

MARY RIVER PROJECT FINAL ENVIRONMENTAL IMPACT STATEMENT

VOLUME 3 PROJECT DESCRIPTION



DOCUMENT STRUCTURE

Volume 1 Main Document

Volume 2

Consultation, Regulatory, Methods

Consultation

Regulatory Framework

Impact Assessment Methodology

Volume 3

Project Description

Project Description

Workforce and Human Resources

Alternatives

Volume 4

Human Environment

Population Demographics

Education and Training

Livelihood and Employment

Economic Development and Self Reliance

Human Health and Well Being Community Infrastructure and Public Service

Contracting and Business Opportunities

Cultural Resources

Resources and Land Use

Cultural Well-being

Benefits, Taxes and Royalties

Government and Leadership

Volume 5

Atmospheric Environment

Climate

Air Quality

Noise and Vibration

Volume 6

Terrestrial Environment

Landforms, Soil and Permafrost

Vegetation

Birds

Terrestrial

Volume 7

Freshwater Environment

Freshwater Quantity

Freshwater Quality

Freshwater Biota and Habitat

Volume 8

Marine Environment

Sea Ice

Seabed Sediments

Marine Fish and Invertebrates

Marine Mammals

Volume 9

Cumulative Effects and Other

Assessments

Cumulative Effects Assessments

Effects of the Environment on the Project

Accidents and Malfunctions

Transboundary Effects Assessment

Navigable Water Assessment

Volume 10

Environmental, Health and Safety

Management System

Individual Management Plans



PROJECT FACT SHEET

Location	Located at Mary River, North Baffin Island. 1000 km north of Iqaluit, 160km south of Pond Inlet
Reserves	 Comprised of nine known iron ore deposits around Mary River. The current project is focused on Deposit No.1 with known reserves of 365 million tonnes estimated at >64 % iron
Construction Phase	 Construction of the project could commence as early as 2013 Milne Port will support construction activities, receiving materials during the open water season and moving them to the Mine Site along the existing Tote Road Construction materials will also be received at Steensby Port 4 years to complete construction
Operational Phase Open Pit Mine Processing	 Operations will involve mining, ore crushing and screening, rail transport and marine shipping to European markets Projected production of 18 million tonnes per year for 21 years No secondary processing required; no tailings produced due to the high grade of ore
Rail Transport and Shipping	 A rail system will be built for year round transfer (~150 km) of ore to Steensby Inlet A loading port constructed at Steensby Inlet will accommodate cape sized vessels These specially designed ships will transport to the European market year round Milne Port will be used to receive construction materials in the open water season and then very rarely to ship, during the open water season, oversized materials
Environment	 Baseline studies have been conducted by Baffinland since 2005 Inuit Qaujimajatuqangit (traditional knowledge) information collected since 2006 These baseline studies form the foundation for the environmental impact statement and provide information for the development of mitigation and management plans Studies cover terrestrial environment, marine environment, freshwater environment, air quality, and resource utilization Extensive ongoing consultation with communities and agencies Monitoring during project activities will be important in validating predictions and mitigating potential affects
Social and Economic Benefits	 Mineral royalties will flow to NTI Taxes will flow to governments of Nunavut and Canada Baffinland finalizing negotiations with the Qikiqtani Inuit Association (QIA) for an Inuit Impact Benefits Agreement (IIBA) During the four year construction period employment will peak at 2,700 people Through the 21 years of operations about 950 people on the payroll each year
Closure and Post-Closure Phase	 Conceptual mine closure planning has been completed Closure will ensure that the former operational footprint is both physically and chemically stable in the long term for protection of people and the natural environment Post closure environmental monitoring will continue as long as needed to verify that reclamation has successfully met closure and reclamation objectives



TABLE OF CONTENTS

PAGE DOCUMENT STRUCTURE PROJECT FACT SHEET TABLE OF CONTENTS.....i PROJECT DESCRIPTION OVERVIEW...... 1 1.1 SCOPE AND SCHEDULING......7 1.2 NEED AND PURPOSE OF THE PROJECT9 1.3 Benefits of the Project9 1.3.1 POTENTIAL FOR FUTURE DEVELOPMENT10 1.4 COMPLIANCE WITH REGULATIONS AND AUTHORIZATIONS.......11 1.5 2.1 Site Capture 12 2.1.1 2.1.2 2.1.3 2.1.4 2.1.5 2.1.6 2.1.7 2.1.8 2.1.9 Security......32 2.1.13 Ongoing Geotechnical and Geophysical Survey Programs and Environmental Studies 33 2.2 2.2.1 2.2.2 2.2.3 2.2.4 2.3 2.3.1 2.4 2.4.1 Overview 36 2.4.2 2.4.3 2.4.4 Wastewater Treatment 39







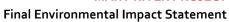
	2.4.6	Permanent Facilities	39
	2.4.7	Air Strip	41
	2.4.8	Stockpile Development	41
	2.4.9	Site Access Roads	41
2.5	RAILW	/AY - CONSTRUCTION PHASE	41
	2.5.1	Overview	41
	2.5.2	Design Considerations	43
	2.5.3	Railway Embankment	46
	2.5.4	Rock Cuts and Tunnels	47
	2.5.5	Disposal of Waste Rock and Soil Spoils	47
	2.5.6	Watercourse and Drainage Crossings	48
	2.5.7	Construction Access Road	49
	2.5.8	Temporary Airstrips and Air Traffic	49
	2.5.9	Aggregate Sources	50
	2.5.10	Explosives Storage and Use	50
	2.5.11	Construction Camps and Related Facilities	50
2.6	STEEN	NSBY PORT - CONSTRUCTION PHASE	52
	2.6.1	Overview	52
	2.6.2	Siting Considerations	53
	2.6.3	Port Facilities	53
	2.6.4	Construction Docks	54
	2.6.5	Aggregate Sources and Concrete Production	54
	2.6.6	Construction Camps and Related Facilities	54
	2.6.7	Water Supply	55
	2.6.8	Power Supply	55
	2.6.9	Wastewater Treatment	
	2.6.10		
	2.6.11	Freight Dock	56
		Crossing to Island	
		Site Roads	
		Laydown Areas and Shops	
		Ore Stockpile	
2.7	AIRST	RIPS AND AIR TRAFFIC	57
SECTION	3 N - DD	OJECT DESCRIPTION – OPERATION PHASE	61
3.1		ATION SUMMARY	
3.2		PORT- OPERATION PHASE	
3.3		INLET TOTE ROAD - OPERATION PHASE	
0.0	3.3.1	Milne Inlet Tote Road Operation	
3.4		SITE - OPERATION PHASE	
5.7	3.4.1	Open-pit Operations	
	3.4.2	Explosives Manufacture and Storage	
	3.4.3	Ore Crushing/Screening and Conveyance	
	3.4.4	Ore Stockpiles	
	3.4.5	Waste Rock Stockpile	
	J. 7 .J	Tradio Took Glockpilo	







	3.4.6	Mine Site Support Facilities	71
3.5	RAILW	/AY - OPERATION PHASE	75
	3.5.1	Overview	75
	3.5.2	Railway Components	75
	3.5.3	Railway Operation and Maintenance	80
3.6	STEEN	NSBY PORT SITE – OPERATION PHASE	82
	3.6.1	Ore Handling Operations	83
	3.6.2	Ore Shipping Fleet	84
	3.6.3	Shipping and Port Operations	87
	3.6.4	Sea-lift Re-supply Operations	90
	3.6.5	Port Site Support Facilities	91
3.7	OFF-S	ITE FACILITIES SUPPORTING THE PROJECT	93
SECTION	l 4.0 - CL	OSURE	94
SECTION	1 5.0 - WC	ORKFORCE AND HUMAN RESOURCES	96
5.1	WORK	FORCE REQUIREMENTS	96
	5.1.1	Workforce - Construction Phase	96
	5.1.2	Workforce - Operation Phase	98
	5.1.3	Contract Opportunities and Associated Workforce Demand	
	5.1.4	Transportation of the Workforce	
5.2	RESO	URCING STRATEGY	
5.3	HUMA	N RESOURCES TRAINING AND CAPACITY DEVELOPMENT	104
	5.3.1	Training Program Overview	104
	5.3.2	Job-Specific Training For Operations	106
	5.3.3	Previous Education and Training Initiatives	108
SECTION	1 6.0 - AL	TERNATIVES	110
6.1	EVALU	JATION CRITERIA FOR PROJECT ALTERNATIVES	110
	6.1.1	Technical Feasibility	110
	6.1.2	Environmental Acceptability	111
	6.1.3	Social Acceptability	111
	6.1.4	Economic Viability	111
6.2	ASSES	SSMENT OF ECONOMIC VIABILITY FOR ALTERNATIVES TO MEET	
	CUST	OMER REQUIREMENTS	112
	6.2.1	Market Conditions	112
	6.2.2	Alternatives Considered	113
6.3	ORE C	CARRIER CAPACITY	115
6.4	PORT	SITE LOCATION	116
	6.4.1	East and North Coast of Baffin Island	117
6.5	SHIPP	ING VIA FOXE BASIN	118
	6.5.1	Ore Transportation Alternatives from Mine Site to Port Location	118
	6.5.2	Alternative Port Locations accessible via Foxe Basin	
	6.5.3	Alternative Railway Routing Between the Mine Site and Steensby Port	121
	6.5.4	Conclusions Related to Overland Transportation Corridor and Port Site	124







	6.5.5	Shipping Route Alternatives Through the Foxe Basin	126
6.6	PROJE	ECT FEASIBILITY	
	6.6.1	Project Go/No-Go Decision	127
	6.6.2	Decreased Production Rates	128
	6.6.3	Increased Production Rates	128
6.7	ASSES	SSMENT OF ALTERNATIVES WITHIN THE PROJECT	128
	6.7.1	Production Rate	128
	6.7.2	Trucking of 3 Mt/a via Milne Inlet	129
	6.7.3	Rail Transport to Milne Port	129
	6.7.4	Mining Methods	129
	6.7.5	Power Supply	130
	6.7.6	On-site Accommodations and Worker-Related Issues	130
	6.7.7	Airstrip Locations	131
	6.7.8	Steensby Ore Dock and Freight Dock Location and Configuration	131
	6.7.9	Ice Management at Steensby Port	131
	6.7.10	Ore Crushing Optimization	132
	6.7.11	Waste Rock Disposal	132
	6.7.12	Closure and Reclamation Alternatives	133
SECTION	7.0 - RE	FERENCES	134
SECTION	8.0 - DE	FINITIONS AND ABBREVIATIONS	137
8.1	GLOS	SARY	137
8.2	ABBRI	EVIATIONS	147
		LIST OF TABLES	
Table 3-1.1		y Project Facts	
Table 3-2.1		ajor Project Components	
Table 3-3.1		eliminary Schedule of Waste Rock Production	
Table 3-5.1		versity of Jobs at a "Typical" Iron Mine Construction Project	
Table 3-5.2		timated Operations Team Workforce by Skill Level and Location	
Table 3-5.3		versity of Jobs at a "Typical" Operating Iron Mine Project	
Table 3-5.4		amples of Potential Contract Opportunities and Associated Jobs	
Table 3-6.1		pital Costs Attributed to the Seasonal Shipping Alternative	
Table 3-6.2		e Carrier Capacity Configuration Alternatives	
Table 3-6.3		y Findings of Cockburn Lake – Nuvuit Coastal Rail Link Feasibility Report	
Table 3-6.4	l Co	mparison of Railway Routing Alternatives to Steensby Port	123
		LIST OF FIGURES	
Figure 3-1.	1 Pro	oject Location Map	2
Figure 3-1.	2 Lo	cation of Project Activities	3
Figure 3-1.	3 Life	e of Project Schedule	8

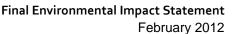




Figure 3-2.1	Milne Port Layout	16
Figure 3-2.2	Milne Inlet Tote Road	17
Figure 3-2.3	Mine Site Layout	18
Figure 3-2.4	Railway Layout - Construction Phase	19
Figure 3-2.5	Railway Construction Potential Development Area (Sheet 1 of 4)	
Figure 3-2.6	Railway Construction Potential Development Area (Sheet 2 of 4)	21
Figure 3-2.7	Railway Construction Potential Development Area (Sheet 3 of 4)	22
Figure 3-2.8	Railway Construction Potential Development Area (Sheet 4 of 4)	
Figure 3-2.9	Steensby Port Layout	30
Figure 3-2.10	Project Air Traffic Patterns	58
Figure 3-3.1	Overall Process Flow Diagram	62
Figure 3-3.2	Material Handling	65
Figure 3-3.3	Mine Site Primary and Secondary Crushing	65
Figure 3-3.4	Mine Site Ore Stock Yard	66
Figure 3-3.5	Example Railway Locomotive and Ore Car	
Figure 3-3.6	Railway Terminal Layouts	78
Figure 3-3.7	Icebreaking Ore Carrier - Conceptual Design	86
Figure 3-5.1	'Life-Cycle' for Operations Training Program	105
Figure 3-6.1	Potential Port Locations	116
Figure 3-6.2	Alternative Rail Routes Between Mine Site and Steensby Port	122
Figure 3-6.3	Shipping Route Alternatives	125

APPENDICES

Appendix 3A	Site Layout and Drawings
Appendix 3B	Type A Water License Application
Appendix 3C	Mobile Equipment Lists
Appendix 3D	Mine Site Documents
Appendix 3E	Railway Information
Appendix 3F	Steensby Documents
Appendix 3G	Ice and Marine Shipping Assessment
Appendix 3H	Trade Off Studies
Appendix 3I	2012 Work Plan





SECTION 1.0 - INTRODUCTION

1.1 PROJECT DESCRIPTION OVERVIEW

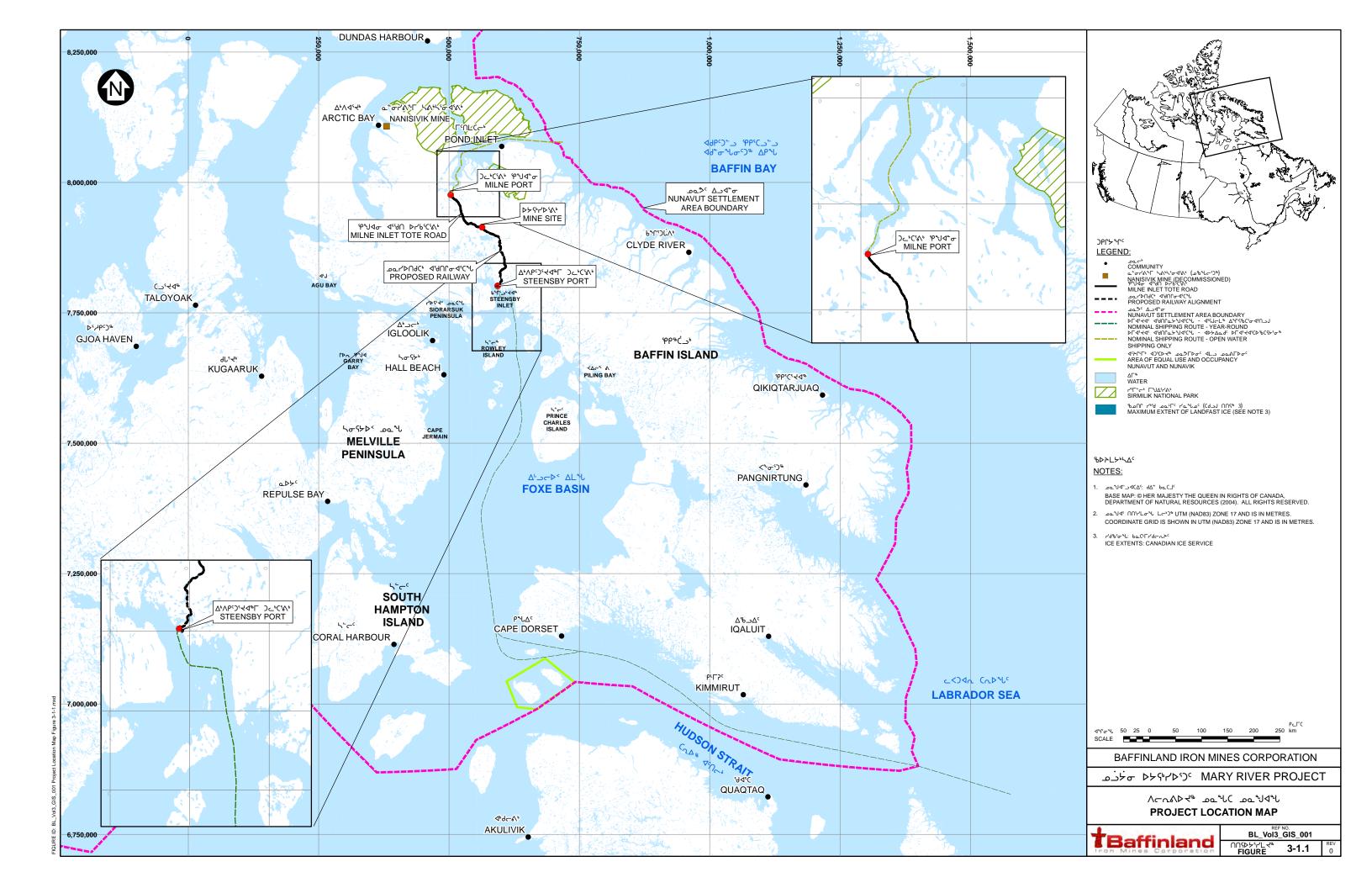
Baffinland Iron Mines Corporation ("Baffinland" or "the Company") proposes to develop an open-pit iron ore mine in northern Baffin Island, Nunavut Territory (Figure 3-1.1). The Mary River Project (the Project) will extract iron ore from Deposit No. 1, located in the Qikiqtaaluk Region of Nunavut. Reserves consist of approximately 365 million tonnes (Mt) of direct shipping iron ore at an average grade of 64 %. The basis of the Mary River Project is production and shipment of 18 million tonnes per annum (Mt/a) of high grade iron ore after crushing and screening, with no need for additional processing. Deposit No. 1 has resources capable of meeting the production design for 21 years of operation. This EIS has been prepared for a maximum Project duration of 21 years so that the environmental effects can be properly characterized.

Baffinland is committed to developing the Project in an environmentally and socially sustainable manner that will benefit the Company and the people of Nunavut.

The Project consists of the construction, operation, closure, and reclamation of an open-pit mine and associated infrastructure for extraction, transportation and shipment of iron ore. A Railway will be constructed to connect the Mine Site to Steensby Port. For the construction period, material, equipment and supplies required for the construction at the Mine Site and the northern portion of the railway will be received via Milne Port. Likewise, construction materials for Steensby Inlet and the southern portion of the railway will be received at Steensby Port.

It is proposed that Milne Port will operate during the open-water season while Steensby Port will operate year round. A floating dock will be placed at Milne Port. At the onset of the Project, much of the construction material and supplies, fuel and mining equipment will be received at Milne Port during the open-water season. Once Steensby Port is operational, Milne Port will only be used occasionally for the delivery of oversized equipment to the Mine Site. It is expected that the Steensby Port facilities and the Railway will take four years to construct. Once the Railway is operational, 18 Mt/a of iron ore will be transported by Railway and shipped from Steensby Port. Shipping of ore will occur year round and will require vessels with icebreaking capabilities.

Figure 3-1.2 shows the key Project sites along with land ownership and current surface and mineral leases. The key facts about the Project are summarized by site location in Table 3-1.1. Site layouts and drawings relevant to the understanding of the Project Description are presented in Appendix 3A.



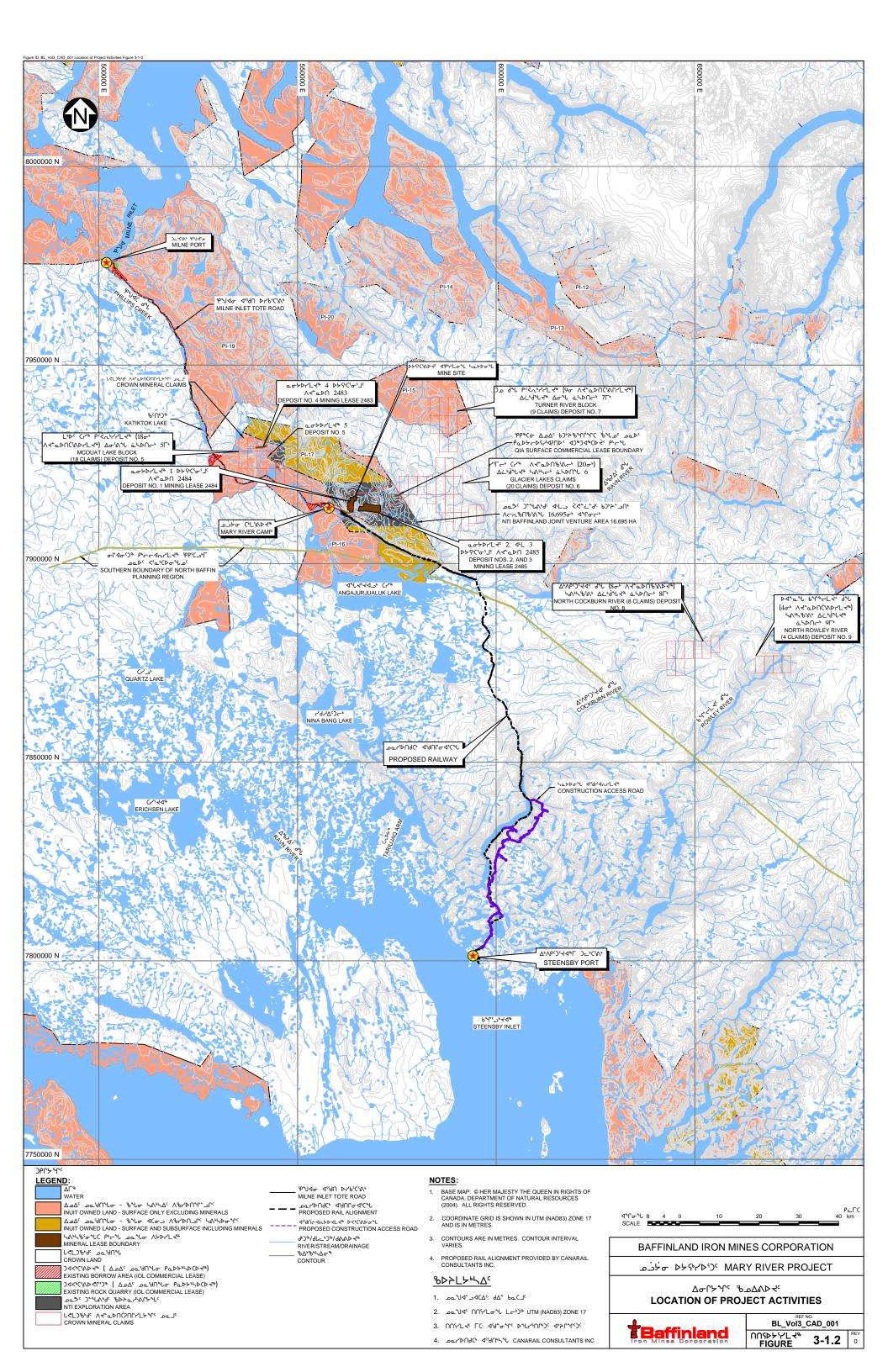




Table 3-1.1 Key Project Facts

		Potential De	evelopment Area	a (PDA)	Footprin	t of Facilities within PDA	
	Milne Port	224 ha		35 ha			
Potential	Tote Road		865 ha		-		
Development	Mine Site		2,739 ha			787 ha	
Area (ha)	Railway		1,308 ha		47 ha		
	Steensby Port		2,482 ha			213 ha	
Number of	Milne Port	One borrow area	and one rock qu				
Identified		One existing born	row area (Borrov	/ Area #3),			
Potential	Mine Site	One existing rock	quarry (Rock Qu	uarry #2) and c	ne proposed qu	uarry (QMR2)	
Quarries/	Railway	79 rock quarries					
Aggregate Site	Steensby Port	1 rock quarry (QS	52), plus one larg	e rock cut for a	airstrip		
		Q	uarried Rock		Borro	wed Sand and Gravel	
Total Quantities	Milne Port		600,000			80,000	
Aggregate	Mine Site		5,000,000			0	
(m ³)	Railway		16,000,000			0	
	Steensby Port		12,500,000			0	
			Construction	n Phase		Operation Phase	
Shipping of Freigl	ht and Fuel	Year 1	Year 2	Year 3	Year 4	Year 5 - 26	
	Freight vessels	20	20	3	3	Only oversized equipment delivered when required	
Shipping Milne Port	Freight (tonnes)	165,000	95,000	43,000	46,000	See above	
	Fuel tankers	2	3	3	3	0	
	Diesel delivery	20 ML	30 ML	30 ML	30 ML	0	
	Freight vessels	22	20	7	4	3	
	Freight (tonnes)	206,000	150,000	107,000	80,000	60,000	
Shipping	Fuel tankers	2	4	4	3	3-6	
Steensby Port	Diesel delivery	40 ML	35 ML	35 ML	120 ML	160 ML	
	Marine diesel	-			50 ML	50 ML	
			Construction	n Phase		Operation Phase	
Traffic		Year 1 Year 2 Year 3			Year 4	Year 5 - 25	
Air Traffic (Total Annual	Milne Port (Dash-8/ATR)	210	210	105	105	occasional	
Departures) Smaller aircraft	Mine Site (B737, C130)	550	550	550	550	365	
traffic not included.	Steensby Port (B737, C130)	550	550	550	550	183	
Road Traffic (Trucks/day)	Tote Road	30	30	30	30	No regular traffic	
Railway traffic	Railway		N/A			4 round trips/day	



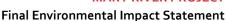
Table 3-1.1 Key Project Facts (Cont'd)

Workforce			Constructi	on Phase		Operation Phase
workforce		Year 1	Year 2	Year 3	Year 4	Year 5 - 25
	Exploration	150	150	150	150	150
Workforce	Construction On-Site	570	1,800	1,600	900	
(numbers)	Construction Payroll	800	2,680	2,440	1,710	
	Operation	0	0	0	0	950
Camps, Water	Supply and		Constructi	on Phase		Operation Phase
Wastewater		Year 1	Year 2	Year 3	Year 4	Year 5 - 25
	Milne Port	150	150	150	150	40
	Mine Site	1,200	1,200	1,200	1,200	500
	Mid-Rail		200	200	200→0	
	Ravn River		400	400	400→0	Common manual d
Camp Capacity	S. Cockburn		300	300	300→0	Camps removed
(peak # of	N. Cockburn		200	200	200→0	
people)			Stee	nsby Camps	-	
people	Floating Accommodati on	600	600	600	600	Removed
	Land based camp	600	600	600	600	300
Water Demand	Milne Port	70	70	70	70	30
m ³ /day	Mine Site	655	655	655	655	352
(expected)	Railway	440	440	440	440	0
(схрестеа)	Steensby Port	426	426	426	426	245
	Milne Port	55	55	55	55	14
	Mine Site	560	560	560	560	200
Treated Sewage	Ravn River			Camp removed		
Effluent (m ³ /day)	Mid-Rail			Camp removed		
	Cockburn S.		Trucked to Steen	sby Port WWTF		Camp removed
	Cockburn N.		Trucked to Steen	sby Port WWTF		Camp removed
	Steensby Port	310	310	310	310	102
Waste	Waste					
Waste to Landfill	Mine Landfill	6,373	6,373	6,373	6,373	1,763
m³/yr	Steensby Landfill	3,972	3,972	3,972	3,972	650
Waste to	Milne Port	135	135	135	135	46
Incinerator	Mine Site	980	980	980	980	550
Tonnes/yr	Steensby Port	490	490	490	490	202



Table 3-1.1 Key Project Facts (Cont'd)

Fuel Storage			Constructio	Operation Phase			
		Year 1	Year 2	Year 3	Year 4	Year 5 - 25	
Milne Port	Arctic diesel	1 t	1 tank @ 5ML and 4 tanks @ 10N			no requirements	
Willie FOIL	Jet A		2 tanks @	no requirements			
Mine Site	Arctic diesel		3 tanks @ 5.2ML				
Willie Site	Jet A			2 tanks @ 1	1.5ML		
Railway	Arctic diesel	Multiple 20,000 L	Multiple 20,000 L ISO containers positioned as required no requireme				
Quarries	Arctic diesel	Multiple 20,000 L	. ISO containers p	ositioned as requ	ired	no requirements	
	Arctic diesel	15 tanks @ 1ML	15 tanks at 1	ML		4 tanks @ 40 ML	
Shipping		20ML fuel barge	4 tanks @ 40				
Steensby Port	Jet A			5 tanks @	1ML		
	Marine diesel				1 tank	@ 7.5 ML; 2 tanks @ 25 ML	
Explosives							
	Milne Port		Magaz				
	Mine Site		obile Mixing Unit	_		Permanent Emulsion Mixing	
Explosives		Te	emporary Emulsic	n Mixing Plant		Plant	
p	Railway		obile Mixing Unit				
	Steensby Port		obile Mixing Unit	_			
	Steeling 7 : 5 : t	Te					
Production		Construction Phase				Operation Phase	
		Year 1	Year 2	Year 3	Year 4	Year 5 - 25	
Waste Rock &	Approximate	0	0	0	22	30	
Overburden	Mt/a	Ů					
Mine	ROM, tonnes		0	0	400,000	400,000	
Ore Stockpiles	Rail Loadout,					1,400,000	
	tonnes					, i	
		L.4 Mt fine ore stoc	900,000				
Steensby Port		3.2 Mt coarse ore st	2,300,000				
•	Steensby Port		10				
	Dedicated icebre	eaker ore carriers (1	160,000 to 190,0	00 DWT)			
Power Supply							
Power Supply	Camp generator		Mobile genset fo				
Milne Port	_	rators installed for		od			
	Annual consump		114,000 MWh				
Power Supply	Running Load/In		9.8 MW/15.8MW				
Mine Site	Installed Power		15.8 MW				
	Number / Size o	unit	5 units at 5.6 MW	/ each (2 standby	units)		
Railway Construction	Temporary gene	erators installed at camps and quarries					
Down Comple	Annual consump	otion	120,000 MWh				
Power Supply	Running Load/In	stalled Power	11 MW/22MW				
Steensby Port	Number / Size o	funit	3 units at 5.6 MW	/ each (2 standby	units)		



February 2012



1.2 SCOPE AND SCHEDULING

The construction and operation of a major capital project in the Arctic requires significant advanced planning to address the short summer and open-water season, activity-limiting extreme cold and darkness of winter, and challenging logistics due to remoteness. These factors were considered throughout Project planning and construction activities will be scheduled accordingly.

Construction and operation of the Project will require a Type A Water Licence. The Type A Water Licence Application and supporting technical information (attached in Appendix 3B) provides detailed design information for the various Project components which will assist in the review of the FEIS. The Type A Water License application contains general site layouts (Appendix 3B, Attachment 9), information on water intake and effluent discharge points and Block Flow Diagrams for water, wastewater, waste and fuel for each Project site (Milne Port, Mary River and Steensby Port) which will facilitate the review process. Additional detail and concept developments are summarized in design criteria documents supplied within the application. Readers can refer to these materials for additional detail supporting the general overviews provided in the body of the Project Description.

The scope of the Project defined in the FEIS includes all works or undertakings required for the construction, operation, modification, maintenance, decommissioning, closure & reclamation or other undertakings for the following components:

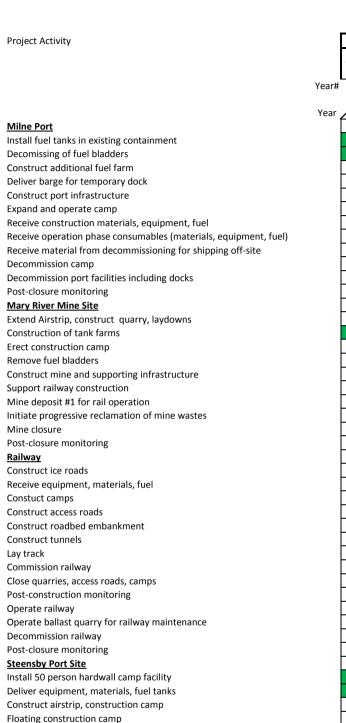
- Mine Site support infrastructure and facilities;
- Railway:
- Steensby Port docks, port and railway terminal infrastructure and support facilities;
- Marine Shipping;
- Air Traffic;
- Milne port infrastructure development; and
- Ongoing Geotechnical Exploration.

Air traffic and ongoing geotechnical exploration are discussed within each of the main Project locations. There are three main project phases described herein:

- Four-year Construction Phase (Year 1 through Year 4);
- An approximate 21-year Operation Phase (Year 5 through Year 25); and
- A three-year Closure Phase (Year 26 through Year 28) and a five-year Post-Closure Monitoring Phase (Year 29 to Year 33).

The Life of Project schedule is presented in Figure 3-1.3.

Project Activity



Project Phases Construction Operation Closure **Post Closure** 10 11 12 13 14 15 16 17 18 19 20 21

Floating fuel barge Construction of tank farm

Install construction docks Install freight dock Install ore dock

Construct port infrastructure Remove temporary docks Operate port facilities Ship ore for markets Close-out port facilities Post-closure monitoring

Quarry rock and construct roads, laydowns



1.3 NEED AND PURPOSE OF THE PROJECT

The purpose of the Project is to extract, crush, screen, and ship approximately 18 Mt/a of iron ore for use in overseas steel mills over a 21 year period in an environmentally and socially sustainable manner, while providing a competitive rate of return to the Company's investors and lenders, and sharing Project benefits directly with the local Inuit communities.

There is a five-fold need for the Project:

- 1. To provide a return on investment to the Company's shareholders.
- To supply high quality iron ore to the international marketplace. The reasonably foreseeable international demand for iron ore has created market conditions that Baffinland believes are favourable for opening a mine at Mary River.
- 3. To support the Nunavut Planning Commission Broad Planning Principles, Policies and Goals (Nunavut Planning Commission, 2007). The Planning Commission goals include:
 - · Strengthening Partnerships and Institutions;
 - Protecting and Sustaining the Environment;
 - Encouraging Conservation Planning;
 - Building Healthy Communities; and
 - Encouraging Sustainable Economic Development.
- To contribute to the development of infrastructure, skills training, employment, and business opportunities in Nunavut, as outlined in the Nunavut Exploration and Mining Strategy (Government of Nunavut, 2007).
- 5. To contribute to Canada's northern strategy to strengthen Canada's sovereignty, protect the country's environmental heritage, promote economic and social development and improve Northern governance. (Indian and Northern Affairs Canada, 2008).

1.3.1 Benefits of the Project

Given the future demand for iron ore in the global marketplace, the Project has the potential, through its mineral exploration and mining activities, to contribute to meeting Nunavummiut needs for infrastructure, training, and sustainable economic development. The Project will generate benefits to local Inuit communities through capacity-building, employment and business opportunities, and revenues to the territorial and federal governments in the form of tax revenues. The Inuit Impact and Benefits Agreement (IIBA), currently under negotiation between Baffinland and the Qikiqtani Inuit Association (QIA), will ensure that benefits from the Project flow to nearby Inuit communities and the Qikiqtaaluk Region of Nunavut.

Over the long-term the Project infrastructure may provide opportunities to access further mineral deposits in the North Baffin Region. Steensby Port may provide opportunities for additional commercial uses and the bathymetry data collected by the Project will provide important information for shipping lanes and improved safety through Foxe Basin. In addition, Project activity will help to reinforce Canadian sovereignty over the region.

The Project will grow the overall size of the economy of Nunavut through its investments in capital infrastructure, employment creation, and payments of taxes, mineral royalties, and other payments. The macro economic benefits of the Project are described in Volume 4 and Appendix 4B.



1.3.2 Project Accommodation for Concurrent Uses

Baffinland recognizes the need to accommodate the safe joint use by the Project and the people of Nunavut of the Project sites. Examples of the accommodation provisions include:

- The NLCA establishes the requirements and expectations for development activities occurring in Nunavut. This Agreement includes a public easement on the Milne Inlet Tote Road; therefore access to this Road will not be restricted. Provisions will ensure that hunter use is compatible with Project operations as stipulated in the Road Management Plan (Volume 10).
- Hunters will be welcome to stop into the Project sites for food, shelter and fuel as indicated in the negotiated Inuit Impact and Benefits Agreement (IIBA) and in the Human Resources Management Plan (Volume 10).
- Along the Railway, locations will be provided for hunter crossings and animal crossings. Final positions
 of these crossings will be determined in consultation with stakeholders.
- Hunters who would pass by snowmobile across the landfast ice at the entrance of Steensby Inlet will
 need to circle around the Steensby Port. In consideration of this, Baffinland will invite hunters/travellers
 to stop in at Steensby Port for food, shelter and fuel.

1.4 POTENTIAL FOR FUTURE DEVELOPMENT

The Project involves the development of the ore reserves and resources identified and currently under exploration in Deposit No.1, one of nine known iron ore deposits within Baffinland-held mineral claims and leases. As the Company develops Deposit No.1, it will continue further exploration programs to identify additional ore reserves in the region. Exploration activities will utilize relevant Project infrastructure such as accommodation, flights and laboratory space. Exploration equipment not owned by the Project will be sourced from companies under contract for exploration work.

The Project addresses a nominal 18 Mt/a production rate for mining of Deposit No. 1 only. Annual production rates will vary with factors such as market conditions, ore grades and unanticipated events. In order to ensure a nominal 18 Mt/a of iron ore, the Project infrastructure are designed for a capacity of 30 Mt/a. Deposits No. 2 and 3 could be readily accommodated within minor expansion to the proposed mining infrastructure. The Railway would accommodate the higher iron ore quantities and required supplies by adding additional trains. The ore dock at Steensby Port can accommodate an additional ore carrier. Adequate space is available for larger stockpiles, additional material handling facilities and personnel accommodations. Development of Deposits No. 4 and 5 would require additional rail capacity from the Mine.

A potential hydroelectric development site, identified at Separation Lake, could supply up to 32 MW, enough to potentially supply power to Steensby Port and the Mine Site. If developed, the diesel generators would be retained for backup power.

Should Baffinland plan to mine other deposits in the area or if feasibility studies determine the hydroelectric project is viable, the Company will submit another package of permit applications to the applicable authorizing agencies for screening by NIRB, in anticipation that another environmental assessment will likely be required.





1.5 COMPLIANCE WITH REGULATIONS AND AUTHORIZATIONS

Baffinland will carry out the Project in compliance with all applicable Nunavut and Canadian laws, regulatory requirements, agreements, permits and licences. In addition to conforming to regulatory requirements, Baffinland is committed to carrying out the Project in accordance with its Sustainable Development Policy. Baffinland's EHS Management System documents commitments and requirements toward achieving the goal of sustainability.



SECTION 2.0 - PROJECT DESCRIPTION - CONSTRUCTION PHASE

2.1 CONSTRUCTION OVERVIEW

Construction of the Project is expected to be carried out over four years. The construction phase will begin upon completion of approved pre-construction staging activities and receipt of Project approvals.

The remoteness of the Project site and the short duration of the open-water shipping season are major factors in planning the delivery of equipment, fuel and other materials to facilitate construction. The Project recognizes the eastern Arctic marine conditions as the most significant constraint, both in peak season capacity and the short duration of an open delivery window.

The following are key parameters that have been addressed in the planning and execution of construction:

- Remoteness of the Project sites;
- Short open-water season for annual delivery of equipment and materials;
- Duration and degree of extreme cold and darkness;
- Presence of existing infrastructure at Milne Port and the Mine Site;
- Present condition of the Milne Inlet Tote Road;
- Absence of existing infrastructure, variable ground conditions and uneven topography at Steensby Inlet;
 and
- Construction on permafrost.

Construction will follow best practices. For example, berms will be constructed to divert waters around construction areas and discharge them into their respective watersheds, fish screens will be installed on all water intakes, and an archaeologist will be available to confirm potential archaeological finds and determine the appropriate mitigation strategy.

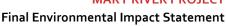
2.1.1 Site Capture

The focus of early construction activities is on site capture – establishing the basic infrastructure such as camps, airstrips, docks, fuel storage facilities and laydown areas to allow the construction workforce to expand and focus on construction of permanent Project infrastructure.

Site capture at Milne Port and the Milne Inlet Tote Road will be facilitated by existing infrastructure. Site capture at Steensby Port will take longer given the absence of existing infrastructure and poor ground conditions. However, the Steensby site capture will be facilitated by the execution of the proposed 2012 work plan presented in Appendix 3I. Supplies and equipment will be shipped to Steensby Port during the open water season early in the construction period. Approximately nine to ten months will be required to establish the basic infrastructure to provide for the mobilization and support of the large workforce needed for construction at Steensby Port and the Railway. Table 3-1.1 shows the expected workforce composition and numbers.

Railway construction will be staged from both the Mine Site via Milne Port and Steensby Port. The railway embankment will be used as a construction access road where possible. Where required along the proposed rail route, a separate temporary all-season construction access road will be built. These roads will allow for multiple work fronts with camp facilities, fuel storage, laydown areas, temporary airstrips suitable for small aircraft (e.g., Twin Otter) and access to aggregate sources. Site capture for Railway construction activities will require the construction of winter (ice) roads for the initial years of construction. Site capture will begin once basic infrastructure has been established at the Mine Site and Steensby Port.

February 2012





2.1.2 Mobilization and Re-Supply

During construction, containerized equipment and materials will be shipped to the Milne and Steensby Ports during the open-water season, in compliance with all the applicable Arctic shipping acts and regulations. Personnel, equipment and materials will also be flown into the Mine Site, Steensby and Milne Port airstrips, and then to construction camps using temporary airstrips built into the railway construction access road. Items bound for the Mine Site will be transported from Milne Port over the Milne Inlet Tote Road. To facilitate rapid off-loading of ships delivering supplies other than fuel (e.g., equipment and materials), three temporary docks will be constructed at Steensby Port, and a floating construction dock will be constructed at Milne Port.

2.1.3 Shipping Activities during Construction

All shipping will conform to the government of Canada's Marine Transportation Security Regulations (SOR/2004-144). Table 3-1.1 presents the estimated number of ships that will arrive at Milne and Steensby Ports each year during construction, as well as the total approximate tonnage of materials to be delivered each year. The estimated number of annual voyages is based on use of conventional sea-lift ships with cargo capacities of 7,000 to 16,000 deadweight tonnage (DWT). Larger ships or barges may be used for delivery of supplies and equipment depending on cost and availability.

A freight forwarding team will be responsible for receiving all cargo in the port of discharge, customs documentation, obtaining customs clearance, and inland freight to the consolidation point. Port facilities will be operated in accordance with Canada's Marine Transport Security Regulations for marine facilities. Shipping logistics at both ports will be managed by a Harbourmaster. A Port Superintendent will be onsite at Milne Port and Steensby Port during periods of shipping activity. The ports will be equipped with laydown areas and warehousing. Most materials will arrive in containers and will be stored in laydown areas before overland transport to the Mine Site. Warehousing will accommodate less than load materials for consolidation and possible loading into containers.

Hazardous and non-hazardous wastes that will be taken off-site for licensed disposal or recycling will be back-hauled on the supply sea-lifts.

Sea-lifts in Years 3 and 4 of construction and Year 1 of operation will be used to demobilize equipment as the construction activity winds down. Ships will not be serviced at either Milne or Steensby Ports. No water, food or fuel will be loaded onto the ships at these locations.

2.1.4 Types of Construction Activities

A dedicated and experienced construction team with the necessary equipment and labour will:

- Fabricate and construct the Project facilities (civil, building, building mechanical, steel structure, equipment installation, piping, electrical, instrumentation, insulation, and painting works);
- Inspect all phases of the work; and,
- Provide pre-commissioning and commissioning assistance.

The main activities within each of the major works are listed below:

Civil Works

- General site preparation and construction of temporary facilities
- Earthworks and soil exchange
- Foundation preparation
- Pre-stripping and removal of overburden in preparation for ore extraction



- Surveying
- · Construction of roads, airstrips, the railway, bridges, tunnels, ports and buildings
- Drainage management including construction of ditches and ponds

Mechanical Works

Steel structure, ladders and platforms will be supplied prefabricated to the maximum degree allowable for transport. The mechanical works will mainly comprise:

- Equipment installation
- Piping installation including prefabrication
- · Ore crushing and screening stations
- Construction of steel structures and pipe racks
- · Installation of mechanical systems in buildings

Electrical and Instrumentation Works

The prefabrication and assembly of electrical system components (e.g., switchboards, light tower, lighting fixtures, cable trays) will occur prior to shipping when possible. Instrumentation works will be scheduled to avoid interference with the other activities and to ensure operating continuity. The electrical and instrumentation works will mainly comprise:

- Construction and installation of electric power distribution systems
- Installation of sockets and motive power
- Installation of lighting systems
- Installation of electricity grounding systems

Pre-commissioning Activities

Pre-commissioning activities will be carried out prior to mine commissioning (start-up), including:

- Non-destructive testing (e.g., railway tracks)
- Cold alignment checks
- Vendor checks
- · Flushing of pipelines
- · Equipment adjustments
- Temporary hook ups
- · Compressed air testing

2.1.5 Equipment Fleet and Fuel Consumption

A large fleet of equipment is required to construct the key Project components including expanded facilities at Milne Port, Mine Site facilities and infrastructure, the Railway and Steensby Port facilities. In addition, equipment will be required for stripping and removal of overburden and ore extraction. A preliminary list of mobile heavy equipment is presented in Appendix 3C.

2.1.6 Strategy for Sourcing Aggregate

Significant quantities of aggregate will be required for construction activities. Crushed rock from quarries and sand and gravel from borrow sources will be required for construction of Project components, primarily for railway construction.

During the bulk sampling program in 2007-2008, Baffinland established three large borrow areas (Milne Inlet Borrow Area, the Mid-rail Camp Borrow Area and the Mary River Borrow Area) and two rock quarries (Rock Quarry #1 at Milne Port and Rock Quarry #2 at the Mine Site). These aggregate sources form part of

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

the Company's current Commercial Lease with the QIA (Figures 3-2.1, 3-2.2 and 3-2.3). In addition, a number of small roadside borrows were developed during road upgrades at that time (Figure 3-2.2).

To support mine construction, a number of additional aggregate sources have been identified, mainly along the transportation corridors. A total of 21 rock quarries (Q1 to Q16, Q16A, and Q17 to Q20) and 16 borrow areas (P1 to P16) have been identified along the Milne Inlet Tote Road (Figure 3-2.2). These quarries will be used as source material for ongoing maintenance of the Tote Road. Up to 79 rock quarries (identified by the railway kilometre post measured from the Mine Site) have been identified along the Railway, including those at the Mine Site and Steensby Port (Figures 3-2.4 through 3-2.8).

