TECHNICAL SPECIFICATIONS
GARROW LAKE DAM DECOMMISSIONING
POLARIS MINE, LITTLE CORNWALLIS ISLAND, NUNAVUT

TABLE OF CONTENTS

1.0 General

.1 The Garrow Lake Dam is to be decommissioned as part of the Polaris Mine closure plan. Decommissioning is to be achieved by removing the central portion of the dam and re-establishing Garrow Creek.

.2 Garrow Lake Dam was constructed with a core comprised of ice-rich saturated granular soil, frozen in place. The slopes of the core were covered with a 2.0 m wide blanket of saturated shell material also frozen in place. On top of the core exists a layer of insulation (Styrofoam SM) sandwiched between two layers of bedding material. The bulk of the dam was constructed using shell material. A layer of rip rap was placed on the upstream shell.

.3 During operation of the mine, tailings were deposited in the reservoir upstream of the dam. Siphons were started and run annually during the summer to decant clean surface water over the dam. Prior to decommissioning, the lake level will be reduced to that equalling the level prior to dam construction. The siphons will have to be removed.

2.0 Scope of Work

.1 Scope of work required to complete the decommissioning of the dam includes, but is not limited to, the following items:

a. Drawdown of the reservoir to appropriate levels;
b. Removal of the discharge siphons and associated structures;
c. Excavation and salvage of rip rap material;
d. Excavation and salvage of shell material;
e. Excavation and disposal of insulation and bedding material;
f. Excavation and disposal of frozen core (granular) material;
g. Placement of salvaged shell material to construct final cover and appropriate slopes;
h. Excavation of a new creek bed and placement of non-woven geotextile and salvaged erosion protection;
i. Remediation of creek upstream of dam; and
j. Removal and remediation of the wave break structure.

.2 The drawdown of the reservoir and removal of the siphon discharge system will be substantially complete prior to this work commencing. Draw down of the annual spring freshet and precipitation during construction will be required as part of this contract depending on when the work is carried out.

3.0 Materials

.1 The various material types referenced in these specifications are designated on the drawings. Material quantities have been estimated as shown in the table below.

Table 1
GARROW LAKE DAM DECOMMISSIONING QUANTITIES

Material Type	Quantity
Rip rap Excavation, m^3	1,600
Rip rap Fill, m^3	1,150
Shell Material Excavation, m^3	13,800
Shell Material Fill, m^3	6,200
Core Material Excavation, m^3	4,700
Bedding Material Excavation, m^3	300
Wavebreak Structure Excavation, m^3	1,000
Insulation, m^2	1,000
Non woven Geotextile, m^2	2,300
Total Excavation, m^3	21,400
Total Fill, m^3	8,150

[End of Section]

1.0 This section describes water quality control and water discharge during decommissioning of the Garrow Lake Dam.

2.0 Water Quality

.1 Prior to excavation of any material from the dam, a silt fence, or approved alternate method, shall be installed downstream of the dam. This barrier shall prevent turbid, dirty, and/or other potentially harmful water from direct discharge into the stream and ocean. This becomes especially important as the core of the dam and the new creek bed are excavated.

.2 The downstream barrier (silt fence, or alternate) shall remain in place for the duration of the dam decommissioning project, but shall be removed following completion of the excavation and fill placement work.

.3 Upon completion of the work, the barrier shall be removed in such a manner to prevent discharge of silt-laden or otherwise dirty water. It may be necessary to excavate deposited sediment upstream of the barrier prior to its removal. Any excavated sediment, as well as the barrier itself, shall be disposed of into the Little Red Dog Quarry, the on site landfill, or as directed by the Engineer.

3.0 Water Discharge

.1 Discharge of water from the reservoir will be completed prior to the construction phase of the project. Water accumulated between the time of mine closure and construction completion must be discharged in a controlled manner using pumps or siphons. Any and all water discharge must comply with the requirements set forth in the current water licence for the site, regardless of the timing of such discharge.

.2 It may be necessary to construct a small cofferdam (or alternate structure) upstream of the toe of the existing dam to control discharge during construction.

.3 A sump (excavation) shall be provided immediately downstream of the cofferdam to collect any seepage through the cofferdam. A pump, or alternate means of discharge, shall also be provided to return the seepage to the reservoir. It is not suggested that the water be discharged downstream to avoid conflict with any of the construction activities.

[End of Section]

1.0 This section describes the excavation and disposal requirements for the Garrow Lake Dam decommissioning project.

2.0 Materials to be excavated include the following:

.1 Rip Rap

a. Removal of the rip rap material shall be completed in areas designated on the drawings.
b. Removal may be anticipated using conventional excavation methods (i.e. using backhoes, rippers, loaders, etc.).
c. The excavated material shall be stockpiled on site in an approved location, for re-use on the slopes of the decommissioned dam or elsewhere. Material from the "upper rip rap" layer and "lower rip rap layer should be stockpiled separately. Following completion of the work, excess rip rap shall be deposited in Red Dog Quarry, or as directed by the Engineer.

