

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 Section 312310 – Excavation, Trenching and Backfill

**1.2 DESCRIPTION OF WORK**

- .1 The work performed and materials supplied under this section shall conform to the City of Winnipeg Standard Construction Specifications CW 2110, CW 2160, CW 2125, latest editions and Approved Products for Underground use, except as amended in these Specifications.
- .2 The work described herein shall consist of the construction of watermains, including the supply and installation of pipe, appurtenances (crosses, tees, elbows, reducers, caps), as well as accessories such as couplings, services saddles, hydrants, cathodic protection, thrust blocks, lubricant and including gate valves, the connection of the pipe to the source of water supply, the hydrostatic and bacterial testing of the pipe and the disinfection of those pipes to be used to convey potable water.

**1.3 QUALITY ASSURANCE**

- .1 CONCRETE - The Contract Administrator shall carry out such tests on concrete (used in thrust blocks) as he considers necessary in accordance with the current CSA Standard A23.2, Methods of Test for Concrete. Such tests shall be at the expense of The City except that the Contractor shall furnish any and all test samples free of charge. Water used for mixing concrete shall be clean and free of oil and alkali, organic matter or other deleterious substances. Water shall be equal to potable water (drinking water) in physical and chemical properties.
- .2 PRESSURE TEST - The Contractor shall, at his expense, pressure test the pipeline under the direct supervision of the Contract Administrator.
- .3 BACTERIOLOGICAL TESTS - Upon completion of the watermains intended to convey potable water, the Contract Administrator shall take water samples and conduct bacteriological tests as he considers necessary at the Contractor's expense.

**1.4 STORAGE AND HANDLING**

- .1 Pipe and other materials associated with the construction of watermains shall be stored and handled in accordance with the recommendations of the manufacturer and to the satisfaction of the Contract Administrator.

## **PART 2 PRODUCTS**

### **2.1 PIPE**

- .1 The following pipe materials shall be considered approved for watermains 150 mm in diameter:
  - .1 Polyvinyl Chloride Class 150 conforming to American Waterworks Association Standard C900, ASTM Specification D-1784 shall be Bell & Spigot with gaskets conforming to ASTM Specification F477.

### **2.2 APPURTENANCES**

- .1 All bends, crosses, tees, reducers and specials shall be of a type approved for use in the City of Winnipeg Specification, Products Approved for Use in Underground Works.
- .2 All tees and bends shall be injection moulded PVC fittings in conformance with AWWA Standard C-907-91.
- .3 All fasteners, tie rods, clamps, nuts, and bolts used to prevent movement shall be stainless steel conforming to ANSI Specification 303 and ASTM Specification A320. (AISI Type 316). Marking requirements for Type 316 stainless steel shall conform to the City of Winnipeg standards.
- .4 Where tie rods are required to be connected to PVC fittings, they shall be affixed by means of a joint harness (restrainer) conforming to Uni-Bell Standard B-13. The joint harness shall be protected against corrosion by wrapping all exposed ductile iron surfaces with Denso Tape System No. T-1 (LT).

### **2.3 GASKETS AND LUBRICANTS**

- .1 Gaskets and lubricant used to join pipes and to join pipes and appurtenances shall be of a type compatible with the particular pipe or appurtenance being used. Oil and gasoline resistant gaskets are generally not required but if, during construction, the Contract Administrator determines that the soil has been contaminated by petroleum and petroleum by-products, oil and gasoline resistant gaskets shall be used on all pipe installed within, and extending 100 metres beyond the outermost limit of, the contamination zone.

### **2.4 GATE VALVES**

- .1 All gate valves shall conform to American Waterworks Association Standard C509 and shall be direct bury, non-rising stem, resilient seated wedge gate valve rated at 1.0 Mpa and approved for use in the City of Winnipeg.

### **2.5 HYDRANT**

- .1 All hydrants shall be Mueller Canada or Clow Canada, approved for the use in the City of Winnipeg.

## **2.6 COUPLINGS**

- .1 All couplings shall be of a type approved for use in the City of Winnipeg Specification, Products Approved for Use in Underground Works.

## **PART 3 EXECUTION**

### **3.1 DEPTH OF WATERMAIN**

- .1 The Contractor shall in all cases install the proposed watermain to the design grade shown on the drawings. It is the intent that the new watermain shall be installed to a depth of a minimum of 2.75 m from the finished grade to the top of the watermain pipe.