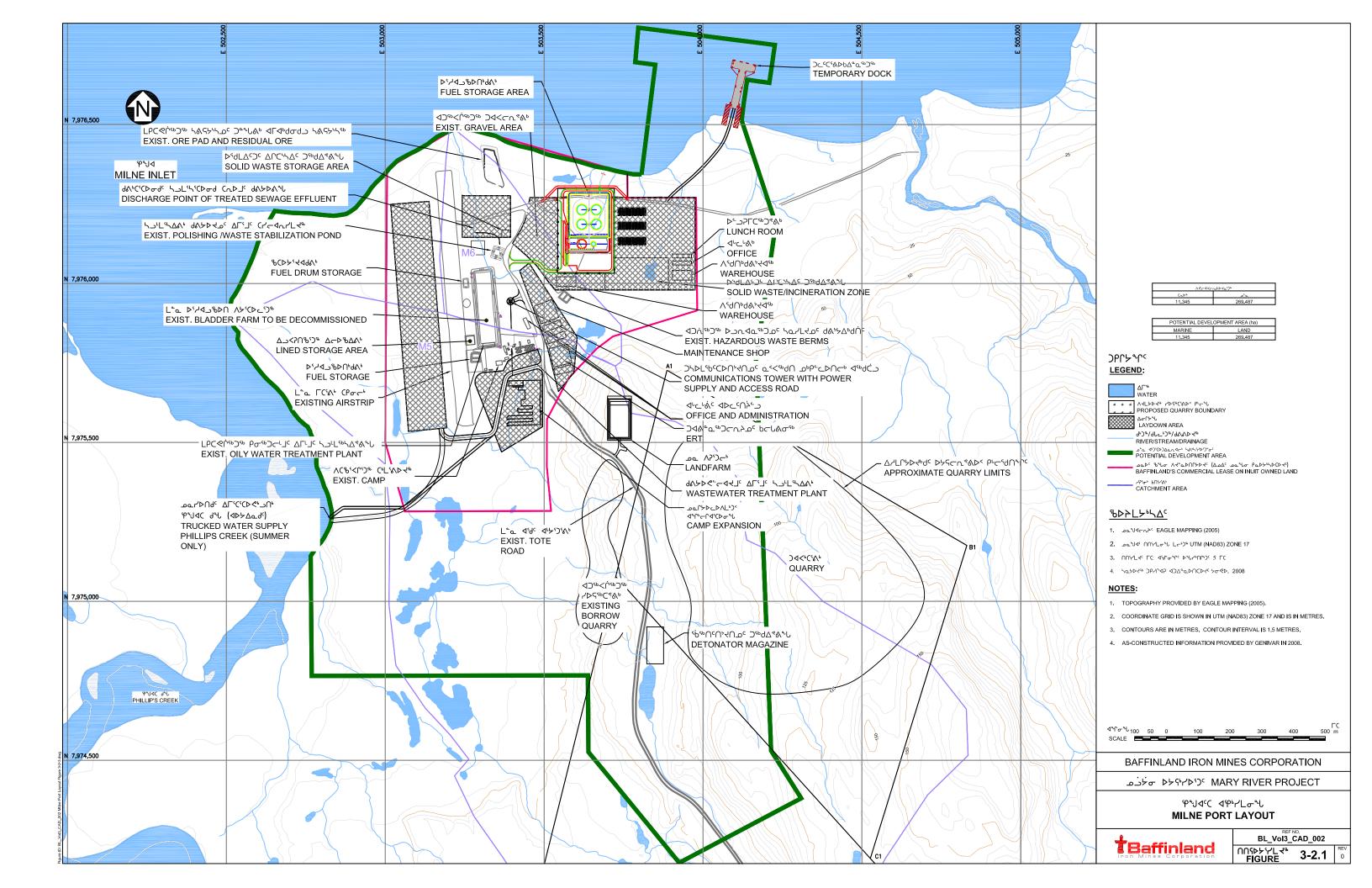
Analyses of select sand and gravel samples from borrow areas have indicated that crushing, screening and/or blending will be required to produce material suitable for structural fill, as the unprocessed material has poor compaction characteristics. At rock quarries, portable crushers and screens will be set to prepare aggregate to meet construction specifications.

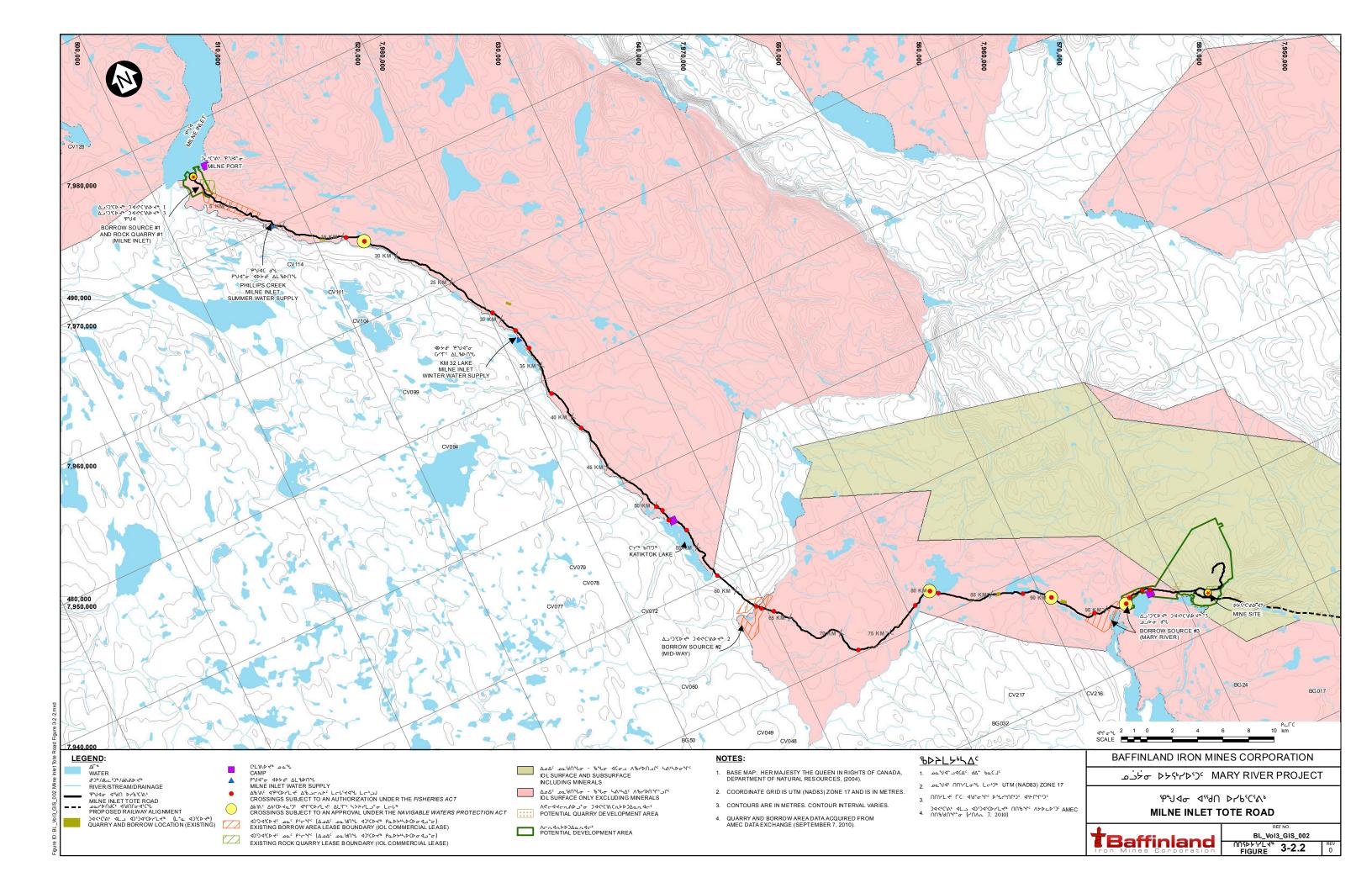
Baffinland's Borrow Pit and Quarry Management Plan is presented in support of the Type A water license application (Attachment 6 of Appendix 3B). This management plan includes a procedure for acid rock drainage/metals leaching (ARD/ML) testing of the quarry material prior to development. Baffinland will avoid all potential sites that have the potential for ARD/ML.

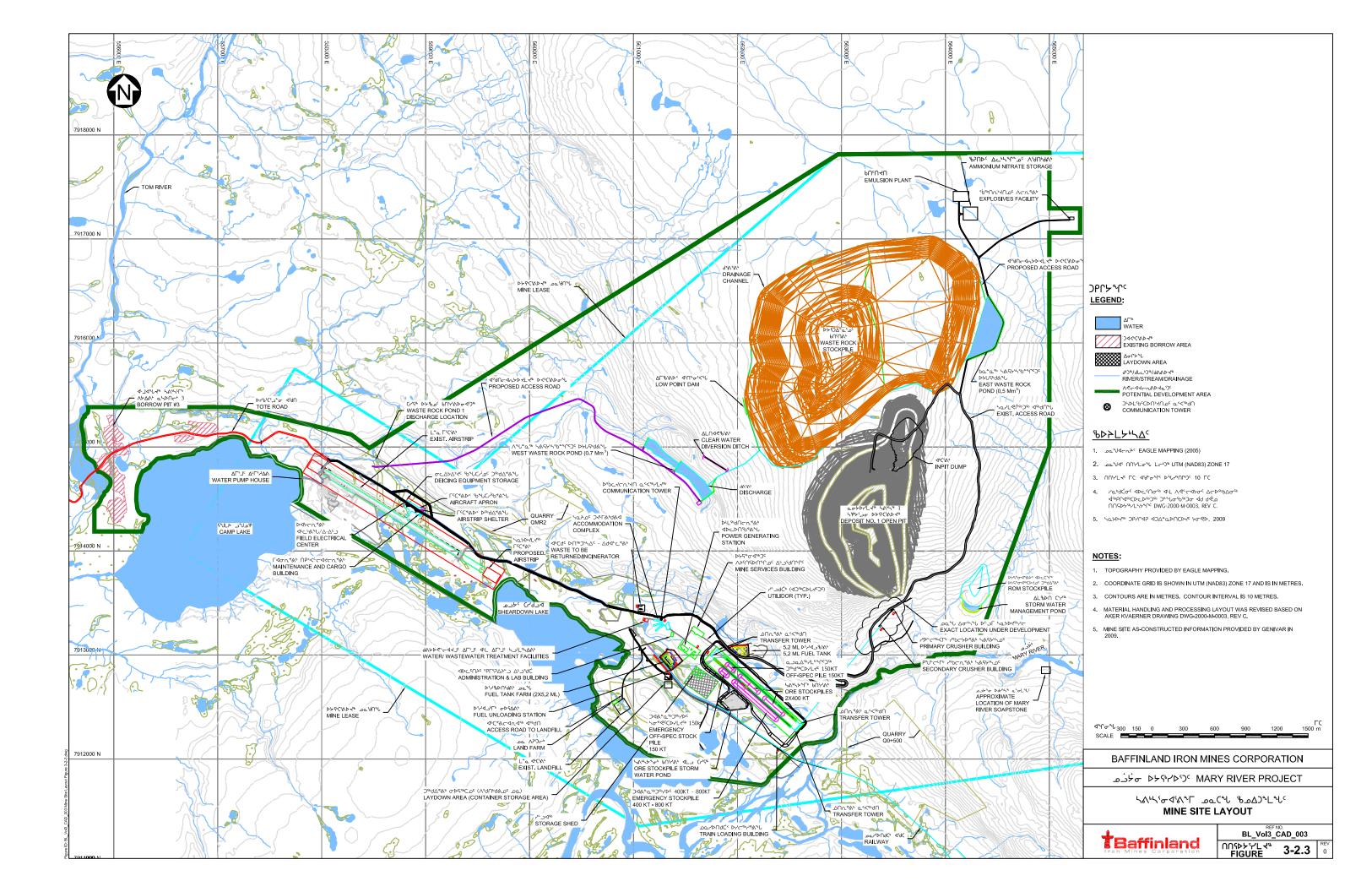
Each quarry site located on Crown Land will be the subject of a quarry permit application which will include an estimate of available resources, a quarry specific development plan, drainage plan, and closure plan. Three quarry permit applications are presented in Attachment 6 of the Type A Water License application (Appendix 3B).

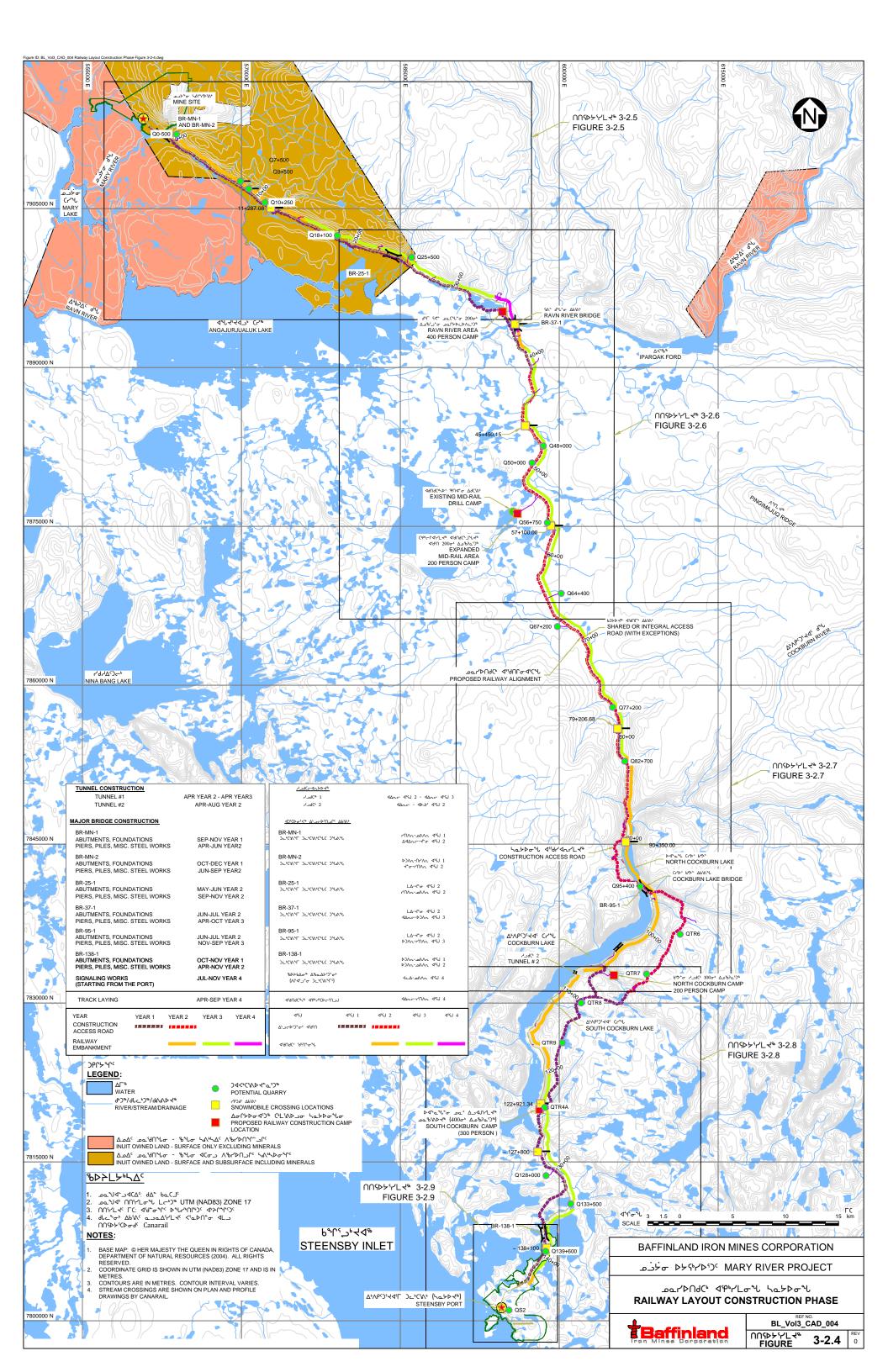
2.1.7 <u>Strategy for Temporary and Permanent Support Infrastructure</u>

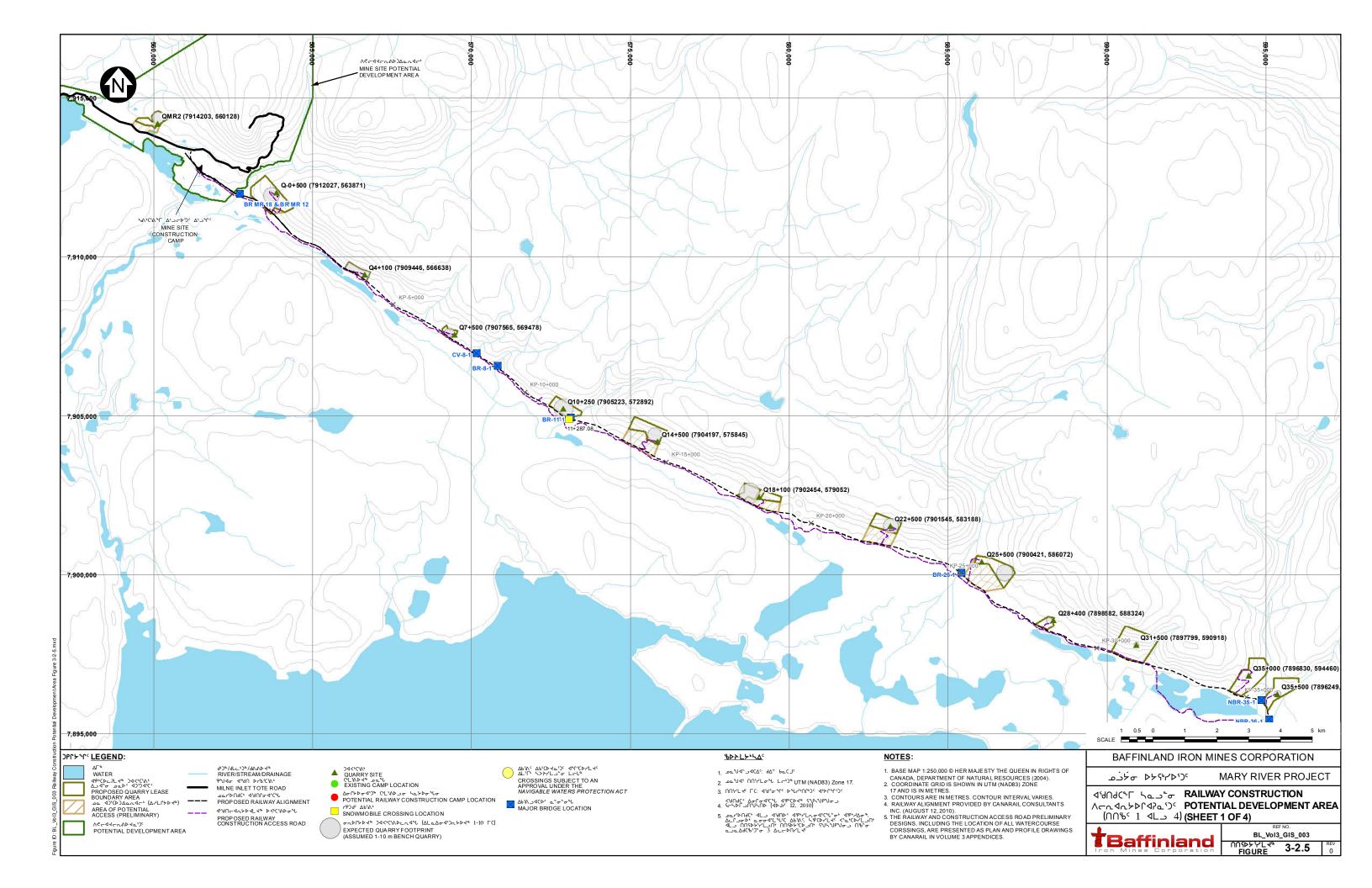
Where possible, permanent support infrastructure will be built at the onset of construction, and will be used during both the construction and operation phases of the Project. Temporary infrastructure constructed or positioned at Project sites needed only for the construction phase will be removed once construction is complete. In line with this strategy, most of the infrastructure developed at the onset of construction activities remains in service for the Life of the Project. Major components in each area are presented in Table 3-2.1, with temporary infrastructure distinguished from permanent facilities.

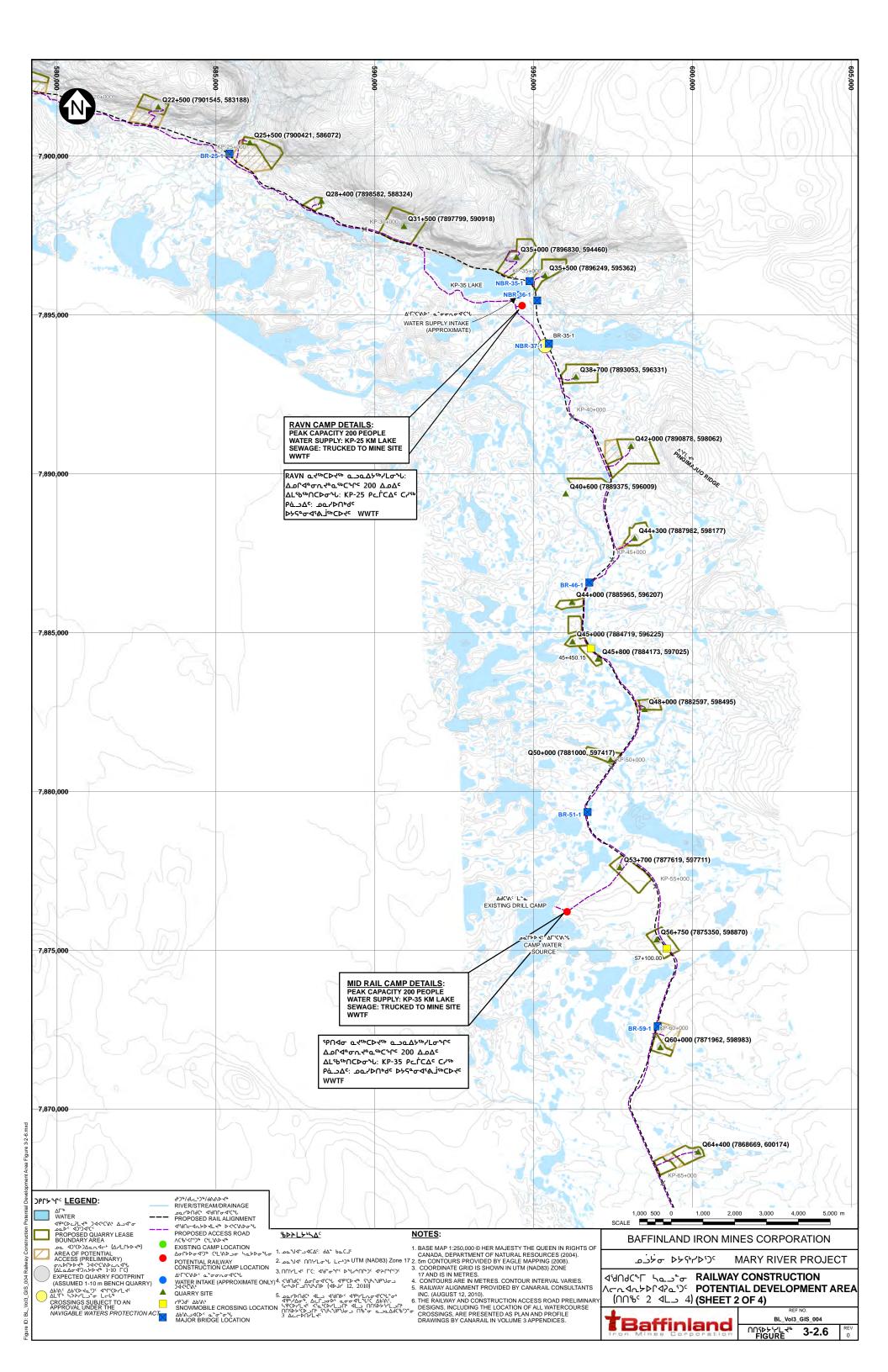


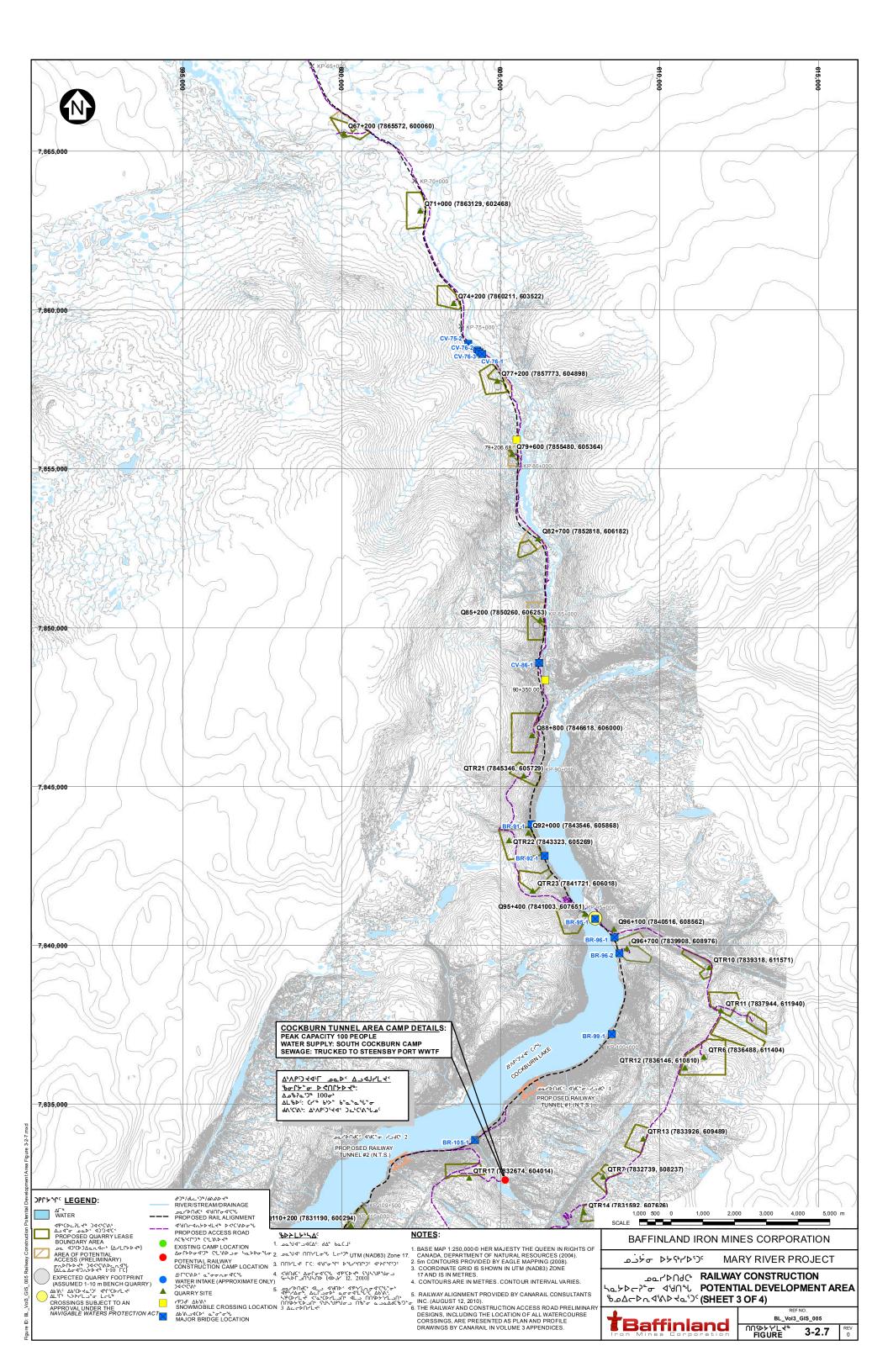












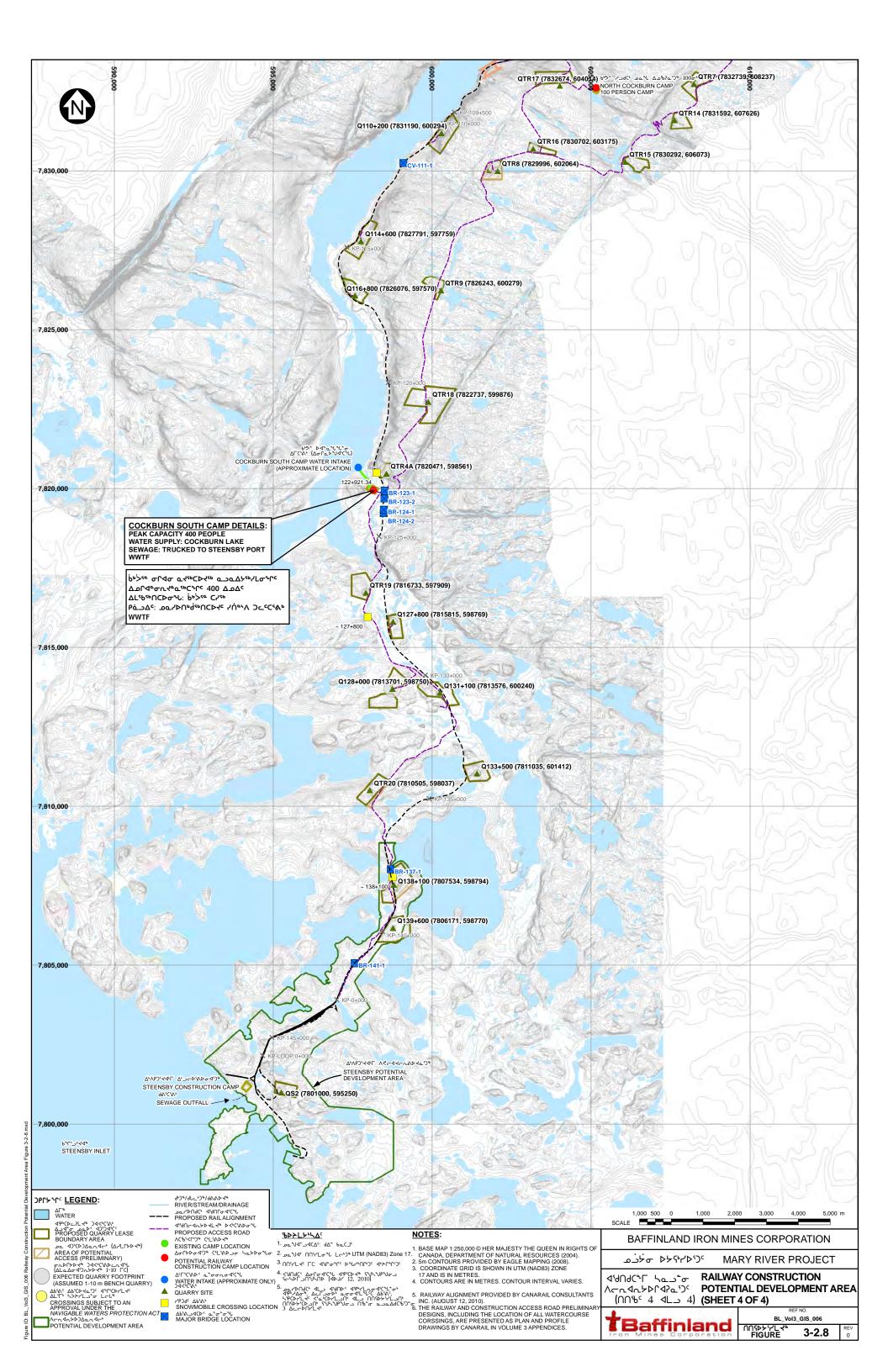




Table 3-2.1 Major Project Components

Mil	ne Port
Temporary Facilities	Permanent Facilities
 Bulk fuel storage facilities (fuel bladders to be decommissioned as part of 2012 work program) Camp facilities Mobile gensets 	 Beach laydown area for sea-lift unloading Laydown areas (existing) Airstrip (existing) Waste management facilities Quarries and borrow sources (existing) Camp facilities (existing and upgraded) Water supply (existing and upgraded) Mobile gensets Bulk fuel tank farm Explosives storage Communication systems Floating dock
Milne Inl	et Tote Road
Quarries and borrow sources	 Milne Inlet Tote Road (existing and upgraded) Quarries and borrow sources (existing and new) Communication towers Emergency shelters
Mi	ne Site
 Construction camp Contractor offices Quarries and borrow sites Temporary fuel storage (ISO containers) Aggregate crusher and stockpiles Concrete batching plants Temporary power generators Portable lighting plants Construction workshops and maintenance shops Construction warehouses and stores 	 Ore crushing and screening facilities Ore stockpiling facilities Railway loading and unloading facilities Mine Equipment maintenance facilities Permanent worker accommodations Communication systems Site roads Laydown areas Airstrip (upgraded) Bulk fuel storage and distribution facilities Explosives manufacturing and storage Water supply Power generation Waste management facilities Landfill site Landfarm Mine Waste rock stockpile
Ra	ailway
 Construction access roads Quarries and borrow sources Construction camps (4) and airstrips Refuelling depots at camps Explosives magazines 	 Railway embankment Communication systems Tunnels, bridges Rail sidings Quarry for ongoing railway ballast during operations (also used in construction)



Table 3-2.1 Major Project Components (Cont'd)

Steensby Port					
Temporary Facilities	Permanent Facilities				
Temporary Facilities Floating construction docks Fuel barge Quarry Concrete batch plant(s) Construction workshops and maintenance shops Construction warehouses/stores Temporary power generators Portable lighting plants Laydown areas/freight storage Parking areas for construction fleet Temporary fuel storage (ISO containers) Construction equipment maintenance facilities Mobile explosives plant and magazines	 Ore stockpiling facilities Ore crushing and screening Ore and freight docks Ship loading and unloading facilities Cargo (container) handling facilities Warehouses Permanent worker accommodations Rail shops and maintenance infrastructure Equipment maintenance facilities Buildings and offices Communication systems Site roads Causeway Laydown areas/freight storage Airstrip and related access road Bulk fuel storage and distribution facilities Water supply facilities Waste management facilities Power plant Landfill 				
	LandfarmNavigational aids (shipping lane and port)				

2.1.8 Fuel Supply, Storage and Distribution

Overall Strategy

Baffinland's fuel strategy is to begin development of the permanent fuel storage facilities early in the construction period. It is intended that these fuel storage facilities will remain in place for the Life of the Project.

During Construction, Jet A and diesel fuel will be delivered to Milne Port and Steensby Port during the open water season. From Milne Port, Jet A and diesel fuel will be transported to the Mine Site by 30,000L tanker trucks.

For Steensby Port, construction of the permanent secondary containment area for the tank farm will take place during Year 1. A combination of 20 steel fuel tanks each holding 1 ML and a fuel barge will be used to supply fuel during the early construction period.

Once the tank farms have been constructed, diesel and jet fuel will be delivered in bulk to both port locations by tankers. Small quantities of gasoline will be delivered in 20,000 L ISO containers. Fuel destined for the Mine Site, and the construction camps along the Railway will be delivered using 30,000 L capacity tanker trucks. Appropriate security will be provided at work sites to restrict access to fuel storage facilities by the public.

The potential for accidental releases during ship-to-land fuel transfer has been identified as a risk. In accordance with regulation, each both Steensby Port and Milne Port will have a transport Canada approved



Oil Pollution Emergency Plan (OPEP) as presented in Appendix 3B, Attachment 5. A tanker company with Arctic experience will be contracted to deliver fuel. Potential spills on land have also been identified as a risk. All fuel transfers will be carried out in areas that are bermed so that spills can be readily contained and managed.

The total estimated annual quantities of fuel to be offloaded at both Milne and Steensby Ports and consumed during construction are listed in Table 3-1.1. Further details on fuel handling at each major site are provided below.

Baffinland intends to use several 20,000L double-wall fuel ISO containers for storage of fuel at the various quarry sites during the construction of the railway. These containers will be delivered at the onset construction and positioned along the work fronts as required during the construction period. Each ISO container will be resupplied by tanker truck, either from the Mine Site tank farm or the Steensby tank farm.

Milne Port

At Milne Port, a permit was granted in 2011 for the replacement of the fuel bladder farm by a 5 ML permanent steel fuel tank as part of ongoing site operations and maintenance, as the bladders are reaching their design life. Construction of the 5 ML steel tank is underway. Two new 1.5 ML steel tanks will also be constructed for storage of Jet A fuel in early 2012, under existing permits. Once these two tanks are tested and commissioned, the remaining fuel contained in the bladder farm (diesel and Jet A) will be transferred during the working season of 2012.

The approach for the first year of construction will consist of expanding this fuel tank farm and initiation of construction of four additional 10 ML permanent steel diesel storage tanks in an engineered lined tank farm required to support subsequent construction activities. The new tanks will be constructed in accordance with appropriate guidelines and regulations for fuel tank farm construction and would remain in service for the Life of the Project.

The quantities and types of fuel stored at Milne Port are presented below:

Fuel Type	Storage Location	Storage Quantities
Diesel	Milne Port Tank Farm	45 ML (one 5 ML steel tank and 4 x 10ML steel tanks
Jet A	Milne Port Tank Farm	3 ML (2 x 1.5 ML; receives shipment of Jet A fuel for Mine Site)

Design criteria, technical specification and layout drawings for the Milne tank farm are presented in Attachments 3, 4 and 9 of Appendix 3B.

Mine Site

The strategy is to replace the existing bladder farm with a larger steel tank fuel farm. The new tanks will be constructed in accordance with appropriate guidelines and regulations for fuel tank farm construction and will remain in service for the Life of the Project.

The erection of three 5.2 ML fuel tanks and two 1.5 ML Jet A fuel tanks will take place early in the construction phase. Design criteria, technical specification and layout drawings for the Mine Site are presented in Attachments 3, 4 and 9 of Appendix 3B.



Steensby Port

A large volume of fuel will be required at Steensby Port early in the construction phase. The development of fuel storage and handling capacity at the port site will occur in stages.

The construction of the containment area for the permanent fuel tank farm required to support construction and operations will begin early during the first year of construction. The tank farm will be constructed in accordance with appropriate guidelines and regulations for fuel tank farm construction and will remain in service for the Life of the Project. Design criteria, technical specification and layout drawings for Steensby Port are presented in Attachments 3, 4 and 9 of Appendix 3B.

During the first year of construction, twenty prefabricated one million litre (1 ML) steel fuel tanks will be installed within the permanent containment of the future 160 ML tank farm. The 20 1 ML temporary steel tanks will eventually be decommissioned and removed during the construction phase of the Project once four 40 ML steel storage tanks are constructed and operational. The initial fuel requirements for Steensby will be provided by a fuel tanker. A 20 ML fuel tanker will be anchored near shore during the first year of construction and overwinter in Steensby Inlet. The related work will be contracted to a qualified Operator who has proven experience in providing such facilities to meet the Canadian Shipping Act 2001 regulations. The owner of the contracted vessel will provide a Transport Canada approved Shipboard Oil Pollution Emergency Plan (SOPEP), which includes a comprehensive risk assessment, once the vessel has been selected.

The permanent engineered lined tank farm containing four 40 ML steel tanks will supply the operation phase. A pipeline will be installed from the tank farm to the permanent freight dock to allow for dockside fuel deliveries. Before the freight dock is constructed, the tank farm will be re-supplied from tankers using the floating hose fuel transfer method. A draft Oil Pollution Emergency Plan (OPEP) for oil-handling facilities at Steensby Port is included in Attachment 5 of Appendix 3B.

During operation at Steensby Port, year round shipping requires use of up to four ice management vessels which use marine diesel. During the third year of construction, 15 of the 1 ML steel tanks installed during early construction will be dismantled and removed to make room for two new 25 ML steel tanks which will be used for storage of marine diesel. A smaller 7.5 ML marine diesel tank will be constructed adjacent to the freight dock. These tanks will be placed within impermeable secondary confinement.

Table 3-1.1 presents an overview of the fuel types and quantities stored at Steensby Port.

2.1.9 Explosives Manufacture, Storage, Transportation and Use

At the onset of construction, prepackaged explosives will be used. Once portable explosives mixing plants are established at the Mine Site and Steensby Port, an emulsion will be produced and used for explosives required during the construction period. These portable explosives mixing plants will be operated by a licensed explosives contractor and will be removed at the completion of construction activities. During construction, a permanent emulsion mixing facility will be built at the Mine Site. This facility will produce the explosives required for the ongoing mining operation.

The use of explosives is essential for the construction activities and the mining operation. The Explosives Management Plan (Attachment 8, Appendix 3B) describes the requirements for the transportation, handing and use of explosives at the Project site. Estimated quantities of explosives are also provided in the management plan.

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

The Project will require a supply of ammonium nitrate prills and diesel fuel to manufacture emulsions explosives for blasting as part of construction activities and mining. Explosives and associated items (detonators, ammonium nitrate, and the like) will be handled, stored, transported, used and disposed of in accordance with Natural Resources Canada (NRCan) requirements which include:

- Blasting Explosives and Initiation Systems Storage, Possession, Transportation, Destruction and Sale, March 2008
- Guidelines for Bulk Explosives Facilities Minimum Requirements, July 2010
- Quantity Distance Principles User's Manual
- Storage Standards for Industrial Explosives, May 2001

These requirements address the appropriate security and restricted access of explosives and explosives materials. Two explosives mixing plants will be constructed early in the construction phase; one at the Mine Site to supply construction activities and mining operations, and another at Steensby Port to supply construction activities at the port and Railway. The temporary explosives mixing plant at Steensby Port will be dismantled following the completion of construction activities.

Temporary explosives storage facilities at each port site will be bermed and grounded as necessary, and have been located in accordance with the D8 setback requirements outlined in Natural Resources Canada Quantity-Distance Tables (Natural Resources Canada 2011, Internet Site). Packaged explosives will also be stored in a magazine area at the Mine Site which will be set-back from the mine in accordance with the D5 distance criteria applicable to mine site operations from the Natural Resources Canada Quantity-Distance Tables.

Once the Mine Site explosives mixing plant, ammonium nitrate storage facility, and truck wash facilities have been commissioned, materials to manufacture the explosives will be delivered in bulk via Milne Port (construction phase) or Steensby Port (operation phase).

Once the Steensby Port temporary explosives mixing plant, ammonium nitrate storage facility, and truck wash facilities have been commissioned, emulsion explosives will be produced and distributed by truck to the construction fronts of the Railway and construction access road. Explosives will be required for rock cuts and tunnelling along the railway alignment and also for quarrying, as large quantities of gravel and ballast material will be required for construction of the rail bed and the construction access road. Temporary day-use magazines will be located as required, generally at intervals of approximately 5 km.

The ammonium nitrate storage pad will be constructed of crushed fill and a berm will surround the pad. Ammonium nitrate will be stored in Sea Can containers. Sandwiched in the fill and continuing up into the berm will be a geomembrane liner to ensure the facility is impermeable. Water will be allowed to drain to a sump and be pumped out as needed.

There will be no effluent discharge from the explosive manufacturing facilities. The temporary mixing facilities will be set up in self contained fold-away structures equipped with dedicated wash bays for vehicles. All wastewater will be contained and collected within the temporary facility. An evaporator will be installed to dispose of effluents. Design criteria, technical specification and the Explosives Management Plan are presented in Attachment 8 of Appendix 3B.



2.1.10 Waste Management

The waste management facilities placed during early construction will remain in use for the Life of the Project. Handling, storage, transportation and disposal of wastes generated by the Project will be conducted in a safe, efficient, and environmentally-compliant manner designed to:

- Limit the risk of adverse environmental effects and access to wildlife;
- Protect the health and safety of site personnel;
- · Limit the generation of waste; and
- Reduce costs associated with closure of waste handling, storage, and treatment facilities.

The Waste Management Plan (Attachment 5 of Appendix 3B) incorporates the waste minimization principles of Reduction / Recovery / Reuse / Recycling.

