BACK RIVER PROJECT
Wildlife Mitigation and Monitoring Program Plan
(Version 10)

October 2019

BACK RIVER PROJECT
WILDLIFE MITIGATION AND MONITORING PROGRAM PLAN (VERSION 10)

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List of Acronyms

BACI	Before-After-Control-Impact
CWS	Canadian Wildlife Service
dB	decibel; dBA and dBC are frequency weightings used to measure and report noise levels.
DEIS	Draft Environmental Impact Statement
DFO	Fisheries and Oceans Canada
ECCC	Environment and Climate Change Canada
FEIS	Final Environmental Impact Statement
GN	Government of Nunavut
GN DOE	Government of Nunavut Department of Environment
GNWT	Government of the Northwest Territories
GNWT ENR	Government of the Northwest Territories Department of Environment and Natural Resources
GPS	Global positioning system
HMMP	Hazardous Materials Management Plan
IMO	International Maritime Organization
KIA	Kitikmeot Inuit Association
NIRB	Nunavut Impact Review Board
OPMP	Oil Pollution Management Plan
OR	Odds ratio
QA/QC	Quality assurance/quality control
SARA	*Species at Risk Act*
SCP	Spill Contingency Plan
SOP	Standard operating procedure
SOPEP	Shipboard Oil Pollution Emergency Plan
TK	Traditional knowledge
TSF	Tailings storage facility
USFWS	United States Fish and Wildlife Service
VEC	Valued ecosystem component
WEMP	Wildlife Effects Monitoring Program
WMMP	Wildlife Mitigation and Monitoring Program
ZOI	Zone of influence

Definitions of Project Areas

RSA	Regional Study Area – The area identified for baseline studies for large mammals, raptors and waterfowl and used in the FEIS as the assessment area. The RSA is defined as the area within 30 km of the Project Footprint. This area was extended to 35 km on the east side of the RSA to encompass the Western River.
LSA	Local Study Area – The area used for baseline studies for upland birds and vegetation mapping. The LSA is defined by local watersheds surrounding the PDA, MLA and winter road.
PDA	Project Development Area – The area assessed for the FEIS where the Project will be constructed. The planned footprint of the Goose site is approximately 15% of the Goose PDA area. The PDA was chosen to be large enough to allow future changes in the locations of Project features.
MLA	Marine Laydown Area – The PDA surrounding the marine laydown in Bathurst Inlet.
Footprint	The physically constructed area of the Project where wildlife habitat will be removed or directly physically disturbed.
On-Site	Within the footprint, or immediately adjacent to the footprint. Accessible by Project personnel by land based vehicle or on foot from the footprint.
Local-Scale	Studies or activities taking place on-site or in the area surrounding the Project footprint out to the visible horizon.
Regional-Scale	Studies or activities taking place within the RSA. Generally, regional-scale monitoring is conducted to evaluate if wildlife are avoiding the Project so the scale extends from the Project footprint out to a distance where no avoidance is anticipated to provide a control area for monitoring.
ZOI Test Area	As part of the camera monitoring program to determine whether there is a zone of influence, cameras are placed within a ZOI test area close to the Project footprint where fewer wildlife may be observed.
ZOI Control Area	As part of the camera monitoring program to determine whether there is a zone of influence, cameras are placed in a ZOI control area at a distance beyond where a ZOI may occur to provide a comparison for the cameras in the ZOI test area.

1. Introduction

The Back River Project (the Project) has been designed to minimize, mitigate, and/or manage potential adverse effects on the environment while systematically seeking to enhance positive effects. As part of the requirements of the Final Environmental Impact Statement (FEIS) guidelines issued by the Nunavut Impact Review Board (NIRB), this document presents the Wildlife Mitigation and Monitoring Program (WMMP) Plan (the WMMP Plan) that Sabina Gold & Silver Corp. (Sabina) will follow concurrent with the development of the Project.

This Plan describes actions that are intended to reduce Project-related effects on wildlife. The Plan is intended to ensure wildlife habitats and populations are maintained in the area that will be influenced by Project development, while taking into account operational requirements and the safety of Project employees.

Unless otherwise indicated, measures described in the Plan apply to all Project components for the life of the Project. This plan is designed to be adaptive, effective, and achievable in both the short and long term, and includes measurable objectives that will be evaluated in the monitoring program.

The WMMP Plan for the FEIS includes considerable changes and additions in response to comments, suggestions and requests from the reviewers of the previous version of the WMMP Plan, including: Kitikmeot residents, Hunters and Trappers Organizations, the Kitikmeot Inuit Association (KIA), the NIRB, the Government of Nunavut (GN), the Government of the Northwest Territories (GNWT) and Aboriginal groups from the NWT.

Sabina is committed to minimizing its impacts to wildlife and has designed its monitoring and mitigation activities to be flexible and adaptable as part of its overall management strategy to be responsive to concerns regarding uncertainty in potential effects to wildlife, particularly caribou, raised during the FEIS. As a result, the WMMP Plan meets and in most cases exceeds the mitigation and management measures for any mining project in the Canadian Arctic. The monitoring program used to trigger mitigation and management activities for potential Project effects is likewise the most advanced and comprehensive monitoring program in the Canadian Arctic.

1.1 INTEGRATION OF TRADITIONAL KNOWLEDGE

This Plan represents an adaptive approach to understanding the effects of the Project on the landscape and the species that live there. In this context, the Plan is part of a continually evolving process that relies not only on the efficacy of data collection and analytical results, but is also dependent on feedback from the communities, government, Aboriginal groups and the public. Having an adaptive and flexible program allows for appropriate and necessary changes to the design of monitoring studies, and the mitigation and monitoring plans. Some changes may come about through the observation of unanticipated effects or inadequacies in the sampling methods used to detect measurable effects. Other changes may result from ecological knowledge acquired through working with Aboriginal community members and discussions with elders, both in the field and through workshops.

Sabina is committed to considering and incorporating traditional knowledge (TK) into the Plan on an ongoing basis. The incorporation of traditional knowledge will occur throughout all stages of the Plan, including identification of mitigation measures, monitoring study design, data collection, and follow-up programs to obtain feedback.

2. Scope and Objectives

The WMMP Plan targets the following valued ecosystem components (VECs) that are included in the Final Environmental Impact Statement (FEIS):

1. caribou (Bathurst, Beverly/Ahiak, and the Dolphin and Union herds);
2. grizzly bear;
3. muskox;
4. wolverine/furbearers;
5. migratory birds (waterbirds, upland birds);
6. raptors (e.g., falcons, eagles, hawks, ravens, and owls);
7. seabirds and seaducks; and
8. marine mammals (ringed seals).

In addition, while not included as a VEC in the FEIS, the Plan also considers polar bear.

Mitigation for potential effects of the Project was taken into consideration in the Project design and included avoidance of key wildlife habitats. The process of Project design and avoidance was conducted during the preparation phase for the Draft Environmental Impact Statement (DEIS) and FEIS. The FEIS evaluates the potential for effects given the final footprint after the redesign of Project elements. The overall objective of the Plan is to minimize effects due to the Project given this final footprint design.

The objectives of the WMMP Plan are to:

- guide on-site adaptive management (both monitoring and mitigation activities) at the Project site;
- incorporate Traditional Knowledge (TK) into the Plan wherever possible;
- minimize any Project-related effects on wildlife species and their habitat predicted in the FEIS;
- avoid adverse effects on protected species and their habitats;
- describe regional-based monitoring activities for selected wildlife VEC species and their habitat;
- provide achievable and measureable goals for evaluating mitigation and monitoring activities;
- ensure monitoring is based on current methods that are consistent with other monitoring programs in the Arctic; and
- identify opportunities for regional, collaborative monitoring with government agencies where a need has been identified.

The WMMP Plan describes and presents the following components:

- the planning and implementation processes for the Plan, including the personnel and their responsibilities (Section 5);

- the mitigation and adaptive management measures that will be carried out on-site to reduce any predicted effects due to the Project (Sections 6 to 15);
- the Wildlife Effects Monitoring Program (WEMP) including:
  - numerous on-site monitoring programs to evaluate the success of mitigation and management, and to trigger and guide adaptive mitigation and management activities (Sections 7 to 15);
  - species-specific monitoring programs to monitor regional populations of selected VEC species to evaluate the predicted effects from the FEIS (Sections 7 to 15); and
- the process for adaptive management, checking and corrective action, record keeping, reporting, and quality assurance/quality control (QA/QC).

The WMMP Plan is designed to be effective for all Project sites, including:

- the Goose Project Development Area (Goose site) including buildings, on-site roads, open pits, ponds, and the Tailings Storage Facility (TSF);
- the Marine Laydown Area Project Development Area (MLA PDA);
- the winter ice roads between the two PDAs as well as winter ice roads to George and the proposed Bathurst Inlet Port and Road (BIPR);
- the shipping corridor through the Northwest Passage; and
- areas surrounding the areas listed here that may be accessed by aircraft.

3. Planning and Implementation

Planning for the WMMP Plan started with the development of the EIS, which identified existing (baseline) conditions and available TK, assessed potential effects of the Project, and developed mitigation measures to minimize these effects. These plans will continue to be elaborated and executed throughout the construction, operation, and closure phases of mining. Environmental management and monitoring will be tracked, reviewed, and updated through ongoing maintenance of the plan. These updates will incorporate relevant feedback from interested parties which include, but are not limited to, the KIA, GN, GNWT, NIRB, and community members and groups.

The FEIS identified potential effects of the Project on wildlife VECs. Mitigation to reduce these effects and monitoring to evaluate the efficacy of mitigation and interactions between the Project and wildlife VECs is included in the Plan (Sections 7 to 15).

Regional VEC monitoring is described (Sections 7 to 15) for those VEC species included in the assessment (including polar bears). Results of these studies will guide management activities. The Plan will be updated periodically, as mitigation standards change, due to data recorded by the WMMP and/or data available from outside sources. In some cases, such as caribou, regional monitoring is planned through a collaborative process with government biologists and other industrial operations. To date, no regional monitoring plan is available for Sabina to contribute to.

3.1 UPDATES TO THE WMMP PLAN

The WMMP Plan has been updated several times following input during the DEIS and FEIS process. The versions of the WMMP Plan include:

1. Version 1 (2013) – This was the original draft of the WMMP Plan and was included in the DEIS application.
2. Version 2 (2015) – The DEIS WMMP Plan was updated following commitments made during the DEIS hearings and following discussions with the KIA, GN and GNWT.
3. Version 3 (March 2016) – The FEIS WMMP Plan was updated following Information Requests and Technical Comments and technical meetings with the KIA and GN and presented to the NIRB and reviewers prior to the FEIS hearings in April, 2016.
4. Version 4 (September 2016) – Version 3 of the WMMP Plan was re-arranged to organize the document by species, rather than by facility type. The Plan was updated following joint submissions of proposed Terms and Conditions and Commitments made with the KIA and the GN during the FEIS hearings. The Version 4 WMMP Plan also includes measures to address the proposed commitments made by the GNWT during the FEIS review phase.
5. Version 5 (October 2016) – Version 4 of the WMMP Plan was updated following a meeting with the KIA to produce Version 5, which was presented to the KIA, GN and GNWT in October, 2016.
6. Version 6 (November 2016) – Following a meeting with the GNWT on October 24th in Yellowknife and a two day workshop with the KIA and GN on October 25th and 26th, Version 6 of the WMMP Plan was produced. This workshop resulted in an additional 86 commitments and text changes to the WMMP Plan. The majority of these changes were small changes, or clarifications to the text

of proposed monitoring programs. This document was submitted for additional peer review, conducted by Golder Associates and Environmental Dynamics Inc. (EDI).

7. Version 7 (February 2017) – Version 6 of the WMMP Plan was updated following peer review to produce Version 7, the current version of the WMMP Plan.
8. Version 8 (May 2017) – Version 7 of the WMMP Plan was updated following final Technical Comments received in April 2017 from the KIA, GN, GNWT, ECCC, NSMA, and LKDFN.
9. Version 9 (September 2018) – Version 8 of the WMMP Plan was updated following commitments made to the GN during the Final Hearing for the Back River Project, May 2017.
10. Version 10 (October 2019) (this version) Version 9 of the WMMP Plan was updated to address a commitment to the KIA to include information on spill response equipment contact information for community organizations.

The WMMP Plan will be updated as needed during the life of the Project in conjunction with the KIA, GN, GNWT, and community members and groups. The WMMP Plan will be submitted to the NIRB for review and approval. Prior to commencement of any WMMP Plan update, the KIA, GN and GNWT will be consulted on the scope of the update to ensure that concerns are addressed. Sabina will work collaboratively with the KIA, GN and GNWT on relevant elements of the update. Sabina will be the holder of the document and once the draft updates are complete, the GN, KIA and GNWT will be given the opportunity for a full review of the updated Plan.

Updates may be triggered by significant changes in the Project plan, results reported in the annual WEMP report that indicate changes in conditions that are likely to be biologically meaningful, significant updates to the scientific understanding or methods relevant to wildlife at the Project site, or as necessary.

3.2 CARIBOU TECHNICAL ADVISORY GROUP

Prior to construction of the Project, Sabina will set up a Caribou Technical Advisory Group consisting of technical representatives from Sabina, the KIA, the GN and the GNWT. The purpose of this group will include:

- Provide independent advice on study design(s) and analyses to be carried out by Sabina for the testing and evaluation of the Project’s adaptive management measures for reducing disturbance of caribou.
- Within the early stages of the Project (e.g. first five (5) years, recommend appropriate testing to be carried out by Sabina of the caribou detection methods, group size thresholds, and distance thresholds employed.
- On the basis of these tests conducted by Sabina, and any other available evidence, may make appropriate recommendations respecting the Project's adaptive management measures for reducing disturbance of caribou.

Sabina will provide a report to NIRB on Sabina's testing and evaluation of the Project adaptive management measures and the report will include responses to any recommendations made by the Caribou Technical Advisory Group.

4. Applicable Legislation and Guidelines

Mitigation measures to lessen Project effects on wildlife are derived, in part, from federal and territorial legislation. A summary of this legislation is listed in Table 4-1.

Table 4-1. Relevant Acts and Regulations for Wildlife and Wildlife Habitat

Act or Regulation	Implications for Management
Canada *Species at Risk Act (SARA)* (2002)	• Protects wildlife on federal lands as well as the critical habitat of those species listed on the "List of Wildlife Species at Risk," and protects all SARA-listed migratory birds. • Section 137 amends the *Canadian Environmental Assessment Act* (1992) to clarify, for greater certainty, that environmental assessments must always consider effects to listed wildlife species, their critical habitat, or the residences of individuals of that species. • Section 79(2) states "the person must 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 measures must be taken in a way that is consistent with any applicable recovery strategy and action plans."
Canada *Migratory Birds Convention Act* (1994)	• Prohibits the taking or killing of migratory birds, their nests, and eggs, and the deposition of harmful substances in areas frequented by migratory birds. • Species protected include waterbirds, cranes, rails and coots, shorebirds including gulls and terns, pigeons and doves, insectivorous songbirds (excluding blackbirds), seabirds, loons, grebes, herons, egrets, and bitterns. Raptors are not protected under the *Act*.
Nunavut *Scientists Act* (2011)	• Requires a licence to conduct environmental research (except for wildlife).
Nunavut *Wildlife Act* (2003)	• Provides guidelines on wildlife harvesting, habitat protection, respectful conduct toward wildlife, and designation and protection of species at risk and their habitat. • Pertinent regulations are: Wildlife General Regulations (1999), and Wildlife Licenses and Permits Regulations (1999).
Nunavut *Land Claims Agreement Act* (1993)	• Provides guidelines for NIRB on the review of potential environmental and social effects of development projects.

4.1 SPECIES AT RISK

Species at risk confirmed and potentially occurring in the RSA and along the shipping route are listed in Table 4.1-1 along with the mitigation and management to meet s.79 of SARA. This list will be updated by consulting the SARA registry whenever the WMMP is updated and for the annual WEMP Report.

