



August 22, 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
(Revised 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 revised modification that involves increasing the capacity of the Milne Inlet Fuel Storage Facility (Fuel Storage Facility) at Mary River Project's Milne Port location. The revised modification involves the addition of a 3 MI and a 0.75 MI tank to the Fuel Storage Facility.

Background

On July 19, 2017, Baffinland Iron Mines Corporation (Baffinland) submitted a Request for Modification to the NWB to increase the Arctic Diesel (P50) and Jet A-1 capacity of the Fuel Storage Facility by 18 MI and 0.75 MI, respectively. On August 8, 2017, Baffinland received comments from Indigenous and Northern Affairs Canada (INAC) on the proposed capacity increase stating that the proposed capacity increase was outside the scope of the Project originally assessed by the Nunavut Impact Review Board (NIRB) and therefore INAC was of the opinion that the proposed capacity increase was not consistent with the Project Certificate issued for the Project by the NIRB. To address INAC's comments, Baffinland submitted a request to NIRB on August 11, 2017 to review Baffinland's original Request for Modification to determine if the proposed capacity increase to the Fuel Storage Facility is consistent with the Project Certificate.

Modification Request

Due to the late timing of the request, the limited shipping season at the Project and the urgent need for increased fuel capacity to support operations in 2018, Baffinland has decided to withdrawal its original Request for Modification and submit a scoped down revision of the Request for Modification to the

NWB. The revised modification removes the 15 MI Arctic Diesel (P50) tank included in Baffinland's original submission and proposes the addition of a 3 MI and a 0.75 MI tank to the Fuel Storage Facility at Milne Port. These two (2) additional tanks, included in Baffinland's original submission, will ensure the Project has enough fuel onsite to support the increased ore haulage associated with a 4.2 Mtpa operation in 2018. It is Baffinland's understanding that this scoped down Request for Modification should be justifiable under the existing conditions of the Project Certificate and should allow for a determination by the NWB without the need for additional public review.

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. Table 1 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 revised tank volume increase proposed in this Request for Modification. As shown in Table 1, the proposed modification increases the Fuel Storage Facility's overall fuel capacity to a volume below the overall fuel capacity (Arctic Diesel and Jet A-1) required for a 4.2 Mtpa Early Revenue Phase operation and therefore should address INAC's comments on Baffinland's original Request for Modification.

Table 1: Proposed Fuel Storage Capacity Increase at Milne Port

Fuel Type	ERP Estimate (3.5 Mtpa)	Increased ERP (4.2 Mtpa)	Current Tank Volume	Proposed Tank Volume
Arctic Diesel	46 MI	55.2 MI	46 MI	49 MI
Jet A-1	1.5 MI	1.8 MI	2.25 MI	3 MI ¹
Total	47.5 MI	57 MI	48.25 MI	52 MI

Both tanks will be placed within the existing containment of the Fuel Storage Facility. As per CCME guidelines, an assessment of the Fuel Storage Facility's secondary containment, provided in Attachment 6, confirmed that there was sufficient secondary containment for Baffinland's original Request for Modification. Based on this original assessment, the Fuel Storage Facility's existing containment will not need to be modified and will have ample secondary containment to accommodate the two (2) additional fuel tanks proposed in this revised Request for Modification.

¹ 0.75 MI tank may be used for Arctic Diesel (P50) instead of Jet A-1, depending on operational requirements
 2275 Upper Middle Road East, Suite 300 | Oakville, ON, Canada L6H 0C3
 Main: 416.364.8820 | Fax: 416.364.0193 | www.baffinland.com

Under the Oil Handling Facilities Standards issued by the Canadian Coast Guard², the proposed fuel capacity increase (addition of 3.75 MI) will not change the Fuel Storage Facility's Level 1 classification since Baffinland does not plan on increasing the rate at which fuel is transferred at the Fuel Storage Facility. As a result, Baffinland's spill response supplies and procedures, as outlined in Baffinland's Oil Pollution Emergency Plan for the Milne Inlet Fuel Storage Facility (BAF-PH1-830-P16-0013), are adequate and will meet the requirements set out in Section 2 of the Oil Handling Facilities Standards following the proposed fuel capacity increase.

The proposed modification to the Milne Inlet Fuel Storage Facility will occur within the Project's Development Area. Financial security for the works outlined in Baffinland's 2017 Work Plan Addendum, including the two (2) proposed fuel tanks, was posted by the Qikiqtani Inuit Association (QIA) on August 7, 2017.

To expedite the Nunavut Impact Review Board's (NIRB) review of this submission and determination on whether it is consistent with the Project Certificate (Project Certificate 005 – Amend. 1) issued for the Mary River Project, Baffinland will submit a review request to the NIRB in parallel with this submission to the NWB.

Details of the modification are provided in the subsections below and in the attached documentation, including issued-for-construction drawings, engineering documentation, construction methodology, and environmental mitigation measures to be implemented during construction.

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

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

The proposed capacity increase of the Milne Inlet Fuel Storage Facility involves the construction and placement of two (2) additional fuel tanks. Both tanks will be placed within the existing containment of the Fuel Storage Facility and are presented in Table 2 below.

² Oil Handling Facilities Standards (TP 12402), Canadian Coast Guard, 1995
2275 Upper Middle Road East, Suite 300 | Oakville, ON, Canada L6H 0C3
Main: 416.364.8820 | Fax: 416.364.0193 | www.baffinland.com

Table 2 – Proposed Additional Fuel Tanks

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

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 & 5 show the earthworks for the additional fuel tanks and the Facility's overall piping layout. As mentioned above, Attachment 6 confirms the ability of the Facility's existing secondary containment to accommodate the additional fuel tanks. Attachment 7 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

Both 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 Table 3 below.

Table 3 – Setting Out Points for Proposed Tanks

Tag Number	UTM (NAD83)		Tank Perimeter Levels (m.a.s.l.)
	Northing	Easting	
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 two (2) 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 two (2) 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 their review of this request 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 and 5 of this submission.

