July 12, 2017

Sean Joseph
Senior Technical Advisor, NWB
P.O. Box 119
Gjoa Haven, NU X0B 1J0

RE: Mary River Project - Milne Inlet Fuel Storage Facility Capacity Increase (Modification Request)
Water Licence 2AM-MRY1325 – Amend. No. 1

In accordance with Part G of Baffinland Iron Mines Corporation's (Baffinland) Type "A" Water Licence 2AM-MRY1325 – Amend. 1 (Type "A" Water Licence), the purpose of this letter is to request approval from the Nunavut Water Board (NWB) for a planned modification at the Mary River Project's Milne Port location that involves increasing the capacity of the Milne Inlet Fuel Storage Facility (Fuel Storage Facility).

Baffinland has found during its history of operations that more equipment, and therefore more fuel, is required to reach full production (4.2 Mt per annum). The additional capacity at the Fuel Storage Facility will ensure sufficient fuel is available to achieve full production and execute operational improvement plans for the upcoming year.

The fuel tank composition of the current Fuel Storage Facility is presented in the table below.

Fuel Type	Tank Volume (Ml)	Number of Tanks (Ml)	Total Tank Volume (Ml)
Arctic Diesel	5	2	10
Arctic Diesel	12	3	36
Arctic Diesel Total			**46**
Jet A-1	0.75	3	2.25
Jet A-1 Total			**2.25**

To accomplish full production (4.2Mtpa), fuel consumption calculations indicate that approximately 47 Ml of Arctic Diesel is required to ensure that sufficient fuel volumes are stored on site over the winter when no fuel shipments are possible.

In order to store this amount of Arctic Diesel at the Fuel Storage Facility, a minimum tank space of 64 Ml is required. This calculation includes a 20 percent (%) operational contingency factor to account for

variation in estimated fuel consumption and/or delays in fuel delivery as well as a fill factor of 88 percent (%). The fill factor allows for empty space at the top of each tank for gas and thermal expansion (approximately 7% of tank volume) and inaccessible space at the bottom of each tank below the tank outlet pipe (approximately 5% of tank volume).

In addition, with the increased amount of equipment, more operators and support personnel are required for operations. This results in additional charter flights to and from the Project and increases the estimated Jet A-1 consumption to 2.3 Ml per year. In order to store this amount of Jet A-1 at the Fuel Storage Facility, assuming an 88 percent (%) fill factor based on the factors discussed above, a minimum tank volume of 2.6 Ml is required.

The proposed capacity increase involves the construction and placement of three (3) additional fuel tanks at the Fuel Storage Facility, increasing the Facility's tank volumes of Arctic Diesel and Jet A-1 to 64 Ml and 3 Ml, respectively. All three (3) tanks will be placed within the existing containment of the Fuel Storage Facility and presented in the table below.

Tag Number	Description	Fuel Stored	Diameter	Height
TK-003	15M Litre Tank	Arctic Diesel	32.50m	18.30m
TK-010	750K Litre Tank	Jet A-1	10.25m	9.14m
TK-011	3M Litre Tank	Arctic Diesel	16.20m	15.25m

A review of the Fuel Storage Facility's secondary containment, presented in Attachment 5, confirms that there is sufficient secondary containment to accommodate the proposed additional fuel tanks, as per CCME guidelines.

Details of the modification are provided in the subsections below and in the attached documentation, including issued-for-construction drawings and engineering documentation.

The proposed modification to the Milne Inlet Fuel Storage Facility will occur within the Project's Development Area and is consistent with approved activities outlined in the Project Certificate (Project Certificate 005 – Amend. 1) issued for the Mary River Project by the Nunavut Impact Review Board (NIRB). The Early Revenue Phase (ERP) Project Description included a Key Facts Table that estimated Arctic Diesel and Jet A-1 fuel requirements for a 3.5 Mtpa operation.

The table below shows the tank volume estimates from the Key Facts Table, the tank volume increased by 20% to account for the change in the approval from 3.5 to 4.2 Mtpa, and the proposed tank volume increase.

Fuel Type	ERP Estimate (3.5 Mtpa)	Increased ERP (4.2 Mtpa)	Current Tank Volume	Proposed Tank Volume
Arctic Diesel	46 Ml	55.2 Ml	46 Ml	64 Ml
Jet A-1	1.5 Ml	1.8 Ml	2.25 Ml	3 Ml

The increased Jet A-1 storage at the Milne Inlet Fuel Storage Facility will replace some of the originally planned Jet A-1 storage at the Mary River Mine Site. The Jet A-1 storage volume at the Mary River Mine Site was originally planned to be 3 Ml, as stated in the Key Facts Table, however these tanks have not been installed and storage has been limited to 100,000 L in iso-containers located at the airport.

The requested modification is described below and is consistent with the requirements of Part G of the Type "A" Water Licence.

a. Description of Facilitiies and/or Works to be Constructed

The proposed capacity increase of the Milne Inlet Fuel Storage Facility involves the construction and placement of three (3) additional fuel tanks, increasing the Facility's tank volumes of Arctic Diesel and Jet A-1 to 64 Ml and 3 Ml, respectively. All three (3) tanks will be placed within the existing containment of the Fuel Storage Facility and are presented in the table below.

Tag Number	Description	Fuel Stored	Diameter	Height
TK-003	15M Litre Tank	Arctic Diesel	32.50m	18.30m
TK-010	750K Litre Tank	Jet A-1	10.25m	9.14m
TK-011	3M Litre Tank	Arctic Diesel	16.20m	15.25m

A review of the Fuel Storage Facility's secondary containment, presented in Attachment 5, confirms that there is sufficient secondary containment to accommodate the proposed additional fuel tanks, as per CCME guidelines.

The design and construction of the proposed additional fuel tanks and associated piping will be similar to the Fuel Storage Facility's existing tanks and in accordance with the applicable guidelines and standards.

Attachments 1 & 2 show the process flow diagram and general layout for the Fuel Storage Facility, respectively, including the proposed additional fuel tanks and associated piping.

Attachments 3 & 4 show the earthworks setting out points for the additional fuel tanks and the Facility's overall piping layout, respectively. As mentioned above, Attachment 5 confirms the ability of the Facility's existing secondary containment to accommodate the additional fuel tanks. Attachment 6 discusses the construction methodology for the proposed additional fuel tanks and associated piping.

Moreover, the diesel piping system that runs from the Fuel Storage Facility to the Milne Port diesel generators, as shown in Attachment 2, was not completed during the construction of the Fuel Storage Facility in 2013. This diesel piping system, included in the Fuel Storage Facility's original design, will be completed during the installation of the fuel tanks and associated piping.

b. Proposed Location of the Structure

All three (3) fuel tanks will be installed in the Milne Inlet Fuel Storage Facility's existing secondary containment at Milne Port, adjacent to existing fuel tanks. Associated piping, with the exception of the diesel piping system feeding the Milne Port generators, will be installed inside the Fuel Storage Facility's secondary containment to allow for fuel transfer with minimal additional piping and no additional dispensing modules. The coordinates of the tank earthworks setting out points are presented in the table below.

Tag Number	UTM (NAD83)		Tank Perimeter Levels (m.a.s.l.)
	Northing	Easting	
TK-003	7976196.348	503616.933	11.95
TK-010	7976164.948	503608.208	12.55
TK-011	7976273.168	503641.393	12.30

c. Identification of any Potential Impacts to the Receiving Environment

Baffinland foresees minimal impacts to the receiving environment during the construction and installation of the three (3) additional fuel tanks and associated piping at the Milne Inlet Storage Facility. As discussed in Attachment 6, the majority of the work will occur within the existing secondary containment of the Fuel Storage Facility and therefore sediment releases to nearby water bodies from earthworks are not expected. Appropriate crane pads and access ramps will be constructed at the Fuel Storage Facility to prevent mobile equipment from coming into contact and transferring hydrocarbon impacted soils outside the Facility's containment. In

addition, construction activities at the Milne Inlet Fuel Storage Facility will be conducted in accordance with Baffinland's suite of environmental management plans including but limited to:

- Waste Management Plan (BAF-PH1-830-P16-0028)
- Hazardous Materials and Waste Management Plan (BAF-PH1-830-P16-0011)
- Spill Contingency Plan (BAF-PH1-830-P16-0036)
- Environmental Protection Plan (BAF-PH1-830-P16-0008)

d. Monitoring

Environmental monitoring of construction activities will include periodic environmental inspections conducted by Baffinland's Environmental personnel in concert with the Contractor's Health, Safety and Environment Lead. Inspections will ensure Contractors are properly managing waste and hazardous materials and operating in accordance with Project's onsite procedures and management plans. Inspections will be documented by taking photos of any deficiencies and using Baffinland's existing environmental inspection forms. Deficiencies identified will be compiled and forwarded to the responsible Contractor to be corrected and addressed. In addition, before, during and after photographs of the tank construction and installation will be taken.

e. Schedule for Construction

Construction and installation of the three (3) additional tanks and associated piping at the Milne Fuel Storage Facility are planned to start as soon as approval has been received from NWB with the intent of completing construction prior to the arrival of the fuel sealift vessels in September 2017. Baffinland would appreciate that the NWB expedite the approvals process In order allow time for the tanks to be assembled prior to the end of the open water shipping season, so that the tanks can be filled before winter.

f. Drawings of Engineered Structures

Hatch Associates were retained to develop the design and construction plan for the proposed fuel tanks and associated piping at the Milne Inlet Fuel Storage Facility. Issued for construction drawings are provided in Attachments 2, 3 & 4 of this letter. Confirmation that the Fuel Storage Facility's secondary containment can accommodate the proposed additional fuel tanks is provided in Attachment 5.

g. Proposed Sediment and Erosion Control Measures

Baffinland does not foresee sedimentation and erosion as a likely environmental concern during the construction and installation of the additional fuel tanks and associated piping at the Milne Inlet Fuel Storage Facility. In the unlikely event that sedimentation and erosion become a concern during construction, Baffinland will employ a combination of sediment and erosion control measures (check dams, rip-rap, silt fences, etc.), as outlined in Baffinland's Environmental Protection Plan (BAF-PH1-830-P16-0008 – Rev. 1) and Surface Water and Aquatic Ecosystems Management Plan (BAF-PH1-830-P16-0026 - Rev. 4), to address and manage sedimentation and erosion concerns.

