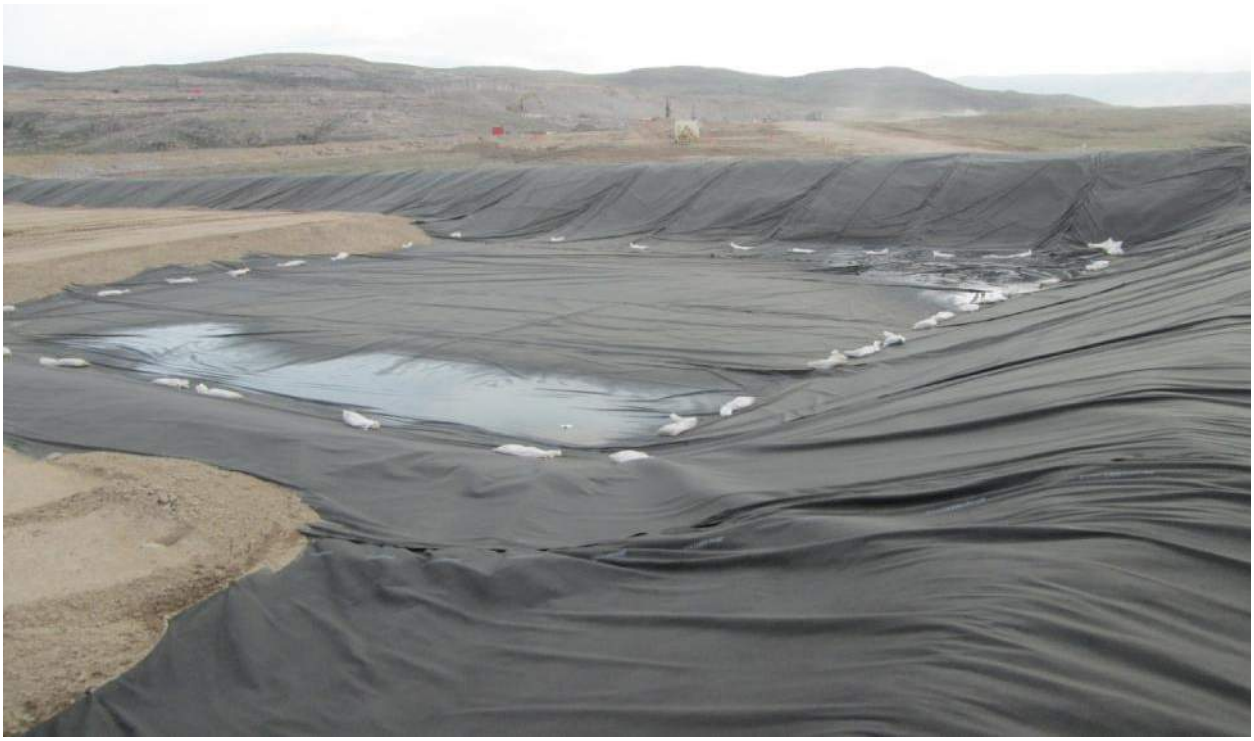


Photo taken looking into the sump at the north east corner of the Landfarm.

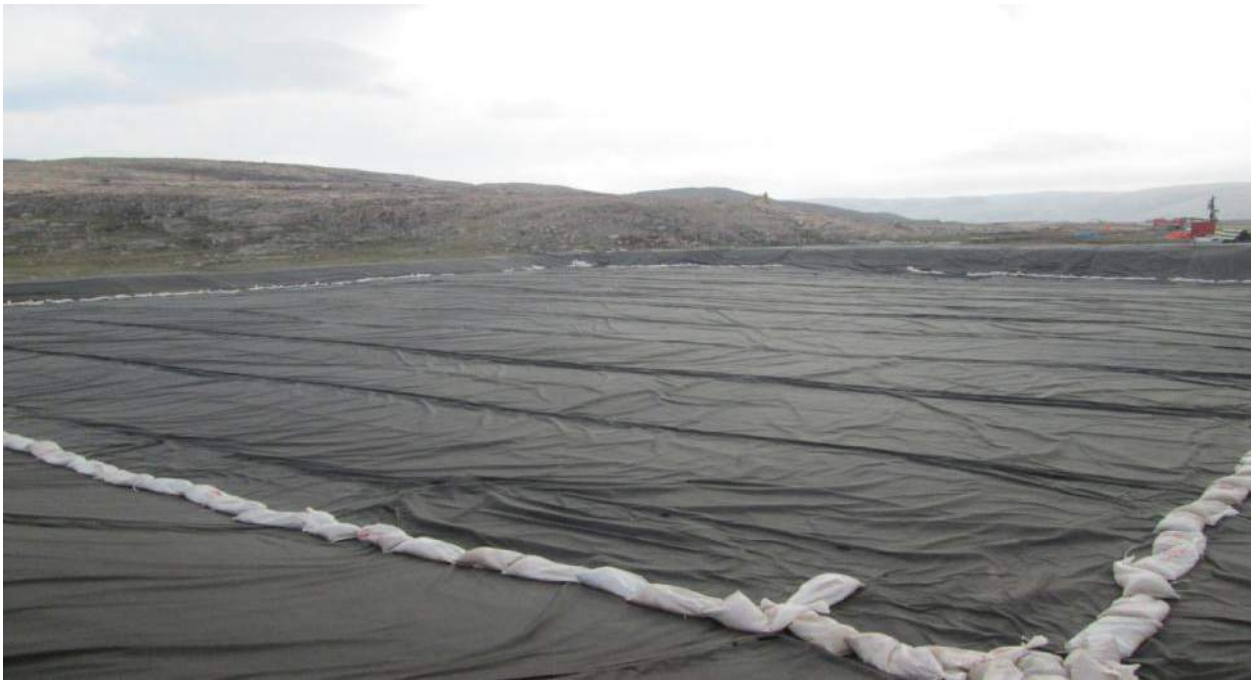


Photo taken from atop the dyke looking into the contaminated snow containment.

