

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for constructing new outfall structures, precast and cast-in-place manholes and catch basins.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 74 19 – Construction Waste Management and Disposal
- .3 Section 03 30 00 – Cast-in-Place Concrete
- .4 Section 31 05 17 – Aggregate Materials
- .5 Section 31 23 10 – Excavation, Trenching and Backfilling

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A48/A48M-00, Standard Specification for Gray Iron Castings.
 - .2 ASTM C139-99, Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
 - .3 ASTM C478M-97, Specification for Precast Reinforced Concrete Manhole Sections [Metric].
 - .4 ASTM C618-00, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 - .5 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ftlb/ft³ (600 kN-m/m³)).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2MM, Sieves, Testing, Woven Wire, Metric.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-98 (April 2001), Cementitious Materials Compendium. Includes:
 - .1 CAN/CSA-A5-98, Portland Cement.
 - .2 CAN/CSA-A8-98, Masonry Cement.
 - .3 CAN/CSA-A23.5-98, Supplementary Cementing Materials.
 - .2 CSA-A23.1/A23.2-00 (June 2001), Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete.
 - .3 CSA-A165 Series-94 (R2000), CSA Standards on Concrete Masonry Units.
 - .4 CAN/CSA-G30.18-M92 (R1998), Billet Steel Bars for Concrete Reinforcement.
 - .5 CAN/CSA-G164-M2R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.

1.4 SUBMITTALS

- .1 Submittals in accordance with Section 01 33 30 – Submittal Procedures.
- .2 Submit manufacturer's test data and certification at least 4 weeks prior to beginning Work. Include manufacturer's drawings, information and shop drawings where pertinent.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material for recycling in accordance with Waste Management Plan.
- .3 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by Contract Administrator.
- .4 Divert unused concrete materials from landfill to local facility as approved by Contract Administrator.
- .5 Divert unused aggregate materials from landfill to facility for reuse as approved by Contract Administrator.
- .6 Fold up metal banding, flatten and place in designated area for recycling.

Part 2 Products

2.1 MATERIALS

- .1 Cast-in-place concrete:
 - .1 In accordance with Section 03 30 00 – Cast-in-Place Concrete.
 - .2 Portland cement with 40% Fly ash replacement to CAN/CSA-A5, Type 10.
 - .3 Concrete mix design in accordance with Section 03 30 00.
 - .4 Additives: Fly ash to CAN/CSA-A23.5 ASTM C618.
- .2 Concrete reinforcement: in accordance with Section 03 20 00 – Concrete Reinforcing.
- .3 Precast manhole units: to ASTM C478M, circular or oval. Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation. Monolithic bases to be approved by Contract Administrator and set on concrete slabs cast in place.
 - .1 Acceptable material: in accordance with drawing.
- .4 Precast catch basin sections: to ASTM C139.
 - .1 Acceptable material: in accordance with drawing.
- .5 Joints: to be made watertight using bituminous compound.

- .1 Masonry Cement: to CAN/CSA-A3000-A8.
- .6 Ladder rungs: to CAN/CSA-G30.18, No. 25M billet steel deformed bars, hot dipped galvanized to CAN/CSA-G164. Rungs to be safety pattern drop step type.
- .7 Adjusting rings: to ASTM C478M.
- .8 Concrete Brick: to CAN3-A165 Series.
- .9 Drop manhole pipe: to be same as sewer pipe.
- .10 Galvanized iron sheet: to be approximately 2 mm thick.
- .11 Steel gratings
- .12 Frames, gratings, covers 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/A48M, strength class 30B.
 - .3 Castings: in accordance with drawing.
 - .4 Manhole frames and covers: in accordance with drawings.
 - .5 Catch basin frames and covers: in accordance with drawings.
 - .6 Manhole frames and covers: in accordance with drawings.
 - .7 Catch basin frames and covers: in accordance with drawings.
 - .8 Manhole frames and covers: in accordance with drawings.
 - .9 Catch basin frames and covers: in accordance with drawings.
 - .10 Size: to drawings.
- .13 Granular bedding and backfill: in accordance with Section 31 05 17 – Aggregate Materials and following requirements:
 - .1 Crushed gravel.
 - .2 Gradations to be within limits specified when tested.
 - .3 Table

Sieve Designation	% Passing Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	50-100
2.00 mm	-	30-90
0.425 mm	10-25	10-50

0.180 mm	-	-
0.075 mm	0-8	0-10

- .4 Concrete mixes and materials: in accordance with Section 03 30 00 – Cast-in-Place concrete.
- .14 Unshrinkable fill: in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.

Part 3 Execution

3.1 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 10 – Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Contract Administrator before installing manholes or catch basins.

3.2 CONCRETE WORK

- .1 Do concrete work in accordance with Section 03 30 00 – Cast-in-Place Concrete.
- .2 Place concrete reinforcement in accordance with Section 03 30 00 – Cast-in-Place Concrete.
- .3 Position metal inserts in accordance with dimensions and details as indicated.

3.3 INSTALLATION

- .1 Construct units in accordance with details indicated, plumb and true to alignment and grade.
- .2 Complete units as pipe laying progresses. Maximum of three units behind point of pipe laying will be allowed.
- .3 Dewater excavation to approval of Contract Administrator and remove soft and foreign materials before placing concrete base.
- .4 Cast bottom slabs directly on undisturbed ground.
- .5 Set precise concrete base in accordance with drawings.
- .6 Precast Units:
 - .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base. Make each successive joint watertight with Contract Administrator approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination thereof.
 - .2 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.

- .3 Plug lifting holes with precise concrete plugs set in cement mortar or mastic compound.

