Environmental Design Basis

2012-01-16	E	Approved for Use – Environmental Permit	D. Ersenkal	J. Binns	H. Charalambu	
2011-11-01	D	Approved for Use – Environmental Permit	D. Ersenkal	J. Binns	H. Charalambu	
2011-10-06	C	Approved for Use – Environmental Permit	D. Ersenkal	J. Binns	H. Charalambu	
2011-07-25	B	Client Review	D. Ersenkal	J. Binns	H. Charalambu	
DATE	REV.	STATUS	PREPARED BY	CHECKED BY	APPROVED BY	APPROVED BY
			HATCH			CLIENT

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1. General

1.1 Objectives/Purpose

The purpose of this document is to record the environmental design basis for the engineering design and contribution of the Mary River Project being developed by Baffinland Iron Mines (BIM). These environmental standards must be met by the Project and should be fully addressed when developing the relevant engineering design criteria. These environmental design criteria are based on commitments made in the Draft Environmental Impact Statement (EIS) 01/20/2011) and the associated baseline studies.

1.2 Project Description

The Mary River Project (the Project) consists of mining high grade iron ore from Deposit No. 1 at a production rate of 18 Mt/a. The development of the Project includes the construction, operation, closure and post-closure activities associated with the mine and its associated infrastructures, the construction of a 149 km long railway to link the Mine Site at Mary River to a new port facility located at Steensby Inlet, the upgrade of the existing 100 km Milne Tote road, and construction of the Steensby port. Approximately 18Mt of ore will be shipped year-round from Steensby Port using ice breaking ore carriers. The main destination of the ore is Europe.

The iron ore deposit, Deposit No. 1, is located on North Baffin Island, in the Qikiqtani Region of Nunavut. The Deposit No. 1 reserves consist of approximately 365 Mt of direct shipping iron ore at an average iron grade 64.66%. The basis of the Mary River Project (the Project) is production and shipment of 18 million tonne-per-annum (Mt/a) of high grade iron ore from this deposit. The high grade ore is suitable for shipment to international markets after crushing and screening with no need for additional processing.

1.3 Exclusions

Project Operations and Shipping outside of Steensby Port.

2. Abbreviations, Acronyms and Units of Measurement

2.1 Abbreviations and Acronyms

The following abbreviations and acronyms are used in this document:

BIM or Baffinland	Baffinland Iron Mines Corporation
DIO	Designated Inuit Organization
EC	Environment Canada
DFO	Fisheries and Oceans Canada
GN	Government of Nunavut
GN-CLEY	Government of Nunavut Department of Culture, Language, Elders, and Youth
HADD	Harmful Alteration Disruption or Destruction
AANDC	Aboriginal Affairs and Northern Development Canada
NRCan	Natural Resources Canada
NIRB	Nunavut Impact Review Board

NTI	Nunavut Tunngavik Incorporated
NWB	Nunavut Water Board
OPEP	Oil Pollution Emergency Plan
QIA	Qikiqtani Inuit Association
TC	Transport Canada
TC – NWPP	Transport Canada Navigable Waters Protection Program

2.2 Units of Measurement

The Project will be designed using the "Système International" (SI) units of measure (m, kg, etc.).

3. Reference Documents

Environmental Impact Statement – Draft, December 2010 (Published January 20 2011)

4. Regulatory Context

The Project will be carried out in conformance with all applicable Nunavut and Canadian laws, regulatory requirements, agreements, permits and licences. BIM will comply with and where it is economically and technically feasible, exceed Nunavut and federal regulatory requirements by applying technically proven and economically feasible environmental protection measures for each part of the Project.

BIM will carry out the Project in an environmentally and socially responsible manner. The needs and values of other resource users will be respected throughout development and operation of the Project. The Project will be designed to meet all relevant regulatory requirements and to avoid, limit, and, minimize negative effects where possible and to enhance socio-economic benefits.

The standards and norms discussed in this document are taken from the Canadian and Nunavut laws and regulations.

Applicable environmental regulations and guidelines from the governing regulatory agencies are presented in Table 4-1 and the applicable territorial acts, regulations and guidelines, are presented in Table 4-2.

Table 4-1: Applicable Federal Acts, Regulations, and Guidelines

Act	Regulation	Responsible Agency	Guideline
Aeronautics Act, [R.S. 1985, c. A-2]	Canadian Aviation Regulations, [SOR/96-433]	Transport Canada (TC)-Civil Aviation	-
Arctic Waters Pollution Prevention Act [R.S.C. 1985, c. A-12]	Arctic Waters Pollution Prevention Regulations [C.R.C., c.345]	Transport Canada (TC)-Marine Safety	Guidelines for the Operation of Tankers and Barges in Canadian Arctic Waters (Interim)
	Arctic Shipping Pollution Prevention Regulations	Transport Canada (TC)-Marine Safety	Arctic Ice Regime Shipping System Standards; Arctic Waters Oil Transfer Guidelines
Canada Shipping Act 2001 [2001, c.26]	Ballast Water Control and Management Regulations SOR/2006-129	Transport Canada (TC)-Marine Safety	A Guide to Canada's Ballast Water Control and Management Regulations
	Anchorage Regulations SOR/88-101	Transport Canada (TC)-Marine Safety	-
	Oil Pollution Prevention Regulation	Transport Canada (TC)-Marine Safety	-
	Response Organization and Oil Handling Facilities Regulation	Transport Canada (TC)-Marine Safety	-
Canada Transportation Act [1996, c. 10]	Handling of Carloads of Explosives on Railway Trackage Regulations SOR/79-15	Transport Canada (TC)	-
	Railway Employee Qualification Standards Regulations SOR/87-150	Transport Canada (TC)	-

Act	Regulation	Responsible Agency	Guideline
	Railway Prevention of Electric Sparks Regulations SOR/82-1015	Transport Canada (TC)	-
	Railway Third Party Liability Insurance Coverage Regulations SOR/96-337	Transport Canada (TC)	-
	Railway Traffic Liability Regulations	Transport Canada (TC)	-
	Railway Service Equipment Cars Regulations SOR/86-922	Transport Canada (TC)	-
Canada Marine Act 1998, c. 10	Natural and Man-made Harbour Navigation and Use Regulations SOR/2005-73	Transport Canada (TC)	-
	Port Authorities Management Regulations	Transport Canada (TC)	-
	Port Authorities Operations Regulations SOR/2000-55	Transport Canada (TC)	-
	Seaway Property Regulations SOR/2003-105	Transport Canada (TC)	-
Canada Water Act, [R.S.C. 1985, c. C-11]		Environment Canada (EC)	-
Canada Wildlife Act (R.S., 1985, c. W-9)	Wildlife Area Regulations (C.R.C., c. 1609)	Environment Canada (EC)	-
Canadian Environmental Protection Act 1999, [1999, c.33]	Environmental Emergency Regulations [SOR/2003-307]	Environment Canada (EC)	CCME Canada Wide Standards for Dioxins and Furans CCME Canada Wide Standards for Mercury Emissions Health Canada Federal Contaminated Sites Guidance on Human Health Risk Assessment in Canada
	Federal Registration of Storage Tank Systems for Petroleum Products and Allied Petroleum Products on Federal Lands or	Environment Canada (EC)	-

Act	Regulation	Responsible Agency	Guideline
	Aboriginal Lands Regulations (SOR/97-10)		
	Fuels Information Regulations, No. 1 (SOR/C.R.C., c. 407)	Environment Canada (EC)	-
	Interprovincial Movement of Hazardous Waste Regulations (SOR/2002-301)	Environment Canada (EC)	-
	Sulphur in Diesel Fuel Regulations (SOR/2002-254)	Environment Canada (EC)	-
	Sulphur in Gasoline Regulations (SOR/99-236)	Environment Canada (EC)	-
	Proposed - Interprovincial Movement of Hazardous Waste and Hazardous Recyclable Material Regulations	Environment Canada (EC)	-
	Proposed - Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations	Environment Canada (EC)	-
	Proposed - Regulations Amending the Environmental Emergency Regulations	Environment Canada (EC)	www.ec.gc.ca/CEPARegistry/guidelines
Explosives Act [R.S.C. 1985, c. E-17]	Ammonia Nitrate and Fuel Order, [C.R.C., c. 598]	Natural Resources Canada (NRCan)	
	Explosives Regulations [C.R.C., c. 599]	Natural Resources Canada (NRCan)	
Fisheries Act [R.S.C. c. F-14]	Metal Mining Effluent Regulations, [SOR/2002-2222]	Fisheries and Oceans Canada (DFO)	DFO Policy for the Management of Fish Habitat; Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters; DFO - Freshwater Intake End-of-Pipe Fish Screen Guideline; DFO-Habitat Conservation and Protection Guidelines, 1998; Various DFO Operational Statements