Table 4.1-1. Species of Conservation Concern Known or Potentially Occurring at the Project

VEC or VEC Group	Species	Scientific Name	Federal Designation		Territorial Status[1]	Mitigation and Management for this Species
			COSEWIC Status	*Species At Risk Act* Schedule 1		
Species Confirmed to Occur in the Project Terrestrial or Marine Regional Study Areas						
Caribou (Beverly/Ahiak herd and Bathurst herd)	n/a	*Rangifer tarandus groenlandicus*	Threatened	No	Apparently Secure	No significant effects identified. Mitigation includes: • Habitat Loss (Section 7.1.4) • Disturbance (Section 7.1.5) • Disruption of Movement (Section 7.1.6) • Direct Mortality and Injury (Section 7.1.7) • Indirect Mortality (Section 7.1.8) • Attraction (Section 7.1.9) • Exposure to Contaminants (Section 7.1.10) Detailed monitoring programs developed to trigger mitigation (Section 7.2.1) and measure predicted project effects (Section 7.2.2).
Grizzly Bear	n/a	*Ursus arctos horribilis*	Special Concern	Yes	Vulnerable	No significant effects identified for grizzly bear and wolverine. Similar mitigation to reduce Project effects are proposed for these two species, including mitigation for: • Habitat Loss (Section 9.1.2) • Disturbance (Section 9.1.3) • Disruption of Movement (Section 9.1.4) • Direct Mortality and Injury (Section 9.1.5) • Indirect Mortality (Section 9.1.6) • Attraction (Section 9.1.7) • Exposure to Contaminants (Section 9.1.8) Detailed monitoring programs developed to trigger mitigation (Section 9.2.1) and measure predicted project effects (Section 9.2.2).
Wolverine	n/a	*Gulo gulo*	Special Concern	Yes	Vulnerable	

(continued)

Table 4.1-1. Species of Conservation Concern Known or Potentially Occurring at the Project (continued)

VEC or VEC Group	Species	Scientific Name	Federal Designation		Territorial Status[1]	Mitigation and Management for this Species
			COSEWIC Status	*Species At Risk Act* Schedule 1		
Species Confirmed to Occur in the Project Terrestrial or Marine Regional Study Areas *(cont'd)*						
Upland Birds	American Golden-plover	*Pluvialis dominica*			Vulnerable	No significant effects identified to upland birds. Mitigation to reduce Project effects on upland birds include mitigation for: • Habitat Loss (Section 12.1.2) • Disturbance (Section 12.1.3) • Direct Mortality and Injury (Section 12.1.5) • Indirect Mortality (Section 12.1.6) • Attraction (Section 12.1.7) • Exposure to Contaminants (Section 12.1.8) Detailed monitoring programs developed to trigger mitigation (Section 12.2.1) and measure predicted project effects (Section 12.2.2).
	Harris's Sparrow	*Zonotrichia querula*	Special Concern	No	Unrankable	
	Hoary Redpoll	*Carduelis hornemanni*		No	Vulnerable	
	Least Sandpiper	*Calidris minutilla*		No	Vulnerable	
	Red-necked Phalarope	*Phalaropus lobatus*	Special Concern	Yes	Vulnerable	
	Semipalmated Sandpiper	*Calidris pusilla*		No	Vulnerable	
Raptors	Golden Eagle	*Aquila chrysaetos*	Not at Risk	No	Vulnerable	No significant effects identified to raptors. Mitigation to reduce Project effects on raptors include mitigation for: • Habitat Loss (Section 10.1.2) • Disturbance (Section 10.1.3) • Direct Mortality and Injury (Section 10.1.5) • Indirect Mortality (Section 10.1.6) • Attraction (Section 10.1.7) • Exposure to Contaminants (Section 10.1.8) Detailed monitoring programs developed to trigger mitigation (Section 10.2.1) and measure predicted project effects (Section 10.2.2).
	Peregrine Falcon	*Falco peregrinus anatum/tundrius*	Not at Risk	Yes	Apparently Secure	
	Short-eared Owl	*Asio flammeus*	Special Concern	Yes	Vulnerable	

(continued)

Table 4.1-1. Species of Conservation Concern Known or Potentially Occurring at the Project (continued)

VEC or VEC Group	Species	Scientific Name	Federal Designation		Territorial Status[1]	Mitigation and Management for this Species
			COSEWIC Status	*Species At Risk Act* Schedule 1		
Species Confirmed to Occur in the Project Terrestrial or Marine Regional Study Areas *(cont'd)*						
Seabirds and Seaducks	Common Eider[2]	*Somateria mollissima*		No	Vulnerable	No significant effects identified to seabirds and seaducks. Mitigation to reduce Project effects on seabirds and seaducks include mitigation for: • Habitat Alteration (Section 13.1.2) • Disturbance (Section 13.1.3) • Direct Mortality and Injury (Section 13.1.4) • Indirect Mortality (Section 13.1.5) • Exposure to Contaminants (Section 13.1.6) Detailed monitoring programs developed to trigger mitigation (Section 13.2.1) and measure predicted project effects (Section 13.2.2).
Species that Could Occur in the Project Terrestrial or Marine Regional Study Areas						
Caribou (Bathurst herd)	n/a	*Rangifer tarandus groenlandicus*	Threatened	No	Apparently Secure	No interaction between the Bathurst herd and the Project at present. No significant effects to this herd are expected. Various mitigation to reduce Project effects on all caribou herds that might be encountered at the Project are detailed above.
Upland Birds	Black-bellied Plover[2]	*Pluvialis squatarola*		No	Vulnerable	As described above for upland birds that have been confirmed to occur in the Project Regional Study Area.
	Buff-breasted Sandpiper	*Tryngites subruficollis*	Special Concern	Yes	Vulnerable	
	Hoary Redpoll[2]	*Acanthis hornemanni*		No	Vulnerable	
	Ruddy Turnstone	*Arenaria interpres*		No	Vulnerable	
	Red Knot	*Calidris canutus*	Endangered/ Special Concern	Yes	Imperiled	
	Sanderling	*Calidris alba*		No	Vulnerable	

(continued)

Table 4.1-1. Species of Conservation Concern Known or Potentially Occurring at the Project (continued)

VEC or VEC Group	Species	Scientific Name	Federal Designation: COSEWIC Status	Federal Designation: *Species At Risk Act* Schedule 1	Territorial Status[1]	Mitigation and Management for this Species
Species that Could Occur in the Project Terrestrial or Marine Regional Study Areas *(cont'd)*						
Upland Birds *(cont'd)*	Snow Bunting	*Plectrophenax nivalis*		No	Vulnerable	
Species that could be encountered along the Project Shipping Route						
Caribou (Dolphin and Union herd)	n/a	*Rangifer tarandus groenlandicus*	Endangered	Yes	Apparently Secure	Very limited to no interaction between the Dolphin and Union caribou herd and the Project expected, as Project shipping will only occur during the open water season and the winter range of Dolphin and Union caribou does not currently overlap the Project site. Various mitigation to reduce Project effects on all caribou herds that might be encountered at the Project are detailed above in the caribou section.
Caribou (Peary caribou)	n/a	*Rangifer tarandus pearyi*	Threatened	Yes	Apparently Secure	Project shipping will occur during the open water season. Hence, no interaction between Peary caribou and the Project. Various mitigation to reduce Project effects on all caribou herds that might be encountered at the Project are detailed above.
Waterbirds	Horned Grebe	*Podiceps auritus*	Special Concern	Yes	Unrankable	No significant effects identified to waterbirds. Mitigation to reduce Project effects on waterbirds include mitigation for: • Habitat Loss (Section 11.1.2) • Disturbance (Section 11.1.3) • Direct Mortality and Injury (Section 11.1.5) • Indirect Mortality (Section 11.1.6) • Attraction (Section 11.1.7) • Exposure to Contaminants (Section 11.1.8) Detailed monitoring programs developed to trigger mitigation (Section 11.2.1) and measure predicted project effects (Section 11.2.2).
Upland Birds	Hudsonian Godwit	*Limosa haemastica*		No	Vulnerable	As described above for upland birds that have been confirmed to occur in the Project Regional Study Area.
	Lesser Yellowlegs	*Tringa flavipes*		No	Vulnerable	

(continued)

Table 4.1-1. Species of Conservation Concern Known or Potentially Occurring at the Project (continued)

VEC or VEC Group	Species	Scientific Name	Federal Designation		Territorial Status[1]	Mitigation and Management for this Species
			COSEWIC Status	*Species At Risk Act* Schedule 1		
Species that could be encountered along the Project Shipping Route *(cont'd)*						
Seabirds and Seaducks	King Eider	*Somateria spectabilis*		No	Vulnerable	As described above for seabirds and seaducks that have been confirmed to occur in the Project Regional Study Area.
	Ivory Gull	*Pagophila eburnea*	Endangered	Yes	Critically Imperiled	
	Ross's Gull	*Rhodostethia rosea*	Threatened	Yes	Critically Imperiled	
Marine Mammals	Beluga (Eastern High Arctic - Baffin Bay population)	*Delphinapterus leucas*	Special Concern	No	Secure	No significant effects identified to ringed seals. Proposed mitigation for ringed seals are intended to safeguard all marine mammals. Mitigation to reduce Project effects on ringed seals and marine mammals include mitigation for: • Habitat Alteration (Section 14.1.2) • Disturbance (Section 14.1.3) • Direct Mortality and Injury (Section 14.1.4) • Indirect Mortality (Section 14.1.5) • Exposure to Contaminants (Section 14.1.6) Detailed monitoring programs developed to trigger mitigation (Section 14.2.1) and to monitor marine mammals during Project shipping (Section 14.2.2)
	Walrus	*Odobenus rosmarus rosmarus*	Special Concern	No	Vulnerable	
	Polar Bear	*Ursus maritimus*	Special Concern	Yes	Vulnerable	Polar bear are not considered to be a VEC; however, potential effects to this species were evaluated (Appendix V7-6A of the FEIS). Mitigation to reduce Project effects on polar bear include mitigation for: • Accidental Fuel Release or Spill Event in the Marine Environment (Section 15.1.2). • Direct Mortality and Injury (Section 15.1.3) A monitoring program will be in place for polar bears (Section 15.2)

Notes:
Gray and underline refer to species' statuses that have changed or been added since the original table in the WMMP Plan from 2012.
[1] Territorial status is current to 2015 and are presented in the 2015 Wild Species Report (CESCC 2015).
[2] Species are also likely to be encountered along the Project shipping routes.

5. Roles and Responsibilities

The General Manager of the Project is ultimately responsible for the success of the Plan and approves all relevant policies and documents, audits, action plans, and the verification process.

The Environment Manager, along with their direct reports, is responsible for the implementation of this Plan including: overall management of the plan, monitoring, operations, internal and external reporting, and ensuring compliance and adaptive management.

6. General Mitigation, Management and Monitoring

This section describes a series of mitigation and management measures that will be implemented to eliminate or minimize effects of the Project for wildlife, backed by a suite of monitoring programs to trigger mitigation when necessary and to evaluate potential effects of the Project on wildlife. The Plan is designed to be effective and achievable, and will incorporate Aboriginal TK, land user information, the latest scientific information, best management practices, and the results of monitoring activities specifically designed to evaluate the efficacy of the mitigation and management activities.

Mitigation

Mitigation measures are activities that are ongoing on a constant basis, or are designed into the Project. Examples of mitigation actions include the no-hunting regulation for employees while on site, keeping wastes in wildlife-proof buildings, and maintaining all Project vehicles and equipment to minimize the noise they make. Examples of design mitigation are the building skirting which will prevent wildlife such as wolverine from access under Project buildings, and ramps to facilitate caribou crossing all-season roads.

Monitoring

Three types of monitoring will be conducted: 1) to evaluate the success of mitigation actions, 2) to trigger management, and 3) to evaluate predicted Project effects.

Monitoring will be conducted to evaluate the success of mitigation – including camp inspections for cleanliness, inspections of buildings and skirting to ensure they are wildlife-proof, monitoring the waste facility for wildlife use, and noise and dust monitoring. If these inspections indicate a problem, the mitigation activities will be updated accordingly. Monitoring will also be conducted to trigger management —wildlife monitors will record the presence of caribou and other wildlife near the Project, and all drivers and pilots will monitor for and avoid wildlife. Monitoring will also be conducted to evaluate predicted Project effects, for example, caribou collars will be monitored to evaluate if caribou are avoiding the Project site.

Management

Management actions are triggered by monitoring. Examples include giving wildlife the right of way whenever they are observed on Project roads and ceasing blasting and heavy mobile equipment when caribou are observed near the Project site.

This section describes: 1) the general mitigation and management measures applicable to all wildlife species, and 2) the framework of the Wildlife Effects Monitoring Program (WEMP) that will evaluate the effectiveness of mitigation and management measures and will monitor them for predicted effects on VEC species.

Sections 7 to 15 describe the mitigation, management, and monitoring for each wildlife VEC species and for polar bears. The sections are organized by potential effects (e.g., habitat loss, disturbance, etc.). There is some overlap between the general mitigation and management strategies provided in Section 6 and the specific strategies outlined in Sections 7 to 15 for individual wildlife VECs (and polar bears).

6.1 MITIGATION AND MANAGEMENT FOR WILDLIFE

There are several general mitigation and management measures that will be implemented for wildlife at the Project. These general measures include the development of a wildlife education program (including training for all Project employees), enforcement of wildlife policies, a noise abatement program, and fuel management plans. Many other measures are presented elsewhere in this document, such as those to reduce the potential effects in relation to Project construction and operation activities (including attractants) and road, aircraft, and ship traffic.

6.1.1 Wildlife Policies and Employee Education

The goal of wildlife policies and employee education is to create employee and contractor awareness of each person's responsibilities to minimize Project effects on wildlife, including disturbance and disruption to wildlife, and ensure the safety of all employees. All contractors and employees working on the Project will participate in the program through inductions and annual refresher courses. Through this program, all Project personnel will be encouraged to promote stewardship activities and will be educated about and expected to comply with the management provisions in the WMMP.

There will be three wildlife policies that will be used at the Project:

- no feeding of wildlife;
- no littering; and
- no firearms and no hunting by Project personnel while on an active shift at the Project site.

The education program will include training in the following areas:

- employees and contractors will be educated on basic local wildlife ecology (including wildlife information from TK) and possible Project-related effects on wildlife and biodiversity;
- road restrictions and operating protocols (e.g., wildlife right-of-way, speed limits, check-ins, road-wildlife reporting programs);
- awareness of wildlife-sensitive locations (e.g., movement corridors, breeding areas) and wildlife-sensitive periods;
- local wildlife species of concern and threats to native biodiversity;
- wildlife attractant management;
- bear-aware training for relevant staff who work outdoors;
- wildlife incidental observation reporting;
- wildlife incident/accident reporting and response procedures;
- anonymous reporting system for employees to voice concerns and inform management of non-compliance; and
- compliance requirements and disciplinary action that will be enforced by Project management.

6.1.2 Noise Abatement

Noise abatement will be conducted throughout the life of the Project to meet safety regulations for Project personnel and to reduce any disturbance to wildlife. Mitigation measures will include:

- ensuring equipment is fitted with appropriate mufflers and silencers;
- ensuring equipment is well maintained;
- identifying enclosures, berms, acoustic screening, and shrouding where stationary sources require control;
- strategic placement of waste rock piles to block plant sources of noise;
- housing stationary sources of noise in buildings; and
- other possible general noise abatement measures that can be implemented on-site to minimize static noise due to generators, vehicles, and other sources.

Management of noise sources, e.g., staged reduction of Project activities when wildlife are present, is discussed in the appropriate section for each wildlife species.

6.1.3 Spill Management

Prevention of unplanned releases of fuel or other chemicals during the life of the Project will be accomplished through strict enforcement of the fuel and spill management plans (FEIS, Volume 10), including the following plans:

- The Fuel Management Plan (FMP) outlines the approach for managing hydrocarbon products that are to be stored and managed at the Project. The FMP meets Federal and Territorial statutory requirements and will be included in Sabina's future Type A Water Licence Application. The scope of this plan focuses on the environmental protection measures required for fuel management. This entails the implementation of procedures for transportation, handling, inspection, storage, transfer, reporting, and documentation for all fuel products throughout the mine life. These products include diesel, gasoline, lubricating oils, hydraulic fluids, propane, and paint thinner. Sabina's intent is that through the diligent implementation of measures outlined in this plan the frequency of spill incidents will be minimized at the mine.
- The Spill Contingency Plan (SCP) is designed to protect worker and public safety and minimize any effects of a spill on the environment. It addresses all potential spills of fuel, soluble solids, liquids like solvents or paint, flammable gases and other hazardous substances at all Project sites, including the Goose site, the Marine Laydown Area, temporary winter supply road (winter ice road), on-ice airstrips, etc. It meets all Canadian legislation and will be updated as part of the Type A Water License.
- The Oil Pollution Management Plan (OPMP) is a requirement of the *Canada Shipping Act* (2001) and describes the responses to oil spill scenarios at the Marine Laydown Area to minimize environmental damage and ensure worker safety. It provides instructions to guide all personnel in emergency spill response situations, defines the roles and responsibilities of management and responders and outlines the measures taken to prevent spills, the related exercise and evaluation programme, and the mechanism for regular updates to the plan.
- The Shipboard Oil Pollution Emergency Plan (SOPEP) is a requirement of the International Maritime Organization (IMO) for all ships transporting fuel; it describes the equipment, training and procedures that the ship must have on board in order to manage and address any fuel spills during shipment or unloading to minimize any effects on the environment. Sabina will require

that the shipping company providing fuel to the Project will have an approved SOPEP in place prior to shipping any fuel to site.

- The Hazardous Materials Management Plan (HMMP) outlines the safe handling requirements, storage, transportation, disposal, and reporting of hazardous materials at the Goose site and the Marine Laydown Area throughout the life of the Project. This plan provides environmental protection measures, spill response procedures, and conforms with all existing federal and territorial acts and regulations. A Cyanide Management Plan is a sub-plan of the HMMP and is in accordance with the International Cyanide Management Code; it addresses the transportation, handling, storage, management, and monitoring of cyanide at the Project.

All vessels utilized for the Project must have spill response supplies and equipment available as per their Shipboard Oil Pollution Emergency Plan (SOPEP), or as per their legal/company requirements. Sabina has also placed significant spill response supplies and equipment at the Marine Laydown Area. In the future Sabina intends to position spill response supplies and equipment at Bathurst Inlet and/or Bay Chimo.

