TECHNICAL SUPPORTING DOCUMENT

Mary River Project | Phase 2 Proposal | FEIS Addendum | August 2018

TSD 02

Project Description





TSD 02: Project Description
Mary River Project Phase 2 Proposal

Baffinland Iron Mines Corporation
Mary River Project
NIRB File No. 08MN053

Date: August 2018

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1 PROJECT DESCRIPTION

This project description provides technical details for the Phase 2 Proposal, which includes changes to the production rate, rail construction, and modifications at Milne Inlet and to marine transportation.

1.1 Background

The Mary River Project (the Project) was approved by the NIRB in 2012, and involves the development of an open pit iron ore mine on northern Baffin Island, with associated infrastructure that includes the use of an existing Tote Road between Milne Inlet and a mine site at Mary River, ports at Milne Inlet and Steensby Inlet, and a railway connecting the mine site to the Steensby Port (Figure 1.1). The iron ore would be transported from the mine site via a railway to be constructed by Baffinland Iron Mines Corporation (Baffinland) to the port at Steensby Inlet. The ore would be shipped year-round shipping using ice-breaking ore carriers through Foxe Basin and Hudson Strait to markets in Europe.

In January 2013, Baffinland applied for a modification, seeking to amend specific project components and activities to support mining activity to commence prior to the construction of the railway and facilities at the Steensby Port. Baffinland proposed to use the Milne Inlet Tote Road (the Tote Road) to transport ore to Milne Inlet for shipment during the open water season. In 2014 the NIRB recommended that the Early Revenue Phase (ERP) Proposal should be allowed to proceed with amendments to the terms and conditions of Mary River Project Certificate No. 005. The Mary River Project Certificate No. 005 was amended and re-issued on May 28, 2014. The current site layouts are presented in Appendix A.

1.2 Phase 2 Proposal Overview

Baffinland is seeking an amendment to its Project Certificate No. 005 to allow the Company to implement its Phase 2 Proposal for the Mary River Project. Phase 2 would enable Baffinland to transport by rail and ship up to 12 million tonnes per year (Mtpa) of ore from Milne Port and to retain the current authorizations for the construction and operation of the Steensby Port and South (Mine to Steensby) Railway as proposed in 2012.

On April 23, Baffinland submitted a request to the NPC and NIRB to amend the North Baffin Regional Land Use Plan and Project Certificate No.005, respectively, to allow for a marginal increase in production and transportation of ore via the Tote Road through Milne Port from 4.2 Mtpa to 6.0 Mtpa (the Production Increase Proposal). This document is a request for an additional amendment (the Phase 2 Proposal). Phase 2 involves increasing the quantity of ore shipped through Milne Port to 12 Mtpa, via the construction of a new railway running largely parallel to the existing Tote Road (called the North Railway). The total mine production will eventually increase to 30 Mtpa, with 12 Mtpa being transported via the North Railway to Milne Port and 18 Mtpa transported via the South Railway to Steensby Port.

The site layouts for Phase 2 proposal are presented in Appendix B. The additional or new facilities and activities required at each of the Project sites for the implementation of Phase 2 are located at Mine Site, the Tote Road, a new railway corridor adjacent to the Tote Road, and at Milne Port.

Table 1.1 identifies the facilities and activities authorized under Project Certificate No. 005, as amended in 2014 for the ERP (the Approved Project), current/existing facilities and activities, and Baffinland’s request for the Phase 2 Proposal.

Table 1.1 Comparison of the Approved Project to the Phase 2 Proposal

Components		FEIS Project Description	ERP Project Description	Current Facilities and Activities	Phase 2 Project Description
		28-Dec-12	28-May-14		Total
Mine Site Construction, Facilities and Activities					
PDA	Potential Development Area (PDA)	2740 ha	No Change	2740 ha	No Change
RAIL	Railway switch yard (southern railway)	Approved	No Change	Deferred to 2021	No Change
	Railway switch yard (northern railway)	Not applicable	Not applicable	Not applicable	Northern railway turning loop added
ORE HANDLING	Open Pit Mine	Mining Deposit No. 1 365 Mt at > 64% iron	No Change	Mining Deposit No. 1	No Change
	Mining Rate	18 Mtpa	22.2 Mtpa (18 Mtpa through Steensby; 4.2Mtpa though Milne)	4.2 Mtpa	30 Mtpa (18 Mtpa through Steensby; 12 Mtpa though Milne)
	Waste Rock Stockpile	Waste Rock Management Plan (2012) approved, 640Mt waste rock estimated	No Change	Waste Rock Management Plan (2018) approved, 630 Mt waste rock estimated	No Change
	Ore Crushing Facilities	Permanent crushing/screening facilities to process 18 Mtpa for southern shipping	Mobile crushing/screening facilities to process 4.2 Mtpa for northern shipping	Semi-portable crushing/screening facilities to process 4.2 Mtpa for northern shipping	Relocation of primary crushing facilities within PDA at Mine Site. Secondary ore crushing relocated to Milne Port.
	Ore Stockpiles	Run of Mine: 0.4 Mt Crushed ore: 1.4 Mt	Truck loading stockpile: 0.2 Mt	Truck loading stockpile: 0.2 Mt	Run of Mine: 0.4 Mt Crushed ore: 1.4 Mt
POWER AND FUEL STORAGE	Power Plant	28 MW installed capacity	No Change	8.1 MW installed capacity	28 MW install capacity
	Wind turbines	Not applicable	Not applicable	Not applicable	1 turbine, up to 4.2MW
	Fuel storage (Arctic Diesel, Jet Fuel, Other Fuels)	15.6 ML arctic diesel 3 ML Jet A 400,000 L other fuel	No Change	2 ML arctic diesel	47.6 ML artic diesel 3 ML Jet A fuel 400,000 L other fuel

Table 1.1 Comparison of the Approved Project to the Phase 2 Proposal

Components		FEIS Project Description 28-Dec-12	ERP Project Description 28-May-14	Current Facilities and Activities	Phase 2 Project Description Total
ACCOMMODATIONS	Accommodation complex	Construction (Peak): 1200 Beds Operations: 500 Beds	Construction (Peak): 1220 Beds Operations: 710 Beds	800 Beds	Construction (Peak): 1200 Beds Operations: 800 Beds
WATER SUPPLY	Water Supply (Domestic & Industrial)	Type A Water License limits (Camp Lake): Construction - 657 m3/day Operations - 367.5 m3/day	No Change	Current water usage within Type A Water License limits	Anticipated water usage within Type Water Licence limits
WASTE MANAGEMENT	Sewage Treatment Plant	Described in Water Supply, Sewage and Wastewater Management Plan (2012) approved under Type A Licence 2AM-MRY1325	Described in Water Supply, Sewage and Wastewater Management Plan (2014) approved under Type A Licence 2AM-MRY1325	Described in Water Supply, Sewage and Wastewater Management Plan (2018) approved under Type A Licence 2AM-MRY1325	Water Supply, Sewage and Wastewater Management Plan updated as required and submitted to NWB for approval under Type A Licence MRY-1325
	Incinerator	Incineration Management Plan (Waste Management Plan) approved under Type A Licence MRY-1325 (2013)	No Change	Waste Management Plan (2018) updated and approved 1-2T mobile incinerator	Incineration Management Plan (Waste Management Plan) to be updated with camp expansion and to be submitted under Type A Licence MRY-1325
	Landfill	Mine Site landfill - Landfill Management Plan (Waste Management Plan) approved under Type A Licence 2AM-MRY1325	No change	Expansion of Mine Site landfill to be undertaken in 2018 under the terms and conditions of Type A Licence 2AM-MRY1325.	Extend operation of Mine Site landfill for the duration of the Project Life.

Table 1.1 Comparison of the Approved Project to the Phase 2 Proposal

	Components	FEIS Project Description 28-Dec-12	ERP Project Description 28-May-14	Current Facilities and Activities	Phase 2 Project Description Total
	Landfarm	Landfarms approved under Type A Licence 2AM-MRY1325	No change	Landfarms approved under Type A Licence 2AM-MRY1325	No Change
	Hazardous Waste Storage	Hazardous Materials and Hazardous Waste Management Plan (2012) approved under Type A Licence 2AM-MRY1325	No change	Hazardous Materials and Hazardous Waste Management Plan (2017) approved under Type A Licence 2AM-MRY1325	No Change
WATER MANAGEMENT	Mine site water management infrastructure (drainage, ponds and ditches)	As necessary to capture runoff from Mine Site facilities. Drainage plans and design criteria detailed in Surface Water, Aquatic Ecosystems, Fish and Fish Habitat Management Plan (2012) approved under Type A Licence 2AM-MRY1325	No Change	As necessary to capture runoff from Mine Site facilities. Drainage plans and design criteria detailed in Surface Water, Aquatic Ecosystems, Fish and Fish Habitat Management Plan (2018) approved under Type A Licence 2AM-MRY1325	Rerouting/additional drainage, ponds, and ditches as required. As necessary to capture runoff from Mine Site facilities. Drainage plans and design criteria detailed in Surface Water, Aquatic Ecosystems, Fish and Fish Habitat Management Plan (2018) approved under Type A Licence 2AM-MRY1325
SUPPORTING FACILITIES	Quarries	Three quarries identified	No Change	One quarry operating under QMR2 Quarry Management Plan (2017)	Two quarries identified
	Stream/river crossing	Two stream crossings (bridges)	No Change	Two stream crossings (bridges)	No Change
	Equipment Maintenance Facilites	Permanent mine maintenance facilities approved	Temporary mine maintenance facilities approved	Mine truck shop under construction	No change
	Temporary construction facilities	Multiple shelters and temporary workshops as required for construction activities	Multiple shelters and temporary workshops as required for construction activities	In operation	Multiple temporary facilities as per 2012 FEIS; NWB will be notified as necessary for any additions, modifications, or changes in locations of facilities

Table 1.1 Comparison of the Approved Project to the Phase 2 Proposal

	Components	FEIS Project Description	ERP Project Description	Current Facilities and Activities	Phase 2 Project Description
		28-Dec-12	28-May-14		Total
	Communication facilities	Satellite communications systems	No Change	Existing system is being upgraded	No Change
	Explosives	Permanent Emulsion Mixing Plant Ammonium storage pad; Multiple magazines	No Change	Permanent Emulsion Mixing Plant Ammonium storage pad; Multiple magazines	Expansion of explosives area to accommodate increases in volume of ammonium nitrate; storage of pre-packaged explosives
AIRSTRIP	Airstrip	Airstrip (gravel) extended from 1600 m to 2000 m length	No Change	2000 m airstrip (gravel)	No Change
AIRSTRIP	Air Traffic	Construction: 550 flights/year Operations: 365 flights/year	No Change	220 flights/year	No Change
Tote Road Construction, Facilities and Activities					
PDA	Potential Development Area (PDA)	865 ha	No change	865 ha	No Change
ORE HANDLING	Transportation of ore by trucks	Not applicable	4.2 Mtpa Average 90 round trips/day	4.62 Mtpa Average 98 round trips/day	Commissioning of the North Rail includes a temporary increase to 12 Mtpa at an average of 280 round trips/day
CONSTRUCTION	Upgrade of the existing Tote Road	Improved road base Minor realignments Grade improvements	Not applicable	In operation	Modified for Indexer at Port
CONSTRUCTION	Realignment of sections of Tote Road	Not applicable	Several realignments	In operation	Several realignments to facilitate railroad crossings
CONSTRUCTION	Replacement of water crossings	Not applicable	114 stream crossings	In operation	Up to 13 new culverts and relocation of 5 existing culverts

Table 1.1 Comparison of the Approved Project to the Phase 2 Proposal

Components		FEIS Project Description	ERP Project Description	Current Facilities and Activities	Phase 2 Project Description
		28-Dec-12	28-May-14		Total
Northern Railway (Mine Site to Milne Port) Construction, Facilities and Activities					
PDA	Potential Development Area (PDA)	Not applicable	Not applicable	Not applicable	1,306 ha
RAIL	Railway alignment and railway bed	Not applicable	Not applicable	Not applicable	110 km single track railway, one passing track midway in rail circuit; Approximate 7 km deviation over a 20 km in length from Milne Inlet Tote Road; Up to 3 passing sidings
	Transportation of ore by railway	Not applicable	Not applicable	Not applicable	2 to 3 trains with 60 to 90 cars completing 5 to 8 loads loads per day, respectively
CONSTRUCTION	Bridges and culvert water crossings	Not applicable	Not applicable	Not applicable	Up to 425 crossings (421 culverts and 4 bridges)
	Staging area for railway construction	Not applicable	Not applicable	Not applicable	14 laydowns
	Quarries	Not applicable	Not applicable	Not applicable	Up to 30 quarries will be sourced for construction materials
	Construction camp	Not applicable	Not applicable	Not applicable	4 locations, 3 remote camps
Milne Port Construction, Facilities and Activities					
PDA	Potential Development Area (PDA)	245 ha	No Change	245 ha	415 ha
RAIL	Railway switch yard	Not applicable	Not applicable	Not applicable	Railway switch yard
	Railway unloading station	Not applicable	Not applicable	Not applicable	Railway unloading station
	Railway maintenance facility	Not applicable	Not applicable	Not applicable	Railway maintenance building

Table 1.1 Comparison of the Approved Project to the Phase 2 Proposal

Components		FEIS Project Description 28-Dec-12	ERP Project Description 28-May-14	Current Facilities and Activities	Phase 2 Project Description Total
ORE HANDLING	Truck ore unloading station	Not applicable	4.2 Mtpa capacity	4.2 Mtpa capacity	No Change
	Ore crushing and sizing facilities	Not applicable	Not applicable	Not applicable	12 Mt secondary crushing capacity, housed in new building
	Ore stockpiles	Not applicable	4 Mt	4 Mt	7.8 Mt
	Ore loading facilities – dock #1	Not applicable	Supra-panamax capacity	4.2 Mtpa capacity	Realigned conveyor / ore reclaiming system
	Ore loading facilities - dock #2	Not applicable	Not applicable	Not applicable	Capesize capacity
	Shipping of ore	Not applicable	Ore Shipped: 4.2 Mtpa Number of Sailings: 55	Ore Shipped: 4.2 Mtpa Number of Sailings: 55	Ore Shipped: 12 Mtpa Number of Sailings: 134 - 164
FREIGHT	Freight dock	Floating freight dock	No Change	Barge Landing Area	No Change
	Peak Annual Freight Deliveries	20	14	8	18
	Peak Annual Fuel Deliveries	3	2	4	12
ELECTRICAL POWER	Power Plant	Temporary generators	9.45 MW installed capacity	9.45 MW installed capacity	22 MW installed capacity
	Wind turbines for power generation	Not applicable	Not applicable	Not applicable	1 turbine, up to 4.2 MW
FUEL STORAGE	Fuel storage (Arctic diesel, jet fuel, other)	45 ML arctic diesel storage 3 ML Jet A storage 400,000 L other fuel storage	Additional: 1 ML arctic diesel fuel storage 200,000L marine diesel	64 ML arctic diesel fuel storage 3 ML jet fuel storage 200,000 L marine diesel	No Change
ACCOMMO-DATIONS	Accommodation complex	Construction: 150 Operations: 40	Construction: 225 Operations: 60	Operations: 500 beds	Construction: 800 Operation: 680
WATER SUPPLY	Water Supply (Domestic & Industrial)	Type A Water License limits: Construction - 367.5 m3/day Operations - 367.5 m3/day	No Change	Type A Water License limits: Construction - 367.5 m^3/day Operations - 367.5 m^3/day	Anticipated water usage within Type Water Licence limits

Table 1.1 Comparison of the Approved Project to the Phase 2 Proposal

Components		FEIS Project Description	ERP Project Description	Current Facilities and Activities	Phase 2 Project Description
		28-Dec-12	28-May-14		Total
WATER MANAGEMENT	Mine site water management infrastructure (drainage, ponds and ditches)	As necessary to capture runoff from Milne Port facilities. Drainage plans and design criteria detailed in Surface Water, Aquatic Ecosystems, Fish and Fish Habitat Management Plan (2012) approved under Type A Licence 2AM-MRY1325	No Change	As necessary to capture runoff from Milne Port facilities. Drainage plans and design criteria detailed in Surface Water, Aquatic Ecosystems, Fish and Fish Habitat Management Plan (2018) approved under Type A Licence 2AM-MRY1325	Rerouting/additional drainage, ponds, and ditches as required. As necessary to capture runoff from Milne Port facilities. Drainage plans and design criteria detailed in Surface Water, Aquatic Ecosystems, Fish and Fish Habitat Management Plan (2018) approved under Type A Licence 2AM-MRY1325
WASTE MANAGEMENT	Sewage Treatment Plant and PWSP	Described in Water Supply, Sewage and Wastewater Management Plan (2012) approved under Type A Licence 2AM-MRY1325	Described in Water Supply, Sewage and Wastewater Management Plan (2014) approved under Type A Licence 2AM-MRY1325	Described in Water Supply, Sewage and Wastewater Management Plan (2018) approved under Type A Licence 2AM-MRY1325	Water Supply, Sewage and Wastewater Management Plan updated as required and submitted to NWB for approval under Type A Licence MRY-1325
	Incinerator	Incineration Management Plan (Waste Management Plan) approved under Type A Licence MRY-1325 (2013)	Incineration Management Plan (Waste Management Plan) approved under Type A Licence MRY-1325 (2013)	Waste Management Plan (2018) updated and approved 1-2 T mobile incinerator	Incineration Management Plan (Waste Management Plan) to be updated with camp expansion and to be submitted under Type A Licence MRY-1325
	Hazardous Waste Storage	Hazardous Materials and Hazardous Waste Management Plan (2012) approved under Type A Licence 2AM-MRY1325	No change	Hazardous Materials and Hazardous Waste Management Plan (2017) approved under Type A Licence 2AM-MRY1325	Hazardous Materials and Hazardous Waste Management Plan will be updated and submitted for approval

Table 1.1 Comparison of the Approved Project to the Phase 2 Proposal

Components		FEIS Project Description	ERP Project Description	Current Facilities and Activities	Phase 2 Project Description
		28-Dec-12	28-May-14		Total
SUPPORT FACILITIES	Laydown areas	Multiple laydown areas authorized	Reconfiguration of site plan to accommodate expanded laydown areas	Laydown construction ongoing	No Change
	Permanent warehouse, administrative buildings, and Emergency Response Facilities	Multiple buildings for warehouse, workshops, maintenance shops, emergency response, administration within the PDA.	Facilities added as required within the PDA as authorized under Type A Licence MRY 2AA-1325.	In operation	Existing building augmentation, Rail workshop, and Crusher work shop; NWB will be notified as necessary for any additions, modifications, or changes in locations of facilities
	Temporary construction facilities	Multiple shelters and temporary workshops as required for construction activities	Multiple shelters and temporary workshops as required for construction activities	In operation	Up to 6 temporary structures will be built to support Phase 2 activities; NWB will be notified as necessary for any additions, modifications, or changes in locations of facilities
	Quarries	1 quarry identified	7 quarries identified	One quarry operating under Q1 Management Plan (2017)	2 quarries identified
AIRSTRIP	Airstrip	Maintain existing airstrip	Relocated	Deferred until 2020	No Change

Table 1.1 Comparison of the Approved Project to the Phase 2 Proposal

Components		FEIS Project Description	ERP Project Description	Current Facilities and Activities	Phase 2 Project Description
		28-Dec-12	28-May-14		Total
Shipping General					
SHIPPING	Shipping Mtpa - Steensby Port	18 Mtpa	No Change	Deferred until 2025	No Change
	Shipping Mtpa - Milne Port	Not applicable	4.2 Mtpa	4.2 Mtpa	12 Mtpa
	Shipping Route - Steensby Port	Foxe Basin / Hudson Strait	No Change	Deferred until 2025	No Change
	Shipping Route - Milne Port	Not applicable	Milne Inlet / Eclipse Sound	Milne Inlet / Eclipse Sound	No Change
	Shipping Season - Steensby Port	Year Round	No Change	Deferred until 2025	No Change
	Shipping Season - Milne Port	Not applicable	Open Water (98 days) July 25 - October 30	Open Water (98 days) July 25 - October 31	Extended Season (138 days) July 1 - November 15
	Ice Management - Steensby Port	Ice Breaking (Foxe Basin)	No Change	Deferred until 2025	No Change
	Ice Management - Milne Port	Not applicable	Not applicable	Not applicable	Limited Ice Management at Milne Port during shoulder seasons

1.2.1 Mine Site

For the Mine Site, the Potential Development Area (PDA) defined in 2012 remains unchanged. However, some infrastructure within the PDA will be re-arranged in order to accommodate the construction of the North Railway line, support the increase in mine production and the construction of the northern section of the South Railway.

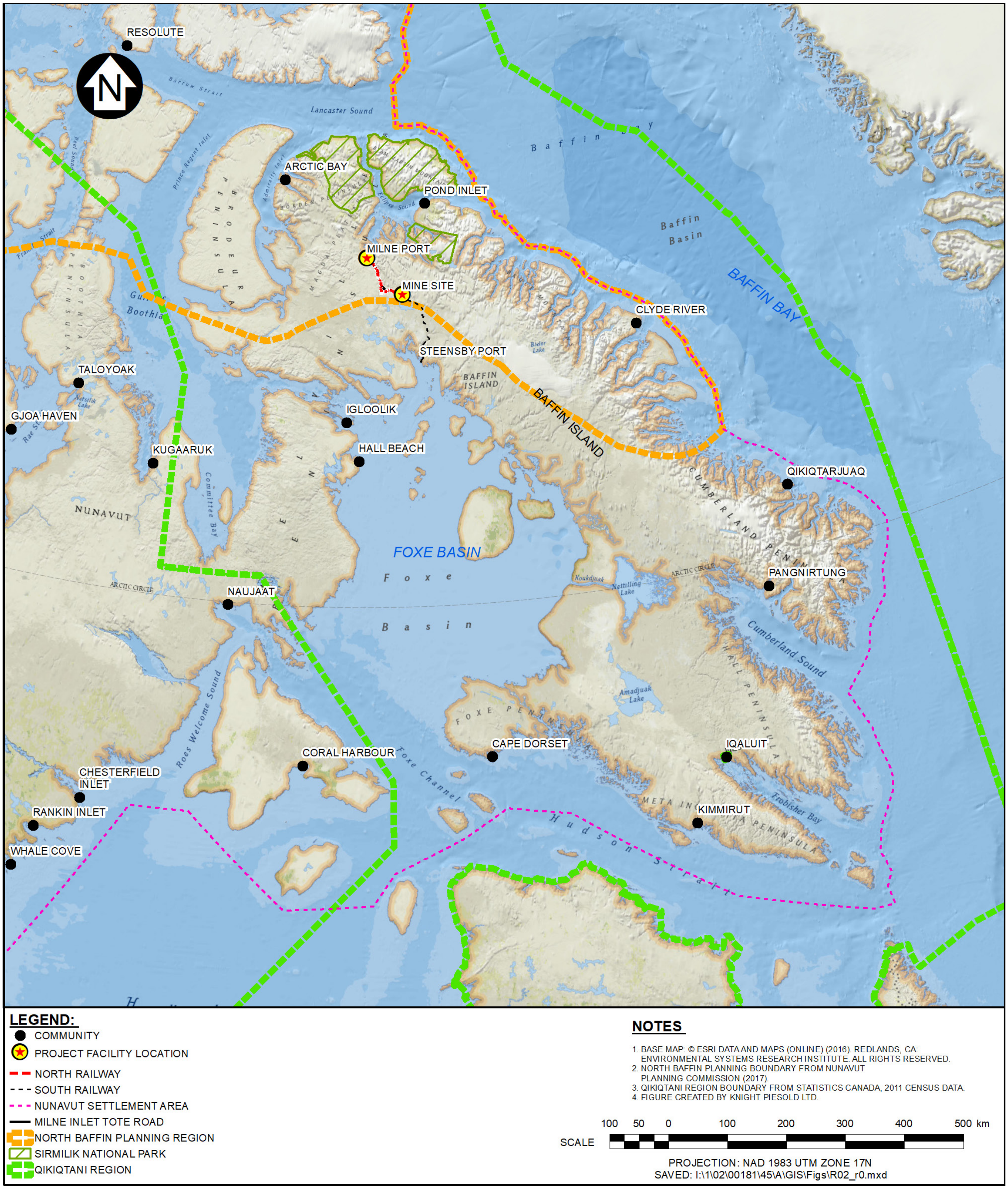


Figure 1.1 Project Location Map

The additional Phase 2 Proposal facilities and activities for construction and operation of the Project will consist of:

- Changes to crushing and transport of ore;
- Construction of the Mine Site North Railway Terminal;
- Expansion of the permanent fuel depot;
- Expansion of the power plant;
- Installation and operation of a wind turbine;
- Expansion of the accommodation complex;
- Expansion of the water supply and sewage treatment facilities; and
- Expansion of the mine maintenance facilities and support administration buildings/facilities (warehouses, shops, etc.).

A detailed description of the facilities and activities listed above is presented in Section 2.0. The proposed layout of the Mine Site for the Phase 2 Proposal is presented on Figure 1.4 and in more details in Appendix B.

1.2.2 Tote Road

The Tote Road alignment will remain unchanged. The use of the Tote Road during the Project is described in Section 3.1. Some upgrades and minor realignments will be required to facilitate railway crossings. These are identified under the North Railway description in Section 3.2.

Baffinland believes that it holds all the necessary authorizations from the Land Owner and the Licensing Agencies to carry out the necessary upgrades/improvements to the Tote Road.

Aggregate material required for the Tote Road maintenance and upgrades will be extracted from the quarry sites that have been identified along the Tote Road. Under the Type A Water Licence MRY 2AA-1325, Baffinland has an overarching Borrow Pit and Quarry Management Plan that has been approved by the Nunavut Water Board (NWB).

1.2.3 North Railway

The North Railway line will be 110 km in length, from the loading station at the Mine Site to the unloading station at Milne Port. The alignment of the railway corridor is presented on Figure 1.3. For most of the length, the railway embankment will be constructed adjacent to the Tote Road. However, due to the steep topography, a 20 km section of the railway will deviate from the Tote Road alignment. As this stretch of land is on Inuit Owned Land (IOL), Baffinland's IOL lease will need to be amended.

Construction of the North Railway is expected to take three years with the railway being operational by 2021. Construction will require multiple laydown sites equipped with shelters and quarry sites for fill and borrow material to construct the rail embankment. A detailed description of the North Railway components and construction strategy is presented in Section 3.2.

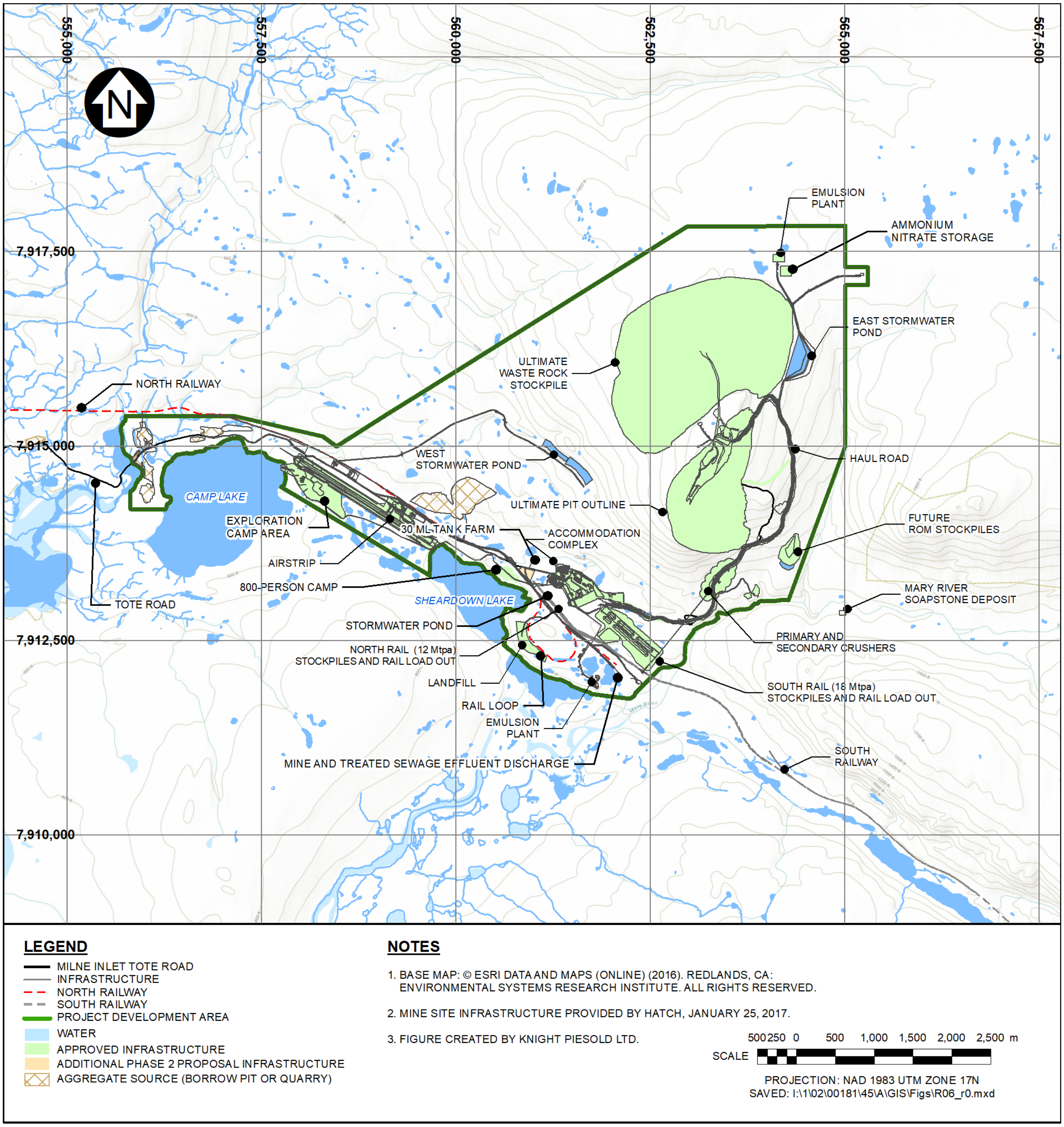


Figure 1.2 Mine Site - Phase 2 Proposal Layout

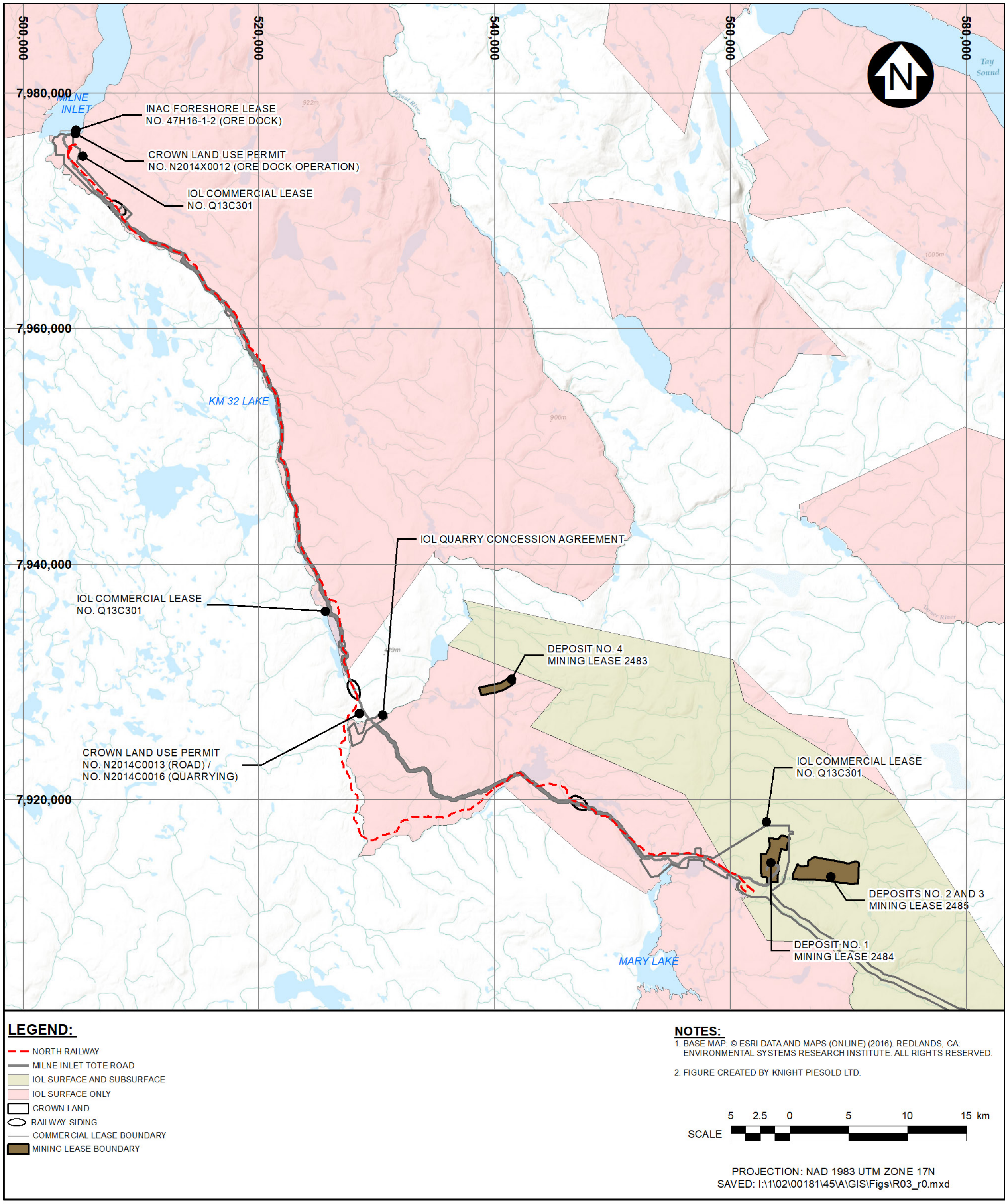


Figure 1.3 Northern Transportation Corridor

The facilities and activities required for the construction and operation of the North Railway include:

- Construction of the railway embankment and railway;
- Construction/erection of signalling equipment and communication tower as required;
- Construction of multiple water crossings;
- Construction and use of multiple laydown areas, shelters, and small equipment shops at each laydown;
- Use of the laydown area at km 57 as an intermediate staging area for ore transportation;
- Construction and operation of four temporary camp pads and mobile camps;
- Construction of several level crossings for the Tote Road;
- Exploitation and closure of multiple quarries along the railway corridor;
- Ongoing inspection and maintenance of the railway embankment, railway, signalling and communication equipment, wayside condition monitoring equipment; and
- Transportation of iron ore by trucks and by railway to Milne Port.

A detailed description of the facilities and activities listed above is presented in Section 3.2.

1.2.4 Milne Port

In order to accommodate the shipment of 12 Mtpa and the North Railway operation, the Milne Port PDA must be expanded. The expanded PDA will cover 415 ha of land and up to 36 ha of foreshore. Both the IOL Lease and the Crown Land lease will be amended for the additional foreshore occupation, as required.

The additional Phase 2 facilities and activities required at Milne Port will consist of:

- Expansion of the Milne Port PDA;
- Construction and operation of a second ore dock capable of berthing capesize ore carriers;
- Modifications/expansion of ore stockpiling, new ore crushing/screening facility and ore handling systems;
- Construction and operation of railway maintenance facilities;
- Expansion of the Port Site Complex, potable water treatment plant and associated sewage treatment plant;
- Expansion of the existing power plant and installation of wind turbines;
- Expansion and re-purposing of laydown areas and ancillary facilities;
- Construction and operation of a landfill site; and
- Increase shipping activities at the Port.

A detailed description of the new facilities and activities listed above is presented in Section 4.0. The proposed layout for the expanded Milne Port site in presented on Figure 1.4 and in more details in Appendix B.

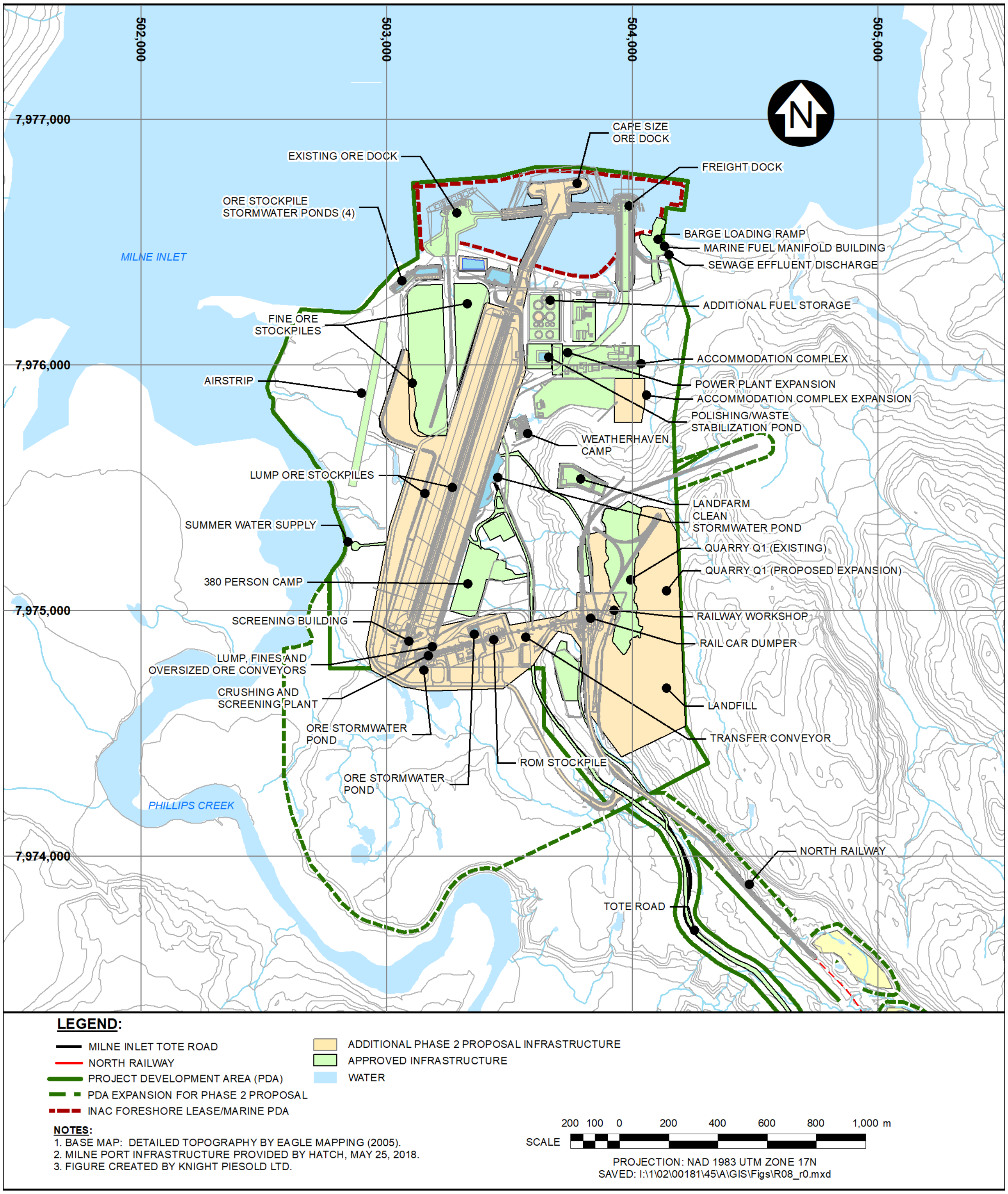


Figure 1.4 Milne Port - Phase 2 Proposal Layout

1.2.5 Phase 2 Proposal Implementation Strategy and Schedule

Increasing shipment of ore to 12 Mtpa by 2021 will enable Baffinland to enlarge its customer base and the demand for its iron ore. Revenues generated from the increase in shipments will facilitate financing of the South Railway and Steensby Port components of the Project. The construction period for the Phase 2 Proposal will span from 2019 to 2024 (6-year period) and overlap with operation of the Mine and Milne Port for the entire construction period as mining, trucking, and shipment of ore from Milne Port will continue.

After receiving the Minister's approval for the Phase 2 Proposal, construction will begin at Milne Port and on the North Railway. During the first year of construction, the Milne Port additional infrastructure components will be completed as well as the second ore dock and the construction of the northernmost 60 km of the railway. The construction strategy will be to conduct pre-assembly of Project components off-site for installation on site. Commissioning of the North Railway will begin during the second phase of construction while the final segment of the railway (the southernmost 57 km of the rail alignment) is being completed. For commissioning of the railway, the construction staging area established at km 57 will be re-purposed as a trans-loading station for ore. Ore will be transported by truck to this staging area and loaded onto railcars and transported by railway to Milne Port.

By the end of the second year, construction of the North Railway and its Mine Site terminal (turning loop and loading station) will be completed. Transportation by rail of up to 12 Mtpa to Milne Port will commence.

Once the North Railway is operational, the construction efforts will shift to the South Railway and Steensby Port (year 3 of the construction period). The construction strategy for these components of the Project was described in the Approved Project and is not expected to change. Construction will begin on two fronts with Milne Port and the Mine serving as staging areas for the construction activities on the northern segment of the South Railway (e.g. staging of fuel, equipment, supplies, accommodation) required to support construction activities. In parallel, site capture and development of the Steensby Port site will commence. As the overall construction period of the South Railway and Steensby Port is expected to take 4 years, mining at the Mine Site, transportation of ore and supplies via the Tote Road or by rail, and shipping of ore at Milne Port, will overlap with the construction activities for the entire construction period of the South Railway.

The expected schedule for implementation of the Phase 2 Proposal, with consideration of the previously approved Steensby component, is as follows:

- Increase mine production to 12 Mtpa by 2020 with the operation of the North Railway line; and
- Increase mine production by 18 Mtpa by 2024 with the operation of the South Railway and Steensby Port.

Under this implementation schedule, the Project Life for Deposit No. 1 is expected to be 17 years. The expected mine ore production and waste rock generation schedule is presented in Table 1.2. The following development sequence applies to the Phase 2 Proposal:

- 2018 (end of Q4) to 2020: Construction of the North Railway and related infrastructure;
- 2020: Commissioning of the North Railway with operation of a staging area at km 60;
- Shipping from Milne Port increase to 12 Mtpa in 2020 with the operation of the North Railway;

- 2021: Begin construction of the South Railway and Steensby Port with the use of the Mine Site and Milne Port infrastructures for staging of fuel, equipment, supplies and workforce required for the construction of the South Railway line;
- 2024: Mine production includes 12 Mtpa for shipment to Milne Port and 18 Mtpa via Steensby Port.;
- 2024: Commissioning of the South Railway and Steensby Port facilities; and
- Shipping of 18 Mtpa from Steensby Port begins in 2025.

The incremental approach of the Phase 2 Proposal provides advantages to Baffinland. It is an opportunity for Baffinland to gain operational experience and learnings while gradually scaling up the Project. The Project's labour requirement will also grow incrementally, which allows local communities to develop the capacity for a greater involvement in the Project's workforce over time.

Based on the existing development plan and the known mineral resource in Deposit No. 1, the mine will be exhausted by 2035. If additional mineable iron ore is not identified in Deposit No. 1 or in adjacent deposits, the mine will advance through a 3-year active closure phase (2036 to 2039), followed by a minimum 5 year post-closure monitoring phase (2040 to 2046). A timeline for the Phase 2 Proposal is shown in Table 1.2. The table also includes an increase in production for which Baffinland has requested NIRB's approval in 2018 (trucking and shipment of 6 Mtpa from Milne Port).

Key information for the duration of the Phase 2 Proposal is presented in Appendix C: Key Facts Table. The Environmental Assessment of the Phase 2 Proposal is based on the quantities presented in Appendix C.

Table 1.2 Phase 2 Proposal Timeline

Area	2018	2019-2020	2021	2022-2023	2024	2025-2035
Mine	5.5 Mtpa	6 Mtpa	12 Mtpa	12 Mtpa	21 Mtpa	30 Mtpa
Tote Road/Trucking	5.5 Mtpa	6 Mtpa	12 Mtpa*	NA	NA	NA
North Rail	NA	NA	12 Mtpa*	12 Mtpa	12 Mtpa	12 Mtpa
South Rail	NA	NA	NA	NA	9 Mtpa	18 Mtpa
Milne Port	5.5 Mtpa	6 Mtpa	12 Mtpa	12 Mtpa	12 Mtpa	12 Mtpa
South/Steensby Port	NA	NA	NA	NA	9 Mtpa	18 Mtpa

* during commissioning, both rail and trucking will be used

1.3 Type A Water License 2AM MRY-1325

The Phase 2 Proposal will increase the intensity and frequency of the certain activities, such as ore transportation and shipping. Part A Item 1(a) of Water Licence 2AM MRY-1325 details the scope of the current Type A license. Appendix D is an application for an amendment to the Water Licence.

2 MINE SITE

As stated in Section 1.2.1, the Mine Site PDA will remain unchanged. The general arrangement of the Mine Site which includes the facilities proposed for the Phase 2 Proposal is presented in Figure 1.2 and Appendix B. Construction activities will be confined to the existing PDA for which the Approved Project presented the initial effects assessment. The proposed changes to the Mine Site infrastructure consist of expansion of existing facilities to accommodate the mining rate and infrastructure to accommodate the construction and operation of the North Rail and South Rail. The North Railway terminal and loading facility will replace the existing truck loading facility.

The Phase 2 Proposal will involve minor changes to the existing or planned diversions at the Mine Site. Major diversions related to the collection of stormwater from the waste rock stockpile remain unchanged. The ore stockpile will be expanded, which may necessitate enlarging the associated stormwater pond, and/or the addition of runoff collection pond(s). Some of the permitted facilities may be relocated within the PDA due to poor geotechnical conditions. Effluent discharge locations as well as runoff discharge locations to the receiving environment (out of PDA) will remain unchanged. These minor changes to surface drainage within the PDA will be captured in Baffinland's Surface Water and Aquatic Ecosystems Management Plan which is submitted to the NWB for approval on an annual basis.

The mining equipment fleet will expand as mining production increases. Maintenance and other ancillary facilities to sustain the mining fleet will also expand. Precipitation will collect within the pit and will require management. The estimated pit inflows and management of pit water inflows remain unchanged.

2.1 Overburden and Waste Rock Stockpile

The long-term disposal plan for overburden and waste rock remains unchanged from what was presented in the Approved Project. In 2015, Baffinland filed an updated Life of Mine Waste Rock Management Plan (Baffinland 2014a) and a Phase 1 Waste Rock Management Plan (Baffinland 2014b) in its 2014 Annual Report to the NIRB. The latter report presents Baffinland's plan for managing waste rock during the first 5 years of mining.

Geochemical evaluations have also been ongoing since production of the Approved Project. Geochemical testing completed in 2014 (AMEC 2014) contributed to the development of the Phase 1 Waste Rock Management Plan. Additional waste rock was tested in 2014 (AMEC 2015a), and humidity cell (kinetic) testing of representative waste rock samples has been ongoing for several years (AMEC 2015b; 2016).

A treatment program was initiated in 2017. As a requirement of the Type A Licence MRY 2AA-1325, ongoing plans for addressing acid runoff from the Waste Rock stockpile were submitted and approved by the NWB in 2018.

2.2 Changes to Crushing and Transport of Ore

The ERP operation involves the trucking of run of mine (ROM) ore from the open pit to a stockpile at the Mine infrastructure area. The Approved Project Mine Site layout is presented in Appendix A. Front end loaders move ore from the ROM stockpile and deposit the ore into hoppers that feed semi-portable crushers with screens separating the crushed ore. Conveyors and trucks are used to place the lump and fines ore into separate stockpiles.

For the commissioning of the North Railway, the construction laydown area developed for the construction of the railway at km 57 will be repurposed as an ore staging area. The conceptual layout for this ore loading staging area in presented in Appendix B. Ore will be transported by trucks to this staging area, dumped on a small 12,000 t stockpile, and loaded onto railcars by front end loaders. This trans-loading facility will remain in operation until the railway terminal at the Mine Site is fully operational.

Once the North Railway is hauling ore at full production. The mining fleet will expand to accommodate the increase in mining production rate and larger (220 t) haul trucks will be used. While primary crushing will be done at the Mine Site, secondary crushing of the ore will be carried out at Milne Port.

The site drainage plan will be updated to accommodate the Mine Site configuration.

The initial period of the Phase 2 Proposal involves primary crushing at the Mine Site, with secondary crushing taking place at Milne Port. This will reduce dust generation at the Mine Site and along the Northern Transportation Corridor. Ore from the ROM stockpile will be front-end loaded into a vibrating grizzly feeder and ore >100 mm will go to the mobile jaw crusher. After the jaw crusher, 80% of the ore will be <100 mm. A rock breaker will be used to crush oversized ore. A stacking conveyor will transfer the ore to a stockpile, and front-end loaders will load the rail cars.

A permanent, enclosed primary crushing plant will be installed as part of the second period of the Phase 2 Proposal expansion. The existing crushing installation will be retained, ore stockpiles will be enlarged and railway loading facilities will be installed for the South Railway (these facilities were described in the Approved Project and permitted under Project Certificate No. 005). The North Railway will be extended to link with the South Railway and use common loadout facilities.

Ore stockpiling at the Mine Site will increase with the addition of the North Railway stockpile and a Temporary Ore Transfer Area. Refer to the Phase 2 Proposal Mine Site layout for the locations of these facilities (Appendix B).

2.3 Construction of the North Railway Terminal at the Mine Site

The function of the terminal at the Mine Site will include:

- Loading of ore;
- Unloading of fuel and freight; and
- Material back-haul.

Rail car loading will be carried out using front end loaders. The implementation of an automated rail loading system may be considered at a future date pending lead time of procurement, construction of foundations and securing and installing support equipment.

The North Railway line will extend through the Mine Site and eventually connect with the future South Railway line located at the opposite end of the Mine Site. A railway loop, siding and rail car loading terminal will be constructed.

2.4 Mine Site Camp

Once construction of the South Railway begins, the camp will be further expanded to accommodate the construction workforce required for the construction of the northern section of the South Railway The expected workforce and bed count required for the duration of the Phase 2 Proposal are presented in the Key Facts Table (Appendix C).

2.5 Expansion of Water Supply and Sewage Treatment Facilities

Both the potable water treatment plant and the sewage treatment plant will be expanded over time to meet the increased load requirements at the Mine Site. Requirements for water supply as well as volumes of sewage effluent to be discharged are presented in the Key Facts Table (Appendix C) for the duration of the Mary River Project. Details regarding approved water supply and sewage treatment facilities are presented in the Fresh Water Supply, Sewage and Wastewater Management Plan (Baffinland 2016a). Camp Lake will continue to be the water supply source for the Mine Site.

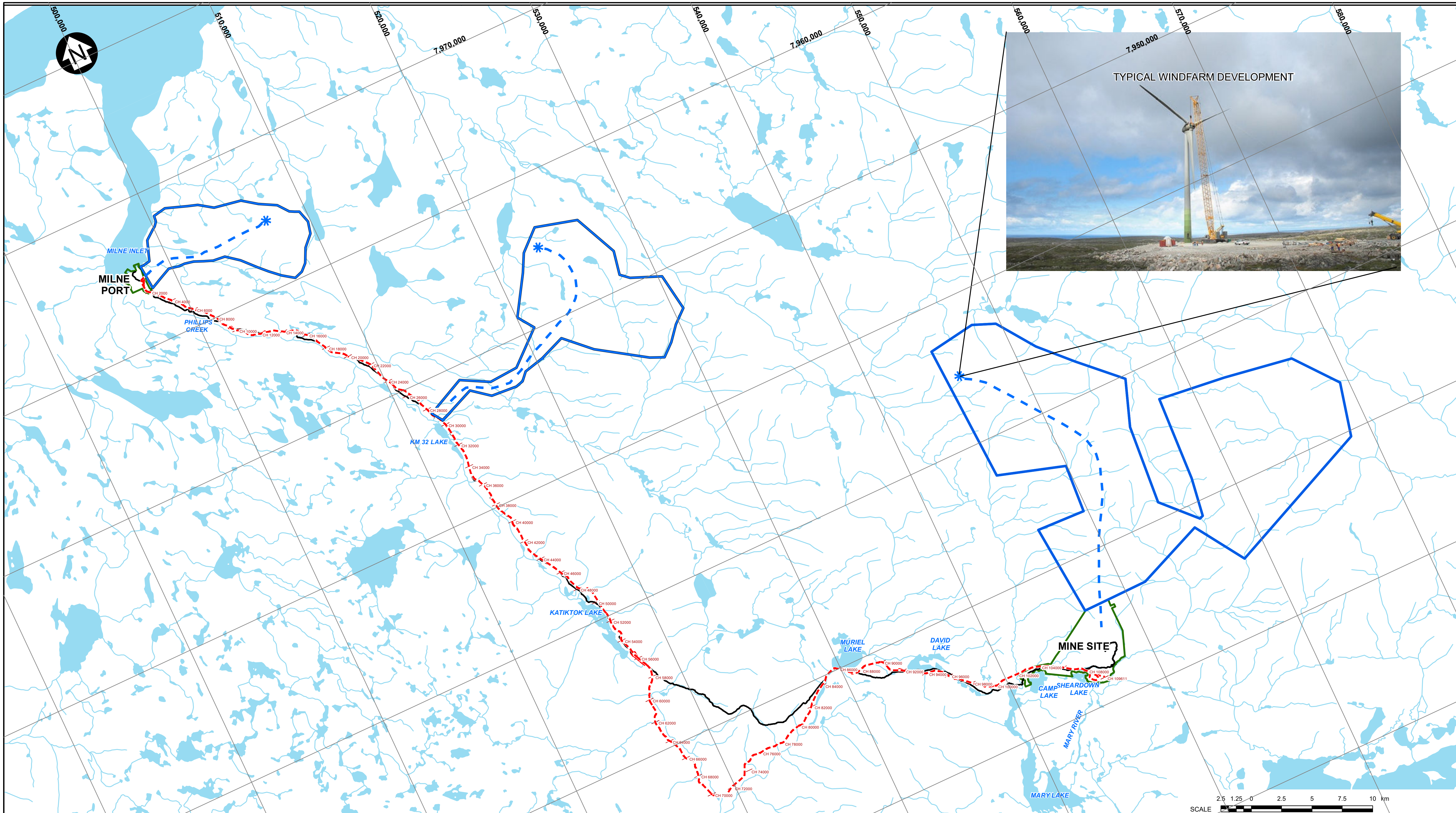
Water withdrawal amounts authorized under Type A Licence 2AB MRY-1325 are adequate to satisfy the water demand for the Phase 2 Proposal.

2.6 Expansion of the Power Plant

Power is supplied to Mine Site facilities with six 1.35 MW diesel generators, with a capacity of 5.4 MW. At the time of writing, peak power demand of 3.5 MW will gradually increase to 22 MW. Air dispersion modelling carried for the Phase 2 Proposal (TSD 07 Atmospheric Assessments) at the Mine Site is based on diesel generators operating at a continuous load of 23 MW.

2.7 Installation of Wind Turbines

As a means of reducing operating costs and site fuel consumption, Baffinland is evaluating the use of wind turbines. The capacity of the wind turbines under consideration ranges from 3.5 MW to 4.2 MW per unit. Initially, two wind turbines would be installed at locations near Milne Inlet, close to the Tote Road, or the Mine Site (Figure 2.1). Information on wind turbine installation is presented in Appendix E.



LEGEND:

- TURBINES
- WIND FARM STUDY AREAS
- NORTH RAILWAY
- NORTH RAILWAY CHAINAGE (m)
- MILNE INLET TOTE ROAD
- PROJECT DEVELOPMENT AREA
- WATER

NOTES:

1. COORDINATE GRID IS IN KILOMETRES.
   COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. BASE MAP/IMAGERY: © ESRI AND DATA (ONLINE) SERVICE LAYERS (2017). REDLANDS, CA: ENVIRONMENTAL SYSTEM RESEARCH INSTITUTE. ALL RIGHTS RESERVED.
3. FIGURE CREATED BY KNIGHT PIESOLD LTD.
4. INSET IMAGE OF DIAVIK DIAMOND MINE'S WIND TURBINE WHILE UNDER CONSTRUCTION (MININGANDENERGY.CA, ACCESSED JUNE, 2018)

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	19JUN18	ISSUED WITH TRANSMITTAL	RAC	SBF	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PROJECT OVERVIEW SHOWING WIND STUDY AREAS

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE 2.1 REV 0

SAVED: I:\1\02\00181\45\A\GIS\Figs\NB18-00286\ArcMap 10.5 Versions\Fig8.8 Wind Study Area.mxd, Jun 19, 2018 4:08 PM; sfoster

2.8 Expansion of Mine Site Fuel Storage

Fuel storage at the Mine Site is small (2 Million Litres, ML), sufficient for 20 days of operation, with fuel delivered by truck on a regular basis. Fuel at the Mine Site is used mainly for power generation, to supply the mining fleet, and for aircraft.

The Key Facts Table presented in Appendix C presents the expected fuel consumption over the years as mining production increases to the include the Phase 2 project and Steensby Project. Fuel consumption is expected to peak in the late 2026-2028 period when the strip ratio will peak for the mining operation. However, by this time, Steensby Port and the South Railway will be operational, and fuel will be delivered as required to the Mine Site by rail cars (refer to description presented in the Approved Project).

The construction years of the Phase 2 Proposal are critical for providing adequate storage capacity of fuel both at Milne Port and at the Mine Site to support the mining operation and construction activities. Expected annual fuel consumption for the construction period is presented in Appendix C. For this period, fuel storage requirements must balance consumption rates with ship deliveries at Milne Port during open water season.

It is expected that fuel will continue to be delivered at Milne Port in 15 ML shipments between July 15 and October 15, annually. Each shipment will be unloaded at the Milne Port tank farm. Fuel will then be transferred by tanker trucks (30,000 L capacity) to the Mine Site. Once the North Railway is in operation, consideration will be given to transportation of the fuel by rail from Milne Port to the Mine Site. Should this occur, it would be subject to the same management practices as described in the FEIS for the potential transportation of rail on the South Railway.

2.9 Other Facilities

The Mine Site requires several ancillary building and maintenance facilities to support the operation. Most of the facilities are existing (maintenance facilities, warehouses, shops, and administration building) and will be expanded. Additional temporary shops and shelters may be required during the construction period.

2.9.1 Waste Management Facilities

Table 2.3 lists the waste management facilities operating in accordance with the Type A Water Licence, along with the relevant management plans that govern their operation.

Table 2.1 Approved Waste Management Facilities

Facility	Purpose	Relevant Management Plan(s)
Incinerator (Both Sites)	Disposal of combustible, non-hazardous waste	Waste Management Plan (Baffinland 2018)
Landfill (Mine Site)	Disposal of non-combustible, non-hazardous waste	
Landfarm (Both Sites)	Treatment of hydrocarbon contaminated soils and snow/ice	Landfarm Operation Maintenance and Monitoring Manual (Baffinland 2016f)
Hazardous Waste Storage Areas (Both Sites)	Designated areas used to temporarily store hazardous wastes until they can be removed from site	Hazardous Material and Hazardous Waste Management Plan (Baffinland 2016h)
Sewage Treatment Plant (Both Sites)	Treat human waste and greywater	Fresh Water Supply, Sewage and Wastewater Management Plan (Baffinland 2016a)

Baffinland's Waste Management Plan approved by the NWB outlines Baffinland's approach for managing wastes. Expected quantities of waste generated during the Project are presented in the Key Facts Table (Appendix C). The existing waste management facilities, transfer stations, and landfarm can accommodate the increased production rate. The EPP (Baffinland 2016c) contains Operational Environmental Standards that are relevant to waste management practices at the site. An inventory of materials expected to be landfilled is provided within the Waste Management Plan (Baffinland 2018)

The landfill will be expanded under the Approved Project. Details for this expansion will be submitted to the NWB for approval under the Type A Water Licence MRY 2AA-1325. The Waste Management Plan will be updated as required and submitted to the NWB for approval should any changes be considered. Expansion of the landfill will be permitted with the NWB.

2.9.2 Explosives Facilities

An established explosives contractor is responsible for the handling, manufacture, storage and use of explosives at the Project. Existing explosives handling facilities and infrastructure includes:

- One modular emulsion manufacturing plant at the Mine Site;
- Storage areas for Ammonium Nitrate (in 1,000 kilogram (kg) tote bags, stored inside weatherproof shipping containers) near the emulsion plant;
- Storage for pre-packaged explosives at magazine depots which are separate from the emulsion plant at the Mine Site;
- Raw Materials Storage inside weatherproof shipping containers, located at the Mine Site; and
- Emulsion truck staging areas.

The design premise of the facilities is based on working to achieve a zero-effluent process. Contaminated wastewater generated from manufacturing operations as well as truck wash water is collected and re-used in the process.

The explosives plant will continue to be used until the quantities of explosives required by the Project exceed the quantity that can be stored at the existing magazines in accordance with Natural Resources Canada's (NRCan) quantity-distance tables (NRCan 2014). The quantity of explosives will increase as the Mine production rate and the waste rock stripping ratio increase, and eventually a new explosives plant and storage facilities will be constructed to the north of the open pit, at the location approved for the original 18 Mtpa South Railway operation in the FEIS (Baffinland 2012). This second location will meet the quantity-distance requirements for the quantity of explosives required for the project.

2.10 Construction of the South Railway (Mine Site-to-Steensby Port)

The facilities included in the Phase 2 Proposal will permit the expansion of the mining production as well as providing support facilities for the construction phase of the northern section of the South Railway line as was described in the FEIS (Baffinland 2012) and are authorized under Project Certificate No. 005. Additional laydowns, shops, shelters, fuel, and accommodations will be required for the 4-year construction period. The Key Facts Table (Appendix C) summarizes the quantities of fuel, water, sewage effluent and wastes that will be generated during this construction period.

2.10.1 Accommodation

For the construction phase of the South Railway, the Mine camp will be expanded to house the additional peak workforce (as assessed in the 2012 FEIS). Refer to Appendix C for expected work force level, water demand and expected waste generation.

2.10.2 Other Construction Support Infrastructure

As stated in the 2012 FEIS, a number of temporary buildings, shelters, and structures will most likely be required to support the construction of the South Railway.

2.11 Post-Steensby Construction Period

By 2024, both the South Railway and Steensby Port will be operational. Steensby Port will become the primary supply port for fuel, supplies and equipment required for the Mary River Project. The port will remain active year-round with ongoing shipping during the winter months. The operation of the Steensby Port is described in the 2012 FEIS.

3 NORTHERN TRANSPORTATION CORRIDOR

3.1 Tote Road

In 2014, the North Baffin Regional Land Use Plan (NBRLUP) was amended to establish the Tote Road as a transportation corridor (AANDC 2014). The road is a vital transportation link for the Project and, as such, upgrades to the road have been ongoing since 2013. Additional upgrades will continue during the Phase 2 Proposal. These are discussed under Section 3.1.3.

The road right-of-way may also be used to stage rail construction, though some activities will occur from the railway PDA. Culverts will be required to accommodate changes due to rail construction. There will be an increase of traffic during construction of the North Railway.

For approximately 3 years during development of the North Railway, construction under the Phase 2 proposal and operations under existing authorizations will occur concurrently. Traffic will increase during the railway construction. Road usage will subsequently be reduced, once the North Railway is operational. Expected traffic volume on the Tote Road are shown in Key Facts Table (Appendix C).

Road maintenance equipment consists of various pieces of heavy equipment (graders, loaders, dump trucks excavators, water trucks) stationed at Milne Port and/or the Mine Site. Equipment maintenance occurs at garages located at both Project sites.

3.1.1 Safe Use of the Road by Others

The road is a link for hunters to access the interior of northern Baffin Island in both summer and winter months.

The road is a public right-of-way, which Baffinland maintains. Land users are permitted to use the road as prescribed in the Nunavut Agreement. Nonetheless, Project use of the road poses a public safety concern due to the interaction of Mine trucks and land users. To increase the safety of all users, Baffinland has implemented its Roads Management Plan (Baffinland 2016b), which includes a Hunter and Visitor Site Access Procedure (Baffinland 2015a). This requires hunters to register at Milne Inlet that they are in the area, and for the hunters and their equipment to be transported up or down the Tote Road by Baffinland, in accordance with its Tote Road Travel Procedure (Baffinland 2015b). Hunters are offered to come into the sites for a hot meal, fuel is made available, and the hunters and their equipment are transported up the Tote Road to the Mine Site by company truck. This controlled access reduces safety concerns and provides a benefit to the hunters also in terms of accessing inland areas.

Project drivers are expected to remain aware of individuals observed along the road, as they may not be aware of the hazards associated with Project activities and traffic. Observations of non-Project personnel are reported and recorded (Section 2.2 of the EPP; Baffinland 2016c).

Access management will remain in place on the Tote Road pursuant to the Roads Management Plan. Once the railway is operational, Project traffic on the Tote Road will be reduced, but not eliminated. Baffinland will maintain its current practices in regard to escorting public traffic up the road, as described in its Roads Management Plan. The Railway Management Plan (Canarail Consultants Ltd. 2010) will be updated to consider potential interactions between land users between both the Tote Road and the North Railway.

3.1.2 Wildlife Protection Measures

Road operation measures to protect potential interactions with wildlife considering the level of traffic associated with the ERP were identified in the Addendum to the FEIS (Baffinland 2013a) and have been incorporated into the Terrestrial Environment Mitigation and Monitoring Plan (TEMMP; Baffinland 2016d) and the Roads Management Plan (Baffinland 2016b). Key wildlife protection and monitoring measures include:

- All traffic will yield to wildlife encountered on roads (when possible/safe to do so);
- Wildlife sightings along roads are reported and recorded as incidental observations on posted wildlife logs at accommodations complexes (Section 2.23 of the EPP);
- The Environmental Manager maintains a registry of wildlife sighting locations and frequencies; and
- Wildlife mortalities on Project sites and roads are reported to the required government agencies and stakeholders.

This information is used to inform terrestrial wildlife studies and to formulate mitigation measures for wildlife protection and is included in annual (or more frequent) reports to government agencies and stakeholders.

The Phase 2 Proposal involves an increase in traffic during Stage 1 (construction of the North Railway). The mitigation measures presented in the management plans will continue unchanged during this period.

3.1.3 Ongoing Road Improvements

Improvements to the Tote Road since 2013 have included the following:

- Installation of four bridges and removal of the temporary bridges;
- Culvert replacement and extension;
- Road base improvements;
- Realignment of several sections of the road; and
- Grade reductions at several locations.

The Tote Road Earthworks Execution Plan (TREEP; Golder 2017), outlines future road improvements to be undertaken in 2017 and beyond. The TREEP identifies measures to manage sedimentation potential, and upgrades to existing culverts.

The upgrades associated with the TREEP will be completed prior to initiating the Phase 2 Proposal, and, will support the expected temporary increased traffic.

Stream diversions will be required to accommodate the North Railway. As a result, additional culverts will be upgraded along the Tote Road. Details pertaining to the upgrades of these culverts will be explored in the detailed engineering phase. The installations will be consistent with direction previously received from Fisheries and Oceans Canada (DFO) in the fisheries authorization and the letters of advice.

3.1.4 Road Use During North Railway Construction

The primary use of Tote Road is to support ERP mining operations including personnel and supplies. The road will also provide necessary access to the railway alignment, particularly during the initial stages of rail construction.

The estimated traffic volume of service vehicles (e.g., personnel transport, supplies, fuel and water) is expected to increase from current levels. Predicted vehicle traffic on the Tote Road is listed in the Key Facts Table (Appendix C).

Ongoing maintenance of the Tote Road will require borrow material from several quarry and borrow sites. The Roads Management Plan (Baffinland 2016b) describes the approach to Tote Road maintenance. The plan addresses:

- Sourcing of borrow material for ongoing maintenance;
- Development and approval of borrow and quarry site;
- Freshet management;
- Runoff water management;
- Dust management; and
- Road use during North Railway operation.

3.2 North Railway

3.2.1 Railway Components

The North Railway will be a heavy-haul mineral transport railway built to transport iron ore from the Mine Site to Milne Port (Figure 1.3). It will also transport equipment, materials, and fuel. The railway design is similar to that of the South Railway proposed in the FEIS. Key specifications of the conceived operating North Railway are summarized in Table 3.1. Drawings are presented in Appendix B.

Table 3.1 North Railway Operating Specifications

Ore Transport		**Locomotives**	
Ore Traffic	12 Mtpa	Fleet size	4 + 1 spare
Train design speed	75 km/h	Engine type	Diesel electric
Operating speed	60 km/h	Horsepower	4,400 HP
Number of trains	2 - 4	Special specifications	Tier 4, Extreme cold weather
Locomotives per train	2, 1 spare	Size	6 axles, 23 m length
Rail cars per train	72, up to 90	**Ore Cars**	
Train length	1000 m	Fleet size	up to 200 (including spares)
-	-	Car tare weight	22 t
-	-	Maximum payload	108 t
Net weight	9540 t	Coupler to coupler length	10.5 m
Trainloads per day	8 loads/d	Car width	3.2 m
Wheel track gauge	Standard 1,435 mm	Maximum car height	7.0 m from top of rail

The North Railway will consist of the following components:

- Railway embankment and track;
- Quarries along the alignment, to source construction materials for the embankment;
- Quarries near Milne Port and the Mine Site to obtain rock for ballast replacement for railway maintenance;
- Watercourse crossings (bridges and culverts);
- Locomotives and cars (ore, fuel, and general freight cars);
- Ore and freight loading/unloading facilities at the Mine Site and Milne Port;
- Railway maintenance yard at Milne Port; and
- Ancillary facilities (e.g., communication towers).

Appendix B contains indicative figures showing existing and proposed infrastructure within the Northern Transportation Corridor. Existing features include the Tote Road, borrow areas, communications towers, and approved water sources.

Appendix D presents the following additional information on the North Railway:

- North Railway engineering drawings;
- Preliminary list of watercourse crossings and stream diversions showing fish habitat designations, along with typical bridge and culvert drawings; and
- List of proposed aggregate sources within the Northern Transportation Corridor.

The railway embankment will be comprised of fill, sub-ballast, and ballast materials, with ties and steel rails. The railway main line will be about 105 km long from loading station to unloading station, and 110 km in total length. Additional track will be located at a strategic location along the railway to allow loaded ore trains to pass an oncoming empty train. Other sidings will exist at the Mine Site and Milne Port. Construction sidings may be used during construction.

North American standard heavy haul locomotives will be used; the same locomotives that are proposed to be used on the South Railway. The locomotives are approximately 23 m long, weigh 190 tonnes and are powered with AC diesel generators. All locomotives will be equipped with US EPA Tier 4 diesel engines in accordance with the new Locomotive Emissions Regulations, which came into force on June 9, 2017 (Transport Canada 2017a) as well as Commitment #18 in the Final Hearing Report (NIRB 2012). The engines will also be equipped to adapt the engines to the cold climate, potentially including special electronic control systems, and supplementary heaters on small reservoirs separate from the larger fuel tanks so that fuel is delivered to the generators at an optimum temperature. The locomotive engines will be running continuously, even during the loading and unloading process.

The railway design has focused on developing streamlined railway infrastructure necessary for operational viability and safety, considering the following factors:

- Arctic cold climate and streamflow conditions;
- Permafrost conditions;

- Impacts of climate change;
- Remoteness of the Project site; and
- Applicable legislation and standards for railway design and operation in Canada.

Railways in Canada are highly regulated and operate in accordance with several acts, regulations, standards, and guidelines. Prior to operating either of the railways associated with the Project, a Certificate of Fitness from the Canadian Transportation Agency (CTA) will be required following completion of the Project Certificate reconsideration process. A detailed discussion regarding the Legislation and standards applicable to the design and operation of the railway is found in the Railway Management Plan (FEIS Appendix 10D-9.1), which will be updated to suit the North Railway.

3.2.2 Lessons Learned from Other Northern Rail Operations

To the extent possible, experience from railway operations in other northern locations has been incorporated into the design. The Alaskan Railway, the Canadian line to Churchill, Manitoba, some of the most northerly lines in Scandinavia, and China's Tibet railway all deal with permafrost. Furthermore, with the Quebec Cartier Mining, ArcelorMittal has acquired decades of experience with the operation of a railway in cold climate conditions. Baffinland will draw on this expertise to guide the development of its railway operation.

Railway operating conditions will not be significantly different, in terms of the extremes of climate, from those already experienced by the Quebec North Shore and Labrador Railway when it served Schefferville (as the Tshiuetin Transportation Company still does). For example, in the past 30 years of weather records the extreme low at Pond Inlet was only 4° colder than the extreme low at Schefferville and the daily average of the coldest month was only 6° colder at Pond Inlet than at Schefferville. However, Schefferville's extremely cold weather lasts for 6 to 7 weeks, whereas the extreme cold in northern Baffin Island lasts for 5 to 6 months. This will be demanding on the operating and maintenance crews but will be managed to a large extent by the relatively rapid rotation of crews at the Project site.

3.2.3 General Characteristics of the Northern Transportation Corridor

The Northern Transportation Corridor generally follow a northwest-southeast oriented glacial valley between Milne Port and the Mine Site. Surficial deposits along this alignment include till veneer or blankets on the higher elevations with some drumlins and moraines. Glaciofluvial outwash sediments (gravel and sand) forming braided floodplains, terraces and fans or stratified glacial drift (gravel and sand) are typically found in the valley floors.

