	Terrestrial Environment Mitigation and Monitoring Plan	Issue Date: March 14, 2016 Rev.: 1	Page 1 of 128
	Environment	Document #: BAF-PH1-830-P16-0027	


# Baffinland Iron Mines Corporation

## Terrestrial Environment Mitigation and Monitoring Plan


**BAF-PH1-830-P16-0027**

**Rev 1**

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 3 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

## REVISIONS DETAILS

Date	Summary of Changes
February 2012	Original version presented in the Final Environmental Impact Statement, February 2012
08 May 2012	TEWG Meeting: BIM and QIA contract biologist (Kim Poole) meet to discuss general layout of TEMMP. Meeting minutes recorded
May 2012	Incorporation of Qikiqtani Inuit Association contract biologist (Kim Poole) comments. Included snow tracking survey to detect caribou deflections to movement.
23 May 2012	TEWG Meeting: BIM, EC, GNDoe, QIA teleconference to discuss TEMMP and Terrestrial Environment Working Group (TEWG)
	Draft Terrestrial Working Group Terms of Reference (ToR) distributed to TEWG for comments.
July 2012	Grammatical changes with no changes to content. Removed FEIS-type headers to make this a stand-alone document. This document now supersedes FEIS Appendix 10D-11
October 2012	<p>Include a description of the Terrestrial Environment Working Group in the Roles and Responsibilities Section</p> <p>Incorporate caribou mitigation measures initially identified in the Mary River Water Licence Application Attachment 5: Environmental Protection Plan, Appendix 10B. Caribou mitigation identified in this TEMMP supersedes mitigation identified in the water licence Attachment 5: Environmental Protection Plan, Appendix 10B.</p> <p>Include the May 2012 Draft ToR for the TEWG</p> <p>Appendices providing more detailed description of some monitoring plans, including methods where currently available.</p> <p>Included monitoring requirements from the September 2012 NIRB Project recommendation.</p> <p>Seabird section deleted, moved to MEMMP.</p>
May 2013	Addition of Project terms and conditions table with cross-references to sections of TEMMP, compliance linking, updates to meet terms and conditions, some formatting. Formatting for submission as an appendix to the FEIS addendum (for the Early Revenue Program).
October 2013	Included figures for dust fall collection, methods for dust fall collection, draft material for caribou height of land surveys. Updated mailing address in footer. Terms and conditions sub-terms (e.g., a), b), c)) corrected to match Project Certificate 005
December 2013 -- January 2014	Incorporated commitments made during technical review for the Early Revenue Plan (ERP) — includes various mitigation and monitoring for caribou along the Tote Road, incorporation of the Caribou Decision Tree, and additional detail on the dust fall and vegetation monitoring programs, among others. Included reference to North Baffin Regional Land Use Plan.
June 2014	Roles and Responsibilities table updated to match CEPP.
September 2014 – February 2015	<p>Incorporate updated Project terms and conditions from the NIRB Public Hearing Report for the Mary River Project Early Revenue Phase Proposal, March 2014;</p> <p>Include Project commitments table;</p> <p>Addressed GN's TEMMP comments from April 2014</p>

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 4 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

Date	Summary of Changes
	Update vegetation sections (Appendix B 4-1 and 4-2) Update Roles and Responsibilities table for onsite environmental staff
March 2016	Overall editing for operational sensibility. Incorporated changes suggested during TEWG meetings, adjust monitoring plans and schedules. Updated vegetation monitoring plan based on statistical power analyses and power to detect change. Update to cliff nesting raptor monitoring program with a focus from mine site north to Milne Inlet. Distance bins. In response to request from EC, included EC Conservation Officer contact information for reporting project-related mortality of migratory birds. To add context to existing vegetation and wildlife protection measures, expanded discussion of federal and territorial acts and regulations applicable to management and protection of vegetation and wildlife. Included methods for cliff nesting raptor monitoring from the mine site north to Milne Inlet port. Updated methods, such as Height of Land.

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 5 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

## TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION.....</b>	<b>11</b>
1.1	Purpose.....	11
1.2	Regulatory Requirements .....	11
1.2.1	Territorial Legislation.....	11
1.2.2	Territorial Management Plans and Strategies, and Other Regulatory Instruments .....	12
1.2.3	Federal Legislation.....	15
1.2.4	International Conventions and Agreements .....	16
1.3	Project Commitments .....	16
1.4	Project Terms and Conditions.....	16
1.5	Relationship to Other Management Plans .....	34
1.6	Baffinland’s Commitment .....	34
1.7	Roles and Responsibilities.....	34
1.7.1	Terrestrial Environment Working Group .....	34
1.8	Specialists.....	35
1.9	Incorporation of Inuit Qaujimajatuqangit.....	35
1.10	Update of the TEMMP.....	35
<b>2</b>	<b>KEY INDICATORS FOR FOLLOW-UP MONITORING.....</b>	<b>40</b>
2.1	Vegetation.....	40
2.2	Birds.....	41
2.3	Terrestrial Wildlife.....	42
<b>3</b>	<b>MITIGATION MEASURES.....</b>	<b>43</b>
3.1	Vegetation.....	43
3.1.1	General Mitigation for Vegetation .....	43
3.2	Birds.....	44
3.2.1	General Mitigation for Birds .....	44
3.2.2	Reporting Migratory Bird Mortalities .....	46
3.2.3	Predation .....	46
3.2.4	Aircraft .....	46
3.2.5	Nest Management Plans .....	47
3.3	Terrestrial Wildlife.....	51


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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 6 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

3.3.1	Habitat Mitigation .....	51
3.3.2	Aircraft .....	52
3.3.3	Movement Mitigation.....	52
3.3.4	Mortality Mitigation .....	53
3.3.5	Railway-specific Mitigation.....	55
3.3.6	Tote Road-specific Mitigation.....	55
3.3.7	Health Mitigation .....	55
3.3.8	Other Mitigation.....	55
<b>4</b>	<b><i>MONITORING FRAMEWORK</i></b> .....	<b>59</b>
4.1	<b>Monitoring Principles</b> .....	<b>59</b>
4.2	<b>Monitoring Framework Overview</b> .....	<b>59</b>
4.3	<b>Vegetation Monitoring</b> .....	<b>61</b>
4.4	<b>Birds Monitoring</b> .....	<b>64</b>
4.5	<b>Terrestrial Wildlife Monitoring</b> .....	<b>67</b>
4.5.1	Caribou Habitat Monitoring.....	67
4.5.2	Caribou Movement.....	70
4.5.3	Caribou Mortality .....	71
4.5.4	Caribou Health .....	72
4.6	<b>Wolf-specific Monitoring</b> .....	<b>74</b>
4.7	<b>Monitoring for all Wildlife Species</b> .....	<b>74</b>
<b>5</b>	<b><i>REPORTING</i></b> .....	<b>76</b>
<b>6</b>	<b><i>ADAPTIVE STRATEGIES</i></b> .....	<b>76</b>
<b>7</b>	<b><i>REFERENCES</i></b> .....	<b>77</b>
<b>Appendix A.</b>	<b><i>Terrestrial Environment Working Group Terms of Reference</i></b> .....	<b>78</b>
<b>Appendix B.</b>	<b><i>Monitoring Details and Methods</i></b> .....	<b>86</b>
4-1	<b>Vegetation Monitoring: Exotic Invasive Vegetation and Natural Revegetation</b> .....	<b>87</b>
4-2	<b>Vegetation Monitoring: Vegetation Health</b> .....	<b>91</b>
4-3	<b>Vegetation Monitoring: Dust fall</b> .....	<b>104</b>
4-4	<b>Migratory Bird Monitoring: Peregrine Falcon and Gyrfalcon Nesting</b> .....	<b>111</b>
4-5	<b>Migratory Bird Monitoring: Nesting of Common and King Eider, and Red Knot</b> .....	<b>117</b>
4-6	<b>Migratory Bird Monitoring: Songbirds and Shorebirds</b> .....	<b>117</b>

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 7 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

<b>4-7</b>	<b>Caribou Monitoring: Indirect Habitat Loss .....</b>	<b>117</b>
<b>4-8</b>	<b>Caribou Monitoring: Habitat Use during Calving.....</b>	<b>117</b>
<b>4-9</b>	<b>Caribou Monitoring: Movement.....</b>	<b>125</b>
<b>4-10</b>	<b>Caribou Monitoring: Harvest-related Mortality.....</b>	<b>126</b>
<b>4-11</b>	<b>Caribou Monitoring: Health Contaminants and Body Condition .....</b>	<b>126</b>
<b>4-12</b>	<b>Wolf Monitoring: Den Sites .....</b>	<b>127</b>
<b>4-13</b>	<b>Wildlife Monitoring: Direct Habitat Loss .....</b>	<b>127</b>
<b>4-14</b>	<b>Wildlife Monitoring: Incidental Observations and Project Mortality Wildlife Log.....</b>	<b>127</b>

## LIST OF TABLES

Table 1-1.	Project Commitments Relevant to the Mary River Project’s Terrestrial Ecosystem Mitigation and Monitoring Plan as outlined in Appendix A of the NIRB Final Hearing Report (2012).....	17
Table 1-2.	NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan.....	22
Table 1-3.	Roles and Responsibilities (February 16, 2015) .....	39
Table 2-1.	Key Indicators for Follow-up Monitoring.....	40
Table 3-1.	Recommended Setback Distances for Activity near Active Bird Nests.....	49
Table 4-1.	Monitoring Framework — Overview and Definitions .....	60
Table 4-2.	Vegetation Monitoring: Exotic Invasive Vegetation and Natural Revegetation.....	62
Table 4-3.	Vegetation Monitoring: Vegetation Health.....	63
Table 4-4.	Vegetation Monitoring: Dust fall.....	64
Table 4-5.	Migratory Bird Monitoring: Peregrine Falcon and Gyrfalcon Nesting.....	65
Table 4-6.	Migratory Bird Monitoring: Nesting of Common and King Eider, and Red Knot.....	66
Table 4-7.	Migratory Bird Monitoring: Songbirds and Shorebirds .....	66
Table 4-8.	Caribou Monitoring: Indirect Habitat Loss .....	68
Table 4-9.	Caribou Monitoring: Habitat Use during Calving.....	69
Table 4-10.	Caribou Monitoring: Movement.....	71
Table 4-11.	Caribou Monitoring: Harvest-related Mortality.....	72
Table 4-12.	Caribou Monitoring: Health Contaminants and Body Condition.....	73
Table 4-13.	Wolf Monitoring: Den sites .....	74

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 8 of 128
	<b>Environment</b>	<b>Document #: BAF-PH1-830-P16-0027</b>	

Table 4-14.	Wildlife Monitoring: Direct Habitat Loss.....	75
Table 4-15.	Wildlife Monitoring: Incidental Observations and Project Mortality.....	75
Table 7-1.	Thresholds Identified for CoPCs in Soils and Lichen — Vegetation and Soil Base Metals Monitoring Program. ....	100
Table 7-2.	Dust (TSP) Deposition Rates and Criteria for Potential Effects on Vegetation Health. ....	106
Table 7-3.	Height of Land Monitoring Stations in the vicinity of the Mary River Project.....	119
Table 7-4.	Example summary table where details of Height of Land surveys conducted in the Mary River Project study would be summarized on an annual basis.....	120
Table 7-5.	Height of Land survey form C1 is used during all HoL surveys. If Caribou are observed during a survey, form C2 is triggered.....	122
Table 7-6.	Height of Land survey form C2 is used when caribou are observed during a HoL survey, resulting in a lengthy and detailed observation of the caribou.....	123
Table 7-7.	Wildlife Log 2008 Wildlife Monitoring Program Mary River Project.....	128

## LIST OF FIGURES

Figure 1-1.	Baffinland Iron Mines Corporation’s Sustainable Development Policy.....	38
Figure 3-1.	Snow Goose Area Area.....	50
Figure 3-2.	Caribou Disturbance Decision Tree .....	58
Figure 7-1.	Schematic diagram showing the location of sampling sites along a transect.....	93
Figure 7-2.	Diagram showing a typical plot where the point quadrat method is used to measure percent plant cover.....	93


## LIST OF MAPS

Map 1.	Dust fall sample locations for the Project Area. ....	110
Map 2.	Cliff-nesting Raptor Project Effects Study Area. ....	116
Map 3.	Height of Land Survey Stations in the Vicinity of the Mary River Project.....	124


## LIST OF APPENDICES

Appendix A.	Terrestrial Environment Working Group Terms of Reference
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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 9 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

Appendix B. Monitoring Details and Methods

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 10 of 128
	<b>Environment</b>	<b>Document #: BAF-PH1-830-P16-0027</b>	

## ABBREVIATIONS

BACI.....	Pairwise Before-After-Control-Impact
Baffinland.....	Baffinland Iron Mines Corporation
BIM.....	Baffinland Iron Mines Corporation
CCME.....	Canadian Council Ministers of Environment
CITES.....	Convention on International Trade in Endangered Species
COSEWIC.....	Committee on the Status of Endangered Species in Canada
CoPC.....	Chemical of potential concern
CWS.....	Canadian Wildlife Service (Environment Canada)
EC.....	Environment Canada
EEM.....	Environmental Effects Monitoring
EHS.....	Environmental, Health, and Safety
EIS.....	Environmental Impact Statement
EPP.....	Environmental Protection Plan
ERP.....	Early Revenue Plan
FEIS.....	Final Environmental Impact Statement
GNDoe.....	Government of Nunavut Department of Environment
HTO.....	Hunter and Trapper Organization
IQ.....	Inuit Qaujimagatuqangit
KI.....	Key Indicator
LSA.....	Local Study Area
Project.....	Mary River Project
MEMMP.....	Marine Environmental Mitigation and Monitoring Plan
Mtpa.....	million tonnes per annum
NIRB.....	Nunavut Impact Review Board
PDA.....	Project development area
QIA.....	Qikiqtani Inuit Association
RSA.....	Regional Study Area
SARA.....	Species at Risk Act
TEMMP.....	Terrestrial Environment Mitigation and Monitoring Plan
TEWG.....	Terrestrial Environment Working Group
ToR.....	Terms of Reference
TSP.....	Total suspended particulates
VEC.....	Valued Ecosystem Component
ZOI.....	Zone of Influence

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 11 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

# 1 INTRODUCTION

## 1.1 PURPOSE

The Terrestrial Environment Mitigation and Monitoring Plan (TEMMP) describes mitigation and monitoring actions Baffinland Iron Mines Corporation (Baffinland) uses so the Mary River Project (Project) has no net adverse impacts on the terrestrial environment. The TEMMP provides guidance to protect and limit disturbances to vegetation, birds and terrestrial wildlife from Project activities.

The TEMMP is a “living” document and is revised regularly as new information becomes available, methods are developed, or management issues become apparent and need to be addressed. Further details will continue to be developed in continued discussion with the management agencies, Qikiqtani Inuit Association (QIA), community Hunter and Trapper Organizations (HTO), the Terrestrial Environment Working Group (TEWG) and other involved parties.

## 1.2 REGULATORY REQUIREMENTS

There are a number of existing acts, regulations and laws that Baffinland must follow, the guidelines and requirements of which have been adapted in this TEMMP. Highlights of the various acts, regulations, land use plans and management guidance documents that are related to the management and protection of vegetation and wildlife are described below.

### 1.2.1 TERRITORIAL LEGISLATION


#### 1.2.1.1 NUNAVUT WILDLIFE ACT

The *Nunavut Wildlife Act* (Government of Nunavut 2005) and applicable regulations that came into effect in July 2015, is territorial legislation established for the management of wildlife and habitat in Nunavut, including the conservation, protection and recovery of species at risk. The Act applies to all terrestrial and aquatic wildlife and their habitat. The Government of Nunavut Department of Environment has a legislated mandate for the management of terrestrial species in Nunavut and is responsible for fulfilling GN responsibilities under federal legislation, and national and international agreements and conventions.

**Harvest** — Section 10(1) identifies the Inuit right to harvest subject to where harvesting does not exceed his or her basic needs level or where a total allowable harvest for a population is established. Section 10(2) further states that where a total allowable harvest for a population is

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 12 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

not established, than an Inuk can harvest, without exceeding, their full economic, social and cultural needs. Section 10(4) states that non-quota limitations established on Inuit shall not unduly or unreasonably constrain their harvesting activities. Section 11 states that “...*all Inuit have the free and unrestricted right of access for the purpose of harvesting wildlife to all lands within Nunavut.*” The right of access is excluded within a radius of 1.6 km of any building, structure or other facility on lands under a surface lease (11(2)(f)). The right of access may also be limited by the Nunavut Wildlife Management Board (NWMB) for the purposes of conservation (11(3)(b)). Section 11(4) states that “*Pursuant to the Agreement, any term of an employment contract that attempts to limit an Inuk’s rights of access to wildlife or harvesting of wildlife during the Inuk’s leisure hours shall be null and void.*” Section 120(1) identifies the NWMB as the authority in the Nunavut Settlement Area that establishes levels of total allowable harvest or harvesting. Section 121 states that the Minister may establish limits on the quantity of wildlife that may be harvested where necessary to implement a decision of the NWMB or where the Minister considers it necessary or advisable in respect to those matters within the jurisdiction of the Government of Nunavut.

## 1.2.2 TERRITORIAL MANAGEMENT PLANS AND STRATEGIES, AND OTHER REGULATORY INSTRUMENTS


### 1.2.2.1 DRAFT NUNAVUT CARIBOU STRATEGY FRAMEWORK (MARCH 2010)

The Government of Nunavut prepared a draft caribou strategy framework in 2010 to “...*lay the foundation for future programs and decisions affecting caribou and people...*” It reiterates that The Government of Nunavut, through the NLCA and the Nunavut Wildlife Act has legislated responsibility for the management of caribou and caribou habitat, and that the responsibilities include research and monitoring, harvest management, habitat management, land-use planning and environmental impact assessment.

The strategy was developed in part to address uncertainties about where and how to develop to avoid sensitive habitats and direct conflict. The strategy identified the need for more investment in research and monitoring, supporting informed decision making, and implementing measures to manage development. Informed decision making is facilitated through Action Item 2.3 that identifies working with industry to make data and information readily available for baseline and impact assessment studies. Action Item 3.1 suggests that there will be development of a set of general guidelines for mitigation development impacts on caribou, and the development of recommendations on the methods and research standards to adequately monitor and mitigate impacts on caribou around development sites. Action Item 3.1 also suggests working with industry to integrate local monitoring into herd-level research programs to support future sustainable development and caribou management.

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 13 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

### 1.2.2.2 NORTH BAFFIN REGIONAL LAND USE PLAN (APPROVED JUNE 2000), CARIBOU PROTECTION MEASURES

The North Baffin Regional Land Use Plan (Nunavut Planning Commission 2000) is in effect for the northern part of the Project area, roughly from the mine site north. The primary purpose of the land use plan is to ensure the well-being of the communities and permanent residents of the North Baffin Planning Region, while still taking into account the interests of all Canadians.

Vegetation and wildlife concerns addressed in the land use plan include the following:

- The need to conserve wildlife species, habitat and community harvesting areas;
- The desire for completion of a region-wide protected areas system;
- The need to resolve conflicts between mineral exploration parties requiring access to land, and the wildlife and community uses of that land;
- The communities are particularly concerned that no land use activity disturb or deplete habitat or wildlife to such an extent that populations could not fulfill continuing harvest needs.


Vision statements for the plan related to mining effects include the following:

- The renewable resource-based lifestyle of the residents will be maintained;
- Wildlife populations will be managed so that they continue to meet the needs of the young and growing population;
- Research into sustained yield, and into the effects of development on wildlife, will lead to improved land and resource management.
- The concept of sustainable development will be widely applied, through the conservation of the region's natural and cultural resources, the establishment of protected areas, and the promotion of self-reliant, long-term, sustainable economic growth in both the renewable and nonrenewable sectors.

Land Use Planning Objectives include:

- Ensuring that the effects of any land use activity do not threaten the sustainable wildlife harvest.

All discussion related to terrestrial environment wildlife in the Land Use Plan is centered on the sustainability of caribou and assurances that project effects do not hinder the sustainable harvest of caribou.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 14 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

Particular to caribou, Land Use Term 3.3.7 states

- Development activities shall be prohibited within all caribou calving areas during calving season, as well as caribou water crossings in the North Baffin region. The QIA and DIAND shall implement caribou protection measures on Inuit Owned and Crown lands respectively. These protection measures should follow the proposed measures found in Appendix I [of the land use plan].


And term 3.4.5 states:

- The NPC, the NWMB, NIRB, DIAND, Inuit land managers and DSD [GN] should work together to monitor the effectiveness of the caribou protection measures and compliance, and to determine whether special protected areas for caribou are required.

Caribou Protection Measures (Department of Indian Affairs and Northern Development 1978; Appendix I of North Baffin Regional Land Use Plan) apply to the Project area. The protection measures restrict:

- Activities, without approval, between 15 May and 15 June within the caribou protection areas as depicted on the 1978 'Caribou Protection Map [these areas exist only on mainland Nunavut, no areas are identified on Baffin Island].
- The location of any operation that will block or divert seasonal migrations
- Activities that will interfere with seasonal migrations, and that those activities must cease until migrating caribou have passed
- Activities within 10 km of designated caribou water crossings from 15 May and 1 September [there are no designated water crossings on Baffin Island].

Adaptations of these caribou protection measures to make them specific to north Baffin Island caribou were discussed between Baffinland and the QIA in January 2014. The discussions resulted in enhancements to measures that were included in the January 2014 update of the TEMMP, and a commitment to adapt to changing caribou presence in the project area as the herd numbers are expected to increase in the future.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 15 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

### 1.2.3 FEDERAL LEGISLATION

#### 1.2.3.1 NUNAVUT LAND CLAIMS AGREEMENT

Under the NLCA, the government has the ultimate responsibility for wildlife. The GN Department of the Environment is the lead GN Agency in fulfilling Government obligations with respect to wildlife in Nunavut.

The Nunavut Wildlife Management Board (NWMB) is the main instrument of wildlife management and the main regulator of access to wildlife in Nunavut. Among the functions of the Board is the establishment, modification or removal of total allowable harvest (TAH) levels. The exercise of harvesting by Inuit is overseen by the Regional Wildlife Organizations (RWO) and the community-based Hunters and Trappers Organizations (HTO). Powers and functions of the HTO include regulation of harvest technique, allocation and enforcement of community basic needs and management among members. Section 5.2.1 (i) of the NLCA states that government retains the ultimate responsibility for wildlife management. Project Monitoring is identified in Section 12.7.1 to 12.7.5; contribution to General Monitoring identified in Section 12.7.6.


#### 1.2.3.2 SPECIES AT RISK ACT

The *Species at Risk Act* (SARA) is federal legislation that “*provides for the legal protection of wildlife species and the conservation of the biological diversity*” (SARA website). The SARA is designed to prevent the extirpation and/or extinction of wildlife species through formal protection measures identified through a species recovery planning process. The plans are designed to identify actions that will lead to the recovery of species of conservation concern. Schedule 1 of the SARA lists the status of species of conservation concern under four risk categories: extirpated, endangered, threatened, and species of special concern. Once a species is listed on Schedule 1 of the SARA, individuals of these species are protected from “killing, harming, harassing, capturing, taking, possessing, collecting, buying, selling or trading” (SARA website). Recovery or management plans are required for listed species.

Under the SARA, persons/organizations who are “required by or under an Act of Parliament to ensure that an assessment of the environmental effects of a project is conducted” must inform the competent minister if a project “...*is likely to affect a listed wildlife species*” (Subsection 79[1]). Further, those persons/organizations are required to “...*identify the adverse effects of the project on the listed wildlife species and its critical habitat and, if the Project is carried out, must ensure that measures are taken to avoid or lessen those effects and to monitor them. The*

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 16 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

measures must be taken in a way that is consistent with any applicable recovery strategy and action plans” (Subsection 79[2]). Monitoring is identified in Section 79 (2).

#### 1.2.4 INTERNATIONAL CONVENTIONS AND AGREEMENTS

##### 1.2.4.1 MIGRATORY BIRDS CONVENTION ACT

The *Migratory Birds Convention Act* (Section 5) provides “...for the protection of migratory birds through the *Migratory Birds Regulations*.” The Act protects migratory populations, individuals and their nests (1994, c. 22, s. 4; 2005, c. 23, s. 3) through prohibition of:

- Possession of a migratory bird or nest
- The purchase, sale or exchange of migratory birds or nests
- Deposition of substances into waters that is harmful to migratory birds, or in a location where the substance can enter waters, without appropriate authorizations

#### 1.3 PROJECT COMMITMENTS

At the Nunavut Impact Review Board (NIRB) Final Hearing, a commitment list was confirmed by the parties involved and provided in the NIRB’s Final Hearing Report for the Project, Appendix A. Baffinland honors the commitments and will fulfil them as part of mitigation and monitoring for the Mary River Project. To support transparency and accountability as associated with Baffinland’s commitments, Table 1-1 provides a list of the commitments and areas in the TEMMP or other plans that address the commitments.

#### 1.4 PROJECT TERMS AND CONDITIONS

Project Certificate No 005 (issued May 28, 2014) authorizes Baffinland to mine up to 22.2 million tonnes per annum (Mtpa) of iron ore from Deposit No. 1, to ship up to 18 Mtpa of iron ore by railway and Steensby Port via the Southern Shipping Route (Foxe Basin – Hudson Strait), and to ship up to 4.2 Mtpa of iron ore by the Tote Road and Milne Port via the Northern shipping route (Milne Inlet – Eclipse Sound – Baffin Bay). The certificate included 184 conditions, many of which require Baffinland to gather additional information to enhance the terrestrial environment baseline data and to start effects monitoring identified in the TEMMP. The terms and conditions relevant to the terrestrial environment, with cross-reference to where the terms are addressed are summarized in Table 1-2.