- .7 For sewers:
 - .1 Place stub outlets and bulkheads at elevations and in positions indicated.
 - .2 Bench to provide a smooth U-shaped channel. Side height of channel to be 0.75 times full diameter of sewer. Slope adjacent floor at 1 in 20. Curve channels smoothly. Slope invert to establish sewer grade. For pipes smaller than 200 mm, use standard fittings, breaking out upper half of fitting upon completion of manhole.

- .8 Compact granular backfill to 95% standard maximum dry density to ASTM D698 00 (a).

- .9 Place unshrinkable backfill in accordance with Section 31 23 10 – Excavating, Trenching and Backfill.

- .10 Installing units in existing systems:
 - .1 Where new unit is to be installed in existing run of pipe, ensure full support of existing pipe during installation, and carefully remove that portion of existing pipe to dimensions

required and install new unit as specified.
 - .2 Make joints watertight between new unit and existing pipe.
 - .3 Where deemed expedient to maintain service around existing pipes and when

systems constructed under this Project are ready to be put in operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.

- .11 Set frame and cover to required elevation on no more than four courses of brick. Make brick joints and join brick to frame with cement mortar. Parge and make smooth and watertight.

- .12 Place frame and cover on top section to elevation as indicated. If adjustment is required, use concrete ring.

- .13 Clean units of debris and foreign materials. Remove fins and sharp projections. Prevent debris from entering system.

- .14 Install safety platforms in manholes having depth of 5 m or greater, as indicated.

3.4 ADJUSTING TOPS OF EXISTING UNITS

- .1 Remove existing gratings, frames and beams and store for re-use at locations designated by Contract Administrator.

- .2 Sectional units:

- .1 Raise or lower straight walled sectional units by adding or removing precise sections as required.
- .2 Raise or lower tapered units by removing cone section, adding, removing or substituting riser sections to obtain required elevation, then replace cone section. When amount of raise is less than 600 mm, use standard manhole brick moduloc or grade rings.

3.5 SEALING OVER EXISTING UNITS

- .1 Cut galvanized iron sheet to extend 50 mm beyond opening of existing manhole or catch basin grating. Centre iron sheet over existing grating and spot or switch weld to grating.
- .2 If permissible leakage is exceeded, correct defects. Repeat until approved by Contract Administrator.
- .3 Contract Administrator will issue Test Certificate for each manhole passing test.

3.6 LEAKAGE TEST

- .1 Install watertight plugs or seals on inlets and outlets of each new [sanitary sewer] manhole and fill manhole with water. Leakage not to exceed 0.3% per hour of volume of manhole.
- .2 If permissible leakage is exceeded, correct defects. Repeat until approved by Contract Administrator.
- .3 Contract Administrator will issue Test Certificate for each manhole passing test.

END OF SECTION.

Part 1 General

1.1 SECTION INCLUDES:

- .1 Materials and installation for water mains, hydrants, valves, valve boxes and valve chambers, including service connections.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 78 00 – Closeout Submittals.
- .3 Section 31 23 10 – Excavating, Trenching and Backfilling.

1.3 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA B300-99, Hypochlorites
 - .2 ANSI/AWWA B301-99, Liquid Chlorine
 - .3 ANSI/AWWA B303-00, Sodium Chlorite
 - .4 ANSI/AWWA C500-02, Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95)
 - .5 ANSI/AWWA C651-99, Disinfecting Water Mains
 - .6 ANSI/AWWA C800-01, Underground Service Line Valves and Fittings (also included: Collected Standards for Service Line Materials).
 - .7 ANSI/AWWA C900-97, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch through 12 inch (100 mm – 300 mm), for water distribution.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM A307-02, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
 - .2 ASTM B88M-99, Standard Specification for Seamless Copper Water Tube [metric].
 - .3 American Water Works Association (AWWA)/Manual of Practice
 - .1 AWWA M17-1989, Installation, Field Testing and Maintenance of Fire Hydrants.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-M88, Sieves, Testing, Woven Wire, Metric.
- .5 Canadian Standards Association – Not Applicable
- .6 Department of Justice Canada (Jus)
 - .1 Canadian Environment Protection Act, 1999 (CEPA),
- .7 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .8 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual – March 1998 (R2002).

- .9 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S520-1991, Hydrants
 - .2 CAN4-S543-1984, Internal Lug, Quick Connect Couplings for Fire Hose Submittals.
- .10 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .11 Submit complete shop drawings and construction schedule for water mains 600 mm diameter and larger. Include method for installation of water main.
- .12 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .13 Inform Contract Administrator of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing Work.
- .14 Submit to Contract Administrator for testing at least 4 weeks prior to beginning work, samples of materials proposed for use, as follows:
 - .1 Water Main and valves
 - .2 Hydrants and fittings
- .15 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least 4 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.
- .16 Pipe certification to be on pipe.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details, maintenance and operating instructions in accordance with Section 01 78 00 – Closeout Submittals.
 - .1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

1.5 SCHEDULING OF WORK

- .1 Schedule work to minimize interruptions to existing services.
- .2 Submit schedule of expected interruptions to Contract Administrator for approval and adhere to interruption schedule as approved by Contract Administrator.
- .3 Notify Contract Administrator a minimum of 24 hours in advance of interruption in service.
- .4 Do not interrupt water service for more than 3 hours and confine this period between 10:00 and 16:00 hours local time unless otherwise authorized.
- .5 Notify fire department of any planned or accidental interruption of water supply to hydrants.
- .6 Provide "Out of Service" sign on hydrant not in use.
- .7 Advise local police department of anticipated interference with movement of traffic.