We trust that this information meets the requirements under Part G under Baffinland's Type "A" Water Licence and look forward to the NWB's response. Please do not hesitate to contact the undersigned or Andrew Vermeer should you have any questions or comments.

Regards,

Wayne McPhee,
Director Sustainable Development

Attachments:

Attachment 1: Port Site TM001 Fuel System Process Flow Diagram
(H353004-48000-210-282-0001-0001, Rev. 1)
Attachment 2: Port Site TM001 Fuel System Overall Layout
(H353004-48400-240-272-0001, Rev. 2)
Attachment 3: Milne Port Fuel Tanks 003, 010 & 011 Setting Out Earthworks
(H353004-40000-220-260-0003-0001, Rev. 0)
Attachment 4: Port Site TM001 Fuel System Piping Layout (H353004-48400-240-272-0002, Rev. 4)
Attachment 5: Memo: Calculations of Tank Farm Containment Capacity
(H353004-00000-240-202-0001, Rev. A)
Attachment 6: Construction Methodology Milne Inlet Fuel Storage Facility System
(H353004-40000-400-050-0002, Rev. 0)

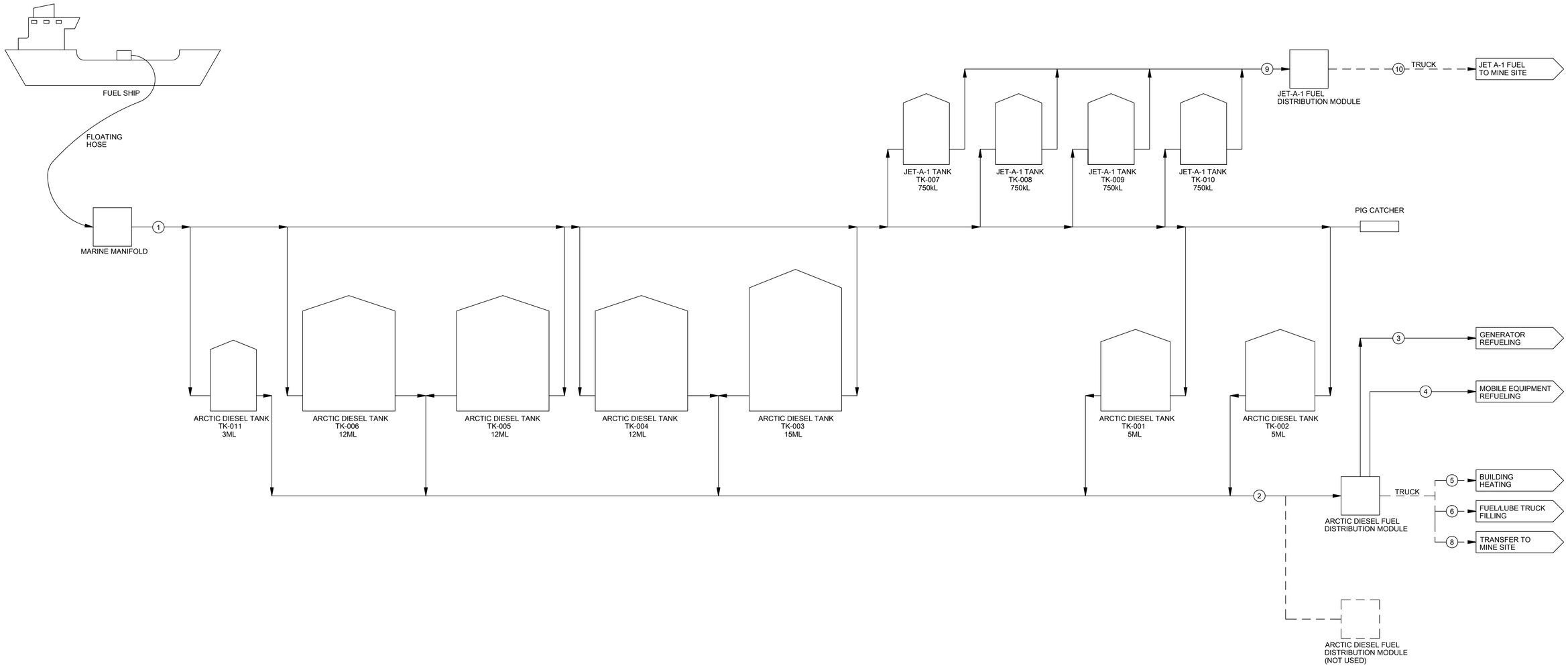
Cc: Stephen Williamson Bathory (Qikiqtani Inuit Association)
Manager of Licensing, David Hohnstein (NWB)
Justin Hack, Jonathan Mesher, Sarah Forté, Karen Costello (INAC)
Todd Burlingame, Adam Grzegorczyk, Andrew Vermeer (Baffinland)

Attachment 1

Port Site TM001 Fuel System Process Flow Diagram

(H353004-48000-210-282-0001-0001, Rev. 1)

DWG. No. H353004-48000-210-282-0001-0001



STREAM NUMBER	UNIT	1	2	3	4	5	6	7	8	9	10
DESIGN FLOW	L/min	2,500	1,600	100	100	1,500	1,500	1,500	1,500	1,500	1,500
MAX FLOW	ML/YR	55,3	-	8	1,8	1,4	4,4	4,4	38,7	-	3
DESIGN TEMPERATURE(MAX)	°C	20	20	20	20	20	20	20	20	20	20
DESIGN TEMPERATURE(MIN)	°C	-54	-54	-54	-54	-54	-54	-54	-54	-54	-54

NOTES

1. TANKS ARE FILLED ONE AT A TIME
2. TANKS ARE DRAWN DOWN ONE AT A TIME
3. TANKS FILLED TO 95% OF NOMINAL CAPACITY

DRAWING No.	DRAWING TITLE
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PROJ. MANAGER			

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Baffinland

MARY RIVER PROJECT
BAFFINLAND IRON MINES LP

PORT SITE
TM001 FUEL SYSTEM
PROCESS FLOW DIAGRAM

SCALE	DWG. No.	REV
1:1 OR AS NOTED	H353004-48000-210-282-0001-0001	1

SHEET SIZE: A1

Attachment 2

Port Site TM001 Fuel System Overall Layout

(H353004-48400-240-272-0001, Rev. 2)

NOTES:

1. REFER TO THE FOLLOWING DRAWINGS FOR GENSET PIPING DETAILS:
   H353004-48400-240-270-0014
   H353004-48400-240-270-0015
2. REFER TO THE FOLLOWING DRAWING FOR FUEL SYSTEM PIPING SYSTEM:
   H353004-48400-240-272-0002

PLAN VIEW
SCALE 1:750

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No.	DESCRIPTION	BY	CHK'D	DATE
2	GENERAL UPDATE; ISSUED FOR CONSTRUCTION	S.S.	MMI	07/06/17
1	MANIFOLD RELOCATION AND MARINE FUEL LINE ON HOLD			
0	ISSUED FOR CONSTRUCTION			

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CHECKER		Michael MacIntyre	07/06/17
DESIGN COORD.			
RESP. ENG.		F. Butts	07/06/17
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER			