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:

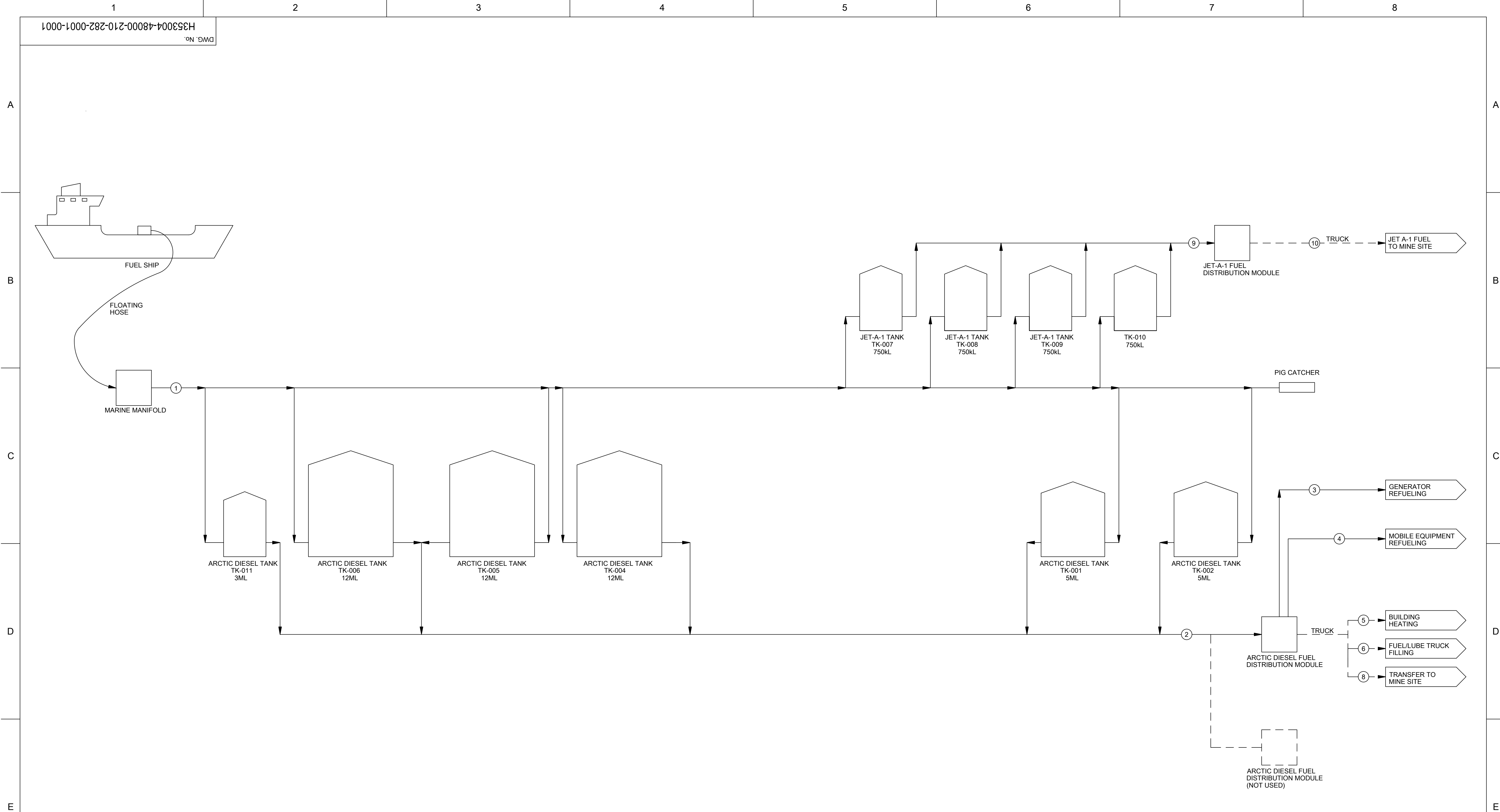
- Attachment 1: Port Site TM001 Fuel System Process Flow Diagram
(H353004-48000-210-282-0001-0001, Rev. 3)
- Attachment 2: Port Site TM001 Fuel System Overall Layout
(H353004-48400-240-272-0003, Rev. 0)
- Attachment 3: Port Site TM001 Fuel System Piping Layout (H353004-48400-240-272-0002, Rev. 5)
- Attachment 4: Milne Port Fuel Tanks 010 & 011 Setting Out Earthworks
(H353004-40000-220-260-0003-0001, Rev. 1)
- Attachment 5: Milne Port Fuel Tanks 010 & 011 Details Typical Sections
(H353004-40000-220-273-0001-0001, Rev. 1)
- Attachment 6: Memo: Calculations of Tank Farm Containment Capacity
(H353004-00000-240-202-0001, Rev. A)
- Attachment 7: Construction Methodology Milne Inlet Fuel Storage Facility System
(H353004-40000-400-050-0002, Rev. 1)

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 Grzegorzczuk, Andrew Vermeer (Baffinland)

Attachment 1

Port Site TM001 Fuel System Process Flow Diagram

(H353004-48000-210-282-0001-0001, Rev. 3)