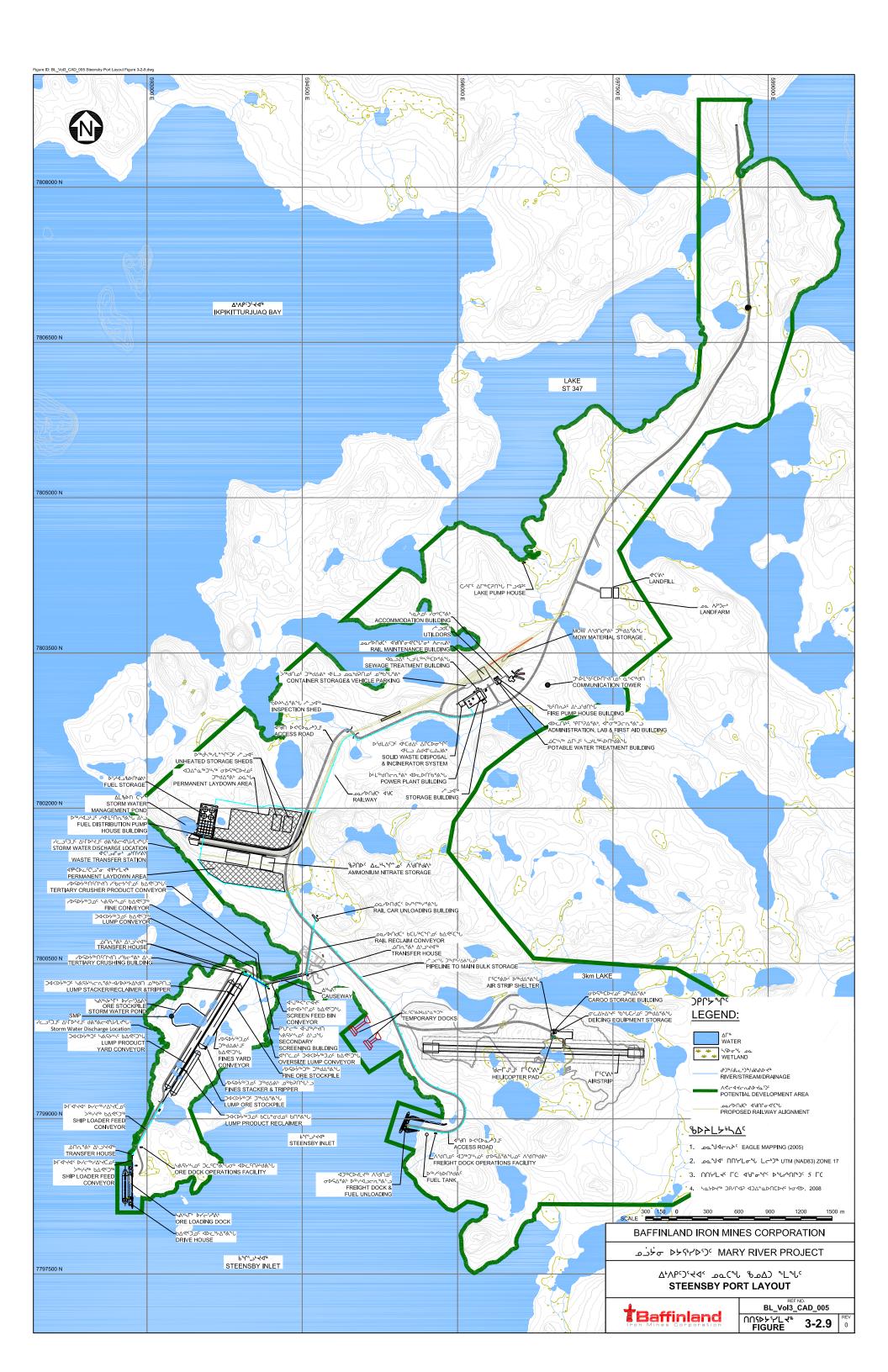
Permanent waste-management facilities to be constructed at the Mine Site and Steensby Port will consist of heated all-season buildings and adjacent laydown areas that provide:

- A central depot where waste will be managed, properly processed, packaged, labelled, inventoried, secured (e.g., on pallets) and stored for removal on annual sea-lift or reused on site;
- A waste management facility has a poured concrete floor with large doors for transferring waste in and out, plus an adjacent office for the waste management technician;
- Waste oil storage tank adjacent to the facility with waste oil filtering process inside and temporary storage for filtered/unfiltered oil. The filtered waste oil will be used for waste oil burners used to heat select facilities on site, including the waste management facility itself and the truck warming shed.
 Waste oil can also be blended into fuel for certain operations;
- Oil-water separator with holding tanks (typically 1 m³ totes);
- Oil filter draining and crushing facility;
- Drum crushing machine;
- Strapping and plastic wrap capabilities; and
- Label making capabilities.

Where possible and practical, the waste streams will be sorted at the source. Wastes remaining will be treated and disposed of in a practical and environmentally responsible manner. The following methods will be applied:

- Temporary safe storage and off-site shipping of hazardous and recyclable waste materials;
- Incineration of non-hazardous combustible wastes;
- Landfilling of inert non-combustible wastes at approved land fill locations (Mine Site and Steensby Port only);
- Landfarming of contaminated soil, ice, and snow (Milne, Mine Site and Steensby);
- Separation of oil from contaminated water in oil/water separation facilities; and
- Stockpiling of waste rock and overburden in designated stockpiles.

Waste disposal methods are discussed below. Waste generated at Milne Port will either be incinerated, transported to the Mine Site for landfilling, or (for hazardous waste) stored at the port site for shipment south to a licensed disposal facility. The location of waste management facilities are shown on Figure 3-2.1 for Milne Port, Figure 3-2.3 for the Mine Site and Figure 3-2.9 for Steensby Port.





Expected volumes of waste are summarized in the Waste Management Plan (Attachment 5 of Appendix 3B):

- Table 4.1: Waste Type and General Disposal Methods
- Table 4.2: Waste Quantities
- Table 4.3: Estimated Domestic Solid Non Hazardous Waste
- Table 4.4: Estimated Hazardous Waste
- Table 4.5: Mary River Waste Management Facility
- Table 4.6: Incinerator Allocation

Incineration

The main disposal method for combustible non-hazardous wastes generated on-site at each main camp location will be incineration, which diverts putrescible waste from the landfill and thus prevents odours that attract wildlife. It will use an appropriately designed variable-flow dual chamber incinerator, and ashes from the incineration process will be placed in closed drums and buried within a designated area of the approved landfill. Only trained personnel will operate the incinerators in accordance with applicable emission requirements. Waste oil will be recycled and consumed within waste oil burners in the maintenance shops.

Design criteria, technical specification, drawings, operating and maintenance manuals for the camps incinerators are presented in Attachments 3, 4, 5 and 9 of Appendix 3B.

Landfill

Approved landfill sites at the Mine Site (an expansion of the existing, approved landfill) and Steensby Port will be used to dispose of inert solid waste and ashes from the incinerator. An operation and maintenance plan for the landfill will guide operations (refer to Waste Management Plan, Attachment 5 of Appendix 3B). Regular cover will be applied and a cap of native overburden will be placed on top of the landfill before decommissioning so that the contents will remain permanently frozen and isolated. Open air controlled burning of inert combustible materials will be conducted on an as-needed basis to eliminate large quantities of wood waste and cardboard that would otherwise use up landfill capacity.

The land size and footprint will be minimized through planned waste minimization, recycling practices, and volume reduction from the incineration of a portion of the waste stream. The landfill will be operated only by trained site services personnel who will carry out regular inspection and monitoring.

Layout drawings and typical cross-sections of the landfills are presented in Attachment 9 of Appendix 3B.

Hazardous and Recyclable Wastes

Hazardous and recyclable wastes will be temporarily stored in special containers and/or at designated locations on-site and will be shipped annually on the sea-lift back haul to approved registered hazardous waste disposal facilities or to recycling depots. Manifests will be prepared for all materials shipped off-site and the receivers will be required to maintain chain of custody records.

Hydrocarbon Contaminated Materials

Soil, water ice and snow contaminated by accidental oil spills will be collected and deposited within landfarm treatment facilities for remediation. A bermed and lined landfarm facility will likely be constructed at the Mine Site and Steensby Port. The landfarms will consist of multiple cells to handle waste generated from several events separately. Soil remediation will occur through volatilization and natural biological processes, and once hydrocarbon levels meet the applicable Nunavut remediation standards, the soil will be transferred to the landfill, likely to be used as cover material. Landfarms have been successfully used in the

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

Arctic for similar applications (e.g., at the EKATI™ Diamond Mine near Lac de Gras in the Northwest Territories). If treatment is not effective, the material will be disposed of off-site at a licensed disposal facility.

Hydrocarbon-contaminated water, snow and ice will be treated within the oily water treatment systems at the railway maintenance shops located at the Mine Site and Steensby Port. Excessive volumes of contaminated snow and ice will be stored in a dedicated cell of the landfarm until the material has melted and can be transported by pump truck to an oily water treatment system.

Layout drawings and typical cross-sections of the Mine Site and Steensby landfarms are presented in Attachment 9 of Appendix 3B.

Excess Cut and Spoils From Construction Activities

Most of the waste rock generated from construction activities will be used as aggregate, with the exception of the waste rock generated from construction of the railway tunnels, which will be incorporated into the railway embankment along Cockburn Lake and operation of the open pit.

Soil spoils may be generated during construction of the Railway, site access roads and temporary roads to access borrow areas. This material will be re-used nearby as general fill if suitable, or will be stockpiled in roadside borrows that will be reclaimed to provide stable side slopes and restore natural drainage.

2.1.11 Communications

An integrated communications and networking infrastructure will service the Mine Site, the ports and other Project facilities located in Iqaluit, Toronto, and possibly other southern destinations during construction and operation. The construction camp at Milne Port will be serviced by a satellite communications (satcom) system. The Mine Site will be serviced by a telecommunications satellite dish installation. The option of servicing the Mine Site with its own local cellular phone network is also under consideration. Communications between the Mine Site and Steensby Port and the Mine Site and Milne Port will be provided by communication towers along the Railway and Milne Inlet Tote Road, respectively. The communication towers will be powered by diesel generators. Communications between the Steensby Port and the Mine Site may be provided by a second satellite dish installation.

The communications and networking systems will provide a very reliable, secure and comprehensive telecommunication network for all voice and data requirements.

2.1.12 Security

To protect employees and the public as well as Company assets, access to Project areas containing hazardous materials (explosives, chemicals) and operating equipment (crushers, conveyors) will be restricted with fencing and warning signs. Trained security personnel will be posted at Milne and Steensby Ports and the Mine Site and will conduct regular inspections. Visitors will be required to sign in and to be briefed on safety precautions before entering Project sites. Port facilities will be operated in accordance with Marine Transportation Security Regulations.



2.1.13 Ongoing Geotechnical and Geophysical Survey Programs and Environmental Studies

Detailed geotechnical investigations have been undertaken at the Project sites and will continue through construction. The studies include:

- Geomechanical investigations of open-pit slopes, railway rock cuts and tunnels;
- Geophysical (seismic) surveys within Project area;
- · Geotechnical investigations at all Project sites but particularly focused along the Railway; and
- Physical and geochemical testing of proposed construction aggregate and railway ballast materials and waste rock.

The results of these investigations have been incorporated into the planning and design of all phases of the Project and are briefly addressed in the relevant sections below.

Social and environmental studies were undertaken between 2005 and 2008 and elements of these studies are continuing. Since the submission of the Draft EIS, numerous environmental studies have continued to further compliment baseline data already collected for the Mary River project. In the freshwater environment, a surface water and sediment sampling program was initiated and completed in 2011 adding to information in the baseline. In the terrestrial environment, an additional year of raptor data was collected as part of the bird baseline. In the marine environment, further bathymetric studies were conducted in Hudson Strait and at Steensby Inlet. Results of all environmental studies have contributed to baseline conditions and are utilized within the respective assessments of this Final EIS.

Mineral exploration, geotechnical investigations and socio-economic and environmental monitoring studies during the construction phase will be staged from existing exploration camp facilities. Mineral exploration will focus on Baffinland's nine ore deposits along with regional exploration throughout the general area, and geotechnical investigations will focus mainly along the railway alignment. Environmental studies will continue around the proposed project infrastructure and new drill locations, with focus shifting from documenting baseline conditions to monitoring.

2.2 MILNE PORT - CONSTRUCTION PHASE

Figure 3-2.1 shows the layout of Milne Port.

2.2.1 Overview

Milne Port and the Milne Inlet Tote Road will be the primary transportation system supporting construction at the Mine Site and the north portion of the Railway. During the open-water season equipment and materials will be delivered to Milne Port by conventional sea-lift and trucked to the Mine Site via the Milne Inlet Tote Road. The existing facilities at Milne Port will play a key logistical support role for receiving materials at Milne Port and supporting upgrades and operation of the Milne Inlet Tote Road.

The existing Milne Port facilities will be expanded to prepare for the receipt of equipment and supplies including fuel. Existing facilities include: a personnel camp for 50 people, water supply and treatment facilities, mobile diesel generators, a sewage treatment plant, an incinerator, fuel bladder tanks, a 5 ML steel fuel tank, borrow areas, rock quarries, laydown area, airstrip, and temporary bulk sampling ore stockpile area. During construction, a floating dock will be installed to facilitate the timely offloading of equipment and materials from ships. The existing camp will be expanded to accommodate the estimated peak personnel requirements. The shipping routes to and from Milne Port are described in Section 3.2.3. The proposed facilities and their locations are shown in Figure 3-2.1.



Temporary and permanent facilities at Milne Port are listed in Section 2.1.7, and their construction is discussed in the following sections.

2.2.2 Temporary Facilities Additional to Existing Facilities

Construction Camp Facilities

A construction camp will be installed at Milne Port to accommodate personnel needed for construction activities (see Table 3-1.1). The existing camp facility will also be used during construction.

Laydown Areas

The existing laydown areas developed for the bulk sample operation will be supplemented with an additional laydown area within the existing lease (Figure 3-2.1). Approximate laydown area sizes are provided in Table 3-1.1.

Aggregate Sources

Aggregate for construction activities at Milne Port will be obtained from Borrow Source No. 1. Quantities are provided in Table 3-1.1.

2.2.3 Permanent Facilities at Milne Port

The design of port facilities has incorporated numerous precautions to address the construction and operation of port facilities in the arctic. Bathymetric work has been carried out to confirm safe and operationally-practical shipping routes.

Site Access Roads

Access roads will be constructed between the laydown area and the freight dock as well as between the beach and the laydown area.

Power Supply

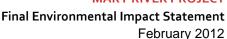
The number of modular mobile diesel generators in containers, currently used by the existing site facilities, will be increased to accommodate the increase in camp size, to operate ship loading and off-loading equipment, and other site requirements during construction.

Water Supply

Two approved water sources supply the Milne Port camp depending on the season (Figure 3-2.2). During summer, water is withdrawn by water truck from nearby Phillip's Creek next to the camp,. During winter, water is collected from a lake adjacent to the road at Km 32. Water is treated by filtration and UV exposure prior to consumption. These sources will supply the expanded camp during construction. Estimated consumption quantities are listed in Table 3-1.1.

Wastewater Treatment

The existing sewage treatment plant consists of a packaged treatment plant with a peak capacity of 50 people. Treated sewage is discharged to a local drainage ditch that drains to Milne Inlet. A polishing and waste stabilization pond (PWSP) provides for sludge disposal and discharge of treated effluent. This system will be expanded to accommodate the larger camp occupancy during construction. No sewage will be discharged by shipping vessels while they are at Milne Port.





2.2.4 Freight Dock

A floating freight dock will handle freight and fuel during construction and operation (see Figure 3-2.1). Cargo vessels using the freight dock include barges and ocean going vessels. It is expected that the fuel storage capacity of the tankers visiting the dock will be in the order of 10 to 20 ML. Fuel transfer will be via the floating hose method.

The construction methodology for the freight dock is aimed at reducing construction time, which is critical to the project schedule and considers the very short ice-free season. A lightering area will be prepared on shore and the inner end of the floating dock will extend from this area. The outer edge of the floating dock will be supported by spuds resting on the seabed. The dock will be anchored to hold it in place. The floating dock will be stored on shore during winter periods. The floating dock can be readily deployed following storage as required.

2.3 MILNE INLET TOTE ROAD – CONSTRUCTION PHASE

The Milne Inlet Tote Road was upgraded in 2008 from a winter road to an all-season road adequate for transporting equipment and ore using 45-t trucks during the bulk sampling program. The upgraded road follows the original 1960s alignment.

The Tote Road is the only overland transportation link between the Milne Port and the Mine Site. During construction, the road and stream crossings will be maintained. Sections of the road will be upgraded to reduce hazards and risks. The construction activities consist of:

- Improvement to the road base;
- Realignment of the road where necessary to facilitate passage of large loads and fuel tanker trucks;
- Improvement to the grade in certain areas: and
- On-going efforts to reduce risk at stream crossings through the implementation of the freshet management plan.

No work other than routine maintenance and some improvements to stream crossings are envisaged. Therefore, there is no requirement for an additional HADD authorization or NWB authorization for water crossings.

2.3.1 Road Operation During Construction

The Milne Inlet Tote Road will be an important transportation link for the Mine Site. Equipment and materials will be delivered by sea-lift, off-loaded at laydown areas at Milne Port and transported by truck and trailer to their final destination. Workers stationed at Milne Port will be flown into the Mine Site and bussed to Milne Port.

The transport of equipment and materials will be highly organized, forming one component of a Materials Management System carried out by a freight forwarding team under the supervision of a logistics manager. The use of containers and flat racks will be maximized for safe handling and efficient movement of materials. The truck and trailer movement will be concentrated during the open-water season. A portion of the sea-lift will be stored at Milne Port and transported to the Mine Site over the rest of the year, with possible short breaks during significant weather events and when driving conditions are unsafe.

The volume of traffic on the road will vary from year to year and will include truck and trailer traffic, personnel bus traffic, road construction related traffic during Years 1 and 2, and road maintenance traffic in all years of construction. The estimated truck, trailer and personnel traffic is provided in Table 3-1.1.



A Road Management Plan (Volume 10) will stipulate the rules of the road, including for example: the safe access and use by the public including hunters, limiting travel speed, yielding the right-of-way to wildlife, reporting wildlife observations, travelling in convoys for safety, emergency and spill response procedures, a safety policy addressing safe discharge of firearms near the road, truck traffic communications, and a community notification and update process.

Maintenance and regular inspections of the road will be carried out routinely. Inspections will be increased during the spring freshet to check culverts and the road for needed maintenance and repairs. Baffinland's experience operating the road year-round over the past several winters has been that significant snow drifting occurs periodically, making the road impassable for several days. As a result of this experience, emergency response measures will be put in place. Emergency shelters and implementation of protocols regarding maintaining sufficient fuel and/or provision of smaller naphtha heaters in the vehicles will be established.

2.4 MINE SITE - CONSTRUCTION PHASE

2.4.1 Overview

Construction infrastructure and work areas at the Mine Site during peak construction are presented in Figure 3-2.3. Appendix 3D and Attachment 9 of Appendix 3B contain additional information regarding the mine site.

At the onset of construction, the Mine Site will utilize existing camp infrastructure from the bulk sample program as follows:

- The 120-person camp for exploration, geotechnical and environmental personnel;
- Related water supply; sewage treatment plant, ponds and outfall; and power supply;
- Existing airstrip;
- Laydown areas; and
- Temporary explosives magazines.

Activities at the Mine Site during construction will include:

- Development of existing rock, sand and gravel aggregate sources;
- Upgrading of the airstrip to accommodate Boeing 737s and similar sized aircraft;
- Preparation of additional laydown areas or work areas;
- Establishment of an additional camp and related infrastructure;
- · Construction of a concrete batch plant;
- Construction of site access roads;
- Replacement of existing bladders with steel fuel tanks;
- Construction of bulk explosives plant and magazines:
- Development of mining facilities (e.g., crusher, conveyors, stockpiles and ore loading facilities);
- Pre-stripping and removal of overburden at the open pit;
- Construction of the northern section of the Railway;
- Commissioning of mining facilities;
- Ongoing exploration activities:
- Ongoing geotechnical investigations; and
- Environmental monitoring and sampling.

Construction activities will utilize existing infrastructure where possible to decrease the land disturbance area, minimize erosion and sedimentation potential, and improve construction efficiency. Fuel storage and distribution facilities are described in Section 2.1.8, explosives storage and handling facilities in



Section 2.1.9, waste management facilities in Section 2.1.10, and the communication system in Section 2.1.11. Upgrading and use of the existing airstrip are described in Section 2.7.

2.4.2 Temporary Facilities

2.4.2.1 Laydown Areas and Shops

A laydown area of approximately 30,000 m² will be provided at the Mine Site to store equipment and materials needed for construction. Proposed locations are shown on Figure 3-2.3. Areas have been selected which coincide with laydown areas already established during the bulk sampling program or with future development areas such as the accommodation complex and ore stockpiles. Additional laydown areas will also be established along the existing road where ground conditions require little or no grading or fill. A number of maintenance shops will be established for equipment maintenance and indoor storage during construction.

2.4.2.2 Aggregate Sources

Aggregate will be used during construction at the Mine Site as both general and structural fill for things such as site grading, backfill, foundations, embankments of water impoundments, and bedding in lined containment facilities. The aggregate will be obtained from rock quarries at the Mine Site (Figure 3-2.3). In addition to fill requirements, an estimated 32,000 m³ of concrete will be manufactured, composed of water, sand and gravel, and cement. The total estimated volumes of aggregate from each of the borrow sources and quarries identified for the Project are shown in Table 3-1.1. Section 2.1.6 describes the overall strategy for sourcing aggregate, with additional detail on the development and management of aggregate sources provided in the Borrow Pit and Quarry and Management Plan (Attachment 6 of Appendix 3B).

Crushed rock will be obtained from an existing quarry (Rock Quarry #2) at the Mine Site, supplemented with the proposed quarrying of a granitic (non-ore) outcrop on Deposit No. 1 and other quarry sites along the proposed Railway (Figure 3-2.4).

2.4.2.3 Concrete Manufacture

Volumetric concrete trucks will be used for initial concrete mixing and delivery until a winterized concrete batch plant is operational; subsequently, the trucks will be used at remote concrete pours. Borrowed and screened sand and gravel (or crushed rock fines), a large volume of water derived from the potable water supply at Camp Lake (Section 2.4.2.4), and cement transported via ship and road from Milne Port will be used for concrete manufacture.

2.4.2.4 Construction Camps and Related Facilities

To accommodate the construction workers, personnel participating in ongoing exploration, geotechnical drilling, archaeological and environmental programs, a new trailer camp will be located in the mine infrastructure area and the existing 120-person tent camp will be expanded. Camp capacities are provided in Table 3-1.1.

2.4.3 Water Supply

The water supply for the Mine Site will be sourced from Camp Lake located about 3 km from the Mine Site and from Mary River (Figure 3-2.3). Camp Lake will supply water for the following uses:

- Potable (drinking) water;
- Exploration and geotechnical drilling;
- Aggregate washing;



- Concrete manufacture;
- Explosives truck wash and explosives manufacture;
- Dust suppression (summer season only); and
- Other miscellaneous camp uses (small relative volume) such as emergency water supply (fire fighting systems) and steaming of culverts prior to freshet.

Table 3-1.1 summarizes the estimated daily consumption of water during the construction phase. Water for exploration, geotechnical drills and aggregate washing will be sourced from Mary River. These sources will be used during both construction and operation.

The potable water supply system will consist of a pump house, an insulated steel raw water pipeline and potable water storage tanks (also used to store fire protection water). A permanent intake structure, similar to the typical drawing presented in Attachment 9 will be installed in Camp Lake (drawing # E337967-0000-07-042-0001 Conceptual Lake Water Intake). All water intakes will be equipped with screens of a mesh size to meet Department of Fisheries and Oceans guidelines (DFO 1995).

The potable water treatment plant will be located near the accommodation/administration/laboratory complex. Water treatment will consist of chemical treatment followed by settlement, filtration, polishing and chlorine or ultraviolet disinfection. Treated potable water will be stored in an insulated and heat-traced water storage tank sized to meet peak requirements.

A water truck will deliver potable water for local consumption in remote areas such as the mine maintenance shop/office, explosives handling facility and other ancillary facilities as needed. The drinking water will be checked regularly to ensure health standards are maintained.

2.4.4 Power Supply

A centralized power plant designed to service the facilities of the entire Mine Site will be located near the accommodation complex as shown in Figure 3-2.3. The power plant building will be connected to the accommodation complex through an utilidor.

The estimated power demand for the mine and number of diesel generators are provided in Table 3-1.1. One diesel unit will be on standby and one will be a spare unit for maintenance. There will be no transmission lines constructed as part of the Project; distribution lines will run from the power plant to points of use throughout the Mine Site.

A built-in waste heat recovery system will circulate recovered waste heat from the generators to the accommodation/maintenance/administration complex and other buildings. A boiler building will be located approximately 20 m to 40 m away from the power plant and close to the accommodation complex. The boiler system will provide a fail-safe system to supply the required building heat from the boilers, in the event of power plant failure. The boilers will be sized to supply the entire demand of building heat for one week.

Alternative energy options to supply power to either or both the Mine Site and Steensby Port have been considered, focusing on opportunities for hydro-electricity and wind turbines. A candidate hydro-electric site has been identified near Steensby Port and a test wind tower was installed at the Mine Site. Both options could partially off-set diesel use. These alternatives are discussed in Section 6. While these options do not form part of the Project, Baffinland continues to evaluate these energy options for potential longer-term implementation. Separate approvals will be sought if either hydro-electricity or wind power were to be developed.

February 2012





2.4.5 Wastewater Treatment

Two independently operated wastewater treatment facilities (WWTFs) will serve the two camps at the Mine Site during the construction phase. The WWTF currently serving the existing 120-person exploration camp will be modified to accommodate additional volume. Another larger WWTF will be located in the vicinity of the accommodation/administration/laboratory complex. Wastewater will be collected within each building and pumped to the WWTF via a main pipe. At remote areas, such as the mine maintenance/mine office, wastewater will be collected in local holding tanks and collected by tanker truck for treatment at the WWTF.

The existing WWTF consists of a modular rotating biological contactor (RBC) design that incorporates: a primary settling tank and screen; secondary biological treatment; humus removal in a secondary settling tank; dosing with divalent metal salts to remove phosphorus; and UV disinfection. The RBC uses a series of slowly rotating polyurethane discs that have their bases submerged in the wastewater. Over time a dense biological mass that builds up on the surface of the discs is responsible for breakdown of organics within the wastewater. The operation of the RBC-based system is optimized for nitrate/nitrite and suspended solids (SS) removal. This WWTF will be expanded. Sludge extracted from the secondary settling tank will be dewatered to 25 % (w/w) solids and then incinerated or landfilled.

Treated effluent from the existing exploration camp WWTF will continue to be discharged into the northern section of Sheardown Lake (to the west of the main tributary) through an insulated and heat-traced pipeline (Figure 3-2.3). This existing WWTF has been designed to meet current effluent discharge requirements.

A new larger WWTF will be provided to serve the new construction camp and remote areas such as the construction offices and explosives-handling facility. This WWTF will consist of a modular RBC design. Treated effluent will then undergo sand filtration and tertiary polishing before seasonal discharge to Mary River during periods of flow. The new WWTF will operate in accordance with effluent discharge requirements. Additional detail on the existing and proposed WWTFs at the mine site is provided in the Fresh Water Supply, Sewage and Wastewater Management Plan (Attachment 5 of Appendix 3B).

Oil/water separation facilities will be constructed within the maintenance facilities to treat contaminated water and soil.

2.4.6 Permanent Facilities

A number of facilities will be constructed or upgraded early in the construction phase that will remain in place through the Life of the Project:

- Airstrip;
- Mine haul roads;
- Communication systems;
- Fuel storage; and
- Waste management facilities.

Construction will also be undertaken to build mining infrastructure to support the operations as follows:

- Open-pit pre-strip and waste rock stockpile development;
- Ore crushing, screening and conveyor systems;
- Ore stockpile pads and related water treatment facilities:
- Truck loading and unloading systems for fuel and containers;
- Upgraded road from open pit to crusher;
- Railway loading and unloading systems for ore, fuel and containers;



- · Permanent accommodations, offices and other buildings;
- Permanent power generation, boilers and substations; and
- Mine maintenance facilities and warehouse.

The siting considerations for the Mine Site have included:

- · Limiting environmental effects by reducing the overall footprint;
- Providing a safe working facility (e.g., locating explosives storage areas away from camps and other facilities). Refer to Section 2.1.9 for a description of the explosives management approach and Attachment 8 of Appendix 3B for the Explosives Management Plan;
- Limiting earthworks;
- Minimizing mining haul distances;
- Providing efficient heat recovery from power plants;
- Providing attractive and effective living accommodation for employees; and
- Reducing the distance between the accommodation area and work areas as much as practical.

The Mine Site building foundations and major structures such as crushers and other ore-handling facilities will be sited on bedrock when possible (typical for work in permafrost areas). Where this is not practical, a variety of different pile systems will be used in combination with elevated building designs. Surface pads consisting of locally quarried crushed rock (gravel) will be used for access and laydown areas, parking areas, raising of grade, and generally to protect the permafrost around all of the permanent infrastructure facilities.

Careful consideration was given to the choice and location of ancillary facilities including the incinerator, landfill, water treatment, wastewater treatment, ammonium nitrate storage, explosives mixing and explosive magazines. Most of these facilities will be housed in buildings, and some, such as the explosives storage areas, will be located away from other permanent workplace facilities for reasons of health, safety and regulatory compliance.

Geotechnical and exploration drilling are ongoing, and the results from these activities may influence the positioning of site infrastructure. Additional geotechnical drilling could identify important constraints that result in minor changes to the location and design of facilities. Ongoing drilling of Deposit No. 1 could result in minor changes to the pit configuration and therefore volumes and positioning of related waste rock stockpiles, explosives storage, conveyor systems, maintenance shops, access roads, and the primary crusher. In addition, geotechnical and exploration drilling will continue at Deposits No. 2, 3, 3B, 4 and 5.

Surface water drainage diversion associated with the Mine Site infrastructure (e.g., waste rock pile) will use best practices that minimize disturbances to terrain, thereby minimizing erosion and sedimentation of watercourses.

2.4.6.1 Buildings

Various buildings, described in Section 3.4.3, will be erected during the construction phase. Buildings and structures will be designed and constructed in a manner to reduce or eliminate denning, roosting and nesting sites for avian predators.

2.4.6.2 Mine Facilities

Ore sizing facilities including primary and secondary crushers, screens and associated conveyors will be constructed as follows:

- Rough grading and bulk excavations;
- Forming and pouring large foundations;



- Backfilling;
- Perimeter building foundations, floor slabs and minor footings;
- Rough settling of major equipment and large bins;
- Installation of conveyor gallery sections, pulleys, drives and take up mechanisms;
- · Structural work, including cladding and roofing; and
- Mechanical and electrical installation.

2.4.7 Air Strip

The existing Mary River Airstrip will be upgraded to include an extension to the runway (340ft to the west and 1300ft to the east) and a new taxiway/apron along the north side of the runway. The extensions will be gravel surface, and will be combined with an upgrade to the existing gravel runway surface (approx. 1m depth of gravel added). Part of the airfield lighting upgrades will include the addition of Omni-Directional Approach Lights (ODAL's) for the Runway 12 approach (approach from the west). The runway will be classified as Code 3D non-precision, requiring a graded area up to 45m either side of centerline, and an obstacle free area 75 m either side of centerline. Obstacle limitation surfaces will also require that no structures, vehicles or objects fall within specified runway approach slopes and runway transitional surface areas.

2.4.8 Stockpile Development

A run-of-mine (ROM) ore stockpile will be provided for temporary storage of ore waiting to be loaded into the crusher. In addition, a separate stockpile area will be provided for temporary storage of ore for loading into railway cars. A minimum 1.5 m granular pad will be constructed on top of bedrock to support the ore stockpiles. The permafrost has been assumed to extend into this layer. Infiltrated water from the ore will reach this frozen layer and work its way out to the edges. A lined ditch will be constructed along the stockpile perimeter to collect this water and monitor and treat as necessary to meet effluent discharge requirements. Conceptual drawings of stormwater management ponds are presented in Attachment 9 of Appendix 3B. As the open pit pre-strip activities progress, the development of the waste rock and overburden stockpile will proceed in accordance with the Waste Rock Management Plan (Attachment 5 of Appendix 3B).

2.4.9 Site Access Roads

Two categories of roads will be constructed for mine operation. Mine haul trucks will use a 13 km main haul road connecting the open pit, primary crusher, and waste rock stockpile areas. Access and service roads will be constructed to handle light-duty site and commercial traffic. Other light-duty roads include a 6.5 km road from the mine haul road in the north to the plant and the airstrip, and a 3.5 km road from the haul road to the explosive magazines, raw water pump house, water treatment plant and conveyors. Existing watercourses on these roads are currently equipped with culvert installations.

Traffic along roads will be managed in accordance with the Road Management Plan (Volume 10, Appendix 10D-8). Roads will be inspected regularly, and repaired as necessary. Runoff collected in stormwater management ponds or treated sewage effluent ponds may be used for dust suppression, provided the water quality meets applicable water licence standards.

2.5 RAILWAY - CONSTRUCTION PHASE

2.5.1 Overview

A 149 km Railway will be built to transport iron ore from the Mine Site to Steensby Port (Figures 3-2.4 to 3-2.8). The Railway will be constructed to accommodate heavy-haul mineral transport. It will also include

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

some mixed general freight to supply the Mine Site may include a passenger train for employees. Along the Railway will be an estimated 31 bridges (seven of which will be longer than 100 m), two tunnels (one approximately 1000 m and one approximately 300 m in length), and more than 200 culvert crossings (using 1.5 m and 3.0 m diameter pipes). Representative depictions of typical crossing types are presented in Appendix 3B, Attachment 7, along with a table correlating structure type with each crossing. Appendix 3E and Attachment 9 of Appendix 3B contain additional information regarding the Railway.

The proposed Railway includes:

- Rail line and embankment, including tunnels, bridges and sidings;
- Crossings of watercourses and drainages;
- Yards and terminals, including loading and unloading (loop) tracks, turning tracks for the locomotives and service and storage tracks;
- Supporting facilities, including maintenance and emergency facilities;
- Train, including locomotives (engines) and cars; and
- Signalling and telecommunications.

The activities to construct the Railway include:

- Construction of winter (ice) roads during the early years of the Construction Phase to enable access to all the Railway staging areas;
- Construction of an access road, including a roadbed and installation of temporary drainage facilities (e.g., bridges and culverts);
- Establishment of quarries;
- Establishment of construction camps;
- Ongoing geotechnical investigations;
- Construction of embankments and excavation of tunnels;
- Installation of drainage structures (e.g., bridges, culverts and berms);
- Surfacing the embankment with ballast;
- Placing the rails;
- Installing communication towers and bungalows;
- Placing the locomotives and cars on the rails; and
- Commissioning the Railway through testing and de-stressing.

The sequencing of these activities is shown on Figure 3-2.4. Construction will be staged from both ends of the Railway at the Mine Site and Steensby Port (Figures 3- 2.5 to 3-2.8). For the early years of construction, winter roads will be used to access the Railway staging sites. It is expected that a winter road will be constructed from the Mine Site to the Ravn River and Mid-Rail camps and another winter road will be constructed from Steensby Port to the Cockburn Lake camps (Volume 3, Appendix 3F). Water use required for the construction of winter roads will be the subject of a separate Type B Water License Application. This application will be submitted once the final routing of the winter road is established and all the water draw points are identified.

A construction access road will facilitate establishment of temporary construction camps, quarries and airstrips which are necessary to position the large workforce, equipment fleet and fuel required to construct the Railway from multiple work fronts. The construction methods and equipment will be appropriate for Arctic conditions and terrain consisting of permafrost, rock and various soil textures. Section 2.5 outlines the Railway design and construction requirements including all necessary support infrastructure and supplies. Section 2.1.5 provides an estimate of the types and amount of equipment that will be required for construction. Plan, profile and standard cross-section Railway drawings are presented in Appendix 3E.

February 2012





2.5.2 **Design Considerations**

The Railway is being designed by Canarail Consultants Inc. (Canarail) of Montreal, with bridge design supported by Dillon Consulting Ltd. (Dillion). Canarail has worked on the design since 2006, and engineering work continues as additional geotechnical and environmental information becomes available. Air photo interpretation and extensive geotechnical drilling and test pitting along the proposed and former railway alignments have been undertaken by Knight Piésold in association with EBA Engineering Consultants Ltd. (EBA); about 400 drill holes and 270 test pits have been completed over a three-year period. Additional work has been carried out in 2010 and 2011 to advance Railway design.

The design has focused on developing the minimum railway infrastructure necessary for operational viability and safety. Management, operations and maintenance have been centralized in one facility. Sidings have been determined by operational requirements, and located to minimize earthworks where possible.

The Railway alignment has been designed to minimize intrusion into water bodies and reduce multiple crossings of the same watercourse. A stringent evaluation procedure was used to select the appropriate structure for each water crossing, considering technical, geotechnical, environmental and cost conditions (Dillon 2008).

The railway route has been subject to extensive watershed modeling using recognized HEC-RAS software, to ensure that the railway roadbed imposes the minimum impact on the established patterns of water flow throughout the project. The design of bridges and culverts has focused on control of the rates of flow in the vicinity of, and through, all crossing structures to control erosion and debris flow and the prevention of ponding and damming effects.

The railway loading yard has been sited as close as possible to the ore stockpiles in consideration of general topography, subsurface soils, and foundation stability required for the loading machinery and track. The unloading loop at Steensby Port has been sited to obtain the elevation necessary to install rotary dumping equipment and the nearby railway yard and has been located to provide foundations on bedrock for the maintenance centre while remaining close to unloading facilities and living quarters.

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 (QCM), 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.

The major design and maintenance problems in discontinuous permafrost regions relate to transitions between zones with and without permafrost or to very small changes in ground temperature that will 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 approach to subgrade design of the Railway is summarized as follows:

- Promote raising the transition zone between the permanently frozen ground and the active layer by using self-ventilating embankments;
- Minimize disturbance to natural drainage patterns:
- Minimize thawing of sensitive soils;



- Avoid cuts in thaw-sensitive soils when the soils themselves cannot be avoided; and
- Preparation of remedial work once the Railway is operational. This could require the use of stabilization berms, thermosyphons or the shading of south facing embankments not adequately cooled by natural ventilation.

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 six to seven weeks, whereas the extreme cold in northern Baffin Island lasts for five to six months. This will be demanding on the operating and maintenance crews, but will be ameliorated to a large extent by the relatively rapid rotation of crews at the Project site.

Routing

To limit effects on the existing environment, encroachment of the railway track near lakes, rivers and other sensitive natural features has been minimized. However, the geometric requirements of railway alignment design place particular restrictions upon the route selection.

- Railway lines cannot include tight curves. There are issues relating to rail wear and train speed, the
 rigid bogies of cars and locomotives (particularly three-axle locomotive bogies) can only negotiate a
 tight curve at very low speeds.
- Winding 'S' shaped routes (to avoid natural features) require a section of truly straight track between the
 two portions of the curve plus sufficient space to provide the necessary transitions between curved and
 straight tracks.
- Changes in grade are carefully planned to avoid multiple changes in the direction of the railway gradient within a single train length to limit changes in compression and tension in the couplers between cars.
- Curved sections of track and increases in grade present a physical resistance to the forward motion of the train, resulting in increased power demands upon locomotives. Consequently, the maximum achievable grade must be decreased if the track is also curved.

Existing and apparently well-used caribou trails have been identified in the field, and trails that cross the railway embankment will be re-established by constructing crossings. IQ knowledge has been incorporated into an appropriate design for caribou crossings, by softening the embankment side slopes to an acceptable grade and providing a surface treatment that will make the crossings more accessible to the caribou.

The proposed railway alignment is shown on Figure 3-2.4. From the Mine Site the Railway proceeds approximately southeast for about 35 km across a long series of sand and gravel terraces that lie at the southern foot of the same mountain range that bears the Mine Site iron ore deposits. These terraces are often deeply cut by drainage channels from the mountains.

The route then turns towards the south and crosses the Ravn River at around the kilometre post (kp) 37 marker. At the southern end of the plateau, the route enters Cockburn Lake valley and continues southerly until it skirts the western shore of Cockburn Lake at kp 89 before crossing the lake at a natural constriction at kp 95. The route then follows the east bank of Cockburn Lake for approximately 14 km, through an area requiring tunnelling and benching in bedrock. Two short tunnels will be constructed to direct the track southward, down the east side of Cockburn Lake valley.

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

The route continues along the east side of the lake for another 13 km across well established sand and gravel terraces and benches. At the southern end of the lake, it continues southeast, avoiding numerous rocky hills and waterlogged ground around small lakes, until it reaches the port site at Steensby Port (kp143).

Controls during construction and an additional culvert have been incorporated in the design to ensure no change to the drainage characteristics of an uncommon stand of Richardson's willows, thus limiting the effect of the Railway on that site as well as an important archaeological feature (a wolf trap). Affected watercourse crossings are shown on the detailed Canarail drawings in Appendix 3E and are discussed in more detail in the Fish Habitat Compensation (Volume 10, Appendix 10D-7).

A number of routing alternatives were considered early in the feasibility study process: crossing Cockburn River at the southern end of Cockburn Lake; crossing the Ravn River downstream of Angajurjualuk Lake; running along the base of the steep cliffs along Tariujaq Arm; and hybrid combinations of these routes with portions of the proposed route (see Section 6). An alternate Cockburn Lake to Nuvuit Coastal Rail Link was also considered in the fall of 2011, after a site visit with QIA Executives (see related Canarail and QIA reports, Appendix 3E). The proposed route was determined to be preferred based on technical, operational, environmental and cost considerations.

Ground Conditions

Permafrost and ground conditions influence Railway design and route alignment in particular. The ground on Baffin Island has continuous permafrost, defined as ground (rock and/or soil) remaining at or below 0°C continuously for at least two years. Above the continuous permafrost is the active layer of ice, soil and rock which is subject to seasonal freezing and thawing. In the Project location the active layer is typically from 1 to 3 m thick. Ground conditions along the Railway alignment vary; site investigations have been undertaken and will continue to define areas with thaw-susceptible soils. The embankment design, including drainage facilities has (to the extent possible), addressed ground conditions through the following general methods:

- Maintaining the existing thermal regime by using run of quarry fill embankments that are not permeable;
- Avoiding cuts into the existing ground in favour of placing additional fill;
- Maintaining current drainage patterns to avoid alteration of the ground's thermal regime; and
- Excavating thaw-susceptible and ice-rich soils (in select instances).

For the construction of bridge foundations, special consideration has been given to the potential effects of climate change, which could increase the depth of the active layer. A minimum 2 m embankment will be provided over thaw-susceptible soils. The general characteristics of the surrounding terrain along the proposed Railway corridor, including surficial materials (ground thermal condition and ice and moisture content), topography, drainage conditions, and other factors influencing landscape stability are further described in Volume 6.

The potential for freeze-thaw damage along the Railway is predominant in sections where the railway line crosses thaw-sensitive ground with ice-rich soils. The embankment design has been developed specifically to minimize the effects of freeze thaw cycles.

Experience elsewhere in the Arctic has shown that this type of structure responds very slowly to the thaw cycle so that over a period of time the interface between the true permafrost and the active layer rises above ground level. With the appropriate embankment configuration, the natural ground ultimately remains entirely within the continuous permafrost layer and the active layer is lifted into the embankment, which itself is not thaw-sensitive and thus not prone to freeze-thaw damage. Results of geotechnical investigations

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

throughout the design and construction of the Railway will be used to determine the appropriate embankment configuration for the different types and depths of thaw sensitive ground encountered.

<u>Drainage Facilities (Drainages, Streams and Rivers)</u>

A number of drainage facilities including crossing structures (large bridges, smaller single-span bridges and culverts) will be constructed along the route. The identification of appropriate engineering options was carried out using a systematic decision-making process to evaluate each of the 214 drainage crossings. This process considered engineering and environmental factors to determine the optimum site-specific crossing at each location (culvert or bridge). Detailed evaluations and screenings were performed during the design process. Decision-making criteria included the need to minimize impacts to freshwater biota and habitat (including required erosion control measures), hydraulic conditions, ease of construction and cost.

Other drainage facilities (ditches, dikes, berms and other protection works), will be provided along the entire railway route to protect against subgrade washout due to surface drainage flow.

2.5.3 Railway Embankment

The Railway bed will consist of subgrade (on embankments or in cuts) and sub-ballast, a layer of graded crushed rock that acts as a filter layer between the embankment material and the ballast. The track structure, consisting of ballast, ties and rail, will be laid on top of the sub-ballast. During construction, quantities of sub-ballast and ballast will be sourced from borrow areas located close to the railway route.

Standard cross-sections of the railway embankment are presented in Appendix 3E. Depending on ground conditions, the rail embankment may be 1.5 m in height where the rail is constructed over rock or other thaw-stable soils, or a minimum 2 m in locations of thaw-susceptible soils. Ground conditions have a very large bearing on rail embankment construction. Mitigation of poor ground conditions ranges from avoidance, where possible, to excavation of thaw-susceptible and ice-rich soils, to construction of embankments high enough to insulate underlying soils and minimize or eliminate disturbance of the natural ground thermal regime. The height of the embankment has a large bearing on its width; a 1.5 m high embankment may measure about 12 m toe-to-toe, whereas a 4 m embankment will measure about 50 m across its base. When embankments on ice-rich and thaw-susceptible soils are high, slopes will be low (5 to 1), which will also allow ready crossing by animals and vehicles and will encourage snow to blow over rather than accumulate on the embankments.

Design has focused on providing stable embankments on very soft thaw-sensitive ground where the dead load of the embankment is a challenge. The embankment and sub-ballast layers have been designed to diminish the transmittal of the dynamic loads that are related to the weight and speed of the operating trains. Recommended train speeds have been limited to approximately 60 km/h and as an additional precaution the operation has been designed to facilitate lowered speeds through sensitive areas during the thaw period.

Consideration has been given to caribou and to hunters on snowmobiles or ATVs crossing the embankment. Preliminary snowmobile crossings have been identified (see Figures 3-2.4 to 3-2.8) and final locations are expected to be finalized in consultation with the communities. Crossings will consist of visible signage, finer sized material treatment over the embankment, and wooden timbers next to the rails (similar to a road-railway crossing in southern Canada). Caribou crossings have also been designed with similar features, so that caribou can safety climb the blasted rock embankment at key trail locations.



2.5.4 Rock Cuts and Tunnels

A number of rock cuts will be required along the length of the Railway. Geomechanical investigations have provided railway engineers with information about stable slope angles, and conceptual designs for various rock cut scenarios have been produced. Rock cuts are shown on the Railway plan and profile drawings in Appendix 3E.

Two tunnels, measuring 1,000 m (Tunnel 1) and 300 m (Tunnel 2) long and approximately 7.8 m high and 5.5 m wide, will be bored into the side of the mountain along the east shore of Cockburn Lake (Figures 3-2.4 and 3-2.8 and Appendix 3E).

Tunnels are necessary at these locations to avoid cutting back the entire slope of the mountain. The tunnel design will be based upon the American Railway Engineering and Maintenance-of-Way Association guidelines (AREMA, 2010). Construction will involve a large amount of drilling and blasting through solid rock. Tunnels will be built by first removing loose rock and soil at the portal entrances, establishing the portals, tunnelling from one end, constructing the second portal, and then completing the tunnelling. The process will consist of repetitive cycles of drill, blast, muck, and consolidate (rock bolts, wire mesh, or shotcrete) carried out around the clock. Drilling will be carried out using a semi-automated multi-core 'Jumbo' drill rig to blast 70 to 80 holes into the full face. Tunnelling progress is estimated at 4 m each drill blast or each day, requiring about one year to complete tunnel works.

During hard rock drilling a drill fluid prevents the drill head from overheating. Due to the permafrost conditions, it is likely that brine (solution containing water and calcium chloride) will be used as the principal drill fluid to prevent drill rods from freezing in the rock. The face and muck pile may also require washing down with brine. There will be a net loss of brine in the muck; hence salt and water replenishment will be required. Water consumption sourced from Cockburn Lake during tunnelling is estimated at 16,000 m³ over the one year. A brine plant will be provided at the tunnel portal linked to the temporary service pipe system which will run down one side of the tunnel wall. The brine will be re-circulated to the brine plant by sump pumps in the tunnel. As little brine as possible will be lost. Total calcium chloride requirement is estimated at 1,400 t. Runoff from tunnel construction activities will contain some brine, cementitious residues, and fugitive petroleum products. Provisions for water treatment (carbon dioxide gas-dosing for the cementitious alkalinity and oil-water separation) will be identified during design. Sediment basins will be used to retain suspended solids and will be periodically cleaned out and the sludge disposed of. At the portals, surface water runoff will be directed away from the tunnel to a sump located at a low point in the portal area. This water will pass through sedimentation tanks before disposal in nearby creeks or water courses.