While limited bedrock exposure is notable along the Northern Transportation Corridor, bedrock is present at relatively shallow depths along much of the alignment, covered by the till veneer. Starting at Milne Port, and alignment crosses approximately 20 km of Precambrian terrain, glaciofluvial sand and gravel terraces. Further south, the rail alignment spans across relatively flat lying Paleozoic rocks mainly dolomitic limestone units for approximately 70 km. The final stretch of the rail alignment traverses glaciolacustrine and glaciofluvial plains, terraces, eskers, and bedrock outcrops ranging from granitic gneiss to sedimentary rocks.

Fragile landscapes in the region are generally associated with frost/thaw sensitive till blankets and the presence of massive ground ice within glaciofluvial deposits. A number of significant polygons and areas of high potential for ground ice content are present along the Tote Road alignment and in the vicinity of the Mine Site. Geotechnical investigations conducted in

2016 along the proposed alignment prompted localized adjustments to the routing to avoid massive ice deposits. Further geotechnical investigations were completed in 2017.

3.2.4 Consideration of Inuit Land Use and Public Safety

The location of the railway alignment in relation to outpost camps as well as hunting and travelling routes is an important consideration. The only outpost camp in the area is located on the west side of Camp Lake; this is the Mittimatalik Hunters and Trappers Organization (MHTO) cabin that Baffinland constructed in 2013 to compensate for the former MHTO cabin located within the Mine Site. The railway is located further away from the outpost camp than the road.

Inuit travel extensively throughout the North Baffin region, including in the vicinity of the Tote Road and the proposed North Railway. Primary travel routes, derived from Inuit knowledge workshops completed in the late 2000's for the Project, are presented on Figure 3.1. This information was presented previously in FEIS Appendix 4C (Knight Piésold Ltd. 2010).

The Phillip's Creek valley, as well as the Tugaat River to the northeast, are important routes for hunters accessing the inland as well as for inter-community travel between Pond Inlet and Igloolik or Hall Beach. The Pisiksik Working Group indicated that travelers follow the road alignment occasionally because of easier travel; however, snowmobile traffic will also follow parallel routes inland, in part seeking better snow conditions. Some travel from Milne Inlet, the Tugaat River or other coastal entry points inland reach the height of land at the top of the Phillip's Creek watershed (just south of Katiktok Lake) and head due south towards Foxe Basin.

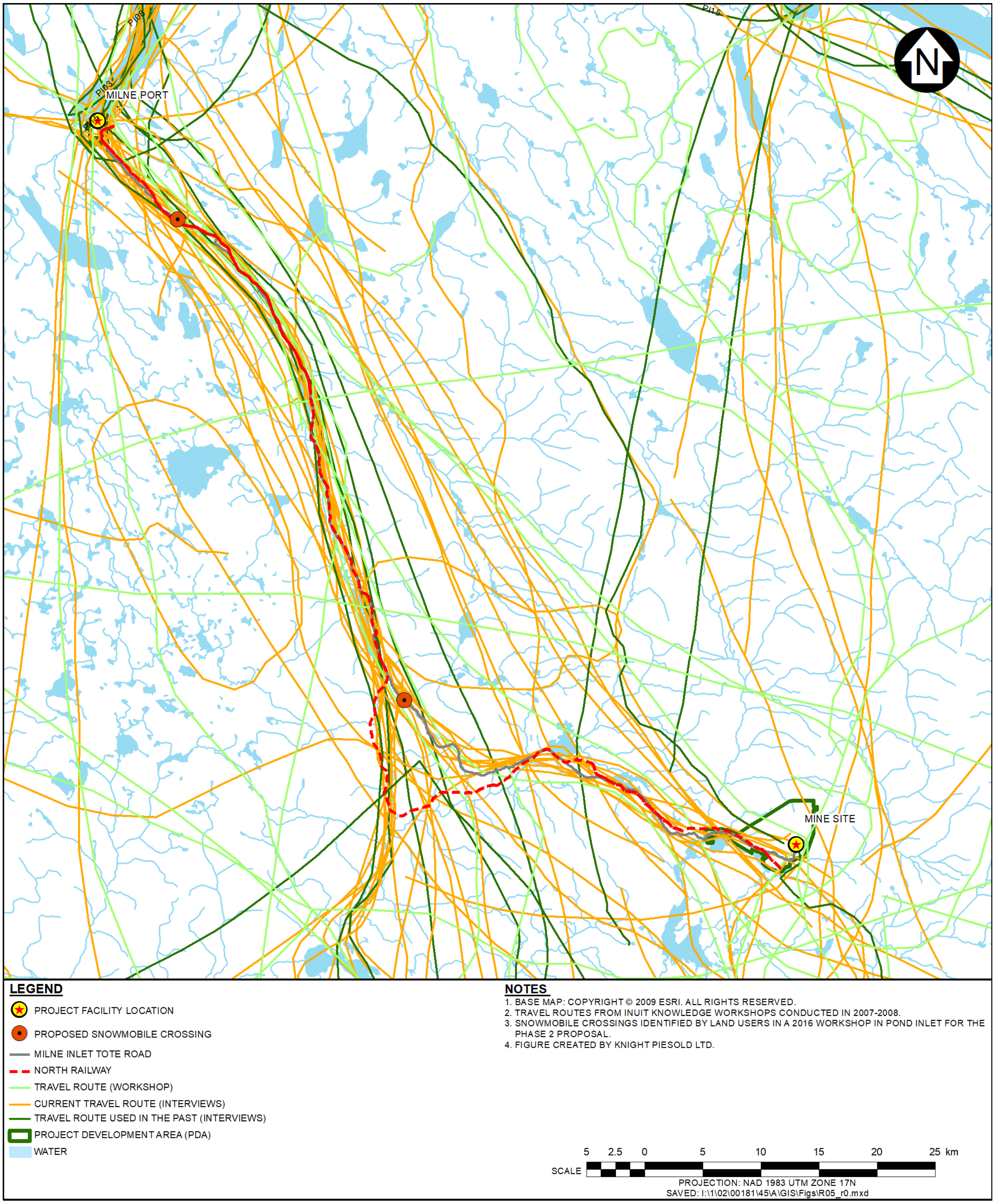


Figure 3.1 Travel Routes near the Northern Transportation Corridor

3.2.5 Consideration of Effects to Wildlife

Caribou are a key wildlife resource for local communities, and therefore consideration of impacts to terrestrial wildlife focuses on caribou as a key indicator of other terrestrial wildlife.

Conversion of ore haulage operations from road to rail, and construction of the railway adjacent the existing road within the Northern Transportation Corridor, by design, mitigates impacts on caribou:

- The reduction in ore haul vehicle passes with transition from truck to rail reduces sensory disturbance effects;
- The railway can generally be constructed from the Tote Road, avoiding the need to construct a dedicated construction access road, which will reduce the overall disturbance footprint;
- Use of a railway will reduce dust generation and resultant impacts to vegetation as caribou forage; and
- The location of the railway within the valley avoids potential caribou calving habitat at higher elevations.

Baffinland has discussed the potential impacts of a railway on caribou with communities and hunters. A comprehensive Inuit knowledge study or Inuit Qaujimajatuqangit (IQ) was undertaken with the potentially affected North Baffin communities from 2006 to 2010, focusing on Inuit land use, marine mammals, and caribou.

As it relates to caribou, this included conducting individual interviews with 45 elders, and caribou workshops in five communities, and workshops in March 2008 and September 2010 that incorporated representatives from the five potentially-affected North Baffin communities. The scope of the study is described in FEIS Appendix 2B, and the results of that work are incorporated throughout the FEIS. From this database, 53 comments were noted specifically in relation to caribou interactions with the railway. Volume 6 of the FEIS incorporated IQ and scientific knowledge of caribou biology, trends, distribution, and potential impacts.

Information on caribou and the proposed North Railway was collected at a caribou workshop held in Pond Inlet in November 2015. This information was subsequently verified at follow up workshops in Arctic Bay and Pond Inlet in April 2016. Workshop results are presented in TSD 03.

Additional caribou information relevant to the Northern Transportation Corridor (including the North Railway) includes caribou trail mapping completed along the Tote Road (EDI 2011). The objective of that work was to determine movement trajectories and identify potential crossing areas. Caribou trails were marked, the angle at which the trail approached the rail line (crossing or parallel), and substrate material (wet vegetation, dry vegetation, sand, and rock) were described.

The trail crossing data were classified as high, medium, and low. Segments within each of the classes were ground-surveyed for animal sign to verify aerial trail survey results, collect finer-scale wildlife use information, and identify broad timing windows (recent and old) of use. The mapped trails from EDI (2011) are presented as Figure 3.2.

A large number of raptor nests (mainly occupied by Peregrine Falcon) were also identified in the general area of the North Railway, with seven nests being located within or adjacent to the original North Railway PDA. Modifications to the Project footprint were made to the extent feasible for the setback from the North Railway PDA. This included adjusting the extent of or moving proposed quarries.

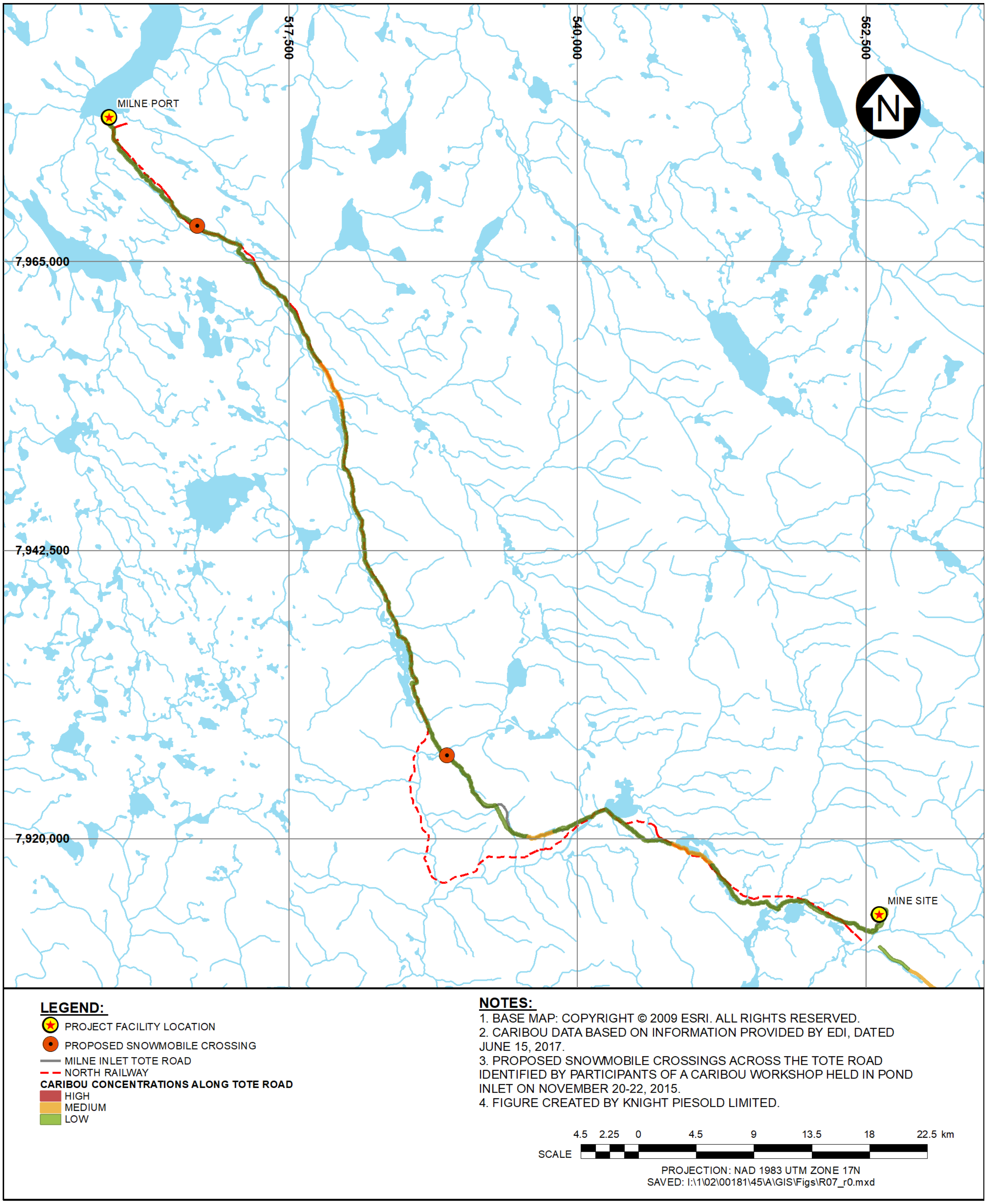


Figure 3.2 Caribou Crossings near the Northern Transportation Corridor

Further terrestrial and marine wildlife workshops are planned for the fall of 2018. Feedback from these workshops will be considered for the final design.

3.2.6 Selection of a Preferred Railway Route

Alternatives analyzed included a comparison of rail versus road for hauling ore to Milne Port, and an evaluation of route alternatives for the North Railway (Section 7 and TSD 01 Alternatives Analysis). The preferred route parallels the Tote Road to the extent feasible, considering ground conditions as well as grade and turn radius limitations of railways (i.e., an allowable maximum 1.5% uphill grade in the loaded direction and 3.0% downhill grade in the loaded direction).

The proposed routing of the North Railway is shown on Figure 1.3. Starting from Milne Port, the railway will run alongside the Tote Road within the Phillip's Creek valley to the top of the watershed at km 57. From this point until km 84.5, it is necessary for the railway to deviate from the Tote Road alignment, travelling west of the road to circumvent a localized land elevation to maintain acceptable grades for the railway. The only alternative to circling this hill would be to undertake a massive excavation, which would be both costly and create a large disturbance on the landscape. The maximum distance between the rail alignment and the Tote Road is 7 km. From km 84.5 to the Mine Site, the railway once again parallels the Tote Road.

Locating the railway adjacent to the existing Tote Road is preferred for the following reasons:

- The alignment is located within the existing transportation corridor established by Appendix P of the NBRLUP. Transportation corridors are established under land use planning principles with the intent of accommodating future transportation and/or communications facilities, to reduce the overall disturbance to the landscape. Therefore, construction of the North Railway within the existing transportation corridor is consistent with both land use planning principles and with the amended NBRLUP.
- The existing road is available to support construction, which significantly reduces the railway construction costs. By comparison, when Baffinland builds the south rail in the future, it will be necessary to construct a dedicated construction access road to facilitate construction, because a road does not exist in that location. Selection of an alternative route for the North Railway would require additional construction access roads.
- By using a common transportation corridor, impacts to land users as well as wildlife is reduced. Losses of wildlife habitat, sensory disturbance effects to wildlife, and impacts to Inuit land use and harvesting are reduced.
- Archaeological surveys over multiple years along with mitigation of site through systematic data recovery have established that while archaeological sites do exist within the corridor, no culturally significant sites have been identified to date.
- Paleontological studies of the area have identified several sedimentary deposits that may overlap with the railway alignment, and these deposits may contain fossils (Rybczynski 2008).

3.2.7 Climate Change Considerations

Climate change is an important consideration in the railway design. In support of its feasibility studies and this environmental assessment, Baffinland undertook a climate change assessment, which included a review of the latest available research and modelling of climate change scenarios applicable to the region in which the Project is located (TSD 06). As it relates to the design and construction of the North Railway, the climate change assessment identified several climate change impacts and adaptation measures.

3.2.7.1 Increased Precipitation

Increased precipitation could result in increased runoff and more extreme storm events (TSD 06 Climate Change Assessment). Therefore, bridges and culverts have been designed conservatively, by applying a higher return period to the design basis than otherwise may be used.

3.2.7.2 Increased Active Layer Thickness and Permafrost Degradation

Warmer air temperatures will increase the thickness of the active layer, and in some cases will result in degradation of permafrost. Where ice-rich soils exist, this will likely result in some settlement. The primary mitigation measure for addressing this is to avoid ice-rich soils and construct on top of rock or well-drained soils that are not thaw-sensitive. Secondarily, a number of strategies will be employed to preserve the existing thermal regime of the ground beneath the embankment. The assumed thickness of the active layer has been increased in accordance with estimates presented by the (TSD 06), as presented in Table 3.2.

Table 3.2 Permafrost Depth and Active Layer Thicknesses

Frost	Value	Additional Active Layer Thickness for Climate Change
Permafrost depth	Down to rock	
Depth of active layer	0.6 to 3.0 m	
Till	1.0 m	0.5 m
Sand and Gravel	1.5 to 2.5 m	1.0 m

3.2.7.3 Other mitigation measures to preserve the existing thermal regime in the ground

Monitoring of temperatures within and surrounding the railway embankment will be undertaken as described in the Railway Management Plan. Baffinland is also developing a climate change strategy and while specific actions are yet to be developed under the strategy, it is likely that this monitoring will be incorporated into Baffinland's climate change monitoring and research program to be further detailed in the Climate Change Strategy.

3.2.8 Embankment Design for Permafrost

3.2.8.1 Design Criteria

A key aspect of the railway design is designing for construction on continuous permafrost. Even moderate alteration of the thermal regime at the ground surface can alter the ground surface energy balance and induce permafrost thawing that can result in consequent settlement and damage to the railway embankment. Railway embankments are susceptible to thaw settlement damage because more cuts and fills are required (compared to a road) to reduce changes in grade. Additional allowances have been made to account for climate change effects, including an assumed increased thickness of the active layer.

Excessive settlement of the rail embankment may occur due to:

- Permafrost degradation;
- Poor quality construction materials;
- Poor construction methods;
- Overlooked geotechnical conditions; and
- Extreme natural events.

Permafrost degradation presents the greatest risk to settlement of the railway embankment. This may occur when ice lenses are present in the railway cut location or if water ponds against the upstream side of the rail embankment. If excessive settlement and permafrost degradation is not monitored and remediated there is a potential for train derailment causing property damage, negative environmental impacts, and possible human injury.

Geotechnical site investigations were completed along the North Rail alignment in 2010 and 2016, and further investigations were completed in 2017 and 2018. These geotechnical site investigations include the identification of suitable aggregate sources for construction. Comprehensive geotechnical site investigations and the use of appropriate construction materials and procedures help mitigate the risk associated with excessive settlement.

The primary design and maintenance challenges in discontinuous permafrost regions relate to transitions between zones with and without permafrost or to very small changes in ground temperature that create new permafrost zones or eliminate existing ones. These issues do not occur in zones with permanently frozen ground encountered in the deeper cold permafrost (average -9°C) and colder environment of northern Baffin Island.

The following routing criteria have been applied to provide a stable substructure and reduce capital costs:

- Route railway on/through areas of rock sub-grade where available;
- Utilize rock cuts to level track and as a quarry source for areas where rock fill is required;
- Avoid ice-rich permafrost where practical;
- Reduce the amount of permafrost excavation used;
- Align railway to reduce cut volumes; and
- Use deviations from the existing road where substantial benefits can be realized.

The approach to railway subgrade design is summarized as follows:

- Promote raising the transition zone between the permanently frozen ground and the active layer;
- Reduce disturbance to natural drainage patterns;
- Reduce thawing of sensitive soils;
- Avoid cuts in thaw-sensitive soils when the soils themselves cannot be avoided;

- Prepare for remedial work once the railway is operational. This may require the use of stabilization berms, thermosyphons or the shading of south facing embankments not adequately cooled by natural ventilation; and
- Upgrade structure periodically.

Foundation recommendations have been established for the railway embankment by sub-grade type as follows:

- Railway constructed on rock;
- Embankment on permafrost (standard profile); and
- Embankment on ice-rich permafrost.

The preliminary design criteria for earthworks, including embankment design and cuts, are presented in Table 3.3.

Table 3.3 Earthworks Preliminary Design Criteria

Element	Design Criteria
Embankments	
Typical side slopes	1V: 1.5H
Sub ballast layer 150 mm	Type 26 crushed rock
Second layer 550 mm in non-susceptible and potentially susceptible to ice soils, choked with Type 26	Type 12 run of quarry rock fill
Second layer 1,350 mm in moderately susceptible and highly susceptible to ice soils, choked with Type 26	Type 12 run of quarry rock fill
Geotextile below 1,350 mm layer	1,800 g/m^2 stiff woven
Sub-Grade Cuts	
Cut side slopes in rock	8V:1H
Cut side slopes in ice rich soils and insulation	1V:2H
Recovery of cut frozen ground for fills	Reuse or disposal in former borrow areas and quarries

3.2.8.2 Railway Excavations (Cuts)

One of the fundamental criteria for the railway alignment is to reduce cuts in ice-rich soils to avoid inducing thermal changes that may cause thaw settlement. The majority of the cuts will be into rock, most of which will be used as fill in the railway embankment. Approximately 25.5 km of the railway alignment may involve rock cuts (Appendix F). The need to excavate in permafrost soils was avoided to the extent practical, but in certain locations it could not be avoided or justified in terms of bulk earthworks volumes. The unavoidable cuts in ice-rich soils will be mostly at the approaches to crossings to avoid excessive pier height for the bridges or excess fill over culverts. Cuts that are not near crossings are more likely to be in rock than in ice-rich soils.

Typical drawings showing the preliminary design of the railway substructure constructed on rock, on permafrost, and ice-rich permafrost are presented in Appendix D, and a cross section for a typical excavation in (non-ice rich) permafrost is presented as Figure 3.3. The approach for excavation of permafrost soils is as follows:

- The excavation should be day lighted to the low side of the side slope. In locations where daylighting is not possible the side slope on the other side will be a mirror image of the slope in the figure to a height where it cuts the natural ground level.

- The side slopes of 1V:2H of the excavation are covered by a layer of 1,000 g/m^2 non-woven geotextile and a 500 mm cover of selected type 12 material.
- The layerworks for the embankment are the standard 700 mm under the ballast toe plus 100 mm polystyrene layer for a total of 800 mm from top of sub ballast to top of excavated permafrost.
- The polystyrene insulation layer is overlain by a 1,800 g/m^2 geotextile for protection.
- The standard widths of the top formation apply for tangent track to curves of less than 400 m radii (i.e., 4,624 mm, 4,900 mm, and 5,100 mm).

At substructure locations, efforts were made to daylight the cutting to one side to avoid snow traps. This approach, however, cannot be implemented everywhere, and snow barrier mitigation measures will need to be taken to reduce the trapping of snow.

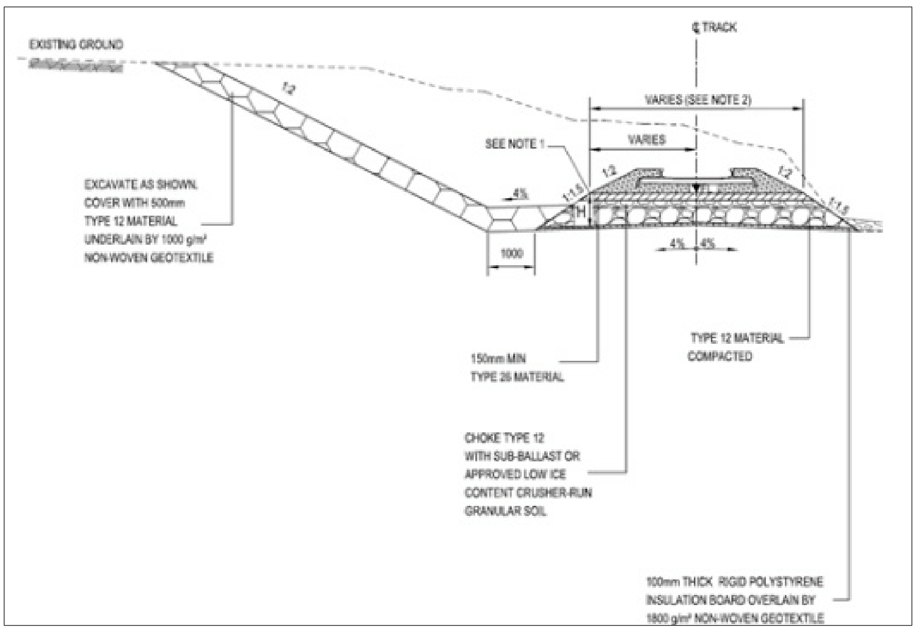


Figure 3.3 Typical Excavation in Permafrost

The embankment will be monitored during operations as described in the Railway Management Plan (FEIS Appendix 10D-9.1), which will be updated to incorporate the North Railway. This includes regular inspections as well as possible instrumentation within certain sections of the railway to monitor potential settlement in the embankment.

3.2.8.3 Disposal of Ice-Rich Soils (Spoils)

Ice-rich soils, when thawed, will be wet and prone to slumping, and considerable quantities of sediment-laden water may be released. To reduce the potential for sediment runoff into water bodies and to improve long-term stability of these materials, soil spoils will be disposed of in exhausted quarries and borrow areas as a preferred option if reuse in deep cuts is not feasible. Where quarries or borrow sources are not available nearby, local depressions will be selected as opposed to slopes where material can run-off. Any stockpiles will be designed with a minimal slope that is physically stable. Sediment and erosion control measures will be applied to prevent runoff of sediment and to possibly divert runoff away from the disposed material, as identified in the Surface Water and Aquatic Ecosystems Management Plan.

3.2.8.4 Track Substructure, Alignment, and Gradient Design

Timber ties will be used, as their performance in cold climate heavy haul operations has been proven.

The basic objective of heavy haul rail design is to have the gradients as flat as possible and the radii as large as possible. The railway design is based on a maximum grade of 1.5% for loaded ore trains, and 2.0% for empty ore trains. In some locations this is not possible due to permafrost, the topography, and geotechnical considerations. Allowance has been made for exceptional grades of 3.0% for empty ore trains at three locations over the North Railway mainline, totalling approximately 3 km in total length. These relatively steep gradients are necessary to adjust to the challenging topography and in an effort to reduce the need for extensive excavations in permafrost. To the extent possible, the railway alignment is located within 100 m of the Tote Road centerline. Key rail alignment parameters are presented in Table 3.4.

Table 3.4 Preliminary Key Rail Alignment Parameters

Item/Parameter	Value
Total main line length	110.5 km
Maximum gradient - loaded uphill	1.5%
Maximum gradient - loaded downhill	3.0%
Total length constructed on rock subgrade (pending further geotechnical verification)	23 km
Total length constructed on ice-rich permafrost	4 km
Number of bridges	4
Number of level crossings	8

A major deviation is required to circumvent the grade at km 67 hill. The existing tote road climbs over a hill between bridges at km 62 and km 80, with the hillcrest at about km 67. The total elevation change is too great without undertaking a massive cut into the hill. Several potential routes around the hill were considered, and the selected alignment was selected to avoid operational issues associated with options with higher grade changes, to avoid significant gullying on the west side of the hill, and approaches to a major bridge following the hill at km 80.

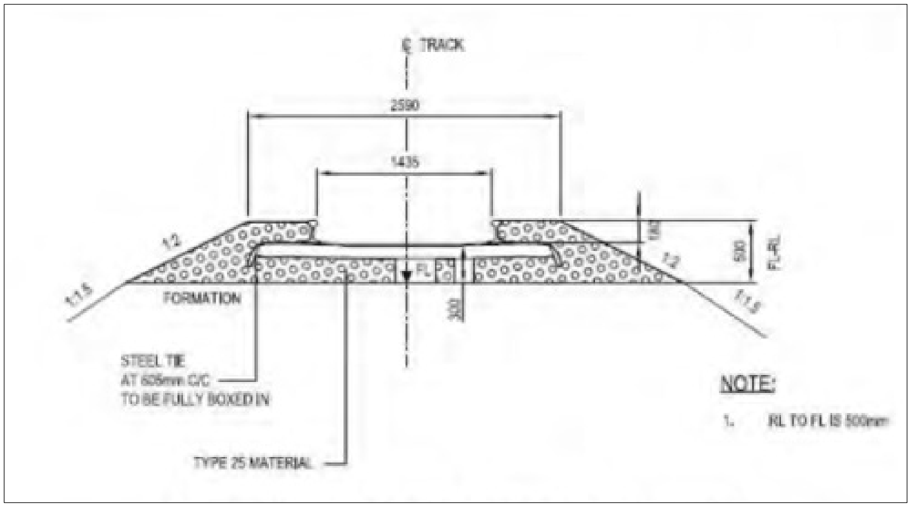
3.2.9 Track Superstructure and Substructure

The specifications of the track superstructure are presented in Table 3.5.

Table 3.5 Indicative Track Superstructure and Substructure Specifications

Item	Specification
Rail	136 lb RE (67.4 kg/m) or extreme cold weather UIC 68 equivalent
Welded/jointed	Welded mostly with possible jointed track in yards and sidings
Ties	Timber
Ballast shoulder slope	1V:1.5H
Sub-ballast details	Cross slope 0.00% No sub-ballast shoulder Width as per track geometry
Material types	Type 12: Minus 1 m run of quarry rock fill Type 25: Minus 75 mm crushed rock for ballast layer Type 26: Minus 50 mm crushed rock for sub ballast layer and to choke top of Type 12 fill

Figure 3.4 presents a typical cross section of the superstructure. Material types shown in the figure are described in Table 3.5.



NOTES:
Type 25 Material - Minus 75 mm crushed rock for ballast layer.

Figure 3.4 Typical Superstructure Cross Section

The track substructure has been designed to match the selected track superstructure, with consideration of construction timing and techniques, and to reduce capital cost. In areas of rock sub-grade, sub-ballast is placed directly on the rock foundation. Over soils, rock fill embankment is constructed with rock obtained from cuts or from quarries. Figure 3.5 shows the typical embankment profile. Material types shown in the figure are described in Table 3.5.

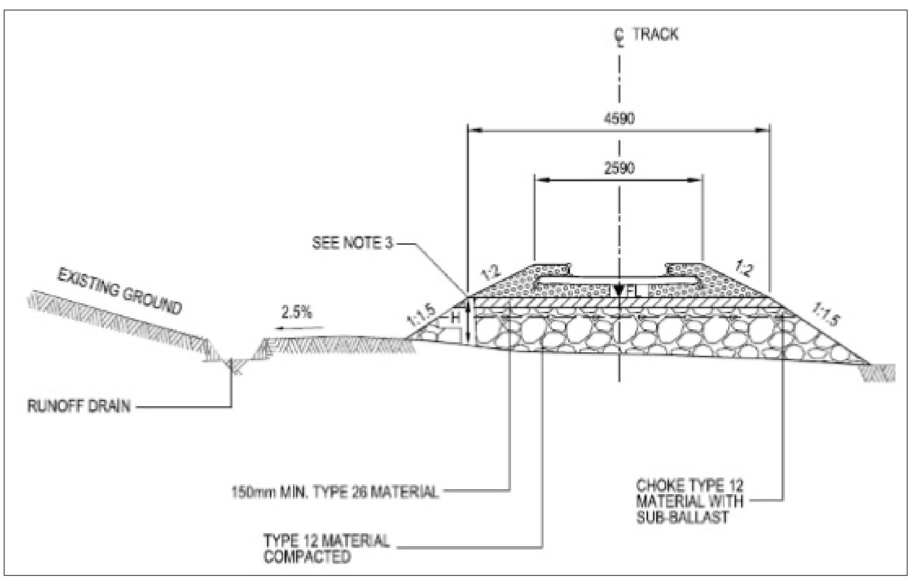


Figure 3.5 Typical Embankment Cross Section

3.2.9.1 Source of Borrow Material

A number of rock quarries and borrow areas have been permitted to date as part of the Approved Project. These sources have been subject to geochemical testing.

Multiple new quarries have been identified along the North Railway (refer to Section 3.0), providing an estimated 12.7 M m^3 of rockfill to be used for railway construction. This excludes material from cuts within the railway right-of-way that will also be used in construction. The locations are shown in detail on the Northern Transportation Corridor figures in Appendix B. A detailed list of the proposed quarries is included in Appendix F. Each of the new aggregate sources will be developed as rock quarries. A number of the quarries are covered with a thin veneer of overburden; this material will also be salvaged and used as general fill during construction. Quarry development will follow the guidance in the Borrow Pits and Quarry Management Plan (Baffinland 2013b). Site-specific quarry management plans will be prepared and submitted to the NWB for approval in accordance with the Type A Water Licence.

New sources will be tested geochemically in accordance with the Protocol for the Assessment for the Potential for Acid Rock Drainage (Appendix B of the Borrow Pits and Quarry Management Plan). At quarries close to one another that consist of the same geological materials, representative sampling for geochemical testing may be completed.

3.2.10 Rail Construction

The activities to construct the Railway include:

- Ongoing geotechnical investigations;
- Establishment of quarries;
- Construction of an access trail within the railway right-of-way;
- Installation of temporary culvert crossings at two key bridge crossings;
- Installation of drainage structures (e.g., bridges, culverts, and berms);
- Construction of the railway embankment;
- Surfacing the embankment with ballast;
- Placing the rails;
- Installing additional communication towers and bungalows;
- Placing the locomotives and cars on the rails; and
- Commissioning the railway through testing and de-stressing.

Railway construction may begin from Milne Port, and a functional railway will be constructed such that the railway itself can be used to deliver materials such as aggregate, railway ties and rails to the construction front. This will reduce the amount of construction truck traffic needed to move materials from Milne Port to the construction face. The benefits will be reduced fuel consumption and reduced dust emissions.

3.2.10.1 Spoils Generated During Railway Construction

Typically, roads and railways are constructed using a combination of cut and fill, with material gained from cuts filling the lower lying areas along the alignment. A fundamental criterion for constructing the Railway on permafrost is to minimize cuts in soils (particularly ice-rich soils), so as to avoid inducing thermal changes and causing geotechnical stability issues. The majority of the cuts will be into rock, most of which will be used as fill in the Railway embankment. Rock cuts will generate some soil spoils that will require disposal if the material is not suitable as fill.

There will be locations where cuts in overburden will occur. In some locations, shallow ice-rich soils will be excavated to bedrock, only to be backfilled with rockfill. Soils will be excavated at other locations such as at the approaches to crossings to avoid excessive pier height for the bridges or excess fill over culverts. Up to 650,000 m^3 of soil spoils will be generated during construction of the North Railway. Approximately half of the material will be unfrozen and excavated, and the other half will be frozen material that will be drilled and blasted. The soil spoils will require disposal at locations and in a manner that does not result in runoff of sediment-laden water. Spoils that are ice-rich are a particular concern; when thawed, ice-rich soils will be wet and prone to slumping, and considerable quantities of sediment-laden water may be released. To reduce the potential for sediment runoff into water bodies and to ensure long-term stability of these materials the following disposal criteria will be applied:

- Soil spoils will be disposed of in exhausted quarries and borrow pits along the Tote Road as a preferred option. Quarries and borrow areas represent an existing disturbed footprint with limited future use, and therefore make ideal disposal sites, provided they are not planned for use as explosive storage areas during construction.
- Other disposal sites will be identified near to the construction activity. Local depressions or low-relief areas will be selected as opposed to slopes where material can run-off.
- In all instances, as a standard condition of land-use approvals, disposed overburden materials will be placed > 33 m from a surface water body.
- Disposal locations will be approved by the appropriate construction personnel (i.e., engineer, construction superintendent or foreman) who have been given such authority, to avoid unauthorized and indiscriminate disposal.
- Disposal locations will be well removed from the railway embankment.
- The stockpile will be designed with a minimal slope that is physically stable.
- Overburden spoils in construction will not be re-used without prior approval by the supervising engineer.
- Sediment and erosion control measures will be identified in the Surface Water and Aquatic Ecosystems Management Plan to prevent runoff of sediment and to possibly divert runoff away from the disposed material.
- Overburden soils will be transported directly to the disposal site, without short-term storage and re-handling.

3.2.10.2 Mobile Temporary Construction Camps

To facilitate construction of the railway, temporary camps will be established near the work front.

Temporary mobile construction camps will be in use at any time during the construction. The mobile camps will be relocated closer to the work areas as necessary. It is anticipated that up to four temporary camp site locations will be established and that only two temporary camps will be in services at any time. Water will be trucked to the temporary camp while sewage and waste will be returned by truck to either the Mine Site or Milne Port for treatment/disposal.

3.2.11 Water Crossings

3.2.11.1 Crossing Inventory

The North Railway will cross, divert, or encroach/infill at a total of 465 sites in waterbodies along the corridor. All sites were assessed for the potential to support Arctic Char using remote imagery and through field studies. A total of 298 of these sites were identified as not supporting Arctic Char. A total of 167 sites were identified as occurring in known, probable, potential, or unlikely Arctic Char habitat. Crossing locations, based on preliminary design, are shown on the figures in Appendix D, Attachment 8.

Streams with a connection to overwintering refuge will contain one or both of the fish species present in the region: arctic char and nine-spine stickleback. Streams were assessed for the potential to contain fish habitat (TSD 14) – a summary of results is presented in Table 3.6.

Table 3.6 Indicative Proportion of Rail Crossings in Fish Habitat

Fish-Bearing Potential	No. of Crossings	Proportion of Total
Certain	65	14%
Probable	35	7%
Potential	42	9%
Unlikely	45	10%
Not fish-bearing	278	60%
Total	465	100%

The majority of crossings (approximately 58%) are confirmed as not fish-bearing. About 17% are confirmed as fish-bearing, and the balance (approximately 115 crossings, or 26% of the total) are undetermined. Baffinland will conduct field fisheries surveys on the undetermined crossings to confirm the presence/absence of fish habitat.

3.2.11.2 Design of Crossing Structures

Bridges will be installed at four railway water crossings. Bridge spans are based on the existing normal flow riverbank. Bridge designs will be based on the 1:200 year 24-hour storm, sufficiently conservative to account for climate change induced increases in precipitation and runoff (TSD 06).

The design of bridges and culverts has focused on controlling flow rates near and through the crossing structures, to control erosion and debris flow and prevent ponding and damming effects. At crossings known or suspected to be fish-bearing, watershed modeling was undertaken to inform the railway roadbed design to limit the impact on the established patterns of water flow (TSD 13). Erosion protection will be provided using riprap. All four bridges are proposed to be plate girder structure with piled foundations, either adfreeze or end bearing (rock), pending geotechnical drilling results. The use of piles at bridge abutments will help mitigate potential issues with thaw-sensitive soils near the watercourses.

Culverts will be installed at other water crossings along the railway. Culverts will be designed in accordance with American Railway Engineering and Maintenance-of-Way Association (AREMA) 2010 guidelines (AREMA 2010). Culvert diameters will range from 0.6 m to 1.8 m and will be covered with a minimum of 1 m of fill.

Tables in TSD 14, Appendix 1 list the indicative crossings, catchment areas, fisheries designation, flow estimates, and crossing type, and present indicative bridge drawings and typical culvert installations.

3.2.12 Road Crossings

The railway will cross the existing Tote Road at 10 locations. Each crossing will be constructed in accordance with Transport Canada requirements for grade crossings. The following safety features will increase the visibility of the crossings and increase safe use of the road:

- Early warning signs will warn road users of an approaching railway crossing and stop sign ahead;
- A combined stop and railway crossing sign will be located on either side of the crossings;
- Crossing timbers will ease vehicle, ATV, and snowmobile crossing; and
- Instructional bulletins regarding the rail crossings will be posted in English and Inuktitut at each end of the Tote Road.

During railway construction, traffic volumes on the Tote Road will be very busy (ore haulage plus railway construction). Once the railway is operational, there will be reduced Project truck traffic and potentially incidental community use of the road by ATV or snowmobile.

Mine traffic using the Tote Road will be regulated reducing the risk for collisions at railway crossings to occur with Mine vehicles.

3.2.13 Safe Crossing of the Railway by Other Users

While Baffinland will likely continue to restrict unescorted access along the Tote Road (Section 11.2.5), the railway will be designed and operated to consider safety issues related to crossing the railway track. This was considered for the South Railway in the FEIS (Volume 4, Section 10.5.2, Baffinland 2012).

Snowmobiles can damage the rail track. Therefore, for safety and protection of the integrity of the rail, land users will be directed to dedicated crossing locations. The embankment at its lowest will be about 1.5 m above the grade with side slopes at three horizontals to one vertical (3H:1V). Representative railway embankment cross-sections are provided in Appendix D. The highest embankment is 5 m above grade, but the slopes at these locations are 1V:5H, a very gentle grade. The embankment slopes along most of the alignment will be blasted rock, which will be large diameter and angular material. While this material is not dissimilar to the local terrain and, with snow cover, will likely be passable with a snowmobile, ATV operators may experience difficulties in some locations. To reduce risk while crossing, several mitigation measures were identified in the Railway Maintenance Management Plan presented in FEIS (Volume 10, Appendix 10D-9.1). This plan will be updated to reflect conditions specific to the North Railway. The plan considers two primary mitigation measures to address public safety hazards along the railway: public education, and the establishment of designated locations for safe crossing.

To reduce risk the proposed snowmobile crossings at strategic locations will consist of signage, a surface treatment of finer filled material over the embankments, and wooden timbers next to the steel rails, to prevent ATVs and snowmobiles from getting caught. The locations of these crossings will be finalized after consultation with the communities. Discussions of safety aspects in relation to the railway, crossing it, and travel in inclement weather will be included in these consultations.

The safety and ease of travel will remain an important aspect post closure. The steel rails, culverts and bridges will be removed, and the railway embankments will be breached to re-establish natural drainage.

3.2.14 Wildlife Crossings of the Railway

A commitment was made in the FEIS to construct caribou crossings along the South Railway as part of design. Baffinland has identified areas where caribou trails appear to be most concentrated along the Northern Transportation Corridor (Figure 3.2) and commits to providing such crossings. It is proposed, that this be completed post-construction and in consultation with community elders. Ramps can be constructed with finer grained material, reducing the embankment grades if necessary, in a manner and at locations identified in agreement with community elders.

3.2.15 Railway Terminals

There will be a railway terminal at the Mine Site and a railway terminal at Milne Port. The function of the terminal at the Mine Site will include:

- Loading of ore;
- Unloading of fuel and freight; and
- Material back-haul.

The function of the terminal at Milne Port will include:

- Unloading of ore;
- Loading of fuel and freight;
- Maintenance yard for rolling stocks and locomotives; and
- Ore car loading system.

Rail car loading will be carried out using front end loaders. Automated rail loading systems will not be utilized due to the capital cost of procuring and installing a suitable system with the associated foundations and support equipment.

3.2.16 Ore Car Unloading System

A rotary car dumper will be used to unload ore from the rail cars at Milne Port. This is the same system planned for use at Steensby Port. It was preferred over three other options (bottom dump, helix dumper, conventional side dump) because of its proven use in cold climates, the ability to maintain the equipment, reduced freezing of the product in the car, and off-loading ability of the product.

3.2.17 Signaling, Communications and Other Safety Features

Radio distributed power is required to link the locomotives, with one at either end of the train.

The operating system will be radio order system based, with a backup of robust instruments and the existing Tote Road radio repeater and microwave tower backbone. Repeaters will be expanded for the track deviations where necessary.

Train movements will be controlled by rail traffic controllers and an occupancy control system as outlined in the Canadian Rail Operating Rules of July 27, 2015. The empty return train will stop in one of the passing sidings to wait for the next loaded train to pass on the mainline or will be authorized to continue directly to the Mine if the next train has already passed or if another train is still being loaded at the Mine. The same principle can be applied to the loaded train heading to Milne Port.

During the spring/summer thaw period there is a possibility that temporary speed restrictions might be imposed over sections of the line if the effects of the permafrost prove to be a concern. This will be determined by intensified track and substructure inspection and monitoring on a daily basis or even on a train-by-train basis where the maintenance engineer can decide to reduce the operating speed, or even to suspend operations for a determined period.

The telecoms and signalling systems are configured to be self-inspecting in that the fail safety of the signalling system will be fulfilled by self-diagnosing, hot reservation (stand-by), and automatic reconfiguration at failure of separate elements. Maintenance activities with diagnostic system shall provide in time message reception regarding system element malfunction (fault and pre-fault status diagnostics) and its operative elimination. Safety systems will assist in detection of malfunctioning railway stock or rails. These systems will include wayside detectors (to monitor passing trains for defects such as hot bearings/wheels and dragging equipment), wheel impact detectors (to identify defective wheels). Loaded trains will be subject to a visual safety inspection at the start of every trip. Cars will undergo a standing inspection every sixth round-trip, and locomotives will be subjected to varying levels of daily inspection based on distance travelled.

3.2.18 Railway Commissioning

For the commissioning of the North Railway, the construction laydown area developed for the construction of the railway at km 57 will be re-purposed as an ore staging area. The conceptual layout for this ore loading staging area in presented in Appendix B. Ore will be transported by trucks to this staging area, dumped on a small 12,000 t stockpile, and loaded onto railcars by front end loaders. This temporary ore transfer area will remain in operation until the railway terminal at the Mine Site is fully operational.

3.2.19 Rail Operations

There are two scenarios currently being contemplated for the operation of the North Railway, the first is a two train system that uses up to 90 cars a piece, and the second is a three train system that uses up to 60 cars a piece. In each of these scenarios a locomotive would be attached to each end of the trains giving an overall length between 600 m for the three train system and 900 m for the two train system. Depending on the scenario, an average of 5 to 8 round trips will be completed each day.

Bulk materials may be hauled in tank cars or containers. Flat cars may be used to transport containers and large equipment and machinery. Ballast and maintenance equipment will also be part of the car fleet. Car switchers may be used to facilitate loading and unloading of fuel, general freight, and explosives without using locomotives.

A spare ore train and the freight train locomotives will stand in the yard. The trains will be staffed with a 2-person crew (including at least one experienced operator), with the possibility of reducing to a single operator in the future. A single dispatcher will control main line and yard operations. Canadian railways are to a large extent self-regulating, subject to compliance with federal regulations. They set their own internal standards for the level of knowledge and competence required for any operating position, subject to regulatory audits of safety that include the way safety-critical positions are qualified or licensed.

Ore trains will not operate on the same section of track simultaneously (i.e., not within the same virtual signal block). In most cases, general freight and other trains will be dispatched to follow ore trains to avoid meeting on the main line. Telecommunications systems will be used to safely manage the operation of ore and freight trains.

The design speed for the railway will be maximum 75 km/h. The initial maximum operating speed is expected to be 60 km/h or less under all conditions.

It is proposed that personnel will not be transported by rail because of train schedule and use of buses on the Tote Road provides the necessary flexibility; however, the mode of personnel transport will be reviewed periodically.

3.2.19.1 Vibration and Noise

In general, noise and vibration are not considered an issue for low speed operations except near rail yards where tight curves can result in wheel squeal, and, shunting and train building produces a lot of noise as cars collide. The iron ore trains, which constitute most of the railway's traffic, will be operated as unit trains and will not be subject to regular shunting activities. Vibration damping will be employed by the construction of a stable embankments.

Ballasted track absorbs vibration to some extent. Preventive maintenance activities (i.e., rail grinding, wheel truing and track lining) carried out on a regular basis will also correct many of the small irregularities that cause major noise and vibration in a railway system.

The frequency of normal track inspections will increase during the freshet to confirm that all culverts are free flowing, and that bridge freeboard is maintained. Additional safety information is provided in the Railway Management Plan (FEIS Appendix 10D-9-1).

Noise and vibration caused by train passage are not anticipated to be a major deterrent to normal wildlife behavior. Noise and vibration levels from a well-maintained railway using modern high-efficiency motive power and modern rolling stock is not particularly high, and more importantly is not long-duration. Disturbance occurs only during actual passage of a train and is short-duration and will occur 14 times a day at the most (six roundtrips for ore trains and one for freight trains).

3.2.20 Railway Maintenance and Inspection

A rigorous schedule of equipment inspections and maintenance will be implemented during the operating life of the railway. Locomotives will be subject to regular inspections during crew changes, plus 90-day, bi-annual and annual locomotive scheduled maintenance shop visits. Rail cars will be subject to routine detailed inspections, with major scheduled maintenance on brakes, wheels and couplers at other regular intervals based on the distance travelled. Inspection and maintenance activities will be performed at Milne Port at the maintenance centre, which consolidates most of the facilities required for railway operations into a single building. Rail-mounted cranes will be available to load and offload materials for repair and maintenance. The Railway Management Plan provides more details on routine railway inspection and maintenance activities.

Regular track inspection will allow for spot replacement of defective components and renewal of infrastructure. Programmed maintenance over specific track segments will include rail grinding and the replacement of worn or defective components on a designated track section.

Regular track maintenance will be planned on the basis of a series of specific types of inspection: general visual inspections, detailed safety inspections, ultrasonic scanning for rail flaws and measurements of the track geometry.

Railway bridges and culverts will be subject to the following inspections and maintenance:

- Annual inspections of condition and structural integrity;
- Thawing of ice-blocked culverts prior to spring freshet;
- Maintenance of scour protection around piers and culvert inverts;
- Adjustment of bridges to compensate for subsidence if the necessary adjustment cannot be accommodated by the ballasted deck; and
- Safety inspections after seismic events.

Regular train schedules will be generally sufficient for keeping the main line free of snow. Remote switches at sidings will be provided with snow blowers to prevent the switch points from becoming blocked, and track maintenance equipment will “broom” turnouts in yards. Sites identified during early operations as susceptible to drifting will be protected with snow fencing and subject to regular observation by the track maintenance crews. The wayside measuring equipment will be used to proactively measure aspects of the locomotives and cars as well as to protect strategic fixed infrastructure assets from potential derailments. Various selected equipment will be deployed on the line to increase safety such as: faulty equipment detectors, dragging equipment detectors, wagon identification system, hot wheel detection system.

3.2.21 Rail Transportation of Other Materials

The North Railway, once operational, in addition to transporting ore, will be also used eventually to transport fuel as well as most equipment and consumables. The preference will be to transport fuel over the railway, but it will be necessary for some period of time to transport fuel over the road.

In addition to ore and eventually fuel, materials that may be hauled to the Mine using rail will include lubricants, ammonium nitrate, and various non-hazardous materials.

3.2.22 Railway Management Plan

A Railway Management Plan written for the South Railway was presented as Appendix 10D9-1 of the FEIS (Baffinland 2012). The document describes the regular monitoring and inspection that will be undertaken to detect, among other things, settlement in the embankment and other concerns with the railway. The frequency of inspections will be increased during spring freshet or when unexpected weather events including natural disasters occur. The document will be revised for the North Railway when Baffinland seeks its Certificate of Fitness for the North Railway from the CTA.

Most spills relating to railway operations are the consequence of a derailment. Derailments are typically caused by equipment failure, vandalism, human error, and less commonly, natural disaster. Given the nature of the operation and the climatic conditions, the railway will be subject to a frequent and strict regimen of regular inspection and preventive maintenance, of both rolling stock and infrastructure.

Train crew assignments will be planned to confirm that unqualified, fatigued, or sick employees will not operate trains. At a minimum, the following regulations will be respected:

- Railway Employee Qualification Standards;
- Railway Medical Rules for Positions Critical to Safe Railway Operations;
- On-Board Trains Occupational Safety and Health Regulations; and
- Work/Rest Rules for Rail Operating Employees (Train Crew Hours of Service Regulations).

To confirm compliance with these regulations for such an isolated railway operation, several members of the railway organization will be multidisciplinary and, although not necessarily members of the train-crewing team, will be qualified and experienced in the operation of trains and available to do so in emergencies.

Nearly all the freight being transported by the railway under the category of dangerous and hazardous goods, except fuel, will be containerized for transportation by sea to Milne Port. Dangerous goods will not be removed from containers for rail transportation. The containers will be lifted onto flat cars specifically constructed to hold and lock the containers in place. All the provisions for safe transportation of these goods at sea will remain in place during rail transportation. Manifests to accompany dangerous and hazardous goods will reflect this routing.

The Transportation of Dangerous Goods Regulations, SOR/2011-60 specifies which hazardous commodities can be transported on the same train. Class 1.1 or Class 1.2 hazardous commodities cannot be coupled directly to railway vehicles carrying Class 2, 3, 4, or 5 commodities. Ammonium nitrate is either in Class 1.1D if it has more than 0.2 percent combustible substances, including any organic substance calculated as carbon. Otherwise, ammonium nitrate is designated as Class 5.1. Diesel Fuel and Jet-A are in Hazard Class 3 per Schedule 1 of these regulations. Assuming the worst class classification, diesel fuel and ammonium nitrate could be shipped in the same freight goods train, provided that there is a non-hazardous carrying railcar between them. However, in recognition of the community concerns relative to the consequences of a fuel spill due to an incident on the railway, fuel will be transported in a dedicated fuel train.

Tank cars will exceed the requirements of Specification 112 and 114 Tank Cars Regulations; their performance specifications will require the tank cars to have special features to greatly reduce the possibility of spillage in the event of a derailment. These features include double-walled containment; a shielded bulkhead; and top loading shielded values with no bottom valves.

3.2.23 Railway Emergency Response

A Railway Emergency Response Plan was also developed for the South Railway (FEIS Appendix 10D9-2), and similarly, this document will also be updated to suit the North Railway. The plan provides the response mechanisms for responding to emergencies on the railway, including spill contingency and response plans.

Online equipment failure of any kind will be reported immediately to the dispatcher, who will advise all online trains and maintenance vehicles on appropriate action. Trains are operated with two locomotives as a safety provision, so in the case of an engine failure, many trains will be able to continue on the power of the second locomotive, at low speed to the next siding, clearing the line. In the case of a complete standstill, the train crew will have one fully functional heated cab for refuge.

In the case of equipment failure that results in a derailment or blocking of the line, the dispatcher will be immediately notified; loaded and empty trains will be held at their terminals and equipment will be dispatched. Minor derailments can often be re-railed with light equipment that will be standard equipment for the track maintenance vehicles; more complex incidents will require either a work train or the full emergency train.

The telecommunications and signalling systems are designed at the outset as a failsafe in that every functionality is designed with multiple duplications to reduce the possibility of complete failure. In addition to the signalling, communications and other safety features described in section 3.2.17, the operating rules will clearly state the authorities, responsibilities, and actions appropriate for all implicated parties, should a complete communication failure occur. The locomotives will be equipped with cabs specified to provide additional protection from extreme cold and with additional heating capacity for the cab itself. Emergency equipment (protective clothing, emergency rations, and supplemental heating) will also be stored in the cab, so that the cab itself can function as an emergency refuge.

4 MILNE PORT

Milne Port is a fully functional port operating during the open water season. For the Phase 2 Proposal, total shipment of ore from Milne Port will reach 12 Mtpa.

Changes to Milne Port site will be driven by the construction of a second ore dock capable of berthing capesize vessels, supplementing of the existing ore stockpiling capacity and associated conveyance facilities to accommodate the North Railway, the installation of ore crushing facilities, and the addition of laydown areas and services shops necessary to support the railway operation and staging for construction of the South Railway components of the Project. These additional Phase 2 Proposal facilities and activities required at Milne Port for the construction and operation of the Project are described in this section. They include:

- Expansion of the Milne Port PDA and modification to drainage works;
- Construction and operation of a capesize ore dock;
- Modification to ship loading systems;
- Modification to the ore handling, crushing/screening and stockpiling facilities;
- Construction and operation of a rail unloading, rail yard, and rail maintenance facilities;
- Expansion of the Port Site Complex and its associated water supply, sewage treatment plant, and, incinerator;
- Expansion of the diesel power plant;
- Construction and operation of wind turbine(s);
- Expansions of laydown down areas and ancillary buildings, shops, warehouses, and maintenance facilities;
- Relocation of the airstrip compared to the Approved Project location; and,
- Expansion of the Port operation.

The Milne Port Phase 2 Proposal layout is presented in Appendix B.

Construction of these facilities will be undertaken following receipt of Project approvals over a period of approximately two years, concurrent with construction of the North Railway. Further description of the changes proposed at Milne Port is provided below. Details regarding shipping and the size and number of vessels calling at Milne Port is described in Section 5.

4.1 Milne Port Layout

4.1.1 Design Considerations

A key aspect of design of the facilities at Milne Port and at other locations involves properly accounting for ground conditions, including permafrost and the potential presence of thaw-sensitive soils and ground ice. Three geotechnical investigation campaigns have been conducted at Milne Port (Knight Piésold Ltd. 2007; AMEC 2010; Hatch 2016). These form the basis for foundation designs.

Foundation settlement due to thawing of ground ice will be limited by design measures. Infrastructure foundations at Milne Port are expected to be a combination of the following types:

- Shallow foundation on rock;
- Shallow foundation on permafrost;
- Adfreeze pile; and
- Rockfill embankment with shallow foundation.

Because of the risk of thaw settlement, a precautionary approach is undertaken when selecting the appropriate foundations.

4.1.2 Expansion of the PDA

4.1.2.1 Land Based

The expected PDA will increase to 415 ha. This expansion is necessary to accommodate the larger ore stockpiles, the new crushing plant, ore unloading facility and reconfiguration of the ore reclaim systems, the new ore dock, railway yard and railway maintenance facilities, expanded camp, additional laydown areas and ancillary facilities required to support the larger operation.

To accommodate these additional facilities, Baffinland will need to negotiate an expansion of its IOL Lease with QIA.

4.1.2.2 Foreshore

The Crown Lease for foreshore occupation is for 36.4 ha. No increase is required to accommodate the footprint of the second ore dock. The footprint of the future ore dock is shown on Figure 1.4.

4.1.3 Source of Fill Material

A quarry will be developed to provide the fill material necessary for the expansion of the site. The locations of the proposed quarry sites are illustrated in Appendix D.

The quarry will be developed in accordance with Baffinland's approved Borrow Pit and Quarry Management Plan.

4.1.4 Construction Approach

The approach for construction of Phase 2 Proposal components at Milne Port is driven by procurement, installation, and commissioning of material handling equipment in the most efficient and cost-effective methods possible while reducing site installation time frames.

4.2 Capesize Ore Dock

A second ore dock capable of berthing capesize ore carriers will be required to be able to deliver 12 Mtpa of ore to market via Milne Port. Capesize vessels are up to 230,000 dead weight tonnage (DWT), with a length of approximately 316 m, and a draft of about 21 m.

The orientation of the dock (Ore Dock No. 2) is augmented to allow a clear approach for vessels parallel to the berth face and clearing the existing dock. Position of the new dock relative to the existing dock also considered the spacing requirements for vessels when both docks are in use. Based on the optimum angle for mooring lines the position chosen allows for a minimum clear spacing of greater than 150 m. This then confirms mooring lines from vessels at the adjacent docks will not be crossed, something which is desirable from a safety and operations aspect.

The dock face will be parallel to the seabed contours. It was also necessary to keep water depths to within a range that would provide sufficient depth and under keel clearance for fully laden vessels and stay within the physical limitations of steel sheet pile dock construction.

The conceptual design of Ore Dock No. 2, the construction methodology, and associated environmental protection measures are outlined in Appendix F. While blasting will not be required, it may be necessary to dredge sediments/soft material on the ocean floor beneath the dock embankment. Localized removal of the upper layer of unsuitable substrate material is anticipated within the confined limits of the sheet pile enclosure. The materials will be transported and disposed with consideration of mitigation design considerations taken to reduce the potential for environmental impacts. The materials may be suctioned and pumped directly to a disposal area located either on land or within a silt curtain confined water lot area. Design shall include consideration of an outlet for stormwater release as required.

All materials removed from the seabed shall be tested in accordance with all applicable environmental testing regulations and standards. Based on preliminary geotechnical investigations in the areas surrounding the Ore Dock, there is no indication that the materials will pose a concern with regards to environmental contamination.

In accordance with the requirements of the *Fisheries Act*, a fish habitat offsetting plan (TSD 23) will be developed in consultation with DFO and the communities.

4.2.1 Silt Curtain Installation

Silt curtains will be installed prior to causeway construction or any in-water work in order to encapsulate the entire footprint of the ore dock and causeway. Sufficient room will be left between the curtain and the footprint for the settlement of suspended solids. The curtain shall be designed and procured in sections that relate to the water depth in order to remain buoyant and extend to the ocean floor with sufficient slack.

Silt curtains will be deployed and installed as follows:

- Temporary buoys placed in water at each breaking/inflection point of curtain using survey coordinates;
- One large anchor installed on the shore at each side of the silt curtain;
- Bundled sections (bottom fastened to top) lifted and set in water near shore by means of crane;
- Sections will then be floated to the final location by small boat;
- Fasten first section to the shore anchor;
- Deploy each section one by one, attaching to the previous section and dropping anchors as needed to prevent movement; and
- Once the entire bundled curtain has been deployed, anchored and location confirmed, remove bundle wires to allow chain to lower to ocean floor.

4.2.2 Mooring Points

One mooring point is required in the existing ore dock (West side) and another required in the new ore dock (East side). The west mooring point will be installed following fill placement and therefore can be done by the same technique as the east point; drilling and piling if necessary. Foundations will be installed to specified depths to achieve the required stability for mooring both the bow and stern of the ship.

4.2.3 Scour Protection

The scour protection is to be executed as protection of the seabed layer under the mooring vessels. As a design requirement, the scour protection in the first 15m next to the quay needs to consist out of rock. The rock scour protection consists of different layers. For the exact built-up of this part, please refer to the relevant design note. The layers with the smallest rocks can be placed with a clamshell, the largest rocks will be positioned by a crawler crane equipped with a grab.

4.2.4 Controls and Monitoring

A detailed construction execution plan will be developed by the installation contractor(s) prior to the commencement of construction for review and approval. The plan will align all parties and assure adequate equipment and materials will be mobilized on the sealift for execution.

Several methods of survey will be used to monitor construction and confirm that design grades and coordinates are achieved. A strong focus will be put on the fill placed in water to limit the impacted area. Piling rigs and cranes with clams will also have grade control devices to achieve precision and accuracy underwater.

Environmental monitoring during ore dock construction will be specified in a future Authorization under the *Fisheries Act* (Fisheries Authorization) issued by DFO. Given the similar design and construction methodology proposed for the second ore dock, Baffinland anticipates that construction environmental monitoring will include:

- Turbidity monitoring outside of the silt curtain;
- Field measurements of underwater noise levels during pile driving operations; and
- Monitoring for the presence of marine mammals within a 200 m safety zone.

Monitoring of suspended solids will take place at predetermined sampling points outside of the installed silt curtain. Monitoring will commence once the silt curtain is fully installed and take place regularly until in-water construction work has reached completion.

A 200 m safety zone will be used during pile driving activities; field measurements will be conducted to verify noise predictions at the beginning of vibratory pile driving operations.

The pile driving safety zone will be monitored for marine mammal presence for 30 minutes prior to commencing vibratory pile driving. Pile driving will be halted if marine mammals are observed within or approaching the safety zone.

An overview of environmental protection measures employed during construction is presented with the construction methodology in Appendix F.

4.3 Ship Loading System

During the shipping season, ore from the lump ore stockpile will be reclaimed using the travelling (rail-mounted) stacker/reclaimer which will load the ore onto the stacking/reclaim conveyor. Reclaimed ore will then be transferred onto a shiploader feed conveyor for transport to the shiploader. Weigh scales and product samplers will be installed on the conveyors to facilitate inventory recording and quality control sampling.

Ore from the fines stockpile will be loaded onto the shiploader as is currently undertaken.

4.3.1 Ship Loading Fines Ore at the Existing Panamax Ore Dock

The shiploader is the conveyance system used to fill the holds of vessels with the ore, and has a capacity of 6,000 t/h (Figure 1.4). Ore is reclaimed from the ore stockpiles and fed to the shiploader using front end loaders. This shiploader will continue to be used to fill Panamax and Supermax size vessels at the existing ore dock.

4.3.2 Shiploading Lump Ore at the New Capesize Ore Dock

A second shiploader will be constructed to fill vessels berthing at the new capesize dock with ore from the lump ore stockpile. A bucket wheel reclaimer will be used to reclaim ore from the stockpile and feed the shiploader. The new shiploader will be a dual linear luffing shiploader with a capacity of 16,000 t/h. This type of shiploader has the advantage of full luffing capability, which reduces drop heights which reduces product degradation and dust emissions.

4.4 Ore Crushing, Screening, Stockpiling and Handling Systems

4.4.1 Haul Truck Unloading Area

Until railway infrastructure is commissioned, the iron ore haul trucks will continue to dump coarse ore on a stockpile adjacent to the crusher building. This ore will be reclaimed by front end loaders and fed to the crushing plant.

Long-haul trucks dump ore (either lump or fines) into small stockpiles, and mobile radial stackers are used to transfer the ore into the appropriate (lump or fines) stockpile (Figure 1.4).

4.4.2 Rail Car Unloading

Ore arriving in rail cars will be unloaded using a rotary dumper without any requirement to uncouple the cars. The material will be stockpiled in a small run-of-mine (ROM) stockpile that feeds the crushing and screening plant. Ore is conveyed from the rail unloading area to the ROM stockpile followed by the crushing and screening plant.

4.4.3 Ore Crushing and Stockpiling

Ore arriving to Milne Port by truck from the Mine Site has already been crushed and screened into lump ore and fine ore products, as follows:

- Lump ore - 31.5 mm to 6.3 mm in size; and
- Fine ore - less than 6.3 mm in size

The Phase 2 Proposal will involve the following changes to how ore is crushed and stockpiled at Milne Port:

- Secondary ore crushing and screening operations will be located at Milne Port (previously located at the Mine Site);
- The crushing and screening plants will be located indoors (the crushing at screening plant at the Mine is currently outdoors);
- Rail will deliver ore;
- Product stockpile sizes will increase in accordance with the increased quantity of ore being loaded onto ships; and
- Fine ore will be loaded into vessels at the existing ore dock only; lump ore will be loaded into vessels berthing at the new capesize ore dock.

The crushing and screening plants will consist of large cone crushers fed from large vibrating screens, which will produce the lump and fine ore products to the same specifications as the crushing and screening operation at the Mine Site. Placement of the crushers and screens indoors will substantially reduce dust emissions and lower noise levels. Dust collectors will be installed at ore screening and crusher transfer points.

A transfer conveyor will deliver lump and fine ore from the crushing and screening plant to a stacker/reclaimer at the lump ore stockpile, and to the mobile radial stackers at the stockpile.

4.4.4 Stockpiles Runoff Management

New catchment areas or ponds will be built as required to contain runoff from the expanded stockpile; all runoff will be analysed and meet discharge criteria prior to release to the receiving environment of Milne Inlet as per current authorizations.

4.5 Rail Terminal, Unloading, Rail Yard and Railway Maintenance Facility

Rail access at Milne Port will include tracks to the freight unloading/laydown areas, the fuel tank farm, and the railway maintenance yard. The railway maintenance facility at Milne Port will include the following:

- Maintenance shops and management offices;
- Repair areas for locomotives and cars;
- Shop for the care of track maintenance equipment;
- General storage area for spare parts and consumables;
- Wheel and axle repair area; and
- Locomotives will be moved in and out of the maintenance shop by a railcar mover.

4.6 Camp Expansion, Water Supply and Sewage Treatment Facilities

The expansion of the camps and associated water supply and sewage treatment plant will include the following:

- **Expansion of camp**: An additional 180 beds will be relocated from the Mine Site Complex and added to the existing Port Site Complex, bringing the facility total to 300 beds. For Milne Port this will bring the overall total of available beds for operations to 680. A temporary 300-bed camp will be installed to accommodate personnel during construction. Following construction and commissioning, the 300-bed camp will be removed.

- **Milne Port potable water supply**: The existing water supply infrastructure and maximum daily water consumption approved under the Type A Water Licence will accommodate the increase in camp occupancy. Potable water will continue to be sourced from Philips Creek and the lake at kilometer 32. The potable water treatment plant will be expanded.
- **Sewage treatment plant**: The sewage treatment plant will be expanded to accommodate the larger camp facilities. Treated sewage effluent will continue to discharge to Milne Inlet via the existing outfall.

4.6.1 Expansion of Camp

Baffinland has three separate camp facilities at Milne Port:

- Port Site Complex - 120 beds;
- 380 Person Camp – 380 beds;
- Weatherhaven™ camp - 153 beds; and
- Shanco hard-wall camp - 54 beds.

Three dormitory wings (180 beds) will be relocated from the Mine Site Complex and added to the Port Site Complex to increase the permanent number of beds at Milne Port to 680. A temporary 300-bed camp will be installed to accommodate personnel during construction. Following construction and commissioning, the 300-bed camp will be removed.

Expected water demand, sewage production and waste production associated with these number of beds are presented in the Key Facts Table (Appendix C).

4.6.2 Milne Port Potable Water Supply

The existing water supply infrastructure and maximum daily water consumption approved under the Type A Water Licence will accommodate the increase in camp occupancy. Potable water will continue to be sourced from Philips Creek and the lake at kilometer 32. The potable water treatment plant will be expanded.

4.6.3 Sewage Treatment Plant

The sewage treatment plant will be expanded to accommodate the larger camp facilities. Treated sewage effluent will continue to discharge to Milne Inlet via the existing outfall.

4.7 Expansion of the Power Plant

4.7.1 Expansion of Diesel Generation Power Plant

The power plant at Milne Port is equipped with seven 1.35 MW diesel generators, providing firm capacity of 9.45 MW. The expanded port facility including ore crushing and screening operations and a second shiploader will require additional power. Peak power requirements are estimated to be 22 MW during the shipping season and average 8 MW throughout the remainder of the year.

4.7.2 Installation and operation of Wind Turbines

As a means of reducing operating costs and site fuel consumption, Baffinland is evaluating the use of wind turbines. The capacity of the wind turbines under consideration ranges from 3.5 MW to 4.2 MW per unit. Information on the wind turbine installation is presented in TSD 01 Alternatives Analysis.

4.8 Expansion of the Milne Port Fuel Storage

In 2016, 31.5 ML of arctic diesel and 2.0 ML of Jet A aviation fuel was delivered to Milne Port. Arctic diesel stored at Milne Port is used to supply the power plant and other port users as well as trucks operating over the Tote Road. The main tank farm at Milne Port stores arctic diesel, with a capacity of 49 ML (an available volume of 41.4 ML allowing for 10% thermal expansion). In April 2018, Baffinland requested authorization to expand the Milne Port fuel depot to 64 ML. With the approval of this additional tankage, storage of fuel at Milne Port will be sufficient to support all of the Phase 2 Proposal.

Locomotives will be fueled by a fixed tank located next to the track or mobile equipment. Fueling locations will be designed with spill containment to reduce the risk of a release.

The Milne Port tank farm is part of what is considered an Oil Handling Facility (OHF), as per the Response Organizations and Oil Handling Facilities Regulations under the Canada Shipping Act, 2001. Baffinland has a Transport Canada approved Oil Pollution Emergency Plan (OPEP; Baffinland 2017), which will require updating to reflect the additional tankage.

The FEIS and FEIS Addendum reported the use of marine diesel for support vessels (i.e., tugs and line boats) at the ports. Support vessels are currently using arctic diesel. However, as the number of operating tugs increases, the need may arise for storage of marine diesel at Milne Port to support tug operations. Baffinland expects that the storage capacity approved under the existing Project Certificate No. 005 will be adequate.

4.9 Expansion and Re-purposing of Ancillary Milne Port Facilities

4.9.1 Ancillary Buildings and Maintenance Facilities

Some of the existing maintenance facilities will be expanded to support the additional trucking fleet for the early period of the Phase 2 Proposal. Once the North Railway is in operation, it is expected that some of these supporting facilities will be repurposed to support the rail operation. Buildings and structures that are redundant or no longer have a useful life will be demolished.

4.9.2 Waste Management

Baffinland will continue to manage all waste generated in accordance with its approved Waste Management Plan. This management plan will be updated as required and submitted to the NWB for approval should any significant changes in practices be necessary.

A landfill at Milne Port will be constructed for the Phase 2 Proposal. The proposed location of this landfill is illustrated on Figure 1.4 and Appendix B. The landfill will be developed and operated in accordance with the NWB-approved management plan for the Mine Site landfill.

The Milne Port landfill will be designed based on the design of the existing landfill at the Mine Site (Knight Piesold 2008) and consistent with the *Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories* (Ferguson, Simek Clark Engineers & Architects 2003). Unlike the Mine Site landfill, however, the Milne Port landfill will be constructed inside the boundaries of the exhausted Quarry Q1 following construction. The area method will be used for waste disposal wherein a low height berm will be constructed along up to two sides of the landfill site (or using a quarry face) and then waste will be disposed of against the berms and directly onto the ground downstream of the berms. Sand and gravel will be used as the cover material. To achieve permafrost encapsulation in the landfill site, the final cover will be thicker than the active layer. Appropriate surface water, erosion and sediment control measures will be implemented during operations. The landfill is not expected to significantly change the quality of surface waters in the area due to the inert nature of the waste and small landfill footprint. Because the landfill will be positioned within a rock quarry, no groundwater monitoring is proposed.

A design report which includes an operations and maintenance manual will be submitted to the NWB in accordance with Part G of the Water Licence.

4.10 Airstrip Relocation

The relocation of the existing airstrip at Milne Port is part of the Approved Project (Baffinland 2013a); however, its construction has been deferred to 2020. It is to be located west of the ore stockpile (Figure 1.4).

4.11 Port Operations

4.11.1 Ore Carriers

Tugs and line boats will be used to shift the ore vessels from anchorages onto and off the dock. Market ore carriers transiting towards Milne Port will proceed directly to either an open loading dock, or to one of several anchorages available in the event dock space is full. Six to 10 tugs/line boats are expected to be required to operate the port. Three of these tugs will be ice management vessels (IMVs) to assist with ice management at the Port during the ice break-up period and at the end of the shipping season (mid-October to mid-November) and to provide safe transit of ore carriers along the Northern Shipping Route. The tugs and IMVs will sail to site at the beginning of each shipping season and will sail south at the end of each season. Refuelling of tugs and IMVs will be done by ship-to-ship transfer.