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

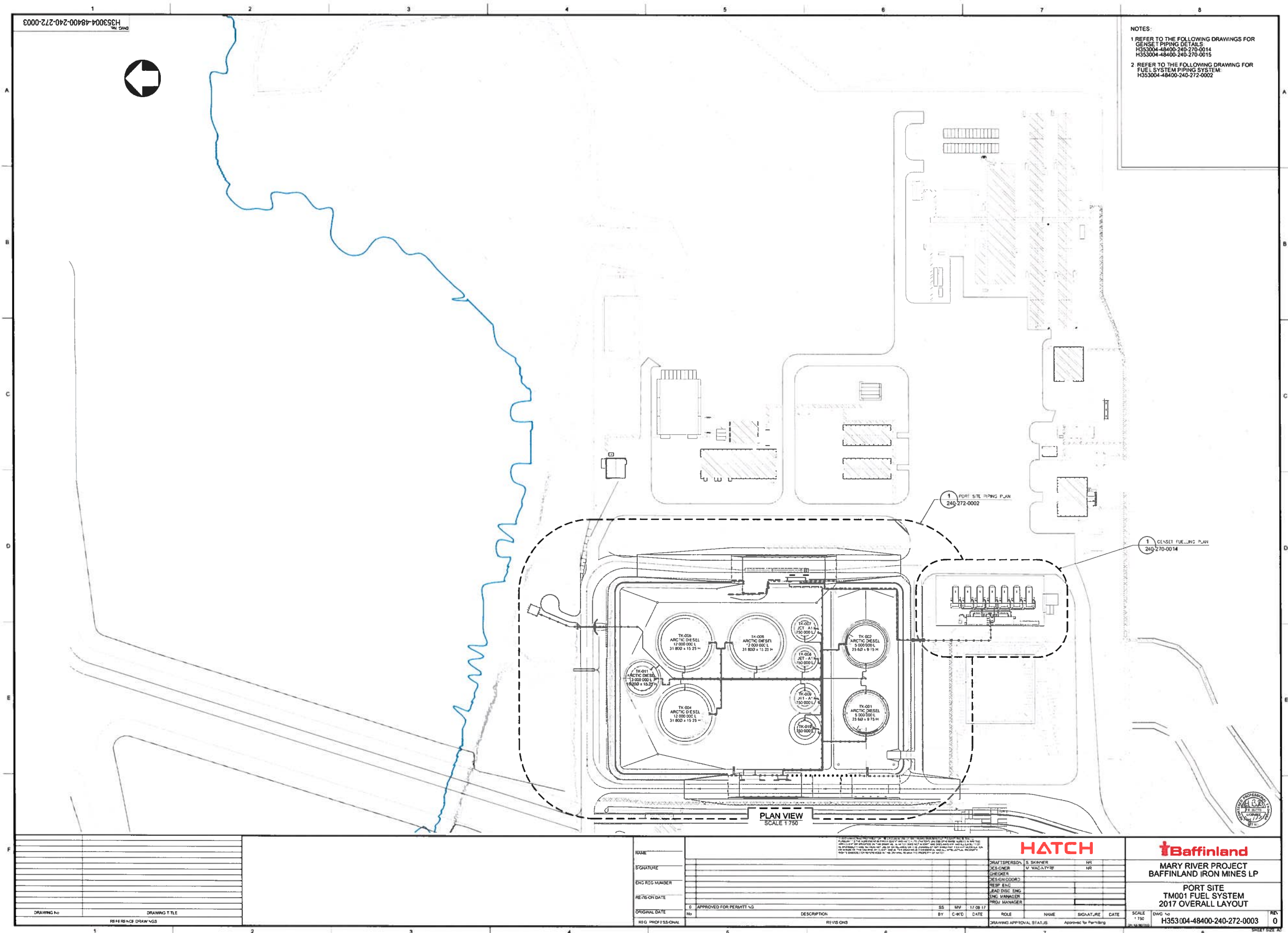


		Reserved space for Issue Reason stamp applied by Document Control	THIS DRAWING WAS PREPARED FOR THE EXCLUSIVE USE OF BAFFINLAND IRON MINES LP ("CLIENT") AND IS ISSUED PURSUANT TO THE AGREEMENT BETWEEN CLIENT AND HATCH LTD. ("HATCH"). UNLESS OTHERWISE AGREED IN WRITING WITH CLIENT OR SPECIFIED ON THIS DRAWING, HATCH DOES NOT ACCEPT AND DISCLAIMS ANY AND ALL LIABILITY OR RESPONSIBILITY ARISING FROM ANY USE OF OR RELIANCE ON THIS DRAWING BY ANY THIRD PARTY OR ANY MODIFICATION OR MISUSE OF THIS DRAWING BY CLIENT, AND (B) THIS DRAWING IS CONFIDENTIAL AND ALL INTELLECTUAL PROPERTY RIGHTS EMBODIED OR REFERENCED IN THIS DRAWING REMAIN THE PROPERTY OF HATCH.				HATCH											
	NAME																	
	SIGNATURE										DRAFTSPERSON	J. MCNEIL		17/08/17	MARY RIVER PROJECT BAFFINLAND IRON MINES LP			
											DESIGNER	M. MACINTYRE		17/08/17				
											CHECKER	S. SKINNER		17/08/17				
	ENG REG NUMBER									DESIGN COORD.	M. MACINTYRE		17/08/17	PORT SITE TM001 FUEL SYSTEM PROCESS FLOW DIAGRAM				
										RESP. ENG.	F. BUTTS		17/08/17					
										LEAD DISC. ENG.	F. BUTTS		17/08/17					
	REVISION DATE	3	APPROVED FOR USE															
		2	GENERAL UPDATE: ISSUED FOR USE															
		1	APPROVED FOR USE															
		0	APPROVED FOR FEASIBILITY STUDY															
	ORIGINAL DATE	No.																
	DRAWING No.		DRAWING TITLE															
	REFERENCE DRAWINGS		REG. PROFESSIONAL															