### **3.2 METHOD OF PIPE INSTALLATION**

- .1 Watermains shall be installed either by open trench excavation with the appropriate class of backfill or by trenchless methods. Watermains to be installed under existing or proposed pavements within the City right-of-way shall be installed in a cored hole as per CW 2110, latest edition.
- .2 Shafts for coring shall be adequately sized to safely accommodate all coring equipment and personnel required for pipe extraction, coring and pipe installation.
- .3 Where field conditions are such that a cored hole cannot be made, the Contractor shall install the pipe in an open trench with the appropriate class of backfill in accordance with Section 312310 Excavation, Trenching and Backfill. No additional payment will be made for pipe required to be installed by open trench. The Contractor shall only proceed with open trench installation after receiving written approval from the Contract Administrator.

### **3.4 CLEANING**

- .1 Prior to installation, the interior and joining surfaces of all pipes, accessories, and appurtenances shall be cleaned of dirt and foreign material and wiped dry.

### **3.5 PUSH-ON JOINTS**

- .1 Pipe with push-on type bell and spigot joints (PVC) shall be laid with the bell end toward the direction of laying unless otherwise directed by the Contract Administrator. The lubricant recommended by the pipe manufacturer shall be applied to the spigot end only. The spigot end shall be inserted into the bell end of the previously laid pipe to the stop mark on the pipe, such that a secure joint is obtained.

### **3.6 THRUST BLOCKS**

- .1 Concrete thrust blocks shall be installed at crosses, tees, elbows, plugs, reducers, and caps. The minimum bearing areas (upon undisturbed trench soil) for thrust blocks shall be as outlined in Table 3.1.

**Table 3.1**  
**MINIMUM BEARING AREAS (on undisturbed trench soil)**  
**FOR THRUST BLOCKS**

<b>PIPE DIAMETER (mm)</b>	<b>TEES &amp; PLUG &amp; THRUST (m<sup>2</sup>)</b>	<b>90° BEND (m<sup>2</sup>)</b>	<b>45° BEND (m<sup>2</sup>)</b>	<b>22.5° BEND (m<sup>2</sup>)</b>
100	0.2	0.3	0.2	0.1
150	0.4	0.5	0.3	0.2
200	0.6	0.9	0.5	0.3
250	1.0	1.5	0.8	0.4
300	1.5	2.0	1.2	0.6

### **3.7 GATE VALVES AND FITTINGS**

- .1 Gate valves shall be installed at the locations shown on the Construction Drawings in accordance with Standard Specification CW 2110 – latest edition. Direction to open shall be counter clockwise.
- .2 Where shorts are used at valves and fittings (including couplers), the shorts shall be of sufficient length to ensure that there is a minimum 600 mm (face to face) between fittings.

### **3.8 HYDRANT**

- .1 Hydrants shall be installed at the locations shown on the Construction Drawings. The work shall be performed in accordance with Specification CW 2110 – latest edition, and as shown in Standard Drawings SD 006 and SD 007. Depth of bury shall be to suit the watermain profile and shall be placed so that the pumper nozzle faces the building entrance. The finished flange elevation shall be between 50 mm and 150 mm above proposed finished grade. No extra payment will be made for any extensions or adjustments required to meet this grade.

### **3.9 ACCESSORIES**

- .1 Accessories i.e., adaptors, couplings, etc., shall be installed by a method compatible with the pipe used and as approved by the Contract Administrator.

### **3.10 TEMPORARY PLUGS**

- .1 During prolonged pauses in pipe laying, and always overnight, any open ends of the pipe shall be properly plugged with a cap compatible with the type of pipe being installed so as to prevent entry of foreign material into the pipe.

### **3.11 PROHIBITION OF USE AS DRAIN**

- .1 Under no circumstances shall the trench or the pipeline be used as a drain.