Act	Regulation	Responsible Agency	Guideline
Marine Transportation Security Act (R.S. 1994, c.40)	Marine Transportation Security Regulations (SOR/2004-144)	Transport Canada (TC)-Marine Safety	-
Migratory Birds Convention Act 1994 [1994, c.22]	Migratory Bird Sanctuary Regulations, [C.R.C., c.1036]	Environment Canada (EC)	-
	Migratory Birds Regulations, [C.R.C., c.1035]	Environment Canada (EC)	-
Navigable Waters Protection Act [R.S. 1985, c. N-22]	Navigable Waters Bridges Regulations (C.R.C., c. 1231)	Transport Canada Navigable Waters Protection Program (TC – NWPP)	-
	Navigable Waters Works Regulations (C.R.C., c. 1232)	Transport Canada Navigable Waters Protection Program (TC – NWPP)	-
Nunavut Act [1993, c. 28]	Nunavut Archaeological and Paleontological Sites Regulations, [SOR/2001-220]	Government of Nunavut Department of Culture, Language, Elders, and Youth (GN-CLEY)	-
Nunavut Land Claims Agreement		Nunavut Tunngavik Incorporated (NTI)	A Guide to Mineral Exploration and Development on Inuit Owned Lands in Nunavut
NLCA Article 12-Development Impact		Nunavut Impact Review Board (NIRB)	-
NLCA Article 13-Water Management		Nunavut Water Board (NWB)	-
NLCA Article 26-Inuit Impact Benefit Agreement		Designated Inuit Organization (DIO)	-
NLCA Article 6-Wildlife Compensation			-

Act	Regulation	Responsible Agency	Guideline
NLCA Article 20-Inuit Water Rights		Nunavut Water Board (NWB)/(DIO)	-
NLCA Article 21-Entry and Access Part 4			-
Nunavut Waters and Nunavut Surface Rights Tribunal Act [2002, c.10]	Application of Regulations made under paragraph 33(1)(m) or (n) of the Northwest Territories Waters Act in Nunavut Order	Indian and Northern Affairs Canada (AANDC)	-
Species At Risk Act [2002, c.29]		Environment Canada (EC)	Species at Risk Act: A Guide
Territorial Lands Act [R.S. 1985, c. T-7]	Canada Mining Regulations, [C.R.C., c. 1516]	Indian and Northern Affairs Canada (AANDC)	AANDC Mine Site Reclamation Policy for Nunavut
	Territorial Land Use Regulations, [C.R.C., c. 1524]	Indian and Northern Affairs Canada (AANDC)	-
	Territorial Quarrying Operations, [C.R.C., c. 1527]	Indian and Northern Affairs Canada (AANDC)	-
	Northwest Territories Mining District and Nunavut Mining District Order	Indian and Northern Affairs Canada (AANDC)	-
Transportation of Dangerous Goods Act [1992, c.34]	Transportation of Dangerous Goods Regulations	Transport Canada (TC)	-

Table 4-2: Applicable Territorial Acts, Regulations, and Guidelines

Act	Regulation	Guideline
Apprenticeship, Trade and Occupations Certification Act [R.S.N.W.T. 1988, c. A-4]	Apprenticeship, Trade and Occupations Certification Regulations, R.R.N.W.T. 1990 c. A-8	-
	Occupation Designation Order, N.W.T. Reg. 026-96	-
	Trade Advisory Committees Order, R.R.N.W.T. 1990 c. A-9	-
	Trade Designation Order, R.R.N.W.T. 1990 c. A-10	-
Boilers and Pressure Vessels Act, [R.S.N.W.T. 1988, c. B-2]	Boilers and Pressure Vessels Regulations, N.W.T. Reg. 006-93	-
Child and Family Services Act [R.S.N.W.T. 1997, c. 13]	Child and Family Services Regulations, N.W.T. Reg. 142-98	-
Commissioner's Land Act (Nunavut), [R.S.N.W.T. 1988, c C-11]	Commissioner's Airport Lands Regulations, N.W.T. Reg. 067-97	-
	Commissioner's Land Regulations, R.R.N.W.T. 1990 c. C-13	-
Electrical Protection Act [R.S.N.W.T. 1988, c. E-3]	Electrical Protection Regulations, R.R.N.W.T. 1990 c. E-21	-
Environmental Protection Act (Nunavut), [R.S.N.W.T. 1988, c. E-7]	Spill Contingency Planning and Reporting Regulations, N.W.T. Reg. 068-93	Spill Contingency planning and reporting in Nunavut: A Guide to the new regulations
	Asphalt Paving Industry Emission Regulations, R.R.N.W.T. 1990 c. E-23	Government of Nunavut (GN) Environmental Guidelines for: Site Remediation; Management of Waste Lead and Lead Paint; Air Quality Sulphur Dioxide and Suspended Particulates; Dust Suppression; General Management of Hazardous Waste; Industrial Waste Discharges; Waste Antifreeze; Waste Asbestos; Waste Batteries; Waste Paints; Waste Solvents

Act	Regulation	Guideline
Emergency Medical Aid Act, [R.S.N.W.T. 1988, c. E-4]		-
Explosives Use Act, R.S.W.N.T. 1988, c.E-10	Explosives Regulations, R.R.N.W.T. 1990 c. E-27	-
Fire Prevention Act, R.S.N.W.T. 1988, c. F-6	Fire Prevention Regulations, R.R.N.W.T. 1990 c. F-12	-
	Propane Cylinder Storage Regulations, N.W.T. Reg. 094-91	-
Gas Protection Act, [R.S.N.W.T. 1988, c. G-2]	Gas Protection Regulations, R.R.N.W.T. 1990 c. G-1	-
Hospital Insurance and Health and Social Services Administration Act, [R.S.N.W.T. 1988, c. T-3]	Baffin Regional Health and Social Services Board Order, N.W.T. Reg. 059-98	-
	Hospital Standards Regulations, R.R.N.W.T. 1990 c. T-6	-
	Territorial Hospital Insurance Services Regulations, R.R.N.W.T. 1990 c. T-12	-
Liquor Act, R.S.N.W.T. 1988, c. L-9	***Various general and community specific regulations and orders***	-
Mine Health and Safety Act, [S.N.W.T 1994, c.25]	Mine Health and Safety Regulations, [R-125-95]	-
	Mine Health and Safety Regulations, amendment, Nu. Reg. 016-2003	-
Public Health Act, R.S.N.W.T. 1988, c. P-12	Camp Sanitation Regulations, R.R.N.W.T. 1990 c. P-12	-
	General Sanitation Regulations, R.R.N.W.T. 1990 c. P-16	-
	Public Water Supply Regulations, R.R.N.W.T. 1990 c. P-23	-
	Public Sewerage Systems Regulations, R.R.N.W.T. 1990 c. P-22	-
Safety Act, R.S.N.W.T. 1988, c. S-1	Asbestos Safety Regulations, N.W.T. Reg. 016-92	-
	General Safety Regulations, R.R.N.W.T. 1990 c. S-1	-
	General Safety Regulations, amendment, Nu. Reg. 021-2000	-
	Safety Forms Regulations, N.W.T. Reg. 102-91	-

Act	Regulation	Guideline
	Silica Sandblasting Safety Regulations, N.W.T. Reg. 015-92	-
	Work Site Hazardous Materials Information System Regulations, R.R.N.W.T. 1990	-
Scientists Act [R.S.N.W.T. 1988, c. S-4]	Scientists Act Administration Regulations, N.W.T. Reg. 174-96	-
Transportation of Dangerous Goods Act [R.S.N.W.T. 1988, c. 81 (Supp.)]	Transportation of Dangerous Goods Regulations, 1991, N.W.T. Reg. 095-91	-
Wildlife Act, [R.S.N.W.T. 1988, c. W-4]	Wildlife General Regulations, N.W.T. Reg. 026-92	-
	Critical Wildlife Areas Regulations, R.R.N.W.T. 1990 c. W-3	-
	Polar Bear Defense Kill Regulations, N.W.T. Reg. 037-93	-
	Wildlife Management Barren-Ground Caribou Areas Regulations, N.W.T. Reg. 099-98	-
	Wildlife Management Grizzly Bear Areas Regulations, N.W.T. Reg. 155-96	-
	Wildlife Management Muskox Areas Regulations, R.R.N.W.T. 1990 c. W-11	-
	Wildlife Management Polar Bear Areas Regulations, R.R.N.W.T. 1990 c. W-13	-
	Wildlife Sanctuaries Regulations, R.R.N.W.T. 1990 c. W-20	-
	Wildlife Preserves Regulations, R.R.N.W.T. 1990 c. W-18	-
Workers' Compensation Act, R.S.N.W.T. 1988, c. W-6	Workers' Compensation General Regulations, R.R.N.W.T. 1990 c. W-21	-

Table 4-3: Current Authorization Governing Exploration Activities

Type of Authorization	Permit No.	Authorizing Agency	Period Valid
Water Licence (Type B)	2BB-MRY1114	NWB	April 5, 2011 to April 5, 2014
Letter of Advice (July 25, 2007)	File No. NU-06-0084	DFO	N/A
Authorization under S.35(2) of *Fisheries Act*	File No. NU-06-0084	DFO	No expiry
Approvals under S.5(1) of *Navigable Water Protection Act*	8200-09-10414	Transport Canada	June 22, 2009 to June 30, 2015
	8200-09-10415		
	8200-09-10424		
	8200-09-10425		
Inuit Land Use Lease and Aggregate Concession	Q07L3C001	QIA	November 1, 2010 to December 31, 2012
Land Use Permit (Crown Land)	N2007F0004	AANDC	July 4, 2010 to July 4, 2011
Land Use Permit (Crown Land)	N2006C0036	AANDC	April 3, 2010 to April 3, 2011
Quarry Permit	2007QP0098	AANDC	May 12, 2010 to May 12, 2011

Notes:
1. Water Licence Renewal Application submitted for 2BB-MRY0710. Application is currently being processed by the NWB.
2. N/A: Not application.