Shipping companies are responsible for compliance with Canadian regulations with respect to the type of fuel used by their vessels (Benzene in Gasoline Regulations 1997; Contaminated Fuels Regulations 1991; Gasoline Regulations 1990; Fuel Information Regulations No. 1 1999; Sulphur in Diesel Fuel Regulations 2002; Sulphur in Gasoline Regulations 1999). The chartered vessels will comply with the requirements of the Arctic Shipping Pollution Prevention Regulation (ASPPR). Under the *Canada Shipping Act*, ships navigating in Canadian waters are also required to have a Ship Oil Pollution Emergency Plan that must be reviewed and accepted by Transport Canada.

4.11.2 Freight Operations

Construction of the freight dock will commence in 2018 once DFO authorization is received. Once the dock is operational, cargo and fuel required for the Phase 2 Proposal will be unloaded at this dock. The marine side will be modified over time to adapt to vessel specific requirements. Details of the dock configuration and operation were described in the document entitled "Floating Freight Dock – Application for Fisheries Act Authorization", February 2018.

5 MARINE SHIPPING

5.1 Shipping Legislation

Shipping is undertaken in accordance with the *Canada Shipping Act* and the *Arctic Waters Pollution Prevention Act* (AWPPA). One of the key regulations of the AWPPA is the Arctic Shipping Pollution Prevention Regulations (ASPPR), which concerns navigation in coastal waters within Canadian jurisdiction north of latitude 60°N. The ASPPR covers various aspects related to safe shipping in Arctic waters, such as: ship construction requirements, bunkering stations, Arctic Pollution Prevention certificates, Ice Navigators, fuel, sewage, and oil leaks.

Ship access is also outlined in the ASPPR under two systems: the Zone/Date System (ZDS) and the Arctic Ice Regime Shipping System (AIRSS) established under the AWPPA (Transport Canada 1998). The shipping regulatory regime applicable to the Project is described further in Baffinland's Shipping and Marine Wildlife Management Plan (SMWMP; Baffinland 2016e). Table 5.1 presents the permissible shipping dates for Shipping Safety Control Zone 13, which includes Pond Inlet, Eclipse Sound and Milne Inlet, for the various ice class vessels.

Table 5.1 Permissible Vessel Entry/Exit Date for Milne Inlet and Eclipse Sound

Canadian ASPPR Category	Equivalent Polar Class[1]	Equivalent International Ship Classifications				Milne Port Entry/Exit Dates	
		ABS Ice Strengthening Class (A1 AMS)	Bureau Veritas Ice Class	Det Norske Ice Class (1 A 1 ICE)	Lloyd's Register Ice Class (10 A1 LMC)	Z/DC Zone 13 Stipulated Dates	Dates Based on Z/DS and Baffinland Experience
Arctic Class 6+	PCI-2	-	-	-	-	All Year	Polar Class Vessels[4] Jul 1 - Dec 20
Arctic Class 4	PC3-4-5 operating under AIRSS[2]	-	-	-	-	Jun 1 - Feb 15	
Arctic Class 3						Jun 10 - Dec 31	
Arctic Class 2						Jun 25 - Nov 22	
Arctic Class 1A						Jul 15 - Oct 31	
Arctic Class 1						Jul 14 - Oct 15	
Type A	PC6[3]	AA or A1	1A Super	A or 1A	1A Super	Jun 25 - Oct 22	Ice Class Vessels July 25 - Oct 15
Type B	PC7[3]	A or 1A	1A	A or 1A	1A	Jul 15 - Oct 15	
Type C	n/a	B or 1B	1B	B or 1B	1B	Jul 15 - Oct 10	
Type D	n/a	C or 1C	1C	C or 1C	1C	Jul 30 - Sep 30	
Type E	n/a	n/r	n/r	n/r	n/r	Aug 15 - Sep 20	No ice classification Aug 15 - Sep 20

NOTES:
1. General Equivalence only, refer to transport Canada regulations for details.
2. specific access Dates for pc3, pc4 and pc 5 vessels are not defined in the regulations and have not been assessed.
3. as an interim measure for navigation purposes, transport CANADA considers that pc6 and pc7 vessels are allowed to operate as type a and b vessels, respectively.
4. operation of polar class vessels constrained by permitting limits.

The published open water shipping season for Arctic Class 1A vessels that call on Milne Port during the open water season is from July 15 to October 15 (Table 5.1). During this period, Class 1A Baltic ships are able to sail to Milne Port. Open water conditions, however, change from year to year. Ice break up and freeze up dates for a 20-year period (1997 to 2016) are shown in Table 5.2. The originating ice conditions and ship access study is presented as TSD 16.

Table 5.2 Open Water Conditions for Shipping to Milne Inlet, 1997-2016

Year	Ice Break Up	Open Water	Freeze Up	Season Length (Days)	Presence of Drift Ice
1997	July 24	Aug 7	Oct 2	56	Late Aug / early Oct
1998	July 16	Aug 10	Oct 19	70	None
1999	July 26	Aug 18	Oct 11	54	None
2000	July 12	July 31	Oct 16	77	None
2001	July 23	Aug 15	Oct 15	61	None
2002	July 27	Aug 15	Oct 21	67	None
2003	July 15	Aug 1	Sept 29	59	Mid Aug / late Sept
2004	July 19	Aug 11	Oct 18	68	Late Sept / early Oct
2005	July 29	Aug 15	Oct 14	60	None
2006	July 14	July 28	Oct 23	87	None
2007	July 19	Aug 6	Oct 11	66	None
2008	July 18	Aug 1	Oct 6	66	None
2009	July 17	Aug 6	Oct 12	67	None
2010	July 15	Aug 5	Oct 11	67	None
2011	July 8	July 29	Oct 21	84	None
2012	July 12	Aug 18	Oct 15	58	None
2013	July 20	Aug 9	Oct 7	59	None
2014	July 24	Aug 9	Oct 23	75	None
2015	July 17	July 25	Oct 19	86	None
2016	July 11	July 23	Oct 10	78	Early Oct
Average	July 18	Aug 6	Oct 14	68	
Range	July 8 to July 29	July 23 to Aug 18	Sept 29 to Oct 23	54 to 87	
Variability	21 days	26 days	24 days	33	

Shipping routes are generally open water during the period of July 25 to October 15. However, ice class ships are still expected to be required during the early season and late season periods (i.e., July 15 to November 15).

5.2 Northern Shipping Route

The Northern Shipping Route to Milne Port and anchorage locations are shown on Figure 5.1. Instructions to shippers, prepared by Fednav Limited (2016), provide waypoints to navigate in and out of Milne Port, along with approved anchorage locations, vessel speed limits, and other important information for safe navigation to the Port. The need for seasonal changes to this routing have not been identified to date, nor have navigational aids been required. The anchorage locations, originally established by the Canadian Hydrographic Service (1985), were confirmed as acceptable to the community of

Pond Inlet prior to initiating construction of the ERP, in accordance with PC Condition 125(a). The standing instructions require vessels to reduce speed to a maximum of 9 knots beginning at the entrance to Pond Inlet (at 76° longitude) through Eclipse Sound and Milne Inlet.

The Approved Project includes sealift deliveries of equipment and materials to Milne Port, and the shipment of ore from Milne Port to Europe, during the open water season. Annual expected ore shipping, freight and fuel shipments are presented in the Key Facts Table (Appendix C).

Changes to shipping from Milne Port will include:

- The use of capesize vessels in addition to various sized market vessels for ore shipment;
- The operation of six to ten tugs during the shipping season;
- Shipping in the open-water season with shipping during periods of ice-break up (after July 15) and ice formation (up to November 15);
- Up to approximately 200 vessels calling at Milne Port annually.

5.2.1 Proposed Shipping Activities from Milne Port for the Phase 2 Proposal

The amount of vessel traffic calling on Milne Port will increase with the Phase 2 Proposal. Baffinland intends to increase ore shipment during the open water season as defined under the *Canada Shipping Act*. This estimated total shipping window is 79 days of open water (mid-July to October). The actual shipping window will be adjusted to adapt to annual fluctuations in weather and ice conditions.

For the Phase 2 Proposal, shipping will also occur, as required, during periods of ice-break up (early July) and ice formation (up to mid-November) which will effectively extend the annual shipping window to approximately 137 days.

Baffinland had contemplated a much longer shipping season in its original Phase 2 Proposal (Baffinland 2014c). In 2015 and 2016, Baffinland undertook five community workshops to collect IQ relevant to understanding the potential effects of the Phase 2 Proposal on Inuit land use and harvesting, with a particular focus on winter shipping impacts on Inuit use of the landfast ice for travel and harvesting. The results of these IQ workshops as well as public consultation on the Phase 2 Proposal are provided in TSD 03 (IQ Workshops Report), TSD 04 (Phase 2 Public Consultation Report) and TSD 05 (IQ Mapbook).

An assessment of shipping season alternatives is presented in TSD 01.

Increasing shipment of ore during the open water season is made possible by using larger ore carriers, and by constructing a second ore dock at Milne Port capable of berthing capesize vessels. A variety of market vessels will be used depending on the time of year and the availability of vessels, including:

- Supramax vessels (50,000 - 55,000 DWT);
- Panamax vessels (65,000 - 75,000 DWT);
- Post Panamax vessels (80,000 - 90,000 DWT); and
- Capesize vessels (130,000 - 250,000 DWT).

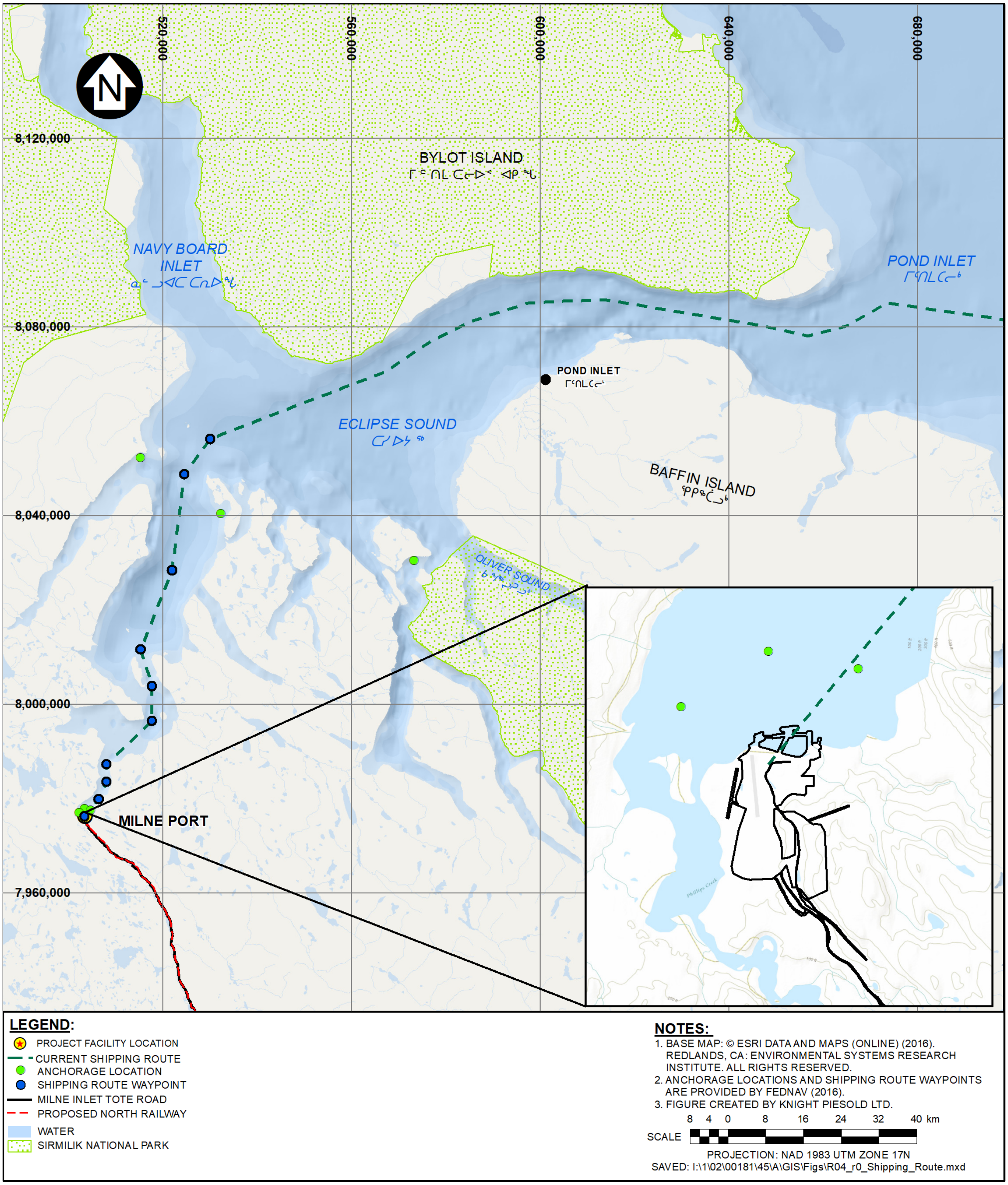


Figure 5.1 Shipping Route to Milne Port

Shipments will commence in early July with the use of suitable Polar Class ore carriers. As Milne Inlet becomes free of ice, market ore carriers (Supramax and Panamax vessels) will arrive at Milne Port (mid to late July)

Operations utilize ice class ships for ore transport throughout the open water period. However, due to limited availability of these ships, non-ice class ships will be used during the mid-season period. The availability of additional ships is not a constraint during mid-season. The final complement of ships will be determined based on availability, suitability for the time of year, and capacity. These parameters will influence the total number of ships that are required each year, which is expected to range between 134 and 176. The number of vessels cannot be confirmed at this time as it depends on many variables. Subject to prevailing ice conditions, the availability of Ice Class vessels, the scheduling of said Ice Class vessels, Transport Canada, and IMO regulations, Non Ice Class vessels will be used.

5.3 Southern Shipping Route and Shipping Activities

By 2024, as the South Railway and Steensby Port become operational, Baffinland will commence shipment of ore from Steensby Port. Up to 18 Mtpa will be shipped from Steensby Port on a year-round basis via the Foxe Basin-Hudson Strait shipping route (Southern Shipping Route).

The operation and shipping activities from Steensby Port will be carried out as described in the FEIS 2012 and approved under the initial Project Certificate No. 005.

5.4 Ballast Water Management

Ballast is water taken on in chambers of vessels mainly to stabilize them by adding weight to the vessels and maintaining a certain draft (the depth a vessel sits in the water). Empty vessels take on much more ballast than a fully laden ship. Ballast water is stored in dedicated ballast water chambers and is not in contact with iron ore storage chambers.

The Canadian Ballast Water Control and Management Regulations require that ships have a ballast water management plan, and either exchange or treat their ballast prior to discharge in waters under Canadian jurisdiction (Transport Canada 2017b). The majority of the ships calling at Milne Port use ballast water exchange as the preferred method of ballast water management.

The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM Convention) was adopted in 2004 and entered into force on September 8, 2017. Under the BWM Convention, ballast water needs to be treated before it is released into a new location, so that any microorganisms or small marine species are killed off. Aspects of the BWM Convention require ship owners to undertake measures already covered by Canadian legislation, including managing ballast water in accordance to a ship-specific ballast water management plan; to carry a ballast water record book, and an International Ballast Water Management Certificate.

The adoption of all the required Guidelines for the uniform implementation of the BWM Convention and the approval and certification of modern ballast water treatment technologies have removed the major barriers to the ratification of the instrument and several additional countries have indicated their intention to comply with this Convention in the near future.

Ballast water exchange involves the exchange of ballast water (discharge of ballast and taking on new ballast water) in deep seas away from coastal zones, to limit the potential for foreign harmful aquatic organisms or pathogens to be released in Canadian waters where they may colonize. The ore carriers that call at Milne Port ship to Europe, and the vessels exchange their ballast water in the mid-north Atlantic Ocean, which is part of the same ocean regime as Milne Inlet.

Project Certificate Condition 89 requires that Baffinland demand the ship owners to test their ballast water to confirm it meets the salinity requirements of the applicable regulations (30 parts per thousand, in Section 8(2)(b) of the Ballast Water Control and Management Regulations) prior to discharge at the Milne Port. Baffinland's Ballast Water Management Plan (found in the SMWMP) requires sampling a random ballast water hold prior to discharge at the dock.

6 AIR TRAFFIC

There is only one operational airstrip at the Mine Site that services the Project. An airstrip will be constructed at Steensby Port once construction of the South Railway begins, and this is described in the FEIS (Baffinland 2012). The construction of the airstrip approved for Milne Port will be deferred until 2020.

6.1.1 Current Air Traffic

The Project's air traffic consists of Jet (Boeing 737) flights from Montreal via Iqaluit (approximately 225 flights per year), and 19-seater Dornier flights between the site and the North Baffin direct hire communities (approximately 315 flights per year). The jet flights operate two to three times per week, and the community flights visit each community approximately once a week. Together these flights result in semi-daily community flights to site each week. In addition, one helicopter is normally stationed at site seasonally to support regional mineral exploration and environmental monitoring programs.

6.1.2 Phase 2 Proposal Air Traffic

During the first two stages of Phase 2 Proposal (construction and operation of the North Railway), the present arrangement will continue with increased flights. No modifications to the existing airstrip at the Mine Site will be necessary. During South Railway construction period, the Steensby airstrip will be constructed (Baffinland 2012). In addition, temporary airstrips will be used along the South Railway during its construction, as described in the FEIS.

Expected flights at each airstrip are presented in the Key Facts Table (Appendix C).

The estimated flight impact zones will remain unchanged from that described in the FEIS (Baffinland 2012).

Baffinland is evaluating the option of paving the Mine Site airstrip. If completed, this will substantially reduce dust emissions within the Mine Site area. Other less expensive dust suppression options are being evaluated in the shorter-term.

7 ENVIRONMENTAL MANAGEMENT SYSTEM

7.1 Environmental and Socio-economic Management, Monitoring and Mitigation Plans

Baffinland's Environmental Management System (EMS) is its Environmental, Health and Safety (EHS) Management System Framework Standard, were developed in 2010 (FEIS Appendix 10A-1; Baffinland 2010a) and presented in the FEIS. The EHS Standard is accompanied by the Hazard Identification and Risk Assessment Standard (FEIS Appendix 10A-2; Baffinland 2010b). The EMS regroups a number of environmental management plans (EMPs) that enables Baffinland to track its environmental performance along with the effectiveness of mitigation measures that prevent adverse effects on the VECs and VSECs. These EMPs are listed in Table 7.1 below. Additional discussion is provided in the following sections.

Table 7.1 Baffinland Environmental Management Plans

Document Number	Plan Name	Current Revision Date
BAF-PH1-300-P16-0002	Snow Management Plan	Sep-17
BAF-PH1-830-P16-0001	Surface Water Sampling Program - Quality Assurance and Quality Control Plan	Mar-17
BAF-PH1-830-P16-0002	Air Quality and Noise Abatement Management Plan	Mar-16
BAF-PH1-830-P16-0004	Borrow Pit and Quarry Management Plan	Mar-14
BAF-PH1-830-P16-0006	Cultural Heritage Resource Protection Plan	Mar-16
BAF-PH1-830-P16-0008	Environmental Protection Plan	Aug-16
BAF-PH1-830-P16-0010	Fresh Water Supply, Sewage and Wastewater Management Plan	Mar-18
BAF-PH1-830-P16-0011	Hazardous Materials and Hazardous Waste Management Plan	Mar-17
BAF-PH1-830-P16-0012	Interim Abandonment and Reclamation Plan	Mar-16
BAF-PH1-830-P16-0013	Oil Pollution Emergency Plan - Milne Inlet (OPEP)	Jun-17
BAF-PH1-830-P16-0017	Q1 Quarry Management Plan	Jul-17
BAF-PH1-830-P16-0023	Roads Management Plan	Mar-16
BAF-PH1-830-P16-0024	Shipping and Marine Wildlife Management Plan	Mar-16
BAF-PH1-830-P16-0025	Stakeholder Engagement Plan	Mar-16
BAF-PH1-830-P16-0026	Surface Water and Aquatic Ecosystems Management Plan	Mar-16
BAF-PH1-830-P16-0027	Terrestrial Environmental Management and Monitoring Plan	Mar-16
BAF-PH1-830-P16-0028	Waste Management Plan	Mar-18
BAF-PH1-830-P16-0029	Phase 1 Waste Rock Management Plan	Nov-17
BAF-PH1-830-P16-0030	Borrow Source Management Plan – Kilometre 2	Oct-14
BAF-PH1-830-P16-0031	Life of Mine Waste Rock Management Plan	Apr-14
BAF-PH1-830-P16-0032	Borrow Source Management Plan – Kilometre 97	Oct-14
BAF-PH1-830-P16-0035	Borrow Source Management Plan – Kilometre 104	Mar-14
BAF-PH1-830-P16-0036	Spill Contingency Plan	Mar-17
BAF-PH1-830-P16-0037	Exploration Spill Contingency Plan	Jun-14
BAF-PH1-830-P16-0038	Exploration Closure and Reclamation Plan	Jul-14

Table 7.1 Baffinland Environmental Management Plans

Document Number	Plan Name	Current Revision Date
BAF-PH1-830-P16-0039	Aquatic Effects Monitoring Plan	Oct-15
BAF-PH1-830-P16-0040	QMR2 Quarry Management Plan	Jul-17
BAF-PH1-830-P16-0041	Polar Bear Safety Plan	Mar-16
BAF-PH1-830-P16-0042	Spill at Sea Response Plan	Aug-15
BAF-PH1-830-P16-0046	Marine Environmental Effects Monitoring Plan	Mar-16
BAF-PH1-830-P16-0047	MMER Emergency Response Plan	Oct-17
BAF-PH1-840-P16-0002	Emergency Response Plan	Mar-18
11030-RP-OP-2000-001	Railway Management Plan (draft)	Jan - 12
SD-STD-002	Standard for Hazard Identification and Risk Assessment	
H349000-3000-07-245-0001	Q7 Quarry Management Plan	Oct-13
H349000-3000-07-245-0002	Q11 Quarry Management Plan	Oct-13
H349000-3000-07-245-0003	Q19 Quarry Management Plan	Oct-13
H349000-4200-07-245-0001	D1Q1 Quarry Management Plan	Oct-13
H349000-4200-07-245-0002	D1Q2 Quarry Management Plan	Oct-13

Baffinland has also established several socio-economic management plans (SEMPs) in accordance with the Guidelines (NIRB 2015). Table 7.2 lists Baffinland's socio-economic management plans.

Table 7.2 Baffinland Socio-economic Management Plans

Document Number	Plan Name	Current Revision Date
BAF-PH1-830-P16-0006	Cultural Heritage Resource Protection Plan	Mar-16
BAF-PH1-830-P16-0025	Stakeholder Engagement Plan	Mar-16
H337697-0000-01-126-0002	Health and Safety Management Plan	
SD-SEMP-003	Human Resources Management Plan	
	Inuit Procurement and Contracting Strategy (see Note)	
	Inuit Human Resources Strategy (see Note)	

NOTE:
Baffinland has jointly developed with the QIA two strategic documents that complement its existing socio-economic management plans: Inuit Procurement and Contracting Strategy and Inuit Human Resources Strategy

Section 9.3 of the Amended EIS Guidelines outlines the requirements for monitoring and mitigation within the biophysical environmental and socio-economic management plans prescribed in Sections 9.4 and 9.5 of the Amended EIS Guidelines (NIRB 2015). The various EMPs and SEMPs incorporate the required mitigation and monitoring.

Details on updates required for the Phase 2 proposal of the various monitoring and mitigation plans (or management plans) are provided in Section 10.4.

7.2 Environmental Protection Plan

Baffinland first developed its Environmental Protection Plan (EPP) in support of its bulk sample program initiated in 2007. The EPP is organized as follows:

- Section 1 - Purpose, Organization, Environmental Commitments, Environmental Approvals and Responsibilities.
- Section 2 - 33 Operational Environmental Standards covering archaeological protection, water use, fuel storage and handling, aircraft operation, wildlife protection and waste management.
- Section 3 - 14 Logs and forms, for recording various information including observations of human land use and wildlife, various environmental inspections and recording of environmental data.
- Section 4 - Form to request revision to an Operational Standard.

The EPP has undergone numerous revisions since 2007. The latest update of the EPP (BAF-PH1-830-P16-0008) was presented in Baffinland's 2016 Annual Report to the NIRB (Baffinland 2017).

7.3 Other Plans and Procedures

Several procedures, manuals and guides have been developed, either as an outcome of previous NIRB reviews, or because Baffinland recognized the need:

- Tote Road Travel Procedure
- Hunter and Visitor Site Access Procedure
- Sump Water Disposal Procedure
- Ice Auger Operation Procedure
- Snowmobile Operation Procedure
- Incinerator Ash Sampling Procedure
- Mobile Oily Water Separator Manual
- Waste Sorting Guideline
- Waste Sorting Guidelines Open Burning of Untreated Wood Cardboard and Paper Product

These documents also form part of the operational EMS System.

7.4 Mine Closure and Reclamation Plan

An Interim Closure and Reclamation Plan (ICRP) has been developed by Baffinland and approved by the NWB under the Type A Water Licence, and conditionally approved by the QIA under the Commercial Lease. Financial assurance in the is currently held by the QIA and CIRNA, which reflects the proportioning of IP (IOL) and Crown Land, respectively. The Annual Security Review (ASR) process has been ongoing since 2013 in which the quantum of security is revisited considering the proposed work plan for the year following. The closure estimate will be updated after Ministerial approval of the Phase 2 Project, in accordance with Part J of the water license.

The Phase 2 Proposal involves additional infrastructure that will require an update to the ICRP. This includes additional infrastructure at the Mine Site (mainly a replacement of ore handling and stockpiling equipment for the ERP with the same equipment for the 12 Mt/a operation), the North Railway, and at Milne Port the additional ore dock and ore handling and stockpiling equipment. The current ICRP already describes the reclamation measures to be undertaken for a railway and ore dock, but will need to be updated to identify the additional infrastructure, and associated reclamation security.

7.5 Follow-up and Adaptive Management Plan

Section 9.7 of the Amended EIS Guidelines provides direction to Baffinland for the development of a Follow-up and Adaptive Management Plan. Follow-up and adaptive management have been incorporated into the individual biophysical EMPs and socio-economic management plans and associated monitoring plans identified above. Updates to existing documents which are required as a result of the Phase 2 Proposal are reflected in Section 10.4.

8 MINE CLOSURE

Under the proposed development scenario, the operation period will extend to the end of 2035, after which a 3-year closure phase will be executed.

Baffinland currently has an Interim Closure and Reclamation Plan (ICRP) approved by the NWB under Part J of its Type A Water Licence and by the QIA under the company's Commercial Lease for mine development activities on IOL (Baffinland 2016g). The ICRP is an evolving document, which will be updated as new knowledge is gained from operational monitoring, refinement of methods based on progressive rehabilitation, and to reflect any relevant changes in the Project. It is updated annually or as required on the basis of the annual Work Plan.

A further update to the ICRP will be prepared to incorporate the elements of the Phase 2 Proposal for the water licence amendment component of the Project Certificate No. 005 reconsideration process. All the elements of the Phase 2 Proposal are already captured in the approved ICRP; only quantities and the associated reclamation security estimate will change.

9 EXPLORATION

9.1 Known Iron Ore Deposits

The North Baffin Island region has an abundance of high grade iron ore deposits. Baffinland has a number of mineral leases on which 11 exploitable high-grade iron oxide deposits and two other early stage but large-scale exploration prospects have already been identified, as listed in Table 9.1, and shown on Figure 9.1.

These deposits and prospects are defined as high grade iron oxides (>65% iron) and generally comprise a number of iron formations which have been enriched and altered to varying degrees. Original banded iron formations comprised of alternating layers of magnetite and hematite appear to have been preserved in several locations along strike of potential high-grade deposits. It is generally believed that regional metamorphism and folding associated with geological events in the past resulted in significant crustal thickening together with the creation of zones of weak to very efficient leaching of silica. Subsequent geological events appear to have led to the alteration of magnetite to hematite and specular hematite. Surface outcrops differ in iron, silica, and sulphur content and in the proportions of their main oxide minerals – hematite, magnetite, and specularite.

The existence of a large number of deposits and prospects containing high grade iron oxides speaks to the significant long-term upside of the Mary River Project. The Project has the potential to exist as a multigenerational mining development. To adapt to emerging iron ore demand, changing environmental conditions, and evolving technologies, development of these resources will require the continued use of a phased approach to development.

9.2 Near-Term Development Plan

Development of a large-scale iron ore district is an iterative process, evolving over time based on the results of advanced exploration as well as commercial factors. The NIRB Inuit communities and Baffinland's stakeholders have witnessed the ongoing evolution of this Project to date.

As of December 31, 2017, Deposit No. 1 contains an estimated 653 Million dry metric tonnes (Mdmt) of Mineral Resources (inclusive of Mineral Reserves) with an estimated grade of 65.3%. The mine plan proposes to exploit the 383.7 Mdmt of established Mineral Reserves in Deposit No. 1. Depending on iron ore prices and further economic evaluation, a larger portion or all of the 653 Mdmt of Mineral Resource may be mined. This would extend the life of, and/or accommodate a further increase in production at Deposit No. 1.

Deposits No. 2 and No. 3 are located adjacent to Deposit No. 1 and have been investigated (drilled) more extensively than the other deposits. Given their proximity to the current Mine Site, it is expected that these deposits will be developed either prior to or following exhaustion of ore in Deposit No. 1, utilizing much of the same Project infrastructure. Additional drilling will be required to further define the orebodies, establish safe pit slope angles, and geochemically characterize the associated waste rock. Mine plans can then be developed, establishing open pit dimensions, ore extraction and handling operations, and waste rock disposal plans.

Deposits No. 4 and No. 5 have been drilled at a relatively very broad spacing while others have not been drilled to date. Drill information is currently insufficient and lacks the necessary confidence level to define mineral resources in these deposits. Deposits No. 4 and No. 5 are located approximately 7 km and 2 km from the proposed North Railway along the Northern Transportation Corridor. If proven to be economic, ore from these deposits could be transported to a new load-out facility along the North Railway for shipment via Milne Port. As with Deposits No. 2 and No. 3, additional drilling is required to define the ore bodies, characterize the waste and to develop a Mine plan. A trade off study would be conducted to determine the most optimal means of transporting the ore to the North Railway (i.e., by a spur rail line, by road or by overland conveyor).

Table 9.1 Baffinland's Regional Iron Ore Deposits and Prospects

Deposit No.	Deposit Name	Description
1	-	653 Mdmt of mineral resources and reserves at approximately 65% iron, of which 383.7 Mdmt are mineral reserves that will be exploited by the current mine plan.
2	-	26 Mt indicated mineral resources at 65% iron.
3	-	336 Mt inferred mineral resources at 65.9% iron.
4	-	Elongated zones of high grade iron oxide from 5 to 75 m in width over a 2,800 m strike length.
5	-	Attenuated and well exposed zones of high grade iron oxide over an approximate 6 km strike length; with individual high-grade zones up to 700 m in length and up to 70 m wide.
6	Glacier Lake Prospect	High grade iron oxide exposed for 1 km strike length and up to 100 m width; prospect located on a major fold structure that can be traced for up to 20 km.
7	Turner River Prospect	High grade iron oxide exposed over a 700 m strike length and up to a potential 100 m width; prospect located on a major fold structure that can be traced for up to 25 km.
8	Cockburn River Prospect	High grade iron oxide exposed for a combined 2.4 km strike length and approximately 20-140 m width; prospect located on a geological structure that can be traced for up to 10 km.
9	Rowley River Prospect	High grade iron oxide exposed for combined 1.4 km strike length and up to 150 to 200 m outcrop width and potential 40+ m thickness.
10	Triangle Lake Prospect	High grade iron oxide along an approximate 1.1 km strike length and exposed 20 to 25 m width; additional discontinuous mineralization extends this zone to a potential 3.5 km.
11	Long Lake Prospect	Main high-grade iron oxide zone exposed for a 200 m strike length and a 20 to 30 m width; additional discontinuous mineralization extends this prospective assemblage to a potential 3.5 km strike length. There is additional potential (gold) beyond the high-grade iron oxides.
	Isortoq Fold belt	Includes several high-grade iron oxide prospects; very early stage of exploration.
	Eqe Bay Fold belt	Includes the Cake Lake Prospect, which contains a zone of massive, hard high-grade hematite iron formation set within an oxide facies iron formation sequence 10+ km in length; potential high-grade hematite ore zone up to 800 m length by 100 m width. There are additional mineral prospects (gold) beyond the high-grade iron oxides.

9.3 Long-Term Development

Baffinland's active mineral exploration claims are shown on Figure 9.1. Baffinland's regional exploration efforts in the past few years have helped to further demonstrate the long-term potential of the region as having sufficient resources to support a high tonnage iron ore mining operation over a long duration. While Deposits No. 6 through No. 11 and the Isortoq Fold Belt and Eqe Bay Fold Belt Prospects have been confirmed as containing high grade iron oxide (>65% iron), additional drilling is required to delineate mineral resources at these locations. Therefore, no development plans have been established for these deposits and prospects. Baffinland acknowledges that pending further exploration work, it is possible that priorities may shift to the development of one or more of these deposits. For example, the Isortoq Fold Belt and Eqe Bay Fold Belt Prospects appear to each contain multiple high-grade prospects and are located very close to tidewater, and as such, would require less infrastructure to transport the ore to the coast.

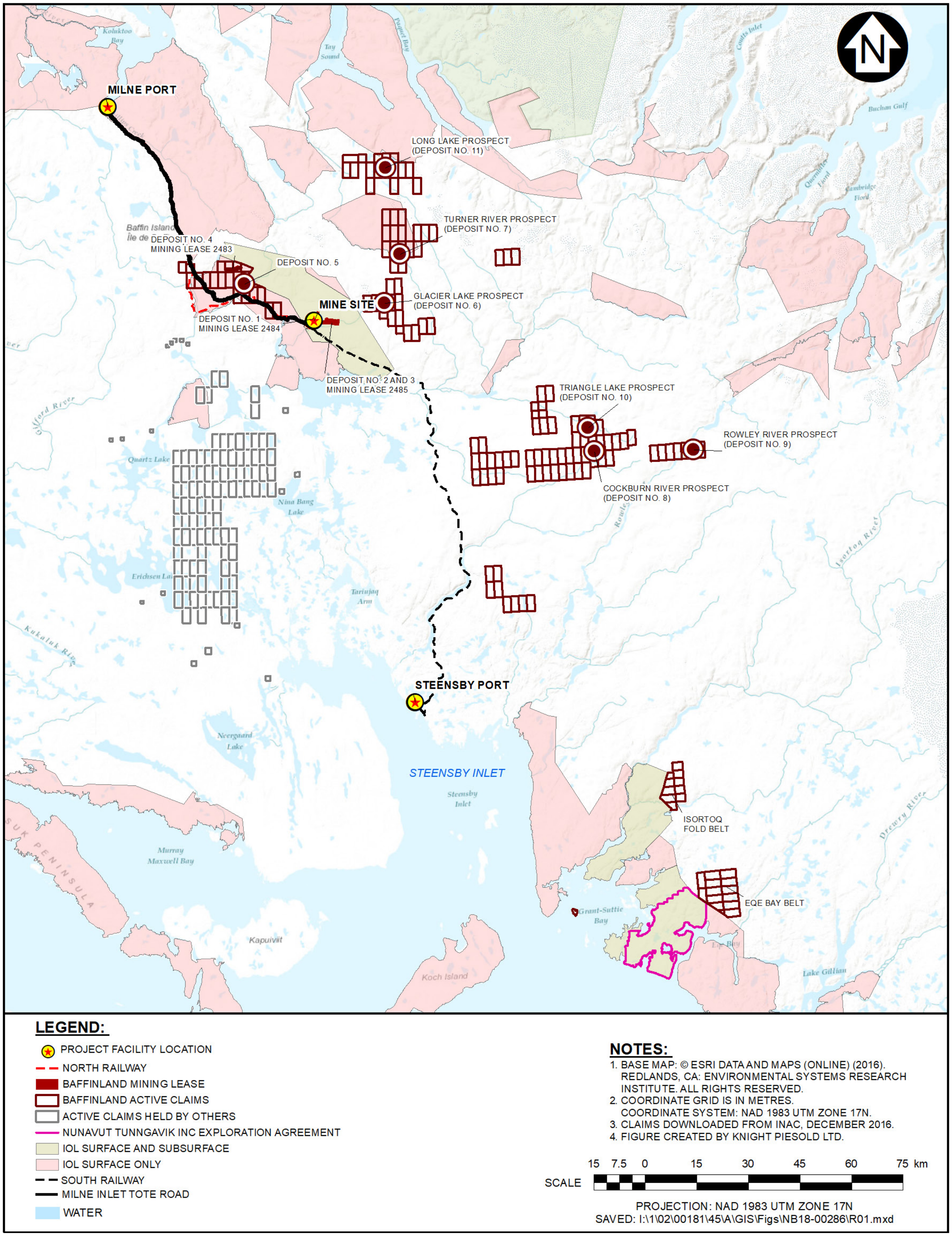


Figure 9.1 Active Mineral Claims

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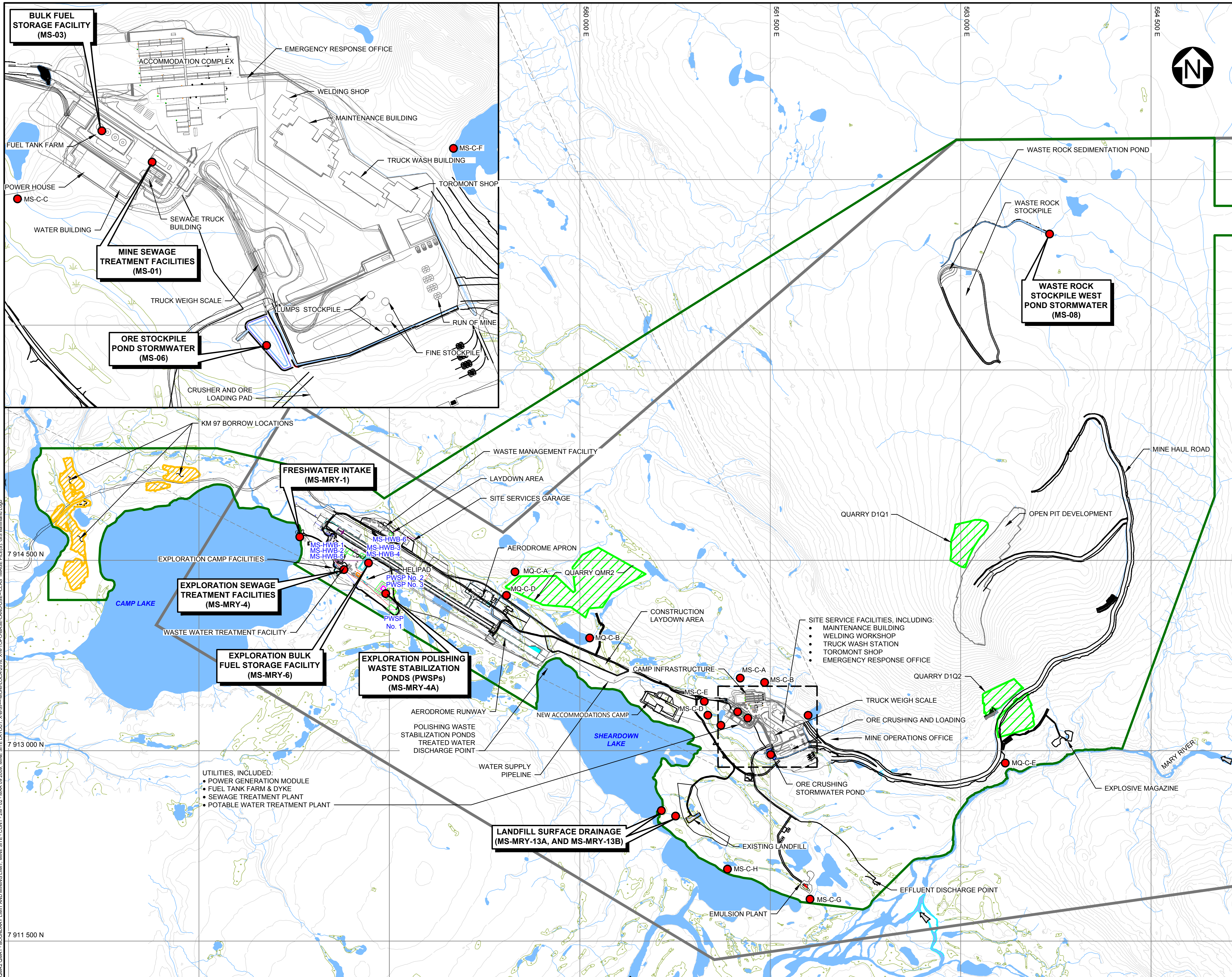
APPENDIX A:
CURRENT SITE LAYOUTS



LEGEND:

- WATER
- EXISTING BORROW AREA
- QUARRY
- WASTE STORAGE AREA
- ROAD
- QIA SURFACE COMMERCIAL LEASE BOUNDARY
- POTENTIAL DEVELOPMENT AREA BOUNDARY
- WATER LICENCE SURVEILLANCE NETWORK PROGRAM (SNP) STATION

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 17N.
2. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
3. PLAN BASED ON INFORMATION PROVIDED BY HATCH, DATED (JAN 13, 2015).
4. CONTOUR INTERVAL IS 2.5 METRES.
5. FIGURE CREATED BY KNIGHT PIESOLD LTD.

SCALE A 300 150 0 500 1000 1500 m

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

CURRENT MINE SITE LAYOUT

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE A.1 REV 0

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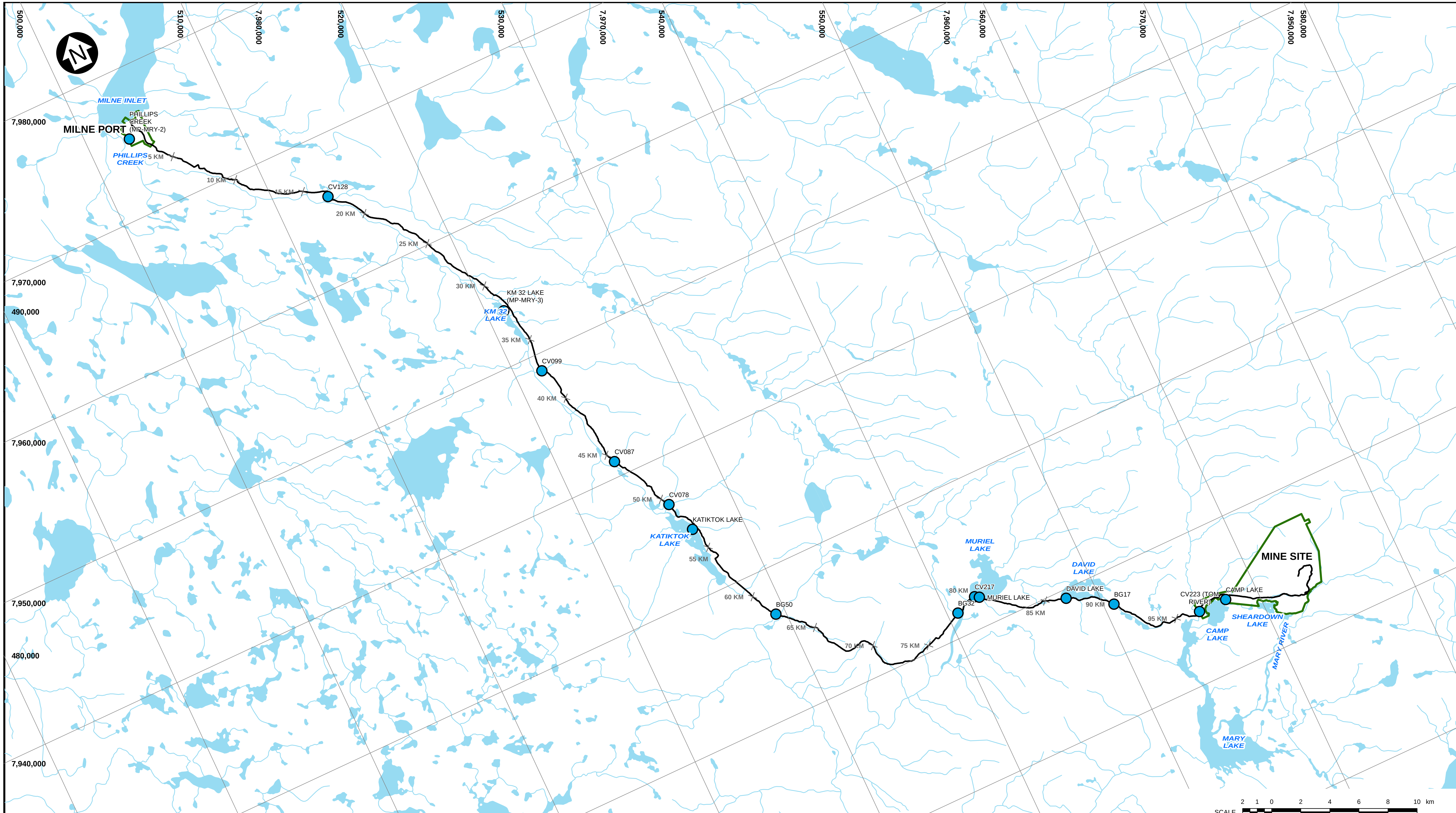

LEGEND:

- APPROVED LAKE WATER SOURCE
- MILNE INLET TOTE ROAD
- WATER
- PROJECT DEVELOPMENT AREA

NOTES:

1. BASE MAP: HER MAJESTY THE QUEEN IN RIGHTS OF CANADA, DEPARTMENT OF NATURAL RESOURCES, (2004).
2. COORDINATE GRID IS UTM (NAD83) ZONE 17 AND IS IN METRES.
3. FIGURE CREATED BY KNIGHT PIESOLD LIMITED.

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

CURRENT MILNE INLET TOTE ROAD SHOWING APPROVED WATER SOURCES

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE A.2 REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	25JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

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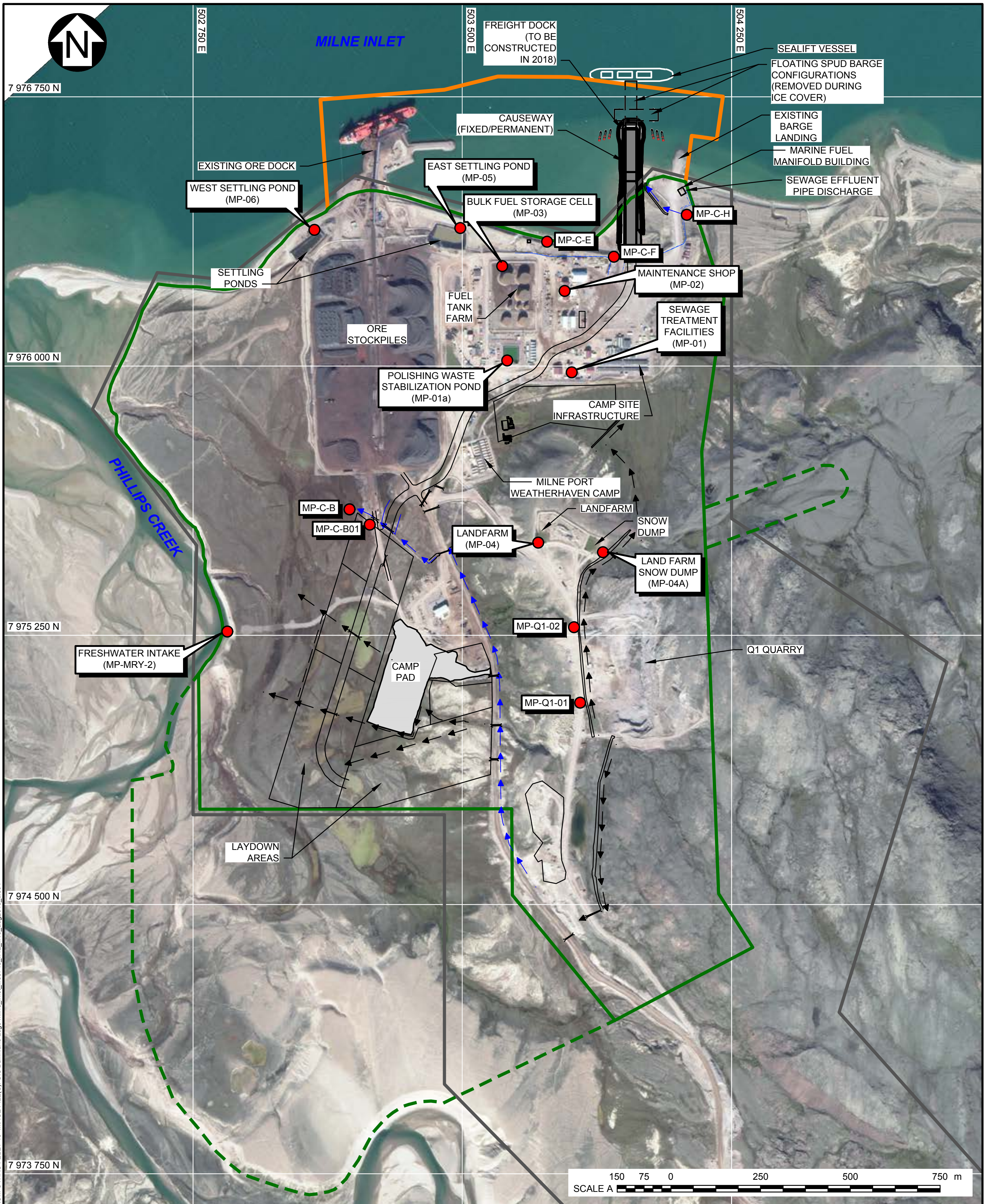

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 17N.
2. AERIAL PHOTOGRAPHY PROVIDED BY BAFFINLAND.
3. FIGURE CREATED BY KNIGHT PIESOLD LTD.

LEGEND:

- SURVEILLANCE NETWORK PROGRAM MONITORING STATIONS
- COMMERCIAL LEASE BOUNDARY
- POTENTIAL DEVELOPMENT AREA (PDA) BOUNDARY
- PDA EXPANSION FOR PHASE 2 PROPOSAL
- FORESHORE LEASE BOUNDARY / MARINE PDA

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	15JUN'18	ISSUED WITH TRANSMITTAL	WOG	MMD	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

**MILNE PORT
CURRENT LAYOUT WITH AERIAL PHOTO**

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE A.3 REV 0

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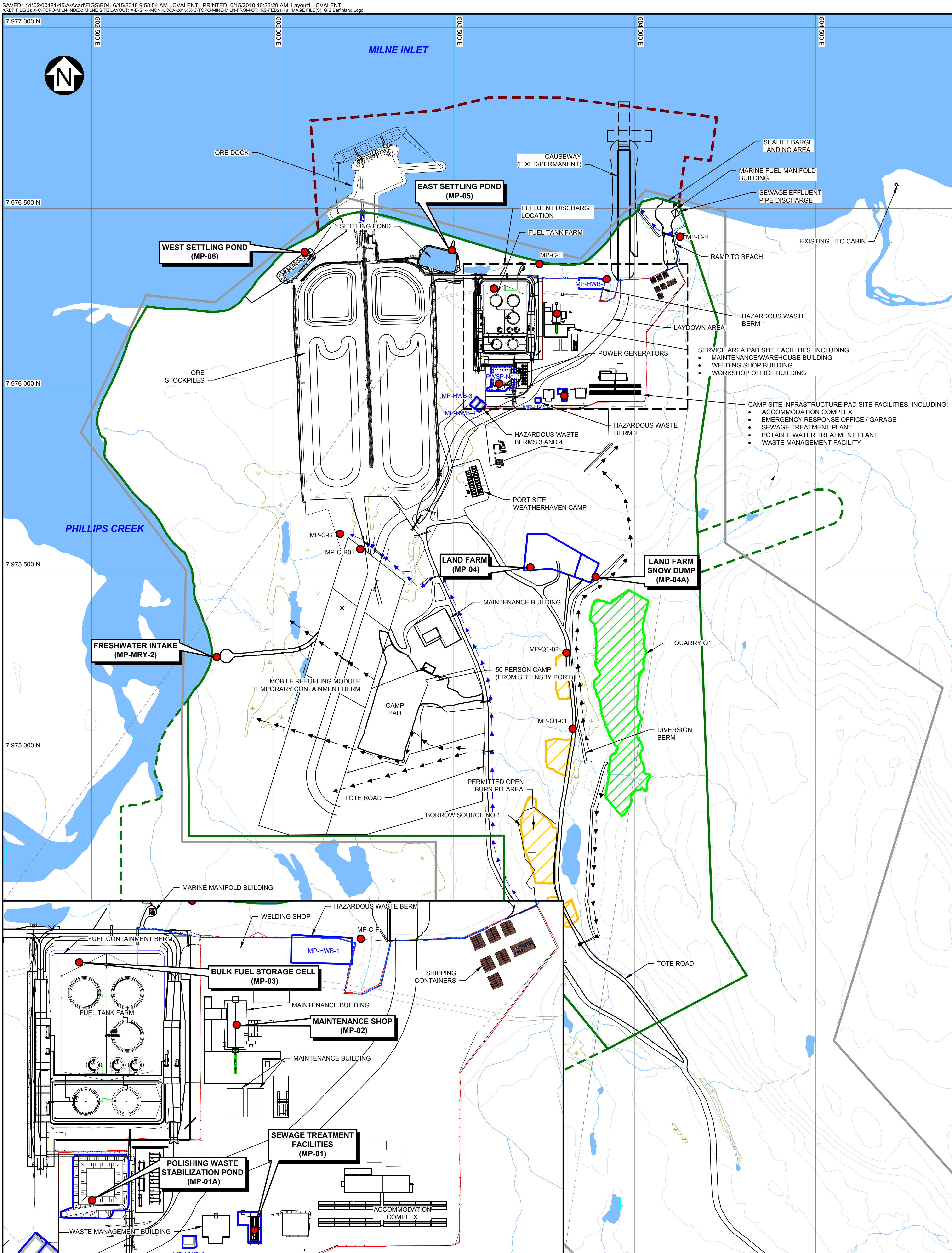


LEGEND:

- WATER
- BORROW AREA
- QUARRY
- WASTE STORAGE AREA
- ROAD
- PROJECT DEVELOPMENT AREA (PDA)
- PDA EXPANSION FOR PHASE 2 PROPOSAL
- FORESHORE LEASE BOUNDARY / MARINE PDA
- COMMERCIAL LEASE BOUNDARY
- FLOW DIRECTION
- WATER LICENCE SURVEILLANCE NETWORK PROGRAM (SNP) STATION

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 17N.
2. CONTOUR INTERVAL IS 10 METRES.
3. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005)
4. PLAN/SECTION BASED ON INFORMATION PROVIDED BY HATCH, DATED (JAN 31,2014).
5. FIGURE CREATED BY KNIGHT PIESOLD LTD.

SCALE A 100 50 0 100 200 300 400 500 m

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	15JUN'18	ISSUED WITH TRANSMITTAL	RAC	MMD	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

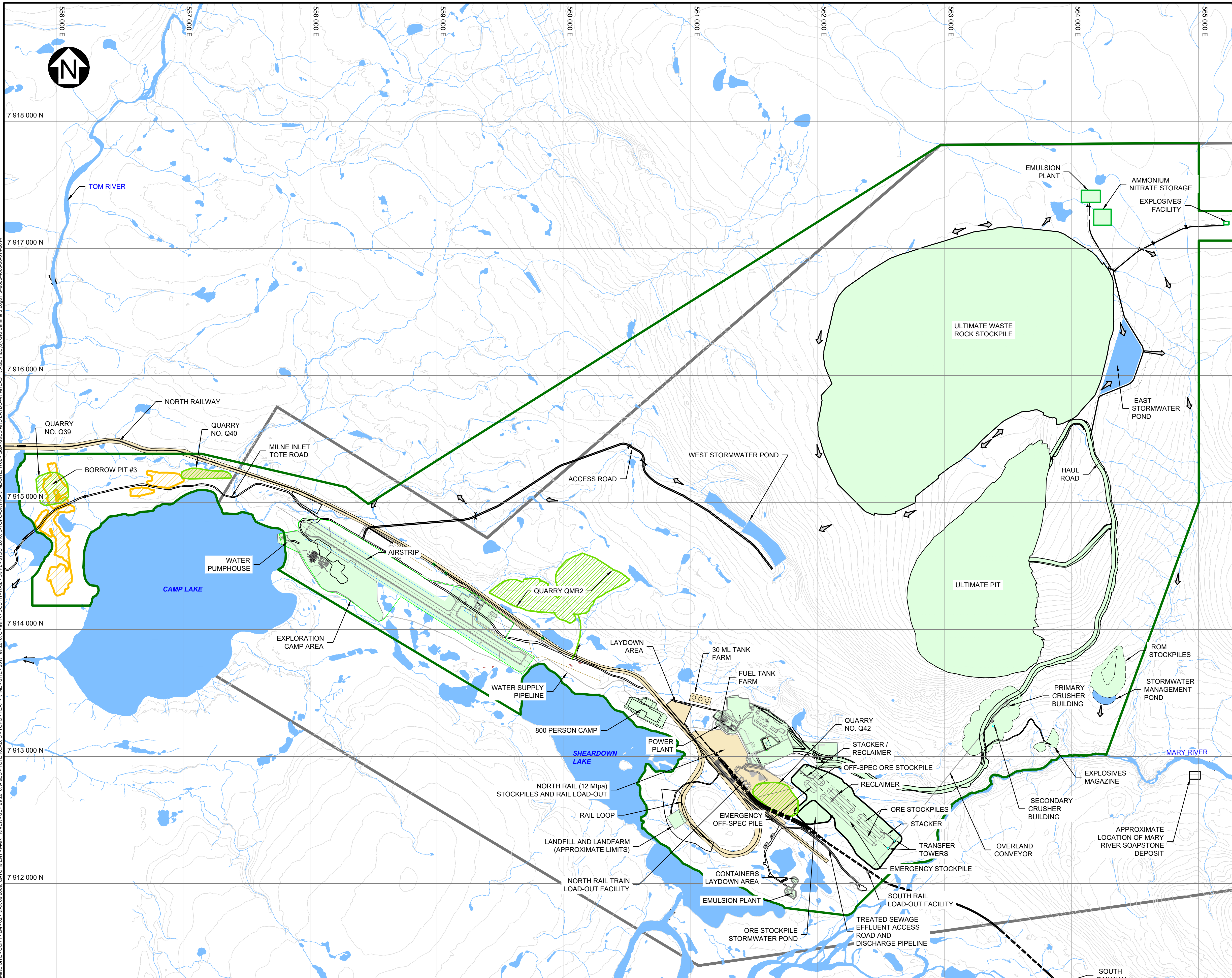
CURRENT MILNE PORT SITE LAYOUT

Baffinland

P/A NO. NB102-181/45 | REF NO. NB18-00286

FIGURE A.4 | REV 0

APPENDIX B:
PHASE 2 SITE LAYOUTS



LEGEND:

- APPROVED INFRASTRUCTURE
- ADDITIONAL PHASE 2 PROPOSAL INFRASTRUCTURE
- EXISTING BORROW AREA
- QUARRY
- WATER
- MILNE INLET TOTE ROAD
- COMMERCIAL LEASE BOUNDARY
- PROJECT DEVELOPMENT AREA
- RAILWAY
- FLOW DIRECTION

NOTES:

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 10 METRES.
4. MINE SITE INFRASTRUCTURE PROVIDED BY HATCH AND AMEC. HATCH ADDITIONAL DETAILS PROVIDED IN DRAWINGS H352034-4100-240-290-0001 H352034-4100-240-290-0002 AMEC ADDITIONAL DETAILS PROVIDED IN DRAWINGS A1-164512-6120-121-0100 A1-165926-6000-121-GAD-0100 A1-159952-6020-121-0200

SCALE A 300 150 0 500 1000 1500 m

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

MINE SITE LAYOUT
PHASE 2 PROPOSAL
FINAL YEAR OF MINING

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.1 REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
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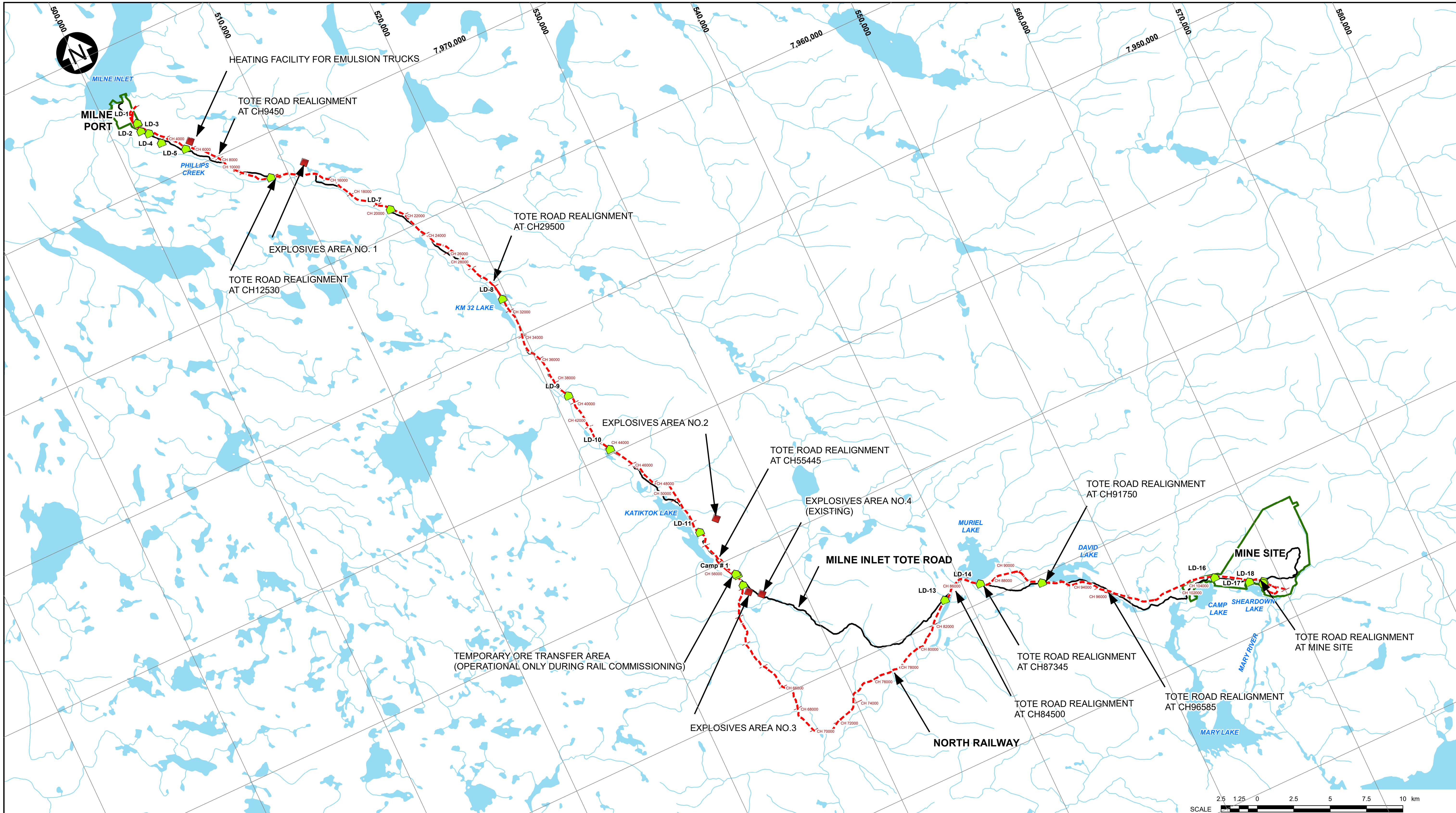

LEGEND

- LAYDOWN AREA
- NORTH RAILWAY
- NORTH RAILWAY CHAINAGE (m)
- MILNE INLET TOTE ROAD
- PROJECT DEVELOPMENT AREA
- EXPLOSIVES STORAGE AREA
- WATER

NOTES:

1. COORDINATE GRID IS IN KILOMETRES.
   COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. BASE MAP/IMAGERY: © ESRI AND DATA (ONLINE) SERVICE LAYERS (2017). REDLANDS, CA: ENVIRONMENTAL SYSTEM RESEARCH INSTITUTE. ALL RIGHTS RESERVED.
3. FIGURE CREATED BY KNIGHT PIESOLD LIMITED.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
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BAFFINLAND IRON MINES CORPORATION

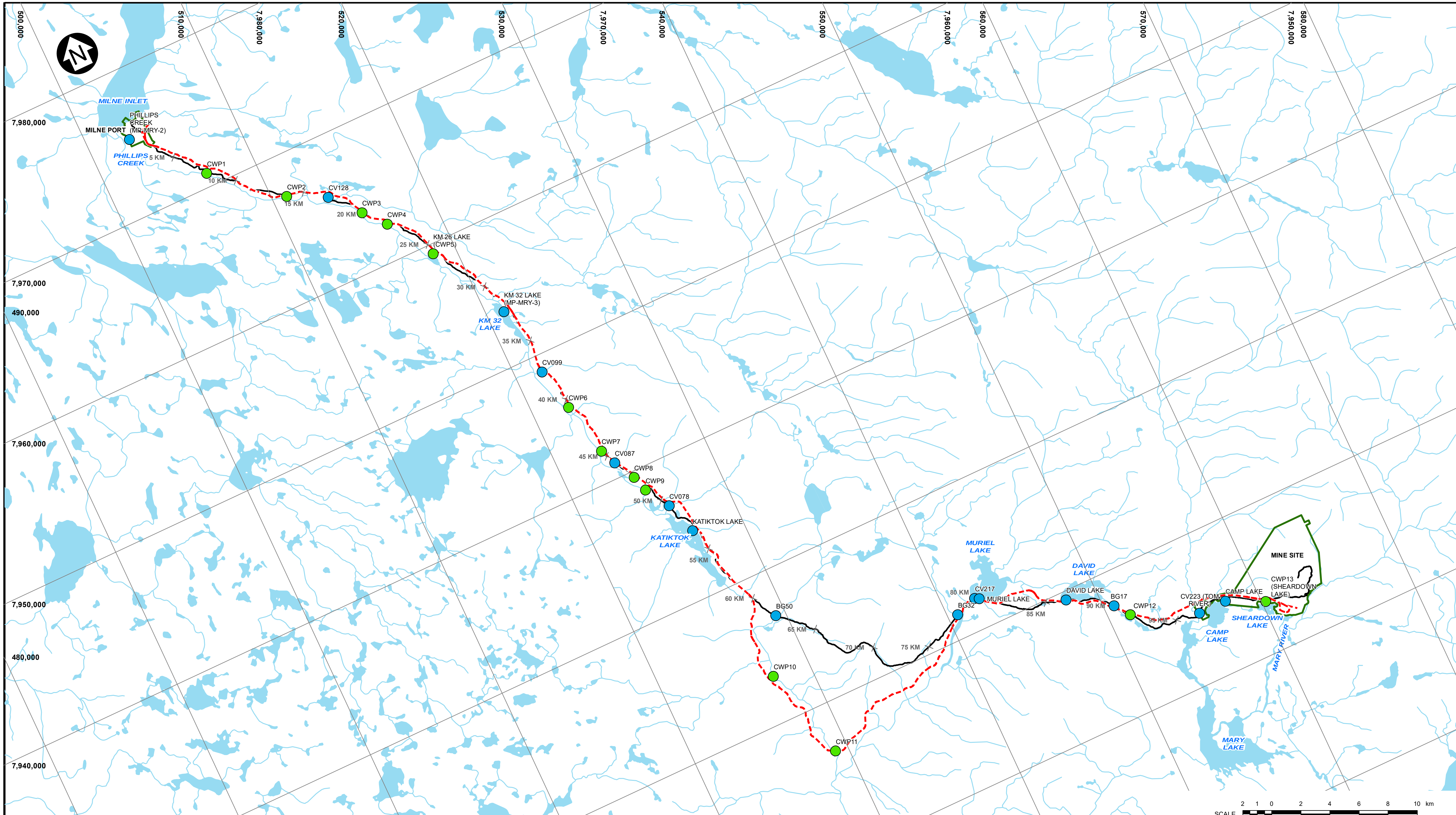
MARY RIVER PROJECT

NORTHERN TRANSPORTATION CORRIDOR CONSTRUCTION PHASE LAYOUT

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.2 REV 0



LEGEND:

- APPROVED WATER SOURCE
- PROPOSED WATER SOURCE
- MILNE INLET TOTE ROAD
- WATER
- PROJECT DEVELOPMENT AREA

NOTES:

1. BASE MAP: HER MAJESTY THE QUEEN IN RIGHTS OF CANADA, DEPARTMENT OF NATURAL RESOURCES, (2004).
2. COORDINATE GRID IS UTM (NAD83) ZONE 17 AND IS IN METRES.
3. FIGURE CREATED BY KNIGHT PIESOLD LIMITED.

