

**1.0 GENERAL**

**1.1 Description**

- .1 This section specifies requirements for constructing gravity storm sewer with bedding material to lines, grades and dimensions indicated or directed.

**1.2 Related Work Specified Elsewhere**

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| .1 | Trenching, Backfilling, and Compaction | Section 02315 |
| .2 | Manholes                               | Section 02536 |
| .3 | Catch Basins, Grates and Frames        | Section 02631 |
| .4 | Building Services                      | Section 02539 |
| .5 | Perforated Subdrain Pipe               | Section 02636 |
| .6 | T.V. Camera Sewer Main Inspections     | Section 02800 |

**1.3 Schedule of Work**

- .1 Schedule work to minimize interruptions to existing services.

**1.4 Measurement and Payment**

- .1 Storm Sewers: Measurements will be made in lineal metres from centre to centre of manholes and the depths of excavation will be those determined at the time the grade stakes are set. The elevations of ground opposite the stake and on the centre line of the proposed trench will be recorded, and the final estimate will be considered as the average of the depths in vertical metres taken every 15 lineal metres between every pair of manholes.

The unit price tendered shall cover the cost of supplying, hauling, laying and jointing all pipe, together with the necessary excavation, bedding, backfilling, connection to existing storm sewer mains, and all other work required to install the storm sewer mains as specified.

- .2 Storm Sewer Main Construction and Replacement: Measurements will be made in lineal metres from centre to centre of manholes and the depths of excavation will be those determined at the time the grade stakes are set. The elevations of ground opposite the stake and on the centre line of the proposed trench will be recorded, and the final estimate will be considered as the average of the depths in vertical metres taken every 15 lineal metres between every pair of manholes.

The unit price tendered shall include excavation, removal and salvage of existing pipe, excavation, bedding, supply and installation of new pipe, initial backfilling, general backfilling and all other work required to install the storm sewer as specified.

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- .3 Existing Manhole Removal: Payment shall be paid at the lump sum price bid on an individual basis and shall include excavation, removal and salvage of the existing manhole.

The lump sum bid price shall include all labour, equipment and materials required to complete the removal.

- .4 Remove / Salvage Existing Storm Sewer: Payment shall be paid by the lineal metre for the length of pipe removed and salvaged in an undamaged condition. The payment shall include all labour, equipment and materials required to remove and salvage the existing pipe in an undamaged condition.

Backfill of the salvaged pipe trench after pipe removal to Class III final backfill is also included in the payment.

- .5 Catch Basin Leads: Measurements will be made in lineal metres from center of manhole to center of catch basin along the pipe alignment.

The unit price tendered shall cover the cost of supplying, hauling, laying and jointing all pipe, together with the necessary excavation, bedding, backfilling, connection to existing manholes or mains, and all other work required to install the catch basin leads as specified.

- .6 Weeping Tile: Refer to section 02636 Perforated Subdrain Pipes.

**2.0 PRODUCTS****2.1 Storm Sewer Pipe****.1 Reinforced Concrete Pipe for Direct Bury**

- .1 Storm sewers larger than 900 mm diameter (unless otherwise specified) shall be reinforced concrete pipe.

- .2 Conform to ASTM C76-08, ASTM C655 and CSA A257.2.

- .3 Pipe sections shall conform to ASTM C76-08 Standard pipe classifications as indicated on drawings

- .4 Flexible rubber gaskets conforming to CAN A257.3 and ASTM C443-05a.

- .5 Portland Cement: CSA A3001 Type HS.

**.2 Profile Wall PVC Sewer Pipe and Fittings**

- .1 Pipe shall conform to CSA B182.4.

- .2 Minimum Pipe Stiffness: 320 kPa as per ASTM D2412-02

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- .3 Factory installed locked-in gasket and integral bell system conforming to ASTM F477-07.
- .4 IPEX Ultra-Rib (300 to 600 mm diameter), IPEX Ultra X2 (750 to 900 mm diameter) or approved equal.
- .3 Type PSM PVC Sewer Pipe and Fittings
  - .1 Pipe shall conform to CSA B182.2.
  - .2 Standard Dimension Ratio SDR 35
  - .3 Factory installed locked-in gasket and integral bell system conforming to ASTM F477-07.
  - .4 IPEX Ring-Tite or approved equal.

**2.2 Catch Basin Leads**

- .1 Catch basin leads shall be 250 mm diameter SDR 35 PVC pipe complete with rubber gaskets. Tandem catch basin installations shall be 250 mm diameter between catch basins and 300 mm diameter SDR 35 PVC pipe from catch basin to manhole or mains. Connection directly to storm sewer mains shall only be as directed by the Engineer and the diameter of the main must be twice that of the catch basin lead. IPEX-ULTRA-RIB may be used as an alternate.

**2.3 Weeping Tile**

- .1 Refer to section 02636 Perforated Subdrain Pipes.

**2.4 Cement Mortar**

- .1 Portland Cement: to CSA A5-171, CSA A5-1977, Sulphate Resistant Type 50.
- .2 Mortar to be one part by volume of cement to two parts of clean, sharp sand mixed dry. Add only sufficient amount of water after mixing to give optimum consistency for placement. Do not use additives.