1.6 EXTRA MATERIALS

- .1 Provide Contract Administrator with the following tools (one of each):
 - .1 Service post wrenches for curb stops.
 - .2 Hydrant wrenches.
 - .3 Tee-handle operating keys for valves.

Part 2 Products

2.1 PIPE, JOINTS AND FITTINGS

- .1 Fittings:
 - .1 PVC fittings to AWWAC907.
- .2 Polyvinyl chloride pressure pipe to ANSI/AWWA C900, pressure class 150, DR 18, 1 MPa gasket bell end, cast iron outside diameter.
 - .1 Acceptable material: DR 18, CCASI 150.
 - .2 CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket / coupling.
 - .3 Acceptable material: PVC.
 - .4 Composite epoxy impregnated fibreglass, PVC pipe to ASTM D2996, class H. Unplasticized PVC core over wrapped with bonded fibreglass reinforced epoxy resin. Pressure class 300, 2.4 MPa with cast iron outside diameter and integral bell gasketed joints to ANSI/ASTM D2992. Material to ASTM D2310, classification RTRP-11 HZ-5001-PVC-13323.
 - .5 Pipe and hydrants to conform with City of Winnipeg specifications.

2.2 PIPE PROTECTION

- .1 Provide means of protection for iron pipe in corrosive soils in accordance with local practices and authorities having jurisdiction to ANSI/AWWA C105/A21.5.

2.3 VALVES AND VALVE BOXES

- .1 Valves to open counter clockwise – conform with local standard.
- .2 Gate valves to ANSI/AWWA C509, standard iron body, bronze mounted double disc valves with non-rising stems suitable for 1 Kpa service with push on joints to match pipe.
- .3 Cast iron valve boxes in accordance with drawings.
 - .1 Base to be large round type with minimum diameter of 300 mm.
 - .2 Top of box to be marked "WATER"/"EAU".

2.4 SERVICE CONNECTIONS

- .1 Copper tubing to ASTM B88M type K, annealed.
- .2 Copper tubing joints: compression type suitable for 1 MPa working pressure.
- .3 Brass corporation stops: red brass.
- .4 Brass inverted key-type curb stops; red brass to ASTM B62, compression type with drains.

- .1 Curb stops to have adjustable bituminous coated cast iron service box with stem to suit depth of bury.
- .2 Top of cast iron box marked “WATER”/“EAU”.
- .5 Service connections for PVC pipe:
 - .1 Service connections less than 100 mm: Corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.
 - .2 Service connections 100 mm and over: Use tee fitting or tapping valve and sleeve.
- .6 Bronze type service clamps for PVC pipe service connections.
 - .1 Service clamps to be of strap-type, with confined “O” ring seal cemented in place.
 - .2 Clamps to be tapped with threads to ANSI/AWWA C800.
- .7 Tee connections for services above NPS 1. Tee connections to be fabricated of same material and to same standards as specified pipe fittings and to have ends matching pipe to which they are joined.
- .8 Double strap service clamps, for taps NPS 1 ½ and larger in asbestos-cement pipe, with galvanized malleable iron bodies, with neoprene gasket cemented to body, and cadmium plated or stainless steel mounting hardware.

2.5 HYDRANTS

- .1 Hydrants: compression type hydrant, designed for working pressure of 1035 kPa with two 65 mm threaded hose outlets, one 100 mm threaded pumper connection, 125 mm bottom valve and 150 mm connection for main.
 - .1 Hydrants to open to local standard, threads to local standard, fittings to be internal lug quick-connect to CAN4-S543. Provide metal caps and chains.
 - .2 Provide key operated gate valve located 1 m from hydrant.
 - .3 Depth of bury to 3.00m.
- .2 Hydrant paint: exterior enamel to CAN./CGSB-1.88 MPI #96, to local standard.

2.6 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular material to CBSCS and the following requirements:
 - .1 Crushed or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136 / ASTM C117. Sieve sizes to CAN/CGSB-8..
 - .3 Table:

Sieve Designation	% Passing Stone/Gravel	Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-

Sieve Designation	% Passing Stone/Gravel	Gravel/Sand
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	65-90	100
9.5 mm	-	-
4.75 mm	35-55	80-100
2.00 mm	-	50-90
0.425 mm	10-25	10-50
0.180 mm	-	-
0.075 mm	0-8	0-10

- .2 Concrete mixes and materials required for bedding cradles, encasements, supports, thrust blocks: to Section 03 30 00 – Cast-in-Place Concrete.

2.7 BACKFILL MATERIAL

- .1 Type 3, in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.

2.8 PIPE DISINFECTION

- .1 Sodium hypochloride to ANSI/AWWA B300 and ANSI/AWWA B301 to disinfect water mains.
- .2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651.

Part 3 EXECUTION

3.1 PREPARATION

- .1 Clean pipes, fittings, valves, hydrants and appurtenances of accumulated debris and water before installation.
 - .1 Inspect materials for defects to approval of Contract Administrator.
 - .2 Remove defective materials from site as directed by Contract Administrator.

3.2 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
- .2 Trench depth to provide cover over pipe of not less than 3.0 m from finished grade or as indicated in the drawings.
- .3 Trench alignment and depth require Contract Administrator’s approval prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

- .1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness.
- .2 Do not place material in frozen condition.
- .3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

- .4 Shape transverse depressions in bedding as required to suit joints.
- .5 Compact each layer full width of bed to at least 95% of standard maximum dry density to ASTM D698-00a.
- .6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling, with compacted bedding material.