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTHERN TRANSPORTATION CORRIDOR SHOWING WATER WITHDRAWAL LOCATIONS

Baffinland

P/A NO.	REF NO.	
NB102-181/45	NB18-00286	
FIGURE B.3		REV 0

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
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SAVED: I:\1\02\00181\45\A\GIS\Figs\B06_r0.mxd; Aug 03, 2018 4:26 PM; asimpson

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY
- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION
- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)
- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 1 OF 33)

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.1 REV 0

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 2 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.2 REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

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0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

**NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 3 OF 33)**

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.3 REV 0

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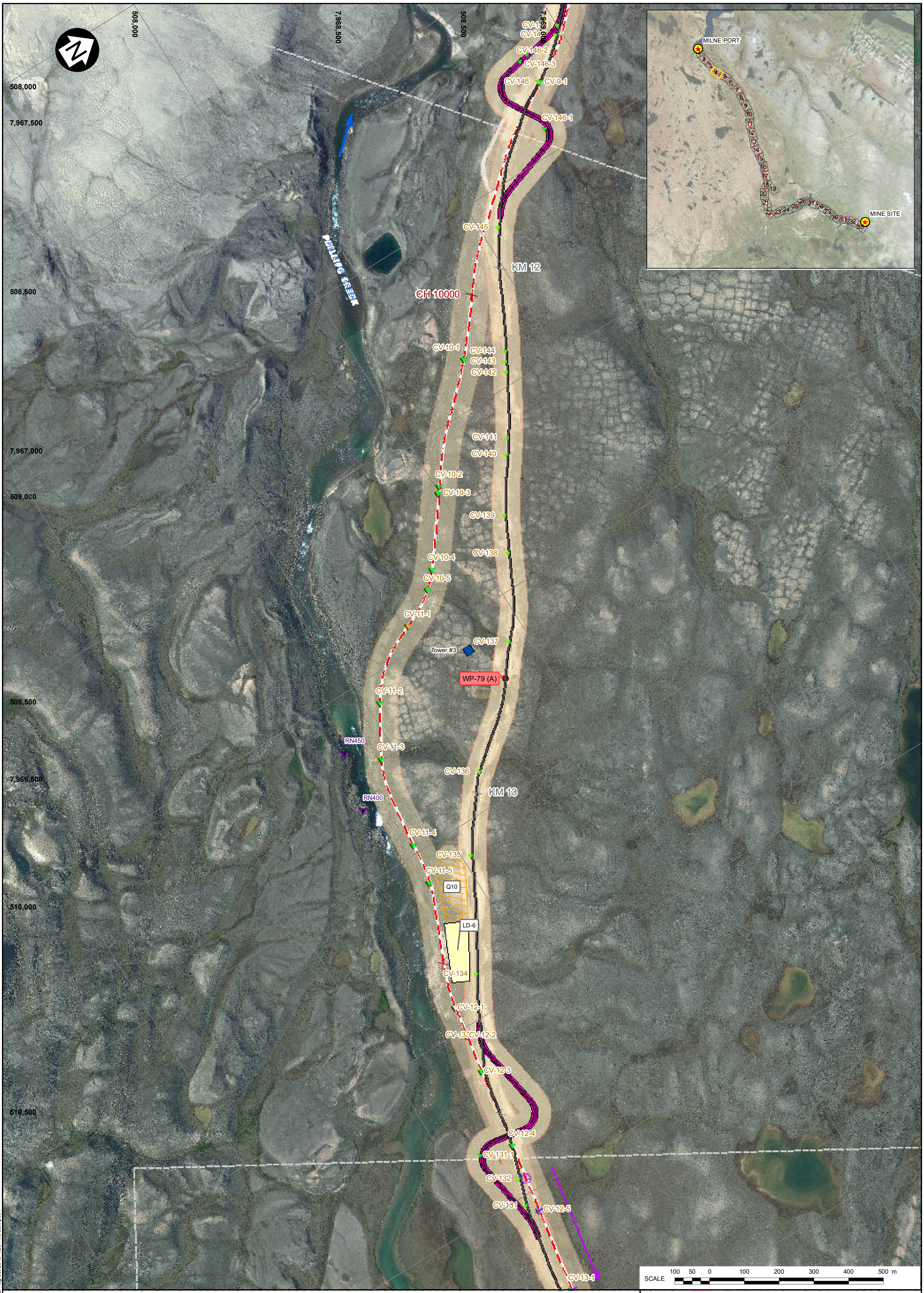

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

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0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 4 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.4 REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 5 OF 33)

Baffinland

P/A NO. NB102-181/45

REF NO. NB18-00286

FIGURE B.4.5

REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT
- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION
- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY (FROM EBA TETRATECH, 2014)
- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY DETAILED CONSTRUCTION PHASE LAYOUT (SHEET 6 OF 33)

Baffinland

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FIGURE B.4.6 REV 0

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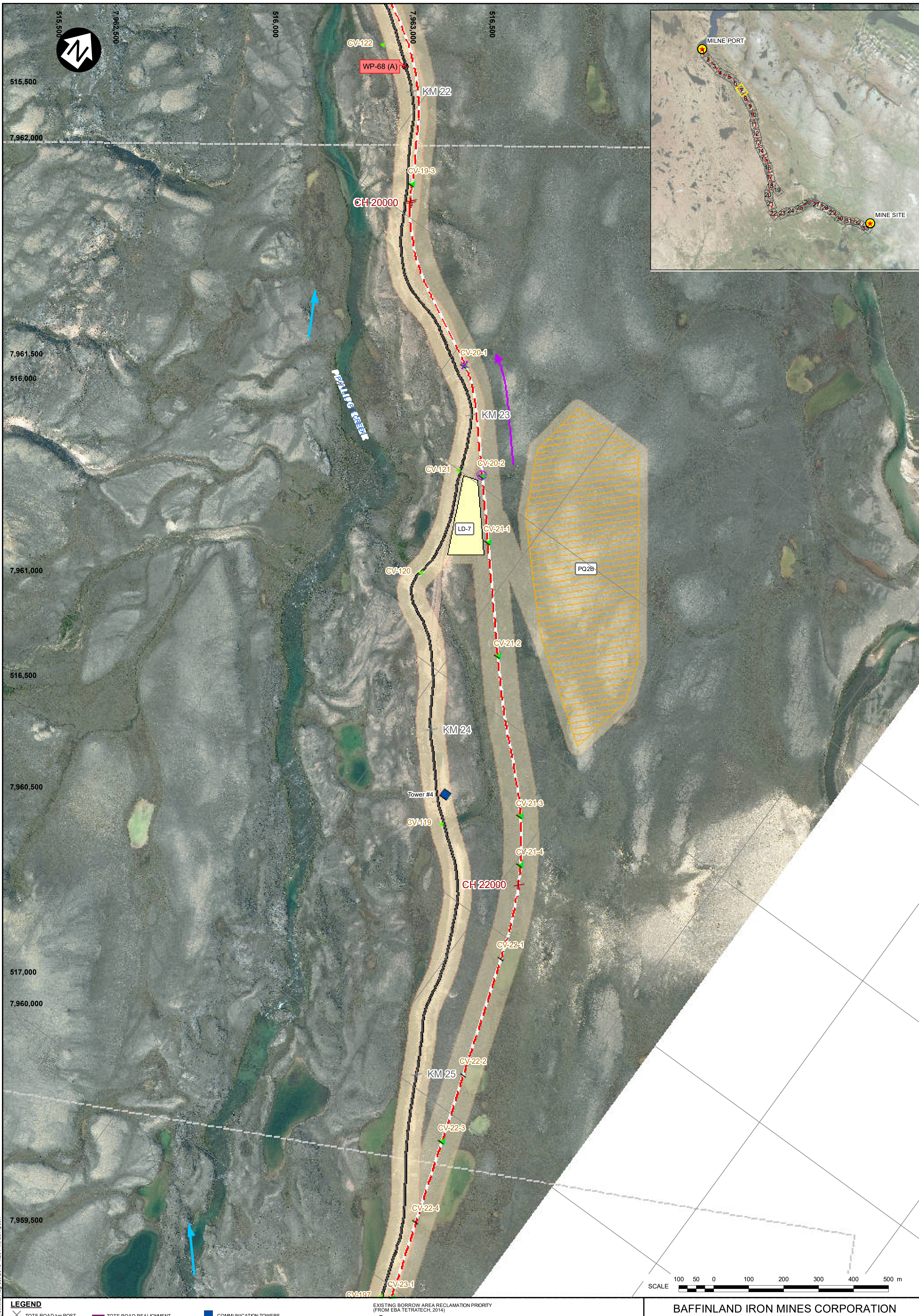

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

**NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 7 OF 33)**

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.7 REV 0

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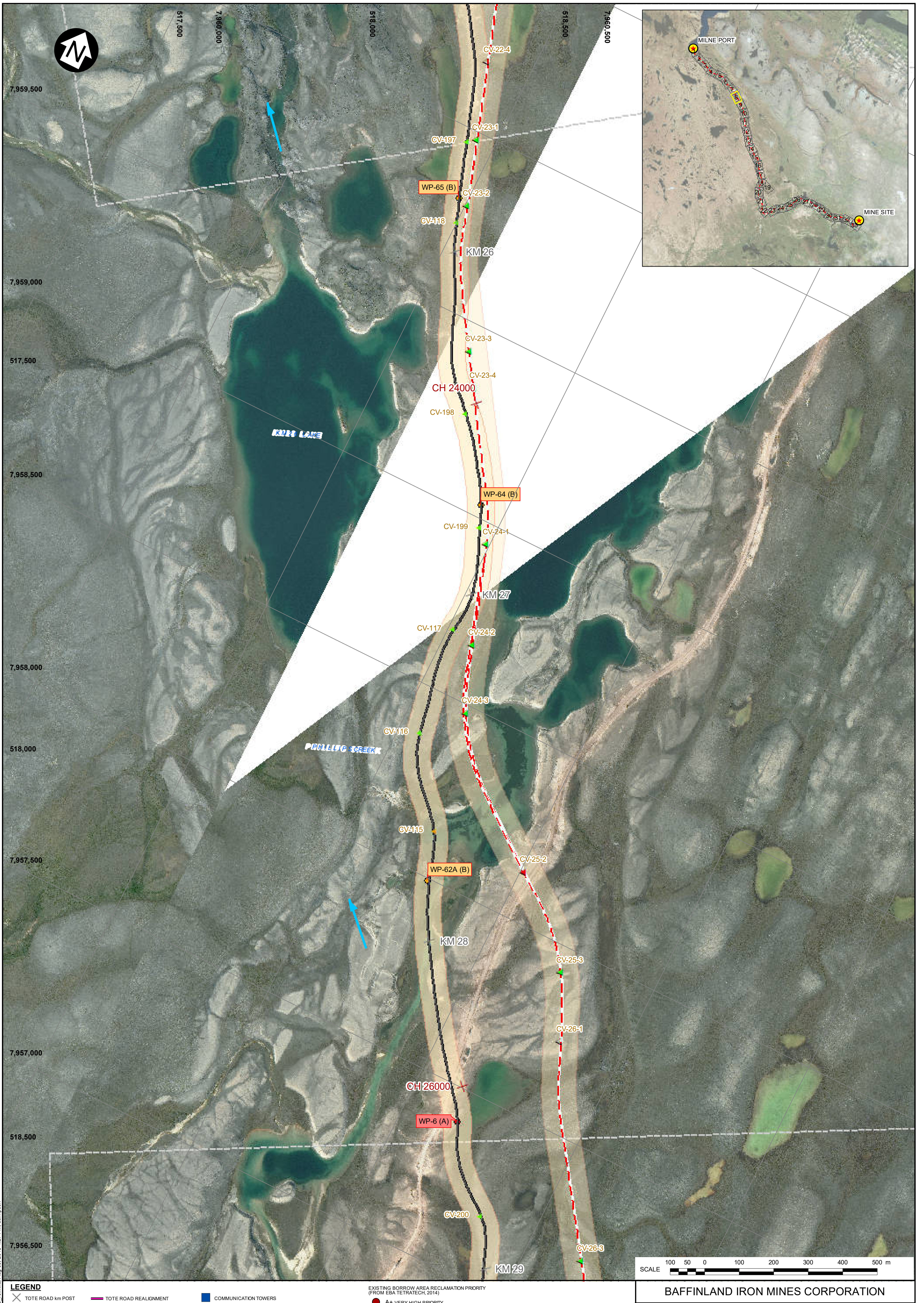

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

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BAFFINLAND IRON MINES CORPORATION

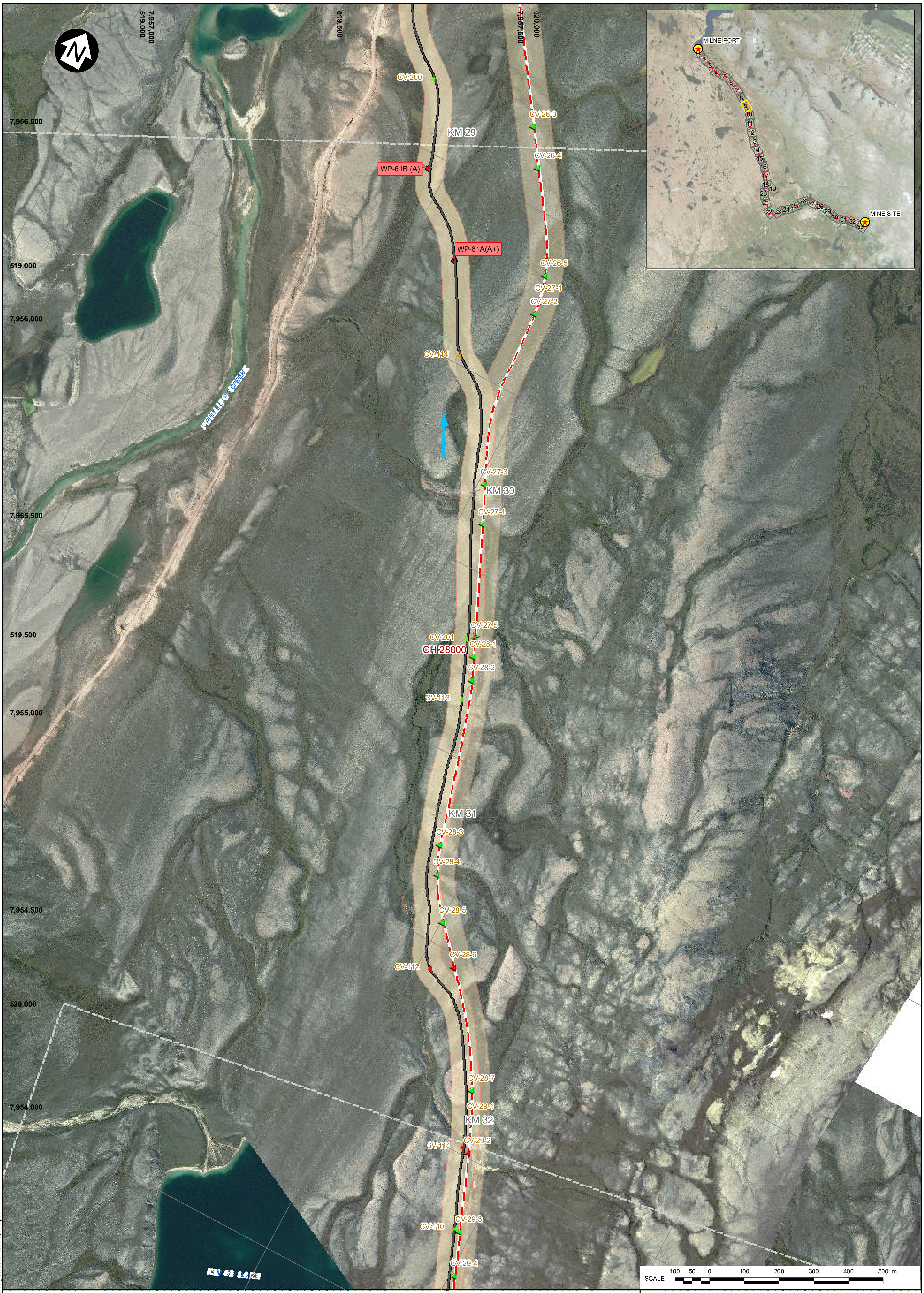
MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 8 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.8 REV 0



LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY
- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION
- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
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- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)
- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 9 OF 33)

Baffinland

P/A NO.	REF NO.	
NB102-181/45	NB18-00286	
FIGURE B.4.9		REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY
- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION
- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)
- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
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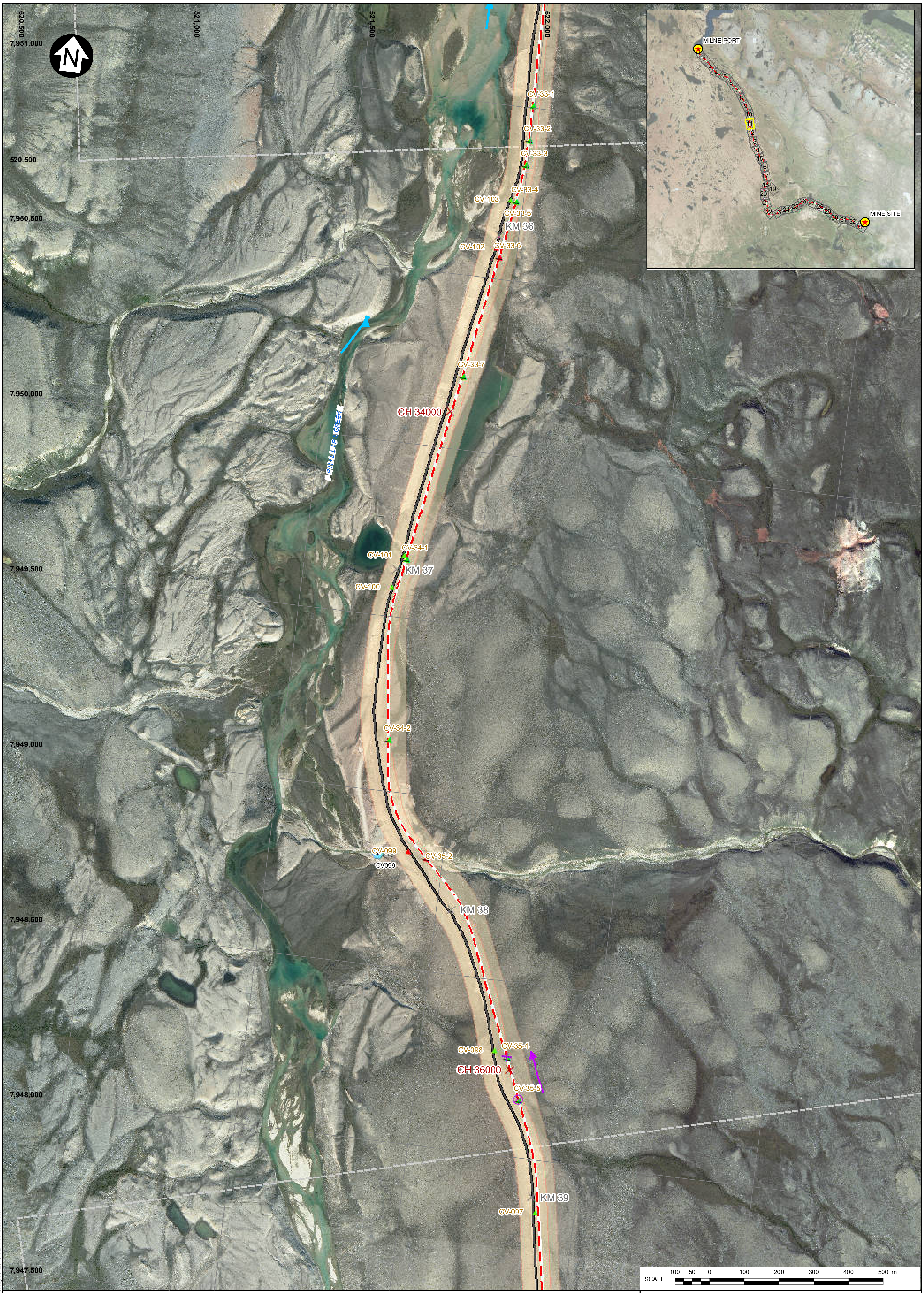
BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY DETAILED CONSTRUCTION PHASE LAYOUT (SHEET 10 OF 33)

Baffinland

P/A NO.	REF NO.	
NB102-181/45	NB18-00286	
FIGURE B.4.10		REV 0



LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 11 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.11 REV 0

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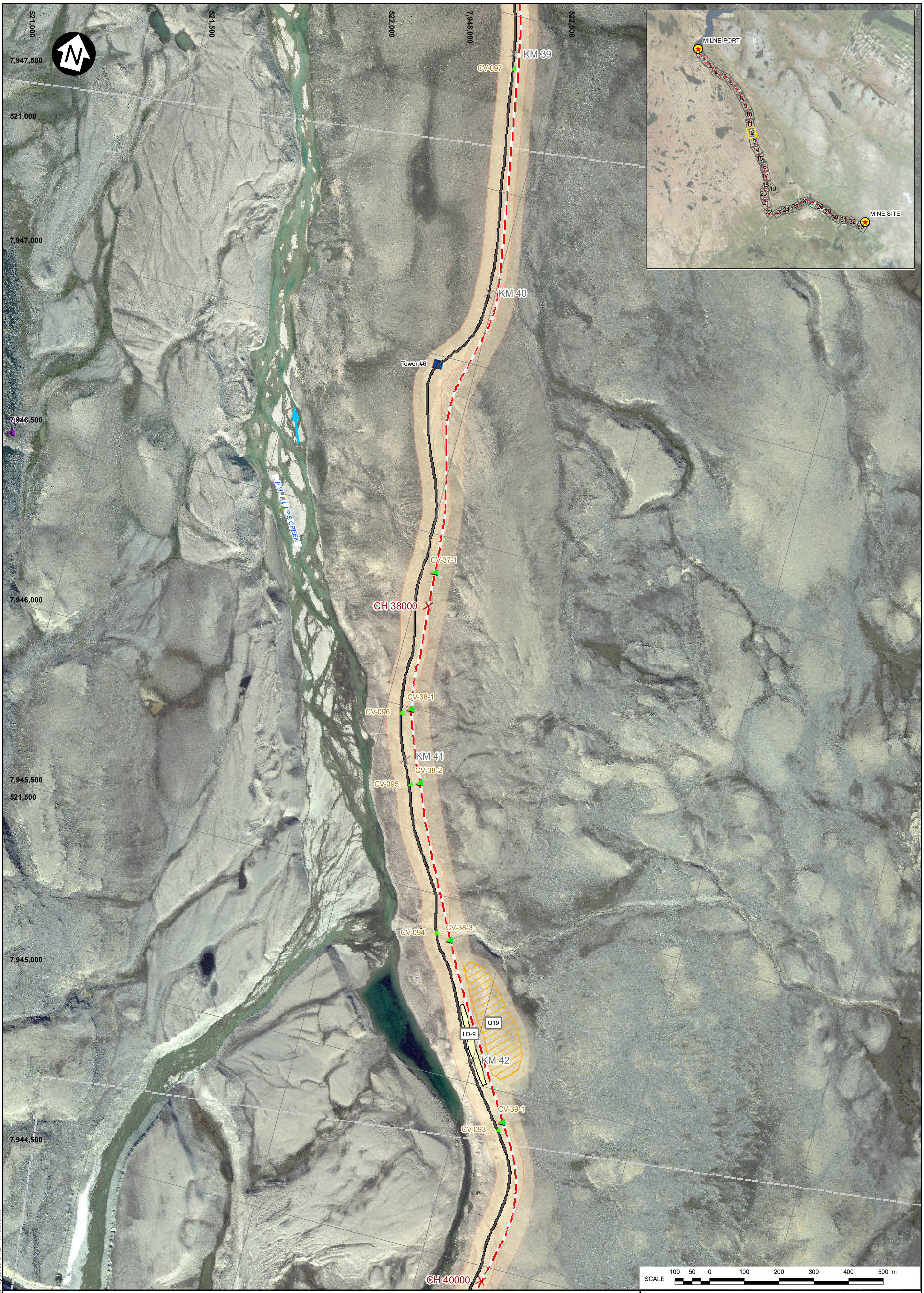

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 12 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.12 REV 0

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 13 OF 33)

Baffinland

P/A NO.	REF NO.
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FIGURE B.4.13 REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 14 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.14 REV 0

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

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0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 15 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.15 REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

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MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 16 OF 33)

Baffinland

P/A NO. NB102-181/45

REF NO. NB18-00286

FIGURE B.4.16

REV 0

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 17 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.17 REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY (FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 18 OF 33)

Baffinland

P/A NO. NB102-181/45

REF NO. NB18-00286

FIGURE B.4.18

REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

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NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 19 OF 33)

Baffinland

P/A NO.	REF NO.	
NB102-181/45	NB18-00286	
FIGURE B.4.19		REV 0

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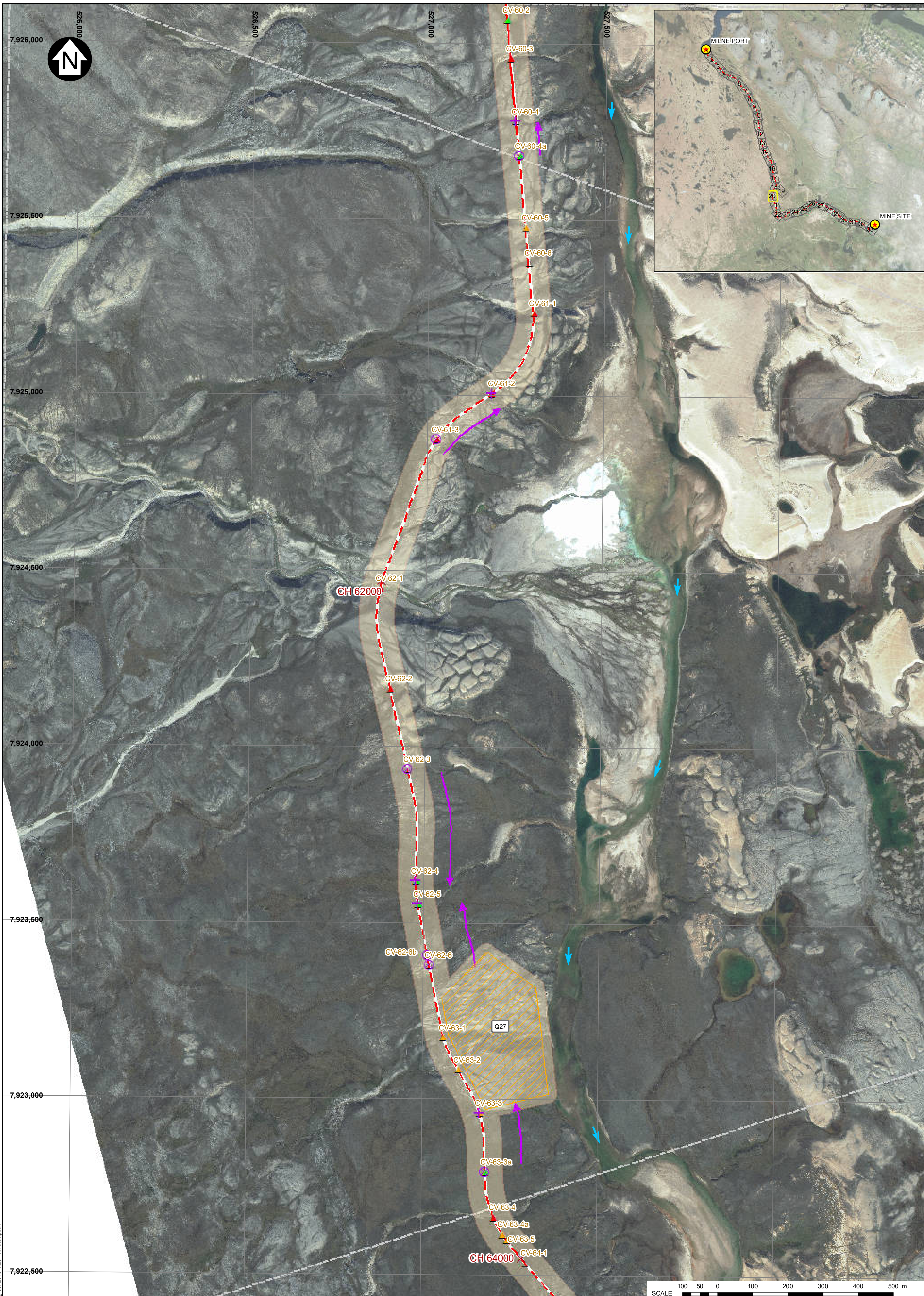

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

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0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

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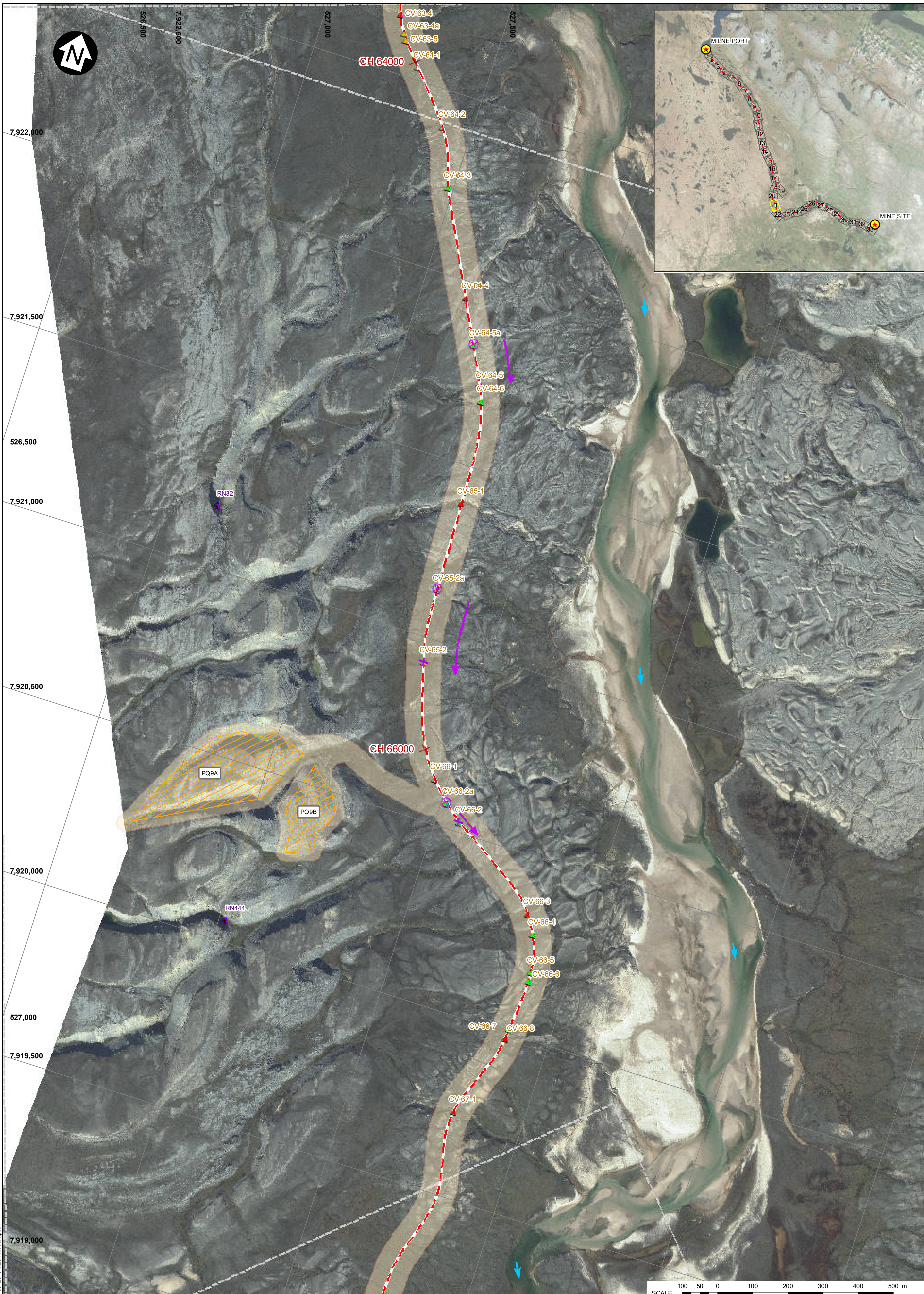
MARY RIVER PROJECT

NORTH RAILWAY DETAILED CONSTRUCTION PHASE LAYOUT (SHEET 20 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE	REV
FIGURE B.4.20	0



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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY
- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION
- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)
- FLOW DIRECTION
- REFERENCE SHEET EXTENT

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

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NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 21 OF 33)

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Baffinland

FIGURE B.4.21 REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
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BAFFINLAND IRON MINES CORPORATION

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NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 22 OF 33)

Baffinland

P/A NO.	REF NO.
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FIGURE B.4.22 REV 0

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY
- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION
- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY (FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)
- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 23 OF 33)

Baffinland

P/A NO. NB102-181/45 | REF NO. NB18-00286

FIGURE B.4.23 | REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 24 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.24 REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 25 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.25 REV 0

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 26 OF 33)

Baffinland

P/A NO. NB102-181/45

REF NO. NB18-00286

FIGURE B.4.26

REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 27 OF 33)

Baffinland

P/A NO. NB102-181/45

REF NO. NB18-00286

FIGURE B.4.27

REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY
- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION
- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY (FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)
- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 28 OF 33)

Baffinland

P/A NO. NB102-181/45 | REF NO. NB18-00286

FIGURE B.4.28 | REV 0

SAVED: I:\102\00181\45\A\GIS\Figs\B06_r0.mxd; Aug 03, 2018 4:29 PM; asimpson

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY
- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION
- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY (FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)
- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY DETAILED CONSTRUCTION PHASE LAYOUT (SHEET 29 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.29 REV 0

SAVED: I:\1\02\00181\45\A\GIS\Figs\B06_r0.mxd; Aug 03, 2018 4:29 PM; asimpson

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY
- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION
- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)
- FLOW DIRECTION
- REFERENCE SHEET EXTENT

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 30 OF 33)

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.4.30	REV 0

LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY (FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:
1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY DETAILED CONSTRUCTION PHASE LAYOUT (SHEET 31 OF 33)

P/A NO. NB102-181/45 | REF NO. NB18-00286

FIGURE B.4.31 REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY
- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION
- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)
- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

NORTH RAILWAY
DETAILED CONSTRUCTION PHASE LAYOUT
(SHEET 32 OF 33)

Baffinland

P/A NO. NB102-181/45

REF NO. NB18-00286

FIGURE B.4.32

REV 0

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LEGEND

- TOTE ROAD km POST
- NORTH RAIL CHANAGE (m)
- LAYDOWN AREA

FISH HABITAT ASSESSMENT

- FISH BEARING
- NONE
- POTENTIAL
- PROBABLE
- UNLIKELY

- TOTE ROAD REALIGNMENT
- PROPOSED NORTH RAILWAY
- STREAM DIVERSION
- TEMPORARY HAUL ROAD
- EXPLOSIVES FACILITIES
- RAPTOR NEST
- STREAMS DIVERTED BY LARGE CUTS
- STREAMS RECEIVING DIVERSION

- COMMUNICATION TOWERS
- APPROVED WATER SOURCE
- PROPOSED CONSTRUCTION WATER SOURCE
- POTENTIAL DEVELOPMENT AREA (MINE, PORT)
- POTENTIAL DEVELOPMENT AREA (TOTE ROAD, NORTH RAIL)
- MILNE INLET TOTE ROAD
- QUARRY AREA
- BRIDGE LOCATIONS

EXISTING BORROW AREA RECLAMATION PRIORITY
(FROM EBA TETRATECH, 2014)

- A+ VERY HIGH PRIORITY
- A HIGH PRIORITY
- B MODERATE PRIORITY
- C LOW PRIORITY; STABLE (NOT SHOWN ON THIS FIGURE)

- FLOW DIRECTION
- REFERENCE SHEET EXTENT

NOTES:

1. COORDINATE GRID IS IN METRES. COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. DETAILED WATER AND ORTHO IMAGERY BASED ON AUGUST 2016 SATELLITE IMAGERY PROVIDED BY BAFFINLAND.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

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MARY RIVER PROJECT

NORTH RAILWAY DETAILED CONSTRUCTION PHASE LAYOUT (SHEET 33 OF 33)

Baffinland

P/A NO. NB102-181/45 | REF NO. NB18-00286

FIGURE B.4.33 | REV 0

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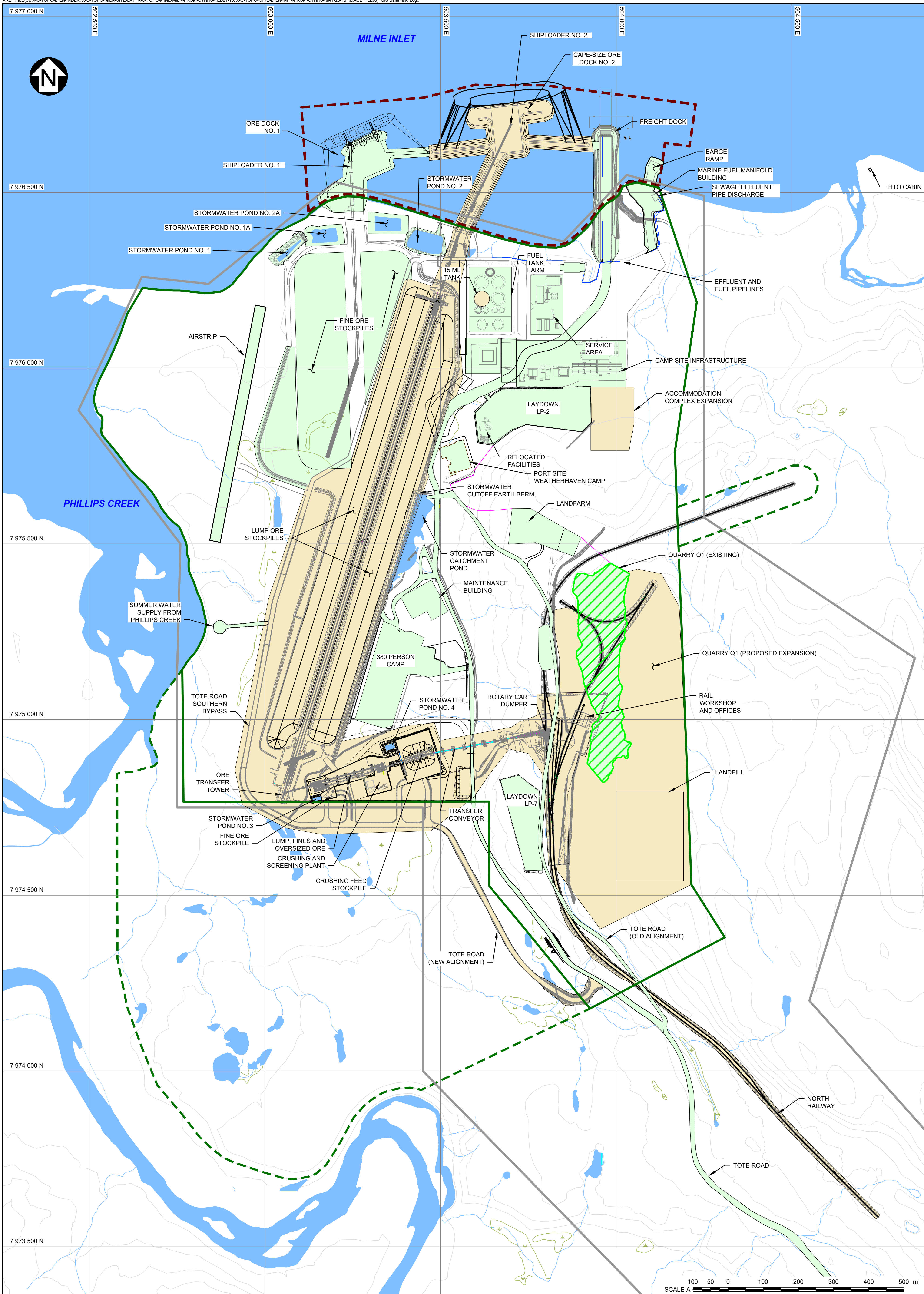
XREF FILE(S): X-C-TOPO-MILN-INDEX; X-C-TOPO-MILN-SITE-LAY; X-C-TOPO-MINE-MILN-FROM-OTHRS-FEB21-18; X-C-TOPO-MINE-MILN-INFR-FROM-OTHRS-MAY-25-18 IMAGE FILE(S): GIS Baffinland Logo



LEGEND:

- WATER
- QUARRY
- WASTE MANAGEMENT INFRASTRUCTURE
- ROAD
- NORTH RAILWAY
- APPROVED INFRASTRUCTURE
- ADDITIONAL PHASE 2 PROPOSAL INFRASTRUCTURE
- COMMERCIAL LEASE BOUNDARY
- PROJECT DEVELOPMENT AREA (PDA)
- PDA EXPANSION FOR PHASE 2 PROPOSAL
- FORESHORE LEASE BOUNDARY / MARINE PDA

NOTES:

1. COORDINATE GRID IS UTM NAD83 ZONE 17N.
2. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
3. CONTOUR INTERVAL IS 10 METRES.
4. PROPOSED MILNE PORT INFRASTRUCTURE PROVIDED BY HATCH MAY 25, 2018.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30JUL'18	ISSUED WITH TRANSMITTAL	RAC	MMD	CM

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

MILNE PORT LAYOUT
PHASE 2 PROPOSAL

Baffinland

P/A NO.	REF NO.	
NB102-181/45	NB18-00286	
FIGURE B.5		REV 0

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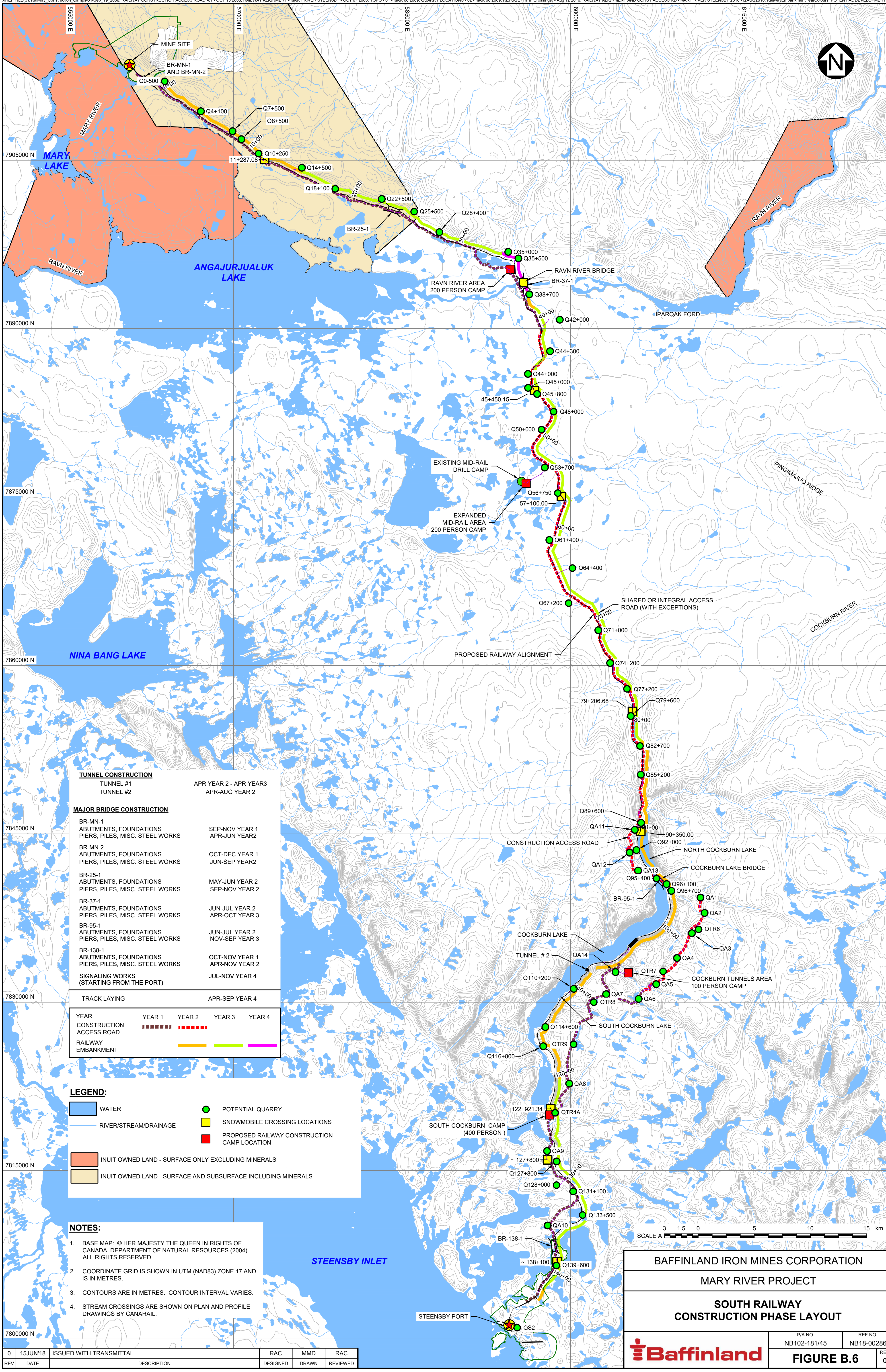
XREF FILE(S): Railway_Construction_Camps-01-Sep_19_2008; RAILWAY CONSTRUCTION ACCESS ROAD -01 - OCT 15 2008; RAILWAY ALIGNMENT - MARY RIVER STEENSBY - OCT 07 2008; TOPO - 01 - MAR 06 2009; QUARRY LOCATIONS - 02 - MAR 06 2009; REFUGE (Farm Crossings) - Aug 12 2010; RAILWAY ALIGNMENT AND CONST ACCESS RD - MARY RIVER STEENSBY 2010 -12AUG2010; RailwayEmbankmentYearColours; POTENTIAL DEVELOPMENT AREAS; KP_PD_



TUNNEL CONSTRUCTION

TUNNEL #1	APR YEAR 2 - APR YEAR3
TUNNEL #2	APR-AUG YEAR 2

MAJOR BRIDGE CONSTRUCTION

BR-MN-1	
ABUTMENTS, FOUNDATIONS	SEP-NOV YEAR 1
PIERS, PILES, MISC. STEEL WORKS	APR-JUN YEAR2
BR-MN-2	
ABUTMENTS, FOUNDATIONS	OCT-DEC YEAR 1
PIERS, PILES, MISC. STEEL WORKS	JUN-SEP YEAR2
BR-25-1	
ABUTMENTS, FOUNDATIONS	MAY-JUN YEAR 2
PIERS, PILES, MISC. STEEL WORKS	SEP-NOV YEAR 2
BR-37-1	
ABUTMENTS, FOUNDATIONS	JUN-JUL YEAR 2
PIERS, PILES, MISC. STEEL WORKS	APR-OCT YEAR 3
BR-95-1	
ABUTMENTS, FOUNDATIONS	JUN-JUL YEAR 2
PIERS, PILES, MISC. STEEL WORKS	NOV-SEP YEAR 3
BR-138-1	
ABUTMENTS, FOUNDATIONS	OCT-NOV YEAR 1
PIERS, PILES, MISC. STEEL WORKS	APR-NOV YEAR 2
SIGNALING WORKS (STARTING FROM THE PORT)	JUL-NOV YEAR 4
TRACK LAYING	APR-SEP YEAR 4

YEAR	YEAR 1	YEAR 2	YEAR 3	YEAR 4
CONSTRUCTION ACCESS ROAD				
RAILWAY EMBANKMENT				

LEGEND:

- WATER
- RIVER/STREAM/DRAINAGE
- INUIT OWNED LAND - SURFACE ONLY EXCLUDING MINERALS
- INUIT OWNED LAND - SURFACE AND SUBSURFACE INCLUDING MINERALS
- POTENTIAL QUARRY
- SNOWMOBILE CROSSING LOCATIONS
- PROPOSED RAILWAY CONSTRUCTION CAMP LOCATION

NOTES:

1. BASE MAP: © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA, DEPARTMENT OF NATURAL RESOURCES (2004). ALL RIGHTS RESERVED.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL VARIES.
4. STREAM CROSSINGS ARE SHOWN ON PLAN AND PROFILE DRAWINGS BY CANARAIL.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	15JUN'18	ISSUED WITH TRANSMITTAL	RAC	MMD	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

SOUTH RAILWAY CONSTRUCTION PHASE LAYOUT

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.6 REV 0

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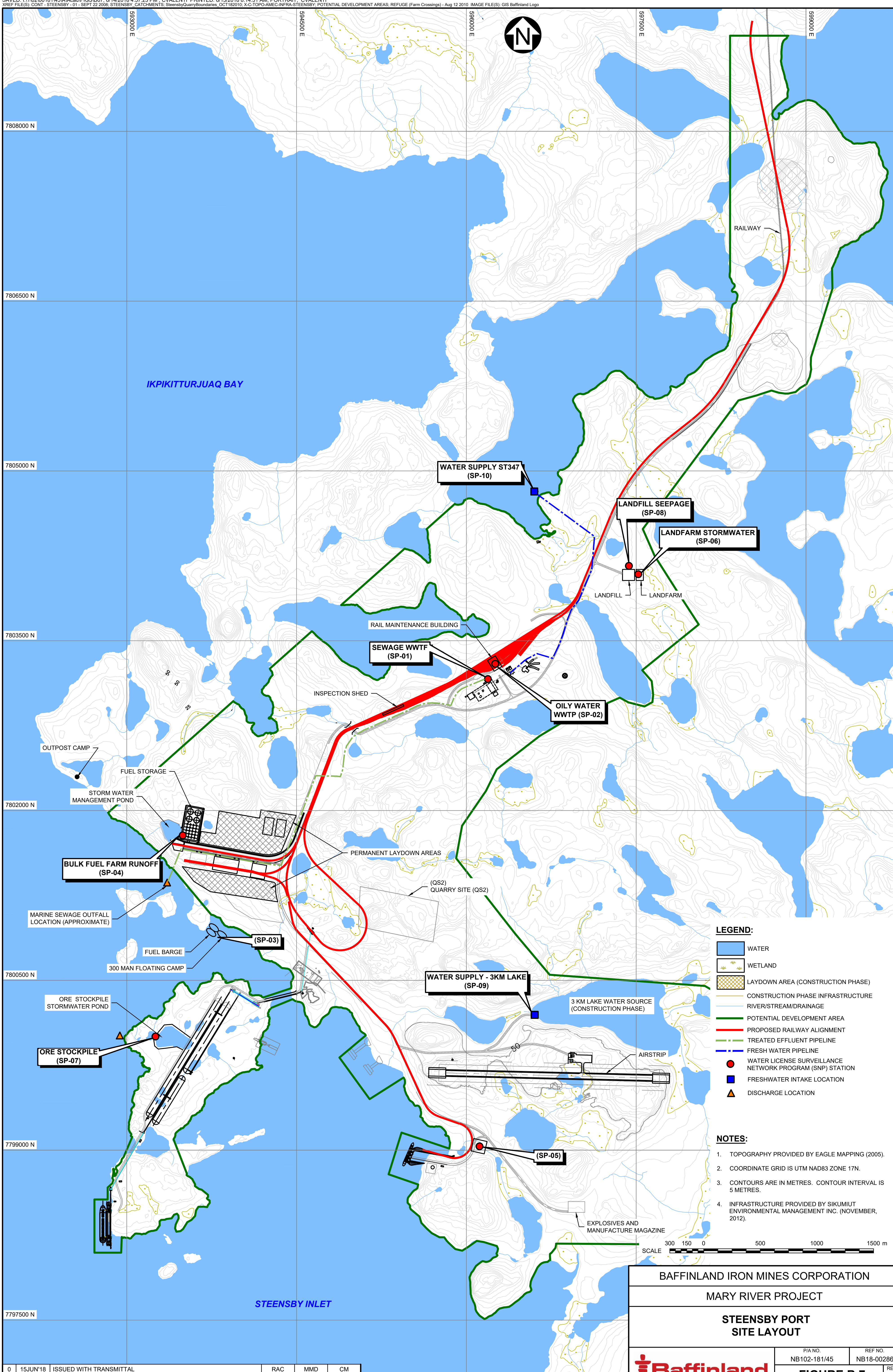
XREF FILE(S): CONT - STEENSBY - 01 - SEPT 22 2008; STEENSBY_CATCHMENTS; SteensbyQuarryBoundaries_OCT182010; X-C-TOPO-AMEC-INFRA-STEENSBY; POTENTIAL DEVELOPMENT AREAS; REFUGE (Farm Crossings) - Aug 12 2010 IMAGE FILE(S): GIS Baffinland Logo



NOTES:

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS UTM NAD83 ZONE 17N.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 5 METRES.
4. INFRASTRUCTURE PROVIDED BY SIKUMIUT ENVIRONMENTAL MANAGEMENT INC. (NOVEMBER, 2012).

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

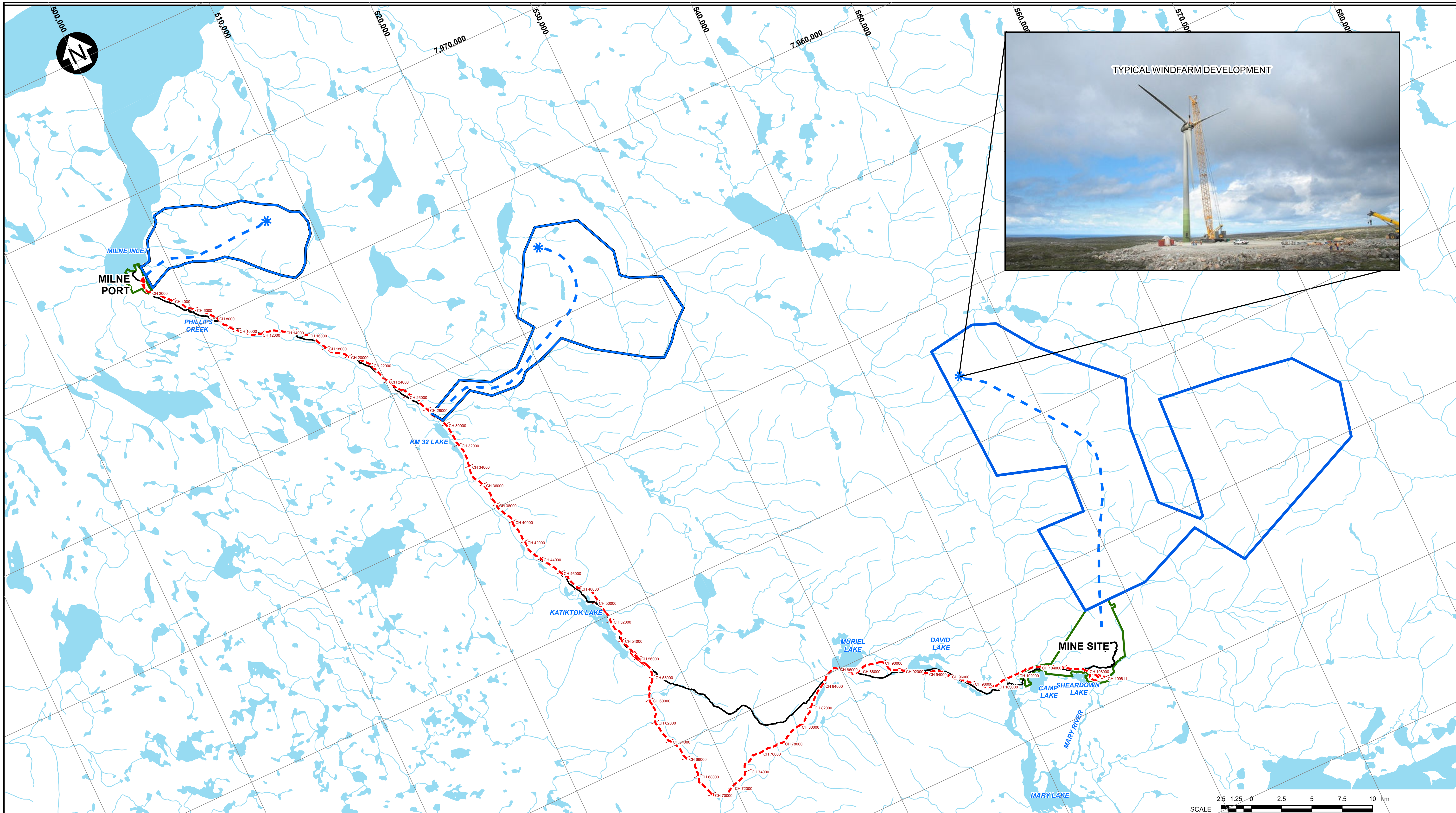
STEENSBY PORT SITE LAYOUT

Baffinland

P/A NO. NB102-181/45 | REF NO. NB18-00286

FIGURE B.7 REV 0

0	15JUN'18	ISSUED WITH TRANSMITTAL	RAC	MMD	CM
REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED



LEGEND:

- TURBINES
- WIND FARM STUDY AREAS
- NORTH RAILWAY
- NORTH RAILWAY CHAINAGE (M)
- MILNE INLET TOTE ROAD
- PROJECT DEVELOPMENT AREA
- WATER

NOTES:

1. COORDINATE GRID IS IN KILOMETRES.
   COORDINATE SYSTEM: NAD 1983 UTM ZONE 17N.
2. BASE MAP/IMAGERY: © ESRI AND DATA (ONLINE) SERVICE LAYERS (2017). REDLANDS, CA: ENVIRONMENTAL SYSTEM RESEARCH INSTITUTE. ALL RIGHTS RESERVED.
3. FIGURE CREATED BY KNIGHT PIESOLD LTD.
4. INSET IMAGE OF DIAVIK DIAMOND MINE'S WIND TURBINE WHILE UNDER CONSTRUCTION (MININGANDENERGY.CA, ACCESSED JUNE, 2018)

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	27JUL'18	ISSUED WITH TRANSMITTAL	RAC	AS	RAC

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BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

PROJECT OVERVIEW SHOWING WIND STUDY AREAS

Baffinland

P/A NO.	REF NO.
NB102-181/45	NB18-00286

FIGURE B.8 REV 0

APPENDIX C:
PHASE 2 KEY FACTS TABLE

PRODUCTION AND EMPLOYMENT

Calendar Year		2019	2020	2021	2022	2023	2024	2025	2026 - 2035
Project Year	**Measure**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8 - 17**
		Phase 2 Construction							
Pit Production Rates Schedule (Mtpa)				**South Railway/Steensby Port Construction**					
- Full Project	Mtpa	6	6	12	12	12	21	30	30
- North Railway	Mtpa	6	6	12	12	12	12	12	12
- South Railway	Mtpa						9	18	18
- Total Material Moved	Mtpa	7.9	9.4	21.3	24.0	25.8	51.1	80.5	75 (Average)
- Strip Ratio	%	0.3	0.6	0.8	1.0	1.1	1.4	1.7	1.5 (Average)
- Waste Rock	Mtpa	1.9	3.4	9.3	12.0	13.8	30.1	50.5	45 (Average)
Direct Employment									
- Operations	FTE	1,010	1,010	1,010	1,010	1,010	1,247.50	1,960	1,960
- Construction (North Railway)	FTE	1,050	950	180					
- Construction (South Railway)	FTE			800	2680	2440	1710		
- Total	FTE	2,060	1,960	1,990	3,690	3,450	2,957.50	1,960	1,960

MINE SITE FACILITIES, INFRASTRUCTURE AND ACTIVITIES

Year	Measure	2019	2020	2021	2022	2023	2024	2025	2026 - 2035
Project Development Area									
- Land	ha	The land based development area (2740 ha) will not change							
- Laydown areas	ha	Up to 20 hectares will be used for laydowns							
Ore Movement									
- Ore mined	Mt	6	6	12	12	12	21	30	30
- Run of Mine stockpile	Mt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
- Crushed ore stockpile	Mt	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
- Waste rock stock pile	Mt	4.4	7.8	17.1	29.1	42.8	73.0	123.5	643 (Total)
Fuel Storage on Site									
- Arctic diesel	ML	45	45	45	45	45	45	45	45
- Other fuels	ML	4	4	4	4	4	4	4	4
Fuel Consumption									
- Arctic diesel		22	25	53	58	60	88	121	80 - 140
Power Generation Capacity									
- Diesel power plant (installed)	MW	11	14	16	19	22	28	28	28
- Avg annual power demand	MW	6	7	9	9	9	9	9	9
- Wind turbines	MW	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Accommodation									
- Temporary	# of beds	150	150	400	400	400	400		
- Permanent	# of beds	800	800	800	800	800	800	800	800
Total	# of beds	950	950	1,200	1,200	1,200	1,200	800	800
Miscellaneous buildings and facilities (warehouses, shops, maintenance buildings, administration building, etc.)									
- Permanent	#	1 additional permanent structures will be built to support increased operations							
- Temporary/transitional	#	5 temporary structures will be built to support construction activities							
Water Supply									
- Camp Lake (Construction)	m^3/day	Licensed for 657m^3/day during construction and 367.5m^3/day during operation for domestic and industrial purposes							
- Demand (domestic & industrial)	m^3/day	285	285	360	360	360	360	240	240
Sewage Treatment (discharge to tundra)									
- required capacity	m^3/day	285	285	360	360	360	360	240	240
- process water sewage pond	m^3	110,000 m^3 - PWSP sized to hold 10 months of sewage effluent							
Waste Management and Expected Quantities									
- to landfill	m^3/yr	7,500	7,500	7,500	7,500	7,500	7,500	2,500	2,500
- to incinerator	m^3/yr	1,457	1,457	1,840	1,840	1,840	1,840	1,227	1,227
Quarried Material									
- Number of quarries	#	Material will be sourced from 4 quarries within the Mine Site PDA							
- quantities	m^3	100,000	100,000	100,000	To be sourced as necessary for road repairs				
Airstrip									
- B737 / C130 airplanes	flights/yr	550	550	550	550	550	550	365	365

MILNE INLET TOTE ROAD FACILITIES, INFRASTRUCTURE AND ACTIVITIES

Calendar Year	Measure	2019	2020	2021	2022	2023	2024	2025	2026 - 2035
Project Development Area									
- Land	ha	The land based development area will not change							
- Length of road	km	The Tote Road length remains unchanged							
- Water crossings	#	Up to 13 new culverts and relocation of 5 existing culverts							
Tote Road Operation									
- Service vehicle traffic									
- Construction (railway)	trips/week	Use of Tote Road will be mostly localized around construction points between 2019 and 2021							
- Operations	trips/week	250	250	250	250	250	250	250	250
- Ore transportation traffic									
- Quantity	Mtpa	6	6	12					
- Round trips per day	trips/day	280	280	560					
Fuel Consumption									
- Arctic diesel	ML/yr	18	18	36					

NORTH RAILWAY FACILITIES, INFRASTRUCTURE AND ACTIVITIES									
Calendar Year	**Measure**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026 - 2035**
Project Development Area									
- Land	ha	The land based development area will be 1,306 hectares							
- Staging/laydown areas	ha	Up to 14 hectares will be used for laydowns							
- Length of railway	km	The railway will be approximately 110 km long							
- Length of additional service trail	km	An additional service trail 27.5 km in length will be required							
- Water crossings	#	Up to 425 crossings will be established (421 culverts and 4 bridges)							
Quarried Material									
- Quantities	m^3	1,000,000	1,000,000	800,000					
- Number of quarries	number	Material will be sourced from up to 30 quarries, plus one borrow area (Rail Sand Pit) during the operation phase							
Railway Operation									
- Railway ore shipment	trips/day			8	8	8	8	8	8
- Railway track inspection	trips/week			4	4	4	4	4	4
Fuel Consumption									
- Arctic diesel	ML/yr			8	8	8	8	8	8
Temporary Accommodations									
- Staging camps		3	3	3					
- Beds	# of beds	255	255	255					
- Water supply (Camp Lake)	m^3/day	76.5	76.5	76.5					
- Sewage (to Milne)	m^3/day	76.5	76.5	76.5					
- Incinerator (to Milne)	m^3/yr	192	192	192					
- Fuel storage	litres	30,000	30,000	30,000					
- Temporary facilities		3	3	3					

MILNE PORT FACILITIES, INFRASTRUCTURE AND ACTIVITIES									
Calendar Year	**Measure**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026 - 2035**
Project Development Area									
- Foreshore	ha	The foreshore development area will remain at 36.4 hectares							
- Land	ha	The land based development area will increase to 379 hectares							
- Laydown areas	ha	Up to 44.5 hectares will be used for laydowns							
- Ore stockpiles	Mt	Ore stockpiles increased to hold 7.8 Mt for operations							
Quarried Material									
- Quantities	m^3	400,000	200,000	100,000					
- Number of quarries	#	Material will be sourced from a single quarry (Q1) within the Milne Port PDA							
Fuel Storage Capacity									
- Arctic diesel	ML	64	64	64	64	64	64	64	64
- Jet fuel	ML	3	3	3	3	3	3	3	3
- Marine diesel	ML	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
- Other fuels	ML	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Fuel Consumption									
- Arctic diesel	ML	11	13	29	30	30	30	30	30
Power Generation Capacity									
- Diesel power plant	Installed MW	9.45	22	22	22	22	22	22	22
- Avg annual power demand	MW	6	6	8	8	8	8	8	8
- Wind turbines	Installed MW	4.2	4.2	4.2	4.2	4.2	4.2	4.2	4.2
Accommodation									
- Temporary	# of beds	300	300	300					
- Permanent	# of beds	680	680	680	680	680	680	680	680
- Total beds	# of beds	980	980	980	680	680	680	680	680
Miscellaneous buildings and facilities (maintenance, warehouses, administration buildings, others)									
- Permanent	#	3 additional permanent structures will be built to support increased operations							
- Temporary/transitional	#	6 temporary structures will be built to support construction activities							
- Ore crushing/sizing plant	#	1 secondary crushing/screening plant will be built to support operations							
Water Supply									
- Philips Creek/Km 32	m^3/day	Licensed for 367.5m^3/day during construction and operation for domestic and industrial purposes							
- Demand (domestic & industrial)	m^3/day	294	294	294	204	204	204	204	204
Sewage Treatment Plant (discharge to Milne Inlet)									
- Required capacity		294	294	294	204	204	204	204	204
- Process water sewage pond	m^3	Licensed for 575m^3 process water sewage pond							
Waste Management and Estimated Quantities									
- Landfill	m^3/yr	7,500	7,500	7,500	7,500	7,500	7,500	2,500	2,500
- Incinerator	m^3/yr	738	738	738	512	512	512	512	512
- Shipped off site	m^3/yr	510	510	1,020	600	600	1,050	1,500	1,500
- Hazardous waste	m^3/yr	240	240	480	480	480	840	1,200	1,200

NORTHERN SHIPPING FACILITIES, INFRASTRUCTURE AND ACTIVITIES									
Year	**Measure**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026 - 2035**
Ore Docks									
- Ore docks	#	A second ore dock capable of berthing Cape-size vessels will be constructed							
- Support vessels	#	6-10 tug/line boats will be required to operate the port							
Shipping Route and Season									
- Seasonal shipping		Open Water Shipping		Extended Shipping (July 1 to November 15)					
- Shipping route		Milne Inlet - Eclipse Sound - Baffin Bay							
Ore Shipments									
- Ore carriers	type	Panamax/Supramax		Addition of Cape-size ore carriers					
- Ore shipments	Mtpa	6	6	9	12	12	12	12	12
- Ore shipments	trips/yr	83	83	134	134	134	134	134	134
Freight Shipments									
- Freight deliveries	trips/yr	18	18	18	18	18	18	10	10
- Freight tonnage	m^3/yr	350,000	350,000	350,000	350,000	350,000	350,000	200,000	200,000
Fuel Shipments									
- Fuel deliveries	trips/yr	3	4	8	6	7	8	11	8 - 10
- Arctic diesel	ML/yr	51	56	126	96	98	126	159	120 - 180
- Marine diesel	ML/yr	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
- Jet A	ML/yr	3	3	3	3	3	3	3	3

APPENDIX D:
TYPE A WATER LICENCE AMENDMENT APPLICATION

Provided Under Separate Cover

APPENDIX E:
WIND TURBINE INFORMATION

Appendix E: Wind Energy Project

1.0 Energy Generation and Electricity Storage

Baffinland proposes to facilitate the construction and operation of wind turbines with a battery energy storage system (BESS) (the "Wind Energy Project"). These technologies together with the diesel generators will form a microgrid and will be optimized to consume the least amount of diesel fuel. Power generation from diesel has both direct environmental impacts related to emissions and indirect impacts, based on fuel transportation and storage.

The wind turbines will be located in the vicinity of the mining area and/or the port, with the BESS being located near the existing mine and/or port power plants (See Figure B.8 (Wind Study Area) in Appendix B of TSD 02). The implementation of a full-scale renewable energy microgrid will allow for a substantive reduction of carbon-dioxide and other pollutant emissions through cleaner power generation, and reduced fuel transportation. The use of wind energy and BESS creates no air pollution and does not use water in its processes. These technologies also require very little land, enabling people and wildlife to utilize space surrounding the footprint. Reducing fuel consumption will also reduce the potential of environmental incidents from fuel leakage related to its transportation and storage. The development of this Wind Energy Project will significantly cut carbon-dioxide emissions and demonstrate how the industry can continue to operate and grow, while limit its impact on climate change.

2.0 Project Description

The Wind Energy Project will consist of wind turbines, each capable of producing 3 to 4.2 MW; a meteorological mast; a buried and/or overhead electrical collector system; service building, and access roads to each turbine. Each turbine will be mounted on a concrete foundation with a transformer located outside of the tower, at its base. The nacelle houses the electrical and mechanical components for the production of electricity. The addition of wind turbines at the Mine Site is to supplement the existing Mary River power grid, and thus aims to utilize existing surface infrastructure where possible.

The overall design concepts for the wind turbine infrastructure (i.e. pads and roads) are based on the same principles as used for Mary River. All pads and roads will be constructed either on bedrock, or geochemically suitable rock fill pads designed to protect the permafrost. Site layouts are designed to reduce the overall footprint and avoid disturbance of waterways.

The BESS will use an array of Lithium ion battery modules. The modules will withdraw, store, and deliver energy from and into the mine power grid. The batteries will be contained in several stationary containers or a centralized structure and connected to inverters. A pad-mounted transformer and requisite power system equipment will be included for interconnection to the distribution system. A Battery Management System will monitor cells and control voltage, temperature and current for safe, reliable transfer of energy. A computerized monitoring system will provide up-to-date weather forecasts, historical electrical use, the amount of charge remaining in the batteries, and when to use the energy storage system. Energy from the wind turbines will be delivered and converted from alternating current (AC) into direct current (DC) for storage. When the energy is needed on the power system, the inverters will be used to convert the DC from the batteries into AC. Once the power has been transformed, it will be stepped up in voltage and subsequently sent to the Mine power grid.

A summary of key energy project information below in Table 1.

Table 1: Summary of Project Information

General	*Project Name:*	Baffinland Energy Centre
	Project Lifespan (commercial operation):	Up to 30 Years
	Project Nameplate Capacity:	TBD Based on load
Project Area	*Location of Project:*	North Baffin Island, Nunavut
	Total Project Study Area:	TBA
	Total Area of Project Location (total disturbance	TBA
Wind Turbine Generators	*Make and Model:*	Enercon E-126 EP3 or similar
	Approximate Number Constructed:	Load and resource dependent. Greater than load requirements.
	Nominal Turbine Power:	3 to 4.2 MW
	Number of Blades:	3
	Blade Length:	41-63 m
	Rotor Diameter:	82-126 m
	Hub Height:	77-116 m
	Foundation Dimensions:	Gravity or pile or anchor
Access Roads	*Access Roads – Operations:* *(includes shoulder, travel width and ditch)*	Approximately 8-15 km x 6 to 12 m wide
	Access Roads – Construction (with shoulder):	Approximately 8-15 km x 6 to 15 m wide
Collector Lines	*34.5 kV Collector Lines:*	Approximately 8 - 20 km
Other Project Structures and Facilities	*Collector Substation:*	Approximately 2 acres (0.8 ha)
	Operations and Maintenance Building:	Approximately 1 acre (0.4 ha)
Temporary Land Use *(Construction Phase)*	*Construction Staging Areas:*	5-10 acres (2-4 ha)
	Wind Turbine Laydown Area (each turbine):	1.5 acres (0.6 ha)
	Crane Pads:	0.2 acres (0.08 ha)

2.1 Phases and Related Activities

The activities involved in the pre-construction, construction, operation, and decommissioning phases of the energy project are outlined in Table 2 and the following sections.

Table 2: Energy Project Phase and Related Activities

Phase	Activities	
Pre-Construction	• Scoping Study to ensure suitability of the location and conditions • Capacity determination, PPA with owner, permits • Preliminary Engineering • Stakeholder Consultation • Procurement of turbines and substation equipment • Constructor selection	• Government Consultation • Wind measuring • Geotechnical assessment • Infrastructure surveying • Crossing design and permitting • Land consultation • Detailed design • Final Siting of turbines
Construction	• Up to 75 workers required • Preparation of temporary work space and construction staging area	• Clearing and removal of vegetation and top layer • Upgrading of public roads

Table 2: Energy Project Phase and Related Activities

Phase	Activities	
	• Upgrading existing access roads and the construction of new access roads • Excavation and installation of wind turbine foundations • Turbine delivery to site • Installation of pad-mount transformers • Construction of collection substation • Construction of operations and maintenance building • Reclamation of construction laydown, staging, and other construction required road modifications	• Delivery of construction vehicles and equipment • Installation of crane pads and turbine laydown at turbine sites • Erection of wind turbines • Installation of electrical collector lines • Installation of interconnection equipment • Installation of meteorological towers • Commissioning and testing • Environmental and permit compliance • Installation of batteries.
Operations and Maintenance	• Up to 8 permanent staff required • Preventative and unplanned maintenance to project components • Meter calibrations	• Field monitoring • Performance testing and improvements • Remote operation of the wind turbines • Inclusion of local labour force
Decommissioning	• Disassembly and removal of the turbine infrastructure up to 1 m depth • Reclamation of access roads (discretion of landowner) • Disconnection of the collector substation • Disassembly and removal operations and maintenance building (discretion of landowner)	• Removal of pad-mount transformers • Removal of electrical system up to 1m depth • Disassembly and removal of the collector substation, interconnection equipment, and foundations up to 1m depth • Disassembly and removal of any meteorological towers

2.1.1 Pre-Construction Phase

Conceptually the Wind Energy Project would begin with a detailed permitting review and initial Inuit community and stakeholder engagement by meeting with the local/territorial governments, indigenous groups, and other stakeholders. This is followed by the development of a business model integrating indigenous participation and to obtain initial permitting, approvals. This approval process will depend heavily on the local and Inuit Qaujimajatuqangit traditional knowledge in the development of the Project. At the same time the engineering and design of the microgrid will begin with renewable resource analysis. This is achieved by installing MET towers/SODAR (SOnic Detection And Ranging) to collect data at the site for a period of at least one year.

The electrical, heating, and fuel demand for the Mine will be reviewed to identify all areas where diesel consumption can be reduced. Vendors for OEM (Original Equipment Manufacturer) technology, such as wind turbines and batteries, will then be screened to meet the unique operating and permitting environment. For these technologies a detailed capital, operating, and logistics cost analysis will be performed. The cumulative information will then be used in optimization studies to determine the ideal mix of renewables and energy storage based on emissions reductions and cost of energy.

Site studies will be completed including topographical surveying, land surveys, and geotechnical analysis. A wind turbine layout will be developed by incorporating all site studies and a site suitability analysis will be performed. Final design stage will occur including electrical (thermal and electric resistivity, SLD (Single-line Diagram), HVAC, and interconnection), civil (foundation design, roads, pads), construction (project logistics, housing, construction plan, delivery, etc.). The design of software and controls for forecasting and operation for renewables, energy storage and diesel will be completed. These include a consultation, meteorological survey, environmental surveys, geotechnical surveys, and land surveys.

2.1.1.1 Consultation

Public consultation will be planned with the Baffinland communities as part of the ongoing consultation plan. During the public consultation sessions information will be provided regarding the Wind Energy Project. Baffinland will address community concerns and provide appropriate follow up.

2.1.1.2 Meteorological Survey

The purpose of a meteorological survey is to determine exact wind conditions. Prior to the construction of the Wind Energy Project, measurement towers (met towers or SODAR) are erected. For met towers, masts are typically mounted with anemometers at a range of heights up to the hub height of the proposed wind turbines which log the wind speed data at frequent intervals (e.g. every ten minutes) for at least one year. The data collected then allows for the design of the wind component of the Energy Project, and to choose wind turbines optimized for the local wind speed distribution. Meteorological surveys are not required for a BESS.