2.5.5 Disposal of Waste Rock and Soil Spoils

The majority of the cuts will be into rock, most of which will be used as fill in the Railway embankment. Approximately 1 million m³ of rock generated at the tunnels will not be used as fill and will be disposed of nearby within the railway right of way (ROW) south of the tunnels and alongside Cockburn Lake.

One of the fundamental criteria for the railway design was to stay away from cuts in ice-rich soils to avoid inducing thermal changes and causing geotechnical stability issues. The unavoidable cuts in ice-rich soils were 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.

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

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 ensure long-term stability of these materials the following disposal criteria will be applied:

- Soil spoils will be disposed of in exhausted quarries as a preferred option, particularly low-lying areas or below-grade excavations within quarries. Quarries represent a 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.
- 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.
- Local depressions or low-relief areas will be selected as opposed to slopes where material can run-off.
- 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 (Attachment 5 of Appendix 3B) 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.

Disposal sites will be identified early in the construction phase once main spoils generation sites are determined.

2.5.6 Watercourse and Drainage Crossings

A number of large bridges, smaller single-span bridges and culverts will be constructed along the route. A study was conducted to assess suitable criteria for culverts and bridges to avoid flooding of the railway infrastructure or any unexpected damage to the adjacent ground (Dillon 2008b). Culvert capacities and bridge locations were assessed using a river hydraulics analysis software package assuming a 200-year return period with an allowance made for ice accumulation (Dillon 2008c).

The identification of appropriate engineering options for each of the 214 crossings was presented in the Mary River Development Proposal (Baffinland 2008b). The evaluation took into account engineering and environmental factors at each crossing location. Screening and detailed evaluations were performed to aid in determining the optimum site-specific crossing at each location (culvert or bridge). Decision-making criteria included potential effects on freshwater aquatics, hydraulic conditions, ease of construction and cost.

Preliminary assignments of crossing structures for each drainage crossing along the Railway are presented in Attachment 9 of Appendix 3B. At the majority of locations corrugated steel pipe (CSP) culverts will be used. Alternatively, corrugated structural plate pipe (CSPP) culverts will be used, as required. Erosion protection will be provided using riprap. Culverts have been designed in accordance with AREMA (2010) guidelines. In general, all culverts will have a minimum of 1 m cover.

Several shorter bridges will be required over smaller watercourses. These will be simple single-span structures, with a length of 15 m and varying vertical clearances. Standard Arctic foundation construction



techniques similar to those used in northern Canadian mining and infrastructure projects will be used (e.g., embedding piles in bedrock or the use of ad-freeze piles). Additional geotechnical investigations will facilitate the final foundation designs. Special consideration has been given to the potential effects of climate change (especially for foundations), which could increase the depth of the permafrost active layer.

2.5.7 Construction Access Road

The construction access road, if built in its entirety, will be about 162 km long and will consist of a main access road with secondary arteries leading to areas such as quarry sites and camps. To the extent possible, the access roads will be within the railway right-of-way and either constructed integral to the railway embankment (integral access roads), adjacent and with a nominal separation between the road and the railway embankment, or separate from the railway right-of-way (independent access roads). Depending upon construction execution, the length of construction access road built may be less than 162 km. A number of factors influence whether the access road is integral or independent: steep topography, number of rock cuts, avoiding disturbance of the ground thermal regime and avoiding placement of two consecutive long culvert lengths (for railway and access road crossings) that may create a barrier to fish movement. About 65 % of the access road will need to be independent of the railway right-of-way.

The main construction access road and its arteries located within the railway alignment have been designed to accommodate trucks of up to 100 t capacity and will have a minimum road surface width of 8 to 12 m. Other related access roads (e.g., to explosives magazines) have been designed to accommodate 50 t trucks and to have a minimum road service width of 8 m. The road surfaces will consist of a 50 mm base (minus 50 mm) and a 150 mm sub-base (minus 150 mm). An embankment of approximately 0.9 m thickness may be placed over thaw-sensitive ground to preserve the thermal regime. Typical construction access road cross-sections and plan and profile drawings are presented in Appendix 3E.

A number of bridges and culverts will be installed along the length of the railway construction access road. All will be designed for a one in 10-year hydrological event. Culverts will be fabricated out of corrugated steel pipe (CSP) with a minimum diameter of 1.6 m. Bridges have been designed to support a 100 t load and a minimum deck width of 8 m. Representations of typical culvert installations along the construction access road are included in Appendix 3B, Attachment 9. Because the hydrological return period for the construction access road is shorter, and the crossing location in some instances is different from the Railway, there will be locations where a bridge along the Railway will be matched by a culvert along the road. In many locations, the culvert for the access road will be an extension of a culvert needed for the Railway and will be cut back to the desired length when the access road is decommissioned.

The access road will be constructed during winter as much as possible to avoid disturbing nesting birds. In general, roads will be constructed to avoid cuts on thaw-sensitive ground. No major diversions of water courses are required for construction of any of the roads. In some locations, to channel sheet flow, a ditch may be excavated and water diverted through culverts under the roads. Soil spoils may be generated during road construction. This material will be re-used nearby as general fill if suitable, or will be disposed of in roadside borrows, which will be reclaimed to provide stable side slopes and restore natural drainage. Water may be used for dust suppression, and this water may be derived from stormwater or treated sewage effluent, provided the water quality meets applicable water licence standards.

2.5.8 Temporary Airstrips and Air Traffic

Air access for workers and materials for railway construction will be via the airstrips at either the Mine Site or Steensby Port, and possibly from small temporary airstrips suitable for the landing and take-off of small



aircraft such as Twin Otter. The small temporary airstrips may be constructed by widening small portions of the construction access road near each construction camp. Exact locations will be determined during construction. The sites selected for the airstrips will avoid encroachment on fish habitat.

2.5.9 Aggregate Sources

Aggregate is required for the construction access road and the railway embankment and will be derived mostly from quarried rock and, to a lesser extent, cobbles and boulders.

Ongoing efforts have identified 79 potential quarries to date (Figure 3- 2.4). Locations and bounds have been screened against environmental constraints such as a 500 m buffer from known raptor nests, and a minimum 31 m setback from watercourses. The results of this screening exercise are presented in Appendix 3E.

Some identified quarry sites have undergone geotechnical site investigations; additional work will confirm the sites to actually be used, the estimated volumes and the boundaries to be quarried. The Borrow Pit and Quarry Management Plan (Attachment 6 of Appendix 3B) includes a procedure for acid rock drainage/metals leaching (ARD/ML) testing of the quarry material prior to development. Results, to date, of geochemical testing for acid rock drainage and metal leaching indicate that quarry materials have low potential for acid generation and metals leaching. The tested and untested quarries will be subject to additional geotechnical and geochemical investigation as the Project proceeds. Baffinland will avoid potential quarry sites that have the potential for ARD/ML. Preliminary access road locations and quarry bounds are shown on the access road and quarry access road drawings in Figure 3-2.4. Expected quantities of aggregates are presented in the Borrow Pit and Quarry Management Plan (Attachment 6 of Appendix 3B).

2.5.10 Explosives Storage and Use

A large quantity of explosives will be required to quarry rock for the construction access road and railway embankment, for rock cuts and the two tunnels to be excavated alongside Cockburn Lake. Explosives for Railway construction will be sourced from the bulk emulsion plants at the Mine Site and Steensby Port. Magazines will be located along the Railway, usually within spent quarries. The magazines will be positioned and bermed as required to meet applicable regulatory requirements. Refer to Section 2.1.9 for the overall Project explosives management approach.

2.5.11 Construction Camps and Related Facilities

Railway construction camps will be located at the following locations (all distances are kilometres along the railway route from the Mine Site; occupancy numbers provided above are expected peaks):

- Ravn River area (km 35) 400-person camp;
- Mid-Rail area (km 55) 200-person camp;
- North Cockburn Camp (km 105) 200-person camp; and
- Cockburn South Camp (km 125) 300-person camp.

The locations of these camps are shown in Figures 3-2.4 to 3-2.8. Camps will be established as construction access road completion allows, and they will likely operate at some level of occupancy for the duration of the construction phase.

Each of the camps is expected to be trailer style and will be equipped with modular power generators. Water treatment will consist of chemical treatment followed by settlement, filtration, polishing and chlorine or ultraviolet disinfection, with treated potable water stored in insulated and heat-traced water storage tanks.



Sewage at the Ravn River and Mid-Rail camps will be collected and trucked to the Mine Site WWTF, and sewage from the Cockburn camps will be trucked to the Steensby Port WWTF. Combustible wastes generated at each of the construction camps will be either incinerated on-site or trucked to the Mine Site for incineration. Inert waste will be trucked to the landfill sites at either the Mine Site or Steensby Port. Hazardous wastes generated from Railway construction will be stored at the Steensby Port and taken offsite by sea-lift to licensed disposal facilities in the south. Communications between the construction camps and other Project sites will be provided by temporary satellite communications (satcom) systems. Specific details about each camp including siting considerations are provided below.

Ravn Area Camp

This camp will support construction of the major bridge crossing over the Ravn River as well as the Railway in this general area. This area is characterized by rolling terrain of large glacio-fluvial deposits spotted by small, shallow lakes that have made identification of a suitable water supply and receiving water for sewage difficult. The nearby Ravn River freezes to the bottom. The lake to the immediate north of this camp (Figure 3-2.9) has been identified as the water supply for this camp, with an intake structure installed. Alternatively, water will be taken from the main water source at the Mine Site (Camp Lake). In the absence of a suitable receiving waterbody nearby, sewage will be trucked to the Mine Site for treatment. A relatively large laydown area (about 29,000 m²) will be established at this camp location.

Mid-rail Camp

An existing 40-person drill camp at this location will be expanded to accommodate a portion of the Railway construction workforce to minimize travel distances between the Ravn River camp and the camps further south at Cockburn Lake. The general area throughout this section of Railway is flat, wet and uneven, and full of boulders. Lakes are generally small and shallow, providing few options for ideal camp siting. Therefore the existing drill camp is proposed to be used as the Mid-rail Camp. Its advantages include an existing footprint of disturbance and an adequate water source, despite being located several kilometres from the railway alignment and construction access road. Mid-Rail Camp will draw water from Nivek Lake in summer and Ravn Camp Lake in winter. Sewage will be trucked to the Mine Site WWTF.

North Cockburn Camp

Excavation of the two tunnels along Cockburn Lake will take a specialized team approximately one year to complete. In the absence of sufficient area lakeside, this camp will be located on the plateau above the worksite. The ground in this area is extensive exposed bedrock with water channelled in crevasses. Water will be derived from Cockburn Lake, either by a dedicated intake pipeline or by trucking water from the larger camp to the south. Sewage will be collected in holding tanks and trucked to the Steensby Port WWTF. While this camp may be required for about one year for tunnel construction, the camp will continue to be used in constructing the railroad north of the tunnels in order to minimize travel times for the construction workforce.

Cockburn South Camp

The camp will be located on an outwash plain next to a stream that flows into Cockburn Lake. The camp water supply will be drawn from an upstream location on Cockburn Lake. The plan will be to have an anchored buoy placed a distance from the shoreline which will connect to the end of a surface pipe. The pipe end will be screened in accordance with DFO requirements. No concrete pad will be required. Sewage will be trucked to the Steensby Port for WWTF. A large laydown area of approximately 39,000 m² will be provided.







2.5.11.1 Fuel Storage and Distribution

The primary fuel storage facilities for railway construction will be located at the large tank farms at the Mine Site and Steensby Port. Temporary storage, consisting of multiple 20,000 L capacity double-walled ISO containers, will be established at construction camps, quarries and major bridge sites. These ISO containers will be re-supplied by tanker trucks. Equipment at the railway construction fronts will be refuelled by smaller fuel trucks. Refer to Section 2.1.8 for a description of the overall Project fuel storage and distribution facilities.

Laydown Areas and Shops

Shops and office facilities to support railway construction will include:

- Mine Site Office, shop and welding shop, aircraft receiving, maintenance office and dry shack and warehouse.
- Construction camps Warehouse/shop and maintenance office and dry shack.
- Steensby Port Office, main shop, maintenance office and dry shack, welding shop and warehouse.

In addition to the laydown areas at each of the construction camps, smaller laydown areas will be established at small bridges (about 1,500 m²) and large bridges (about 4,000 m²).

2.5.11.2 Emergency Shelters

Emergency shelters consisting of up to four mobile trailer camps, will be positioned at strategic locations along the construction access road and relocated as appropriate throughout the construction period.

2.6 STEENSBY PORT - CONSTRUCTION PHASE

2.6.1 Overview

Facilities at Steensby Port will be located on the mainland as well as nearby Steensby Island in Steensby Inlet (Figure 3-2.9). Appendix 3F and Attachment 9 of Appendix 3B contain additional information regarding Steensby Port. Construction will include a longer site-capture phase than at Milne Port, owing to more difficult ground conditions that result in limited pre-existing laydown areas, difficulty in accessing quarry sites and the absence of an airstrip to mobilize a large workforce at the onset.

Development of an initial quarry will allow for the establishment of access roads and laydown areas to receive the very large volume of equipment, materials and fuel that will be delivered by sea-lift in the openwater season of Year 1, and for access to additional quarries to construct the airstrip. Construction and use of the airstrip is described in Section 2.7. Site capture, involving the establishment of basic infrastructure (camps, airstrips and docks) to allow full construction to proceed, will take an estimated six to nine months.

Unloading of materials and equipment will be facilitated by the installation of temporary docks early in the construction period during open-water season, prior to the arrival of major sea-lift deliveries.

Figure 3-2.9 shows the layout during the construction phase.

Activities at Steensby Port will include:

- Build access road to initial quarry;
- Construct laydown areas, work areas, and access roads;
- Construct the airstrip, beginning with a starter airstrip;
- Install construction docks on the island and mainland;
- Receive sea-lift deliveries of equipment and materials:
- Establish construction camps and related infrastructure;



- Construct the railway construction access road;
- Establish railway construction camps;
- Construct a concrete batch plant at Steensby Port; and
- Build permanent port infrastructure, including permanent ore and freight docks, permanent accommodations, and railway/port ore handling facilities.

A starter airstrip will be provided to receive the additional workers needed for construction.

Fuel storage and distribution facilities are described in Section 2.1.8, the explosives storage and handling facilities in Section 2.1.9, the waste management facilities in Section 2.1.10, and the communication system in Section 2.1.11. Airstrip construction and use is described in Section 2.7.

Efforts have been made to make the Steensby Port site as compact as possible, and to ensure that construction areas overlap with the same lands to be used during the operation phase.

2.6.2 <u>Siting Considerations</u>

The siting objectives for the Steensby Port infrastructure are similar to the Mine Site:

- Limit environmental effects:
- Provide a safe working facility;
- · Reduce the amount of earthworks;
- Provide efficient heat recovery from power plants;
- · Provide attractive and effective living accommodation for employees; and
- Minimize the distance between the accommodation area and work areas to the maximum practical extent.

The location of important archaeological resources has had a considerable bearing on the location of port infrastructure. Several years of archaeological surveys have identified a number of sites, some of which have been deemed significant due to their age, condition or uniqueness in the currently limited regional archaeological record. A major reconfiguration of the Steensby Port layout was undertaken following the 2008 archaeological field program to avoid those areas expected to be archaeologically significant. Prior to construction at the Steensby Port proceeding, final detailed archaeological surveys (including the involvement of representatives from the Department of Culture, Language, Elders and Youth – CLEY – as well as local Inuit representatives) will be carried out within the revised site layout; sites within the Project footprint will be documented and mitigated as necessary through excavation and systematic data recovery. Nearby archaeological sites outside of the Project footprint will be protected to restrict access and/or mitigated as necessary.

The ground conditions at the Steensby Port site consist of exposed rock or bedrock relatively close to the surface. As a result, foundations for the majority of structures will be founded directly on rock. For facilities that cannot be located on rock, short rock socketed steel piles will be used.

2.6.3 Port Facilities

The design has incorporated numerous precautions to address the construction and operation of port facilities in the Arctic. These precautions are described in the following subsections of Sections 2.6.4 and Section 3.6.

- The concrete plant will be winterized;
- The dock design uses caissons instead of a solid structure to allow brash ice to accumulate between the caissons and help it to move past the dock structure;



- Bathymetric work has been carried out to confirm a safe and operationally-practical route to deal with ice conditions;
- An ice study and/or marine assessment were carried out to support the selection of Steensby Port as a
 port location, to define shipping lanes and determine the ice class of the vessels;
- Ore will be shipped to markets on icebreaking carriers;
- Ballast water discharged from vessels will be warmed through heat recovery;
- A bubbler system will be installed around the dock:
- Ice-reinforced tugs will be available to break up ice, load it into crushers and move it away from the port;
- The freight dock has been located not only to avoid important archaeological resources, but also to provide for improved ship navigation in the expected ice and wind conditions;
- Treated potable water will be stored in an insulated and heat-traced water storage tank;
- The water intake will be located below surface and will be pumped through a heat-traced pipeline and a small freeze-protection pump will keep water moving if the heat trace system fails; and
- Elevated corridors/utilidors will provide access corridors for personnel and contain heating services, piping and electrical trays/conduits.

2.6.4 Construction Docks

To provide rapid and efficient unloading of a large volume of equipment and materials at Steensby Port early in the construction phase, two floating construction docks will be installed during the open-water season (Figure 3-2.9). One dock will be situated on the island to facilitate construction of the ore dock and ore handling systems, and the other on the mainland to support all other construction activities at Steensby Port.

The docks will be constructed as per methods outlined for the similar dock at Milne Port (Section 2.2). They will accommodate barges and shallow-draft ships.

2.6.5 Aggregate Sources and Concrete Production

Quarry materials, including rock, sand and gravel, will be required for construction of Steensby Port, the airstrip and the Railway. Lists of aggregate sources, locations and estimated in-situ volume requirements are presented in the Borrow Pit and Quarry Management Plan (Attachment 6 of Appendix 3B). Proposed quarry sites at Steensby Port are shown on Figure 3-2.9. At Steensby Port, local bedrock knolls will initially be quarried to establish basic roads and laydown areas, starting with QS2 and QS3 (Figure 3-2.9). The bulk of the aggregate for construction at Steensby Port will come from the cut-and-fill operations needed to produce a level site.

Volumetric concrete trucks will be used for initial concrete mixing and delivery until the concrete batch plant is operational. Subsequently, the volumetric concrete trucks will be used in remote concrete pours, as required. A winterized concrete batch plant will be set up and operated at Steensby Port to manufacture concrete for foundations and footings at the port site. There will be no effluent generated by the concrete batch plant. The plant simply mixes the correct proportions of the dry concrete ingredients which will be discharged to a ready-mix truck.

2.6.6 Construction Camps and Related Facilities

For the 2012 work activities, Steensby Port will require the construction of an additional 50 person capacity hard-walled camp. This camp is currently being stored in container units on site and will be built at the beginning of the 2012 work activities. During 2012, the existing 40 person tent camp will also be used for some of the staff and as overflow facilities for the purpose of supporting drilling, geology, and environmental programs planned and permitted for 2012.



At the onset of construction, two 300 person self-contained floating barge accommodations will be anchored at Steensby Inlet (total capacity of 600 persons). These two floating camps will overwinter in Steensby Inlet for the duration of the construction period and will be similar in construction to floating camps currently used in remote coastal areas of Canada. The main reason for choosing a floating camp accommodation for early construction activities is due to the immediate requirement for workers accommodation during the open water sealift operation. The floating camps will be completely self contained (desalination water supply, onboard sewage treatment, onboard waste incinerator, and power supply). Details of the floating camp design are presented in Appendix 3F.

An additional 600-person hardwall camp will be constructed at Steensby Inlet to house workers during the construction phase. The camp will be downsized to 300 beds during the operations phase. The camp size and estimated workforce at Steensby Port are provided in Table 3-1.1.

2.6.7 Water Supply

Water will be used for the following activities at the Steensby Port during construction:

- Potable (drinking) water;
- Geotechnical drilling;
- Aggregate washing;
- Concrete manufacture;
- Explosives truck wash and explosives manufacture;
- Dust suppression (summer season only); and
- Other miscellaneous camp uses (small relative volume) such as emergency water supply (fire fighting systems) and steaming of culverts prior to freshet.

Water for the Steensby construction camp will initially be obtained from a small unnamed lake dubbed "3-km Lake" (Figure 3-2.9), where the current seasonal drill camp obtains its water. A standard water supply intake structure will be installed at this location to draw water year-round, and an insulated pipeline will run overland to the camp. This lake will be sufficient to meet the growing demands of the early construction camp.

Once an access road has been constructed, a larger unnamed lake called "ST347 Lake" will be accessed for the potable and industrial uses listed above. An intake will be installed in the lake at the location shown on Figure 3-2.9 and an insulated pipeline will be installed alongside the road. The intake will be equipped with a screen to prevent fish entrainment in accordance with Department of Fisheries and Oceans guidelines (DFO 1995). The potable water supply system during construction will consist of a pump house, an insulated steel raw water pipeline and potable water storage tanks. Water treatment will consist of chemical treatment followed by settlement, filtration, polishing and chlorine or ultraviolet disinfection. Treated potable water will be stored in an insulated and heat-traced water storage tank sized to meet the peak requirements. "ST347 Lake" is a large lake that has sufficient capacity to supply all potable and industrial water requirements during construction and operation phases.

2.6.8 Power Supply

Temporary power will be provided through modular gensets in shipping containers until the centralized power plant is built for the operation phase. The future power plant will be connected to the accommodation complex through an utilidor. The estimated demand and number of diesel generators are provided in Table 3-1.1.







2.6.9 **Wastewater Treatment**

Sewage from the permanent camp will be treated using a rotating biological contactor (RBC) wastewater treatment followed by filtration and discharge to the ocean via an outfall that is directionally drilled through the bedrock to a point north of the Steensby Island. The outfall will be located at a water depth of at least 35 m, so that the effluent will mix well within the water column. The approximate proposed location of the sewage outfall is shown on Figure 3-2.9. Estimated sewage volumes are provided in Table 3-1.1. The effluent will be treated to meet effluent requirements for discharge to marine waters.

2.6.10 Ore Dock

The location of the ore dock is shown in Figure 3-2.9. The ore dock will consist of a dock structure on discrete caissons, connected directly to Steensby Island. Drawings of the dock design in plan and profile are presented in Appendix 31.

The dock will be constructed by blasting and dredging level pads for each of the caissons, placing and backfilling the caissons, and completing the dock superstructure. Levelling the seabed at the -25 m contour through blasting, sidecasting and dredging will involve eventual removal of approximately 300,000 m³ of material (this estimate includes dredge material from freight dock construction). Dredged materials are likely to be contained on barges until used as backfill. Concrete caissons will be floated into place and then backfilled with dredged and excavated materials as well as local aggregate. No ocean disposal of dredged material will be required.

In-water blasting will be carried out by an experienced contractor following a blasting plan to be developed and filed with the Department of Fisheries and Oceans, meeting their published overpressure guideline of 100 kilopascals (Wright and Hopky 1998). In-water blasting will likely be carried out during late winter with ice cover; marine mammals present will be limited to ringed seals, reducing disturbance to marine wildlife. Winter blasting will also ease the construction schedule. The approach to in-water blasting will likely involve the following activities and steps:

- Drill the blast holes from the ice during late winter;
- Divers install the charges and blast decks under ice;
- Use of a sonic deterrent device to repel seals, possibly in combination with harvesting of seals in the immediate area by local Inuit hunters;
- Divers install a bubble curtain around the blast area;
- Additional use of the sonic device or another deterrent to scare fish from immediate area prior to activating the bubble curtain; and
- Initiate the blast sequence.

Blasting will be preferentially carried out during ice cover, but removal of the material will take place during the following open-water season, so it will be necessary to over-blast up to 1 m deeper than the target elevation to be certain the required elevation is achieved during the blasting.

Bedrock blasted will be removed during the open water season and used for the construction of the causeway that links Steensby Island to the shore of Steensby Port (refer to section 2.6.12).

2.6.11 Freight Dock

A freight dock to support the Project during the operation phase, to be constructed at the location shown on Figure 3-2.9, will allow for the safe and efficient unloading of the large volumes of fuel, ammonium nitrate to manufacture explosives, other consumables and replacement equipment to be delivered each year of operations.



The freight dock will utilize sheetpiling for the dock face, back filled behind the sheets to provide an area for equipment access. The dock will be constructed by placing fill between the sheetpiles and the shore with locally quarried aggregate, and completing the dock superstructure and backfilling the land side. Sheet pile driving is scheduled to occur over a two month duration between mid July and mid September in year one of construction (2013). Sheet piles (50 cm wide by 22 m long) will be embedded approximately 1.5 m into the harbour bottom. Piles will be embedded via vibration at 2500 rpm.

The dock will have a minimum draft of approximately -13 m below the low water level. In addition to a large working area for vehicles and cranes for off-loading, a fuel off-loading manifold will be located on the dock to allow for dock to shore fuel transfers.

The dredged material from the berth will be dewatered and used for fill in other construction areas.

2.6.12 Crossing to Island

A causeway structure will be constructed to link the ore dock, stockpiles, tertiary crusher, ore screens and ship loading facilities on Steensby Island to all other infrastructure on the mainland. The causeway will support conveyors that carry ore from the railway car dumper to the ore stockpiles on the island. The structure will also allow the movement of vehicles between the island and the mainland.

The proposed causeway will be built from both directions by placing fill that is appropriately sized to withstand ice loading. Construction of the causeway will take place during the open-water season, and no blasting will be required during its construction.

2.6.13 Site Roads

Site roads will be constructed using aggregate from locally quarried and crushed rock. Most of these roads (with the exception of the road to the water supply intake at ST-347 Lake) will be integral to the Railway or will be decommissioned early in the operation phase. Traffic along roads will be managed in accordance with the Road Management Plan (Volume 10). Roads will be constructed as described in Section 2.5.7.

2.6.14 Laydown Areas and Shops

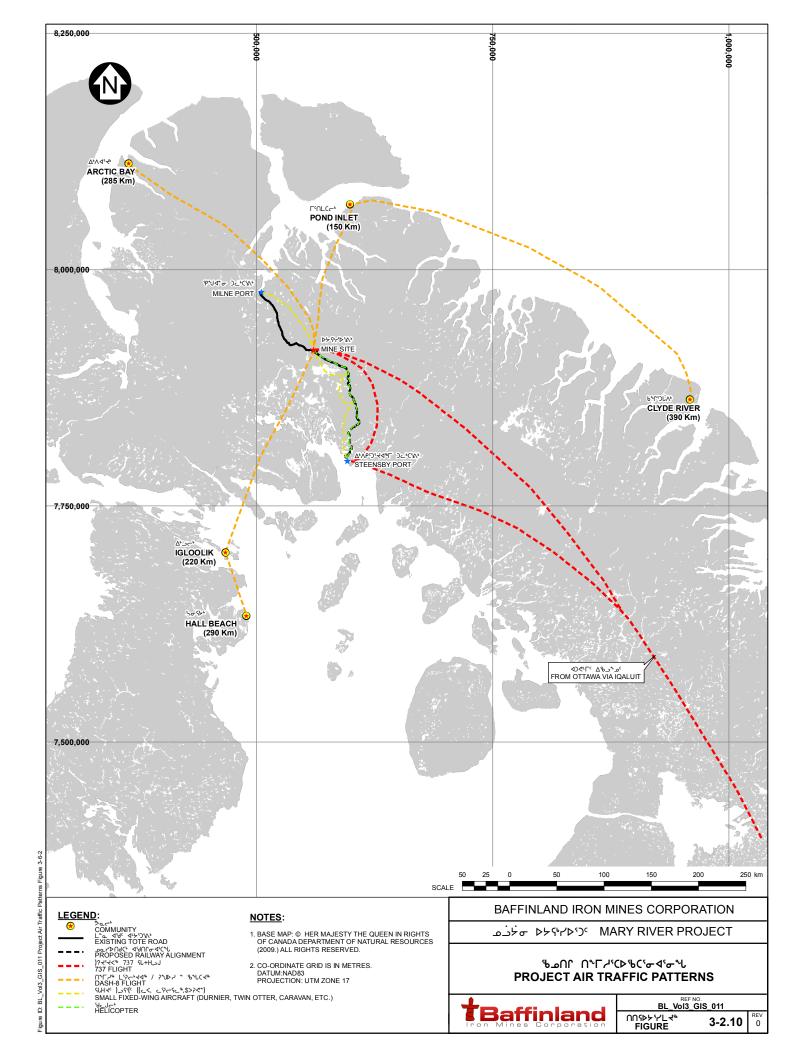
Laydown areas have been identified at various locations at the Steensby Port where future infrastructure will be located (Figure 3-2.9). A total of about 70 ha of laydown area have been identified on the mainland and 4.5 ha on the island. Because of the typically soft ground conditions, up to one metre of crushed rock will be placed within the proposed laydown areas.

2.6.15 Ore Stockpile

An ore stockpile will temporarily store ore waiting to be loaded onto ships. A 1.0 m to 1.5 m granular pad will be constructed on top of bedrock to support the ore stockpile. The permafrost has been assumed to extend into this layer. Infiltrated water from the ore will reach this frozen layer and work its way out to the edges. A lined ditch will be constructed along each stockpile perimeter to collect this water and monitor runoff water quality.

2.7 AIRSTRIPS AND AIR TRAFFIC

Due to the remote location of the site relative to the workforce, and the initial lack of transportation infrastructure, movement of people and supplies will be important throughout the Life of the Project. A description of Project airstrips and traffic is provided below. Regional air traffic patterns are shown on Figure 3-2.10, and estimated air traffic is provided in Table 3-1.1.





Milne Port

The existing airstrip will be maintained through the life of the Project. During the construction phase, it is expected workers will be flown to the Mine Site and bussed over the road. A helicopter pad will be located near the accommodation complex and will provide for emergency use.

The airstrip will be maintained for emergency purposes throughout the operation phase. The estimated air traffic is provided in Table 3-1.1.

Mine Site

The airstrip at the Mine Site will be a primary air access point throughout the Project life. Due to the number of operating personnel at the mine and the requirement for year-round accessibility by air, the existing gravel runway will be upgraded to accommodate jet aircraft (Boeing 737 – 200) and L-382 Super Hercules turboprop aircraft. The existing airstrip will be extended from 1,600 m to 2,000 m with a graded area consistent with the dimensions detailed in the Aerodrome Standards and Recommended Practices document (Transport Canada 2005). Additional fill will be placed to build up the runway surface.

Surface watercourses that would otherwise traverse the runway will be diverted and routed through culverts around the end of the airstrip to avoid problems of thermal degradation. These diversions around the ends and away from the airstrip will be placed sufficiently far away from the embankment fill to prevent settlement problems. Diverted waters will be discharged into their respective watersheds. The existing temporary airstrip lighting will be replaced with upgraded lighting that will include runway and taxiway edge, threshold/end (Category 1), approach (two approaches Category 1), and apron lights. Aircraft warning, obstruction, runway and approach lighting will conform to Transport Canada requirements.

Parking, loading, unloading and other services will be developed within the apron area. The Boeing 737 airplanes regularly servicing the site will not normally re-fuel at the Mine Site but in Iqaluit. No large fuel storage will be provided at the airstrip. Jet fuel for fixed-wing aircraft, when required, will be provided by truck. De-icing facilities at the airstrip will consist of a portable discharge unit for application of the de-icing fluid, carried out in a defined area to the side of the runway, using propylene glycol, a biodegradable fluid which requires no treatment. A polymer will be used as a dust suppressant on the airstrip as needed, similar to what is approved and used successfully at other northern mining operations. Accident reporting with respect to air traffic will follow procedures in the Emergency Response and Spill Response Plan (Attachment 5 of Appendix 3B).

Estimated air traffic during construction is provided in Table 3-1.1. Dash 8 flights will transport personnel to and from surrounding point-of-hire communities. Personnel only will be transported in these aircraft. Personnel will be flown from the Mine Site to Milne Inlet and Steensby Port via helicopter and/or Dash 8.

Helicopters will also be used for ongoing exploration activities, geotechnical drilling along the railway route and environmental monitoring and archaeological activities. One to three helicopters will be in use daily during the summer and as needed during the winter.

Regional air traffic patterns (flight impact zones) are shown on Figure 3-2.10. A zone of influence delineated at the Mine Site encompasses the approach and take-off of fixed-wing aircraft and lower level helicopter traffic between the camp and drilling sites where minimum flight altitude is not possible.

Steensby Port

To facilitate port re-supply and personnel transportation, Steensby Port will include an airstrip capable of supporting aircraft such as the Boeing 737-200. This will require an airstrip 1,830 m long by 45 m wide,

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

which will be designed to operate on a 24-hour-a-day, year-round basis, weather permitting. Prevailing westerly and north-westerly winds require the airstrip be oriented to minimize cross wind effects. A helipad will be established adjacent to the airstrip to accommodate helicopter travel to and from the site. Helicopters will be in use for geotechnical drilling along the Railway and for environmental monitoring.

Surface watercourses that would otherwise traverse the runway will be diverted and routed through culverts around the end of the airstrip to avoid problems of thermal degradation. These diversions around the ends and away from the airstrip will be placed sufficiently far away from the embankment fill to prevent settlement problems and will be routed into their respective watersheds. In addition, two ponds will be filled to accommodate the airstrip.

Airstrip design will comply with all relevant Transport Canada standards and recommended practices. The airstrip will be equipped with edge lighting, runway end, threshold lighting and Precision Approach Path Indicator lights. Omni-Directional Approach Lighting Systems will be installed at both ends of the runway. Parking, loading, unloading and services will be conducted within the apron area. Aircraft will be refuelled directly from a tank truck. De-icing facilities, provided to the side of the runway, will consist of a portable discharge pump for the application of de-icing fluid from 200 L drums of propylene glycol, a biodegradable fluid which requires no treatment.

Construction of the airstrip will involve cut-and-fill operations and development of a large quarry identified as QS3A. A starter airstrip for landing Twin Otter aircraft will be constructed first so that reliance on helicopters for workforce movements to and from Steensby Port can be minimized as soon as possible. Completing the full sized airstrip will be a priority in Year 1 to support movement of the full construction workforce at the port site and the southern portion of the Railway.

A polymer dust suppressant will be used on the airstrip as needed, similar to what is approved and used successfully at other northern mining operations. Accident reporting will follow procedures established by the EHS Management System (Volume 10) and the Emergency Response and Spill Response Plan (Attachment 5 of Appendix 3B). Estimated air traffic is provided in Table 3-1.1. Regional air traffic patterns (flight impact zones) are shown on Figure 3-2.10.



SECTION 3.0 - PROJECT DESCRIPTION - OPERATION PHASE

3.1 OPERATION SUMMARY

The following major activities characterize the operation phase:

- Open-pit mining of iron ore from Deposit No. 1;
- Crushing and stockpiling of ore at the Mine Site;
- Loading and railway transport of ore to Steensby Port, offloading to stockpiles;
- Loading of ore carriers (ships) at Steensby Port;
- Shipping of the iron ore from Steensby Port to customers;
- Occasional resupply from Milne Port during the open-water season; and
- Annual re-supply for operations by ship during open-water season to Steensby Port and infrequently to Milne Port, Railway and truck transport of supplies from ports to the Mine Site.

The process flow of ore production for the railway operation, inclusive of the Mine Site and Steensby Port, is presented as Figure 3-3.1. Mining and ore sizing will occur at an established rate. Ore stockpiles at the Mine Site have been sized to consider the mining rate and the railway schedules, including shut-down periods for extreme cold and repairs. The ore stockpiles at Steensby Port are sized according to the rate at which ships are loaded and considering that a portion of the annual ore production may be moved by non-project charter ore carriers during the brief open-water season.

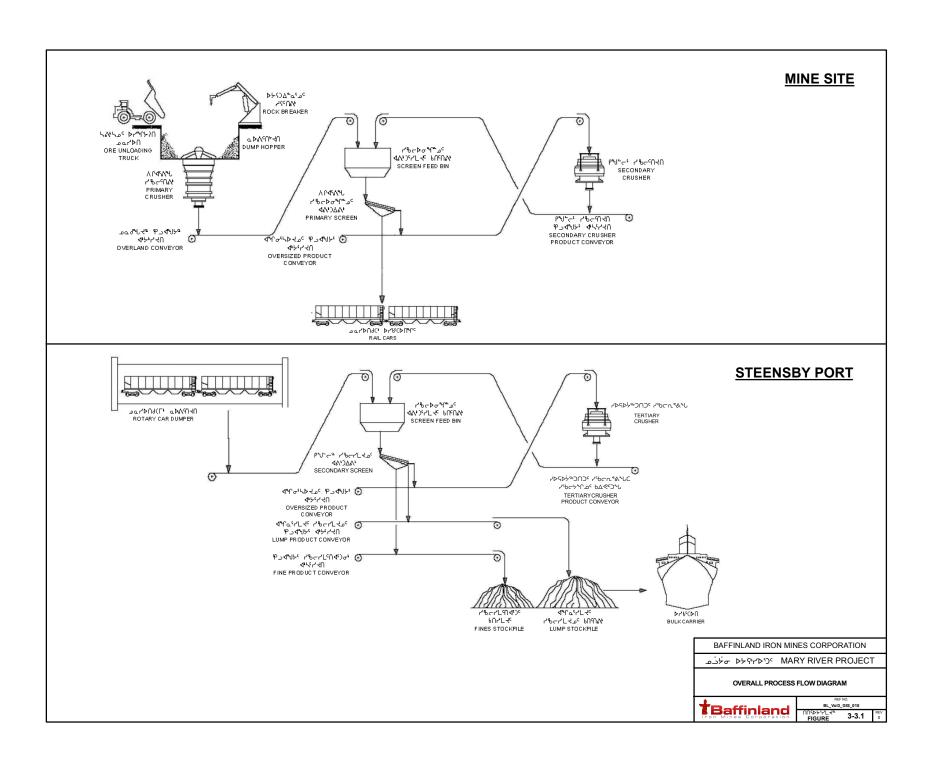
All other ancillary activities, such as operating camps and the supply of consumables (e.g., fuel, ammonium nitrate for explosives manufacture and other materials) will allow Project mining and transportation facilities to operate effectively and reliably.

The Project will produce a nominal 18 Mt/a of ore for about 21 years, based on proven and probable ore reserves in Deposit No. 1. To achieve this production capacity, the nominal design capacities of all Project infrastructure are 30 Mt/a. The design capacity takes into account lost production time due to scheduled maintenance related activities, annual maintenance shutdown, and, unforeseen shutdown due to weather or malfunction and accidental events. Ore will be transported by rail to Steensby Port for year round shipping. Key Project facts are summarized in Table 3-1.1.

3.2 MILNE PORT- OPERATION PHASE

Activity at Milne Port during operation will be periodic and only during the open-water season. The frequency of shipment of oversized equipment (mining equipment fleet) will range from a single sea-lift each year to one every few years, depending on the needs of the Project.

A full-time presence at Milne Port will not be required. The camp facilities will be scaled back to accommodate the small workforce (approximately 40 people) necessary to receive periodic sea-lifts during open water periods. The floating freight dock and laydown areas will remain through the operation phase.





The following will occur to construction infrastructure at Milne Port early in the operation phase:

- The tank farm will be drained, with only a small amount of contingency fuel held in smaller tank(s);
- The camp facilities may be physically reduced;
- No changes to the water supply and mobile genset are proposed;
- Sewage treatment facilities will be decommissioned and replaced with a system or method (e.g., incineration toilets) more suited to periodic occupancy of a small camp, thereby eliminating sewage effluent discharge, and
- Wastes will either be incinerated, transported to the Mine Site for landfilling, or (for hazardous waste) stored at the port site for shipment south to a licensed disposal facility in accordance with the Waste Management Plan (Attachment 5 of Appendix 3B).

Estimated quantities of water use and wastes are provided in Table 3-1.1.

3.2.1.1 <u>Sea-lift Re-supply Operations</u>

Heavy and/or oversized equipment that cannot be accommodated on the Railway will be delivered to Milne Port during the open-water season. All other equipment and supplies, including fuel, will be delivered during the open-water season to Steensby Port. Conventional sea-lift vessels of 10,000 to 17,000 DWT capacity, or barges, that operate in the area, will be used. Cargo ships or barges will dock at the floating dock facility that was used during the Construction period.

Equipment will be stored at the Milne Port laydown areas for transfer to vehicles and delivery to the Mine Site.

3.2.1.2 Site Roads

Site roads established during the construction phase will remain in place during operations and will be maintained as outlined in Baffinland's Road Management Plan (Volume 10).

3.2.1.3 Communications

Communications infrastructure established for construction will remain for operations (see Section 2.1.11).

3.2.1.4 Port Security

Port facilities will be operated in accordance with Marine Transportation Security Regulations.

3.3 MILNE INLET TOTE ROAD – OPERATION PHASE

3.3.1 <u>Milne Inlet Tote Road Operation</u>

During operations, the road will be used for the occasional transport of oversized equipment. The road will not be used on a regular basis, and will only be plowed and operated during the snow cover period if materials need to be transported over the road. However, in order to ensure that the road remains serviceable, and to fulfill environmental protection obligations, an annual maintenance program will be carried out each summer. Estimated traffic is provided in Table 3-1.1.

Road operations during the operation phase will be similar to that of the construction phase, described in Section 2.3. Spill response is included in the Environmental Health and Safety Management System (Volume 10) and the Emergency Response and Spill Response Plan (Attachment 5 of Appendix 3B).

The Road Management Plan (Volume 10, Appendix 10D-8) will stipulate the rules of the road, including for example: the safe access and use by the public (including hunters); limiting travel speed; yielding the right-



of-way to wildlife; reporting wildlife observations; travelling in convoys for safety; emergency and spill response procedures; a safety policy addressing safe discharge of firearms near the road; truck traffic communications; and a community notification and update process. The emergency shelters and emergency response measures established during the construction phase will remain in place during operation.

3.4 MINE SITE - OPERATION PHASE

During the operation phase, the Mine Site will consist of the following infrastructure:

- Open-pit mine and related facilities including: mine haulage roads; run-of-mine (ROM) ore stockpile; ore stockpiles including stacker/reclaimer system; waste rock stockpile; primary crusher; secondary crusher; stormwater management and treatment facilities; and the explosives magazines and emulsion plant.
- Mine site support facilities including: the power generating station; main office; service, administration
 and accommodation buildings including existing exploration camp; warehouse and storage yard;
 communications system; drill core storage; airstrip; geological and environmental laboratories; water
 treatment system; wastewater treatment system; mine water treatment system; bulk fuel storage
 facilities; incinerator; landfill; railway line terminus and loading facilities; site roads and parking;
 maintenance shop; and equipment ready line.

A plan view of the Mine Site facilities is shown on Figure 3-2.3.

Mining operations will include:

- drilling and blasting within an open pit to remove overburden and access the ore;
- loading of ore into mine haul trucks;
- delivery of the ore to a series of crushers;
- · movement of the ore by conveyors to stacker/stockpiles; and
- reclaiming of stockpiles for loading into railway cars.

These operations are described further below. Figure 3-3.1 presents the overall process flow for ore handling. Figures 3-3.2, 3-3.3 and 3-3.4 present the configuration of the material handling, primary and secondary crushing, and the ore stock yard at the Mine Site.

3.4.1 Open-pit Operations

Overburden will be removed by blasting and placed in the waste rock stockpile. The open-pit will then be excavated with conventional open-pit mining equipment using a typical bench configuration with access via ramps. Blast holes will be drilled, an explosives truck will deliver and dispense explosives into the holes, blast sequences will be established, the open pit cleared of all personnel, and the blasts detonated. Blasting at the open pit will be carried out using emulsion explosive product manufactured on site.

Diesel-hydraulic face shovels backed up by front-end loaders will load mine haul trucks to transport ore to the primary crusher next to the ROM stockpile. Waste rock will be hauled to the waste rock stockpiles. Movement of vehicles within the pit will be monitored by a central dispatching system to ensure worker health and safety and operational efficiency.

Backhoe excavators will be used for general earthworks, snow removal, and limited mining activity where the larger equipment may have limited access. Wheel and track bulldozers will be used for cleanup around mining activities and for control of rock on the benches. Graders and water trucks will be used for main haul road maintenance.



Figure 3-3.2 Material Handling

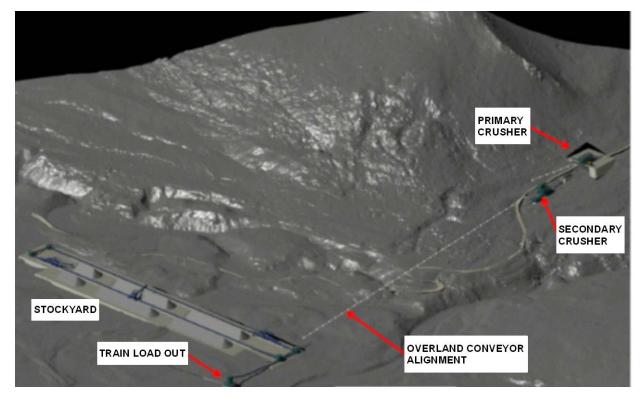


Figure 3-3.3 Mine Site Primary and Secondary Crushing

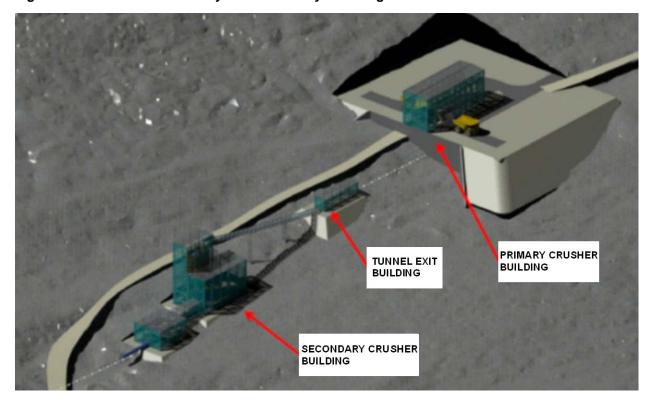
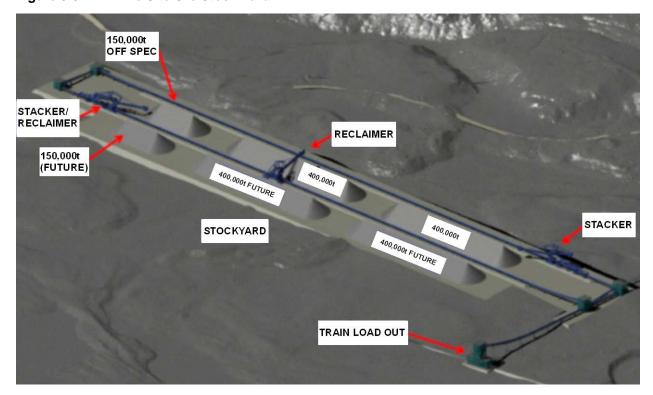




Figure 3-3.4 Mine Site Ore Stock Yard



Mining will generally occur in 15 m benches. The general dimensions of the final open pit are approximately 2 km long by 1.2 km wide at its maximum, with a depth ranging from 465 m (northern side) to 195 m (southern side). Inter-bench pit slope angles are expected to range from 60 - 70 % with benching and interramp angles of approximately 45 %. Final pit design will optimize stability, health and safety, and mineral economics.