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**Table 1-1. Project Commitments Relevant to the Mary River Project’s Terrestrial Ecosystem Mitigation and Monitoring Plan as outlined in Appendix A of the NIRB Final Hearing Report (2012).**

Commitment No.	Subject	Commitment	Issue raised by (date of commitment)	Project Phase/Timing	Area(s) addressed	
					Mitigation	Monitoring
<b>Vegetation Category</b>						
39	Design (Abandonment & Restoration)	Baffinland is committed to investigating and exploring the potential for native species of flora to be used for re-vegetating areas disturbed within the Project area.	Baffinland/GN (July 26, 2012)	All/closure	Mine Closure Plan	
60	Air Quality (Fugitive Dust from Railway Shipping)	Baffinland is committed to monitoring fugitive dust emissions on vegetation along the first few kilometres of the Railway leaving both terminals (Mary River and Steensby Inlet). This monitoring will be extended if it is identified that other areas of the project site are also being impacted by fugitive dust emissions	EC (July 16, 2012)	All	Section 3.1 Mitigation Measures: Vegetation	Table 4-4
67	Monitoring Plans (Vegetation)	Baffinland is committed to carrying out the monitoring plans for native plant species and vegetative health.	Baffinland (July 19, 2012)	operations/ abandonment and reclamation	Section 3.1 Mitigation Measures: Vegetation	Table 4-3
68	Vegetation (Invasive Species / Re-vegetation Studies)	Baffinland is committed to examining invasive species as well as carry out reclamation experiments on re-vegetation options and practices within the Mary River Project area.	Baffinland (July 16, 2012; July 23, 2012)	All	Section 3.1 Mitigation Measures: Vegetation	Table 4-2
<b>Terrestrial Wildlife and Habitat Category</b>						

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 18 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

**Table 1-1. Project Commitments Relevant to the Mary River Project's Terrestrial Ecosystem Mitigation and Monitoring Plan as outlined in Appendix A of the NIRB Final Hearing Report (2012).**

Commitment No.	Subject	Commitment	Issue raised by (date of commitment)	Project Phase/Timing	Area(s) addressed	
					Mitigation	Monitoring
15	Design (Railway-Caribou)	Baffinland is committed to creating crossings along the Railway track which facilitate the passage of caribou.	Baffinland (July 23, 2012)	Operations	Section 3.3.3 Movement Mitigation	Section 4.5.2 Caribou Movement
40	Monitoring (Abandonment and Restoration)	Baffinland is committed to undertaking environmental effects monitoring during the mine life mine as well as after closure.	NIRB (July 23, 2012)	All		Table 4-1
46	Working Group	Baffinland is committed to participating in formal, stakeholder working groups, such as terrestrial environment and marine environment working groups, as established within and/or outside of the scope of the IIBA, to gain input, insight, advice and oversight from stakeholders throughout the life of the project and to ensure that adaptive management principles are applied accordingly.	Baffinland (July 16, 2012)	All	Agency/Partner participation identified monitoring framework tables (Section partnership opportunities discussed in the Terrestrial Environment Working Group)	
57	Management Plans	Baffinland is committed to updating its management plans to reflect new information, new practices and changes to operating conditions.	Baffinland (July 17, 2012)	All	The TEMMP is updated on a regular basis (Section 1.1)	
58	Monitoring	Baffinland is committed to contributing to regional monitoring and information gathering.	NIRB (July 16, 2012)	All		Affirmed in Section 4

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**Table 1-1. Project Commitments Relevant to the Mary River Project’s Terrestrial Ecosystem Mitigation and Monitoring Plan as outlined in Appendix A of the NIRB Final Hearing Report (2012).**


Commitment No.	Subject	Commitment	Issue raised by (date of commitment)	Project Phase/Timing	Area(s) addressed	
					Mitigation	Monitoring
66	Monitoring	Baffinland is committed to the development and implementation of a monitoring program during the construction and other phases of the Mary River Project.	EC (July 23, 2012)	Construction/All		Table 4-1
69	Terrestrial (Monitoring)	Baffinland is committed to undertaking the required or relevant monitoring for both terrestrial wildlife and vegetation throughout the life of the Mary River Project to verify predictions made as well as to confirm compliance with applicable regulations. The information would be used to support adaptive management strategies and required mitigation measures.	Baffinland (July 16, 2012)	Operations	Section 3 Mitigation Measures	Table 4-1
70	Terrestrial (Management Plan)	Baffinland is committed to developing and implementing a Terrestrial Environment Management Plan and track progress of the plan to assist in guiding adaptive management strategies slated for implementation at the Mary River Project.	Baffinland/GN (July 16, 2012)	Operations		Section 6 Adaptive Strategies

**Table 1-1. Project Commitments Relevant to the Mary River Project’s Terrestrial Ecosystem Mitigation and Monitoring Plan as outlined in Appendix A of the NIRB Final Hearing Report (2012).**

Commitment No.	Subject	Commitment	Issue raised by (date of commitment)	Project Phase/Timing	Area(s) addressed	
					Mitigation	Monitoring
71	Railway (Caribou Mortality)	Baffinland is committed to investigating any mortality to caribou resulting from project activity, and to investing in a precautionary monitoring and adaptive management program to mitigate caribou responses to development activities.	QIA (July 16, 2012; July 17, 2012)	Operations	Section 3.3.4 Mortality Mitigation	Table 4-15
72	Railway (Caribou Mortality)	Baffinland is committed to implementing appropriate measures to ensure that all caribou carcasses linked to the project activities are discarded in accordance with applicable regulations and guidelines.	Arctic Bay Community Member (July 19, 2012)	All	Section 3.3.4 Mortality Mitigation	Table 4-15
73	Railway (Caribou Mortality)	Baffinland is committed to implementing traffic controls along the Railway if it is determined that the caribou mortality rate is impacted by the Railway.	Baffinland (July 16, 2012)	Operations	Section 3.3.4 Mortality Mitigation	Table 4-15
74	Monitoring (Wolves)	Baffinland is committed to monitoring the effects of the Mary River Project on wolf and wolf denning areas.	Baffinland (July 23, 2012)	All	Section 3.3.1 Habitat Mitigation	Table 4-13
75	Monitoring (Birds)	Baffinland is committed to monitoring relevant sections of the project area for nesting and migration activities, noting both areas and patterns, for Falcons, Eiders, Red Knots, sea birds, song birds and shore birds.	Baffinland (July 19, 2012)	All	Section 3.3.2 Aircraft	Table 2-1

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 21 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

**Table 1-1. Project Commitments Relevant to the Mary River Project’s Terrestrial Ecosystem Mitigation and Monitoring Plan as outlined in Appendix A of the NIRB Final Hearing Report (2012).**

Commitment No.	Subject	Commitment	Issue raised by (date of commitment)	Project Phase/Timing	Area(s) addressed	
					Mitigation	Monitoring
76	Monitoring (Birds)	Baffinland is committed to carrying out monitoring over the next few years to look at other types of birds not considered during other research for the Mary River Project.	Hall Beach HTO (July 19, 2012)	All	Section 3.3.1 Habitat Mitigation	Section 2.2 Birds Table 4-5 Table 4-6 Table 4-7

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 22 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project's Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
<b>Vegetation</b>			
31	The Proponent shall ensure that Project activities are planned and conducted in such a way as to minimize the Project footprint.	Section 3 Mitigation Measures	Section 4.7 Monitoring for all Wildlife Species Table 4-14
32	The Proponent shall ensure that equipment and supplies brought to the Project sites are clean and free of soils that could contain plant seeds not naturally occurring in the area. Vehicle tires and treads in particular must be inspected prior to initial use in Project areas.	Section 3.1.1 Construction Environmental Protection Plan	Section 4.3 Vegetation Monitoring Table 4-2 Appendix B 4-1
33	The Proponent shall include relevant Monitoring and Management Plans within its Environmental Management System, Terrestrial Environment Management and Monitoring Plan (TEMMP).	The TEMMP addresses Project Condition 33	
34	The Proponent shall conduct soil sampling to determine metal levels of soils in areas with berry-producing plants near any of the potential development areas, prior to commencing operations.		Table 4-3
35	The Proponent shall undertake monitoring of baseline metal levels in organ tissue from caribou harvested within the local study area, prior to commencing operations. The proponent is strongly encouraged to coordinate with local Hunters and Trappers Organizations regarding procurement of harvested caribou organs.		Table 4-12
36	The Proponent shall establish an on-going monitoring program for vegetation species used as caribou forage (such as lichens) near Project development areas, prior to commencing operations		Table 4-3

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	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
37	The Proponent shall incorporate protocols for monitoring for the potential introduction of invasive vegetation species (e.g. surveys of plant populations in previously disturbed areas) into its Terrestrial Environment and Monitoring Plan. Any introductions of non-indigenous plant species must be promptly reported to the Government of Nunavut Department of Environment.	3.1 Mitigation Measures: Vegetation	Table 4-2
38	The Proponent shall review, on an annual basis, all monitoring information and the vegetation mitigation and management plans developed under its Environmental Management System, Terrestrial Environment and Monitoring Plan (TEMMP) and adjust such plans as may be required to effectively prevent or reduce the potential for significant adverse project effects on vegetation abundance, diversity and health.	Section 6 Adaptive Strategies	
39	The Proponent shall develop a progressive revegetation program for disturbed areas that are no longer required for operations, such program to incorporate measures for the use of test plots, reseeded and replanting of native plants as necessary. It is further recommended that this program be directly associated with the management plans for erosion control established for the Project.	Mine Closure Plan	
40	The Proponent shall include revegetation strategies in its Site Reclamation Plan that support progressive reclamation and that promote natural revegetation and recovery of disturbed areas compatible with the surrounding natural environment.	Mine Closure Plan	

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**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
<b>Terrestrial Wildlife and Habitat</b>			
49	The Proponent shall establish a Terrestrial Environment Working Group ("TEWG") which will act as an advisory group in connection with mitigation measures for the protection of the terrestrial environment and in connection with its Environmental Effects Monitoring Program, as it pertains to the terrestrial environment. Members may consider the draft terms of reference for the TEWG filed in the Final Hearing, but they are not bound by them. The role of the TEWG is not intended to either duplicate or to affect the exercise of regulatory authority by appropriate government agencies and departments.	Appendix A	
50	The Proponent shall continue to develop and implement Project-specific monitoring for the terrestrial environment, and will demonstrate appropriate refinements to design, incorporation of analytical methods and elaboration of methodologies. The monitoring plan shall contain clear thresholds to allow for the assessment of long-term trends and cumulative effects where project interactions are identified. Coordination and cooperation will be required where data collection, analysis and interpretation, or responsibility for mitigation and management requires the efforts of multiple parties (e.g., government, Qikiqtani Inuit Association, communities).	Current version of the Terrestrial Environment Mitigation and Monitoring Plan (this document)	
51	The Proponent, either directly or as part of the TEWG, shall consider and, where appropriate, cooperate with relevant regional and/or community-based monitoring initiatives that raise issues or produce information pertinent to mitigating project-induced impacts. The Proponent shall give special consideration for supporting regional studies of population health and harvest programs for North Baffin caribou which help address areas of uncertainty for Project impact predictions.	Agency/Partner Participation identified monitoring framework tables partnership opportunities discussed in Terrestrial Ecosystem Working Group (Appendix A)	

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**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
52	<p>Within 3 months of issuance of the Project Certificate, the Proponent shall initiate design, and develop the timeline to test and implement means of deterring caribou from pits and other hazardous areas. A review of best practices and techniques will be undertaken at other Northern mines where interactions with caribou occur. Considerations should include temporary ribbon placement, inuksuks, or fencing and subsequent monitoring for effectiveness. These activities shall be reported back to the Terrestrial Environment Working Group.</p>		Table 4-10
53	<p>The Proponent shall demonstrate consideration for the following:</p> <ul style="list-style-type: none"> <li>a. Steps taken to prevent caribou mortality and injury as a result of train and vehicular traffic, including operational measures meant to maximize the potential for safe traffic relative to operations on the railway, Milne Inlet, Tote Road, and associated access roads.             <ul style="list-style-type: none"> <li>i. Specific measures intended to address the reduced effectiveness of visual protocols for the Milne Inlet Tote Road and access roads/trails during times of darkness and low visibility must be included.</li> </ul> </li> <li>b. Monitoring and mitigation measures at points where the railway, roads, trails and flight paths pass through caribou calving areas, particularly during caribou calving times. The details of these monitoring and mitigation measures shall be developed in conjunction with the Terrestrial Environment Working Group.</li> <li>c. Evaluation of the effectiveness of proposed caribou crossings over the railway, Milne Inlet Tote Road and access roads as well as the appropriate number.</li> <li>d. Development of a surveillance system along the railway corridor to identify the presence of caribou in proximity to the train tracks and operational</li> </ul>	a. Figure 3-2	<ul style="list-style-type: none"> <li>b. Table 4-9</li> <li>c. Table 4-10</li> <li>d. This condition is not relevant until construction of the railway</li> <li>e. Table 4-15</li> </ul>

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**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
	<p>protocols for the train to avoid collisions and enable caribou to cross the train tracks unimpeded.</p> <p>e. Protocols for documentation and reporting of all caribou collisions and mortalities, as well as mechanisms for adaptive management responses designed to prevent further such interactions.</p>		
54	<p>The Proponent shall provide an updated Terrestrial Environmental Management and Monitoring Plan which shall include, but not be limited to the following:</p> <p>a. Details of the methods and rationale for conducting monitoring prior to the commencement of construction;</p> <p>b. Monitoring for caribou presence and behavior during railway and Tote Road construction.</p> <p>c. Description and justification of statistical design or other means of determining effect and proposed analyses to support the conclusions drawn from monitoring impacts of the mine and related infrastructure on wildlife;</p> <p>d. Details of monitoring and mitigation activities, which should be established in collaboration with the Terrestrial Environment Working Group and are expected to include: :</p> <p>i. Dust fall (fugitive and Total Suspended Particulates), that addresses methods to reduce risk to caribou forage from dust fall;</p> <p>ii Snow track surveys during construction and the use of video-surveillance to improve the predictability of caribou exposure to the railway and Tote Road. Using the result of this information, an early warning system for caribou on the railway and Tote Road shall be developed for operation.</p> <p>e. Details of monitoring thresholds related to level of mitigation and management;</p>	<p>c. Section 3 Mitigation Measures</p>	<p>a. Section 4 Monitoring Framework  b. Table 4-8, Table 4-9, Table 4-10  d. Table 4-14  di. Section 4.3 Vegetation Monitoring  dii. Appendix B 4-9  e. Monitoring thresholds listed in all of the Monitoring tables.  f. Table 4-11, Table 4-12</p>

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**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
	f. Details of a comprehensive hunter harvest survey to determine the effect on caribou populations and potential effects on caribou behaviour resulting from increased human access caused by upgrades to the Milne Inlet Tote road (and any other roads if they are shifted from private to public use) and increase local knowledge of the mine site, including establishing pre-construction baseline harvesting data.		
55	<p>The Proponent shall develop an adaptive management plan applicable to wolves and wolf habitat in collaboration with the Government of Nunavut-Department of Environment (GN-DOE) to ensure compliance with the Nunavut Wildlife Act. Consideration must be given to the following:</p> <p>a. Monitoring for active wolf dens within a 10 km radius from the mine site, under the direction and prior approval of the GN DOE, and reporting the results through NIRB’s Annual Reports on terrestrial wildlife in the Potential Development Area (PDA);</p> <p>b. Estimating the available (glacio-fluvial materials) esker habitat within the Regional Study Area/PDA and identifying such habitat as ecologically sensitive</p> <p>c. Developing “wolf indices” for presence/abundance of wolves (by conducting studies) to set a baseline pre-construction baseline;</p> <p>d. Ensuring that wolf monitoring is capable of determining the relative abundance and distribution of wolves in the Project Development Area over time</p>		<p>a. Table 4-13</p> <p>b. Addressed and completed in the FEIS of the ERP</p> <p>c. Addressed and completed in the FEIS of the ERP</p> <p>d. The Government of Nunavut suggested that the wolf monitoring program be discontinued until wolves are present</p>
56	<p>The Proponent shall develop a strategy for the recovery of terrestrial wildlife habitat in a progressive manner that is consistent with the <i>Nunavut Wildlife Act</i>. Overall, this will require the integration of a decision-making process and the identification of mitigation responses to cumulative impacts on caribou survival, breeding propensity, and population dynamics.</p>	Section 3.1 Vegetation	See Project Condition 39 and 40 (first sentence). Second sentence of this PC is not actionable.

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**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
57	<p>The Proponent shall report annually regarding its terrestrial environment monitoring efforts, with inclusion of the following information:</p> <ul style="list-style-type: none"> <li>a. Description of all updates to terrestrial ecosystem baseline data;</li> <li>b. A description of the involvement of Inuit in the monitoring program;</li> <li>c. An explanation of the annual results relative to the scale of the natural variability of Valued Ecosystem Components in the region, as described in the baseline report;</li> <li>d. A detailed presentation and analysis of the distribution relative to mine structures and activities for caribou and other terrestrial mammals observed during the surveys and incidental sightings;</li> <li>e. Results of the annual monitoring program, including field methodologies and statistical approaches used to support conclusions drawn;</li> <li>f. A summary of the chronology and level of mine activities (such as vehicle frequency and type);</li> <li>g. An assessment and presentation of annual environmental conditions including timing of snowmelt, green-up, as well as standard weather summaries; and</li> <li>h. A discussion of any proposed changes to the monitoring survey methodologies, statistical approaches or proposed adaptive management stemming from the results of the monitoring program.</li> </ul>		Section 5 Reporting
58	<p>Within its annual report to the NIRB, the Proponent shall incorporate a review section which includes:</p> <ul style="list-style-type: none"> <li>a. An examination for trends in the measured natural variability of Valued Ecosystem Components in the region relative to the baseline reporting;</li> <li>b. A detailed analysis of wildlife responses to operations with emphasis on calving and post-calving caribou behavior and displacements (if any), and</li> </ul>		Section 5 Reporting

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**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
	<p>caribou responses to and crossing of the railway, the Milne Inlet Tote Road and associated access roads/trails.</p> <p>c. A description of the extent of dust fall based on measured levels of dust fall (fugitive and finer particles such as TSP) on lichens and blueberries, and ash content of caribou fecal pellets;</p> <p>d. A demonstration and description of how the monitoring results, including the railway, road traffic, air traffic and dust fall contribute to cumulative effects of the project;</p> <p>e. Any proposed changes to the monitoring survey methodologies, statistical approaches or proposed adaptive management stemming from the results of the monitoring program;</p> <p>f. Any updates to information regarding caribou migration trails. Maps of caribou migration trails, primarily obtained through any new collar and snow tracking data, shall be updated (at least annually) in consultation with the Qikiqtani Inuit Association and affected communities, and shall be circulated as new information becomes available.</p>		
59	<p>The Proponent shall ensure that aircraft maintain, whenever possible (except for specified operational purposes such as drill moves, take offs and landings), and subject to pilot discretion regarding aircraft and human safety, a cruising altitude of at least 610 metres during point to point travel when in areas likely to have migratory birds, and 1,000 metres vertical and 1,500 metres horizontal distance from observed concentrations of migratory birds (or as otherwise prescribed by the Terrestrial Environment Working Group) and use flight corridors to avoid areas of significant wildlife importance. The Proponent, in collaboration with the Terrestrial Environment Working Group shall develop a program or specific measures to ensure that employees and subcontractors</p>	<p>Section 3.2.4 Aircraft Section 3.2.1 General Mitigation for Birds</p>	

**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
	providing aircraft services to the Project are respectful of wildlife and Inuit harvesting that may occur in and around project areas.		
60	Prior to construction, the Proponent shall develop a detailed blasting program to minimize the effects of blasting on terrestrial wildlife that includes, but is not limited to the restriction of blasting when migrating caribou, sensitive local carnivores or birds may be negatively affected.	Section 3.3.1 Habitat Mitigation	
61	Whenever practical and not causing a human safety issue, a stop work policy shall be implemented when wildlife in the area may be endangered by the work being carried out. An operational definition of ‘endangered’ shall be provided by the Terrestrial Environment Working Group.	Section 3.3.4 Mortality Mitigation	
62	The Proponent shall prohibit project employees from transporting firearms to site and from operating firearms in project areas for the purpose of wildlife harvesting.	Section 3.3.4 Mortality Mitigation	
63	The Proponent shall liaise with local Hunters and Trappers Organizations in advance of carrying out terrestrial wildlife surveys. At a minimum, The Proponent shall also meet annually in person with Hunters and Trappers Organizations to discuss wildlife monitoring and mitigation plans and address community concerns regarding wildlife interactions. The Proponent may be required to facilitate these meetings through payment of honoraria and meeting costs.		
64	The Proponent shall ensure that its Environment Protection Plan incorporates waste management provisions to prevent carnivores from being attracted to the Project site(s). Consideration must be given to the following measures: a. Installation of an incinerator beside the kitchen that will help to keep the food waste management process simple and will minimize the opportunity for human error (i.e. storage of garbage outside, hauling in a truck (odours	Section 1.5 Relationship to Other Management Plans Section 3.3.8	

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Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
	remain in truck), hauling some distance to a landfill site, incomplete combustion at landfill, fencing of landfill, etc.); and b. Installation of solid carnivore-proof skirting on all kitchen and accommodation buildings (i.e., heavy-duty steel mesh that would drop down from the edge of the buildings/trailers and buried about a half meter into the ground to prevent animals from digging under the skirting).	Other Mitigation	
65	The Proponent shall ensure all employees working at project sites receive awareness training regarding the importance of avoiding known nests and nesting areas and large concentrations of foraging and moulting birds.	Section 3.2.1 General Mitigation for Birds Table 3-1	
66	If Species at Risk or their nests and eggs are encountered during Project activities or monitoring programs, the primary mitigation measure must be avoidance. The Proponent shall establish clear zones of avoidance on the basis of the species-specific nest setback distances outlined in the Terrestrial Environment Management and Monitoring Plan.	Table 3-1	
67	The Proponent shall ensure that the mitigation and monitoring strategies developed for Species at Risk are updated as necessary to maintain consistency with any applicable status reports, recovery strategies, action plans and management plans that may become available during the duration of the Project.	Section 1.2.3.2 Species at Risk Act	
68	The Proponent shall ensure flashing red, red strobe or white strobe lights and guy-wire deterrents are used on communications towers established for the Project. Consideration should also be given to reducing lighting when possible in areas where it may serve as an attractant to birds or other wildlife.	Section 3.2.1 General Mitigation for Birds	
69	Prior to bird migrations and commencement of nesting, the Proponent shall identify and install nesting deterrents (e.g. flagging) to discourage birds from	Section 3.2.1	

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**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
	nesting in areas likely to be disturbed by construction/clearing activities taking place during the nesting season.	General Mitigation for Birds	
70	The Proponent shall protect any nests found (or indicated nests) with a buffer zone determined by the setback distances outlined in its Terrestrial Environment Mitigation and Monitoring Plan, until the young have fledged. If it is determined that observance of these setbacks is not feasible, the Proponent will develop nest-specific guidelines and procedures to ensure bird’s nests and their young are protected.	Section 3.2.1 General Mitigation for Birds Table 3-1	
71	Subject to safety requirements, the Proponent shall require all project related aircraft to maintain a cruising altitude of at least: <ul style="list-style-type: none"> <li>a. 650 m during point to point travel when in areas likely to have migratory birds</li> <li>b. 1100 m vertical and 1500 m horizontal distance from observed concentrations of migratory birds</li> <li>c. 1100 m over the area identified as a key site for moulting snow geese during the moulting period (July-August), and if maintaining this altitude is not possible, maintain a lateral distance of at least at least 1500 m from the boundary of this site.</li> </ul>	Section 3.2.4 Aircraft	
72	The Proponent shall ensure that pilots are informed of minimum cruising altitude guidelines and that a daily log or record of flight paths and cruising altitudes of aircraft within all Project Areas is maintained and made available for regulatory authorities such as Transport Canada to monitor adherence and to follow up on complaints.	Section 3.2.4 Aircraft	



**Table 1-2. NIRB Project Certificate #005 (May 28, 2014): Terms or Conditions Relevant to the Mary River Project’s Terrestrial Environment Mitigation and Monitoring Plan**

Term and Condition No.	Term or Condition	Area(s) addressed	
		Mitigation	Monitoring
73	The Proponent shall develop detailed and robust mitigation and monitoring plans for migratory birds, reflecting input from relevant agencies, the local Hunters and Trappers Organizations and communities as part of the Terrestrial Environment Working Group and to the extent applicable the Marine Environment Working Group.	Appendix A	
74	The Proponent shall continue to develop and update relevant monitoring and management plans for migratory birds under the Proponent’s Environmental Management System, Terrestrial Environment Mitigation and Monitoring Plan prior to construction. The key indicators for follow up monitoring under this plan will include: peregrine falcon, gyrfalcon, common and king eider, red knot, seabird migration and wintering, and songbird and shorebird diversity.		Table 2-1
75	The Proponent’s monitoring program shall assess and report, on annual basis, the extent of terrestrial habitat loss due to the Project to verify impact predictions and provide updated estimates of the total project footprint.		Table 4-14

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 34 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## 1.5 RELATIONSHIP TO OTHER MANAGEMENT PLANS

This Plan is intended for use in conjunction with the following environmental management plans:

- Environmental Protection Plan (EPP) (BAF-PH1-830-P16-0008)
- Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002)
- Surface Water and Aquatic Ecosystems Management Plan (BAF-PH1-830-P16-0026)
- Borrow Pit and Quarry Management Plan (BAF-PH1-830-P16-0004)
- Roads Management Plan (BAF-PH1-830-P16-0023)
- Railway Management Plan
- Waste Management Plan (BAF-PH1-830-P16-0028)
- Emergency Response Plan (BAF-PH1-840-P16-0002)
- Spill Contingency Plan (BAF-PH1-830-P16-0036)
- Oil Pollution Emergency Plan — Milne Port (BAF-PH1-830-P16-0013)
- Oil Pollution Emergency Plan — Steensby Port

## 1.6 BAFFINLAND'S COMMITMENT

In accordance with Baffinland's Sustainable Development Policy (Figure 1-1), Baffinland will provide the necessary human, material and financial resources to implement and maintain the TEMMP.

## 1.7 ROLES AND RESPONSIBILITIES

Baffinland's Environmental Department is responsible for monitoring compliance with applicable regulations and permit requirements. The responsibility for implementation of mitigation measures rests with the VP of Operations.


Compliance is achieved through continuous monitoring, development and implementation of operational standards, procedures in addition to employee training and awareness strategies. Baffinland's roles and responsibilities for the implementation of the TEMPP and the Environmental Protection Plan (EPP) are identified in Table 1-3.

### 1.7.1 TERRESTRIAL ENVIRONMENT WORKING GROUP

The role of the TEWG is to act as an advisory group in support of ongoing cooperation and communication, as well as to review and provide advice on all aspects of the TEMMP including reviewing:

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 35 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- The development and revision of the TEMMP;
- The implementation of the TEMMP;
- Monitoring reports and findings;
- The assessment of potential impacts of the Project on terrestrial wildlife;
- The effectiveness of mitigation measures; and
- Action plans for the development and implementation of appropriate mitigation measures.

As required, the TEWG will provide recommendations to Baffinland on aspects of the TEMMP, or for the adoption of additional mitigation or monitoring measures which are technically and economically feasible.

As per the Terms of Reference (Appendix A), the TEWG consists of six members, including two members from the QIA, two members from Baffinland, one member from the Government of Nunavut (GN), and one member from Environment Canada (EC). Other member affiliates are considered when appropriate or necessary.

## 1.8 SPECIALISTS

The monitoring program established by Baffinland requires the input of specialists to conduct select surveys and monitoring studies. Throughout the life of the Project, Baffinland will contract qualified personnel to conduct these studies. As much as possible, Baffinland will insist on inclusion/participation of local experts/individuals in the execution of these surveys and studies.