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MARY RIVER PROJECT
BAFFINLAND IRON MINES LP

PORT SITE
TM001 FUEL SYSTEM
OVERALL LAYOUT

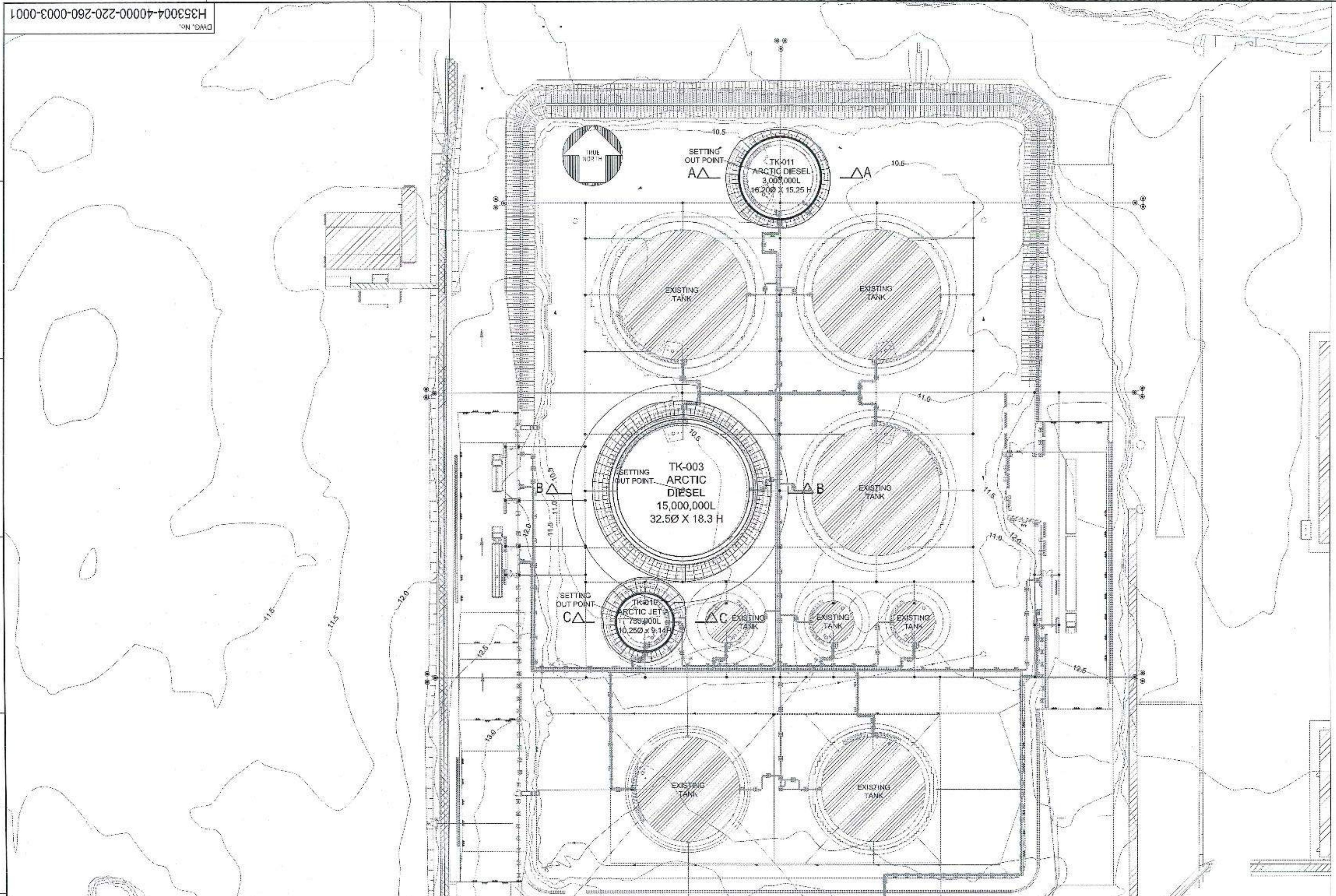
SCALE 1:750 OR AS NOTED
DWG. No. H353004-48400-240-272-0001
REV 2
SHEET SIZE: A0

DWG. No. H353004-48000-240-272-0001

Attachment 3

Milne Port Fuel Tanks 003, 010 & 011 Setting Out Earthworks

(H353004-40000-220-260-0003-0001, Rev. 0)



MATERIAL VOLUMES

CRUSHER FINES MATERIAL (-2mm)	= 160m3
FILL MATERIAL (TYPE 5)	= 3822m3
TOTAL FILL MATERIAL REQUIRED	= 3982m3
TOTAL SURFACE AREA	= 2490m2

TANK EARTHWORKS SETTING OUT POINT (CENTRE OF TANK)

TANK No.	N	E	TANK PERIMETER LEVEL (EL)
TANK 011	7976273.168	503641.393	11.95
TANK 003	7976197.158	503617.743	12.55
TANK 010	7976164.948	503608.208	12.30

NOTES:

1. LIDAR SURVEY PROVIDED BY PHOTSAT (2016)
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 0.5m.
4. FOR TYPICAL CROSS SECTIONS REFER TO DRAWING No. H353004-40000-220-273-0001-0001

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Signature [signature]
Date July 3, 2017
PERMIT NUMBER: P 512
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REGISTERED PROFESSIONAL ENGINEER
L1247
R. A. HALIM
LICENSEE
03/07/2017
NWT/NU

DRAWING No.	DRAWING TITLE
H353004-40000-220-273-0001-0001	FUEL TANK No. 3,10 & 11 DETAILS - TYPICAL SECTIONS

REFERENCE DRAWINGS

REG. PROFESSIONAL:
NAME: R. HALIM
SIGNATURE: [signature]
ENG REG NUMBER: L1247
REVISION DATE: 03/07/2017
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DESIGNER	S HALL	NR	30/06/2017
CHECKER	M BRONDANI	[signature]	30/06/2017
DESIGN COORD.	R GOOSEN	[signature]	30/06/2017
RESP. ENG.	R. HALIM	[signature]	03/07/2017
LEAD DISC. ENG.	A GROBBELAAR	[signature]	30/06/2017
AREA MANAGER	T BRUCE	[signature]	30/06/2017
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CLIENT			

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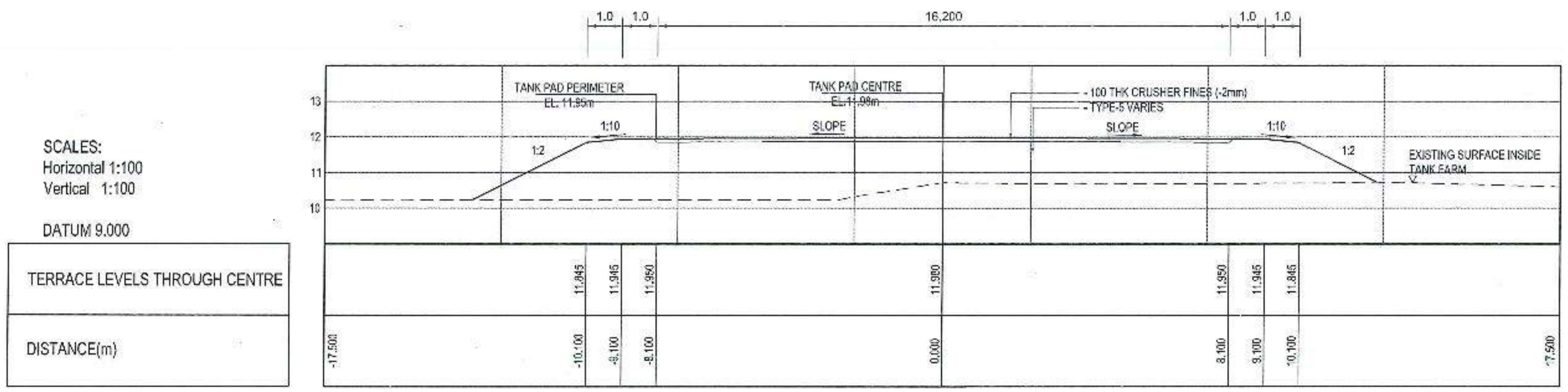
BAFFINLAND IRON MINES LP
MARY RIVER PROJECT

MILNE PORT
FUEL TANKS 003, 010 & 011 SETTING OUT EARTHWORKS

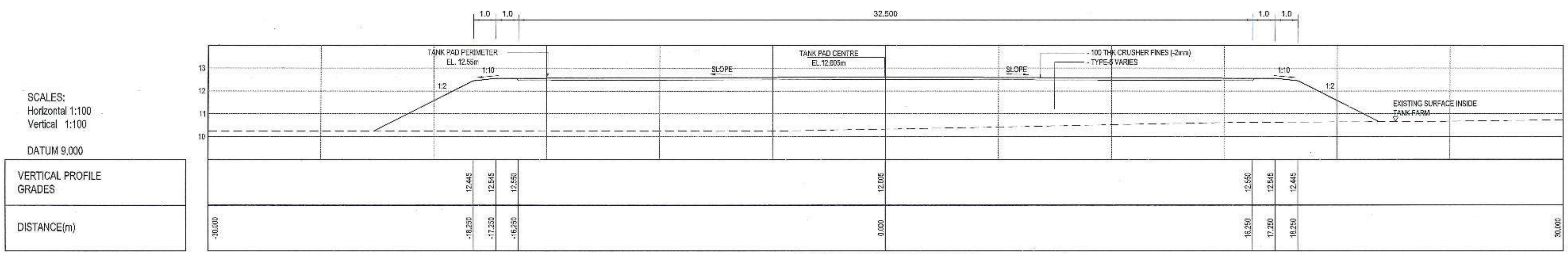
SCALE 1:500 OR AS NOTED | DWG. No. H353004-40000-220-260-0003-0001 | REV 0

