
CONSTRUCTION TECHNIQUES

CAPE CHRISTIAN to CLYDE RIVER CULVERT INSTALLATION PROJECT



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September 2008

September 2009



1 **General****1.1 DESCRIPTION OF WORK**

- .1 Work under this Contract covers the installation of culverts at 1 creek crossing on a re-routed 10 km road between Clyde River and Cape Christian, Nunavut.
- .2 Size, number and location of culverts are summarized in the following table

Culvert number	Latitude	Longitude	Nb of culverts	Culvert Diameter (inches)
3	70°29'51.99"	68°25'52.48"	2	24

1.2 CODES

- .1 Perform work in accordance with National Building Code of Canada (NBC) and any other code of provincial or local application provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
- .2 Perform the work in compliance with requirements specified in the Land Use Permit, the Water License and with requirements from the Department of Fisheries and Oceans.

1.3 DOCUMENTS REQUIRED

- .1 Maintain at job site, one copy each of following:
- .1 Project drawings.
- .2 Permits and Licenses
- .3 Fish and fish habitat assessment at stream crossings, August 2008
- .4 Arctic char migration monitoring plan, August 2008

1.4 MITIGATION MEASURES

- .1 The guidelines and mitigation measures presented below are presented as indicative, and do not necessarily encompass all measures to be considered for the installation of crossing structures (culverts).
- .2 General measures:
 - 1) The construction work shall only be conducted during frozen condition where any water flowing in the area of installation is frozen to ground. Therefore, work is expected to be conducted from the third week of September 2009 and be completed no later than June 15, 2010.
 - 2) Designate a supervisor responsible for the surveillance and the proper application of the environmental protection measures at

all sites, throughout the duration of work. The supervisor is also responsible to communicate all necessary procedures and guidelines to the contractor.

- 3) Delineate in the field the limits of the working area, in order to keep instream equipment activity to a minimum.
- 4) Delineate in the field the area where refueling, maintenance and cleaning of the machinery and equipment will be restricted. This area should be located at a minimum of 30 m away from the stream banks.
- 5) All construction equipment shall be inspected daily to ensure that leaks or discharges of lubricants, fuels, or hydraulic fluids does not occur.
- 6) Ensure that all necessary equipment and all construction materials are present and ready, to avoid any delays during installation work.

.3 Culvert Installation:

- 1) Install all fence/geotextile where necessary to intercept sediment release and transportation downstream.
- 2) Prepare and grade the culvert bed to conform to the design elevation and gradient of the stream, using benchmarks, in order to lay the culvert at the same natural stream gradient. Road access to Cape Christian - Municipality of Clyde River Fish habitat assessment at stream crossings August 2008
- 3) The bottom of the culvert should be embedded at 20% below the streambed in fish-bearing streams (at both downstream and upstream ends), in order to allow fish passing at all natural flow conditions. In non-fish bearing streams, culvert embedment can be set at 10%.
- 4) The culvert foundation, trench walls, and backfill should be free of logs, stumps, limbs, or rocks that could damage or weaken the pipe. All materials used for culvert trench walls and backfill should be compacted to achieve maximum density.
- 5) Road slope embankments, down to each side of culvert bottom, should be covered with large size rocks (200 to 300 mm diameter), in order to prevent erosion. Thickness of the rip-rap should be 1.5 to 2 times the rock size.

1.5 SETTING OUT OF WORK

- .1 Set grades and lay out work in detail from control points and grades.
- .2 Assume full responsibility for and execute complete layout of work to locations, lines and elevations indicated.
- .3 Provide devices needed to lay out and construct work.
- .4 Supply such devices as straight edges and templates required to facilitate inspection of work.
- .5 Supply stakes and other survey markers required for laying out work.

1.5RELICS AND ANTIQUITIES

- .1Protect relics, antiquities, items of historical or scientific interest such as cornerstones and contents, commemorative plaques, inscribed tablets, and similar objects found during course of work.
- .2Give immediate notice to the Nunavut Department of Culture, Language, Elders and Youth written instructions before proceeding with work in this area.
- .3Relics, antiquities and items of historical or scientific interest remain her Majesty's property.

2 **Products (not applicable)**

3 **Execution (not applicable)**

END OF SECTION

1 General**1.1 FIRES**

- .1 Fires and burning of rubbish on site not permitted.
- .2 Where fires or burning permitted, prevent staining or smoke damage to structures, materials or vegetation which is to be preserved. Restore, clean and return to new condition stained or damaged work.
- .3 Provide supervision, attendance and fire protection measures as directed.

1.2 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.3 DRAINAGE

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.4 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.

1.5 WORK ADJACENT TO WATERWAYS

- .1 Do not operate construction equipment in waterways.