## 1.9 INCORPORATION OF INUIT QAUJIMAJATUQANGIT


The monitoring program established by Baffinland requires the input and knowledge of Inuit hunters, trappers and land users to design, conduct and review results of some of the surveys and studies required for monitoring. When required, throughout the life of the Project, Baffinland will facilitate consultations with knowledgeable individuals throughout these studies. As much as possible, Baffinland will include participation of local experts/individuals in the execution of the surveys and studies.

## 1.10 UPDATE OF THE TEMMP

The TEMMP is updated periodically as required on the basis of management reviews, incident investigations, regulatory changes, or other Project related changes. Updates to this Plan are completed as new methods or technologies become available. Mitigation and monitoring

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 36 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

strategies developed for Species at Risk will be updated as necessary to maintain consistency with any applicable status reports, recovery strategies, action plans, and management plans that may become available during the duration of the Project.

## **SUSTAINABLE DEVELOPMENT POLICY**

At Baffinland Iron Mines Corporation (Baffinland), we are committed to conducting all aspects of our business in accordance with the principles of sustainable development & corporate responsibility and always with the needs of future generations in mind. Baffinland conducts its business in accordance with the Universal Declaration of Human Rights and ArcelorMittal’s Human Rights Policy which applies to all employees and affiliates globally.

Everything we do is underpinned by our responsibility to protect the environment, to operate safely and fiscally responsibly and with utmost respect for the cultural values and legal rights of Inuit. We expect each and every employee, contractor, and visitor to demonstrate courageous leadership in personally committing to this policy through their actions. The Sustainable Development and Human Rights Policy is communicated to the public, all employees and contractors and it will be reviewed and revised as necessary on a regular basis. These four pillars form the foundation of our corporate responsibility strategy:

1. Health and Safety
2. Environment
3. Upholding Human Rights of Stakeholders
4. Transparent Governance

### **1.0 HEALTH AND SAFETY**


- We strive to achieve the safest workplace for our employees and contractors; free from occupational injury and illness, where everyone goes home safe everyday of their working life. Why? Because our people are our greatest asset. Nothing is as important as their health and safety. Our motto is “Safety First, Always”.
- We report, manage and learn from injuries, illnesses and high potential incidents to foster a workplace culture focused on safety and the prevention of incidents.
- We foster and maintain a positive culture of shared responsibility based on participation, behaviour, awareness and promoting active courageous leadership. We allow our employees and contractors the right to stop any work if and when they see something that is not safe.

### **2.0 ENVIRONMENT**

- Baffinland employs a balance of the best scientific and traditional Inuit knowledge to safeguard the environment.
- Baffinland applies the principles of pollution prevention, waste reduction and continuous improvement to minimize ecosystem impacts, and facilitate biodiversity conservation.
- We continuously seek to use energy, raw materials and natural resources more efficiently and effectively. We strive to develop more sustainable practices.

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 37 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- Baffinland ensures that an effective closure strategy is in place at all stages of project development to ensure reclamation objectives are met.

### 3.0 UPHOLDING HUMAN RIGHTS OF STAKEHOLDERS

- We respect human rights, the dignity of others and the diversity in our workforce. Baffinland honours and respects the unique cultural values and traditions of Inuit.
- Baffinland does not tolerate discrimination against individuals on the basis of race, colour, gender, religion, political opinion, nationality or social origin, or harassment of individuals freely employed.
- Baffinland contributes to the social, cultural and economic development of sustainable communities in the North Baffin Region.
- We honour our commitments by being sensitive to local needs and priorities through engagement with local communities, governments, employees and the public. We work in active partnership to create a shared understanding of relevant social, economic and environmental issues, and take their views into consideration when making decisions.
- We expect our employees and contractors, as well as community members, to bring human rights concerns to our attention through our external grievance mechanism and internal human resources channels. Baffinland is committed to engaging with our communities of interest on our human rights impacts and to reporting on our performance.

### 4.0 TRANSPARENT GOVERNANCE

- Baffinland will take steps to understand, evaluate and manage risks on a continuing basis, including those that may impact the environment, employees, contractors, local communities, customers and shareholders.
- Baffinland endeavours to ensure that adequate resources are available and that systems are in place to implement risk-based management systems, including defined standards and objectives for continuous improvement.
- We measure and review performance with respect to our safety, health, environmental, socio-economic commitments and set annual targets and objectives.
- Baffinland conducts all activities in compliance with the highest applicable legal & regulatory requirements and internal standards.
- We strive to employ our shareholder's capital effectively and efficiently and demonstrate honesty and integrity by applying the highest standards of ethical conduct.


#### 4.1 FURTHER INFORMATION

Please refer to the following policies and documents for more information on Baffinland's commitment to operating in an environmentally and socially responsible manner:

Health, Safety and Environment Policy  
 Workplace Conduct Policy  
 Inuktitut in the Workplace Policy

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 38 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

Site Access Policy  
Hunting and Fishing (Harvesting) Policy  
Annual Report to Nunavut Impact Review Board  
ArcelorMittal Canada Sustainability and Corporate Responsibility Report

If you have questions about Baffinland’s commitment to upholding human rights, please direct them to [contact@baffinland.com](mailto:contact@baffinland.com).

Brian Penney  
Chief Executive Officer  
March 2016

**Figure 1-1. Baffinland Iron Mines Corporation’s Sustainable Development Policy**

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**Table 1-3. Roles and Responsibilities (February 16, 2015)**

<b>Baffinland Iron Mines Corporation On-Site Environmental Team</b>	
<b>Position</b>	<b>Responsibilities and Accountabilities</b>
Environmental Manager	<ul style="list-style-type: none"> <li>• Reports directly to VP Sustainable Development, Health, Safety and Environment and Indirect reporting and coordination with Operations VP and Director Environment</li> <li>• Overall accountability for environmental staff and performance at site</li> <li>• Coordinates implementation and monitors the performance of the Environmental Management System at site</li> <li>• Liaises with the senior management, regulators and stakeholders</li> <li>• Ensures effective monitoring and auditing of environmental performance of departments and contractors on site and identifies opportunities for improvement</li> <li>• Monitors compliance with permits, licenses and authorizations</li> <li>• Ensures all regulatory environmental monitoring and reporting requirements (monthly, annual) are met</li> <li>• Leads and coordinates site permitting requirements.</li> <li>• Initiates and oversees environmental studies</li> <li>• Oversees investigations and reporting of environmental incidents to regulatory bodies, stakeholders and senior management</li> <li>• Reviews and updates environmental management plans</li> </ul>
Environmental Superintendent	<ul style="list-style-type: none"> <li>• Reports to Environmental Manager</li> <li>• Specific accountabilities for environmental monitoring and reporting</li> <li>• Leads investigations and reporting of environmental incidents onsite</li> <li>• Serves as the liaison for regulators during onsite inspections and visits</li> <li>• Provides ongoing environmental education and environmental awareness training to all employees and contract workers</li> <li>• Oversees environmental database management</li> <li>• Prepares updates for management plans</li> </ul>
Environmental Coordinator	<ul style="list-style-type: none"> <li>• Reports to the Environmental Superintendent and Manager</li> <li>• Specific accountabilities for environmental monitoring and reporting</li> <li>• Provides day to day direction to Environmental staff onsite</li> <li>• Serves as a liaison for regulators during onsite inspections and visits.</li> <li>• Provides ongoing environmental education and environmental awareness training to all employees and contract workers</li> <li>• Assists with environmental database management</li> </ul>
Environmental Advisor	<ul style="list-style-type: none"> <li>• Reports to the Environmental Superintendent and Manager</li> <li>• Specific accountabilities for environmental monitoring and reporting</li> <li>• Assists with environmental database management</li> <li>• Prepare updates for management plans</li> </ul>
Environmental Monitor and Technician	<ul style="list-style-type: none"> <li>• Reports to the Environmental Superintendent or designate</li> <li>• Assists with environmental database management</li> <li>• Assists with monitoring and sampling activities as per the Project's management plans</li> </ul>
QIA Monitor	<ul style="list-style-type: none"> <li>• Works alongside the Baffinland Environment Department to ensure the proper implementation of all environmental management and monitoring plans</li> <li>• Acts as the QIA liaison for onsite environmental matters</li> </ul>
Environmental Support Groups (Consultants,	<ul style="list-style-type: none"> <li>• Assists with sampling, monitoring and reporting activities as required by permits, licenses and environmental management plans</li> <li>• Provides technical expertise to various environmental studies</li> </ul>

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## 2 KEY INDICATORS FOR FOLLOW-UP MONITORING

The TEMMP focuses on targeted valued ecosystem components (VECs) and their key indicators (KIs; Table 2-1). Select KIs were identified during the Terrestrial Environmental Impact Assessment (refer to various sections in Volume 6 of the Final Environmental Impact Statement [FEIS]) based on criteria outlined in Volume 2 (Impact Assessment Methodology) and baseline information. KIs that were identified for follow-up monitoring were selected based on confidence identified in the Impact Assessment prediction, practicality of monitoring, and mitigation potential. Not all of the KIs identified in the Impact Assessment (Volume 6) were selected as KIs for monitoring (Table 2-1), although specific mitigation measures for these KIs are included in this TEMMP. In some instances where residual Project impacts to a KI were assessed as low, and the confidence level in the Impact Assessment prediction was high, follow-up monitoring was deemed not necessary.

**Table 2-1. Key Indicators for Follow-up Monitoring**


VEC	Key Indicators for Impact Assessment (Volume 6)	Key Indicators for Follow-up Monitoring (this document)
Vegetation	Vegetation abundance and composition, vegetation health, culturally valued vegetation	Exotic invasive vegetation and natural revegetation, vegetation health, dust fall
Birds	Peregrine falcon, snow goose, common and king eider, red-throated loon, thick-billed murre, Lapland longspur, other bird species of conservation concern	Peregrine falcon, gyrfalcon, common and king eider, red knot, seabird migration and wintering <sup>1</sup> , and songbird and shorebird diversity
Terrestrial Wildlife	Caribou	Caribou and wolf

### 2.1 VEGETATION

Within the Zone of Influence (ZOI), vegetation abundance, composition and health could potentially be affected by Project construction, operation and closure activities; however, overall these effects were predicted to be insignificant with a high level of confidence (see FEIS Volume 6, Section 3.2.4). Project effects on vegetation health are expected to be limited; however, assessment confidence was moderate due to uncertainties on the effects of dust and other contaminants on vegetation abundance, composition, and health. Although the introduction of exotic invasive vegetation is unlikely, their introduction could potentially threaten abundance and composition of native plant species. While the potential may still exist,

<sup>1</sup> Sea bird migration and wintering studies are conducted independently by Environment Canada with support from Baffinland.



	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 41 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

control measures have been established to limit the potential for introduction of exotic invasive vegetation. Therefore, vegetation monitoring strategies have been developed to detect the presence of exotic invasive vegetation and Project effects on vegetation abundance, composition, and health.

## 2.2 BIRDS


The Project has the potential to affect the abundance, diversity and health of birds within the RSA. To assess Project impacts on birds, the Impact Assessment (Volume 6, Section 4) selected the following KIs: peregrine falcon, snow goose, common and king eider, red-throated loon, thick-billed murre, Lapland longspur, and additional Species at Risk (harlequin duck, Ross's gull, ivory gull, red knot and short-eared owl). The assessment determined with a high level of confidence that Project effects on most of these species would be low or negligible. The exception to this was red knot; Project effects on red knot are expected to be limited but the assessment confidence was moderate due to uncertainties in whether or not the species is breeding in the RSA.

Peregrine falcon is a wide-spread and abundant breeder within the RSA and greater North America, and is listed as a species of 'Special Concern' by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2011). It is the only bird Species at Risk which is expected to regularly occur in close proximity to the Project; all of the remaining Species at Risk are expected to be encountered only rarely. In addition, eiders have been rated as sensitive by the Government of Nunavut (CESCC 2006) and, although they are not listed by COSEWIC, they have recently been identified as a Species of Interest by the Canadian Wildlife Service (CWS) because of an unexplained nationwide decline (Suydam 2000). Migrating common and king eiders are seen in large numbers in the coastal waters of the RSA during their spring and fall migrations, and dozens of females were seen raising broods in Steensby Inlet around the proposed port location. Inuit Qaujimagatuqangit (IQ) studies indicated that eiders are an important species to the local communities for harvesting and consumption, and that some Inuit still use eider feathers in clothes, pillows, and quilts. As a result, peregrine falcon, common and king eider and selected Species at Risk are selected as KIs for follow-up monitoring.

Although Baffinland is confident that Project effects will have a non-significant effect on other bird species, information deficiencies within the baseline surveys are acknowledged. Therefore, at the request of government regulators, the following additional KIs were included in follow-up monitoring:

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 42 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- Gyr Falcon were added due to differences in ecology (Peregrine Falcon acts as a representative of most cliff-nesting raptors; however, in contrast to Peregrine Falcons, Gyr Falcons may be present in the study area year round, and the timing of nesting is much earlier);
- Seabird migration and overwintering — Baffinland will participate in a larger research project lead by Environment Canada on seabird migration and overwintering; the project will provide input on the potential interactions of Project shipping with migrating and wintering seabirds; and
- Songbird and shorebird diversity — Baffinland will assist in regional-level monitoring by the Canadian Wildlife Service (CWS) looking at regional diversities of songbirds and shorebirds.


### 2.3 TERRESTRIAL WILDLIFE

Caribou were identified as the terrestrial wildlife KI because of their ecological and social significance. Caribou are a keystone species in the north Baffin Island ecosystem. A number of other species, particularly the island’s carnivores, rely on caribou population size and distribution for survival. Additionally, caribou were consistently identified as a species of great significance to local communities — caribou have historically been, and continue to be, a key component of Inuit diet and culture. When present, caribou are harvested and consumed by local people, and hunters from nearby communities currently harvest caribou within the RSA. Additionally, a number of studies have been conducted on caribou responses to industrial activities throughout the species’ range.

The Environmental Impact Statement (Volume 6, Section 5) assessed Project effects on caribou habitat, movement, mortality and health. Project effects on caribou are expected to be non-significant; however, confidence in the assessment prediction was moderate for some effects (particularly relating to Project effects on caribou habitat and movement). Therefore, caribou was selected as a KI for continuous monitoring and several monitoring programs for caribou were developed.

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 43 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

### 3 MITIGATION MEASURES

#### 3.1 VEGETATION

Vegetation will be affected mostly by physical disturbance (footprint of facilities), exhaust emissions, dust deposition and any potential changes to localized surface water quantity and quality. Thus, mitigation measures for vegetation are mainly related to limiting the physical footprint of the Project and reducing emissions and dispersal of particulates. Mitigation measures are detailed below. Refer to the Air Quality and Noise Abatement Management Plan (Volume 10, Appendix 10D-1) and the Surface Water and Aquatic Ecosystems Management Plan (BAF-PH1-830-P16-0026) for a description of mitigation measures related to air and surface water quality.

Additionally, the delivery of material, equipment and freight to Steensby and Milne Ports presents the potential for the introduction of exotic invasive plant species into the arctic environment (e.g., via seeds in wheel tread or the undercarriage of vehicles). Although climate conditions within the RSA are expected to be a substantial barrier to the survival of exotic invasive plant species, equipment brought to the Project site will be cleaned of other soils to help prevent the introduction of exotic invasive plant species. If exotic invasive plant species are found within the Project area, they will be removed and destroyed, and, if possible, efforts will be made to determine the path of entry to prevent further spread of exotic invasive plant species.


##### 3.1.1 GENERAL MITIGATION FOR VEGETATION

Mitigation measures to reduce Project effects on vegetation include:

- Project activities will be planned and conducted to minimize the Project footprint.
- Project personnel will remain within the Project Development Area (PDA) during operation, and vehicles will stay on established roads, limiting new disturbance to the PDA.
- In compliance with Project Condition 32, all equipment arriving new on site are investigated for exotic invasive plant potential (e.g., soil in tires, entrapped vegetation etc). Prior to initial use in Project areas, equipment and supplies are cleaned of soils that could contain plant seeds not naturally occurring in the area.
- Disturbed terrestrial habitat will not be reseeded during construction, operation and closure. Revegetation of the terrestrial habitat will be allowed to occur naturally — natural revegetation trials will be conducted during mine operation to inform Project

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 <b>Baffinland</b>	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 44 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

closure. This mitigation will reduce the potential for the establishment of exotic invasive plant species within the RSA due to Project development activities.

- Dust control measures for Project infrastructure, including Project roads, are outlined in the Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002), and the Road Management Plan (BAF-PH1-830-P16-0023).

## 3.2 BIRDS


There are several pathways through which the Project could potentially affect bird individuals and local populations within the ZOI. These include direct loss of habitat within the Project footprint and indirect loss of habitat due to sensory disturbance adjacent to the footprint, increased mortality due to collisions with Project equipment, ships, aircraft, and permanent structures, increased mortality due to increased hunter use of the area or increased predator abundance within the ZOI, and increased mortality or effects to bird health resulting from contamination of the surrounding environments (through dust deposition or other contamination within the terrestrial environment, or through chronic leakage or catastrophic release of oils or other chemicals within the marine environment).

A number of mitigation measures are designed to limit the Project effects on bird species; these are detailed below. Several other management plans will contribute to the protection of bird species and habitats within the Project Area — for example the Air Quality and Noise Abatement Management Plan (Volume 10, Appendix 10D-1), the Surface Water and Aquatic Ecosystems Management Plan (BAF-PH1-830-P16-0026), the Waste Management Plan (BAF-PH1-830-P16-0028), the Emergency Response Plan (BAF-PH1-840-P16-0002), Spill Contingency Plan (BAF-PH1-830-P16-0036), and the Oil Pollution Emergencies Plan — Milne Port (BAF-PH1-830-P16-0013) for a description of mitigation measures related to each of these areas.

### 3.2.1 GENERAL MITIGATION FOR BIRDS

General mitigation measures that apply to all bird species within the RSA include:


- Project activities are planned and conducted to minimize the Project footprint to the extent possible, thus minimizing the direct loss of habitat or the reduction of habitat effectiveness.
- Enforcement of a no-hunting policy for Project personnel; Project personnel are prohibited from transporting firearms to site and from operating firearms in Project areas for the purpose of wildlife harvesting.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 45 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- Project personnel orientation will include best practices with regard to waste management and avoiding wildlife (workers should not disturb, harass, or feed wildlife); orientation will also include the importance of avoiding identified nests and large concentrations of foraging or molting birds.
- Large concentrations of foraging or molting birds will be avoided by Project personnel and equipment to the extent possible.
- Where required, installation of deterrents (e.g. flagging) prior to commencement of nesting to discourage birds from nesting in areas likely to be disturbed by construction/clearing activities taking place during the nesting season<sup>2</sup>.
- To comply with Project Condition 70, inspections of each work area for nests will be conducted prior to any clearing of land occurring during the nesting season. Any nests (or indicated nests) found are protected with a no-disturbance buffer zone outlined in the Table 3-1. The buffers will be in effect until the young have fledged and left the area. If it is determined that the setbacks are not feasible, nest-specific guidelines and procedures to ensure bird nests and their young are protected shall be developed by competent individuals (refer to Nest Management Plans below).
- To comply with Project Condition 66, if Species at Risk or their nests and eggs are encountered during Project activities, the primary mitigation is avoided. Project personnel will establish no-disturbance buffer zones on the basis of the species-specific nest setback distances outlined in Table 3-1.
- Bird sightings, particularly raptors or large concentrations of birds, should be reported to the on-site environmental supervisor who will report to Project biologists and recorded in the wildlife log posted at site accommodations.
- To comply with Project Condition 68, temporary communication towers using guy wires are fitted with bird diverters to help minimize the risk of bird collisions. Lighting is reduced when possible in areas where it may serve as an attractant to birds or other wildlife.
- To comply with Project Condition 61, whenever practical and not causing a human safety issue, a stop work policy shall be implemented when wildlife in the area may be endangered (at risk of immediate injury or death) by work being conducted.

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<sup>2</sup> Baffinland prepared a bird deterrence review that was reviewed at the TEWG May 21, 2013. There was no feedback from the group on what would prove practical solutions prior to the 2014 construction season. Although active nest surveys were completed, deterrents were not erected. There were no apparent nesting attempts by birds in the cleared areas.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 46 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

### 3.2.2 REPORTING MIGRATORY BIRD MORTALITIES

Should a Project-related mortality of a migratory bird or birds occur, Environment Canada has requested that notice be sent to the following e-mail inbox that is accessed by Conservation Officers after the incident has been investigated (as per direction provided in the April 2015 TWEG Meeting and communication with Jean-Francois Dufour, Environmental Assessment Officer):

ec.dalfnord-wednorth.ec@canada.ca

### 3.2.3 PREDATION

To minimize the potential for increasing densities of bird nest predators (e.g., foxes, gulls, jaegers) Baffinland will:


- Implement effective waste management procedures as outlined in the Waste Management Plan (BAF-PH1-830-P16-0028). As required by Baffinland’s EHS Management System, audits will be completed periodically to assess the effectiveness of waste management practices. Buildings are designed to avoid/eliminate denning, roosting and nesting sites (e.g., installation of bird spikes on horizontal surfaces, particularly near heat sources, and buildings to reduce the number of sheltered surfaces where nests could be established).
- Baffinland will also conduct regular surveillance of Project facilities and waste disposal sites to determine where predator deterrence may be required and to ensure that predator control strategies are effective.

### 3.2.4 AIRCRAFT

- Subject to safety requirements, Baffinland requires all Project-related aircraft to maintain a minimum cruising altitude of:
  - a) 650 m above ground level during point-to-point travel when in areas likely to have migratory birds present;
  - b) 1,100 m vertical and/or 1,500 m horizontal distance from observed concentrations of migratory birds (e.g. a known breeding colony of over 5,000 snow geese is located on the southwest shore of Steensby Inlet)
  - c) 1,100 m vertical and/or 1,500 m horizontal distance over the area identified by CWS as a key site for moulting snow geese (Figure 3-1) during the moulting period (July–August). Other than environmental monitoring and research surveys, no other Project activities will occur in this area during the moulting period. For the

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 47 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

remainder of the migration and breeding season air traffic is required to maintain a minimum of 650 m above ground level and refrain from excessive hovering or circling.

- Pilots are required to collect track logs for all helicopter flights within the RSA and submit these to Baffinland, or the contracted helicopter company will provide track logs to Baffinland on a regular basis to monitor compliance.
- Development of appropriate aircraft approach and departure flight paths are required for the airstrips at the Milne and Steensby Inlet port sites to reduce the likelihood of bird strikes to the extent possible.
- Pilots are informed of minimum cruising altitude guidelines.
- Employees are required to report improper flight practices to the appropriate supervisor.

#### Exceptions


- Low-level flights are required during slinging operations.
- Low-level flights are permitted during wildlife surveys, as directed by the Project biologists in accordance with wildlife research permits.

#### 3.2.5 NEST MANAGEMENT PLANS

Should a nest be identified within the confines of a prescribed setback distance in a work area during the nesting season (31 May to 5 August<sup>3</sup>), environmental staff are contacted and mitigation plans such as closure of the area within a specific buffer area of the nest until fledging occurs will be implemented. Table 3-1 provides the setback distances recommended for tundra-nesting species that will be applied within the Mary River Project area. Additionally:

- If it is not be feasible to maintain the recommended buffer between known nests and Project activities, nest-specific guidelines and procedures will be developed and issued to all Project personnel to ensure the duration of the activity and the magnitude of the disturbance to that nest is minimized. Project biologists are required to monitor each individual case as often as possible and in a manner that does not cause added disturbance to the nest, to assess the effectiveness of the nest-specific management plans. To prevent thermoregulatory stress to eggs, incubating adults should not be disturbed/flushed from their nests during inclement weather (rain, snow, cold temperatures) in June and July.

<sup>3</sup> Source: Government of Canada: Environment and Climate Change Canada. 2014. General Nesting Periods of Migratory Birds in Canada. Nesting Calendars in zone N, technical information for planning purposes covering Arctic Plains and Mountains (BCR3). Accessed January 19, 2016.

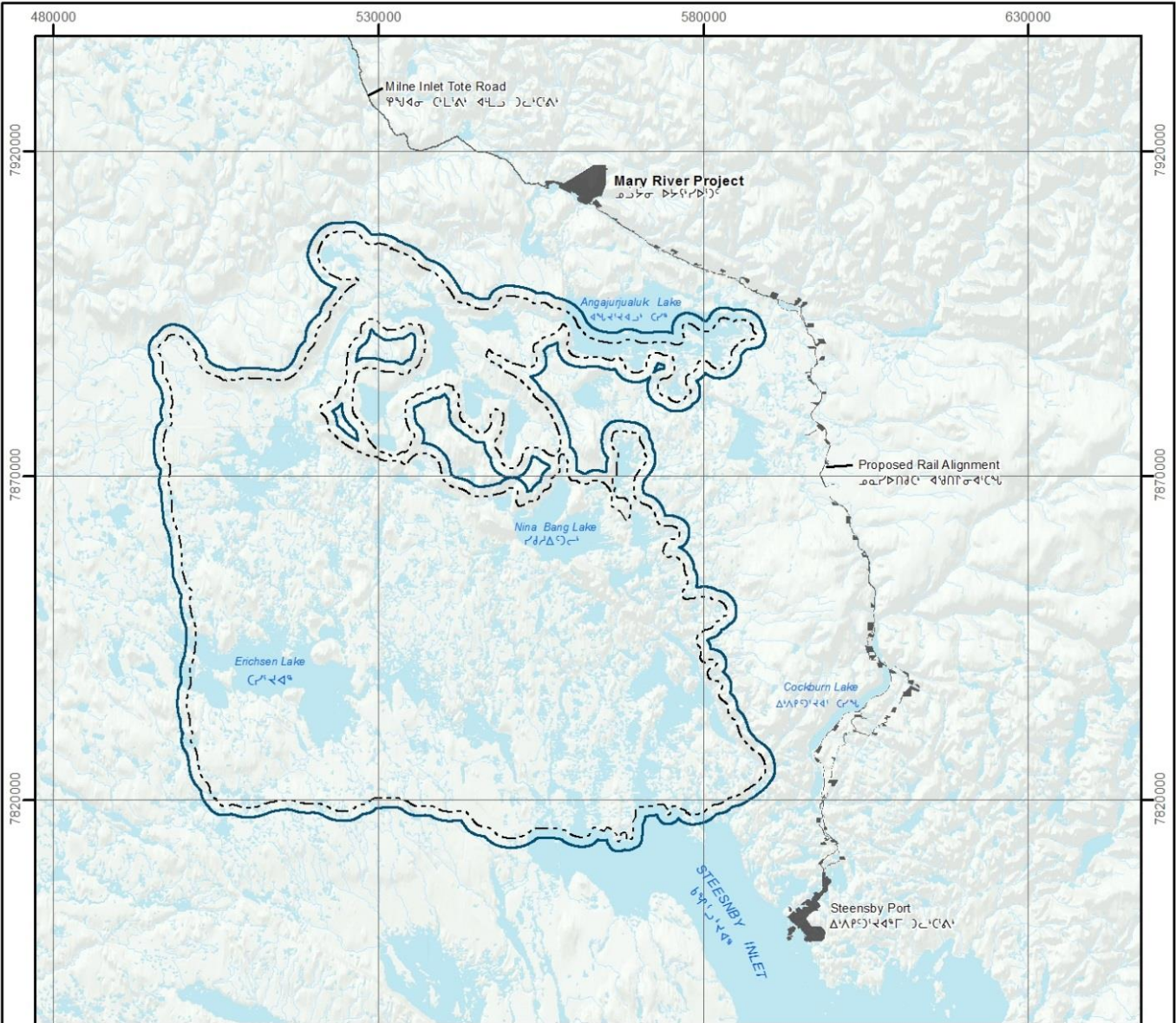
	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 48 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- If any bird Species at Risk (including red knot, Ross’s gull, ivory gull, harlequin duck, and short-eared owl) are found to be nesting within 750 m of Project activities, appropriate setback buffers will be applied, and the nests will be monitored by environmental staff to confirm that Project activities are not affecting the nest and/or bird nesting behavior.
- Due to the importance of specific sites for nesting peregrine falcon and other cliff-nesting raptors (i.e. sites are re-used year after year), a nest-specific assessment and management plan will be developed for every known cliff-nesting raptor nest site within 1 km of Project activities. Where possible, a site-specific no-disturbance buffer (of approximately 500 m) will be implemented for both Project personnel and equipment around active nests during the nesting period (mid-April to mid-August) — this will be achieved by relocating Project activities at a minimum of 500 m from the nest or rescheduling Project activities to occur outside the nesting period.