**2.5 Pipe Foundation and Embedment Materials**

- .1 Granular Material for Final Backfill: As per Section 02315
- .2 Common Backfill: As per Section 02315
- .3 Pipe Embedment Zone Materials As per Section 02315 with the exception that the initial backfill material for reinforced concrete pipe can be Common Backfill material.

- .4 Bedding Stone for Foundation Material: As per Section 02315
- .5 Concrete: As per Section 02315

**3.0 EXECUTION****3.1 Delivery and Stockpiling Materials**

- .1 The Contractor shall be responsible for arranging, stockpiling, and protecting the materials from damage and theft.
- .2 The Contractor shall be responsible for the delivery of material and the Owner will not pay for materials ordered by the Contractor and not used in the work, nor pay for shipping charges on the return of such material to the supplier.

**3.2 Preparation**

- .1 Clean pipes and fittings of debris and water before installation. Carefully inspect materials for defects before installing. Remove defective materials from site.

**3.3 Trenching and Backfill**

- .1 Do Type PSM PVC and Profile Wall PVC storm sewer trenching and backfill work in accordance with ASTM D2321-04 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as modified in Section 02315 - Trenching, Backfilling and Compaction for Utilities, and herein.
- .2 Do reinforced concrete pipe storm sewer trenching and backfill work in accordance with ASCE Type 2 Standard Installation except as modified in Section 02315 - Trenching, Backfilling and Compaction for Utilities, and herein.
- .3 Do not allow contents of any sewer or sewer connection to flow into trench.
- .4 Confirm trench line, grade and depth meet design requirements prior to placing bedding material and pipe.
- .5 Do not backfill trenches until pipe grade and alignment have been reviewed by the Engineer.

**3.4 Construction in Pipe Embedment Zone**

- .1 Construct pipe embedment zone for PVC storm sewer in accordance with ASTM D2321 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications except as noted herein.

- .2 Construct embedment zone for reinforced concrete pipe storm sewer pipe in accordance with ASCE Standard Practice 15 – Standard Practice for Direct Design of Buried Precast Concrete Pipe Using Standard Installations except as modified herein.
- .3 Pipe Embedment Zone Construction:
  - .1 Place granular bedding, haunch and initial backfill materials to details indicated in Section 02315 and drawing details.
  - .2 Shape bed true to grade and to provide continuous, uniform bearing surface for barrel of pipe. Do not use blocks when bedding pipe.
  - .3 Shape transverse depressions as required to receive bell if bell and spigot pipe is used.
  - .4 Install PVC and reinforced concrete pipe as a Type 2 installation as per the detail drawings. As noted on the detail drawing, do not compact bedding material under the middle 1/3 of pipe diameter of the pipe.
  - .5 Place haunch and initial backfill to 300 millimeteres above the crown of the pipe. Compact in maximum 150 millimetre lifts to the specified density for a Type 2 installation.
  - .6 For flexible pipe, exercise caution and place and compact material for haunch and initial backfill area in such a manner that adverse vertical and horizontal deflection does not occur.
- .4 Concrete Bedding:
  - .1 Pipe may be positioned on concrete blocks to facilitate placement of concrete. When necessary, sufficiently anchor or weight pipe, to prevent floatation and resultant compromised line and grade, while concrete is placed and sufficiently cured.
  - .2 Do not backfill over concrete within 24 hours after placing.

### **3.5 Pipe Installation in Open Trench Construction**

- .1 The horizontal alignment of the centreline of the pipe shall not be more than 75 mm off the given line.
- .2 The vertical grade of the sewer main shall not deviate from the given grade by an amount greater than 20 mm.

- .3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends. Do not exceed maximum joint deflection recommended by pipe manufacturer. Install PVC pipe and fittings in accordance with CSA B181.12.
- .4 Lay and join pipes in accordance with specified Standard Practices and manufacturer's requirements. Lay pipes on prepared bedding, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed providing uniform support throughout its full length. Commence laying at the lowest point of the length being laid and proceed in upstream direction with bell socket ends of pipe facing upgrade.
- .5 Do not allow water to flow through pipe during construction.
- .6 Whenever work is suspended, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .7 Pipe Jointing:
  - .1 Install flexible rubber gaskets in accordance with manufacturer's recommendations.
  - .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 carefully before joining. Maintain pipe joints free from mud, silt, gravel and other foreign material.
  - .4 Avoid displacing gasket or contaminating with dirt or other foreign material. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced before joining is attempted. Only the lubricant recommended by the rubbing ring manufacturer shall be applied to the rubber ring or ends of the pipe.
  - .5 Complete each joint before laying next length of pipe. Minimize joint deflection after joint has been made to avoid joint damage. Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
  - .6 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
  - .7 Plug lifting holes with approved prefabricated plugs set in non-shrink grout.