- .2 Do not use waterway beds for borrow material.
- .3 Do not dump excavated fill, waste material or debris in waterways.
- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .7 Do not blast under water or within 100 m of indicated spawning beds.

1.6 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

2 **Products (not applicable)**

3 **Execution (not applicable)**

END OF SECTION

1 General**1.1 REFERENCES**

- .1 ASTM C117-90, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
- .2 ASTM C131-89, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .3 ASTM C136-91, Method for Sieve Analysis of Fine and Coarse Aggregates.
- .4 ASTM D698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600kN·m/m³).
- .5 ASTM D4318-84, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- .6 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.
- .7 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

2 Products**2.1 MATERIALS**

- .1 Granular base material: to following requirements:

- .1 Crushed stone or gravel consisting of hard, durable, angular particles, free from clay lumps, cementation, organic material and other deleterious materials.
- .2 Graduations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
- .3 Gradation to:

<u>Sieve Designation</u>	<u>%Passing</u>
100 mm	-
75 mm	-
50 mm	-
37.5 mm	-
25 mm	-
19 mm	100
12.5 mm	70-100
9.5 mm	-
4.75 mm	40-70
2.00 mm	23-50
0.425 mm	7-25
0.180 mm	-
0.075 mm	<u>3-8</u>

3 Execution**3.1 SEQUENCE OF OPERATION****.1 Compaction equipment**

- .1 Compaction equipment to be capable of obtaining required material densities.

.2 Compacting

- .1 Compact to density not less than 95% maximum dry density in accordance with ASTM D698.
- .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
- .3 Apply water as necessary during compaction to obtain specified density.
- .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.

.3 Repair of soft areas

- .1 Correct soft areas by removing defective material to depth and extent directed. Replace with material acceptable and compact to specified density.
- .2 Maintain reshaped surface in condition conforming to this section until succeeding material is applied.

3.2 SITE TOLERANCES

- .1 Reshaped compacted surface to be within plus or minus 10 mm of elevation as indicated.

END OF SECTION

1 General

1.1 REFERENCES

- .1 ASTM C117-90, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
- .2 ASTM C131-89, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
- .3 ASTM C136-92, Method for Sieve Analysis of Fine and Coarse Aggregates.
- .4 ASTM D698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³) (600 kN·m/m³).
- .5 ASTM D1557-91, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³) (2,700 kN·m/m³).
- .6 ASTM D1883-92, Test Method for CBR (California Bearing Ratio) of Laboratory Compacted Soils.
- .7 ASTM D4318-84, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
- .8 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire, Inch Series.
- .9 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

1.2 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver and stockpile aggregates. Stockpile minimum 50% of total aggregate required prior to commencing operation.

2 Products

2.1 MATERIALS

- .1 Granular base: material to following requirements:
 - .1 Crushed stone or gravel.
 - .2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.
 - .3 Gradation to:

Sieve Designation	%Passing		
	(1)	(2)	(3)
100 mm	-	-	-
75 mm	-	-	-
50 mm	100	-	-
37.5 mm	70-100	-	-
25 mm	-	100	-
19 mm	50-75	-	100
12.5 mm	-	65-100	70-100
9.5 mm	40-65	-	-
4.75 mm	30-50	35-60	40-70

2.00 mm	-	22-45	23-50
0.425 mm	10-30	10-25	7-25
0.180 mm	-	-	-
0.075 mm	<u>3-8</u>	<u>3-8</u>	<u>3-8</u>

.2 Material to level surface depressions to meet gradation (2) limits in accordance with 2.1.1.2.1.

3 Execution

3.1 SEQUENCE OF OPERATION

.1 Placing

- .1 Construct granular base to depth and grade in areas indicated.
- .2 Ensure no frozen material is placed.
- .3 Place material only on clean unfrozen surface, free from snow and ice.
- .3 Place material using methods which do not lead to segregation or degradation of aggregate.
- .4 Place material to full width in uniform layers not exceeding 300 mm compacted thickness.
- .5 Shape each layer to smooth contour and compact to specified density before succeeding layer is placed.
- .6 Remove and replace that portion of layer in which material becomes segregated during spreading.

.2 Compaction Equipment

- .1 Compaction equipment to be capable of obtaining required material densities.

.3 Compacting

- .1 Compact to density not less than 95% maximum dry density in accordance with ASTM D698.
- .2 Shape and roll alternately to obtain smooth, even and uniformly compacted base.
- .3 Apply water as necessary during compacting to obtain specified density.
- .4 In areas not accessible to rolling equipment, compact to specified density with mechanical tampers.
- .5 Correct surface irregularities by loosening and adding or removing material until surface is within specified tolerance.