Attachment 2

Port Site TM001 Fuel System Overall Layout

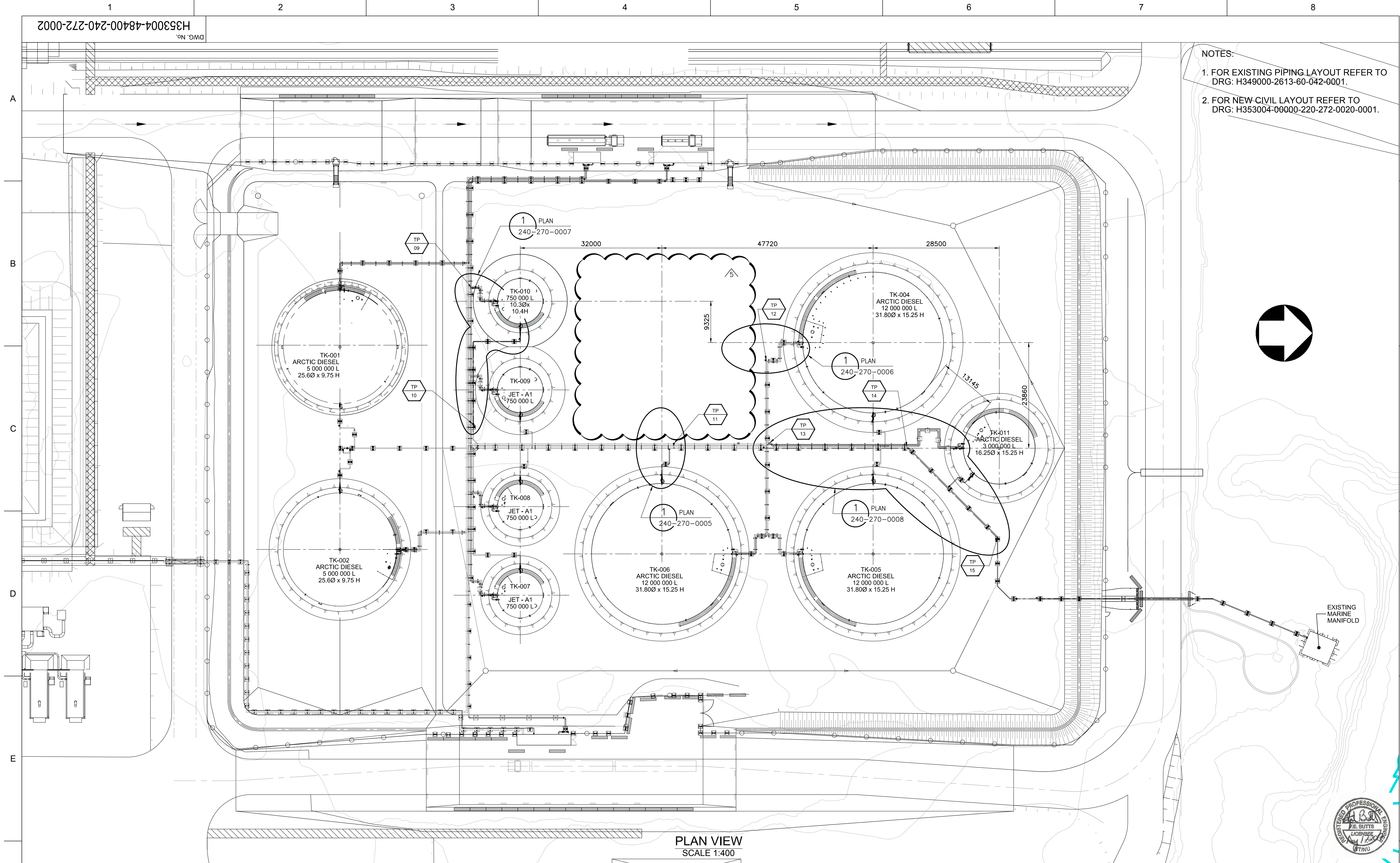
(H353004-48400-240-272-0003, Rev. 0)



Attachment 3

Port Site TM001 Fuel System Piping Layout

(H353004-48400-240-272-0002, Rev. 5)



- 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.

PLAN VIEW
SCALE 1:400

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Attachment 4

Milne Port Fuel Tanks 010 & 011 Setting Out Earthworks

(H353004-40000-220-260-0003-0001, Rev. 1)

H353004-40000-220-260-0003-0001
DWG. No.

MATERIAL VOLUMES

TK010
CRUSHER FINES MATERIAL (-2mm) = 16m³
FILL MATERIAL (TYPE 5) = 410m³
TOTAL FILL MATERIAL REQUIRED = 426m³
TOTAL SURFACE AREA = 341m²

TK011
CRUSHER FINES MATERIAL (-2mm) = 35m³
FILL MATERIAL (TYPE 5) = 525m³
TOTAL FILL MATERIAL REQUIRED = 560m³
TOTAL SURFACE AREA = 495m²

TOTALS
CRUSHER FINES MATERIAL (-2mm) = 51m³
FILL MATERIAL (TYPE 5) = 935m³
TOTAL FILL MATERIAL REQUIRED = 986m³
TOTAL SURFACE AREA = 836m²

TANK EARTHWORKS SETTING OUT POINT (CENTRE OF TANK)

TANK No.	N	E	TANK PERIMETER LEVEL (EL)
TANK 011	7976273.198	503641.393	11.95
TANK 010	7976164.943	503608.208	12.30

NOTES:

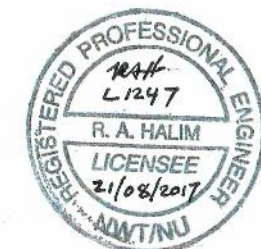
- LIDAR SURVEY PROVIDED BY PHOTOSAT (2016)
- COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
- CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 0.5m.
- FOR TYPICAL CROSS SECTIONS REFER TO DRAWING No. H353004-40000-220-273-0001-0001

PERMIT TO PRACTICE HATCH LTD.

Signature *R. A. Halim*

Date **AUG 21, 2017**

PERMIT NUMBER: P 512
The Association of Professional Engineers,
Geologists and Geophysicists of NWT/NU



HATCH

Baffinland

BAFFINLAND IRON MINES LP
MARY RIVER PROJECT

MILNE PORT
FUEL TANKS 010 & 011 SETTING OUT
EARTHWORKS

SCALE 1:500
DWG. No. H353004-40000-220-260-0003-0001
REV 1

R. HALIM
NAME

RAH
SIGNATURE

L1247
ENG REG NUMBER

21/08/2017
REVISION DATE

03/07/2017
ORIGINAL DATE

REG. PROFESSIONAL

1 APPROVED FOR CONSTRUCTION

2 APPROVED FOR CONSTRUCTION

No.