**Table 3-1. Recommended Setback Distances for Activity near Active Bird Nests**

Species Group	Recommended Setback Distances (m)		Exceptions/Comments
	Pedestrians /ATVs	Roads/Construction /Industrial Activities	
Songbirds	30	100	
Shorebirds <sup>a</sup>	50	100	For nests of American Golden Plover or Ruddy Turnstone setbacks should be increased to 150 m for Pedestrians/ATVs and 300 m for Roads/Construction/Industrial Activities. For nests of Black-bellied Plover, Whimbrel or Red Knot, setbacks should be increased to 300 m and 500 m respectively.
Terns/Gulls	200	300	For nests of Ross’s Gull setbacks should be increased to 500 m for Pedestrians/ATVs and 750 m for Roads/Construction/ Industrial Activities. For Ivory Gull nests, a 2 km setback should be applied to all activity.
Ducks	100	150	
Geese	300	500	
Swans/Loons/Cranes	500	750	
Cliff-nesting Raptors	500	500	
Ground-nesting Raptors	400	400	Includes short-eared owl.
<sup>a</sup> If field crew are untrained in the identification of these species, then the higher setbacks should be applied for all shorebird species. In areas where several species are nesting in proximity, setbacks for the most sensitive species should be used if they are present. [Baffinland believes these set-backs apply when introducing new disturbance to an area. For example, if while construction activities are ongoing, a duck establishes a nest 50 m from the construction activity, we don’t need to then halt all construction activities within 150 m of the nest; we just need to make sure that they do not encroach any closer to the nest. TEWG discussion.]			



**LEGEND ᐃᑭᑦᑲᑦ**

- Milne Tote Road
- Environment Canada Area of Interest (Geese)
- Environment Canada Area of Interest (Geese) 1500 m Buffer
- Potential Development Area ᐃᐃᑦᑲᑦ ᐃᑭᑦᑲᑦ ᐃᑭᑦᑲᑦ

0 5 10 20 30 40  
Kilometers  
Map Scale: 1:1,000,000 (printed on 8.5 x 11)  
Map Projection: NAD 1983 UTM Zone 17N

**The Mary River Project and the Snow Goose Area**

**NOTES ᐃᑭᑦᑲᑦ**

Updated PDA provided by Hatch (25 April 2013).  
Snow goose area of interest (management area) provided by Environment Canada.


Drawn: MP	Checked: MAS/DH	Date: 12/02/2016	<b>FIG 3-1</b>
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Path: z:\na\en\Projects\011615\2011\_BAF Mapping\Print\_Mapping\PH\_3\_1\_Snow\_Goose\_11Feb2016.mxd

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 51 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

### 3.3 TERRESTRIAL WILDLIFE

Caribou distribution, abundance, and health within the ZOI could be affected by Project activities. Assessment of Project effects on caribou evaluated four measurable parameters; habitat, movement, mortality, and health — mitigation measures for caribou are described for each of these parameters. In general, caribou management within the RSA was characterized by the application of the precautionary principle and by employing an adaptive management strategy to minimize and/or mitigate negative impacts of the Project to caribou populations. Select mitigation measures were identified as being more general in nature and are applied to all wildlife in the ZOI.


#### 3.3.1 HABITAT MITIGATION

Sensory disturbances that affect habitat effectiveness within a ZOI can only be partially mitigated. Caribou, wolves and other terrestrial wildlife will find some Project activities disturbing, and the degree to which animals will adapt to those disturbances is not precisely known. Mitigation measures that will reduce the likelihood of reduced habitat effectiveness for caribou include:

- Project activities will be planned and conducted to minimize the Project footprint to the extent possible, thus minimizing the direct loss of habitat or the reduction of habitat effectiveness (indirect habitat loss).
- Sensory disturbances will be limited where possible throughout the year. This will be realized by developing a blasting program to minimize the effects of blasting on terrestrial wildlife that includes, but is not limited to the restriction of blasting when migrating caribou and other wildlife may be negatively affected.
- Active caribou calving sites (as identified by Project biologists or observed by aircraft pilots) will be avoided between May 15 and July 15, and where possible, there will be no increase in mine construction or operational activity within 3 km of the calving sites during this time period.
- In the Cockburn Lake Area (identified during baseline studies as having the highest occurrence of caribou calving sites), all non-essential activities will cease between May 15 and July 15 (e.g. construction activities will be planned to avoid this area during the calving season).
- If any females (one or more) are observed within 3 km of a planned Project activity such as drilling or road construction from May 15 through to July 15, then the activity location will either be moved or the activity deferred as appropriate and if possible, until a later date when caribou are not present.

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 52 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- Should a female caribou or a female with calves approach within 3 km of Project activities (between May 15 and July 15), the animals will be observed on the ground. If it is obvious they are being disturbed, the activity will cease until they have moved away by at least 3 km.
- If caribou approach a Project activity site before work commences, the animals will be observed on the ground and if it is obvious that they are being disturbed, work will not commence until they have moved on. If caribou approach a Project site while work is in progress, caribou will be observed for signs of disturbance. If the caribou are disturbed, the activity will be modified or cease until the caribou have moved away or they are guided away from the worksite.
- A wildlife monitor will be present on site during the calving season to detect calving activities near the Tote Road, monitor cow/calf behavior in relation to traffic, designate a temporary no-stopping zone, guide traffic, and document measures taken to reduce sensory disturbance to calving caribou.

### 3.3.2 AIRCRAFT

- Subject to safety requirements, Baffinland requires all Project-related aircraft to maintain a minimum cruising altitude of 650 m above ground level during point-to-point travel.
- Pilots shall report caribou movements and locations during calving and post-calving periods, so that these areas can be avoided.
- If large concentrations of wildlife or sensitive areas for wildlife (e.g. caribou calving areas) are identified, pilots will be informed and aircraft will avoid these areas to the extent possible.
- Hovering or circling over wildlife may greatly increase disturbances and will be avoided.

#### Exceptions

- Low-level flights are required during slinging operations.
- Low-level flights are permitted during wildlife surveys, as directed by the Project biologists in accordance with wildlife research permits.


### 3.3.3 MOVEMENT MITIGATION

The effect of the Project on caribou movement is expected to be non-significant. Mitigation measures that will reduce the likelihood of a barrier effect on caribou movement include:

- Snow management activities will, either cumulatively through the season or within a reasonable period of a weather event, maintain a snow bank height less than 1 m along

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 53 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

the railway and Tote Road with smooth top edges. This will permit caribou to cross the transportation corridor without being blocked by steep snow banks. In addition to reducing the barrier effect, this snow management practice will also likely reduce drifting snow.


- Identified trail crossings along the railway and the Tote Road where the physical structure might result in a barrier to caribou movement will be constructed of finer fill material to replicate natural trail conditions, preventing leg entrapment, and gentler gradients to reduce the visual barrier of the embankments. Any additional (i.e. new) trail crossings identified during construction or operation will also be modified with gentler slopes and finer fill if caribou deflections are detected.
- An on-site review of caribou trail crossings will be conducted and adjustments implemented to the structure of embankments with QIA-identified elders and hunters.
- Wildlife signage will be posted at trail crossings along the Tote Road. Railway operators will be made aware of the crossing areas along the railway.
- A large railway bridge will be constructed at the Cockburn Lake caribou water crossing; the bridge will be tall enough (10 magl) to allow caribou to pass underneath.
- Consistent trainset passes will be employed along the railway to which caribou are expected to adapt.
- Surveillance system along the railway corridor will be used to identify the presence of caribou in proximity to the train tracks and operational protocols for the train to avoid collisions and enable caribou to cross the train tracks unimpeded.
- Based on IQ knowledge provided by hunters and elders, if migratory caribou start to move through the RSA again, then the leading caribou will be allowed to cross over the Tote Road and railway undisturbed so that others will follow.
- Truck drivers will be provided with wildlife awareness training including known crossing locations. Drivers will use the Caribou Decision Tree (Figure 3-2).
- All site personnel entering and exiting the Tote Road will notify site dispatch and/or security. Notifications to road uses will include mandatory wildlife reporting (Appendix B 4-14 — Wildlife Monitoring: Incidental Observations and Project Mortality Wildlife Log).
- Railway operators will be required to report any caribou sighting along the railway.

### 3.3.4 MORTALITY MITIGATION

Residual effects of the Project on caribou mortality are not anticipated. Project-related mortality, should it occur, will be rare and limited to individuals, within the PDA. Anticipated effects of the Project on caribou mortality are non-significant. In terms of Project management, the threshold for caribou mortality is zero — that is, any Project-related caribou mortality will

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 54 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

trigger an investigation into the cause of the accident and potential contributing factors (direct and/or indirect). Depending on the outcome of the investigation, additional mitigation actions may be implemented to prevent future mortality. If caribou mortality increases due to Project activities, the effects can be readily mitigated by increasing traffic controls including seasonal traffic limitations of both the Tote Road and rail. Timing and duration of limitations will be determined by repeated on-site observations of caribou behaviour along the transportation corridors as the Project proceeds through construction and operation.

Mitigation measures implemented to reduce the likelihood of the Project having an effect on caribou mortality include:

- Wildlife right-of-way policy on Project roads and railway.
- Use of railway to Steensby Inlet with consistent trainset passes to which caribou are expected to adapt.
- All site personnel entering and exiting the Tote Road will notify site dispatch and/or security. Notifications to road uses will include mandatory wildlife reporting (Appendix B. 4-15 Wildlife Monitoring: Incidental Observations and Project Mortality Wildlife Log).
- Reporting and documentation of all mortalities and near misses is mandatory, and follow-up investigations will be conducted for all mortality events.
- When caribou are observed on roads or railway, a “caribou advisory” will be issued through the site radio network to alert operators and drivers that caribou are in the area and to maintain extra vigilance while driving or operating the railway in accordance with Baffinland’s Caribou Decision Tree (Figure 3-2).
- Speed limits along Project roads are set at a maximum of 55 km/hr. In combination with the caribou decision tree (Figure 3-2), this will allow caribou time to get off the road and will increase the chance of a truck being able to stop before colliding with a caribou.
- Any carcasses will be promptly removed from transportation corridors to discourage further collisions (e.g., scavengers on railway).
- A no-hunting policy for Project personnel will be implemented (notwithstanding the accommodation provided for traditional Inuit activities [Human Resource Management Plan SD-SEMP-003]). All site personnel are prohibited from transporting firearms to site.
- Whenever practical and not causing a human safety issue, a stop work order will be used when wildlife in the area may become endangered (i.e., risk of physical injury or death<sup>4</sup>) by the work being undertaken.

<sup>4</sup> As per Project Condition No. 61, the term “endangered” was defined by the TEWG as at risk of physical injury or death.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 55 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- A means of deterring caribou from the pits and other hazardous areas will be designed and implements, such as installing poles with fluorescent flagging, creating physical barriers (berms or fences), installing auditory deterrents, and/or using wildlife monitors to survey for wildlife in hazardous areas<sup>5</sup>.

### 3.3.5 RAILWAY-SPECIFIC MITIGATION

- The train is expected to operate 300 days per year, so seasonal stoppages are possible if large groups of migratory caribou move through the area.

### 3.3.6 TOTE ROAD-SPECIFIC MITIGATION

- Along the Tote Road, animals, including caribou, have the right-of-way. Traffic is to slow down and keep distance from the animals as much as possible. If necessary, traffic will stop to enable crossings of groups or to allow groups of caribou paralleling the road to move into adjacent habitat. Caribou occurrence in the vicinity of the road and their responses to traffic will be monitored by on the ground behavioral observations, to determine if it is apparent that caribou are being disturbed or displaced by construction or traffic. Specific guidance is provided in the Caribou Decision Tree (Figure 3-2).

### 3.3.7 HEALTH MITIGATION


The primary pathway of Project-related health effects on caribou is expected to be dust fall and ingestion of vegetation that accumulates the dust. Dust suppression and other mitigation measures related to air quality are detailed in the Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002).

### 3.3.8 OTHER MITIGATION

Baffinland maintains an active employee and site personnel induction program designed to increase personnel awareness of health, safety and environmental issues at the site. The program addresses wildlife encounters, behavior to discourage wildlife habituation, waste management and other practices likely to impact wildlife and birds. During site orientation, employees are provided with Baffinland’s Waste Management Policy and Guidelines, and are instructed on the purpose and benefits of avoiding wildlife, where possible.

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<sup>5</sup> As per Project Condition No. 52, BIM prepared a caribou deterrence review and presented at the TEWG 21 May, 2013. It was noted that there would be no “pit” for at least the first 10 years of mining. Meadowbank, the only other operating mine in Nunavut, does not, nor does it need to, use deterrence (caribou in pits have never been a problem). Suggested within the TEWG that this be considered a “step-wise” mitigation to be addressed if animal and pit conflict ever occurs.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 56 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- Site and working areas will be kept clean of food scraps and garbage and disposed of in accordance with Baffinland’s Waste Management Guidelines.
- Feeding wildlife is prohibited.
- In compliance with Project Condition 64(b), solid wire skirting is installed along kitchen and accommodation buildings to prevent access for animals under buildings.
- Wildlife attempting to approach personnel will be deterred by shouting, chasing and using noise makers such as bear bangers. Should those deterrents not work, the site Environmental and Health and Safety Supervisors will be notified for their assessment.
- Typically wolves can be readily deterred by the above methods. Based on site experience, foxes are less responsive to deterrence. Due to the high incidence of rabies in foxes on Baffin Island, foxes that exhibit aggressive behaviour to humans, regardless of deterrence measures, are presumed to be rabid. The Environmental and Health and Safety Supervisors will assess the situation and make the recommendation for or against dispatching a likely rabid fox by lethal shot.
- In the rare situation where a lethal shot is necessary, approval to proceed will be provided by the Environmental Manager. Only personnel trained in the use of firearms will be authorized for this activity. This task will be conducted so that site personnel, equipment and infrastructure are not endangered. If rabies is suspected, a body shot will be taken, and the carcass will be handled to avoid direct physical contact. The carcass will be incinerated immediately.
- Fox and wolf interactions with Project activities will be documented and included in wildlife logs and annual reports.
- Baffinland’s Polar Bear Safety Plan (BAF-PH1-830-P16-0041) provides specific information on mitigation measures and safety measures for polar bear encounters.


As with vegetation and birds, several other management plans will contribute to the protection of wildlife species and habitats within the Project Area. These plans include the Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002), Surface Water and Aquatic Ecosystems Management Plan (BAF-PH1-830-P16-0026), and Waste Management Plan (BAF-PH1-830-P16-0028) for additional mitigation measures pertaining to each of these areas.

Present in low numbers, wolves and foxes are the dominant predators within the RSA. The Project is not expected to cause an increase in predator abundance as Project effects will likely be undetectable compared to the main effect of carnivore response to caribou abundance; however, waste management and mitigations are addressed in Baffinland’s Environmental Protection Plan (BAF-PH1-830-P16-0008) and Waste Management Plan (BAF-PH1-830-P16-0028). Waste is segregated and food waste and combustible waste are incinerated. Waste

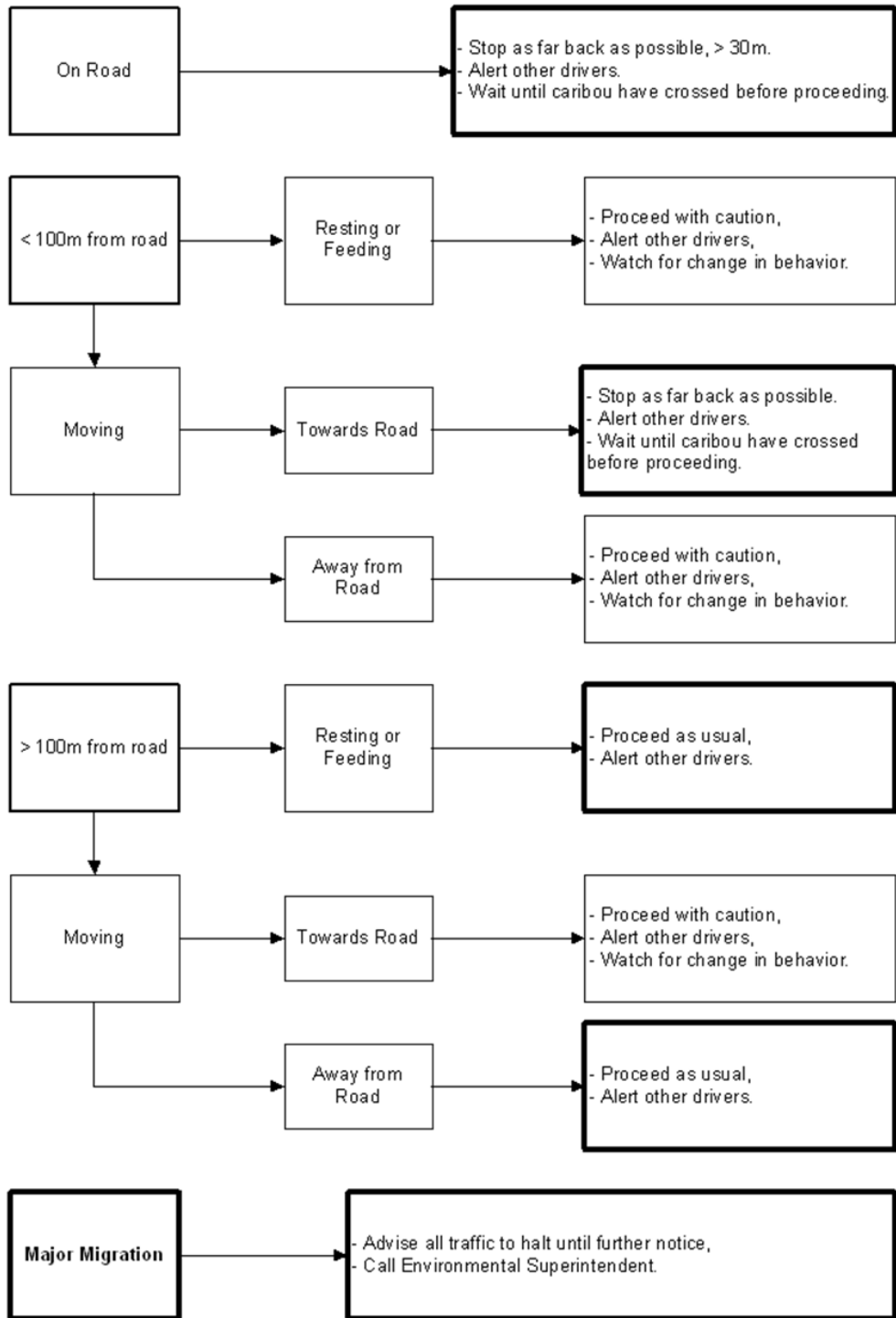
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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 57 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

collection bins are located in all major facilities. Only inert and non-combustible waste is permitted to be disposed of at the landfill. Waste audits are an integral part of monitoring and the Waste Management Plan. Also, in accordance with Project Condition 55(e), qualified biologists have and will continue to survey for carnivore (wolf and fox) dens on an as-need basis. A 2 km avoidance buffer will be established at all active dens until Project biologists have determined the carnivores have left the area (for wolves, dens may be active ~mid-May to mid-August). Den locations will be identified and all site personnel and Project activities will adhere to the avoidance announcement.



**Figure 3-2. Caribou Disturbance Decision Tree**

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 59 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## 4 MONITORING FRAMEWORK

Monitoring of Project effects must be relevant to the Project and to the possible effects which the Project will have on the environment. The monitoring framework will inform adaptive management strategies that can be effectively implemented.

The objectives of the monitoring framework are to:

- Develop a comprehensive and integrated environmental monitoring program;
- Incorporate an ecosystem-based approach for monitoring and management of Project related environmental effects;
- Integrate IQ knowledge into the development and implementation of the environmental monitoring programs;
- Include the meaningful participation of QIA in all aspects of the environmental monitoring program in all phases of the development, including decommissioning and reclamation;
- Coordinate aspects of the environmental monitoring program with Baffinland, the GN, QIA, EC-CWS, and other agencies/organizations conducting work in the region where results could inform Project effects; and
- Report in an effective and timely manner on the environmental monitoring program and its results in ways that are meaningful to stakeholders.

### 4.1 MONITORING PRINCIPLES

The framework's objectives provide guidance for the development of specific Project monitoring principles:

- Monitor and verify potential effects related to the Project;
- Monitor and evaluate the effectiveness of mitigation measures;
- Identify unanticipated effects;
- Monitor effects where predictions were based on weak data;
- Provide an early warning of undesirable change in the environment; and
- Inform adaptive management measures.

### 4.2 MONITORING FRAMEWORK OVERVIEW

The following three categories of study pertain to monitoring and follow-up of Project-related effects (adapted from Voisey's Bay EEM 2006):

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1. **Baseline Research** — background studies intended to establish need for, or parameters of, an Environmental Effects Monitoring (EEM) program. Research studies could address issues such as natural variability of a measurable parameter or monitoring target, or examine the nature, extent, or duration of a potential Project – VEC interaction.
2. **Surveillance** — programs to produce information about the pattern of occurrence of key indicators.
3. **Monitoring** — programs to address and quantify cause and effect linkages between Project activities and components of the receiving environment.

Table 4-1 defines the key considerations for each monitoring plan component outlines the monitoring approach taken for a number of VECs as identified by the NIRB. Monitoring is focused on measureable parameters of identified KIs.

**Table 4-1. Monitoring Framework — Overview and Definitions**

<b>VEC</b>	Valued Component (e.g., Terrestrial Wildlife) — identified by NIRB, addressed in Mary River Project EIS
<b>Key Indicator</b>	The species or relevant feature selected to represent the VEC (e.g., caribou)
<b>Monitoring Category</b>	One of three categories – Research, Surveillance, full EEM
<b>Design</b>	e.g., Before-After-Control-Impact (BACI), opportunistic, etc.
<b>Measurable Parameter</b>	A quantifiable feature used to assess potential effects on an indicator (e.g., movement)
<b>Key Project Interactions</b>	Identification of key project features that result in residual effects on the Indicator and Measurable Parameter (e.g., Railway as a filter to caribou (Indicator) movement (Measurable Parameter)).
<b>Goal</b>	Statement of the expected residual effect of the Project (e.g., the Project will have a non-significant effect on caribou movements across Project infrastructure).
<b>Objective</b>	Evaluate a potential response specific to the mine and operations (e.g., evaluate movement patterns of caribou as they approach or cross the railway).
<b>Threshold</b>	Early warning indicator (note: usually about an order of magnitude lower than the significance criteria used in the EIS)
<b>Scope of Monitoring Work</b>	Brief overview of key components of a monitoring program including note of temporal and spatial scale, frequency, duration.
<b>Agency/Partner Participation</b>	Identification of agencies or key partners in the monitoring programs (e.g., Qikiqtani Inuit Association).
<b>Mitigation Measures</b>	A list of measures used to reduce or remove project related effects (e.g., project design elements, adjustments to operations)
<b>Project Terms and Conditions</b>	Indicates the Project Terms and Conditions (NIRB Project Certificate No. 005) that are being addressed by this monitoring plan component

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 61 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

### 4.3 VEGETATION MONITORING

Vegetation will be monitored during Project construction, operation, and closure. Exotic invasive vegetation and natural revegetation monitoring was initiated to ensure that exotic invasive plant species are not introduced to the Arctic environment via Project activities. Pending preliminary results from early monitoring during construction and early operations, monitoring may occur every 3-5 years in conjunction with other monitoring programs or as triggered by observations of exotic invasive plant species. If exotic invasive plant species are found, they will be destroyed and, if the pathway of entry can be determined, changes will be made to reduce the possibility of further introduction. See Table 4-2 for additional information on exotic invasive vegetation and natural revegetation monitoring and Appendix B 4-1 — Vegetation Monitoring: Exotic Invasive Vegetation and Natural Revegetation, for specifics regarding the monitoring program.


Vegetation health monitoring includes two components: 1) vegetation abundance and composition, and 2) metal concentrations in soil and vegetation. The first component was initiated through establishing long-term monitoring plots in a habitat-type selected to represent caribou forage. These long-term monitoring plots are located near Project infrastructure and also in control areas within the RSA. Plots located in the vicinity of Project infrastructure are situated at varying distances from infrastructure to determine the extent of air quality impacts (exact distances were determined by the air quality monitoring program). Within each of the plots, plant composition is documented, and the percent cover of each plant group is estimated. Based on early results, monitoring may occur every 3-5 years, but the schedule will be determined by vegetation growth rates and observed effects.

The second component of vegetation health monitoring involves the collection of soil and vegetation tissue samples for analysis of select chemicals of concern (CoPC) by an accredited laboratory. Sample sites are situated at varying distances from Project infrastructure and in control areas within the RSA to determine if there is a change in base metal concentrations (mg/kg) from Project activities. Pending results from early analyses, monitoring will occur every 3-5 years as determined by changes to base metal concentrations based on data collected during sampling and consideration of adaptive management required to mitigate effects to vegetation health. See Table 4-3 for additional information on vegetation health monitoring and Appendix B 4-2 — Vegetation Monitoring: Vegetation Health, for specifics regarding the monitoring program.