Tied to the water licensing process is the approval of a preliminary mine closure plan, and the posting of financial assurance in the form of a bond, letter of credit or other instrument to cover the costs to close the mine.

Table 4-4: Federal and Territorial Permits, Licences, and Approvals that may be required for the Project

Permit/Approval Legislation	Administering Agency	Project Activity
FEDERAL		
Project Certificate Nunavut Land Claims Agreement (Article 12)	Nunavut Impact Review Board	Required to obtain the requisite permits and approvals to proceed with Project
Inuit Impact and Benefits Agreement *Nunavut Land Claims Agreement (Article 26)*	Qikiqtani Inuit Association	Required to proceed with Project
Mineral Lease Canadian Mining Regulations	Indian and Northern Affairs Canada	Obtained for surface and subsurface rights to mineral deposit
Inuit Water Rights Compensation Agreement Nunavut Land Claims Agreement (Article 20)	Qikiqtani Inuit Association	TBC
Wildlife Compensation Agreement Nunavut Land Claims Agreement (Article 6)	Qikiqtani Inuit Association	TBC
Water Licence Type A Nunavut Land Claims Agreement (Article 13) *Nunavut Waters and Nunavut Surface Rights Tribunal Act* Northwest Territories Water Regulations	Nunavut Water Board	Required for water use and waste disposal
Archaeology Permit *Nunavut Act*	Government of Nunavut - Department of Culture Language and Youth	Required to conduct archaeology research, and to mitigate archaeological sites to allow development to occur
Inuit Owned Land - Commercial Land Use Lease Nunavut Land Claims Agreement	Qikiqtani Inuit Association	Long term land tenure required for land use on Inuit Owned Land; land required for infrastructure and activities associated with construction, operations, and closure phases

Permit/Approval Legislation	Administering Agency	Project Activity
Inuit Owned Land - Quarry Concession Permits Nunavut Land Claims Agreement	Qikiqtani Inuit Association	Required for quarrying of material during construction, operation and closure
Crown Land - Class A Land Use Permit(s) *Territorial Lands Act* Territorial Land Use Regulations	Indian and Northern Affairs Canada	Required for construction related infrastructure and activities on Crown Land
Crown Land - Land Lease and Waterlot Lease *Territorial Lands Act* Territorial Land Use Regulations	Indian and Northern Affairs Canada	Required for railway and port operation on Crown Land
Crown Land - Quarry Lease/Permit *Territorial Lands Act* Territorial Land Use Regulations Territorial Quarrying Regulations	Indian and Northern Affairs Canada	Required for quarrying of material during construction, operation and closure on Crown Land
Approval and/or Exemption	Transport Canada	Construction of works in navigable waters (e.g., port facilities, railway and road watercourse crossings)
Navigable Waters Protection Act		
Sections 5		
Fisheries Authorization for Harmful Alteration Disruption or Destruction (HADD) of Fish or Fish Habitat *Fisheries Act*, Section 35(2)	Department of Fisheries and Oceans	Required if HADD cannot be avoided (e.g., port facilities, railway crossings). If HADD can be avoided, DFO may provide a letter of advice outlining best management practices.
Licence for a Factory and Magazine *Explosives Act* and Regulations	Natural Resources Canada (NRCan)	Required for construction of explosives factories and magazine(s) and storage of explosives
Certificate of Fitness Section 98 Approval *Canadian Transportation Act*	Canadian Transport Agency	Railway Construction and Operation
TERRITORIAL		
Permit to Store Detonators *Explosives Use Act* *Mine Health and Safety Act* and Regulations	Mine Health and Safety, Workers Compensation Board	Required to store detonators in a magazine

Permit/Approval Legislation	Administering Agency	Project Activity
Explosive Use Permit *Explosives Use Act* *Mine Health and Safety Act and Regulations*	Mine Health and Safety, Workers Compensation Board	A permit is required to use explosives unless used in accordance with the regulations
Spill Contingency Plan Approval *Environmental Protection Act* *Spill Contingency Planning and Reporting Regulations*	Department of Environment	A Spill Contingency Plan must be filed with the Chief Environmental Protection Officer to store fuel in an aboveground facility with a 20,000 L capacity or greater

5. BIM Corporate Standards and Practices

In addition to conforming to regulatory requirements, the Project will be designed and operated in conformance with BIM's Sustainable Development Policy, Environmental, Health and Safety (EHS) Management System documents commitments and requirements toward achieving the goal of sustainability.

BIM's comprehensive Environmental, Health, and Safety Management System are an integral part of the Project. The philosophy that underlies this environmental management system is the application of the precautionary principle and BIM's commitment to reduce and mitigate potentially adverse effects of its operations on its employees, residents of Nunavut, and the natural environment.

BIM's Environment, Health, and Safety (EHS) Management System is the framework for management plans that that have been developed to address all aspects of the company's activities. These plans document the conclusions of the EIS and relevant commitments and requirements for each phase of the Project. Each management plan targets a specific Valued Ecosystem Component (VEC) or Valued Socio-economic Component (VSEC) and contains the detailed mitigation measures and monitoring to be implemented throughout the life of the Project in order to eliminate, limit or minimize adverse effects. All BIM employees and contractors are required to comply with these management plans. The reporting and documentation requirements for these management plans, auditing, and process of management review and revisions are specified in the EHS Management System.

BIM's Sustainable Development Policy is a key pillar of company operations. It provides the basis for the company's sustainable development goals and outlines commitments regarding environmental protection and stakeholder engagement. The following elements of the Sustainable Development Policy apply to BIM's engagement of its stakeholders:

- Contribute to the social, cultural and economic development of sustainable communities adjacent to our operations;
- Engage with governments, employees, local communities and the public to create a shared understanding of relevant social, economic, and environmental issues, and take their views into consideration in making decisions;

- Employ our shareholder's capital effectively and efficiently; and
- Demonstrate honesty and integrity by applying the highest standards of ethical conduct.
  - The Sustainable Development Policy is presented at: http://www.baffinland.com/Governance/SustainableDevelopmentPolicy/default.aspx
  - The Sustainable Development Policy in Inukitut is presented at: http://www.baffinland.com/Theme/Baffinland/files/Sustainable%20Development%20Policy%20-%20Inuktitut%20(February%202009)%20(5).pdf

The Company also embraces the principle of Social Responsibility as outlined by the emerging voluntary International Standard, ISO 26000:2010, and Guidance for social responsibility.

6. Project Environmental Standards

Project Environmental Standards are central to environmental protection practices and they provide direction and guidance on the design of facilities for the purpose of minimizing the impacts on the environment. This section is intended to be a practical guideline for ensuring that planning and design in all phases of project development is conducted in compliance with relevant Canadian legislation and to specify environmental standards for this Project with due regard to managing the impacts on the environment.

6.1 Air Emissions

The Project is in a remote location with no existing local sources of air pollutants other than exploration facilities at the Mine Site area. Contaminants present in the air are primarily due to long-range transport from the more southerly industrial and urban areas located in North America and Eurasia. Airborne emissions may occur during each stage of the mine cycle, although in particular during exploration, development, construction, and operational activities. Ore handling, as well as driving on access roads, and emissions from power plants, trucks, and camp incinerators will also reduce air quality, and generate noise. The principal sources include fugitive dust from blasting, exposed surfaces such as ore stockpiles, waste dumps, haul roads and infrastructure, and to a lesser extent, gases from combustion of fuels in stationary and mobile equipment.

Construction and operation of the Project will introduce new, local sources of air contaminants such as particulate matter (TSP, PM10, and PM2.5), nitrogen dioxide (NO2), sulphur dioxide (SO2), and carbon monoxide (CO) to the project area. A reduction in air quality due to these emissions may, in the extreme, result in potential effects to vegetation or wildlife species; an ecosystem's structure or processes; or human health. These potential effects can either result from exposure to ambient air concentrations or from accumulation in (i.e. deposition to) the environment. The Table 6-1 presents the applicable regulations for air emissions.