DESCRIPTION

REVISIONS

KT MB 21/08/2017
FH MB 30/06/2017
BY CHK'D DATE

DRAFTSPERSON K TEFFU NR 21/08/2017
DESIGNER K TEFFU NR 21/08/2017
CHECKER F HUGO 21/08/2017
DESIGN COORD. R GOOSEN 21/08/2017
RESP. ENG. R HALIM 21/08/2017
LEAD DISC. ENG. A GROBBELAAR 21/08/2017
AREA MANAGER J HOWES 21/08/2017
PROJ. MANAGER

CLIENT

ROLE NAME SIGNATURE DATE

DRAWING APPROVAL STATUS: Approved for Construction

SHEET SIZE: D

Attachment 5

Milne Port Fuel Tanks 010 & 011 Details Typical Sections

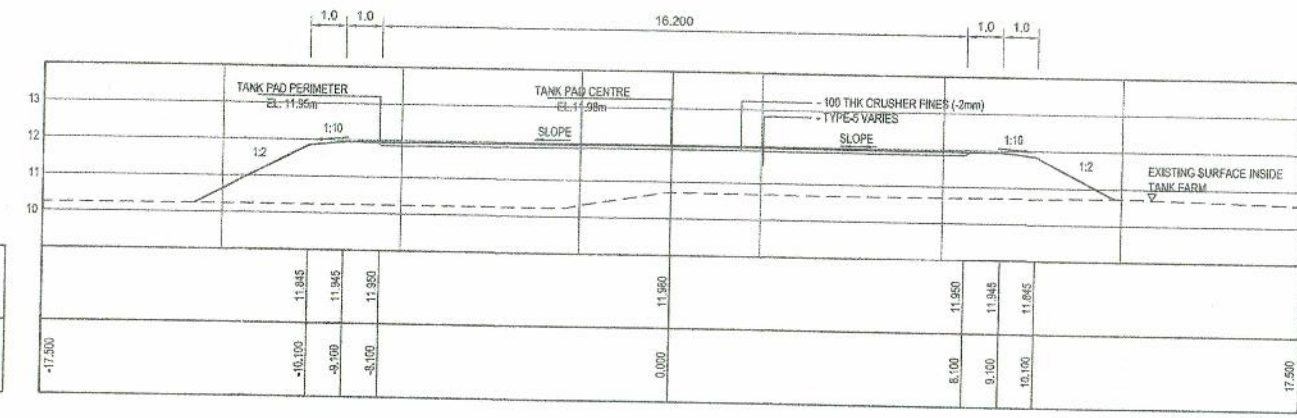
(H353004-40000-220-273-0001-0001, Rev. 1)

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

SCALES:
Horizontal 1:100
Vertical 1:100

DATUM 9.000

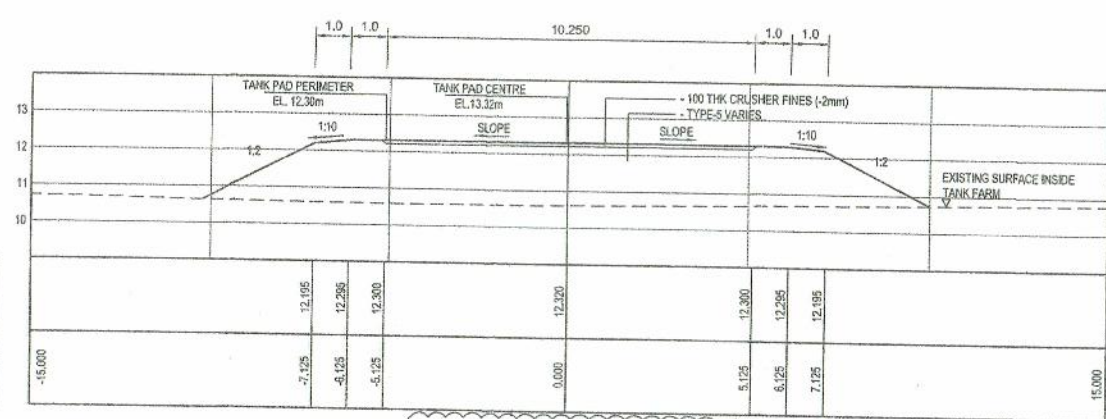
TERRACE LEVELS THROUGH CENTRE
DISTANCE(m)



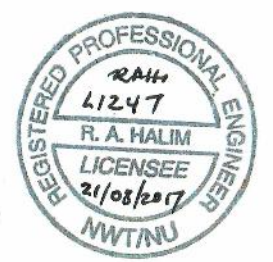
SCALES:
Horizontal 1:100
Vertical 1:100

DATUM 9.000

VERTICAL PROFILE GRADES
DISTANCE(m)



**PERMIT TO PRACTICE
HATCH LTD.**
Signature *R. A. Halim*
Date *Aug 21, 2017*
PERMIT NUMBER: P 512
The Association of Professional Engineers,
Geologists and Geophysicists of NWT/NU



H353004-40000-220-273-0001-0001		NEW FUEL TANKS SETTING OUT DETAILS		R. HALIM NAME R.A.H. SIGNATURE L1247 ENG REG NUMBER 21/08/2017 REVISION DATE 03/07/2017 ORIGINAL DATE		1 APPROVED FOR CONSTRUCTION 0 APPROVED FOR CONSTRUCTION		KT MB 21/08/2017 FH MB 30/06/2017		BY CHKD DATE		ROLE NAME SIGNATURE DATE		DRAFTSPERSON K TEFFU NR 21/08/2017 DESIGNER K TEFFU NR 21/08/2017 CHECKER F HUGO 21/08/2017 DESIGN COORD. R GOOSEN 21/08/2017 RESP. ENG. R HALIM 21/08/2017 LEAD DISC. ENG. A GROBBELAAR 21/08/2017 AREA MANAGER J HOWES 21/08/2017 PROJ. MANAGER		Baffinland BAFFINLAND IRON MINES LP MARY RIVER PROJECT MILNE PORT FUEL TANKS 010 & 011 DETAILS TYPICAL SECTIONS		SCALE 1:100 OR AS NOTED		DWG. No. H353004-40000-220-273-0001-0001		REV 1	
DRAWING No.		DRAWING TITLE		REG. PROFESSIONAL		No.		DESCRIPTION		REVISIONS		DRAFTING APPROVAL STATUS: Approved for Construction								SHEET SIZE: 0			

Attachment 6

Memo: Calculations of Tank Farm Containment Capacity

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

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:	<i>M. MacIntyre</i>	Date:	27 June 2017		
Print Name >	Michael MacIntyre				
Approved by:	<i>F. Butts</i>	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. ** 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	
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 attached 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	
67,000,000.00	52,000,000.00	20,200,000.00	m^3 21,417.78	L 21,417,782.47