Geotechnical investigations have included a 400 m drill hole that was instrumented with thermistors down its length to record ground temperatures at various depths. Extrapolation of temperature gradients with depth suggests that permafrost conditions (i.e., below zero degrees Celsius for two consecutive years) extend to approximately 610 m, well below the planned mine depths, even when climate change is taken into account. The geotechnical factors and geological characteristics (permafrost and related seasonal thawing and seepage conditions) considered in the design of the open pit, including ramps, high walls, slopes, kinetic analysis of slope stability, and other features are discussed in Volume 6, Section 2.

Water inflows to the pit consist primarily of direct contribution from precipitation events. As necessary, snow will be removed by ploughing within the pit to access active mining areas. Pit inflow water during the summer season may require removal by pumping to the waste rock stockpile east stormwater collection pond. Monitoring of water quality from stormwater collection ponds will be conducted prior to release to the environment to ensure compliance with MMER effluent discharge requirements. Based on available site geological, geochemical and hydrological data, predictive modelling of the expected mine pit water quality was undertaken. This modelling indicates that the pit water will be in compliance with discharge criteria established by the MMER. The report on pit water inflow quality modelling is provided as an attachment to the Waste Rock Management Plan (refer to Appendix 3B, Attachment 5).



3.4.2 Explosives Manufacture and Storage

Emulsion explosive product will be manufactured on site for use in the open pit. The emulsion plant and magazines to support mining are those built early in the construction phase (Section 2.1.7). The explosives facility will include:

- Bulk ammonium nitrate outdoor storage area;
- Bulk fuel area;
- Magazine for storage of items such as detonators, detonating cord and boosters; and
- Emulsion manufacturing facility.

The explosives facility has been located to the north of the open pit at some distance from the rest of the Mine Site, as shown on Figure 3-2.3, in accordance with the regulatory requirements for safe storage of explosives. Design criteria, technical specifications and drawings for the explosives manufacturing facility are presented in Attachment 8 of Appendix 3B. The Explosives Management Plan is presented in Appendix 3B, Attachment 8.

3.4.3 Ore Crushing/Screening and Conveyance

Ore will be brought out of the pit to the ROM stockpile which feeds a crushing process train equipped with rail car loading facilities. Ore from the open pit or a ROM stockpile will be processed by crushing, to reduce ore to the required size for feeding to the tertiary crusher located at Steensby Port. The location of the crusher systems are shown on Figure 3-2.3. The primary objective of crushing is to maximize the production of lump product (less than 31.5 mm and greater than 6.3 mm), while at the same time, keeping the amount of ore fines (less than 6.3 mm) generated at a minimum, since lump product has a greater sale value. The crusher system includes a primary crushing station, a primary screening station, a secondary crushing station, and conveyors to transfer the ore to a stockpile at the mine site. The ore is then reclaimed from this stockpile and loaded on the rail cars for transport to Steensby Port. Ore is then transported by rail to Steensby Port.

The crushers and screens will be installed inside buildings to reduce dust and noise exposures. Material-handling equipment, including reclaimers, stackers and conveyors will be installed outdoors. Conveyors will be covered and equipped with wind hoods to reduce wind exposure and the potential for ore fines to be blown off the conveyors. Dust collectors will be installed at transfer points and other required areas to limit dust emissions.

Dust suppression techniques may consist of the following measures:

- · Conveyors will be covered and equipped with wind hoods; and
- Dust collectors will be installed at ore screening and crusher transfer points.

The various steps of mining are described below.

3.4.4 Ore Stockpiles

Ore will be stored in a ROM stockpile located near the crusher or fed directly into the primary gyratory crusher. The capacity of the ROM stockpile is expected to be in the order of 400,000 t. A drainage ditch will be constructed on the perimeter of the ROM stockpile. This ditch will be directed to a discharge point where natural drainage to the Mary River occurs. The discharge point will be engineered to prevent erosion and silt fences will be used for sediment retention.

Following secondary crushing, temporary ore stockpiles will be used for storing ore, with an expected total capacity on the order of 1.4 Mt.







Ore stockpile will be constructed of a 1.0 to 1.5 m thick granular pad base with a lined perimeter ditch to direct runoff to a stormwater pond. Periodic maintenance of ditching may be required to account for the melting of ice lenses or other factors that reduce the integrity of the ditching side walls. Permafrost will limit downward migration of runoff beneath the ore stockpiles. Separate stormwater management (SWM) ponds manage runoff from the 400,000 t ROM stockpile and the 1.4 Mt stockpile supplying the railway operation (Figure 3-2.3). Drawings of the SWM ponds are included in Attachment 9 of Appendix 3B. Ore stockpile SWM ponds were sized to retain one year of runoff for the stockpile drainage areas. Given the variability in annual runoff flows, and to allow for years with higher precipitation, the capacity of each pond has been sized to twice the mean annual discharge from the stockpile areas.

Water quality predictions based on the results of lysimeter testing conducted in 2010 on crushed ore remaining from the bulk sample predicted that the runoff from ore stockpiles will be high in suspended solids, about neutral to mildly acidic (pH 5.5 to 6), with metal concentrations below limits established under the applicable Metal Mining Effluent Regulations (MMER). SWM ponds may be required to reduce suspended solids below the MMER average criterion of 15 mg/L.

3.4.5 Waste Rock Stockpile

Baffinland's approach to management of potential ARD/ML from the waste rock pile is four fold:

- 1. On-going gap-filling program for geological and geochemical characterisation of waste rock that will assist in confirming water quality model assumptions and predictions, and will inform and improve waste rock management and design practices in an ongoing fashion:
- 2. Optimization of waste rock pile design that will prevent the development of ARD/ML by effectively managing rock material groups based on projected lithology, mineralogy, chemical reactivity, and physical properties.;
- 3. Runoff and seepage water from the waste rock pile will be captured, diverted, and contained in storm water / sedimentation ponds where the water quality can be monitored prior to discharge to the receiving environment; and,
- 4. Should, despite the application of best practices, ARD/ML develop, and the waste rock stockpile runoff water collected does not meet discharge criteria established by the MMER regulation, the water will be treated to acceptable effluent limits, prior to discharge to the environment.

The Waste Rock Management Plan presented in Attachment 5 of Appendix 3B describes Baffinland's approach. Table 3-3.1 provides a preliminary estimate of waste rock production.

Table 3-3.1 Preliminary Schedule of Waste Rock Production

Period (Year)	Non-PAG Waste Rock (Mt)	Overburden (Mt)	PAG Waste Rock (Mt)	Waste Rock Total (Mt)
Pre-production Material	0.4	-	0.1	0.5
1	7.9	-	3.0	10.9
2	6.7	0.5	2.5	9.7
3	18.1	0.3	0.3 5.2	
4	17.4	1.8	6.1	25.3



Table 3-3.1	Preliminary	Schedule of Waste Rock Produc	tion (Cont'd)
-------------	-------------	-------------------------------	---------------

Period (Year)	Non-PAG Waste Rock (Mt)	Overburden (Mt)	PAG Waste Rock (Mt)	Waste Rock Total (Mt)				
5	24.0	1.3	7.2	32.5				
6	21.4	2.1	6.3	29.8				
7	26.0	2.8	7.8	36.6				
8	31.4	2.5	9.6	43.5				
9	25.8	4.7	7.6	38.1				
10	27.9	2.6	8.2	38.7				
11-15	132.0	13.2	41.3	186.5				
16-21	126.8	0.7	39.8	167.3				
Total	465.80	32.50	144.70	643.00				
NOTE: PAG: Potential	NOTE: PAG: Potentially acid generating rock.							

3.4.5.1 Characterization of the waste rock

Since 2006, waste rock samples have been collected from drill cores and submitted for Acid-base Accounting (ABA) and kinetic testing. Results of this testing have indicated that approximately 86 % of the waste rock samples collected are unlikely to generate acidic drainage in the future. The remaining 14 % were classified as potentially acid-generating (PAG) materials. Generally, low quantities of PAG material have been identified in wall rocks to the deposit with apparently slow sulphide reactivity, Geochemical studies and further kinetic testing are ongoing to fully evaluate and assess the waste rock characteristics. Refer to Appendix 6B-1 for a compilation of geochemistry test data from the period 2006 to the present).

A waste rock drainage water quality model based on available site geological, geochemical, hydrological data, and other available data was used to predict the waste rock stockpile runoff and seepage water quality. The interim report that presents the results of this modelling effort is presented as an attachment to the Waste Rock Management Plan (refer to Appendix 3B- Attachment 5, Annex 4).

A comprehensive geochemical characterization program consisting of additional drilling, sampling and testing is planned for the 2012-2014 period. This program will enable Baffinland to improve its understanding of the waste rock geochemistry and to evaluate and adjust as warranted current assumptions used in its waste rock stockpile runoff water quality predictive models. The 2012-2014 characterization program focused on information gaps in the existing database identified in the following areas:

- Waste rock geology on the deposit scale utilizing mainly drilling techniques.
- Predictive geochemical sampling and testing programs using mineralogical, static testing, and kinetic testing methodologies.
- Sensitive input parameters (i.e., climate, hydrology, permafrost, and geochemical source terms) used to make water quality predictions for waste rock and open pit.

The report detailing the above characterization program is presented in the Waste Rock Management Plan, Appendix 3B, Attachment 5. The characterization program was developed under the review and guidance



of independent experts. The characterisation work will enable Baffinland to validate results obtained for predicted waste rock stockpile runoff and mine pit water quality.

3.4.5.2 Waste Rock Stockpile Configuration

The low quantities of PAG material identified in hanging wall and footwall rocks, and the apparently slow sulphide reactivity, supports the planned management of PAG materials by encapsulation in a permafrost core of the constructed stockpile. In addition, the location of the PAG within the stockpile can, if warranted, be placed within a single watershed, thus minimizing the number of potential discharge locations where there is the potential for ARD/ML.

Because of the northern location and Arctic climate, it is likely that the majority of waste rock material will become permanently frozen as the base of the active layer rises through conduction as the waste rock stockpile is developed, and that only the upper surficial material will be subject to seasonal freezing and thawing. The frozen material will form an effective barrier for acid-forming reactions since liquid water is unavailable and this will limit the potential for formation and transport of sulphide oxidation products. Waste rock deposition methods that enhance permafrost aggradation into the waste rock stockpile will be employed. Such operational procedures have been used successfully at Ekati and Diavik mines which are further South in Nunavut. The waste rock deposition guidelines are presented in the Waste Rock Management Plan (refer to Appendix 3B-Attachment 5).

It is expected that a permanently frozen impermeable subsurface layer will form in the waste rock storage area within the first few years after emplacement that will limit the development of ARD-ML in the waste rock stockpile. Therefore, over the long term, runoff water quality which is influenced by contact water that flows through the active layer in the waste rock stockpile will not be affected. Thermal modeling of the temperature regime within the waste rock pile over time that incorporates global warming has been carried out and the report is presented in Appendix 3B, Attachment 5, Waste Rock Management Plan, Annex 2).

3.4.5.3 Containment of Waste Rock Stockpile Runoff

The runoff management system for the waste rock storage area will consist of berms around the stockpile perimeter and two appropriately sized surface water management (SWM) ponds. The system is designed to allow "clean" or non-contact water to be diverted away from the waste rock stockpile to minimize the volume of water that comes into contact with the waste rock (contact water). The non-contact waters will be discharged (drain) into their respective watersheds. The larger "west" SWM pond, located west of the open pit and southwest of the waste rock stockpile, will decant water to an existing drainage that leads to a tributary of Camp Lake. The smaller "east" SWM pond will discharge to an existing drainage that reports to a tributary of the Mary River. During detailed design phase when the final configuration of the stockpile has been determined, collection berms will be designed.

Berms rather than ditches will be used to provide drainage diversions in consideration of the challenges in the arctic, e.g., ice-rich soils and lenses. Berm construction is designed to maintain the frozen layer and prevent any subsurface flows or flows that would undermine the berms.

3.4.5.4 Discharge of Waste Rock Stockpile Runoff

The pond collection system will be monitored for runoff quality and compared to MMER criteria. Batch treatment of the water can be implemented within the pond(s) if necessary

Baffinland has stated that the discharge from the waste rock pile sedimentation pond will be in compliance with the discharge criteria established by the MMER. This regulation imposes an obligation for ongoing



acute lethal toxicity testing of the discharge as well as Environmental Effects Monitoring Studies (Schedule 5). As a last resort, treatment will be provided if the quality of the runoff exceeds discharge criteria imposed by the MMER regulation. In accordance with the MMER, an Environmental Effects Monitoring (EEM) plan has been designed and will be implemented to monitor the environmental effects of this discharge from the waste rock SWM ponds. The results of the EEM plan can trigger additional adaptive management procedures such as further treatment of pond effluent, if required. The MMER Environmental Effects Monitoring Study Design Framework is presented in Volume 10, Appendix 10D-14. Further details about waste rock runoff water and contingency treatment options are provided in the Waste Rock Management Plan (Attachment 5 of Appendix 3B).

Based on the predictive modeling results presented with the Waste Rock Management Plan, Baffinland does not expect that runoff will exceed these discharge criteria, nor will this runoff have adverse effects on aquatic ecosystems. However, the ongoing and planned geochemical waste rock characterization program will validate this assumption.

3.4.6 Mine Site Support Facilities

3.4.6.1 Mine Site Buildings

To the extent possible, buildings have been consolidated to hold accommodation, administration, maintenance and laboratory complexes to reduce outside travel of in-building workers. The accommodation building will consist of a prefabricated modular unit supported on pile foundations, and will house personnel in four two storey dormitory wings. A central core area will comprise: kitchen/dining facilities, recreational facilities, and general service space. Attached administration, laboratory, maintenance and warehouse facilities will be constructed of structural steel with a pre-finished metal roof and wall cladding. Waste heat will be recovered from the power plant to feed heat into the accommodation building via an utilidor.

The assay laboratory will house the metallurgical office and will be used for ore sample storage, preparation and analyses. The maintenance area will be equipped with oil/water separators in areas associated with the steam-cleaning facility.

Elevated corridors/utilidors will connect all buildings in this area. In addition to providing corridor access for personnel, they will also contain heating services, piping and electrical trays/conduits. The corridors/utilidors will be constructed using prefabricated modular units supported on a structural steel framing system and pipe piles.

The fire protection system will include a primary fire pump (with backups) and sprinkler systems for the accommodation, administration, laboratory and warehouse facilities, and a dry sprinkler system for the plant maintenance complex. Fully-equipped hose cabinets will be available in heated buildings.

3.4.6.2 Power Supply

The centralized power plant and waste heat recovery system established during construction will service the entire Mine Site during operations. Estimated power demands and fuel consumption are provided in Table 3-1.1. Generators in the boiler building will provide a back-up system to supply heat in the event of catastrophic failure of the power plant.

3.4.6.3 Water Supply

Water will continue to be supplied from Camp Lake (potable water and most other uses) and Mary River (water for exploration drilling; summer only). Table 3-1.1 summarizes the estimated water consumption for



the operation phase, and a detailed breakdown of water uses and sources for the operation phases is provided in Attachment 9 of Appendix 3B.

3.4.6.4 Wastewater Treatment

The Wastewater Treatment Facility (WWTF) will be a subset of the modular packaged sewage treatment plant used during the construction phase, scaled down to meet the smaller peak flow requirements during the operation phase.

Wastewater will be collected within each building and pumped to the treatment plant via a pressurized main pipe. Final effluent from the Wastewater Treatment Facility will be discharged into Mary River via an outfall. The WWTF is designed to meet the effluent discharge quality criteria established in by the Wastewater System Effluent Regulation (WSER) under the Fisheries Act. Dewatered WWTF sludge will be disposed of in the landfill.

At remote areas, such as the mine maintenance/mine office and the explosives handling facility, wastewater will be collected in holding tanks and periodically transported via tanker truck for treatment at the WWTF. Wash water from the garage and rail maintenance shop will be directed through the oily water treatment systems within the maintenance shop. Estimated quantities are provided in Table 3-1.1.

3.4.6.5 Site Water Management

Site water will be managed in accordance with the Surface Water and Aquatic Ecosystems Management Plan (Attachment 5 of Appendix 3B). Due to the arid climate, significant volumes of surface runoff will not normally be generated except during the spring freshet. Runoff from ore stockpiles will be collected and treated as necessary. Runoff from the waste rock stockpiles will be collected in one or more ponds for settlement of sediment and subsequent release to the receiving environment (see Waste Rock Management Plan – Attachment 5 of Appendix 3B).

Water inflows into the open pit are expected to be minor and related to incoming precipitation and a limited amount of seepage from the active layer around the pit perimeter. In the event that pit dewatering is required (albeit on an intermittent basis), the water will be collected in sumps located in the pit and transferred by pump truck to the waste rock stockpile east pond. As a contingency, should the mine water volumes be significantly larger than estimated, excess water will be pumped to the waste rock stockpile and treated as necessary in the stockpile sedimentation pond.

Precipitation leading to runoff that could be contaminated with oil will be treated in the oil-water treatment facility in the truck/rail maintenance shops. Contaminated snow will be placed into a dedicated lined cell and allowed to thaw in summer, for treatment as above.

3.4.6.6 Waste Management

Baffinland's approach to waste management was discussed in section 2.1.10. The Mine Site will be equipped with an approved landfill and an incinerator for disposal of non-hazardous wastes. Hydrocarbon contaminated soils and water will be treated in a landfarm and hydrocarbon contaminated snow will be staged at a contaminated snow unit until it can thaw and the resulting meltwater treated. Handling, storage, transportation, recycling and disposal of wastes generated by the Project will be managed in accordance with the Waste Management Plan (Attachment 5 of Appendix 3B). The expected types and quantities of wastes are identified in this plan. The cumulative volume of waste entering the two landfills (Mine Site and Steensby Port) from all camps during construction and operation phases is provided in Table 3-1.1.



Hazardous wastes will be stored and secured, then shipped off site for disposal in appropriate southern facilities.

3.4.6.7 Fuel Storage and Distribution

The fuel storage and distribution strategy was described in section 2.1.8. Storage and distribution facilities will be constructed at the onset of the Project.

The Mine Site fuel tank farms will store quantities required for four months of operation. The main tank farm, two 5.2 ML tanks, will be located near the railway load-out and will be re-supplied from Steensby Port on a weekly basis via railway fuel cars. The fuel unloading facility will facilitate quick unloading of fuel tanker cars, five at a time. This unloading facility will be mounted on a concrete spill containment pad equipped with a collection sump to contain fuel spills.

The tank farm will be equipped with a containment system lined with Arctic-grade synthetic liner. Day-to-day refuelling of vehicles will be carried out at a filling bay. Additional tanks will store Jet A fuel required for fixed-wing and rotary aircraft.

Aircraft and tracked equipment in the open pit will be refuelled using a fuel truck. Refuelling of mobile mine vehicles will be carried out at a second fuel farm located near the primary crusher containing a 5.2 ML diesel tank.

Diesel fuel day tanks ranging in size from 1,000 L to 40,000 L will be located across the Mine Site as required at areas such as the power plant, boilers, mine day tanks, water intake pump house, incinerator, and explosives emulsion plant. Exception for remote locations such as the water pump house and explosives plant, these tanks will be supplied by the fuel distribution pipeline from the tank farm.

Bulk antifreeze and heating glycol fluids will be stored in the power plant and maintenance complex. Storage capacities will be based on the anticipated consumption required for a minimum operating period of 12 months. The annual antifreeze inventory will be stored in the same area as the lubricant storage tanks, based on the following estimated requirements:

- antifreeze (coolant) tank capacity: 50,000 L:
- power plant glycol initial fill of heat recovery and distribution systems: 14,000 L; and
- building heating circuit initial fill: 100,000 L.

The premixed glycol solution will be transported by sea to Steensby Port and then by rail to the Mine Site, where the system will be filled directly.

Lubricating oils for the power plant and maintenance shop will be stored in bulk in tanks ranging in size from 12,000 L to 200,000 L. Waste oil will be collected in a common sump linked to a receiving tank, from which it will be pumped to waste oil storage tanks. Approximately 1 ML of used lubricating oil produced annually will be burned in dedicated government-approved waste oil burners that will recover heat for use in space heating.

3.4.6.8 Truck Parking and Maintenance

There will be designated parking areas for trucks and other mobile vehicles. A mobile vehicle maintenance shop will provide routine maintenance for haul trucks and other mobile equipment at the Mine Site.



3.4.6.9 Airstrip and Air Traffic

The airstrip at the Mine Site, as upgraded and lengthened during construction, will service the mine for shift rotations. The runway will include aircraft warning, obstruction, runway and approach lighting conforming to the requirements of the *Aeronautics Act*. Parking, loading, unloading and services will be conducted within the apron area.

Aircraft traffic during the operation phase is summarized in Table 3-1.1 and presented conceptually in Figure 3-2.10. The airstrip at the Mine Site will be the primarily used during operations; workers at Steensby Port will travel to and from the Mine Site via the Railway for flights home. Workers at Milne Inlet will travel to and from the Mine Site via the Milne Inlet Tote Road. If weather conditions allow, the airstrips at Steensby Port and infrequently at Milne Port may be used for crew rotations.

No fuel will be stored at the airstrip. A tank truck will be used to dispense Jet A fuel to aircraft and helicopters. De-icing facilities, provided to the side of the runway, will consist of a portable discharge pump for the application of de-icing fluid from 200 L drums of propylene glycol, a biodegradable fluid that requires no treatment.

Flight patterns will be the same as during construction. Estimated air traffic is provided in Table 3-1.1.

3.4.6.10 Site Roads

Graders, snowplows and other equipment will operate as needed during the operation phase. Snow fencing will be used to limit the formation of snow drifts on the roads. Dust suppressant will be sprayed on the roads as needed. Inspections will be more frequent during the spring freshet to check culverts and roads for needed maintenance and repairs. Traffic will be managed in accordance with the Road Management Plan (Volume 10, Appendix 10D-8).

3.4.6.11 Railway Terminal

The Mine Site yard will include a track for loading the iron ore, an inspection track, a run-around or service track, two industrial tracks for the handling of containers and one for unloading tank cars, a Maintenance of Way (MoW) or railway maintenance building, and a track unloading full containers and loading empty containers for return to Steensby Port.

3.4.6.12 Communications

The communications network installed during construction will continue to be used during operations. The various sub-systems will include satellite land stations; telephone exchange switching systems (complete with voice message and plant internal PA capabilities); VHF radio systems including base stations and vehicle and handheld portable radio equipment; integrated multi-use fibre-optic network with Ethernet TCP/IP network infrastructure; and an optional cellular phone system.

3.4.6.13 Aggregate Sources

Aggregate requirements for the Mine Site during operations will be limited to sand and gravel needed for maintenance of access roads. The existing borrow area west of the Mine Site, used during the bulk sample program and construction, will be sourced throughout the operation phase by leaving an active face open in the borrow area.





3.5 RAILWAY - OPERATION PHASE

3.5.1 Overview

The Railway will transport ore from the Mine Site to Steensby Port. It will also transport annual consumables and equipment arriving at Steensby Port to the Mine Site.

The main components of the operating Railway include:

- Railway embankment and track;
- Locomotives and cars (ore, fuel and general freight cars);
- Bungalows small sheds along the Railway containing power supply and signalling equipment;
- Communication towers approximately twelve towers positioned in line-of-sight from each other along the railway alignment;
- Ore and freight loading/unloading facilities at the Mine Site and Steensby Port;
- Railway maintenance yard at Steensby Port; and
- Quarry near Steensby Port to obtain rock for ballast replacement for railway maintenance.

Design and construction of the Railway is described in Section 2.5. The Railway Management Plan, covering environmental, health and safety aspects, is located in Volume 10, Appendix 10D-9.1. The railway alignment is shown on Figure 3-2.4 and preliminary engineering design drawings are presented in Appendix 3E.

3.5.2 Railway Components

The various railway components are described further below.

3.5.2.1 Railway Tunnels

Ventilation requirements were considered for construction and operation of the railway tunnels. The longer of the two tunnels down the east side of Cockburn Lake is considerably shorter than several railway tunnels in British Columbia that are safely operated with diesel locomotives and without mechanical ventilation. Given that the locomotives that will be operating through the Cockburn tunnels will have lower emission than diesel locomotives currently operating and that the ore trains are long enough that there will only be one locomotive in the tunnel at a time, mechanical ventilation is not believed to be required. Nevertheless a detailed evaluation of the potential for emission build up in the tunnel will be made on the basis of train occupancy as predicted by the proposed operating plan as part of detailed design.

3.5.2.2 Railway Embankment

The railway main line will be about 150 km in length from loading station to unloading station. The railway embankment will be comprised of sub-ballast and ballast materials, with wood ties and steel rails.

3.5.2.3 Trains and Rail Cars

Three train sets, each consisting of two diesel-electric locomotives hauling between 110 and 130 rail cars, will operate to transport ore in open-top ore cars. Fuel tanker cars will be used to transport fuel, and most freight will be transported in containers to facilitate handling from ship to shore to rail. Bulk materials will be hauled in tank cars or containers. Dedicated tank cars will be used to transport diesel and Jet A fuels to the Mine Site. Flat cars will be used to transport containers and large equipment and machinery.

The total fleet required has been estimated at 11 locomotives (six for ore transport, two for general freight service, and three spares), and 433 cars (including 42 spares). A photograph of the type of locomotive and

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

ore cars to be used is shown on Figure 3-3.5. Each train will travel about 1,824 km over 66 hours, after which it will be subjected to a detailed safety inspection. Two car switchers will be used (one at Steensby Port to switch cars within the port area and one at Mary River to switch cars at the small yard at the mine) to facilitate loading and unloading of fuel, general freight and explosives without using locomotives.

New North American standard heavy haul locomotives will be used. The locomotives are approximately 23 m long, weigh 190 tonnes and are powered with AC diesel generators. All locomotives will be equipped with "Arctic packs", special control systems (electronics), that are suitable for the cold climate. They will also have supplementary heaters within the fuel tanks to ensure that fuel is delivered to the generators at an optimum temperature. Only a small reservoir within the tank is heated, not the entire tank. The fuel will be supplied to the generators directly from the small reservoir. At any given time there will be six locomotives operating on the ore trains with their engines running continuously, even during the loading and unloading process.

Two other locomotives that run freight or passenger services will run their engines at idle speed during loading and unloading.

There are four routine maintenance and inspection bays in the heated maintenance shop for locomotives. Consequently, there will sometimes be one locomotive not in use that cannot be housed in the shop due to lack of space. It will stand in the yard and, depending on the temperatures and length of time out of use, it will either sit with its generators idling (as many of the diesel pickup trucks do in the north) or it will be plugged into "wayside power" (the railway equivalent of plugging in a block heater). Experience will determine the temperature at which the wayside power approach becomes ineffective and it becomes necessary to fire up the engine to be sure that it will run when required.

3.5.2.4 Railway Sidings and Bungalows

Three main line sidings of approximately 2 km, large enough for ore trains to pass, will be located at strategic locations along the Railway. A fourth siding near Steensby Port will provide access to the ballast quarry. An additional short siding will be provided for Maintenance of Way purposes. Bungalows (a railway term to describe small sheds containing power switching and signalling systems) will be located at each siding, within the railway right-of-way.

Equipment in the bungalows will include a power source, consisting of a solar panel and/or wind turbine with a back-up diesel generator and fuel tank.

3.5.2.5 Communication Towers

Up to 12 communication towers will be positioned along the length of the railway in line-of-sight of one another. The towers will form a microwave communication system between the dispatcher, trains, trackside equipment and track maintenance crews on the line. Preliminary locations have been selected based on a desk top propagation study and are placed within the railway right-of-way. Each communication tower will be situated by a bungalow to provide power.

3.5.2.6 Railway Terminal at Mine Site

A conceptual layout of the railway terminal at Steensby Port is shown on Figure 3-3.6, the main functions include:

- Unloading of ore;
- Safe loading and unloading of passengers (Steensby Port personnel); and
- Loading of freight and fuel, and unloading of backhauled wastes.





BAFFINLAND IRON MINES CORPORATION

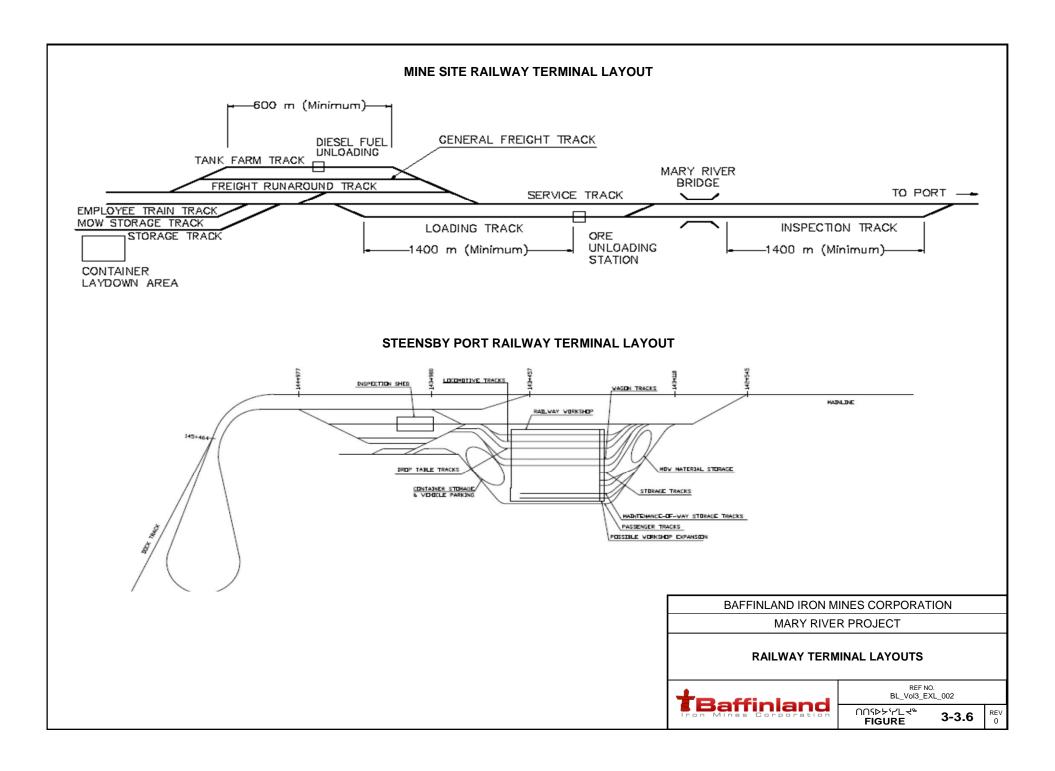
MARY RIVER PROJECT

EXAMPLE RAILWAY LOCOMOTIVE AND ORE CAR



REF NO.
BL_Vol3_EXL_001

OOSPYCLせ 3-3.5 REV A





Ore Loading

The Mine Site rail yard will include a track for loading iron ore, a run-around track, two industrial tracks for the handling of containers, a track for unloading tank cars, and a track for loading and unloading containers. There will also be a Maintenance of Way (MoW) or railway maintenance building. Ore will be loaded at the Mine Site into the uncovered cars at an estimated rate of 6,000 tonnes per hour, while the cars are in motion. The crew will control train speeds during loading. The loading equipment operator will be in continuous communication with the train crew during the process. The train crew may control the train directly from the locomotive cab with a wireless link to the loading equipment operator or a crew member may control the train remotely from the cabin of the loading equipment.

Freight Offloading

The railway terminal at the Mine Site will feature a load-out station for loading ore into cars. It will also have a station for unloading fuel (diesel and Jet A) into the tank farm (Section 3.4.6.7) and for unloading of general freight and ammonium nitrate.

3.5.2.8 Railway Terminal at Steensby Port

A conceptual layout of the railway terminal at Steensby Port is shown on Figure 3-3.6, the main functions include:

- Unloading of ore;
- Safe loading and unloading of passengers (Steensby Port personnel); and
- Loading of freight and fuel, and unloading of backhauled wastes.

Ore Unloading Facilities

The cars will be unloaded at Steensby Port using a rotary dumper, which simultaneously turns two cars upside down to empty the ore into unloading bins, without any requirement to uncouple the cars. Material will be withdrawn from the bins at an average rate of 6,000 t/h by two variable-speed apron feeders. The material will then be conveyed from the rail unloading area to the tertiary crushing/screening building. The ore will be passed through this system and the resulting separated lump and fine products will be conveyed to their respective stockpiling areas.

Freight Loading Facilities

Rail access at the Steensby Port terminal will include tracks to provide service for the tank farm and for container handling.

3.5.2.9 Railway Maintenance Facility and Yard

A railway maintenance facility at Steensby Port will include maintenance shops, management offices, welding and machine shops, a warehouse and an inspection shed. Locomotives and cars will be brought indoors for inspections, maintenance and cleaning. A shop for the care of track maintenance equipment, motor vehicles, and a general storage area for spare parts and consumables will support a minimum of 12 months of operation. A wheel and axle repair area will be used for the replacement of wheels and traction motors on locomotives and for the re-profiling of wheels. Locomotives will be moved in and out of the shop by a railcar mover, and will be fuelled at one end of the sheltered areas from a 400,000 L fuel tank located next to the track. The track maintenance crews will be housed at Steensby Port.



3.5.2.10 Ballast Quarry for Railway Maintenance

The railway embankment will require periodic maintenance, including the replacement of ballast beneath the rails. Quarry Q133+500 near Steensby Port has been identified as a suitable source of rock with the correct rock qualities for ballast. A railway siding will be constructed to the ballast quarry for access throughout the operation phase.

3.5.3 Railway Operation and Maintenance

The trains will be staffed with experienced 2-person crews, with the possibility of reducing to a single person in the future. A single dispatcher will control main line and yard operations. Canadian railways are to a large extent self regulating, subject to 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 manner in which 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). General freight and other trains will be dispatched to follow ore trains to avoid meeting on the main line. Combined signal and telecommunications systems will be used to safely manage the operation of mineral and freight trains. Track occupation by any vehicle, train or road-rail equipment will rely on the vehicle operator receiving exclusive authority to occupy the block, or specific section of track, by the Dispatcher. In 'dark territory', where there are no fixed signals, blocks are not fixed but defined as needed by the dispatcher, using clearly identifiable physical features such as wayside kilometre posts, yard limit signs (which permit a train to occupy part of the main line at a siding to set off a bad order car) or switch-points at a siding. A Computer Assisted Manual Block System (CAMBS) will help the dispatcher verify that any authority issued is not in conflict with any other active authority. Sidings have been strategically located to allow trains to pass each other.

The maximum design speed for the Railway will be 75 km/h. The initial maximum operating speed is expected to be 60 km/h under all conditions, staying at 60 km/h loaded and moving to 70 km/h empty.

Safety systems will assist in detection of malfunctioning railway stock or rails. These systems will likely include track circuits (to detect broken rails), wayside detectors (to monitor passing trains for defects such as hot bearings/wheels and dragging equipment), wheel impact detectors (to identify defective wheels), and rock fall detectors. 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.

Other than the construction of a stable embankment, no technologies solely specific to vibration damping are employed by the Railway. In general, noise and vibration are not considered an issue for low speed operations, even in urban environments, except in the vicinity of yards where tight curves can result in wheel "squeal", and shunting and train building produces a lot of noise as cars bang into each other. The iron ore trains, which constitute the majority of the Railway's traffic, will be operated as unit trains and will not be subject to regular shunting activities.

Ballasted track (particularly with timber ties) absorbs vibration to some extent. Homogeneous soft soils are the best transmitters of vibration, and their influence will be limited to the active layer during the thaw period and by the level of non-homogeneous inclusions in the soils themselves. Many 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.



Standard North American railway operating rules relating to earthquakes will be respected. In the event of an earthquake, and depending upon its severity, slow orders or no operation whatsoever will be permitted over bridges until safety inspections have been completed. The frequency of normal track inspections will increase during the freshet to ensure that all culverts are free flowing and that bridge freeboard is maintained. Areas exposed to potential rockfall will be protected with alarm fencing, not designed to stop the rock fall but to alert the signalling system that a fence has been broken and debris may be on the track. This alert will automatically stop trains until an inspection is carried out. The Railway Management Plan is located in Volume 10.

3.5.3.1 Movement of Cargo

Ore

Typically three train sets, each with two locomotives and 110-130 ore cars, will each make about two round trips per day (for a total of five to six round trips per day) to transport the 18 Mt/a of ore from the Mine Site to Steensby Port. Total ore train length will be 1,096-1,201 m depending on maximum axle load.

The main line transit time for ore trains between terminals will normally be less than 8 hours. Total terminal times to load, unload, safety inspect, fuel and crew change will be less than 4 hours. The total cycle time will 12 to 14 hours during summer (due to reduced travel speeds).

Fuel

Nineteen tank cars will transport fuel to the Mine Site, and fuel trains will each run once a week, dispatched whenever possible to minimize main line meets. The projected volumes of materials transported by rail are provided in Table 3-1.1. Contingency planning for spills is outlined in the Emergency Response and Spill Contingency Plan (Attachment 5 of Appendix 3B).

General Freight

General freight trains will operate approximately once a week and will normally be dispatched between ore trains in a pattern that minimizes main line meets.

Dangerous and Hazardous Materials

The transport of dangerous or hazardous materials via rail cars will abide by all applicable labelling, environmental, health and safety regulations (see the Waste Management Plan and the Emergency and Spill Response Plan, Attachment 5 of Appendix 3B).

3.5.3.2 Railway Equipment Inspections and Maintenance

A rigorous schedule of equipment inspections and maintenance will be implemented during the operating Life of the Railway. Locomotives will be subject to daily inspections during crew changes, plus 90-day, biannual and annual locomotive scheduled maintenance shop visits. Cars will be subject to detailed inspections every sixth trip (1,824 km), 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 Steensby Port at the maintenance centre, which consolidates most of the facilities required for railway operations into a single building. The Railway Management Plan presented in Volume 10, Appendix 10D-9.1 provides more details on routine railway inspection and maintenance activities.

February 2012





3.5.3.3 Railway Track Inspection and Maintenance

The following summarizes the inspections and maintenance to be carried out on the railway track:

- Regularly scheduled line inspections at different levels of detail and at different frequencies;
- Daily minor maintenance:
- Re-welding broken rails as required;
- Rail grinding three times a year, for four to five days each time:
- Ultra-sonic rail inspection three times a year for two to three days each time;
- Track surfacing program two to three months per year (planning and extent dependent upon observations from the scheduled line inspections);
- Rail replacement approximately 12 km of track rerailed every year after 12 years; and
- Tie replacement approximately 7 % of timber ties replaced every year after Year 10.

Daily 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;
- 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.

Additional ballast, generated from a designated quarry near Steensby Port will be used in the track surfacing program.

3.5.3.4 Snow Removal

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.

3.5.3.5 Waste Management

Solid waste generated on board will be sorted and disposed of at either the Mine Site or Steensby Port waste management facilities.

3.6 STEENSBY PORT SITE - OPERATION PHASE

During operations the Steensby Port infrastructure will include:

- Service and tug docks;
- Ore management facility, including:
 - Rotary rail car dumper;
 - Ore stockpiles and rail-mounted stacker/reclaimer system;



- Secondary screening plant;
- Tertiary crushing/screening building; and
- Ore loading dock.
- Port site facilities which include:
 - Power generating station;
 - Communications system;
 - Service/administration/accommodation buildings;
 - Maintenance shop/main office;
 - Potable water treatment system;
 - Wastewater treatment system;
 - Tank farm;
 - Incinerator;
 - Airstrip;
 - Navigational aids as required by the Canadian Coast Guard;
 - Site roads:
 - Railway maintenance facility and offices; and
 - Rail yard.

Figure 3-2.9 shows the Steensby Port layout. An estimated 18 Mt/a of ore will be transported from the Mine Site to Steensby Port via the Railway year-round, with possible short breaks during significant weather events and scheduled maintenance shut-downs. The ore will be stored in stockpiles at Steensby Port ready for loading onto icebreaking ore carriers. Shipping and port operations will be year-round.

Most resupply sea-lifts, including fuel, for operations will be delivered to Steensby Port during the open water shipping season only (approximately mid-July through mid-October). Some freight and oversized equipment that cannot pass through the tunnels will be directed to Milne Port.

The construction camp at Steensby Port will be downsized early in the operation phase, but other infrastructure built during construction will remain in place. During operations, Steensby Port personnel will be transported to and from the port site in Railway passenger cars.

The airstrip will remain fully operational and will be available for incidental and emergency use. The helicopter pad near the accommodation complex will be maintained for emergency use.

3.6.1 Ore Handling Operations

3.6.1.1 Ore Stockpiles

Railway ore cars will unload at the dumper pit using a rotary car dumper. The ore from the dumper pit is conveyed to the ore stockpiles on Steensby Island.

An ore stockpile pad, runoff collection ditches and a SWM pond will store ore and manage runoff in the same manner as described for the Mine Site ore stockpiles (Section 3.4.4). Ore fines will be stacked onto a 1.3 Mt temporary stockpile, and the lump product will be stacked in stockpiles totalling 3.2 Mt. Runoff from stockpiles on the island will be collected and, if necessary, treated if runoff quality exceeds MMER effluent discharge quality guidelines.

3.6.1.2 Ore Screening and Tertiary Crushing

At Steensby port, the ore is crushed to produce lump product suitable for shipping; lumps and fines are separated by screening and stored in separate stockpiles to await shipping to market.



The crushers and screens will be installed inside buildings to reduce dust and noise exposures. Material-handling equipment, including reclaimers, stackers and conveyors will be installed outdoors. Conveyors will be covered and equipped with wind hoods to reduce wind exposure and the potential for ore fines to be blown off the conveyors. Dust collectors will be installed at transfer points and other required areas to limit dust emissions.

Dust suppression techniques consist of the following measures:

- Conveyors will be covered and equipped with wind hoods.
- Dust collectors will be installed at ore screening and crusher transfer points.

3.6.1.3 Ore Dock and Ore Handling Facilities

The ore dock and associated ore-handling facilities are an important component of the transportation link to move ore from the Mine Site to market. The ore dock will accommodate icebreaking ore carriers as well as lower ice class ships during open-water season.

The ore dock design is based on the following requirements:

- Safe approach and departure routes for ships accessing the ore carrier berth;
- Safe berthing for the ore carriers with adequate water depth and moorings;
- Ship loading facilities for loading ore carriers;
- Access to shore for conveyors, maintenance vehicles and operating personnel;
- Mooring and fuelling capabilities for icebreaking vessels and tugs;
- Discrete dock foundations that help facilitate effective ice management;
- Cost-effective construction and operation;
- Capability to withstand significant ice loading;
- A design that can be built within a short construction season; and
- No bunkering, fresh water or fuelling to be provided to the ore carriers.

The ore dock will receive an average of 12 ore carriers per month year-round and up to 17 vessels per month in summer open-water season, when non-icebreaking ships will be chartered to ship additional ore. The dock has been designed to accommodate cape-size ore loading carriers with a draft of 20 m.

Ore will be reclaimed from the temporary ore stockpiles using one stacker-reclaimer (capacity 6,000 t/h) and one reclaimer (capacity 7,200 t/h) to give an average reclaiming rate of 13,200 t/h. The units will feed onto a series of conveyors, each having a design capacity of 16,000 t/h and an average capacity of 12,000 t/hour, which will convey the ore to a traveling ship loader which will load the holds of the ship.

3.6.2 Ore Shipping Fleet

A dedicated fleet of 10 to 12 ice class cape-size vessels with a nominal capacity of 160,000 to 190,000 dead weight tonne (DWT) cargo capacity will operate year round to transport the annual ore production to market.

It is anticipated that dedicated ore carriers will complete about 102 round trips from Steensby Port to customers across the Atlantic Ocean each year (i.e., 204 transits to and from Steensby Port). This equates to a ship moving through the shipping lane roughly every 1.8 days (43 hours). Shipping frequency will increase during the open-water season when sea-lifts will provide annual re-supply and supplemental vessels will be chartered to ship additional ore. These supplemental ore carriers are anticipated to be used, based on Baltic ice class designs, between approximately early August to about the third week of October. The number of supplemental ship voyages during the open-water season will vary from year to year. Some factors that influence the number of supplemental vessel voyages include the dry docking maintenance schedule for the dedicated fleet and the productivity of shipping through the winter. The chartered vessels

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

will be similar to those used for the existing annual sea-lift operations and will comply with the requirements of the Arctic Shipping Pollution Prevention Regulation (ASPPR).

Icebreaker ore carrier designs have been and continue to be evaluated. The currently envisioned 160,000 to 190,000 DWT capacity icebreakers will be designed as Polar Class 4 vessels, which relate to Canadian classification between a CAC 3 and CAC 4 design (Consulting and Audit Canada, 1993). A conceptual sketch of a 190,000 DWT icebreaking ore carrier, scaled in comparison to the *MV Arctic*, which has shipped to Polaris and Nanisivik Mines and now the Raglan Mine in Nunavik, is shown on Figure 3-3.7.