3.4 PIPE INSTALLATION

- .1 Terminate building water service 1 m outside building wall opposite point of connection to main. Install coupling necessary for connection to building plumbing. If plumbing is already installed, make connection; otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.
- .3 Join pipes in accordance with manufacturer's recommendations.
- .4 Bevel or taper ends of PVC pipe to match fittings.
- .5 Handle pipe by methods approved by Contract Administrator and recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
- .6 Lay pipes on prepared bed, true to line and grade.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 - .2 Take up and replace defective pipe.
 - .3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
- .7 Face socket ends of pipe in direction of laying. From mains on a grade of 2% or greater, face socket ends up-grade.
- .8 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.
- .9 Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 - .1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .10 Position and join pipes with equipment and methods approved by Contract Administrator.
- .11 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
- .12 Align pipes before jointing.
- .13 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as
required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

- .14 Avoid displacing gasket or contaminating with dirt or other foreign material.
 - .1 Remove disturbed or contaminated gaskets.
 - .2 Clean, lubricate and replace before jointing is attempted again.
- .15 Complete each joint before laying next length of pipe.
- .16 Minimize deflection after joint has been made.
- .17 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
- .18 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Contract Administrator.
- .19 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
- .20 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
- .21 Do not lay pipe on frozen bedding.
- .22 Do hydrostatic and leakage test and have results approved by Contract Administrator before surrounding and covering joints and fittings with granular material.
- .23 Backfill remainder of trench.

3.5 VALVE INSTALLATION

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Support valves located in valve boxes or valve chambers in accordance with drawings. Valves not to be supported by pipe.

3.6 SERVICE CONNECTIONS

- .1 Terminate building water service 1 m outside building wall opposite point of connection to main.
 - .1 Install coupling necessary for connection to building plumbing.
 - .2 If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
- .2 Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.
- .3 Construct service connections at right angles to water main unless otherwise directed. Locate curb stops 300 mm inside right-of-way.
- .4 Tappings on asbestos cement may be threaded without service clamps.
 - .1 Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used.
 - .2 Tappings for asbestos cement or PVC-C900 pipe to conform to the following:

Pipe Diameter (mm)	Maximum Tap Without Clamp (mm)	Maximum Tap With Clamp (mm)
100	20	25
150	20	40
200	25	50
250	25	50
300	40	75

.5 Maximum dried direct tapplings (mm) for ductile iron pipe to conform to:

Nominal Pipe Size (mm)	Pressure Class/Max.				
	150	200	250	300	350
75	-	-	-	-	19
102	-	-	-	-	19
152	-	-	-	-	25
203	-	-	-	-	25
254	-	-	-	-	25
305	-	-	-	-	32
356	-	-	32	38	38
406	-	-	38	50	50
457	-	-	50	50	50
508	-	-	50	50	50
610	-	50	50	50	50
762	50	50	50	50	50

- .6 Tappings on PVC pipe to be either PVC valve tees or bronze type service clamps, strap type with “O” ring seal cemented in place.
- .7 Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
- .8 Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.
- .9 Install multiple corporation stops, 30 degrees apart around circumference of pipe and minimum of 300 mm apart along pipe.
- .10 Tap main at 2:00 or 10:00 position only, not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m, whichever is greater.
- .11 Leave corporation stop valves fully open.
- .12 In order to relieve strain on connections, install service pipe in “Goose Nick” form “laid over” into horizontal position.
- .13 Install rigid stainless steel liners in small diameter plastic pipes with compression fittings.
- .14 Install curb stop with corporation box on services NPS 2 or less in diameter.
 - .1 Equip larger services with gate valve and cast iron box. Set box plumb over stop and adjust top flush with final grade elevation.
 - .2 Leave curb stop valves fully closed.

- .15 Place temporary location marker at ends of plugged or capped unconnected water lines.
 - .1 Each marker to consist of 38 X 89 mm stake extending from pipe end at pipe level to 60 mm above grade.
 - .2 Paint exposed portion of stake red with designation "WATER SERVICE LINE" in black.

3.7 HYDRANTS

- .1 Install hydrants at locations as indicated.
- .2 Install hydrants in accordance with drawings.
- .3 Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated by drawings.
- .4 Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.
- .5 Place concrete thrust blocks as indicated and specified, ensuring that drain holes are unobstructed.
- .6 Drain holes to be plugged as shown on the drawings.
- .7 Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.8 THRUST BLOCKS AND RESTRAINED JOINTS

- .1 For thrust blocks: do concrete work in accordance with the drawings.
- .2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by Contract Administrator.
- .3 Keep joints and couplings free of concrete.
- .4 Do not backfill over concrete within 24 hours after placing.
- .5 For restrained joints: only use restrained joints approved by Contract Administrator.

3.9 HYDROSTATIC AND LEAKAGE TESTING

- .1 Do tests in accordance with ANSI/AWWA C600 C603.
- .2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
- .3 Notify Contract Administrator at least 24 hours in advance of proposed tests.
 - .1 Perform tests in presence of Contract Administrator.
- .4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days

after placing concrete or 2 days if high early strength concrete is used.