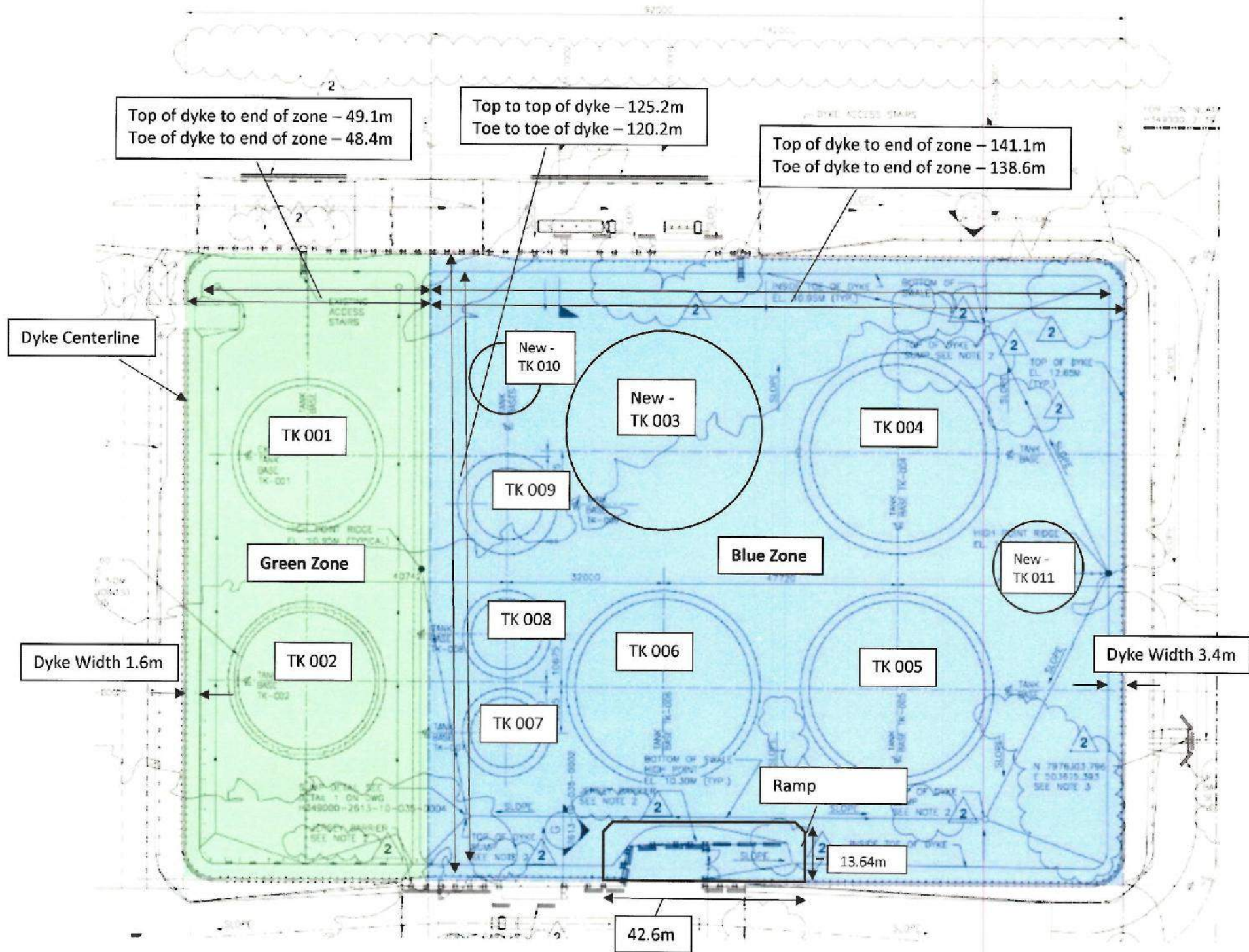
Spill Volume Available > Minimum Volume Needed

Pad Containment Volume (m³)							
Zone / Area	Dimension	Length of Zone	Width of Zone	Elevation	Height	Volume	Notes & Assumptions
Blue Zone	Top of Dyke	125.20	141.10	12.95	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	12.95	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) m³							
Tank	Tank # / Zone	Dimension	Radius	Height	Quantity	Unit Volume	Volume
750000 L	TK 7,8 - Blue	Top/Inner Radius	7.16	0.95	2.00	197.00	394.00
		Floor/Outer Radius	9.06				
		Constant Radius	5.16				
	TK 9,10 - Blue	Top/Inner Radius	7.16	1.50	2.00	356.62	713.23
		Floor/Outer Radius	10.16				
		Constant Radius	5.16				
3 ML	TK 11 - Blue	Top/Inner Radius	10.10	1.15	1.00	458.84	458.84
		Floor/Outer Radius	12.40				
		Constant Radius	8.10				
5 ML	TK 1,2 - Green	Top/Inner Radius	14.01	0.80	1.00	555.66	555.66
		Floor/Outer Radius	15.71				
		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				
		Constant Radius	16.00				
	TK 5,6 - Blue	Top/Inner Radius	18.00	1.15	2.00	1,326.50	2,653.00
		Floor/Outer Radius	20.30				
		Constant Radius	16.00				
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				
		Constant Radius	16.25				

Other Volumes (m³)			
Zone / Area	Dimension	Volume	Notes & Assumptions
Access Ramp	Whole Ramp	418.93	**See attached 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	
67,000,000.00	52,000,000.00	20,200,000.00	m³	L
			21,417.78	21,417,782.47



HATCH

CALCULATION SHEET

SHEET NO.