.4 Proof rolling

- .1 For proof rolling use standard roller of 45400 kg gross mass with four pneumatic tires each carrying 11350 kg and inflated to 620 kPa. Four tires arranged abreast with centre to centre spacing of 730 mm.
- .2 Make sufficient passes with proof roller to subject every point on surface to three separate passes of loaded tire.
- .3 Where proof rolling reveals defective base or sub-base, remove defective materials to depth, extent and replace with new materials.

3.2 SITE TOLERANCES

- .1 Finished base surface to be within plus or minus 10 mm of established grade and cross section but not uniformly high or low.

3.3 PROTECTION

- .1 Maintain finished base in condition conforming to this section until succeeding material is applied.

END OF SECTION

1 General**1.1 REFERENCES**

- .1 ASTM C14M-90, Specification for Concrete Sewer, Storm Drain and Culvert Pipe.
- .2 ASTM C76M-90, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
- .3 ASTM C117-90, Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing.
- .4 ASTM C136-84a, Method for Sieve Analysis of Fine and Coarse Aggregates.
- .5 ASTM C443M-85a(1990), Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
- .6 ASTM D698-91, Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN·m/m³).
- .7 ASTM D1248-84(1989), Specification for Polyethylene Plastics Molding and Extrusion Materials.
- .8 ASTM F667-85, Specification for 8, 10, 12, and 15 inch Corrugated Polyethylene Tubing and Fittings.
- .9 CAN/CSA-A5-M88, Portland Cement.
- .10 CSA A82.56-M1976, Aggregate for Masonry Mortar.
- .11 CAN/CSA-A257 Series-M92, Standards for Concrete Pipe.
- .12 CAN3-G401-M81, Corrugated Steel Pipe Products.
- .13 CAN/CGSB-8.1-88, Sieves Testing, Woven Wire.
- .14 CAN/CGSB-8.2-M88, Sieves Testing, Woven Wire, Metric.

2 Products**2.1 CORRUGATED STEEL PIPE**

SPEC NOTE: Re 2.1. Corrugated steel pipe products are zinc coated by a hot dip galvanizing process.

- .1 Corrugated steel pipe: to CAN3-G401.
- .2 Water-tight cut-off collars: as indicated.

2.2 GRANULAR BEDDING AND BACKFILL

.1 Granular bedding and backfill material to Section [02230 - Aggregates: General] and following requirements:

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

.2 Gradations to be within limits specified when tested to ASTM C136 and ASTM C117. Sieve sizes to CAN/CGSB-8.1.

<u>Sieve Designation</u>	<u>% Passing</u>
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

3 Execution**3.1 BEDDING**

.1 Dewater excavation, as necessary, to allow placement of culvert bedding in the dry.

SPEC NOTE: Sometimes bedding is not needed with corrugated steel pipe culverts, depending on native soil type.

.2 Place minimum thickness of 200 mm of approved granular material on bottom of excavation and compact to minimum 95% 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, free from sags or high points.

.4 Place bedding in unfrozen condition.

3.2 LAYING CORRUGATED STEEL PIPE CULVERTS

.1 Commence pipe placing at downstream end.

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

3.3 JOINTS: CORRUGATED STEEL CULVERTS

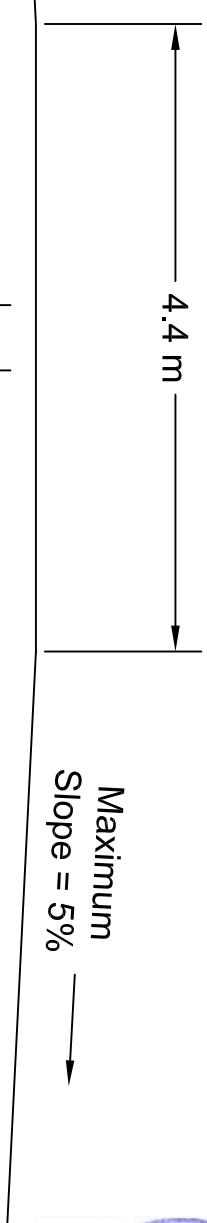
- .1 Corrugated steel pipe:
 - .1 Match corrugations or indentations of coupler with pipe sections before tightening.
 - .2 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.
 - .3 Insert and tighten bolts.
 - .4 Repair spots where damage has occurred to spelter coating by applying two coats of zinc rich paint.

3.4 BACKFILLING

- .1 Place granular backfill material, in 300 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.
- .2 Compact each layer to 95% maximum density to ASTM D698 taking special care to obtain required density under haunches.
- .3 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross. 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.
- .4 Place backfill in unfrozen condition.