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- .8 Cut pipes as required for special inserts, fittings or closure pieces in a neat manner, as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.
- .9 Make watertight connections to manholes. Use non-shrink grout when suitable gaskets are not available.
- .10 Upon completion of pipe laying, and after Engineer has inspected pipe joints, place specified granular material to dimensions indicated or directed.
- .11 Hand place granular material in uniform layers of 150 mm thick or less. Dumping of material directly on top of pipe is not permitted.
- .12 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

**3.6 Appurtenances**

- .1 Install all manholes, drop inlets, junctions, risers, catch basins and other appurtenances at the locations shown on the construction drawings and/or as directed by the Engineer. Installation shall be in accordance with the drawings for each appurtenance.
- .2 Maximum allowable tolerances for installed manhole and catch basins are:
  - .1 Horizontal: 10 mm horizontal in 1.5 m vertical.
  - .2 Vertical:  $\pm 10$  mm for any elevation shown.
- .3 A minimum of 2 grade rings are required immediately beneath the manhole cover.
- .4 Confined rubber gasket joints conforming to ASTM C443-05a shall be used between all joints and between manhole barrel joints. All joints shall be finished smoothly with cement mortar.
- .5 The channelled floor of the manholes shall be smooth and true to line and grade and shall be constructed of concrete shaped to provide a smooth, unobstructed flow. The benching shall be trowelled to a smooth finish. Branch lines entering the manhole shall be channelled to join the main line at an acute angle.
- .6 Sewer pipe into existing manholes must be grouted in. Since concrete will not bond to PVC pipes, it will be necessary to coat the PVC pipe with an approved cementing agent to which sand has been added to form a suitable surface to which the concrete will bond. All PVC pipe shall be connected in accordance with the ASTM Standard.

- .7 Break into existing manholes, catch basins or sewers as shown on the construction drawings. This work shall be performed in a workmanlike manner according to the dictates of good practice. Existing manhole floors shall be rechannelled and properly benched, the junction area shall be grouted to form a smooth joint, all debris including concrete and excavated material shall be removed and the vicinity of the connection shall be left in a tidy condition acceptable to the Engineer.

### **3.7 Weeping Tile Installation**

- .1 Refer to section 02636 Perforated Subdrain Pipes.

### **3.8 Acceptance Testing**

- .1 Sewer inspection by televising:
  - .1 Storm sewers less than 1350 mm diameter shall be inspected by camera after backfilling of the trench to finished grade.
  - .2 The inspection shall be made by employing television scanning equipment which shall be provided by the Contractor. The Contractor shall employ a qualified closed circuit television Contractor acceptable to the Engineer to carry out the inspection.
  - .3 The closed circuit television Contractor shall provide all equipment and materials necessary to conduct the inspection as specified in Section 02800.
  - .4 All television inspection shall be carried out in the presence of the Engineer who shall be given at least 48 hours advance notice of any testing to be carried out. Television inspection shall be performed by the Contractor on all sewers unless otherwise directed by the Engineer.
- .2 Exfiltration Testing:
  - .1 If required by the Engineer, the Contractor shall conduct an exfiltration test.
  - .2 Fill test section with water in such a manner as to allow displacement of air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are commenced.
  - .3 Immediately prior to test period add water to pipeline until there is a head of 1.0 m over interior crown of pipe measured at highest point of test section or water in manhole is 1.0 m above static groundwater level, whichever is greater.
  - .4 Duration of exfiltration test shall be two hours.

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- .5 Water loss at end of test period shall not exceed maximum allowable exfiltration over any section of pipe between manholes.
- .3 Infiltration test:
  - .1 Storm sewer pipe 1350 mm diameter and larger and manholes, shall be examined visually for infiltration ensuring required provincial safety measures are employed to conduct such an examination. Where required by the Engineer, the Contractor shall conduct an infiltration test, as specified herein.
  - .2 Conduct infiltration test in lieu of exfiltration test where static groundwater level is 300 mm or more above top of pipe measured at highest point in the test section.
  - .3 Do not interpolate a head greater than 750 mm to obtain an increase in allowable infiltration rate.
  - .4 Install a watertight plug at upstream end of pipeline test section.
  - .5 Discontinue pumping operations for at least 72 hours before test measurements are to commence, and during this time keep thoroughly wet at least one third of pipe invert perimeter.
  - .6 Prevent damage to pipe and bedding material due to flotation and erosion.
  - .7 Place a 90° V-notch weir, or other measuring device approved by Engineer, in invert of sewer at each manhole.
  - .8 Measure rate of flow over a minimum of 1 hour, with recorded flow for each 5 minute interval.
- .4 Allowable Infiltration/Exfiltration:
  - .1 Infiltration and exfiltration shall not exceed following 0.2 litres per millimetre of pipe diameter per hour per 100 metres of pipe.

**3.9 Acceptance**

- .1 The location of all deficient work will be recorded and the Contractor will be required to repair, relay, restore or otherwise make good, to the satisfaction of the Engineer any deficient work including the repair of alignment problems, cracked or broken pipe, deformed pipe, leaks or any other faults not conforming with these specifications or the pipe manufacturers which the television inspection revealed.
- .2 After the deficiencies are repaired and corrected and before final acceptance, the Owner reserves the right to have the faulty areas re-inspected at the Contractor's expense.

**END OF SECTION**