1 OF 3

DESCRIPTION

Fuel Pad Containment Volume

PROJECT NO

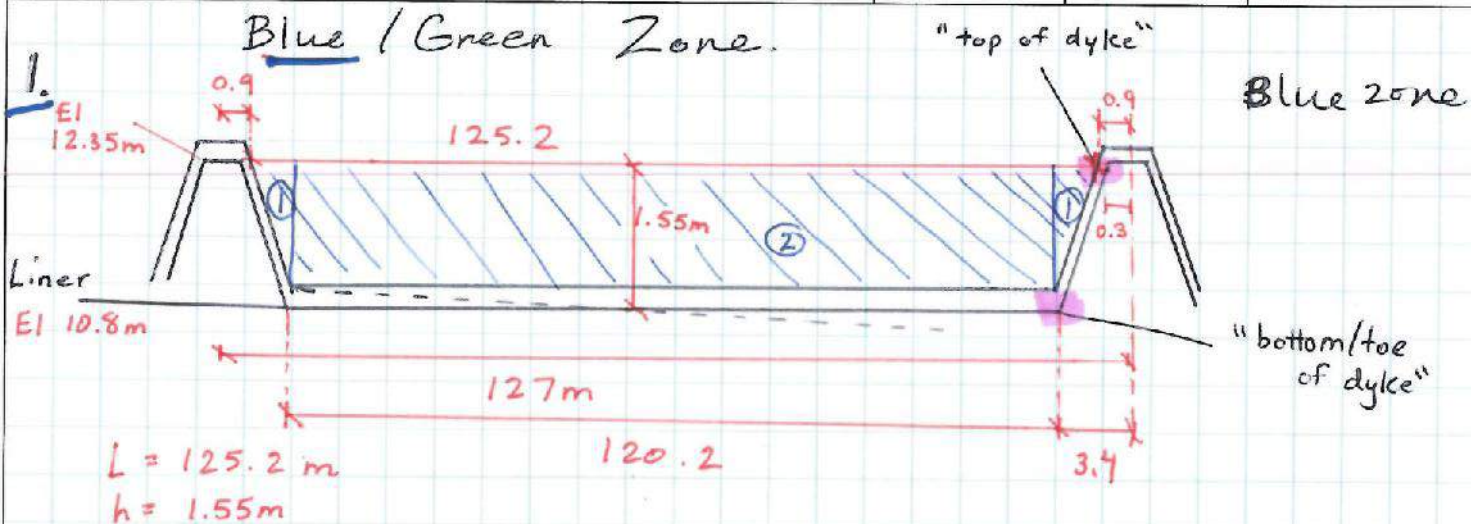
H 353004

MADE BY

"MD"

CHECKED BY

DATE



width top = 141.1m

width floor = 138.6m

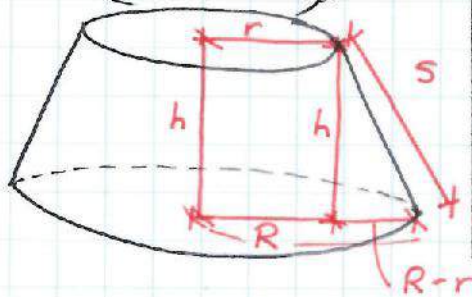
$$V = A \times L_{avg}$$

$$= (\textcircled{1} + \textcircled{2}) \times L_{avg}$$

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

$$= 26,597.37 \text{ m}^3$$

2. Tank ex.
(General)

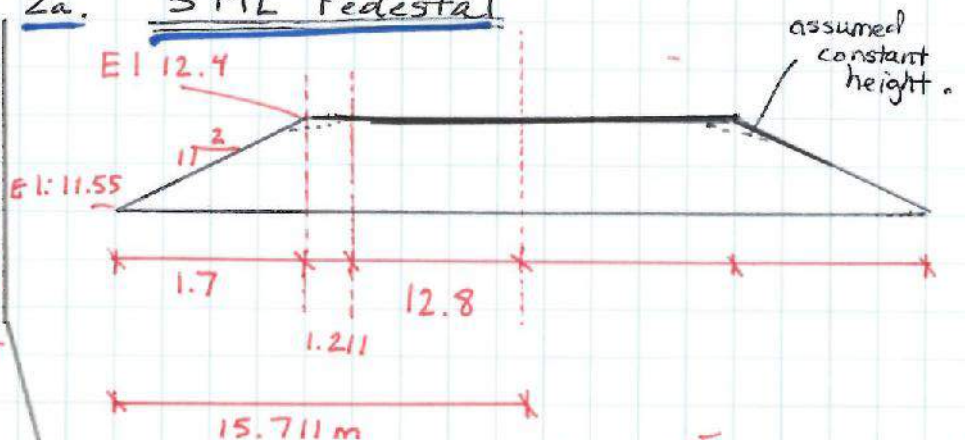


$$S = \sqrt{(R-r)^2 + h^2}$$

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

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

2a. 5 ML Pedestal



$$R = 15.711 \text{ m}$$

$$r = 14.01 \text{ m}$$

Since EI > 12.35

use 12.35 as top elevation

11.55 as floor elevation

$$\therefore h = 0.8$$

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

$$= 555.62 \text{ m}^3$$

HATCH

CALCULATION SHEET

SHEET NO.

2 OF 3

DESCRIPTION

PROJECT NO

MADE BY

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DATE

DATE

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

EI 11.95 (TK 4, EL 12.25) $\frac{1}{2}$

EL 10.8

2.3 2 16

2.9 (TK 4)

$h = 1.15m$

$R = 20.3$

$r = 18$

$R = 20.90$

$r = 18$

2c ~~4~~ x 750 KL

(TK 7,8)

EI 11.75

$h = 0.95m$

EI 10.80 $\frac{1}{2}$

1.9 2 5.156

$R = 9.056m$

$r = 7.156m$

(TK 9,10)

EI 12.30

$h = 1.5m$

EI 10.80 $\frac{1}{2}$

3 2 5.156

$R = 10.156m$

$r = 7.156m$

2d 3 ML

EI 11.95

EI 10.80

assumed

2.3 2 8.1

$h = 1.15m$

$R = 10.1m$

$r = 12.4m$

2e 15 ML

EI 12.55 assumed

EI 10.80

assumed

3.5 2 16.25

$1.55m$ governs

$R = 21.75m$

$r = 18.25m$

HATCH

CALCULATION SHEET

SHEET NO.