Additional detail on vessel ice classes is provided in Appendix 3G. These ships will be approximately 329 m long, 50 to 53 m beam and maximum draft 20 m when fully loaded. Currently, it is anticipated that the ore carriers will have the following design features:

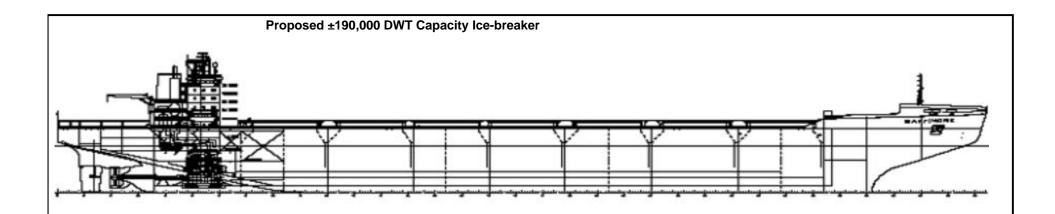
- Twin nozzle propellers (7.5 to 8.0 m diameter);
- Twin rudders (one behind each propeller) approximately 11 m high by 6 m wide;
- Full power: 42,500 hp per shaft with engine running at constant 78 rpm; and
- Shaft centreline approximately 6.5 to 7.0 m above vessel baseline.

The service speed of the dedicated ice-capable ore carriers and other vessels in open water at full draught is about 14.5 knots; maximum speed is over 18.5 knots. Speed is governed by a number of factors including weather, ice conditions, observance of other vessels and marine mammals. In ice conditions and at full power, 1.2 m level ice can typically be broken at over 7 knots speed; 2 m ice at 3 knots. The duration of a round trip from Steensby Port to a European destination in open water is around 20 days; in the heaviest ice conditions during a severe winter, it may be over 45 days.

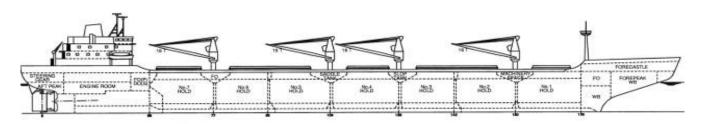
The ability of a ship to transit ice-covered waters is determined by the it's ice class, a notation applied to the vessel's class certificate based on the amount of ice strengthening. The International Association of Classification Societies (IACS), as well as governments including Canada and Russia, have set rules to classify ships based on the ice strengthening contained in the vessel. The IACS Unified Requirements for polar vessels is the standard by which all IACS members classify Polar Vessels built after July 1, 2007, including the vessels built for the Project. The Polar Class 4 vessels identified for the Project are classed by IACS for "year-round operation in thick first-year ice with old ice inclusions."

Transport Canada regulates an Ice Regime Shipping Control System (IRSCS) as part of Arctic Shipping Pollution Prevention Regulations - ASPPR. The IRSCS defines "Ice Regimes" as regions of generally consistent ice conditions based on a simple calculation that produces an "Ice Numeral" that combines the ice regime with the vessel's ability to navigate in the region. Every ice type (including open water) has a numerical value that is dependent on the ice category of the vessel. This number is called the Ice Multiplier. The value of the Ice Multiplier reflects the level of risk or operational constraint that the particular ice type poses to each category of vessel. The ASPPR Zones that are transited to reach Steensby Port are Zones 15 and 8, with Zone 8 covering Foxe Basin being the limiting zone with the higher ice regime designation.

The IRSCS is based on previous vessel ice classification nomenclature, for which there are no established equivalencies to the new polar class standard. In the selection of the Polar Class 4 vessels as appropriate for the Project, Enfotec used the parameters of the ASPPR and the Arctic Ice Regimes Shipping System (AIRSS; Transport Canada, 1998) to determine estimated access dates by ice class.



28,000 DWT Capacity MV Arctic (Owned and Operated by Fednav)



	Mary River	MV Arctic	Difference
Length Overall (m)	329.0	220.8	149%
Beam (m)	52.0	22.9	127%
Depth (m)	27.0	15.2	78%
Draft (m)	20.0	11.5	74%
Displacement (mt)	248,000	41,300	500%
Ore Cargo (mt)	±190,000	28,500	595%

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

ICE BREAKING ORE CARRIER CONCEPTUAL DESIGN



P/A NO. BL_Vol3_EXL_003

∩∩ና⊳৮′イL√° FIGURE

3-3.7



Because the vessels for the Mary River Project will be of modern construction and specifically designed for Project operational conditions features can be designed into the ships to mitigate air, noise and water interactions. Fuel for shipping will be purchased only from accredited suppliers that can provide assurance that the fuel conforms to Canadian and international marine regulations (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).

3.6.3 Shipping and Port Operations

The long-term viability of the Project depends on a constant supply of iron ore to customers. Customer facilities do not have significant ore storage capabilities, necessitating year-round shipping. Baffinland has engaged FedNav to assist with meeting shipping operational requirements.

The dedicated fleet of icebreaking cape-size ore carriers will transport most of the ore from Steensby Port to market, supplemented by the use of ships chartered on the open market during the open-water season. The ships will operate in accordance with two primary legal instruments regulating ship traffic in the Canadian Arctic: the Canada Shipping Act, and the Arctic Waters Pollution Prevention Act, and their associated regulations.

Routing has been determined based on ice navigation characteristics of the region and will be generally constrained by the availability of adequately detailed bathymetric charting. In the selection of routing, allowance has been made for other users and the need for mitigation measures. For example, a routing south of Mill Island has been identified and will be followed in order to respect the request from the community of Cape Dorset. As well, an easterly route was selected for northern Foxe Basin in order to minimize disruption to marine mammals and harvesters from Igloolik and Hall Beach. During operations, the nominal route as indicated will be followed. The exceptions will relate to ice conditions, e.g. near Resolution Island where changing conditions of pressured ice can affect vessel passage.

The Project has been designed so that there is an estimated 20 % operational flexibility in timing on an annual basis. This provision makes allowance for unplanned delays, e.g. in loading, offloading, vessel operations and ice conditions, while providing that delivery to market on a continuing basis can be maintained.

The required total number of vessel transits enables the Project requirement for delivery of 18Mt to be met. Flexibility is introduced by the possibility of external charters which would operate during the open water season and would supplement the capacity of the dedicated fleet of ice breaking ore carriers.

Overall the Project has made adequate allowance for flexibility to ensure that the required level of production and delivery of iron ore can be met annually and through safe operation of shipping.

There will be two main shipping routes from Steensby Port:

- Steensby Port to the Project's European customer base, for the movement of ore; and
- Southern Canadian port to Steensby Port, for re-supply of materials and some fuel and equipment by conventional sea-lift during open water periods.

The nominal shipping route through Foxe Basin in and out of Steensby Port is along the east side of Koch and Rowley Islands to where it joins with the established shipping lanes in southern Foxe Basin accessing Hall Beach and Igloolik (Figure 3-1.1). Two shipping routes through northern Foxe Basin were considered initially: the selected route and a more westerly route that departs from the existing shipping lanes near Igloolik and Hall Beach and runs west of Rowley and Koch Islands. Bathymetric surveys carried out over two years (2007 and 2008) on behalf of Baffinland by Kivalliq Marine Ltd. fleshed out cursory



hydrographic surveys that had been completed in the area by the Canadian Hydrographic Service (CHS) about 40 years ago. The results indicated that, while both routes were viable, the easterly route was operationally preferable. Baffinland's Mary River Inuit Knowledge Study (MRIKS) in Igloolik, Hall Beach and three other North Baffin Island communities provided a volume of information that spoke to the reliance on the waters of the westerly route and a relative absence of use of the marine waters along the preferred shipping route east of Rowley and Koch Islands. This information, along with feedback from public meetings in Igloolik and Hall Beach in 2007 and 2008, indicated a clear community preference for the selected eastern route.

Bathymetric surveys were carried out for the Project, and to meet CHS standards a senior CHS hydrographer was on-board. The surveys will be provided to the CHS for the development of navigational charts for use by the public, including Baffinland. The preferred route and the navigational charts have been studied by experienced ship masters at Fednav who have practical knowledge of ice interpretation and navigation in ice conditions.

Ships passing through Hudson Strait will remain within the Nunavut Settlement Area (NSA) and under normal circumstances, are not expected to pass through the Nunavik Marine Region of Northern Quebec or the area of shared Nunavut-Nunavik occupancy. In public meetings in Cape Dorset, community representatives requested Baffinland to put as much distance between its ships and the community as reasonably possible and as safety allows. The Company has modified its proposed nominal shipping route at this request. While better ice conditions are found closer to the coast of Baffin Island, ships will pass to the south of Mill Island (between Mill Island and Salisbury Island) to the extent possible (Figure 3-1.1; or Option D on Figure 3-6.3). The Company has stated that ships will likely need to pass to the north of Mill Island (Option C on Figure 3-6.3) when ice conditions are very poor, to maintain safe and reliable passage.

3.6.3.1 Navigation and Navigational Aids

Experienced ship captains will command the ore carriers on the Project. The ships will be equipped with the most advanced navigational equipment appropriate for ice navigation. Requirements for navigational aids will be determined by the Canadian Coast Guard and may include some type of beacons to be located on the islands in Foxe Basin.

As a prudent measure for safety and efficient operations, vessel docking will be assisted in the ice-free period by harbour tugs and lines personnel on the docks. Two to four ice-capable harbour tugs will be available. It may be necessary as part of normal shipping operations for ships to stage and anchor until the port is clear of other ships. This could occur within Steensby Inlet or along the shipping lane. Within northern Foxe Basin the ships will remain within the sounded shipping lane and will avoid staging near the islands and shoreline entering Steensby Inlet, where the potential to encounter marine wildlife such as walrus is higher.

3.6.3.2 Ice Conditions Along Icebreaker Shipping Route

Enfotec Technical Services, the ice navigation consulting arm of Fednav, conducted an ice and marine shipping assessment in support of the Project. The complete Enfotec report is attached in Appendix 3G.

The study included a detailed analysis of the series of winter ice atlases of the region compiled by the Canadian Ice Service since 1990 as well as numerous satellite images, to delineate areas of old ice concentration, ridged and pressured ice, and shear zone locations. The ice study supported the selection of Steensby Port as a port location, defined the proposed shipping lanes, and determined the appropriate ice class of the proposed vessels.



Ice conditions along the shipping route (extracted from Enfotec, 2011) are as follows:

- The waterway in the access to Steensby Port develops shore-fast ice each winter. The southern anchor of shore-fast ice reaches Koch Island. The boundary between shore-fast ice and mobile pack ice of the northern Foxe Basin represents a diverging ice edge over the winter, with the result that an open water lead is usually always present off the fast-ice edge. The additional benefit of this diverging condition is that no shear ridge occurs along the fast-ice edge in winter. There is an average of 35 nautical miles of shore fast ice leading to Steensby Port.
- The thickness of the fast ice of Steensby Port was recorded during geotechnical drilling to be generally in the order of 150 cm to 200 cm (Knight Piésold, 2008). However, the closest ice thickness measurement station in the region at Hall Beach to the southwest of Steensby Port has recorded average ice thickness at the end of the winter's growth of 192 cm with extremes of over 250 cm. The shore-fast ice appears very level with few ridges or leads and no possibility that old ice can become entrained in the ice over, as is the case in Eclipse Sound.
- The first sign of spring break-up is the widening of the leads in northern Foxe Basin and along the south coast of Baffin Island during April and May as solar radiation increases in the region.
- Ice reduction is slow and gradual during June and July as Hudson Strait clears of sea ice and the ice edge in the Foxe Basin retreats northward.
- The fast ice of Steensby Port fractures during the second and third weeks of July, beginning with the
 fracture of the lower portion of the fast ice in late June, followed by the complete fracture of the Inlet by
 the fourth week of July.
- Sea ice can commonly occur in the access channels into the month of September before clearing.
 The occurrence of remnant ice in the Foxe Basin does not preclude the use of market vessels during
 the late summer period for the Project; measures such as using an owner familiar with navigation in sea
 ice and experienced Ice Navigators would provide mitigation.
- Freeze-up starts in late October / early November with new/young ice expanding southward from northern Foxe Basin and extending eastward through Hudson Strait in December.

The estimated 204 transits (102 round trips) by the icebreaking ore carrier fleet to Steensby Port each year correspond to some 136 transits that will occur during the period of November through June, when air temperatures result in the formation of ice within the ship track. Evidence of the ship track in the mobile pack ice south of the Steensby Port fast ice edge will quickly disappear due to winds and tide. Evidence from the *MV Arctic* transit of Hudson Strait in winter indicates that the ship track is indiscernible in pack ice within six hours of the ship passing. Within the landfast ice of Steensby Port, the ship track will remain throughout the winter. Due to the extreme cold, the ship track will quickly begin to refreeze, and the frequency of transits means that ice formation will be continuous, resulting in the build-up of rubble in the track over time. Consequently, the track will gradually widen from the initial width of 50 metres to 1.5 km or more by late winter as subsequent transits are made to the side of previous tracks.

3.6.3.3 Ice Management at the Dock

Icebreaking activities around the dock will result in an accumulation of broken brash ice. The dock design will allow ice to accumulate between individual caissons thus helping ice to move past the dock, an advantage over a flat dock structure.



The winter ice cover is expected to remain stable in the area, even if it is repeatedly broken because of rapid refreezing of ship tracks. The dock may be subjected to substantial ice forces and ship impacts. Partially-frozen backfill will provide a strong stratum against these forces.

Additional measures will assist in reducing the growth and accumulation of ice around the dock. A maximum of 200,000 m³ of ballast water from each ship, warmed through heat recovery from the ship engines, will be discharged as the ship is loaded with iron ore. A bubbler system may be installed around the dock. In addition to two tugs, measures also include positioning two ice management vessels (ice-reinforced tugs) at the ore dock to assist with ice management.

3.6.3.4 Tug and Ice Management Vessel Docking

The ore dock and freight dock will be used to dock tugs and ice management vessels. These vessels will be refuelled from the marine diesel fuel tank adjacent to the freight dock. The docking facility has been designed to accommodate the movement of oils, lubricants, waste products, fuel, potable water and personnel.

3.6.3.5 Freight Dock Fuel Storage

Ore carriers will not be re-fuelled at Steensby Port and fuel will be delivered to the freight dock as part of normal operations. One of the ore carriers in the fleet will be equipped with a diesel fuel tank suitable for delivery of fuel to the ore carrier dock on an emergency basis.

One 7.5 ML marine diesel storage tank will be located adjacent to the freight dock to supply the tugs and ice-management vessels, and to receive emergency fuel from a vessel berthed at the ore carrier dock as a contingency (Figure 3-2.9). Fuel will be delivered to this tank by pipeline from the main tank farm. Refuelling procedures for the tug boats will be covered under the Steensby Port OPEP (Attachment 5 of Appendix 3B).

3.6.4 Sea-lift Re-supply Operations

Each year, fuel, ammonium nitrate to manufacture explosives, consumables and replacement equipment will be delivered at Steensby Port. The dedicated dock will allow conventional sea-lift vessels and fuel tankers to berth and unload during the open-water season in a safe and efficient manner. Estimated quantities are provided in Table 3-1.1.

All re-supply operations will follow the nominal shipping route and will take place during the open-water season. Conventional 10,000 to 17,000 DWT capacity sea-lift vessels that operate in the area will deliver dry freight.

Approximately 160 ML of Arctic grade diesel fuel, 50 ML of marine diesel and 5 ML of Jet A fuel will be delivered to the freight dock to be offloaded dockside. About 5 to 8 voyages per year will be made using double-hulled tankers of 30-50 ML capacity. A fuel off-loading manifold on the dock will allow for dock-to-shore fuel transfers, with a pipeline to the tank farm. The facility will be an Oil Handling Facility (OHF), and fuel transfer and spill prevention and response plans will be outlined in an Oil Pollution Emergency Plan (OPEP) approved by Transport Canada pursuant to regulations under the *Canada Shipping Act*. Attachment 5 of Appendix 3B contains a conceptual OPEP for Steensby Port.

Design and construction of the freight dock is described in Section 2.6.11. The dock will have a minimum draft of -13 m below the low water level, in addition to a large working area for vehicles and cranes for off-loading and a small intermodal yard for container handling.



3.6.4.1 Ballast Water Management

Ballast is water taken on to stabilize sea-going vessels by adding weight and maintaining a certain draft (the depth a vessel sits in the water). Ballasting is also used to keep the ice draft of the vessels constant, and to stabilize the ship, thereby optimizing stresses in different loading conditions.

The Ballast Water Control and Management Regulations require ships have a ballast water management plan, and either exchange or treat their ballast prior to discharge in waters under Canadian jurisdiction (Transport Canada, 2010). The dedicated fleet of icebreaking ore carriers are expected to use ballast water exchange as the proposed method of ballast water management. Charter ships calling on Steensby Port during open-water season will operate in compliance with the regulations; it is expected that they will use the same method.

Ballast water exchange will occur in deep seas away from coastal zones to limit the potential for foreign aquatic organisms or pathogens to be released in Canadian waters, where they may colonize. Ballast water will be exchanged in the mid-north Atlantic Ocean, which is part of the same ocean regime as Milne Port.

Upon arrival at the port, the ships will discharge ballast water and take on ore. During winter full ballast is required to assist in ice breaking so the entire amount of ballast water (approximately 200,000 m³) will be discharged at the ore dock. During summer, the ships can discharge ballast water before arriving at the dock so that only a partial load (in the order of 70,000 m³), will be discharged at the dock. Dispersion of ballast water for Steensby Port has been modelled and results are reported in Volume 8. Management of ballast water is also addressed in the Shipping and Marine Mammals Management Plan (Volume 10, Appendix 10D-10).

3.6.4.2 <u>Vessel Waste Management</u>

All vessels will be equipped with sewage treatment plants and incinerators for solid and liquid wastes. All tanks containing oil or oily waste will be placed in isolation from clean areas. No sewage effluent or untreated sewage will be discharged from the vessels. Inert and/or hazardous solid wastes will be stored and unloaded for disposal in approved facilities in southern locations.

3.6.5 Port Site Support Facilities

3.6.5.1 Port Site Buildings

The accommodation complex will consist of a combination of prefabricated modular units supported on pile foundations. The facility will accommodate personnel in two, two-storey dormitory wings. A central core area will include kitchen/dining facilities, recreational facilities and general service space. The building will be located near the power plant, the WWTF, the railway maintenance facility and the water supply source. It will be well removed from the railway ore unloading facilities and docks. Waste heat recovered from the power plant will feed heat into the accommodation building via an utilidor.

3.6.5.2 Power Supply

A centralized power plant designed to service the entire port will be located near the accommodation complex. The capacity of the power plant, running load and annual energy consumption are provided in Table 3-1.1.

Elevated corridors and utilidors will connect all buildings in the port area. In addition to providing access corridors for personnel, they will also contain heating services, piping and electrical trays/conduits. Utilidors will consist of prefabricated modular units on a structural steel framing system and pipe piles.



3.6.5.3 Water Supply

The potable water supply will be obtained from ST-347. The water intake design will be identical to the jetty structure to be used in Camp Lake at the Mine Site. A conceptual drawing of the jetty intake is included in Attachment 9 of Appendix 3B.

The intake will be located 7 m below surface and water will be conveyed to shore through a pipe buried in the lake bed. Onshore pumps will be used to propel the water through a heat-traced pipeline to Steensby Port. As an added precaution, a small freeze-protection pump will be installed to keep water moving in the pipeline in the event that the heat trace system fails.

3.6.5.4 Wastewater Treatment

The wastewater treatment facility will be the modular system used during the construction phase, scaled down to manage the smaller capacity during the operation phase, and will conform to effluent discharge requirements.

Treated effluent will be discharged to the Steensby Inlet via an outfall at a water depth of at least 20 m. The effluent will mix well within the water column. The location of the sewage outfall is shown on Figure 3-2.9.

3.6.5.5 Runoff Management

Site runoff will be managed in accordance with Baffinland's Surface Water and Aquatic Ecosystems Management Plan (Attachment 5 of Appendix 3B).

3.6.5.6 Waste Management Facilities

Solid and hazardous wastes will be managed in accordance with Baffinland's Waste Management Plan (Attachment 5 of Appendix 3B). Waste management facilities will include an incinerator, a landfill for inert, non-combustible and non-hazardous wastes, and waste oil burners. A landfarm, consisting of a lined containment area with multiple cells, will be used for temporary storage and treatment of hydrocarbon-contaminated soil and water. An adjacent lined contaminated snow storage area will be used to contain contaminated snow until it thaws and the meltwater treated. Final treatment of contaminated water will occur in a treatment unit within the railway maintenance facility. Designated temporary areas will store hazardous and recyclable wastes that will be backhauled on sea-lifts to disposal or recycling facilities in the south.

Estimated quantities to be stored in the landfill and quantities to be incinerated are provided in Table 3-1.1.

3.6.5.7 Fuel Storage and Distribution

The main diesel tank farm at Steensby Port will have a total storage capacity to account for Project needs, as well as the planned re-supply method (i.e., large shipments via tanker in open water periods). Tank volumes and estimated fuel consumption during operation are provided in Table 3-1.1.

An additional single 7.5 ML diesel storage tank located adjacent to the freight dock will act as a storage/transfer tank to receive marine diesel fuel and deliveries from one of the ore carriers, as well as to re-fuel tugs and ice management vessels. One of the ore carriers in the fleet will have a 5 ML fuel tank that can be used to deliver fuel to the Project throughout the year, if necessary. The 7.5 ML tank will be equipped with a refuelling manifold to the ore dock and dispensing equipment for the tugs and ice management vessels.



Based on a transfer rate from the ship to the storage tank of 6,660 litres per minute, the fuel unloading facility at the freight dock is designated as Level 2, according to the Canadian Coast Guard Oil Handling Facilities Standard TP 12402. A fuel response plan will be in place in accordance with a Level 2 Oil Handling Facility (refer to Steensby Port OPEP, Attachment 5 of Appendix 3B).

The distribution pumps at the tank farm closer to the power plant will be a self-contained, skid-mounted module in a pump house. The distribution pump module will be mounted on a concrete pad and attached to a fully-equipped instrumentation and control room positioned to monitor, record and control unloading and distribution operations. Fuel will be loaded to five railcars at a time via loading arms and loading platforms, and transported to the Mine Site.

The main tank farm fuel system will distribute fuel to the following locations:

- Power plant;
- · Heavy and light equipment fuel pumps;
- · Incinerator building;
- Heating boiler building; and
- Railcar fuel loading station.

In addition to the main tank farm and the island tank, day tanks will be required at the port site, ranging in capacity from 2,000 to 50,000 L and located within and outside of the power plant, boiler building, at fuel dispensing stations for light vehicles, and the incinerator. The railway maintenance building will contain bulk storage tanks for unused and waste oil.

3.6.5.8 Ammonium Nitrate Storage

Ammonium nitrate (used for making explosives) will be securely stored in a facility located close to the freight dock, where the temporary explosives plant was located during the construction phase (Figure 3-2.9).

3.6.5.9 Site Roads and Causeway

The portion of the road to the water supply intake at ST-347 Lake will be maintained throughout the operation phase, when graders, snowplows and other equipment will operate continuously. Snow fencing will be used to limit the formation of snow drifts on the road. Dust suppressants will be sprayed as needed. Inspections will be more frequent during the spring freshet to check culverts and the road for needed maintenance and repairs. Traffic will be managed in accordance with the Roads Management Plan (Volume 10).

The causeway crossing to the island will provide road access for light vehicles and heavy equipment working the ore stockpiles. Two conveyors over the causeway will convey ore from the dumper pit to temporary ore stockpiles on the island.

3.6.5.10 Port Security

Port facilities will be operated in accordance with Marine Transportation Security Regulations.

3.7 OFF-SITE FACILITIES SUPPORTING THE PROJECT

In addition to facilities constructed on-site, Baffinland will maintain a logistics and administrative office in Iqaluit and the head office in Toronto.



SECTION 4.0 - CLOSURE

The Preliminary Mine Closure and Reclamation Plan (MC&RP) has been prepared in accordance with the following requirements:

- the Qikiqtani Inuit Association (QIA) Abandonment and Reclamation Policy for Inuit Owned Lands,
- the conditions of the Nunavut Water Board water licence amendments (License number: 2BB-MRY1114), and
- the Aboriginal Affairs and Northern Development Canada (AANDC) 2002 Policy and 2007 "Mine Site Reclamation Guidelines For The Northwest Territories and Nunavut".

The MC&RP addresses all project-related activity areas and infrastructure related to the Mary River Project and provides a cost estimate for the final mine closure. The update MC&RP and its associated cost estimate is presented in the Type A Water License Application (Attachment 10 of Appendix 3B).

Project related facilities were designed and constructed to minimize the footprint and to be temporary in nature. These design and construction considerations have facilitated reclamation plans and minimized the engineering required to support the complete decommissioning and reclamation of the site.

Three abandonment scenarios have been described in this MC&RP: short-term temporary mine closure, long-term temporary mine closure and final mine closure. Additionally, progressive reclamation measures have been proposed to facilitate temporary and final mine closures.

Short-term temporary closure is the planned shutdown of a mine site for a period of less than one year. All facilities would be secured, an inventory of all hydrocarbon products, chemicals, explosives and hazardous wastes would be carried out and all effluents would be monitored. Explosives would be removed from the site.

Long-Term Closure is the state of inactivity resulting from economic considerations or a reduction in ore reserves for a period greater than one year. During Long-Term Closure the Project sites will be maintained in a secure condition. Site personnel will conduct general inspections once a month. They will maintain a record of these inspections. Although protective measures will be in place the Project will no longer be monitored on a continuous 24 hour basis.

Final closure and reclamation will occur when the ore deposit is exhausted and the mine ceases operations without the intent to resume mining activities in the future. Final closure and reclamation will include removing all infrastructure, equipment and materials either off-site or into an on-site landfill (for inert, non-hazardous, non-combustible materials), contouring ground surfaces to mimic the natural surrounding topography and re-establishing natural drainage patterns. Arrangements will be made with a sealift contractor to collect materials and equipment at Milne Port and Steensby Port and ship material offsite. The airstrips will be abandoned, but left in good working order unless otherwise directed by regulatory agencies, to provide emergency/rescue landing spots for regional aircraft and access for post closure monitoring.

The final closure and reclamation activities are expected to last from May to October for a period of three years. Post closure monitoring will continue until closure objectives have been met or shown by monitoring results. This is estimated to last five years. Monitoring and follow-up inspections will be conducted to assess the physical and chemical stability of various components after closure and reclamation of the facilities. Biological monitoring and follow-up inspections will assess the effectiveness

MARY RIVER PROJECT



Final Environmental Impact Statement February 2012

of the reclamation. No facilities are expected to be left as a result of the Project that will require monitoring or management in perpetuity. Baffinland recognizes that the duration of the post closure monitoring activities will depend on the outcome of the post closure monitoring and the extent that the final closure objectives have been achieved.

The Mining RECLAIM spreadsheet provided by AANDC has been used as the basis for the estimate of the financial cost of final closure and reclamation measures. It addresses all project-related activity areas and infrastructure related to the Mary River Project, mobilization and post-closure monitoring. The financial cost obtained is based on the information available at the time of publishing and will require updating as the Project progresses. The cost estimate follows the QIA Abandonment and Reclamation policy guiding principles and stated assumptions.

The Preliminary Mine Closure & Reclamation Plan is presented in Attachment 10 of Appendix 3B. For the reader's convenience, Tables of concordance with the mine closure guidelines cited above are included at the end of the document to cross reference the requirements of the various mine closure guidelines and the commitments made by Baffinland at the DEIS Pre-Hearing Conference in November 2011.



SECTION 5.0 - WORKFORCE AND HUMAN RESOURCES

Baffinland is committed to developing a Project that provides sustainable benefits to the people of Nunavut. The success of Baffinland depends upon the combined capabilities of its employees, technology, resources, and customers. Human Resources management activities are guided by the following commitments to the workplace and to people:

- Baffinland is committed to promoting a safe, healthy and productive workplace, and will embrace
 principles of good corporate citizenship and responsibility. Respect for human rights and the traditional
 culture, values and customs of Inuit, will be central to this commitment.
- Baffinland will strive to achieve a workplace for our employees and contractors free from occupational
 injury and illness. Baffinland will provide suitable work facilities and conditions with the objective of
 safeguarding the health, safety, and general well-being of employees. Baffinland will require all
 employees and contractors to maintain safe and effective work practices, including observing all
 legislated health and safety requirements.
- Baffinland is committed to treating all employees with dignity and respect. Harassment in the workplace
 is against the law and will not be tolerated. Baffinland is committed to providing a workplace free from
 harassment.
- Baffinland will seek to create a work environment that supports continuous improvement, and will
 provide opportunities for individual growth and career satisfaction. Baffinland will assist employees to
 realize their potential by providing appropriate training, development, education, and opportunities for
 promotion.
- Promotion and reward will be based on merit and performance. Baffinland HR will strive to create a workplace environment that is characterized by mutual trust and transparent HR processes.
- Baffinland will seek to foster and maintain a positive culture of shared responsibility based on participation, effective behaviour and awareness.

Baffinland's commitments and employment policies with respect to its workforce are described in more detail in the Human Resource Management Plan (Volume 10, Appendix 10F-3).

The Company is working in cooperation with stakeholders in Nunavut to establish education and training programs that will provide opportunities for employment of local residents in the Project and equip them with skills that will provide sustainable contributions to the well-being of the region far into the future.

5.1 WORKFORCE REQUIREMENTS

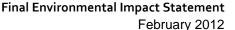
Workforce requirements estimated for both the construction and operation phases of the Project are presented in Table 3-1.1. These estimates provide a guide to the general size of the workforce during the construction and operation phases. Personnel requirements during the closure and reclamation phase are a subset of the operational requirements, and as such are not discussed separately.

5.1.1 Workforce - Construction Phase

Estimates of the construction phase workforce range from 1,710 to 2,680 individuals on payroll over four years (Table 3-1.1). The estimated site workforce includes the workers on shift at each of the Project sites but excludes workers expected to be involved in ongoing exploration. Workers on ore carriers, sea-lifts and tanker vessels are also not included in these estimates.

The Construction Phase workforce will largely be hired by the Engineering, Procurement, Construction Management (EPCM) Contractor and its contractors and subcontractors. As such, a precise estimate of Construction Phase workforce loadings is not possible prior to engagement of these entities. For this







reason, the estimates are considered to be approximate. In addition, the intensity of work and number of workers are expected to vary seasonally through the year and from year to year.

The work week will consist of 12-hour days, seven days per week. The planned scheduled work rotation for most contractors during the construction phase is expected to be four weeks on/two weeks off. Workers hired from northern communities will work two weeks on/two weeks off during construction.

Successful completion of the construction phase depends on the quality and commitment of the workforce. The accommodation camps will offer comfortable quarters and recreational and entertainment facilities to promote a safe, healthy, and inviting worker environment, and to encourage workers to remain within the accommodation boundaries during leisure time. The capacity and number of accommodation camps during construction are provided in Table 3-1.1.

The construction labour force will fall into several major categories of work: site services/logistics, construction, maintenance, and support services. Each of these categories include a wide range of subareas of work along with associated jobs. An estimate of the relative breakdown of the workforce in each of these sub-areas according to skill level required for eligibility is provided in Table 3-5.1. This table is intended to be indicative of the areas of work where individuals having different levels of education, skills, and qualification can expect to engage with the Project.

Table 3-5.1 Diversity of Jobs at a "Typical" Iron Mine Construction Project

		Skill Level B+	Skill Level C	Skill Level D
Area	Job Title	(University, Journeyman Trades, Managers)	(Secondary school and/or occupation- specific training)	(Labourers, helpers, on- the-job training)
		(estimate	d percentage of p	ositions)
Medical facility & Emergency Response	Nurse, Paramedic, EMT	30 %	60 %	10 %
Logistics & Accommodations	Administrators, Expeditor, Logistics, Airport Dispatcher	10 %	70 %	20 %
Catering & Housekeeping	Chef, Cook, Cook Helpers, Baker, Housekeeper, Administrators	20 %	20 %	60 %
Site Services	Heavy Equipment Operators, Labourers, Sewage & Water Treatment Operators	30 %	50 %	20 %
Security	Security Guard, Administrators	20 %	50 %	30 %
Procurement & Warehousing	Buyers, Warehousing Technicians, Expeditor	30 %	30 %	40 %
Power Generation	Power Engineer	80 %	10 %	10 %
Project Management	Supervisors, Managers, Engineers, Surveyors, Document Control Technicians, Administrative Assistants	50 %	40 %	10 %
Steel Works (Building Construction) & Tank Farm Construction	Carpenters, Plumbers, Electricians, Millwrights, Iron Workers, Crane operators, Labourers, Liner Technicians, Small Equipment Operators	50 %	20 %	30 %
Blasting & Quarrying	Blaster, Blaster Helper, Operators	20 %	30 %	50 %



Table 3-5.1 Diversity of Jobs at a "Typical" Iron Mine Construction Pr	roject (Cont'd՝)
------------------------------------------------------------------------	-----------------	---

Earthworks & Rail Works	Drillers, Excavator operators, Haul Truck Operators, Dozer Operators, Grader Operators, Front End Loader Operators, Shovel Operators, Construction Helpers	10 %	30 %	60 %
Building Construction	Electricians, Millwrights, Carpenters, Instrumentation Technicians, Welders, Apprentices	70 %	20 %	10 %
General Maintenance	Heavy Duty Mechanics, Automotive Mechanics, Welders, Fuel/Lube Truck Operators, Apprentices	70 %	20 %	10 %
Finance & Information Technology	Accountants, Accounting Technicians, IT Technicians	60 %	30 %	10 %
Human Resources & Training	Human Resources Coordinators, Payroll Coordinators, IIBA Coordinators, Elders, Trainers	30 %	40 %	30 %
Environment, Health, Safety & Sustainability	Community Liaison Officers, Environmental Technicians, Safety Officers	40 %	30 %	30 %

Source: Baffinland, 2011. These are examples of some of the positions that are typical for construction of an iron mine, rail and port project.

5.1.2 Workforce - Operation Phase

The total estimated workforce on payroll during the operation phase is roughly 950 persons (on-site and off-site, Baffinland and contract personnel). This estimate does not include staffing required for any ongoing exploration work throughout the operations phase. Most on-site staff will work on a scheduled rotation of two weeks on and two weeks off.

The projected allocation of positions to different Project locations, and distribution of the workforce by level of education and skill is provided in Table 3-5.2, based on Baffinland estimates of its operations labour force requirements.

Table 3-5.2 Estimated Operations Team Workforce by Skill Level and Location

Location of Position	Management	University	College, Skilled	Superintendent	Supervisor	Trades, Technical	Operator	Clerical	Semi or Unskilled	Total
Toronto or other southern city	4	3	4		2	4		3		20
Iqaluit and North Baffin	2		2		2	7		1		14
Corporate Total	6	3	6		4	11		4		34
Mary River - Mine	1	15	42	1	16	6	122	2	20	225
Mary River - Maintenance	1		23		2	84	10	4	19	143
Site Services - Mary River	1	8	9		26		16	6	112	178
Maintenance - Steensby	1		24			80	6	6	19	136



Table 3-5.2 Estimated Operations Team Workforce by Skill Level and Location (Cont'd)

Location of Position	Management	University	College, Skilled	Superintendent	Supervisor	Trades, Technical	Operator	Clerical	Semi or Unskilled	Total
Site Services - Steensby	1	8	24		8		44	2	64	151
Mary River - Port and Rail					2				18	20
Steensby - Port and Rail	1		16				32	10	4	63
Site Total	6	31	138	1	54	170	230	30	256	916
Total operations workforce	12	34	144	1	58	181	230	34	256	950

There will be a wide diversity of positions required to operate the Project. These will fall into several major categories of work: site services/logistics, mine operations, rail and port operations, maintenance, and support services. Each of these categories, and their respective sub-areas, will require individuals having skills and experience ranging from basic on-the-job training through to university degrees combined with extensive professional experience.

Table 3-5.3 provides a summary of the positions that are typically experienced in a mine operation having characteristics similar to that of the Project. The table includes an estimation of the typical skill level requirements associated with these jobs. This table is intended to be only indicative of the areas of work where individuals having different levels of education, skills, and qualification can expect to engage with the Project.

Table 3-5.3 Diversity of Jobs at a "Typical" Operating Iron Mine Project

			Skill Level B+	Skill Level C	Skill Level D
Area Sub-Area		Job Titles, Trades, Certifications, Experience	(University, Journeyman Trades, Managers)	(Secondary school and/or occupation- specific training)	(Labourers, helpers, on-the- job training)
			(estimated percenta	ige of positions)	
	Medical Clinic & Emergency Response	Nurse, Paramedic, EMT, Firefighter	30 %	50 %	20 %
Site Services, Logistics	Travel & Accommodation s	Hotel Management, Logistics	30 %	50 %	20 %
	Catering & Housekeeping	Chef, Cook, Baker, Hotel/Restaurant Management	30 %	20 %	50 %



Table 3-5.3 Diversity of Jobs at a "Typical" Operating Iron Mine Project (Cont'd)

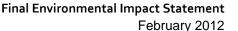
			Skill Level B+	Skill Level C	Skill Level D
Area	Sub-Area	Job Titles, Trades, Certifications, Experience	(University, Journeyman Trades, Managers)	(Secondary school and/or occupation- specific training)	(Labourers, helpers, on-the- job training)
			(estimated percen	tage of positions)	
	Site Services Operators	Heavy Equipment Operator, Water Treatment Plant, Sewage Treatment Plant	20 %	40 %	40 %
	Security	Security Guard	20 %	30 %	50 %
Site Services,	Procurement & Warehousing	Procurement, Warehousing, logistics, Buyers	20 %	40 %	40 %
Logistics	Power Plant Operation	Power Engineer	70 %	20 %	10 %
	Supervision & Management	Supervisors, Managers, Administrative Assistants	40 %	40 %	20 %
	Sewage & Water Treatment Operator	Water, Wastewater, Solid Waste Management - Water Testing	30 %	30 %	40 %
	Geology	Mine planners, geologists	40 %	40 %	20 %
	Supervision & Management	Supervisors, Managers, Administrative Assistants, Dispatch Operators Chemist, Sample Prep	40 %	40 %	20 %
	Laboratory	Technician, Geological Technician	20 %	20 %	60 %
	Blasting	Explosives Plant, Blaster, Blaster Helper	20 %	30 %	50 %
Mine	Engineering	Mining/Civil Engineer, Surveyor, GIS/CADD Operator, Document Control	40 %	40 %	20 %
	Heavy Equipment Operator	Drill, Excavator, Haul Truck, Dozer, Grader, Front End Loader, Shovel, Mine Helper	20 %	30 %	50 %
	Crushing,	Crusher Plant Operator,	ZU 70	30 %	JU %
	Screening	Process Helper	20 %	30 %	50 %
	Stockpile Management	Dozer, Front End Loader	10 %	40 %	50 %
Rail & Port Operations	Track Maintenance	Trackmen, Welder, Maintenance of Way Operator	10 %	60 %	30 %



Table 3-5.3 Diversity of Jobs at a "Typical" Operating Iron Mine Project (Cont'd)

			Skill Level B+	Skill Level C	Skill Level D
Area	Sub-Area	Job Titles, Trades, Certifications, Experience	(University, Journeyman Trades, Managers)	(Secondary school and/or occupation- specific training)	(Labourers, helpers, on-the- job training)
			(estimated percentage of positions)		•
	Train Operations	Locomotive Operator, Dispatch Operators	30 %	60 %	10 %
	Supervision & Management	Supervisors, Managers, Administrative Assistants	40 %	40 %	20 %
Rail & Port Operations	Port Operations	Shiploader Operator, Tertiary Crushing Plant Operator, Screening Plant Operator	20 %	30 %	50 %
	Stockpile Management	Dozer, Front End Loader, Port Helper	10 %	20 %	70 %
	Fixed Plant Equipment	Electricians, Millwrights, Carpenters, Instrumentation, Welders, Apprentices	70 %	20 %	10 %
Maintenance	Mobile Equipment	Heavy Duty Mechanics, Automotive Mechanics, Locomotive Mechanics, Welders, Apprentices	70 %	20 %	10 %
	Supervision & Management	Supervisors, Managers, Administrative Assistants, Maintenance Planners	40 %	40 %	20 %
	General Maintenance	Fuel/Lube Truck Operators, Maintenance Assistants	10 %	20 %	70 %
	Finance & Information Technology	Accountants, Accounting Technicians, IT Technicians	50 %	30 %	20 %
Support Services	Human Resources & Training	Human Resources, Payroll, IIBA Coordinators, Elders, Trainers, Recruitment, HR Analysts	40 %	30 %	30 %
	Environment, Health, Safety & Sustainability	Liaison Officers, Environmental Technicians, Safety Officers	20 %	40 %	40 %
	Exploration	Geologists, Geophysicists, Geological Technicians	30 %	30 %	40 %

Source: Baffinland, 2011. These are examples of some of the positions that are typical for an open pit iron mine operation. Note that not all these positions are "in-house." Some may be contract positions.





Closure and Reclamation Phase Workforce

The expected duration of the closure phase is three years, followed by post closure activities expected to last for five years. If closure objectives are not met, post closure would extend beyond five years. During this phase a small fraction of the operation phase workforce will be retained to carry out reclamation activities. The details of the size and composition of the closure and reclamation workforce will be developed during the operation phase, no later than two years prior to the planned commencement of closure and reclamation activities.

5.1.3 Contract Opportunities and Associated Workforce Demand

The following table provides an overview of the areas where contracts may typically arise in a project such as the Mary River Project, along with a general presentation of the types of jobs and labour demand that these contract areas typically require.

All companies doing business with Baffinland will be required to comply with the obligations and requirements of the signed IIBA. These obligations will "flow through to the companies" and will be embodied in the contracts between Baffinland and these companies.

To encourage access to contract opportunities presented by the Project, Baffinland's Procurement and Contracts group will regularly visit communities to report and advise of opportunities. This group will assist with maximizing the capacity of existing businesses to allow them to participate in the Project. Baffinland intends to work closely with the Project liaison office in Iqaluit to support on-going communications with North Baffin LSA communities so that local entrepreneurs are aware of the future contracts being prepared. Additional detail on support for local business capacity development is provided in the Human Resources Management Plan (HRMP) (Appendix 10F-3).

Table 3-5.4 Examples of Potential Contract Opportunities and Associated Jobs

Contract Opportunity Area	Typical Job / Labour Requirements		
Security Services	Security guard		
	Food preparation, some cooking		
Complessations apprehing	Kitchen assistant		
Camp/catering operations	Cleaner, housekeeper		
	General labour		
Tomporony construction / rough component structures	General labour		
Temporary construction / rough carpentry structures	Truck driver of light vehicles i.e., pick-up trucks		
Site services	General labour		
Site Services	Light maintenance		
	Sampling		
Environmental	Monitoring activities		
	Wildlife management		
	Offloading trucks		
Logistics/warehousing	Tool crib assistant		
	General labour in warehouse		

Source: Baffinland, 2011. These are examples of some of the service contracts that may be expected to arise.



5.1.4 Transportation of the Workforce

As a remote fly-in/fly-out Project, employee transportation to the Project site during all phases of the Project is a critical component. Transportation will be provided by the Company for all employees.

The Company will provide air transportation for Inuit employees from the Baffin Region to and from the mine or Project at no cost to the employee. This air transportation may take the form of charter aircraft provided by the Company or schedule commercial aircraft where available, at the Company's sole discretion.

Flights will operate between the five North Baffin community points of hire, including, listed from west to east, Hall Beach, Igloolik, Arctic Bay, Pond Inlet, and Clyde River. Iqaluit will also be a point of hire. Baffinland may in its sole discretion, consider other communities as points of hire if Baffinland deems there are sufficient individuals from such a community available to work on the Project.

Overnighting of employees from non-Point-of-Hire communities passing through Iqaluit or other locations will be avoided where possible, however this may be required during poor weather. When overnighting is required, Baffinland will work with local accommodation providers to adequately plan for accommodation in Iqaluit and other locations.

Larger aircraft, as needed, will be chartered to transport workers from Iqaluit and from a southern hub, or hubs, to the Mine Site and Steensby Port Site. The possibility that the southern flight may include a refuelling stop in Iqaluit or some other major air facility will be considered as necessary. If such a refuelling stop is required, plans will be implemented to ensure that passengers are able to deplane and re-board without causing undue congestion at the local airport terminal facilities.

5.2 RESOURCING STRATEGY

Baffinland Iron Mines is committed to the hiring and development of Inuit with a particular focus on Inuit from North Baffin Communities. An IIBA will be signed with QIA to support this commitment. The following activities will be put in place:

- Two Inuit Employment and Training Coordinators will be hired to work in the five North Baffin Communities to inform local communities of position vacancies and support Human Resources managers in identifying candidates for vacancies.
- A candidate database identifying position interests, skills and education will be established (primarily
 maintained by the Employment and Training Coordinators) the database will be accessible during the
 construction phase to internal hiring managers as well as contractors.
- All vacancies will be posted in North Baffin Communities for 28 days; only if there are no suitable
 applications (either from the advertisement or search of the database) will the vacancy be sourced in
 southern locations. This may be waived where it is agreed between Baffinland and QIA that no suitably
 qualified candidates are likely to be identified.
- Vacancies will be advertised in English and Inuktitut.
- Where safety is not compromised, Inuktitut speaking workgroups will be established. To support this, recruitment materials, company policies and where practicable, training materials will be translated to Inuktitut.
- Inuit will be given preference over other applicants (provided skill requirements are met).
- A job description will be established for each position detailing the skill and performance requirements.



Final Environmental Impact Statement February 2012

Identification of potential employees for mobilization during the Construction Phase will begin early in the process. The EPCM Contractor will be required to follow Inuit hiring preference protocols that arise from the IIBA that pertains to the Project. This will include flowing this requirement out to all contractors and subcontractors of the EPCM. To assist the EPCM in meeting this obligation, Baffinland will utilize its experience and resources in the Baffin Region to generate an initial list of interested and eligible applicants. This will be done by utilizing the local Baffinland Community Liaison Officers as well as by drawing from the Company's experience gained during the bulk sample activities.

As suggested earlier, the demand for workers from across all skill levels will be very high during the Construction Phase. Labour demand will decline as the Project evolves into the Operations Phase and will decline further during the Closure and Reclamation Phase. Demobilization will take place carefully to ensure that employees are fully aware of their period of employment, given adequate notice at the close of their employment and provided with opportunities to apply to positions in the operations team.

During the Construction Phase, most labour will be engaged by the EPCM Contractor that will be hired to oversee construction of the Project. During this phase, there will be many positions for a broad range of individual skill sets including labourers and helpers who fall into the "Level D" or "unskilled" labour force category. It is expected that during construction there will be more jobs available, across all skill levels, than the local labour force will be readily able to supply.

During the Operations Phase the total number of jobs will decline from the levels seen during construction. This decline will be most evident in the area of "Level D" or "unskilled" labour / helper positions. It is anticipated therefore that many individuals hired into lower skill-level positions will need to gain the necessary skills and certifications to enable them to advance to higher skill-level positions if they are to maintain engagement in the Project. For this reason, a substantial training program has been integrated as a key component of the Project, as outlined in Section 5.3, below.