- .5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Contract Administrator.
- .6 Upon completion of pipe laying and after Contract Administrator has inspected work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated, as directed by Contract Administrator.
- .7 Leave hydrants, valves, joints and fittings exposed.
- .8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
- .9 Strut and brace caps, bends, tees and valves, to prevent movement when test pressure is applied.
- .10 Open valves.
- .11 Expel air from main by slowly filling main with potable water.
 - .1 Install corporation stops at high points in main where no air-vacuum release valves are installed.
 - .2 Remove stops after satisfactory completion of test and seal holes with plugs.
- .12 Fill asbestos cement pipe and concrete pipe at least 24 hours before testing to allow water absorption by pipe material.
- .13 Thoroughly examine exposed parts and correct for leakage as necessary.
- .14 Apply hydrostatic test pressure in accordance with elevation of lowest point in main and corrected to elevation of test gauge, for a period of 1 hour.
- .15 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.
- .16 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.
- .17 Repeat hydrostatic test until defects have been corrected.
- .18 Apply leakage test pressure in accordance with AWWA-C600, C603 after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.
- .19 Define leakage as amount of water supplied from water meter in order to maintain test pressure for 2 hours.
- .20 Do not exceed allowable leakage as specified by AWWA C600, C603, including lateral connections.
- .21 Locate and repair defects if leakage is greater than amount specified.
- .22 Repeat test until leakage is within specified allowance for full length of water main.

3.10 PIPE SURROUND

- .1 Upon completion of pipe laying and after Contract Administrator has inspected work in place, surround and cover pipes as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 60 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Do not place material in frozen condition.
- .5 Compact each layer from pipe invert to mid-height of pipe in conformance with CBSCS.
- .6 Compact each layer from mid-height of pipe to underside of backfill in accordance with CBSCS.

3.11 BACKFILL

- .1 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Do not place backfill in frozen condition.
- .3 Under paving and walks, compact backfill to at least 95% corrected maximum dry density.
 - .1 In other areas, compact to at least 90% corrected maximum dry density.

3.12 HYDRANT FLOW TESTS

- .1 Conduct flow tests on every hydrant to determine fire flows prior to painting hydrant caps and ports.

3.13 PAINTING OF HYDRANTS

- .1 After installation, paint hydrants in accordance with local standard.
- .2 After hydrant flow tests, paint caps and ports to meet colour selections approved by authority having jurisdiction.

3.14 FLUSHING AND DISINFECTING

- .1 Flushing and disinfecting operations: witnessed by Contract Administrator.
 - .1 Notify Contract Administrator at least 4 days in advance of proposed date when disinfecting operations will begin.
- .2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum of 10 minutes, or until foreign materials have been removed and flushed water is clear.
- .3 Flushing flows as follows:

Pipe Size NPS	Flow (L/s) Minimum
6 and below	38
8	75
10	115
12	150

- .4 Provide connections and pumps for flushing as required.
- .5 Open and close valves, hydrants and service connections to ensure thorough flushing.
- .6 When flushing has been completed to Contract Administrator approval, introduce strong solution of chlorine as approved by Contract Administrator in to water main and ensure that it is distributed throughout entire system.
- .7 Disinfect water mains. Specialist contractor to perform disinfection with local authority standard.
- .8 Rate of chlorine application to be proportional to rate of water entering pipe.
- .9 Chlorine application to be close to point of filling water main and to occur at same time.
- .10 Operate valves, hydrants and appurtenances while main contains chlorine solution.
- .11 Flush line to remove chlorine solution after 24 hours.
- .12 Measure chlorine residuals at extreme end of pipe line being tested.
- .13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.
 - .1 Take samples daily for minimum of two days.
 - .2 Should contamination remain or recur during this period, repeat disinfecting procedure.
 - .3 Specialist contractor to submit certified copy of test results.
- .14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.
- .15 After adequate chlorine residual not less than 50 ppm has been obtained, leave system charged with chlorine solution for 24 hours.
 - .1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

3.15 SURFACE RESTORATION

- .1 After installing and backfilling over water mains, restore surface to original condition as directed by Contract Administrator.

END OF SECTION.

1.1 SECTION INCLUDES

- .1 Materials and installation for gravity sewers.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 78 00 – Closeout Submittals.
- .3 Section 31 05 17 – Aggregate Materials
- .4 Section 31 23 10 – Excavating, Trenching and Backfilling

1.3 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA).
- .2 American Society for Testing and Materials International (ASTM).
 - .1 ASTM C14M-99, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .2 ASTM C76M-02, Standard Specification for reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .3 ASTM C117-95, Standard Test Method for Material finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C443M-02, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
 - .6 ASTM D698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort 12,400 ft⁴-lbf/ft³ (600 kN-m/m³).
 - .7 ASTM D3034-00, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .4 Canadian Standards Association (CSA International)
 - .1 CAN CSA –A257 Series-M92 (R1998), Standards for Concrete Pipe.
 - .2 CSA B1800-02, Plastic Non-Pressure Pipe Compendium – B1800 Series (consists of B181.1, B181.2, B181.5, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
 - .1 CSA B12.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.
 - .2 CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).
- .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 199 (CEPA).
- .6 Transport Canada (TC)

- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.4 DEFINITIONS

- .1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.

1.5 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate proposed method for installing carrier pipe for undercrossings.
- .3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .4 Inform Contract Administrator at least 4 weeks prior to beginning work, of proposed source of bedding materials and provide access for sampling.
- .5 Submit to Contract Administrator for testing at least 2 weeks prior to beginning work, following samples of materials proposed for use: all manholes, sewer fittings.
- .6 Submit manufacturer's test data and certification at least 2 weeks prior to beginning work.
- .7 Ensure certification is marked on pipe.
- .8 Submit manufacturer's information data sheets and instructions in accordance with Section 01 33 00 – Submittal Procedures.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials as directed by Contract Administrator and in accordance with applicable by-laws.

1.7 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 Contract Administrator and building manager 24 hours minimum in advance of any interruption in service.

2.1 PLASTIC PIPE

- .1 Type PSM Polyvinyl Chloride (PVC) to ASTM D3034 CSA-B182.2.
 - .1 Standard Dimensional Ratio (SDR): 35.
 - .2 Separate gasket and integral bell system.
 - .3 Nominal lengths: 6 m.