Table 6-1: Applicable Regulations for Air Emissions

Source	Regulation
Mobile Equipment/Mining Equipment	The *On-Road Vehicle and Engine Emission Regulations* introduce more stringent national emission standards for on-road vehicles and engines and a new regulatory framework under the *Canadian Environmental Protection Act*, 1999 (CEPA, 1999). These Regulations for controlling emissions from on-road vehicles and engines came into effect January 1, 2004.
Diesel Generators/Compressors	*Regulations Amending the Off-Road Compression-Ignition Engine Emission Regulations*- The objective of the proposed Regulations Amending the Off-Road Compression-Ignition Engine Emission Regulations (hereinafter referred to as "the proposed Amendments") is to further reduce emissions from off-road diesel engines in Canada by establishing more stringent Canadian off-road diesel emissions standards and test procedures. The proposed Amendments would align Canadian emission standards with those of the United States Environmental Protection Agency (U.S. EPA). The U.S. EPA introduced interim Tier 4 and Tier 4 emission standards in 2004 and began phasing in these standards for the 2008 to 2015 model years and beyond. The proposed Amendments apply to off-road diesel engines used in machines such as tractors, bulldozers and log loaders. The proposed Amendments would reduce emissions from off-road diesel engines by setting new standards for emissions of volatile organic compounds (VOCs), nitrogen oxide (NOx), particulate matter (PM), and other pollutants listed as "toxic substances" (see footnote 1) in Schedule 1 of the Canadian Environmental Protection Act, 1999 (CEPA 1999). In addition, the proposed Amendments would minimize the regulatory burden on manufacturers and importers by recognizing U.S. EPA certificates as evidence of compliance. Furthermore, the proposed Amendments would allow companies to use the transition engine provisions, and these provisions would also be available to companies that sell exclusively to Canada. US EPA has adopted a comprehensive national program to reduce emissions from future nonroad diesel engines by integrating engine and fuel controls as a system to gain the greatest emission reductions. *US EPA Clean Air Nonroad Diesel - Tier 4 Final Rule*
Incinerator	Camp incinerators are to be installed at each of the camps associated with the Mary River Project, namely Milne Port, Mine Site, and Steensby. Each of these incinerators uses dual-chamber, variable airflow design technology specifically designed for remote camp operations. Manufacturer's data indicate that under ideal conditions these incinerators are capable of meeting emission standards established by the Canadian Council of Ministers of the Environment

Source	Regulation
	(CCME) Canada-Wide Standards (CWS) for Mercury Emissions and CCME CWS for Dioxins and Furans without emission control equipment.

There are several air quality guidelines specific to Nunavut. In addition to these guidelines, National Air Quality Objectives defined under the Canadian Environmental Protection Act (CEPA, 1999) and other criteria will be considered to assess effects on air quality. The Table 6-2 identifies and compares the Federal objectives, the Northwest Territories (NWT) criteria, the Nunavut guidelines, the Canada Wide Standard (CWS), and the World Health Organization (WHO) guidelines. The criteria refer to different averaging periods to account for potential short-term acute exposures and long-term chronic exposures. On the basis of the precautionary principle, the most stringent criteria from the various Canadian jurisdictions are selected as the threshold for each contaminant indicator.

Table 6-2: Ambient Air Quality Criteria, Standards and Objectives

Contaminant	Averaging Time	Federal Air Quality Objectives			Canada Wide Standard	Nunavut	NWT	WHO	Indicator Threshold
		Desirable	Acceptable	Tolerable					
TSP ($\mu g/m^3$)	24 hr		120	400		120	120		120
	Annual	60	70			60	60		60
PM_{10} ($\mu g/m^3$)	24 hr						50*	50	50
$PM_{2.5}$ ($\mu g/m^3$)	24 hr				30**		30	25	30
SO_2 ($\mu g/m^3$)	1 hr	450	900			450	450		450
	24 hr	150	300	800		150	150	20	150
	Annual	30	60			30	30		30
NO_2 ($\mu g/m^3$)	1 hr		400	1,000				200	400
	24 hr		200	300					200
	Annual	60	100					40	60
CO ($\mu g/m^3$)	1 hr	15,000	35,000						15,000
	8 hr	6,000	15,000	20,000					6,000
O_3 ($\mu g/m^3$)	1 hr	100	160	300					
O_3 ($\mu g/m^3$)	8 hr				127***		127	100	
O_3 ($\mu g/m^3$)	24 hr	30	50						
O_3 ($\mu g/m^3$)	Annual		30						
Municipal waste incineration Dioxions/Furans					80				

Contaminant	Averaging Time	Federal Air Quality Objectives			Canada Wide Standard	Nunavut	NWT	WHO	Indicator Threshold
		Desirable	Acceptable	Tolerable					
(pg I-TEQ/m^3)									
Municipal waste incineration Mercury ($\mu g/Rm^3$)					20				
Medical waste incineration Dioxions/Furans (pg I-TEQ/m^3)					80				
Medical waste incineration Mercury ($\mu g/Rm^3$)					20				
Hazardous waste incineration Dioxions/Furans (pg I-TEQ/m^3)					80				
Hazardous waste incineration Mercury ($\mu g/Rm^3$)					50				
Sewage sludge incineration Dioxions/Furans (pg I-TEQ/m^3)					80				
Sewage sludge incineration Mercury ($\mu g/Rm^3$)					70				

Notes:
* Ontario Interim Ambient Quality Criterion (AAQC). Ontario Ministry of the Environment, September 2001.
** Annual 98th percentile 24-hour concentration, averaged over three years.
*** Annual 4th highest 8-hour concentration, averaged over three years.

Table 6-3: Ambient Air Quality Criteria (AAQC) for Metals

Contaminant	Averaging Time	Ontario AAQC	Alberta Residential and Recreation Areas	Alberta Commercial and Industrial Areas	Indicator Threshold
Iron (Fe) ($\mu g/m^3$)	24 hr	4 $\mu g/m^3$			4 $\mu g/m^3$
Manganese (Mn) ($\mu g/m^3$)	24 hr	2.5			2.5 $\mu g/m^3$
Arsenic (As) ($\mu g/m^3$)	24 hr	0.3			0.3 $\mu g/m^3$
Calcium (Ca) ($\mu g/m^3$) (as calcium oxide)	24 hr	10			10 $\mu g/m^3$
Cobalt (Co) ($\mu g/m^3$)	24 hr	0.1			0.1 $\mu g/m^3$
Dust Deposition (g/m^2/30 d)	1 Month	7	5.3	15.8	
Dust Deposition (g/m^2/year)	Annual	55 g/m^2/year Or 4.6 g/m^2/day			

6.1.1 Dust Deposition

Ground deposition of particular material is also important as the dust deposition levels exceed its respective threshold, and the effects are irreversible. Dust deposition at the Mine Site in particular will be relatively high. The Table 6-3 identifies dust deposition criteria for Alberta and Ontario.

Crushers and screens will be installed inside buildings; conveyors will be covered and equipped with wind ventilation hoods to reduce wind exposure and the potential for dust generation. All ventilation ducts will be routed to dust collectors which will limit dust emissions. Project facilities have been made compact to minimize the Project footprint and control techniques will be used to limit dust emissions.

Air pollution controls such as enclosing facilities and the use of dust-collection equipment will prevent significant effects on air quality.

The management procedures used for dust emissions for different sources on site are explained in Table 6-4 below. A "Dust Suppression Guideline" by Department of Sustainable Development Environmental Protection Service – Government of the Nunavut outlines procedures that must be followed before applying dust suppressants in the Nunavut. This guideline is presented at: env.gov.nu.ca/sites/default/files/Guideline%20Dust%20Suppression.pdf.

Table 6-4: Dust Management Procedures

Source	Dust Management
Dust Emissions from Ore	1. Crushers and screens will be installed inside the buildings.
	2. Conveyors will be covered and equipped with wind ventilation hood.
	3. All ventilation ducts will be routed to the dust collectors.
	4. Ore crushing facilities will be enclosed, vented and equipped with dust collection equipment.
Fugitive Dust Emissions from Material-Handling Equipment	1. Crushers and screens will be installed inside the buildings.
	2. Material handling equipment will be installed outdoors.
	3. Conveyors will be equipped with wind hoods.
	4. Regular maintenance of equipment and vehicles will be preformed.
	5. Dust collectors will be installed at transfer points.
	6. Approved chemical binding agents including calcium chloride will be applied, as necessary.
	7. Appropriate speed limits will be observed.
	8. Ultra low sulphur arctic grade diesel (ULSD) fuel will be used for all diesel engines.
	9. Design of operations will be optimized to avoid double handling of materials.
	10. Procurement policy on emissions from equipment (incinerator, generators, and vehicles) will be developed and implemented.
	11. Drop distances (i.e., utilize adjustable stackers) for stockpiling activities will be minimized.
	12. Conveyors at Steensby will have contained return belts.
	13. Where possible, screened granular material will be used for road construction.
	14. Concrete batch plant will be equipped with industry standard dust collection
Emissions of Dioxins/Furans and Mercury from Waste Incineration	1. Best waste management practices
	2. Standard Operating Procedures

6.1.2 *Climate Change*

The Table 6-5 provides design measures that will be implemented to protect the project structures from the impacts of construction, operations and potential changes to the climate. In general, conservative assumptions are used as the way to address potential effects of climate change.

Table 6-5: Design Measures Used to Account for Climate Change

Project Structure	Design Measures used to Account for Climate Change
Milne Inlet Tote Road - Upgrades	No specific measures were taken into account for climate change beyond those for construction on permafrost.
Milne Inlet Tote Road - Water Crossings	A 1:100 year storm event to be used for design of all water crossings.
Railway - Embankment	Embankment thickness and over-excavation depths in ice-rich materials increased based on a 50% greater thickness of active layer.
Railway - Water Crossings (Bridges)	Designed culverts and bridges to a higher return period of 1:200
Railway - Auxiliary Facilities	Loading and unloading facilities and the workshop will be located on bedrock or piles to account for the increased thickness of the active layer. The inspection shed will be unheated and placed on run of quarry rock fill. Telecommunication towers will be located on bedrock or piles into bedrock where possible; towers installed on thaw sensitive soils will be monitored for subsidence during thawing months; further, specific operating instructions will dictate how everyone is to act in the case of a tower failure; redundant measures will be in place.
Port Facilities	Docks can account for the fluctuation in sea levels due to climate change.
Open Pit Mine	Thermal Barrier on ice-rich overburden slopes should be of adequate thickness to account for increase to active layer thickness.
Waste Rock Stockpile	Potentially-acid generating (PAG) rock will be buried sufficiently deep within the pile to account for increase in active layer thickness.
Airstrips and Access Roads	Thermal barrier (non-frost/thaw sensitive fill) thickness increased to account for increases active layer depth.
Building foundations	Adfreeze pile calculations to account for slightly warmer permafrost and deeper active layer. Thermal barriers and foundation pads thicker.

