS AND GROUND MAT**

- .1 Provide in accordance with Section 26 05 28 - Secondary Grounding.

### **PART 3 EXECUTION**

#### **3.01 PREPARATION OF POLES**

- .1 Where poles require shortening, cut piece from top only.
- .2 Treat roof top, gains, bored holes with preservative before assembly.
- .3 Bore holes in poles as required for pole-mounting hardware, with all holes to be bored through the full diameter of the pole.
- .4 Fasten wood insulator hardware with galvanized steel mounting studs.
- .5 Install neutral brackets.
- .6 Install communication/fibre-optic hardware.

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### 3.02 INSTALLATION

- .1 Install poles at locations indicated by design drawings and in accordance with the installation details.
- .2 Stake locations prior to installation of poles and advise the Departmental Representative where site conditions prohibit installation as indicated.
- .3 Locate and dig pole holes. Make holes large enough to allow space for tamping backfill.
- .4 Where bedrock is encountered, make provision for excavation to depth indicated by the design drawings.
- .5 Set poles.
- .6 At change in direction of line, set connectors to bisect angle formed by change.
- .7 Set poles to maintain even grade. Allow for contour of terrain and do not exceed grading of 1.5 m per pole.
- .8 Replace backfill in 150mm layers. Tamp each layer, and apply final layer to drain water away from pole.
- .9 For rock mounted poles, install cribs per manufacturer's recommendations.
- .10 Locate and install guy wires and anchors at dead-ends, corner poles, and start of branch feeders.
- .11 Insert anchor at least 1.8m into ground. Backfill and tamp in 150 mm layers.
- .12 Install insulators.
- .13 Install grounding conductors and other related pole hardware to constitute system as indicated on drawings.
- .14 Bond all messengers and overhead bond wires together and to grounding electrode, as indicated on the design drawings.

**END OF SECTION**