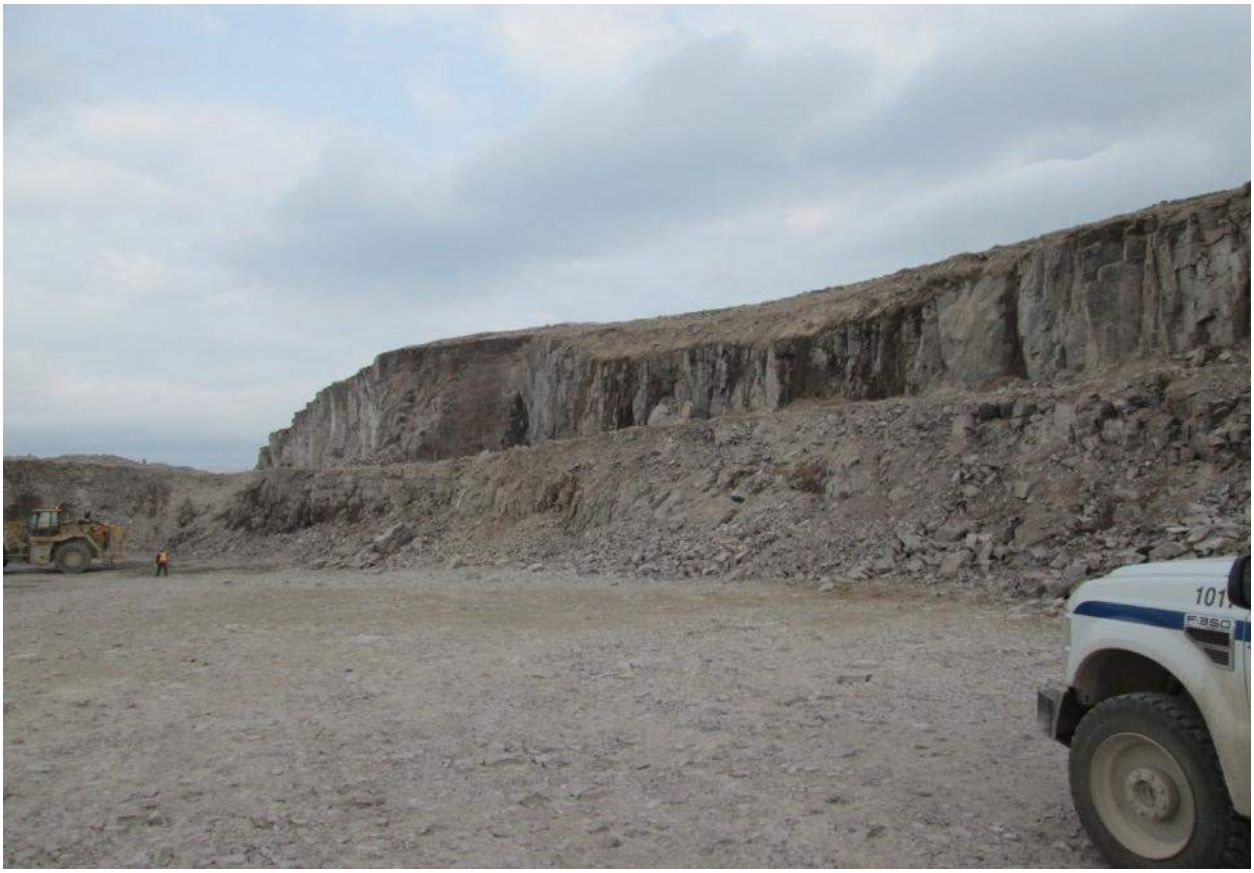
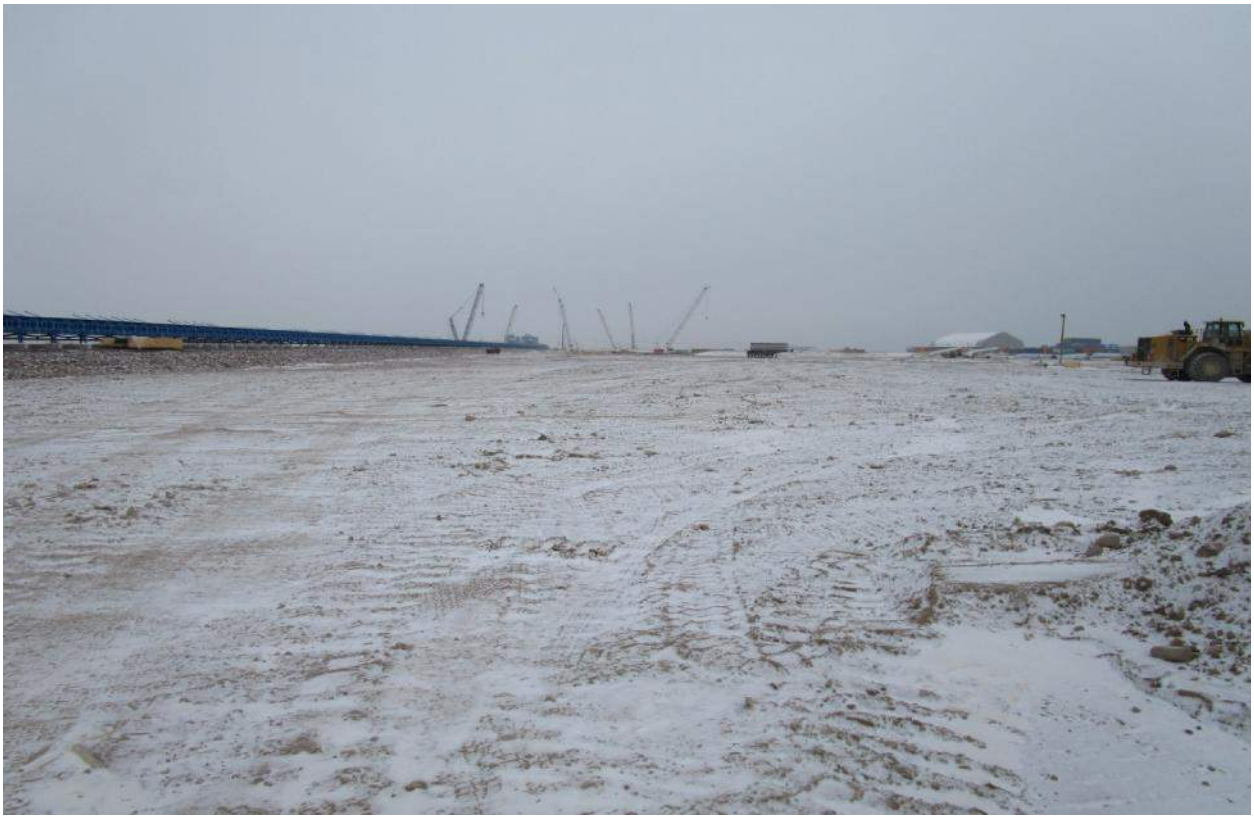


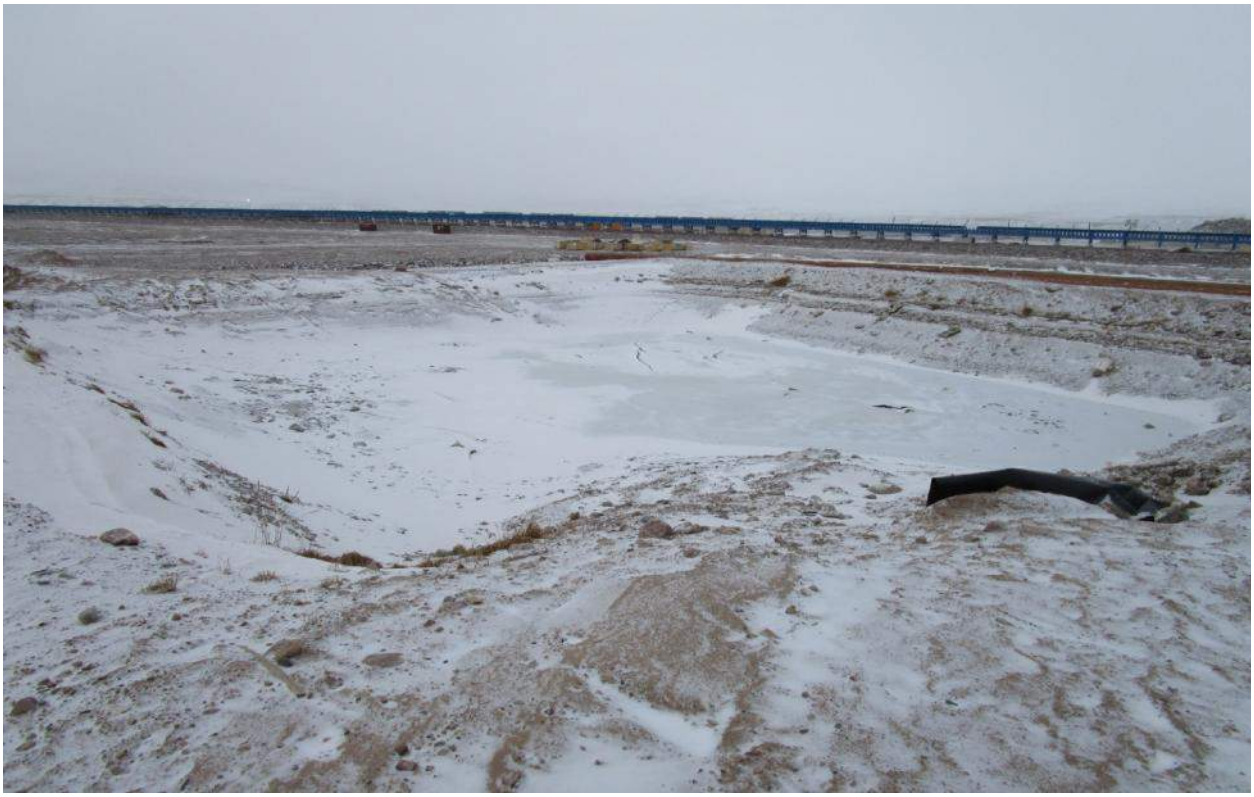
Photo taken looking at the quarry face in the quarry showing the well developed benches and cover removed from atop solid rock.