### **3.12 CONNECTIONS**

- .1 The Contractor shall make connections at prearranged times and prearranged durations subject to approval by the Contract Administrator. Such time and duration shall be kept to minimize disruption of existing services.
- .2 Further to the requirements of Standard Specifications CW 2110 – latest edition, the Contractor shall note the following additional requirements regarding interruptions to existing water service:
  - .1 Where a shutdown of services involves the interruption of an adequate pressurized water supply to an industrial, commercial or institutional consumer for which water is a requirement for the facility to be open or operate, the Contractor shall make the necessary arrangements to meet these requirements. Such arrangements shall include but not be limited to evening or weekend work or the provision of a temporary pressurized water supply during the period of the shutdown.
- .3 The Contractor shall note the provision of temporary pressurized water supplies, where required.
- .4 The Contractor shall expose existing watermains at proposed connection points to determine existing watermain inverts.
- .5 After the existing watermain has been exposed and existing elevations and dimensions determined or confirmed, the Contractor shall notify the Contract Administrator of any discrepancy prior to construction. The Contract Administrator will modify design grades as required.
- .6 No additional payment will be made for exposing existing watermains to verify inverts.
- .7 Where connecting to existing cast iron watermains the Contractor shall install 10.9 kg sacrificial anodes as specified under Standard Specification CW 2110 – latest edition.

### **3.13 DEFLECTIONS**

- .1 Where minor deflections in line or grade are required the pipe shall be deflected as required but not in excess of that recommended by the pipe manufacturer.

## **PART 4 MEASUREMENT AND PAYMENT**

### **4.1 WATERMANS**

- .1 Measurement and payment for Section 331117, Incoming Site Water Utility Distribution Piping shall be included with the project total Lump Sum Price and in accordance with Part A – Bid Submission of the Contract documents for Bid Opportunity No. 832-2007 – Construction of Bronx Park Community Centre and Home of Good Neighbours Senior Centre Winnipeg Manitoba.

END OF SECTION

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 Section 312310 – Excavation, Trenching and Backfill

**1.2 DESCRIPTION OF WORK**

- .1 The work performed and materials supplied under this section shall conform to the City of Winnipeg Standard Construction Specifications CW 2130 – latest edition, except as amended in these Specifications.
- .2 The Work described herein shall consist of the supply and construction of wastewater sewer, manhole, and related accessories, all as specified and/or shown on the Construction Drawings.

**PART 2 PRODUCTS**

**2.1 PIPE**

- .1 Pipe shall be PVC SDR 35, or as specified on the drawings and approved for use in the City of Winnipeg.

**2.2 FITTINGS**

- .1 PVC Sewer fittings shall be PVC injection moulded fittings in accordance with ASTM D3034, SDR 35.

**2.3 BEDDING AND BACKFILL**

- .1 Bedding and backfill of sewer pipe shall be as Specified in Section 312310.

**PART 3 EXECUTION**

**3.1 METHOD OF PIPE INSTALLATION**

- .1 Sewermains to be installed within the site development shall be installed either by open trench excavation with the appropriate class of backfill or by trenchless methods. Sewermains to be installed under existing or proposed pavements within the City right-of-way shall be installed in a cored hole as per CW 2110, latest edition.
- .2 Shafts for coring shall be adequately sized to safely accommodate all coring equipment and personnel required for pipe extraction, coring and pipe installation.

**3.2 CONNECTIONS**

- .1 Prior to installation, the Contractor shall expose existing wastewater sewer connection points to verify existing inverts.

- .2 The Contractor shall notify the Contract Administrator of any discrepancy prior to construction and the Contract Administrator shall modify design grades as required. Excavation and backfilling operations as required to expose existing sewers to verify existing inverts shall be incidental to the contract.

### **3.3 MAINTENANCE OF SERVICE**

- .1 The Contractor shall maintain service to affected residents throughout construction. At no time shall raw sewage be allowed to discharge into any trenches. Bypass pumping will be required to divert sewer flows to permit continuity of sanitary sewer service. Payment for bypass pumping shall be incidental to the contract.

### **3.4 CONNECTING TO EXISTING SEWERS**

- .1 Connecting to existing sewers shall be in accordance with CW 2130, latest edition, and as per the details on the construction drawings.

### **3.5 SEWER CONNECTION RISERS**

- .1 Risers shall be installed on all sewers for connections, in accordance with City of Winnipeg Standard Drawings SD-014 or SD-015. Riser pipe shall be connected to the junction and sewer with an appropriate adaptor to ensure a water tight connection is achieved.

### **3.6 SEWER INSPECTION**

- .1 All new sewer installations shall be inspected as per specification Section 334200, Sewer Inspection.