.2 Shell Material

a. Excavation of the shell material shall be completed as shown on the drawings.
b. The shell material to be excavated may be in any of the following states: frozen, unfrozen, saturated, or unsaturated. As such, conventional excavation methods may or may not be sufficient to facilitate removal of some of the material. Other excavation options include drill and blast techniques. The implementation of such excavation methods shall be the sole responsibility of the Contractor, including design of layout, depth, explosive type and charge, and any other parameters required to complete the excavation in accordance with the drawings.
c. The excavated material shall be stockpiled separately from the rip rap stockpile, so it may be re-used in the decommissioned dam. The Engineer shall approve the location of the stockpile. Following completion of the work, excess shell material shall be deposited in Red Dog Quarry, or as directed by the Engineer.

.3 Bedding and Insulation

a. Excavation of the bedding and removal of the insulation shall be completed within the limits of excavation as shown on the drawings, or as otherwise required.
b. Conventional excavation methods and/or other excavation methods may be required to complete the excavation, especially if the bedding material has become saturated and frozen.
c. The excavated bedding material shall be disposed of in the Little Red Dog Quarry, or in an approved alternate location.
d. The removed extruded polystyrene insulation shall be disposed in the site landfill, or in an approved alternate location.

.4 Core Material

a. Excavation of the core material shall be completed in accordance with the drawings.
b. The core material will be saturated and frozen, and will likely require a drill and blast operation to be excavated. The design of such excavation shall be the sole responsibility of the Contractor, including design of layout, explosive type and charge, depth, and any other parameters required to complete the excavation in accordance with the drawings. The design should be such that the integrity of the surrounding ground and the portion of the dam to remain are not adversely affected.
c. Excavation of the core material shall be completed below the original ground surface and base of the core to create a new channel for Garrow Creek to flow through. The new channel shall be excavated to the slopes and dimensions shown on the drawings.
d. A silt fence, or approved alternate barrier, shall be installed in the creek downstream of the excavation to prevent turbid or otherwise dirty water from being discharged to the stream and the environment.
e. Excavated core material is not deemed reusable on this project, and shall therefore be disposed in the Little Red Dog Quarry, or an approved alternate location.

3.0 The Contractor shall submit for approval the details of any non-conventional excavation method at least 48 hours prior to excavation using the method.

[End of Section]

1.0 General

.1 The product and installation specifications for the non-woven geotextile to be used are presented in this Section.

.2 The liner system will be provided and installed by the Contractor.

2.0 Reference Standards

.1 American Society for Testing Materials

a. ASTM D4632-91 (1996) - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

b. ASTM D4533-91 (1996) - Standard Test Method for Trapezoidal Tearing Strength of Geotextiles.

c. ASTM D4833-00E1 - Standard Test Method for Index Puncture Resistance for Geotextiles, Geomembranes, and Related Products.

d. ASTM 4751-99A - Standard Test Method for Determining Apparent Opening Size of a Geotextile.

e. ASTM D5199-01 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.

f. ASTM D5261-92 (1996) – STD Test Method for Measuring Mass Per Unit Area of Geotextiles.

3.0 Materials

.1 Geotextile

a. The non-woven geotextile shall have a weight of 542 g/m^2. The manufacturer shall provide to the Engineer, prior to shipment of materials, a signed manufacturing certification that materials to be shipped to site have test values that meet or exceed the requirements listed in Table 3.1.

Table 3.1
RECOMMENDED MINIMUM GEOTEXTILE PROPERTIES

Physical Property	Minimum Average Roll Value (Weakest Principal Direction)
Thickness – Typical (ASTM D5199)	3.6 mm
Grab Tensile Strength (ASTM D4632)	1690 N
Elongation at Failure (ASTM D4632)	50%
Trapezoidal Tear Strength (ASTM D4533)	645 N
Puncture (ASTM D4833)	1065 N
Apparent Opening Size (ASTM D4751)	150 microns
Weight – Typical (ASTM D5261)	542 g/m^2

b. Any visible damage to the shipment of geotextile shall be noted on the freight receipt and project records.

c. Storage of geotextile rolls on site shall be in a secure location that will minimize exposure to the elements and physical damage.

4.0 General Installation

.1 The Contractor shall ensure that the integrity of the geotextile is not compromised during construction. Precautions the Contractor may take to avoid damaging the liner system may include, but will not be limited to, providing light plants in the work area to improve visibility or using pylons to mark the lift/liner system interface.