PHOTOS

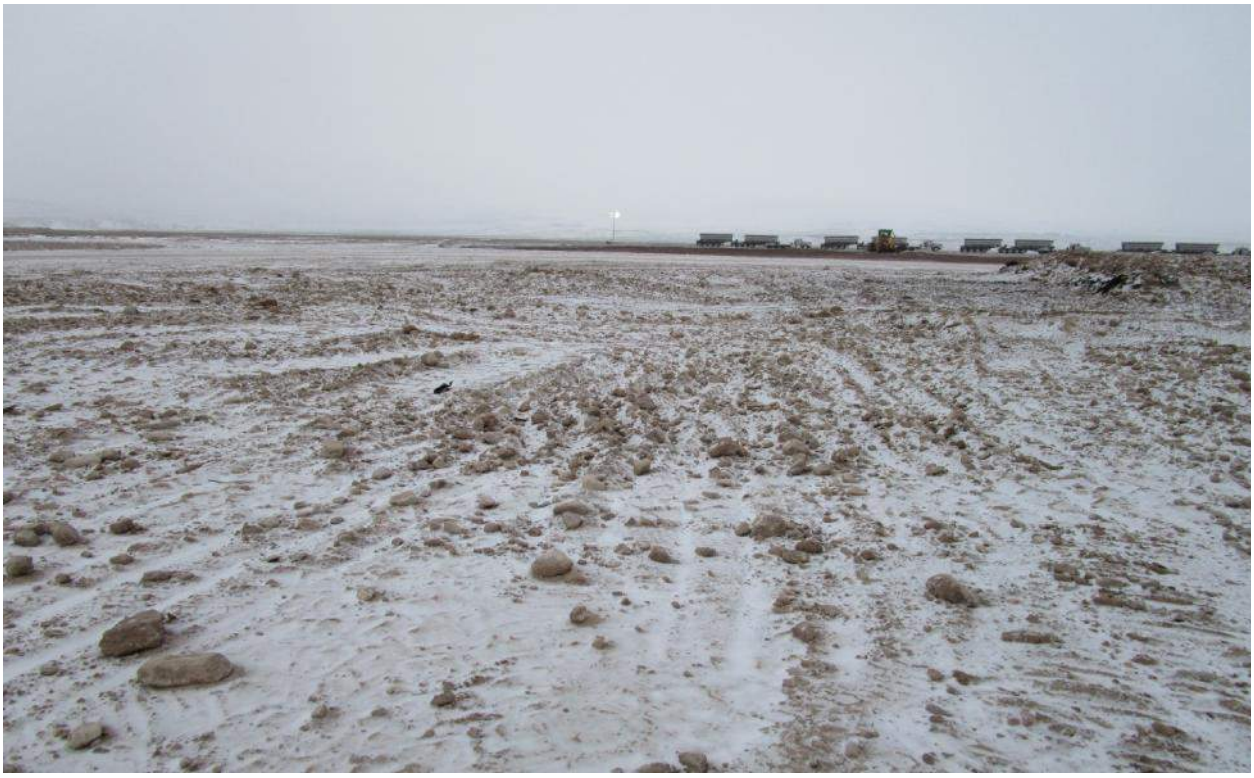
Milne Inlet September Inspection



Site of recently decommissioned bulk fuel containment



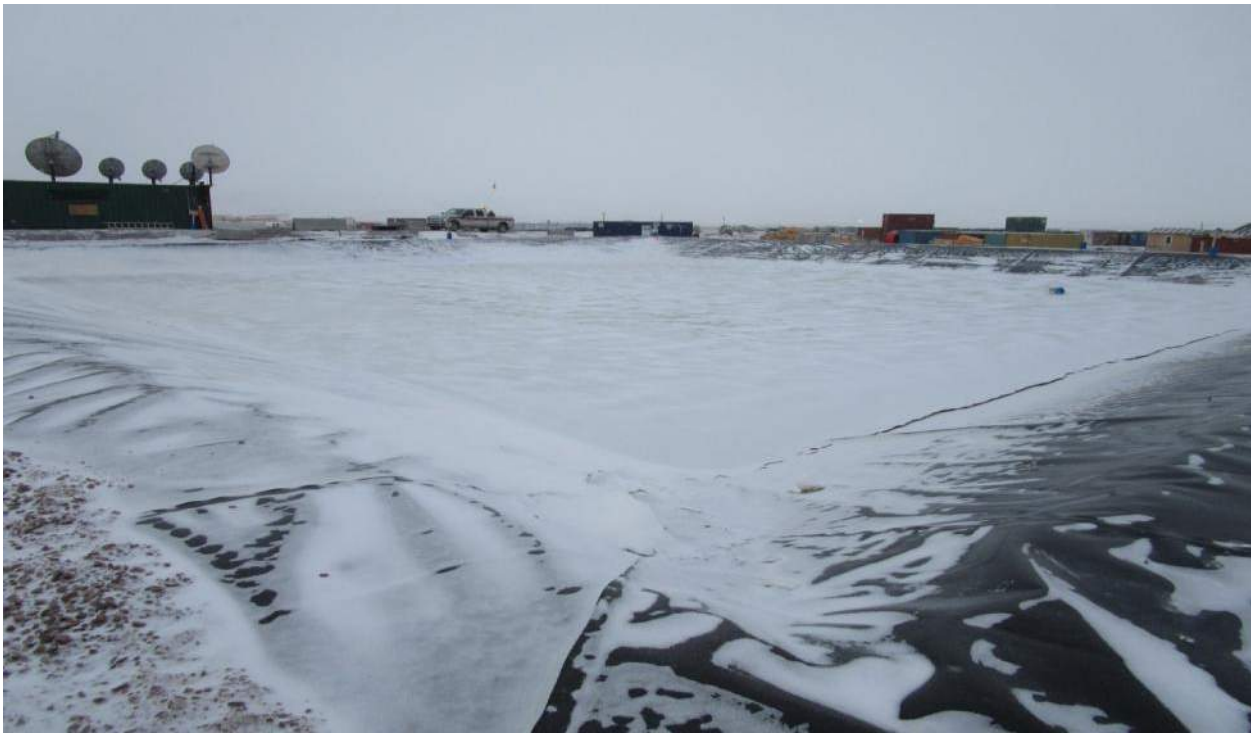
Existing PWSP now empty and being decommissioned