Table 6.1-1 provides a list of community organizations that would be contacted to inform traditional land users of shipping activity in the area, any spills and actions to ensure public safety and plans for clean-up. In case of a marine spill, contact information for government agencies and Sabina are provided in Tables 6.1-2 and 3.

Table 6.1-1. Community Organizations and Contact Information in case of a Marine Spill.

Community	Organization	Telephone
Clyde River	Nangmautaq Hunters & Trappers Organization Clyde River Hamlet	867-924-6202 867-924-6220
Pond Inlet	Mittimatalik Hunters & Trappers Organization Pond Inlet Hamlet	867-899-8856 867-899-8924
Arctic Bay	Ikajutit Hunters & Trappers Organization Arctic Bay Hamlet	867-439-8483 867-439-9917
Resolute Bay	Resolute Bay Hunters & Trappers Organization Resolute Bay Hamlet	867-252-3170 867-252-3832
Kugaaruk	Kurtairujuark Hunters & Trappers Organization Kugaaruk Hamlet	867-769-7002 867-769-6281
Taloyoak	Spence Bay Hunters & Trappers Organization Taloyoak Hamlet	867-561-5066 867-561-6341
Gjoa Haven	Gjoa Haven Hunters & Trappers Organization Gjoa Haven Hamlet	867-360-6028 867-360-7141
Cambridge Bay	Ekaluktutiak Hunters & Trappers Organization Cambridge Bay Hamlet	867-983-2426 867-983-4650
Kugluktuk	Kugluktuk Angoniatit Hunters & Trappers Organization Kugluktuk Hamlet	867-982-4908 867-982-6500
Bathurst Inlet/Bay Chimo	Connie & Allan Kapolak Sam & Susie Kapolak Martina & Peter Kapolak	867-983-2052 867-444-8653 867-983-2023

Table 6.1-2. Government Organizations and Contact Information in case of a Marine Spill.

Organization	Position	Location	Telephone
Nunavut Spill Line	24 hour Spill Report Line	Yellowknife	867-920-8130
Canadian Coast Guard – Central and Arctic Region (Any discharge to the marine environment during fuel transfer)	24 hour Spill Report Line	Yellowknife	800-265-0237
GN Department of Environment	Director Environmental Protection Division	Iqaluit	867-975-7729
Nunavut Water Board	Executive Director	Gjoa Haven	867-360-6338
Kitikmeot Inuit Association	Sr. Lands Officer	Kugluktuk	867-982-3310
Indigenous and Northern Affairs Canada	Inspector	Yellowknife	867-669-2438
Environment and Climate Change Canada	Manager of Enforcement	Yellowknife	867-669-4730
Department of Fisheries and Oceans	Habitat Team Leader	Ottawa	705-522-9909

Table 6.1-3. Emergency Contact Information for Sabina in case of a Marine Spill.

Position	Telephone Number
VP, Environment and Community Matthew Pickard	416-605-7881
Manager, Environmental Permitting Merle Keefe	604-240-6619
Manager, Construction Jaymes Dircks	250-802-3390

6.2 MONITORING FOR WILDLIFE

A Wildlife Effects Monitoring Program (WEMP) is proposed to evaluate the effectiveness of mitigation and management in reducing potential effects of the Project on wildlife. The goal of the WEMP is to assess interactions between the Project and wildlife populations in order to modify operations if there is evidence that the Project is having an effect on wildlife. Wildlife monitoring programs will be conducted to:

1. evaluate whether mitigation is working;
2. trigger management actions; and
3. test the predictions of the FEIS.

Monitoring programs of facilities and mitigation measures are summarized in Table 6.2-1 and described in the section for the relevant wildlife species. Monitoring programs to test the predictions of the FEIS are presented in Table 6.2-2.

This WEMP will be updated by Sabina prior to construction of the Project to include the detailed study designs of programs as well as standard operating procedures and sent to the NIRB, KIA, GN, GNWT for comment prior to use.

Monitoring programs will be largely conducted in the Local Study Area (LSA) and Regional Study Area (RSA) for terrestrial and marine wildlife, as presented in Figures 6.2-1 and 6.2-2. Some monitoring programs for select wildlife VECs may extend beyond the boundaries of the Regional Study Area, particularly for regional collaborative programs with government.

Table 6.2-1. Overview of Wildlife Monitoring Programs that Trigger Management Actions

Monitoring Programs that Trigger Management (Section of the document where they are described)	Baseline/ Pre-Construction	Mobilization and Construction	Operations	Temporary Closure	Care and Maintenance*	Reclamation/ Closure*	Post-Closure
Caribou (Section 7.2)							
1) Monitor Seasonal Caribou Ranges *Use collar data to track during which seasons caribou are likely to interact with the Project*	--	Yearly	Yearly	Yearly	Yearly	Yearly	--
2) Near Real-time Collar Monitoring *Use collar data to track near real-time location of caribou herds*	--	Ongoing	Ongoing	--	--	Ongoing	--
3) Active Caribou Monitoring *Wildlife monitors will survey for caribou from raised platforms or using cameras*	--	Ongoing	Ongoing	--	--	Ongoing	--
4) Incidental Wildlife Reporting *Incidental observations of wildlife and incidents*	Ongoing	Ongoing	Ongoing	--	Ongoing	Ongoing	--
5) On-site Camera Monitoring *Use motion-trigger cameras to track caribou interactions with Project infrastructure*	Ongoing	Ongoing	Ongoing	--	Ongoing	Ongoing	--
6) Over the Horizon Monitoring *If ZOI monitoring indicates that management must be conducted for caribou when they are over the horizon (greater than can be observed from site)*	--	If triggered	If triggered	--	--	If triggered	--
7) Human Activity Monitoring *Reporting hunting and fishing on the Project site*	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	Ongoing	--
8) Noise Monitoring *Monitor noise levels outside the footprint*	One time	One time	Every three years	--	--	One time	--
Muskox (Section 8.2)							
1) On-site Camera Monitoring *Use motion-trigger cameras to track muskox interactions with Project infrastructure*	Ongoing	Ongoing	Ongoing	--	Ongoing	Ongoing	--
2) Incidental Wildlife Reporting *Incidental observations of wildlife and incidents*	Ongoing	Ongoing	Ongoing	--	Ongoing	Ongoing	--

(continued)

Table 6.2-1. Overview of Wildlife Monitoring Programs that Trigger Management Actions (continued)

Monitoring Programs that Trigger Management (Section of the document where they are described)	Baseline/ Pre-Construction	Mobilization and Construction	Operations	Temporary Closure	Care and Maintenance*	Reclamation/ Closure*	Post-Closure
Muskox (Section 8.2) *(cont'd)*							
3) Active Caribou Monitoring *Wildlife monitors will also survey for muskox from raised platforms or using cameras*	--	Ongoing	Ongoing	--	--	Ongoing	--
Grizzly Bear (Section 9.2)							
1) On-site Camera Monitoring *Use motion-trigger cameras to track grizzly bear interactions with Project infrastructure*	Ongoing	Ongoing	Ongoing	--	Ongoing	Ongoing	--
2) Incidental Wildlife Reporting *Incidental observations of wildlife and incidents*	Ongoing	Ongoing	Ongoing	--	Ongoing	Ongoing	--
3) Infrastructure Monitoring *Fence inspections and wildlife observations*	--	Monthly	Monthly	--	Monthly	Monthly	--
4) Waste Management Monitoring *Monitoring waste storage areas for misdirected waste or signs of wildlife*	Weekly	Weekly	Weekly	--	Weekly	Weekly	--
5) Pre-clearing Surveys for Bear Dens *Identify dens prior to construction of the winter ice road*		If triggered	If triggered			If triggered	
Raptors (Section 10.2)							
1) Pit and Quarry Wall Nest Monitoring *Monitor pits for nesting raptors*	--	Yearly, in Spring	Yearly, in Spring	--	--	--	--
2) Pre-clearing Surveys for Nests *Pre-survey areas if construction occurs during nesting season*	--	If triggered, in Spring	If triggered, in Spring	--	--	--	--
3) Incidental Wildlife Reporting *Incidental observations of wildlife and incidents*	Ongoing	Ongoing	Ongoing	--	Ongoing	Ongoing	--

(continued)

Table 6.2-1. Overview of Wildlife Monitoring Programs that Trigger Management Actions (completed)

Monitoring Programs that Trigger Management (Section of the document where they are described)	Baseline/ Pre-Construction	Mobilization and Construction	Operations	Temporary Closure	Care and Maintenance*	Reclamation/ Closure*	Post-Closure
Waterbirds (Section 11.2)							
1) Waterbird Monitoring in Ponds *Monitor waterbird usage of Project ponds if water quality does not meet wildlife guidelines (if water is present in ponds during the Project Phase in question)*	--	Weekly (May through October)	Weekly (May through October)	Twice yearly (Spring and late Summer)	Twice yearly (Spring and late Summer)	Weekly (May through October)	--
2) Pre-clearing Surveys for Nests *Pre-survey areas if construction occurs during nesting season*	--	If triggered, in Spring	If triggered, in Spring	--	--	--	--
3) Incidental Wildlife Reporting *Incidental observations of wildlife and incidents*	Ongoing	Ongoing	Ongoing	--	Ongoing	Ongoing	--
Upland Birds (Section 12.2)							
1) Pre-clearing Surveys for Nests *Pre-survey areas if construction occurs during nesting season*	--	If triggered, in Spring	If triggered, in Spring	--	--	--	--
2) Incidental Wildlife Reporting *Incidental observations of wildlife and incidents*	Ongoing	Ongoing	Ongoing	--	Ongoing	Ongoing	--
Marine Birds (Section 13.2)							
1) Pre-clearing Surveys for Nests *Pre-survey areas if construction occurs during nesting season*	--	If triggered, in Spring	If triggered, in Spring	--	--	--	--
Marine Mammals (Section 14.2)							
On-Ice Monitoring at the MLA *Pre-survey sea ice if on-ice works occur Feb 15-March 15*	--	If triggered	If triggered	--	If triggered	If triggered	--

** Monitoring is dependent on personnel being present at site.*

Table 6.2-2. Overview of Proposed Focal Species Monitoring Programs to Test Predictions of FEIS

Focal Species Monitoring[1]	Baseline/ Pre-Construction	Site Prep/ Construction	Operations	Temporary Closure	Care and Maintenance	Reclamation/ Closure	Post-Closure
Caribou (Section 7.2)							
Local-Scale Monitoring							
1) Footprint Size Monitoring	--	Ongoing	Ongoing	--	--	--	--
2) On-site Monitoring by Wildlife Monitors	--	Ongoing	Ongoing	--	--	Ongoing	--
3) Behaviour Monitoring Program	--	Ongoing	Ongoing	--	--	--	--
4) Stress Hormone Study	--	--	1 Time	--	--	--	--
Regional Monitoring							
5) Regional Collar Monitoring for ZOI (reporting)	--	Every 3 years	Every 3 years	Every 3 years	Every 3 years	Every 3 years	Every 3 years
6) Regional Camera Monitoring Program for ZOI	2 years	Every 3 years	Every 3 years	--	--	--	Every 3 years
7) Noise Monitoring	1 Time	1 Time	Every 3 years	--	--	1 Time	--
8) Dust Monitoring	1 Time	1 Time	Every 3 years	--	--	--	--
Herd-Scale Monitoring							
9) Contribution to GN/GNWT monitoring initiatives	--	TBD	TBD	TBD	TBD	TBD	TBD
Muskox (Section 8.2)							
Local-Scale Monitoring							
1) Footprint Size Monitoring	--	Ongoing	Ongoing	--	--	--	--
Regional Monitoring							
2) Regional Camera Monitoring Program	2 years	Every 3 years	Every 3 years	--	--	--	Every 3 years
Herd-Scale Monitoring							
3) Contribution to GN/GNWT monitoring initiatives	--	TBD	TBD	--	--	--	--
Grizzly Bear (Section 9.2)							
Local-Scale Monitoring							
1) Footprint Size Monitoring	--	Ongoing	Ongoing	--	--	--	--
Regional Monitoring							
2) Regional Camera Monitoring Program for ZOI	2 years	Every 3 years	Every 3 years	--	--	--	Every 3 years
Herd-Scale Monitoring							
3) Contribution to GN/GNWT monitoring initiatives	--	TBD	TBD	--	--	--	--

(continued)

Table 6.2-2. Overview of Proposed Focal Species Monitoring Programs to Test Predictions of FEIS (continued)

Focal Species Monitoring	Baseline/ Pre-Construction	Site Prep/ Construction	Operations	Temporary Closure	Care and Maintenance	Reclamation/ Closure	Post-Closure
Wolverine/Furbearer (Section 9.2)							
Local-Scale Monitoring							
1) Footprint Size Monitoring	--	Ongoing	Ongoing	--	--	--	--
Regional Monitoring							
2) Regional Camera Monitoring Program for ZOI	2 years	Every 3 years	Every 3 years	--	--	--	Every 3 years
Herd-Scale Monitoring							
3) Contribution to GN/GNWT monitoring initiatives	--	TBD	TBD	--	--	--	--
Raptors (Section 10.2)							
Local-Scale Monitoring							
1) Footprint Size Monitoring	--	Ongoing	Ongoing	--	--	--	--
Regional Monitoring							
2) Aerial monitoring to estimate productivity	3 years	Every 3 years	Every 3 years	--	--	--	--
Waterbirds (Section 11.2)							
Local-Scale Monitoring							
1) Footprint Size Monitoring	--	Ongoing	Ongoing	--	--	--	--
Regional Monitoring							
2) Aerial and ground surveys to measure breeding for waterbirds	3 years	Every 3 years	Every 3 years	--	--	--	--
3) Aerial surveys to examine staging areas for waterbirds	3 years	Every 3 years (2 times yearly)	Every 3 years (2 times yearly)	--	--	--	--
Upland Birds (Section 12.2)							
Local-Scale Monitoring							
1) Footprint Size Monitoring	--	Ongoing	Ongoing	--	--	--	--
Regional Monitoring							
2) PRISM/ VRPC surveys for upland breeding birds	3 years	Every 2 years	Every 2 years	--	--	--	--

(continued)

Table 6.2-2. Overview of Proposed Focal Species Monitoring Programs to Test Predictions of FEIS (continued)

Focal Species Monitoring	Baseline/ Pre-Construction	Site Prep/ Construction	Operations	Temporary Closure	Care and Maintenance	Reclamation/ Closure	Post-Closure
Seabirds/Seaducks[2] (Section 13.2)							
Local-Scale Monitoring							
1) Footprint Size Monitoring	--	Ongoing	Ongoing	--	--	--	--
Regional Monitoring							
2) Aerial and ground surveys to measure breeding for marine birds	3 years	Every 3 years[2]	Every 3 years[2]	--	--	--	--
3) Aerial surveys to examine staging areas for marine birds	3 years	Every 3 years (2 times yearly)	Every 3 years (2 times yearly)	--	--	--	--
4) Incidental Seabird Observations from Ships	--	Ongoing	Ongoing	--	Ongoing	Ongoing	--
Marine Mammals (Section 14.2)							
Regional Monitoring							
1) Incidental Marine Mammal Observations from Ships	--	Ongoing	Ongoing	--	Ongoing	Ongoing	--
Polar Bears (Section 15.2)							
Regional Monitoring							
1) Incidental Marine Mammal Observations from Ships	--	Ongoing	Ongoing	--	Ongoing	Ongoing	--

[1] Monitoring programs to test the predictions of the FEIS will also be used to trigger mitigation and management as discussed in the text of each monitoring section.
[2] Proposed monitoring for seabirds/seaducks and ringed seals would be conducted only when the Marine Laydown Area is active.
Note: Survey frequency may change depending on Project-related changes to population abundances and distributions or climate change or upon consultation with stakeholders.