Dust fall monitoring is conducted year-round at a number of infrastructure sites and seasonally at a number of control areas within the RSA to determine the level of dust deposition

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 62 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

associated with Project activities. Sampling locations are situated at varying distances from the PDA to determine the areal extent of dust fall on vegetation. At each sampling location a sample is collected and analyzed by an accredited laboratory for total suspended particulate (TSP), fixed and volatile components of TSP, and metals (all in units of mg/m<sup>2</sup>/day). See Table 4-4 for additional information on dust fall monitoring and Appendix B 4-3 — Vegetation Monitoring: Dust fall, for specifics regarding the monitoring program.

**Table 4-2. Vegetation Monitoring: Exotic Invasive Vegetation and Natural Revegetation**

<b>Indicator</b>	Exotic Invasive Plant Species
<b>Monitoring Category</b>	Surveillance
<b>Design Type</b>	Regularly-occurring inventory and observation
<b>Measurable Parameter</b>	Occurrence of exotic invasive plant species
<b>Key Project Interactions</b>	Introduction of exotic invasive plant species
<b>Goal</b>	The Project will not introduce exotic invasive plant species to the RSA
<b>Objective</b>	To quantify: 1) The presence of exotic invasive plant species within and adjacent to the Project footprint; and 2) Assess disturbed areas to determine recolonization by plants, invasive or native, through long-term monitoring.
<b>Threshold</b>	No introduction of exotic invasive plant species as a result of Project activities
<b>Scope of Monitoring Work</b>	<u>Local monitoring:</u> Assess the Project footprint and adjacent habitats for the occurrence of exotic invasive plant species and progress of revegetation in disturbed areas. Monitoring may occur every 3-5 years in conjunction with other monitoring programs or as triggered by observations of exotic invasive plant species.
<b>Agency/Partner Participation</b>	None required
<b>Project Terms and Conditions</b>	37, 50

**Table 4-3. Vegetation Monitoring: Vegetation Health**

<b>Indicator</b>	Vegetation Health
<b>Monitoring Category</b>	Environmental Effects Monitoring
<b>Design Type</b>	Before-After-Control-Impact (BACI)
<b>Measurable Parameter</b>	1) Vegetation composition and percent cover of plant groups 2) Metals concentrations in soil and vegetation
<b>Key Project Interactions</b>	Dust, effluent, and air emissions released into the environment have the potential to impact vegetation health. Dust and other contaminants may affect the survival of plant species (leading to changes in plant composition and abundance) and if contaminants are absorbed by plants then they may be ingested by wildlife or humans, which may have an effect on the health of individuals.
<b>Goal</b>	The Project will not results in a significant increase in contaminant uptake in vegetation
<b>Objective</b>	To quantify: 1) Vegetation abundance and composition; and 2) Metal concentrations in soil and vegetation through continued monitoring during the duration of the Project.
<b>Threshold</b>	1) Thresholds for vegetation abundance and composition to be determined. 2) Refer to Appendix B, Table 4-19 Vegetation Toxicity Thresholds for Potential Effects on Vegetation Health.
<b>Scope of Monitoring Work</b>	<u>Regional monitoring:</u> Assess vegetation abundance and composition and metal concentrations in soil and vegetation. Monitoring will occur every 3-5 years as determined by: 1) Vegetation growth rates (vegetation abundance and composition) and changes to base metal concentrations (vegetation and soil base metals) based on data collected during sampling; and 2) Consideration of adaptive management required to mitigate effects to vegetation health. To implement adaptive management during the life of a 21 year mine this would require 3-4 sampling periods over 15 years.
<b>Agency/Partner Participation</b>	None required
<b>Project Terms and Conditions</b>	34, 36, 38, 50

**Table 4-4. Vegetation Monitoring: Dust fall**

<b>Indicator</b>	Dust fall
<b>Monitoring Category</b>	Environmental Effects Monitoring
<b>Design Type</b>	Control-Impact
<b>Measurable Parameter</b>	Dust fall deposition rates (TSP; mg/dm <sup>2</sup> /day)
<b>Key Project Interactions</b>	Dust fall has the potential to affect vegetation health, as well as forage palatability for caribou
<b>Goal</b>	The project will have a non-significant effect on palatability of vegetation for caribou
<b>Objective</b>	Quantify: 1) The extent and magnitude of dust fall on vegetation generated by Project activities; 2) Determine seasonal variation in dust fall; and 3) Determine if annual changes in dust fall exceed identified thresholds associated with isopleth dispersion models.
<b>Threshold</b>	Refer to Appendix B, Table 7-2 Dust (TSP) Deposition Rates and Criteria for Potential Effects on Vegetation Health..
<b>Scope of Monitoring Work</b>	<u>Regional monitoring:</u> Dust fall is monitored at 33 sampling sites. Sample sites within the PDA (21 out of 33 sample sites) are monitored year round; however, more distant control locations are not included in winter sampling due to access limitations during the winter season.
<b>Agency/Partner Participation</b>	None required
<b>Project Terms and Conditions</b>	50, 54d(i), 58c

#### 4.4 BIRDS MONITORING

Four monitoring programs for birds will be implemented by Baffinland over the course of the construction, operation, closure, and post-closure phases to enhance baseline knowledge, to detect possible changes to KI birds in the RSA, to assess the magnitude of these changes, and to determine whether these changes are naturally occurring variations or Project-related effects.

NIRB Project Condition 74 identifies peregrine falcon and gyrfalcon as KI birds for follow up monitoring. Further, during the final hearing, Baffinland committed to monitoring relevant sections of the Project area for peregrine falcon nesting activities (Commitment no. 75). Monitoring of peregrine falcon and gyrfalcon nesting occurs annually to quantify occupancy and productivity and ensure that the Project is having a non-significant effect on cliff-nesting raptors. At a minimum, the monitoring program involves conducting aerial surveys — one early

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in the nesting period, and one just before fledging, when a helicopter is available on site. Survey results for nests in close proximity to the Project footprint are compared with results from further distance “bins” and with baseline findings to determine whether the Project is affecting cliff-nesting species (Table 4-5). Details are provided in Appendix B 4-5 — Migratory Bird Monitoring: Nesting of Common and King Eider, and Red Knot.

The density of Common Eider, King Eider, and Red Knot nests (if nest sites are found) along the Port Sites and appropriate control shorelines are surveyed over three consecutive years to ensure that sensory disturbance from Project activities and wake effects from shipping do not have a significant detrimental effect on shoreline nesting birds (Table 4-6).

Although Baffinland is confident that Project effects will have a non-significant impact on migratory songbirds and shorebirds within the RSA, they have committed to assisting the CWS in regional baseline research and monitoring of these species. The monitoring program involves 20 PRISM plots conducted within the RSA every five years (Table 4-7).

**Table 4-5. Migratory Bird Monitoring: Peregrine Falcon and Gyrfalcon Nesting**

<b>Indicator</b>	Peregrine Falcon and Gyrfalcon
<b>Monitoring Category</b>	Baseline Research and Surveillance
<b>Design Type</b>	Before-After-Control-Impact (BACI)
<b>Measurable Parameter</b>	Occupancy and productivity
<b>Key Project Interactions</b>	Sensory disturbances generated from various Project activities
<b>Goal</b>	The Project will have a non-significant effect on peregrine falcon and gyrfalcon occupancy and productivity
<b>Objective</b>	To quantify peregrine falcon and gyrfalcon occupancy and productivity within the RSA
<b>Threshold</b>	Less than a 10% difference in near-site and far-site occupancy and productivity averaged over three consecutive years
<b>Scope of Monitoring Work</b>	<u>Local monitoring:</u> Annual territory surveys to determine occupancy and productivity of peregrine falcons and gyrfalcons (total of four surveys — peregrine falcon occupancy and productivity, and gyrfalcon occupancy and productivity).
<b>Agency/Partner Participation</b>	<u>Local monitoring:</u> Government of Nunavut, Department of Environment, Arctic Raptors Inc.
<b>Project Terms and Conditions</b>	73

**Table 4-6. Migratory Bird Monitoring: Nesting of Common and King Eider, and Red Knot**

<b>Indicator</b>	Common and King Eider, and Red Knot
<b>Monitoring Category</b>	Baseline Research and Monitoring
<b>Design Type</b>	Before-After-Control-Impact (BACI)
<b>Measurable Parameter</b>	Habitat — nesting
<b>Key Project Interactions</b>	Sensory disturbance and wake effects on shoreline nesting birds
<b>Goal</b>	The Project will have a non-significant effect on eider and red knot nesting density
<b>Objective</b>	Quantify number of eider and red knot nests at the port sites, and appropriate control shorelines
<b>Threshold</b>	Less than a 20% decrease in nesting within the Steensby Port ZOI relative to control areas over three consecutive years of monitoring.
<b>Scope of Monitoring Work</b>	<u>Local</u> : Pre and post-disturbance surveys of eider and red knot nesting densities within and adjacent to the port site and control areas.
<b>Agency/Partner Participation</b>	Environment Canada - Canadian Wildlife Service
<b>Project Terms and Conditions</b>	73

**Table 4-7. Migratory Bird Monitoring: Songbirds and Shorebirds**

<b>Indicator</b>	Shorebirds and Songbirds
<b>Monitoring Category</b>	Baseline Research
<b>Design Type</b>	PRISM plots
<b>Measurable Parameter</b>	Abundance and density
<b>Key Project Interactions</b>	Habitat loss and sensory disturbance due to Project activities
<b>Goal</b>	The Project will have a non-significant effect on songbird and shorebird abundance and density within the RSA. There is high confidence in this prediction. Follow-up monitoring is not required.
<b>Objective</b>	Contribute to baseline knowledge of songbird and shorebird distribution and abundance in the Eastern Arctic.
<b>Threshold</b>	No thresholds identified – this is a contribution to regional baseline research and monitoring

**Table 4-7. Migratory Bird Monitoring: Songbirds and Shorebirds**

<b>Scope of Monitoring Work</b>	<u>Regional</u> : 20 PRISM plots every 5 years
<b>Agency/Partner Participation</b>	Canadian Wildlife Service
<b>Project Terms and Conditions</b>	73

## 4.5 TERRESTRIAL WILDLIFE MONITORING

The Impact Assessment did not identify significant impacts to caribou present in the RSA and confidence is limited in the predictions of these impacts on caribou behaviour due to insufficient study population (low number of caribou present in the RSA. To ensure that the Project does contribute detrimental effects on local caribou, several monitoring programs have been developed. These programs are focused within the ZOI assessed for caribou, as identified in Volume 6, Section 5 of the FEIS. Although there are varying levels of disturbance relative to distance from activities, the ZOI is conservatively expected to extend no further than 14 km.

### 4.5.1 CARIBOU HABITAT MONITORING

Monitoring of caribou habitat use involves two monitoring programs: the first assessing indirect habitat loss (resulting from sensory disturbances) and the second, observing caribou calving behavior within the RSA. Monitoring of indirect habitat loss occurs at both the local level by tracking incidental observations of caribou by Project personnel, and at the regional level via aerial surveys. Initial surveys were conducted within the ZOI during Project construction and initial years of operation which determined that there were not enough caribou present to warrant continued aerial surveys. When caribou numbers are sufficient enough for robust statistical analysis aerial surveys may resume if further data are required. This will support long-term monitoring of North Baffin Island caribou for caribou that have the potential to interact with the Project area by a GN-sponsored caribou satellite collaring program. Confirmed methods for regional-level monitoring will be determined in conjunction with the TEWG when caribou numbers are sufficient to support comprehensive statistical analyses. Table 4-8 provides additional information on the monitoring of indirect habitat loss.

Monitoring of habitat use during the calving season includes the following surveys (Table 4-9) established within the ZOI:

- Aerial surveys of known calving sites within the ZOI during construction and initial years of operation to document occurrence.
- Height of land surveys during the calving season to examine caribou use near the Project footprint.
- Behavioural monitoring during the calving season — to be conducted in association with the height of land surveys and/or other observations of caribou along Project infrastructure (e.g., Tote Road).
- Wildlife monitor on site during the calving period to detect any calving activity near the Tote Road.

At the regional level, collar data from a GN-sponsored caribou satellite collaring program could inform calving distribution patterns. Additionally, periodic consultation will be conducted with local HTOs to provide information on the relative abundance of caribou in and around the RSA.

**Table 4-8. Caribou Monitoring: Indirect Habitat Loss**


<b>Indicator</b>	Caribou
<b>Monitoring Category</b>	Surveillance
<b>Design Type</b>	Observational (aerial surveys, collar data) and opportunistic
<b>Measurable Parameter</b>	Distribution
<b>Key Project Interactions</b>	Indirect habitat loss from Project activities that create sensory disturbances and/or temporarily reduce the effectiveness (usefulness) of habitats adjacent to the Project footprint (e.g., dust deposition reducing palatability of vegetation), resulting in changed distribution
<b>Goal</b>	The Project will have a non-significant effect on distribution of the North Baffin Island caribou
<b>Objective</b>	Evaluate trends in caribou distribution in the ZOI
<b>Threshold</b>	Caribou occurrence within the ZOI equivalent to the prediction made in the Project Impact Assessment.
<b>Scope of Monitoring Work</b>	<p>Addressing this target requires regional-level surveys.</p> <p><u>Local monitoring:</u> Continuous log of caribou observations from staff to document occurrence and maintain a record of flight paths and cruising altitudes of aircraft within ZOI.</p> <p><u>Regional monitoring:</u> When caribou numbers are sufficient to provide robust statistical analysis of distribution within the ZOI, an annual aerial survey program will be implemented to document abundance and distribution of caribou in the RSA.</p> <p>Long-term distribution patterns as identified by a GN-sponsored caribou satellite collaring program.</p>

**Table 4-8. Caribou Monitoring: Indirect Habitat Loss**

<b>Agency/Partner Participation</b>	<u>Local monitoring:</u> Baffinland employees, Qikiqtani Inuit Association, Pond Inlet, Igloolik, Arctic Bay HTOs <u>Regional monitoring:</u> Government of Nunavut, Department of Environment
<b>Project Terms and Conditions</b>	53b, 54b

**Table 4-9. Caribou Monitoring: Habitat Use during Calving**

<b>Indicator</b>	Caribou
<b>Monitoring Category</b>	Baseline Research and Surveillance
<b>Design Type</b>	Observational (aerial surveys, height of land surveys, collar data) and opportunistic (behavioural observations)
<b>Measurable Parameter</b>	Calving habitat use
<b>Key Project Interactions</b>	Project footprint in known calving habitats and sensory disturbances to caribou during the calving season
<b>Goal</b>	The Project will have a non-significant effect on caribou calving habitat use
<b>Objective</b>	Allow caribou to calve undisturbed within the ZOI
<b>Threshold</b>	Not a quantifiable threshold
<b>Scope of Monitoring Work</b>	<u>Local monitoring:</u> Aerial surveys of known calving sites within the ZOI prior to construction, opportunistic documentation of other calving sites, and height of land surveys in appropriate areas during the calving season and construction activities. Monitoring during construction and post-construction to document occurrence, particularly in the vicinity of Cockburn Lake. Wildlife monitor will be on site to detect calving activities near the road. If a caribou is found to be calving near Tote Road mitigation measures will be implemented. <u>Regional monitoring:</u> Long-term calving distribution patterns as identified by a GN-sponsored caribou satellite collaring program. Collar data will inform regional calving distribution.
<b>Agency/Partner Participation</b>	<u>Local monitoring:</u> Qikiqtani Inuit Association, Pond Inlet, Igloolik, Arctic Bay HTOs, Government of Nunavut, Department of Environment <u>Regional monitoring:</u> Government of Nunavut, Department of Environment
<b>Project Terms and Conditions</b>	53d, 54b

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 70 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

#### 4.5.2 CARIBOU MOVEMENT

When caribou numbers are present in a high enough density to provide for robust experimental design and statistically robust analyses, caribou monitoring will include a program to observe Project effects on caribou movement within the ZOI. Specifically, the program will monitor:

- The effects of railway infrastructure and operations on caribou movements through seasonal track surveys for the first 3–5 years of operation in key movement areas, and remote motion-sensing cameras set up at select trails that cross or approach the railway.
- The effects of the Tote Road, particularly road maintenance activities (e.g. snow banks) and road traffic, on caribou movements through snow track surveys, snow bank height monitoring, and remote motion-sensing cameras set up at select trails that cross or approach the road.
- The effectiveness of the Caribou Decision Tree (Figure 3-2) in facilitating caribou movement across the road and preventing caribou mortality.
- The effects of the Tote Road and railway on caribou movements at water crossings (first step will be additional baseline data collection to confirm the location and use of the water crossings identified in the terrestrial baseline<sup>6</sup>).

If deemed necessary during railway operation, additional monitoring of caribou movements could involve having wildlife monitors visit the 52 identified trails at least once annually to document recent use (the focus of this work would be to determine if caribou are crossing the transportation infrastructure), and/or having wildlife monitors ride the trail and drive project roads once a month (when daylight allows sufficient visibility) to count the number of caribou in the area (see Table 4-10 for additional information).

Additionally, during the technical review process of the mitigation and monitoring plan, dash-mounted cameras within Project vehicles were suggested as a means of monitoring caribou response to road traffic. However, dash-mounted cameras are not being considered for implementation at this time due to: 1) excessive data management issues that would result from all the camera footage, with caribou being observed only rarely on the footage; and 2) the limited field of view of the cameras would mean that the cameras would only capture caribou response when caribou were either on the road, or immediately adjacent to the road.

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<sup>6</sup> The potential for Project interaction with water crossings was evaluated in the 2014 Terrestrial Environment Annual Report. The potential for interaction is low to nil and the Project is unlikely to affect inland water crossings, should they occur.

**Table 4-10. Caribou Monitoring: Movement**

<b>Indicator</b>	Caribou
<b>Monitoring Category</b>	Baseline Research and Surveillance
<b>Design Type</b>	Observational
<b>Measurable Parameter</b>	Movement in the ZOI
<b>Key Project Interactions</b>	Road and railway structure and operations may act as a filter or barrier to the movement of caribou through the Regional Study Area
<b>Goal</b>	The Project will have a non-significant effect on caribou movements across Project infrastructure
<b>Objective</b>	Evaluate movement patterns of caribou as they approach or cross the Road/Railway and other Project infrastructure
<b>Threshold</b>	Less than 10% deflection of approaches to Railway and infrastructure
<b>Scope of Monitoring Work</b>	<p>Local monitoring: Have an on-site wildlife monitor to implement seasonal caribou track surveys; these can be ground-based (snow machine) to observe movement during early winter and spring seasons. Trail monitoring using remote motion-sensing cameras and documenting fresh tracks at select trails that cross or approach the Road/Railway. Monitor response of caribou to railway bridge and tunnels. In conjunction with snow track surveys monitor snow bank heights maintained at &lt;1 m; monitor the use of snow banks by caribou along the Tote Road. Monitor and document effectiveness of the Caribou Decision Tree. Monitor caribou use of water crossings.</p> <p>Regional monitoring: Long-term movement patterns as identified by a GN-sponsored caribou satellite collaring program. This is a longer-term approach that requires analyses at a regional scale. These analyses are expected to be conducted by the Government of Nunavut.</p>
<b>Agency/Partner Participation</b>	<p><u>Local monitoring:</u> Qikiqtani Inuit Association, Pond Inlet, Igloolik, Arctic Bay HTOs, Baffinland employees</p> <p><u>Regional monitoring:</u> Government of Nunavut, Department of Environment</p>
<b>Project Terms and Conditions</b>	53c, 53e, 54b

#### 4.5.3 CARIBOU MORTALITY

Project-related caribou mortality is tracked along with mortalities of other wildlife species as part of general wildlife monitoring (Section 4.7). Additionally, Baffinland will continue to monitor the potential for increased caribou mortality as an indirect result of the Project (i.e., indirectly through increased harvester knowledge of the area due to continuous human presence at the Mary River site). This is accomplished through tracking the number of hunters passing through, and visiting the Project accommodations. To gather further information, a region-wide hunter harvest study could be partly sponsored by Baffinland and conducted in

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collaboration with local HTOs and the Government of Nunavut Department of Environment GNDoe.

**Table 4-11. Caribou Monitoring: Harvest-related Mortality**

<b>Indicator</b>	Caribou
<b>Monitoring Category</b>	Surveillance
<b>Design Type</b>	N/A
<b>Measurable Parameter</b>	Mortality risk
<b>Key Project Interactions</b>	Caribou mortality risk may increase as an indirect result of the Project through increased harvester knowledge
<b>Goal</b>	The Project will have a non-significant increase on caribou mortality risk
<b>Objective</b>	Quantify caribou mortality risk in the RSA caused by increased harvesting knowledge
<b>Threshold</b>	Exceeding the herd's Total Allowable Harvest
<b>Scope of Monitoring Work</b>	<u>Local monitoring:</u> Log of hunters passing through and using the camp. <u>Regional monitoring:</u> Potential Baffinland-sponsored multi-year hunter harvest study, which includes a summary of annual caribou harvest and, if possible, harvest locations.
<b>Agency/Partner Participation</b>	<u>Local monitoring:</u> Qikiqtani Inuit Association, Pond Inlet, Igloodik, Arctic Bay HTOs, Baffinland employees (e.g., train conductor) <u>Regional monitoring:</u> Government of Nunavut, Department of Environment, Nunavut Wildlife Management Board
<b>Project Terms and Conditions</b>	54f

#### 4.5.4 CARIBOU HEALTH

Changes to the health of the existing caribou population due to Project activities are unlikely. However, there is insufficient baseline knowledge to predict how caribou health might be affected by consumption of vegetation with heavy dust deposition. Therefore, several programs have been developed to monitor caribou health in response to the Project. The Vegetation Health monitoring program is an integral component to this monitoring. Additional monitoring programs will investigate metal concentrations in caribou tissues and body condition measurements as a part of a hunter-harvest study (Table 4-12). The GNDoe initiated a regional caribou health monitoring program; a hunter-harvest study that Baffinland could partially sponsor could use standardize methods so that results are comparable. The data could be used to help monitor potential effects that have a time component (i.e., length of exposure to disturbance). Hunter-harvest data can be collected immediately to acquire pre-development

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information and the study can be reassessed after five years to determine efficiency and efficacy of the data collected.

**Table 4-12. Caribou Monitoring: Health Contaminants and Body Condition**

<b>Indicator</b>	Caribou
<b>Monitoring Category</b>	Surveillance
<b>Design Type</b>	Opportunistic sample collection
<b>Measurable Parameter</b>	Health — contaminants in caribou tissues and body condition measurements
<b>Key Project Interactions</b>	Sensory disturbances related to Project construction and operation
<b>Goal</b>	The Project will have a non-significant effect on North Baffin Island caribou population-level condition
<b>Objective</b>	Quantify indices of caribou body condition from individuals harvested within the RSA, as an index of population health.
<b>Threshold</b>	No detectable change in caribou health as a result of Project activities
<b>Scope of Monitoring Work</b>	<u>Regional monitoring:</u> Tissue samples and body measurements collected through the Baffinland-sponsored multi-year hunter harvest study; and opportunistic collection of fresh fecal samples
<b>Agency/Partner Participation</b>	<u>Regional monitoring:</u> Qikiqtani Inuit Association, Pond Inlet, Igloodik, Arctic Bay HTOs, Government of Nunavut, Department of Environment, Nunavut Wildlife Management Board
<b>Project Terms and Conditions</b>	54d

#### 4.6 WOLF-SPECIFIC MONITORING

Although not identified as a KI in the FEIS, wolves were identified as a KI for follow-up monitoring. During baseline studies, one wolf den was identified within the Mary River RSA; due to insufficient sample size, a monitoring program investigating variability in den occupancy is not currently feasible. However, monitoring can track the annual occupancy of identified dens when wolves are found in sufficient numbers and interacting with the project to warrant monitoring. Should additional dens be identified within 10 km of Project infrastructure, the monitoring program can be revisited.

**Table 4-13. Wolf Monitoring: Den sites**

<b>Indicator</b>	Wolf
<b>Monitoring Category</b>	Baseline Research and Surveillance
<b>Design Type</b>	Observational (aerial surveys) and opportunistic
<b>Measurable Parameter</b>	Dens within 10 km of mine site
<b>Key Project Interactions</b>	Project activities that create sensory disturbances and/or temporarily reduce the effectiveness (usefulness) of habitats adjacent to the Project footprint potentially resulting avoidance of habitats or disturbance to denning wolves.
<b>Goal</b>	The Project will have a non-significant effect on wolf den sites
<b>Objective</b>	Allow wolves to den undisturbed within the ZOI
<b>Threshold</b>	No threshold at this time
<b>Scope of Monitoring Work</b>	<u>Local monitoring:</u> Aerial surveys of known den sites within a 10 km radius of the mine site to document occupancy, opportunistic documentation of other den sites. <u>Regional monitoring:</u> Maintain/add to long-term regional den site database in cooperation with GN-DOE and support any regional programs targeting wolves.
<b>Agency/Partner Participation</b>	<u>Local monitoring:</u> Qikiqtani Inuit Association, Pond Inlet, Igloolik, Arctic Bay HTOs, Government of Nunavut, Department of Environment <u>Regional monitoring:</u> Government of Nunavut, Department of Environment
<b>Project Terms and Conditions</b>	55a

#### 4.7 MONITORING FOR ALL WILDLIFE SPECIES

To ensure that Project effects on all wildlife species are minimized, Baffinland monitors and annually reports on the amount of direct habitat loss resulting from the Project footprint (see Table 4-14). Baffinland also tracks incidental wildlife observations made by Project personnel within the PDA (Table 4-15).

**Table 4-14. Wildlife Monitoring: Direct Habitat Loss**


<b>Indicator</b>	All species
<b>Monitoring Category</b>	Surveillance
<b>Design Type</b>	Footprint survey
<b>Measurable Parameter</b>	Project footprint
<b>Key Project Interactions</b>	Direct habitat loss within the footprint of the Project (either temporary or permanent)
<b>Objective</b>	Quantify direct habitat loss in the Project footprint
<b>Threshold</b>	Habitat loss limited to the amount identified in the Project description
<b>Scope of Monitoring Work</b>	<u>Local monitoring</u> : Measure area of Project disturbance on an annual basis
<b>Agency/Partner Participation</b>	None required
<b>Project Terms and Conditions</b>	75

**Table 4-15. Wildlife Monitoring: Incidental Observations and Project Mortality**

<b>Indicator</b>	All species
<b>Monitoring Category</b>	Surveillance
<b>Design Type</b>	Opportunistic
<b>Measurable Parameter</b>	Wildlife mortality
<b>Key Project Interactions</b>	Wildlife mortality due to Project activities and indirect habitat loss associated with the Project.
<b>Objective</b>	Track wildlife observations and Project-related mortality within and adjacent to the Project footprint
<b>Threshold</b>	Every Project-related mortality of caribou will be reviewed to determine if further action is needed. Other species dealt with on a species-by-species basis.
<b>Scope of Monitoring Work</b>	<u>Local monitoring</u> : Log of wildlife observations within the RSA. Record of collisions and all other observed wildlife mortalities within the RSA.
<b>Agency/Partner Participation</b>	None required
<b>Project Terms and Conditions</b>	53e

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 76 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## 5 REPORTING

Baffinland prepares annually a Terrestrial Environment Annual Report. A draft report is prepared by early winter (usually ~ November) for TEWG review before an early winter TEWG meeting. TEWG comments from the winter meeting and written comments on the draft report are incorporated into revisions for the final annual report that becomes an appendix to the NIRB annual report submitted in March the following year. The annual reports summarize the year's terrestrial environment monitoring activities, any mitigation actions that were taken, and describes adaptive management practices that were implemented to address unexpected project effects.