6.1.3 *Occupational Health and Safety Standards for Air Emissions and Dust in the Workplace*

Please refer to the Air Quality and Noise Abatement Management Plan in Attachment 5.

6.1.4 Noise

Noise is no regulations or guidelines in Nunavut that address environmental noise levels. However, noise has been addressed in recent EIS for other mining projects in Nunavut (i.e. Meadowbank Gold Project, Doris North Gold Project, and High Lake Project). These projects and other projects in the Northwest Territories have adopted Alberta Energy Resource Conservation Board (ERCB) Directive 038 Guidelines (ERCB 2007) as indicative of what is generally considered acceptable with respect to noise levels from industrial activities in remote areas. Directive 038 (D038) guidelines have been adopted for the Mary River Project for comparison purposes in evaluating the magnitude of noise emission effects.

D038 sets out Permissible Sound Levels (PSLs) which must be met at all dwellings surrounding the project development. These limits apply to operational noise only. The cumulative sound level from all energy-related (in this case Project-related) development in the area is measured or predicted. This is called the Comprehensive Sound Level (CSL), and is compared against the PSL. The CSL includes background ambient sound levels.

The base PSL value is an average 1-hour sound level (Leq (1-hour)) of 40 dBA, which is based on a typical rural or remoter Ambient Sound Level (ASL) of 35 dBA, plus a 5 dB allowance for the industrial activity (research conducted by Alberta Environment showed that in general, people tolerate sound from energy facilities of up to 5 dB above the ambient sound environment).

The PSL may be increased to account for the presence of other industrial and transportation noise sources, such as road and rail traffic, and for the population density of developed areas.

In remote pristine areas, an ambient sound level adjustment, based on measured existing sound levels, may be applied, which may reduce the PSL at these locations. The overview of Alberta Energy Resource Conservation (ERC) Directive 038 guidelines is presented in Table 6-6.

Table 6-6: Alberta Energy Resource Conservation (ERC) Directive 038 Guidelines

General Format of Directive D038	Directive D038 sets out permissible sound levels (PSLs), which must be met at all dwellings surrounding the Project development. These limits apply to operational noise only. The cumulative sound level from all energy-related (in this case Baffinland-related) development in the area is measured or predicted. This is called the comprehensive sound level (CSL) and is compared against the PSL. The CSL includes background ambient sound levels. The base PSL value is 40 dBA, which is based on a typical rural or remote ambient sound level (ASL) of 35 dBA, plus 5 dBA allowance for the industrial activity (Alberta Environment research showed that in general, people tolerate sound from energy facilities of up to 5 dBA above the ambient sound environment). The PSL can be increased to account for the presence of other industrial or transportation noise sources, such as road and rail traffic, and for the population density of developed areas. In remote pristine areas, an ASL adjustment, based on measured existing sound levels, can be applied, which might reduce PSL at

	these locations. For areas where there are no dwellings, a sound level limit of 40 dBA 1.5 km from the facility fence is applied.
Dwellings	A dwelling is defined in Directive D038 as a permanently or seasonally occupied residence, including trailer parks and campgrounds in regular consistent use. For assessment, the only dwelling near Baffinland-related activities is a seasonally occupied hunt camp at Milne Inlet. Worker residences, dormitories, and construction camps are specifically excluded as dwellings under Directive D038.
Noise Limit for Remote Area	Where no noise-sensitive receptors are located within 1.5 km of the facility, the CSL from the facility (facility noise plus ambient) must meet a PSL of 40 dBA Leq (night) measured at 1.5 km from the facility fenceline.

The Table 6-7 presents the noise performance indicators and thresholds for Milne Inlet, Mary River and Steensby Inlet.

Table 6-7: Noise Performance Indicators and Thresholds

Location	Performance Indicator	Threshold
Milne Inlet	Noise level at fenceline	40 dbA
Mary River	Noise level at fenceline	40 dbA
Steensby Inlet	Noise level at fenceline	40 dbA
Milne Inlet	Noise level at seasonal hunt camp	40dbA

6.1.4.1 *Noise Limit for Work Camps*

Work camps such as those associated with the Project are specifically excluded from the requirements of Directive D038. These dwellings were considered, however, as it is important for worker health to maintain an adequate sleep environment. Interior noise can be characterized using balance noise criteria (NCB) curves. For sleeping areas in larger complexes, NCB ratings of NCB 28 to NCB 33 are generally accepted. A NCB rating of thirty-three (33) has been adopted for the Project.

6.1.5 *Vibration*

Vibration impacts can be broken down into two zones: terrestrial (above ground, on land) and underwater.

6.1.5.1 *Terrestrial Vibration*

Human perception of ground-borne vibration can be ranked as follows (Bender, 1996):

- Barely to distinctly perceptible - 0.5 to 2.5mm/s ppv;
- Distinctly to strongly perceptible - 2.5 to 6.25mm/s ppv;

- Strongly perceptible to mildly unpleasant - 0.5 to 2.5mm/s ppv; and
- Increased potential for structural damage - 12.5 to 25.4mm/s ppv.

The potential for structural damage increases for airborne vibration overpressure in excess of 120 dB (MOE, 1997).

6.1.5.2 Underwater Shockwaves

Fisheries and Oceans Canada (DFO) has produced Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters to protect marine wildlife, including fish and marine mammals from underwater vibrations (DFO, 1998).

Highlights of the guideline include the following:

- No explosive is to be knowingly detonated within 500 m of any marine mammal (or no visual contact from an observer using 7 x 35 power binocular);
- No explosive is to be detonated in or near fish habitat that produces, or is likely to produce, an instantaneous pressure change (i.e. overpressure) greater than 100 kPa in the swim bladder of a fish;
- No explosive is to be detonated that produces, or is likely to produce, a peak particle velocity greater than 13 mm/s in a spawning bed during the period of egg incubation;
- The guideline also presents tables of weight of explosive change versus distance and other estimation methods are provided to determine the potential impacts; and
- This guideline is relevant mostly for the construction phase of the Project (construction of docking facilities, creek/river crossings).

6.2 Water

6.2.1 Drinking Water

The Table 6-8 illustrates the new and revised guidelines for Canadian Drinking Water Quality as well as current water quality conditions at Milne, Steensby and Mary River.

Table 6-8: Drinking Water Quality and Current Water Quality

Parameter	Guideline (mg/L)	Previous guideline (mg/L)	CHE approval	Current water quality at Milne Inlet	Current water quality at Mary River	Current water quality at Steensby Port
Microbiological Parameters[a]						
Bacteriological		0 coliforms/100 mL				
E.coli	0 per 100 mL		2006			
Total coliforms	0 per 100 mL		2006			
Heterotrophic plate count	No numerical guideline required		2006			
Emerging pathogens	No numerical guideline required		2006			
Protozoa	No numerical guideline required	None	2004			
Enteric viruses	No numerical guideline required	None	2004			
Turbidity	0.3/1.0/0.1 NTU[b]	1.0 NTU	2004			
Chemical and Physical Parameters						
Aluminum	0.1/0.2[c]	None	1999			
Antimony	0.006	None	1997			
Arsenic	0.010	0.025	2006			
Benzene	0.005	0.005	2009			
Bromate	0.01	None	1999			
Chlorate	1.0	None	2008			
Chlorine	No numerical guideline required	None	2009			
Chlorite	1.0	None	2008			

Parameter	Guideline (mg/L)	Previous guideline (mg/L)	CHE approval	Current water quality at Milne Inlet	Current water quality at Mary River	Current water quality at Steensby Port
Cyanobacterial toxins--microcystin-LR	0.0015	None	2002			
Fluoride	1.5	1.5	1996			
Formaldehyde	No numerical guideline required	None	1998			
Haloacetic Acids-Total (HAAs)	0.080	None	2008			
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	0.1	None	2010			
Methyl *tertiary*-butyl ether (MTBE)	0.015	None	2006			
Trichloroethylene (TCE)	0.005	0.05	2005			
Trihalomethanes--Total (THMs)[d]	0.100	0.100	2006			
Uranium	0.02	0.1	2000			
Radiological Parameters						
Cesium-137 (^{137}Cs)	10 Bq/L	10 Bq/L	2009			
Iodine-131 (^{131}I)	6 Bq/L	6 Bq/L	2009			
Lead-210 (^{210}Pb)	0.2 Bq/L	0.1 Bq/L	2009			
Radium-226 (^{226}Ra)	0.5 Bq/L	0.6 Bq/L	2009			
Strontium-90 (^{90}Sr)	5 Bq/L	5 Bq/L	2009			
Tritium (^{3}H)	7000 Bq/L	7000 Bq/L	2009			

Notes:

a) Refer to section on Guidelines for microbiological parameters.

b) Based on conventional treatment/slow sand or diatomaceous earth filtration/membrane filtration.

c) This is an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants. The operational guidance values of 0.1 mg/L apply to conventional treatment plants, and 0.2 mg/L applies to other types of treatment systems.

d) The separate guideline for BDCM was rescinded based on new science. See addendum to the THM

Parameter	Guideline (mg/L)	Previous guideline (mg/L)	CHE approval	Current water quality at Milne Inlet	Current water quality at Mary River	Current water quality at Steensby Port
document. In certain situations, the Federal-Provincial-Territorial Committee on Drinking Water may choose to develop guidance documents: for contaminants that do not meet the criteria for guideline development, and for specific issues for which operational or management guidance is warranted.						