Figure 6.2-1
Local Study Area and Regional Study Area for Caribou and Terrestrial Wildife

ERM

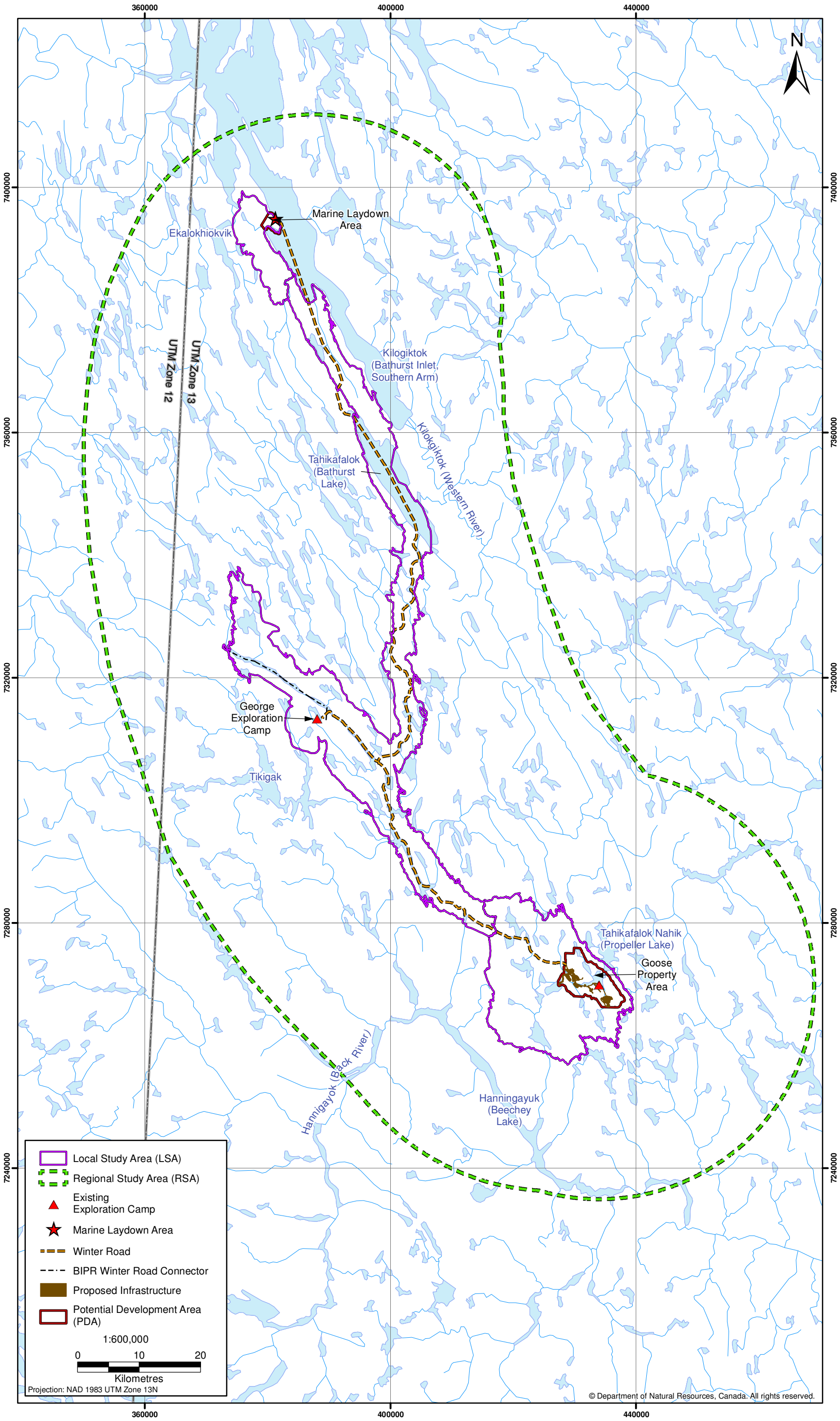
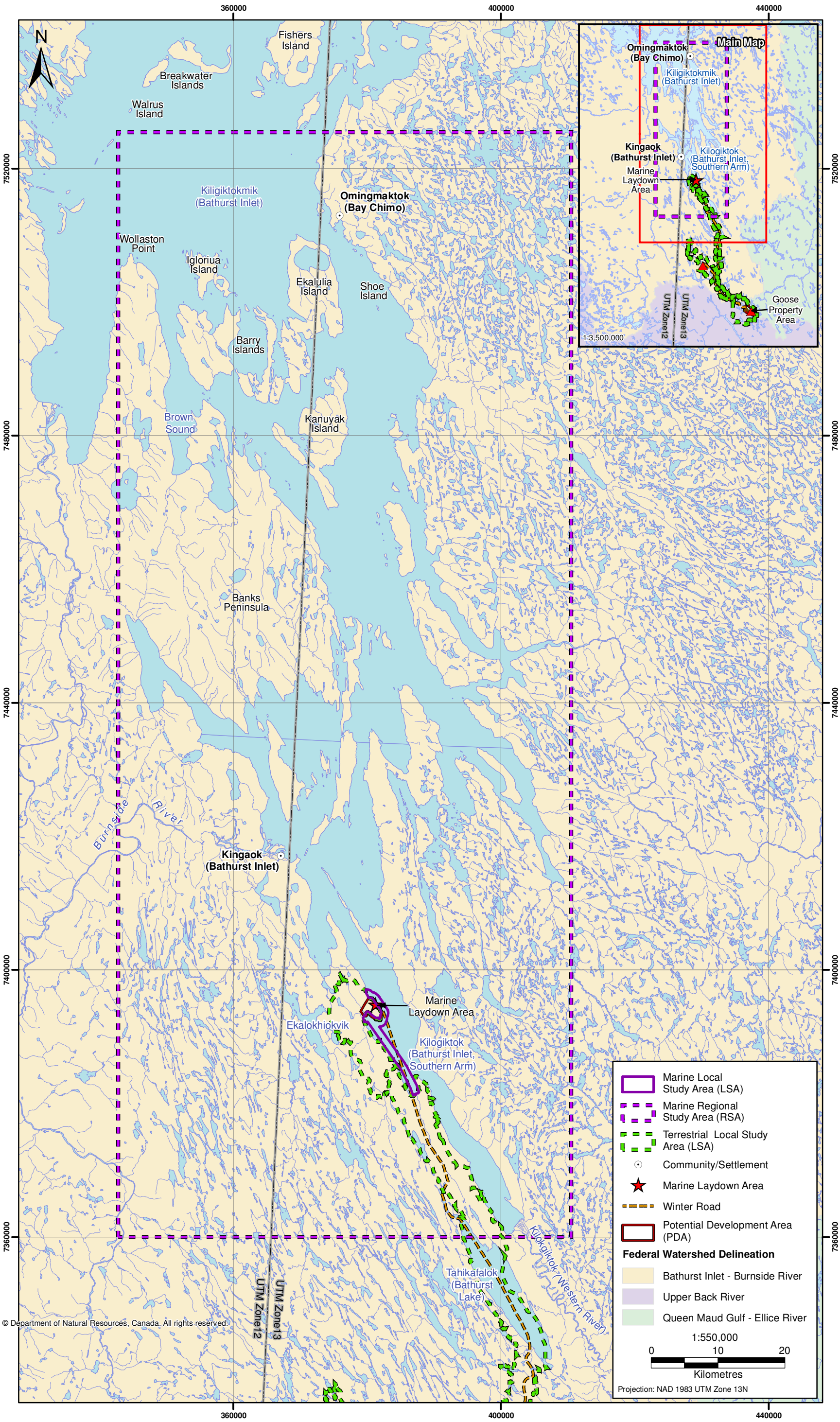


Figure 6.2-2
Local and Regional Study Areas for Marine Wildlife



7. Caribou

7.1 MITIGATION AND MANAGEMENT FOR CARIBOU

7.1.1 Overview of Project Interactions with Caribou

Mitigation, management and monitoring is presented for the Beverly/Ahiak, Bathurst, and Dolphin and Union caribou herds. Caribou from the Beverly/Ahiak herd will likely interact with the Project during the summer months, and to a lesser degree during the fall and winter periods. The range boundaries for the Bathurst and Dolphin and Union caribou herds are approximately 100 km from the Project site, and do not interact with the Project. Despite this, mitigation, management and monitoring is proposed for all caribou, regardless of herd.

7.1.1.1 Beverly/Ahiak Caribou

The Beverly caribou are named for Beverly Lake, where they historically calved. The Ahiak caribou was formerly known as the Queen Maud Gulf herd. Currently, both herds calve in the Queen Maud Gulf area.

Inuit TK has identified historic patterns in caribou movements and distribution, with relatively static calving areas and more unpredictable distribution during winter (KIA 2012, 2014). Inuit TK indicates that caribou have historically calved in the Queen Maud Gulf area over a long period, and wintered further south. Inuit TK includes observations of large numbers of caribou migrating across nadlok (crossing places), including the river crossing of the Back River at the east end of Beechey Lake and a lake crossing on the northern arm of Beechey Lake (KIA 2012, 2014). Based on the migration route of the Beverly/Ahiak herd, it is likely that these caribou, crossing in late summer and fall were from this herd. The abundance of caribou, and of their main predators, wolves, was high enough around Beechey Lake to support a large winter camp, the settlement of families for multiple years, and two fur trading posts. Inuit TK includes reference to an important community at Beechey Lake called Tudlak (KIA 2012, 2014).

The Beverly/Ahiak caribou herd consists of the Beverly and the Ahiak caribou sub-populations. Traditionally, the Beverly sub-population overwinters (November 1 to April 14) in the boreal forest below the treeline, generally to the east of the winter distribution of the Bathurst caribou herd. The Ahiak sub-population generally overwinters on the tundra between the treeline and Bathurst Inlet. During this period, some Beverly/Ahiak caribou may occur near the Project area. However, the herd appears to have merged their seasonal distribution in recent years (Adamczewsk et al. 2015).

During spring migration (April 15 to June 5), Beverly/Ahiak caribou travel north and east towards their calving grounds in the Queen Maud Gulf area (Figure 7.1-1). A small proportion (approximately 2%) of the Beverly/Ahiak caribou spend the winter to the west of the proposed winter ice road, and may cross the winter ice road while it is still in operation. Specific mitigation is proposed for the period of April 15 to the end of the winter ice road season to reduce any disruption of movement to these caribou.

During calving (June 5 to 20), the Beverly sub-population generally occupies the western half of the Queen Maud Gulf, while the Ahiak sub-population occupies the eastern half of the gulf. The calving grounds of the Beverly sub-population average 252 km (minimum of 145 km) northeast of the Goose site. The Ahiak sub-population calves further east away from the Goose site.

During post-calving (June 20 to July 25), Beverly/Ahiak caribou generally stay in the Queen Maud Gulf area, with the Beverly sub-population averaging 274 km (minimum of 165 km) from the Goose site.

During summer (July 26 to August 31), the Beverly/Ahiak caribou disperse south and west to areas between the treeline and Bathurst Inlet. This is the period when the highest numbers of caribou are observed at the Goose site.

During fall (September 1 to October 31), the Beverly/Ahiak caribou herd generally proceed south and the number of caribou observed at site decreases to low numbers for the winter period.

7.1.1.2 Bathurst Caribou

The Bathurst caribou herd is named for Bathurst Inlet. Inuit TK reports that the historic calving ground of the Bathurst caribou is both east and west of Bathurst Inlet (KIA 2012) approximately 100 km north of the Goose site. This is consistent with scientific reports listed above for the period of 1930s to present (Gunn, Poole, and Wierzchowski 2008).

Inuit TK also identifies areas with observations of females with calves surrounding Contwoyto, Nose and Beechey lakes (Luoma and Presser 2009; KIA 2012). This is also consistent with scientific data, with the current post-calving and summer range occurring near these lakes.

TK also identified several important nadlok for caribou and harvesting including two esker complexes north of Nose Lake used for movement (KIA 2012, 2014). Baseline studies reported that caribou continue to use these sites in moderate to large numbers. The islands of Bathurst Inlet were considered to be good places to hunt caribou in the open water season, and several key nadlok were observed where caribou swam across Bathurst Inlet. Note that these naddlok are all more than 30 km from Project sites.

The Bathurst herd moves yearly between calving grounds on the tundra and wintering range in the boreal forest. The Bathurst caribou herd overwinters in the boreal forest (November 1-April 14), generally below treeline, 250 to 750 km southwest of the Goose site. During spring (April 15 to June 5), Bathurst caribou move quickly north to their calving sites via Contwoyto Lake, which is an average of 185 km west of the Goose site.

From approximately June 5 to 15, the Bathurst herd occupies the calving grounds located between the Hood and Burnside Rivers, approximately 210 km northwest of the Goose site. During post-calving (June 15 to July 20), Bathurst caribou travel southeast and make their closest approach to the Goose site, approximately 60 km west of the Project site. The Nunavut Planning Commission (NPC) identified core calving and post-calving ranges for the Bathurst caribou herd (Figure 7.1-2). These areas do not overlap with the Project site, with the calving range approximately 210 km north-west of the Goose site (minimum of 160 km) and the post-calving range an average of 192 km from the Goose site (minimum 82 km).

During summer (July 21 to August 31), Bathurst caribou are centered around Contwoyto Lake, which is approximately 185 km from the Project site. During late summer and fall (September 1 to October 31), they travel south, away from the Project, and return to their wintering grounds below the treeline.

Even though the current Bathurst herd range does not overlap the Project site, mitigation is planned specifically for this herd to limit any potential disturbance should they move near the Project site.

Figure 7.1-1
Calving, Post-Calving and Total Herd Ranges of the Beverly/Ahiak Caribou

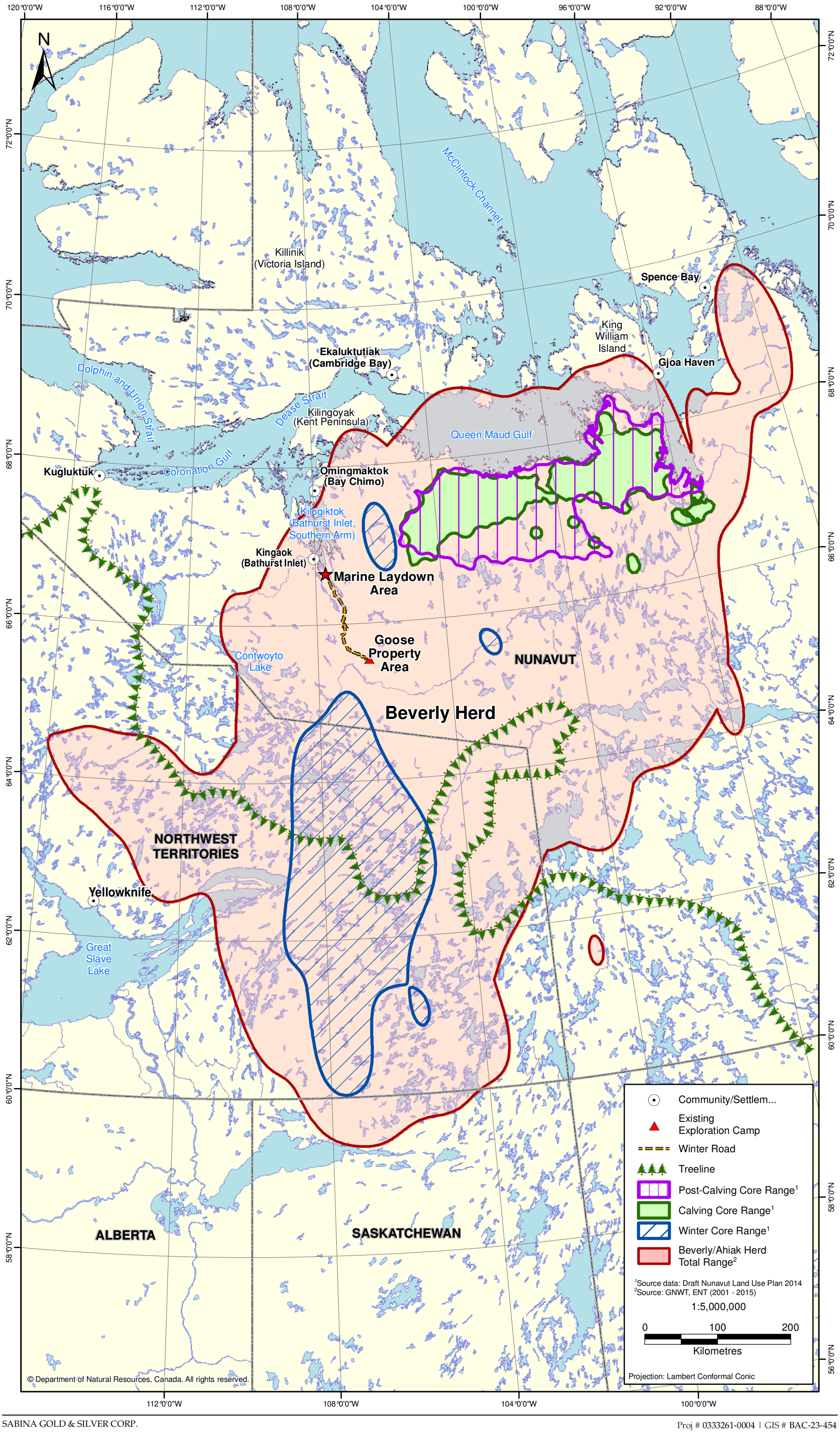
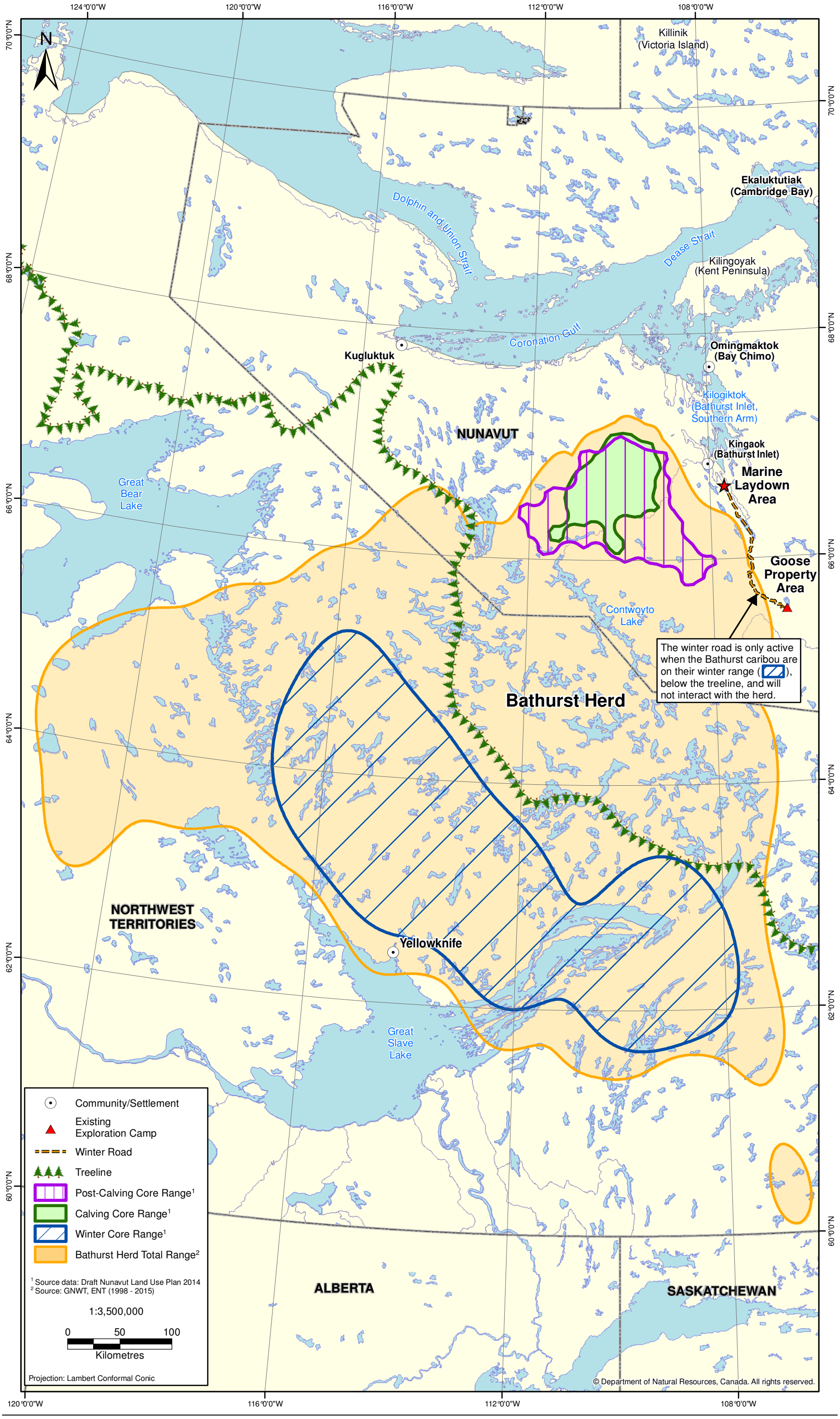