SHEET SIZE: D

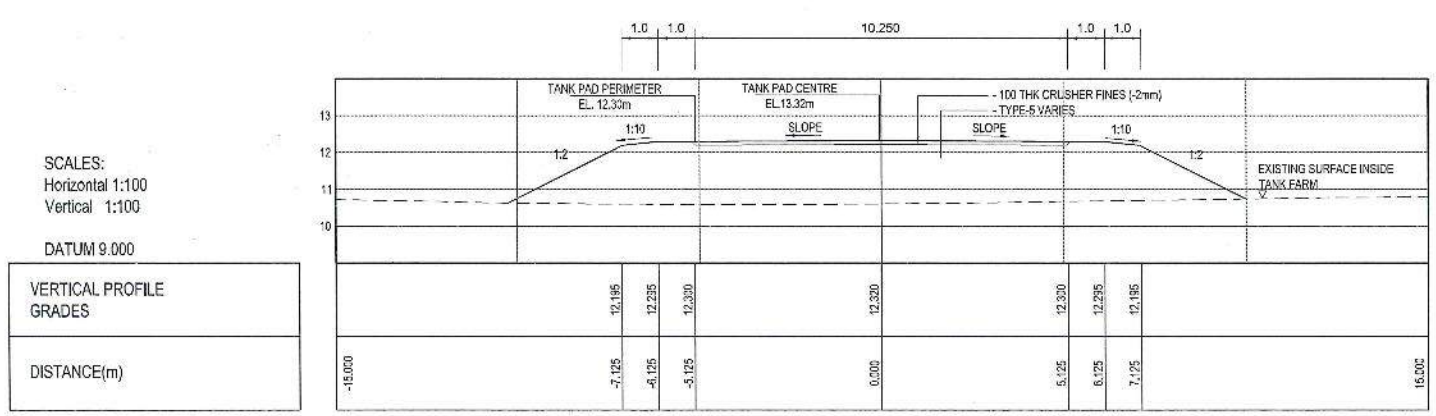
DWG. No.
H353004-40000-220-273-0001-0001



SECTION A-A THROUGH TK011 TERRACE
FROM -17.500 TO +17.500



SECTION B-B THROUGH TK003 TERRACE
FROM -30.000 TO +30.000



SECTION C-C THROUGH TK010 TERRACE
FROM -15.000 TO +15.000

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Signature [signature]
Date July 3, 2017
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REGISTERED PROFESSIONAL ENGINEER
L1247
R. A. HALIM
LICENSEE
03/07/2017
NWT/NU

DRAWING No.	DRAWING TITLE
H353004-40000-220-260-0003-0001	NEW FUEL TANKS SETTING OUT DETAILS

REFERENCE DRAWINGS

REG. PROFESSIONAL
NAME: R. HALIM
SIGNATURE: RAH
ENG REG NUMBER: L1247
REVISION DATE: 03/07/2017
ORIGINAL DATE: -

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DESIGN COORD.	R GOOSEN	[signature]	30/06/2017
RESP. ENG.	R. HALIM	RAH	03/07/2017
LEAD DISC. ENG.	A GROBBELAAR	[signature]	30/06/2017
AREA MANAGER	T BRUCE	[signature]	30/06/2017
PROJ. MANAGER	S HEINER	[signature]	30/06/2017
CLIENT			

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BAFFINLAND IRON MINES LP
MARY RIVER PROJECT

MILNE PORT
FUEL TANKS 003, 010 & 011 DETAILS
TYPICAL SECTIONS

SCALE 1:100 OR AS NOTED
DWG. No. H353004-40000-220-273-0001-0001
REV 0

SHEET SIZE: D

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Attachment 4

Port Site TM001 Fuel System Piping Layout

(H353004-48400-240-272-0002, Rev. 4)

DWG. No. H353004-48400-240-272-0002

NOTES:

1. FOR EXISTING PIPING LAYOUT REFER TO DRG: H349000-2613-60-042-0001.
2. FOR NEW CIVIL LAYOUT REFER TO DRG: H353004-00000-220-272-0020-0001.

TK-001
ARCTIC DIESEL
5 000 000 L
25.6Ø x 9.75 H

TK-002
ARCTIC DIESEL
5 000 000 L
25.6Ø x 9.75 H

TK-003
ARCTIC DIESEL
15 000 000 L
32.65Ø x 18.30 H

TK-004
ARCTIC DIESEL
12 000 000 L
31.80Ø x 15.25 H

TK-005
ARCTIC DIESEL
12 000 000 L
31.80Ø x 15.25 H

TK-006
ARCTIC DIESEL
12 000 000 L
31.80Ø x 15.25 H

TK-007
JET - A1
750 000 L

TK-008
JET - A1
750 000 L

TK-009
JET - A1
750 000 L

TK-010
JET - A1
750 000 L
10.30Ø x 10.4H

TK-011
ARCTIC DIESEL
3 000 000 L
16.25Ø x 15.25 H

TP 09
TP 10
TP 11
TP 12
TP 13
TP 14
TP 15

1 PLAN 240-270-0007
1 PLAN 240-270-0006
1 PLAN 240-270-0005
1 PLAN 240-270-0008

31200
48520
28500
10869
16302
8525
800
800
16202
13145
23860

EXISTING MARINE MANIFOLD

PLAN VIEW
SCALE 1:400

REGISTERED PROFESSIONAL ENGINEER
K.E. BUTTS
LICENSEE
L1112230
NT/NU

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DRAWING No.	DRAWING TITLE

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REVISIONS

No.	DESCRIPTION	BY	CHK'D	DATE
4	GENERAL UPDATE; ISSUED FOR CONSTRUCTION	S.S.	MM	07106117
3	MANIFOLD RELOCATION AND MARINE FUEL LINE ON HOLD			
2	TK-003 LOCATION REVISED FOR CODE COMPLANCE TO SUIT TANK SHOP DRAWINGS			
1	BACKGROUND UPDATED; ISSUED FOR CONSTRUCTION			
0	ISSUED FOR CONSTRUCTION			

HATCH

ROLE	NAME	SIGNATURE	DATE
DRAFTSPERSON	S. LEY	NR	
DESIGNER	M. MACINTYRE	NR	
CHECKER		Michael MacIntyre	07106117
DESIGN COORD.			
RESP. ENG.		K. Butts	07106117
LEAD DISC. ENG.			
ENG. MANAGER			
PROJ. MANAGER			

DRAWING APPROVAL STATUS: Approved for Construction

Baffinland

MARY RIVER PROJECT
BAFFINLAND IRON MINES LP

PORT SITE
TM001 FUEL SYSTEM
PIPING LAYOUT

SCALE	DWG. No.	REV
AS NOTED OR AS NOTED	H353004-48400-240-272-0002	4

SHEET SIZE: A1

Attachment 5

Memo: Calculations of Tank Farm Containment Capacity

(H353004-00000-240-202-0001, Rev. A)

Baffinland HATCH

Calculation Cover Sheet

Client:	Baffinland Iron Mines LP		
Project Title:	Mary River Project		
Discipline:	Mechanical		
Calculation No.:		**File No:**	**Number of Sheets:** 7

Description:

The Mary River tank farm located on Baffin Island will be modified to include the installation of one 15 ML Marine Diesel Tank, one 3ML Marine Diesel Tank and one 750,000l Jet Fuel tank. The attached calculations provide the volume required by code, and the approximate available volume within the dyke.

Category of calculation verification required *tick box* ☑ 1 ☐ 2 ☐ 3 ☐ 4

Prepared by:	Michael Doodeman	**Date:**	22 June 2017
Print Name >	(Responsible Engineer)		
Preliminary Review by:	James Cleland	**Date:**	22 June 2017
Print Name >			

Can the calculation now be released for work? ☑ Yes ☐ No **To the Client?** ☑ Yes ☐ No

Checked by: by:		**Date:**	
Print Name >			
Reviewed by:	M. MacIntyre	**Date:**	27 June 2017
Print Name >	Michael MacIntyre		
Approved by:	J. Butts	**Date:**	27 June 2017
Print Name >	Floyd Butts		

General Notes:

The referenced 3d model (Baffinlands_Dyke_Storage_17_06_27.dwg) was utilized to establish overall available dyke volume based on As-Built data. The available dyke volume is 4.73 % greater than code requirements.
Required Liquid Volume: 20,461m3
Actual Dyke Liquid Volume: 21,476m3

Revisions

Rev.	Date	Prepared by	Checked by	Approved by	Description

Superseded by Calculation No. **Date:**

Reason voided:

Milne Port Dyke Calculations to NFC Requirements

11 Tank Combined Dyke (two tier)		**353004 Earth Dyke**
Tanks 4, 5 & 6 Diameter (3 Tanks)	31.80	m
Tanks 4, 5 & 6 Height	15.3	m
Tanks 3 Diameter (1 Tank)	32.65	m
Tanks 3 Height	18.15	
Tanks 1 & 2 Diameter (2 Tanks)	25.6	m
Tanks 1 & 2 Height	9.76	m
Tanks 7, 8, 9 & 10 Diameter (4 Tanks)	10.25	
Tanks 7, 8, 9 &10 Height	9.14	
Tanks 11 Diameter (1 Tank)	16.25	
Tanks 11 Height	15.10	
Tanks 4, 5 & 6 Capacity	12,151,658	Litre
Tank 3 Capacity	15,196,126	
Tanks 1 & 2 Capacity	5,023,653	Litre
Tanks 7, 8, 9 & 10 Capacity	754,195	
Tanks 11 Capacity	3,131,652	
Total Tank Volume	67,846,841	Litre
Tank Volume	67,847	m^3
Required Volume	20,461	m^3
Number of Tanks	11	
Dyke - Overall Height	1.7	m
Dyke - Crest Width	0.6	m
Max Liquid Height	1.400	m
Freeboard	0	m

