

## **PART 1 – GENERAL**

### **1.1 RELATED REQUIREMENTS**

- .1 Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Section 31 05 16 – Aggregate Materials
- .3 Section 33 05 13 – Manholes, Catch Basin and Utility Structures
- .4 The project is a Lump Sum project that includes the supply and installation of sanitary sewer, including testing, excavation and backfilling, granular bedding and surround horizontally from wet well face in 1.5 metres outside of the future building using the pipe identified.

### **1.2 MEASUREMENT AND PAYMENT**

- .1 After video and photographic pipe inspections:
  - .1 If no defective work is found, Departmental Representative will pay costs for inspectors, trained operators, equipment rental and materials.
  - .2 If defective Work is found, pay Departmental Representative part of total inspection cost proportional to number of defective pipe sections of sewer to total number of pipe sections inspected.

### **1.3 REFERENCES**

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
- .2 ASTM International
  - .1 ASTM C 117-04, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
  - .2 ASTM C 136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
  - .3 ASTM D 698-07e1, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft<sup>4</sup>-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
  - .4 ASTM D 2680-01(2009), Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
  - .5 ASTM D 3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
  - .6 ASTM D 3350-10, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- .3 Canada Green Building Council (CaGBC)
  - .1 LEED Canada-NC Version 1.0-2004, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference

Package For New Construction and Major Renovations (including Addendum 2007).

- .4 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.
- .5 CSA International
  - .1 CSA A3000-08, Cementitious Materials Compendium.
  - .2 CSA B1800-11, Thermoplastic Non-pressure Pipe Compendium.
    - .1 CSA B182.1-11, Plastic Drain and Sewer Pipe and Pipe Fittings.
    - .2 CSA B182.2-11, PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.
    - .3 CSA B182.6-11, Profile Polyethylene (PE) Sewer Pipe and Fittings for Leak-Proof Sewer Applications.
    - .4 CSA B182.11-11, Standard Practice for the Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.

#### **1.4 ADMINISTRATIVE REQUIREMENTS**

- .1 Scheduling:
  - .1 Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.
  - .2 Submit schedule of expected interruptions for approval and adhere to approved schedule.
  - .3 Notify Departmental Representative and building manager superintendent 24 hours minimum in advance of any interruption in service.

#### **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
  - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes, and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Newfoundland and Labrador, Canada.
  - .2 Indicate on drawings 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.
  - .2 Submit for testing at least 2 weeks prior to beginning Work, samples of

materials proposed for use as follows:

- .1 Bedding and surround.
  
- .5 Certificates:
  - .1 Certification to be marked on pipe.
  
- .6 Test and Evaluation Reports:
  - .1 Submit manufacturer's test data and certification 2 weeks minimum before beginning Work.
  
- .7 Sustainable Design Submittals:
  - .1 LEED Canada submittals: in accordance with Section 01 35 21 - LEED Requirements.
  - .2 Erosion and Sedimentation Control: submit copy of erosion and sedimentation control plan in accordance with EPA 832/R-92-2005 authorities having jurisdiction and Section 01 35 21 - LEED Requirements.
  - .3 Construction Waste Management:
    - .1 Submit project Waste Management Plan Waste Reduction Workplan highlighting recycling and salvage requirements.

## **1.6 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
  
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labeled 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.
  
- .4 Develop Construction Waste Management Plan Waste Reduction Workplan related to Work of this Section and in accordance with Section 01 35 21 - LEED Requirements.
  
- .5 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding, and packaging materials as specified in Construction Waste Management Plan Waste Reduction Workplan in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal and Section 01 35 21 - LEED Requirements.

## **PART 2 – PRODUCTS**

### **2.1 PLASTIC PIPE**

- .1 Type PSM Polyvinyl Chloride (PVC): to ASTM D 3034 CSA B182.2.
  - .1 Standard Dimensional Ratio (SDR): 35.
  - .2 Locked-in Separate gasket and integral bell system.
  - .3 Nominal lengths: 4 6 m.
- .2 Acrylonitrile - Butadiene - Styrene (ABS): to CSA B182.2.
- .3 Corrugated High Density Polyethylene (HDPE): to CSA B182.6.
  - .1 320 kPa 180 kPa pipe stiffness.
  - .2 Sewer Storm sewer class.
  - .3 Gasket and bell Mechanical non-gasket coupling system.

### **2.2 SERVICE CONNECTIONS**

- .1 Type PSM Poly (Vinyl) Chloride: to CSA B182.2.
- .2 Plastic pipe: to CSA B182.1, with push-on joints.

### **2.3 CEMENT MORTAR**

- .1 Portland cement: to CSA A3000, normal type 10.
- .2 Mix mortar 1 part by volume of cement to two parts of clean, sharp sand mixed dry.
  - .1 Add only sufficient water after mixing to give optimum consistency for placement.
  - .2 Do not use additives.

### **2.4 PIPE BEDDING AND SURROUND MATERIALS**

- .1 Granular material to 211.09 of the City of St. John's Department of Engineering Specifications book. Bedding and surround material to be Granular "B" as in the section labelled as "Gravel for Streets".