Figure 7.1-2
Calving, Post-Calving and Total Herd Ranges of the Bathurst Caribou



7.1.1.3 Dolphin and Union Caribou

Inuit TK distinguishes Dolphin and Union from mainland caribou by their light color, and refers to the Dolphin and Union herd as island caribou (KIA 2012, 2014). Inuit TK includes observations of the historical distribution of the Dolphin and Union herd in winter, primarily in two concentrations on the east and west of Bathurst Inlet, which corresponds with their current winter distribution based on collar data. Collar data indicates that the Dolphin and Union caribou herd winters (December 8 to April 16) on the Nunavut mainland between Kugluktuk and the Queen Maud Gulf, generally within 100 to 150 km from the coast (Figure 7.1-3. Their winter distribution is generally north of the Project Marine Laydown Area.

Inuit TK indicates that the Dolphin and Union caribou migrate across Dease Strait and Queen Maud Gulf during the spring to Victoria Island. Collar data indicates that spring migration (April 17 to June 29) averages 48 days. They spend the calving (June), post-calving and summer (July 1 to October 19) periods on Victoria Island.

TK indicates that caribou historically gathered on the southern coastline of Victoria Island to rut and wait for the sea ice to form. Once the sea ice is solid, these caribou migrate south. TK identified a variety of crossing locations on the ocean, often near islands and points of land. Collar data indicates that the migration starts in the last week of October and takes an average of 23 days.

Due to their use of the sea ice for migration, ice-breaking shipping has been identified as a threat to this species (COSEWIC 2004). As a consequence, the Project will not ship after October 15 except for emergency or unforeseen circumstances.

7.1.2 Overview of Potential Effects to Caribou

Seven potential effects of the Project on caribou were evaluated in the FEIS: habitat loss, disturbance, disruption of movement, direct mortality, indirect mortality, attraction, and exposure to contaminants. The potential for synergistic effects to result in reduced productivity of caribou was also considered in the FEIS. The potential for synergistic effects will be limited by implementing mitigation and management measures for the seven direct effects listed above, and discussed further in this section.

Habitat loss will occur in the Project footprint where natural vegetation is removed during construction of the Project, and habitat loss was rated as a residual effect in the FEIS. Habitat loss will be minimized by reducing the Project footprint.

The primary effect evaluated for caribou was indirect habitat loss caused by disturbance, measured as the potential for caribou to avoid the Project site, which was rated as a residual effect in the FEIS. A variety of mitigation, monitoring and management activities are proposed, including design mitigation to limit noise, fixed and rotary-winged aircraft management, and management of blasting, on-site roads and winter ice roads should caribou be observed near the site. Following comments from the KIA, GN, and GNWT during the FEIS review, the proposed trigger distances for management activities were increased and the group size required to trigger management decreased. A planned shutdown procedure for the Goose site was developed for the unlikely event of the Bathurst or Beverly caribou herds shifting their core calving or post-calving areas to overlap with the Project site.

The potential for disruption of caribou movement patterns by the winter ice road was predicted to not result in a residual effect to caribou during the winter and spring migration periods after the implementation of mitigation measures, including traffic management. Following comments from the KIA and GN during the FEIS review phase, additional monitoring and mitigation was included in the plan.

The potential for direct mortality due to vehicle collisions was not rated as a residual effect to caribou after the implementation of mitigation measures, including the setting speed limits and giving all wildlife the right of way.

The potential for indirect mortality associated with increased access for hunters to the Project area was not rated as a residual effect to caribou after the implementation of mitigation measures, including closing the winter ice road to the public, prohibiting employees from bringing firearms to the site, and hunting while at work.

The potential for caribou to be attracted to the Project site was not considered a residual effect in the FEIS because caribou are not typically attracted to industrial facilities.

A risk assessment provided in the FEIS concluded that caribou would not be at risk of uptake of hazardous chemicals. A series of standard management plans for chemicals will be implemented, including fuel, spill response, marine spills, and management of hazardous materials. After the implementation of mitigation measures, potential exposure to contaminants is not expected to result in a residual effect to caribou. Following comments from the KIA during the FEIS review, additional monitoring of the TSF is proposed, as well as adaptive management should caribou be attracted to the Project infrastructure as a source of salt.

7.1.3 Herd Vulnerability and the Sabina Adaptive Management Approach

The Project will be following the management philosophy described in the Beverly and Qamanirjuaq Caribou Management Plan 2013-2022 (BQCMB 2014). This plan proposes a suite of monitoring and management actions in response to the vulnerability level of the herd. The Beverly and Qamanirjuaq Caribou Management Board (BQCMB) determines the vulnerability of the herd in collaboration with co-management partners. The determination is based on a suite of indicators, such as seasonal distribution and range use, population size, herd productivity, health, harvest level, range quality, predators and insects, and weather and climate. The herd is then assigned a vulnerability score from very low to very high, which informs monitoring for seasonal distribution, population size, productivity, and harvest management.

The Project will be following the recommendations of this plan using the herd vulnerability scores set by the management groups for each herd, with intense management of the Project when the vulnerability level of caribou herds is high, and more relaxed management should the herds vulnerability become low or very low (Figure 7.1-4). Should the herd management groups not have an established vulnerability score Sabina will engage the relevant authorities (KIA, GN, GNWT) to determine an interim vulnerability score. Wildlife biologists and land users consider the current vulnerability of the Bathurst herd to be high to very high. Wildlife biologists and land users consider the Beverly herd is possibly in decline, and hence the herd vulnerability level may be low to medium.

As a consequence of the Bathurst herd vulnerability score, Sabina is proposing a set of mitigation and management actions for the Project that are very protective of caribou, and represent the highest level of protection of any proposed or operating mine in Nunavut or the Northwest Territories.

Should the herd vulnerability change in the future resulting from a change in caribou herd size or distribution then this plan may be revisited to provide an appropriate level of protection for caribou. Sabina will engage with the KIA, GN and GNWT to discuss options of how the change in herd vulnerability should influence the WMMP prior to revising the WMMP and the WMMP will be made available for review and comment prior to implementation.

Figure 7.1-3
Distribution of the Dolphin and Union Caribou Herd

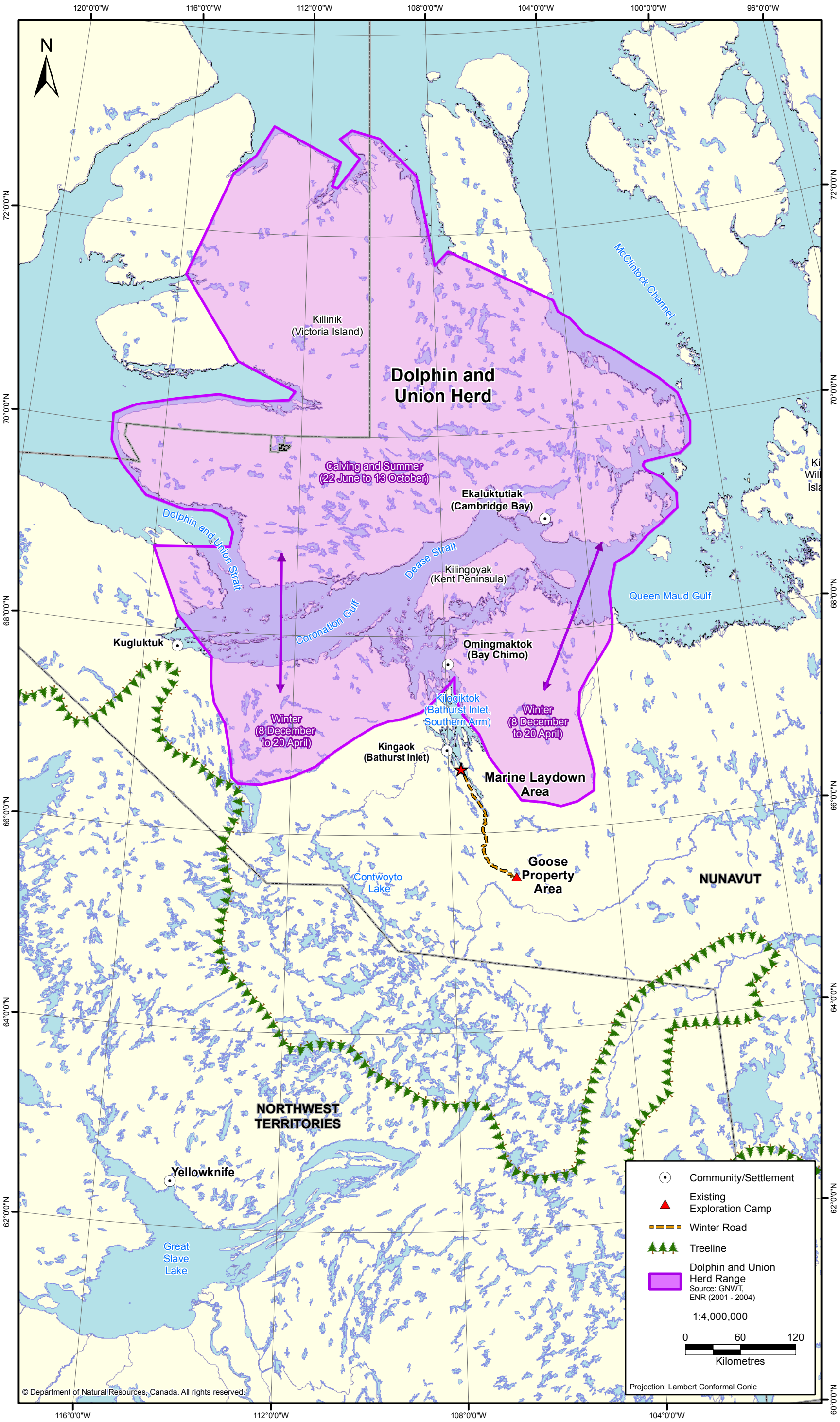
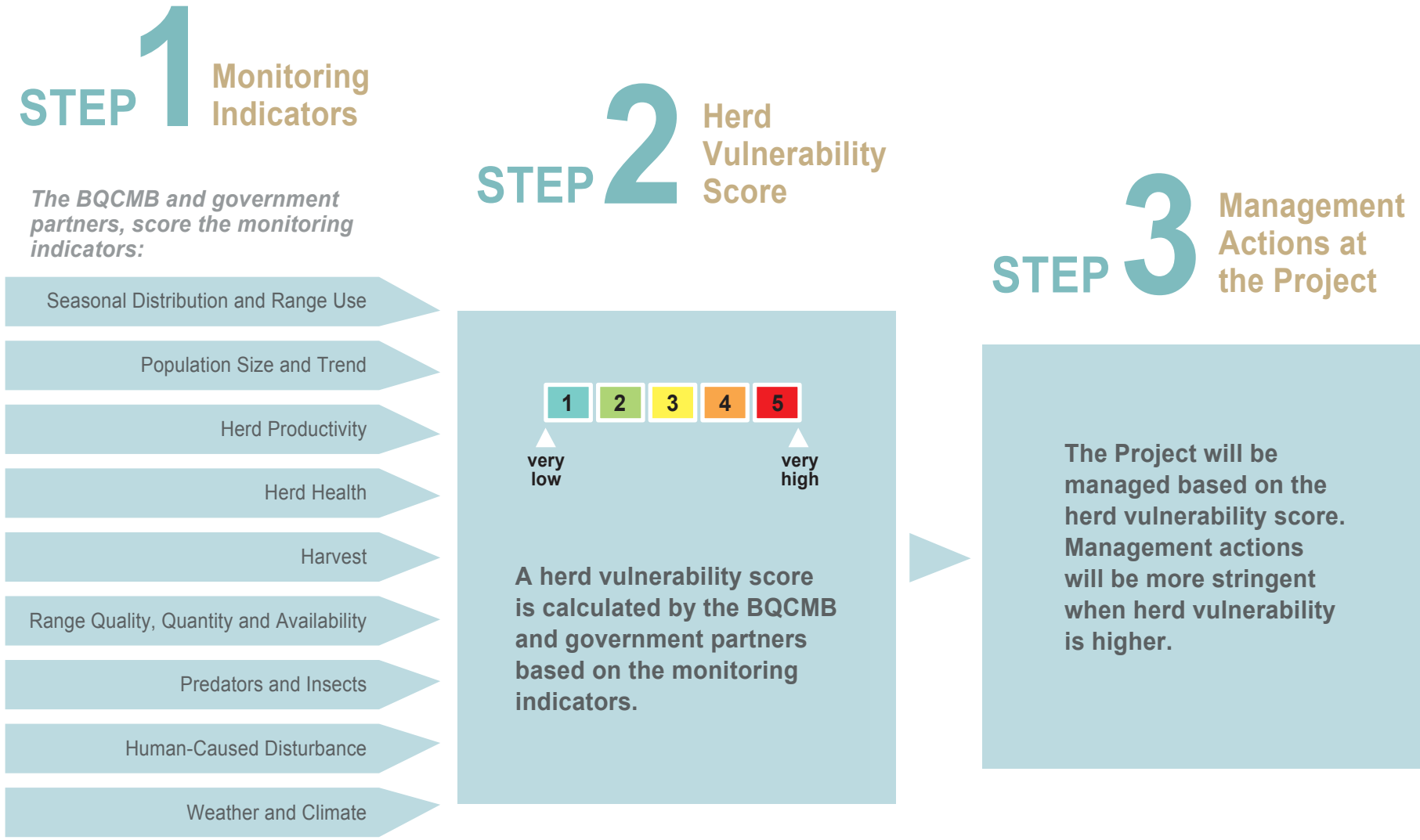


Figure 7.1-4

Caribou Herd Vulnerability Assessment and Management Actions



7.1.4 Mitigation and Management for Habitat Loss for Caribou

The following mitigation and management measures will be conducted during the construction, operations, and closure phases of the Project to reduce the potential for habitat loss for caribou:

- Sabina has designed the Project footprint to be as small as possible.
- Sabina has designed the Project footprint to fall outside of important areas for caribou wherever possible. Special locations were identified from TK and baseline studies and include river and lake crossing points, eskers used as movement corridors, hills and ridges used as insect relief, and important traditional Inuit harvesting sites. The nearest of these are the crossing of the Back River at the east end of Beechey Lake (more than 35 km south of the Goose site), a lake crossing on the northern arm of Beechey Lake (more than 30 km south), two large eskers used for movement (more than 35 km west of the RSA), the Western River (more than 30 km east of the Goose site), and the islands east of Kingaun (Bathurst Inlet Lodge) used by caribou to cross Bathurst Inlet (more than 40 km north of the MLA). These special locations are all more than 30 km from Project sites and will not be affected by the Project.
- Dust will be managed on the Project site by setting and enforcing speed limits on all-season on-site roads and applying dust suppressants, as needed. Dust suppressants will be approved and non-toxic for wildlife. Dust deposition rates and potential effects on vegetation will be monitored as described in the Air Quality Monitoring and Management Plan (Volume 10, Chapter 17).
- Areas of the Project will be reclaimed progressively during operations and at closure to minimize the area of disturbance to wildlife as described in the Mine Closure and Reclamation Plan (Volume 10, Chapter 29). Post-closure environmental monitoring will continue until it has been verified that reclamation has successfully met closure and reclamation objectives.