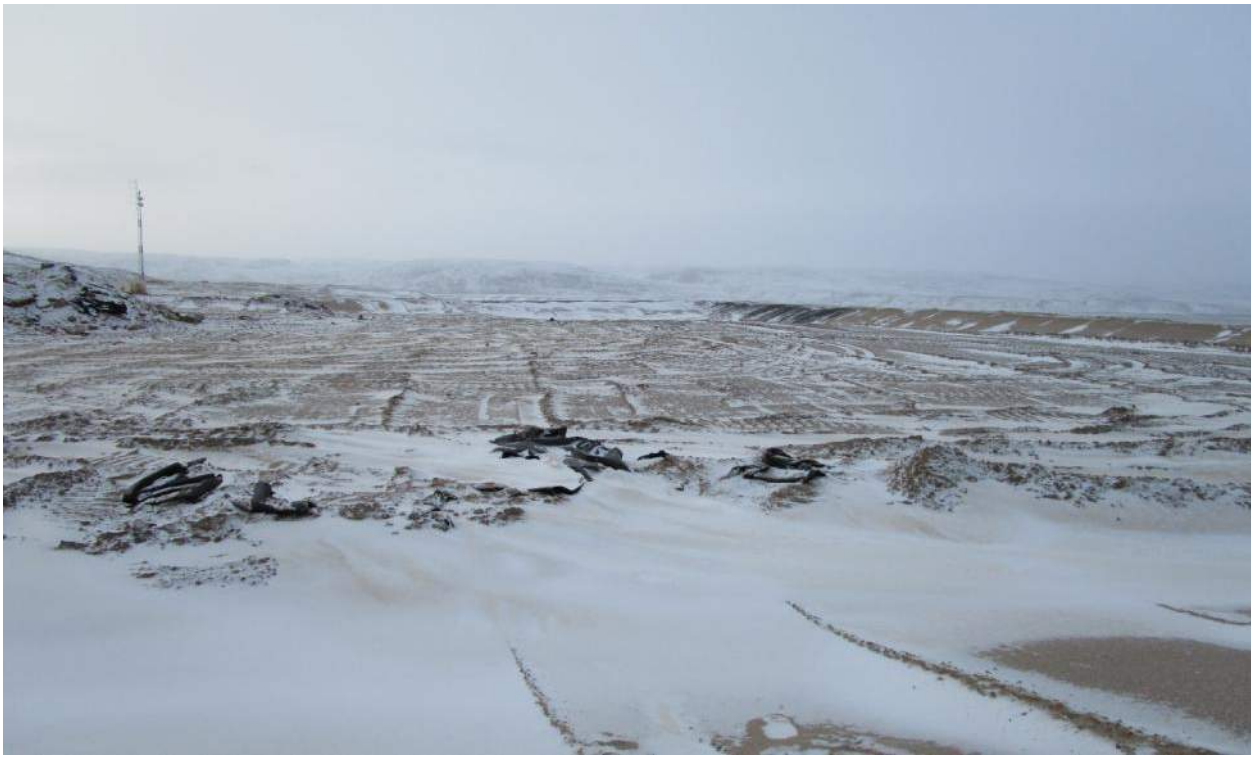
Site of recently decommissioned barrel fuel containment.

Hazardous waste storage containing bladder of contaminated material.