6.2.2 *Wastewater Discharge and Runoff Water Quality*

Water quality standards for wastewater (oily water) treatment facilities (WWTF) are based on Metal Mining Effluent Regulations (MMER) and Guidelines: Industrial Waste Discharges in Nunavut (GIWDN). All discharge from the open-pit mine, ore stockpile, and waste rock stockpile areas will not exceed the limits identified by the Metal Mining Effluent Regulations (MMER). Treated oily water from the bulk fuel storage areas and treated sewage will meet the criteria identified in the predevelopment and exploration water licence. Sewage will be treated by sewage treatment plants (STPs) at the Mine Site, Milne Port, and Steensby Port unless otherwise approved. Nutrient loading in the effluent discharges shall not cause eutrophication of the freshwater receiver. The following measures will be implemented to protect water quality:

- Non-compliant discharges from the STPs will be retained in the effluent tank. It is intended that the effluent tank will be at a low level during operation such that if sampling indicates that the effluent quality does not meet the applicable criteria further discharge can be prevented for a period in excess of a day to allow this effluent to be mixed, retreated, and retested. In addition this retention volume will allow for a minimal amount of recirculation through the STP using any spare STP capacity;
- Discharge will be released in a manner that minimizes surface erosion;
- Greywater not directed to one of the treatment plants will be contained in sumps located at least 31m from the ordinary highwater mark of any waterbody, at a site where direct flow into the waterbody is not possible and additional impacts are not created, unless otherwise approved; and
- Latrines, if used, will be located at least 31m from the ordinary highwater mark of any waterbody. In most cases latrine waste collected at small remote camps will be collected and either incinerated or transported to a STP for treatment.

Table 6-9: Mine and Stockpile Runoff – Quality Standards

Parameter	Maximum Average Concentration (MAC), mg/L	Maximum Concentration of Any Grab Sample, mg/L	Reference Standard
Total Arsenic (As)	0.50	1.00	
Total Copper (Cu)	0.30	0.60	
Total Lead (Pb)	0.20	0.40	
Total Nickel (Ni)	0.50	1.00	

Parameter	Maximum Average Concentration (MAC), mg/L	Maximum Concentration of Any Grab Sample, mg/L	Reference Standard
Total Zinc (Zn)	0.50	1.00	
Total Suspended Solids (TSS)	15.0	30.0	
Oil and Grease	No visible sheen	N/A	
Note: Waste discharged will have a pH between 6 and 9.5.			

Effluent discharge to freshwater or marine receivers from WWTFs, PWSPs, bulk fuel storage facilities, and mine/stockpile areas will be acutely non-toxic.

6.2.2.1 Sewage

The Table 6-10 presents the design sewage flows and strengths and the current water licence discharge requirements

Table 6-10: Design Sewage Flows and Strengths

Facility Type	Water/Sewage Quantity (Lpcd)	BOD_5/TSS (Avg. - mg/L)	No. of Persons (Capita)	Total Daily Flow (L/d)	Total Flow 400 days (m^3)
Drilling Camp	83 to 227	460/490			
Average Work Camp	170	460/490			
Average Construction Camp	220				
Design Criteria for Mary River Camp	225	460/490	150	33,750	13,500
Design Criteria for Milne Inlet Camp	225	460/490	60	13,500	5,400

Table 6-11: Water Licence Discharge Requirements

Parameter	Water Licence Requirements Max. Average Conc.		Wastewater Treatment Plant Design Effluent Conc.	
	Milne Inlet WWTF	Mary River WWTF	Milne Inlet WWTF	Mary River WWTF
BOD_5	100 mg/L	30 mg/L	20 mg/L	10 mg/L
TSS	120 mg/L	35 mg/L	20 mg/L	10 mg/L
Faecal Coliform	10,000 CFU/100 mL	1,000 CFU/100 mL	Less than 200 Counts per 100 mL	Less than 200 Counts per 100 mL
Oil and Grease	No visible sheen	No visible sheen	Removed by	Removed by grease

Parameter	Water Licence Requirements Max. Average Conc.		Wastewater Treatment Plant Design Effluent Conc.	
	Milne Inlet WWTF	Mary River WWTF	Milne Inlet WWTF	Mary River WWTF
			grease traps	traps
pH	6-9.5	6-9.5	6-9.5	6-9.5
Toxicity	Final effluent not acutely toxic	Final effluent not acutely toxic	not acutely toxic due to nitrification	not acutely toxic due to nitrification
Ammonia	N/A	N/A	2 mg/L NH_3-N	2 mg/L NH_3-N
Total Phosphorus	N/A	N/A	N/A	0.5 mg/L target level**

**Note:

The 0.5 mg/L phosphorus target level is considered to be conservative based on anticipated overall phosphorus loadings to Sheardown Lake and modeling results. It also needs to be recognized that because these target levels are very close to what is technically achievable, that levels may on occasion may range between 0.5 to 1.0 mg/L, especially as related to discharge from the PWSPs. The modeling takes this 0.5 to 1.0 mg/L range into consideration when calculating loadings for discharge from the PWSPs.

6.2.2.2 *Discharge from Bulk Fuel Facilities*

The Table 6-126 in Section 6.6.1 indicates Fuel Storage effluent standards.

6.2.3 *Freshwater Environment*

Freshwater quality measurements in the Mary River area indicate naturally elevated concentrations of dissolved oxygen, turbidity, aluminum, and iron. Some average values for pH, as well as cadmium and mercury in fresh water are greater than levels recommended by the guidelines of Canadian Council of Ministers of the Environment.

6.2.3.1 *Freshwater Quality*

The Table 6-12 illustrates the Canadian Environmental Quality Guidelines for Water as well as the surface water quality performance indicators.

Table 6-12: Canadian Environmental Quality Guidelines for Water

Parameter	Units	Potable Water	Freshwater Aquatic Life	Marine Aquatic Life	Maximum Average Concentration (MAC)	Maximum Concentration of any Grab Sample
Aluminum*	mg/L	0.1-0.2	0.005-0.1	-		
Cadmium	µg/L	5	0.017[1]	0.12		
Chloride*	mg/L	≤250	-	-		
Chromium[2]	mg/L	0.5				
Trivalent (Cr^{3+})	mg/L	-	0.0089	0.056		
Hexavalent (Cr^{6+})	mg/L	-	0.001	0.0015		
Copper*	mg/L	1.0	0.002-0.004	-	0.3	0.6
Iron*	mg/L	≤0.3	0.3	-		
Lead	mg/L	0.01	0.001-0.007	-	0.2	0.4
Nickel	mg/L	-	0.025-0.15	-	0.5	1.0
pH		6.5-8.5	6.5-9.0	7.0-8.7		
Sulphate*	mg/L	≤500	-	-		
Temperature*	°C	≤15	Dependant on thermal stratification	±1		
TDS	mg/L	≤500	-	-		
Uranium*	mg/L	0.02	-	-		
Zinc*	mg/L	5.0	0.03	-	0.5	1.0
Arsenic	mg/L	-	-	-	0.5	1.0
Total Suspended Solids (TSS)	mg/L	-	-	-	15.0	50.0
Oil and Grease	mg/L	-	-	-	No visible sheen	N/A
*Aesthetic objective (or operational guideline in the case of aluminum)						

6.2.3.2 *Freshwater Aquatic Environment*

There are two fish species in the freshwater environment: arctic char and a minnow species named nine-spine stickleback. The inland waters near the Project mainly contain landlocked arctic char, though anadromous or searun char are present in a lake next to Steensby Port and up the Cockburn River system next to a portion of the railway. Fish in the marine waters captured during fisheries studies included arctic char, sculpin, and Atlantic lumpfish at Steensby Inlet, and Arctic char, sculpin and Greenland cod at Milne Inlet.

Freshwater quality measurements in the Mary River area indicate naturally elevated concentrations of dissolved oxygen, turbidity, aluminum, and iron. Some average values for pH, as well as cadmium and mercury in fresh water are greater than levels recommended by the guidelines of Canadian Council of Ministers of the Environment.

A number of proven mitigation measures have been included in the Project to reduce potential effects on water quality, freshwater fish, fish habitat, and other aquatic organisms. These mitigations are detailed in the Freshwater Supply and Wastewater Management Plan, Waste Management Plan and Emergency Spill Response Contingency Plan.

Runoff from fuel storage and maintenance facility areas will be contained and treated as necessary to meet regulatory requirements. Sewage and wastewater from truck and rail maintenance facilities, and explosives equipment-washing facilities will be treated to meet established standards before being discharged to the natural environment. An Emergency Response & Spill Contingency Plan will be in place to promptly clean up spills should they occur.

