
PART 1: GENERAL

1.1 MEASUREMENT AND PAYMENT

- .1 Refer to Section 01 11 50 - Measurement and Payment.

1.2 COMPLIANCE REQUIREMENTS

- .1 ASTM International
 - .1 ASTM A48/A48M-03(2012), Standard Specification for Gray Iron Castings.
 - .2 ASTM A123/A123M-2012, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - .3 ASTM C117-13, Standard Test Method for Materials Finer than 75- μ m (No. 200) Sieve in Mineral Aggregates by Washing.
 - .4 ASTM C136-06, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .5 ASTM C139-11, Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
 - .6 ASTM C478M-13, Standard Specification for Precast Reinforced Concrete Manhole Sections (Metric).
 - .7 ASTM D698-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³(600 kN-m/m³)).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-8.1-[88], Sieves, Testing, Woven Wire, Inch Series.
 - .2 CAN/CGSB-8.2-[M88], Sieves, Testing, Woven Wire, Metric.
- .3 CSA Group
 - .1 CSA A23.1/A23.2-[09], Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
 - .2 CAN/CSA-A165 Series-[04(R2009)], CSA Standards on Concrete Masonry Units (Consists of A165.1, A165.2 and A165.3).
 - .3 CAN/CSA-A3000-[08], Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .4 CSA G30.18-[09], Carbon Steel Bars for Concrete Reinforcement.

1.3 SUBMITTAL GENERAL REQUIREMENTS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for maintenance holes and catch basin structures and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of New Brunswick, Canada.

1.4 QUALITY ASSURANCE

- .1 Submit in accordance with Section 01 45 00 - Testing and Quality Control.
- .2 Certifications:
 - .1 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.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Store and protect maintenance holes and catch basin structures from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

PART 2: PRODUCTS

2.1 MATERIALS

- .1 Precast maintenance hole units: to ASTM C478M, circular or oval.
 - .1 Top sections eccentric cone or flat slab top type with opening offset for vertical ladder installation.
 - .2 Monolithic bases to be approved by Departmental Representative and set on concrete slabs cast in place].
- .2 Precast catch basin sections: to [ASTM C139] [ASTM C478M].
- .3 Joints: made watertight using rubber rings, bituminous compound, epoxy resin cement or cement mortar.
- .4 Mortar:
 - .1 Masonry Cement: to CAN/CSA-A3002.
- .5 Adjusting rings: to ASTM C478M.
- .6 Concrete Brick: to CAN/CSA-A165 Series.
- .7 Frames, gratings, covers to dimensions as indicated and following requirements:
 - .1 Metal gratings and covers to bear evenly on frames.
 - .1 Frame with grating or cover to constitute one unit.
 - .2 Assemble and mark unit components before shipment.
 - .2 Gray iron castings: to ASTM A48/A48M, strength class[30B].
 - .3 Castings: coated with two applications of asphalt varnish
 - .4 Maintenance hole frames and covers: cover cast with and complete with two 25 mm square lifting holes to OPSS 407.
 - .5 Catch basin frames and covers: to OPSS 407.
 - .6 Maintenance hole frames and covers: to CCDG.
 - .7 Catch basin frames and covers: to CCDG.
 - .9 Catch basin frames and covers: minimum 187 kg per set.
 - .10 Size: 762 mm clear diameter.
- .8 Granular bedding and backfill: in accordance with Section 31 23 33 .01 - Excavating Trenching and Backfill.

-
- .9 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

PART 3: EXECUTION

3.1 EXAMINATION

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

3.2 EXCAVATION AND BACKFILL

- .1 Excavate and backfill in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling and as indicated.
- .2 Obtain approval of Departmental Representative before installing outfall structures, maintenance holes or catch basins.