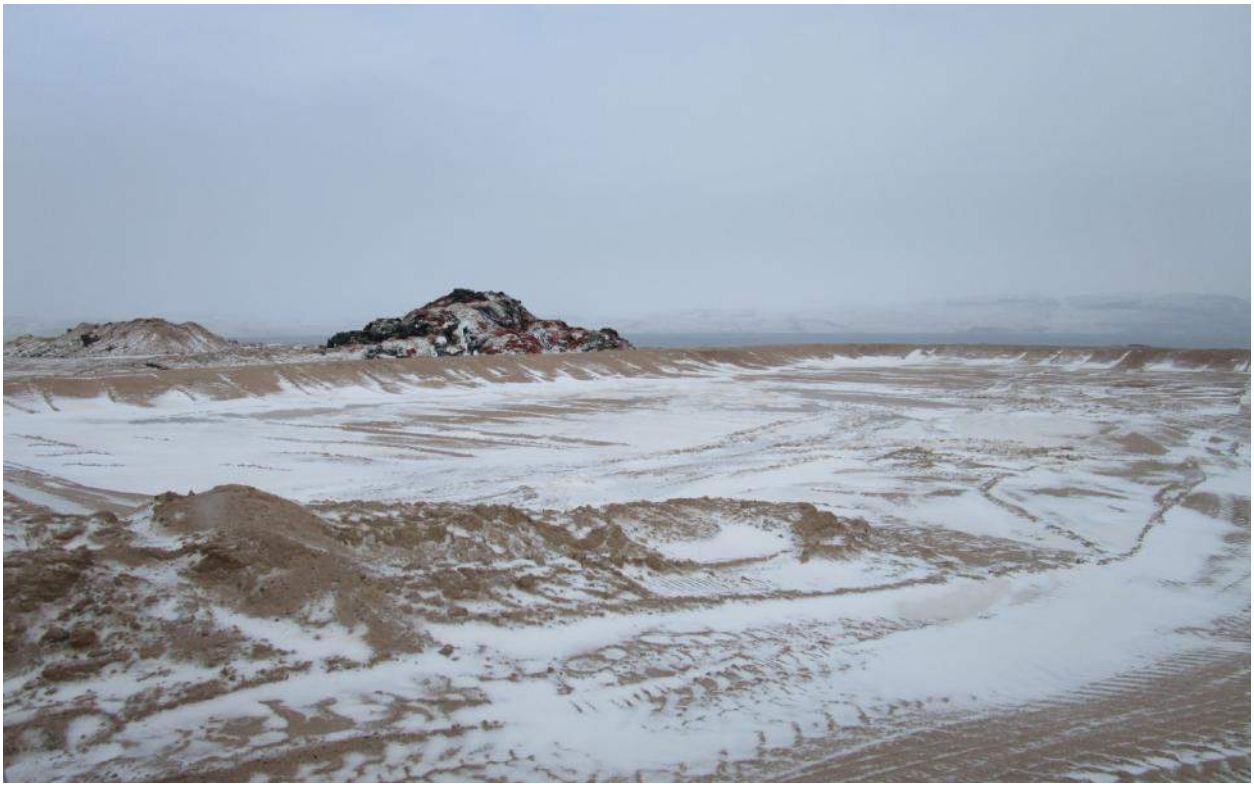
Fuel tank farm containment



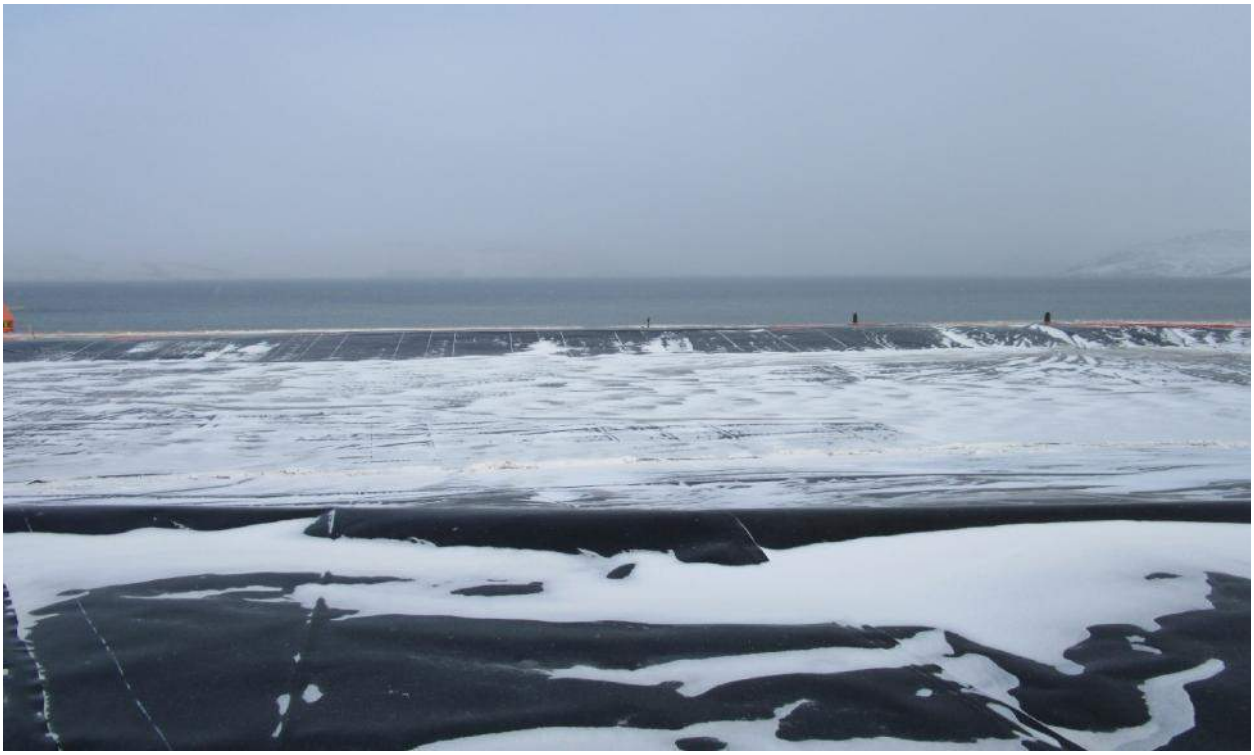
New effluent pond



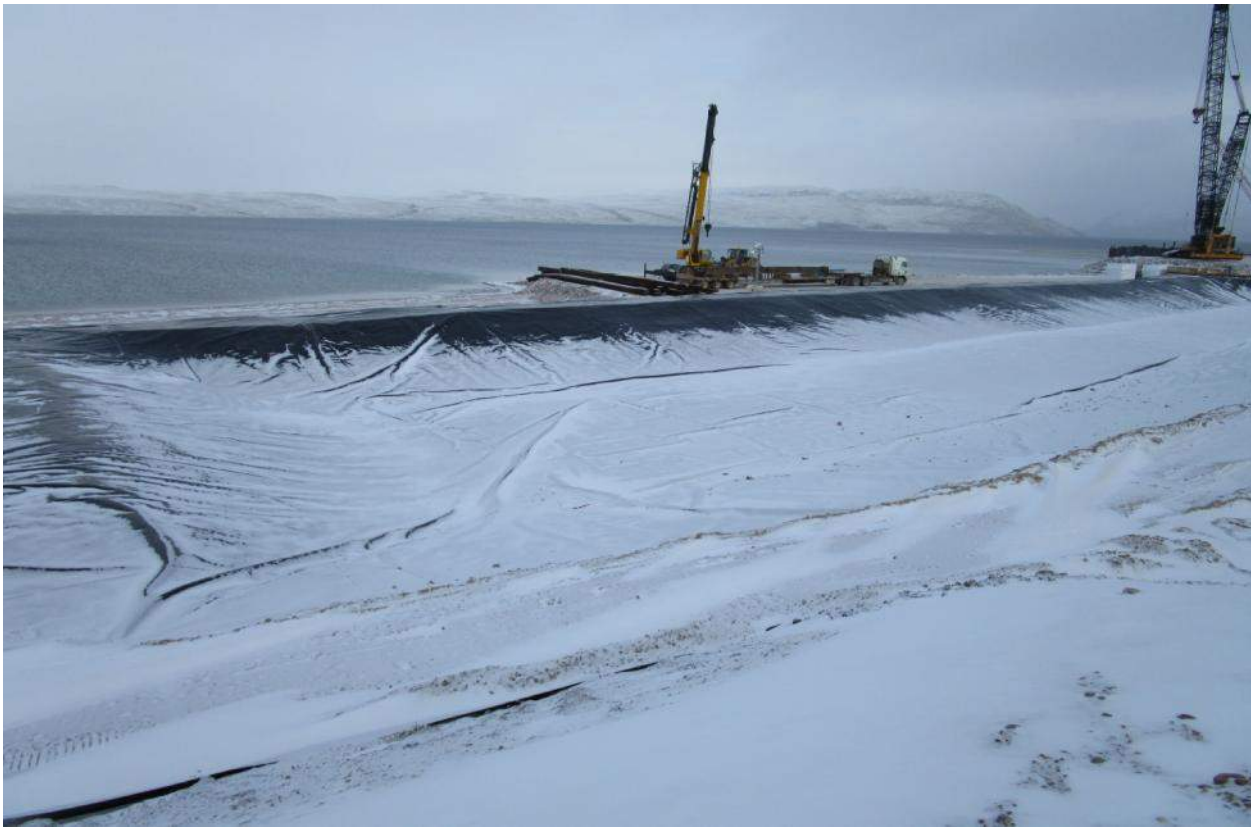
Land farm containment



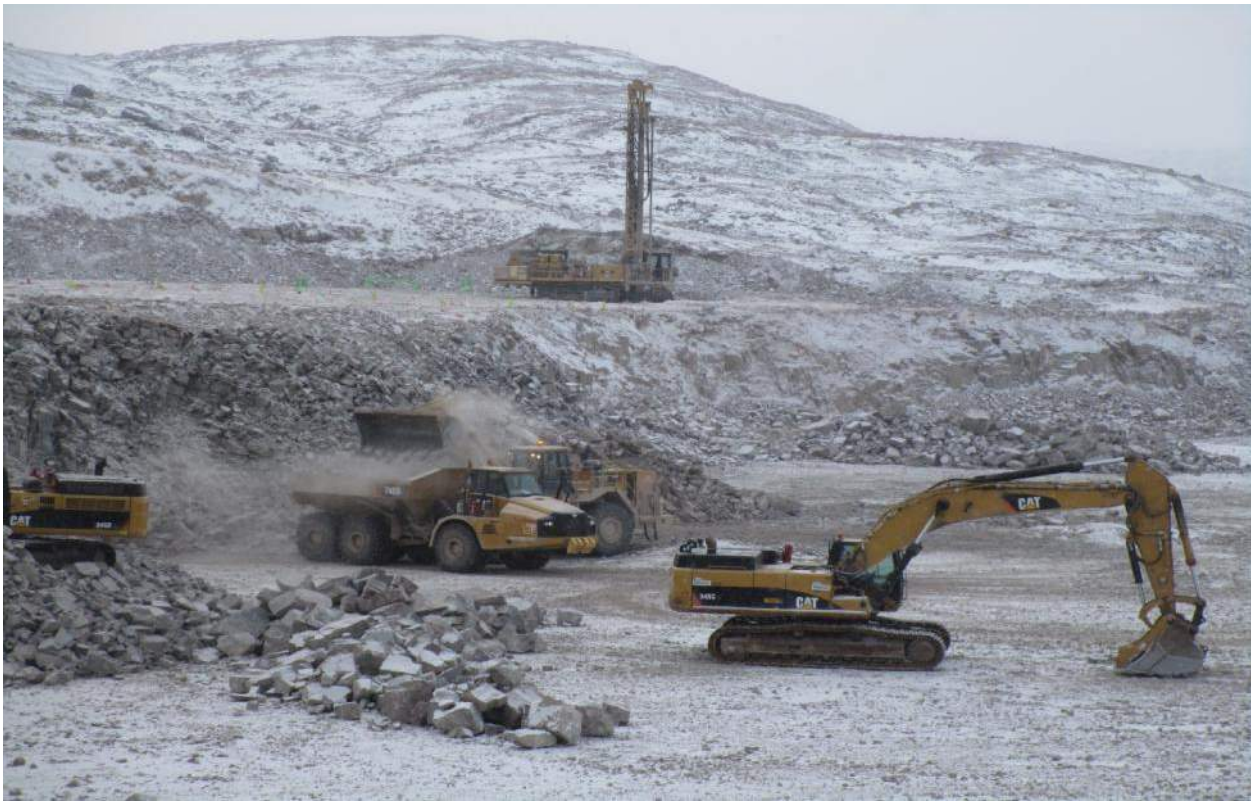
Contaminated snow containment



Sediment pond east

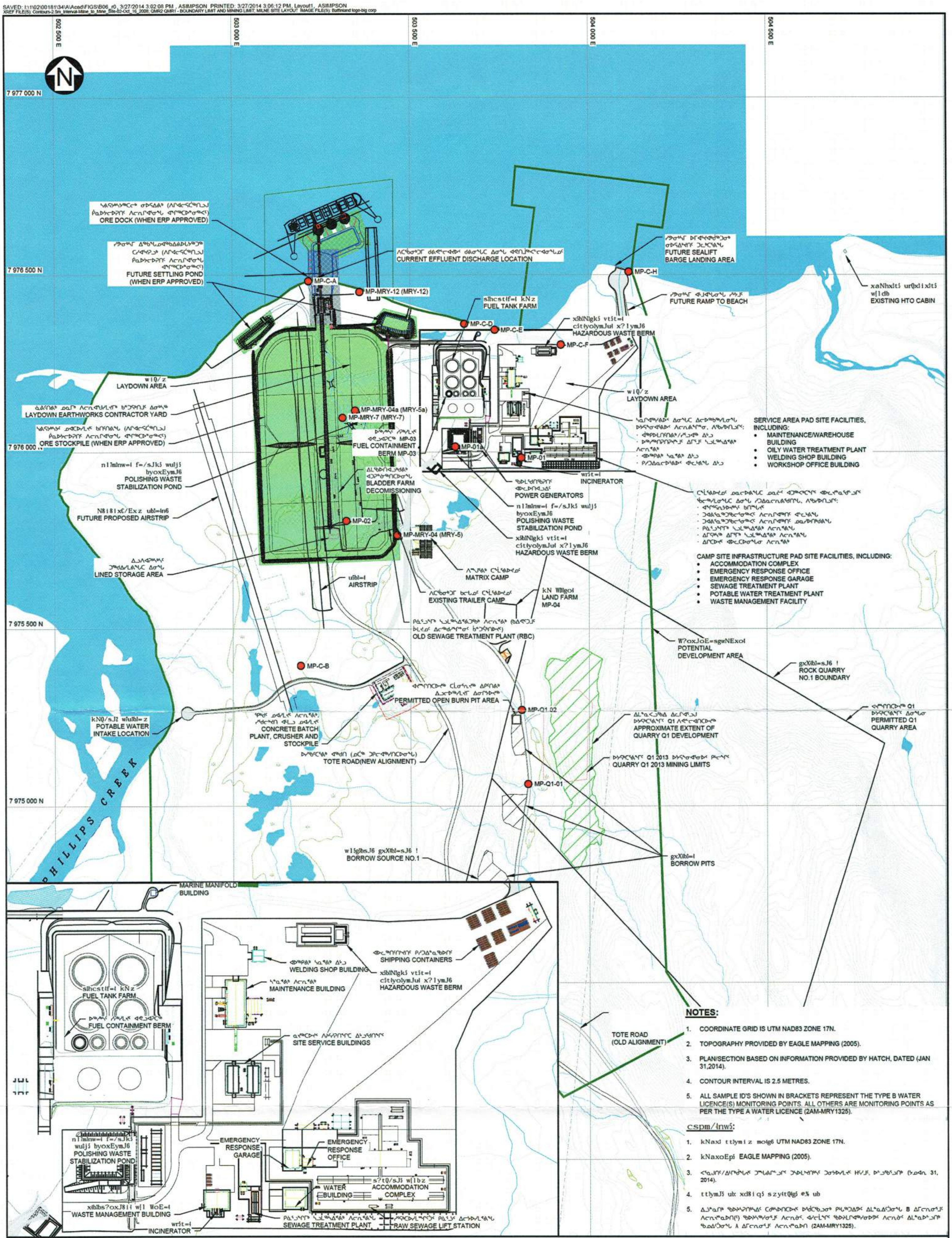


Sediment pond west



Quarry

SAVED: I:\1\02\00181\34\A\Acad\FIGS\B06_r0, 3/27/2014 3:02:08 PM , ASIMPSON PRINTED: 3/27/2014 3:06:12 PM, Layout1, ASIMPSON
XREF FILE(S): Contours-2.5m_Interval-Milne_to_Mine_Site-02-Oct_16_2008; QMR2 QMR1 - BOUNDARY LIMIT AND MINING LIMIT; MILNE SITE LAYOUT IMAGE FILE(S): Baffinland logo-big corp


502 500 E
503 000 E
503 500 E
504 000 E
504 500 E
N
7 977 000 N
7 976 500 N
7 976 000 N
7 975 500 N
7 975 000 N
ORE DOCK (WHEN ERP APPROVED)
FUTURE SETTLING POND (WHEN ERP APPROVED)
CURRENT EFFLUENT DISCHARGE LOCATION
FUTURE SEALIFT BARGE LANDING AREA
MP-C-A
MP-MRY-12 (MRY-12)
MP-C-H
FUTURE RAMP TO BEACH
EXISTING HTO CABIN
FUEL TANK FARM
MP-C-D
MP-C-E
HAZARDOUS WASTE BERM
MP-C-F
LAYDOWN AREA
LAYDOWN EARTHWORKS CONTRACTOR YARD
ORE STOCKPILE (WHEN ERP APPROVED)
MP-MRY-04a (MRY-5a)
MP-MRY-7 (MRY-7)
FUEL CONTAINMENT BERM MP-03
MP-01a
MP-01
INCINERATOR
SERVICE AREA PAD SITE FACILITIES, INCLUDING:
MAINTENANCE/WAREHOUSE BUILDING