2.2 SERVICE CONNECTIONS

- .1 Type PSM Polyvinyl Chloride (PVC) to CSA-B182.2.

- .1 Acceptable material: SDR 35.

2.3 CEMENT MORTAR

- .1 Portland cement to CAN/CSA-A5, normal type 10.
- .2 Mix mortar one 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 Section 31 05 17 – Aggregate Materials and following requirements:
 - .1 Crushed or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136, ASTM C117. Sieve sizes to CAN/CGSB-8.2.
- .2 Table

Sieve Designation	% Passing Stone/Gravel	% Passing Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	-	-
9.5 mm	-	-
4.75 mm	35-55	50-100
2.00 mm	-	30-90
0.425 mm	10-25	10-50
0.180 mm	-	-
0.075 mm	0-8	0-10

- .3 Concrete mixes and materials for cradles, encasement, supports to Section 03 30 00 – Cast-in-Place Concrete.

2.5 BACKFILL MATERIAL

- .1 As indicated.
- .2 Type 3, in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.

3.1 PREPARATION

- .1 Clean and dry pipes and fittings before installation.
- .2 Obtain Contract Administrator’s approval of pipes and fittings prior to installation.

3.2 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
- .2 Do not allow contents of any sewer or sewer connection to flow into trench.
- .3 Trench alignment and depth require approval of Contract Administrator prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding materials 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 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 to ASTM D698-00(a).
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.4 INSTALLATION

- .1 Lay and joint pipes to ASTM C12.
- .2 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Contract Administrator.
- .3 Handle pipe using methods approved by Contract Administrator.
 - .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 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .7 Do not allow water to flow through pipe during construction, except as may be permitted by Contract Administrator.
- .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 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 before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
 - .5 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.
 - .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 Contract Administrator to prevent creep during down time.
- .12 Plug lifting holes with pre-fabricated plugs approved by Contract Administrator, 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 Contract Administrator, for connecting pipes to existing sewer pipes.
 - .1 Joints to be structurally sound and watertight.

3.5 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Contract Administrator 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 1.0 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% of standard maximum dry density to ASTM D698 00 (a).

- .6 Compact each layer from mid-height of pipe to underside of backfill to at least 90% standard maximum dry density and to ASTM D698 00 (a).
- .7 When field test results are acceptable to Contract Administrator, place surround material at pipe joints.

3.6 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% standard maximum dry density ASTM D698 00(a).
 - .1 In other areas, compact to at least 90% corrected maximum dry density.

3.7 SERVICE CONNECTIONS

- .1 Install pipe to CSA B182.11, 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 Contract Administrator.
- .3 Service connections to main sewer in accordance with drawings.
 - .1 Do not use break-in and mortar patch-type joints.
- .4 Service connection pipe not to extend in to interior of main sewer.
- .5 Make up required horizontal and vertical bends from 45 degree bends or less, separated by straight section of pipe with minimum length of four pipe diameters.
 - .1 Use long sweep bends where applicable.
- .6 Plug service laterals with water tight caps or plugs as approved by Contract Administrator.
- .7 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 0.6m above grade.
 - .2 Paint exposed portion of stake red with designation SAN SWR LINE in black.

3.5 FIELD TESTING

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 When directed by Contract Administrator, 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 C828.
- .6 Do infiltration and exfiltration testing as specified herein and as directed by Contract Administrator.
 1. Perform tests in presence of Contract Administrator.
 2. Notify Contract Administrator 24 hours in advance of proposed tests.
- .7 Carry out tests on each section of sewer between successive manholes including service connections.
- .8 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.
- .9 Exfiltration test: in accordance with ASTM C828.
- .10 Infiltration test: in accordance with ASTM C828.
- .11 Infiltration and exfiltration not to exceed limits specified in ASTM C828.
- .12 Leakage not to exceed limits of ASTM C828.
- .13 Repair and retest sewer line, as required, until test results are within limits specified.
- .14 Repair visible leaks regardless of test results.
- .15 Television and photographic inspections: in accordance with a certified inspection company.

END OF SECTION.

1.1 SECTION INCLUDES

- .1 Materials and installation for gravity sewers.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 74 19 – Construction Waste Management and Disposal.
- .3 Section 01 61 00 – Product Requirements.
- .4 Section 01 78 00 – Closeout Submittals.
- .5 Section 31 05 17 – Aggregate Materials
- .6 Section 31 23 10 – Excavating, Trenching and Backfilling

1.3 MEASUREMENT PROCEDURES – NOT APPLICABLE

1.4 PAYMENT PROCEDURES – NOT APPLICABLE

1.5 REFERENCES

- .1 American National Standards Institute/American Water Works Association (ANSI/AWWA).
- .2 American Society for Testing and Materials International (ASTM).
 - .1 ASTM C14M-99, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .2 ASTM C76M-02, Standard Specification for reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .3 ASTM C117-95, Standard Test Method for Material finer Than 75 μm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136-01, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C443M-02, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
 - .6 ASTM D698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort [12,400 $\text{ft}\cdot\text{lb}/\text{ft}^3$ (600 $\text{kN}\cdot\text{m}/\text{m}^3$)].
 - .7 ASTM D3034-00, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
- .4 Canadian Standards Association (CSA International)
 - .1 CAN CSA –A257 Series-M92 (R1998), Standards for Concrete Pipe.
 - .2 CSA B1800-02, Plastic Non-Pressure Pipe Compendium – B1800 Series (consists of B181.1, B181.2, B181.5, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
 - .1 CSA B12.1-02, Plastic Drain and Sewer Pipe and Pipe Fittings.
 - .2 CSA B182.2-02, PVC Sewer Pipe and Fittings (PSM Type).
- .5 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 199 (CEPA).
- .6 Transport Canada (TC)

- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.6 DEFINITIONS

- .1 Pipe section is defined as length of pipe between successive manholes and/or between manhole and any other structure which is part of sewer system.