.2 Any damage to the geotextile shall be immediately reported to the Engineer. Repair work shall commence as soon as possible. Fill placement shall cease immediately in an area where the integrity of the liner system has been compromised. Fill surrounding the damaged liner system may have to be excavated, without further damaging the integrity of the liner, to permit repairs to be made. Hand excavation shall be used to expose damaged portions of the liner for repair.

.3 The Contractor shall take the necessary steps to ensure that backfilling does not induce tensile stress in the geotextile during backfilling. Care shall be taken to avoid any damage to the geotextile by making sharp turns, sudden stops or sudden starts adjacent to the geotextile. Non-essential heavy equipment traffic in the immediate vicinity of the geotextile shall be minimized.

.4 The geotextile should be placed with a minimum overlap of 300 mm and connected at the seam by heat bonding. The panel at higher elevation should be lapped over the panel at lower elevation.

.5 Any tears or holes made in the geotextile should be repaired by placing a patch of geotextile on the defect and held in place by heat bonding. The patch should extend at least 300 mm beyond all sides of the defect.

[End of Section]

1.0 This section describes the materials and the placement of material in the decommissioned Garrow Lake Dam.

2.0 Materials for the required backfill are anticipated to be available from the materials salvaged during excavation of the dam. Stockpiles of the salvaged materials should contain sufficient material to complete the backfilling.

3.0 Rip rap material in the reconstructed channel shall be taken from the stockpiled "Upper Layer Rip Rap" salvage, as much as possible, or as directed by the Engineer.

4.0 If the salvaged material is of insufficient quantity or quality, as determined by the Engineer, the backfill materials shall comply to the specifications provided for each material type in the following sections:

.1 Rip Rap Material

a. Rip rap material should be of sound, hard, durable aggregate free from soft, thin, elongated or laminated particles, organic material or other deleterious substances.

b. The grain size distribution of the rip rap material shall be in accordance with the following table:

Sieve Size (mm)	Percent Passing (by weight)
500	100
400	50-100
300	20-40
100	0-10

.2 Shell/General Erosion Protection Material

a. Shell material should be of sound, hard, durable aggregate free from soft, thin, elongated or laminated particles, organic material or other deleterious substances.

b. The grain size distribution of the shell and general erosion protection material shall be in accordance with the following table:

Sieve Size (mm)	Percent Passing (by weight)
300	100
75	45-100
20	15-55

5.0 Material Placement

.1 The rip rap material shall be placed in accordance with the drawings. Hand-placement may be required in the creek bed area.

.2 Compaction of the rip rap material is not required.

.3 The shell material shall be placed within the limits shown and in accordance with the drawings.

.4 Compaction of the shell and erosion protection material shall be achieved by the passing of construction traffic over placed material. Material shall be uniformly compacted. The material should be placed in lifts not exceeding 0.5 m in thickness.

.5 Erosion protection material will be required for placement in erosion gullies and in other eroded areas to protect the natural ground from further erosion.

6.0 Final grading and shaping of the placed fill shall be completed in accordance with the drawings. The fill shall tie-in smoothly with the existing ground to form a natural appearance for the opening for the re-established creek bed.

[End of Section]

1.0 Final clean-up of the area around the decommissioned dam shall be completed to remove any construction debris, or other non-native material from the site.

2.0 Any barriers (silt fence, cofferdam, etc.) upstream and downstream of the decommissioned dam shall be removed to the satisfaction of the Engineer. Disposal of such items shall be into the Little Red Dog Quarry, the site landfill, or as directed by the Engineer.

3.0 Any unused, stockpiled material (shell and/or rip rap material) on site shall also be removed and disposed of in the Little Red Dog Quarry.

4.0 Removal of the access road downstream of the dam shall be completed to the satisfaction of the Engineer. The material removed from this road may be used for erosion protection or may be disposed in Little Red Dog Quarry.

5.0 The access road to the dam and to the wave break structure should likewise be removed and disposed in Little Red Dog Quarry.

6.0 Protective metal casing and ground temperature cables:

.1 Remove surface protective casing prior to excavation of material. Dispose in the landfill, or as directed by the Engineer.

.2 Remove 100 mm steel casing from upper portion of cable and dispose in site landfill. There are no salvageable components from the ground temperature cables, including the cable itself.

.3 Remove and dispose the 50 mm ABS pipe encasing the cable through the core of the dam. Remove any remaining length of cable.

.4 Remove surface survey control (West and East Dam controls), either by pull-out, excavation, or cut-off at grade. Ensure all pipe holes are backfilled with suitable material, as directed by Engineer.

[End of Section]