OILY WATER TREATMENT PLANT
WELDING SHOP BUILDING
WORKSHOP OFFICE BUILDING
POLISHING WASTE STABILIZATION POND
BLADDER FARM DECOMISSIONING
POWER GENERATORS
FUTURE PROPOSED AIRSTRIP
MP-02
MP-MRY-04 (MRY-5)
CAMP SITE INFRASTRUCTURE PAD SITE FACILITIES, INCLUDING:
ACCOMMODATION COMPLEX
EMERGENCY RESPONSE OFFICE
EMERGENCY RESPONSE GARAGE
SEWAGE TREATMENT PLANT
POTABLE WATER TREATMENT PLANT
WASTE MANAGEMENT FACILITY
LINED STORAGE AREA
MATRIX CAMP
AIRSTRIP
EXISTING TRAILER CAMP
LAND FARM MP-04
OLD SEWAGE TREATMENT PLANT (RBC)
POTENTIAL DEVELOPMENT AREA
MP-C-B
ROCK QUARRY NO.1 BOUNDARY
PERMITTED OPEN BURN PIT AREA
PERMITTED Q1 QUARRY AREA
MP-Q1-02
APPROXIMATE EXTENT OF QUARRY Q1 DEVELOPMENT
POTABLE WATER INTAKE LOCATION
CONCRETE BATCH PLANT, CRUSHER AND STOCKPILE
TOTE ROAD(NEW ALIGNMENT)
QUARRY Q1 2013 MINING LIMITS
MP-Q1-01
PHILLIPS CREEK
BORROW SOURCE NO.1
BORROW PITS
MARINE MANIFOLD BUILDING
SHIPPING CONTAINERS
WELDING SHOP BUILDING
HAZARDOUS WASTE BERM
MAINTENANCE BUILDING
FUEL TANK FARM
FUEL CONTAINMENT BERM
SITE SERVICE BUILDINGS
TOTE ROAD (OLD ALIGNMENT)
POLISHING WASTE STABILIZATION POND
EMERGENCY RESPONSE GARAGE
EMERGENCY RESPONSE OFFICE
WATER BUILDING
ACCOMMODATION COMPLEX
WASTE MANAGEMENT BUILDING
INCINERATOR
SEWAGE TREATMENT PLANT
RAW SEWAGE LIFT STATION