5.3 HUMAN RESOURCES TRAINING AND CAPACITY DEVELOPMENT

5.3.1 Training Program Overview

The purpose of the Baffinland Iron Mines training strategy (construction and operation) is to equip employees with the necessary skills, knowledge and attributes to contribute to the Project's labour force needs while achieving personal development goals.

However, it remains that it is the responsibility of each employee to pursue these development opportunities and support continuous improvement across Baffinland Iron Mines. The objectives of the training strategy are to:

- Support the achievement of opportunities related to local employment and human capacity development that are identified in the IIBA and in this FEIS;
- Increase the overall technical and managerial skill level of employees to ensure that the Project is as much as possible self-sufficient in terms of talent development, recruitment and training; and
- Support the achievement of the IIBA-established Minimum Inuit Employment Goal (MIEG) each year.

Baffinland is committed to developing both a construction training program and operations training program. The construction training program will be based on the skill requirements, employment numbers and timing identified by the EPCM and contractors. The operations training program will be focused on supporting 'life-cycle' training for employees as represented in Figure 3-5.1.



Figure 3-5.1 'Life-Cycle' for Operations Training Program





It has been clearly identified during the 'bulk sample' employment period that employees from the LSA may require addition support to make a successful personal, family, and professional transition to fly-in/fly-out work. To assist this process, Baffinland will provide targeted training and support including:

Adult education training: Baffinland will cooperate to support activities onsite or offsite designed to
provide adult basic education, upgrading, and job readiness training programs or services to Inuit
employees. Baffinland will include adult basic education as one of the onsite training opportunities
within the framework of the Inuit Employment and Training Strategy. Onsite training opportunities
will take place during working hours;



- Work-ready program: all successful candidates will undergo (with their immediate family members) a
 program to assist them understand and successfully manage fly-in/fly-out work, basic financial
 management, time management and personal management;
- Elder support: an Elder will be available on site to assist employees with personal/cultural challenges.
- Employee and Family Assistance Program (EFAP): it is the aim to have some employee and family assistance support (related to both personal and financial matters) able to be provided in Inuktitut;
- English language and Inuktitut language training; and
- Adult education, work-ready and induction training are planned to be delivered in Inuktitut, where
 possible job specific training will also be provided in Inuktitut.

All employees will be offered a range of training opportunities, including:

- Induction/orientation program;
- Cultural awareness training; and
- Employee and Family Assistance Program.

In addition a range of training programs will also be accessed through the ArcelorMittal University, these include:

- Function specific training;
- · Core management and leadership skills training;
- E-learning;
- English language learning;
- Talent pipeline programs; and
- Executive training.

The following section provides a broad overview of job specific training.

5.3.2 <u>Job-Specific Training For Operations</u>

At the core of the training program will be technical, job specific training for the Operations Phase. This training activity will begin during the latter part of the Construction Phase so that Nunavummiut residents who are engaged under the EPCM or its contractors and subcontractors will be able to successfully transition into Baffinland operations positions.

A training package (operation and maintenance) will be developed for each key piece of equipment that is required on site. This training will be tailored specifically to the equipment rather than being generic. The training model will be as follows:

- Theoretical training (what is the equipment, how is it operated, what safety procedures are required to be followed);
- Practical training (depending on the nature of the equipment and will largely be used for heavy equipment operators);
- On-the job training (on the job coaching and oversight will be provided by supervisors to ensure learning outcomes are reinforced); and
- At each stage, assessment will take place to ensure that employees are safe and confident to proceed to the next stage of training.



As the training is based on the exact equipment that is purchased and delivered in line with the commissioning schedule, the exact training arrangements will be finalized once the detailed engineering and procurement phases have been completed. The timing will be finalized as part of operational preparedness during the construction phase.

Qualified individuals who are hired into the project will require training to prepare them for the specific tasks and equipment they will be responsible for on the job. An indicative list of training packages and estimated theoretical training requirements is provided below for illustrative purposes. Practical and on the job training will be in addition and dependant on role/equipment. The training will be scheduled so that employees are hired and have completed their work ready, orientation, and job specific training (including practical training) in time to take part in commissioning activities.

Power Plant Operations and Maintenance

- Power plant fitters 20 days training
- Power plan attendants 20 days training
- Power plant electricians 30 days training
- Port generator attendants 20 days training
- Port generator technicians 31 days training
- Power plant operators 21 days training

Mine Operations and Maintenance

- Production drill operators 9 days
- Secondary drill operators 9 days
- Haul truck operators 9 days
- Excavator Operators 9 days
- Front Shove Operators 9 days
- Rubber Tired Dozer Operations 9 days
- Track Dozer Operators 9 days
- Motor Grader Operators 9 days
- Front end loader Operators 9 days
- Low boy Operators 9 days
- Fuel/Lube Truck Operators 9 days
- Boom Truck Operators 9 days
- Manlift Operators 9 days
- Backhoe operators 9 days
- Crane Operators 9 days
- Integrated Tool Handler Operators 9 days
- Forklift Operators 9 days
- Reach Stacker Operators 9 days
- Skid Steer Loader Operator 9 days
- Mine maintenance planner 20 days
- Diesel mechanics 26 days
- Mine welders 12 days
- Crushing plant operators 57 days
- Crushing plant helpers 20 days
- Crushing plant electricians 25 days
- Crushing plant technicians 22 days



Final Environmental Impact Statement February 2012

Rail Operations and Maintenance

- IT signals and communications 12 days
- Lead traffic controller 12 days
- Rail traffic controller 12 days
- Locomotive Driver 15 days
- Switch maintenance crew 3 days
- Maintenance planner 20 days
- Bridge maintenance 6 days
- Track maintenance 9 days

Service Roads

- Mechanical engineer 20 days
- Motor grader operators 9 days
- Rubber-tired operators 9 days
- Track dozer operators 9 days
- Front-end loader operators 9 days
- Backhoe operators 9 days

Port Operations, Maintenance and Workshop

- Material handling planner 20 days
- Crane operators 9 days
- Stacker/reclaimer operators 12 days
- Ship loader operators 12 days
- Ship loader attendants 12 days
- Conveyor attendants 12 days
- Grade control technicians 20 days
- Electricians 20 days
- Mechanics 20 days
- Fitters 20 days
- Technicians 20 days
- Workshop planner 20 days
- Diesel mechanics 20 days
- Hydraulic fitters 20 days
- Auto electricians 20 days
- Welders 20 days

5.3.3 Previous Education and Training Initiatives

Baffinland has been actively pursuing education and training partnerships and initiatives. Prior to submission of the FEIS, during works leading up to and including the bulk sample, the Company accomplished a number of education and training initiatives, as described below.

Inuit Training Program Memorandum of Understanding

Baffinland, the Qikiqtani Inuit Association, Qikiqtaaluk Corporation, and Kakivak Association signed a Memorandum of Understanding (MOU) on May 31, 2008, agreeing to develop and promote the delivery of mine-related training, training related to economic and community development, labour market research, curriculum development, career development, and other related activities for the benefit of Inuit in the communities associated with the Project. The activities being developed under the MOU built on existing training initiatives underway at the Project such as heavy equipment operator training, job-shadowing



Final Environmental Impact Statement February 2012

programs and cultural orientation seminars. Encouraging education and training programs for students, coordinating of work placements, and reducing barriers to Inuit participation are critical to the success of the program. Funding is anticipated to involve both private and public sector sources. The initial term of the MOU is three years with an expectation that the success of the program will be reviewed and next steps identified.

Government of Nunavut & Arctic College Training Program Memorandum of Understanding

A MOU similar to the above was established with the Government of Nunavut and Arctic College in 2008, focusing on trades programs. More recently, in December 2011, Baffinland has renewed its relationship with Arctic College in order to collaborate and assist with the second year of an Environmental Technician training program in Pond Inlet.

Training Initiatives

Over the course of the project definition phase a total of \$2.1 million of third-party training was delivered through approximately \$1.7 million in funding provided by Baffinland. These training activities included emergency first aid/WHMIS to residents of the LSA; cultural awareness training delivered by Qikiqtaaluk Corporation to staff at Mary River; simulator heavy equipment (haul truck/dozer) training delivered to 20 candidates by NUNA Logistics; diamond drill program to ten candidates from Igloolik delivered by Springdale Diamond Drilling; and, heavy equipment operator training for eight students from Pond Inlet.



SECTION 6.0 - ALTERNATIVES

The NIRB guidelines section 6.1 outlines the requirements for the evaluation of alternatives of carrying out the Project components:

"The EIS shall include an explicit analysis of all alternative means of carrying out the Project components, including a "no-go" alternative, the identification and application of criteria used to determine the technical feasibility and economic viability of the alternatives to the Project (e.g., transportation, natural, social, economic and cultural environment). This analysis must be done to a level of detail which is sufficient to allow NIRB and the public to compare the Project with the alternatives in terms of the economic costs and the environmental, social and economic impacts and benefits. The Proponent must include reasons for selection of the Project as the preferred alternative, and the reasons for rejection of other alternatives."

The key features of the Mary River Project are the transportation and logistics aspects. Iron ore mined from Deposit No. 1, located in the central region of North Baffin Island, must be transported to a coastal port on North Baffin Island, loaded on to ore carriers, and, shipped to customers.

The North Baffin region has no existing transportation infrastructure. In order to get the iron ore product to the customers, Baffinland must build:

- a port facility,
- a transportation link from the mine site to the port site,
- · a specialized fleet of ore carriers, and
- the infrastructure and accommodation facilities for its workforce at both the Mine Site and the Port.

To determine the transportation link and associated infrastructure, the evaluation of "alternative means of carrying out the Project components" must be addressed in five distinct stages:

- 1. Alternative ways to meet customer requirements
- 2. Alternative port locations
- 3. Alternatives for moving ore from the mine to the port
- 4. Alternative transportation routes
- 5. Other alternative ways to operate the Project

6.1 EVALUATION CRITERIA FOR PROJECT ALTERNATIVES

Viable alternatives for the development of the Mary River Project must meet the following criteria:

6.1.1 Technical Feasibility

Technical feasibility relates to the appropriateness of an alternative from an engineering or operational perspective and incorporates aspects of known performance and reliability for the Project. Technical feasibility covers physical and operational considerations. In turn, physical constraints or consideration can only be understood in the context of operational constraints.

Given both the cold climate and relative remoteness of the Project, an important consideration in evaluating technical feasibility is proven northern performance.



6.1.2 <u>Environmental Acceptability</u>

Potential residual effects on the environment consider the expected severity of residual effects on the environment of one alternative relative to the other. The "environment" in this context refers to the natural and the socio-economic environments, focusing on valued ecosystem components (VECs) and valued socio-economic components (VSECs) identified in the impact assessment (Volume 2).

6.1.3 Social Acceptability

Community acceptability or preferences are considered in the decision making process. For this Project, this input was derived from community consultations as presented in Volume 2. This criterion is by nature subjective, in terms of the community perspectives that have been expressed and the interpretation and weighing of those perspectives. In some instances communities have varying views on a specific alternative. Baffinland attempted to address concerns by undertaking supplemental studies and developing further processes to facilitate community engagement.

With respect to enhancing socio-economic effects, it is recognized that some alternatives may provide tangible and intangible benefits to local communities and the region.

6.1.4 Economic Viability

Economic viability relates the ability of the Project to achieve sufficient future cash flows to pay back the capital invested, pay the ongoing operating expenses, and cover the closure and reclamation costs while generating the necessary return on investment for shareholders to attract the upfront capital investment needed. These financial projections generate the expected "Net Present Value" (NPV) of the investment which is used by shareholders and the investment community to allocate capital investment. A project that cannot attract the necessary capital will not be developed. This is a basic go/no go decision point for the Project.

For Baffinland, the major factors impacting NPV projections are:

- Expected future prices of iron ore (forecast based on current market conditions, number of competitors and expected growth for steel demand). In turn, this is influenced by Baffinland's ability to meet its customers requirements for quality or product and timeliness of delivery
- 2. Capital cost of the Mary River Project is very high and this capital must be repaid.
- 3. The cost of the capital relating to financing charges for the money invested until capital is repaid.
- 4. Ongoing operating costs for the Project which includes cost of supplies, consumables, manpower availability and training, ongoing monitoring, transportation and marketing charges for the iron ore, taxes and ongoing benefits paid to the land owners.
- Required rate of return for to attract shareholders to allocate the necessary capital to carry out the Project rather than another investment opportunity.

Evaluation of Economic Viability is complex and depends on many external factors on which the Proponent has no control or influence (market forces for iron ore and competitive nature of the industry). These factors add financial risk that investors will consider. In addition, the Mary River Project introduces another dimension to the financial risks in terms of its location in the high Arctic. As a result, an alternative that does not meet Baffinland's criteria in terms of acceptable "business risk" and the related "return on investment" (as measured by NPV projections) will not meet the conditions of Economic Viability and there would be no Project possible using that alternative.



All of the above four factors Technical Feasibility; Economic Viability; Environmental Acceptability and Social/community acceptance are critical. An alternative that fails to meet the criteria in any one of the factors can no longer be considered and any analysis of the remaining factors for this alternative is meaningless.

Only for viable project options would one require an assessment of all four factors in making choices and trade-offs in identifying the preferred options.

6.2 <u>ASSESSMENT OF ECONOMIC VIABILITY FOR ALTERNATIVES TO MEET CUSTOMER</u> REQUIREMENTS

When assessing alternatives it is important to understand the constraints and to build the criteria an alternative would need to meet. For the Project to succeed it must be able to meet the demands of its customers and sell a sufficient quantity of iron ore.

6.2.1 <u>Market Conditions</u>

6.2.1.1 Iron Ore

Iron ore is an abundant commodity. Grades of known iron deposits range from a low of 15 % Fe to a high of approximately 68 %. A high-grade iron ore with specific physical properties can be used as direct feed (lump) by steel makers. Otherwise the ore is crushed to less than 10 mm to be used to make an agglomeration of iron ore fines that are fused but not melted to form a coarser mass that can be charged to the blast furnace. Low grade (below 60 % Fe) iron ore requires additional processing (concentrating and/or pelletization) for upgrading prior to its use by steel makers for the production of sinter or pellets. Therefore, higher grade and quality iron ores command a premium.

The iron ore commodity market is a high volume, low margin operation. There are many producers in the world and as a result, the industry is extremely competitive. The ability to produce the ore and to provide a consistent and reliable ore supply are required in order to secure long-term supply contracts and successfully compete on world markets.

6.2.1.2 The Steel Industry

The primary customer for iron ore is the steel industry. The steel industry is rapidly expanding in Asia in order to satisfy the ever increasing demand for steel which is driven by the strong growth of many Asian countries. Meanwhile, demand for steel in Europe is stabilizing and growth follows economic activity. Over the past decade, the rapid growth of the Asian economies has progressively diverted the higher grades of iron ore from traditional steel makers in Europe, who now need to secure a long-term supply of high quality iron ore.

Steel-making is also a capital intensive, highly energy intensive and, competitive industry. Production costs are largely driven by the quality of raw material inputs (iron ore, coking coal, fluxes) and the associated energy consumption. Most steel mills are located in proximity of large industrial or urban centres where available space (real estate) required to maintain large stockpiles of raw materials is limited and costly. Furthermore, the competitive nature of the iron ore supply markets eliminates this requirement and enables the steel producers to operate on a "just in time" delivery of their raw material. As a result, steel mill operators operate with minimal stockpile inventories. In addition, once a steel mill is configured for a specific type (metelurlogical characteristics) of input materials, like iron ore, it cannot readily re-tool for other sources again underlying their need for a consistent supply.



6.2.1.3 Market Competition

In some regions of the world where other iron ore projects are being developed or expanded (Brazil, South Africa and Australia) climatic conditions make it possible to operate without interruption year-round. Infrastructure is a key component to the development of iron ore deposits. For most of these developments, there is existing transportation infrastructure (ports, roads, railway, and necessary utilities). As well, in some regions of the world, a pool of qualified and non-qualified workers is readily available in close proximity, thus eliminating the requirements for worker accommodations. The last greenfield iron ore development (with new port and rail facilities to be developed) started in 1982-1983 at Carajas in Northern Brazil.

Implications for Baffinland and the Mary River Project

The Project must be able to satisfy the "just in time" delivery requirements of the customers for iron ore and must ensure the consistent and reliable delivery of iron ore, year round. This will enable Baffinland to negotiate long term supply contracts and secure stable sources of revenues for its operations. These types of supply contracts are essential in order to minimize the financial risks associated with widely fluctuating spot prices for iron ore.

6.2.2 Alternatives Considered

There are two alternatives to meeting the customer needs as analysed above.

- 1. Year-round Shipping from an Arctic port site selected for the Project
- Seasonal shipping from an Arctic Port with a secondary port for stockpiling and then forward shipping
 in a consistent manner regular deliveries of ore to the customer. During the review of the Draft
 Environmental Impact Statement, some agencies requested that this seasonal shipping of iron ore be
 considered as an alternative to year round shipping.

Year Round Shipping

Year-round shipping is described in the Project Description. It needs to recognize that there is a relationship to the infrastructure costs and the minimum amount of ore needed to cover these costs. Mining less ore does not lead to reduced infrastructure costs. The Feasibility study determined that for the capital costs for the Project as described, the minimum ore requirement was 18 Mt/a. Lower production levels would still require most of the same fundamental infrastructure and any lower production levels would not be sufficient to cover the costs.

Year Round shipping is economically viable as per the Definitive Feasibility Study (2008)

Seasonal Shipping

In order to meet the customer needs for consistent delivery, seasonal shipping implies the need to:

- Store more ore at the Arctic port:
- Ship a year's supply of ore to an intermediate port in a shorter shipping season;
- Stockpile ore at an intermediate port; and
- Ship regularly to customers from the intermediate port.

There are higher costs for almost all aspects of both construction and operation of a seasonal shipping option and there are no identifiable cost-savings.



Thus seasonal shipping imposes the following requirements at the Arctic shipping port:

- · Larger ore stockpiles;
- Larger loading capacity at the dock (dock and ship loading systems);
- Larger port site infrastructure (power, maintenance facilities, camps, etc.) to deal with increased tonnage handled over a shorter period of time; and
- More ore carriers and/or a much increased shipping schedule to move the required tonnage of ore in a shorter period of time.

Seasonal shipping also implies that working inventories (stockpiles) would be required at the intermediate port (or ports) along the shipping route (between Steensby Port and the receiving port at the customer's location). The intermediate port would need to operate year-round. This would require the establishment at a port with the following infrastructure:

- Construction (or purchase) of dock and port facilities at an appropriate location;
- Construction/installation of conveying/stockpiling and reclaiming equipment;
- Construction and operation maintenance and workforce. Depending on the location of the intermediate port it may require (camps, maintenance, etc.) to support these port operations; and
- · Additional ore carriers.

Since the specific locations of the end use customers (steel mills) is not known and varies, it cannot be assumed that increasing receiving and stockpiling facilities at each of the customer's mill is a feasible option. Most known operations are located in urban areas and have limited stockpile capacity. As noted above steel mills have mostly arranged their operations for just-in-time delivery of input products.

Seasonal shipping implies that in addition to a larger Arctic shipping port facility, the Project would have to support the construction (or purchase) and operation of a second port facility (as described above) and double handling of iron ore shipped from Mary River. Operational logistics would also be much more complex.

All costs are higher and since the 18 mT/a was the minimum needed for economic viability for the base costs identified in the Project Description, 18mT/a is no longer sufficient to provide an acceptable NPV project and attract the needed capital.

The following table presents an overview of the additional costs attributed to seasonal shipping assuming the same production rate of 18 mT/a.

Conclusion:

On the basis of:

- 1. Reliability and security of revenue stream, and
- **2.** Additional costs associated with a seasonal shipping operation.

Seasonal shipping does not meet the criteria of "Economic Viability".

Year Round Shipping meets the criteria for Economic Viability. A potential port location determined to enable year round shipping achieves Technical Feasibility for the port. The assessment of VECs concluded that there were no significant residual effects and thus the alternative meets the criteria in Environmental Acceptance and Community preferences have been taken into account in designing the specific components of the shipping design.

In the assessment of the following alternatives, year-round shipping as the only viable alternative is assumed.



Table 3-6.1 Capital Costs Attributed to the Seasonal Shipping Alternative

Project Component	Additional Capital Cost	Basis	
Larger Arctic Port 1.7 billion		18 Mt to be produced and shipped during an 8 month period rather than 12 month period. To deliver 18 Mt reliably over 8 month requires larger infrastructure at Steensby Port. Steensby Port capacity would increase from a nominal capacity of 30 Mt (which is the required capacity to deliver 18 Mt/a) to a nominal capacity of 45 Mt/a (which is the capacity required to deliver the same tonnage over 8 months).	
Credit for Project Port	(1.0 billion)	Estimated cost of Steensby Port in 2008 Feasibility Estimate	
Additional Transhipment Port	Up to 1.7 billion	Port capacity of 30 Mt/a (assumes a year round open water greenfield site located in the North Atlantic).	
Additional capital cost increase for the Project	2.4 billion	Corresponds to a 58 % increase in Project capital cost excluding the cost of additional ore carriers	
Note: Port construction costs are pro	rated from the 2008 Feasibility E	stimate for Steensby Port	

No cost allowance for additional ore carriers

6.3 ORE CARRIER CAPACITY

The economic viability of the project is dependent on economies of scale. The 2008 Project feasibility estimate indicated that a production rate of 18 Mt/a would be required in order to obtain a satisfactory rate of return on a \$4.1 billion dollars investment in the Mary River Project.

In terms of vessel size for the transportation of the iron ore to markets, a number of ore carrier sizes were considered. The technical constraints for these ore carriers are as follows:

- 1. Ore carriers must have ice breaking capabilities in order to access the port year round; and
- 2. The size of the ore carrier is limited by the size of vessels that the receiving port can accommodate (i.e., Rotterdam or other European ports for the European steel market).

Based on discussion with shipping companies, the return voyage from the shipping port on North Baffin Island to the receiving port in Europe (such as Rotterdam) is expected to be 45 days per vessel. The table below summarizes the number of ore carriers required as a function of carrying capacity for the production of 18 Mt/a.

Table 3-6.2 Ore Carrier Capacity Configuration Alternatives

Vessel Capacity (DWT)	Number of round trips per year	Number of passages (in and out of port)	Frequency of port arrival/loading	Number of ships required
190,000	95	190	1.9 days	10
180,000	102	204	1.8 days	12
160,000	113	226	1.6 days	14
120,000	150	300	1.2 days	19
80,000	225	450	0.8 day	28



In order to minimize congestion at the loading port (shipping port), it is preferable to minimize the number of ore carriers required. As mentioned above, the size limitation is dictated by the capabilities of the receiving port. Few European ports can accommodate the larger cape size vessels. In order to retain maximum flexibility for delivery of iron ore at the receiving ports, Baffinland has opted for a dedicated fleet of 10 to 12 ice class cape size vessels with a nominal capacity of 160,000 to 190,000 dead weight tonne (DWT) cargo capacity. These vessels will have ice breaking capabilities and will operate year round to transport the annual ore production to market. The estimated capital cost of each ore carrier is in the range of \$200 million dollars.

6.4 PORT SITE LOCATION

Due to the geographical location of the Mary River deposit, the selection of a port location is the primary component for the technical feasibility of the Project. Importantly, ports require sufficient water depth for ship docking and transit to and from the port; the port requires sufficient area to allow for stockpiling, loading facilities and the ability to build rail transport to allow transportation of ore from the mine site to the port facility. Deepwater bulk material ports (approximately 20 m depth) are rare. In order to deliver a constant and reliable supply of iron ore to its customers, the port facility must be accessible year round. The selected port must accommodate cape size ore carriers (160,000 to 190,000 DWT; approximately 330 m long by 50 m wide with 20 m depth) with ice breaking capabilities. Several potential port locations on Eastern Baffin Island have been evaluated for suitability of the port site. These sites are shown on Figure 3-6.1.

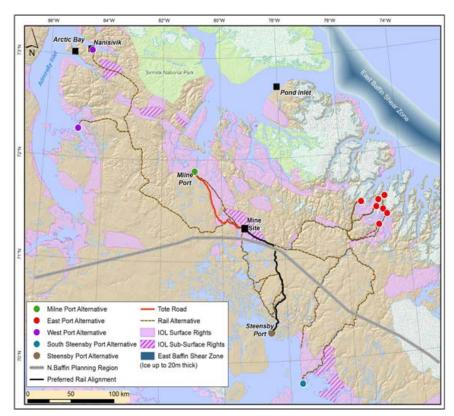


Figure 3-6.1 Potential Port Locations



6.4.1 East and North Coast of Baffin Island

Many of the locations considered for a port location were on the north and north eastern shore of Baffin Island all of which have been found to present navigation challenges due to the large size of the ore carriers. Significant ice formations on the north and north eastern seaboard of Baffin Island effectively form barriers to safe transit during up to two months of the year. As stated in the Enfotec Ice Report (Appendix 3G-1):

- The heavy ridging that can be expected at the entrance to and within Lancaster Sound has the potential to add significant delays to winter transits. This ridging, which has been known to be 20 m in depth, may at times be virtually impenetrable for periods of time while the ice remains under pressure. This may be narrowly viewed as a commercial consideration, however consequent long delays in vessel access to the port would almost certainly lead to congestion with several ships potentially affected. The Project would need to consider this possibility in determining winter shipping schedules.
- The port option to Steensby Inlet would require a vessel two ice classes lower (PC 4/5) compared to Milne Inlet (PC 2/3). This is owing to the much lower concentrations of old ice found along the route to Steensby Inlet than is the case for Milne Inlet. It should be noted that the MV Arctic attempted early winter voyages into the eastern Canadian Arctic in early December in both 1986 and 1989 and had to abandon the voyages because of the heavy old ice concentrations and pressure in Baffin Bay just north of the entrance to Pond Inlet (the Canadian Coast Guard vessel CCGS Louis St. Laurent was with the MV Arctic in 1986 and the CCGS Sir John A MacDonald in 1989 and they both were also unable to contend with the ice conditions). However, the same MV Arctic now trades all winter to Deception Bay on the south side of Hudson Strait independently without any icebreaker escort through essentially similar ice conditions as those that lead to Steensby Inlet. This is an operational example of the difference between the ice conditions to these two port options.
- Ice navigation along the Baffin Coast can present considerable challenges as the full weight of the Baffin pack can descend on the coast south of Pond Inlet. The resulting ridging and shear zones, the locations of which would be dynamic would make route selection to the port subject to constant changes.
- The potential effects of Climate Change were considered as well. The conclusion being that changes
 in ice conditions due to Climate Change will be relatively consistent in the areas in question. There is
 nothing to indicate that Climate Change will effectively alter the localized patterns of ice development,
 indicating to us that ice conditions will remain significantly more difficult along routes to North Baffin
 compared to Foxe Basin.
- The Steensby Inlet fast ice appears level with no shear ridge at the entrance and no inclusions of old ice. The shore fast ice of Eclipse Sound is subject to ridging during freeze-up and often contains old ice inclusions. For these reasons Steensby Inlet has much more favourable fast ice conditions for winter navigation than the ice leading to any site in North Baffin.
- Given the significantly more difficult ice conditions at the North Baffin Sites at present and in the future our recommendation is to pursue shipping through the Foxe Basin.



On the basis of:

- The difficult and potentially impenetrable ice conditions (during several months of the year) on the Eastern and Northern shores of Baffin Island, and
- From an operational standpoint, transiting through such difficult ice conditions, even with a capable ship, results in a higher risk profile.
- A Polar Class 1 or 2 would be able to penetrate the types of ice conditions expected on the east coast
 of Baffin Island. However, there would be likely times when pressured ice would prevent passage for
 long periods. In addition, technical issues around the design of a very large ore carrier with such a
 Polar Ice Class would be extremely challenging.
- The narrow fiords that would lead to navigation congestion within a smaller maneuvering area (due to not being able to effectively turn in heavy ice conditions) and to safety and environmental concerns.
- Finally, the heavier ice conditions and the increase powering requirement of the ships would result in a higher overall fuel consumption and an increased carbon footprint for the Project.

Baffinland does not consider any location on the North (Arctic Bay, Nanasivik, Milne Inlet,) or the Eastern Baffin Coast as viable alternatives for uninterrupted year round shipping.

The Northern and Eastern Baffin Island locations do not meet the criteria of "technical feasibility" with respect to:

- Uninterrupted year round access to the port,
- Navigability in the narrow fjord by the large ore carriers, and
- Environmental and safety concerns related to access to the port sites through the dense ice pack and ice ridging at certain times of the year.

Shipping on north or eastern Baffin Island is not a viable option for the Project and therefore is not considered further.

6.5 SHIPPING VIA FOXE BASIN

Ice conditions are such that year round shipping is possible via Hudson Strait and Foxe Basin. Thus a shipping route through Foxe Basin is technically feasible.

A suitable location for the port is one that can be linked to the mine site for overland transportation of the ore. Therefore, the port location must take into account the technical feasibility of the transportation method for the iron ore from the Mine Site to the selected port location.

6.5.1 Ore Transportation Alternatives from Mine Site to Port Location

Various overland transportation methods were considered to transport ore from the Mary River Mine Site to a potential Port location. The potential overland methods are listed below:

- Conveyor;
- Slurry pipeline;
- Road trucking; and
- Conventional railway.

All four methods require construction of linear infrastructure, including utility roads with various materials, slope and ground stability requirements.

February 2012





6.5.1.1 Conveyor

A conveyor system, while similar to a rail system, was studied and determined to be not technically feasible due to the extreme climate conditions. In this environment, conveyor maintenance over a distance of 100 or more kilometres would be extensive. A conveyor would require very large trestles to deal with the sharp grade changes along the Mary River-Steensby route. A conveyor system could also potentially be a barrier to caribou since the conveyor would be suspended at a level higher than a railway embankment.

6.5.1.2 Slurry Pipeline

Slurry pipelines are effective for moving materials of small particle size. The iron ore produced will be up to 60 mm, which makes slurry transfer not technically feasible.

6.5.1.3 Trucking

Truck transportation of large quantities of material is employed in Australia. Truck transportation is effective and economical over short distances or for seasonal types of operations. Fuel and maintenance requirements for trucking are much higher (\$15/t to \$22/t) than for railway transportation (roughly \$1.50/t).

Moving 18 Mt/a would require a very large fleet of trucks. To ship this quantity of ore, over 51,000 tonnes per day would need to be transported to the port site. Assuming use of conventional highway trucks carrying 50 tonnes per load, moving 51,000 t/day would require over 1,000 truckloads per day. Assuming four trips per day at three hours each way (a distance of 150 km), over 250 trucks would be required, involving over 2,000 passes a day. This translates to over 80 passes per hour, or over one pass per minute. This rate is very intense, exacerbating the already high potential for collisions with other trucks and wildlife. During the summer months, dust generation could be considerable.

Such a large fleet of trucks would have huge maintenance requirements. The cost of purchasing, transporting to site and maintaining such a large fleet would be prohibitive. In addition, the operation of a truck fleet is highly sensitive to fuel prices, which introduces an element of risk in the Project's economic viability.

6.5.1.4 Railway

Railways are the most efficient and economical form of land based transportation for large tonnages of materials over long distances. Rail transportation is the conventional means of transportation for large volumes of iron ore over long distances. For the Project, it is the only practical method for moving 18 Mt/a. Due to economies of scale rail transportation is the only practical and economically viable option.

6.5.2 Alternative Port Locations accessible via Foxe Basin

Based on a requirement to ship ore from a location that is accessible through Foxe Basin, two sites were examined. A location on the shore of Steensby Inlet and a location on the shore of Cape Jensen (Nuvuit) both presented potential port locations based on accessibility from Foxe Basin. The two main criteria that dictate the viability of the potential port site are:

- Bathymetry at the proposed port site the depth of the sea bed at the port site determines the feasibility of navigation by large vessels as well as the capital expenditure required to construct the port docks and considerations of the potential disturbance in building extensive dock structures; and
- Distance between the port site and the Mine Site the construction costs of a railway range from \$12 million to \$15 million per kilometer (primarily depending on tunneling requirements, the number of bridges to be constructed, terrain and ground conditions). In addition to construction cost, the railway



will operate in a difficult and challenging environment. A longer rail corridor implies additional equipment and operational concerns in terms of risks and safety of operation.

During the review of the Draft Environmental Impact Statement, some Inuit proposed the port location be moved from Steensby Inlet to Nuvuit. As a consequence of this concern the following actions were taken:

- In 2011 the company held a series of meetings in Igloolik;
- The Company requested Canarail to prepare a technical review assessing the proposed routes;
- The QIA initiated an independent review of the Canarail Report;
- In September the Company hosted a site visit to tour and compare the two alternatives; and
- The QIA requested their financial advisors evaluate the implications of various alternatives on the project's rate of return (see section 6.1.4).

A detailed feasibility study for the Cockburn Lake – Nuvuit coastal route (based on QIA preferred routing alignment) was prepared by Canarail in September 2011 (Canarail, Cockburn Lake – Nuvuit Coastal Rail Link Alignment Pre-Feasibility Design, September 2011). Key findings of the feasibility report are presented below. The report is located in Appendix 3E. A separate report prepared by consultants to QIA is also included in the appendix.

Table 3-6.3 Key Findings of Cockburn Lake – Nuvuit Coastal Rail Link Feasibility Report

Railway Component	Conclusion of Feasibility Report		
Additional length of railway	104 km		
Incremental capital cost for	Direct capital = up to \$864 million		
construction of railway	Total cost = 1,700 million		
	(including EPCM and contingencies)		
Additional cost of rolling stock	3 locomotives and 141 cars at an estimated cost of \$21.6 million (excluding		
(locomotive, rail cars)	freight & delivery charges)		
Additional fuel consumption	6.44 ML per year (estimated at \$4.5 million/year)		
Increase in Baffinland personnel	el Transportation Department = 44 employees		
	Rolling Stock personnel= 26 employees		
	Maintenance of Way personnel = 42 employees		
	Estimated associated salaries and expenses = \$9.5 million per year		
Requirement for second	Satellite facility at mid point along the railway line		
Maintenance of Way shop	Direct cost = \$15 million		
	Total constructed costs = \$30 million		
Reference:			
Canarail, Cockburn Lake – Nuvuit Coastal Rail Link Alignment Pre-Feasibility Design, September 2011, Appendix 3E.			

The longer rail route and larger fleet increases operating risks in that it increases the number of operating train sets, the operating distance and the number of regular mainline train meets. The Nuvuit route presents a larger terrestrial footprint than the Steensby route, with the associated environmental impacts, both during construction and operation, not least of which will be the impact of the additional mid-rail facility for Maintenance of Way.

In summary, adopting Nuvuit as the port site would have the following impacts on the Project:

- An extension of the railway by 325 km to Nuvuit which would increase building costs by almost \$2 billion:
- The construction schedule would be extended by two years which greatly reduces the attractiveness
 of the Project being developed;



Final Environmental Impact Statement February 2012

- The operating and maintenance costs would more than double (i.e., seven trains instead of three);
 and
- A larger dock structure would be needed at Nuvuit to reach deep water thus further increasing cost.

These above realities must be understood in the overall assessment of environmental and socioeconomic effects. The project capital and operating cost cannot support a rail route to Nuvuit. Economic factors of a rail link to Nuvuit make the alternative unviable.

Although a coastal railway route between the southern end of Cockburn Lake and the Nuvuit Peninsula can be identified, it is questionable whether this route is realistic within the constraints of providing an overall project that has sufficient economic robustness to justify the large investment required.

Therefore, on the basis of "technical feasibility", "environmental acceptability" and "economic viability", the location of the port at Steensby Inlet is the preferred alternative for the Mary River Project.

6.5.3 Alternative Railway Routing Between the Mine Site and Steensby Port

Once a port location is selected, the challenge is to find the optimal alignment for the railway corridor between the port and the Mine Site. The construction and operation of a railway in an Arctic environment presents serious technical challenges:

- 1. Maximum grades of 1 % (1.5 m over 1 km); and
- The longer railway route increases both safety and environmental risks for both construction and operation; the amount of support infrastructure for railways is proportional to the length of the railway.

Several railway alignments were evaluated on the basis of the technical and environmental acceptability. The alignment retained offers the optimal combination of technical, environmental and cost considerations. The two broad rail corridors were evaluated from the Mine Site to Steensby Inlet during feasibility studies:

- One to the west of Angajurjualuk Lake (the Western Route, the original alignment studied); and
- Another to the east (the Eastern Route, and current "base case") (Figure 3-6.2).

The ground conditions along the northern portion of the route west of Angajurjualuk Lake and south of the Ravn River crossing at the outlet of Angajurjualuk Lake were extremely poor. The alignment closely skirted three large areas of tundra polygons, which present continuously wet soil conditions in summer, and ran alongside large lakes that present a high risk of being associated with taliks (unfrozen zones of permafrost induced by the lakes). Poor soil conditions also exist on the Eastern Route around Angajurjualuk Lake, but the Eastern Route was evaluated as the better of the two. Further south, the Western Route was confined between the steep walls of a prominent escarpment and the north east coast of Tariujag Arm, with frozen saline soils as well as talus slopes (rockfall hazards). Additionally, the route along the cliff base of the Tariujag Arm was observed to be rich in archaeological resources, and the abundant water cover in the area means that snow geese and other migratory birds congregate in this area in the spring when other areas are snow-covered. This area also appeared to be a relatively confined corridor used by caribou traveling in a northwest-southeast direction. Further south the Western Route would need to cross the Cockburn River downstream of Cockburn Lake, at a location where a long viaduct would be needed. Bridge foundations would present challenges due to the presence of ice rich soils with undetermined depth to bedrock. These issues, combined with cost and technical concerns related to poor ground conditions at the north end of the route, were the basis for eliminating the Western Route from further consideration.



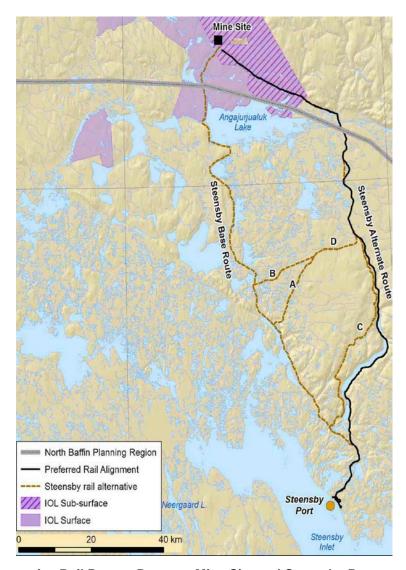
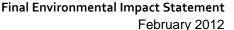


Figure 3-6.2 Alternative Rail Routes Between Mine Site and Steensby Port

The main Eastern Route (the preferred route), follows the eastern side of Angajurjualuk Lake and gradually climbs the plateau to the Cockburn River watershed. The alignment then descends down the western side of the upper Cockburn Lake to cross it at its narrowest point and continue south on the eastern side of the lake, with two tunnels. This route is superior in terms of overall length, geotechnical conditions, and avoidance of areas of environmental sensitivity. It avoids poorest ground conditions associated with the western route and maximizes the proportion of the railway on rock or over shallow soils with no topsoil. Three variations of the main route were also evaluated: two bearing west from a point north of Cockburn Lake and then southeast between the escarpment and Tariujaq Arm (Routes D-A and D-B), and a route bearing south down the valley immediately to the west of Cockburn Lake and crossing Cockburn River at the outflow of Cockburn Lake (C). Routes D-A and D-B, while avoiding the poorest ground conditions to the west of Angajurjualuk Lake, shared the western route section along the poor ground conditions (frozen saline soils and talus slopes) of the Tariujaq Arm. Section B stays high across the plateau and avoiding lakes descends to the western route. Although this option is the more direct compared with Section A, it joins the Western Route in a region with difficult soil and hydrological conditions exposing the alignment to







an area subject to possible solifluxion. Option A is the more southern of the two branches and traverses more difficult topography around hills and steep escarpments to join with the Western Route. This option would have more operational difficulties due to short-radii curves to negotiate the difficult topography compared with Option B, but has the advantage of avoiding permafrost problems and unstable soils where it joins to the western route. Ultimately, Routes D-A and D-B were eliminated on the basis of the poor geotechnical conditions common to the southern portion of the western route at Tariujaq Arm and the Cockburn River crossing.

Route C diverges west at the north end of Cockburn Lake. It generally passes north of the mountain ridges surrounding the northern half of Cockburn Lake and then moves to the hillsides on the western bank of the Lake. The alignment deviates west around small mountains at the south end of the lake and then crosses the Cockburn River at its narrow point and reaches a junction with the South Base Route. While route C avoided the tunnels associated with Cockburn Lake, construction costs were not reduced since some significant rock cuts were required. It is not a better operational choice due to the many short-radii curves needed in the alignment. In addition, the Cockburn River crossing of Option C has the same problems as the crossing needed for the western route. It is wider, with less stable soil conditions than the crossing taken by the base case, which crosses Cockburn Lake towards the northern end of the lake. Environmentally, neither route has the issues related to archaeology, birds and caribou that were identified for the Tariujaq Arm. The Cockburn Lake route was selected over route C on the basis of favourable construction conditions, cost, and operational advantages based on fewer short radii curves and better grades.

Combining the ratings for physical parameters with the environmental ratings, the preferred rail route is the route along the eastern side of Cockburn Lake followed by the route with segment "C" and then the route with segment "D-A". The technical and economic pros and cons for each alternative are summarized as follows:

Table 3-6.4 Comparison of Railway Routing Alternatives to Steensby Port

Route	Length (km)	Capital Cost	Advantage	Disadvantage
Eastern Route (preferred)	148.3	Base	Shortest (only slightly longer than Western Route) Lowest cost Least bridgework Least exposed to glacial ice and solifluxion; greatest amount of construction on rock/shallow soils	Most exposed to rockfalls Adjacent to Cockburn Lake (fisheries and raptor nests)
Western Route (original)	146.6	Base + 2.5 %	Shortest Cost competitive with preferred alignment	 Poorest ground conditions High archaeological potential Expected interactions with wildlife (birds, caribou)

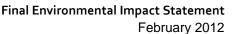




Table 3-6.4 Comparison of Railway Routing Alternatives to Steensby Port (Cont'd)

Route	Length (km)	Capital Cost	Advantage	Disadvantage
D-A	153.3	Base + 8.5 %	 Moderate length and slightly higher than main alternatives Avoids a portion (but not all) of poor ground along Western Route 	 Poorest ground conditions Includes difficult Cockburn River crossing High archaeological potential Expected interactions with wildlife (birds, caribou)
D-B	167.0	Base + 11 %	Moderate length and slightly higher than main alternatives Avoids a portion (but not all) of poor ground along Western Route	 Poorest ground conditions Includes difficult Cockburn River crossing High archaeological potential Expected interactions with wildlife (birds, caribou)
С	151.7	Base + 38 %	 Least exposed to taliks Fewest interactions with raptor nests Lower archaeological potential 	Highest costSignificant fill volumesShort radii turns (operational issues)

Based on this analysis, the selected rail transportation corridor to Steensby Port is the Eastern Route shown on Figure 3-6.2.

6.5.4 <u>Conclusions Related to Overland Transportation Corridor and Port Site</u>

For the Mary River Project to be commercially viable, marine shipment of ore to customers in Europe will be required 12 months of the year. Economic viability requires efficient transportation of iron ore by railway from the Mine Site to the Port location.

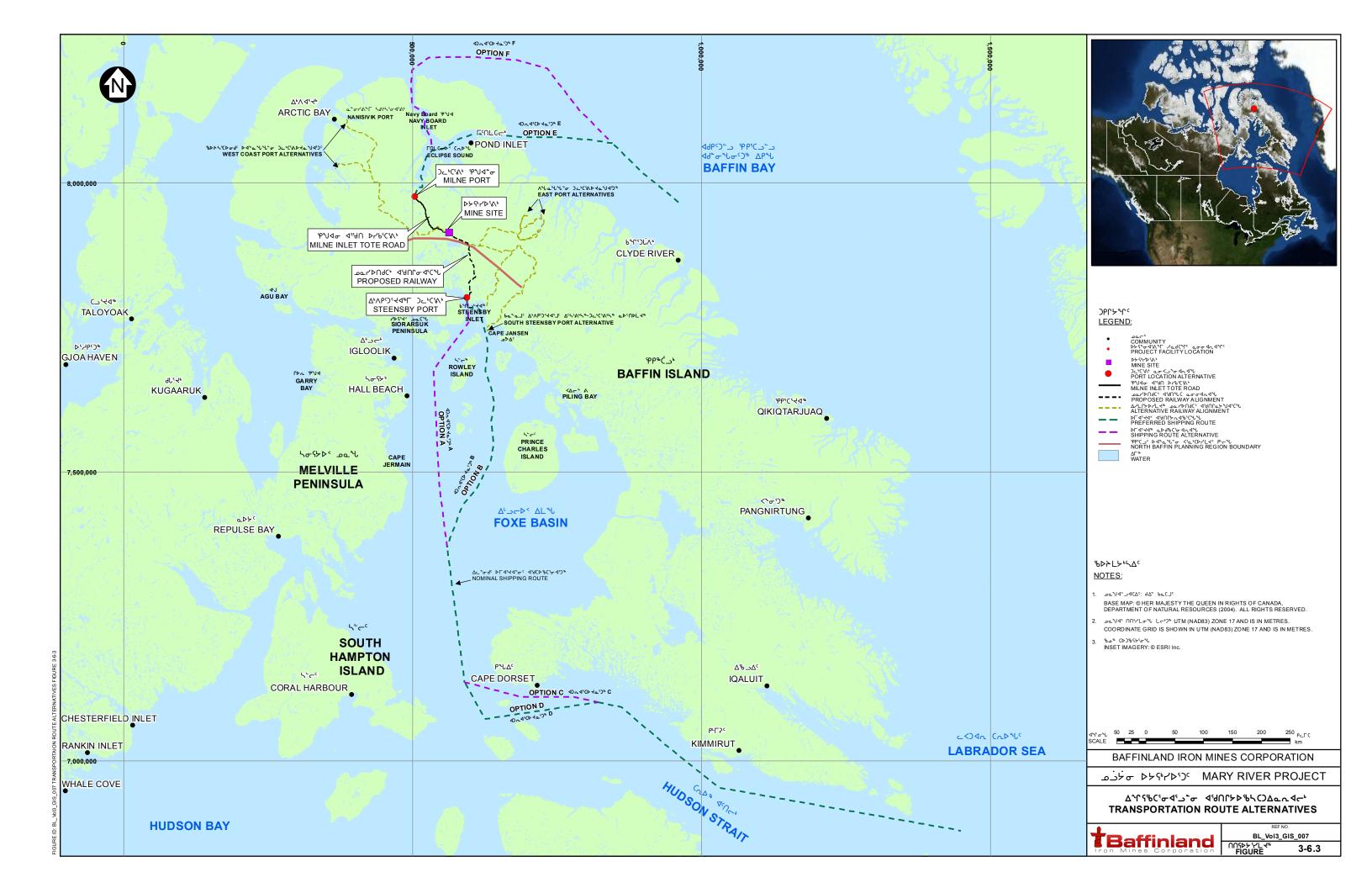
Based on these project fundamentals, a thorough assessment of port and land transportation alternatives indicate that a Port at Steensby Inlet is the only economically viable alternative for the location of the Project port facilities.