Useable volume from 3D Model	21,476 m3	
Difference	1,014.803	4.73%
	1,015	

Pad Containment Volume (m^3)							
Zone / Area	Dimension	Length of Zone	Width of Zone	Elevation	Height	Volume	Notes & Assumptions
Blue Zone	Top of Dyke	125.20	141.10	12.35	1.55	26,597.37	**Used dyke liner elevation as top. Elevation change along width of pad ignored for conservative estimate. Floor length is measured from edge of the dyke at the top of the 350 THK Type 5 fill.
	Toe/Floor of Dyke	120.20	138.60	10.80			
Green Zone	Top of Dyke	125.20	49.10	12.35	0.80	4,855.50	**Volume found by using cross section trapezoidal area across the zones.
	Toe/Floor of Dyke	123.80	48.40	11.55			

Tank Pedestal Volume & Tank Volume (Below Top of Dyke) m^3								
Tank	Tank # / Zone	Dimension	Radius	Height	Quantity	Unit Volume	Volume	Notes & Assumptions
750000 L	TK 7,8 - Blue	Top/Inner Radius	7.16	0.95	2.00	197.00	394.00	**No 150 THK Type 7 Fill as floor of pedestal. **Truncated cone volume used i.e trapezoidal cross section assumed.
		Floor/Outer Radius	9.06					
	Tank Volume	Constant Radius	5.16	0.60	2.00	50.11	100.22	
	TK 9,10 - Blue	Top/Inner Radius	7.16	1.50	2.00	356.62	713.23	** Constant floor elevations assumed for each pedestal; if the height of the pad is greater than the dyke liner height, the dyke liner height governs for height/volume calculation. ** Tank Pad Perimeter Elevation used as constant top height of truncated cone. Top radius includes distance to pad perimeter until meeting slope from base.
		Floor/Outer Radius	10.16					
	Tank Volume	Constant Radius	5.16	0.05	2.00	4.18	8.35	
3 ML	TK 11 - Blue	Top/Inner Radius	10.10	1.15	1.00	458.84	458.84	
		Floor/Outer Radius	12.40					
	Tank Volume	Constant Radius	8.10	0.40	4.00	82.45	329.79	
5 ML	TK 1,2 - Green	Top/Inner Radius	14.01	0.80	1.00	555.66	555.66	
		Floor/Outer Radius	15.71					
	Tank Volume	Constant Radius	12.80					
12 ML	TK 4 - Blue	Top/Inner Radius	18.00	1.45	1.00	1,726.48	1,726.48	
		Floor/Outer Radius	20.90					
	Tank Volume	Constant Radius	16.00	0.10	1.00	80.42	80.42	
	TK 5,6 - Blue	Top/Inner Radius	18.00	1.15	2.00	1,326.50	2,653.00	
		Floor/Outer Radius	20.30					
	Tank Volume	Constant Radius	16.00	0.40	2.00	321.70	643.40	
15 ML	TK 3 - Blue	Top/Inner Radius	18.25	1.55	1.00	1,952.76	1,952.76	
		Floor/Outer Radius	21.75					
	Tank Volume	Constant Radius	16.25					

Other Volumes (m^3)			
Zone / Area	Dimension	Volume	Notes & Assumptions
Access Ramp	Whole Ramp	418.93	**See attatched hand calculation for details & assumptions. Note this calculation is very rough, likely within 20% of actual value (doesn't take into account overlapping volume with dyke i.e conservative estimate)

Diesel Volume (L)	Diesel Volume w/o 15ML (biggest tank)	Minimum Volume Needed	Spill Volume Available	
			m^3	L
67,000,000.00	52,000,000.00	20,200,000.00	**21,417.78**	**21,417,782.47**

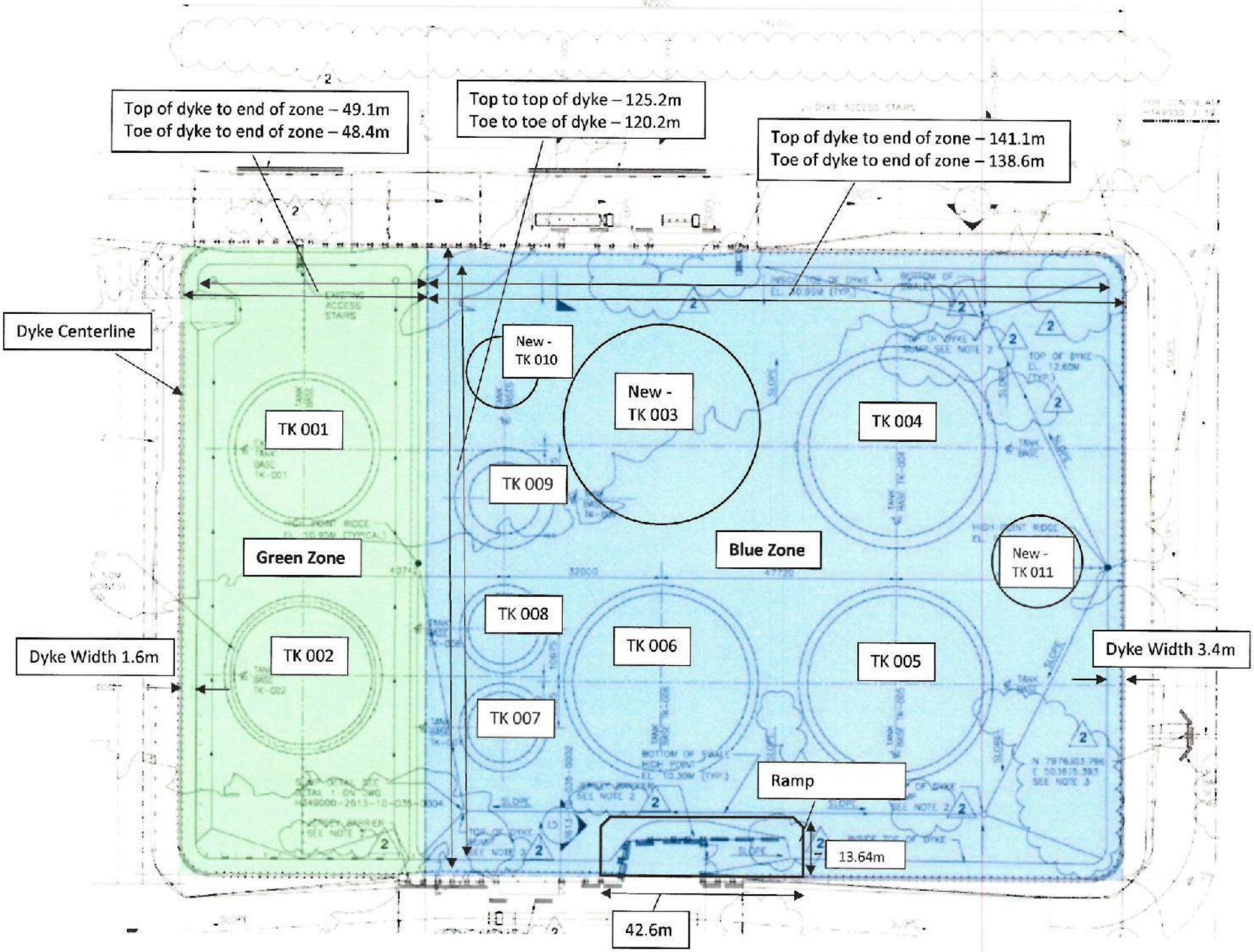
Spill Volume Available > Minimum Volume Needed

Pad Containment Volume (m^3)							
Zone / Area	Dimension	Length of Zone	Width of Zone	Elevation	Height	Volume	Notes & Assumptions
Blue Zone	Top of Dyke	125.20	141.10	12.35	1.55	26,597.37	**Used dyke liner elevation as top. Elevation change along width of pad ignored for conservative estimate. Floor length is measured from edge of the dyke at the top of the 350 THK Type 5 fill.
	Toe/Floor of Dyke	120.20	138.60	10.80			
Green Zone	Top of Dyke	125.20	49.10	12.35	0.80	4,855.50	**Volume found by using cross section trapezoidal area across the zones.
	Toe/Floor of Dyke	123.80	48.40	11.55			

Tank Pedestal Volume & Tank Volume (Below Top of Dyke) m^3								
Tank	Tank # / Zone	Dimension	Radius	Height	Quantity	Unit Volume	Volume	Notes & Assumptions
750000 L	TK 7,8 - Blue	Top/Inner Radius	7.16	0.95	2.00	197.00	394.00	**No 150 THK Type 7 Fill as floor of pedestal. **Truncated cone volume used i.e trapezoidal cross section assumed. ** Constant floor elevations assumed for each pedestal; if the height of the pad is greater than the dyke liner height, the dyke liner height governs for height/volume calculation. ** Tank Pad Perimeter Elevation used as constant top height of truncated cone. Top radius includes distance to pad perimeter until meeting slope from base.
		Floor/Outer Radius	9.06					
	Tank Volume	Constant Radius	5.16	0.60	2.00	50.11	100.22	
	TK 9,10 - Blue	Top/Inner Radius	7.16	1.50	2.00	356.62	713.23	
		Floor/Outer Radius	10.16					
	Tank Volume	Constant Radius	5.16	0.05	2.00	4.18	8.35	
3 ML	TK 11 - Blue	Top/Inner Radius	10.10	1.15	1.00	458.84	458.84	
		Floor/Outer Radius	12.40					
	Tank Volume	Constant Radius	8.10	0.40	4.00	82.45	329.79	
5 ML	TK 1,2 - Green	Top/Inner Radius	14.01	0.80	1.00	555.66	555.66	
		Floor/Outer Radius	15.71					
	Tank Volume	Constant Radius	12.80					
12 ML	TK 4 - Blue	Top/Inner Radius	18.00	1.45	1.00	1,726.48	1,726.48	
		Floor/Outer Radius	20.90					
	Tank Volume	Constant Radius	16.00	0.10	1.00	80.42	80.42	
	TK 5,6 - Blue	Top/Inner Radius	18.00	1.15	2.00	1,326.50	2,653.00	
		Floor/Outer Radius	20.30					
	Tank Volume	Constant Radius	16.00	0.40	2.00	321.70	643.40	
15 ML	TK 3 - Blue	Top/Inner Radius	18.25	1.55	1.00	1,952.76	1,952.76	
		Floor/Outer Radius	21.75					
	Tank Volume	Constant Radius	16.25					