Baffinland also responds to NIRB's request for information and recommendations based on their and regulatory review of the overall annual report to NIRB. If there are comments associated with the Terrestrial Environment, the concerns are addressed either immediately in direct response to NIRB's recommendations, or in the following year's annual report if revisions to methods, analyses or mitigation actions were required.


The final reports, responses, and succeeding annual reports are posted on the NIRB ftp/public registry web site.

## 6 ADAPTIVE STRATEGIES

Adaptive strategies are implemented when unexpected effects are observed, or if effects are larger than predicted and exceed the identified thresholds. The management and mitigation of unanticipated effects will be most effective with collaboration between Baffinland and other local stakeholders and regulators. If effects to vegetation, birds, or terrestrial wildlife exceed identified thresholds, local HTOs, regulators, Baffinland's specialists and representatives and other stakeholders will meet to discuss mitigation options that will remove or reduce the effect. If necessary, further monitoring or research options and details that are acceptable to all parties can be discussed during these meetings. A collaborative approach among stakeholders to mitigating unforeseen effects will lead to more acceptable mitigation strategies and results for all parties involved.


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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 77 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 78 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## **Appendix A. Terrestrial Environment Working Group Terms of Reference**

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 79 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

## TERRESTRIAL ENVIRONMENT WORKING GROUP TERMS OF REFERENCE

Terms of Reference — February 20, 2013

### Terrestrial Environment Working Group (TEWG)

This Terms of Reference (TOR) is intended to be the framework under which the Terrestrial Environment Working Group (TEWG) and its members will operate. Additionally, the TOR outlines the main objectives that the TEWG will fulfill. More detailed work plans will be developed from meetings held by the TEWG.

These draft terms are subject to the terms and conditions of a project certificate issued by Nunavut Impact Review Board (NIRB). A chronology for the drafting of these Terms of Reference is provided in Annex A.

#### 1. Purpose

1.1 The purpose of the Terrestrial Environment Working Group (“TEWG”) is to act as an advisory group to provide for ongoing cooperation, communication, reporting, review and consideration of environmental effects monitoring, mitigation measures and fulfillment of the Project Certificate Conditions as appropriate relating to the interaction between the Mary River Project (the “Project”) and the terrestrial environment.

1.2 The “Parties” to these Terms of Reference are the Qikiqtani Inuit Association, Baffinland Iron Mines, Environment Canada, and the Government of Nunavut’s Department of Environment.


1.3 In alignment with the Nunavut Impact Review Board (NIRB) Final Hearing Report recommendation number 49, these TOR provide the framework for the TEWG and the objectives it will fulfill. It is the intention of Baffinland to establish cooperative environmental arrangements between the company, members of the TEWG and the Inuit of the Qikiqtaaluk region to protect both the environment as well as the traditional relationship of the Inuit with the natural environment. The objectives of these arrangements are to:

- Develop sufficient baseline from which the Project can be effectively monitored and managed;
- Develop a comprehensive and integrated environmental monitoring program as required in the Project Certificate;

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 80 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- Incorporate an ecosystem-based approach for monitoring and management of Project-related environmental effects;
- Include the meaningful participation of members of the TEWG and local Inuit in all aspects of the environmental monitoring program in all phases of the development, including decommissioning and reclamation;
- Integrate traditional knowledge into the development and implementation of the environmental monitoring programs;
- Coordinate all aspects of the environmental monitoring program; and
- Where deemed necessary by the working group, report in an effective and timely manner on the environmental monitoring program and its results in ways that are meaningful to Inuit.

## 2. Composition

2.1 The TEWG shall consist of an appointed member from each of the Parties.

The Parties of the TEWG will be the following:

- a) the Qikiqtani Inuit Association (“QIA”) shall appoint one member;
- b) Baffinland Iron Mines (“Baffinland”) shall appoint one member;
- c) the Government of Nunavut’s Department of Environment shall appoint one member;
- d) Environment Canada shall appoint one member;

2.2 All Parties must consent to the addition or removal of a Party to the TEWG. In the event of an addition or removal of a Party, these Terms of Reference will be amended accordingly.


2.3 Each Party will appoint an alternate member and may send other experts, staff, their legal counsel, or observers to any meeting of the TEWG.

2.4 The TEWG may grant observer status to other organizations from time to time.

2.5 In year one, Baffinland will appoint a chair and alternate member for the TEWG meetings. In year two and subsequent years, the Parties or members of the TEWG will nominate and appoint a chair on consensus.

2.6 When the chair is absent for any reason, the alternate member from the organization serving as chair will act as chair.



 <b>Baffinland</b>	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 81 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

2.7 Quorum, unless otherwise agreed to by all appointed members, requires the participation of a member or an alternate member from the Parties or organizations identified in section 2.1. For example, participation of all members may not be required at meetings of the TEWG where the agenda may not include topics covered under an agency's mandate.

### 3. Meetings of the Terrestrial Environment Working Group

3.1 The first official meeting of the TEWG will be held within three (3) months of NIRB's issuance of a Final Project Certificate, unless otherwise agreed to by the Parties to these Terms of Reference.

3.2 During the first year, the TEWG will meet at least quarterly for the purpose of establishing the functions of the working group and developing a work plan. One of the four (4) meetings could be done in conjunction with the Marine Environment Working Group so as to coordinate the efforts, especially for species using both land and sea (e.g. seabirds, ducks, polar bears).

3.3 After the first year, it is expected that the TEWG will normally meet two times a year but may determine the schedule of meetings based on need and consensus of members of the TEWG. One meeting may be held jointly with the Marine Environment Working Group if deemed necessary to coordinate the efforts.


3.4 Meeting locations and meeting dates will be determined by the working group on an annual basis and will be held face to face or members can participate by conference call.

3.5 The operations of the TEWG including correspondence, documentation and meetings will be in English. It is recognized that on a case by case basis meetings related to the TEWG will require simultaneous translation for the purpose of understanding traditional knowledge and ensuring that traditional knowledge can be incorporated into applicable programs to be reviewed by the TEWG.

### 4. Project Monitoring

4.1 Project monitoring program will comply with the requirements as set out in

- a) the NLCA, specifically Articles 12.7.2 and 12.7.3;
- b) applicable Federal and Territorial legislation and regulations; and
- c) the terms and conditions of the Project Certificate.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 82 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

4.2 As part of Baffinland’s Environmental Management System, an Environmental Effects Monitoring Program (EEMP) will be undertaken. The purpose of the EEMP is to select and design full environmental effects monitoring studies that are capable of meeting all of the relevant criteria and thereby able to detect and measure project-induced changes in the environment. The environmental effects monitoring studies will also provide a context under which the results from EEMP can be evaluated, and enable continuous improvement.

4.3 The specific purposes for conducting the EEMP are to:


- a) Verify effects predictions;
- b) Identify and select appropriate target species, indicators and linkages for monitoring;
- c) Evaluate the effectiveness of mitigation and to support any required improvement of those measures;
- d) Identify any unforeseen environmental effects caused by the Project;
- e) Provide an early warning mechanism to identify any environmental effects caused by the Project;
- f) Conform with relevant Project Certificate conditions; and
- g) Determine and identify any cause-and-effect interactions between the Project and the environment.

4.4 Parties of the TEWG may consider collaborating on research programs, activities, or initiatives relating to the terrestrial environment.

4.5 Baffinland will be responsible for the establishment and implementation of the Environmental Effects Monitoring Program (the “EEMP”) as specified by NIRB, pursuant to Part 7 of Article 12 of the Nunavut Land Claims Agreement (“NLCA”), under any terms and conditions of a Project Certificate, including monitoring programs:

- a) to measure the relevant effects of the Project on terrestrial wildlife;
- b) to confirm that the Project is being carried out within the pre-determined terms and conditions relating to the protection of terrestrial wildlife; and
- c) to assess the accuracy of the predictions contained in the FEIS for the Project.

4.6 In accordance with Article 12.7.4 of the NLCA, and Federal and Territorial Government Mandates, responsible government agencies and departments shall fulfil their responsibilities for monitoring and data collection.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 83 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## 5. Role of the Terrestrial Environment Working Group

Baffinland has an obligation to fulfill requirements contained within the Project Certificate. As such, Baffinland will seek advice from members of the TEWG with respect to field programs that will be designed and drafted by Baffinland and its experts to collect baseline data, monitor potential effects of the Project and determine any adaptive management measures that may be required during the construction, operation and closure of the Project.

5.1 The role of the TEWG is to act as an advisory group to support ongoing cooperation and communication as well as to review and provide advice on all aspects of the Environmental Effects Monitoring Program (EEMP) in relation to the terrestrial environment. Thus, the TEWG and any members and their appointed experts will be required for the following:


- a) Review the development and finalization of the EEMP in relation to the terrestrial environment;
- b) Review the implementation of the EEMP in relation to the terrestrial environment;
- c) Review monitoring reports and results;
- d) Review the assessment of potential impacts of the Project on terrestrial wildlife;
- e) Review the effectiveness of mitigation measures; and
- f) Review action plans for the development and implementation of appropriate mitigation measures.

Baffinland will be required to review comments from members of the TEWG and finalize field programs and or documents taking into consideration input from the members.

5.2 The TOR does not preclude other members of the TEWG from completing and soliciting input for proposals, protocols or field programs within their mandate for the review from TEWG members.

5.3 The TEWG may make recommendations to Baffinland on any aspects of the EEMP for the adoption of mitigation measures in order to comply with applicable regulatory requirement or that may help to mitigate adverse Project effects.

5.4 As per General Term and Condition #1 in Section 4.1 of NIRB Project Certificate (No: 005), the NIRB Monitoring Officers may be consulted by the members of the Working Group to consider and provide advice regarding the adequacy of the monitoring programs as they relate to the requirements under the monitoring program established in accordance with the Project Certificate and/or the achievement of specific objectives associated with

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 84 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

particular Project Certificate Terms and Conditions. If the Working Group consults with and receives advice from the NIRB Monitoring Officers, this activity does not limit or otherwise affect the responsibilities and oversight respecting the mandates of the authorities participating in the Working Group. Nor does the Working Group's consultation with the NIRB Monitoring Officers prevent Baffinland and agencies from working together to resolve monitoring and adaptive management challenges in a preventative and precautionary manner.

## 6. Materials Supporting the Terrestrial Environment Working Group

6.1 When required Baffinland will make reasonable efforts to provide the TEWG with:

- a) Copies of all EEMP documentation in relation to the terrestrial environment;
- b) Copies of all operational plans relating to the mine operations and railway operations of the Project;
- c) Copies of all monitoring reports relating to the EEMP in relation to the terrestrial environment;
- d) Copies of all reports relating to interactions between the Project and terrestrial wildlife; and
- e) Any other documentation reasonably required by the TEWG relating to the interaction between the Project and terrestrial wildlife.

6.2 A summary of the TEWG work and activities will be included in the NIRB Annual Report prepared by Baffinland.

## 7. Costs

7.1 Each party will be responsible for its own costs, including travel costs, relating to participation in the TEWG, but Baffinland will be responsible for the costs incidental to meetings such as venue costs, translation services (if required, as per Section 3.5) and notices.


7.2 Baffinland will be responsible for the costs of the EEM Program related to the Project. Government and regulatory agencies will continue to be responsible for the costs of research and regional resource management studies in accordance to their legislative mandates. Baffinland may provide in-kind and financial support on a project-basis manner, as has been done in the past.

## 8. Community Participation

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 85 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

8.1 Baffinland and the QIA will seek to coordinate the work of the TEWG with programs for community participation and traditional knowledge.

8.2 The QIA shall work with Baffinland to ensure that affected communities receive reports on the EEMP in an effective and timely manner and that the results of the EEMP are communicated in ways meaningful to the Inuit people.

## 9. Regulatory Requirements Prevail

9.1 Nothing in these Terms of Reference will have the effect of altering the requirements of any legislative or regulatory requirements applicable to the Project.


9.2 These Terms of Reference will not cause any duplication in adhering to requirements of any legislative or regulatory requirements applicable to the Project.

9.3 The participation of Qikiqtani Inuit Association, Baffinland Iron Mines Corporation, Environment Canada, and the Government of Nunavut's Department of Environment or any other appointed Parties of the TEWG does not affect or change their obligations for consultations.

## Annex A

The wording in this draft TOR was first developed by Baffinland Iron Mines Corporation (Baffinland) based on the Draft TOR for the Marine Environment Working Group jointly drafted between Baffinland Iron Mines Corporation (Baffinland) and the Qikiqtani Inuit Association (QIA) on May 30th 2012.

Since that time comments were provided by Environment Canada in June 2012. Comments from the Government of Nunavut on this TOR were received on September 11, 2012. On September 14, 2012, the NIRB forwarded a positive decision report to the AANDC Minister for consideration (which referred to this working group). Baffinland then scheduled and chaired three meetings on November 7<sup>th</sup>, 2012, December 6<sup>th</sup>, 2012 and February 6<sup>th</sup>, 2013 in order to reach consensus and finalize the TOR for the TEWG. All agencies agreed to and participated in the scheduled meetings and or had the opportunity to submit comments on the Draft TOR leading up to or following the calls. On February 20, 2013, these TOR were finalized and agreed to by all parties described in Section 2.0.


	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 86 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## **Appendix B. Monitoring Details and Methods**

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 87 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

Appendix B follows numbers associated with the cross-reference to Section 4 — MONITORING FRAMEWORK .

#### **4-1 VEGETATION MONITORING: EXOTIC INVASIVE VEGETATION AND NATURAL REVEGETATION**


Exotic species are species found outside of their natural range where they have not historically been found, often as a result of human activity (Government of Canada 2013). Exotic species are also known as alien, introduced, foreign, non-indigenous, or non-native (BC CDC 2013). These species may not pose an immediate risk; however, some can become invasive and have the potential to pose negative impacts to the environment, economy, and social realms (NatureServe 2010). The term ‘invasive’ is reserved for the most aggressive species that reproduce rapidly and cause major changes to the areas where they are introduced, such as outcompeting and displacing native plant species (YISC 2013).

The *Nunavut Wildlife Act* (2003) states that, “no person shall release a member of a species into a habitat in which that species does not belong or never naturally occurred”, given that such action can lead to environmental, economic, and social harm. Project specific term and conditions relevant to exotic invasive plant species (37) states “The Proponent shall incorporate protocols for monitoring for the potential introduction of invasive vegetation species (e.g. surveys of plant populations in previously disturbed areas) into its Terrestrial Environment and Monitoring Plan. Any introductions of non-indigenous plant species must be promptly reported to the Government of Nunavut Department of Environment.”

Monitoring for exotic invasive vegetation considers exotic plant species known to occur in Nunavut, based on a list of known exotic species provided by the Government of Nunavut (Government of Nunavut 2010). In response to the concern of exotic invasive plants associated with the RSA, EDI has prepared a *Baffinland Field Guide to Exotic Plant Species Identification*. The guide was developed to assist field personnel in the identification of potential exotic invasive plants associated with the Project. The 14 plant species highlighted in the guide are based on known exotic plant species in other areas of Nunavut (Government of Nunavut 2010). Although there are few exotic plant species currently known in Nunavut, their presence must be recorded and tracked in order to prevent further spread and establishment. Exotic invasive vegetation surveys within disturbed areas will also inform the likelihood and status of natural revegetation within the Project footprint.

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 88 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## Objectives

The objectives of the exotic invasive vegetation monitoring program are to:

1. Quantify the presence of exotic invasive plant species within and adjacent to the Project footprint through long-term monitoring; and
2. Assess disturbed areas to determine recolonization by plants, invasive or native.

## Threshold

One of the goals of the Mary River Project is no introduction of any exotic invasive plant species to the RSA. Therefore, the Project threshold for exotic invasive plant species is zero introductions; that is, any confirmed exotic invasive plants located within or adjacent to the Project footprint will trigger mitigation actions. Exotic invasive plants will be destroyed and an investigation conducted to determine if the pathway of entry can be determined; if possible, changes will be made to reduce the possibility of further introduction.


## Methods

Surveys specific to exotic invasive plant species were initiated in 2014. Focal areas for surveying include the Mine Site, Milne Inlet, and the Tote Road. The survey area will expand as necessary to include disturbed areas (i.e., the railway and Steensby Inlet) as the Project develops. Sample site selection considers potential entry points and locations where there is a high volume of humans, vehicles, and equipment entering or leaving the site (i.e., the batch plant, incinerator, landfill, laydown areas, along the airstrip, Mary River camp, and camps).

Presence/absence sampling methods are used to survey areas where exotic invasive species are most likely to be found, because it is an efficient and targeted method for surveying exotic invasive plants (ANPC 2012; Government of Alberta 2014; Oldham 2007). The method involves extensive surveys targeting disturbed habitats (i.e., along buildings, infrastructure and road ditches). Targeted areas are surveyed on foot with some sections surveyed in a vehicle at slow speeds along the Tote Road.

No exotic invasive plant species were detected during initial surveys in 2014. Monitoring will continue every 3-5 years in conjunction with other monitoring programs or as triggered by observations of exotic invasive plant species. If an exotic invasive plant species is positively identified within the Project footprint, the following steps will be taken to document the species occurrence:



	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 89 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

- Identify the species by referring to the *Baffinland Field Guide to Exotic Plant Species*.
- Collect a sample for verification including the roots, flowers and/or fruits.
- Determine species distribution and density by walking for 100 m in each direction (based on Luttmerding et al. 1990).
- Record the location, site information and estimate the area of extent with a GPS. If the species is discontinuous in distribution determine the number of sub-populations and provide the distribution and density for each sub-population based on Luttmerding et al. (1990).
- Photograph and mark the location with a stake.
- Consult a qualified botanist to verify the collected sample.
- Hand-pull individual plants and put in a garbage bag. Dispose of garbage bag in the incinerator or leave the garbage bag in the sun for a week to roast and kill the seeds. Dispose the bag in the landfill once confident that the seeds are dead.
- As per Project term and condition number 37, "*Any introductions of non-indigenous plant species must be promptly reported to the Government of Nunavut Department of Environment.*"

In addition to the exotic invasive plant survey, plant species found revegetating disturbed areas within the Project footprint are recorded to provide information regarding natural revegetation by local species. The survey method is conducted in conjunction with exotic invasive surveys. The survey area includes disturbed habitats (i.e., along buildings, infrastructure, and road ditches). Targeted areas are surveyed on foot with some sections surveyed in a vehicle at slow speeds along the Tote Road. Surveys are conducted every 3-5 years. Following Project construction, select sites will be targeted for revisit and to monitor species composition and abundance as part of revegetation studies.


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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 90 of 128
	<b>Environment</b>	<b>Document #: BAF-PH1-830-P16-0027</b>	

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 91 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## 4-2 VEGETATION MONITORING: VEGETATION HEALTH

### VEGETATION ABUNDANCE AND COMPOSITION

Impacts to vegetation (particularly caribou forage) from dust deposition and other Project emissions (e.g., air emissions, effluent etc.) were identified as a concern in regards to potential effects on vegetation health. Consequently, Baffinland committed to establishing a long-term monitoring program looking at potential changes to vegetation abundance used as caribou forage within the RSA: Project term and condition number 36 states “The Proponent shall establish an on-going monitoring program for vegetation species used as caribou forage (such as lichens) near Project development areas, prior to commencing operations.”

The vegetation abundance monitoring program began in 2014 to measure the relative amount of forage available to caribou at specified distances from Project disturbance over time. Due to inherently high variability, the data was analyzed by plant group (e.g., lichen) within a single habitat type (Moist to Dry Non-Tussock Graminoid/Dwarf Shrub). This habitat type was selected based on information regarding the relative abundance and relative use of forage by caribou in North Baffin Island (Russell 2014). This habitat type is considered high quality caribou forage, given that it contains lichens, sedges, grasses, forbs, and willows (Appendix 6F, Terrestrial Wildlife Baseline Report, FEIS; Baffinland 2012). These plant groups are considered important food items for caribou, especially during the summer when plant nutritional value and digestibility is high.

#### Objectives


The objective of the vegetation abundance monitoring program is to measure percent plant cover and composition by plant group of available caribou forage within the RSA to track potential changes at varying distances from the edge of the PDA through long-term monitoring.

#### Methods

Sampling sites are stratified by Northern Land Cover (NLC) LandSat imagery (30 m x 30 m resolution/pixel) to select the Moist to Dry Non-Tussock Graminoid/Dwarf Shrub habitat type. Within this habitat type, transects are randomly situated at the Mine Site, Milne Inlet, and the Tote Road within distance classes (30 m, 100 m, 750 m, and 1200 m) from the edge of the PDA. Reference (control) sites are located approximately 20 km from the PDA to the north and south of the RSA and outside the ZOI. These distance classes were chosen based on a review of relevant available literature and dust isopleth modeling (Baffinland 2013).

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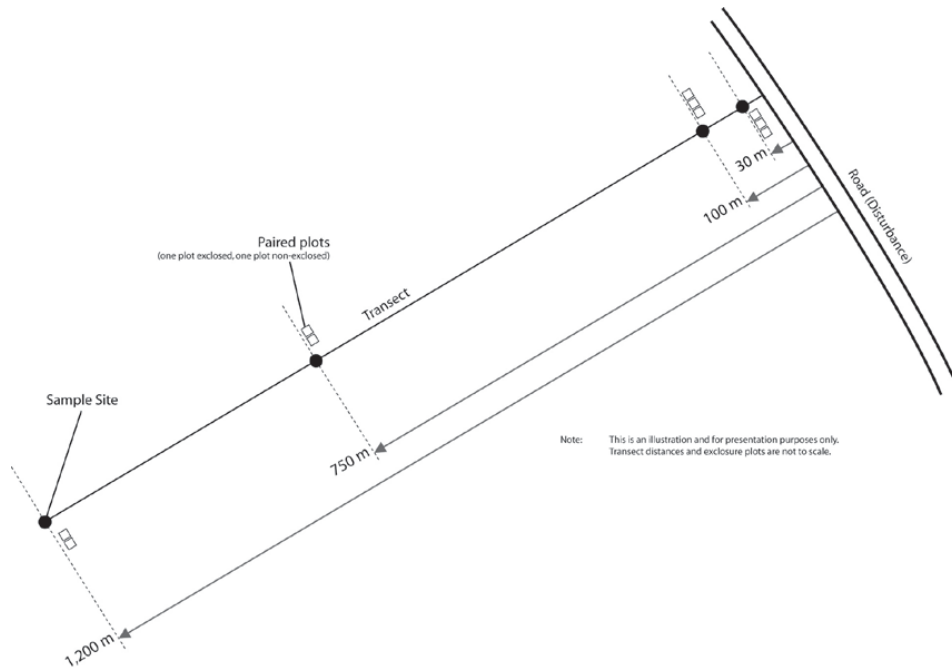
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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 92 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

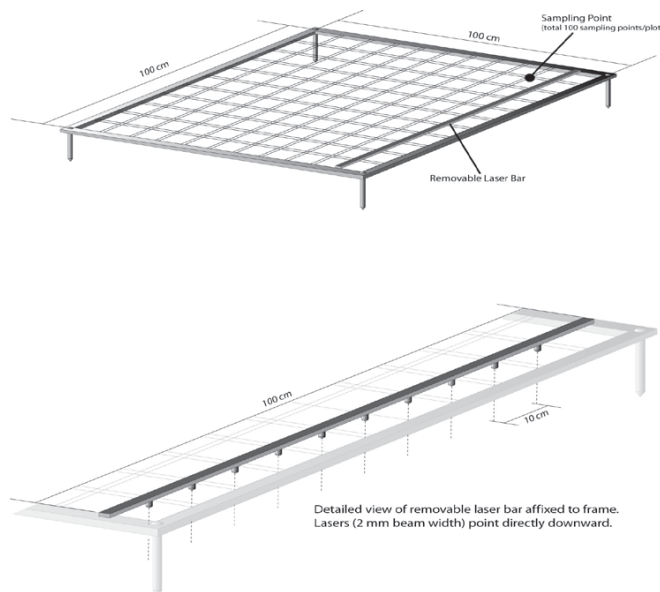
Eight transects were established from mid to end-July, 2014; three at the Mine Site, three along the Tote Road, and two at Milne Inlet for a total of 27 sites within the RSA, including three control sites outside the ZOI. To prevent pseudo-replication, all transects are spaced a minimum of 100 m apart. Each transect extends perpendicular from the source of disturbance (Mine Site, the Tote Road, and Milne Inlet).

Each sampling site consists of an open plot and associated closed plot (Figure 7-1). To account for within-site variability in vegetation cover some sites include a second open plot (total of three plots per site). The total number of plots across all sampling sites is 64. Within a site, plots are spaced 2 m apart. Each plot is 1 x 1 m; closed plots include an additional cage that measures 2 m x 2 m and encompasses the 1 m x 1 m sampling area to assess potential grazing effects by caribou and/or small mammals. The cage design consists of half-inch hardware cloth along the sides and one-inch poultry wire on top with rebar as corner posts. Where necessary, the hardware cloth is flanged at the base and piled with rocks to exclude small mammals (i.e., lemmings).

Each plot is assessed for plant group composition (i.e., lichen) and percent plant cover. The point quadrat method is used to measure percent plant cover with a total of 200 sampling points per plot. This is equivalent to 100 sampling points for the canopy cover layer and 100 sampling points for the ground cover layer (Figure 7-2). Using a 2 mm diameter laser projected onto the vegetation below percent plant cover measurements are determined by the number of “hits” within the plot. A “hit” is where the laser beam intersects a plant at a particular sampling point. This is equivalent to a measurement for percent plant cover (i.e., 1 hit out of 200 possible hits).