7.1.5 Mitigation and Management for Disturbance of Caribou

7.1.5.1 Management System to Reduce Disturbance to Caribou

Sabina has designed a management system to reduce the potential for disturbance to caribou. This system includes design mitigation and management actions that will be triggered by ongoing monitoring. The types of monitoring and the associated management actions fall into three tiers of responses, described below.

<u>Tier 1: Planning for Caribou</u>

Sabina has used TK, collar data, aerial survey data and remote camera data to determine the times of year when caribou may interact with the Project area. These data indicate that there is no interaction with the Bathurst herd over the past 20 years, although TK does tell us that the Bathurst herd has migrated near the Project area in the past but not for at least 20 years. Beverly caribou interact with the Project area primarily during the summer months, and to a lesser degree during the fall and winter. Over the past five years very few caribou have been observed on site during the spring migration, calving, or post-calving periods and these animals tended to be males, which range more broadly than females.

These data were used to plan mitigation and management activities for caribou, which are described in the following sections, and include:

- triggering a site notification where on-site personnel will be notified that caribou may be present and reminded of their responsibilities to mitigate potential effects on caribou;
- managing the winter ice road during spring migration, when Beverly caribou may cross the road; and

- taking into consideration the higher likelihood of caribou near the Goose site during summer when planning outdoor construction activities (Section 7.1.5.3).

Ongoing monitoring for caribou will include re-analyzing collar data each year to investigate if a shift in seasonal distribution is occurring. These data would be supplemented with data from incidental observations and remote cameras (Sections 7.2.1.4 and 7.2.1.5). If a shift in distribution occurs, then additional management is planned for caribou, including:

- If the calving or post-calving core range overlaps the Project site, then Sabina will plan and conduct a Level 6 (planned Operational shutdown) of the Goose site for that period when caribou are present within a suitable buffer to ensure that caribou are not disturbed (see Section 7.1.5.2).

Ongoing monitoring of caribou distribution will enable updates and revisions to the plan on an annual basis. Monitoring results and adaptive management will be reported in the annual WMMP Report.

Tier 2: Active Monitoring for Caribou

Trained wildlife monitors will conduct active monitoring for caribou on the Project site during all seasons. The purpose of active caribou monitoring is to trigger site alerts and a staged reduction in Project activities, including management of helicopters, blasting and heavy mobile equipment.

Wildlife monitors will be Sabina personnel trained to conduct caribou observations from fixed observation points using the proposed long-range monitoring cameras, or through driving surveys on on-site roads or the winter ice road, or a combination of both. Fixed observations point and long-range cameras will be located in areas to maximize the area where monitors can observe caribou at distances of up to 5 km from the Project site. More information on active monitoring for caribou is described in Section 7.2.1.3.

In addition to active monitoring from the Project site, Sabina has committed to implement, if needed, an “over-the-horizon” monitoring program for caribou at distances greater than can be observed directly from the Project site (i.e., more than 5 km). This program would be triggered if the Zone of Influence (ZOI) Monitoring Program indicates that caribou are avoiding the Project site at distances greater than 5 km. More information on the “over-the-horizon” monitoring program is available in Section 7.2.1.6. Additional information on the Zone of Influence Monitoring Program is available in Section 7.2.2.4.

Active monitoring will be used to trigger a staged reduction in Project activities, including management of helicopters, blasting and heavy mobile equipment. More information on the triggers and actions is available in Sections 7.1.5.6 through Section 7.1.5.9.

Tier 3: Incidental and Near Real-time Collar Observations

The majority of monitoring and management actions will be addressed through monitoring long-term data (Tier 1: Planning for Caribou) and active monitoring at the Project site (Tier 2: Active Monitoring). Incidental observations of caribou and near real-time collar monitoring (Tier 3) will also play a role in monitoring and management.

Incidental observations by all Project personnel will be reported to the Environment Department. This includes helicopter and fixed-wing pilots, drivers, and other Project personnel. If caribou are observed near the Project site, the Environment Department may deploy wildlife monitors to conduct additional scans and may trigger a site notification or site alert. More information on incidental observations is available in Section 7.2.1.4.

Incidental observations by drivers will also be used to trigger management actions by those drivers on on-site roads and the winter ice road. Drivers will report observations and give caribou the right of way at all times and will slow down or stop should caribou be located near the road. More information is available in Section 7.1.5.10 and Section 7.1.7.

Caribou collars transmit their location data on a regular basis. This near real-time location data can supplement the planned management activities (Tier 1) and active monitoring (Tier 2) by providing an early warning in the unlikely event that caribou may be shifting their distribution during the sensitive periods of calving and post-calving. Collectively, these data can be used to trigger a staged reduction in Project activities should it appear that caribou have chosen to use the Project area during calving or post-calving. More information on the triggers and management of these staged reductions in activities is available in Section 7.1.5.2.

7.1.5.2 Levels of Management for Caribou during Normal Operations

The Project site will be managed through four levels of response to caribou presence, including:

- Level 1 – Normal operations;
- Level 2 – Site notification;
- Level 3 – Site alert; and
- Level 4 – Staged reduction in Project activities.

The four levels of response are described in the following sections. Similar management would apply during Construction, Operations, and Closure. Management Levels 5 (Rapid Operational Shutdown) and 6 (Planned Operational Shutdown) are directed toward shifts in calving range of caribou and are discussed in Section 7.1.5.3, Management for Shifts in Calving Range. Should pregnant females or family units (one cow and one newborn calf) be identified in close proximity to the Project during the sensitive periods (June 5 – July 31), Sabina will immediately engage the KIA and the GN to determine if additional mitigation, other than what is below, is warranted.

Level 1 – Normal Operations

Normal operations are conducted year-round. Active caribou monitoring is conducted in all seasons during normal operations. Response levels 2 through 4 can be triggered in any season to replace normal operations.

Level 2 – Site Notification

A site notification will be triggered by the Environmental Manager during sensitive seasons for caribou (calving, post-calving and early summer) from June 5 to July 31.

Site notification includes passing information to all Project personnel to be vigilant for caribou on site and to remind personnel of their responsibilities to protect caribou. Site notification methods may include email or radio notices, postings on bulletin boards and entranceways to buildings, and discussing caribou at morning meetings.

Level 3 – Site Alert

A site alert can be triggered at any time of year if groups of caribou are observed near the Project site. Site alerts for caribou are similar to the safety warnings disseminated if a grizzly bear is observed on-site. Active Project personnel will be alerted by radio that caribou are in the area and reminded of their responsibilities to protect caribou and that staged reductions in Project activities may occur imminently.

Site alert methods may include email or radio notices, postings on bulletin boards and entranceways to buildings, and discussing caribou at morning meetings.

A site alert will also trigger the mine manager to prepare for a possible staged reduction in Project activities (Level 4). This will include:

- notifying the manager for the open pits to inform them that blasting may be halted in the near future;
- notifying the vehicle dispatcher that heavy mobile equipment may be halted in the near future;
- notifying the helicopter staff and pilots, and any aircraft in the air, that caribou are in the area and appropriate setback or elevation buffers must be maintained, and that should groups of caribou occur near the heli-pads that helicopter activity may be suspended; and
- notifying the managers of activities that rely on the above that a suspension of activity may occur and to plan accordingly.

Level 4 – Staged Reduction in Project Activities

The objective of staged reductions in Project activities is to limit the amount of noise and/or visual disturbance that emanates from the Project site. Staged reductions in Project activities are triggered by active caribou monitoring (Section 7.2.1.3) or by incidental observations (Section 7.2.1.4) or ordered by the Sabina Environment Manager. This staged reduction in Project activities affects management of the following:

1. Helicopters (Section 7.1.5.7):

   During calving, post-calving, and early summer (June 5 to July 31), helicopter pilots will avoid groups of 25 or more caribou either 610 m vertically or 2 km horizontally. All seasons, pilots will avoid all caribou by 610 m vertically or 1 km horizontally.

2. Open pit blasting (Section 7.1.5.8):

   During all seasons, groups of 25 caribou or more within 4 km will cause cessation of open pit blasting (5 km during calving; June 5-15).

3. Heavy equipment on Goose site roads (Section 7.1.5.9):

   During calving, post-calving and early summer (June 5 to July 31), groups of 25 caribou or more within 1 km of the Goose site will trigger a cessation of heavy mobile equipment, with a 750 m buffer during summer (Aug 1-Aug 30) and a 500 m buffer the rest of the year.

4. Vehicle traffic on the on-site and winter ice roads (Section 7.1.5.10):

   During all seasons, vehicles will slow for caribou within 500 m of the road, stop for up to 20 minutes when caribou are within 50 m of the road and with the intention to cross the road, and give right of way for caribou on the road. Additional mitigation applies on the winter ice road during spring (see Section 7.1.5.10).

Note: During the calving period, the group size used to trigger the mitigation above will be reduced from 25 animals to 10 breeding females.

Details of the triggers (caribou group size and distance from the site) and management are specific to the activity and discussed in the relevant sections of the WMMP Plan listed above and in Appendix 1, Staged Reduction Flowcharts.

Some staged reductions are triggered by the observation of a single animal. Others are triggered by observation of a group of 25 caribou. A group of caribou is defined as an aggregation of caribou that are sufficiently close together that they can see and react to another animal's behaviour, and have the potential of responding should one animal in the aggregation become startled.

Operationally, this definition can be interpreted as: a "group" of caribou are an aggregation of caribou that are closer to each other than they are to other caribou surrounding them.

During a staged reduction in Project activities, some activities will continue, including:

- Activities required to maintain the Project site so that components aren't damaged and for the safety of staff will continue. This includes operation of generators, heating of buildings, operation of circulation pumps, use of dust suppression, etc.
  - Note that the use of dust suppression is to counter dust produced by heavy equipment. If dust suppression isn't required, then Sabina will also discontinue dust suppression (spreading of water on roads) during a staged shutdown.
- Indoor activities will continue to operate, such as the process plant (the mill) and underground mining, but note that operation of heavy mobile equipment to move ore to the stockpile will have ceased.
- A loader will operate inside the plant site to feed ore from the ore stockpile into the adjacent mill. This loader will be chosen and maintained to limit noise propagation outside of the plant site.
- Smaller equipment will continue to be used as long as they meet the requirements of the various mitigation sections.
- Some vehicle and helicopter use may be required to conduct activities such as legally required water sampling to meet compliance obligations to federal and territorial departments or for the safety of Project personnel.
  - Light ground vehicles will be used preferentially over helicopters for these activities at all times. Note that standard vehicle management will occur. Drivers will slow when caribou are less than 500 m from the road, stop when caribou are less than 50 m from the road to let them cross and will stop indefinitely if caribou are resting on the road.
  - Note that standard helicopter management will still occur, including at the helicopter pads. If necessary to avoid caribou, helicopters will land elsewhere at the Project site, outside of the buffer distances for caribou (see helicopters, Section 7.1.5.7).
- Scheduled fixed-wing flights would be minimized, but continue to operate, although see Section 7.1.3.6 for restrictions on landing and takeoff when caribou are present on or near the runway.
- Any personnel who are on site and would normally be involved in blasting or heavy mobile equipment will be assigned to other tasks, such as maintenance, planning, training and other activities indoors or in the plant site.

Noise was modelled for the processing plant, generators and ventilation equipment at the Goose site to determine if there was any potential to disturb caribou during a staged reduction in Project activities.

- Noise from the operation of the generators and ventilation was modeled to occur at five locations. Noise from each source was modeled as reaching 60 dBA within approximately 250 m of the source (i.e., generally within the footprint).
- The operation of the mill and the single loader within the plant site, at the centre of the Goose site, are projected to produce a similar noise profile from a single point source, with noise reaching 60 DBA within approximately 250 m of the source.
- The combination of the generators, ventilation, the mill, and the single loader within the plant site are together modelled to produce a similar noise profile as the generators and ventilation alone.
- Traffic noise produced by transport trucks (A-train single trailer) was modeled for the Project as part of the FEIS (Volume 4, Chapter 2). The results indicated that traffic noise will dissipate to 45 dBA at less than 50 from the road alignment. Busses used to transport workers within the site are expected to produce comparable, or lower noise levels as transport trucks. Light duty pickup trucks are expected to produce significantly less noise than transport trucks.

Other sources of noise at the Goose site, will include helicopters, which will avoid groups of caribou by 2 km horizontally or 610 m vertically during calving, post-calving and early summer (June 5 to July 31), and 1 km horizontally or 300 m vertically the rest of the year, including at the helicopter pads. These distances are the recommended setback distances by multiple management agencies. This management will effectively manage any potential disturbance on caribou near the Goose site.

Baseline noise data gathered at site indicated that continuous noise levels ranged from approximately 20 to over 60 dBA away from the Goose and George camps. Twenty dBA was recorded during periods of no or low wind, while 60 dBA or above was recorded on windy days. Hence, noise during a stage reduction will fall within the natural variability of baseline noise generally within the Project footprint or the tundra immediately adjacent to the Goose site.

7.1.5.3 Management for Shifts in Calving Ranges

This section addresses any potential shifts where the calving range of a herd moves to overlap the Project site; including immediate management when a shift in calving range is observed (Level 5 – Rapid Operational Shutdown) and long-term responses to shifts in calving range in following years (Level 6 – Planned Operational Shutdown).

Level 5 - Rapid Operational Shutdown

This section describes Level 5 management response for caribou; a ‘rapid operational shutdown’ of the Project in response to caribou moving their calving or post-calving range to overlap the Project site. Rapid operational shutdown is intended to occur during the same year that a shift in calving or post-calving range is observed. Long-term response to a shift in calving range is addressed by Level 6 management – Planned Operational Shutdown.

Overall, the chance of a rapid shift in calving range is considered unlikely. The shifts in the calving range of the Bathurst caribou herd from east to west of Bathurst Inlet and of the Beverly from Beverly Lake to the Queen Maud Gulf Migratory Bird Sanctuary both took 10 or more years to occur. The shift in the Bathurst herd calving range began as early as 1981, moving from the western portion of the Queen Maud Gulf to the east side of Bathurst Inlet by the late 1980s, and to the west side of Bathurst Inlet during the 1990s over approximately 15 years (Gunn, Poole, and Wierzchowski 2008).

The Beverly caribou herd shifted its calving range on a similar time scale. Prior to 2000, the Beverly caribou herd historically calved between Garry and Beverly lakes. Aerial surveys conducted on this calving ground between 1967 and 1994 reported that the Beverly herd was consistently using this location (Campbell et al. 2012). An analysis of collaring data indicated that the Beverly had moved their calving area starting sometime in the mid-1990s and continuing through the 2000s, to be largely complete by 2011 in the Queen Maud Gulf area (Nagy et al. 2011).

These slow changes in the Bathurst and Beverly calving range were detected using aerial surveys and satellite collars, respectively, over a period of a decade. Any future changes in the calving ranges of these herds will likely follow a similar timescale and will be detected by monitoring for long-term shifts in calving and post-calving ranges (Section 7.2.1.1). The Bathurst herd moved their calving range approximately 250 km in approximately 15 years, for an average movement rate of 17 km per year. If the Bathurst herd were to move its calving range towards the Project at this same rate, it would take approximately 10 years to reach the Project site.

However, some caribou herds may have exhibited more rapid shifts in calving range and management actions to limit disturbance to Bathurst or Beverly caribou will be undertaken in the unlikely event that either herd has a rapid range shift or shifts its core calving distribution to overlap the Project site. The following management actions will be conducted during construction and operations of the Project:

- Sabina will monitor annually for rapid changes in the Bathurst and Beverly/Ahiak caribou calving and post-calving distribution using a combination of satellite collar data, on-site cameras, and on-site wildlife monitors.
- Should collar data inform, wildlife monitors or cameras observe, a density of greater than 2.0 breeding female caribou/km^2 within 4 km of the Project during calving and post-calving, then Sabina will implement a further reduction of Project activities beyond those planned as part of a staged reduction. These further reductions of Project activities are termed rapid operational shutdown. The density of 2.0 caribou/km^2 was determined through discussion between biologists from the GN and Sabina to represent a density consistent with the low density strata measured during calving ground surveys on the Bathurst and Beverly/Ahiak herds. The vast majority of caribou on the calving ground occur at a density higher than 2.0/km^2, making this value protective of caribou.
- This rapid operational shutdown will affect blasting, open pit and underground operations, heavy equipment use, helicopter and fixed wing use.
- Should rapid operational shutdown be triggered, Sabina will communicate with all appropriate regulators on a regular (daily) basis.