2.1.1.3 Environment Surveys

All environmental and cultural features in the general area of the Wind Energy Project, which could potentially be affected by the proposed facilities, will be assessed. The approach to facilitate the review of identified issues, an understanding and description of the environment within which the activities will occur, or potentially have an influence on will be developed from a review of existing information. Potential positive and negative interactions between the Wind Energy Project activities and the environment will be identified. Where negative interactions were anticipated and potential effects are of concern, methods for mitigation of the effects will be proposed.

In addition to the physical and human environment studies, in order to fully understand the environmental constraints, a number of environmental surveys will be conducted. An assessment of potential environmental effects will be completed in accordance with applicable requirements and will address the following, but not be limited to, considerations:

- Cultural heritage (Protected properties, archeological and heritage resources);
- Natural heritage (e.g.: flora, fauna, caribou, migratory birds, Species at Risk);
- Impacts to surface water and ground water;
- Local interests, land use and infrastructure;
- Public health and safety;
- Noise; and
- Other resources.

For each potential effect mitigation measure will be assessed and implemented.

2.1.1.4 Geotechnical Survey and Land Survey

During the planning phase, a geotechnical survey will be conducted to assess the general subsurface conditions by looking at the physical characteristics of soil and bedrock. The purpose of geotechnical investigations is to determine engineering recommendations for designing the earthworks and foundations for structures in order to prevent human and material damage due to foundation cracks and other issues. The survey generally consists of standard field tests and laboratory analysis. The tests will include drilling and coring for foundations. Test locations are typically accessed using track-mounted drill rigs and bore holes are drilled to varying depths using a combination of auger drilling and rock coring. Test pits will be excavated for the purposes of electrical and thermal resistivity testing. These pits are small excavated areas. The track mounted-rigs typically require a cleared wide swath to allow for access and require additional cleared land for the temporary work area. All drilled boreholes and excavated test pits are backfilled with cuttings and sealed at the ground surface. Site topography surveys will be required to plan roads and wind turbine site work.

A summary of key siting criteria is summarized in Table 3 below.

Table 3: Summary of Key Siting Criteria

Criteria	Description
Flight path	The wind turbines cannot be located within the Mary River Airstrip flight path exclusion zone (Drawing TB-02, Attachment 1).
Ice throw exclusion zone	The wind turbines have a 200 m exclusion zone due to the potential for ice throw from the turbine blades. This applies to regularly occupied or travelled areas including camp pads and haul roads.
Elevation	Typically, there are higher wind speeds on hilltops. Areas of higher elevation are therefore preferred.
Wind potential	A wind resource assessment has been undertaken based on available wind data to determine optimal turbine locations within the project area.
Wake losses	The turbines must be spaced at least 500 m apart to negate wake losses from one turbine to another.
Foundation	The turbines should be founded on competent bedrock where possible.
Constructability	The turbines should be located such that the access roads and crane pads can be constructed with minimal earthworks. This requires large relatively flat areas on or adjacent to bedrock outcrops for the crane pads.
New infrastructure	The turbines should be located to make use of existing infrastructure for access roads and electrical collector cable routes where possible.

2.1.2 Construction Phase

The Wind Energy Project infrastructure (i.e. pads, BESS site, and roads) are based on the same construction principles as used for Mine Site. All pads and roads will be constructed either on bedrock, or geochemically suitable rock fill pads designed to protect the permafrost. Site layouts are designed to reduce the overall footprint and avoid disturbance to waterways. It is anticipated that the construction will commence upon receiving the applicable approvals, depending on time of year and various other factors. The following sections describe the key activities that will be undertaken during construction.

2.1.2.1 Access Road Construction

New access roads will be required to allow transport of equipment from the main road to the turbine sites. If necessary, the topsoil and subsoil will be removed prior to placement of a granular base. The access road will be built in compliance with local applicable regulations and sized to meet the requirements for equipment and machinery for the Energy Project. These roads will lead to the base of each of the wind turbines. Ditches and culverts will be constructed, if necessary, to maintain site drainage. Erosion and sedimentation control measures (e.g., silt fence barriers, rock flow check dams) will be installed, as necessary. The BESS will be accessed through existing roads or roads constructed for the wind turbines.

2.1.2.2 Delivery of Equipment

Equipment will be delivered by ship and barging at the temporary laydown areas surrounding each turbine. On site trucks and trailers will move equipment throughout the construction phase. Each turbine site will include infrastructure to accommodate delivery of oversized loads and temporary storage (e.g. turbine components).

2.1.2.3 Foundations

Foundations and/or support structures will be required beneath the wind turbines, facility equipment, and any necessary operations and maintenance buildings. Foundation will be dependent on subsurface conditions determined during geotechnical investigations. Drilling, piling, and /or excavation of the foundations with utilize typical heavy equipment to the Mary River site. Concrete mixing will be setup onsite or use existing batch plants.

2.1.2.4 Electrical

The collector system will transport the electricity generated at each wind turbine generator to a common point of connection to the mine power grid at the collection station. The collector system is made up of either pole mounted overhead lines, direct laid cables, or buried cables. A collection station will be located near the existing power plants. The BESS will be co-located with the collection station and the power plants.

2.1.2.5 Assembly and Installation

A rotor assembly area and a staging area will be required at each turbine site. A crane pad composed of the same material as the access roads will be constructed to support a large crane for erection of the turbine components. A qualified installer will be on-site to assemble wind turbines and BESS.

A more detailed description of components to be constructed are summarized in Tables 4 and 5 below.

Table 4: Description of the Energy Project Components

Component	Description
Wind Turbine Generators	• The Energy Project will include commercial wind turbines, such as the Enercon E-126 EP3 turbine, with a nominal power of up to 4.2 MW. The wind turbine nacelle includes the electric generator, wind direction and speed sensors and auxiliary equipment. These components are located at the top of a supporting tower and are connected to three blades and a hub via a main shaft.
Wind Turbine Foundation	• Each turbine tower is anticipated to have a concrete foundation up to 20 m wide and 2.5 m deep or a pile design. The land base of each turbine foundation will be dependent on subsurface conditions determined during geotechnical investigations. Following geotechnical investigations, it may be determined that pile or rock anchor type foundations may be suitable.
Pad-mounted Transformers	• A pad-mounted transformer will be located immediately adjacent to each wind turbine. This transformer 'steps-up' the electricity generated by the wind turbine to a common electrical collector line voltage (34.5 kV). Some models could have transformers located within the nacelle.
Wind Turbine Access Roads	• During construction and operation, roads are required to access wind turbine locations. Access roads will be constructed of native materials or engineered fill and are expected to be up to 15 m wide during construction to accommodate cranes and transportation equipment used to deliver wind turbine components.
Collector Lines	• Collector lines carry the electricity from the pad-mounted transformers to the Energy Project substation (described below). The collector lines will be 34.5 kV standard utility generator lines and direct lay will be utilized were possible. • If aboveground electrical collector lines are required, they will be constructed on hydro pole structures.
Collector Substation	• A collector substation is required to bring together all electrical collector lines. • The collector substation will be constructed within a disturbance area of approximately 2 acres (0.8 ha) on a raised pad or a prepared base of engineered fill to a depth of approximately 2 m. • Collector substation equipment will include an isolation switch(es), circuit breaker(s), distribution switch-gear(s), instrument transformers, capacitor banks, communication equipment, Supervisory Control and Data Acquisition ("SCADA") equipment, protection and control equipment, grounding transformers, revenue metering, substation grounding and a control building.
Battery Energy Storage System (BESS)	• Located near Collection Substation • Single building will contain the batteries and racking • HVAC will be on top of the building • Inverters and Pad-mount transformers will be outside of the building • BESS will connect to Collection System at 34.5 kV

Table 5: Description of Temporary Component of the Energy Project

Component	Description
Crane Pads	• Crane pads will be constructed in tandem with wind turbine access roads. Crane pads will be located directly adjacent to wind turbine locations and within the associated construction disturbance area. The crane pad area will be approximately 0.2 acres (0.08 ha) and will consist of a mixture of heavier granular material, native materials and engineered fill, as appropriate.
Wind Turbine Laydown Areas	• Laydown areas adjacent to wind turbine locations will be incorporated into the disturbance area for each turbine. Each disturbance area is approximately 1.5 acres and will allow for temporary turbine component storage during construction.
Construction Staging Area	• The construction staging area will consist of compacted surface material suitable for vehicular traffic. The depth of the material required will vary and will be dependent upon conditions encountered during the time of construction.

2.2.3 Operation and Maintenance

The designed operational life span of the Wind Energy Project is typically over 20 years. The Wind Energy Project will operate year-round and generate electricity if wind conditions are suitable. The amount of power generated will depend on daily weather conditions. The wind turbines are suitable for areas where there are low to medium wind speeds. The turbines have been appropriately designed to perform under varying weather conditions. The BESS will charge when wind generation exceeds load and discharge when wind cannot meet the load. The Wind Energy Project will be operated remotely by way of a 24/7 supervisory control center, local employees on-site for service, maintenance, and inspections. During operation of the Energy Project, on-site activities will be limited primarily to scheduled maintenance of the Wind Energy Project components. Routine maintenance will typically be scheduled two to four times per year per turbine. An operations and maintenance building will be constructed if needed to accommodate control facilities, storage space, and a maintenance work area. It will be located within the same disturbance area as the collector station, power plants, and BESS.

2.2.4 Decommissioning

The Wind Energy Project will be closed in accordance with the principles of the existing Baffinland Reclamation and Closure Plan. The decommissioning process would involve the following:

- The wind turbine (tower, blade, nacelle) will be disassembled and removed from site for re-use or recycling.
- The batteries used for BESS will be removed and are recycled and separated into its components (e.g. plastic, metal) for use in future products.
- Other components (transformers, collector system cabling, containers, and wiring) will be removed from site, recycled or reclaimed, if possible.
- Removal of support structures and foundations to a depth that would allow for surface activities to occur uninhibited. The materials removed will be recycled where possible.
- Access roads, crane pads, and site infrastructure will be remediated, and the site will be returned to original land use.
- A number of technicians will be supervised by an experienced on-site project manager.
- All work will be done in accordance with the same safety standards that are applied for new construction.

1.4 Closing

Overall, the nature of the proposed facilities, their size and scale are such that no significant residual adverse effects are anticipated, with the implementation of mitigation measures.

APPENDIX F:
ORE DOCK NO 2

HATCH Vendor/Contractor Document Review			
Doc Number	E353004-CG001-100-120-0001	SUB	02
Date Received			
Review Grade		Next Submittal Status	
☐ C1 - Proceed to next submission & status ☐ C2 - Proceed with exceptions as noted to next submission & status		☐Certified ☐As-Built	
☐ C3 - Do not proceed. Revise as noted & resubmit		☐Internal Review	
Next Submittal Date:		☐Certified/☐As-Built	
☐ C4 - No further submission required - Complete (select status below) ☐Certified Final ☐ Final ☐ Cancelled ☐ Superseded			
Package Engineer: Name, signature and date			
Reviewed only for general conformity with the specifications. Acceptance by the engineer does not warrant or represent that the information contained on this drawing/document is either accurate or complete. The sole responsibilty for correct design, details & dimensions shall remain with the party submitting the drawing/document.			

BESIX VanPile Joint Venture

Avenue des Communautés 100

1200 Brussels

Belgium

BIM | Expansion Stage 3 | Ore Dock

Mary River Project | CG001

Plan

Project Execution Plan

Baffinland Iron Mines Corporation **Hatch Ltd** Contract No : H353004-CG001		**Client Document No.:**		**Rev No:**	
BESIX-VanPile JV		**BV JV Document/Rev No. :** **[BIM-BV-GE-GE-PL-00013_Rev01]**			
Date	**Description**	**Rev'd**	**Chck'd**	**Appr'd**	**Status Code**
18-Dec-2017	Second issue	GPA	SRE	SRE	For Review

1

BIM-BV-GE-DE-DS-00031_Rev00 - Log Comments received from Hatch

Document name	Client Document Number	JV Document Number
Project Execution Plan	E353004-CG001-100-120-0001	BIM-BV-GE-GE-PL-00013

#	Date	By	Qualification / Question / Response	Page	Section	Status	Rev	Grade
1	12-Dec-17	Employer / Engineer	Recommend a section on how Safety plan will be implemented and managed	p.2	Coverpage	Open	00	C3
	21-Dec-17	Contractor	A new section will be added in the final version.				01	NA
2	12-Dec-17	Employer / Engineer	"measuresoutlines" "takin" ==> Revise text	p.7	§2.3 Purpose of the document	Closed	00	C3
	21-Dec-17	Contractor	Text has been revised accordingly				01	NA
3	30-Nov-17	Contractor	"The primary method to ensure safety is to confirm that ice is not moving laterally—except due to thermal strains and jacking from cracks refreezing in the ice. These are quite small, generally less than about 1m per ice season."	p.9	§3.1 Ice conditions - part 2	Closed	00	NA
	12-Dec-17	Employer / Engineer	These statements need to be compared to planned work. Ice thickness max was just stated as 1m, so 1m cracks would seem significant				00	C3
	21-Dec-17	Contractor	The 1m doesn't refer to the size of the cracks but to a typical value of cumulative lateral movement of the ice during the mid-winter period. The ice is nominally stationary (landfast). However "landfast ice " can move laterally by small amounts and very slowly due to thermal strains and the formation and refreezing of thin cracks (typically a cm in width) caused by temperature fluctuations. The text has been amended accordingly.				01	NA
4	12-Dec-17	Employer / Engineer	The causeway area is only .5 to 1m deep what happens there?	p.9	§3.1 Ice conditions - part 2	Closed	00	C3
	21-Dec-17	Contractor	Please note that the causeway area is between 0 and 2m deep. Deepest seabed elevation is indeed at -1mCD but the mean sea level is at 1.2mCD. This is in fact the "long tidal shelf" referred to in the query 23 (on page 24 of the Rev.0 of document). We expect that tidal cracks will form within this region and gradually move offshore as the ice thickens and becomes grounded. Repeated tidal flooding may also thicken this ice which will accelerate the grounding and the movement of the tidal cracks further offshore. There may also be a shore ridge of ice rubble created if there is an ice push from offshore during the freeze up period before the ice becomes landfast. All these possibilities are recognized and will not affect the construction of the causeway using the proposed methods of working from the shore (after the ice has become landfast). The breaking and excavation of the ice can still be accomplished even in the presence of tidal cracks (which can help) and ice rubble (which means some extra ice volume removal). Any ice rubble is expected to be less than a few m high and will be in very shallow water. The text has been updated accordingly in section 5.2.1.	p.27	&5.2.1 Methodology		01	NA
5	30-Nov-17	Contractor	"An ice bustle can form on a pile or a dock face due to repeated freezing to the surface and may thicken as water floods over the frozen connection."	p.9	§3.1 Ice conditions - part 2	Closed	00	NA
	12-Dec-17	Employer / Engineer	ice bustle ==> risk to incomplete construction?				00	C3
	21-Dec-17	Contractor	This is indeed a risk in case of incomplete construction or if the works are undertaken in 2 seasons. Further to reviews with ice experts, Contractor intends to handle this risk by always keeping free of ice the areas surrounding the temporary structures and the permanent structures before their completion and/or assessing potential loads and assessing consequences .Ice bustles on incomplete constructed and temporary items can be assessed in terms of the vertical loads induced by tidal action. These will likely be small compared to their capacity (essentially a gravity load due to the weight if the ice bustle when the tide is low and a buoyant load when tide is high (1/10 of the gravity load). If these are considered too high then the ice bustles can be removed mechanically or by steamwands. During the majority of the ice season, the ice is landfast and incomplete construction will be protected by slots cut in the ice to accomodate the small slow ice movements during the landfast ice period. During freeze-up ice loads from mobile ice will need to be accommodated on any incomplete or temporary construction items. Causeways will not be overly sensitive to such loads. During break up, the probability of ice moving back into the dock is considered low but loads on incomplete construction during this short period are being assessed and mitigative measures being considered. Text has been amended to include the above.				01	NA
6	30-Nov-17	Contractor	" Small movements occur"	p.9	§3.1 Ice conditions - part 2	Closed	00	NA
	12-Dec-17	Employer / Engineer	small movements occur ==> movement from what?				00	C3
	21-Dec-17	Contractor	Movement from ice, text has been updated accordingly				01	NA
7	30-Nov-17	Contractor	"During the winter months, the opening should be monitored and cleared to ensure that ice thickening does not occur."	p.9	§3.1 Ice conditions - part 2	Closed	00	NA
	12-Dec-17	Employer / Engineer	ice thickening does not occur ==> if so what must be done?				00	C3
	21-Dec-17	Contractor	Re-freezing will occur, Contractor will keep the area free by regularly breaking up and removing the ice so it does thicken too much. The allowable amount of refreezing will be assessed by considering potential ice loads on incomplete and temporary structures.				01	NA

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#	Date	By	Qualification / Question / Response	Page	Section	Status	Rev	Grade
8	12-Dec-17	Employer / Engineer	It is our understanding that NO work is planned from the ice, if so why all the discussion about using the ice as a platform?	p.9	§3.1 Ice conditions - part 2	Closed	00	C3
	21-Dec-17	Contractor	no "from the ice construction" is planned except some ice cutting to create protection slots during the mid-winter period when the ice is thick, landfast, and safe to work from using ice cutting equipment. A ditch witch will work from the ice (see section 5.4.2) to cut the ice around the location of the trestle piles. This is especially required at the trestle location as no causeway is built there and hence there is no access other than from the ice. An excavator may also be positioned on the ice to lift and side cast the ice blocks.				01	NA
9	30-Nov-17	Contractor	" The armour and top layers will be installed afterwards during the piling of the trestle, when the associated earthworks are not a part of the critical path."	p.13	§4.2 Location of the access causeway and access trestle	Closed	00	NA
	12-Dec-17	Employer / Engineer	armour and top layers will be installed afterwards ==> what are the risks associated with this approach?				00	C3
	21-Dec-17	Contractor	The main fill of the causeway consists in relatively core material. The armour is only required considering the design life of the project. Moreover, considering the execution period of the access causeway, the armour will be installed before the causeway is exposed to erosion (it is surrounded by grounded ice till end June 2017). The text has been updated to reflect the above.	p.14			01	NA
10	30-Nov-17	Contractor	"Avoid unnecessary movement and rotations of the travelling platform (used for the berth construction as further described in this document)"	p.14	§4.2 Location of the access causeway and access trestle	Closed	00	NA
	12-Dec-17	Employer / Engineer	rotations ==> rotation from what or how?				00	C3
	21-Dec-17	Contractor	Contractor meant change in working direction of the travelling platform. Indeed, if the trestle is not located at the edge of the berth, the platform will need to start by one side and then when the edge is reached turned back to work in the other direction. All of this resulting in additional time for the berth construction. The text has been updated accordingly.				01	NA
11	12-Dec-17	Employer / Engineer	state distance	p.15	§4.2 Location of the access causeway and access trestle	Closed	00	C3
	21-Dec-17	Contractor	Distance is now stated				01	NA
12	12-Dec-17	Employer / Engineer	abutment?	p.15	§4.2 Location of the access causeway and access trestle	Closed	00	C3
	21-Dec-17	Contractor	Correct, text has been updated to include this comment. Please also see figure 30.				01	NA
13	12-Dec-17	Employer / Engineer	two 45t excavators are listed but only one shown in plan is there enough room for those and wheel loader at the work face?	p.17	§4.3 Work sequence	Closed	00	C3
	21-Dec-17	Contractor	Contractor acknowledge the fact that there is little place to allow for the movement of the equipment at the edge of the workfront. It was initially foreseen to remove the ice with an excavator working from the ice in order to have more space. This is not considered anymore starting from the point where the ice is not anymore grounded. However, the width of each equipment is relatively small: 45 tons excavator are approximately 3.5m wide and the dozer is 3m wide when the causeway width is of 20m. Contractor believes that this is wide enough to make the work-front viable.				01	NA
14	12-Dec-17	Employer / Engineer	abutment?	p.18	§4.3 Work sequence	Closed	00	C3
	21-Dec-17	Contractor	The text has been updated to include the installation of the abutment				01	NA
15	12-Dec-17	Employer / Engineer	"work from the ice" "ice cutting" ==> prior discussion said no equipment on ice. Please clarify how work is to be done if this is the case.	p.18	§4.3 Work sequence	Closed	00	C3
	21-Dec-17	Contractor	Contractor always intended to have equipment working from the ice at the trestle location: This is required as no causeway is built at this location and hence there is no access other than from the ice. A ditch witch will however be used to cut the ice at this location in order to: • Reduce the loads in the sensitive zone (where the ice is broken) • Better control the cracking risk by having a clear cut in the ice. An excavator is also positioned on the ice to lift and side cast the ice blocks but will not be used to directly cut the ice.				01	NA

BIM-BV-GE-DE-DS-00031_Rev00 - Log Comments received from Hatch

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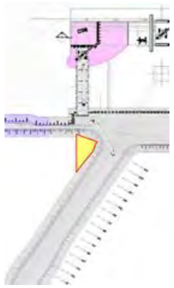
#	Date	By	Qualification / Question / Response	Page	Section	Status	Rev	Grade
16	12-Dec-17	Employer / Engineer	A. How does pile transport not conflict with fill operations? B. How does pile transport get back off the trestle, backup angle seems very narrow?	p.19	§4.3 Work sequence	Closed	00	C3
	21-Dec-17	Contractor	A. The trestle will indeed be used for transport of the piles and of the backfill material. There will therefore be some co-activity in this area which will act as a bottle neck as long as the backfill of the berth and of the shiploader area has not progressed enough to provide an alternative access to the berth. However, it should be noted that, in average, only 4 piles and 2 sheet piles are installed every 3 calendar days. The co-activity will therefore be limited to a few hours per day and special care will be given to it. B. The trucks transporting the piles will drive backward on the trestle once the pile has been offloaded. Contractor is aware of the fact that the back-up angle is very narrow and intend to widen the causeway next to the starting point as shown below: 				01	NA
17	12-Dec-17	Employer / Engineer	what is this lower wall and how installed?	p.20	§4.3 Work sequence	Closed	00	C3
	21-Dec-17	Contractor	See step 3. of the methodology Construction of the secondary causeways and berth: “Placing retaining wall between rear piles” Clutches will be welded on the rear piles and will be used to lower the retaining wall. This retaining wall allow to limit the volume of soil substrate which needs to be handled. The text has been amended to include these additional clarifications.				01	NA
18	30-Nov-17	Contractor	“Berth: same as previously described”	p.21	§4.3 Work sequence	Closed	00	NA
	12-Dec-17	Employer / Engineer	is this a three heavy cranes: two at berth one in yard?				00	C3
	21-Dec-17	Contractor	Correct. An equipment matrix has been added in appendix to clarify the use of the major equipment.				01	NA
19	30-Nov-17	Contractor	"200t heavy duty crawler crane"	p.21	§4.3 Work sequence	Closed	00	NA
	12-Dec-17	Employer / Engineer	is this a fourth heavy crane?				00	C3
	21-Dec-17	Contractor	Correct. An equipment matrix has been added in appendix to clarify the use of the major equipment.				01	NA
20	30-Nov-17	Contractor	"Heavy Crawler Crane for piling"	p.21	§4.3 Work sequence	Closed	00	NA
	12-Dec-17	Employer / Engineer	is this a fifth heavy crane?				00	C3
	21-Dec-17	Contractor	No, this is actually the same crane which is also in charge of the handling of the piles. As this crane will not be used 100% of the time, it will also carry out this activity. An equipment matrix has been added in appendix to clarify the use of the major equipment.				01	NA
21	12-Dec-17	Employer / Engineer	Page is not explained and appears out out of sequence	p.22	§4.3 Work sequence	Closed	00	C3
	21-Dec-17	Contractor	This page details the extent of the berth piling and backfill works that must be completed before the ship loader arrival. It strongly relates to the sequence mentioned above: “Berth, infill for ship loader platform and pivot point”. A new title has been added.				01	NA

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#	Date	By	Qualification / Question / Response	Page	Section	Status	Rev	Grade
22	30-Nov-17	Contractor	"- 250t crawler crane at the laydown area - Flatbed trucks (transport from laydown to site)"	p.23	§4.3 Work sequence	Closed	00	NA
	12-Dec-17	Employer / Engineer	tasks?				00	C3
	21-Dec-17	Contractor	The 250t crane will load the trucks at the laydown area The flatbed trucks will transport the different items (bollards, fenders, etc.) from the laydown to the site. An equipment matrix has been added in appendix to clarify the use of the major equipment.				01	NA
23	12-Dec-17	Employer / Engineer	please address the long shallow tidal shelf	p.24	§5.1 Ice breaking at the shoreline – start point of the causeway	Closed	00	C3
	21-Dec-17	Contractor	See comment no.4. The text has been updated accordingly in section 5.2.1.	p.27	&5.2.1 Methodology		01	NA
24	12-Dec-17	Employer / Engineer	If causeway shallow shelf is largely broken tidal ice how does this approach change?	p.26	§5.2 Construction of the access causeway	Closed	00	C3
	21-Dec-17	Contractor	See comment no.4. The broken tidal ice will still be amenable to the proposed construction method working from the causeway as it is being built. Access to the ice is also still possible as this broken tidal ice is essentially grounded and can be smoothed using earth moving equipment and even thickened by flooding. There may be some extra ice volume to be removed. A visit during this winter and/or a full suite of photos and videos when light conditions allow should be obtained to make a better assessment. The text has been updated accordingly in section 5.2.1.	p.27	&5.2.1 Methodology		01	NA
25	12-Dec-17	Employer / Engineer	this image makes no sense, where is the second excavator to go as to not interfere with the wheel loader?	p.26	§5.2.1 Methodology	Closed	00	C3
	21-Dec-17	Contractor	Please refer to item 13				01	NA
26	30-Nov-17	Contractor	"85ton Excavator"	p.29	§5.3.3 Equipment	Closed	00	NA
	12-Dec-17	Employer / Engineer	confirm 85ton, this was not mentioned elsewhere				00	C3
	21-Dec-17	Contractor	A 85ton excavator is indeed required to place the armour rock at deeper locations. This was indeed not clearly mentioned. This has been updated on p. 22 and in the Equipment Matrix in appendix.				01	NA
27	12-Dec-17	Employer / Engineer	abutment?	p.31	§5.4.2 Methodology	Closed	00	C3
	21-Dec-17	Contractor	Text has been amended to mention the abutment.				01	NA
28	12-Dec-17	Employer / Engineer	Need a description of how you will fuel the equipment on the deck .	p.42	§5.6.4 environmental measures	Closed	00	C3
	21-Dec-17	Contractor	A description has been added.				01	NA
29	12-Dec-17	Employer / Engineer	is this minus 10 ?	p.46	§5.10 Conncrete management	Closed	00	C3
	21-Dec-17	Contractor	This is indeed -10°C (minus ten degree Celsius); Clarification has been added				01	NA
30	12-Dec-17	Employer / Engineer	Explain how equipment on the deck will be fueled	p.49	§6.1 Earthworks	Closed	00	C3
	21-Dec-17	Contractor	Text has been added.				01	NA
31	12-Dec-17	Employer / Engineer	Backfill Phase 6 - Pile hand off is unclear at this stage?		Appendix A - Drawings - Backfilling sequence	Closed	00	C3
	21-Dec-17	Contractor	Drawing has been amended to show the handling of the piles.				01	NA
32	12-Dec-17	Employer / Engineer	Backfill Phase 7 - Pile hand off is unclear at this stage? When is trestle removed?		Appendix A - Drawings - Backfilling sequence	Closed	00	C3
	21-Dec-17	Contractor	Drawing has been amended to show the handling of the piles. The deck of the access trestle will be removed when not anymore needed (= when access to the berth can be done via the ship loader platform infill).				01	NA
33	12-Dec-17	Employer / Engineer	Backfill Phase 8 - When is trestle removed?		Appendix A - Drawings - Backfilling sequence	Closed	00	C3
	21-Dec-17	Contractor	The deck of the access trestle will be removed when not anymore needed (= when access to the berth can be done via the ship loader platform infill). Drawing has been amended accordingly.				01	NA
34	12-Dec-17	Employer / Engineer	Quality is to poor to be able to read, please send better image		Appendix B - Laydown Area	Closed	00	C3
	21-Dec-17	Contractor	Better quality image is now included				01	NA

Rev	Date	Description	Rev'd	Chck'd	App'd	Status
00	25-Nov-2017	First issue	GPA	SRE	SRE	For Review
01	18-Dec-2017	Second issue	GPA	SRE	SRE	For Review

1

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Section 1 - Preamble

This Project Execution Plan discusses many aspects of the project design and methodologies, many of which are under continuing review and development - and therefore aspects of this plan as documented herein may not represent exactly the latest developments and decisions at the time of publication.

For example: At the time of submission, Besix VanPile JV is resolving many of the major equipment to be implemented on the project. Significant items, such as the final pile driving crane capacity; the implementation of barges, or Flexi-Floats; and the specifics of environmental control measures, are not captured in the methodology drawings or the equipment list as presented herein. These items, and others, will however be captured in the overall final Early Works cost estimate reflecting the most current decisions of the project management team.

Section 2 - Introduction

2.1 Project Location and General Description

Baffinland Iron Mines (BIM) currently operates the Mary River iron ore mine in Nunavut, Canada. The site is approximately 550km north of the Arctic Circle. Ore is currently mined, crushed, screened and then trucked to Milne Port, where it is stockpiled until it can be shipped off site during the short arctic summer when the sea is free of ice. Two product types are produced, a lump ore between 32 mm and 6 mm and a fine sinter-feed ore of 6 mm or less. The ore is one of the highest grade direct shipping iron ore's being produced in the world today and requires no subsequent processing before being fed to sinter plants or blast furnaces.

BIM plans to increase the production rate of the mine to 12 million tonnes per annum (Mtpa), shipping the output through Milne Port. This will be achieved by upgrading the mine fleet, constructing a rail line from the mine to the port, building a new crushing and screening facility at the port, construction of larger ore stockpiles, building a second ore dock and ship loader and expanding the general support infrastructure (including fuel systems, camps and power generation).

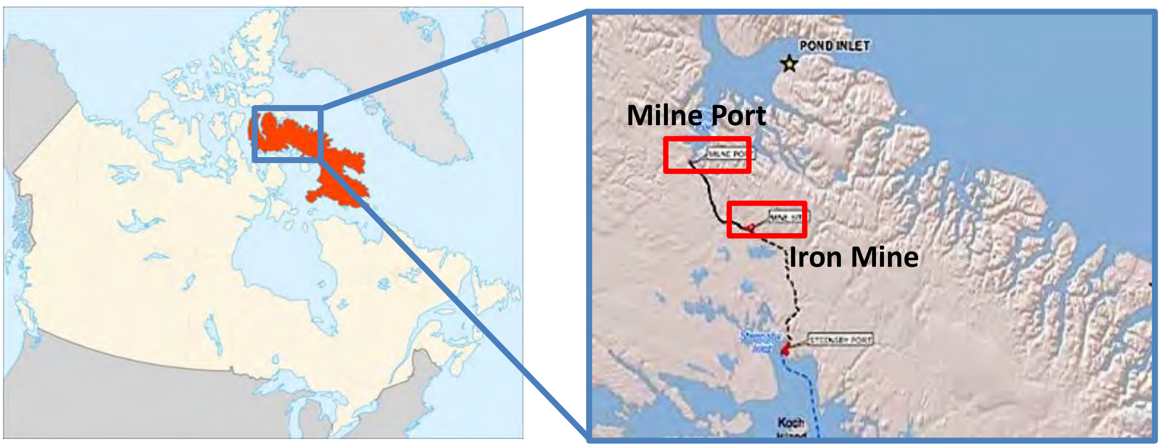


Figure 1 Project location

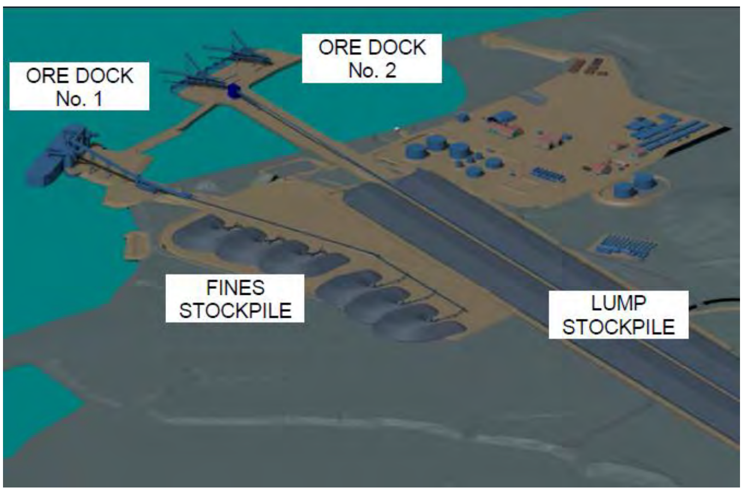


Figure 2 Project overview

2.2 Employer / Main Contractor

- Employer : Baffinland
- Engineer : Hatch
- Contractor : BESIX VanPile Joint Venture

2.3 Purpose of the document

This Project Execution Plan outlines the construction methodology and phasing for the execution of the works.

The work sequence and related construction activities have been established to provide an optimal, safe and cost-effective construction methodology for the execution of the Ore Dock 2, part of Mary River Expansion Stage 3.

The main equipment are listed in this document. However, should there be any discrepancy between this document and the Equipment List (BIM-BV-GE-EQ-LI-00027), the latter shall prevail. The latest version of the equipment list shall always be used, the one in attachment is given for information only.

The Section 3 - Site Conditions, summarizes the available site data as well as the associated working conditions throughout the year. The next section, Section 4 - Sequence of work, provides an overview of the construction sequence which is further detailed in Appendix A - Drawings. Section 5 - Construction Methodology explains the typical methodology for each of the main construction steps. The details relating to the transitions between working areas are described in Section 4 - Sequence of work.

Section 6 - Summary of the environmental measures outlines the different environmental measures that are considered for the project taking into account the project timeline. 1

The overall logistics of the project (including mobilization, laydown area, site management, and demobilization) are discussed in Section 7 - Logistics.

The herein methods of execution have been established on the basis of the available information and to our best knowledge of the site conditions. Changes to those will be done if and when needed and presented in an updated version of this document.

The herein activities will be detailed in specific methods statement prior to execution on site including the safety documentation and quality control related to those.

Section 3 - Site Conditions

3.1 Ice conditions

Ice conditions have been assessed and the related method constraints reviewed in the ice design criteria report (Croasdale and Allyn, 2017); as well as in the BMT Fleet report provided to Hatch in 2014. Therefore, minimal detail is included below.

Actual ice data collected at the site does not exist (if so – we do not have access to it), so reliance is on satellite imagery and nearby locations where ice conditions have been measured—such as Pond Inlet. Figure 3 shows the ice growth and decay for Pond Inlet over many years. As shown below, growth starts in early October peaks in thickness about the end of May and decays to zero in late July/early August.

The ice in Milne Inlet will start to form in September/October and will break up in June/July. There is variability from year to year with respect to these dates. The maximum level ice thickness is approximately 1.7 to 2m but ridging may occur during periods of ice mobility - especially further offshore. If winter construction begins January 1st 2019, the ice will be land-fast and approximately 0.5 to 1m thick. All methods presented in this plan have been adapted to allow for changing ice thicknesses throughout the year.

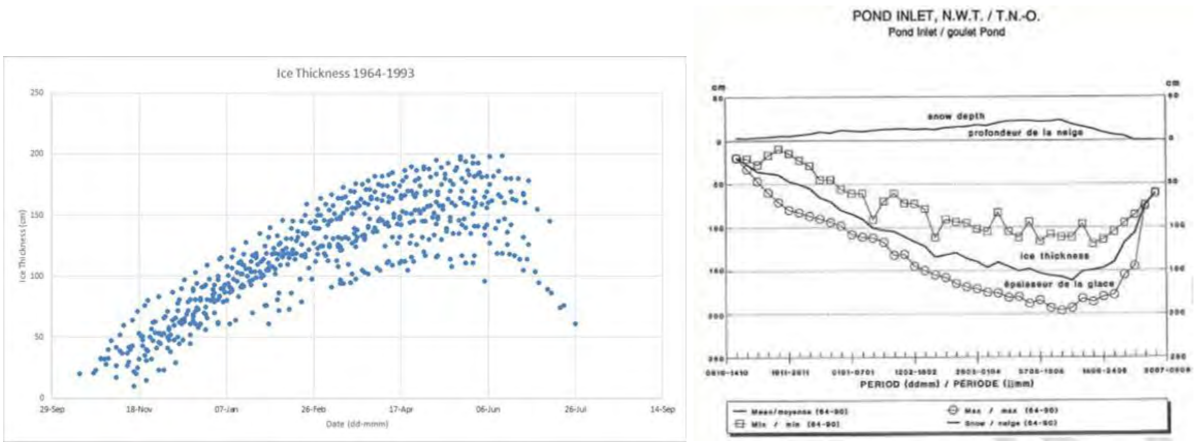


Figure 3: Ice thickness data for Pond Inlet 1964 to 1993

Because the location is in a narrow inlet the mobility of the ice also changes throughout the ice season.

Three periods are categorized:

1. Freeze-up (mobile);
2. Mid-winter (land-fast);
3. Break-up (mobile).

These categories are important for ice loads because only moving ice can exert significant ice loads on structures. The periods are also important when considering the construction planning.

1. During the freeze-up period the ice can be mobile. During this period it is unsafe to be on the ice and only onshore work should be attempted. The period could start early to mid-October and last a few weeks.

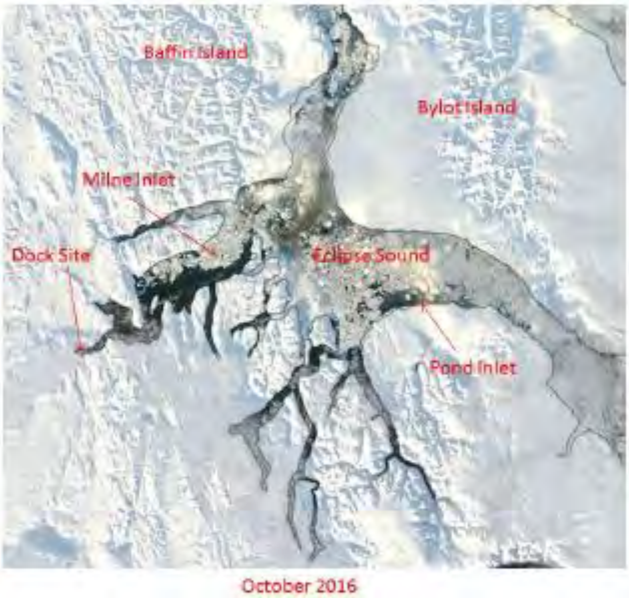


Figure 4: Mobile ice during the freeze-up period

2. The mid-winter (land-fast) period starts when the ice becomes stable at about 0.3 to 0.6m thickness and ends when the ice starts to break-up. As mentioned, the ice attains its maximum thickness by late May. The maximum ice thickness ranges from 1.3 to 2m and depends on the severity of the winter, as shown in Figure 3 above.

   Working off the ice during the mid-winter period is usually quite safe but consideration must be given to equipment weight. The primary method to ensure safety is to confirm that ice is not moving laterally—except due to thermal strains and jacking from cracks refreezing in the ice. These are quite small, generally less than about 1m per ice season.

   Ice will try to move up and down due to tidal action. If it is restrained at the shore, such as being frozen to a pile structure, cracks due to flexure can occur at the location of critical bending moment. These are called tidal cracks. With no structure in place, the tidal cracks occur where the ice freezes to the sea floor and are parallel to the shoreline. The line of cracks can move offshore with time but are found in depths of water from 1 to 1.5m. If a structure is in place, the tidal motion can generate a lifting force on a pile. These forces may cause a tidal crack to form near a pile or dock face. An ice bustle can form on a pile or a dock face due to repeated freezing to the surface and may thicken as water floods over the frozen connection. This action would occur with the cycle of tides.

   Piles placed during the mid-winter period can be driven through openings cut in the ice. A margin around each pile or a slot across the line of piles. This approach is recommended to prevent loading on piles which are not yet fully supported by backfill. The typical value of cumulative lateral movement of the ice during the mid-winter period is of approximately 1m and may need to be widened if small movements of ice occur. The ice is indeed nominally stationary (land fast), however "land fast ice " can move laterally by small amounts and very slowly due to thermal strains and the formation and refreezing of thin cracks (typically 1cm in width) caused by temperature fluctuations. 1
   During the winter months, the opening should be monitored and cleared to ensure that ice thickening does not occur. Re-freezing will occur but Contractor will keep the area free of ice by regularly breaking up and removing the ice so it does thicken too much. The allowable amount of refreezing will be assessed by considering potential ice loads on incomplete and temporary structures. 1
   The potential impact on the Causeway construction is discussed in section 5.2.1. 1

At the end of May, towards the end of the land-fast period, ice begins to thin—although it is usually safe to work on the ice into June. It takes time for the ice to deteriorate but sometime in June, ice will melt close to shorelines and may limit access from shore to the ice cover. Bearing capacities are reduced by thinning ice, so having equipment on the ice needs to be done with care with repeated assessments of ice thickness and bearing capacity. As discussed in the next paragraph, the ice may be dispersed around the dock in early June due to inflow from Mary River. If so, this will eliminate the need for repeated ice cutting around the installed piles.

3. During the break-up period, ice becomes mobile as in the freeze-up period. The process of ice thinning starts when the mean air temperatures rise above zero, typically by May. Thinning also occurs when ice absorbs solar radiation as the sun gets stronger, this also occurs in May. At the dock site, there is a local influence from the Mary River. It appears that inflow of warmer water can open up the ice earlier around the dock location than further offshore. This is shown in Figure 5. We are not sure how consistent this is, but it could be helpful in reducing the need for ice cutting after a certain date.

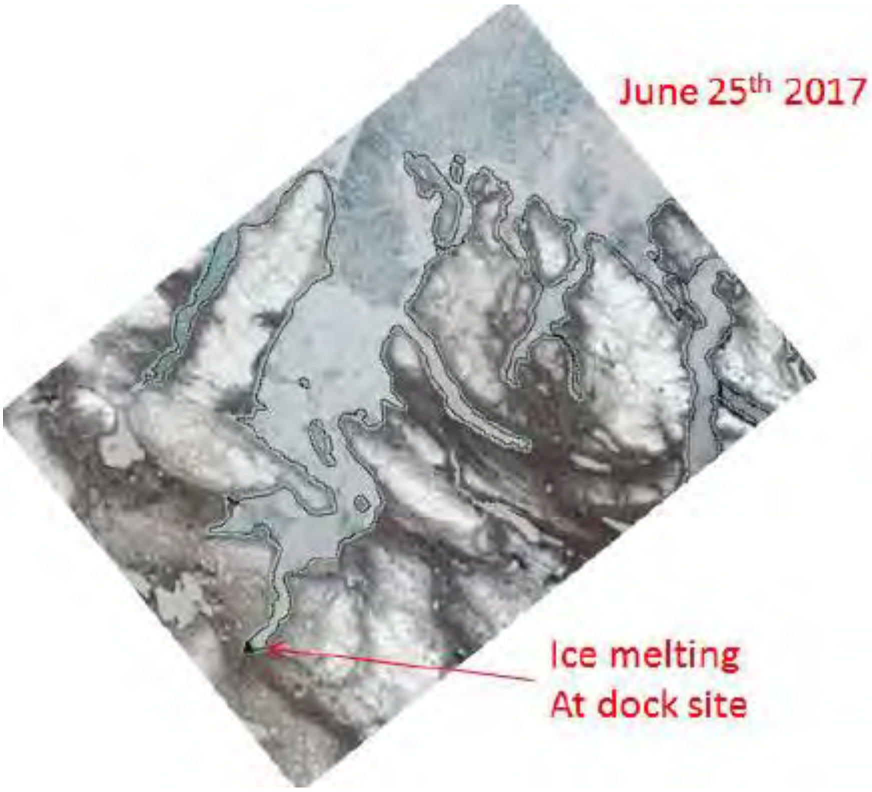


Figure 5: Ice melting at dock site in June

3.2 Climate

The climate at the site can be very harsh during the winter period as very low temperatures are encountered, this will inevitably limit the productivity of outdoor works.

The figures below summarize the key site conditions impacting the works. This information has been heavily considered when choosing the work methods for the project. For example, outdoor works have been limited as much as possible during the winter months and concrete pouring has been scheduled during the best months. The impact of the climate on the productivities and potential downtime is detailed in the Project Calendar (BIM-BV-GE-PM-SC-00007) and Planning Narrative (BIM-BV-GE-GE-REG-00023).

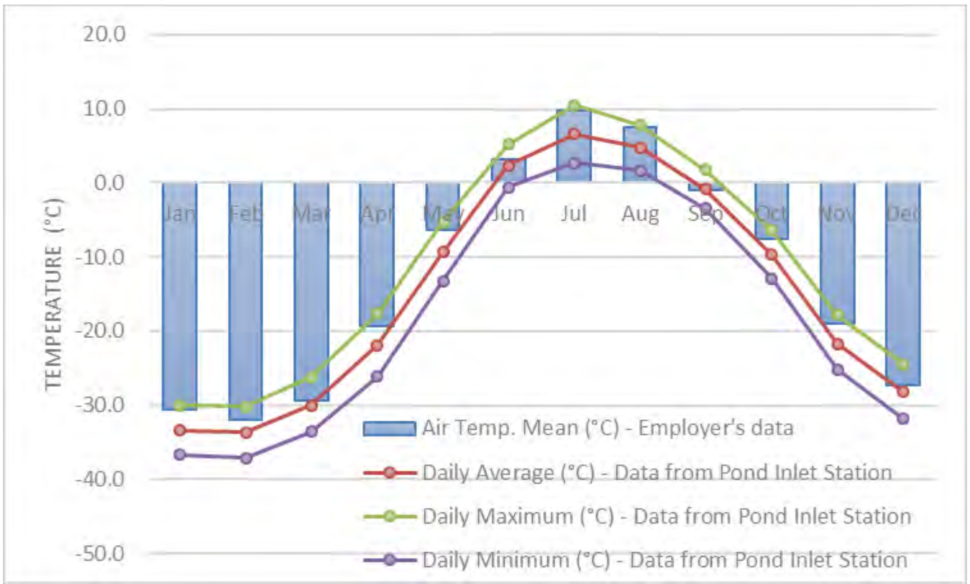


Figure 6: Site data - temperatures

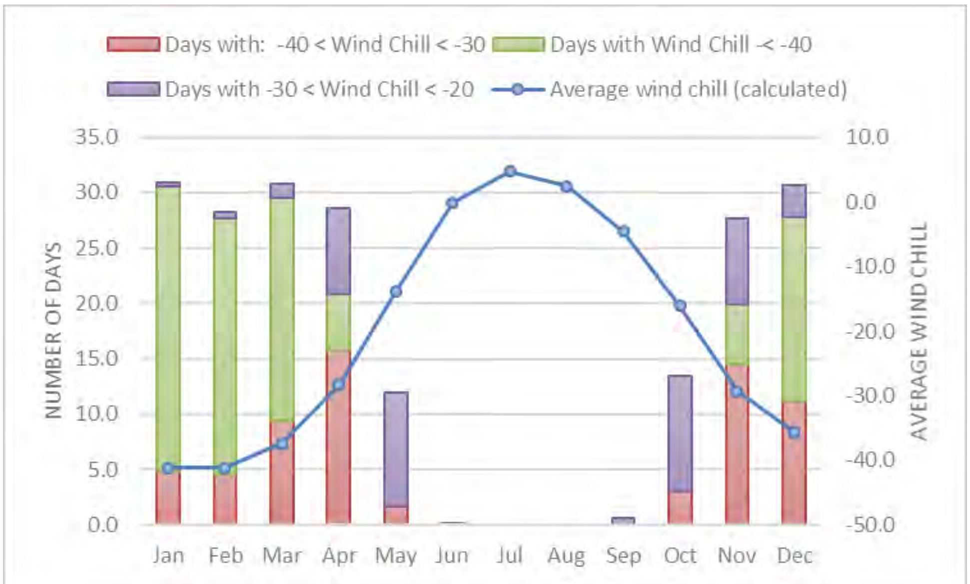


Figure 7: Site data - Wind-chill

Sources:

http://climate.weather.gc.ca - Canadian Climate Normals 1981 - 2010 Station Data Pond Inlet A Nunavut

Site Data H353004-00000-200-078-0008, Rev. 0

The daylight is also a key factor in the execution of the project. From November to March the site is mostly in full darkness, and from May to September there are often 24 hours of daylight in a day (see Figure 8 below).

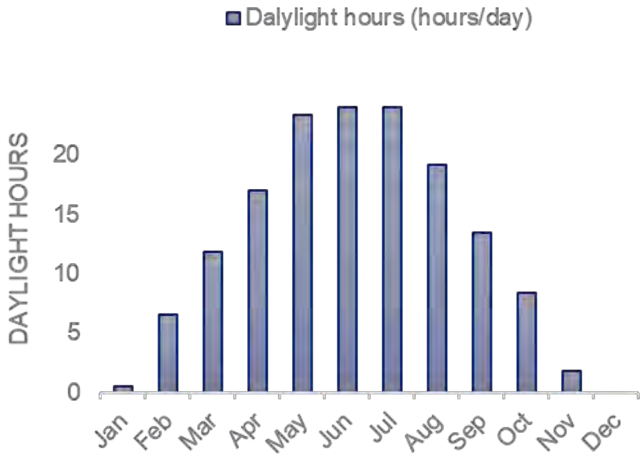


Figure 8: Site data - Daylight

Section 4 - Sequence of work

4.1 Sequence Overview

The site climate, the soil conditions and the challenging execution schedule are the main drivers defining Contractor's work sequence and associated methodology.

To complete the construction of the Ore Dock the most efficiently, all efforts at beginning of the works will focus on creating an access from to the berth to start the associated piling works. An access causeway will therefore be created within the overall project footprint to go as far as possible offshore. An access trestle, consisting of a steel structure on piles, will then be constructed to reach the berth location.

Once the access to the Ore Dock has been created, two fronts will work in parallel:

- The piling front manage the piling work for the berth
- The earthwork front will manage the causeway construction and backfilling behind the berth. Prior to backfilling behind the berth, a sufficient length of quay wall will need to be installed, ensuring that the fill remains within the final footprint of the structure and limiting dispersion of material.

The detailed work sequence is further described in the following chapter and shown in the method drawings listed below:

- Sequence of work (step by step) BIM-BV-GE-MS-DW-00006
- Sequence of work Typical section (Berth) BIM-BV-GE-MS-DW-00007
- Backfilling sequence BIM-BV-GE-MS-DW-00105
- Piling and Backfilling Works – Berth and Causeway Sections BIM-BV-GE-MS-DW-00106

For the general layout and design drawings of the ore dock, reference is made to the drawings issued as part of the different design deliverables. To ease the understanding of this document, some extracts have been used. In case of discrepancy between these extracts and the design drawings, the latter shall prevail.

4.2 Location of the access causeway and access trestle

The position of the access causeway has been chosen to make the best use of the final layout of the structure. It encompasses a portion of the final causeway and will only be made of core material, reducing the installation time within the critical path. The armour and top layers will be installed afterwards during the piling of the trestle, when the associated earthworks are not a part of the critical path.

The main fill of the causeway consists in relatively core material. The armour is only required considering the design life of the project. Moreover, considering the execution period of the access causeway, the armour will be installed before the causeway is exposed to erosion (it is surrounded by grounded ice till end June 2017) which limit the possible risks associated to this phasing of the works. 1

The end point of the access causeway (i.e. starting point of the access trestle) has been defined considering that the stability of the causeway cannot be guaranteed past -1mCD because of the combination of a steep slope and the presence of a soft layer at deeper locations.

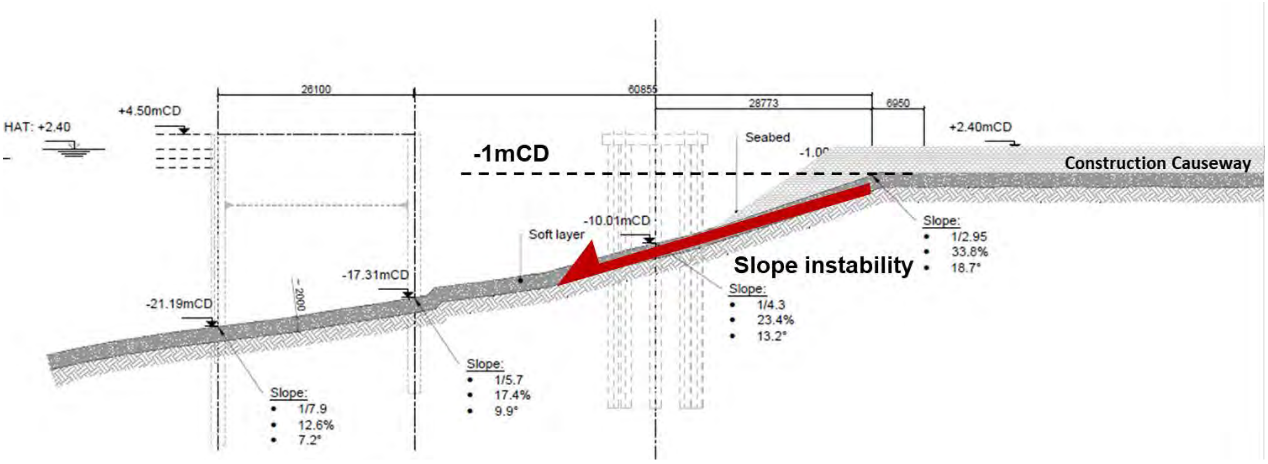


Figure 9: Backfill slope instability

The position of the access trestle in the East-West direction has been chosen to:

- Limit the trestle length
- Avoid unnecessary movement and change of working direction of the travelling platform (used for the berth construction as further described in this document) 1
- Start the backfilling behind the berthing line as soon as possible. The footprint of the backfill slope from the top to the seabed is about 50m; starting in a corner therefore reduces the quay length that is required to commence the backfilling works.

Taking into account the above mentioned constraints and opportunities and considering the construction methods, the positions of the access causeway and access trestle have been chosen and are shown below:

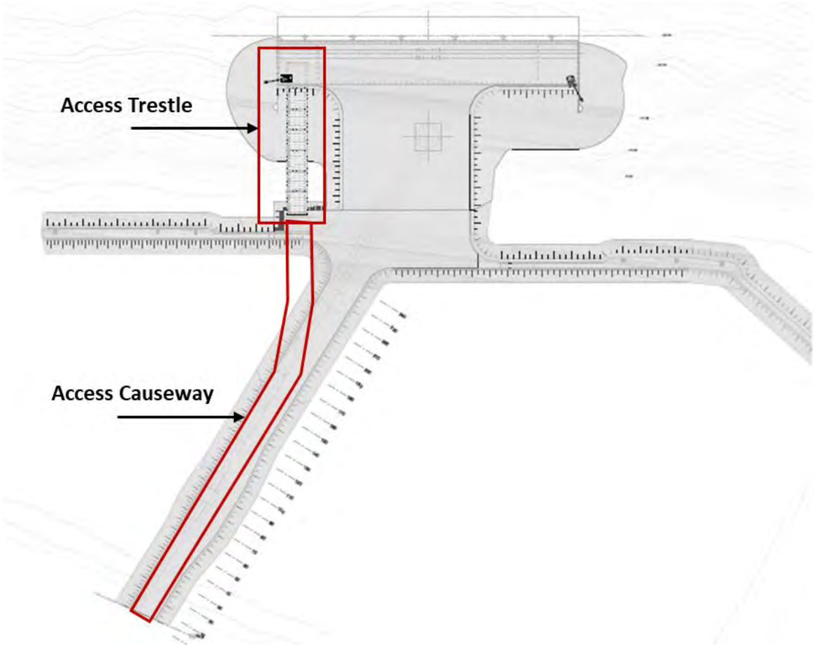


Figure 10: access causeway and access trestle location

The width of the access causeway has been defined by considering the period at which it will be constructed and the associated construction methodology. To progress as fast as possible to the start point of the access trestle, two interchanging front will work in parallel:

1. Ice cutting,
2. Actual construction of the causeway.

The width of each front will be of 10m to ensure efficiency of the reclamation works by allowing the trucks to cross-each other and turn at the end of the causeway (no back driving).

The total width of the causeway will therefore be of 20m.

The trestle will extend from the end of the access causeway (at -1mCD) to the berth location. Seven bents (row of piles) are installed in that manner for a total length of approximately 70m. An abutment is foreseen at the start point. Six bents will be built before the location of the rear berth wall, and one bent between the rear and front walls. This allows the installation of the first section of the combi-wall from that platform.

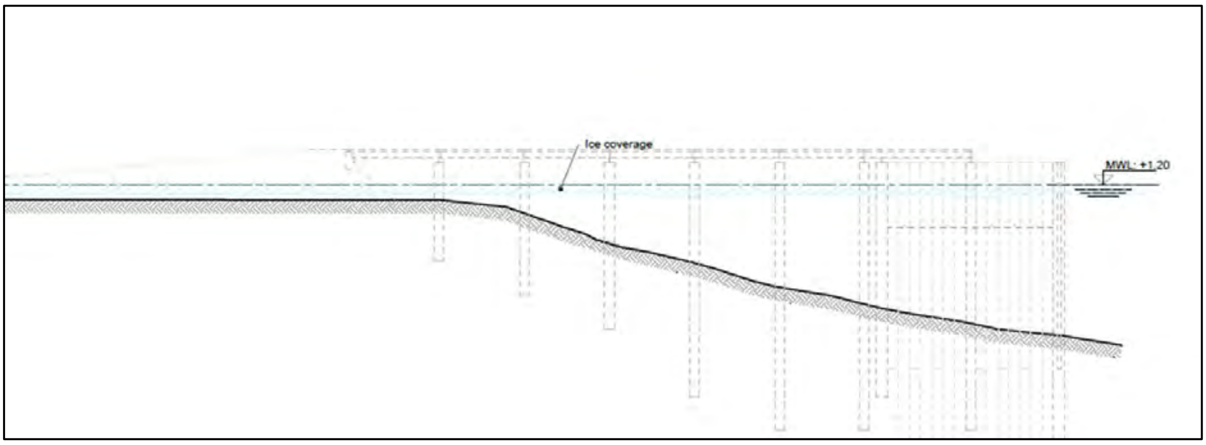


Figure 11: Trestle layout

4.3 Work Sequence

The below sequence of work for the construction of the cofferdam structure has been established considering a travelling platform that would travel on rails, on top of the front and rear wall piles, aided by bogies. The sketch in Figure 12 below illustrates the working principle.

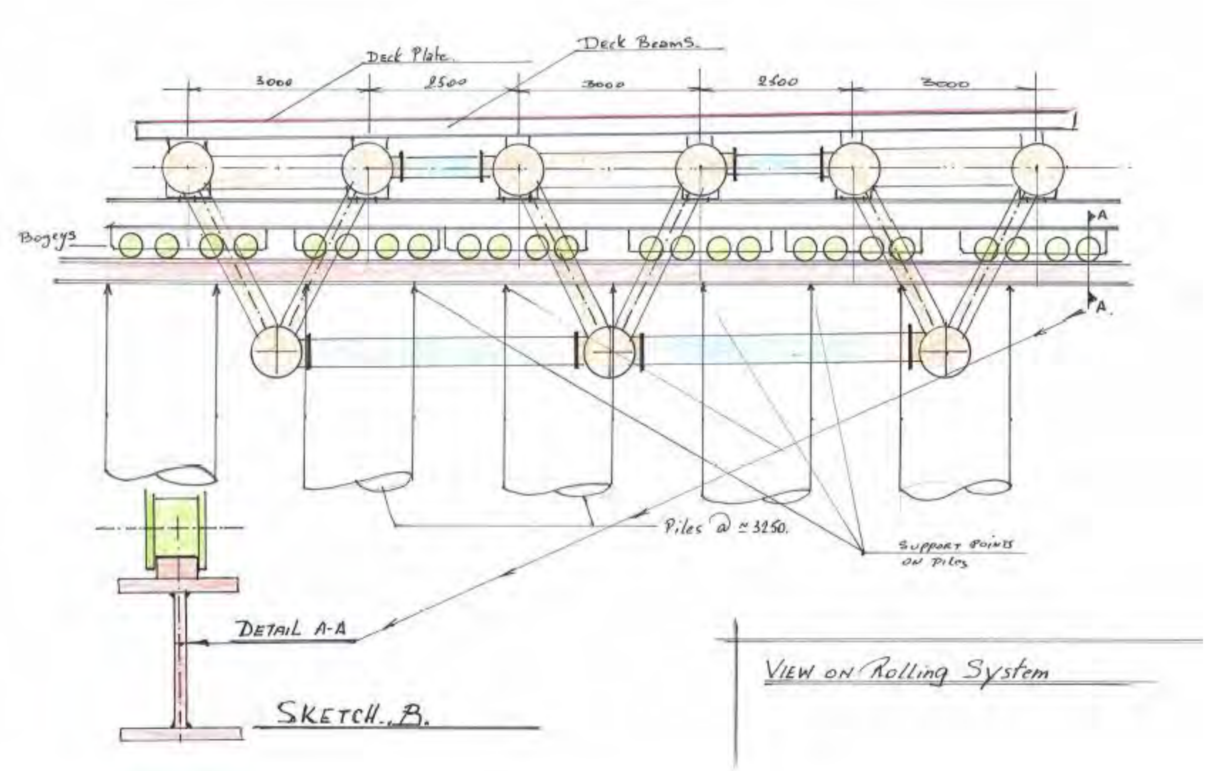
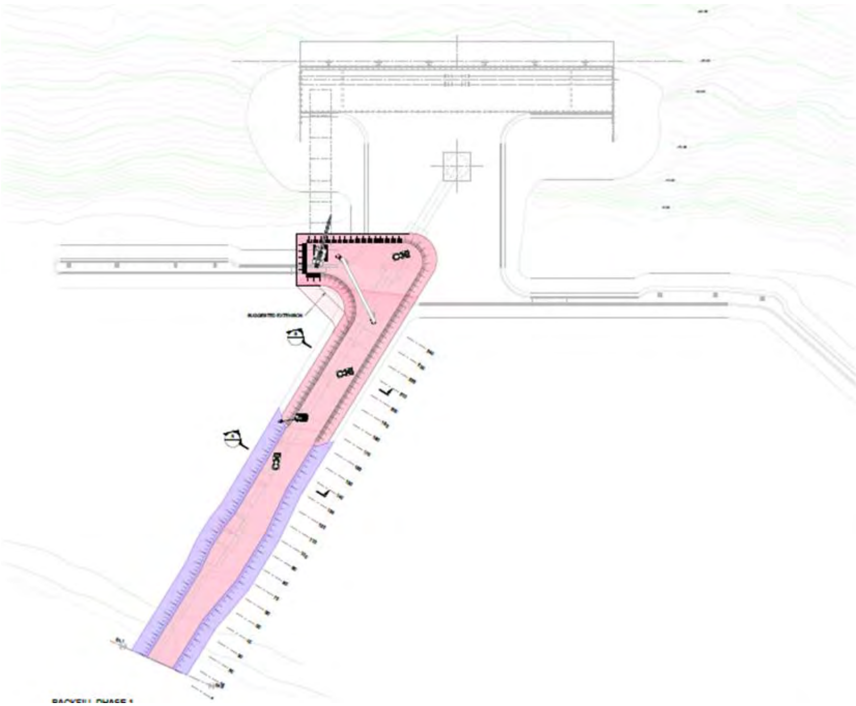
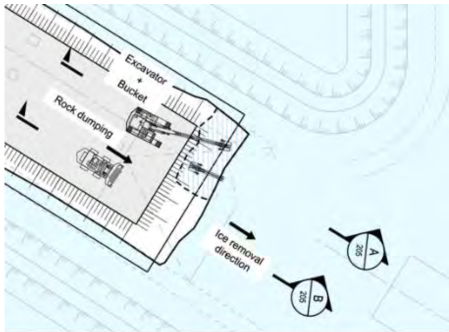


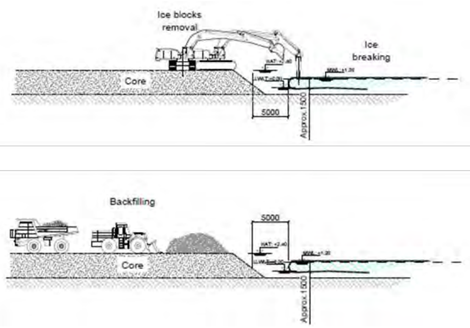
Figure 12: Travelling platform on bogies

The main construction steps are introduced hereunder. For the step by step installation sequence, reference is made to Section 5 - where the most important stages are shown.

Construction of the access causeway:



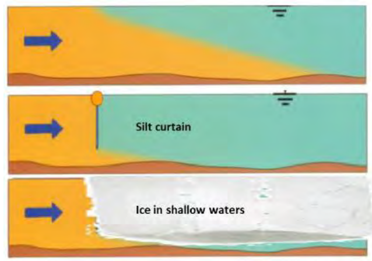




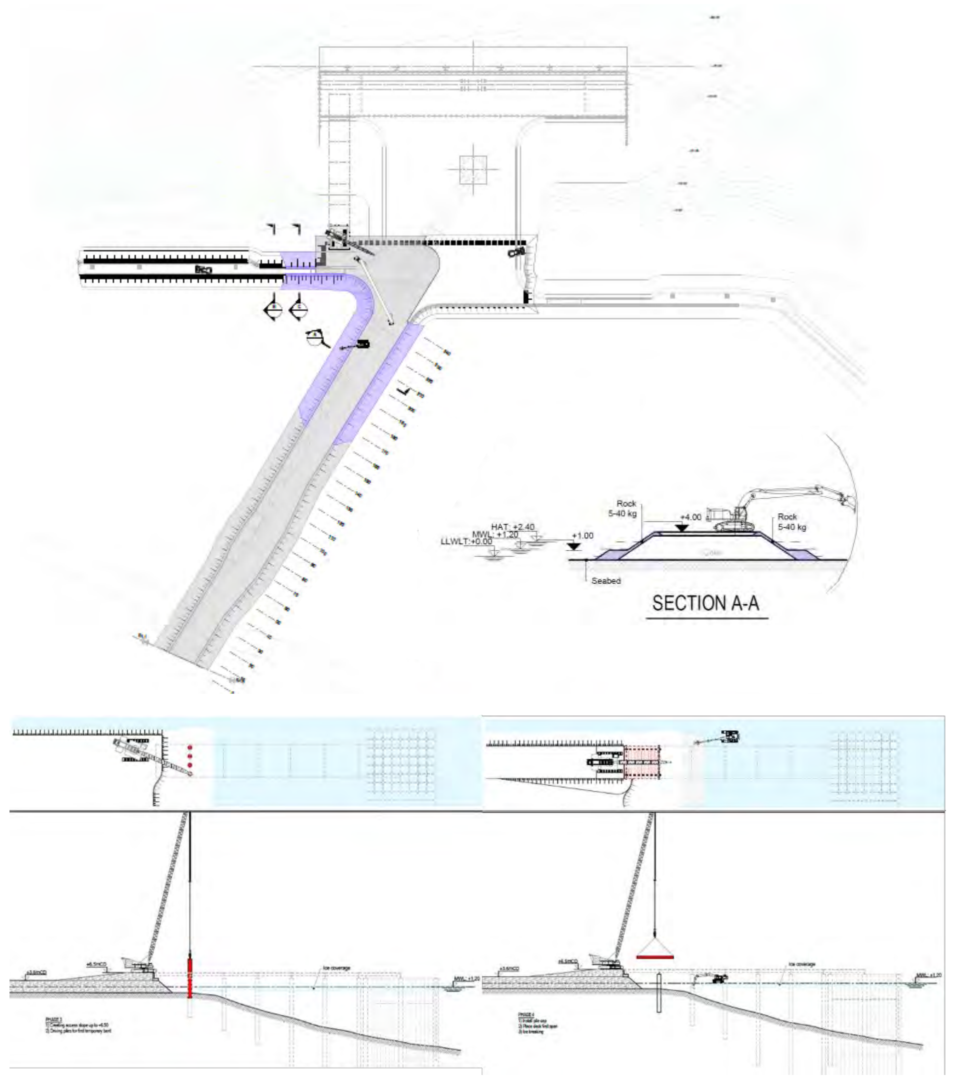
- <u>Methodology:</u>

  Construction of the access causeway with two interchanging front will work in parallel: ice cutting, and actual construction of the causeway.

- <u>Equipment:</u>
  - Ice cutting:
    - 45tExcavator with Eccentric ripper (or rotary cutter)
    - 45t Excavator for side casting of the ice blocks
  - Earthworks:
    - Wheel loader at stockpile (loading of trucks)
    - Dump trucks (hauling of core material from stockpile to site)
    - Bulldozers
- <u>Environmental measures:</u>
  - Minimize works from the ice
  - Implement spill containment plan
  - Fills pushed by dozer/excavator to limit the sedimentation flow
  - Works carried out in shallow water (max 2m water depth) in the winter period (ice thickness between 1 and 2m). The ice will therefore act as the barrier similar to the silt curtain in shallow water.



Construction of the causeways and access trestle:

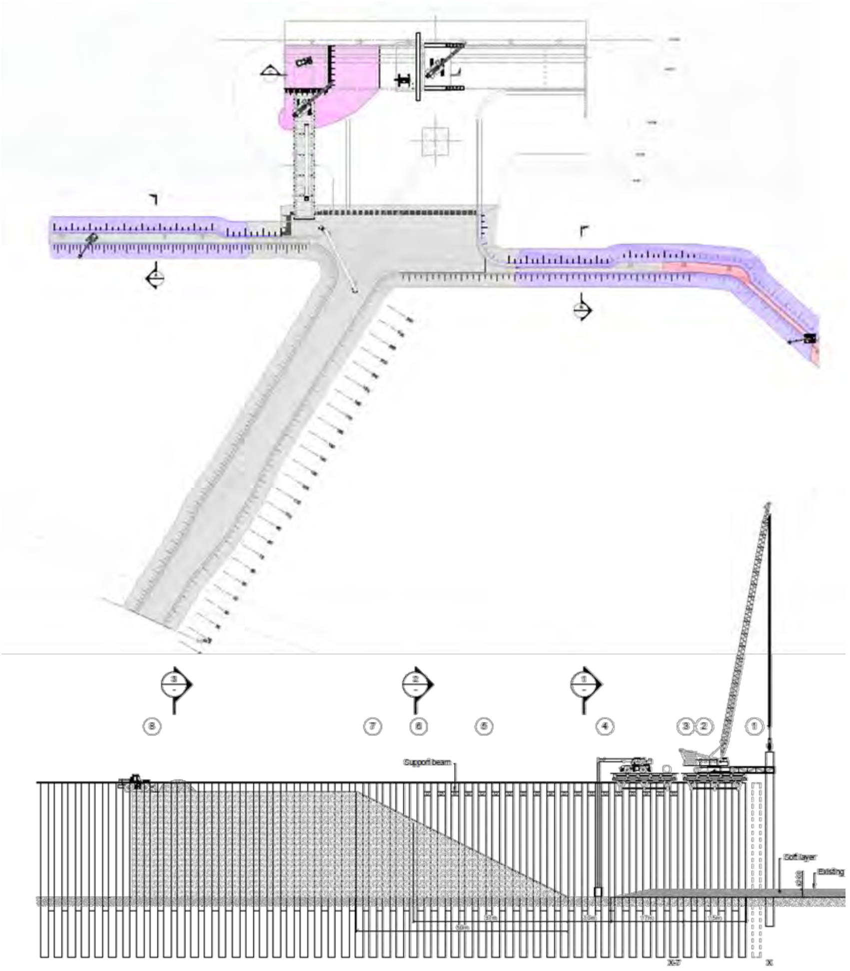


- <u>Methodology:</u>
  - Causeway: ice cutting and reclamation of the rest of the causeway.
  - Armour placement: Armour rock for the access causeway consists of small rocks and the distance of placement is rather small considering the shallow water. Placement will therefore be done with an excavator.
  - Trestle: Installation of the abutment and free driving of the pile (i.e. no piling guide) and installation of a steel deck which can accommodate the piling tolerances.
  - A Ditch Witch will cut ice slots which will be move or pick-up with an Excavator. Both equipment will work from the ice at this stage. (This is fine considering the ice thickness at that time) A 1m clearance will be provided around the piles.
- <u>Equipment:</u>
  - Ice cutting and core fill: same as previously
  - Armour rock
    - Wheel loader at stock pile (loading of trucks)
    - Dump trucks (hauling of material from stockpile to site)
    - 45t Excavator
  - Trestle
    - Heavy Crawler Crane
    - Ditch witch for ice cutting
    - 45t excavator to pick-up or move the ice blocks

	▪ <u>Environmental measures:</u> o Same as previously o Soft start for the piling works Contractor works from the ice at the trestle location to clear the ice around the piles. This is required is required as no causeway is built at this location and hence there is no other access than from the ice. A ditch witch will however be used to cut the ice at this location in order to: ▪ Reduce the loads in the sensitive zone (where the ice is broken) ▪ Better control the cracking risk by having a clear cut in the ice. An excavator is also positioned on the ice to lift and side cast the ice blocks but will not be used to directly cut the ice.