**Figure 7-1. Schematic diagram showing the location of sampling sites along a transect.**



**Figure 7-2. Diagram showing a typical plot where the point quadrat method is used to measure percent plant cover.**

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 94 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## Data Analysis


The vegetation abundance data is analyzed to assess the relationship of percent plant cover and composition with distance from the PDA, while accounting for the potential effect of herbivory (i.e., caribou, small mammals). Differences in caribou forage (e.g., lichen) related to focal area (Mine Site, Milne Inlet, Tote road), distance class (30, 100, 750 and 1,200 m) and enclosure treatment (open vs. closed plots) are explored. The data analysis includes:

1. Total percent canopy cover
2. Total percent ground cover
3. Percent cover by plant group (i.e., deciduous shrubs, evergreen shrubs, forbs, graminoids, moss, and lichen)

## Thresholds

There are no known thresholds for the loss of vegetation through decreasing percent plant cover. Thresholds can only be determined based on our ability to detect change using a statistical power analysis and consideration of what is biologically important. Consequently, thresholds were identified using a power analysis tool to assess two scenarios; the first scenario simulated the data to detect a decline in percent plant cover for canopy cover, ground cover, and lichen cover; the second scenario simulated the data to detect an increase in lichen cover. Specifically, the two scenarios include:

1. Declines in overall percent ground cover, canopy cover, and lichen cover for the 30 m distance class. The 30 m distance class was chosen for the power analysis as it is closest to the Project footprint and presumably the most likely to be affected by Project activity.
2. Increase in overall percent cover of lichen for all distance classes more than 30 m from the Project area; the range of values considers the observed baseline value up to 30 %. This assumption is based on the theory that lichen cover within plots is currently low and over time cover will increase at sites further from the Project footprint; however, sites within 30 m of the footprint are likely to be impacted by Project activities which may counter overall growth and abundance, potentially reducing the percent cover of lichen within 30 m distance classes. Additional background to support this prediction is provided in the 2014 Annual Terrestrial Monitoring Report, Section 3.1.2— Composition by Plant Group.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 95 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

The results of the power analysis are used to inform Project specific thresholds and assess the power of the monitoring program to detect changes in percent plant cover. The power analysis identified the following thresholds, which represents the highest level of power able to detect changes in percent plant cover if future monitoring includes 15 balanced transects:

**Canopy Cover:** 25% decline; 90% of the time

**Ground Cover:** 30% decline; 87% of the time


**Lichen Cover:** 50% decline; 83% of the time<sup>7</sup>; 75% increase; 78% of the time

Monitoring will occur every 3-5 years as determined by vegetation growth rates based on data collected during sampling and consideration of adaptive management required to mitigate effects to vegetation health. After three years of data collection it can be analyzed for overall trends to determine if Project activities are having an effect on vegetation abundance and composition. If no biological differences are noted after three or four consecutive sampling intervals, the sampling frequency may be reassessed.

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<sup>7</sup> The analyses of the ability to detect a decline in lichen abundance near project facilities was considered following a request from the Government of Nunavut in the fall 2014 TEWG meeting.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 96 of 128
	<b>Environment</b>	<b>Document #: BAF-PH1-830-P16-0027</b>	

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 97 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## VEGETATION AND SOIL BASE METALS

Metals or emissions uptake was identified as a concern in regards to vegetation, as well as to humans and wildlife that may consume vegetation. Consequently, Project term and condition number 34) states “the Proponent shall conduct soil sampling to determine metal levels of soils in areas with berry-producing plants near any of the potential development areas, prior to commencing operations” and Project condition number 36) states “the Proponent shall establish an on-going monitoring program for vegetation species used as caribou forage (such as lichens) near Project development areas, prior to commencing operations.”

Baseline data for the vegetation and soil base metal monitoring program includes sampling from 2012-2014 (2012 primarily within the southern region of the RSA; 2013 in the northern sections of the RSA; 2014 in the northern region of the RSA, including areas adjacent to the Mine Site along the northern portion of the railway). Vegetation species chosen for sampling were based on community meetings with elders to determine culturally valued vegetation, while also considering availability of vegetation at sample sites, and included soils, lichen, willow, and blueberry. Additional baseline data on vegetation and soil metal levels was collected in 2008 by Knight Piésold; however, comparison of the 2008 data with the 2012/2013 data showed significant discrepancies. This may be due, at least in part, to different laboratory detection limits; but as the exact methods used in the 2008 collection are not available, the decision was made to drop the 2008 data from the analysis. Future monitoring will compare metal concentrations in soil and vegetation to baseline conditions (2012–2014) for the Mary River Project.

As discussed in the 2014 Annual Terrestrial Monitoring Report (EDI 2015) both blueberry and willow were removed from the monitoring program. Blueberry was removed due to patchiness and limited availability on the landscape. Despite efforts and targeted sampling to collect blueberry within the RSA it is unlikely that blueberry will ever be collected in sufficient quantity or distribution to inform Project effects or mitigation. Willow was removed because it is a species of metal tolerance and without another vascular plant to assess metal concentrations it will likely misinform threshold values. Future monitoring will focus on metal concentrations in lichen. If the sample size for blueberry increases from opportunistic sampling and is determined to be adequate for analysis it may be reconsidered as a focal plant species.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 98 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## Objectives

The objectives of the vegetation and soil base metals monitoring program are to:

1. Monitor metals concentrations in both soils and vegetation, particularly caribou forage (i.e., lichen) near Project infrastructure;
2. Determine if metal concentrations in soil and vegetation exceed available CCME and relevant available threshold levels; and

## Thresholds

Monitoring of metals concentrations within soils and vegetation focusses on CoPCs. These CoPCs were chosen based on the consideration of several factors including baseline metal concentrations in soils and vegetation, metals present in the Mary River ore, and the level of risk associated with each element. Several sources were consulted in the selection of CoPCs including:


- Canadian Environmental Quality Guidelines (provided by the Canadian Council of Ministers of the Environment (CCME) including soil quality guidelines for both agricultural and industrial settings;
- Relevant studies on the presence, effects and other aspects of metals in arctic and northern terrestrial biota (e.g. Gamberg 2008; CACAR 2003); and
- Literature on vegetation and lichen-specific toxicity.

Phosphorus, manganese, and iron are essential elements for vegetation growth and are not considered elements of concern (Intrinsic Environmental Sciences Inc. 2010; US EPA 2007). In addition, mercury was not identified as a CoPC for the Mary River Project because there is no substantial natural source of mercury in the soil or in lichen, it is not a component in the ore for the Mary River Project, and incremental additions of mercury to soil and lichen from ore deposition are insignificant (Appendix 6G-2, Mary River Project Final Environmental Impact Statement, BIM 2012).

Initially, seven CoPCs were selected for monitoring including aluminum, arsenic, cadmium, copper, lead, selenium, and zinc. Based on the results of the 2014 vegetation and soil base metal monitoring program aluminum will be removed as a CoPC due to high variability in the data and its' ubiquitous presence (2014 Annual Terrestrial Monitoring Report, EDI 2015), resulting in six CoPCs for follow-up monitoring. For each of the six CoPCs, toxicity thresholds were determined for soils and lichen (Table 7-1).

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 99 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

**Soils** — CCME soil quality guidelines were consulted for agricultural and industrial settings. As defined by CCME, these land use types are most representative of the land use associated with the Project (CCME 2007). Baseline soil samples indicate that all samples have metals concentrations well below CCME agricultural guidelines; therefore, baseline conditions meet the definition of agricultural guidelines and are used as the most appropriate threshold for CoPCs in soil for the Mary River Project.

**Lichens** — Available toxicity thresholds for lichen species in the Canadian Arctic are limited, regardless of the awareness that they are excellent indicators of pollutants and heavy metal contamination. Determination of thresholds is further complicated by the fact that lichens are intimately tied to site conditions and exhibit species-specific tolerance to pollutants (Dillman et al. 2007); therefore, an inherent level of error must be accepted when trying to determine threshold values and values should be considered predictive. The available literature provided thresholds for lichen toxicity for only four of the six CoPCs: cadmium, copper, lead, and zinc. The available thresholds may or may not be specific to species found on Baffin Island. Where species-specific thresholds could not be found, the following considerations were made: similar genus and known distribution with reference to neighboring Arctic areas (i.e., Greenland and Nunavut). Where multiple thresholds were available for a particular CoPC, the lowest available threshold, in consideration of baseline concentrations, was chosen as a conservative estimate.

**Table 7-1. Thresholds Identified for CoPCs in Soils and Lichen — Vegetation and Soil Base Metals Monitoring Program.**

CoPC <sup>a</sup>	Soils <sup>b</sup>	Lichens		
	Threshold (mg/kg)	Threshold (mg/kg dw <sup>c</sup> )	Lichen species considered	Source
pH	6-8	--		
Arsenic	12	--	--	--
Cadmium	1.4	30	<i>Cladonia uncialis</i>	Nash 1975; Nieboer et al. 1978
Copper	63	15	<i>Cladina rangiferina</i>	Nieboer et al. 1978; Tomassini 1976; Folkesson and Andersson-Bringmark 1987
Lead	70	5	<i>Cladina rangiferina</i>	Tomassini 1976; Nieboer et al. 1978
Selenium	1	--	--	--
Zinc		178	<i>Cladonia uncialis</i> <i>Cladina rangiferina</i>	Nash 1975; Nieboer et al. 1978; Folkesson and Andersson-Bringmark 1987


NOTE(S):  
a Chemical of potential concern (CoPC)  
b Source: Canadian Council of Ministers of the Environment (CCME) Agricultural Soil Quality Guidelines for the Protection of Environmental and Human Health  
c Dry weight (dw)

## Methods

The 2014 Annual Terrestrial Monitoring Report noted that the study design for the vegetation and soil base metal monitoring program would require adjustments in the next sampling period to improve statistical power to detect changes over time in metal concentrations of soil and vegetation (EDI 2015). The enhanced study design aligns with the dust fall monitoring program where reasonable, to include new sample sites at varying distances from the Project development area (PDA) to compare metal concentrations in soil and lichen between near (impacted) and far (control) sites.

The study design for the improved vegetation and soil base metal monitoring program considers three Project areas (Milne Port, Tote Road, Mine Site) at varying distances from the PDA (0–100 m; 101–1000 m; > 1000 m). Control site locations are those that are greater than

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 101 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

1000 m from the PDA. For more information on how these distance categories were selected, including sample scheme refer to the 2015 Terrestrial Environmental Annual Monitoring Report (EDI 2016).


Sampling typically occurs between late-July and mid-August. Focal vegetation includes available fruiticose lichen species (particularly *Cladina mitis*, *Cladina stellaris*, *Cladina arbuscula*, and *Cladina rangiferina*). Collections are made using the following procedures:

- A new pair of nitrile gloves are worn for each vegetation and soil sample.
- Stainless steel tablespoons are used for soil sampling were cleaned with alcohol wipes before and after each sample.
- Approximately 10 grams (roughly a handful) of each vegetation sample are collected at each site.
- Approximately 400–500 grams (two heaping stainless steel tablespoons) of surface soil are collected at each site to a depth of  $\leq 10$  cm. This reflects the top layer of rooting where plants may uptake metals.
- Samples are placed in new zip-loc bags, frozen and sent to an accredited laboratory for metals analyses.

## Data Analysis

Vegetation and soil samples are analyzed for total metal concentrations to assess the relationship of metals in soil, lichen and willow with distance from PDA, including the potential relationship between metal concentrations in soil and vegetation. Metals are analyzed using inductively coupled plasma mass spectrometry (ICP-MS) by an accredited laboratory to determine metal concentrations relative to background concentrations and the identified CoPC thresholds. As discussed in the 2014 Annual Terrestrial Monitoring Report (EDI 2015), there were no differences in vegetation and soil base metal concentrations for any of the baseline samples.

As part of the improved study design, a power analysis was conducted to determine the number of soil and lichen samples required to detect a change in metal concentrations between the ‘before’ period (i.e., baseline sampling) and the ‘after’ period (i.e., post-construction sampling) for all CoPCs before threshold levels are exceeded. The analysis compared six sampling groups, assuming 10 soil and 10 lichen samples are collected in each of the following areas during future monitoring. These sampling groups include:

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 102 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- Baseline samples (2012 – 2014);
- Post-construction — within 100 m of the Mine Site (Near Mine);
- Post-construction — within 100 m of Tote Road (Near Road);
- Post-construction — within 100 m of Milne Port (Near Port);
- Post-construction — 101 to 1000 m from the PDA (Far); and
- Post-construction — > 1000 m from the PDA (Control)


Future analysis will focus on determining if base metal concentrations within 100 m of the Mine Site, Tote Road and Milne Port have:

- Increased relative to baseline concentrations; and/or
- Increased relative to areas further from the PDA.

The vegetation and soil base metal monitoring program will continue to adapt as results are determined. Monitoring will likely occur every 3-5 years as determined by the results and consideration of adaptive management required to mitigate effects to vegetation health. Once three years of ‘after’ data has been collected it can be analyzed for overall trends to determine if Project activities are having an effect on metal concentrations in soil and lichen. If no biological differences are noted after three or four consecutive sampling intervals, the sampling frequency may be reassessed.

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 103 of 128
	<b>Environment</b>	<b>Document #: BAF-PH1-830-P16-0027</b>	

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 104 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

### 4-3 VEGETATION MONITORING: DUST FALL

The potential impacts of dust deposition on soil and vegetation are an issue of concern for the Project. In particular, other studies have shown dust deposition to have a detrimental effect on vegetation health, and dust deposition on caribou forage (i.e., lichen) has been suggested as a potential mechanism causing caribou to avoid habitat at a distance of up to 14 km (Boulager et al. 2012). The main sources of dust emissions are fugitive sources, specifically bulk handling operations, crushing, blasting, storage, and dust emissions from vehicle and equipment traffic, although natural sources of dust fall also exist (e.g. wind erosion). The largest amount of dust fall generated by the Project is expected to be associated with use of the existing Tote road linking the Mine site with the port at Milne Inlet; however, there will also be dust fall generation from the railway and from point source locations at both the Mine site and ports.


The Mary River dust fall monitoring program was initiated in the summer of 2013 with sampling stations set up at the Mine site, Milne Port, along the Tote road, and at reference sites within the RSA. At this time, the railway and Steensby Port are not included in the dust fall monitoring program, due to access issues. Future construction of the railway linking Steensby Port with the Mine site will initiate dust fall monitoring for the southern section of the RSA. In addition to dust fall, this program component includes tracking and enumeration of traffic on the Tote Road, recorded as ‘vehicle passes’. General traffic data are tracked via Baffinland security in a specially designed MS Excel form, and ore haul vehicle passes are tracked by Baffinland Mine Operations. All traffic data are compiled and reviewed as part of the dust fall monitoring program annual reports. The dust fall monitoring program was developed using knowledge gathered from other similar monitoring programs (Ekati Mine, High Lake Project, Rescan 2006), as well as applicable caribou research. Dust fall sampling is carried out in accordance with the American Society for Testing and Materials (ASTM) ASTM D1739-98 sampling method (ASTM 2004).

#### Objectives

The objectives of the dust fall monitoring program are to:

1. Quantify the extent and magnitude of dust fall generated by Project activities;
2. Determine seasonal variations in dust fall at all sampling locations; and
3. Determine if annual changes in dust fall at sampling locations exceed identified thresholds associated with isopleth dispersion models.



	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 105 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

## Thresholds

There are no known dust deposition thresholds specific to effects on vegetation. Health Canada/Environment Canada's national ambient air quality objectives for particulate matter (CEPA/FPAC Working Group 1998) state that for the lack of quantitative dose-effect information, it is not possible to define a reference level for vegetation and dust deposition. In the absence of published thresholds for dust effects on vegetation, the High Lake Project (Wolfden Resources Inc. 2006), a proposed base metal mine in western Nunavut, developed thresholds in consideration of effects to vegetation health ranging from 4.6 g/m<sup>2</sup>/year for a low magnitude effect to ≥50 g/m<sup>2</sup>/year for a high magnitude effect. These values were based on a combination of the Alberta (AB) and Ontario (ON) ambient air quality criteria for human health purposes, and values reported by Spatt and Miller (1981) specific to effects of road dust on vegetation.

In addition to the consideration of thresholds developed by the High Lake Project, isopleth dispersion models (CALPUFF dispersion models) were used to predict deposition patterns from all sources during the operations phase of the Project. The CALPUFF dispersion model was recommended by a number of regulatory agencies and has been the *de facto* standard for environmental assessments in Canada's North. To refer to activities that are included in the assessment of the operations phase refer to the ERP Addendum to FEIS Volume 5.

To align with results of the isopleth dispersion models and the thresholds described above, the following annual TSP depositions thresholds will be used for the Mary River Project (summarized in Table 7-2):

- Low:** 1–4.6 g/m<sup>2</sup>/year;
- Moderate:** 4.6–50 g/m<sup>2</sup>/year; and
- High:** ≥ 50 g/m<sup>2</sup>/year.


**Table 7-2. Dust (TSP) Deposition Rates and Criteria for Potential Effects on Vegetation Health.**

Source of Information	Dust (TSP) deposition rate	Equivalent annual dust deposition rate (g/m <sup>2</sup> /year)	Comments
High Lake Impact Assessment (Wolfden 2006)	1.0–4.6 g/m <sup>2</sup> /year	1.0–4.6	Predicted low magnitude effect on vegetation health
	4.6–50 g/m <sup>2</sup> /year	4.6–50	Predicted moderate magnitude effect on vegetation health
	50–200 g/m <sup>2</sup> /year	50–200	Predicted high magnitude effect on vegetation health
Spatt and Miller (1981)	0.07 g/ m <sup>2</sup> / d	26	Some effects to Sphagnum species
	1.0-2.5 g/ m <sup>2</sup> / d	365-913	Decline in Sphagnum species abundance
Alberta	5.3 g/m <sup>2</sup> /30 d	64	Alberta Guidelines for Residential and Recreational Areas (human health)
Ontario	4.6 g/m <sup>2</sup> /year	4.6	Ontario Ambient Air Quality Criteria (human health)

## Methods

The dust fall monitoring program began in July 2013 with 26 dust fall monitoring sites across the RSA. An additional eight sites were added in August 2014. Dust fall sampling locations were chosen to represent areas of various expected dust fall concentrations based on isopleth dispersion models and considering the direction of prevailing winds within the RSA, excluding areas of future infrastructure development. The 26 dust fall sample sites for the 2013/14 season include:

- Five dust fall samplers located at the Mine Site (three within the Mine Site and two references sites; one to the northeast, and one to the south);
- Three dust fall samplers located at Milne Port (two within the port itself, and one northeast and upwind of the port);
- 16 dust fall samplers divided between two sites along the Tote Road. These two sites are organized into transects, each composed of eight dust fall samplers distributed both north and south of the Tote Road centerline at 30 m, 100 m, 1 km, and 5 km. The prevalent wind direction is roughly parallel to the roadway as opposed to perpendicular, therefore no ‘upwind’ and ‘downwind’ directions from the road are identified; and


	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 107 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

Two reference dust fall samplers located 14 km southwest of the Tote Road.

- Additional sites were added in August 2014 to increase sampling coverage of dust fall in the areas around Milne Port and the Mine Site:
- Four additional dust fall samplers at Milne Port (resulting in a total of seven dust fall samplers in that area); and
- Four additional dust fall samplers located at the Mine Site (resulting in a total of eight dust fall samplers in that area).

Each site is comprised of one sampling apparatus, which is made up of a hollow post (~ 2m long) and terminal bowl shaped holder for the dust collection vessel (Photo 1). The terminal bowl is topped with bird spikes to prevent contamination by bird fecal matter. The sampling apparatus was installed by pounding 5-foot rebar into the ground, placing the post over the rebar, and then stabilizing with guy wires. Dust collection vessels are placed in the holder, pre-charged with 250 mL of algaecide in summer and 250 mL of alcohol in winter. Collection vessels are changed out every month (28–31 days) and shipped to an accredited laboratory for analysis of total, fixed and volatile insoluble particulate matter.

Caribou present are present in the area of the Baffinland Mine Site year-round; therefore, sampling of the dust fall monitoring stations occurs on a year-round basis; however, during the winter, the sampling program is limited to a subset of the monitoring sites. Winter monitoring activities are restricted by safety consideration associated with accessing the more remote reference sites.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 108 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	



**Photo 1. Dust fall collector sampling apparatus, July 10, 2013.**

Annual dust fall results are analyzed against the predicted dust deposition thresholds for the Project to determine if dust fall exceeds the applicable indicator threshold. Results are also reviewed to investigate dust fall on a temporal and spatial scale relative to background with focus on seasonal differences in dust fall data.

## References

American Society for Testing and Materials (ASTM). 2004. Standard Test Method for Collection and Measurement of Dustfall (Settleable Particulate Matter) Designation D 1739-98 Reapproved 2004, West Conshohocken, PA.


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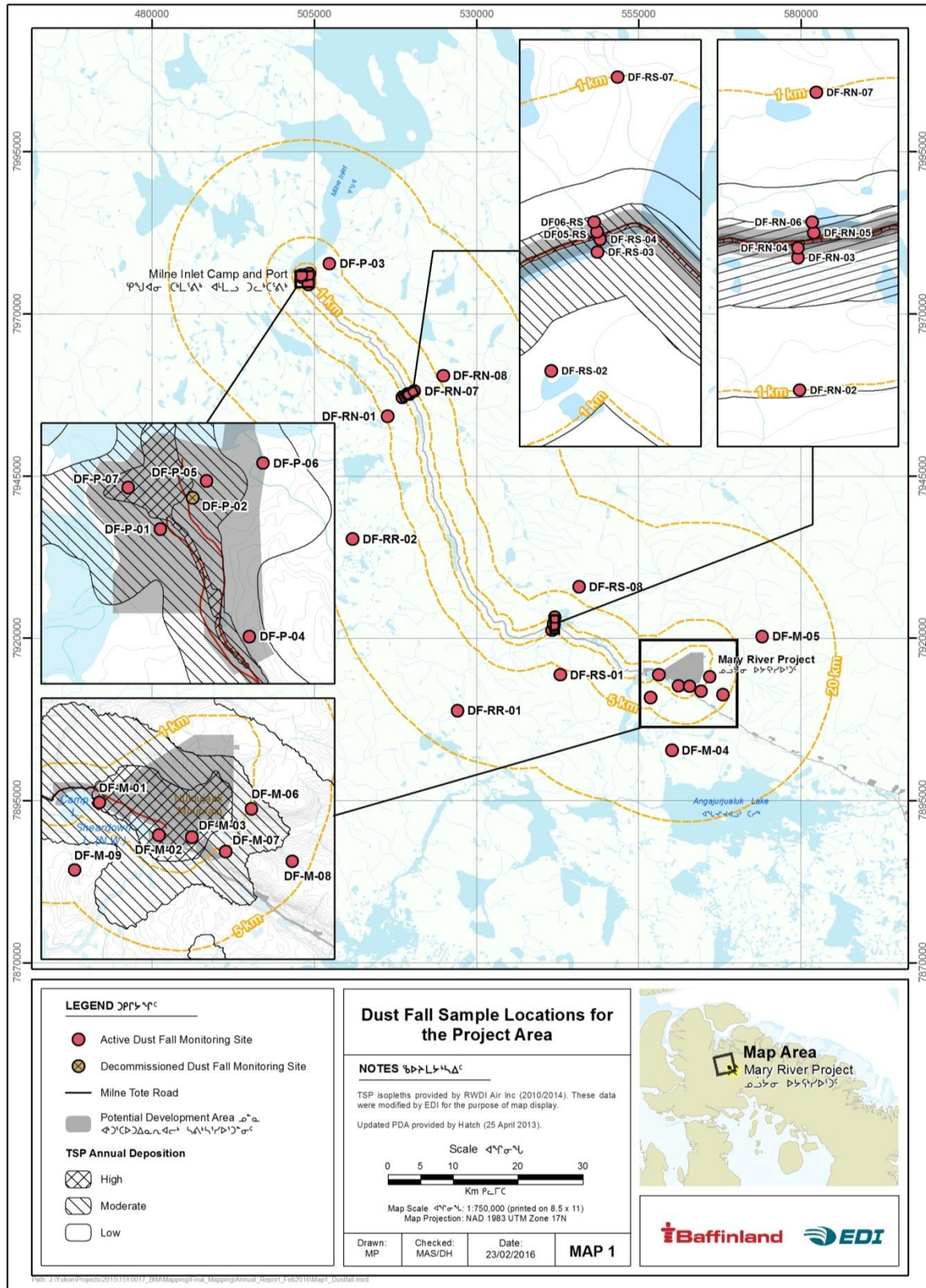
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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 109 of 128
	<b>Environment</b>	<b>Document #: BAF-PH1-830-P16-0027</b>	


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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 111 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

#### **4-4 MIGRATORY BIRD MONITORING: PEREGRINE FALCON AND GYRFALCON NESTING RAPTOR OCCUPANCY AND PRODUCTIVITY**

Baseline data on cliff-nesting raptors began with exploratory surveys in 2006 and continued through 2008. The data collected in those years was examined to determine the utility for monitoring data. By 2011 standardized nest site visits were conducted in conjunction with ongoing research in the Mary River RSA supported by Baffinland. In 2014, a monitoring design program that could differentiate natural variation from project-caused variation using appropriate demographic indicators for cliff-nesting raptors was developed for the Mine Site, Tote Road, and Milne Port. This section describes the information essential to the conduct of that program.

##### **Breeding Phenology**


Breeding phenology is an important determinant of survey timing. In Nunavut, the earliest documented arrival for peregrine falcons is May 10 at a known breeding site near Rankin Inlet. Although arrival timing varies with spring conditions, the majority of sites are occupied during the third week of May. Median laying date in Rankin Inlet (June 9 ± 4.0 days) was earlier than Igloolik (June 15 ± 3.6 days;  $\text{Chi}^2 = 31.56$ ,  $p < 0.001$ ) and north Baffin Island (June 16 ± 3.5 days;  $\text{Chi}^2 = 35.56$ ,  $p < 0.001$ ) with no difference observed between Igloolik and north Baffin Island ( $\text{Chi}^2 = 0.77$ ,  $p = 0.38$ ). The incubation period of the fourth egg (33 days) is similar to what has been reported elsewhere (Burnham 1983). Rough-legged hawk breeding phenology is very similar to peregrine falcon, but is typically advanced by a week to 10 days (Poole and Bromley 1987). Additionally, presence of breeding pairs in locations where ground squirrels are absent (as is the case on Baffin Island) is typically cyclic in association with lemming abundance. Timing of surveys for the Mary River Project is conducted to match the phenology of local breeding birds.

##### **Study Area**

The spatial extent of Project effects monitoring surveys is limited to sites within 10 km of the PDA of the Mine Site, Tote Road, and Milne Inlet (Map 2). The study area is split into different distance categories to facilitate analyses of occupancy and productivity as a function of distance from the PDA (i.e., distance from disturbance). The distance “bin” are 0.0 km ≥ 1.0 km; 1.0 km ≥ 3.0 km, 3.0 km ≥ 5.0 km, 5.0 km ≥ 10.0 km according to the methods outlined in the 2014 Terrestrial Monitoring Report (EDI 2015). Bin cutoffs were arbitrary, but were chosen to identify

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 112 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

the number of known sites that were near and far from the PDA. It is assumed that nest sites  $\geq 10.0$  km from the PDA were not influenced by Project-related disturbance.