1.7 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Indicate proposed method for installing carrier pipe for undercrossings.
- .3 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .4 Inform Contract Administrator at least 4 weeks prior to beginning work, of proposed source of bedding materials and provide access for sampling.
- .5 Submit to Contract Administrator for testing at least 2 weeks prior to beginning work, following samples of materials proposed for use: all manholes, sewer fittings.
- .6 Submit manufacturer's test data and certification at least 2 weeks prior to beginning work.
- .7 Ensure certification is marked on pipe.
- .8 Submit manufacturer's information data sheets and instructions in accordance with Section 01 33 00 – Submittal Procedures.

1.8 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 – Common Product Requirements.

1.9 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
- .4 Separate for recycling and place in designated containers steel, metal and plastic waste in accordance with Waste Management Plan.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Divert unused metal materials from landfill to metal recycling facility as approved by Contract Administrator.
- .7 Divert unused concrete materials from landfill to local facility as approved by Contract Administrator.
- .8 Divert unused Corrugated High Density Polyethylene (HDPE) materials from landfill for recycling as approved by Contract Administrator.
- .9 Divert unused aggregate materials from landfill to facility for reuse as approved by Contract Administrator.
- .10 Place materials defined as hazardous or toxic in designated containers.
- .11 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .12 Dispose of unused asbestos cement pipe in accordance with regulations governing disposal of hazardous materials.
- .13 Fold up metal banding, flatten and place in designated area for recycling.

1.10 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 Contract Administrator and building manager 24 hours minimum in advance of any interruption in service.

2.1 PLASTIC PIPE

- .1 Type PSM Polyvinyl Chloride (PVC) to ASTM D3034 CSA-B182.2.
 - .1 Standard Dimensional Ratio (SDR): 35.
 - .2 Separate gasket and integral bell system.
 - .3 Nominal lengths: 6 m.

2.2 SERVICE CONNECTIONS

- .1 Type PSM Polyvinyl Chloride (PVC) to CSA-B182.2.
 - .1 Acceptable material: SDR 35.

2.3 CEMENT MORTAR

- .1 Portland cement to CAN/CSA-A5, normal type 10.
- .2 Mix mortar one 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 Section 31 05 17 – Aggregate Materials and following requirements:
 - .1 Crushed or screened stone, gravel or sand.
 - .2 Gradations to be within limits specified when tested to ASTM C136, ASTM C117. Sieve sizes to CAN/CGSB-8.2.
- .2 Table

Sieve Designation	% Passing Stone/Gravel	% Passing Gravel/Sand
200 mm	-	-
75 mm	-	-
50 mm	-	-
38.1 mm	-	-
25 mm	100	-
19 mm	-	-
12.5 mm	-	-
9.5 mm	-	-
4.75 mm	35-55	50-100
2.00 mm	-	30-90

Sieve Designation	% Passing Stone/Gravel	% Passing Gravel/Sand
0.425 mm	10-25	10-50
0.180 mm	-	-
0.075 mm	0-8	0-10

- .3 Concrete mixes and materials for cradles, encasement, supports to Section 03 30 00 – Cast-in-Place Concrete.

2.5 BACKFILL MATERIAL

- .1 As indicated.
- .2 Type 3, in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.

3.1 PREPARATION

- .1 Clean and dry pipes and fittings before installation.
- .2 Obtain Contract Administrator’s approval of pipes and fittings prior to installation.

3.2 TRENCHING

- .1 Do trenching work in accordance with Section 31 23 10 – Excavating, Trenching and Backfilling.
- .2 Do not allow contents of any sewer or sewer connection to flow into trench.
- .3 Trench alignment and depth require approval of Contract Administrator prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding materials in uniform layer[s] 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 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 to ASTM D698-00(a).
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.4 INSTALLATION

- .1 Lay and joint pipes to ASTM C12.
- .2 Lay and join pipes in accordance with manufacturer’s recommendations and to approval of Contract Administrator.
- .3 Handle pipe using methods approved by Contract Administrator.
 - .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 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .7 Do not allow water to flow through pipe during construction, except as may be permitted by Contract Administrator.
- .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 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 before joining.
 - .4 Maintain pipe joints free from mud, silt, gravel and other foreign material.
 - .5 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.
 - .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 Contract Administrator to prevent creep during down time.
- .12 Plug lifting holes with pre-fabricated plugs approved by Contract Administrator, 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 Contract Administrator, for connecting pipes to existing sewer pipes.
 - .1 Joints to be structurally sound and watertight.

3.5 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Contract Administrator 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 1.0 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% of standard maximum dry density to ASTM D698 00 (a).
- .6 Compact each layer from mid-height of pipe to underside of backfill to at least 90% standard maximum dry density and to ASTM D698 00 (a).
- .7 When field test results are acceptable to Contract Administrator, place surround material at pipe joints.

3.6 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% standard maximum dry density ASTM D698 00(a).
- .1 In other areas, compact to at least 90% corrected maximum dry density.