Other Volumes (m^3)			
Zone / Area	Dimension	Volume	Notes & Assumptions
Access Ramp	Whole Ramp	418.93	**See attatched hand calculation for details & assumptions. Note this calculation is very rough, likely within 20% of actual value (doesn't take into account overlapping volume with dyke i.e conservative estimate)

Diesel Volume (L)	Diesel Volume w/o 15ML (biggest tank)	Minimum Volume Needed	Spill Volume Available	
			m^3	L
67,000,000.00	52,000,000.00	20,200,000.00	**21,417.78**	**21,417,782.47**


Top of dyke to end of zone – 49.1m
Toe of dyke to end of zone – 48.4m
Top to top of dyke – 125.2m
Toe to toe of dyke – 120.2m
Top of dyke to end of zone – 141.1m
Toe of dyke to end of zone – 138.6m
Dyke Centerline
New - TK 010
New - TK 003
TK 001
TK 004
TK 009
Green Zone
Blue Zone
New - TK 011
TK 008
TK 006
TK 005
TK 002
Dyke Width 1.6m
Dyke Width 3.4m
TK 007
Ramp
13.64m
42.6m

HATCH

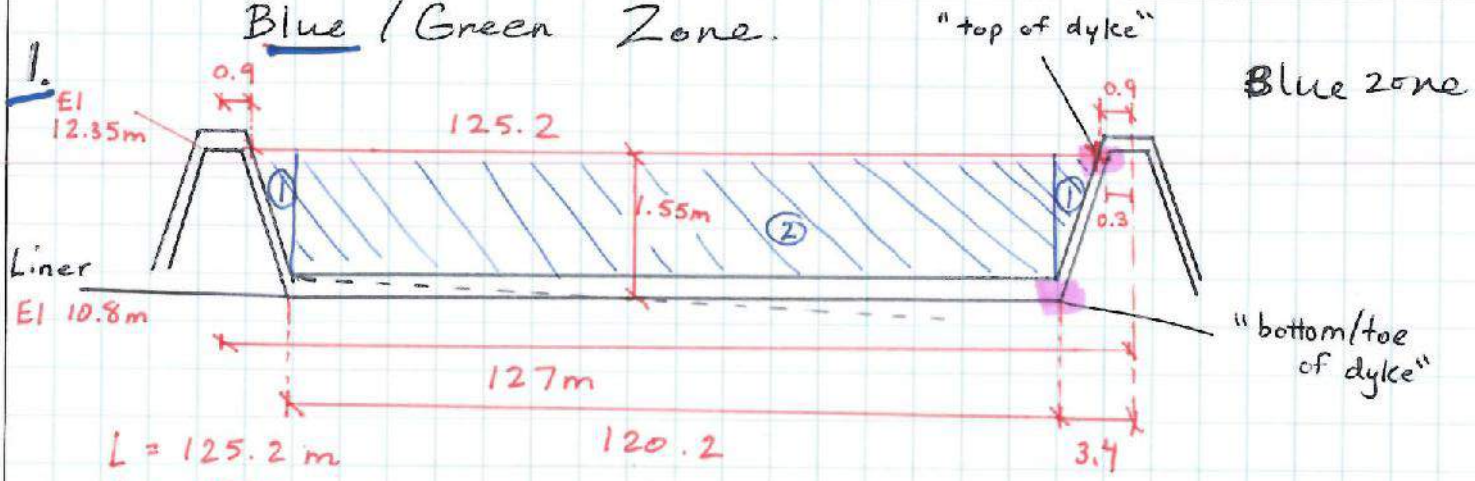
CALCULATION SHEET

SHEET NO. 1 OF 3

DESCRIPTION	PROJECT NO	MADE BY	CHECKED BY
"Fuel Pad Containment Volume"	"H353004"	"MD" DATE	DATE

Blue / Green Zone.

1.



$L = 125.2\ m$

$h = 1.55m$

width top = 141.1m

width floor = 138.6m

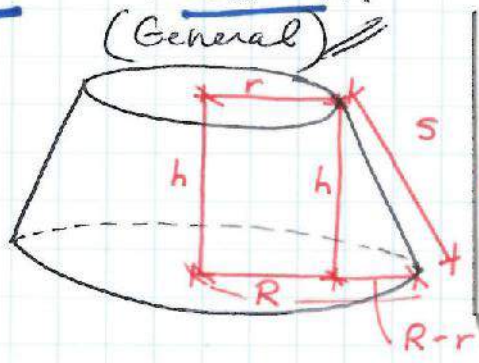
$V = A \times l_{avg}$

$= (① + ②)\, l_{avg}$

$= \left[\frac{1.55(125.2-120.2)}{2} + 120.2(1.55)\right]\left(\frac{141.1+138.6}{2}\right)$

$= 26,597.37\ m^3$

2. Tank or (General)



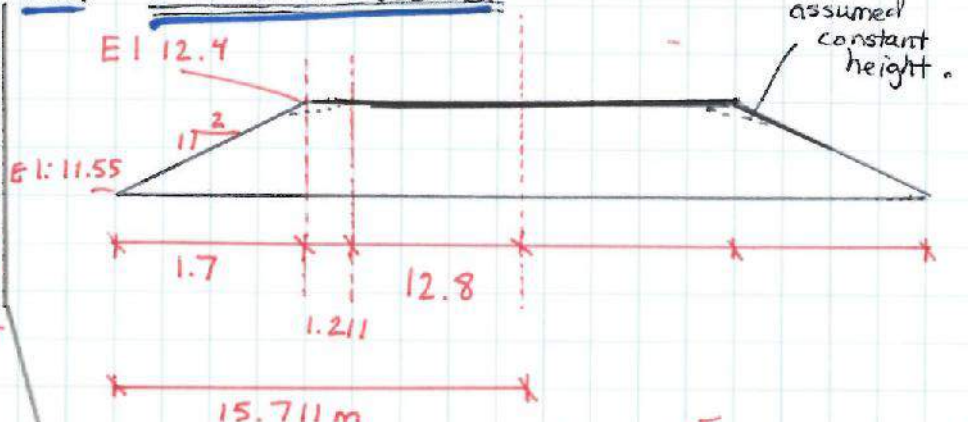
$S = \sqrt{(R-r)^2+h^2}$

LAT S.A. $= \pi(R+r)S$

~~Fo~~

$V = \frac{\pi h}{3}\left[Rr + R^2 + r^2\right]$

2a. 5 ML Pedestal



$R = 15.711m$

$r = 14.01m$

Since El > 12.35

use 12.35 as top elevation

& 11.55 as floor elevation

$\therefore h = 0.8$

$\Rightarrow V = \frac{\pi(0.8)}{3}\left[(15.711)(14.01) + 15.711^2 + 14.01^2\right]$

$= 555.62\ m^3$

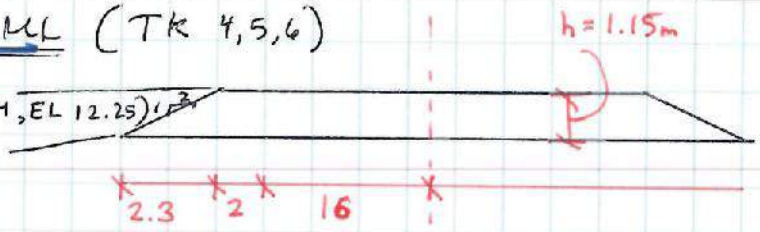
HATCH

CALCULATION SHEET

SHEET NO. 2 OF 3

DESCRIPTION	PROJECT NO	MADE BY	CHECKED BY
" "	" "	" "	
		DATE	DATE

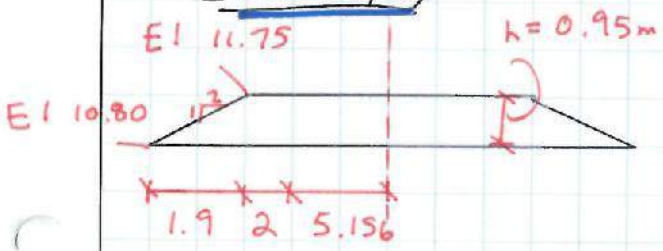
2b 3-12 ML (TK 4,5,6)