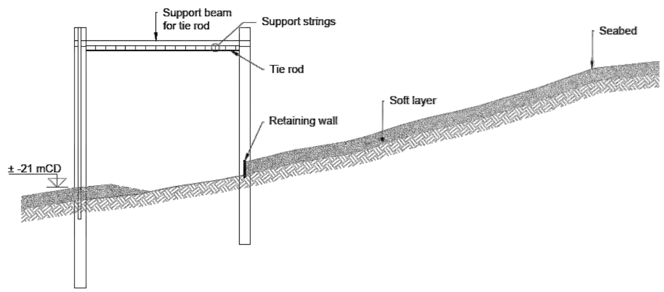
1

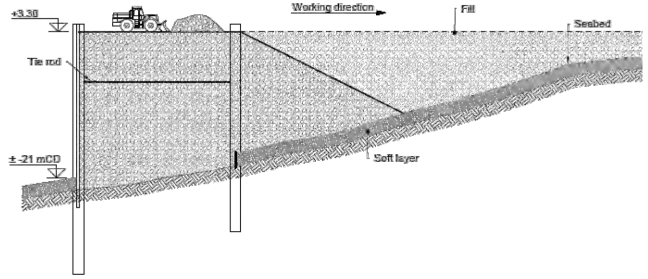
Construction of the secondary causeways and berth



- <u>Methodology:</u>
  - Secondary causeways: ice cutting, core fill, and armour rock as per main causeway.
  - Berth:
    1. Pile driving
    2. Installation of the support tie-rod beam at the back of the platform (x2)
    3. Placing retaining wall between rear piles (clutches are welded on the rear piles and will be used to lower the retaining wall).
       This retaining wall allow to limit the volume of soil substrate which needs to be handled.
    4. Cleaning and levelling of the soft layer within the cofferdam
    5. Backfilling up to tie-rod level (-5mCD) by tip dumping
    6. Lowering of tie-rod to final level
    7. Removal of the supporting beam for tie-rods
    8. Backfilling to final level: (main fill material up to +3.30mCD, compacted backfill up to +4.50mCD)

    A Ditch Witch will cut ice slots which will be move or pick-up with an Excavator. Both equipment will work from the ice at this stage. (This is fine considering the ice thickness at that time) A 1m clearance will be provided around the piles.
- <u>Equipment:</u>
  - Ice cutting, core fill, and armour rock: same as previously
  - Berth
    - Heavy Crawler Crane for piling

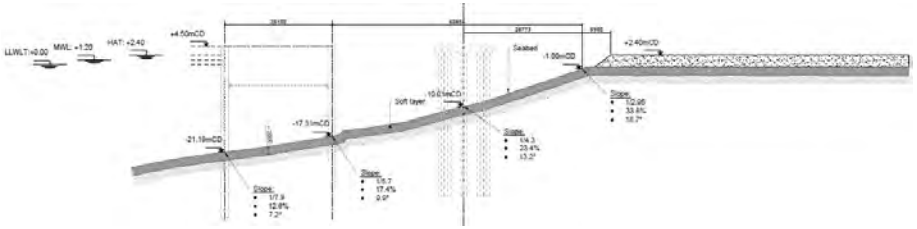




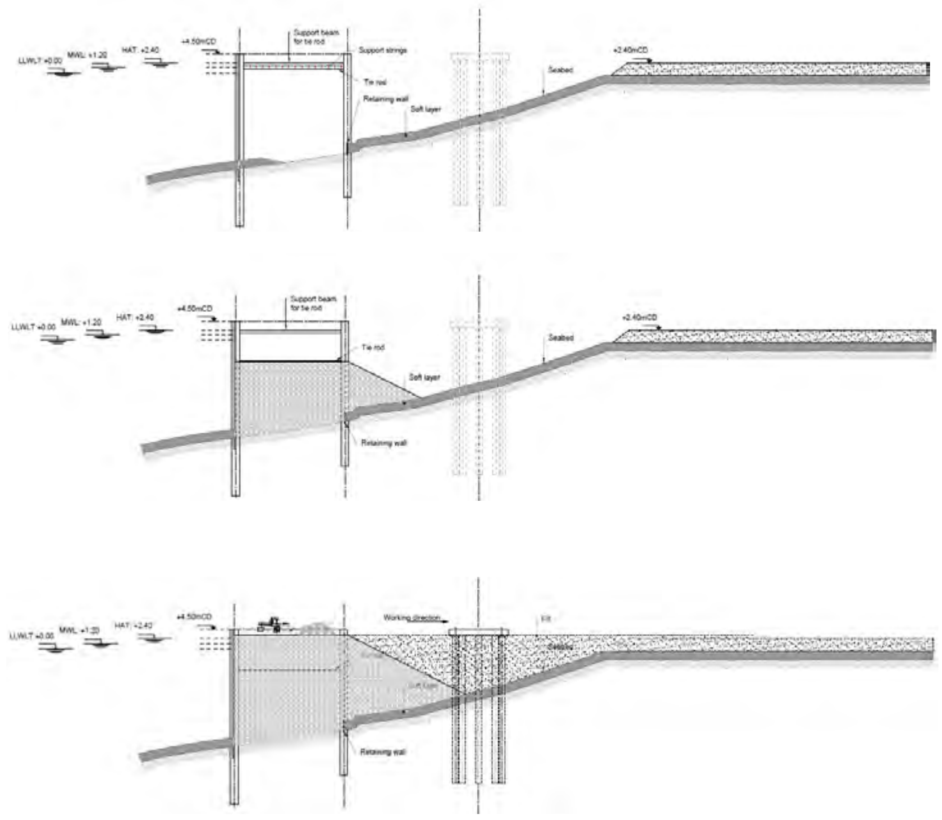
- Heavy Crawler Crane for handling of piles
- Truck for transport of steel piles
- 250t crawler crane for loading of piles at the laydown area
- Travelling platform (on bogies): for pile driving
- Piling guides
- Trolley (on bogies): for transport of piles and small mobile crane
- Mobile crane for removal of the soft layer between front and rear walls.
- Ditch witch for ice cutting
- 45t excavator to pick-up or move the ice blocks

- <u>Environmental measures:</u>
  - Same as previously

Berth, infill for ship loader platform and pivot point



- <u>Methodology:</u>
  - Berth: as previously described.
  - Ice cutting will not be required through the overall execution as the work will be undertaken during through the ice break-up period and be completed in the summer (no ice anymore),
  - infill for ship loader platform: When sufficient quay wall length has been installed the infill of the ship loader platform can be undertaken, the quay wall



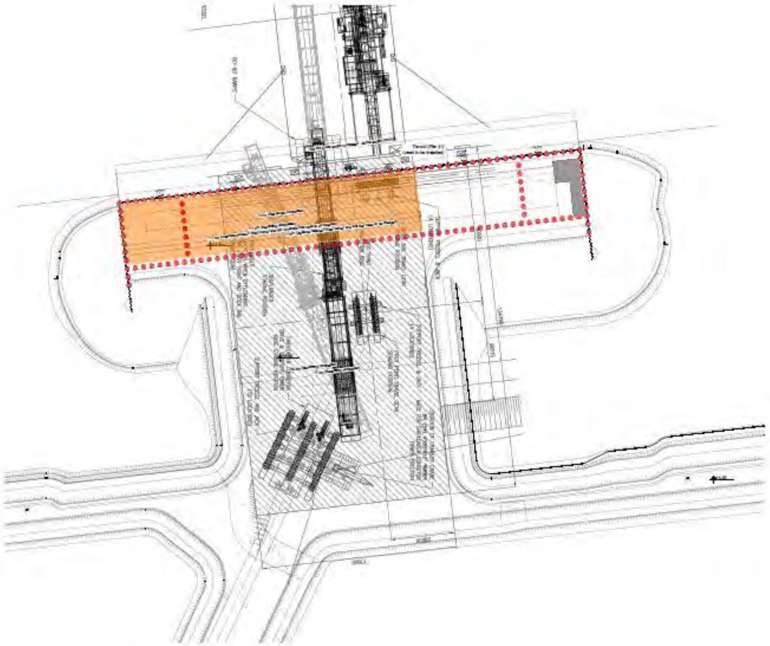
acting as a retaining structure thus solving the slope instability issue mentioned earlier.

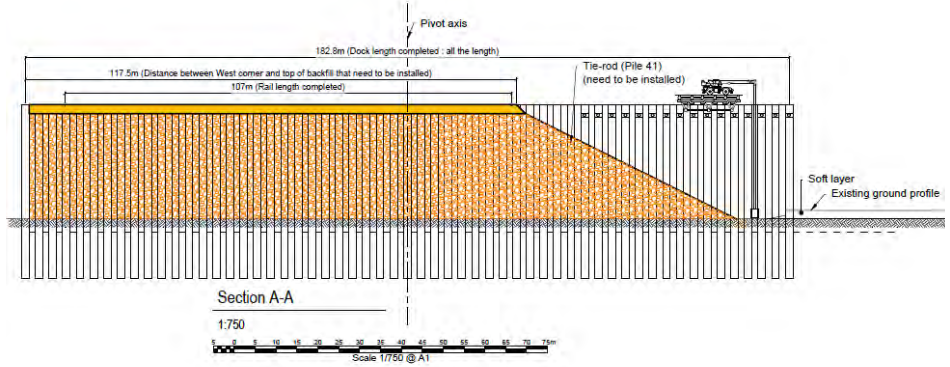
- o Pivot Point and other foundations for ship loader: piling of the required piles, installation of precast items and pouring of in-situ concrete.

- <u>Equipment:</u>
  - o Berth: same as previously described
  - o infill for ship loader platform
    - core material: same equipment as for the causeway construction
    - additional equipment for armour rock:
      - 45t excavator above water level
      - 85t excavator below water level
      - 200t heavy duty crawler crane for the armour rock at the deepest locations.
      - Flatbed truck (hauling armour from stockpile to site)
  - o Pivot point:
    - Heavy Crawler Crane for piling (same on than
    - Truck for transport of steel piles
    - 250t crawler crane for loading of piles at the laydown area
    - Truck (transport of piles)
    - 70t mobile crane (precast units)
    - Concrete mixers (in-situ concrete)
- <u>Environmental measures:</u>
  - o Same as previously
  - o Silt curtain during reclamation of the ship loader platform

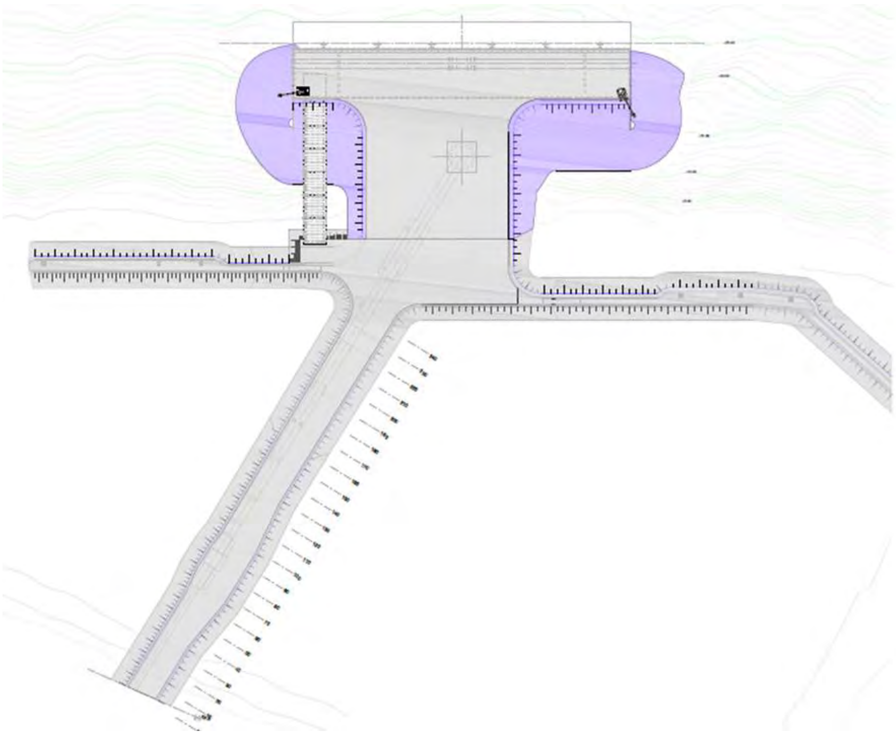
Extent of the berth piling and backfill works that must be completed before the ship loader arrival

1





Completion of the berth, slope revetment, finishing works, and scour protection



- Methodology:
  - Berth: as previously described.
  - Slope revetment: as for the ship loader infill
  - Pivot Point and other foundations for ship loader: piling of the required piles, installation of precast items and pouring of in-situ concrete.
- Equipment:
  - Berth: same as previously described
  - Slope revetment: as for the ship loader infill
  - Finishing works:
    - Heavy Crawler Crane for heavy lifts (e.g. gangway)
    - 250t crawler crane at the laydown area (handling)
    - Flatbed trucks (transport from laydown to site)
    - 70t mobile crane for small lifts (e.g. bollards)
  - Scour protection:
    - 200t heavy duty crawler crane for placing of the rocks
    - Trucks (transport from laydown to site)
- Environmental measures:
  - Same as previously

1

Section 5 - Construction Methodology

5.1 Ice breaking at the shoreline – start point of the causeway

For planning purposes, the type of ice immediately offshore, during the mid-winter (landfall) period is of interest. Tree scenarios are considered.

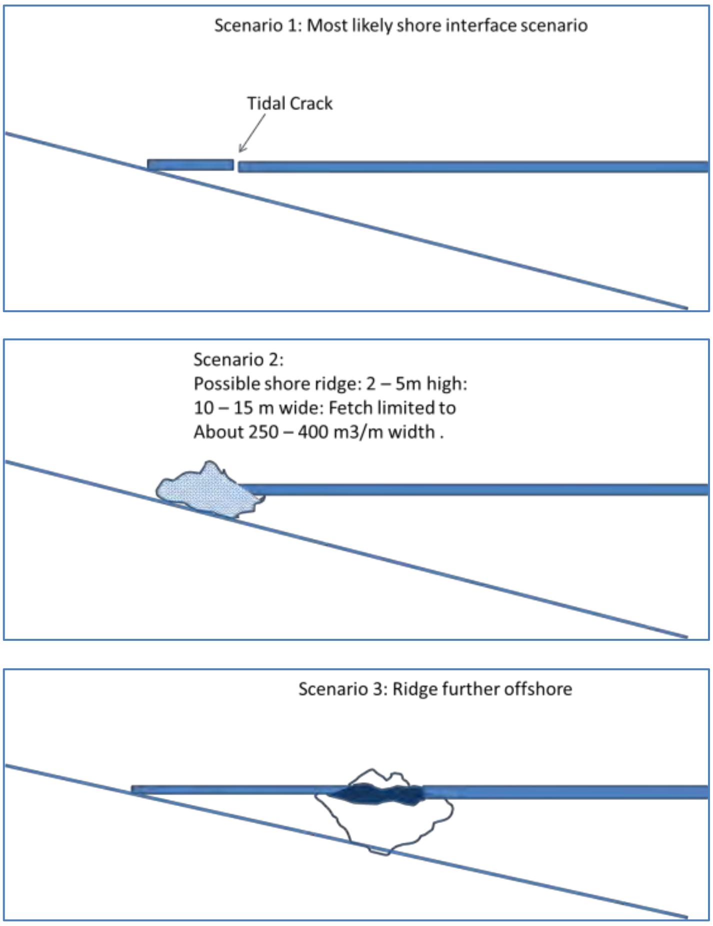


Figure 13 – Possible shoreline ice scenarios

The first scenario is a relatively smooth ice sheet with a tidal crack, this is the most ideal for moving equipment offshore and/or building out the causeway progressively from shore – as described further below.

The second scenario implies a pile up (ridge) at the shoreline. Such a feature may occur due to onshore winds during freeze up. A review of the most likely fetch of ice that can be driven onshore and an associated early ice thickness suggests that such a shore ridge would be limited to about 250 to 400 cubic meters of ice per meter width. This results in a ridge 2 to 5m high and roughly 10 to 15m in width. There will be a consolidated layer about 0.5 to 1m thick by early January, the remainder will be loose blocks of ice.

The third scenario is a similar ridge to scenario 2, but forming further offshore.

Whatever scenario does occurs, the following equipment will be used to cut the ice:

- 45T Track excavator (2 nos.)
- Excavator mounted ripper/rotary cutter (2 nos.)

- Set of survey equipment (1 nos.)

Indeed, the presence of shore ridges might slow down the work but the same principal of approach can apply - as depicted in below Figure 14 and Figure 15. In both cases, the ripper should be well able to demolish the ridge. However, because of larger ice volumes, time required to remove the ice may increase.

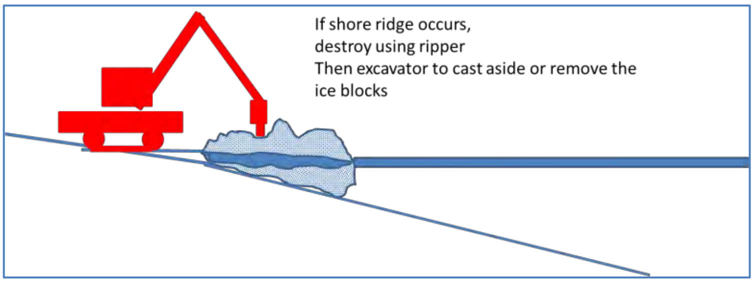


Figure 14 – Ridge at shoreline

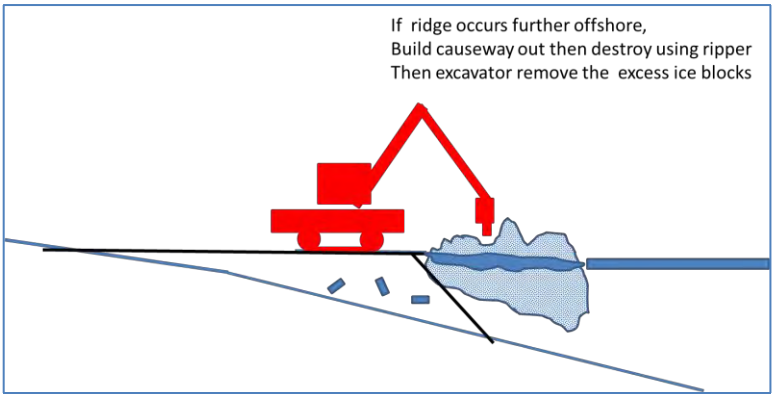


Figure 15 – Ridge further offshore

5.2 Construction of the access causeway

5.2.1 Methodology

The approach is to build the causeway progressively out from shore, breaking and removing as much as possible the ice ahead of dumping the fill at the end of the causeway.

The equipment reaches out further offshore to break the ice for the next dump. Most of the ice is then removed by a second excavator before the dumping of the backfill material. This to avoid excessive settlement during the melting of the ice. To compensate the settlement that will occur due to the melting of the remaining ice a second stage of backfill till final level is planned for the causeway during spring or summer.

The causeway reclamation is done by using core material from the quarry operated by the Employer. The material is loaded at the stockpile area onto dumpers which then transport the material to the access causeway. In order to limit the sedimentation flow, the core material is finally pushed into the water by a dozer.

The sequence of work can be summarized as below:

1. Break the ice with ripper/cutter
2. Side cast the ice blocks with an Excavator
3. Push the fill material in the water

To speed up the works the causeway will be divided on two interchanging work fronts: on one half the ripper will break the ice and the excavator will remove the ice, on the other half the trucks will dump the core material. This will be done alternating in sections of about 10m, as per Figure 16.

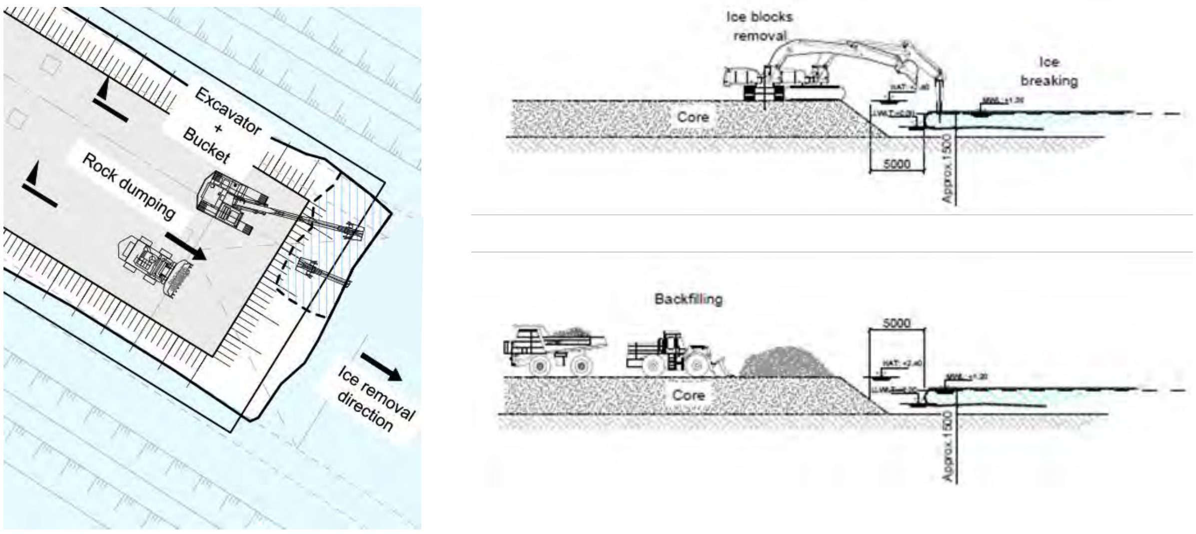


Figure 16: Causeway construction

It is assumed that the truck loading at the quarry will be undertaken by the Employer with suitable equipment in order to fulfil Contractor's production schedule and to avoid jeopardizing the production rates.

The deepest seabed elevation of the causeway is at -1mCD meaning water depth about 2m as the mean sea level is at 1.2mCD. Contractor expects that tidal cracks will form within this region and gradually move offshore as the ice thickens and becomes grounded. Repeated tidal flooding may also thicken this ice which will accelerate the grounding and the movement of the tidal cracks further offshore. There may also be a shore ridge of ice rubble created if there is an ice push from offshore during the freeze up period before the ice becomes land-fast. All these possibilities are recognized and will not affect the construction of the causeway using the proposed methods of working from the shore (after the ice has become land-fast). The breaking and excavation of the ice can still be accomplished even in the presence of tidal cracks (which can help) and ice rubble (which means some extra ice volume removal). Any ice rubble is expected to be less than a few m high and will be in very shallow water. 1

In the event where the causeway shallow shelf is largely broken tidal ice, the broken tidal ice will still be amenable to the proposed construction method working from the causeway as it is being built. Access to the ice is also still possible as this broken tidal ice is essentially grounded and can be smoothed using earth moving equipment and even thickened by flooding. 1

5.2.2 Equipment

- Ice cutting:
  - 45tExcavator with Eccentric ripper (or rotary cutter)
  - 45t Excavator for side casting of the ice blocks

- Earthworks:
  - Wheel loader at stockpile (loading of trucks)
  - Dump trucks (hauling of core material from stockpile to site)
  - Bulldozers

Figure 17: Eccentric ripper (left) and rotary cutter (right)

5.2.3 Environmental measures

To limit the environmental impact of the works, the following measures will be implemented:

- Minimize works from the ice
- Implement spill containment plan
- Fill pushed by dozer to limit the sedimentation flow

Moreover, as the causeway construction will be carried out in shallow water (max 2m water depth) during the winter period (ice thickness between 1 and 2m), the ice will act as the barrier similar to the silt curtain in shallow water (see Figure 18 to the right).

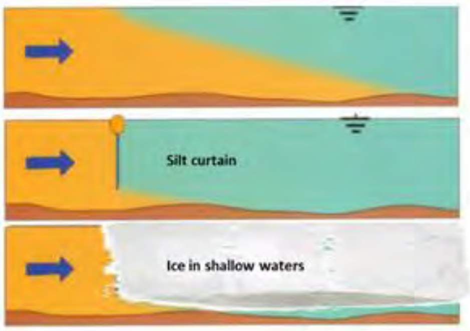


Figure 18: Silt curtain

5.3 Construction of the main and secondary causeways

5.3.1 Methodology – Core material

The construction of the main causeway and the secondary causeways will start when the ice is land-fast and will be completed during the ice break-up period.

The core material will be installed before the ice break-up and the same methodology used for the construction of the access causeway will be implemented.

The sequencing for the core installation can be summarized as follow:

a) Removal of ice: as per previous section

b) Haul material from the quarry (loaded by employer), transport and dump it at the work front by mean of trucks. The supply and transport production rates must be respected at all times, in order to maintain the schedule as per the execution plan.

c) A Dozer will push and move the core material to the required locations, from onshore to offshore, winning extension to the sea. The excavators will make sure that most difficult locations are backfilled and help achieve the correct slope inclination

d) This activity will continue till enough access and working platform is created. After that, permanent work associated with the Ore Dock can commence.

The finalization of the backfill up to design level and the installation of the top layer will be undertaken after initial settlement, past the ice break-up period.

Earthworks activity does not require any special attention regarding laydown area for material and with respect to how the area must be arranged as it is integrated in the working front area. Special attention is required regarding the daily rate/volume of transport/supply (please refer to section above).

It has been assumed that the loading of the truck at the quarry will be undertaken by the Employer with suitable equipment in order to fulfil Contractor’s production schedule and without jeopardizing the production rates.

Figure 19: Overview of the causeway construction

5.3.2 Methodology – Slope revetment

For the main causeway, the armour consists of small rocks and the distance of placement is rather small considering the shallow water. Placement will therefore be done with an excavator

For the secondary causeways, the armour rock will be installed by mean of long reach excavators for the shallower sections and for the parts above water. A heavy duty crawler crane equipped with a clamshell will be used to install the rocks at deeper locations.

Geotextile is currently foreseen below the upper backfill and will be installed by mean of an excavator.

The sequence of work can be summarized as follow:

a) While the core dumping described in previous section is ongoing and after achieving a sufficient advance in execution, the installation of protective layers can start;

b) The protective layers will be executed in parallel with the placing of core material and in determined sections/extensions, in order to minimize the erosion, . This means that after a certain section of core material is placed, the subsequent layers (protective layer and armouring) are to be executed immediately, delivering consecutive fully finished partial sections;

c) First layer to be placed is the filter/protection material. This material is to be loaded at the stockpile and transported from the quarry (by articulated trucks) by the Contractor and dumped near the areas where needed. The placement of the rocks with the excavator (in shallow areas) or with the crane (in deep areas) determines the duration of this activity. Loading and hauling the material must happen as such to keep and ensure this cadence.

d) The armouring, as final protective layer, requires the use of a 200t heavy duty crawler crane with grab, in order to provide a correct placement and level to the rocks.

Figure 20 - Core profiling with long reach excavators (left) & Articulated dump truck (ADT) and long reach excavators for core profiling (right)

It is assumed that the loading of the truck at the quarry will be undertaken by the Employer with suitable equipment in order to fulfil Contractor's production schedule and without jeopardizing the production rates.

Figure 21: Armour rock placing with crane and hydraulic grab

5.3.3 Equipment

▪ 45T Track Excavator	1 nos.	Material loading
▪ Wheel Loader	1 nos.	Material loading
▪ Articulated dumper	5 nos.	Material hauling
▪ Dozer	1 nos.	Material placing
▪ Compactor - 9.2T Articulated tandem roller	1 nos.	Material placing
▪ Wheel loader	1 nos.	Material placing
▪ 45T long reach Track excavator with bucket	1 nos.	Core profiling and filter placing
▪ 85T long reach Track excavator with grab	1 nos.	Armour placing
▪ Heavy Duty Crawler Crane	1 nos.	Armour placing

Figure 22 – Earthwork Equipment

5.3.4 Environmental measures

Environmental measures are identical to the ones implemented for the construction of the access causeway.

5.4 Construction of the access trestle

5.4.1 Trestle overview

As the seabed is too steep and presents a 2m thick soft layer which makes a berm unstable past the -1mCD line, another way of access is required. In order to grant access from the end point of the access causeway to the location of the berth, a temporary road (trestle) is therefore constructed from the end of the access causeway (see sections 4.2 and 4.3) to the berth location.

This access trestle will be built bent by bent and create its own support by doing so: temporary piles are driven and steel deck installed on top of them to create a road as shown on Figure 21.

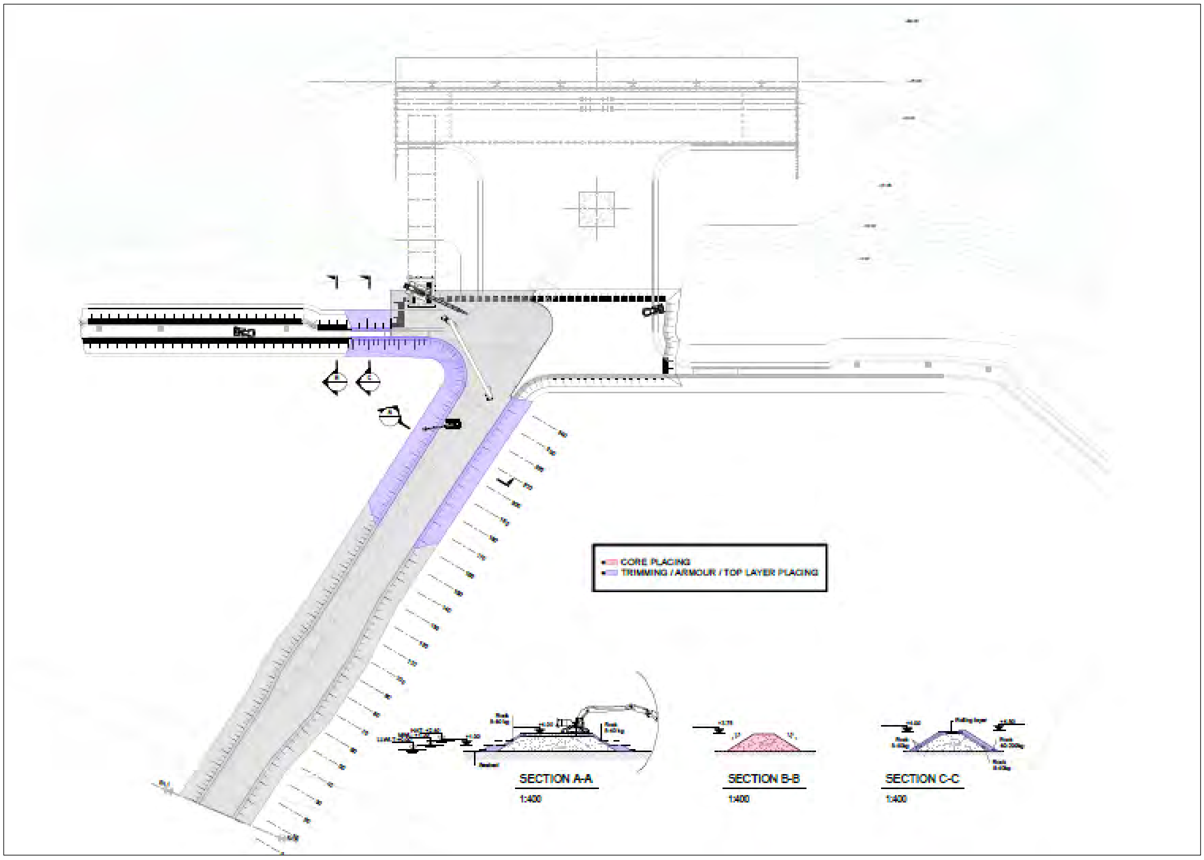


Figure 23: Trestle layout

5.4.2 Methodology

Ice removal

The ice needs to be removed prior to driving of the piles. In order to do so, work needs to be conducted directly from the ice. A Ditch Witch is used, to control the ice breaking process: a clear cut is made in the ice to create ice blocks. This would not be the case if an eccentric ripper was used, the direction of the cracks is less controlled. Although this may not be an issue when working from an alternate platform, this is not safe when equipment is sitting directly on the ice. Lifting lugs will then be drilled in the blocks which are then lifted out of the water and side casted by means of an excavator—also working from the ice.

Consideration has been given to potential movement of the ice after removal and to the ice re-growth process.

A 1m clearance will be kept around the piles. Each step of the construction methodology has been reviewed by an ice expert to identify potential hazards and to agree on the safest and most effective working methodology.

The ice will indeed be laterally stable (except for minor motions due to thermal expansions, contractions and possible creep motions if there is a strong sustained wind storm down the inlet). But will be moving vertically with the tides.

Figure 24: Ice cutting (Ditch Witch) and side casting

Installation of the trestle

The installation of the trestle piles is undertaken by free driving, meaning that no piling guides are used. The installation tolerances are therefore taken into account in the design of the trestle deck which is placed on top of the piles as per below working sequence:

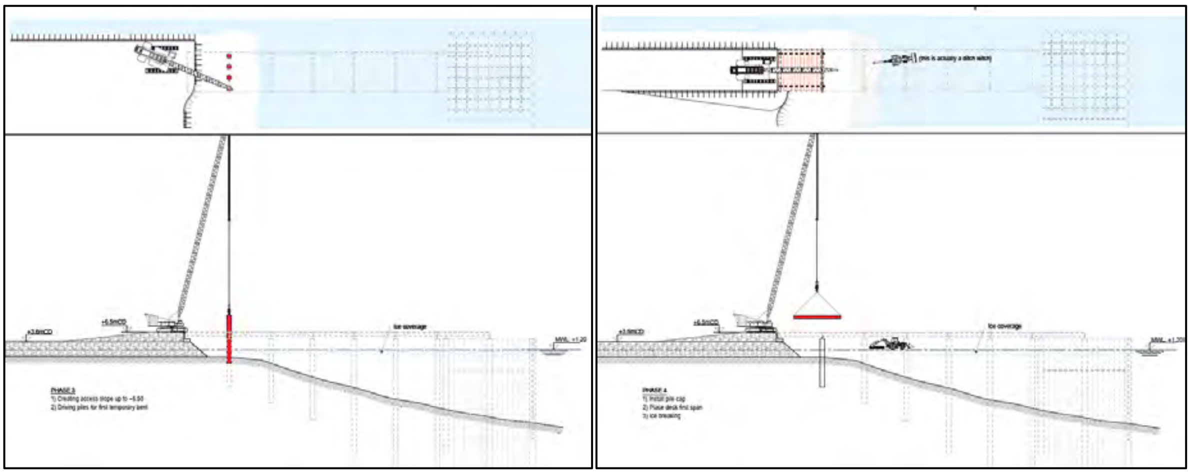


Figure 25: Trestle - sequence overview

Prior to the start of the piling works, an abutment will be installed, with the same equipment, at the starting point of the trestle in order to connect the first bent to the access causeway.

5.4.3 Required Equipment

▪ Ditch Witch	(1 nos.)
▪ Excavator	(1 nos.)
▪ Crawler Crane	(2 nos.)
▪ Impact hammer	(1 nos.)
▪ Vibro-hammer	(1 nos.)
▪ Artic power pack	(1 nos.)

For the exact list of equipment, reference is made to the Equipment List (BIM-BV-GE-EQ-LI-00027).

The piles are intended to be solely driven with the vibro-hammer but the impact hammer may be used in case of difficulty reaching the required penetration depth.

Figure 26 - Hydraulic hammer (left) , Vibro-hammer (midddle) & Crawler Crane (right)

5.4.4 Environmental measures

As part of the mitigation measure to minimize the environmental impact of the piling activities, a soft start procedure is implemented for the piling works. It consists of the following:

1. During installation of the pile and hammer on top of it, inspection is done by a appointed person to see if mammals are present in the area around the piling;
2. After the "Go Ahead" from the mammals observer, a round of approximately 5 blows is carried out at 20% (~20kJ) of the hammer energy;
3. Piling is interrupted for approx. 5 minutes, which allows cross checking of pile gates positions and mammals present in the neighbourhood to escape;
4. These steps (#2 and #3) are carried out four times at the same energy;
5. Then energy is increased up to the required final value (100 % of the hammer power) and continuing piling up to defined refusal.

This procedure will not be implemented between if there is less than 3 hours between the end of a piling activity and the start of a second one.

5.5 Piling works for the Ore Dock Berth

5.5.1 Overview

The 182m long Ore Dock Berth is made of a combi-wall (front wall) and solitary piles (rear wall) which are connected to the piles from the front wall by mean of tie-rods.

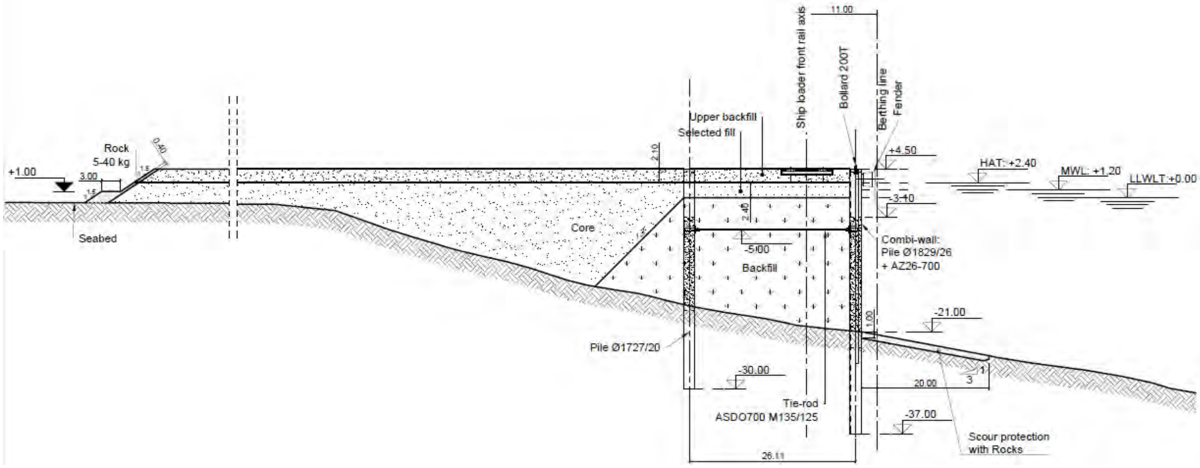


Figure 27: Typical quay-wall section (extract of CAN-BIM-BD-GE-DE-DW-00202_Rev00)

5.5.2 Logistics and platforms

Considering that the works will start before the ice break up period and continue through this period, Contractor uses a travelling platform which is mounted on rails themselves connected to the front and rear piles.

The sketch from Figure 12 details the working principle of the platform. The connection of the platform with the piles is done by mean of rail beams located in a notch (Figure 28) which is cut of the pile after pile driving.

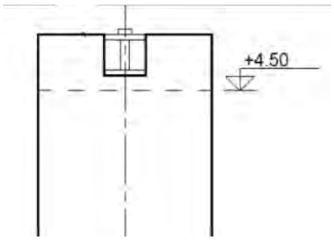
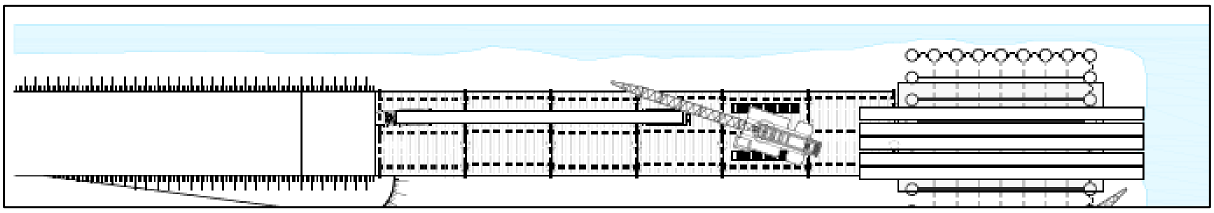


Figure 28: Notch for rail beam

After being shipped from abroad, the piles will be transferred directly from the coaster onto to the employer transport vessel, and from CCH to Milne Port Site. Piles will then be offloaded to be stocked and transported to the laydown area by the Employer.

The piles (and other items) will be brought from the laydown to the construction area using the same access trestle which is used for the construction of the first 6 piles of the berth (see section 4.3). They will then be loaded on a trolley (on boggy) by mean of a crawler crane working from the trestle platform.

Figure 29 – Example of trolley system



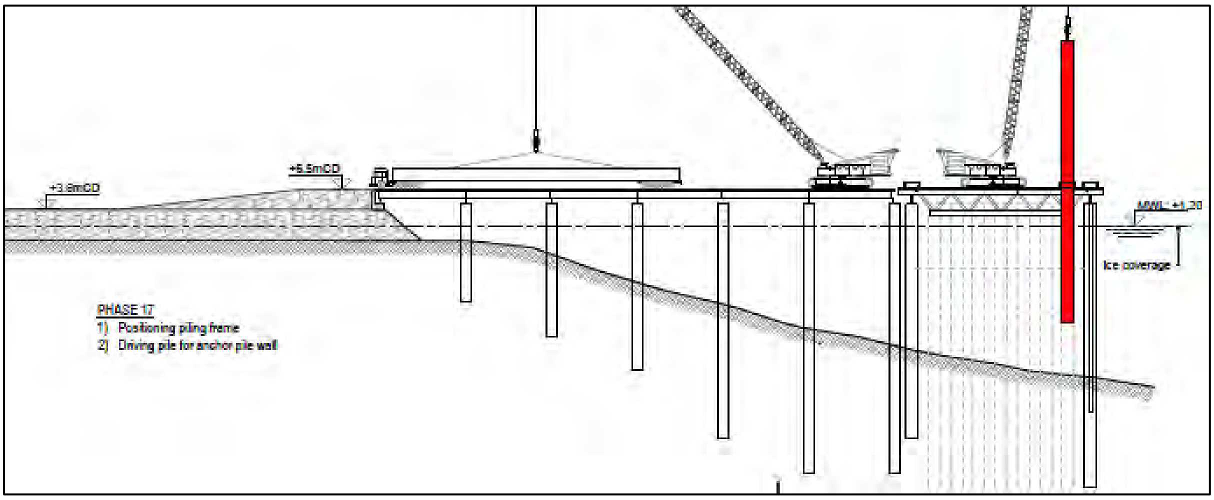


Figure 30: Pile logistics

The trolley is also used for other activities:

- Transport of piles, sheet-piles and tie-rods between temporary access or backfilled area and the piling work front;
- Storage of hammers in heated sea cans near the work-front
- Easy and safe movement of people between the piling work-front and the rest of the site; and,
- Storage of small tools, small office space and limited hygienic facilities near the work-front in sea cans that do not need to be moved as the piling front moves along;
- Removal of the soft layer following the piling front. This specific activity is further discussed later in chapter 5.6

The following terminology is used in this document when talking about these different items:

- Trolley : Used for transport of material on the berth and soft soil removal
- Travelling platform: Used for the piling, the heavy crawler crane is mounted on it

5.5.3 Methodology

5.5.3.1 Ice Removal

During the first part of the works, the ice needs to be removed at the pile location. This is done by implementing the same methodology than the one discussed in section Methodology.

The berth construction extends over the ice breaking period. Over the execution period, the ice thickness will decline from about 1.5 to 2m thick to none.

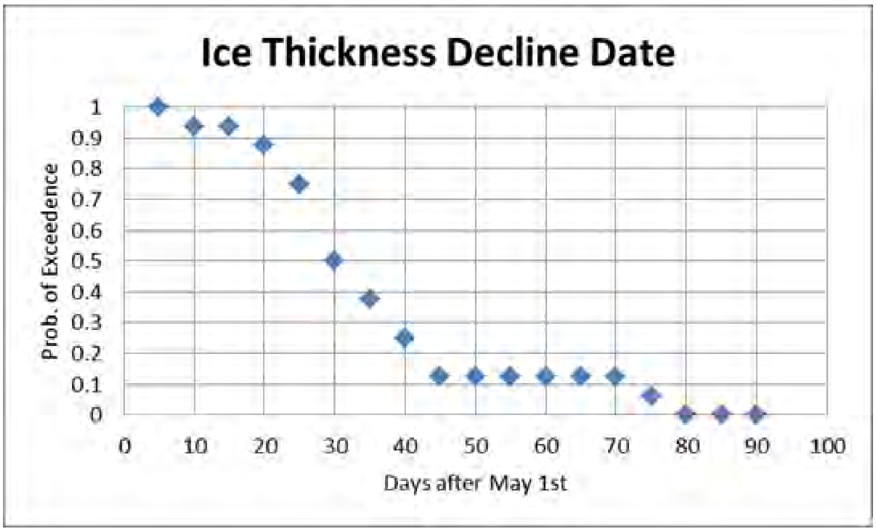


Figure 31 – Ice Thickness Decline Date

During the ice break-up period, heavy ice blocks standing in the way are moved with the help of an excavator from the trolley.

When the size of the ice blocks is thin enough, the piles are directly driven through the ice.

5.5.3.2 Piling

The following work sequence will be implemented (starting from travelling platform in position):

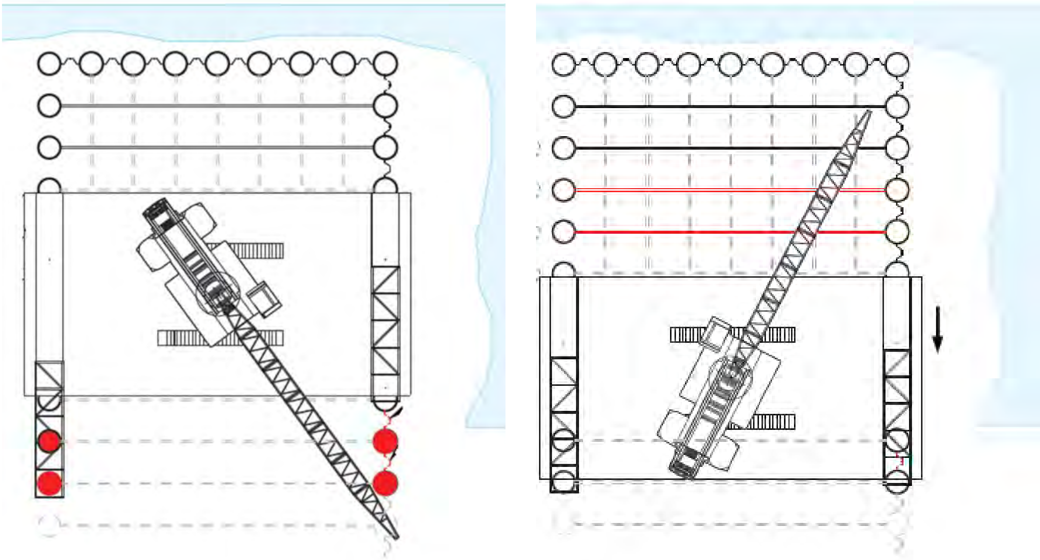


Figure 32: Berth installation Sequence

a) <u>Pile lifting and positioning in piling template:</u>

The crane installing the piles has two hooks.

The first hook is connected to quick releasing shackles which go through the two pre-drilled holes located at one extremity of the pile.

The second hook is connected to the other extremity of the pile by a lifting hook.

The two winches of the crane are used to adjust the length of the two wire rope slings separately, and progressively put the pile from horizontal on the mobile trolley to vertical position. Once in a vertical position, the pile is moved to the piling template.

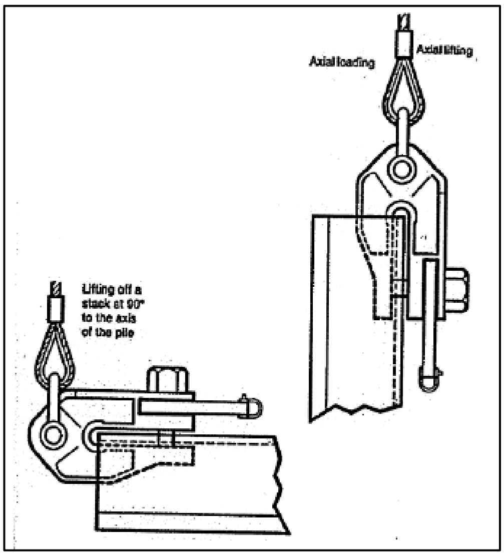


Figure 33 - Piles being lifted, with frame (left) & quick releasing shackles (right)

Fixed piling templates are used to position the pile and comply with the installation tolerances. The templates is connected to the travelling platform and travel with it.

Once the pile is vertical, the pile is subsequently placed in the piling template.

The pile is lowered through the piling template, allowing it to penetrate into the soft seabed materials under its self-weight. The quick-release shackles are then removed.

Each pile has clutches, that helps guiding them in the piling frames and block the rotation of the piles while driving.

b) Vibrating piles

The vibro-hammer is connected to the crane and placed over the pile.

The hammer energy and frequency are carefully monitored during all the driving operation. Record sheets are completed in accordance with the quality assurance and the quality control specific plan.

Latest driving analysis BIM-BV-GE-DC-TR-00027_Rev00 suggests that the pile can be driven to design depth using a vibro-hammer. However, in order to enhance the friction factor on the piles and to mobilize more soil to distribute the loads, the last meters may be installed using an impact hammer – step c).

4 piles (2 at the front wall, 2 at the rear wall) are lifted and subsequently vibrated before removing the vibro-driver and connecting the impact hammer.

The sequence is as follow:

1. Lifting, positioning, and survey of the pile (x1)
2. Connection of the vibro-hammer (x1)
3. Vibrating the pile (x1)
4. Disconnection of the vibro-hammer (x1)

5. Repeat steps 1 to 4 (x3)

c) Hammering of the piles to design penetration depth

Impact hammering of the pile is stopped when the pile reaches the design penetration. Based on driving studies, no early refusals are expected;

The hammer energy and the blow count per 25 cm penetration are carefully monitored during all the driving operation. Record sheets are completed in accordance with the quality assurance and the quality control specific plan.

The hammer is only connected once and the 4 piles are then driven one after the other to the design penetration depth. The impact hammer is then disconnected.

This sequence of work can be summarized as follow:

1. Connection of the impact hammer (x1)
2. Impact piling (x4)
3. Disconnection of the impact hammer (x1)

d) Piles cut-off

Piles are cut slightly above their final level (+4.5mCD) to position the rail beam above the top of the sheet piles, installed at step e). A notch (see Figure 28)is also made on the piles at that stage in order to allow for the installation of the rail beams at a later stage.

The workers access the piles by using the walkways which are provided along the piling template, connected to the travelling platform

e) Sheet-piling

Once the 2 front and rear wall piles have been driven (4 piles in total) the sheet-piles are vibrated in between the front wall piles.

The piling template walkways are used by the workers to help with the interlocking of the sheet-piles and do the cut-off subsequent to their installation when required.

The sequence can be summarized as follow:

1. lifting and positioning of the sheet pile
2. Connection of the vibro-hammer
3. Vibrating the pile to design elevation
4. Disconnection of the vibro-hammer
5. Repeat steps 1 to 4 for the second double sheet pile
6. cut-off sheet piles

f) Install beams and rails on piles ahead of the platform

The rail beam are then welded onto the piles. It is currently foreseen that a single weld on the outer sides of the pile is sufficient for transferring the platform loads. The rail beam will be removed and the piles cut-off to final level once the backfilling is done (see section 5.6)

g) Shift work platform forwards and positioning

Once the rail installed, the travelling platform is transferred to its new position, on the newly installed piles.

First the platform is disconnected from the berth, then it travels on the rails thanks to the bogies.

It is then re-connected to the berth, using the tie-rod guides – described in section 5.7 to make sure that it remains fixed during the installation process.

h) Installation of the supporting beam for tie-rods (x2)

When the travelling platform is in its new position, the 2 supporting beam are installed, connecting the rear to the front wall. This beams are serving 2 purposes:

- Supporting the actual tie-rod which is 26m long, quite thin, and only lowered to final level at a later stage (see section 5.7)
- Bringing rigidity to the structure which is useful for both the stability during the repositioning of the trolley and travelling platform on top of the piles and in case of accidental ice impact during the ice break-up period.

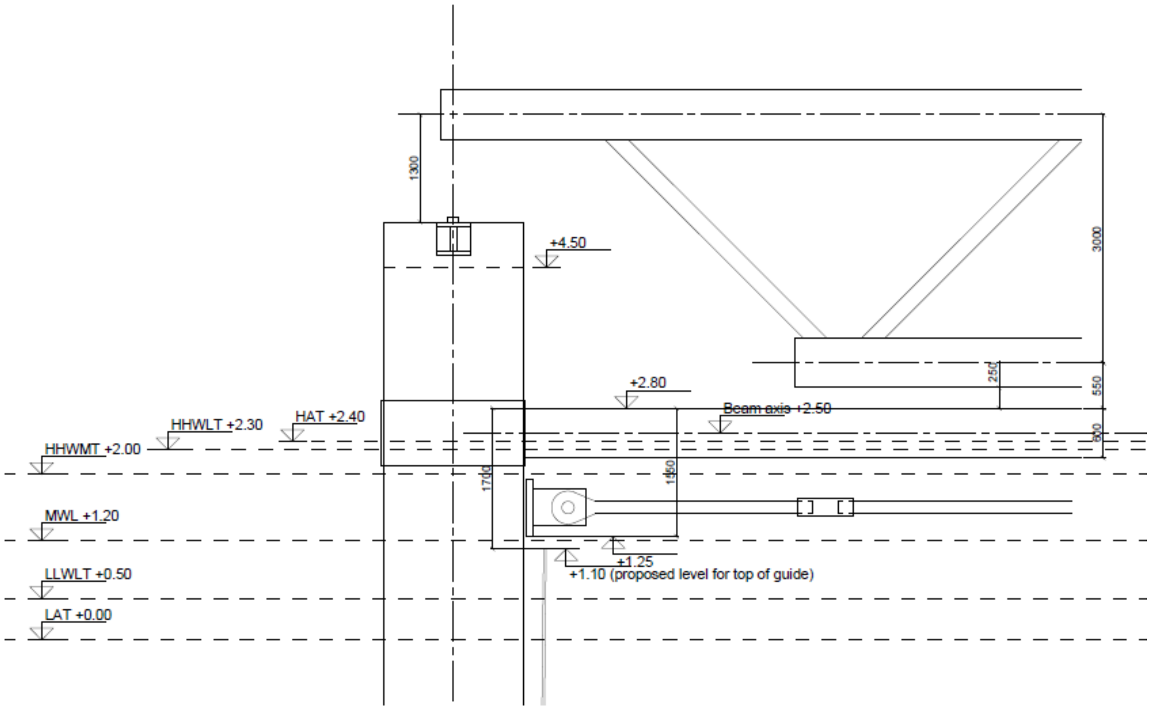


Figure 34: Supporting beam for tie-rods

5.5.4 Required Equipment

▪ Ditch Witch	(1 nos.)
▪ Excavator	(1 nos.)
▪ Crawler Crane	(2 nos.)
▪ Impact hammer	(1 nos.)
▪ Vibro-hammer	(1 nos.)

- Artic power pack (1 nos.)
- Travelling platform (1 nos.)
- Trolley (1 nos.)

For the exact list of equipment, reference is made to the Equipment List (BIM-BV-GE-EQ-LI-00027).

5.5.5 Environmental measures

In order to minimize the environmental impact of the noise during pile driving , the soft start procedure implemented for the construction of the access trestle and discussed in section Environmental measures5.3.4 is also implemented.

5.6 Backfilling works and soft soil removal for the Ore Dock Berth

5.6.1 Overview

Considering the heavy loads that will be applied on top of the berth and the stringent requirements associated with the ship loader installation tolerances, the soft layer (about 2m thick) will need to be removed from the berth area prior to the installation of the backfilling material.

The working methodology is summarized on below drawing:

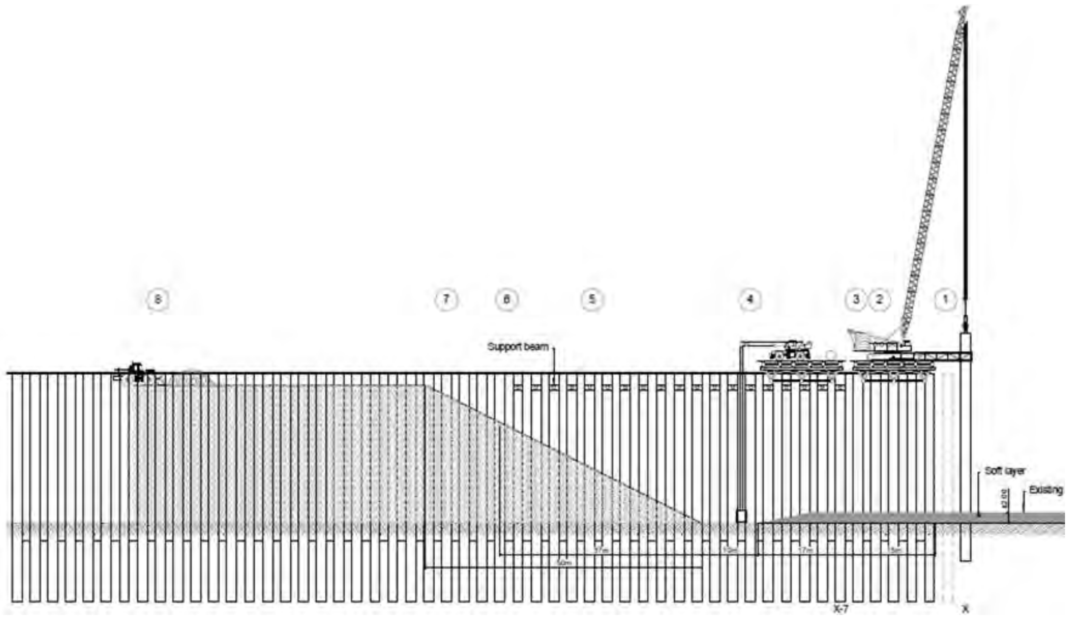


Figure 35: Berth Construction - Works overview

5.6.2 Methodology

5.6.2.1 Removal of the layer

The soft layer is removed as the piling front progress. This is done by mean of a suction pump (Heavy Duty Submersible Pump) which is connected to an all-terrain crane installed on top of the trolley when not used for the transport of piles. This trolley is mounted on bogies and therefore ensure the displacement along the quay wall length. The mobile crane will move the pump between the supporting beams.

The total volume of in-situ soft soil which will be displaced amounts about 10,000m3. When pumping it, water will be added to ensure a good fluidity of the material. The ratio between in-situ and pumped volume will be assessed during detailed design.

The soft layer will be relocated in an agreed location. The discharge line will frequently be repositioned, in order to avoid that too much volume is accumulating at one location.

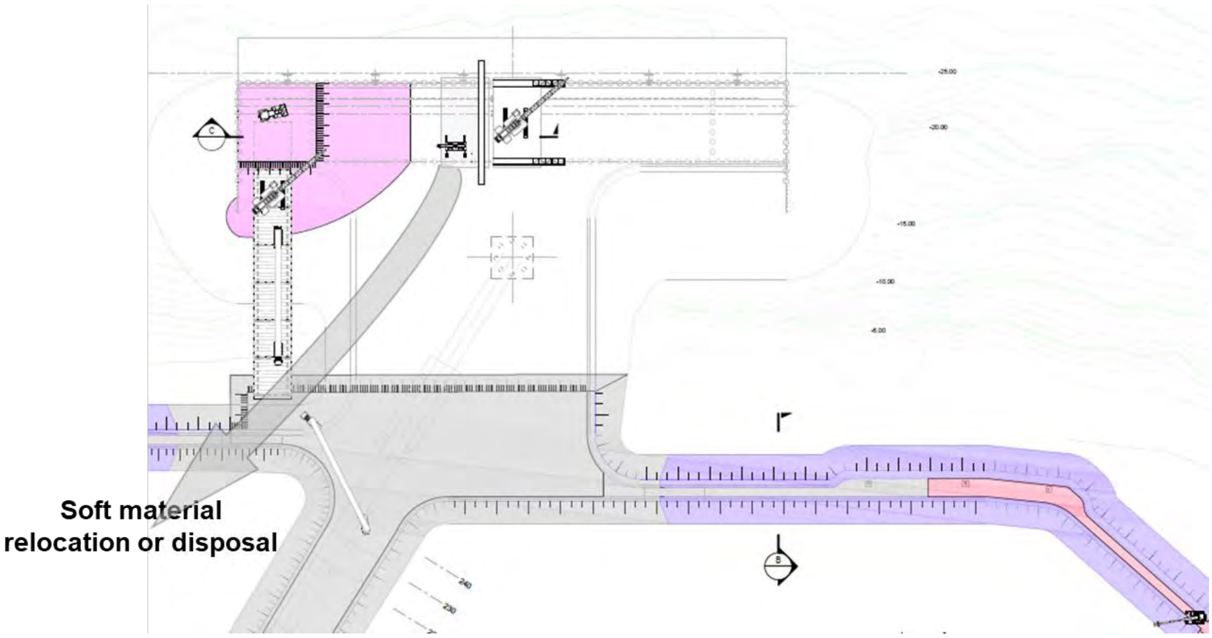


Figure 36: Relocation of the soft layer

5.6.2.2 Backfilling

Backfilling of the core material at the berth location is done using the same working methodology than the one described for the causeways (5.3.1). The trucks will use the access trestle at the beginning before a direct access is created with core material between the access causeway and the berth.

5.6.3 Required Equipment

- Wheel-loader (1 nos.)
- Excavator (1 nos.)
- Dump trucks (5 nos.)
- Compactors (1 nos.)
- Dozer (1 nos.)
- Mobile Crane – all terrains (1 nos.)
- Suction pump (submersible) (1 nos.)

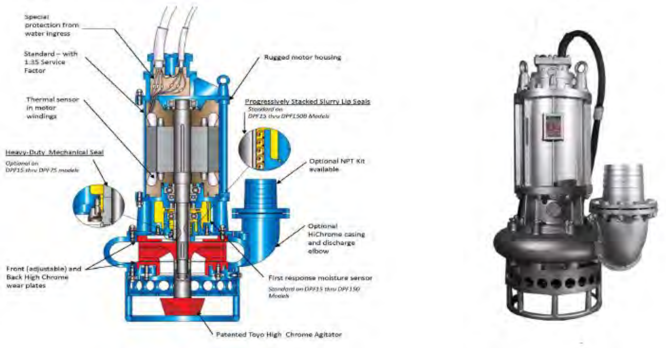


Figure 37: Typical Suction Pump

5.6.4 Environmental measures

The following measures are implemented in order to reduce the environmental impact of the works:

- During the ice break-up period: installation of a localized silt curtain
- After ice break-up: installation of a silt curtain under the full perimeter potentially impacted
- Fill pushed by dozer/excavator

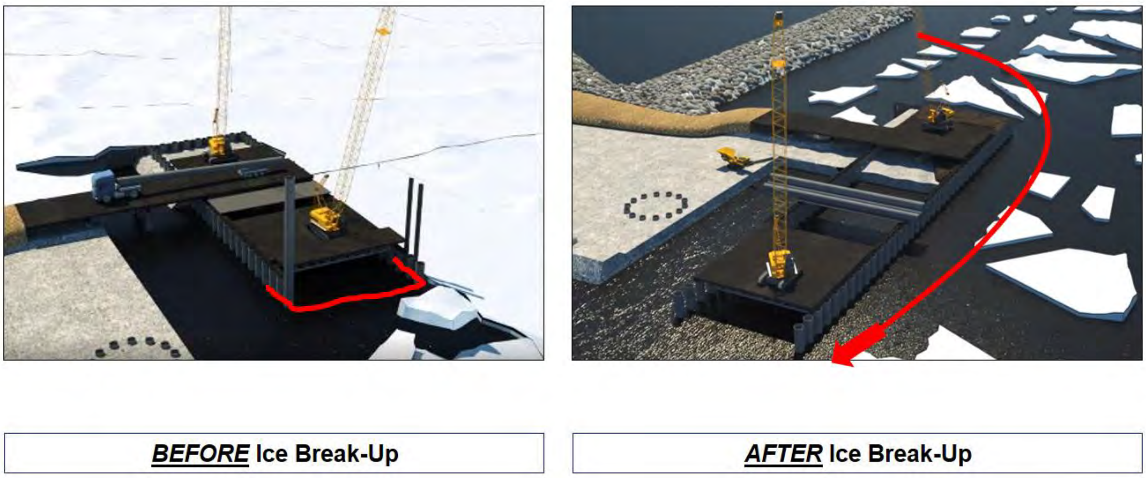


Figure 38: Silt curtain during and after ice break-up

5.6.5 Refuelling of the equipment

1

In order to reduce the time associated with the refuelling of the equipment and to limit the number of movement of the travelling platform, the fuel is pumped in a pipe from the trestle location to the travelling platform. This pipe is then connected to the equipment when refuelling is needed.

5.7 Installation of tie-rods for the Ore Dock Berth

5.7.1 Methodology

The installation of the tie-rods is strongly interacting with the piling works and backfilling works at the berth, respectively described in sections 5.5 and 5.6 :

1. After piling and before backfilling to tie-rod level (-5mCD), the tie-rods are suspended to the supporting beam described in section 5.6 , and shown in Figure 34.

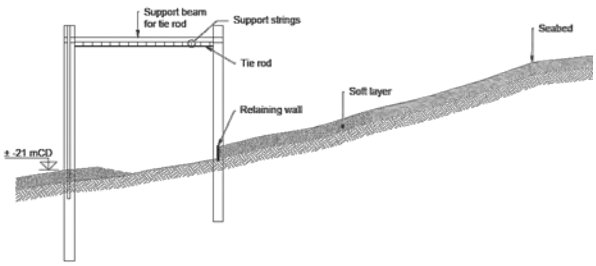


Figure 39: Installation of the supporting beam

2. When the backfilling has reached the tie-rod level (-5mCD), the tie-rods are lowered in their final position by using the sliding gates pre-installed on the piles.

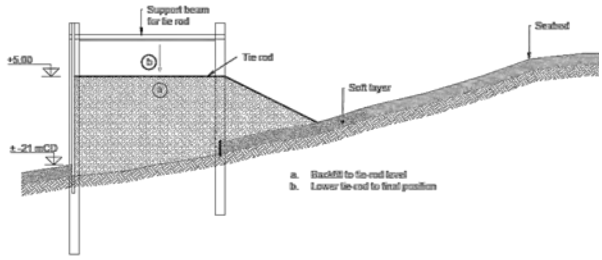


Figure 40: backfill to -5mCD and lowering of tie-rods level

3. The backfilling can then continue to reach the final backfill level. In the meantime, the tension is progressively released from the supporting beam (acting as a tie-rod at this point) and transferred to the final tie-rod.

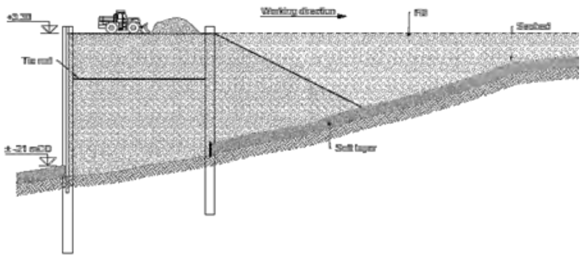


Figure 41: backfilling to final level and transfer of the tension to the tie-rods

This chapter mostly discuss the second point mentioned above.

5.7.2 Tie-rods details and installation tolerances

The installation of the tie-rods (at level -5.00m CD) will be done following the below steps:

a) A sliding gate will be installed at the outside of the piles before arrival on site, as well as a local strengthening inside the piles.

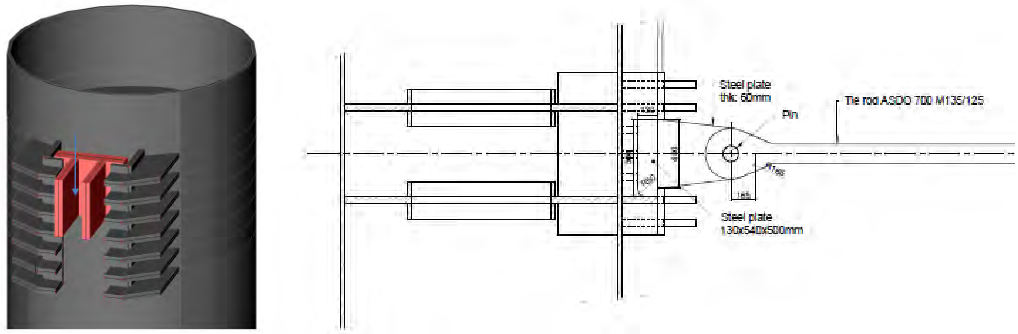


Figure 42: Sliding gate for tie-rods

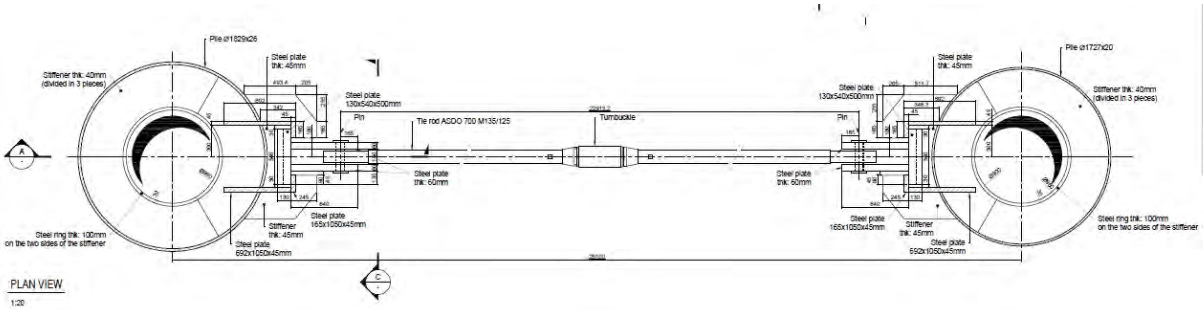


Figure 43: Tie-rod system

b) To be able to install the tie-rods in a fluent manner, the tolerances on the piles are very strict. Based on previous project experience, Contractor can ensure better tolerances when installing vertical piles than installing raked piles. Also, better tolerances are obtained because the piling will happen from a stable platform instead of a floating barge. To further improve the on-site tolerances, several measures have been foreseen:

1. <u>Pile rotation</u>: The piles are driven while being guided by clutches, ensuring the sliding gates for the tie-rods are at 90° on the combi-wall axis.
2. <u>Distance between front and rear pile</u>: A turnbuckle will accommodate potential (but limited) installation tolerances.
3. <u>Pile verticality</u>: based on previous project experience, good tolerances between the pile head as-built and the theoretical pile location can be expected. Because verticality is critical in this case, a piling frame with two different levels is used. The frames can still be adjusted once the pile is positioned in the frame, to obtain the pile in vertical position before the piling commences. Given the pile length, the remaining tolerance between the welded sliding frame and the tie-rod plate are big enough to capture minor verticality misalignment.
4. <u>Relative pile position along the combi-wall axis</u>: along the combi-wall axis, the piles will have a maximal misalignment of some centimetres. To capture this, at each end of the tie-rod a vertical axe is be built-in.

c) Respecting these precautions, the tie-rod will be slid through the guides already welded to the piles.

d) Final position of the tie-rods will be secured by divers.

5.7.3 Equipment

- Heavy Crawler Crane (to install the tie-rod supporting beams) (1 nos.)
- Travelling platform (to install the tie-rod supporting beams (1 nos.)
- Mobile Crane mounted on the trolley (to lower the tie-rod upon backfilling to -5mCD) (1 nos.)

5.7.4 Environmental measures

No specific environmental measures are implemented for this part of the scope of work as Contractor do not foresee any impact on the environment.

5.8 Infill for construction of the ship loader platform

5.8.1 Overview

The infill of the ship loader platform is only installed once a sufficient quay length is constructed in order to make sure that the latter acts as a retaining structure for the fill and thus cope with the stability issue discussed in Figure 9.

Below figure gives an overview of the interface:

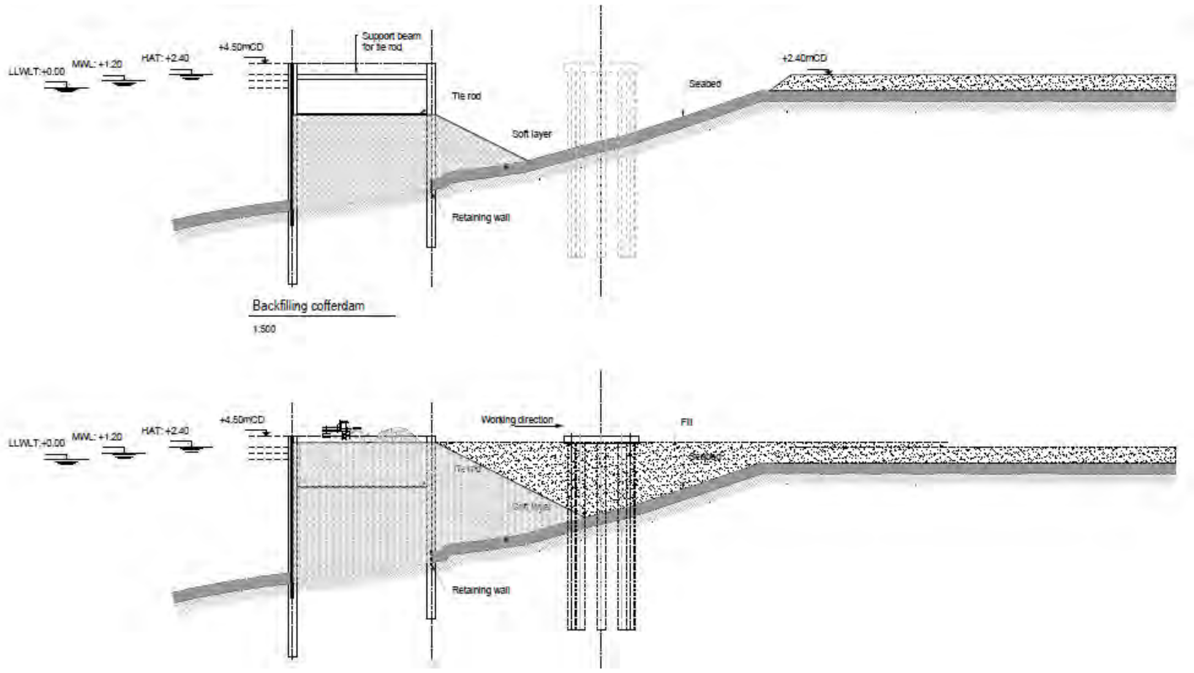


Figure 44: Infill for the construction of the ship loader platform

5.8.2 Methodology & Equipment

The methodology and the equipment used for the infill of the ship loader platform and for the installation of the protective armour rocks is the same as the one described in Section 5.3 - Construction of the main and secondary causeways.