The roads and railway both cross a large number of watercourses, and a portion of these contain fish habitat. Culverts and bridges for stream and river crossings will be designed to limit barriers to fish movement and where possible, minimum flows will be maintained in streams important for fish habitat.

Because railways cannot turn sharp corners, building sections of the railway into the edge of several lakes will be unavoidable. While some fish habitat will inevitably be lost, a compensation plan has been proposed to offset this unavoidable loss. This plan will be further developed and finalized in consultation with Fisheries and Oceans Canada and the Qikiqtani Inuit Association.

The Table 6-13 presents the mitigation measures for surface water and sediment quality, freshwater Aquatic environment.

Table 6-13: Mitigation Measures for Surface Water and Sediment Quality, Freshwater Aquatic Environment

Mitigation Measures	
1.	The facilities/quarries will be sited at least 31m from stream or water body.
2.	A range of sediment and erosion control structures will be installed.
3.	Diversion/collection channel or containment berms will be installed where appropriate.
4.	Ice and freshet management will be implemented.
5.	Best management practices for surface water management will be implemented.
6.	Routine inspection and maintenance will be conducted.
7.	Sewage will be treated in a sewage treatment plant.
8.	Wastewater (oily water, truck wash, maintenance facilities, explosives equipment wash water) will be treated at the wastewater treatment plant.
9.	Potentially acid generating rocks from waste rock pile, ore stockpiles, quarries and mine will be managed.
10.	The footprint of stream crossing will be minimized.
11.	Compensation plan for HADD will be developed and implemented.
12.	Appropriate stream/river crossing structures (culvert, bridges, etc.) will be designed.
13.	Limit barrier to movement with site specific design of rocky ramps at culvert crossing (where required)
14.	Channel enhancement will be done, where required.
15.	Minimum flow in impacted streams will be maintained, where possible.
16.	Low flow stream, fish salvage will be monitored, if necessary.
17.	Use of explosives in or near streams/water bodies will be done as per DFO Guidelines.
18.	Discharge of contaminants will be prevented.
19.	All hazardous materials will be stored on impermeable surface/secondary containment.
20.	Tank farm and large storage tanks will be placed in secondary containment structures (lined and impermeable).
21.	Double wall iso-containers will be used.
22.	Refueling will be done on impermeable surfaces and runoff will be contained.
23.	Fish barrier for extremely low flow streams
24.	Emergency Response & Spill Contingency Plan will be developed and implemented.

6.3 Wastes

The Table 6-14 shows the combined expected waste for the project and the disposal methods involved.

Table 6-14: Combined Expected Waste Total Project

Waste Type	What Waste	Final Disposal
Hazardous	Petroleum oils and lubricants, drilling additives	Incinerator or shipped out
	Calcium chloride flakes	Shipped out
	Lead acid batteries	Shipped out
	Cleaning supplies at camp sites	Hazardous waste facility/shipped out
	Waste oil from equipment and generators	Incinerator or shipped out
	Spent ethylene glycol coolant	Shipped out
Solid/Tire	Tires	Landfill or shipped out (Large tires)
Medical waste	Surgical needles, gloves, etc.	Shipped out
Contaminated Excavated waste	Contaminated soil and waste	Landfarm or shipped out
Dredged Material Placement	**Refer to Section 6.5**	
Sewage Sludge	Sewage sludge	Incinerated/landfill
Liquid Hazardous waste	Lubricants, oils, spent coolant and batteries	Stored in drums in containment/shipped out/recycled
Other	Contaminated soils, snow and ice water	Landfarm

6.4 Dredged Material Placement

Construction of ore and freight docks to design elevation will require both dredging of unconsolidated material and blasting of rock.

Any rock blasted will be used in construction of the causeway or other dock structures.

Dredged unconsolidated material will be used as fill in port structures. If this cannot be done because of scheduling constraints, it will be dewatered in an on land facility and used as general fill.

6.5 Habitat Protection

6.5.1 Creek/Stream/River Crossings – Fisheries and Aquatic Resources

Works for which a DFO-issued authorization might be required include water intake structures and sewage outfall structures at construction camps, the Mine Site and port sites, construction docks at Steensby Port, permanent dock structures at both Milne Port and Steensby Port to support ore, freight, and tug operations, and numerous watercourse crossings, including access to the island at Steensby Inlet, as well as encroachment into lakes/ponds resulting from the railway, access roads, and site infrastructure development and operations.

The following measures will be implemented by Baffinland:

- Streambanks will not be cut and material will not be removed from below the ordinary highwater mark of any waterbody unless authorized;
- Stream crossings will be located so as to minimize approach grades. Approaches will be stabilized during construction and on completion to control runoff, erosion, and subsequent siltation to any waterbody; and
- For creek crossings and construction activities that will likely result in a Harmful Alteration, Disruption, or Destruction (HADD) of fish habitat as defined under the Fisheries Act, a Fish Habitat and Compensation Monitoring Plan (No Net Loss Plan) will be developed to mitigate impacts on associated fish habitat (requirement under the terms of the Section 35(2) Fisheries Authorization issued by Fisheries and Oceans Canada [DFO] for these installations).

6.5.2 Site Selection, Roads, and Railway Routing

The following measures will be implemented to mitigate environmental impacts due to site selection, roads and railway routing activities:

- Project footprint will be minimized to also minimize the loss of habitat and reduction of habitat effectiveness;
- To the extent possible, known archaeological sites will be avoided and the avoidance of important (unique and/or old) sites will be prioritized;
- A 31m buffer will be maintained from streams and waterways;
- A 500m buffer zone will be maintained from important bird nesting areas;
- Sourcing of aggregate and borrow materials from road and railway rights-of-way will be maximized. Care will be taken to ensure ARD material is avoided; and
- Water sources in which Project water withdrawals will minimize the potential for drawdown and effects on fish habitat and the aquatic environment will be selected.

Construction activities will use existing Project infrastructure and footprint to the greatest extent practical to minimize land disturbance and improve overall efficiency of construction activities. Where possible, permanent support infrastructure will be built at the onset of construction, to be used during both construction and operation phases of the Project. In many instances, temporary infrastructure will be constructed or positioned at Project sites for the duration of the

construction phase only. This temporary infrastructure will be removed at completion of the construction phase.

6.6 Storage Facilities

6.6.1 Fuel Storage Facilities

Bulk fuel storage facilities (Jet-A fuel, ULSD, waste oil tank etc.) will be installed according to the following guidelines in Table 6-15.

Table 6-15: Bulk Fuel Storage Facilities and Installation Guidelines

Fuel Storage Facilities	Installation Guidelines	Source of Guidelines
Fuel Tank Farms	Bermed spill containment capacity equal to the volume of the largest tank plus 10% of the volume of the remaining tanks OR 110% volume of the largest tank, whichever is greater. Calculating the volume, the footprint of the smaller tanks is subtracted.	Design Rationale for Fuel Storage and Distribution Facilities by Northwest Territories Department of Public Works
	The lining in the bermed area must be an impervious HDPE liner membrane and industry standards for installing and jointing the membrane must be met to ensure its integrity	
Refuelling Station	lined and bermed area to contain minor spills or leaks during refueling. The liner (e.g., 40-mm hypolon liner or equivalent) is protected by sand bedding. Vehicles and mobile equipment drive onto this bedding for refueling. All fuel transfer is done by pumps.	
Fuel Storage Area	Spill kits for emergency and current Spill Contingency Plan maintained.	
Fuel Barges/Tankers		

Effluents discharged from bulk fuel storage facilities will not exceed the following quality standards outlined in Table 6-16.

Table 6-16: Bulk Fuel Storage Facilities – Quality Standards

Parameter	Maximum Average Concentration (MAC), µg/L	Reference Standfard
Benzene	370	
Toluene	2	
Ehtyl Benzene	90	
Lead	1	
Oil and Grease	15,000 and no visible sheen	

6.6.2 *Explosives Storage Facilities*

Explosives will be stored in explosives magazines positioned in accordance with the Nunavut Mine Health and Safety Act and Regulations. Detonators and explosives will be stored in separate magazines, and inventory is strictly controlled with supervisory control. The explosives magazines will be located at a minimum distance away from other infrastructure (e.g., building or work area) in accordance with the requirements of the Explosives Use Act, warning signs will be prominently posted, and the magazines will be regularly inspected.

Prefabricated magazines will be positioned and appropriately bermed to store explosives as they are unloaded from the ship before being transported to areas of use along the tote road, at the mine site, and the railway and rock quarry sites.

Once the Emulsion Explosives mixing plans have been commissioned at the mine site, and Steensby Port ammonium nitrate will be delivered in bulk to Milne Port and Steensby Port, and transported by truck to the permanent storage facility at Steensby Port and at the mine site.

6.7 Terrestrial Environment

6.7.1 *Landforms, Soil, Climate Data, and Permafrost*

Superficial landforms and deposits in the Mary River Project area are associated with widespread glaciation on Baffin Island. Surface geology consists of locally abundant sediment deposits from glaciers and rivers. Occasional outcrops of granitic and sedimentary rock formations occur. The North Baffin region containing the Mary River area lies within the Committee Belt, a granite-greenstone terrain mixed with sedimentary and volcanic rock. The mountains to the east are older than 540 million years old, and the lowland plateaus to the west are about 250 to 540 million years old.