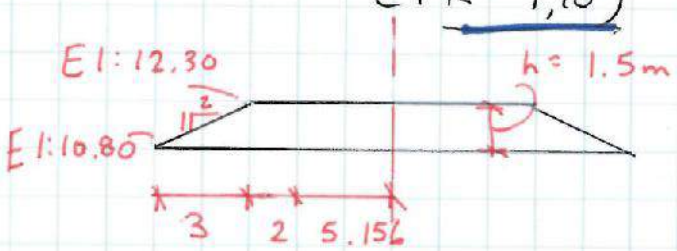
R = 20.3
r = 18

R = 20.90
r = 18

2c ~~4~~ x750 kL

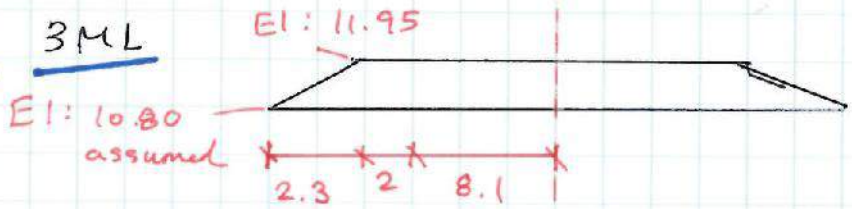


R = 9.056m
r = 7.156m



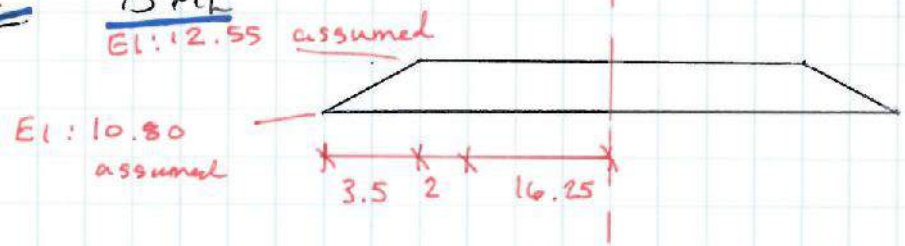
R = 10.156 m
r = 7.156 m

2d 3ML



R = 10.1 m
r = 12.4 m

2e 15 ML



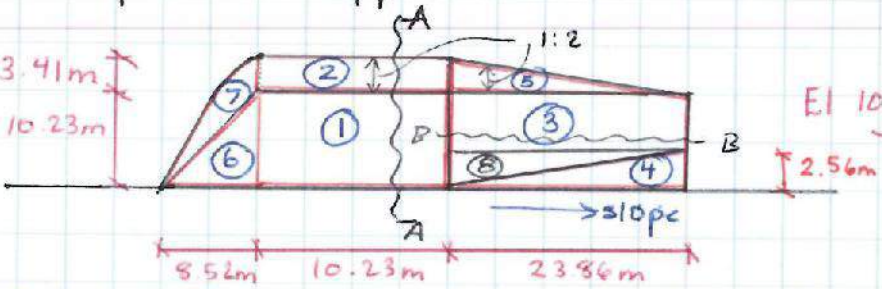
R = 21.75m
r = 18.25m

HATCH | CALCULATION SHEET | SHEET NO. 3 OF 3

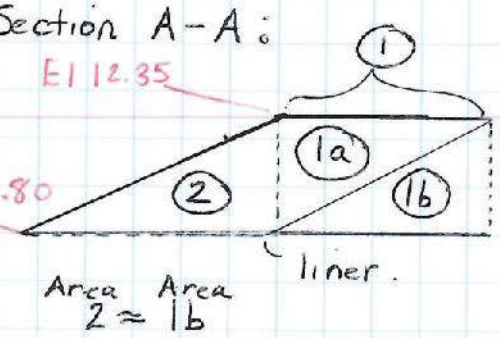
DESCRIPTION | PROJECT NO | MADE BY / DATE | CHECKED BY / DATE

3 Ramp

Top View Approximated



Section A-A:



Area 2 ≈ Area 1b

* Since (1b) already calculated with dyke volume consideration & since (2) ≈ (1b) ∴ total volume of (1) & (2) can be approximated by (1a) + (1b)

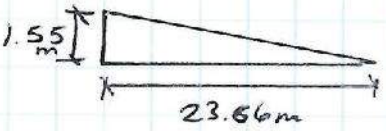
Volume (1) & (2)

$V = 10.23m(10.23m)(12.35-10.8) = 162.21m^3$.

* Assume (4) is at top elevation ~~∴ (4) ≈ (5)~~ ∴ let's assume full height (4) ≈ (4) + (8) + (5)

~~Slope~~ : B : B

Volume (4), (5), (8)



$V = \left[\frac{1}{2}(23.86)(2.56)\right]1.55$

$= 47.34m^3$.

Total Volume $= \sum_{i=1}^{8} V_i$

$= 418.93m^3$.

Volume (3) using section B : B :

$V = \frac{1}{2}(1.55)(23.86)(10.23-2.56)$

$= 141.83m^3$

Volume (6) (7) Since overestimate used for ~~4, 5, 8~~, neglect (7).

So (6):

$V = \frac{1}{2}(8.52)(10.23)(1.55)$

$= 67.55m^3$.

Attachment 6

Construction Methodology Milne Inlet Fuel Storage Facility System

(H353004-40000-400-050-0002, Rev. 0)

Plan

Construction Methodology Milne Inlet Fuel Storage Facility

2017-07-11	0	Approved for Use	L Langlois	T Bruce	S Heiner	M Weaver
Date	Rev.	Status	Prepared By	Checked By	Approved By	Approved By
			HATCH			Employer

Construction Methodology – Milne Inlet Fuel Storage Facility

1. Overview

Capacity increase of the current Milne Inlet Fuel Storage Facility (Fuel Storage Facility) is required to ensure sufficient fuel is available to achieve full production (4.2 Mtpa) and execute operational plans for the upcoming year from September 2017 until July 2018.

2. Scope of Work

The scope of work encompasses the construction and placement of three (3) additional fuel tanks at the Milne Inlet Fuel Storage Facility. The 3 fuel tanks to be added to the Fuel Storage Facility include: a 15M litre diesel fuel tank, a 3M litre diesel fuel tank and a 750K litre Jet-A1 fuel tank along with all associated piping.

All three (3) tanks will be placed within the existing containment of the Fuel Storage Facility and in the specific positions as shown in Hatch document: Milne Port Fuel Tanks 003, 010 & 011 Setting Earthworks (H353004-40000-220-260-0003-0001). Tanks 003 and 011 will be fabricated onsite. Tank 010 will arrive to site prefabricated and will be placed in the Fuel Storage Facility using onsite equipment (cranes).

In addition, one (1) existing piping sub-system will need to be relocated and three (3) new piping sub-systems will need to be installed within the Fuel Storage Facility's containment in order to tie in the three (3) new tanks into the existing piping system and ultimately into the existing Fuel Storage Facility's fuel distribution module(s). Moreover, the incomplete diesel piping system between the Fuel Storage Facility and the Milne Port diesel generators will be completed.

Tag Number	Description	Fuel Stored	Diameter	Height
TK-003	15,000,000 Litre Tank	Arctic Diesel	32.50m	18.30m
TK-010	750,000 Litre tank	Jet A-1	10.25m	9.14m
TK-011	3,000,000 Litre Tank	Arctic Diesel	16.20m	15.25m

3. Planning, Coordination & Security

Perimeter fencing will be maintained throughout the execution of the scope of work. A section of the existing perimeter fence near the equipment access ramp, as shown in Figure 1, will be removed and replaced with a similar height and type fencing which can be opened and closed. This will allow the required mobile equipment to access the Fuel Storage Facility during construction. This equipment access route (gate) will be kept locked when not in use, with care and control of the keys to be maintained by the Construction Manager, the HS&E lead and the responsible Baffinland Operations person designated as the authority. Under no

circumstances will other personnel have access to the keys for this equipment access route (gate).

All signs and lighting will be maintained throughout the execution of the scope of work. All construction personnel will access the construction area through the existing man gates.

An authorized person as designated by the responsible Baffinland Operations department will deliver an area specific orientation program. All personnel involved with the scope of work will be required to attend before they can participate with construction. Should any additional training requirements be required, all relevant personnel will be required to attend. The identity of these authorized personnel will be maintained on a registry which will be held by the Contractor's HS&E lead.

Due to the nature of the scope of work and its execution methodology, the entire Fuel Storage Facility will be considered a Hot Work Zone. At the start of each shift, a JHA (Job Hazard Analysis) will be developed with the involvement of all relevant personnel. A Hot Work Permit process will be approved and implemented in coordination with the Baffinland Health & Safety department and the relevant contractors. A Hot Work Permit will be required to start work at the beginning of each shift. The Contractor's H&SE lead will be present and will ensure that all personnel participating in the JHA have signed the document, are identified on the hot work permit and are also listed on the authorized personnel registry.

The existing Baffinland card identification system will be implemented for this scope of work. All personnel, will participate as required in the scheduled security drills and security exercises.

Upon completion of the scope of work, the Fuel Storage Facility will be reinstated by installing the facility's original perimeter fencing.

Targeted planning sessions will be held between relevant Baffinland Operations personnel and the responsible contractors to develop strategies and coordinate activities for the scope of work and subsequent fuel deliveries (sealifts).