3 OF 3

DESCRIPTION

PROJECT NO

MADE BY

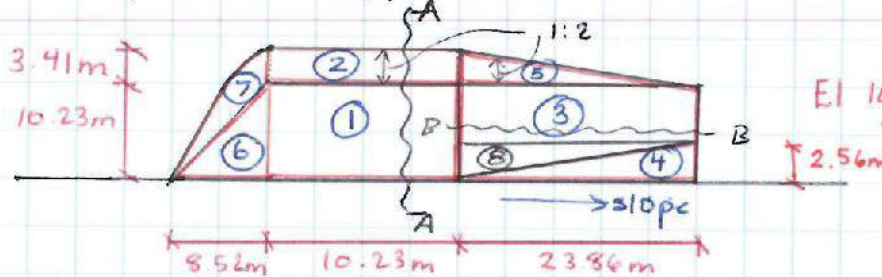
CHECKED BY

DATE

DATE

3 Ramp

Top View Approximated



Section A-A:

EI 12.35

EI 10.80

2.56m

Area 2 ≈ 1b

liner.

* 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)

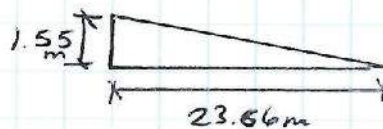
$$V = 10.23m(10.23m)(12.35 - 10.8) = 162.21m^3$$

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

Steps = B:B

Volume

(4), (5), (8)



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

$$= 47.34m^3$$

Total Volume
 $= \sum_{i=1}^6 V_i$

$$= 418.93m^3$$

Volume (5)

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):

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

$$= 67.55m^3$$

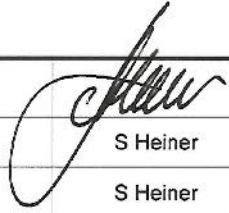
Attachment 7

Construction Methodology Milne Inlet Fuel Storage Facility System

(H353004-40000-400-050-0002, Rev. 1)

Plan

Construction Methodology Milne Inlet Fuel Storage Facility

						
2017-08-21	1	Approved for Use	G Sterling / N Mills	J Howes	S Heiner	M Weaver
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 two (2) additional fuel tanks at the Milne Inlet Fuel Storage Facility. The 2 fuel tanks to be added to the Fuel Storage Facility include: a 3M litre diesel fuel tank and a 750K litre fuel tank along with all associated piping.

Both 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 010 & 011 Setting Earthworks (H353004-40000-220-260-0003-0001). Tank 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 two (2) new piping sub-systems will need to be installed within the Fuel Storage Facility's containment in order to tie in the two (2) 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-010	750,000 Litre tank	-	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 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 Contractor) 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 the two (2) tanks, as shown in Hatch document: Milne Port Fuel Tanks 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 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.

The Mechanical Contractor will be mobilized to the Fuel Storage Facility to begin tank construction of Tank 011 prior to the civil work being completed in the Facility's containment. All associated equipment such as welding units, compressors and tooling will be set up. Plate work will commence with the placement and welding of the floor plates on a temporary level platform outside the Facility's containment, west of the Facility. After the completion of the civil work in the Facility's containment, and after the tank floor plate work is completed, the tank floor will be lifted into place utilizing a crane with the correct capacity. The floor will be positioned in its final location and level checked. Upon verification that the floor is correct, the installation of the first course of the tank shell (wall) will occur. All shell plate welding will start with the vertical joints and then, upon completion, the shell 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
<i>BAF-PH1-310-P16-0001, Rev.7</i>	<i>Milne Inlet Marine Facility Security Plan</i>	<i>Baffinland</i>
<i>H353004-40000-220-260-0003-0001</i>	<i>Milne Port Fuel Tanks 010 & 011 Setting Earthworks</i>	<i>Hatch</i>

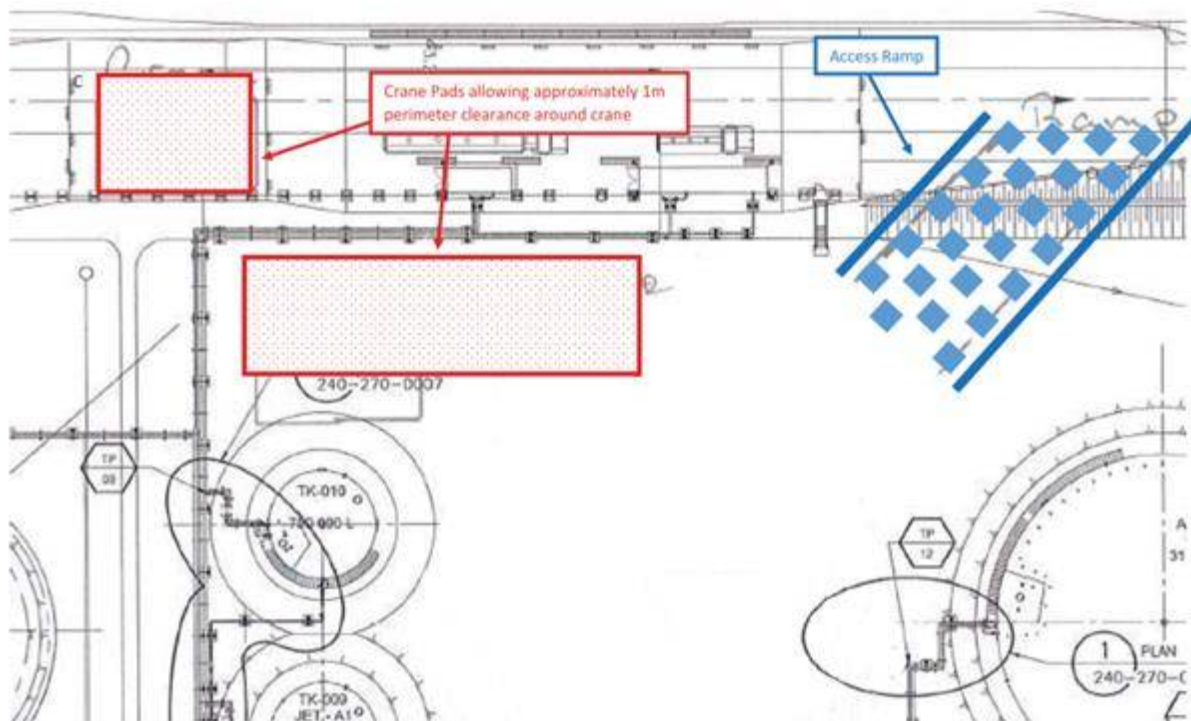


Figure 1: Crane Pad Locations and Access Ramp