## **PART 4 MEASUREMENT AND PAYMENT**

### **4.1 GRAVITY SEWERS**

- .1 Measurement and payment for Section 333113, Public Sanitary Utility Sewerage Piping shall be included with the project total Lump Sum Price and in accordance with Part A – Bid Submission of the Contract documents for Bid Opportunity No. 832-2007 – Construction of Bronx Park Community Centre and Home of Good Neighbours Senior Centre Winnipeg Manitoba.

END OF SECTION

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 Section 312310 – Excavation, Trenching and Backfill

**1.2 DESCRIPTION OF WORK**

- .1 The work performed and materials supplied under this section shall conform to the City of Winnipeg Standard Construction Specifications CW 2130 – latest edition, except as amended in these Specifications.
- .2 The Work described herein shall consist of the supply and construction of storm sewer, manhole, catch basin and related accessories, all as specified and/or shown on the Construction Drawings.

**PART 2 PRODUCTS**

**2.1 PIPE**

- .1 Pipe shall be PVC SDR 35, as specified on the drawings and approved for use in the City of Winnipeg.

**2.2 FITTINGS**

- .1 PVC Sewer fittings shall be PVC injection moulded fittings in accordance with ASTM D3034, SDR 35.

**2.3 BEDDING AND BACKFILL**

- .1 Bedding and backfill of sewer pipe shall be as Specified in Section 312310.

**2.4 CATCH BASIN FRAME AND COVER**

- .1 Catch basin frames and covers shall be as specified in the City of Winnipeg Standard Construction Specifications for frame and cover as per CW 2130, latest edition.

**2.5 INLINE DRAIN AND INLET GRATE**

- .1 Drain inlet grate shall be 300mm Pedestrian H-10 Nyloplast grate complete with pipe adapter for connection to PVC SDR35 storm sewer and fittings.

**PART 3 EXECUTION**

**3.1 METHOD OF PIPE INSTALLATION**

- .1 Sewermains to be installed within the site development shall be installed either by open trench excavation with the appropriate class of backfill or by trenchless methods. Sewermains to be installed under existing or proposed pavements within the City right-of-way shall be installed in a cored hole as per CW 2110, latest edition.



- .2 Areas within Contract Administrator approved limits of clearing and grubbing and where field conditions are such that a cored hole cannot be made; the Contractor shall install the pipe in an open trench with the appropriate class of backfill in accordance with Section 312310 Excavation, Trenching and Backfill. No additional payment will be made for pipe installed by open trench. The Contractor shall only proceed with open trench installation after receiving written approval from the Contract Administrator.
- .3 Shafts for coring shall be adequately sized to safely accommodate all coring equipment and personnel required for pipe extraction, coring and pipe installation.

### **3.2 CONNECTIONS**

- .1 Prior to installation, the Contractor shall expose existing storm sewers at connection points to verify existing inverts.
- .2 The Contractor shall notify the Contract Administrator of any discrepancy prior to construction and the Contract Administrator shall modify design grades as required. Excavation and backfilling operations as required to expose existing sewers to verify existing inverts shall be incidental to the contract.

### **3.3 MAINTENANCE OF SERVICE**

- .1 The Contractor shall maintain service to affected residents throughout construction. At no time shall raw sewage be allowed to discharge into any trenches. Bypass pumping will be required to divert sewer flows to permit continuity of sanitary sewer service. Payment for bypass pumping shall be incidental to the contract.

### **3.4 CONNECTING TO EXISTING SEWERS**

- .1 Connecting to existing sewers shall be in accordance with CW 2130, latest edition, and as per the details on the construction drawings.

### **3.5 SEWER CONNECTION RISERS**

- .1 Risers shall be installed on all sewers for connections, in accordance with City of Winnipeg Standard Drawings SD-014 or SD-015. Riser pipe shall be connected to the junction and sewer with an appropriate adaptor to ensure a water tight connection in achieved.

### **3.6 SEWER INSPECTION**

- .1 All new sewer installations shall be inspected as per specification Section 334200, Sewer Inspection.