The rapid operational shutdown will include:

- cessation of open pit and other surface blasting;
- cessation of open pit activities;
- cessation of heavy equipment on surface;
- cessation of helicopter usage including landings and take-offs;
- reduction of fixed wing aircraft use. Non-essential cargo flights will be suspended. Personnel flights and essential cargo will be paused for up to 2 days. If flights remain necessary, aircraft with a smaller noise profile or aircraft with greater capacity may be used;
- reduction in the number of light vehicles on surface;

- underground activities that do not require heavy mobile equipment use on surface may continue;
- a single loader may continue to operate inside the plant site to feed ore from the ore stockpile into the adjacent mill;
- on-site activities required to maintain the site, personnel safety and environmental compliance will continue; and
- all on-site activities conducted during a rapid operational shutdown will require written authorization from the General Manager, Environmental Manager or the Safety Manager.

Level 6 - Planned Operational Shutdown

This section describes Level 6 management response for caribou; a 'planned operational shutdown' of the Project during the years after collar data indicates that the Bathurst or Beverly/Ahiak caribou have moved their calving or post-calving range over the Project site.

Long-term monitoring for caribou will be conducted to determine if the seasonal ranges of Bathurst and Beverly/Ahiak caribou are remaining constant or changing through time. This monitoring is described as Tier 1 monitoring in Section 7.1.5.1, with details of satellite collar monitoring described in Section 7.2.1.1. The planned operational shutdown includes the following measures:

- Sabina will monitor for changes in Bathurst and Beverly/Ahiak caribou calving and post-calving distribution using a combination of satellite collar data, on-site cameras, and on-site wildlife monitors.
- Should this analysis indicate that core calving or core post-calving ranges have shifted to overlap the Project site then Sabina will conduct a planned operational shutdown the following year. The analysis will consider both the 50% and 80% core calving and core post-calving ranges.
- The detailed methods for kernel density analysis to determine the core calving and post-calving ranges will be determined in collaboration with the Caribou Technical Working Group.
- The planned operational shutdown will occur when caribou is anticipated on site and will be of sufficient duration to take into account annual variation in the timing and distribution of calving and post-calving caribou interactions with the Project.
- Once a range shift is identified Sabina will engage all relevant parties, including the KIA, GN, and GNWT, to discuss details of the planned operational shutdown. This discussion will occur at least 6 months prior to any potential operational shutdown. The final details will consider herd final engineering design, operational plans, noise monitoring results, additional TK information, and new scientific evidence and best management practices.
- The Planned Operational Shutdown will include all of those items listed in Section 7.1.5.3 – blasting, helicopters, outdoor vehicles, etc. (the Planned Shutdown).
- This planned operational shutdown will affect blasting, open pit and underground operations, heavy equipment use, helicopter and fixed wing use, and mill operations. This planned shutdown represents a further decrease in activities as compared to the staged reduction and rapid operational shutdown.

The planned operational shutdown will further reduce potential Project interactions with caribou including:

- reduction of on-site workforce;
- cessation of open pit and other surface blasting;
- cessation of open pit activities;
- cessation of underground activities;
- cessation of heavy equipment on surface;
- cessation of helicopter usage including landings and take-offs;
- cessation of fixed wing aircraft use. Cargo flights will be suspended. Personnel flights will be suspended. Should a flight be required due to emergency of unforeseen conditions, aircraft with a smaller noise profile will be used;
- restriction to essential light vehicles only;
- reduction in mill operations. A single loader may continue to operate inside the plant site to feed ore from the ore stockpile into the adjacent mill;
- on-site activities required to maintain the site, personnel safety and environmental compliance will continue; and
- all on-site activities conducted during a planned operational shutdown will require written authorization from the General Manager, Environmental Manager or the Safety Manager.

7.1.5.4 Design Mitigation

The following mitigation measures will be designed into the Project to limit disturbance to caribou:

- Project equipment will be chosen to limit the continuous noise produced by equipment such as generators, heavy equipment, and other mobile equipment. All Project equipment will be fitted with appropriate mufflers and silencers and will be well maintained.
- Project facilities will be designed to limit the amount of noise that emanates from the Project, such as housing static noise sources (e.g., the crushers, mill, and generators) in buildings and using acoustic screening such as walls or berms to muffle noise.

7.1.5.5 Construction Management

The following management actions will be applied during the construction phase of the Project to limit disturbance to caribou:

- To the extent possible, and with appropriate mitigation and monitoring in place, Sabina will take into consideration the greater potential of caribou presence in the area when planning outdoor construction activities (including site clearing, blasting, and operation of heavy equipment) during the period of July 26 to August 31.
- To limit loss of esker habitat for caribou, Sabina will choose an esker source that does not show, or shows fewer signs of caribou use.

7.1.5.6 Fixed Wing Aircraft Management

The following management actions will be applied to fixed-wing aircraft during all Project phases to limit disturbance to caribou:

- Fixed-wing aircraft will remain above 610 m local ground level at all times, except when landing or taking off from the Marine Laydown Area (MLA) or the Goose Airstrip.
- Note that fixed-wing aircraft flights may be suspended or delayed if large groups of caribou are near the airstrip during calving or post calving. See Section 7.1.5.3 for more information.
- Prior to aircraft landing on the airstrip, a visual inspection will be conducted to identify the presence of any wildlife on the airstrip. Small groups of wildlife will be escorted off the airstrip; the flight crew will be notified by radio that such action is taking place and aircraft will not be approved to land until the airstrip is clear. If groups of greater than 25 caribou are observed on the airstrip then no action will be taken. If the wildlife cannot be escorted from the airstrip within a reasonable length of time, the flight crew will be instructed to divert to another location.

7.1.5.7 Helicopter Management

The following management actions will be applied to helicopters during all Project phases:

- As part of pilot induction, pilots will be informed of the seasons when caribou are more sensitive to disturbance (e.g., calving and post-calving) and their responsibilities to monitor, report, and avoid caribou. Maps will be provided to pilots that identify important habitat areas for wildlife to be avoided, such as caribou water crossings.
- Pilots will report all incidental sightings of caribou to other pilots and the Environment Department.
- During calving, post-calving, and early summer (June 5 – July 31), large groups of caribou (more than 250) will be avoided by 610 m vertically or 4 km horizontally. The elevation of 610 m is taken from the draft Nunavut Land Use Plan (2014) for the operation of aircraft in calving and post-calving seasons/areas.
  - Note that standard helicopter management will still occur, including at the helicopter pads. If necessary to avoid caribou, helicopters will land elsewhere at the Project site, outside of the buffer distances for caribou.
- During calving, post-calving, and early summer (June 5 to July 31), helicopter pilots will avoid groups of 25 or more caribou either vertically (610 m) or horizontally (2 km).
- During all seasons, pilots will avoid groups of less than 25 caribou vertically (610 m) or horizontally (1 km)
- These buffers apply to engine start-up, take-off, landing, and in-flight.

7.1.5.8 Blasting Management

Above-ground blasting will occur in the open pits during the construction and operations phases of the Project. Blasting is typically conducted once per day in each pit and is proceeded by surveys for caribou

presence as part of active monitoring for caribou. The following management actions will be applied during the construction and operations phases to limit any disturbance from open-pit blasting on caribou.

- Primarily the active caribou monitoring by wildlife monitors will determine the presence of caribou near the Project site. Incidental observations of caribou by pilots, drivers, and on-site personnel can also trigger management actions.
- At all times of year, if groups of caribou (25 or more) are observed within 4 km of the Project pits, then blasting in those pits will be delayed until caribou have moved beyond the trigger distance. During calving period (June 5-15) blasting will be stopped for a group of 10 breeding females within 5 km.

  Modelling of typical open pit blast noise was updated at the request of the KIA to determine at what distance noise levels reached 96 dB L_{peak}. This modelling reported that the typical noise from a blast in the Goose Main pit (the largest pit) would reach 96 dB L_{peak} at 3.7 km from the blast location in the pit.

  The noise threshold of 96 dB was chosen after discussion with the KIA and using reviews of the scientific literature. Reimers and Colman (2006) reviewed the effects of noise, vehicles and aircraft on caribou and reindeer and found that caribou will respond to anthropogenic noises, but are typically more sensitive to visual stimuli. Loud noises without accompanying visual stimuli did not provoke strong responses until the noises were very loud. Maier et al. (1998) reported that low-level overflights by jet fighters (a very loud noise, with a brief visual stimuli) averaging 1-1.5 times per day in Alaska caused caribou to increase the amount of time spent being active, and move greater distances during the post-calving period. A noise level of 96 to 106 dBA Sound Exposure Level (SEL) caused these reactions. Other studies of overflights on caribou reported only short-term startle responses to overflights and no effects on movement rates despite overflights that were lower in elevation and louder (115 to 127 dB) than Maier et al. (1998) (Harrington and Veitch 1991; Lawler et al. 2005). Manci et al. (1988) reported that the majority of ungulates have short term responses to noise.
- The distance at which caribou will trigger the cessation of blasting will be updated during the life of the Project based on the results from noise monitoring, behaviour monitoring, and zone of influence monitoring.
- Behaviour monitoring will be conducted periodically on caribou observed near the Project site to evaluate the response of caribou to blasting and whether caribou are more alert near the Project site.
- During all seasons, if any caribou are within the blast safety areas (i.e., the area potentially affected by fly rock or debris), then the blast will be delayed until caribou move out of the area. The blast safety area is part of the personnel safety requirements and is determined prior to each blast. The Explosives Safety and Security Branch (ESSB) of Natural Resources Canada (NRCan) is responsible for administering the *Explosives Act (1985)* and regulations. The *Explosives Act* requires anyone working with explosives to have a licence, certificate or permit issued by the Minister of Natural Resources. The *Explosives Use Act (1988)* states:

  > *Before detonating an explosive, a permit holder shall (a) sound an audible warning at a reasonable time before the detonation; (b) ensure that all avenues of approach to the site are guarded; (c) ensure that all workers and other persons near the site of the explosion have reached a place of safety; and (d) shout "fire" immediately before detonating the explosive.*

  The permit holder is therefore responsible for determining the area of safety prior to initiating a blast. A blast area can be defined as the area in which concussion (shock wave), flying material,

or gases from an explosion may cause injury to persons. Current blasting protocols found in the Explosives Management Plan of De Beers Canada Inc. Gahcho Kue Mine, AREVA Resources Canada Inc. Kiggavik Project, and Victoria Gold Corp. Eagle Gold Project implement a blasting setback radius of 500 m prior to any blasting. The area of safety for the Project will be determined on a case by case basis considering factors such as, but not limited to: material to be blasted; type and amount of explosive material; blast pattern; and delay systems.

- Resumption of activities is discussed in Section 7.1.5.11.

Should less than 25 caribou be observed during calving, post-calving and early summer (June 5 – July 31), the following management will occur:

- Alert the environment department;
- Wildlife monitors will conduct behaviour monitoring of selected groups of caribou; as part of the Behaviour Monitoring Program (Section 7.2.2.2);
- Should animals respond significantly to blasting, consideration will be made for adaptive management, including cessation of blasting;
- Note that standard management for caribou still applies:
  - Standard road management will occur – all caribou will be given the right of way;
  - Standard helicopter management will occur.

In addition to blasts conducted in open pits as part of mining operations, the Project will also be conducting smaller blasting activities as part of construction, quarrying, and underground mining. The following measures apply to these smaller blasts:

- Generally, construction and quarry blasts are much smaller than those in the open pits during operations and therefore may require a smaller setback distance. These distances will be determined based on the size of the planned blasts using the same 96 dB buffer as the main pit blasts.
- Underground mining will also be conducted during certain periods of the Project lifecycle. Blasting is also conducted underground, but is of a lesser magnitude compared to above-ground blasting in the open pits. As a consequence, below-ground blasting may proceed at any time of the year.
- Behaviour monitoring will be conducted periodically on caribou observed near the Project site to evaluate the response of caribou to construction and quarry blasting.
- Resumption of activities is discussed in Section 7.1.5.11.

7.1.5.9 Heavy Equipment Management

Heavy mobile equipment is used to load and move waste rock from the open pits to the waste rock dumps and ore from the pits to the plant site. Heavy mobile equipment is also used in the maintenance of roads. Heavy mobile equipment operation occurs along gravel-surfaced all-season roads within the Goose project area. The following management actions will be applied during the construction and operations phases to limit any disturbance due to heavy mobile equipment operation on caribou:

- Primarily the wildlife monitors will determine the presence of caribou near the Project site. Incidental observations of caribou by pilots, drivers and on-site personnel can also trigger management actions.

- During the calving, post-calving and early summer seasons (June 5 to July 31), if large groups of caribou (more than 250) are observed by wildlife monitors within 4 km of the activity, then the use of heavy mobile equipment in the area will be stopped until caribou move through the area.
- During the calving, post-calving and early summer seasons (June 5 to July 31), if groups of caribou (25 or more) are observed within 1 km of the activity, then the use of heavy mobile equipment in the area will be stopped for one day. The distance of 1 km was chosen because it is larger than distances at which a review of caribou responses to vehicles (Reimers and Colman 2006) and skiers and persons on foot (Reimers et al. 2006).
- During summer (August 1-30) if groups of caribou (25 or more) are observed within 750 m, and during all other seasons (September 1 to June 4), if groups of caribou (25 or more) are observed within 500 m of the activity, then the use of heavy mobile equipment in the area will be stopped until caribou move through the area.
- Sabina will not operate heavy mobile equipment (loaders, haul trucks, tracked drills, etc.) off or away from the on-site roads.
- Resumption of activities is discussed in Section 7.1.3.11.

7.1.5.10 Winter Ice Road Management

Management actions to limit disturbance from the winter ice road are described in Section 7.1.6, management for disruption of movement.

7.1.5.11 Resumption of Activities

In some cases, individuals or groups of caribou may become habituated to the site. Caribou may see the mine site as a refuge from predators such as wolves, which may be less likely to approach areas of human occupation. Structures such as the airstrip may provide relief from insects. On first observation of groups of caribou, mitigation will be carried out as indicated above. Should the wildlife monitors identify an animal or group of animals that are observed on site for more than one day then mitigation actions will be relaxed for these animals. Note that in a circumstance where 250 or more caribou are observed within 4 km of site during calving and post-calving, that activities would not be resumed until after one day. Also note that in circumstances where 25 caribou are observed within 4 km of site during the rest of the year, that blasting will not be resumed until the caribou move beyond the trigger distance. The resumption of activities is approved by the Environmental Manager or designate.

During the seasons when caribou have most frequently been observed on site, collar information indicates that they are moving multiple kilometres per day in summer (10 to 20 km/day) and fall (5 to 10 km/day) (Gunn, Dragon, and Boulanger 2002). Hence, caribou will be moving on a daily basis and are unlikely to be observed on-site over multiple days.

7.1.6 Mitigation and Management for Disruption of Movement of Caribou

The Project will have on-site all season roads that connect the pits, waste rock dump, plant site, camp and airstrip. A winter ice road will also be used to connect the Goose site to the Marine Laydown Area. Mitigation and management for disruption of movement of caribou focuses on management of the winter ice road and on-site Project roads.

The following mitigation will be designed into the Project roads:

- Road-crossing structures will be built on permanent on-site roads at crossing locations identified by land users. Road-crossing structures may include ramps, stretches of the road shoulder made

of smaller rocks, or other methods identified through TK, land user information, scientific literature, or based on best practice.

- The winter ice road will be constructed each winter such that it is not a barrier to movement for caribou; the height of snowbanks will be limited to approximately 1 m and snow plowing will be conducted in such a way as to limit the angle and vertical height of the snowbank edge.
- In each year of winter road operation, Sabina will produce a Winter Road Schedule, which will describe the opening, closing and operational plan for the winter road. This document will be provided and discussed with the Caribou Technical Advisory Group prior to the commencement of construction.

The following management actions will be conducted whenever the winter ice road is in use:

- Traffic on all roads will be managed and monitored through a central dispatch.
- To reduce the frequency of traffic on the winter ice road that may deter caribou from crossing, trucks may be grouped into convoys during the spring migration.
- If a driver observes a caribou (or other large mammal) within 500 m of any road, the driver will slow to 40 km/hr, alert other drivers and proceed with caution.
- If a driver observes that caribou are within 50 m of the road and moving towards the road with the intention to cross it, then the vehicle will stop, the driver will alert the Environment Department, and will proceed when the animals have crossed the road and moved off; alternatively, after 20 minutes the driver may proceed slowly if animals have not made their road crossing.
- If caribou are resting on the road, then the driver will wait until the animals have moved off on their own.