## Methods

Raptor surveys from 2011 through 2014 occurred throughout the Mary River Terrestrial RSA and were necessary to establish regional-level baseline parameters of distribution and demography. The results of those surveys were reported in previous annual monitoring reports (EDI 2012, 2014, 2015) and baseline information for the Early Revenue Phase. In 2015, the monitoring efforts shifted to focusing on measuring suitable demographic indicators to monitor and distinguish natural variability from Project-related effects.

### Occupancy Survey

Occupancy surveys are conducted within a 10 day period from ~June 15–30. The focus of the occupancy surveys as the monitoring program develops is to check known sites for occupancy, and as the program evolves, to search for new sites in distance bins that have a low sample size. Approximately 9 helicopter hours are allotted to checking the status of known sites and 10 hours helicopter time is allotted to searching for new sites (until a suitable sample size has been located to provide a suitable number of sites for robust statistical analyses).

Pre-season site selection is conducted in two separate steps to best use available resources in an effort to 1) select known sites using data collected during surveys conducted in previous years, and 2) determine search areas most likely to harbor pairs of nesting raptors at sites not known by using logistic regression habitat modeling (i.e., Resource Selection Function; Galipeau, unpublished thesis). The 2015 Annual Terrestrial Environment Monitoring Report provides more details on the model used to predict cliff nesting habitat (EDI 2016).


The map output and distribution of known sites is used to focus search efforts, and identify areas of high nesting probability (habitat classes  $0.6 \geq 0.8$  and  $0.8 \geq 1.0$ ) in which nest sites have not been previously identified. In addition, the map output can also be used to identify areas characterized by low probability habitat classes ( $0.0 \geq 0.2$  and  $0.2 \geq 0.4$ ), but with evidence of topographical features (sloped cliffs) typically associated with nesting raptors.

Throughout the survey, the helicopter typically travels between 100–150 km/hr at 50–100 m above ground level, with observers positioned on both sides of the helicopter. Survey routes are planned to include known nest locations. Deviation from pre-determined survey routes is permitted if a raptor or signs of breeding are observed. In addition to the structured surveys,

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 113 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

favourable habitat is searched opportunistically when ferrying between known sites, camps or other mine infrastructure.

Sites are considered occupied if one or more adults displayed territorial or nest building behavior (e.g., vocalization and/or flight behaviour associated with defense of breeding territory, or presence of nest building). Locations with partial or old nests without presence of breeding aged adults are not considered occupied. For sites that were not visited in June during previous surveys, but were found with eggs or nestlings later in the breeding season were added to the database and noted as occupied in the spring.

Site occupancy is generally defined as the proportion of known breeding locations occupied by pairs per year. Mearns and Newton (1984) indicated that the proportion of known territories occupied by pairs in any given year can be used to index the size and status of breeding populations. For the purposes of this monitoring program, occupancy is calculated as follows:

$$Occupancy = N\ Occ/N\ Checked$$

Where:

- *N Occ* is equal to the count of occupied sites; and
- *N Checked* is equal to the count of visited sites.

### **Productivity Survey**

Productivity surveys are conducted in the first week of August when nestlings are expected to range between 10 and 20 days of age, and are conspicuous. Surveys are flown within a 10 day period ~ July 30–August 20 (later in the season, before chicks fledge, is better for counting larger chicks on nests). Sites noted as occupied in the occupancy survey are visited to assess productivity. For nests that were not located in June during previous surveys, but were found with eggs or nestlings during the productivity survey are by default considered to have been occupied in the spring. The number of eggs and/or nestlings is recorded at the time the site is visited. Productivity is calculated as:

$$Productivity = NChicks/NSitesOccupied$$


Where:

- *NChicks* is equal to the total count of chicks observed in the productivity survey; and
- *NSitesOccupied* is equal to the count of sites occupied in the productivity survey.

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	Issue Date: March 14, 2016 Rev.: 1	Page 114 of 128
	<b>Environment</b>	Document #: BAF-PH1-830-P16-0027	

This approach does not address nest sites that attempted but fail, as they are often missed (not counted) during the survey due to limited time on site.

### **Determining nest success**

Precise determination of the number of young in a nest is difficult when counting young from a helicopter; therefore, in addition to productivity, nest success is estimated as an informative index of breeding performance. Nest success is estimated from the proportion of occupied territories among monitored sites in which at least one nestling is counted.

$$Nest\ Success = \frac{NSitesOccupied\ Chicks}{NSitesChicks}$$

Where:

- *NSitesOccupied Chicks* is equal to the total count of chicks at occupied sites; and
- *NSitesChicks* is equal to the count of visited sites where chicks were present and at least one nestling was present.

### **Data Analyses**

The probability of site occupancy, brood size, and nest success is modeled for nest sites located up to 10 km from the PDA using generalized linear mixed effects models in R Statistical Environment version 2.13.0 (R Development Core Team 2010). The probability of site occupancy and nest success is modeled using a logit link function in the package lme4 version 0.999375-39 (Bates et al. 2011) where an occupied site is coded “1” and unoccupied site is coded “0”; similarly, a successful nest site is coded “1” and failed site is code “0”. The probability of 0–4 nestlings per nest is modeled using a Poisson link function in the package lme4 version 0.999375-39 (Bates et al. 2011) where number of nestlings is coded 0, 1, 2, 3, or 4.


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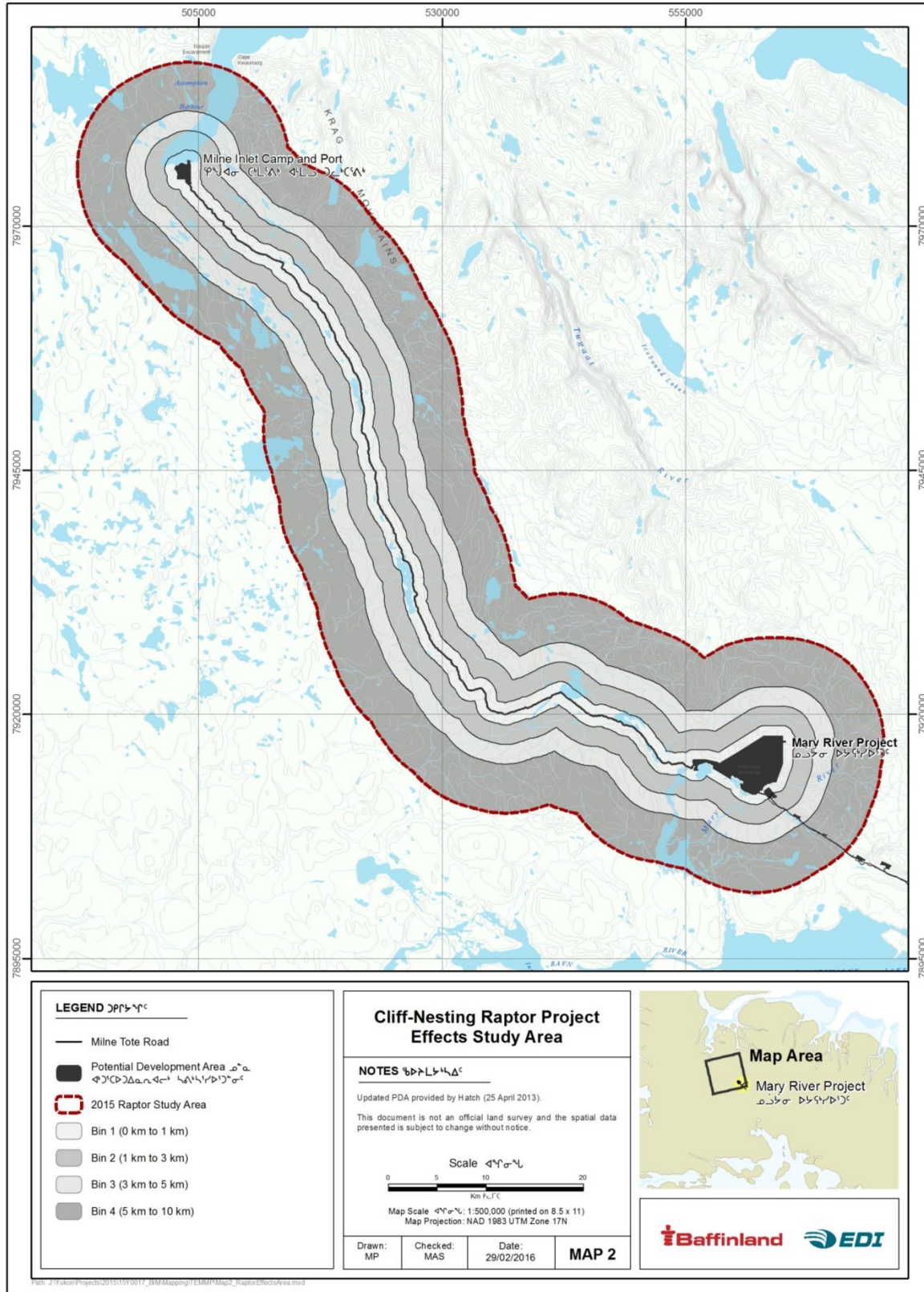
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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 115 of 128
	<b>Environment</b>	<b>Document #: BAF-PH1-830-P16-0027</b>	

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 117 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

#### **4-5 MIGRATORY BIRD MONITORING: NESTING OF COMMON AND KING EIDER, AND RED KNOT**

Baseline surveys were completed in 2014, and methods and results are summarized in the 2013 and 2014 terrestrial annual monitoring reports. Monitoring will begin again in Steensby Inlet prior to shipping beginning out of Steensby Port.

#### **4-6 MIGRATORY BIRD MONITORING: SONGBIRDS AND SHOREBIRDS**

Baseline surveys are complete. Baffinland will support Environment Canada's PRISM program as suggested in Project commitments and terms and conditions.

#### **4-7 CARIBOU MONITORING: INDIRECT HABITAT LOSS**

Indirect habitat loss will be assessed, likely as a measure of caribou distribution within the north Baffin Island region relative to proximity to the Mary River Project. Distribution and density will be assessed at variable distances from the Project to determine if there is a Project and/or habitat related effect on distribution and density. Methods will be developed at a later date when caribou numbers increase and there is a review of current technology to monitor the potential effect of indirect habitat loss.

#### **4-8 CARIBOU MONITORING: HABITAT USE DURING CALVING**


Surveys for caribou use of habitat during the calving season are ground-based within the vicinity of the project area. Ground-based surveys minimize disturbance to caribou, provide extra time for vigilance and observation of caribou use of much of the PDA, and allow for immediate behavior monitoring should caribou been seen interacting with the project. The ground-based method currently being used are height-of-land (HoL) surveys. The HoL surveys are used at other times of year when opportunities are available to observe for caribou presence and behavior in the vicinity of the Project.

#### **HEIGHT OF LAND SURVEYS**

Height of land (HoL) surveys began in 2013 to study caribou use and their behavioural reactions to human activities near the Project footprint, especially during the calving season. The focus of

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 118 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

the HoL surveys is to examine how or if caribou, particularly cows with calves, respond to Project activities and infrastructure. HoL surveys allow for long-term monitoring and observation of caribou behaviour throughout the life of the Project, providing information to verify and monitor predicted Project effects on caribou movement and habitat use. Among other things, behaviour sampling can provide insight into responses to environmental stimuli (Martin and Bateson 1993).

## Objectives

To determine presence and interaction of caribou with Project facilities.

## Thresholds

No thresholds associated with this surveillance program.

## Methods

HoL surveys use a basic survey technique that involves observing an area from a high point of land (to increase the amount of observable area) for a prescribed amount of time, using binoculars and/or a spotting scope to detect and record caribou and their proximity to Project infrastructure. HoL surveys are typically conducted in April and June in an effort to observe caribou during the late-winter and calving periods. At least two observers are present during HoL surveys with a maximum of three observers per survey. The surveys follow the 2013 HoL survey design as closely as possible; however, due to resource constraints on site, a vehicle may not be available for traveling between stations for some surveys, and as a last resort a helicopter has been used to access the sites. Stations visited during the snow season can be accessed via snow machine and hiking from the Tote Road.


As of 2015 there are 24 HoL stations in the vicinity of the Mine Site, Tote Road, and Milne Inlet (Table 7-3; HoL stations are established at the highest point possible, although a 360 degree view was rarely achievable (Map 3). Project components (e.g. the road, camp, or deposit) are visible from each station. Stations were chosen based on their location along the road, gain in height (e.g. improved view), and accessibility in spring conditions. A few of the sites would be inaccessible if not for helicopter support due to waterbodies and long travel time by foot.

At each station, the following information is recorded:

- Station number
- Location description (direction from road, aspect, terrain, other identifying features)

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 119 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- General habitat description (vegetation, soil)
- Photograph numbers (taken in multiple directions)
- Observation start and end time
- Snow cover on landscape
- All bird and wildlife or sign of observed on way to or during the survey

Observations are made using two spotting scopes and one set of binoculars (e.g., Photo 2 and Photo 3). Observations are made continuously for a minimum of 20 minutes by scanning the viewable landscape. If caribou are observed, their behaviour is monitored following protocols established and provided in the 2013 Annual Terrestrial Monitoring Report (EDI 2014).

Observations are to be made as either a focal or scan sample (depending on the number of caribou; Martin and Bateson 1993) and observations are recorded on specifically developed field data sheets (See Survey Forms C1 (Table 7-5) and C2 (Table 7-6)). For both scan sampling, activity categories (i.e., walking, foraging, running, lying, etc.) are to be assigned and tallied every two minutes for the group of caribou, while focal surveys involve recording the activity for each individual every two minutes; However, when certain events or disturbances are encountered (e.g. a truck passing by, or aircraft flying over), they are also recorded, and additional observation of the caribou are completed to document if they display any unique response to the activity. The individual's or group's distance to Project infrastructure and directional movement would also be recorded when possible. Distance from the observers would either be estimated by sight or by using a range finder.

**Table 7-3. Height of Land Monitoring Stations in the vicinity of the Mary River Project.**

HoL Station	Latitude	Longitude
1	71.871	-80.883
2	71.777	-80.620
3	71.730	-80.442
4	71.607	-80.347
5	71.550	-80.264
6	71.483	-80.213
7	71.460	-80.238
8	71.448	-80.174
9	71.382	-79.967
10	71.373	-79.686
11	71.339	-79.522
12	71.363	-79.614
13	71.357	-79.599
14	71.370	-79.661
15	71.339	-79.573
16	71.332	-79.478
17	71.852	-80.935

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**Table 7-3. Height of Land Monitoring Stations in the vicinity of the Mary River Project.**

HoL Station	Latitude	Longitude
18	71.835	-80.831
19	71.801	-80.758
20	71.685	-80.438
21	71.510	-80.311
22	71.479	-80.273
23	71.395	-79.155
24	71.300	-79.195

## Data Analyses

HoL observation data are typically summarized as a narrative and in a table summary (e.g., Table 7-4). Behaviour data summaries and analyses will be determined at a later date pending collection of caribou observation data and discussion with the TEWG.


**Table 7-4. Example summary table where details of Height of Land surveys conducted in the Mary River Project study would be summarized on an annual basis.**

Method of transportation to HoL station	Dates of observation	Number of observers per survey	Survey Effort (hh:mm)
<i>Describe mode of transportation (recognizing that the last resort – helicopter – could influence caribou behaviour</i>	<i>Insert dates of observations</i>	2	<i>A full tally of time spent observing the landscape for caribou from the combined height of land surveys</i>

## References

Martin, P. and P. Bateson. 1993. Measuring behaviour: An introductory guide. Second edition. Cambridge University Press, Great Britain.



	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 121 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	



**Photo 2. Height of Land surveys conducted in April are typically accessed by snowmobile or hiking from the Tote Road**



**Photo 3. Height of Land surveys conducted in June during peak calving are ideally accessed by vehicle and hiking from the tote road.**

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**Table 7-5. Height of Land survey form C1 is used during all HoL surveys. If Caribou are observed during a survey, form C2 is triggered.**



**Instructions:**

- Set-up spotting scope at station, while the other observer begins scoping with binoculars
- Scan in all directions for 20 minutes, record any wildlife observations below. Take note of any wildlife sign at or on the way to the station.
- If caribou are seen, begin a scan survey using Form C2 – Focal/Scan Survey.

Date \_\_\_\_\_ Observers \_\_\_\_\_ Weather \_\_\_\_\_

Station	Time Start	Time End	Visibility <sup>1</sup>	Species	Number	Observation Type <sup>2</sup>	Distance (m) <sup>3</sup>	Direction <sup>4</sup>	Comments/Form C2 Reference <sup>5</sup>	Snow % Cover

<sup>1</sup>Visibility codes: P = poor, G = good, E= excellent  
<sup>2</sup> Observation Type codes: S= sighting, T= track, P= fecal pellet, O= other  
<sup>3</sup> Distance from station  
<sup>4</sup> Direction from station  
<sup>5</sup>If caribou behavioural observations are made, reference the corresponding Form C2 – Focal/Scan Survey 2015. |

**Table 7-6. Height of Land survey form C2 is used when caribou are observed during a HoL survey, resulting in a lengthy and detailed observation of the caribou.**



Form C2 – Focal/Scan Survey 2016  
Page \_\_ of \_\_

Instructions:

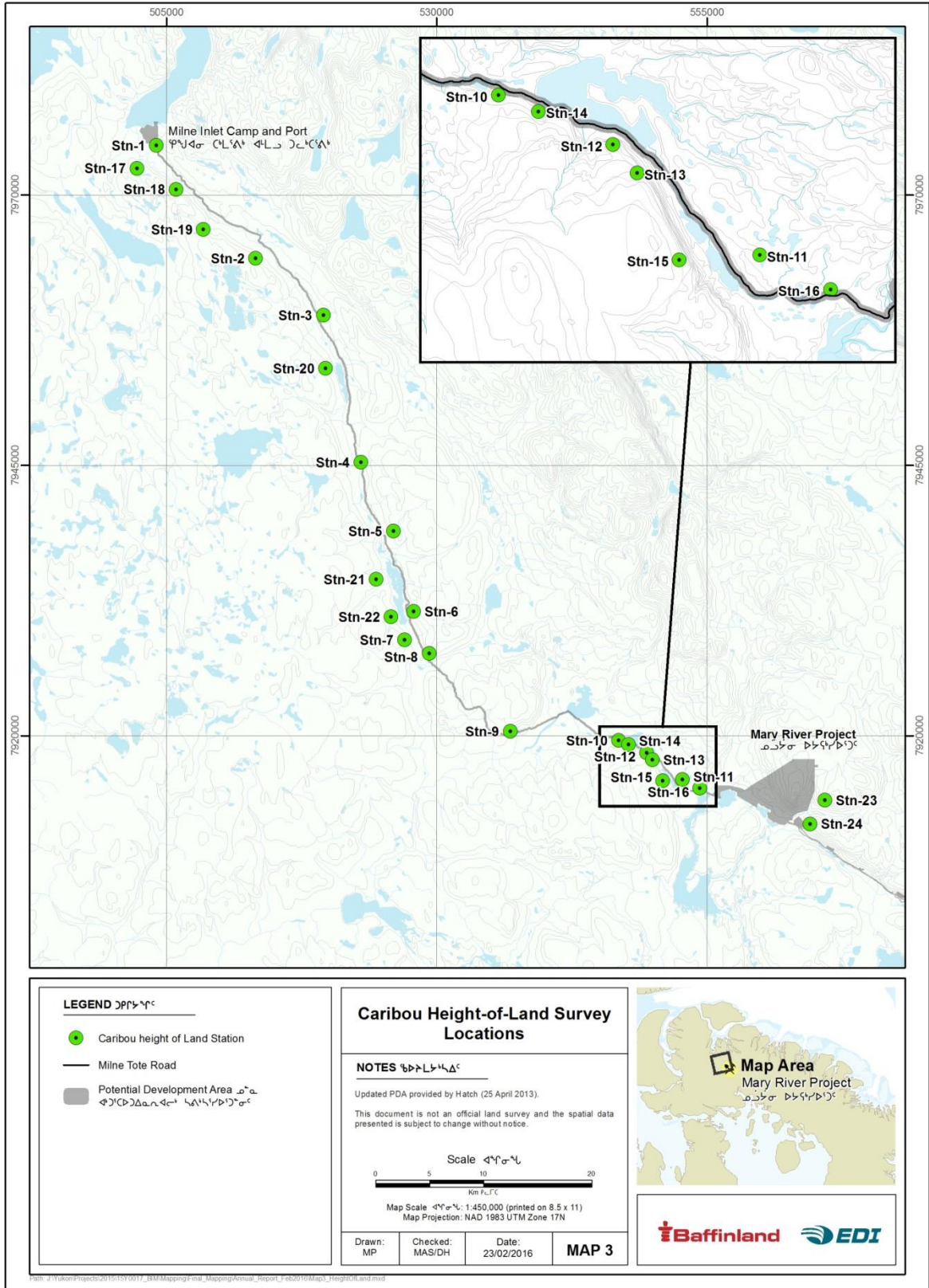
- Conduct a Focal survey if only a few individuals are observed and you can track the behaviour of each one; Scan survey if multiple individuals are observed and you cannot differentiate, then record a tally of the number individuals displaying each activity type
- Tally the type of activity every two minutes, for at least one hour
- If a stressor event occurs, record the time and type of stressor, the time the stressor is gone, and record all caribou activity immediately following the stressor (i.e., even if the two minute pause is not yet complete)

Date:	Time:	Observer:	Recorder:
Visibility (P/G/E):	Temperature:	Wind:	Other weather:
Insect activity:			
Wpt or Station #:	Latitude:	Distance (m) to caribou:	Group size:
<small>Coordinates must be in decimal degrees (e.g. 64.7775, -130.4450)</small>	Longitude:	Direction to caribou:	Group composition: F ___ M ___ Y ___ C ___ U ___
			<small>Females, Males, Yearlings, Calves, Unknown</small>

Start time: \_\_\_\_\_ End Time: \_\_\_\_\_ Total Survey Time: \_\_\_\_\_


Time	Forage <small>(head down walking)</small>	Run	Trot	Alert <small>(standing or bedded with head up, ears pointed)</small>	Walk	Stand	Lie/Bed	Stressor	Distance to Stressor (m)	Comments
<i>Fill out the top of the sheet while waiting to start scan</i>										

Stressor codes: A= aircraft, LV= light vehicle, HV= heavy vehicle, S= snowmobile, B= blasts, H= human, W= wildlife



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Note: This is an UNCONTROLLED COPY. All staff members are responsible to ensure the latest revision is used.

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 125 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

#### 4-9 CARIBOU MONITORING: MOVEMENT

Caribou movement will be monitored as a direct project interaction through snow tracking, and as a regional-level response through analyses of caribou collar data if 1) the GN has collared caribou in the region and 2) if the data are made available to Baffinland.

##### SNOW TRACKING

The purpose of snow track survey is to collect data on caribou response to Project activities based on patterns of movement observed by their tracks.


The survey will remain at the surveillance level until there is a suitable sample of the response variable (caribou tracks) to allow for robust statistical analyses. When caribou observations increase, Baffinland will consider increasing the frequency of surveys within a season to encompass variability and different snow and operation conditions.

Snow track surveys are conducted along the Tote Road in late winter (April). Surveys will be attempted in “fresh” snow conditions to better estimate current animal use. “Fresh” snow likely means fresh blown snow conditions after weather events have settled.

Observers travel by truck slowly along the Tote Road looking for wildlife tracks with a particular focus on caribou tracks. The elevated position of the observer in the truck allows for clear and unrestricted visibility to at least 300 m horizontal distance from the edge of the road (when conditions are clear). Conducting the survey from the road alone limits observation to near-road. More distant surveys using snow machines with transects parallel to the road (e.g., 1 km) can be considered when caribou are observed using the area in numbers sufficient for robust survey data analysis.

When wildlife tracks are observed, surveyors park the truck and walk to the tracks to confirm species and then follow the tracks towards and away from the road to observe behaviour, habitat use and possible divergence of travel paths. When tracks are near or crossed the Tote Road surveyors would record the following information:

- Latitude and longitude at the point where the tracks crossed the road;
- Species the tracks were from;
- Number of sets of tracks counted (i.e. group size);

	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 126 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

- A designation describing travel in relation to the road (e.g., deflected, travelled along, or crossing the Tote Road); and
- Height of the snow bank measured at either the crossing point, or likely point of deflection.

Photos and additional relevant information are recorded for each site.

Results are provided in annual terrestrial environment monitoring reports, beginning with the 2014 annual report.

## **COLLAR DATA**

Caribou collar data can be used to assess individual caribou movement patterns and the data can be used in part to see if those patterns are influenced by Project infrastructure and activity.

It is unknown what technology will be available for collar data collection and analyses when the GN next collars north Baffin Island caribou. Specific methods are not described further, but will be provided as necessary in updates to the TEMMP and as caribou collar studies are initiated and data shared with Baffinland.

### **4-10 CARIBOU MONITORING: HARVEST-RELATED MORTALITY**

Baffinland recognizes that harvest monitoring is the responsibility of the wildlife management authorities.


Baffinland records human use of the project area in the “Human Use Log.” Log entries include an estimate of the caribou harvested if the individuals are willing to share the information. Summaries of the “Human Use Log” are provided in the NIRB annual report.

### **4-11 CARIBOU MONITORING: HEALTH CONTAMINANTS AND BODY CONDITION**

Baffinland will assist with tissue collection, through the GN-led sampling program. Baffinland has offered to the GN the service of providing sampling kits to harvesters passing through the Mary River and Milne Port site.

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	<b>Terrestrial Environment Mitigation and Monitoring Plan</b>	<b>Issue Date:</b> March 14, 2016 <b>Rev.:</b> 1	Page 127 of 128
	<b>Environment</b>	<b>Document #:</b> BAF-PH1-830-P16-0027	

#### **4-12 WOLF MONITORING: DEN SITES**

Methods described in the 2014 annual report. The Government of Nunavut suggested that the wolf monitoring program be discontinued until wolves are present

#### **4-13 WILDLIFE MONITORING: DIRECT HABITAT LOSS**

Baffinland will provide a quantification of the area disturbed (footprint) in each NIRB annual report.

#### **4-14 WILDLIFE MONITORING: INCIDENTAL OBSERVATIONS AND PROJECT MORTALITY WILDLIFE LOG**

Baffinland encourages on-site personnel to record wildlife sightings. Wildlife sightings are recorded by a number of individuals with varying levels of expertise in wildlife identification. The intent of the sightings log is to encourage personnel to maintain an awareness level of wildlife in work areas, and over time to develop general trends in wildlife abundance in the area. A sample of the wildlife sightings log is presented in Table 7-7.

**Table 7-7. Wildlife Log 2008 Wildlife Monitoring Program Mary River Project**

WILDLIFE LOG  
2008 WILDLIFE MONITORING PROGRAM  
MARY RIVER PROJECT

Office Use Only	
Issue Date:	
Return Date:	
Contact:	
Location:	
Tracking ID:	

Your Name	Date	Location Description	Coordinates (NAD 83)		Type of Animal (species)	# of Animals	Comments (behavior/sound)
			Northing	Easting			