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.
 - .1 Maximum of 3 units behind point of pipe laying will be allowed.
- .3 Dewater excavation to approval of Departmental Representative and remove soft and foreign material before placing concrete base.
- .4 Cast bottom slabs directly on undisturbed ground.
- .5 Set precast concrete base on 150 mm minimum of granular bedding compacted to 100% corrected maximum dry density.
- .6 Precast units:

-
- .1 Set bottom section of precast unit in bed of cement mortar and bond to concrete slab or base.
 - .2 Make each successive joint watertight with Departmental Representative's approved rubber ring gaskets, bituminous compound, cement mortar, epoxy resin cement, or combination of these materials.
 - .3 Clean surplus mortar and joint compounds from interior surface of unit as work progresses.
 - .4 Plug lifting holes with precast concrete plugs set in cement mortar or mastic compound.
 - .7 Compact granular backfill to 95% corrected maximum dry density.
 - .8 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
 - .9 Installing units in existing systems:
 - .1 Where new unit is 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 for operation, complete installation with appropriate break-outs, removals, redirection of flows, blocking unused pipes or other necessary work.
 - .10 Set frame and cover to required elevation on no more than 4 courses of brick.
 - .1 Make brick joints and join brick to frame with cement mortar.
 - .2 Parge and make smooth and watertight.
 - .11 Place frame and cover on top section to elevation as indicated.
 - .1 If adjustment required use concrete ring.
 - .2 Catchbasin grates placed within the secure perimeter walls shall be tack-welded in place to prevent removal.
 - .12 Clean units of debris and foreign materials.
 - .1 Remove fins and sharp projections.
 - .2 Prevent debris from entering system.

3.4 ADJUSTING TOPS OF EXISTING UNITS

- .1 Remove existing gratings, frames and I beams and store for re-use at locations designated by Departmental Representative.
- .2 Sectional units:
 - .1 Raise or lower straight walled sectional units by adding or removing precast 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.
 - .1 When amount of raise is less than 600 mm use standard maintenance hole brick, modoloc or grade rings.
- .3 Monolithic units:
 - .1 Raise monolithic units by roughening existing top to ensure proper bond and extend to required elevation with cast-in-place concrete.
 - .2 Lower monolithic units with straight wall by removing concrete to elevation indicated for rebuilding.
 - .3 When monolithic units with tapered upper section are lowered more than 150 mm, remove concrete for entire depth of taper plus as much straight wall as necessary, then rebuild upper section to required elevation with cast-in-place concrete.
 - .4 Install additional maintenance hole ladder rungs in adjusted portion of units as required.
 - .5 Re-use existing gratings, frames and I beams.
 - .6 Re-set gratings and frames to required elevation on not more than 4 courses of brick.
 - .1 Make brick joints and join brick to frame with cement mortar, parge and trowel smooth.
 - .2 Re-set gratings and frames to required elevation on full bed of cement mortar, parge and trowel smooth.
 - .3 Catchbasin grates placed within the secure perimeter walls shall be tack-welded in place to prevent removal.

3.5 SEALING OVER EXISTING UNITS

- .1 Cut galvanized iron sheet to extend 50 mm beyond opening of existing maintenance hole or catch basin grating.

-
- .1 Center iron sheet over existing grating and spot or stitch weld to grating.
 - .2 Fill with cast-in-place concrete material approved by Departmental Representative.

3.6 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
 - .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1: GENERAL

1.1 MEASUREMENT AND PAYMENT

- .1 Refer to Section 01 11 50 - Measurement and Payment.

1.2 COMPLIANCE REQUIREMENTS

- .1 ASTM International
- .1 ASTM C12-09, Standard Practice for Installing Vitrified Clay Pipe Lines.
 - .2 ASTM C14M-07, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe (Metric).
 - .3 ASTM C76M-10a, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .4 ASTM C117-04, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.
 - .5 ASTM C136-06, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
 - .6 ASTM C425-04(2009), Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
 - .7 ASTM C428-97(06), Standard Specification for Asbestos-Cement Nonpressure Sewer Pipe.
 - .8 ASTM C443M-10, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
 - .9 ASTM C506M-10b, Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain and Sewer Pipe.
 - .10 ASTM C507M-10b, Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe (Metric).
 - .11 ASTM C663-[98(2008), Standard Specification for Asbestos-Cement Storm Drain Pipe.
 - .12 ASTM C700-11, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
 - .13 ASTM D698-7e1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³(600 kN-m/m<sup>3 - .14 ASTM D1056-07, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
 - .15 ASTM D1869-95(2010), Standard Specification for Rubber Rings for Asbestos-Cement Pipe.</sup>

- .16 ASTM D2680-01(2009), Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping.
- .17 ASTM D3034-08, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .18 ASTM F405-05, Standard Specification for Corrugated Polyethylene (PE) Tubing and Fittings.
- .19 ASTM F667-06, Standard Specification for Large Diameter Corrugated Polyethylene Tubing and Fittings.
- .20 ASTM F794-03(2009), Standard Specification for Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
- .3 CSA International
 - .1 CAN/CSA-A3000-0], Cementitious Materials Compendium.
 - .2 CSA A257 Series-M92(R2009), Standards for Concrete Pipe.
 - .3 CAN/CSA-B1800-06, Thermoplastic Non-pressure Pipe Compendium - B1800 Series.
 - .4 CSA G401-07, Corrugated Steel Pipe Products.

1.3 SCHEDULING

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

1.4 SUBMITTAL GENERAL REQUIREMENTS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes, and backfill and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
 - .1 Shop drawings to indicate proposed method for installing carrier pipe for undercrossings.

- .2 Submit drawings stamped and signed by a Professional Engineer registered or licensed in Province of New Brunswick, Canada.
- .4 Samples:
 - .1 Inform Departmental Representative at least 4 weeks prior to beginning work, of proposed source of bedding materials and provide access for sampling.
- .5 Certification to be marked on pipe.
- .6 Test and Evaluation Reports: submit manufacturer's test data and certification at least 2 weeks prior to beginning Work.
- .7 Manufacturer's Instructions: submit to Departmental Representative 1 copy of manufacturer's installation instructions.
- .8

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.

PART 2: PRODUCTS

2.1 CONCRETE PIPE

- .1 Reinforced circular concrete pipe and fittings: to CSA A257, diameter as indicated, strength classification 65-D, designed for flexible rubber gasket joints to CSA A257.
- .2 Lifting holes:
 - .1 Pipe 900 mm and less diameter: no lift holes.
 - .2 Pipe greater than 900 mm diameter: lift holes not to exceed two in piece of pipe.

- .3 Provide pre-fabricated plugs to effectively seal lift holes after installation of pipe.

2.2 PLASTIC PIPE

- .1 Type PSM Poly Vinyl Chloride (PVC): to ASTM D3034, CAN/CSA-B1800].
 - .1 Standard Dimensional Ratio (SDR): 35.
 - .2 Locked-in gasket and integral bell system.
 - .3 Nominal lengths: 4.3 m.
- .2 Large diameter, ribbed PVC sewer pipe and fittings: to ASTM F794, CAN/CSA-B1800.
- .3 Corrugated polyethylene pipe: high density to ASTM F667, ASTM F405, BNQ-3624-115.

2.3 PIPE BEDDING AND SURROUND MATERIAL

- .1 Granular material in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.4 BACKFILL MATERIAL

- .1 In accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Unshrinkable fill: in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

2.5 JOINT MORTAR

- .1 Portland cement: to CAN/CSA-A3000, normal type 10.
- .2 Mortar: one part Portland cement to two parts clean sharp sand mixed with minimum amount of water to obtain optimum consistency for use intended. Do not use additives.

PART 3: EXECUTION

3.1 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control plan, specific to site, that complies with EPA

832/R-92-005 or requirements of authorities having jurisdiction, whichever is more stringent.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

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

3.2 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Protect trench from contents of sewer.
- .3 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.
- .4 Water jetting of backfill under haunches of corrugated steel pipe may be permitted if recommended by manufacturer and approved by Departmental Representative.

3.3 CONCRETE BEDDING AND ENCASEMENT

- .1 Place concrete to details as directed by Departmental Representative.
- .2 Position pipe on concrete blocks to facilitate placing of concrete.
- .1 When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.
- .3 Backfill over concrete after 24 hours from placing as directed by Departmental Representative.

3.4 GRANULAR BEDDING

- .1 Place bedding in unfrozen condition.
- .2 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
- .3 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe.
- .1 Do not use blocks when bedding pipes.
- .4 Shape transverse depressions as required to suit joints.

- .5 Compact each layer full width of bed to at least 95 % maximum density to ASTM D698.
- .6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted bedding material and compacted common backfill.

3.5 INSTALLATION

- .1 Lay and join pipes to: ASTM C12.
- .2 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .3 Handle pipe using methods approved by Departmental Representative.
 - .1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
- .4 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.
 - .1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
- .5 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Lay corrugated steel pipe:
 - .1 With outside circumferential laps facing upgrade and longitudinal laps or seams at side or quarter points.
 - .2 With longitudinal centre line of paved invert coinciding with flow line.
- .7 Joint deflection permitted within limits recommended by pipe manufacturer.
- .8 Water to flow through pipes during construction only as permitted by Departmental Representative.
- .9 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .10 Install plastic pipe and fittings in accordance with CAN/CSA-B1800.
- .11 Joints:
 - .1 Concrete, clay and asbestos cement pipe:
 - .1 Install gaskets as recommended by manufacturer.

-
- .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. Remove disturbed or dirty gaskets; clean, lubricate and replace 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 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
 - .9 Mortared joints:
 - .1 Pipe interior: circular pipes 700 mm diameter and larger, and arch or elliptical pipe equivalent to 900 mm diameter or larger shall have interior gap between ends of adjacent pipes filled with mortar.
 - .1 Apply mortar minimum 7 days after backfilling has been completed to allow pipe settlement to occur.
 - .2 Finish interior surface of joints smooth.
 - .2 Pipe exterior: for bell and spigot pipe, use mortar to seal outside of joints. Press and bed mortar into place.
 - .1 Allow mortar to set minimum of 1 hour before backfilling.
 - .12 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.
 - .13 Plug lifting holes with Departmental Representative approved prefabricated plugs, set in shrinkage compensating grout.
 - .14 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.

- .15 Make watertight connections to manholes and catch basins.
 - .1 Use shrinkage compensating grout when suitable gaskets are not available.
- .16 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.
 - .1 Joint to be structurally sound and watertight.
- .17 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.6 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying, and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated.
 - .1 Leave joints and fittings exposed until field testing is completed.
- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
 - .1 Do not dump material within 1.0 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 % maximum density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % maximum density to ASTM D698.
- .7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.7 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 95 % maximum density to ASTM D698. In other areas, compact backfill to at least 90 % maximum density to ASTM D698.

-
- .4 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.8 FIELD TESTS AND INSPECTIONS

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 Draw tapered wooden plug with diameter of 50 mm less than nominal pipe diameter through sewer to ensure that pipe is free of obstruction directed by Departmental Representative.
- .3 Remove foreign material from sewers and related appurtenances by flushing with water.
- .4 Television and photographic inspections:
 - .1 Carry out inspection of installed sewers by television camera, photographic camera or by other related means.
 - .2 Provide means of access to permit Departmental Representative to do inspections.
 - .3 Payment for inspection services in accordance with Section 01 11 50 - Measurement and Payment.

3.9 CLEANING

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

PART 1: GENERAL

1.1 WORK INCLUDED

- .1 This section includes the supply of all labour, materials and equipment and incidentals necessary for the complete installation of all culvert pipes as shown on the drawings and herein specified.

1.2 RELATED SECTIONS

- .1 Section 31 23 33.01: Excavating, Trenching and Backfilling
- .2 Section 31 37 00: Rip Rap

1.3 MEASUREMENT AND PAYMENT

- .1 Refer to Section 01 11 50 - Measurement and Payment.

1.4 COMPLIANCE REQUIREMENTS

- .1 ASTM International
 - .1 ASTM C76M-10a, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).
 - .2 ASTM C443M-10, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).
 - .3 ASTM D698-07e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³
- .2 CSA International
 - .1 CSA A3000-08, Cementitious Materials Compendium.
 - .2 CSA A257 Series-09, Standards for Concrete Pipe and Manhole Sections.
 - .3 CAN/CSA G401-07, Corrugated Steel Pipe Products.

1.5 SUBMITTAL GENERAL REQUIREMENTS

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Product Data:
 - .1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

- .3 Samples:
 - .1 Inform Departmental Representative at least 4 weeks before beginning Work, of proposed source of bedding materials and provide access for sampling.
- .4 Certification: to be marked on pipe.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
 - .1 Store materials in accordance with manufacturer's recommendations.
 - .2 Store and protect pipes from damage.
 - .3 Replace defective or damaged materials with new.
- .4 Carefully lower culvert pipes into trench in such a manner as to prevent damage to them. Under no circumstances shall culvert pipes be dropped into a trench.

PART 2: PRODUCTS

2.1 CONCRETE PIPE

- .1 Minimum size of culvert pipes: 450 mm, unless otherwise noted on the drawings.
- .2 Reinforced concrete pipe: to CSA A257 diameter as indicated.
- .3 Strength classification: Class 65-D unless otherwise noted on the drawings.
- .4 Joints: bell and spigot type with rubber gasket. This is a push-on joint and must be watertight.
- .5 Rubber gaskets for joints: to CSA A257.
- .6 Cement mortar joint filler:
 - .1 Portland cement: to CSA A3000, Type 10.
 - .2 Sand: to ASTM C144.
 - .3 Mortar: one part by volume of cement to two parts of clean, sharp sand mixed dry. Add sufficient water

after mixing to give optimum consistency for hand application.

2.3 GRANULAR BEDDING AND BACKFILL

- .1 Granular bedding and backfill material to Section 31 23 33.01 - Excavating, Trenching and Backfilling.

PART 3: EXECUTION

3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for pipe culvert installation in accordance with manufacturer's written instructions.
 - .1 Visually inspect substrate in presence of Departmental Representative.
 - .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
 - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Departmental Representative.
- .2 Prior to placing the pipe in the ditch or trench, inspect each pipe for defects. Remove all defective pipes from the site and replace with sound material. All dirt and gravel must be kept out of the joint and all gaskets kept clean.

3.2 PREPARATION

- .1 Temporary Erosion and Sedimentation Control:
 - .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control drawings.
 - .2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 - .3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.
- .2 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.

3.4 BEDDING

- .1 Dewater excavation, as necessary, to allow placement of culvert bedding in dry condition.
- .2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to 95% minimum of maximum density to ASTM D698.
- .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 50% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Departmental Representative, free from sags or high points.
- .4 Place bedding in unfrozen condition.

3.5 GENERAL

- .1 Where it is specified that new culverts are to be supplied and installed as part of new roadway construction, or existing culverts are to be removed and replaced with new culvert pipe, this work will be constructed, measured and paid in accordance with this Section.
- .2 Any culverts shown on the Drawings and required to be removed for the purpose of accommodating pipeline installation shall be removed and reinstalled in accordance with the requirements of this Section.
 - .1 Where the condition of an existing culvert including headwalls is deemed by the Departmental Representative to be acceptable for re-installation, re-install the existing culvert.
 - .2 There will be no separate payment for such culvert pipe removals and replacements as this will be considered incidental to the work. Where a culvert pipe or headwall that would have been acceptable for re-installation is damaged by the Contactor and cannot be re-used, the Contractor will replace the culvert pipe with a new culvert pipe meeting this specification at no cost to the Owner.
 - .3 Where the condition of an existing culvert and/or headwall is deemed by the Departmental Representative to not be acceptable for re-installation: supply and install, at the tendered price for culvert pipe and/or headwall, a new culvert pipe and/or headwall meeting this

specification. Use appropriate care to excavate, remove, clean, and store the culvert to prevent damage to the material.

- .4 When multiple culverts are removed prior to being re-installed, properly mark culverts for re-installation in the correct location.
- .5 Provide and use new connectors, gaskets, etc.
- .6 Re-installation to follow the same procedures as required herein for new culvert pipe.
- .7 Adjust or reinstall existing headwalls as required with the same materials as on site, or materials to match the existing.
- .3 Utilize laser beam instrumentation and techniques to determine intermediate line and grade for all culvert pipes except where and when the Departmental Representative may allow other methods to be used.
- .4 Install new culvert pipes according to the sizes, locations, and grades indicated on the drawings.
- .5 Lay culvert pipes in the trench so after the culvert is completed the interior surface will conform accurately to the grades and the alignment of the ditch or other location. All adjustments of line and grade of pipes laid directly upon the bottom must be done by scraping away or filling in the backfill under the body of the pipe and not by blocking or wedging up.
- .6 Any pipes which have a bell end of larger diameter than the pipe shall have the bed of the trench dug out at the bell to conform to this shape and avoid any point loadings of the pipe on the trench.
- .7 Where an existing culvert pipe is being extended, the new pipe shall be installed as described herein, including preparation of the existing pipe as required for the connection, connection to the existing pipe, re-bedding under the existing pipe at the point of connection, and removal of debris.
- .8 Construct new headwalls of the materials and to the dimensions shown on the Drawings. Connect to the culvert pipe to make a tight connection that will not permit soil or debris to wash into the pipe behind the headwall.
- .9 Install culvert pipes to manufacturer's recommendations and in accordance with recognized good practice. Provide and use proper implements, tools and facilities for safe and efficient execution of the work.

- .10 Inspect culvert pipes in the field before and after laying. Remove any defective or damaged culvert pipe and replace with new sound material at the Contractor's expense.
- .11 Lay culvert pipes true to line and grade with uniform bearing under the full length of the barrel of the culvert pipe. Remove and re-lay any culvert pipe which is not in true alignment or shows any undue settlement after laying.
- .12 Until there is at least 300 mm of cover over new or re-installed culvert pipes, no walking on or working over them will be allowed, except as necessary for backfilling the trench and compaction of the bedding material.

3.6 LAYING CONCRETE PIPE CULVERTS

- .1 Begin at downstream end of culvert with flanged end of first pipe section facing upstream.
- .2 Ensure barrel of each pipe is in contact with shaped bed throughout its length.
- .3 Allow water to flow through pipes during construction only as permitted by Departmental Representative.

3.7 JOINTS: CONCRETE PIPE CULVERTS

- .1 Joints may be made with rubber gaskets, bituminous jointing compound or Portland cement mortar.
 - .1 Rubber gasket joints:
 - .1 Install in accordance with manufacturer's written recommendations.
 - .2 Ensure that tapered ends are fully entered into flanged ends.
 - .2 Bituminous filled joint:
 - .1 Make joint with excess of filler to form continuous bead around outside of pipe and finish smooth on inside.
 - .3 Mortar joints:
 - .1 Prepare mortar as specified herein.
 - .2 Clean pipe ends and wet with water before joint is made.
 - .3 Place mortar in lower half of flanged end of pipe section in place.
 - .4 Apply mortar to upper half of tapered end of pipe section being installed.

- .5 Join pipe ends and force joint up tight, taking care to ensure inner surfaces of abutting pipe sections are flush and even.
- .6 Clean inside of pipe and annular space between ends of pipes after each joint is made.
- .7 Fill joint with mortar and finish smooth and even.
- .8 For pipes 800 mm or less diameter, fill joints before mortar in joints has set.
- .9 For pipes over 800 mm diameter, postpone filling joint until backfilling has been completed. Re-clean joints before applying mortar.

3.8 BACKFILLING

- .1 Backfill around and over culverts as indicated or as directed by Departmental Representative.
- .2 Place granular backfill material, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.
- .3 Compact each layer to 95% maximum density to ASTM D698 taking special care to obtain required density under haunches.
- .4 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross.
 - .1 During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.
- .5 Place backfill in unfrozen condition.

3.9 CLEANING

- .1 Cleaning of Existing Culvert Pipes:
 - .1 Clean culvert pipes marked to be cleaned with high water pressure equipment. Work to be done by Contractor specializing in this type of work.
 - .2 Dispose of material removed during the cleaning operations off-site.
- .2 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Leave Work area clean at end of each day.

- .3 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

END OF SECTION