5.8.3 Environmental measures

The following measures are implemented in order to reduce the environmental impact of the works:

- During the ice break-up period: installation of a localized silt curtain
- After ice break-up: installation of a silt curtain under the full perimeter potentially impacted
- Fill pushed by dozer/excavator

5.9 Other piling works (pivot point, monopole for bollards, etc.)

5.9.1 Execution of ship loader pivot point foundation piles

The installation of required steel piles at ship loader pivot point is done using traditional piling techniques. The piles are driven through the core fill (which is not too coarse at that location in order to facilitate the pile driving). The piles are first lifted and pitched with the vibro-hammer to refusal. If design depth is not yet reached then, an impact hammer is then connected to driven the piles to the design penetration depth.

5.9.2 Execution of Concrete for ship loader pivot point

Concrete for the ship loader pivot point consists in precast elements that are then installed by mean of a mobile crane and grouted to connect them to each other.

5.9.3 Execution of conveyor belt foundations

The fourteen precast concrete conveyor belt foundations are installed once the elevation of the causeway has reached its final top elevation, after settlement caused by possible melting of ice.

5.9.4 Execution of drive and tower foundations

The foundations for the drive and tower will are piled. For execution method, please refer to paragraph Execution of ship loader pivot point foundation piles5.9.1.

5.9.5 Execution of ship loader rail foundations

The ship loader foundations consists in precast elements (design as per associated calculation note and drawings). These precast elements are then installed by mean of a mobile crane and grouted to connect them to each other.

5.10 Concrete management

<u>Storage of Constituents</u>

Aggregates will be stored on a firm and clean substrate avoiding contamination with other constituents. Cement will be stored in silos.

Mix-in-Plant Method of Construction Using Volume Batching

The concrete will be produced in a stationary mixing plant that batches by volume and mixes in a forced action mixer, allowing sufficient time in the mixer to produce a homogenous mixture.

The concrete will be transported directly to the point where it is to be poured and protected from the weather during transit.

Cold Weather Working

The temperature of concrete shall not be less than -10°C (minus ten degree Celsius) at the time of laying; 1

In the case of heavy or persistent rain, production shall cease and any laid material shall be compacted immediately.

5.11 Completion of the quay wall construction

After all piles at the step above are installed, or when a determined reasonable advance is verified, execution of pile fill and pile caps will start. The fill in the piles exists out of:

- Sand fill: from seabed (var) to design level (-3mCD)
- Dry mix fill: from top of sand fill (-3mCD) to design level (+4mCD)
- Concrete pile cap: from top of dry mix fill (+4mCD) to top of pile (+4.5mCD)

For the execution of the works, several guidelines will be considered:

All the concrete works required at this stage are to be executed as per design to be developed by Contractor at appropriate time before execution phase, and following all specifications required.

Steel works and concrete works will be executed by qualified personnel, and for this concrete activities, a permanent team will be assigned.

The concrete required will be a fresh concrete produced at site (if pre-fabrication is not possible), and having in consideration the weather site conditions, measures will be adopted in order to control, minimize and ensure good quality of concrete executed, i.e. heating systems of batching, casting and curing must be consider, meaning that all the stages of concrete must be "controlled". As a general precaution, all in-situ concrete works are scheduled to take place in the summer months, where the site conditions will be similar to standard operations.

Depending on the design and requirements delivered by Employer, the Contractor will always try to execute it with pre-fabricated pieces, whenever possible or at least minimize the in situ-concrete required.

5.12 Finishing works (fenders, gangway, etc.)

The quay furniture will be installed after all other permanent works are executed, or whenever possible, when the execution of this elements does not clash or interfere with any critical path activity.

A full team will proceed with installation of all permanent quay furniture. At appropriate time, the materials will be transported to the work front. A dedicated team will take responsibility for installation. All operations during execution will be performed carefully so it avoids any temporary or permanent damage. Installation to be executed in respect with preconized in detailed installation drawings. Most quay furniture will be installed during summer months, to eliminate weather related downtime. Site organization, demobilization and cleaning will follow.

5.13 Scour Protection

The Scour protection is to be executed as protection of the seabed layer under the mooring vessels. As a design requirement, the scour protection in the first 15m next to the quay needs to consist out of rock.

The rock scour protection consists of different layers. For the exact built-up of this part, please refer to the relevant design note.

The layers with the smallest rocks can be placed with a clamshell, the largest rocks will be positioned by a crawler crane equipped with a grab.

Section 6 - Summary of the environmental measures

6.1 Earthworks

3 main periods have been identified for the earthworks and associated environmental mitigations:

1. When the ice is land-fast (mid-winter):

   Earthworks carried out during this period will be done in the shallow areas, the ice will act as the barrier similar to the silt curtain in shallow water (see Figure 18).

2. During the ice break-up period: installation of a localized silt curtain
3. After ice break-up: installation of a silt curtain under the full perimeter potentially impacted

Whatever the ice conditions, the fill is pushed by dozer to limit the sedimentation flow.

A spill containment plan will also be implemented.

Figure 45: Typical installation of a silt curtain

6.2 Piling

As part of the mitigation measure to minimize the environmental impact of the piling activities, a soft start procedure is implemented for the piling works as detailed in section 5.4.4.

6.3 Refuelling of the equipment

In order to reduce the time associated with the refuelling of the equipment and to limit the number of movement of the travelling platform, the fuel is pumped in a pipe from the trestle location to the travelling platform. This pipe is then connected to the equipment when refuelling is needed.

The other equipment will be directly refuelled using a fuel truck.

6.4 Summary

Causeway Construction:

Risks/Actions/Mitigations

Intention	Risk	Action
Ice Removal		
No wreck in the water	Seabed disturbance	Minimize works from the ice
Keep the ice clean	Fuel spillage on the ice	Minimize works from the ice Implement spill containment plan
Backfilling		
Minimize sedimentation flow	Water environment disturbance	Fills pushed by dozer/excavator Controlled progress of the works

Berth Construction and infill for ship loader platform:

Risks/Actions/Mitigations

Intention	Risk	Action
Ice Removal		
No wreck in the water	Seabed disturbance	Minimize works from the ice
Keep the ice clean	Fuel spillage on the ice	Minimize works from the ice Implement spill containment plan
Soft Soil removal and disposal		
Limit impact on existing seabed	Soil disturbance	Minimize footprint of the works
Minimize sedimentation flow	Water environment disturbance	disposal within artificial lake
BackFilling		
Minimize sedimentation flow	Water environment disturbance	Fills pushed by dozer/excavator Ice Present : localized silt curtain After ice-break-up season: silt curtain
Piling		
No impact on mammals	disturbance / harm to mammals	Pile driving *Soft Start* implementation
General		
No work in the water	Seabed disturbance	Work from well studied platform
No fuel spillage	fuel spillage when refueling	Refueling/spillage plans

Section 7 - Logistics

This section gives an overview of the logistical aspects of the site. For more details reference is made to Contractor's Procurement and Logistics Plan (BIM-BV-GE-PR-PL-00017) which also prevails in case of discrepancy between the two documents.

7.1 Overview

Equipment and materials will be source domestically and internationally. Some equipment and materials will be shipped directly to Milne Port and some materials and equipment will be transported to Port Valleyfield. From Port Valleyfield, the freight will be transported to Port Milne by the Employer's Sealift.

The below lists are not exhaustive but show the general intent of the delivery logistics.

1. Equipment and materials being shipped to Port Valleyfield:
   - Earthworks equipment
   - Cranes
   - Small Tools and Equipment
   - Vehicles
   - Site Facilities
   - Sectional Float
   - Consumables
   - Marine Furniture
   - Temporary and Permanent Structural Steel
2. Equipment and Materials being shipped to directly to Milne Port
   - Pipe Piles
   - Sheet Piles
   - Tie-rods

The Contractor (or the supplier) will break bulk transport large equipment and materials directly from the the supplier to Port Valleyfield or Milne Port. Because these items are large and are sole sourced through a limited number of suppliers, the management of this process can be performed from one of the Contractor's regional offices (Vancouver, Toronto, or Brussels).

Management of containerized items will require extensive oversight because these items come from multiple suppliers, are of larger quantities, and require more labour and equipment to handle. The Contractor plans to manage the procurement, receiving, packaging, inventorying, and containerization of small items in North Vancouver at Vancouver Pile Driving Ltd.'s (Vanpile) yard where labour, equipment, and supervision are readily available.

7.2 Mobilization in North Vancouver

The Contractor will procure small equipment and materials in Western Canada and they will be transported to Vanpile's yard. The items will be received, inventoried, stored, packaged (if necessary), and loaded into shipping containers. The containers will be trucked to a local rail yard then transported by rail to Montreal. Once in Montreal, the containers will be trucked to Port Valleyfield. The Contractor will have complete oversight of the activities in Vanpile's yard and the Contractor believes that this will be a benefit to the project because it will reduce the risk of equipment and materials not being on site. Where feasible, the Contractor will request suppliers to containerize items for direct transport to Port Valleyfield.

7.3 Packing, Marking, and Shipping

The Contractor realizes the criticality of proper packing, marking, and shipping. Document *Attachment J - Packing Marking and Shipping Requirements - H353004-00000-350-078-0002 Rev 0* provided in the project specifications will be provided to suppliers and implemented by the Contractor during mobilization. Along with this document, the terms and conditions of the individual purchase orders will outline any special requirements the Contractor asks of the suppliers.

7.4 Receipt of Materials at Port Milne

The Contractor will have personnel at Port Milne when equipment and materials arrive via the Sealift or by other vessels. The Employer will offload the Sealift or other vessels and move the equipment and materials to the Contractor's laydown area. The Contractor's personnel will assist with placement and storage of the items as they are received from the Employer's forces.

7.5 Laydown Area

Appendix B - Laydown Area shows the current configuration of the Contractor's laydown area. The Contractor will have an office building, lunch trailer, and wash cars. Once construction progresses and if space permits, a mobile wash car and lunch trailer will be placed closer to the work front (eg. ship loader platform) to increase efficiencies for breaks. The main office trailer will also have a first aid room and light plants will be situated throughout the laydown area during night-time hours. Water will be delivered and removed by the Employer along with non-construction waste. Construction waste and hazardous waste will be managed and isolated in specific areas.

Two or three shelters will be erected for equipment maintenance, repairs, and the storage of temperature sensitive items. These shelters will be heated and be equipped the tools and equipment necessary to facilitate equipment support activities. The Employer will transport workers and staff to and from the camp accommodations. From the laydown area, workers and staff will use Contractor supplied trucks and vans to transport the workers to their work fronts.

The laydown area will store all Contractor supplied equipment and materials until they are required at the work front. Materials will be transport from the work front with flatbed trucks or specialized trailers for longer items (e.g. pipe piles). A 250 tons crawler crane and a smaller rough terrain crane will be stationed in the laydown for load-out operations. In order to utilize the laydown area efficiently, materials will be stacked when practical. The pipe piles will be stacked in 2 or 3 rows and cradles will be used to ensure the stacks are stable and access is safe for workers. Sheet piles and sectional floats will also be stacked to minimize footprints.

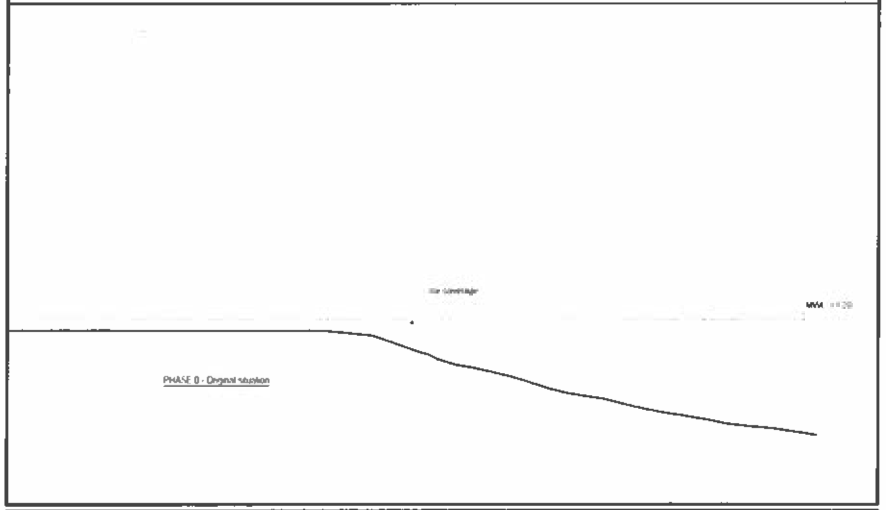
Although not specified by the Employer, the pink hatched area in Appendix B - Laydown Area is proposed by the Contractor as additional area for the Contractor's use.

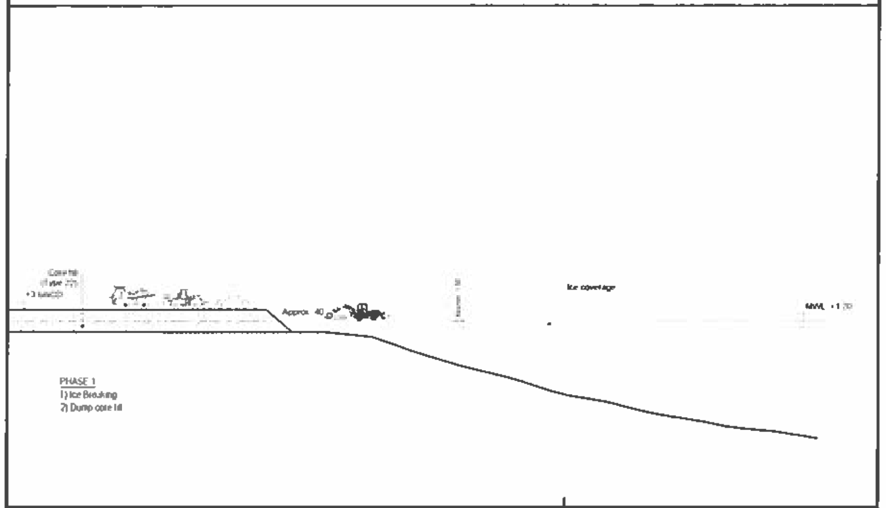
7.6 Demobilization

Upon project completion, the Contractor will disassemble all structures, containerize all materials, and prepare all equipment for transport. The Employer will move all items from the Contractor's laydown area to the Employer's staging area until the items are ready for transport. If equipment and materials are required to remain on site longer than anticipated, an agreement between the Employer and Contractor will be made when to demobilize the Contractor's laydown area. When ready, the Employer will load equipment and materials onto the Sealift and the items will be transported to Port Valleyfield. From Port Valleyfield, the Contractor will either return equipment to suppliers, transport it to Vanpile's yard, or to another destination to be determined at a later date.

Appendix A - Drawings

- Sequence of work (step by step) BIM-BV-GE-MS-DW-00006
- Sequence of work Typical section (Berth) BIM-BV-GE-MS-DW-00007
- Backfilling sequence BIM-BV-GE-MS-DW-00105
- Piling and Backfilling Works – Berth and Causeway Sections BIM-BV-GE-MS-DW-00106





REFERENCES

NOTES
- Coordinate grid is UTM (NAD83) zone
- All elevations are in metres relative to Chart Datum (mCD)
- All dimensions are in metres unless stated otherwise

REVISION	DESCRIPTION	DATE
0B	Update	27-Nov-2017
0A	First issue	10-Nov-2017

CONTRACTOR:
BESIX
VANCOUVER PILE DRIVING

ENGINEER:
HATCH

CLIENT:
Baffinland
Iron Mines Corporation

PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Sequence of work

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	DLO	SRE	FAB
SCALE 1 500	SIZE A1	DATE 21-Nov-2017	

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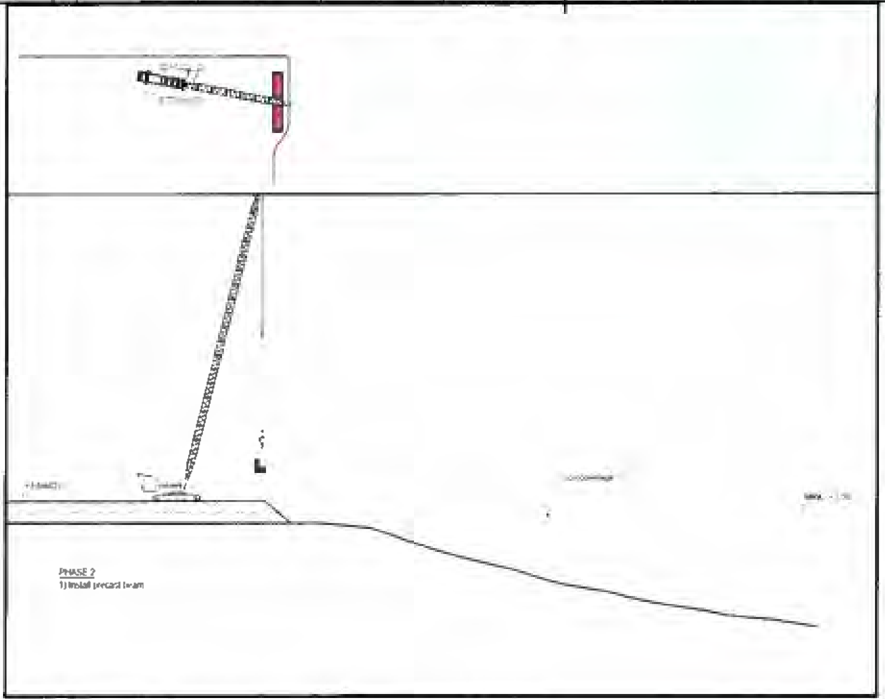

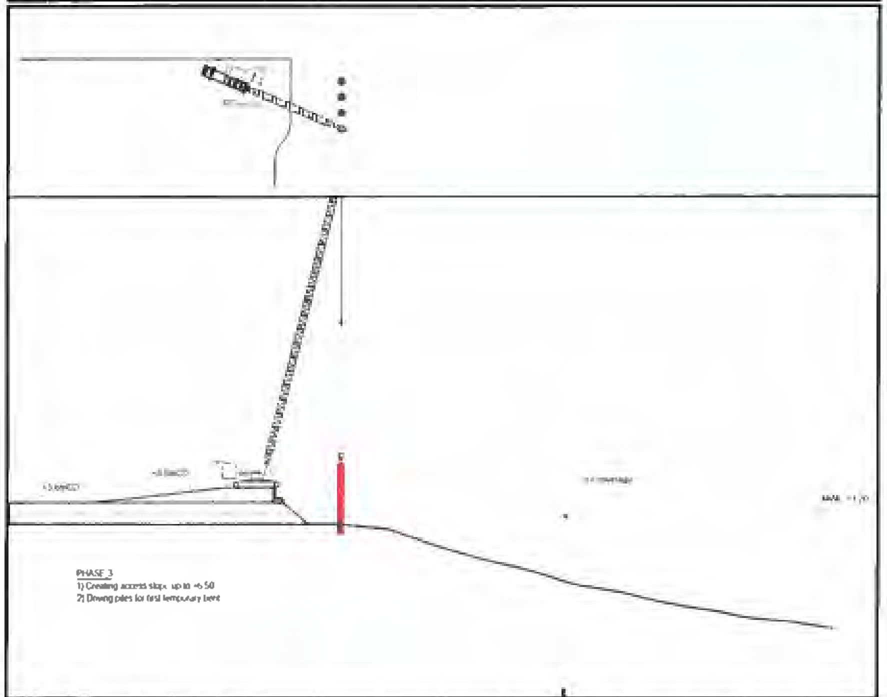

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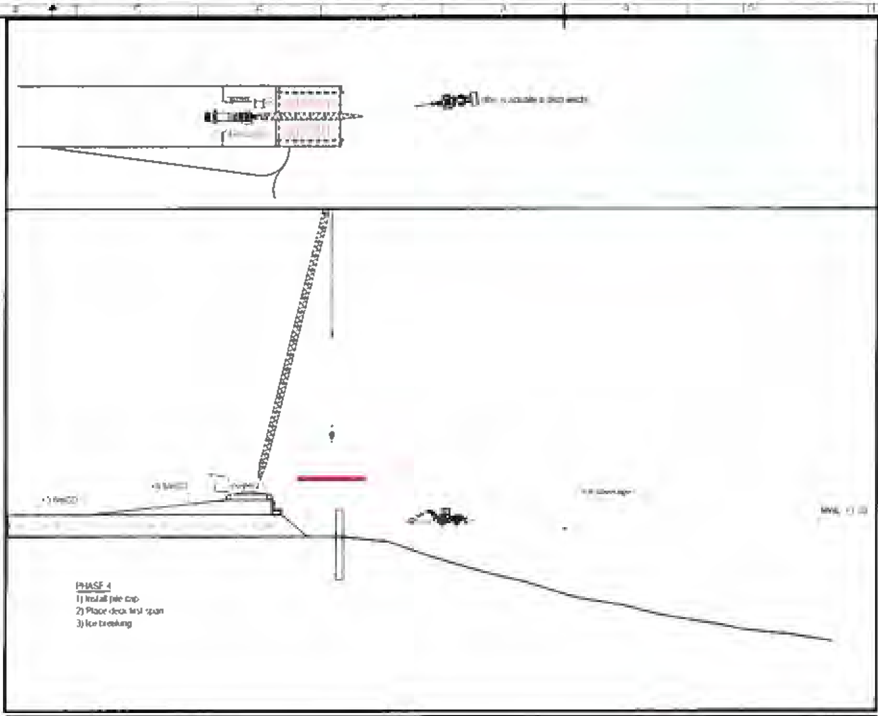
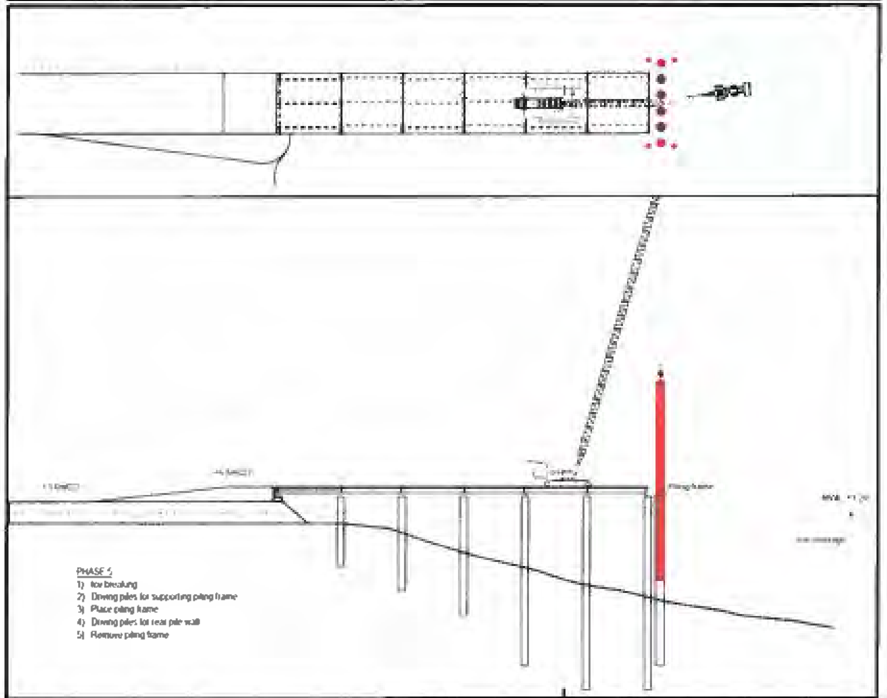


PHASE 4
1) Install pile cap
2) Place deck first span
3) Ice breaking



PHASE 5
1) Ice breaking
2) Driving piles for supporting piling frame
3) Place piling frame
4) Driving piles for real pile wall
5) Remove piling frame

REFERENCES

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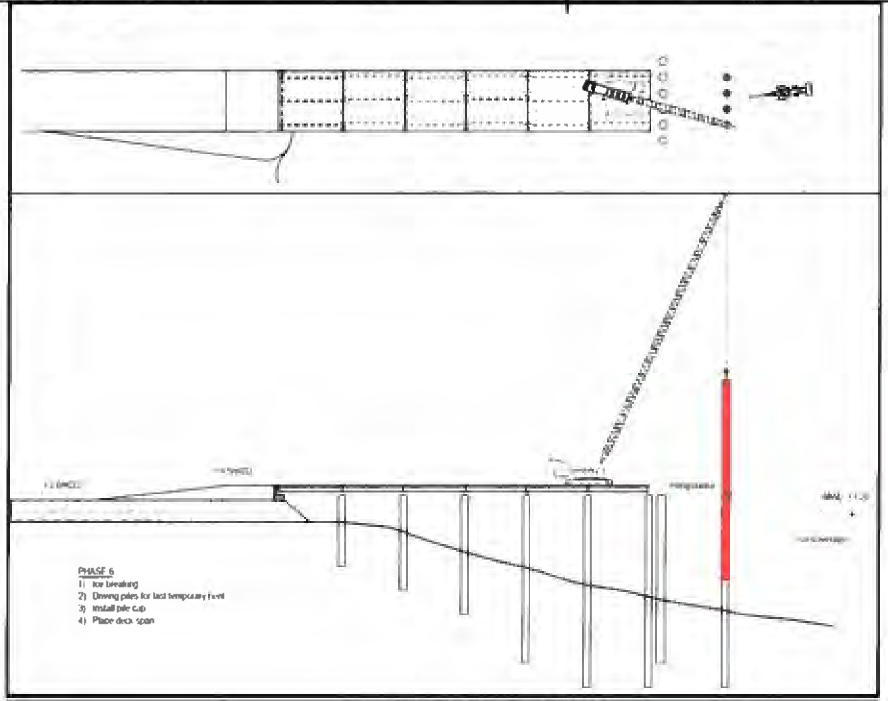
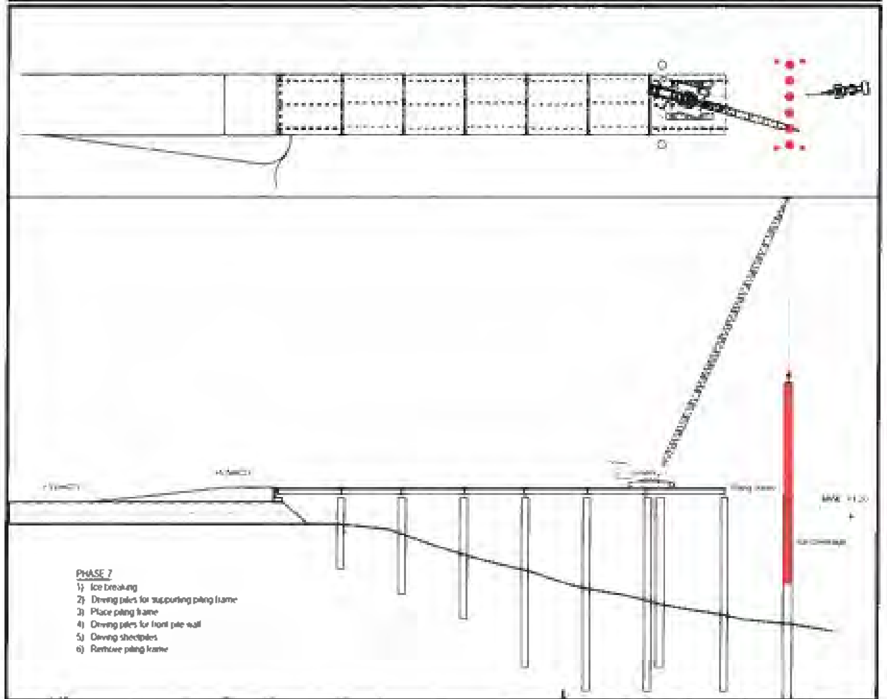


PHASE 6
1) Ice breaking
2) Driving piles for last temporary bent
3) Install pile cap
4) Place deck span



PHASE 7
1) Ice breaking
2) Driving piles for supporting piling frame
3) Place piling frame
4) Driving piles for front pile wall
5) Driving sheetpiles
6) Remove piling frame

REFERENCES

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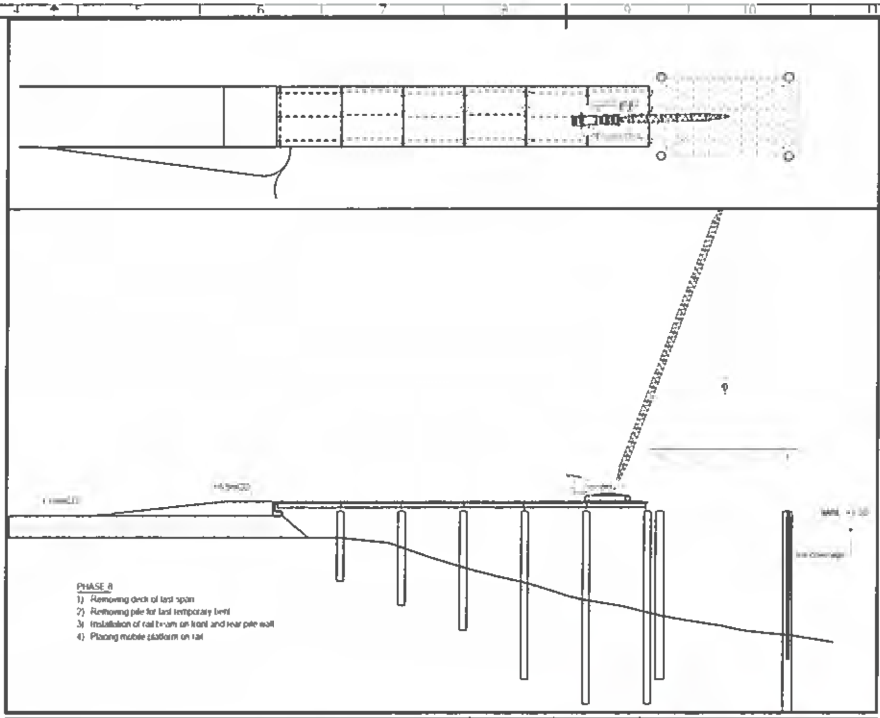

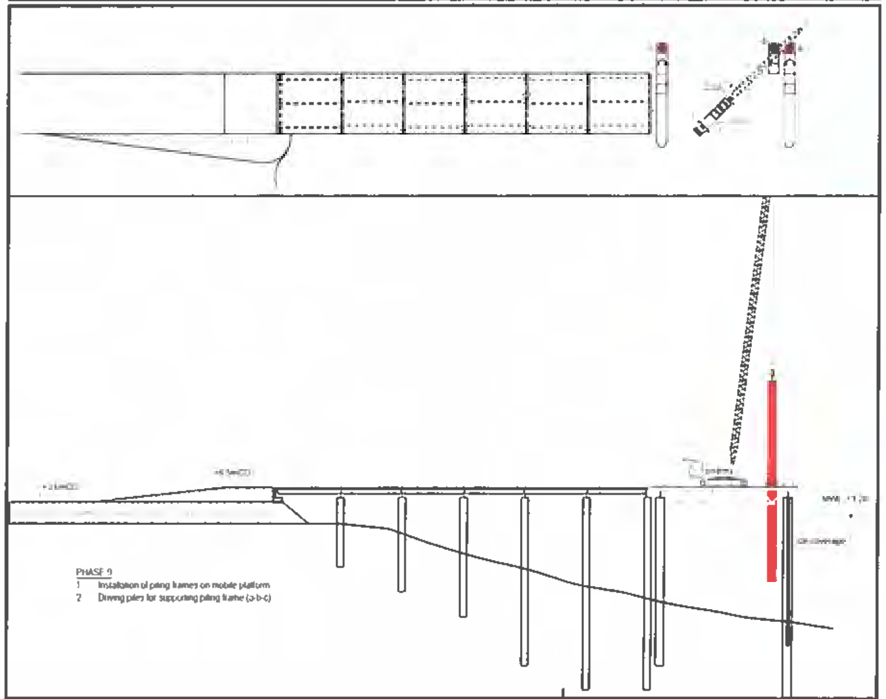

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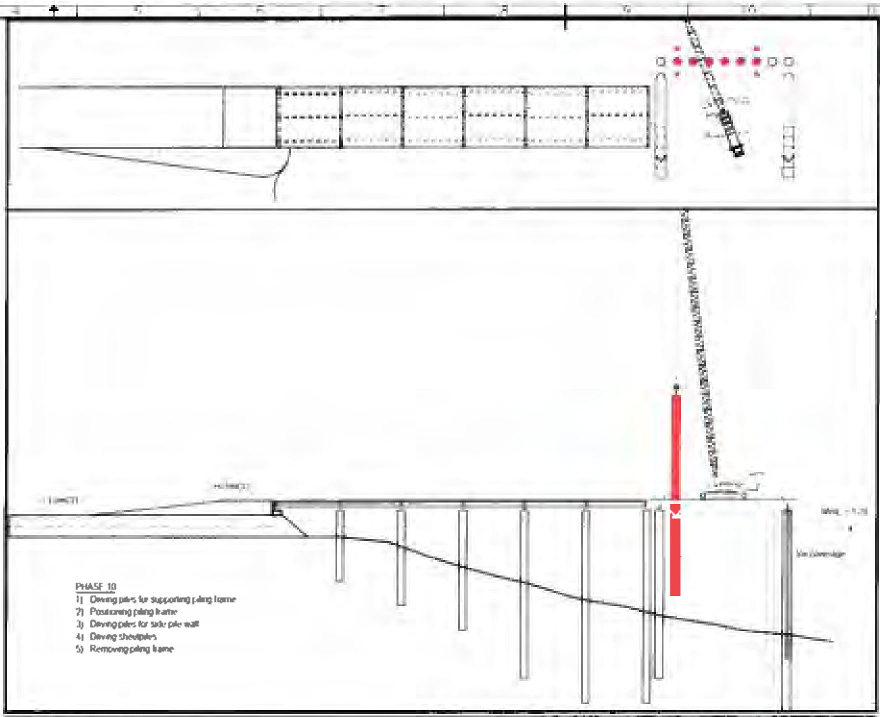

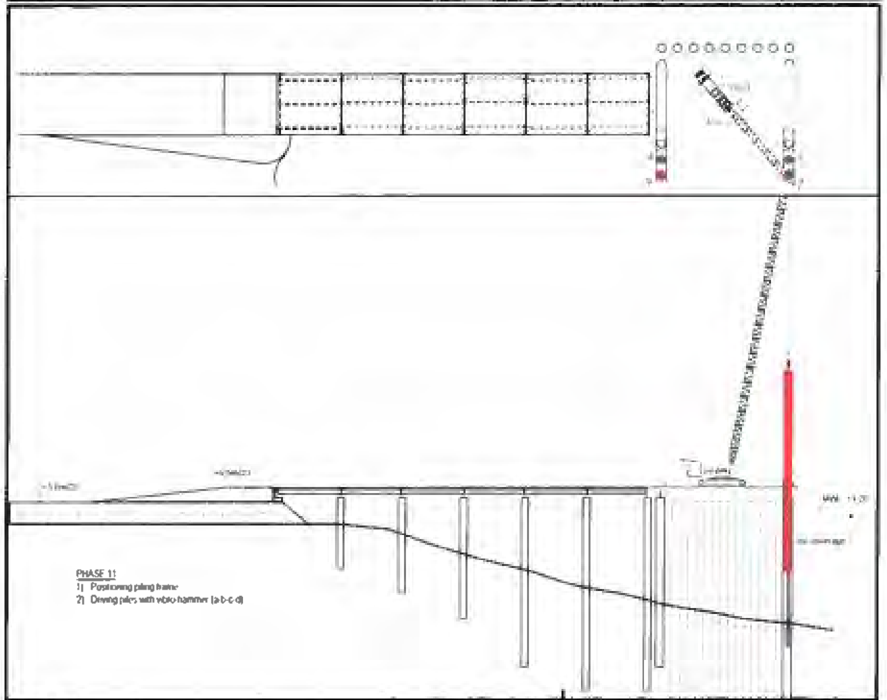

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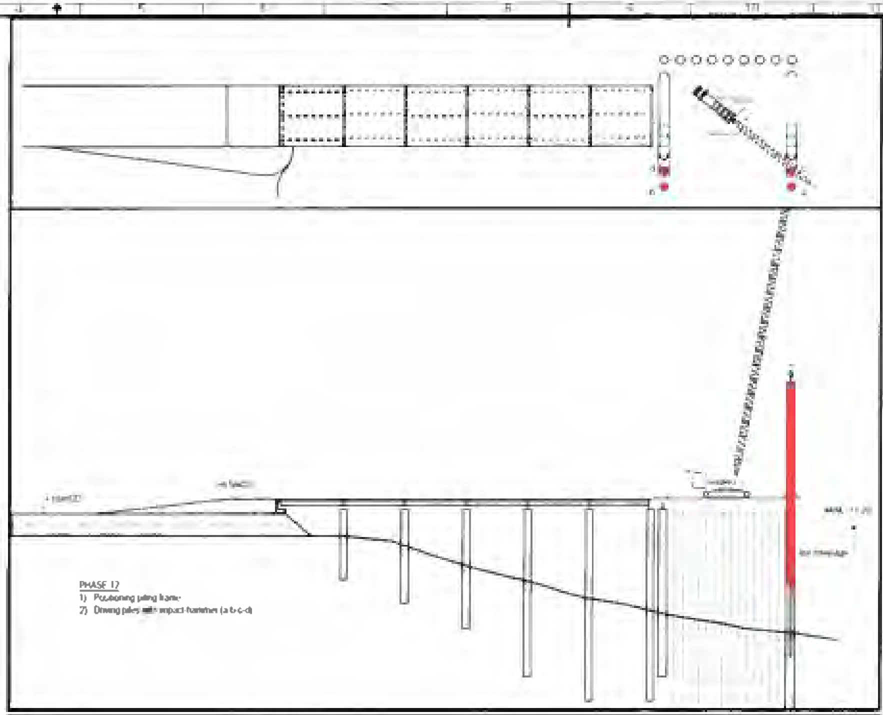

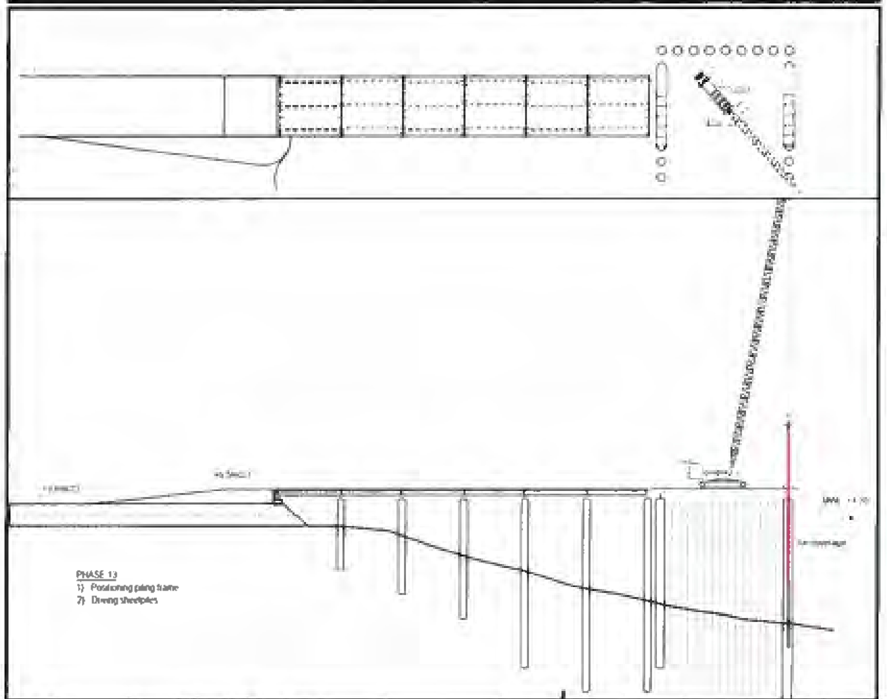

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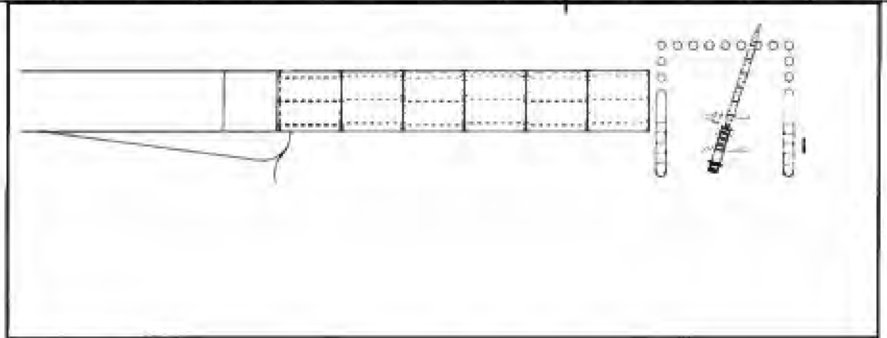

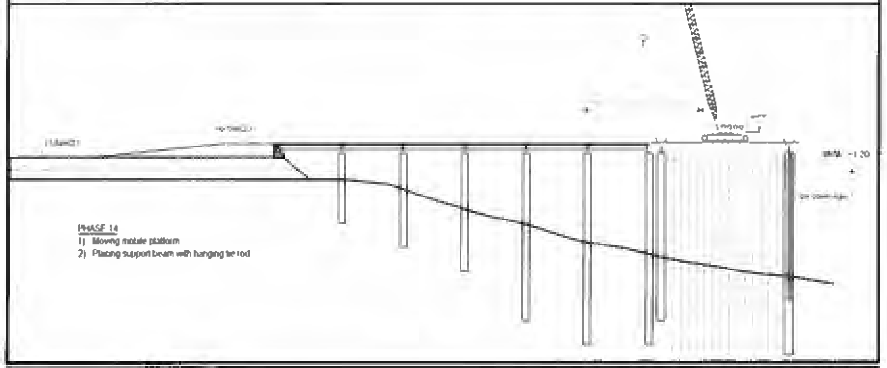

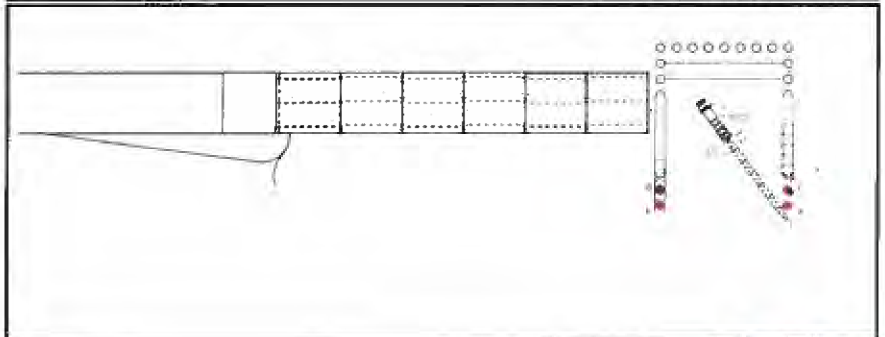

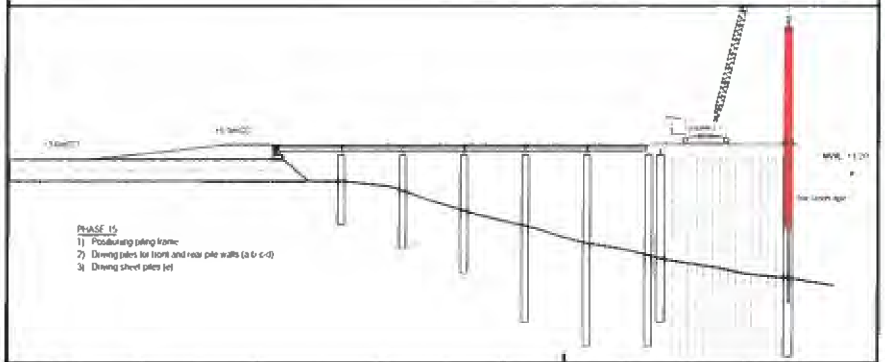

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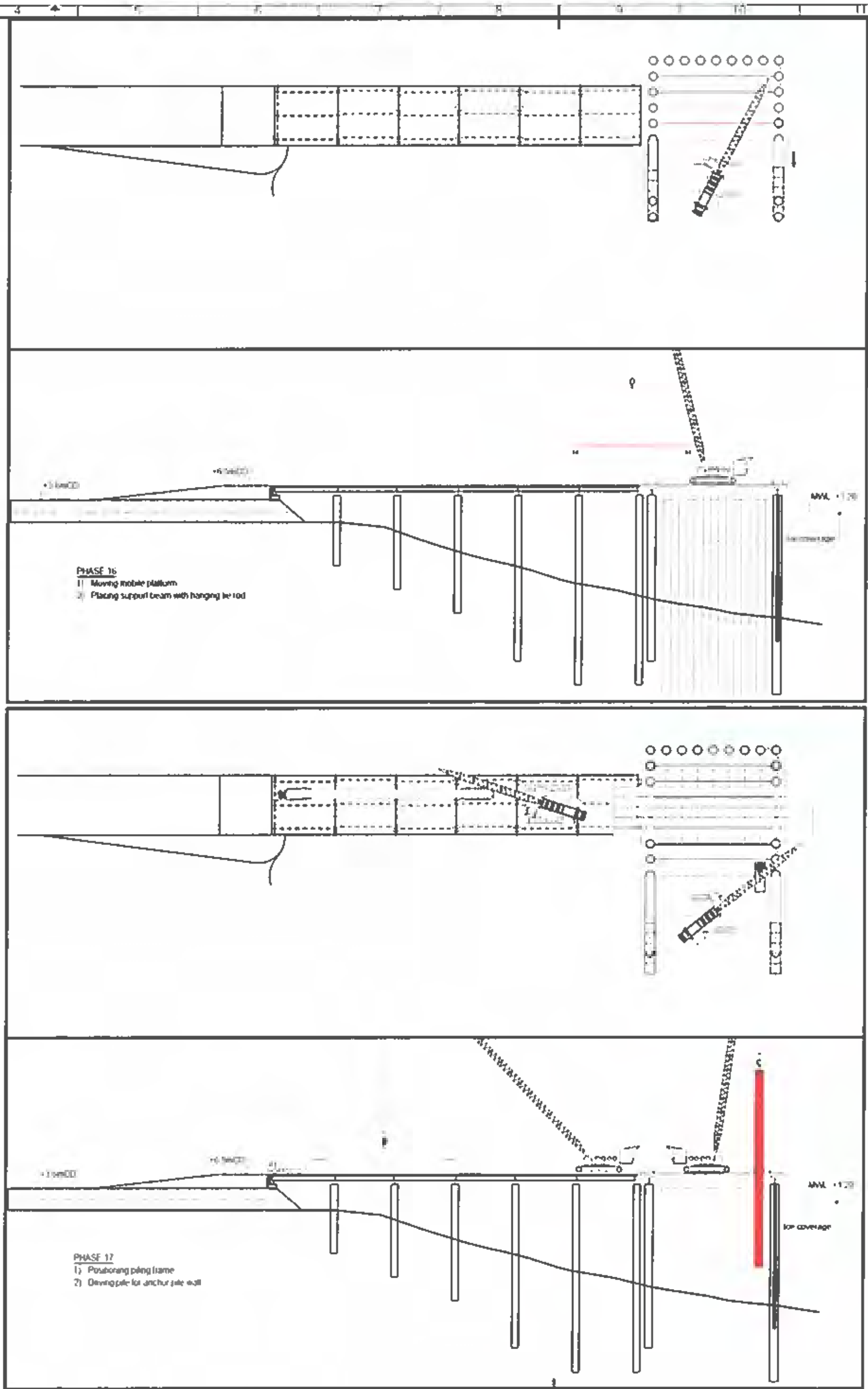

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ENGINEER:

HATCH

CLIENT:

Baffinland Iron Mines Corporation

PROJECT:

MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE

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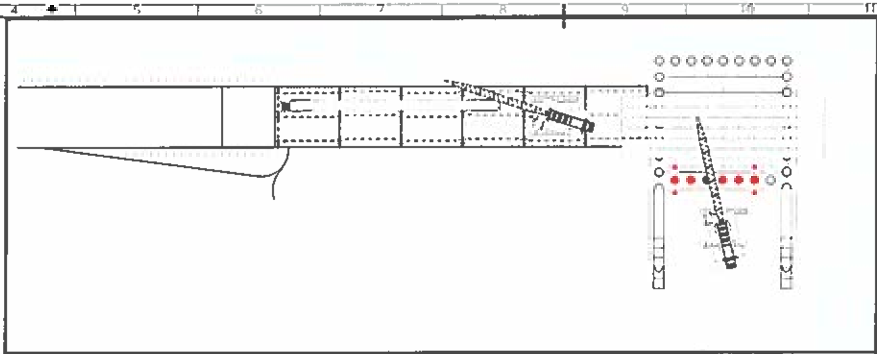

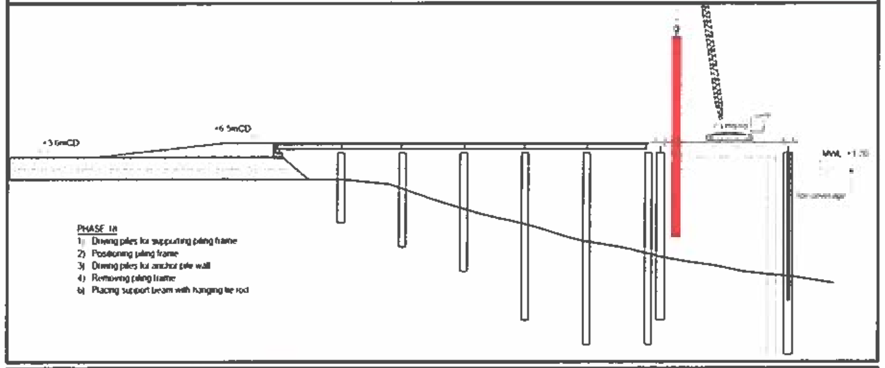

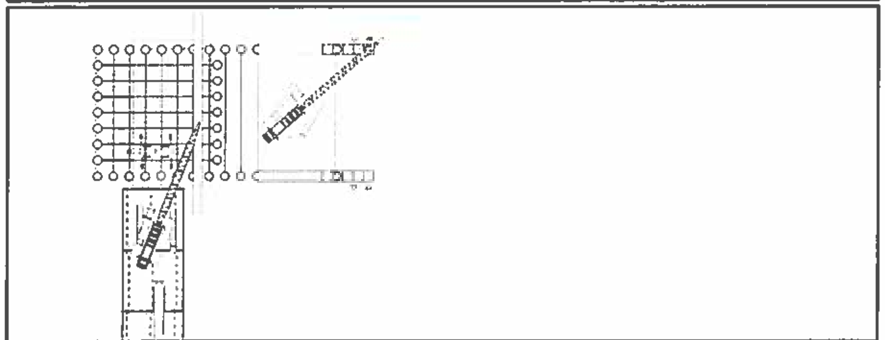

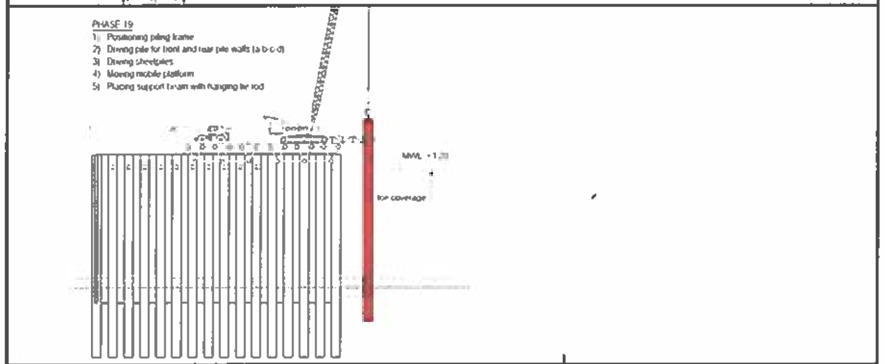

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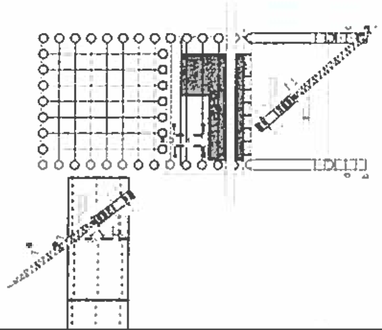
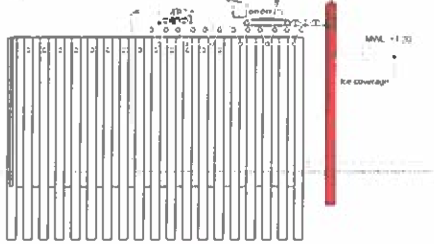
1:500	A1	21-Nov-2017

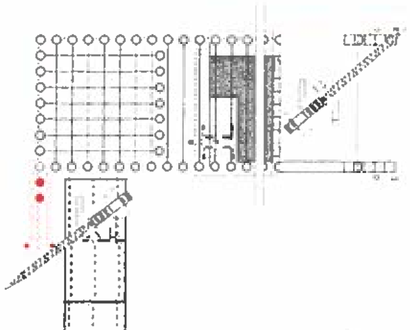
BESIX DRAWING No	REV
BIM-BV-GE-MS-DW-00006 (p10/18)	0B



PHASE 20

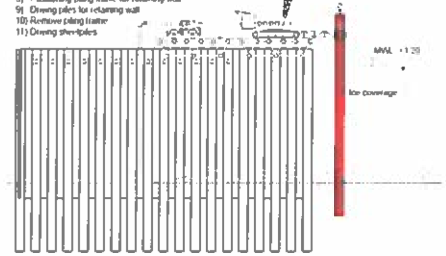
1) Positioning piling frame
2) Driving pile for front and rear pile walls (a-b-c-d)
3) Driving sheetpiles
4) Moving mobile platform
5) Placing support beam with hanging tie rod
6) Removing soft layer
7) Driving extra piles for supporting piling frame





PHASE 21

1) Positioning piling frame
2) Driving pile for front and rear pile walls (a-b-c-d)
3) Driving sheetpiles
4) Moving mobile platform
5) Placing support beam with hanging tie rod
6) Removing soft layer
7) Driving extra pile for supporting piling frame
8) Positioning piling frame for retaining wall
9) Driving piles for retaining wall
10) Remove piling frame
11) Driving sheetpiles



REFERENCES

NOTES
- Coordinate grid is UTM (NAD83) zone
- All elevations are in metres relative to Chart Datum (mCD)
- All dimensions are in metres unless stated otherwise

REVISION	DESCRIPTION	DATE
0B	Update	27-Nov-2017
0A	First issue	10-Nov-2017

CONTRACTOR: BESIX, VANCOUVER PILE DRIVING

ENGINEER: HATCH

CLIENT: Baffinland Iron Mines Corporation

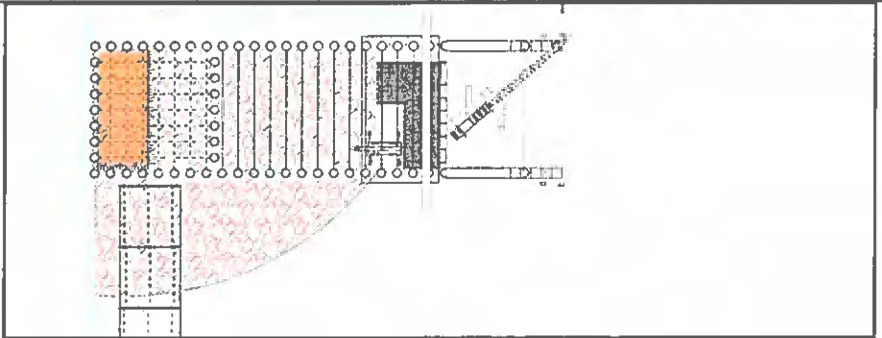
PROJECT: MARY RIVER EXPANSION STAGE 3 BAFFINLAND IRON MINES

DRAWING TITLE: PORT SITE - ORE DOCK N°2 Sequence of work

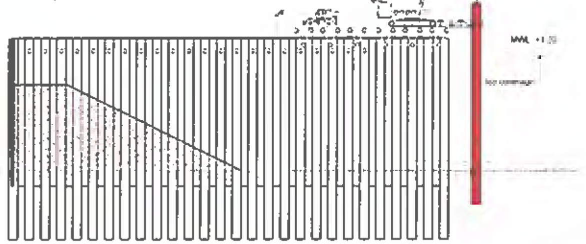
DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	DLO	SRE	FAB

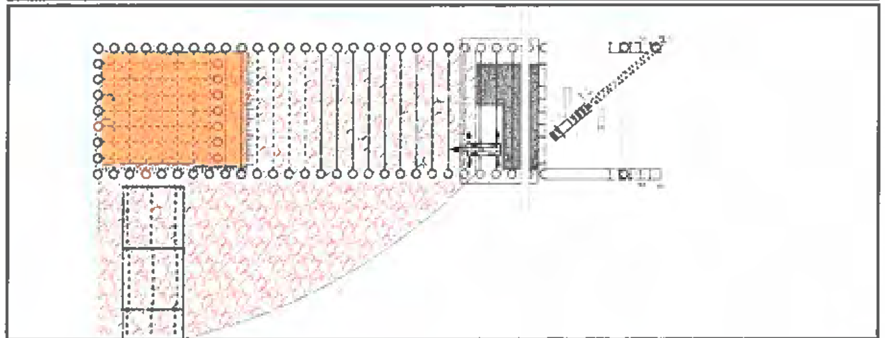
SCALE	SIZE	DATE
1:500	A1	21-Nov-2017

BESIX DRAWING No	REV
BIM-BV-GE-MS-DW-00006 (p11/18)	0B

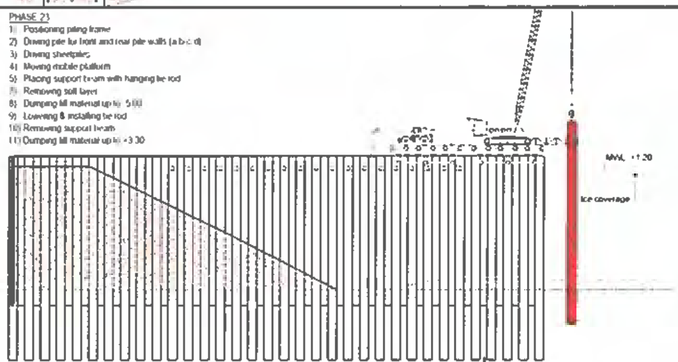


PHASE 22
1) Positioning piling frame
2) Driving pile for front and rear pile walls (a-b-c-d)
3) Driving sheetpiles
4) Moving mobile platform
5) Placing support beam with hanging tie rod
6) Removing soft layer
7) Dumping fill material up to -5.00





PHASE 23
1) Positioning piling frame
2) Driving pile for front and rear pile walls (a-b-c-d)
3) Driving sheetpiles
4) Moving mobile platform
5) Placing support beam with hanging tie rod
7) Removing soil layer
8) Dumping fill material up to -5.00
9) Lowering & installing tie rod
10) Removing support beam
11) Dumping fill material up to +3.30



REFERENCES

NOTES
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- All dimensions are in metres unless stated otherwise

REVISION	DESCRIPTION	DATE
0B	Update	27-Nov-2017
0A	First issue	10-Nov-2017

CONTRACTOR

BESIX VANCOUVER PILE DRIVING

ENGINEER:

HATCH

CLIENT:

Baffinland Iron Mines Corporation

PROJECT:

MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

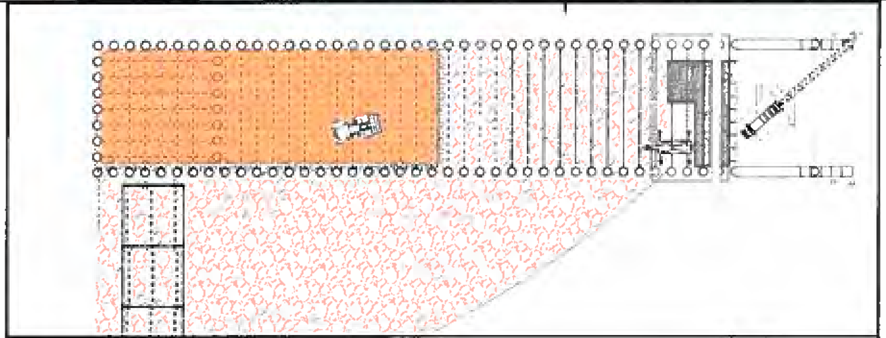
DRAWING TITLE:

PORT SITE - ORE DOCK N°2
Sequence of work

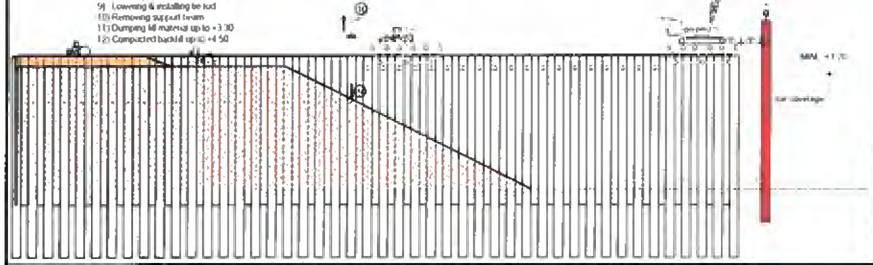
DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	DLO	SRE	FAB

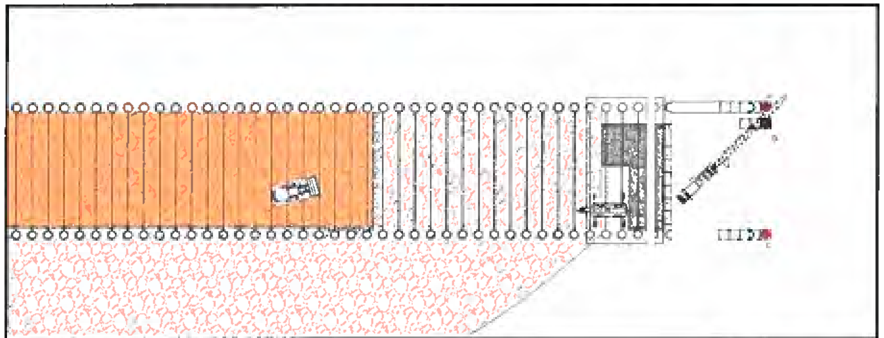
SCALE	SIZE	DATE
1:500	A1	21-Nov-2017

BESIX DRAWING No	REV
BIM-BV-GE-MS-DW-00006 (p12/18)	0B

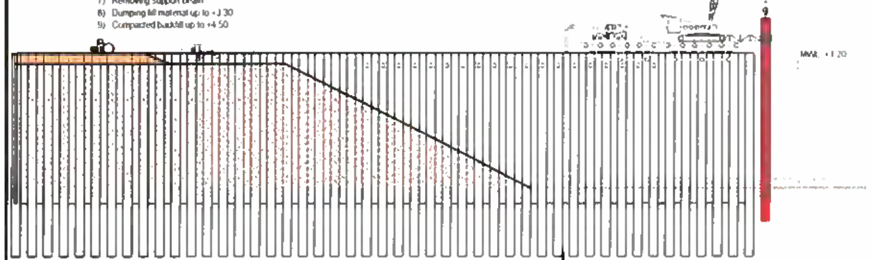


PHASE 24
1) Positioning piling frame
2) Driving pile for front and rear pile walls (a-b-c-d)
3) Driving sheetpiles
4) Moving mobile platform
5) Placing support beam with hanging tie rod
7) Removing soft layer
8) Dumping fill material up to -5.00
9) Lowering & installing tie rod
10) Removing support beam
11) Dumping fill material up to +3.30
12) Compacted backfill up to +4.50





PHASE 25
1) Positioning piling frame
2) Driving piles for side pile wall (a-b-c)
3) Driving sheetpiles
4) Removing soft layer
5) Dumping fill material up to -5.00
6) Lowering & installing tie rod
7) Removing support beam
8) Dumping fill material up to +3.30
9) Compacted backfill up to +4.50



REFERENCES:

NOTES
- Coordinate grid is UTM (NAD83) zone
- All elevations are in metres relative to Chart Datum (mCD)
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REVISION	DESCRIPTION	DATE
0B	Update	27-Nov-2017
0A	First issue	10-Nov-2017

CONTRACTOR:
BESIX VANCOUVER PILE DRIVING

ENGINEER:
HATCH

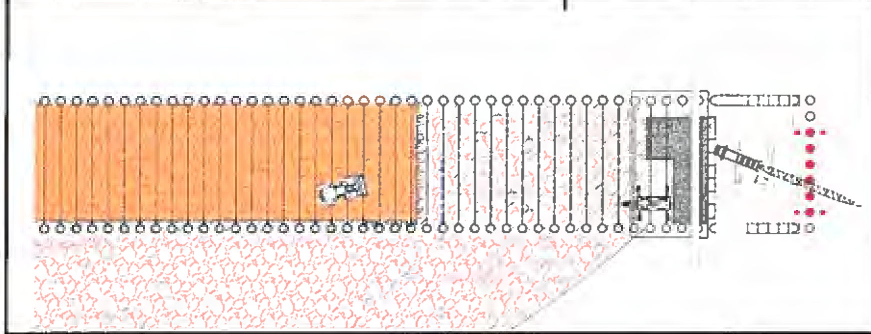
CLIENT:
Baffinland Iron Mines Corporation

PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

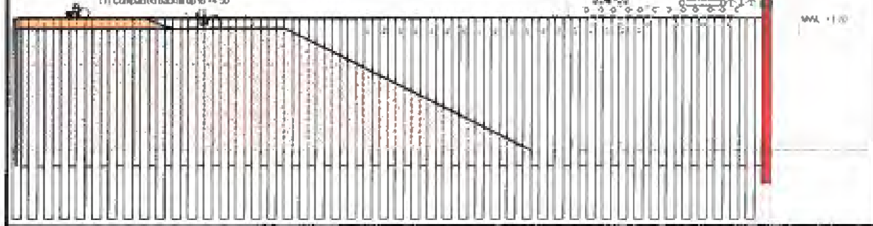
DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Sequence of work

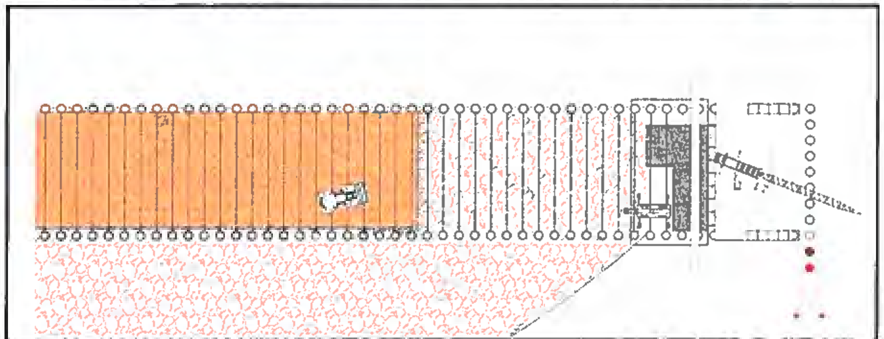
DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	DLO	SRE	FAB
SCALE: 1:500	SIZE: A1	DATE: 21-Nov-2017	

BESIX DRAWING No: BIM-BV-GE-MS-DW-00006 (p13/18) REV: 0B

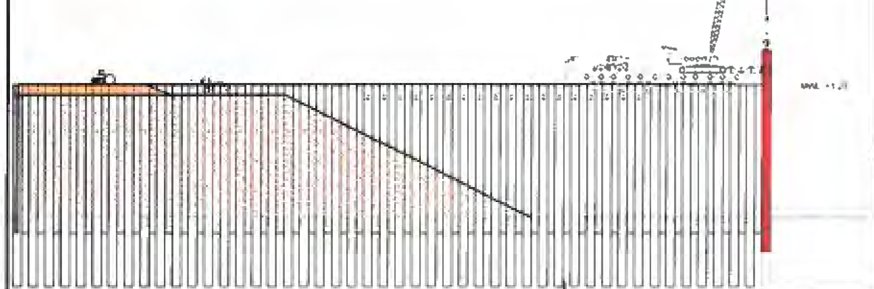


PHASE 26
1) Driving piles for supporting piling frame
2) Positioning piling frame
3) Driving piles for side pile wall
4) Driving sheetpiles
5) Removing piling frame
6) Removing silt layer
7) Dumping fill material up to -5.00
8) Lowering & installing tie rod
9) Removing support beam
10) Dumping fill material up to +3.00
11) Compacted backfill up to +4.50





PHASE 27
1) Driving extra pile for supporting piling frame
2) Place piling frame
3) Driving piles for retaining wall



REFERENCES

NOTES
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- All dimensions are in metres unless stated otherwise

REVISION	DESCRIPTION	DATE
0B	Update	27-Nov-2017
0A	First issue	10-Nov-2017

CONTRACTOR: BESIX / VANCOUVER PILE DRIVING

ENGINEER: HATCH

CLIENT: Baffinland Iron Mines Corporation

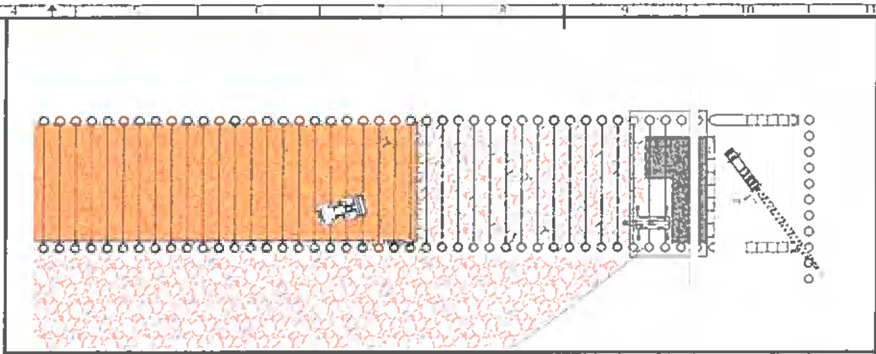
PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Sequence of work

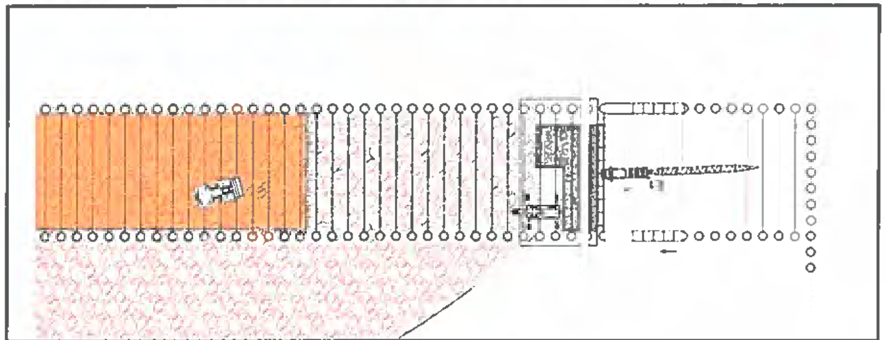
DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	DLO	SRE	FAB

SCALE	SIZE	DATE
1:500	A1	21 Nov-2017

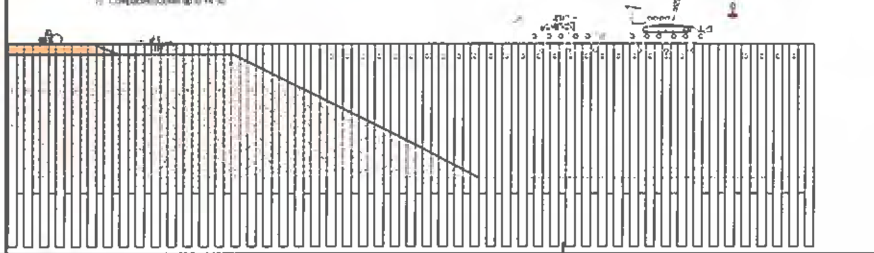
BESIX DRAWING No	REV
BIM-BV-GE-MS-DW-00006 (p14/18)	0B