The key determinants for the selection of Steensby Port are:

- Favourable ice conditions in the Foxe basin that ensure reliable, year round shipping conditions;
- Favourable bathymetry at Steensby port; and
- Shortest distance from the Mine Site to the Port location which maximizes safety and minimizes environmental interactions, capital costs and operating costs associated with the railway operation.

In terms of the railway alignment, the Eastern Route to the east of Angajurjualuk Lake and along Cockburn Lake was selected as the preferred route based upon environmental, geotechnical, cost and constructability considerations.

The proposed railway transportation corridor is removed from communities and does not present major conflicts with land use. The railway corridor does not affect any key wildlife habitat. To the extent possible, the corridor is inland rather than on the scenic coast and avoids known archaeological sites.





6.5.5 Shipping Route Alternatives Through the Foxe Basin

Two shipping corridors (eastern and western) were assessed through northern Foxe Basin into Steensby Inlet, as shown on Figure 3-6.3. The ships will pass through southern Foxe Basin following established shipping lanes accessing Hall Beach and Igloolik. In northern Foxe Basin, the ships will pass to either the east or the west of the Spicer Islands, Rowley Island and Koch Island.

The more westerly route departs from the existing shipping lanes near to Igloolik and Hall Beach and runs west of Rowley and Koch Islands. The easterly route departs from the existing shipping lanes south of the Spicer Islands and runs east. Based on the results of 2007 surveys, both routes are viable for the Project, but the eastern route is operationally preferable. The communities of Igloolik and Hall Beach have indicated preference for the more easterly route during public meetings held by Baffinland in September 2007, on the basis that this route was more removed from their primary land-use areas.

The eastern route is the preferred alternative, as it is considered less intrusive to local land users. The communities of Igloolik and Hall Beach have indicated a clear preference for the eastern route. The Nunavut Wildlife Harvest Study shows harvest locations concentrated near the communities of Igloolik and Hall Beach but virtually none reported along the eastern route (refer to Presentation on Port Location made to QIA Executive Aug 31, 2011, attached in Appendix 3F). Marine Mammal workshops and individual interviews from Inuit knowledge study show that the western route has a higher level of use than the eastern route. The use is limited to Steensby Inlet which is fairly removed from the communities.

6.5.5.1 Shipping Route through Hudson Strait

Ships passing through Hudson Strait will remain within the Nunavut Settlement Area (NSA) and are not expected to pass through the Nunavik Marine Region of Northern Quebec or the area of shared Nunavut-Nunavik occupancy, under normal circumstances. Based on FedNav's experience shipping to the Raglan Mine at Deception Bay in Nunavik, the best ice conditions in Hudson Strait exist closer to the Baffin coast.

At public meetings in Cape Dorset, community representatives requested that Baffinland put as much distance as possible between its ships and the community, as safety allows. The Company has modified its proposed nominal shipping route at this request. While better ice conditions are found closer to the Baffin coast, ships will pass to the south of Mill Island (between Mill Island and Salisbury Island) to the extent possible (Option D on Figure 3-6.3). The Company has stated that ships will likely need to pass to the north of Mill Island (Option C on Figure 3-6.3) when ice conditions are very poor, to maintain safe and reliable passage.

6.6 PROJECT FEASIBILITY

In 2007, after years of exploration to define the ore reserve, Baffinland undertook a "Definitive Feasibility Study" (DFS) to establish the conditions and parameters for which the development of the Mary River Deposit No. 1 would be technically, environmentally, socially and economically viable (Baffinland, 2008a). The DFS was completed in early 2008. The aim of the DFS was to confirm the economies of scale required to achieve long-term economic viability taking into account the context and constraints identified in Section 6.1 and 6.2.



Subsequent to the completion of the DFS, further economic scenarios and sensitivity analyses have been undertaken. However, all studies confirmed that Steensby Inlet is the only viable location for the year round port facilities. The basis of the DFS is thus:

- An open pit mining operation at Deposit No.1;
- Transportation by rail to Steensby Port; and
- · Year round shipping from Steensby Port.

Based on current and long-term forecasts for iron prices and economic analyses, it is concluded that a minimum iron ore production rate of 18 Mt/a would be required to ensure long-term economic viability of this mining operation. On the basis of this DFS and subsequent sensitivity analyses, in addition to an open-pit mine and support facilities, the railway and the Steensby Port, the Mary River Project would include the following key components:

- On-site accommodation for workers at both the Mine Site and Steensby Port, complete with water supply, sewage treatment and waste management facilities;
- Large fuel depots at both Steensby Port and the Mine Site;
- A railway maintenance facility at Steensby Port;
- Associated landfills, landfarms and waste management facilities at the Mine Site and Steensby Port;
 and
- Air strips and improved air access.

The 2008 capital cost of the Project was estimated at C\$4.1 billion, which included:

- C\$1 billion for the Mine Site development;
- C\$1 billion for the Steensby Port;
- C\$1.9 billion for the Railway;
- C\$200 million for the workers accommodation facilities; and
- C\$150 million for the airstrips.

The capital estimate of icebreaking ore carriers was not included in this estimate.

This feasibility estimate is under review and will be updated by Q1 2012.

6.6.1 Project Go/No-Go Decision

The economic analyses enabled Baffinland to evaluate the environmental, social and financial risks associated with the development of the Mary River Project. On the basis of this information, Baffinland had three possible choices for the development of the Mary River Deposit No. 1:

- Proceed with mine development in the near term, as proposed herein;
- Delay the project until circumstances are more favourable; or
- Abandon the Project.

Recognizing that long-term economic viability is highly sensitive to current and expected long-term iron ore prices, Baffinland opted to proceed with the Project at this time (Baffinland, 2008a).

To assist in the cost of the design, construction and operation of the icebreaking ore carrier fleet. The cost of 10 icebreakers (160,000 to 190,000 DWT) is estimated at C\$200 million per vessel.

If the Project does not proceed, the mineral resource will not be developed, and the potential effects and benefits predicted in this EIS will not be realized. For example, the Project is expected to bring a multitude of benefits to local communities supporting both traditional pursuits (hunting is expensive and requires



financial resources) and the generational shift that is occurring within the Inuit community as youth become eager to participate in the wage-based lifestyle.

6.6.2 Decreased Production Rates

The facilities are designed for an optimum production rate that requires a minimum capacity for the associated Project infrastructure (railway, port, roads). Reducing the production rate will not result in a lower fixed capital investment for these facilities. Once the Project is operational, there is the need to repay the capital borrowed to finance the construction. This approach provides more flexibility for the Company to make decisions related to production volumes and potential plant shutdowns during market downturn. For this reason, as long as the iron market remains buoyant, Baffinland intends to operate its facilities at maximum capacity. A decrease in production rate would likely result in a decrease in shipping frequency.

6.6.3 Increased Production Rates

Mineral resources for Baffinland's mining leases are not completely delineated. Exploration activity during 2010 confirmed the presence of additional deposits (Section 1.5). Should there be a need to increase production, Baffinland would accelerate the development of another deposit(s).

Although the Project has been designed for a nominal capacity of 18 Mt/a of iron ore, no additional infrastructure would be required to increase production up to 30 Mt/a. An increase in production rate would likely result in an increase in shipping frequency depending on the duration and magnitude of increased production rates. Consideration for increased shipping frequency would require consultation to relevant aspects of the Project's Environmental, Health and Safety Management Plans.

6.7 ASSESSMENT OF ALTERNATIVES WITHIN THE PROJECT

The NIRB Guidelines directed Baffinland to carry out "an explicit analysis of all alternative means of carrying out the Project components". Once the port location and the railway corridor are established, alternative means of carrying out the Project components can be evaluated. A number of Trade-off studies (Appendix 3H) were carried out during 2011 in order to optimize the design of the various Project components. However, it must be pointed out that for mining methods and power supply, there are no alternative approaches to what Baffinland has presented in the Project Description (Section 3.2 and 3.3). The assessment of alternatives within the Project included the following:

- Production Rate;
- Trucking 3 Mt/a via Milne Inlet;
- Mining methods;
- Power supply;
- On-site Accommodations and Worker Related Issues;
- Air Strip Locations;
- Steensby Ore Dock Location and Configuration;
- Steensby Freight Dock Location and Configuration;
- Ice Management;
- Ore Crushing Optimization;
- Waste Rock Disposal; and
- · Closure Alternatives.

6.7.1 <u>Production Rate</u>

The preferred ore production rate is 18 Mt/a, which results in a 21-year mine life based on current ore reserves in Deposit No. 1. This alternative provides an acceptable return on investment and is environmentally and technically the most practical alternative.



On the basis of the capacity of the equipment and infrastructure required, a lower production rate will not provide an acceptable return on investment. A higher production rate may provide a higher rate of return based on increased economies of scale, but this would require additional ore bodies to be mined. While geological drilling on Deposits No. 2 and 3 to date is encouraging, insufficient drilling has been carried out to confirm the amount and grade of the ore bodies to a level sufficient for investment. Baffinland has expressed an interest in increasing the production rate in the future if ore resources justify this.

6.7.2 Trucking of 3 Mt/a via Milne Inlet

During Q3-Q4 2010, trucking of 3 Mt/a was considered as a means of generating an early cash flow from the Mary River Project that would enable the Company to proceed with the development of the larger scale 18 Mt/a Project.

In the original version the Draft Environmental Impact Statement (DEIS) dated December 2010 (issued in January 2011), the "Project" described was a 21 Mt/a iron ore mine. 18 Mt/a of iron ore was to be transported by railway to Steensby Port with year round shipping from Steensby Port to markets, along with a 3 Mt/a "road haulage" operation comprised of haulage of ore by truck from the Mine Site to Milne Port and shipping of ore to markets from Milne Port during open water only.

Although trucking of 18 or 21 Mt/a to Steensby Port is not a feasible alternative, trucking of a smaller tonnage (3 Mt/a) to Milne Port could be feasible during open-water season. A trucking option to Milne Port with use of the upgraded existing road corridor was evaluated in the last quarter of 2010 in a feasibility study undertaken by Baffinland, as an option to supplement the transport of ore to Steensby Port. The upgrade of the Milne Inlet Tote Road coupled with buoyant iron ore prices makes this option feasible at least in the short term.

However, Baffinland became majority-owned (70 %) by ArcelorMittal, the world's largest steelmaker and a major iron ore miner, on March 25, 2011. The remaining 30 % ownership is held by Iron Ore Holding LP. With a controlling interest in Baffinland, the Mary River Project now forms part of ArcelorMittal's strategic business planning. Therefore, a decision not to proceed with the road haulage option was announced by Baffinland in its April 15, 2011 letter to NIRB (Baffinland, 2011). The decision not to pursue the road haulage operation was made considering the results of the feasibility study, the implications to the Project's development schedule, and ArcelorMittal's corporate objectives and business planning.

6.7.3 Rail Transport to Milne Port

As discussed in Section 6.6.1, with the use of large tonnage ore carriers and difficult ice conditions on the East coast of Baffin Island, there is uncertainty related to the capability of Milne Port to support year-round shipping activity.

Due to the large capital investment required for the construction of a railway in the arctic (approximately \$15 million per km), a railway must operate on continuous basis to be economically viable. Such a large capital investment cannot be justified on the basis of seasonal shipping.

6.7.4 Mining Methods

The geometry of the ore body of Deposit No. 1 is suited for open-pit mining. Underground mining (or a combination of open-pit and underground mining) is not technically feasible since the deposit is at surface. The only proven method for extracting ore from a deposit with such a geological configuration is open-pit mining, the mining method selected for the Project.



Final Environmental Impact Statement February 2012

Overburden will be removed by blasting and will be placed in waste rock stockpiles. The open pit will then be excavated using a conventional bench configuration with access via ramps, using conventional open-pit mining equipment. Blast holes will be drilled, an explosives truck will deliver and dispense explosives into the holes, blast sequences will be established, the open pit cleared of personnel, and the blasts detonated.

The only practical method for excavating the ore released by blasting is mechanical shovels. Diesel-hydraulic face shovels will be used, backed up by front-end loaders to load mine haul trucks to transport ore to the primary crusher or run-of-mine (ROM) stockpile and waste rock to the waste rock stockpiles. Movement of vehicles within the pit will be monitored by a central dispatching system to ensure worker health and safety and operational efficiency.

Backhoe excavators will be used for general earthworks, snow removal, and limited mining activity where the larger equipment may have limited access. Wheel and track bulldozers will be used for cleanup around mining activities and for control of rock on benches. Graders and water trucks will be used for main haul road maintenance. All equipment operators will have heated, enclosed cabins, an integral part of the equipment.

6.7.5 Power Supply

The Project area has no power infrastructure (no power plants, transmission lines, pipelines). Energy must be brought in to the site and generated at the site.

Diesel-generated power supply will provide the required capacity to meet power demands of the Project at the lowest cost. This supply is also the most reliable in Arctic conditions.

Solar power has not been proven for commercial use in the Arctic. Wind, solar and hydro-electricity would all need transmission lines from energy generation locations to Project sites and would require diesel backup at sites in likely periods of inadequate wind or solar energy. Geothermal energy is not feasible due to depth of permafrost.

Hydro-electric with back up diesel could potentially be attractive once the Project is in operation. The technical feasibility of a hydro-electric generation facility remains to be assessed and is not considered part of this Project.

6.7.6 On-site Accommodations and Worker-Related Issues

Construction at large industrial projects requires rapid mobilization of a large temporary workforce. Large construction camps are required at the Mine Site, Steensby Port and along the Railway to support construction of the Project

6.7.6.1 Worker Accommodation at Steensby Port during Construction

At the onset of construction, a hardwall camp will be constructed at Steensby Inlet to house workers during the construction phase which will be subsequently downsized during the operations phase. Baffinland evaluated the potential to utilize temporary camps on barges as an alternate means to accommodate workers at Steensby Port during the initial construction phase of the Project. For the early construction work at Steensby Port, a floating camp was initially considered to enable rapid site capture. However, this approach was not adopted because the benefit of this alternative was not sufficient with respect to overall Project logistics and schedule.



6.7.6.2 Work Scheduling During Operation

For Baffin Island residents, the preferred worker rotation during operation is two weeks on, two weeks off. While this is not the most cost-effective schedule, it has been found by decades of experience at remote mines to be preferred for worker safety, separation from family members, having a consistent workforce that shares the same rotation, and ultimately for retention of the workforce.

6.7.6.3 Worker Sourcing (Direct Points of Hire)

The five North Baffin Communities of Arctic Bay, Clyde River, Hall Beach, Igloolik and Pond Inlet (listed in alphabetical order) will be direct points of hire, where Project aircraft will commute workers. The City of Iqaluit will also serve as a direct point of hire. This proposed arrangement, which still allows workers from other communities to participate in the Project without direct flights, is the preferred alternative because it offers the best "effect – benefit" matching opportunities to the Project and the communities. The five listed communities have traditional ties to the lands of the Project area. They are the closest to the Project and will be most affected by the activities of the Project. Selecting these communities as preferential points of hire optimizes benefits from the Project in view of Inuit land use constraints imposed on these communities.

6.7.7 <u>Airstrip Locations</u>

The existing airstrips at Milne Port and the Mine Site will be adequate to meet Project needs with minor upgrades without additional environmental concerns. There is no reason to relocate these airstrips.

The community of Pond Inlet has expressed a desire for a jet airstrip as a community benefit from the Project. However, an airstrip at or near Pond Inlet would not replace the need to have an airstrip at the Mine Site, since there is no land based transportation corridor between this community and the Project.

There is no existing airstrip at the Steensby Port. During construction an airstrip is critical for positioning and rotating the very large workforce required at that location, and during operation the airstrip will be needed for emergencies. An engineering study identified five alternative locations with relatively equivalent environmental footprint. The selected airstrip is closest to the port, with preferred ground conditions, the shortest required access road, and lowest construction cost.

6.7.8 Steensby Ore Dock and Freight Dock Location and Configuration

The ore dock and freight dock are fundamental for the efficient operation of Steensby Port. Dock configuration also has a significant impact on construction costs. Trade-off studies were carried out during the update of the feasibility study. These trade-off studies considered many technical and environmental factors. These studies are presented in Appendix 3H.

6.7.9 Ice Management at Steensby Port

Year round operation of the Steensby Port is expected to bring significant operating challenges. At the DEIS stage it was anticipated that the ice breaking ore carriers would not require assistance while navigating at Steensby Inlet and approaching the dock. Detailed ice management studies were undertaken in order to better understand the challenges with winter navigation at Steensby and to validate the DEIS assumption.

The ice management study concluded that at least two ice management vessels (with ice breaking capabilities) would be required at Steensby to assist navigation of the ore carriers in the port vicinity. As a result of the ice management studies, Baffinland has decided to equip the future Steensby Port with the necessary equipment required for reliable operation throughout the year. It is expected that up to four



tugs, two of which will have ice-breaking capabilities, will be in place at Steensby Inlet on a year round basis. These ice management tug boats will also be used for Emergency Response situations that may occur throughout Foxe Basin.

The report on ice management is attached in Appendix 3G.

6.7.10 Ore Crushing Optimization

A trade off study was undertaken to evaluate the crushing and screening options for the Project. This study outlines the advantages and disadvantages of four options. These include:

- Option 1: lump/fines screening at both Mary River and Steensby double deck screening at mine site;
- Option 2: lump/fines screening at both Mary River and Steensby single deck screening at mine site;
- Option 3: eliminating lump/fines screening at Mary River and only having lump / fines screening at Steensby; and
- Option 4: only having secondary crushing at Mary River, and considering tertiary crushing and lump/fines screening at Steensby.

Options 1 and 2, previously examined by Aker Kvaerner, involved either having lump and fines screened out at the Mary River and Steensby, or producing a bulk product at the Mary River and having lump and fines screened out at Steensby. Option 3, involving the transport of primary crushed ore directly to Steensby by rail and carrying out all screening and stockpiling at the port location, was reviewed by AMEC as part of the 2008 Project feasibility study. Both Aker Kvaerner and AMEC designs are based on the concepts of Option 1.

Option 2 and 3 have been ruled out of further design work in previous study by AMEC because during alternating thaw-freeze cycles, fines produced would agglomerate contaminating the lump product in Option 2, and risk to rail system and subsequent higher capital and operating costs in Option 3. Option 4, involving primary crushing and open circuit secondary crushing at Mary River, and transporting a bulk mixture of coarser lump and fines to Steensby for screening and tertiary crushing is discussed in more detail in the trade-off study (Appendix 3H - Crushing and Screening Relocation at Steensby Trade-off Study).

6.7.11 Waste Rock Disposal

The waste rock contains both potentially acid generating (PAG) material and potentially non-acid generating material (non-PAG). Preliminary characterization efforts indicate that the amount of PAG rock could be up to 20 % of the waste rock generated. A waste rock geological and geochemical characterization program is underway to gain better understanding of the waste rock ARD/ML and related characteristics. This program will be ongoing for the Life of the Project. Details of this waste rock characterization program are presented in the Waste Rock Management Plan (Attachment 5, Appendix 3B).

Three scenarios have been considered for the disposal of waste rock:

- Disposal of the waste rock in a single stockpile without any segregation of the PAG and non-PAG material;
- 2. Disposal of the waste rock in a single stockpile with segregation of the PAG and non-PAG material. The PAG material would be encapsulated within the non-PAG material; and
- 3. Separate stockpiles for both PAG and non-PAG material.



Final Environmental Impact Statement February 2012

There are major factors that influence the selection of an appropriate site for the disposal of waste rock including economic, safety, and, environmental considerations. From an economic perspective, the waste rock stockpile should be as close to the mine pit as possible in order to minimize trucking distance. From a safety perspective, the stockpile must be located sufficiently far from the mine pit to prevent any slope stability concerns both for the mine pit walls and the stockpile itself. Finally, from an environmental perspective, it is desirable to limit the footprint of the stockpile to defined watersheds so that runoff can easily be contained and monitored for quality over the Life of the Project.

The topography of the site is not easily amenable to the construction of two separate waste rock stockpiles. In addition, sampling and sorting of PAG and non-PAG rock is not a precise operation. Despite best management efforts, over the life of the mine, some PAG material will inevitably be mixed with non-PAG material. For this reason, it is preferable to have a single stockpile and focus on placement of the PAG material within the core of the stockpile. Scenario # 3 was thus rejected.

In terms of Scenarios #1 and 2, a suitable stockpile location was identified north of the mine pit (refer to drawing H337697-7000-10-014-1002 attached in Appendix 3D). This site will enable Baffinland to contain and collect all runoff from the waste rock pile and channel this runoff to sedimentation ponds where the quality can be monitored prior to discharge to the receiving environment. On the basis of waste rock characterization work performed to date, Baffinland believes it is prudent to adopt an approach where, to the extent possible, the PAG rock will be segregated from the non-PAG rock. Therefore, the waste rock stockpile design retained for the Project is based on scenario #2. This decision will be reconsidered and re-evaluated as more information becomes available on the characteristics of the waste rock.

6.7.12 Closure and Reclamation Alternatives

In accordance with regulations, Baffinland is planning for the closure of the facilities at the end of the mine life. Baffinland also intend to establish a working group with community representatives to guide its closure and reclamation efforts.

The Closure Plan (Attachment 10, Appendix 3B) calls for the decommissioning of facilities, removal off-site of materials and equipment that can be reused or recycled, and on-site disposal of remaining materials. Hazardous materials will also be removed for shipping and processing at licensed facilities. The public Milne Inlet Tote Road will be left in place but not maintained after the end of Project life.

At the end of Project life, Baffinland will consider transferring the facilities to a third party, should a third party express such an interest. Changes to regulatory requirements and consultation with communities or stakeholders throughout the Life of the Project could be reflected in subsequent updates to the Closure Plan if required.



SECTION 7.0 - REFERENCES

- 1. American Railway Engineering and Maintenance-of-Way Association (AREMA). 2010. *Manual for Railway Engineering*. Available at: http://www.arema.org/publications/mre/index.aspx.
- 2. Baffinland Iron Mines Corporation. 2008a. Press Release: *Baffinland Announces Exceedingly Robust Economics for the Mary River Direct-Shipping Iron Ore Project*. Dated February 19, 2008. Available at: http://www.baffinland.com/News/default.aspx.
- 3. Baffinland Iron Mines Corporation. 2008b. *Development Proposal for the Mary River Project*. Prepared by Knight Piésold Ltd., North Bay: March 2008.
- 4. Baffinland. 2009. Press Release: *Baffinland Reports Impressive Assay Results from the 2008 Drill Program at its Mary River Iron Ore Deposits*. Dated February 23, 2009. Available at: http://www.baffinland.com/News/default.aspx.
- 5. Baffinland. 2010. Press Release: *Baffinland Initiates Early Stage Production Feasibility Study for Road Haulage*. Dated July 12, 2010. Available at: http://www.baffinland.com/News/default.aspx.
- Canadian Hydrographic Service, Department of Fisheries and Oceans. 2006. Chart 7212 Bylot Island and Adjacent Channels. Ed. Notices to Mariners. Ottawa: Canadian Hydrographic Service, March 31, 2006.
- 7. Consulting and Audit Canada. 1993. *Background Paper to the Regulatory Impact Analysis Statement for the Proposed Amendments to the Arctic Shipping Pollution Prevention Regulations*. Prepared by Environmental Management Practice Consulting and Audit Canada and Melville Shipping Ltd. for Canadian Coast Guard. Northern Project No. 570-0551. February 1993. TP11537E.
- 8. Department of Fisheries and Oceans. 1995. Freshwater Intake End-of-Pipe Fish Screen Guideline. DFO / 5080. ISBN 0-662-23168-6.
- 9. Department of Fisheries and Oceans. 2006. *Tides, Currents and Water Levels*. 15 Oct. 2006. http://www.waterlevels.gc.ca/cgi-bin/tide-shc.cgi?queryType=showRegion&language=english®ion=2.
- 10. Dillon Consulting Ltd. 2008a. *Technical Memorandum: Crossing Decision Process for Rail Line Baffinland Iron Mines Corporation Mary River Project.* Draft memo dated October 15, 2008.
- Dillon Consulting Ltd. 2008b. Hydraulics Design Criteria for Culverts and Bridges Baffinland Iron Mines Corporation - Mary River Project. Prepared for Canarail, Baffinland (Rev. A). Ottawa: September 30, 2008.
- 12. Dillon Consulting Ltd. 2008c. *Hydrology Design Brief Baffinland Iron Mines Corporation Mary River Project*. Prepared for Canarail, Baffinland (Rev. A). Ottawa: September 30, 2008.
- 13. Enfotec Technical Services. 2010. *Ice and Marine Shipping Assessment Mary River Iron Ore Project North Baffin Island, Nunavut, Rev 1.* November 2010.





- 14. Environment Canada, 2002. *Metal Mining Technical Guidance Document for Aquatic Environmental Effects Monitoring under the Metal Mining Effluent Regulations*. SOR/2002-222.
- 15. Government of Nunavut. 2007. Nunavut Exploration and Mining Strategy.
- 16. Indian and Northern Affairs Canada. 1992. *Mine Reclamation in Northwest Territories and Yukon*, prepared by Steffen Robertson and Kirsten (B.C.) Inc. for Indian and Northern Affairs Canada, dated April 1992.
- 17. Indian and Northern Affairs Canada, 2002a. *Mine Site Reclamation Policy for Nunavut*, prepared by Indian and Northern Affairs Canada, dated 2002.
- 18. Indian and Northern Affairs Canada, 2002b. *Mine Site Reclamation Policy for the Northwest Territories*, prepared by Indian and Northern Affairs Canada.
- 19. Indian and Northern Affairs Canada. 2008. *Fact Sheet, Northern Strategy*. www.ainc-inac.gc.ca/ai/mr/is/n-strat-eng.asp>. Last updated November 3, 2008; accessed October 31, 2010.
- Knight Piésold Ltd., 2006. Baffinland Iron Mines Corporation Mary River Project Bulk Sampling Program – Environmental Screening Document. Knight Piésold Ref. No. NB102-00181/6-1, Rev. 0, dated November 20, 2006.
- 21. Knight Piésold Ltd., 2008a. *Baffinland Iron Mines Corporation Mary River Project Environmental Characterization of Deposit No. 1 Waste Rock, Ore and Construction Materials*. Knight Piésold Ref. No. NB102-00181/11-7, Rev. A, dated December 18, 2008.
- 22. Knight Piésold Ltd., 2008. *Baffinland Iron Mines Corporation Mary River Project Steensby Inlet Port Site 2008 On-Ice Site Investigation Summary Report.* Knight Piésold Ref. No. NB102-00181/12-1, Rev. 0, dated November 10, 2008.
- 23. Natural Resources Canada. 1994. The Whitehorse Mining Initiative Leadership Council Accord Final Report. October 1994.
- 24. Northwest Territories Water Board. 1990. *Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories*. September 1990.
- Nunavut Planning Commission. 2007. Nunavut Planning Commission Broad Planning Policies, Objectives and Goals. November 10, 2007. Available at: http://www.nunavut.ca/files/Approved %202007 %20Broad %20Planning %20Policies %20Objectives %20and %20Goals.pdf.
- 26. Prince William Sound Regional Citizens' Advisory Council. 2005. Ballast Water Treatment Methods Fact Sheet No. 1 Overview. Available at: http://www.pwsrcac.org/docs/d0016900.pdf.
- 27. Qikiqtani Inuit Association (QIA). 2009. Abandonment and Reclamation Policy for Inuit Owned Lands (Draft). May 2009.



Final Environmental Impact Statement February 2012

- 28. Transport Canada. 1997. *Arctic Waters Oil Transfer Guidelines*. TP#10783. Ottawa: Transport Canada, 1997.
- 29. Transport Canada. 1998. Arctic Shipping Pollution Prevention Regulations, Arctic Ice Regime Shipping System (AIRSS) Standards. Third Amendment. Ottawa: Transport Canada, May 1998.
- 30. Transport Canada. 2010. A Guide to the Canada's Ballast Water Control and Management Regulations. TC13617E. Ottawa: Transport Canada. Date last modified: January 18, 2010. Available at: http://www.tc.gc.ca/eng/marinesafety/tp-tp13617-menu-2138.htm.
- 31. Transport Canada. 2005. *Aerodrome Standards and Recommended Practices*. Transport Canada document TP312E, revised March, 2005. Available at: http://www.tc.gc.ca/eng/civilaviation/publications/tp312-menu-4765.htm
- 32. Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian fisheries waters. *Can. Tech. Rep. Fish. Aquat. Sci.* 2107: iv + 34p.



SECTION 8.0 - DEFINITIONS AND ABBREVIATIONS

8.1 GLOSSARY

Active Layer of ice, soil and rock which is subject to seasonal freezing

and thawing above the true permafrost. In the region of Baffin Island in which the Project is located, the active layer is typically

from 1 to 3 m thick.

Aggregate Crushed rock from quarries as well as sand and gravel from

borrow sources.

Aggregate Sites Quarries and borrow sources.

Archaeology The scientific study of prehistoric people and their cultures.

Arctic Packs Special control systems (electronics) used in locomotives that

account for the climate.

Ballast Water taken on in chambers of vessels mainly to stabilize sea-

going vessels, 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. For icebreakers, ballasting is also used to keep the ice draft of the vessels constant, and to stabilize the ship, thereby optimizing

stresses in different loading conditions.

Baseline Environmental settings in the Project area as they exist

naturally or pre-development, against which changes in the

environment from a project can be assessed.

Bathymetry Measurement of the elevations of the sea bed, with respect to

the top of the water.

Best Practice Methods A technique, method, process, or activity which conventional

wisdom regards as most effective at delivering a particular

outcome.

Bladder Tank Farm Fabric fuel tanks situated in lined containment that are highly

portable and can be constructed and filled very quickly.

Bollard A fixture on a wharf used to fasten a line from a ship.

Borrow Source Source of sand and gravel.





Bulk Sample

A large ore sample extracted as a test for the purpose of demonstrating the quality of an ore and/or the economic viability of mining the ore.

Bungalows

A railway term to describe small sheds containing power switching and signalling systems

Canada's Northern Strategy

Strategy to strengthen Canada's sovereignty, protect the country's environmental heritage, promote economic and social development and improve Northern governance.

Canadian Sovereignty

Canada having supreme, independent authority over a geographic area, such as Nunavut.

Civil Works

Includes foundation preparations; earthworks and soil exchange; general site preparation and construction of temporary facilities; pre-stripping and removal of overburden in preparation for ore extraction; surveying; construction of roads, airstrips, the railway, bridges, tunnels, ports and buildings; drainage management including construction of ditches and ponds; and ore extraction at a rate of up to 3 Mt/a in the open pit

Closure Plan

The plan incorporates progressive rehabilitation during the course of the Project to limit the work required after cessation of operations and to limit the environmental effects during the Project life. It addresses temporary and long-term closure as well as final cessation of operations. The main objective is to return the Project affected and viable sites (mine site, Milne Port and Steensby Port) to "wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and human activities"

Combustible Wastes

Waste which can be incinerated.

Communication and Networking System

Consists of interconnected communication subsystems which will be interfaced and integrated to provide a very reliable, secure and comprehensive telecommunication network capable of providing for all voice and data communication requirements.

Concrete Caissons

A type of foundation for docks that are hallow and constructed of concrete. Once placed, the hallow caissons are backfilled with local rock or iron ore to make a highly stable dock base.





Conformance Ensuring that all applicable Nunavut and Canadian laws,

regulatory requirements, agreements, permits and licences are

followed

Construction Phase Defined by the length of the construction phase of the railway.

Consultation Information exchange.

Contact Water Water that comes into contact with the waste rock.

Cut and Fill Operations The process during earthworks construction of cutting or

excavating high ground to fill lower ground, to make a level

surface. Used to construct roads and laydown areas.

Dark Territory Where there are no fixed signals along a section of the Railway.

Dedicated Tank CarsRail cars used to transport diesel and Jet A fuels.

Definitive Feasibility StudySee feasibility study. Definitive refers to the estimated level of

accuracy of cost estimates - generally accepted to be +/- 15 %.

Demobilize Equipment Remove equipment from a work area (for this Project from

Baffin Island) and return back to the equipment owner's home.

Development Proposal Proposal to initiate the regulatory review of a project based on

currently defined iron ore reserves.

Distribution (of an Effect)The boundaries or ranges within which effects are found.

Dust Suppressants Suppressants sprayed on the road to limit dust raised by vehicle

traffic.

Ecosystemic Relating to the complex of a natural community of living

organisms and its environment functioning as an ecological unit

in nature.

Electrical and Instrumentation

Works

Includes construction and installation of electric power distribution systems; installation of lighting systems; installation

of sockets and motive power; and installation of electricity

grounding systems.

Environmental Assessment

Process

A planning process to predict the environmental effects of a

proposed development before it Is carried out.



Environmental Effect A positive or negative change in the biophysical and/or

socioeconomic environment caused by or directly related to a

proposed activity.

Environmental Impact Statement A statement of an evaluation of the predicted environmental and

socio-economic effects of a proposed undertaking or project.

Exploration The act of searching a terrain for the purpose of discovering

resources.

Feasibility study A technical analysis of the basic geology, operations,

environmental considerations and economics of constructing

and operating a mine.

Final Closure Occurs when the ore deposit is exhausted and requirements of

the Mine Closure and Reclamation Plan have been completed.

Fine Ore A smaller sized ore product, pea sized.

Fish Entrainment To pull or draw fish into water intake structures.

Flat Cars Rail cars used to transport containers and large sized

equipment and machinery.

Floating Hose Method A method which involves connecting a hose or hoses from

manifolds on the fuel tanker to connections on shore (manifold). It is presently employed for fuel shipments to communities on

Baffin Island.

Footwall Zones Rock masses consisting primarily of a Gneissic rock mass that

locally grades to Schist.

Freshet A rapid temporary rise in stream discharge and level caused by

heavy rains or rapid melting of snow and ice.

Fuel Farm A bulk fuel storage facility, consisting of multiple steel tanks

within a lined containment area.

Fuel Tanker Cars Rail cars used to transport fuel.

Hanging Wall Zones Rock masses consisting primarily of Tuffs, Amphibolites and

Schists.

Hazardous Materials Explosives or chemicals





Hydrocarbon Contaminated Materials

Soil, water, ice, and snow contaminated by accidental oil spills.

Ice Multiplier

Every ice type (including open water) has a numerical value that is dependent on the ice category of the vessel. The value of the Ice Multiplier reflects the level of risk or operational constraint that the particular ice type poses to each category of vessel.

Ice Regimes

Regions of generally consistent ice conditions based on a simple arithmetic calculation that produces an "Ice Numeral" that combines the ice regime with the vessel's ability to navigate in the region.

Ice Rich Soils

Soil with a high ice content.

Ice-Free Season

The summer to early fall period when sea ice is at its minimum.

Incineration

The main disposal method for combustible non-hazardous wastes generated on-site using an appropriately designed variable flow dual chamber incinerator, and ashes from the incineration process will be placed in closed drums and buried within a designated area of the landfill. It diverts putrescible waste from the landfill and thus prevents problems associated with odours which attract wildlife.

Inuit-Owned Land

Land identified in the Nunavut Land Claims Agreement (NLCA) as being held by a designated Inuit Organisation. May include ownership of surface rights only or both surface and subsurface (i.e., mineral) rights.

In-Water Blasting

Specialized blasting under water.

Key Project components

Includes Milne Port, Milne Inlet Tote Road, Mine Site, Railway and Steensby Port facilities.

Landfarming

Facility for the remediation of hydrocarbon contaminated soil, water, ice, and snow. The landfarms will be bermed and lined and consist of multiple cells to handle waste generated from several events separately. Soil remediation will occur through volatilization and natural biological processes and once hydrocarbon levels meet the applicable Nunavut remediation standards, the soil will be transferred to the landfill.

Landfast Ice

Sea ice that is anchored to the shore or ocean bottom.





Landfill Used to dispose of only inert solid waste and ashes from the

incinerator. Contents will remain permanently frozen and

isolated.

Laydown Area The place where equipment, supplies, and material are put

before building begins.

Leads are narrow, linear cracks in the ice that form when ice

floes diverge or shear as they move parallel to each other.

Long-Term Closure the state of inactivity resulting from economic considerations or

a reduction in ore reserves for a period greater than one year.

Lump Ore An iron ore product in which pieces are all about golf ball sized.

Magnitude (of an Effect)

The amount or degree of change in a measurable parameter or

variable relative to existing conditions (the exposed population).

Mainline Sidings Sections of track that allow trains to pull off the "mainline".

Mean Annual Discharge The mean annual flow of a river.

Mechanical Works Includes equipment installation; piping installation including

prefabrication; ore crushing and screening; construction of steel structures and pipe racks; and installation of mechanical

systems in buildings.

Mineral Exploration The systematic practice of searching for mineral resources

(i.e. gold, iron ore, etc.).

Mineral Leases A long-term form of permission to explore (i.e., drill) and mine

mineral resources (subsurface rights).

Minority Strategic Partner

An investment partner who owns a minority interest in a project

and does not have a controlling interest.

Management actions or strategies applied to minimize or

eliminate negative environmental effects. They are also used to reduce or eliminate the potential residual effects of the Project and are identified in each of the effects assessments, along with

potential residual effects of the Project.

Monitoring Systems that will be put into place to document the adequacy of

each mitigating action in reducing impacts to insignificant levels.





Negotiation Face-to-face discussions with the intent of reaching agreement.

Non-Contact ("Clean") WaterWater that does not comes into contact with the waste rock.

Nunavummiut The indigenous inhabitants of Nunavut.

Nunavut Community Skills

Inventory System

A program designed to capture the skill sets of individuals, including but not limited to their academic achievements, and to match them with the skill sets needed for a particular job, thus

allowing them more access to jobs in industry.

Old Ice Concentration A measure of the amount of sea ice that has firmed in the

previous winter (i.e., not "new" ice).

Open Water Shipping SeasonThe summer to early fall period when sea ice is at its minimum.

There are established dates for open water shipping for

different areas of the Arctic and different ice-class ships.

Operation Phase Open pit mining of iron ore in Deposit No. 1 and the related

processing and transportation of the iron ore.

Pack Ice Sea ice that is not landfast; it is mobile by virtue of not being

attached to the shoreline or something else.

Packaged Explosives Explosives that are packaged to be ready to use after

detonators are applied.

Passenger Cars Rail cars used to transport employees between Steensby Port

and the Mine Site.

Permafrost Ground (rock and/or soil) remaining at or below 0°C

continuously for at least 2 years.

both the construction and operation phases of the Project.

Person Years of Employment The number of years that it would take one person to do task; it

is used as a measure of how much labour is required to perform

a task.

Pit Dewatering Removal of water from an open pit that might result from

groundwater inflows or precipitation.

Point-of-Hire LocationsCommunities where the company currently operates and plans

to operate direct flights to and from the Project sites.



Polishing and Waste Stabilization

Pond

Place for sludge disposal and discharge of treated effluent.

Post-Closure Monitoring Program Program to ensure the reclamation measures remain effective

and continue to provide a high level of protection for the public

and the environment.

Potential Development Areas A boundary established to encompass a Project component,

where future development is expected to occur.

Potential Effects Refers to potential changes in the VC that result from

interactions between Project activities and the environment.

(start-up).

Public Easement The right of the general public to use certain streets, highways,

paths or airspace.

Quarries Source of crushed rock

Rate of Return The amount returned per unit of time, expressed as a

percentage of the cost.

Return Period An annual maximum even has a return period (or recurrence

interval) of T years if its magnitude is equalled or exceeded once, on the average, every T years. The reciprocal of T is the exceedance probability of the event, which is the probability that

the event is equalled or exceeded in any one year.

Rock Fall Detectors Safety systems to identify rock falls along the Railway.

Rotary Dumper 3 cars are turned upside down simultaneously to empty the ore

into unloading bins, without any requirement to uncouple the

cars from the rest of the train.

Royalties Usage-based payments made by one party and another for

ongoing use of an asset.

Satellite Communications

(Satcom) System

System which links up with the communications infrastructure at the Mine Site via communication towers to be located along the

Milne Inlet Tote Road.

Sea Ice Ice formed by freezing of seawater.



Semi-Diurnal Tides Two tidal cycles a day (i.e., two high waters and two low waters

each day).

Shareholders One who owns shares of stock in a corporation.

Sinter The agglomeration of iron ore fines that are fused but not

melted to form a coarser mass that can be charged to the blast

furnace.

Site Capture Phase Establishing the basic infrastructure such as camps, airstrips,

docks, fuel storage facilities and laydown areas to allow the construction workforce to expand and focus on construction of

permanent Project infrastructure.

Snow Fencing
Fencing used to limit the formation of snow drifts and snow

banks on the road.

Socio-Economics Includes demographics, workforce experience, health, social

services, youth, education, economic development, opinions,

perceptions, and the spiritual aspects of archaeology.

Splitter Used to bypass the fines product around the screening circuit,

allowing it to go directly to the stockpiling area.

StakeholdersThe Inuit communities proximate to the Project sites the public,

local and regional Inuit organizations, the Government of Nunavut, and federal agencies with a mandate relevant to the

Project.

Staking of Claim Blocks The legal marking and granting of permission by the

government of multiple "claims" - the rights to explore the

mineral potential of sections of land.

Subsistence Economy An economy based on production for consumption rather than

exchange.

Surface Leases Permission to use and place infrastructure and equipment on

surface lands (does not include the right to explore or develop

minerals in the sub-surface).

Tank Cars or Containers Rail cars used to transport bulk material.

Tank Farm See fuel farm definition.



Tax Revenue Government revenue due to taxation.

Temporary Closure the planned shutdown of a mine site for a period of less than

one year.

Temporary Infrastructure Infrastructure constructed or positioned at Project sites needed

only for the construction phase will be removed once

construction is complete.

Thaw Sensitive Ground They are typically "ice rich" or at least contain a small amount of

ice. Depending on the grain size and subsequently the permeability of a soil, even soils that are just borderline ice rich can be thaw sensitive if they are fine grained in nature (i.e.,

have a low enough permeability).

Thermistors Instruments to report ground temperatures at various depths

within the hole.

Track Circuits Safety systems to detect broken rails along the Railway.

Valued Ecosystem Component

(VECs)

Environmental attributes or components perceived to be locally important based on local ecological, social, cultural, and/or

economic reasons.

Valued Socio-Economic

Components (VSECs)

Environmental attributes or components perceived to be locally important based on local social, cultural, and/or economic

reasons.

Waste Heat Recovery System System which circulates recovered waste heat from the

generators to the accommodation/maintenance/administration

complex and other buildings.

Waste Management Handling

Facilities

A central depot where waste generated across the site will be managed, properly processed, packaged, labelled, inventoried,

secured (e.g., on pallets) and stored for sealift or reuse on site.

Waste Oil Burners Consumes waste oil in the maintenance shops.

Wayside Detectors Safety systems to monitor passing trains for defects, such as

hot bearings/wheels and dragging equipment along the

Railway.

Wayside Power Used for locomotives which cannot be stored indoors; the

railways equivalent of plugging in a block heater.





Wheel Impact Detectors

Safety systems to identify defective wheels along the Railway.

Zone of Influence

Zone which encompasses lower level helicopter traffic between the camp and drilling sites, where achieving the minimum flight altitude is not possible, and also including the approach and take off of fixed-wing aircraft at the airstrip.

8.2 <u>ABBREVIATIONS</u>

AANIDO
AANDC Aboriginal Affairs and Northern Development Canada
ABA
ADRAcid Rock Drainage
AEEMAquatic Environmental Effects Monitoring
AIRSSArctic Ice Regimes Shipping System
ANFOAmmonium Nitrate Fuel Oil
AREMAAmerican Railway Engineering and Maintenance-of-Way Association
ASPPR Arctic Shipping Pollution Prevention Regulation
Baffinland Baffinland Iron Mines Corporation
BIMLBaffinland Iron Mines Ltd.
Brunex British Ungava Explorations Limited
CAMBSComputer Assisted Manual Block System
CCG Canadian Coast Guard
CHSCanadian Hydrographic Service
CLEYDepartment of Culture, Language, Elders and Youth
CSP Corrugated Steel Pipe
DWTDeadweight Tonnage
EBA EBA Engineering Consultants Ltd.
EPCMEngineering Procurement Construction Management
hahectare
IACSInternational Association of Classification Societies
IIBA Inuit Impact and Benefits Agreement
IRSCSlce Regime Shipping Control System
KPKilometre Post
KPaKilopascals
L Litres
LTLLess Than Load
m ³ /day Cubic Meters per Day
MLMetal Leaching
ML Mega Litres
MMER Metal Mining Effluent Regulations
MOUMemorandum of Understanding
MoW Maintenance of Way
MRIKS
MtMillion Tonne
Mt/aMillion Tonne-per-annum
MWMega Watts
Wilder Watte





MWh	Mega Watt Hours
NCSIS	Nunavut Community Skills Inventory System
NLCA	Nunavut Land Claims Agreement
NRCan	Natural Resources Canada
NSA	Nunavut Settlement Area
NTI	Nunavut Tunngavik Incorporated
NWTWB	Northwest Territories Water Board
OHF	Oil Handling Facility
OPEP	Oil Pollution Emergency Plan
	Potentially Acid Generating
PDA	Potential Development Area
	Polishing And Waste Stabilization Pond
QIA	Qikiqtani Inuit Association
	Rotating Biological Contactor
	ROGESA Roheisengesellschaft Saar mbH
	Run of Mine
ROW	Right-of-Way
	Stormwater Management
SS	
	Technical Guidance Document
TSS	Total Suspended Solids
	Baffinland Iron Mines Corporation
the Project	Mary River Project
WWTF	Wastewater Treatment Facilities