Reference(s):
Milne Inlet Marine Facility Security Plan (BAF-PH1-310-P16-0001, Rev. 7)
Milne Port Fuel Tanks 003, 010 & 011 Setting Earthworks
(H353004-40000-220-260-0003-0001)

4. Construction Methodology

4.1 Civil

Construction of the tanks will commence upon completion of the decontamination activities within the Fuel Storage Facility's containment. Decontamination activities will consist of treating hydrocarbon impacted storm water within the Fuel Storage Facility's containment using the onsite mobile Oily Water Treatment System operated by Baffinland.

The contract for the mechanical scope of work has been awarded to an experienced tank fabricating contractor (Mechanical Contractor) that has substantial northern experience and significant previous experience constructing tanks at the Milne Inlet Fuel Storage Facility.

Upon completion of the decontamination activities, a small contingent of the Mechanical Contractor's personnel will be mobilized for a brief period to reroute the existing marine receiving piping system which is located inside the facility's containment area. This relocation is required since the current route of the piping system is in the location planned for the new 3M litre diesel tank.

A civil contract has been awarded to a contractor (Civil Contactor) with significant previous experience onsite.

Prior to the execution of any earthworks related activities, a topographical survey will be undertaken to determine the elevation of the existing contours within the Fuel Storage Facility's containment. This activity will assist in safeguarding the integrity of the underlying HDPE liner when the placed materials (i.e., access ramp, crane pads) are recovered.

Along the west side of the Fuel Storage Facility, a temporary access ramp, as shown in Figure 1, will be built on top of the existing berm using fine material and configured in a diagonal direction to enable entry of light equipment such as a tracked Skid Steer and crane. This temporary access ramp will facilitate the access and egress of equipment, materials, and consumables during the construction of the tanks and associated piping. This overbuild approach will ensure that mobile equipment used for the scope of work do not come in contact with any hydrocarbon impacted soils present within the Fuel Storage Facility's containment and do not transfer the impacted soils outside the boundaries of the existing Fuel Storage Facility's containment.

Refer to Section 4.5 for details on the decommissioning and recovery of the temporary access ramp and crane pads.

Reference:
Milne Inlet Marine Facility Security Plan (BAF-PH1-310-P16-0001, Rev 7)
New foundations (pedestals) will be constructed of fine material for all three (3) tanks, as shown in Hatch document: Milne Port Fuel Tanks 003, 010 & 011 Setting Earthworks (H353004-40000-220-260-0003-0001). No heavy, steel tracked equipment will be utilized within the Fuel Storage Facility's containment and all material will be transported into the

facility's containment using rubber tired loaders and rubber tracked Skid Steers. The tank foundation design (pedestal) will be constructed of the same material and in the same configuration as the Fuel Storage Facility's existing tanks.

Determined by the capacity of the cranes being used, 2 locations, as shown in Figure 1, have been identified for the crane position and pads at the Fuel Storage Facility. Construction of the crane pads will involve the placement of fine material followed by the placement of wooden crane pads on top of the fine material to ensure the weight is distributed evenly and consistently. The selected locations for the crane positions and pads will enable a 360° swing radius and enable the crane to pick up and place materials within the Fuel Storage Facility.

References:
Milne Port Fuel Tanks 003, 010 & 011 Setting Earthworks
(H353004-40000-220-260-0003-0001)

4.2 Plate Work

For all hot work (i.e., welding) associated with the Fuel Storage Facility, a Hot Work Policy (referenced below) will be instated, and all relevant procedures followed.

Upon completion of the civil scope of work the Mechanical Contractor will be mobilized to the Fuel Storage Facility to begin tank construction of Tanks 003 and 011. All associated equipment such as welding units, compressors and tooling will be set up. Plate work will commence with the placement and tack welding of the floor plates. Upon placement of the floor, the installation and fitment of the first course shell section will occur. In parallel, the complete fabrication of the floor will be ongoing. All shell plate welding will start with the vertical joints and then, upon completion, will be fitted and welded to the floor.

The erection of each course will start with the fitting and welding of all external vertical welds followed by the welding of the same vertical welds on the inside of the tank. Upon completion of the vertical welds, the horizontal welds will be completed in the same sequence, starting with the external welds and ending with the internal welds. Each course will follow this same sequence.

Upon completion of the shell section, internal columns and roof purlins will be installed and bolted for alignment and welded followed by the fitment and welding of the roof section.

Phased array ultrasonic testing will be ongoing throughout the construction process as well as the installation of the prefabricated nozzles.

During the tank construction and placement, the fabrication and installation of the external circular staircase, complete with hand rails, and the roof top handrails and walkways will be completed. All material will be constructed of pre-galvanized steel.

Taking into account labour densities and respecting the crane hoisting location and activities, installation of concrete pipe supports and pre-spooled piping will be completed during the construction of the tanks.

4.3 Electrical

The earth grounding system for the new tanks will be similar to the Fuel Storage Facility's existing system. As-built documentation for the Fuel Storage Facility will be consulted to determine the location of the buried grounding system. Once the location is determined, the existing buried grounding system will be manually exposed with shovels. The new system will be joined with the existing grounding system with CADWELD connections and hand covered with shovels to reinstate.

4.4 Miscellaneous Piping

The diesel piping system that runs from the Fuel Storage Facility to the Milne Port diesel generators was not completed during the construction of the Fuel Storage Facility in 2013. Currently the diesel piping system exits the Fuel Storage Facility on its south side over a berm via a pipe bridge and follows a previously constructed pipe bench but terminates short of the Milne Port diesel generators. The diesel piping system, consisting of 2" diameter piping, will be extended to the Milne Port diesel generators and commissioned.

4.5 Completion

Upon completing the scope of work detailed above, all material previously placed in the Fuel Storage Facility for the crane pads and access ramp will be recovered. Recovered material will be assessed for hydrocarbon contamination. Material determined to be contaminated will be transferred to the Milne Port Landfarm Facility or transferred into Quatrex bags for shipment offsite for proper disposal at a licensed waste facility.

If during execution, any mobile equipment comes in contact with hydrocarbon impacted soils contained in the Fuel Storage Facility's containment, contaminated components (i.e., wheels, tracks) will be wash-down within the Fuel Storage Facility's containment prior to demobilization.

5. Reference Documents

Table 5-1: Reference Documents

Document Identification	Document Title	Author
BAF-PH1-310-P16-0001, Rev.7	***Milne Inlet Marine Facility Security Plan***	***Baffinland***
H353004-40000-220-260-0003-0001	***Milne Port Fuel Tanks 003, 010 & 011 Setting Earthworks***	***Hatch***

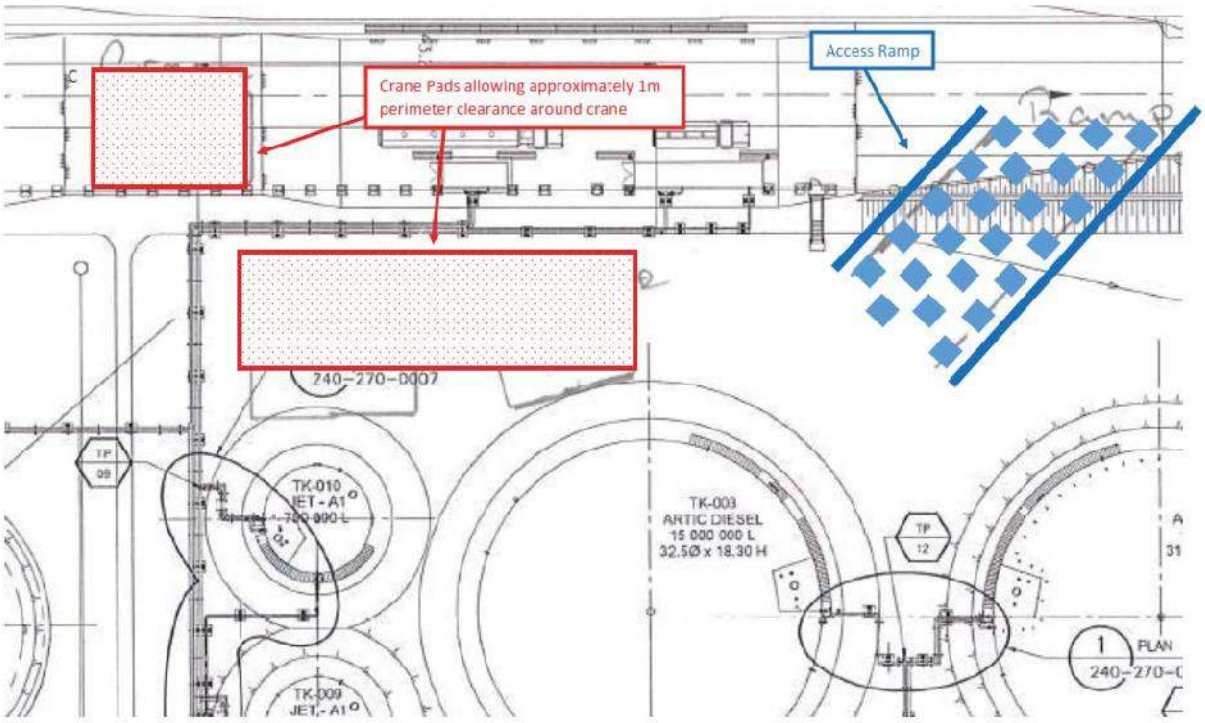


Figure 1: Crane Pad Locations and Access Ramp