## **PART 4 MEASUREMENT AND PAYMENT**

### **4.1 GRAVITY SEWERS**

- .1 Measurement and payment for Section 334100, Storm Utility Drains shall be included with the project total Lump Sum Price and in accordance with Part A – Bid Submission

of the Contract documents for Bid Opportunity No. 832-2007 – Construction of Bronx Park Community Centre and Home of Good Neighbours Senior Centre Winnipeg Manitoba.

END OF SECTION

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 Section 333113 – Public Sanitary Utility Sewerage Piping
- .2 Section 334100 – Storm Utility Drains

**1.2 DESCRIPTION**

- .1 The work performed and materials supplied under this section shall conform to the City of Winnipeg Standard Construction Specifications CW 2145, except as amended in these Specifications.
- .2 Televised sewer inspections shall be performed to observe the condition and grading of all as-built piping.

**PART 2 PRODUCTS**

**2.1 INSPECTION UNIT**

- .1 The inspection unit shall consist of a self-contained vehicle with separate areas for viewing and equipment storage. Each unit shall be equipped with a cellular telephone and a suitable communication system linking all crew members. Each inspection unit shall be equipped with fans and blowers to remove any fog, which may be present in the sewer at the time of the inspection.

**2.2 INSPECTION EQUIPMENT**

- .1 Inspection equipment shall consist of cameras, lighting, cables, power source, monitor, video cassette recorder, and other related equipment. The camera shall be pan and tilt type capable of panning 360° and tilting 270°. The adjustment of focus and iris shall allow optimum picture quality and the focal range shall be adjustable from 100 mm to infinity.
- .2 The light source shall be adjustable to allow an even distribution of light around the sewer perimeter without loss of contrast, flare out of picture, or shadowing. Video overlay equipment shall be capable of superimposing alpha-numeric information onto the video and shall be capable of providing a minimum of 15 lines of information, 30 characters per line. Video recordings shall be recorded in both analog and digital formats. All video cassettes shall be high grade VHS format, new and unused. All video tape recordings shall be first generation recordings.
- .3 The camera shall be transported through the sewer by means of a rubber tired or crawler tractor. The transport unit must be capable of passing over minor surface imperfections including, but not limited to, broken joints and solid debris up to 40 mm in height. Mounting of the camera on a float or skid for tow through the sewer shall only be permitted where the condition of the sewer or flow level precludes the use of a tractor. If the camera is towed the supporting equipment shall not impede the view of the camera and shall be stable to ensure steady and smooth progress.

- .4 The camera transport shall permit complete inspection of the sewer from the centre of the start manhole to the centre of the finish manhole. The camera transport and cable shall be capable of inspecting a minimum of 200 metres of sewer from a single access point. A remote reading counter shall be used to measure distance travelled from the centre of the start manhole and measurements shall be recorded in metres to the nearest 100 mm.
- .5 The camera height shall be adjustable so as to position the centre of the lens in the centre of circular sewers and two thirds of the vertical dimension above the invert of egg shaped sewers.

### **PART 3 EXECUTION**

#### **3.1 SEWER INSPECTION**

- .1 The Contractor shall provide a minimum of 24 hours notice to the Contract Administrator of the locations where the inspections will be performed on the following day(s).
- .2 Prior to beginning the inspection the distance between the centres of the start and finish manhole shall be measured on the ground surface using a steel tape. Flow control measures shall be implemented to ensure a minimum of 80% of the height of the sewer is visible for the entire inspection. All fog shall be evacuated from the sewer. The camera lens shall be kept clean at all times and the sewer shall be kept clear of fog during the entire inspection.
- .3 All inspections shall be conducted in the direction of flow. Inspections shall generally begin with the upstream sewer in the system and proceed downstream in a consecutive manner. Under no circumstances shall the inspection proceed downstream until all contributing upstream sewers have been cleaned. Cleaning of sewers shall be in accordance with City of Winnipeg Standard Construction Specification CW 2140.
- .4 The face of the start manhole shall be clearly visible at the start of the inspection and the inspection shall be performed from the centre of the start manhole to the centre of the finish manhole. At the start of the inspection the length of sewer from the centre of the manhole to the cable calibration point shall be recorded and the distance reading at the cable calibration point shall be adjusted such that zero is at the centre of the start manhole.
- .5 During the inspection automatic distance measurement shall be indicated on the screen and begin to move immediately as the camera moves. The distance measurement shall be accurate from the cable calibration point to the centre of the finish manhole. The camera speed shall not exceed 9 metres/minute.
- .6 During the inspection the picture shall be in focus from the point of observation to a minimum of two pipe diameters ahead.