3.7 SERVICE CONNECTIONS

- .1 Install pipe to CSA B182.11, 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 Contract Administrator.
- .3 Service connections to main sewer in accordance with drawings.
- .1 Do not use break-in and mortar patch-type joints.
- .4 Service connection pipe not to extend in to interior of main sewer.
- .5 Make up required horizontal and vertical bends from 45 degree bends or less, separated by straight section of pipe with minimum length of four pipe diameters.
- .1 Use long sweep bends where applicable.
- .6 Plug service laterals with water tight caps or plugs as approved by Contract Administrator.
- .7 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 0.6m above grade.
- .2 Paint exposed portion of stake red with designation SAN SWR LINE in black.

3.5 FIELD TESTING

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 When directed by Contract Administrator, 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 C828.

- .6 Do infiltration and exfiltration testing as specified herein and as directed by Contract Administrator.
 1. Perform tests in presence of Contract Administrator.
 2. Notify Contract Administrator 24 hours in advance of proposed tests.
- .7 Carry out tests on each section of sewer between successive manholes including service connections.
- .8 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.
- .9 Exfiltration test: in accordance with ASTM C828.
- .10 Infiltration test: in accordance with ASTM C828.
- .11 Infiltration and exfiltration not to exceed limits specified in ASTM C828.
- .12 Leakage not to exceed limits of ASTM C828.
- .13 Repair and retest sewer line, as required, until test results are within limits specified.
- .14 Repair visible leaks regardless of test results.
- .15 Television and photographic inspections: in accordance with a certified inspection company.

END OF SECTION.

1. GENERAL

1.1. RELATED REQUIREMENTS

- .1 Section 31 00 00 – Earthwork

1.2. REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM D 698-[00a], Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - .2 CSA B1800-[02], Plastic Non-pressure Pipe Compendium - B1800 Series (Consists of B181.1, B181.2, B181.3, B181.5, B182.1, B182.2, B182.4, B182.6, B182.7, B182.8 and B182.11).
 - .1 CSA B182.2-[02], PVC Sewer Pipe and Fittings (PSM Type).
- .2 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA)

1.3. WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Divert unused concrete materials from landfill to local facility as approved by Contract Administrator.
- .3 Divert unused aggregate materials from landfill to facility Contract Administrator.
- .4 Divert unused metal materials from landfill to metal recycling facility for disposal approved by Contract Administrator.
- .5 Divert unused geotextiles from landfill to plastic recycling facility for disposal approved by Contract Administrator.
- .6 Place materials defined as hazardous or toxic in designated containers.
- .7 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .8 Dispose of unused asbestos cement pipe in accordance with regulations governing the disposal of hazardous materials.

1.4. SITE CONDITIONS

- .1 Examine sub-surface investigation report as supplied by Contract Administrator.
- .2 Known underground utility lines and buried objects are as indicated on plans.

2. PRODUCTS

2.1. PIPE MATERIALS

- .1 Corrugated Plastic Tubing: Flexible type; 6" diameter, with required fittings.
- .2 Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.2. BEDDING AND SURROUND MATERIALS

- .1 Filter aggregate and bedding materials: as specified in the Drawings.

2.3. BACKFILL MATERIAL

- .1 Excavated or graded material existing on site may be suitable to use if approved by Contract Administrator.

2.4. ACCESSORIES

- .1 Pipe Coupling: Solid plastic.
- .2 Filter Fabric: Water pervious type, black polyolefin.

3. EXECUTION

3.1. EXAMINATION

- .1 Ensure graded subgrade, sub-base and base conforms with required drainage pattern before placing bedding material.
- .2 Ensure improper slopes, unstable areas, areas requiring additional compaction or other unsatisfactory conditions are corrected to approval of Contract Administrator.
- .3 Ensure foundation wall, dampproofing and rigid insulation have been installed and approved by Contract Administrator before placing bedding material.

3.2. BEDDING PREPARATION

- .1 Cut trenches in subgrade, base and sub-base and place bedding material in uniform layer not exceeding 150 mm compacted to depth as indicated.
- .2 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
- .3 Shape transverse depressions, as required, to suit joints.
- .4 Compact each layer full width of bed to at least 95% maximum density to ASTM D 698.
- .5 Fill excavation below design elevation of bottom of specified bedding with common backfill.
- .6 Remove large stones or other material that could damage piping or impede consistent backfilling or compaction.

3.3. PIPE OR TUBING INSTALLATION

- .1 Ensure pipe interior and coupling surfaces are clean before laying.
- .2 Lay perforated pipe level minimum to slope of 1:100. For pipe face perforations and coupling slots downward.
- .3 Lay non-perforated pipe to slope of 1:50 from perforated pipe to disposal area. Make joints watertight.
- .4 Grade bedding to establish pipe slope.
- .5 Install end plugs at ends of collector drains to protect pipe ends from damage and ingress of foreign material.
- .6 Connect non-perforated pipe to sump pit by appropriate adapters manufactured for this purpose.
- .7 Connect drainage system to building sewers, as indicated.

3.4. PIPE OR TUBING SURROUND MATERIAL

- .1 Upon completion of pipe laying and after Contract Administrator has inspected Work in place, surround and cover pipe and install geotextile filter as indicated.
- .2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness, as indicated. Do not drop material within 1 m of pipe.
- .3 Place layers uniformly and simultaneously on each side of pipe.
- .4 Compact each layer from pipe invert to mid-height of pipe to at least 95% maximum density to ASTM D 698.
- .5 Compact each layer from mid-height of pipe to underside of backfill to at least 90% maximum density to ASTM D 698.

3.5. BACKFILL MATERIAL

- .1 Place backfill material above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .2 Under paving and walks, compact backfill to at least 95% maximum density to ASTM D 698. In other areas, compact to at least 90% maximum density to ASTM D 698.

END OF SECTION.