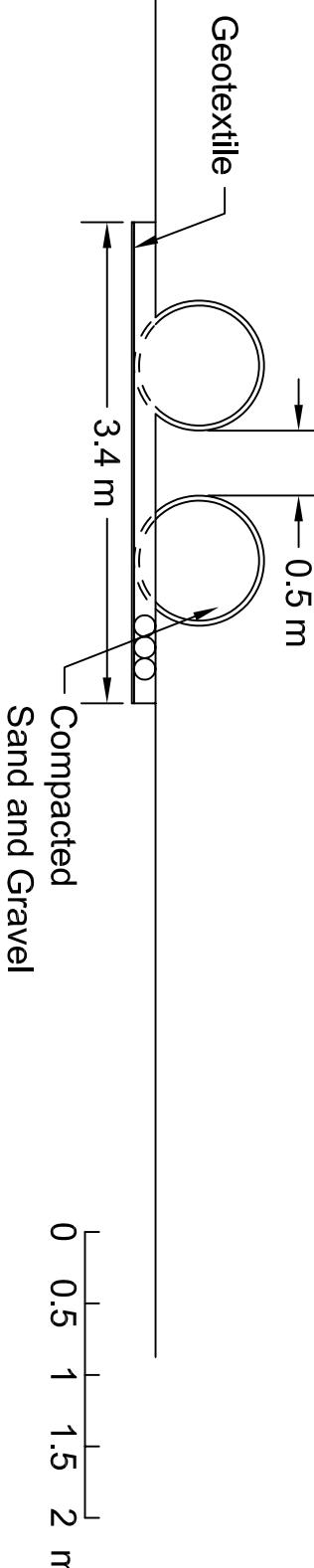
END OF SECTION

Site 3A



Maximum Slope = 5%
4.4 m

0 0.5 1 1.5 2 m



0 0.5 1 1.5 2 m

Legend:

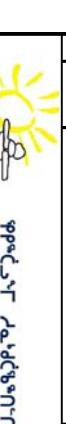
Armour slope with rock
maximum diameter 300 mm

Culvert
0.91 m x 9 m

Minimum slope 0.5%

Natural
River Bed

Detail B



CAPE CHRISTIAN
NUNAVUT
LOGISTICS INC.

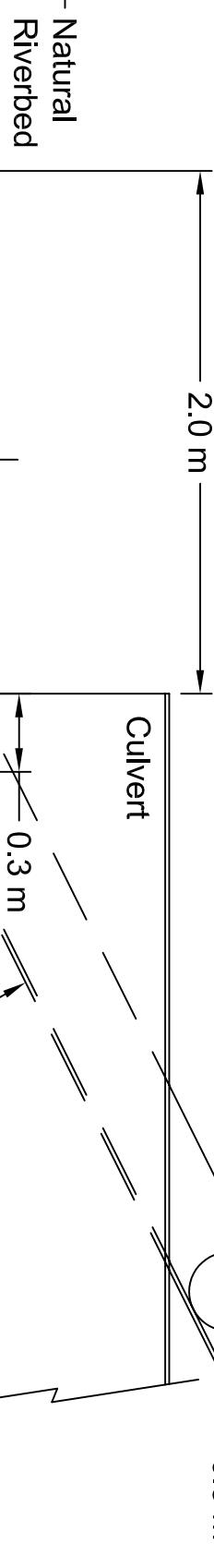
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PROJECT - PROJET
CAPE CHRISTIAN, NUNAVUT

TRADE - MÉTIER
SITING DATE
SCALE - ÉCHELLE AS SHOWN

SUBJECT - SUJET
CAPE CHRISTIAN REMEDIATION PROJECT
CULVERT INSTALLATION IN FISH BEARING WATERS -
CROSSINGS 3A DETAILS

Detail B



0 0.5 1 1.5 2 m

Natural Riverbed
Rocks
Maximum Size 150 mm
ZTG C1450B or equivalent

PERMIT TO PRACTICE QIKIQTAAULK ENVIRONMENTAL			
Signature  Date <u>September 1st, 2009</u>			
PERMIT NUMBER: P 530 The Association of Professional Engineers, Geologists and Geophysicists of the NWT / NU			

 QIKIQTAAULK ENVIRONMENTAL	
General Notes:	
1. This stream crossing has not been surveyed and will have to be field fitted to existing conditions. 2. This culvert installation will be done during freezing conditions. 3. All crossings are assumed to be much shallower than the culvert that will be installed, thus the depth of the creek is not shown on the drawings. 4. All fill material around the culverts must be constructed in lifts of 250 mm of loose material and each lift will be compacted to 95 percent of Maximum Dry Density in accordance with ASTM D698.	