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 17N.
2. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
3. PLAN/SECTION BASED ON INFORMATION PROVIDED BY HATCH, DATED (JAN 31,2014).
4. CONTOUR INTERVAL IS 2.5 METRES.
5. ALL SAMPLE ID'S SHOWN IN BRACKETS REPRESENT THE TYPE B WATER LICENCE(S) MONITORING POINTS. ALL OTHERS ARE MONITORING POINTS AS PER THE TYPE A WATER LICENCE (2AM-MRY1325).

cspm/4nw5:

1. kNaxl ttlymiz mo4g6 UTM NAD83 ZONE 17N.
2. kNaxoEpi EAGLE MAPPING (2005).
3. ... HATCH ... 31, 2014).
4. ttlymJ5 ub xd8iq5 szy4tQ4g5 e% ub
5. ... B ... A ... (2AM-MRY1325).

LEGEND:

- WATER
- LAYDOWN AREA (CONSTRUCTION PHASE)
- BORROW AREAS (2013 UNDER Q10C3001)
- QUARRY AREA (EXISTING UNDER Q13C301)
- EARLY REVENUE PHASE (ERP) WORK SUBJECT TO REGULATORY APPROVAL
- RIVER/STREAM/DRAINAGE
- ROAD
- POTENTIAL DEVELOPMENT AREA
- WATER LICENCE WATER QUALITY MONITORING LOCATION

SCALE A 100 50 0 100 200 300 400 500 m

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	25MAR'14	ISSUED WITH 2013 QIA AND NWB ANNUAL REPORT	RAC	AS	SP	JM

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

ᐃᑲᐱᑦᑐᕐᔪᐊᖅ ᑐᓚᒃᑕᕝᕕᒻᒥ ᐊᖏᑦᓯᒃᓯᒪᓂᖓ ᐊᒻᒪ

ᐃᒥᖅᑕᓂᕐᒧᑦ ᐱᖁᔭᖅᑕᐅᓯᒪᓂᕐᒧᑦ ᖃᐅᔨᒪᑦᑎᐊᒃᓯᓂᕐᒧᑦ ᐃᓂᖏᓐᓄᑦ

MILNE PORT SITE LAYOUT AND WATER LICENCE MONITORING LOCATIONS

Knight Piésold CONSULTING

P/A NO. NB102-181/34 | REF NO. 4 | FIGURE 1.3 | REV 0

Appendix E:
Facility Description Supporting Documents

E.1 E349000-1000-07-220-0001 Design Brief for Milne Inlet Landfarm and Contaminated Snow Containment Facility ***[43 pages]***

TETRA TECH EBA

April 4, 2014

ISSUED FOR USE
FILE: E14103075-01

Baffinland Iron Mines Inc.
120 Adelaide Street West, Suite 1016
Toronto, ON M5H 1T1

Attention: Jim Millard
Environmental Manager

Subject: Design Brief for Milne Inlet Landfarm and Contaminated Snow Containment Facility
Milne Inlet, NU

1.0 INTRODUCTION

1.1 General

Tetra Tech EBA Inc. (Tetra Tech EBA) was retained by Baffinland Iron Mines Corp. (Baffinland) to update the Milne Inlet landfarm design previously completed for the Mary River Project. The update was requested by Baffinland to accommodate increased contaminated soil volumes and provide a secondary containment cell for hydrocarbon contaminated snow.

This document provides a summary of the updated design. Construction drawings and specifications for the updated landfarm and contaminated snow containment facility have been prepared and are attached. In the case of discrepancies, the construction drawings and specifications supersede the design brief.

1.2 Project Details

Tetra Tech EBA completed a design for the landfarm in 2012 (Tetra Tech EBA, 2012). The landfarm facility was sized to accommodate staged remediation of an estimated 1,700 m^3 of contaminated soil from a bladder fuel farm. Subsequent contaminated soil excavation generated approximately 9,000 m^3 of contaminated soil.

To accommodate this increased contaminated soil volume, Baffinland requested that the landfarm footprint be approximately doubled in size. Successive treatments will still be required to remediate the contaminated soil volume; however, increasing the landfarm footprint beyond what is shown on the drawings is not possible due to space constraints at the site, and the increased material volumes required to construct an even larger facility.

In addition to increasing the landfarm footprint, Baffinland requested that a second containment cell be constructed adjacent to the landfarm to contain hydrocarbon contaminated snow. A minimum containment volume of 1,000 m^3 was requested.

2.0 DESIGN SUMMARY

The landfarm and contaminated snow containment facility (facility) location and general site layout is shown on Drawing C01. Design details for the facility are provided on Drawings C02 and C03, and in the construction specifications.

The facility consists of two geomembrane lined containment cells. The larger west cell will be used as a landfarm for the biotreatment of contaminated soil from the bulk fuel storage facility. The smaller east cell will be used for the containment of hydrocarbon contaminated snow collected during winter operations.

Tetra Tech EBA Inc.
14940 - 123 Avenue
Edmonton, AB T5V 1B4 CANADA
Tel 780.451.2121 Fax 780.454.5688

2.1 Landfarm Area

The landfarm cell is an irregularly shaped, lined containment area, measuring approximately 136 m x 63 m with a floor area of 7,620 m^2 (excluding sump). The landfarm is bounded on its south side by water features (channel and pond), and on its north side steep, unstable slopes. The landfarm was sized to maximize the footprint while not encroaching on either of these features.

The cross section design is consistent with Tetra Tech EBA (2012) and consists of a granular containment area utilizing fill materials available on site. The cell is lined with a HDPE geomembrane liner, protected with a top and bottom nonwoven geotextile, and keyed into the perimeter berms. The liner system will be covered with 0.3 m aggregate fill to protect the liner. Liner system and cross section details are provided on Drawing C03.

The landfarm has been designed to contain seasonal water accumulation due to snow melt and precipitation events. The total capacity in the landfarm, assuming a 0.3 m freeboard, is 3,383 m^3. The expected seasonal inputs are summarized in Table 1.