The Project is situated in the Northern Arctic Ecozone. The climate is semi-arid and permafrost coverage is continuous extending to a depth of 500 m, with an active layer of 2-10 metres. The extremely cold temperatures of the region, combined with the low precipitation, result in a short period of runoff that typically occurs from June to September. All rivers and creeks, with the exception of the very largest systems, freeze during the winter months. Due to the combination of low temperatures and low infiltration, the vegetative cover is minimal and surface water is abundant. The region is dotted with thousands of small lakes and streams.

The region experiences near 24-hour darkness with less than two hours of twilight from November to January. During the winter months the treeless topography and fine powdery snow produce blizzard conditions, resulting in restricted visibility. Frost-free conditions occur from late June to late August. There is continuous daylight from May to August. The months of July and August usually experience the greatest precipitation. From September to November, temperature and the number of daylight hours decrease, and by mid-October the mean daily temperature is generally well below 0oC. The highest snowfall typically occurs during this period.

Sensitive landforms in the Project area mainly include frozen soils that contain ice lenses or soils of low bearing capacity. To the extent possible, sensitive landforms will be avoided and appropriate designs will be used where such landforms cannot be avoided. Site preparation will include adequate drainage to prevent water pooling during thaw periods.

The following design measures will be implemented by Baffinland:

- Siting of facilities and alignment of roads and railway;
- Design foundations suitable for site conditions;
- Design stream crossing structures for extreme flood event; and
- Ensure adequate drainage and prevent pooling of water.

6.7.2 *Migratory Birds and Habitat*

Migratory bird species observed in the Mary River study area include snow geese, ducks, eiders, loons, and mergansers. Raptors found include rough-legged hawks, peregrine falcons, gyrfalcons, and snowy owls. Relatively low densities of songbirds and shorebirds were recorded throughout the region.

To mitigate the impacts on the migratory bird populations (peregrine falcons, snow geese, eiders, and loons), nests and nesting areas will be identified before start of activities and avoided where possible until fledging occurs, and workers are not permitted to hunt.

The following measures will be implemented by Baffinland:

- Employee awareness/environmental induction program will be conducted;
- The footprint of facilities will be minimized;
- Nest search will be conducted. prior to start of activities;
- A no hunting policy will be developed and implemented;
- Areas of large concentrations of foraging or moulting birds will be avoided;
- Known nests or nesting areas will be avoided;
- To the extent possible, closure of a 500m radius area from the nest will be enforced until fledging occurs;
- Nest-specific management plans will be developed and implemented; and

- To the extent possible, appropriate aircraft approach and departure flight paths will be developed.

6.7.3 Terrestrial Wildlife and Habitat

Terrestrial mammals in the region include barren-ground caribou of the North Baffin herd, wolf, arctic and red fox, ermine, arctic hare, and lemmings. Marine mammals are found in abundance in the region, including polar bears, narwhals, beluga whales, and bowhead whales, several species of seals, and walrus. Killer whales and northern bottlenose whales were found in small numbers.

North Baffin caribou are currently present at low densities and their numbers seem to vary in accordance with a 60-year to 70-year cycle. The last period of caribou abundance in the regional study area was 1980 to 2000, and the previous period of low abundance was the 1940s. Caribou are expected to remain at low numbers for the next couple of decades. There is evidence that caribou occur throughout the entire region.

While some populations of caribou migrate between preferred habitats in summer and winter, North Baffin caribou appear to be non-migratory and are likely to be found relatively equally in many locations throughout the Project area.

Accidental kills of caribou could occur as a result of Project activities. Several measures are in place to avoid caribou kills. Strict speed limits will be in place for trucks and trains, thus decreasing the probability of collision. Trucks will be required to stop if wildlife is observed on or next to the road. Loaded trains cannot stop quickly enough to avoid collisions with caribou, but during seasons when large herds of caribou return, the train can cease operation until caribou move through the area. Crossings will be provided at strategic locations along the railway corridor to facilitate migration of animals. Workers onsite will not be permitted to hunt.

The following measures will be implemented by Baffinland:

- Dust suppressants will be used on Tote Road during growing season;
- Speed limits for trucks and trains which will provide more time for caribou to get off the road or rail, and will increase the chance of a truck being able to stop before a collision with a caribou;
- The train is expected to operate 300 days per year, so seasonal stoppages are possible if large groups of migratory caribou return to the area;
- Baffinland has a no hunting policy for all personnel while working on site;
- Snow management will be implemented to grade snow banks along railway and roadway so that caribou are able to easily cross the transportation corridor without being blocked by steep snow banks;
- The railway embankment will be constructed of finer fill material at the identified trails for easier caribou movement across the railway embankment. The finer fill will replicate natural trail conditions; and
- Physical barriers from trains will be reduced by limiting train traffic to four passes per day.

6.8 Marine Environment

All sewage and wastewater from maintenance facilities and explosives will be treated before discharge at the two ports. Runoff from Project areas will be contained, monitored, and treated to meet water effluent quality requirements before discharge. No waste will be discharged into the sea by ships. Fuel transfers will take place following the Canada Shipping Act Response Organization and Oil Handling Facilities Regulation and Project Oil Handling Facility Plans for ship-to-land fuel transfer and Project Shipboard Oil Pollution Emergency Plans. In addition, ships are required to exchange ballast water at sea before entering Canadian waters. Such practices will limit the risk of introduction of invasive species.

The marine mammals of concern include ringed seals, walruses, narwhals, beluga whales, and bowhead whales. The interaction of the Project with these mammals will be limited to the shipping activity.

Table 6-17: Mitigation Measures for Marine Environment

Mitigation Measures
1. The width of shipping lane through fast ice will be minimized to the extent possible.
2. Site runoff water management will be done as per management plan.
3. Hazardous substances will be contained within impermeable areas as per Waste Management Plan.
4. Sewage treatment and wastewater treatment plant (oily water, truck wash, maintenance facilities, and explosives equipment wash water) will be constructed.
5. Emergency Response and Spill Contingency Plan, Milne Port OPEP and Steensby Port OPEP.
6. On-board waste management will be implemented and there will be no discharge at sea.
7. The footprint of marine structures will be minimized.
8. Compensation plan for HADD will be developed and implemented.
9. Dock structures will be designed to minimize the footprints in the marine environment.
10. Dock construction activity will be scheduled during period of low mammal occurrence – the open water period (blasting, pile driving, dredging).
11. Proven mitigation measures will be used to mitigate noise during construction (DFO's guideline of 100 kPa overpressure limit, bubble curtain system for blasting).
12. Marine mammals will be discouraged from the blast area with potential use of acoustic deterrent device.
13. Vessels will maintain a constant course and speed whenever possible - reduce vessel speed in Milne Inlet.
14. Vessels will minimize idling of engines when docked at Milne and Steensby ports.
15. Aircraft will be operated at a minimum altitude of 650m over marine areas, when

weather conditions and safety considerations allow.
16. Aircraft will be prohibited from flying low over marine mammals for sightseeing or photography.
17. Mary River airstrip will be primarily used during the Operation Phase.
18. The workers will be provided training about bear safety.
19. Work areas will be kept clean of food scraps, garbage, and toxic materials.
20. Bear monitors will be used at camp sites.
21. Bear deterrent devices will be used.

6.8.1 Shipping Guidelines

6.8.2 Ballast Water

Upon arrival at the port, the ships will discharge ballast water to allow for filling the ship with ore. During winter the full ballast is required to assist in ice breaking and so the entire amount of ballast water (approximately 185,000m3) will be discharged at the ore dock. During summer, the ships may discharge ballast water along the shipping route before arriving at the dock. In such cases only a partial load of ballast (in the order of 70,000 m3) will be discharged at the ore dock. A large concern associated with the discharge of ballast water from ships is the potential to introduce non-indigenous (not native to the area) biota into the marine environment. Biota including phytoplankton, zooplankton, invertebrates, and fish may be taken on board with the ballast water and then released at a new location, resulting in the possible introduction and colonization of species not native to the area. To avoid concerns associated with ballast water the Canadian Shipping Act requires the exchange of ballast water prior to entering Canadian waters.

6.9 Other Project-Specific Design Standards

These environmental standards shall be read in conjunction with the additional project-specific design criteria and documents shown below in Table 6-18.

Table 6-18: Project Specific Engineering Design Documents

Document Number	Engineering Design Document Title	Reference
	Process Flow Diagrams	
	Site Conditions Standard Specification	
	Meteorological and Seismic Data	
	Mechanical Equipment List	
	Process Design Criteria	
	Structural Design Criteria	

Document Number	Engineering Design Document Title	Reference
	Architectural Design Criteria	
	Piping Design Criteria	
	Operability/Maintainability/Layout Design Criteria	
	Electrical Design Criteria	
	Mechanical Design Criteria	
	Systems and Process Control Design Criteria	
	Clean Plant Design Criteria	
	Mine Closure and Reclamation Plan	Appendix 10G of FEIS
	Sewage Treatment Design Basis	Appendix 3B; Att. 3
	Potable Water Treatment Design Basis	Appendix 3B; Att. 3
	Storm Water Drainage Facilities Design Basis	Appendix 10D-5; Att.1
	Wastewater Treatment Design Basis	Appendix 3B; Att. 3
Note: To be populated as data references become available.		