PHASE 2B
1) Removing supporting piling frame
2) Driving sheet piles for retaining wall



PHASE 2C
1) Moving mobile platform
2) Removing soft layer
3) Dumping fill material up to -5.00
4) Lowering & installing tie rod
5) Removing support beam
6) Dumping fill material up to +3.30
7) Compacted backfill up to +4.50



REFERENCES

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REVISION	DESCRIPTION	DATE
0B	Update	27-Nov-2017
0A	First issue	10-Nov-2017

CONTRACTOR
BESIX VANCOUVER PILE DRIVING

ENGINEER
HATCH

CLIENT:
Baffinland Iron Mines Corporation

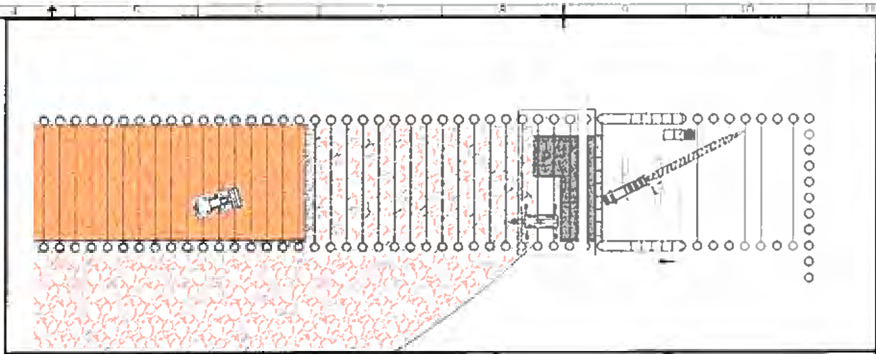
PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

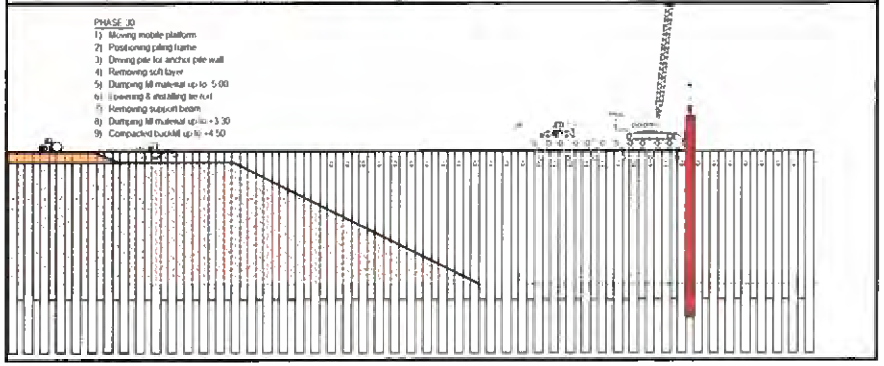
DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Sequence of work

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	DLO	SRE	FAB

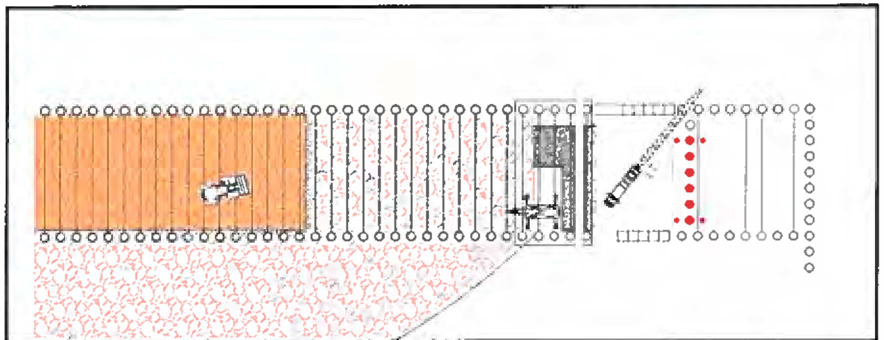
SCALE	SIZE	DATE
1:500	A1	21-Nov-2017

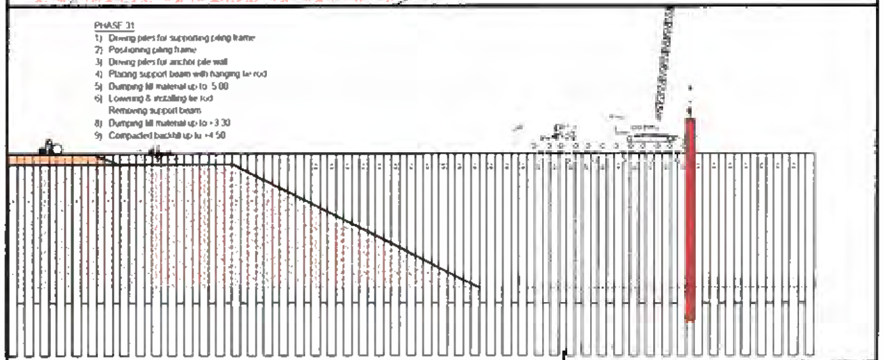
BESIX DRAWING No	REV
BIM-BV-GE-MS-DW-00006 (p15/16)	0B





PHASE 30
1) Moving mobile platform
2) Positioning piling frame
3) Driving pile for anchor pile wall
4) Removing soft layer
5) Dumping fill material up to 5.00
6) Lowering & installing tie rod
7) Removing support beam
8) Dumping fill material up to +3.30
9) Compacted backfill up to +4.50





PHASE 31
1) Driving piles for supporting piling frame
2) Positioning piling frame
3) Driving piles for anchor pile wall
4) Placing support beam with hanging tie rod
5) Dumping fill material up to 5.00
6) Lowering & installing tie rod
Removing support beam
8) Dumping fill material up to +3.30
9) Compacted backfill up to +4.50

REFERENCES

NOTES
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REVISION	DESCRIPTION	DATE
0B	Update	27-Nov-2017
0A	First issue	10-Nov-2017

CONTRACTOR:
BESIX
VANCOUVER PILE DRIVING

ENGINEER:
HATCH

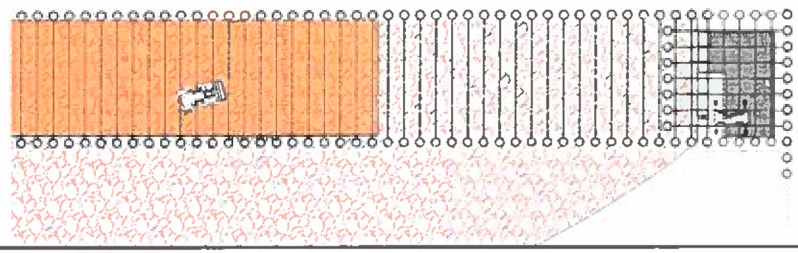
CLIENT:
Baffinland
Iron Mines Corporation

PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

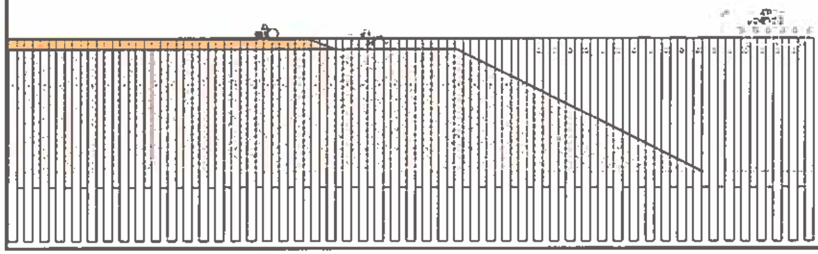
DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Sequence of work

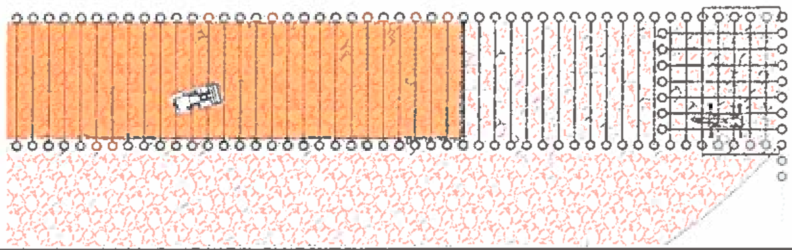
DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	DLO	SRE	FAB
SCALE 1:500	SIZE A1	DATE 21-Nov-2017	

BESIX DRAWING No: BIM-BV-GE-MS-DW-00006 (p16/18)
REV: 0B

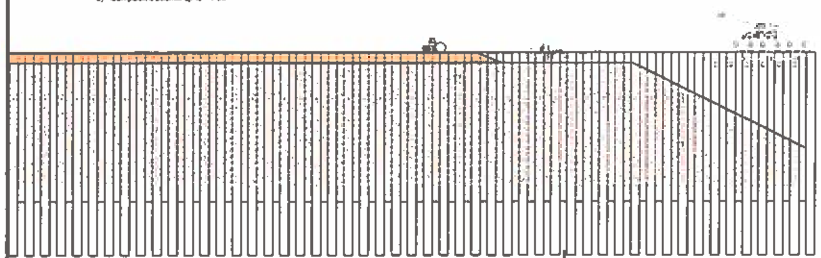


PHASE 32
1) Moving mobile platform
2) Dumping fill material up to -5.00
3) Lowering & installing tie rod
4) Removing support beam
5) Dumping fill material up to +3.30
6) Compacted backfill up to +4.50





PHASE 33
1) Moving mobile platform
2) Dumping fill material up to -5.00
3) Lowering & installing tie rod
4) Removing support beam
5) Dumping fill material up to +3.30
6) Compacted backfill up to +4.50



REFERENCES:

NOTES:
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- All elevations are in metres relative to Chart Datum (mCD)
- All dimensions are in metres unless stated otherwise

REVISION	DESCRIPTION	DATE
0B	Update	27-Nov-2017
0A	First issue	10-Nov-2017

CONTRACTOR: BESIX VANCOUVER PILE DRIVING

ENGINEER: HATCH

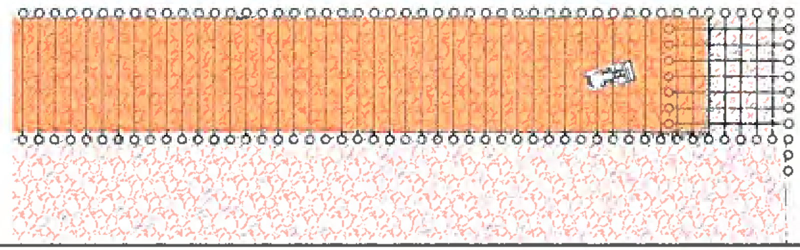
CLIENT: Baffinland Iron Mines Corporation

PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

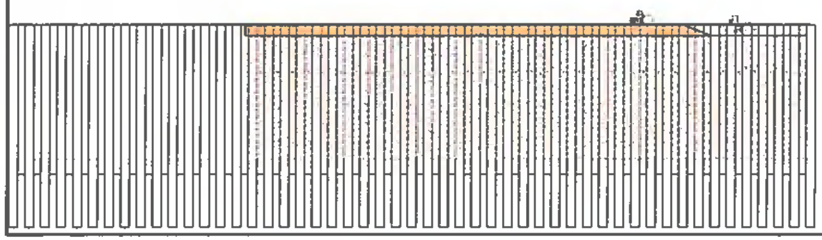
DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Sequence of work

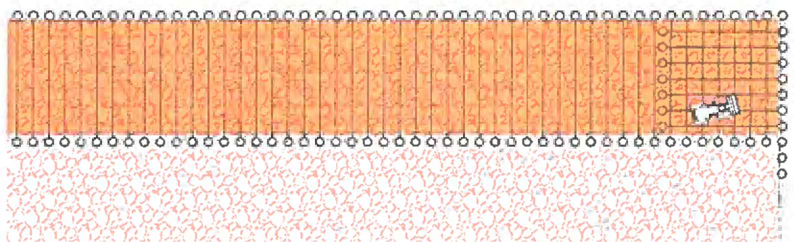
DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	DLO	SRE	FAB
SCALE 1:500	SIZE A1	DATE 21-Nov-2017	

BESIX DRAWING No: BIM-BV-GE-MS-DW-00006 (p17/18) REV 0B

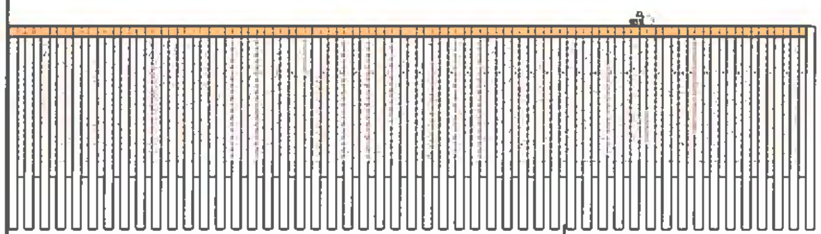


PHASE 34
1) Dumping fill material up to +3.30
2) Compacted backfill up to +4.50





PHASE 35
1) Compacted backfill up to +4.50



REFERENCES:

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- All dimensions are in metres unless stated otherwise

REVISION	DESCRIPTION	DATE
0B	Update	27-Nov-2017
0A	First issue	10-Nov-2017

CONTRACTOR:
BESIX
VANCOUVER PILE DRIVING

ENGINEER:
HATCH

CLIENT:
Baffinland
Iron Mines Corporation

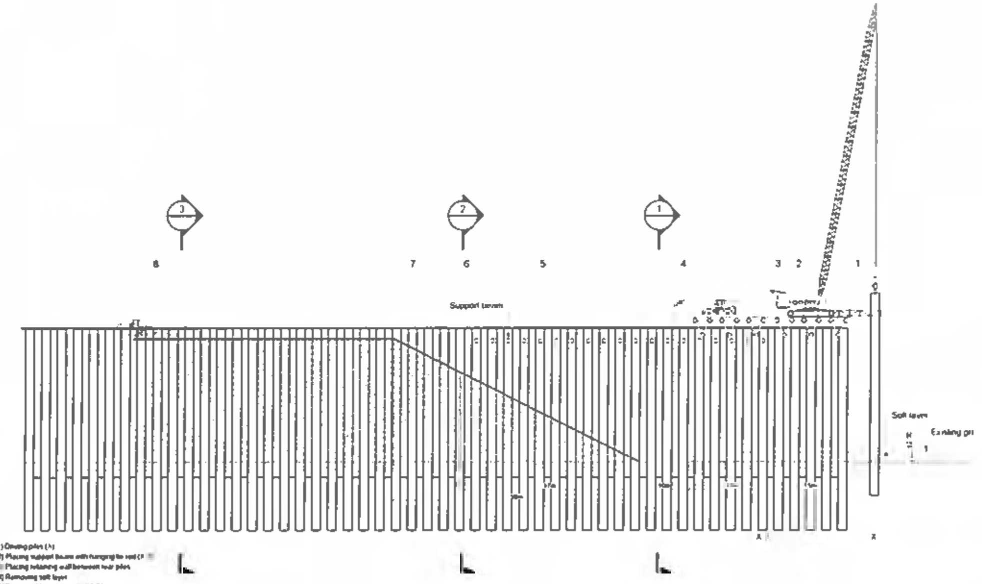
PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Sequence of work

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	DLO	SRE	FAB

SCALE	SIZE	DATE
1:500	A1	21-Nov-2017

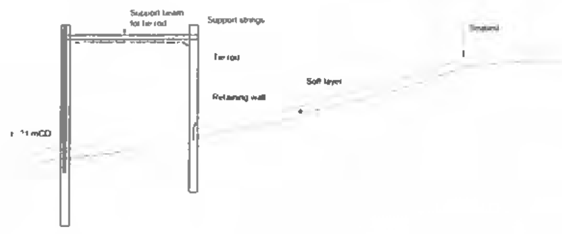
BESIX DRAWING No	REV
BIM-BV-GE-MS-DW-00006 (p18/18)	0B



1) Driving piles
2) Placing support beam with hanging tie rod
3) Placing retaining wall between rear piles
4) Removing soft layer
5) Dumping fill material up to -5.00
6) Installing & adjusting tie rod
7) Removing support beam
8) Dumping fill material up to
9) Compacted backfill up to +4.50

Typical Section

1:500



SECTION 1

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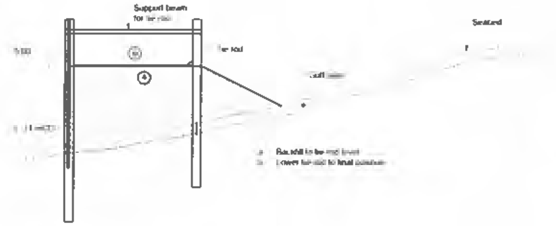

SECTION 2

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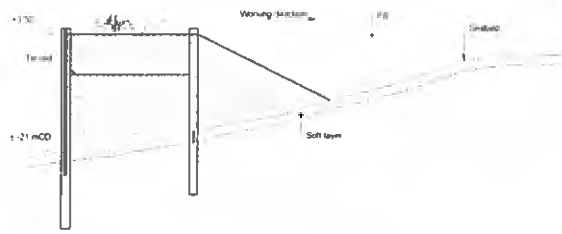
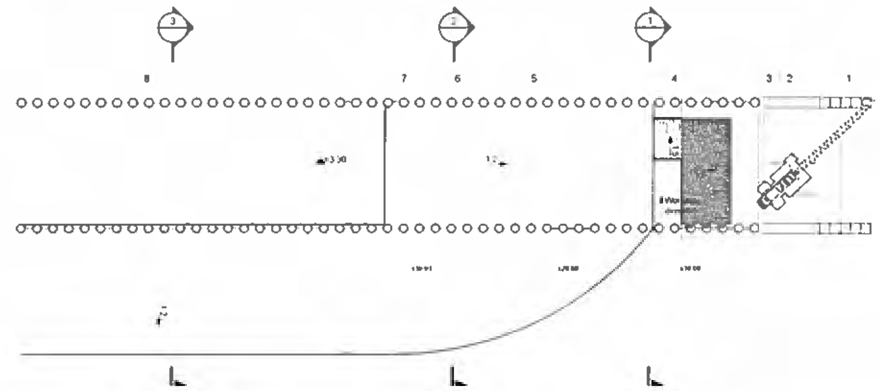


SECTION 3

1:500



Typical Plan View

1:500

REFERENCES

NOTES
- Coordinate grid is UTM (NAD83) zone
- All elevations are in metres relative to Chart Datum (mCD)
- All dimensions are in metres unless stated otherwise

REVISION	DESCRIPTION	DATE
0B	Update	16-Nov-2017
0A	First issue	10-Nov-2017

CONTRACTOR

BESIX VANCOUVER PILE DRIVING

ENGINEER

HATCH

CLIENT

Baffinland Iron Mines Corporation

PROJECT

MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

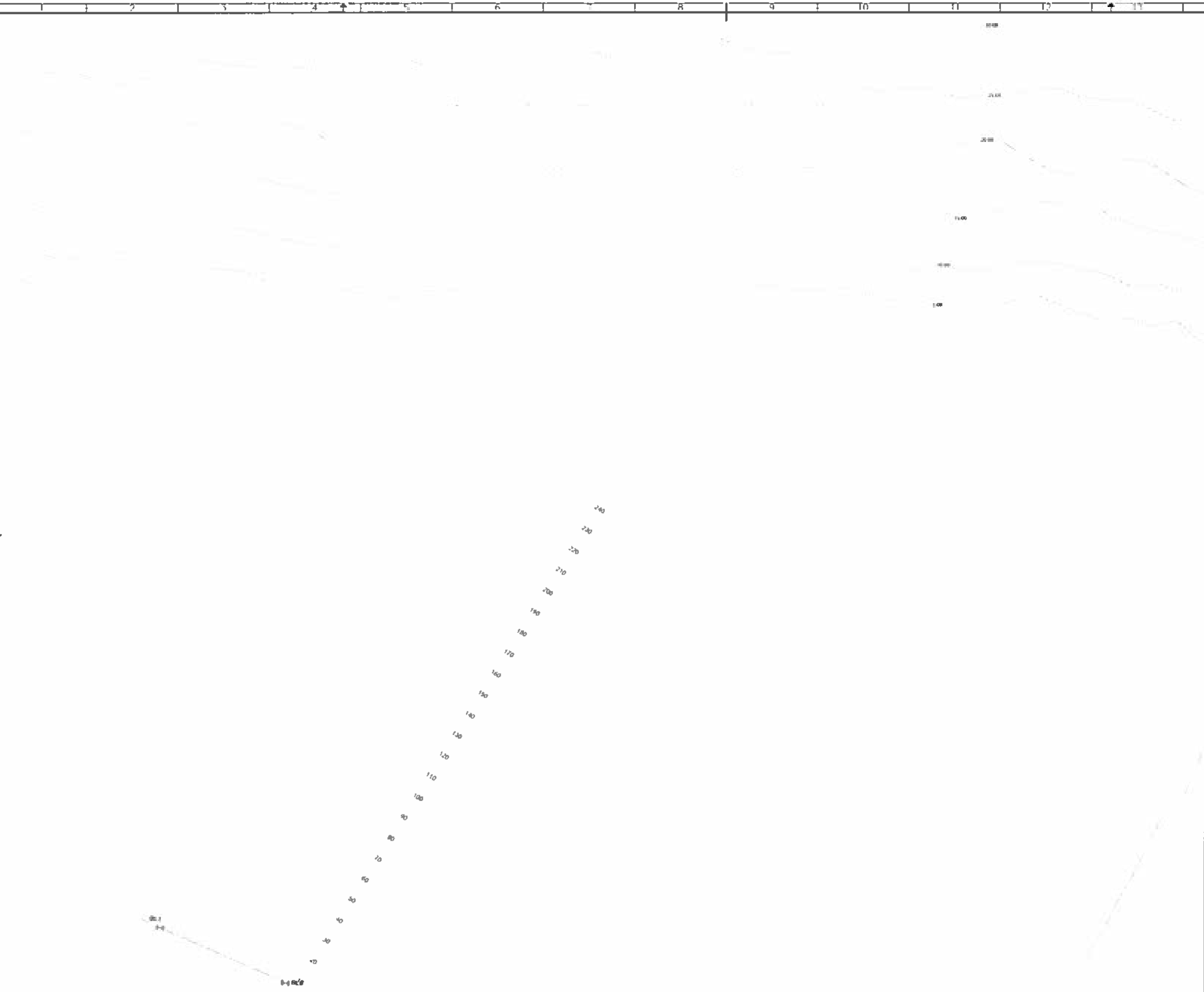
DRAWING TITLE

PORT SITE - ORE DOCK N°2
Sequence of work
Typical section

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	DLO	SRE	FAB

SCALE	SIZE	DATE
1:500	A1	16-Nov-2017

BESIX DRAWING No	REV
BIM-BV-GE-MS-DW-00007	0B



BACKFILL PHASE 0

REFERENCES

NOTES

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	27-Nov-2017

CONTRACTOR: BESIX, VANCOUVER PILE DRIVING

ENGINEER: HATCH

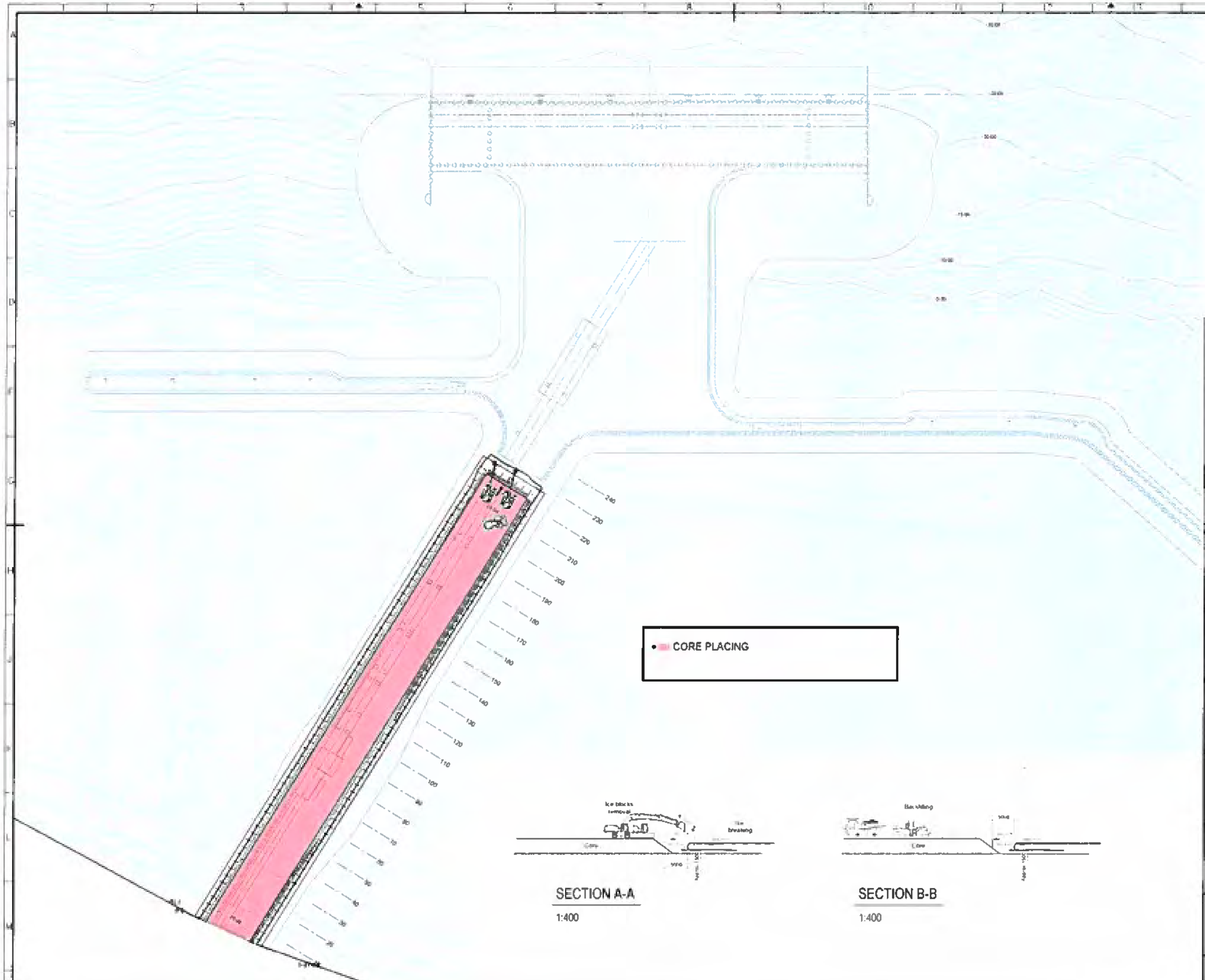
CLIENT: Baffinland Iron Mines Corporation

PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Backfilling sequence

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB
SCALE 1 750	SIZE A1	DATE 27-Nov-2017	

BESIX DRAWING No: BIM-BV-GE-MS-DW-00105 (p1/11) — REV 0B



BACKFILL PHASE 1

REFERENCES:

NOTES:

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	27-Nov-2017

CONTRACTOR: BESIX VANCOUVER PILE DRIVING

ENGINEER: HATCH

CLIENT: Baffinland Iron Mines Corporation

PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Backfilling sequence

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB

SCALE	SIZE	DATE
1:750	A1	27-Nov-2017

BESIX DRAWING No	REV
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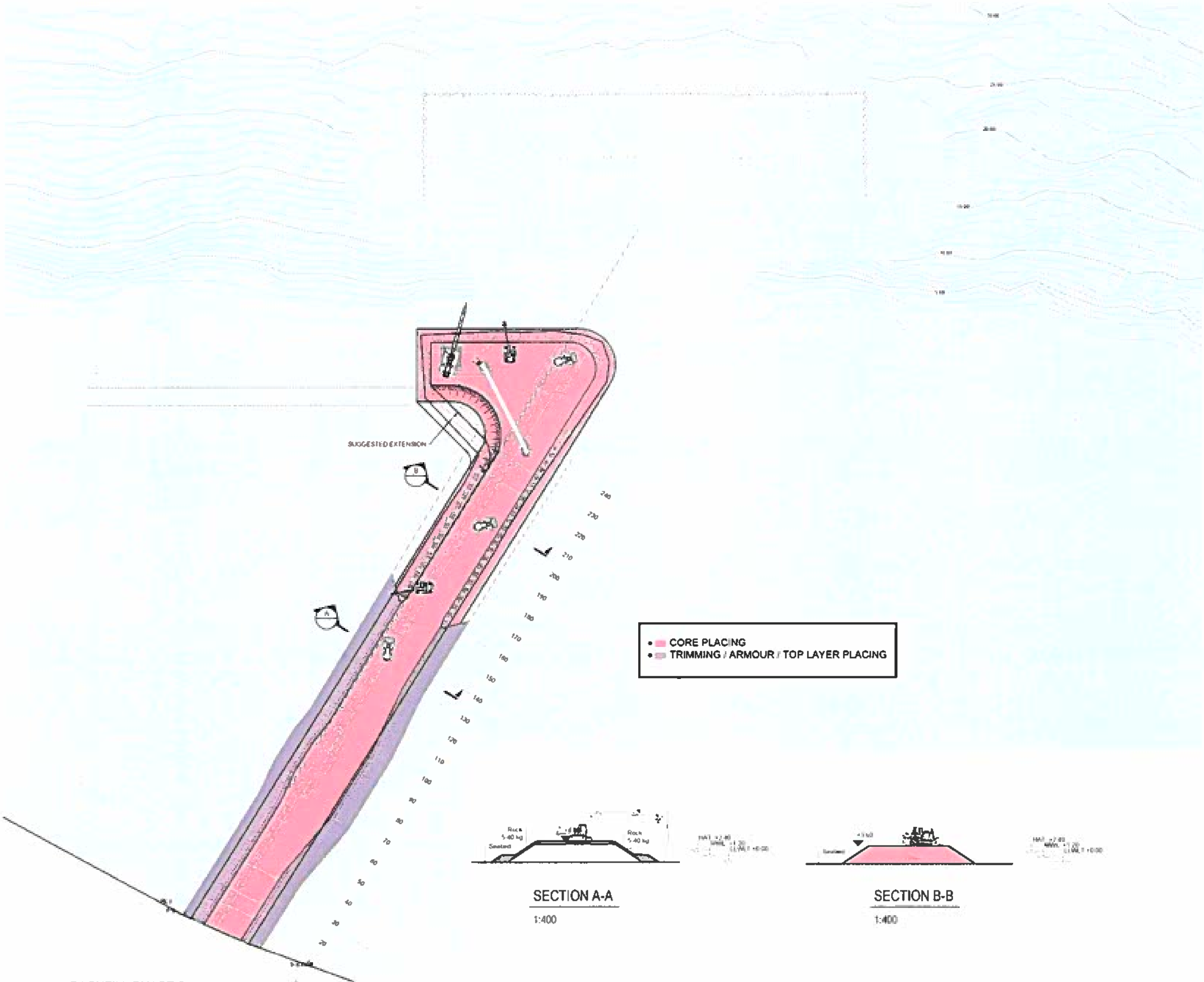
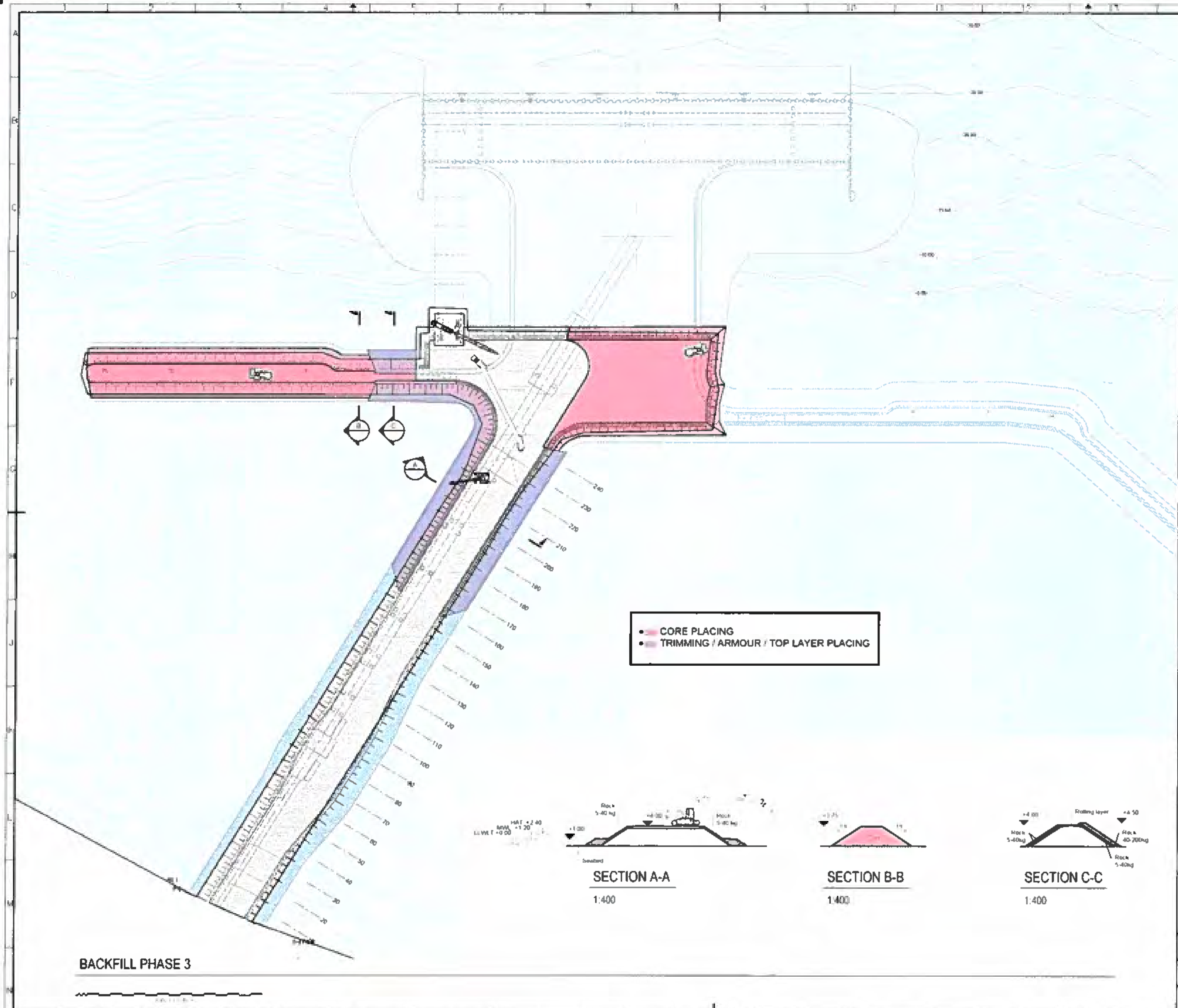


BACKFILL PHASE 2

REFERENCES

NOTES

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	27-Nov-2017



BACKFILL PHASE 3

REFERENCES:

NOTES:

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	27-Nov-2017

CONTRACTOR:
BESIX
VANCOUVER PILE DRIVING

ENGINEER:
HATCH

CLIENT:
Baffinland
Iron Mines Corporation

PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Backfilling sequence

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB

SCALE	SIZE	DATE
1:750	A1	27-Nov-2017

BESIX DRAWING No	REV
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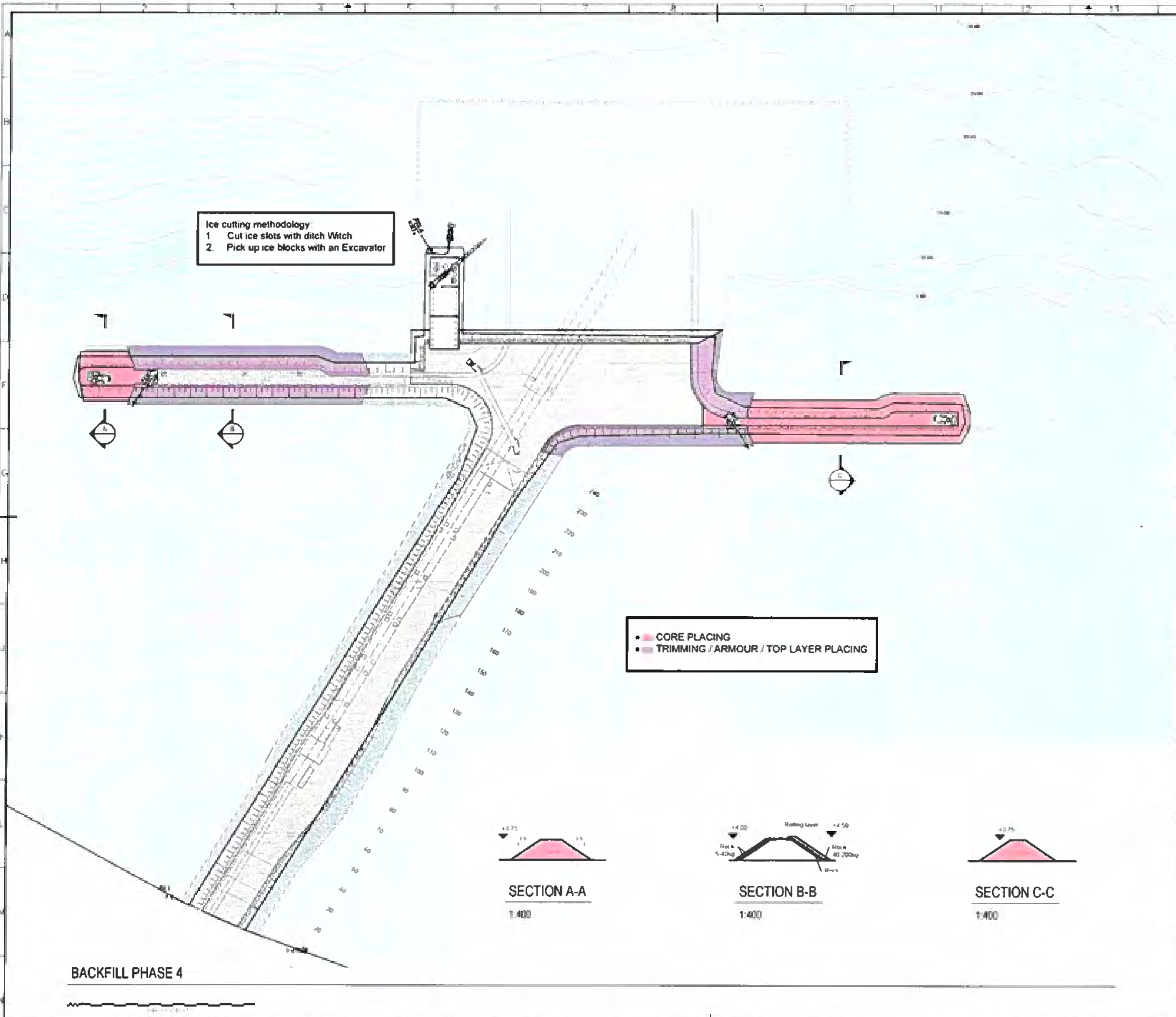

REFERENCES:

NOTES:

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	27-Nov-2017

CONTRACTOR: BESIX / VANCOUVER PILE DRIVING

ENGINEER: HATCH

CLIENT: Baffinland Iron Mines Corporation

PROJECT: MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE: PORT SITE - ORE DOCK N°2
Backfilling sequence

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB

SCALE	SIZE	DATE
1:750	A1	27-Nov-2017

BESIX DRAWING No	REV
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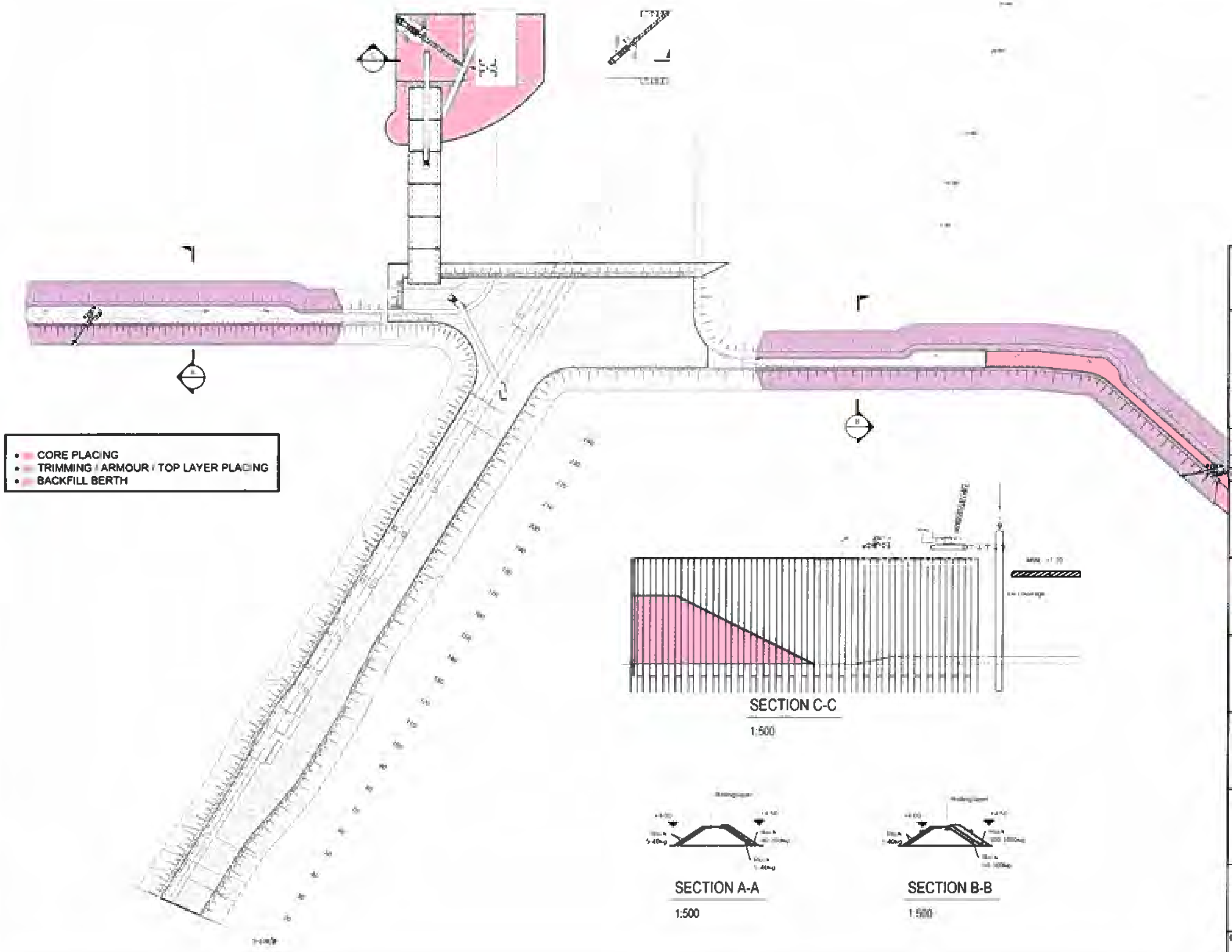

BACKFILL PHASE 5

REFERENCES

NOTES

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	27-Nov-2017

CONTRACTOR: BESIX / VANCOUVER PILE DRIVING

ENGINEER: HATCH

CLIENT: Baffinland Iron Mines Corporation

PROJECT
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE
PORT SITE - ORE DOCK N°2
Backfilling sequence

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB

SCALE	SIZE	DATE
1 750	A1	27-Nov-2017

BESIX DRAWING No	REV
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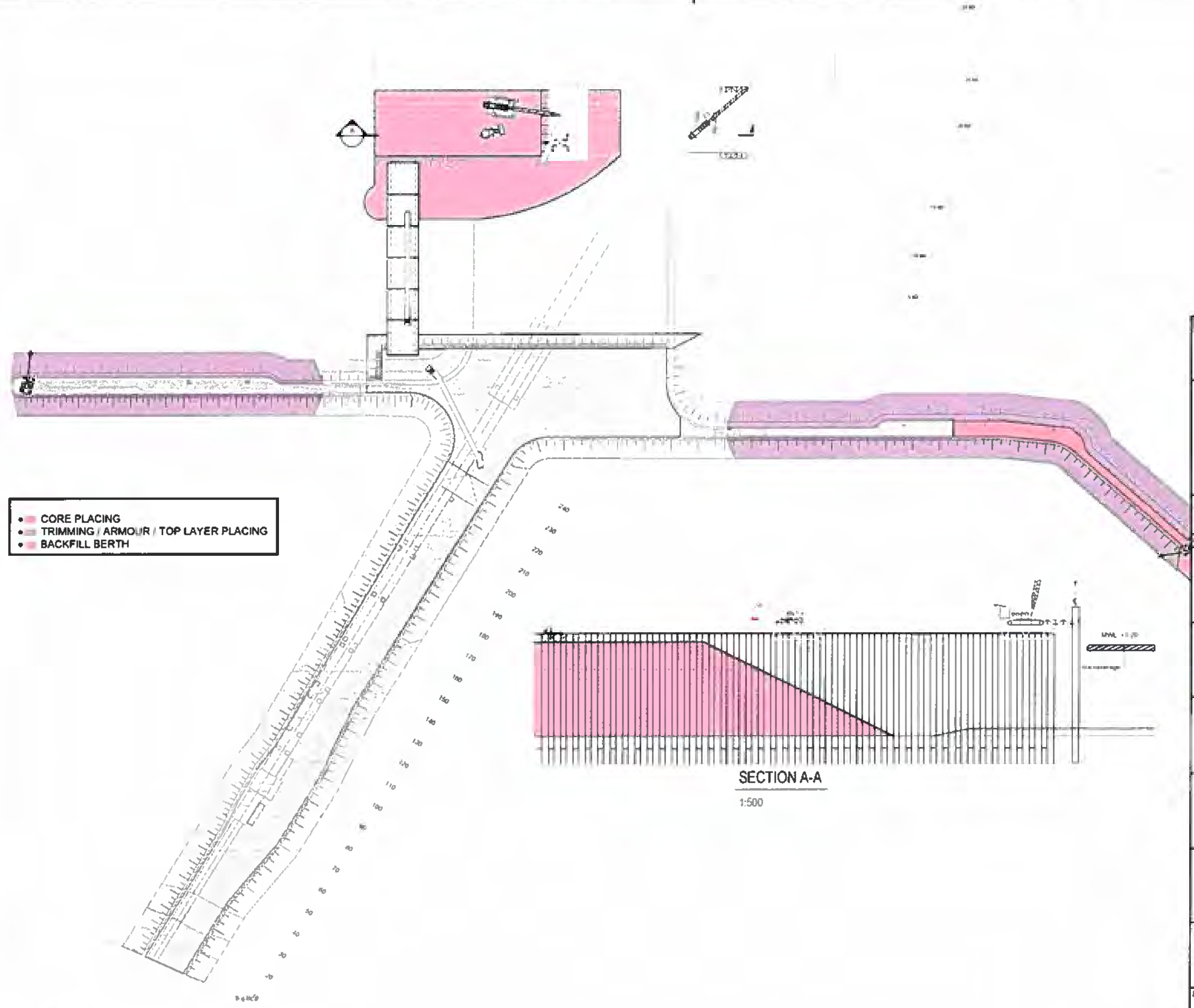

BACKFILL PHASE 6

REFERENCES

NOTES

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	27-Nov-2017

CONTRACTOR: BESIX / VANCOUVER PILE DRIVING

ENGINEER: HATCH

CLIENT: Baffinland Iron Mines Corporation

PROJECT
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE
PORT SITE - ORE DOCK N°2
Backfilling sequence

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB

SCALE	SIZE	DATE
1:750	A1	27-Nov-2017

BESIX DRAWING No	REV
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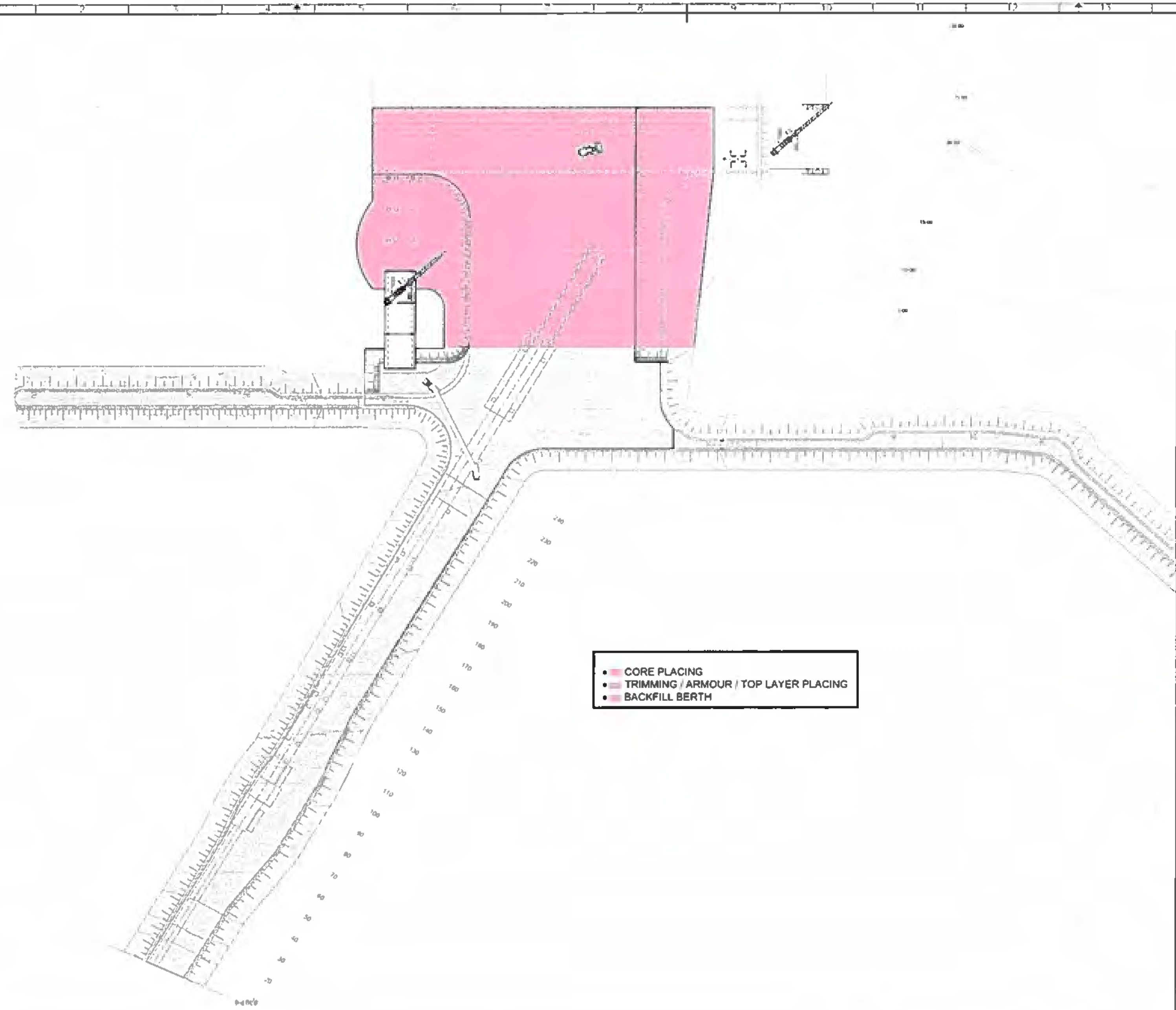


BACKFILL PHASE 7

REFERENCES

NOTES

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	27-Nov-2017

CONTRACTOR: BESIX VANCOUVER PILE DRIVING

ENGINEER: HATCH

CLIENT: Baffinland Iron Mines Corporation

PROJECT

MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

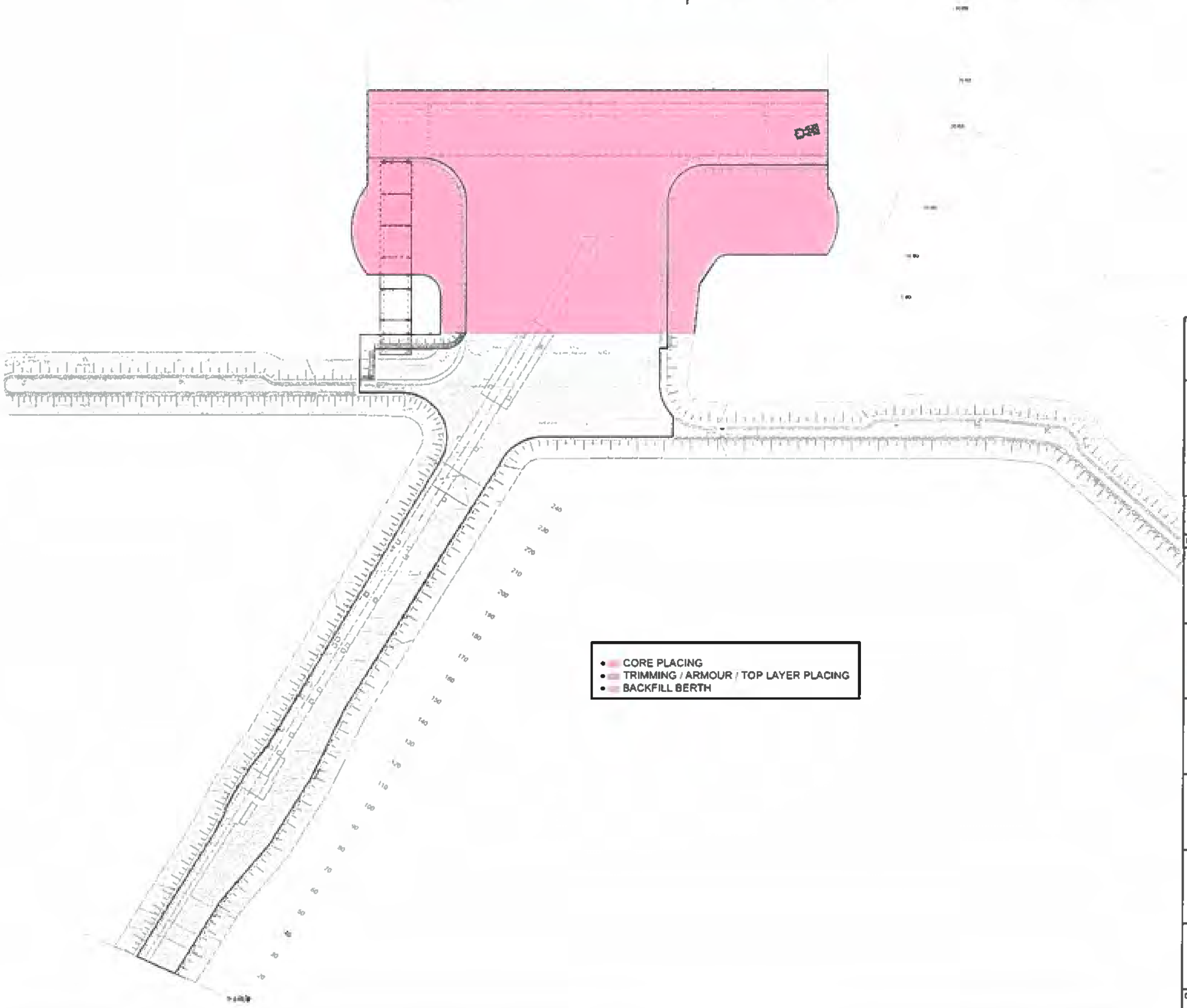
DRAWING TITLE

PORT SITE - ORE DOCK N°2
Backfilling sequence

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB

SCALE	SIZE	DATE
1:750	A1	27-Nov-2017

BESIX DRAWING No	REV
BIM-BV-GE-MS-DW-00105 (p8/11)	0B



BACKFILL PHASE 8

REFERENCES

NOTES

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	27-Nov-2017

CONTRACTOR: BESIX VANCOUVER PILE DRIVING

ENGINEER: HATCH

CLIENT: Baffinland Iron Mines Corporation

PROJECT: MARY RIVER EXPANSION STAGE 3 BAFFINLAND IRON MINES

DRAWING TITLE: PORT SITE - ORE DOCK N°2 Backfilling sequence

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB

SCALE	SIZE	DATE
1:750	A1	27-Nov-2017

BESIX DRAWING No	REV
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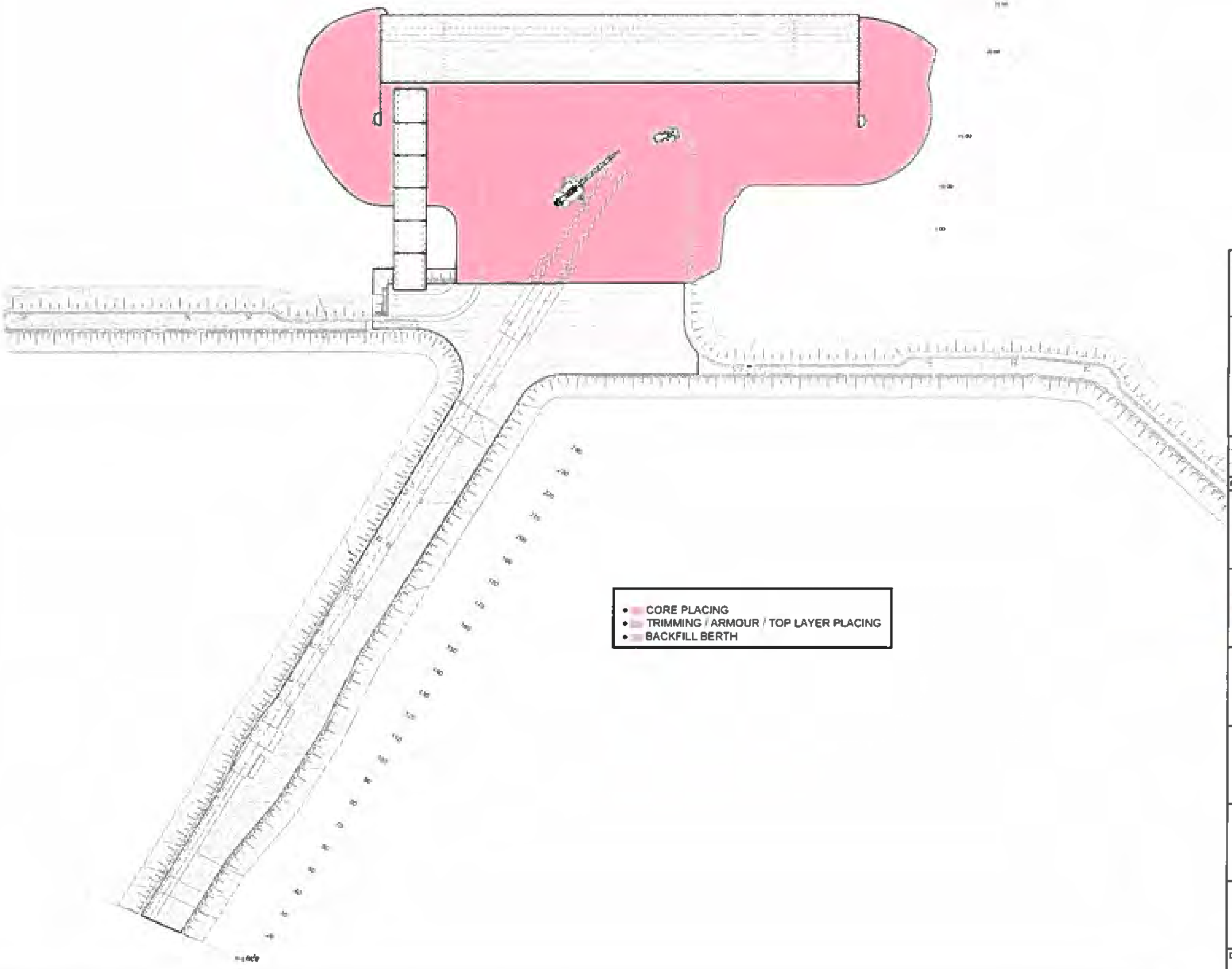

BACKFILL PHASE 9

REFERENCES

NOTES

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	27-Nov-2017

CONTRACTOR

BESIX

VANCOUVER PILE DRIVING

ENGINEER:

HATCH

CLIENT

Baffinland

Iron Mines Corporation

PROJECT:

MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE

PORT SITE - ORE DOCK N°2
Backfilling sequence

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB

SCALE	SIZE	DATE
1 750	A1	27-Nov-2017

BESIX DRAWING No	REV
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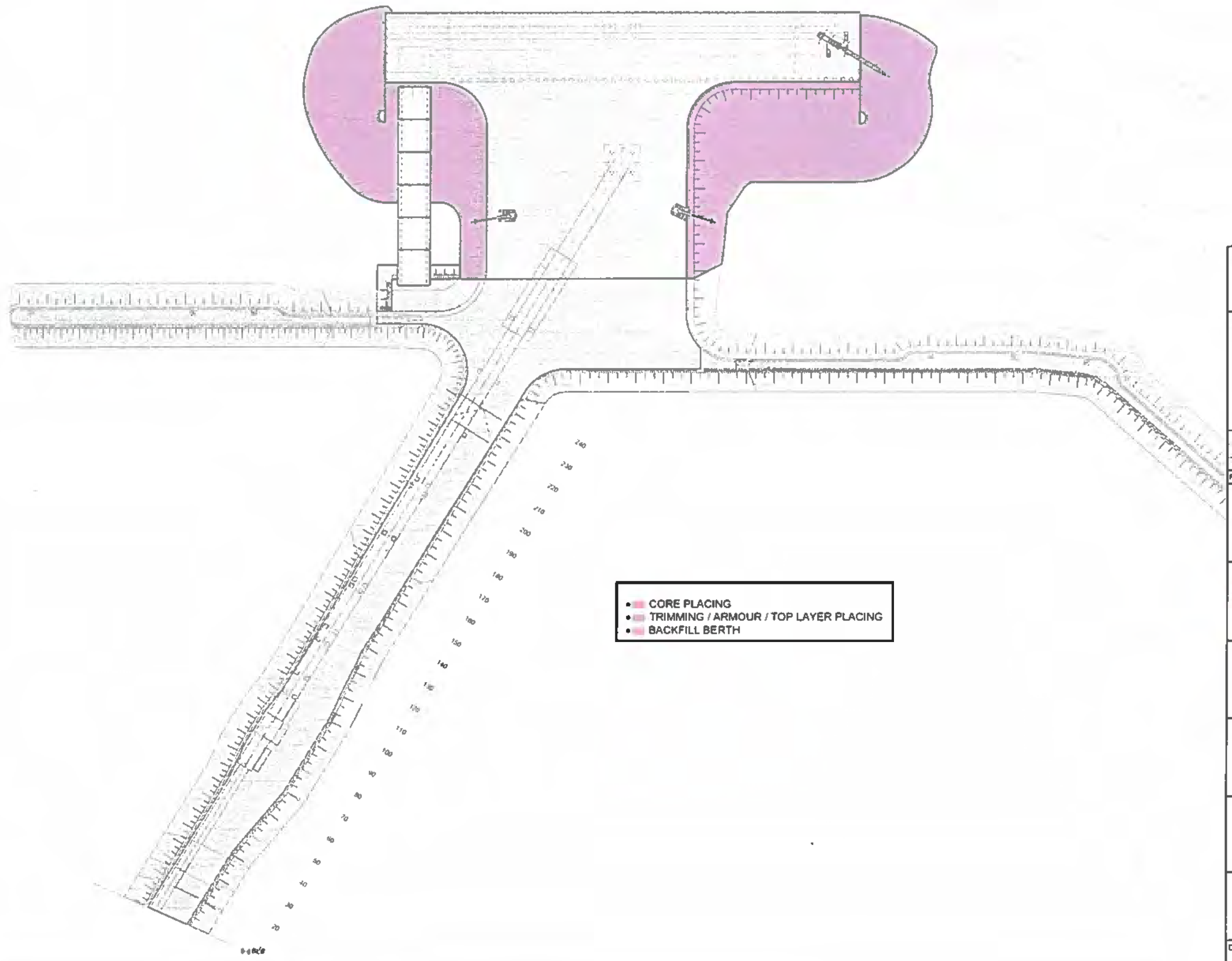

BACKFILL PHASE 10

REFERENCES

NOTES

REVISION	DESCRIPTION	DATE
0B	Update	19-Dec-2017
0A	First issue	21-Nov-2017

CONTRACTOR

BESIX VANCOUVER PILE DRIVING

ENGINEER

HATCH

CLIENT

Baffinland Iron Mines Corporation

PROJECT

MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE

PORT SITE - ORE DOCK N°2
Backfilling sequence

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB

SCALE	SIZE	DATE
1 750	A1	27-Nov-2017

BESIX DRAWING No	REV
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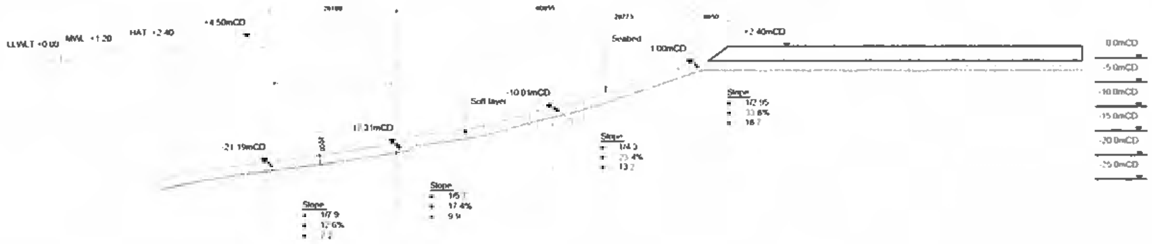
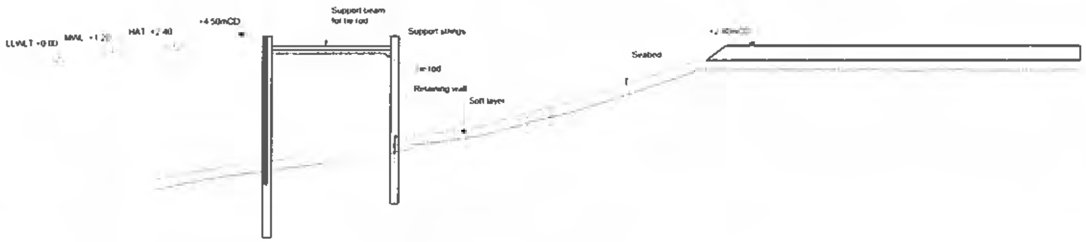


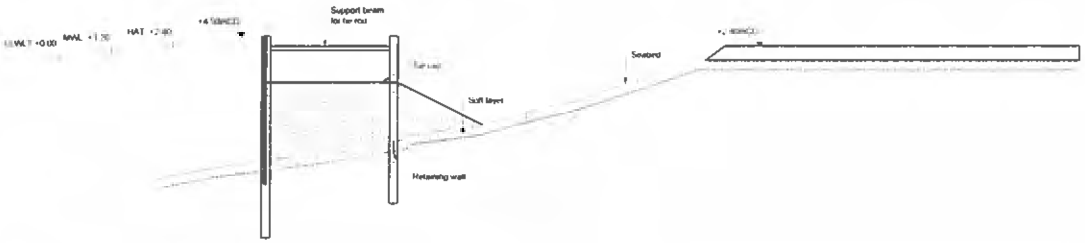
Works for causeway

1:500



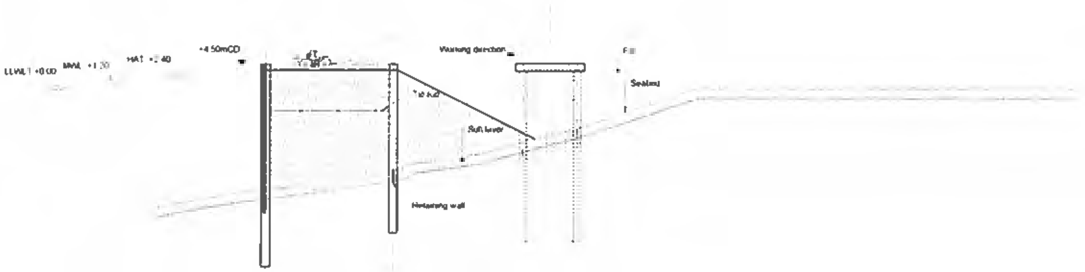
Works for cofferdam + soft layer cleaning and levelling

1:500



Backfilling cofferdam

1:500



Backfilling to causeway + Pivot foundation

1:500

REFERENCES:

NOTES:
- Coordinate grid is UTM (NAD83) zone
- All elevations are in metres relative to Chart Datum (mCD)
- All dimensions are in metres unless stated otherwise

REVISION	DESCRIPTION	DATE
0A	First issue	28-Nov-2017

CONTRACTOR: BESIX / VANCOUVER PILE DRIVING

ENGINEER: HATCH

CLIENT: Baffinland Iron Mines Corporation

PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE:
PORT SITE - ORE DOCK N°2
Works + Backfilling Berth and Causeway
Sections

DRAWN	CHECKED	APPROVED	AUTHORISED
JFK	GPA	SRE	FAB

SCALE	SIZE	DATE
1:500	A1	28-Nov-2017

BESIX DRAWING No	REV
BIM-BV-GE-MS-DW-00106	0A

Appendix B - Laydown Area

1	CONCRETE AREA	11	WASHCAR
2	PILING FRAME AND CRANE PLATFORM	12	LUNCHROOM
3	MARINE FURNISHINGS	13	TEMPORARY MATERIALS
4	TEMPORARY ACCESS TRESTLE	14	250T CRANE
5	SHELTER (HEATED)	15	WASTE AREA
6	PONTOONS (2 ROWS)	16	HAZARDOUS WASTE AREA
7	6.1M X 2.4M CONTAINERS	17	PIPE PILES (2 ROWS)
8	SHELTER (HEATED)	18	HAUL ROAD
9	SHEET PILES	19	TRUCK & TRAILER
		20	ANCHOR SYSTEM
		21	PROPOSED ADDITIONAL LAYDOWN

REFERENCES

NOTES
- Coordinate grid is UTM (NAD83) zone
- All elevations are in metres relative to Chart Datum (mCD)
- All dimensions are in metres unless stated otherwise

REVISION	DESCRIPTION	DATE
00	First issue	30-Nov-2017

CONTRACTOR: BESIX / VANCOUVER PILE DRIVING

ENGINEER: HATCH

CLIENT: Baffinland Iron Mines Corporation

PROJECT:
MARY RIVER EXPANSION STAGE 3
BAFFINLAND IRON MINES

DRAWING TITLE
PORT SITE - ORE DOCK N°2
Laydown Area

DRAWN	CHECKED	APPROVED	AUTHORISED

SCALE	SIZE	DATE
1:1000	A1	30-Nov-2017

BESIX DRAWING No	REV
BIM-BV-GE-LO-DW-00028	00

Appendix C - Equipment Matrix

1

Project Execution Plan - Equipment Matrix

Working Area	Steel Structures			Earthworks					Concrete				
	Piles	Tie-rods	Others (pile caps, etc.)	Ice Removal	Core / Main backfill	Armour rock / Scour Protection	Upper backfill	Substrate modification	Precast concrete	Reinforcement & In-Situ	Gangway Tower	Mooring Furnitures, bull rails, etc.	Others
Access Causeway and secondary causeways	350t Crawler Crane no.2		70t Rough Terrain Crane	45t Excavator with long reach	Dozer	85t Excavator with long reach	Dozer					70t Rough Terrain Crane	
				45t Excavator no.2	Articulated Dumper 5 units	Articulated Dumper 3 units	Articulated Dumper 5 units						
							Single Drum Compactor						
Access Trestle	350t Crawler Crane no.1		350t Crawler Crane no.1	Ditch Witch									
				45t Excavator no.2									
Berth	350t Crawler Crane no.1	350t Crawler Crane no.1	70t Rough Terrain Crane	Ditch Witch	Dozer	85t Excavator with long reach	Dozer	45t Rough Terrain Crane	70t Rough Terrain Crane	70t Rough Terrain Crane	350t Crawler Crane no.2	70t Rough Terrain Crane	70t Rough Terrain Crane
	350t Crawler Crane no.2	350t Crawler Crane no.2		45t Excavator no.2	Articulated Dumper 5 units	Articulated Dumper 3 units	Articulated Dumper 5 units			Volumetric Concrete Mixer	70t Rough Terrain Crane		
						200t Heavy Duty Crawler Crane	Single Drum Compactor						
Infill for ship loader platform and ship loader foundations	350t Crawler Crane no.2		70t Rough Terrain Crane	45t Excavator with long reach	Dozer	85t Excavator with long reach	Dozer		70t Rough Terrain Crane	70t Rough Terrain Crane		70t Rough Terrain Crane	70t Rough Terrain Crane
				45t Excavator no.2	Articulated Dumper 5 units	Articulated Dumper 3 units	Articulated Dumper 5 units			Volumetric Concrete Mixer			
						200t Heavy Duty Crawler Crane	Single Drum Compactor						
Laydown Area / Stockpile	250t Crawler Crane		20T Flat bed truck with truck mounted crane	Skid Steer	Wheel Loader	45t Excavator no.1	Wheel Loader		20T Flat bed truck with truck mounted crane	20T Flat bed truck with truck mounted crane	80T Trailer with Dollie	20T Flat bed truck with truck mounted crane	20T Flat bed truck with truck mounted crane
	80T Trailer with Dollie												