Table 1 – Estimated Seasonal Water Accumulation

Average Snow Accumulation on Base, SWE (m^3)	Snow Drift Accumulation, SWE (m^3)	Extreme Seasonal Precipitation (m^3)	Total Annual Accumulation (m^3)
956	370	2,000	3,307

The average base snow accumulation was calculated using a snow water equivalent of 105 mm applied over the landfarm area, as documented in Tetra Tech EBA (2012). The snow drift volume was based on snow accumulation at a 6:1 slope around the perimeter berms with a density of 325 kg/m^3. The extreme precipitation volume was evaluated by a frequency analysis of recorded summer rainfall events at Igloolik and Pond Inlet. This provided an annual 1:100 year precipitation value of 260 mm.

The total annual accumulation of 3,307 m^3 represents the average snowfall accumulation combined with a 1:100 year annual seasonal rainfall. This volume is considered to be a conservative estimate of the annual precipitation in the landfarm as it represents an extreme annual summer volume and does consider evaporation (estimated at 190 mm per year), and any water treatment and extraction completed by Baffinland.

The landfarm design includes a small sump in the southwest corner of the landfarm to accommodate small seasonal rainfall events. The capacity of the sump area is of 325 m^2.

2.2 Contaminated Snow Containment Facility

The contaminated snow containment facility is located east of the landfarm and shares a common berm with the landfarm. The cross section design is consistent with the landfarm design, with the exception that the cover thickness over the liner system has been increased to 0.6 m. For the landfarm, placement of contaminated soil contributes to the overall cover thickness over the liner system. In the contaminated snow containment facility no contaminated soil was placed so the cover thickness was increased to compensate. Along the crest of the berm, the thickness of the cover over the key trench is only 0.3 m.

The contaminated snow containment facility is a rectangular, lined containment area, measuring approximately 47 m x 43 m. The facility is graded to the south side of cell, to a point, 12 m east of the southwest corner. This will permit the facility to be accessed from either the southwest or southeast corners. The contaminated snow containment facility is shown on Drawing C02.

The contaminated snow containment facility has a containment volume of 929 m^3, with 0.3 m of freeboard. The water capacity at the liner crest is 1,428 m^3. The containment volume was developed in dialogue with Baffinland based on estimated contaminated snow volumes.

2.3 Access Road

The landfarm and contaminated snow containment facility will be accessed from the road located southwest of the facility. A detailed access road design has not been completed as part of this design; however, two possible access configurations are shown on Drawing C01. These configurations can be adjusted based on Baffinland's specific requirements and actual site conditions.

All access roads will be required to cross the small watercourse on the south side of the facility.

3.0 CONSTRUCTION MATERIALS

3.1 Pad and Berm Materials

The pad and berms of both the landfarm and the contaminated snow containment area will be constructed with Type 2 material, while Type 5 material is used adjacent to the liner. Specified particle size distributions for each material are included in construction specifications.

3.2 Geomembrane Liner System

Both the landfarm and contaminated snow containment areas will be lined with an HDPE liner system. The liner system comprises a 60 mil HDPE geomembrane sandwiched between layers of 12-oz non-woven geotextile. The properties and characteristics of the geomembrane are outlined in the construction specifications.

The liner system bedding consists of a 150 mm layer of Type 5 granular fill. The liner system cover in the landfarm area consists of 300 mm of Type 5 granular fill, the contaminated snow containment area cover is 600 mm of the Type 5 granular fill, as discussed above. Soil from the bladder farm that has contaminants below the Government of Nunavut PHC industrial guidelines can be used for Type 5 granular fill on top of the geomembrane liners.

3.3 Quantities

Material quantities for the landfarm and contaminated snow containment facility are summarized in Table 2. The Type 2 and Type 5 quantities represent in place volumes and do not include any allowances for overbreak, wastage, or overbuild.

Table 2 – Estimate Material Quantities

Area	Type 2 Granular Fill (m^3)	Type 5 Granular Fill (m^3)	Geotextile (m^2)*	60 mil HDPE Geomembrane (m^2)*
Landfarm	14,953	4,099	22,733	11,367
Contaminated Snow Containment Facility	2,306	1,745	5,352	2,716
Total	**17,259**	**5,844**	**28,085**	**14,083**

* Geotextile and geomembrane quantities provide a 15 percent allowance for overlap and waste

4.0 CONSTRUCTION CONSIDERATIONS

The following sections provide construction considerations and recommendations for construction of the landfarm and contaminated snow containment facility. Additional construction requirements are available in the construction specifications.

4.1 Foundation Preparation

The landfarm and contaminated snow containment facility will be constructed over the existing ground surface. Any ground disturbance should be minimized. Large boulders which may protrude into the liner system should be removed; however, no excavation of the foundation soils should occur.

Construction over undisturbed natural ground may create a thermal barrier, causing the permafrost table to aggrade upwards towards the base of the fill. Although construction of the landfarm overtop the ice-rich areas is not expected to cause significant permafrost degradation, the naturally-occurring patterns in the ground may eventually translate to the top and side surfaces of the berms, which may require periodic maintenance.

4.2 Material Placement

4.2.1 Granular Materials

All granular materials should be placed in lifts not exceeding 300 mm in thickness and compacted as specified in the construction specifications. Moisture conditioning may be required to achieve the compaction requirements.

4.2.2 Geomembrane Liner

The installation of the non-woven geotextile and geomembrane will commence after the 300 mm layer of Type 5 material has been placed and compacted. The bedding material must be made smooth and must be placed in a manner that will prevent damage to the liner.

The edges of the liners will be terminated in key trenches around the perimeter of the containment areas. Bedding cover material should be placed on the edges of the liner to secure the liner in place within the key trench. Low ground pressure equipment should push cover material ahead of itself, and never travel directly on the geomembrane.

4.3 Quality Assurance / Control

The construction quality assurance program must be structured to ensure that construction sensitive features of the design are achieved. The elements of the program will include:

- Careful surveying to establish material quantities and allow preparation of as-built construction drawings;
- Specific engineering approvals at critical times such as foundation preparation, and key trench excavation and cleaning;
- Monitoring field and laboratory testing of fill materials;
- Specific approval of construction procedures for moisture condition and placement of embankment materials, and liner installation;
- Observation and approval of contractor’s proposed material placement sequences and preparation of each surface prior to the placement of the next lift; and

- Defined procedures for reporting with identified responsibilities for decision making during construction.

Specific testing requirements and frequencies for granular fill and liner installation are outlined in the construction specifications.

5.0 LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of Baffinland Iron Mines Corporation and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Baffinland Iron Mines Corporation, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions are attached to this memo.

6.0 CLOSURE

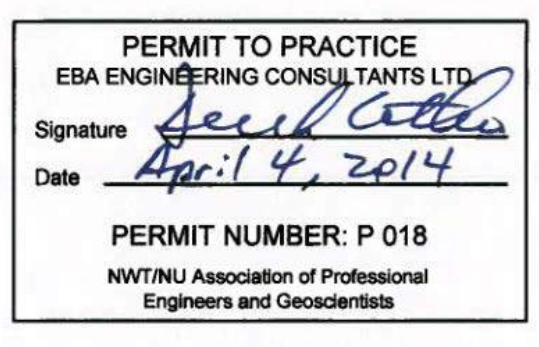
We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.

Prepared by:
Elizabeth A. Garven, M.A.Sc., P.Eng.
Geotechnical Engineer – Arctic Region
Direct Line: 780.451.2130 x257
Elizabeth.Garven@tetratech.com

Reviewed by:
Gary Koop, P.Eng
Project Director – Arctic Engineering
Direct Line: 780.451.2130 x509
Gary.Koop@tetratech.com

/tm



FIGURES