#### **3.2 VIDEO TAPE RECORDINGS**

- .1 The inspections shall be recorded in colour on VHS format at slow play speed (SP mode). The entire inspection shall be contained on one videotape. Videotapes shall be high grade, new unused only. All videotapes shall be first generation recordings. The

contractor shall also capture the inspections in digital format, in colour from the live video source in parallel with the VHS tape recordings.

- .2 At the start of each survey a video overlay system shall be used to clearly display, on the monitor and video recording, the following alpha-numeric information for 30 seconds. This information shall be entered prior to beginning the inspection:

- .1 Line 1: Contract ID e.g., Bronx Park, ID No. 00028
- .2 Line 2: Street Name e.g., Bronx Place
- .3 Line 3: Start MH to Finish MH Names e.g., MH in parking lot to MH at Bronx Place.
- .4 Line 4: Contractor Name e.g., XYZ Limited
- .5 Line 5: Date and Time of Inspection e.g., 08/07/2006 - 14:15
- .6 Line 6: Direction of Inspection e.g., with flow

- .3 The video tape shall be labelled with the following information:

- .1 Contract Name e.g., Bronx Park
- .2 Sewer ID Name: e.g., WWS in parking lot
- .3 Submission ID: e.g., Sewers Inspected Week of 08/24/2008 - 1 of 2

- .4 Analog and digital videos shall be submitted in hard plastic cases with clear plastic windows capable of displaying a summary sheet containing the following information:

e.g.,

Street Name	From MH	To MH	VTR
Bronx Place	Parking lot	Bronx Place	0:00:00

## **PART 4 MEASUREMENT AND PAYMENT**

### **4.1 SEWER INSPECTION**

- .1 Measurement and payment for Section 334200, Sewer Inspection shall be included with the project total Lump Sum Price and in accordance with Part A – Bid Submission of the Contract documents for Bid Opportunity No. 832-2007 – Construction of Bronx Park Community Centre and Home of Good Neighbours Senior Centre Winnipeg Manitoba.

END OF SECTION

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Building perimeter, weep drainage system.
- .2 Filter aggregate and fabric and bedding.

**1.2 RELATED SECTIONS**

- .1 Section 31 23 10 - Excavation, Trenching and Backfill.
- .2 Section 32 11 23 - Granular Base Courses.

**1.3 REFERENCES**

- .1 ASTM D2729 - Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

**1.4 SUBMITTALS AT PROJECT CLOSEOUT**

- .1 Section 01 33 00: Submission procedures.
- .2 Record location of pipe runs, connections, cleanouts and principal invert elevations.

**PART 2 PRODUCTS**

**2.1 PIPE MATERIALS**

- .1 Corrugated Plastic Tubing: Flexible type; 100 mm diameter, c/w geotextile sock and related fittings as manufactured by Big 'O' Drain Tile Co. Ltd.
- .2 Use perforated pipe at subdrainage system; unperforated through sleeved walls top sump pit.

**2.2 AGGREGATE AND BEDDING**

- .1 Filter Aggregate: clean natural stone 12-25 mm size, free from fines, shale, clay and friable materials
- .2 Bedding: Sand, clean, natural, free from silt, clay, loam, friable or soluble materials and organic matter

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- .1 Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout Drawings.

**3.2 PREPARATION**

- .1 Hand trim excavations to required elevations.

- .2 Remove large stones or other hard matter which could damage drainage piping or impede consistent backfilling or compaction.

### **3.3 INSTALLATION**

- .1 Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.
- .2 Minimize bed thickness under pipe so water does not collect under piping and not drain as intended.
- .3 Lay pipe to 1% minimum slope; with maximum variation from true slope of 3 mm in 3 m.
- .4 Place pipe with perforations facing down.
- .5 Install pipe couplings.
- .6 Install aggregate at sides, and top of pipe. Provide top cover compacted thickness of 300 mm and side cover of 200 mm thickness.
- .7 Connect to sump pits with unperforated pipe.

### **3.4 FIELD QUALITY CONTROL**

- .1 Request inspection prior to and immediately after placing aggregate cover over pipe.

### **3.5 PROTECTION**

- .1 Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION