DIVISION 33

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Not used.

1.2 MEASUREMENT AND PAYMENT

.1 Measure excavation for culverts in accordance with Section 31 24 13 - Roadway Embankments.

.2 Measure supply of pipe culvert in metres for each size, type and class of pipe supplied.

.1 No separate measurement will be made for couplings, fittings and beveled ends for steel pipe culverts.

.4 Measure granular material for culvert bedding and backfill in cubic metres, compacted in place, to excavation limits authorized by Departmental Representative in accordance with Section 31 24 13 - Roadway Embankments.

.5 Cost of supply and installation will include riprap of culvert ends and any necessary dewatering prior to placing of bedding, construction and removal of temporary diversions and/or ditch blocks and construction maintenance and removal of any temporary bypass roads.

1.3 REFERENCES

.1 ASTM International

.1 ASTM C 14M-15A, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain and Culvert Pipe (Metric).

.2 ASTM C 76M-15, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).

.3 ASTM C 117-13, Standard Test Method for Material Finer Than 0.075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.4 ASTM C 136M-14, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 ASTM C 144-11, Standard Specification for Aggregate for Masonry Mortar.

.6 ASTM C 443M-11, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).

.7 ASTM D 698-12e2, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).

.8 ASTM D 1248-12, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable.

.9 ASTM F 667M-15, Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings.

.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 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.

.4 U.S. Environmental Protection Agency (EPA) / Office of Water

.1 EPA 832/R-92-005, Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for pipes and backfill and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Samples:

.1 Inform Departmental Representative at least 2 weeks before beginning Work, of proposed source of bedding materials and provide access for sampling.

.2 Submit to Departmental Representative for testing, at least 2 weeks before beginning Work, samples of materials proposed for use as follows:

.4 Certification: to be marked on pipe.

.5 Test and Evaluation Reports:

.1 Submit manufacturer's test data and certification at least [4] weeks prior to beginning Work.

1.6 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 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 CORRUGATED STEEL PIPE

.1 Corrugated steel pipe: to CAN/CSA-G401.

.2 Water-tight cut-off collars: as indicated.

.3 Culverts shall have 4H:1V beveled ends.

2.2 GRANULAR BEDDING AND BACKFILL

.1 Granular bedding and backfill material to Section 31 05 16 - Aggregate Materials and following requirements:

.1 Crushed pit run or screened stone, gravel or sand.

.2 Gradations to be within limits specified when tested to ASTM C 136 and ASTM C 117. Sieve sizes to CAN/CGSB-8.1.

.2 Table:

Sieve Designation	% Passing
200 mm	-
75 mm	100
50 mm	-
38.1 mm	-
25 mm	-
19 mm	-
12.5 mm	-
9.5 mm	-
4.75 mm	25-85
2.00 mm	-
0.425 mm	5-30
0.180 mm	-
0.075 mm	0-10

2.3 HAND-LAID ROCK RIPRAP

.1 Hand-laid rock riprap material shall consist of sound, durable stones that meet the following Class 1M gradation requirements:

Nominal Diameter of 175 mm	**Equivalent Diameter (mm)**	**Percentage (by weight) of Riprap Greater than Equivalent Diameter**
	300	0%
	200	20% to 50%
	175	50% to 80%
	125	100%
Note: Sizes are equivalent spherical diameter, and are for guidance only.		

The minimum dimensions of any single rock shall not be less than one third of its maximum dimension

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.

3.2 PREPARATION

.1 Temporary Erosion and Sedimentation Control:

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.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 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 D 698.

.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.

3.4 LAYING CORRUGATED STEEL PIPE CULVERTS

.1 Begin pipe placing at downstream end.

.2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.

.3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.

.4 Lay paved invert or partially lined pipe with longitudinal centre line of paved segment coinciding with flow line.

.5 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.

3.5 JOINTS: CORRUGATED STEEL CULVERTS

.1 Corrugated steel pipe:

.2 Match corrugations or indentations of coupler with pipe sections before tightening.

.3 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.

.4 Insert and tighten bolts.

.5 Repair spots where damage has occurred to spelter coating by applying two coats of asphalt paint approved by Departmental Representative or two coats of zinc rich paint.

3.6 BACKFILLING

.1 Backfill around and over culverts as indicated or as directed by Departmental Representative.

.2 Place granular backfill material, approved by Departmental Representative, 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 D 698 taking special care to obtain required density under haunches.

.4 Protect installed culvert with minimum 400 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.

.6 Hand-laid riprap shall be placed at culvert inlets and outlets, and at other locations as directed by the Departmental Representative. Stones shall be placed with their beds at right angles to the slope, the larger stones being placed first in the bottom courses and graduating to the smaller stones at the top. Stones shall be laid in close contact so as to break joints, and in such manner that the weight is carried by the earth and not by the adjacent stones. The spaces between the larger stones shall be filled with spalls, securely rammed into place. The finished work shall present an even, tight surface and satisfactory to the Departmental Representative.

.1 Aprons at the base of a culvert shall have a width 3 times the diameter of the installed culvert pipe, length of apron of 1.5 times the diameter at inlets or 2 times the diameter at outlets. At the top side of the culvert, width of apron shall be 2 times the diameter and of sufficient extension equal to at least “one rock” long. (A typical 600 mm diameter pipe requires coverage of approximately 11 square metres, based on 4:1 sideslope).

3.7 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