### **2.5 BACKFILL MATERIAL**

- .1 Backfill material may be uncontaminated site material or contaminated site material that came from the trench or must meet the item entitled "Borrow" in the City of St. John's Department of Engineering Specifications book.

## **PART 3 – EXECUTION**

### **3.1 EXAMINATION**

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sewer pipe installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate in presence of Departmental Representative.
  - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.

### **3.2 PREPARATION**

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

### **3.3 TRENCHING**

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

### **3.4 GRANULAR BEDDING**

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth of mm 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 pipe.
- .4 Shape transverse depressions as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% corrected maximum dry density maximum density to ASTM D 698.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

### **3.5 INSTALLATION**

- .1 Lay and join pipes to: ASTM C 12.
- .2 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .3 Handle pipe using methods approved by Departmental Representative.
  - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
  - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Joint deflection permitted within limits recommended by pipe manufacturer.
- .7 Water to flow through pipe during construction, only as permitted by Departmental Representative.
- .8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Install plastic pipe and fittings in accordance with CSA B182.11.
- .10 Pipe jointing:
  - .1 Install gaskets in accordance with manufacturer's written

- recommendations as indicated.
- .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
  - .3 Align pipes before joining.
  - .4 Maintain pipe joints free from mud, silt, gravel and foreign material.
  - .5 Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to be removed, cleaned and lubricated and replaced before joining is attempted.
  - .6 Complete each joint before laying next length of pipe.
  - .7 Minimize joint deflection after joint has been made to avoid joint damage.
  - .8 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
  - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
- .11 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.
  - .12 Plug lifting holes with pre-fabricated plugs approved by Departmental Representative, set in shrinkage compensating grout.
  - .13 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.
  - .14 Make watertight connections to manholes.
    - .1 Use shrinkage compensating grout when suitable gaskets are not available.
  - .15 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes.
    - .1 Joints to be structurally sound and watertight.

### **3.6 PIPE SURROUND**

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

- .6 Compact each layer from mid height of pipe to underside of backfill to at least 95% corrected maximum dry density maximum density to ASTM D 698.
- .7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

### **3.7 BACKFILL**

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

### **3.8 SERVICE CONNECTIONS**

- .1 Install pipe to CSA B182.11 and manufacturer's instructions and specifications.
- .2 Maintain grade for 100 and 125 mm diameter sewers at 1 vertical to 50 horizontal unless directed otherwise by Departmental Representative.
- .3 Plug service lateral with water tight cap or plug as approved by Departmental Representative.
- .4 Place location marker at ends of plugged or capped unconnected sewer lines.
  - .1 Each marker: 38 x 89 mm stake extending from pipe end at pipe level to 0.6 m above grade.
  - .2 Paint exposed portion of stake red with designation SAN SWR LINE in black.

### **3.9 FIELD TESTING**

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 When directed by Departmental Representative, draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Perform infiltration and exfiltration testing as soon as practicable after jointing

- and bedding are complete, and service connections have been installed.
- .5 Do infiltration and exfiltration test to ASTM C 828.
  - .6 Do infiltration and exfiltration testing as specified herein and as directed by Departmental Representative.
    - .1 Perform tests in presence of Departmental Representative.
    - .2 Notify Departmental Representative 24 hours minimum in advance of proposed tests.
  - .7 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.
  - .8 Exfiltration test:
    - .1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun.
    - .2 Immediately prior to test period add water to pipeline until there is head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static ground water level, whichever is greater.
    - .3 Duration of exfiltration test: 2 hours.
    - .4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.
  - .9 Infiltration test:
    - .1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 750 mm or more above top of pipe measured at highest point in line to be used.
    - .2 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.
    - .3 Install watertight plug at upstream end of pipeline test section.
    - .4 Discontinue pumping operations for at least 3 days before test measurements are to begin and during this time, keep thoroughly wet at least one third of pipe invert perimeter.
    - .5 Prevent damage to pipe and bedding material due to flotation and erosion.
    - .6 Place 90 degrees V-notch weir, or other measuring device approved by Departmental Representative in invert of sewer at each manhole.
    - .7 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.
  - .10 Infiltration and exfiltration: not to exceed following limits in L per hour per 100 m of pipe, including service connections.

Nominal Pipe diameter in mm	Asbestos-Cement or Plastic pipe	Concrete or Vitrified Clay pipe
100	3.88	25.5
125	4.62	30.0
150	5.51	34.0
200	7.45	41.5
250	9.39	49.5
300	11.33	56.5
350	13.27	63.5
400	14.91	70.0
450	16.84	76.0
500	18.78	81.5
550	20.72	87.0
600	22.80	92.5
700	26.53	102.0
800	30.11	110.5
900	33.69	118.0
1000	37.56	124.5
1100	41.29	130.0
1200	45.01	135.0

- .11 Leakage: not to exceed following limits in litres per hour per mm of diameter per 100m of sewer including service connections:
  - .1 Exfiltration, based on 600 mm head: 0.175 L.
  - .2 Infiltration: 0.150 L.
- .12 Repair and retest sewer line as required, until test results are within limits specified.
- .13 Repair visible leaks regardless of test results.

### **3.10 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 01 35 21 - LEED Requirements.
  - .1 Remove recycling containers and bins from site and dispose of materials at appropriate facility.