During the spring, after April 15, when Beverly/Ahiak caribou may cross the winter ice road on their migration to the calving grounds, the following management will take place:

- The winter ice road season will be planned such that trucking on the winter ice road is completed by April 15.
- There is a small chance that due to unforeseen logistical reasons that not all trucking can be completed by April 15th. Examples of unforeseen logistical reasons include poor weather, late winter freeze or thaw, mechanical failures, accidents, or other unforeseen events.
- If Sabina wishes to continue trucking on the road after April 15th, then Sabina will contact the KIA and the GN and explain the reasons why trucking should be allowed to continue.
- The movement of Beverly/Ahiak caribou will be monitored using collars and regular ground-based surveys of the winter ice road to determine if caribou are crossing the road. Ground-based surveys will also be triggered by the proximity of a collared caribou to the ice road.
- The road will be temporarily closed (i.e., no new trucks dispatched) by the Environment Manager during this period if collar data or ground-based survey results indicate that Beverly/Ahiak caribou are attempting to, or crossing the road. Examples of observations that may indicate that caribou are attempting to, or crossing the road include:
  - an incidental report of a group of caribou lingering near the road, or walking toward the road;
  - an incidental report of caribou tracks crossing the road;
  - a report from collar data that a group of caribou are moving towards the road, an observation backed up with reports from wildlife monitors.

These observations would trigger the environmental monitor to survey the road, if they are not doing so already.

- Should the wildlife monitor record a group of caribou attempting the cross the road or lingering on or adjacent to the road, the Environment Manager will instruct the wildlife monitor to stay and observe the caribou and will close the road to new traffic.
- Should a driver on the road observe a large group of caribou attempting to cross the road, the driver will stop and report the observation to the Environmental Manager. The Environment Manager may then close the road before sending out the environmental monitor should the group of caribou be imminently crossing the road.
- If a driver observes that caribou are within 500 m of the road and moving towards the road with the intention to cross it, then the vehicle will stop, the driver will alert the Environment Department, and will proceed either when the animals have crossed the road and moved off or proceed at slow speed after a wait of 20 minutes.
- If a driver observes caribou at a distance greater than 500 m of the winter ice road and moving towards the road then they will alert the Environment Department, slow to 40 km/hr and proceed with caution.

The following management actions will be conducted whenever the all-season roads are in use:

- If a driver observes caribou from the all season road, they will alert the environment department.
- If a driver observes a caribou (or other large mammal) within 500 m of any road, the driver will slow to 40 km/hr, alert other drivers and proceed with caution.
- If a driver on an all-season road observes that caribou are on the road or within 50 m of the road and moving towards the road with the intention to cross the road, then the vehicle will stop, the driver will alert the Environment Department, and will proceed when the animals have crossed the road and moved off or may then proceed slowly after a wait of 20 minutes.
- If a driver on the all-season road observed caribou on the road, they will stop the vehicle until the caribou move off.

7.1.7 Mitigation and Management for Direct Mortality and Injury of Caribou

Mitigation and management to prevent direct mortality and injury of caribou focuses on management of roads and aircraft at the landing strip to prevent any vehicle-caribou collisions. These actions will be conducted during all Project phases:

- Speed limits will be monitored and enforced, and set at 60 km/h on the winter ice road and 60 km/h on all season on-site roads.
- Wildlife will have the right-of-way on all Project roads. See Section 7.1.6 on mitigation and management for disruption of movement of caribou.
- Any wildlife mortalities on Project roads will be recorded through a reporting system and this information will be distributed to drivers. If a location is found where more than one wildlife mortality has occurred, then this location will be relayed to drivers and site-specific mitigation may be conducted, such as additional signage to alert drivers of speed limits, identified wildlife movement corridors, and wildlife sensitive areas (e.g., nearby active carnivore den).
- Any road-kill on Project roads will be removed and disposed of using approved methods (i.e., incineration or transport away from the Project site) as quickly as possible to avoid

attracting other animals to the road side. The KIA, GN and relevant HTOs will be contacted to report and discuss what to do with the carcasses following any wildlife mortalities.

- The Project will conduct regular road and camp cleanups to ensure that no hazardous substances, wires, or loose materials are present to endanger wildlife, and ensure proper storage and disposal of wastes and hazardous wastes as per the Waste Management Plan (Volume 10, Chapter 10).
- Caribou may be deterred from the Project site should their immediate safety be in jeopardy. Examples of situations when deterrence would be acceptable include:
  - caribou have become acclimated to the camp and are posing a safety risk to Project personnel;
  - caribou are attracted to the TSF or other features as a salt source, but TSF water quality does not meet wildlife guidelines;
  - an individual or small group of caribou are occupying the airstrip and have the potential to be alarmed and run into the airstrip during landing or takeoff (but see Section 7.1.5.6 for a description of when this is allowed); and
  - a caribou has entered the open pit or other facility and has become disoriented.
- Prior to aircraft landing on the airstrip, a visual inspection will be conducted to identify the presence of any wildlife on the airstrip. If possible, the wildlife will be escorted off the airstrip; the flight crew will be notified by radio that such action is taking place and aircraft will not be approved to land until the airstrip is clear. If the wildlife cannot be escorted from the airstrip within a reasonable length of time, the flight crew will be instructed to divert to another location.

7.1.8 Mitigation and Management for Indirect Mortality of Caribou

The following mitigation and management actions will be conducted during all Project phases:

- All Project and contractor employees will be prohibited from carrying personal firearms and hunting on the Project site, except in the case of a certified wildlife monitor who is carrying a firearm for the safety of workers in the field when a problem bear, wolf, or wolverine has been identified.
- The winter ice road will be closed to the public.
- The winter ice road will be monitored and should people be observed hunting or using the winter ice road this information will be recorded.
- Should more than five groups of hunters be observed using the winter ice road, then enhanced management will be conducted to limit use of the winter ice road. Observations of persons using the winter ice road will be reported in the annual WEMP Report. If triggered, Sabina will liaise with the relevant HTOs to discuss possible options for enhanced management to limit hunter use of the winter ice road.
- Note that Section 89(1) of the Nunavut *Wildlife Act* (2003) prohibits a person from discharging a firearm along or across a trail, road or highway or within 1 km of a dwelling or building.

7.1.9 Mitigation and Management for Attraction of Caribou

Caribou are not expected to be attracted to the Project site; however, see Section 7.1.10 on mitigation and management for exposure to contaminants by caribou should caribou use Project ponds as a source of salt or water.

7.1.10 Mitigation and Management for Exposure to Contaminants by Caribou

The following mitigation and management actions will be conducted during all Project phases:

- Fuel will be managed safely to ensure fuels do not enter the environment and that wildlife, including caribou, are not exposed to fuels, as per the Fuel Management Plan (Volume 10, Chapter 4).
- Should a fuel spill occur, the fuel will be contained and cleaned up such that wildlife, including caribou, are not exposed to the fuel, on land as per the Spill Contingency Plan (Volume 10, Chapter 5) and in the marine environment as per the Oil Pollution Emergency Plan (Volume 10, Chapter 6) and the Shipboard Oil Pollution Emergency Plan (SOPEP). Sabina's fuel management plan and spill response plans are further discussed in Section 6.1.3.
- Hazardous materials will be stored and handled safely so that wildlife, including caribou, are not exposed to hazardous materials as per the Hazardous Materials Management Plan (Volume 10, Chapter 12).
- The Project will conduct regular road and camp cleanups to ensure that no hazardous substances, wires, or loose materials are present to endanger wildlife and to ensure proper storage and disposal of wastes and hazardous wastes as per the Waste Management Plan (Volume 10, Chapter 10).
- The Project will monitor the quality of water in the TSF as outlined in the Site Water Monitoring and Management Plan (Chapter 7 of Volume 10 of the FEIS). If the water quality in the TSF does not meet wildlife guidelines, then the TSF will be monitored to determine if caribou are drinking from the TSF. If caribou are using the TSF ponds and the water quality does not meet wildlife guidelines, then Sabina will develop an adaptive management plan, in conjunction with the KIA, to manage caribou access to the TSF.

7.2 MONITORING FOR CARIBOU

This section describes monitoring activities to minimize potential effects of the Project on caribou that will be included in the WEMP, primarily the disturbance of female and calf caribou during the important calving, post-calving and early summer periods, but also applies during other seasons. Monitoring and mitigation applies to both the Bathurst and the Beverly/Ahiak caribou herds.

The Project will undertake both long-term monitoring of the location of the calving and post-calving grounds, and site-specific monitoring to trigger mitigation. In addition, the Project will undertake monitoring to evaluate effects of the Project on caribou, as predicted in the FEIS.

This section is divided into two subsections, the first describing the monitoring that will be conducted to trigger mitigation activities designed to minimize impacts to caribou, and the second describing monitoring to evaluate the predicted effects of the Project on caribou in the FEIS.

7.2.1 Caribou Monitoring to Trigger Mitigation

Seven types of monitoring will be conducted specifically to trigger management activities designed to minimize effects on caribou. These monitoring programs are:

1. monitoring of seasonal ranges of caribou;
2. near real-time monitoring of collars;
3. active monitoring by on-site wildlife monitors;
4. incidental observations;
5. on-site cameras;
6. over the horizon monitoring; and
7. human activity monitoring.

Monitoring will also be conducted to test predicted effects on caribou, and may also trigger management of the Project site, as discussed in Section 7.2.2, including:

1. behaviour monitoring;
2. stress hormone study; and
3. regional collar monitoring for zone of influence.

The first step in monitoring and mitigation for caribou is to determine, using long-term collar data, when caribou may interact with the Project. These seasons are known, but will be monitored yearly for any change in distribution of caribou. Site alerts and active monitoring for caribou is based on this information.

Near real-time collar data will be used to evaluate if caribou are moving into new areas within a single year. These data will be used to trigger active monitoring and site alerts if they are not already triggered.

Active monitoring by on-site wildlife monitors will be conducted from spotting positions or using long-range cameras on towers to trigger staged reduction of Project activities. Incidental observations by pilots and drivers will trigger immediate mitigation, such as avoiding caribou or giving them the right of way on the road. Incidental observations will also trigger site alerts and active monitoring. On-site cameras will be used to evaluate caribou (and other wildlife) use of Project facilities, such as waste facilities, the TSF, road crossing ramps, etc. Over-the-horizon monitoring will be conducted if it appears that caribou must be monitored at distances greater than observable from high points of land in the Project site.

Finally, human activity monitoring will also be used to evaluate whether measures to prevent people from using the winter ice road have been successful (Section 7.2.1.7). The FEIS predicted that the winter ice road will not increase access to the Project area and that indirect effects to wildlife from the winter ice road, e.g., hunting pressure, will not occur. For these reasons, activity along the winter ice road will be monitored to verify the accuracy of the FEIS conclusions.

7.2.1.1 Monitoring Seasonal Ranges of Caribou

The seasonal movements of both the Bathurst and Beverly/Ahiak caribou herds are generally well known from TK and collaring studies that have been ongoing since 1996. During winter, the Bathurst caribou are largely below the treeline and more than 300 km to the south of the Goose site. During spring migration, they travel north, largely via Contwoyto Lake, over 150 km west of the Goose site. The calving grounds are centred 210 km to the northwest of the Goose site and their nearest edge is 160 km from the Goose site (Figure 7.2-1). The post-calving range of the Bathurst herd is an average of 92 km from the Goose site, with the nearest approach at 32 km (Figure 7.2-1). The summer range is to the southwest of the Project, centred on Contwoyto Lake.

During winter, Beverly/Ahiak caribou range over the area between Bathurst Inlet and the Saskatchewan border. During spring, the Beverly/Ahiak herd travels northeast to the calving and post-calving grounds in the Queen Maud Gulf Migratory Bird Sanctuary. The summer range of the Beverly herd extends south from Bathurst Inlet to the treeline, overlapping the Project site.

Objective

This program has two objectives:

1. Identify if and when caribou may interact with the Project site so that monitoring and mitigation activities can be planned for caribou, e.g., wildlife monitors can be on-site to conduct active caribou monitoring and mitigation.
2. Identify if the calving ground of the Bathurst or Beverly/Ahiak caribou herd has moved to overlap the Project site.

Triggers for Monitoring

This monitoring program will occur during each year of construction, operations, temporary closure, care and maintenance, and reclamation and closure of the Project.

Methods

To evaluate when caribou are likely to interact with the Project, collar data for the Bathurst and Beverly/Ahiak caribou herds (1996 to present) will be used to calculate kernel utilization distributions (UD) for each season to monitor their degree of overlap with the Project. These distribution data will be used to evaluate what times of year these two herds are likely to interact with the Project. Currently, most interactions occur with the Beverly/Ahiak herd during the summer.

To evaluate if the calving and post-calving seasons of the Bathurst caribou herd are shifting and could overlap the Project site in the future, trends in the overlap of the 50% and 80% kernel density calving and post-calving ranges will be examined each year. The overlap of each seasonal range will be evaluated, as well as the degree of overlap with the Project to determine if the seasonal ranges are moving.

Triggers for Adaptive Management

Should the 50% or 80% core calving or post-calving ranges of the Bathurst herd shift through time to overlap the Project site, Sabina will liaise with the KIA, GN and GNWT to discuss the degree of overlap with the Project, the timing of overlap (is it for a day or several weeks), the details of the proposed planned operational shutdown actions, and the timing of this planned operational shutdown for the following year. Following these discussions, Sabina will conduct planned shutdowns in activities for these seasons as described in Section 7.1.5.2.

Reporting

Results of the calving ground collar monitoring program will be reported annually in the WEMP Report.

7.2.1.2 Near Real-time Collar Monitoring

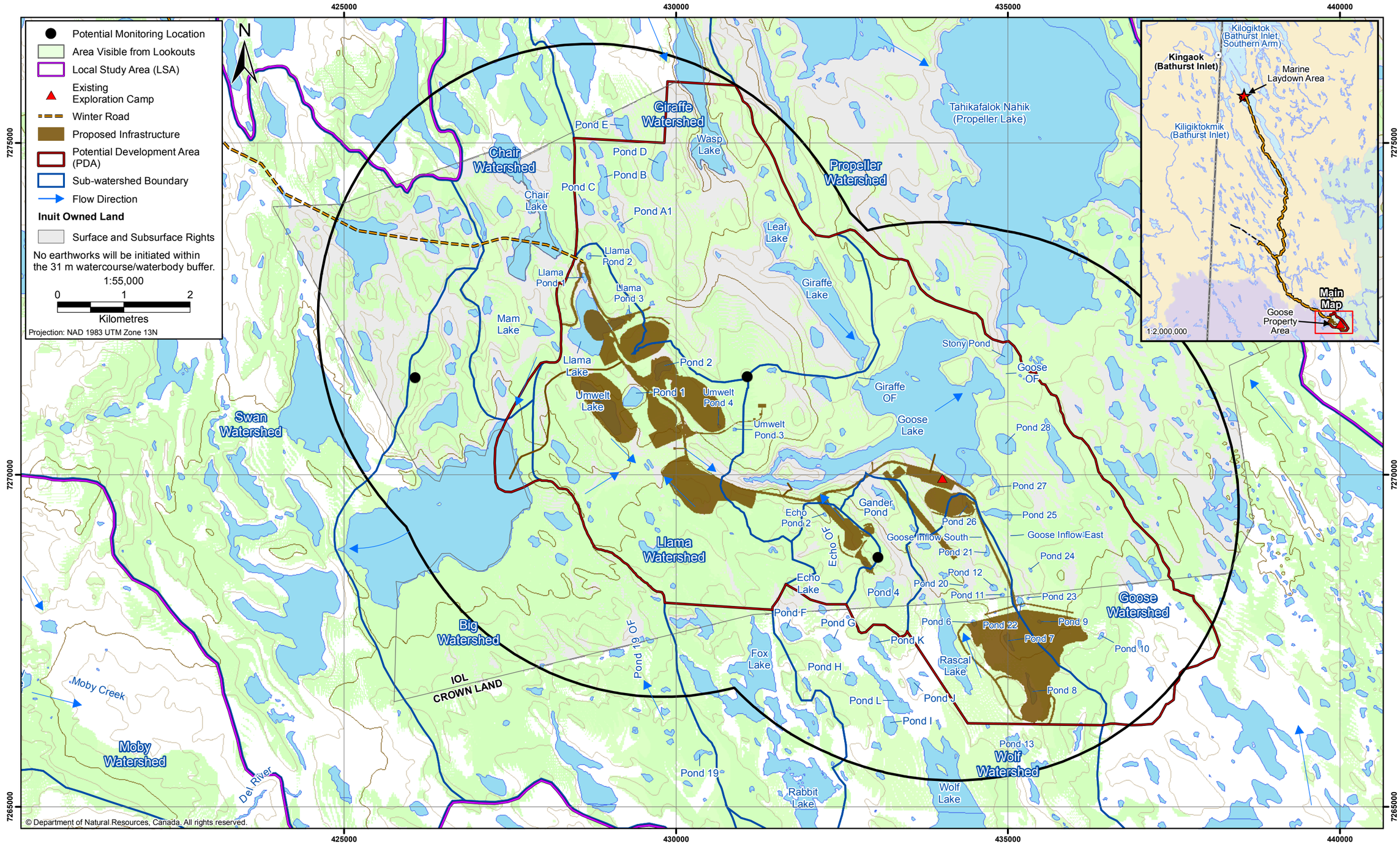
Objective

There are two objectives for the near real-time collar monitoring program:

1. to identify if caribou are approaching the Project site, which will be used to trigger a site alert. Note that in general, the times of year when caribou are likely to interact with the site are well known and will be tracked by monitoring the seasonal ranges of caribou (Section 7.2.1.1). Therefore, this can be considered a backup plan to the long term monitoring of caribou seasonal ranges; and
2. to identify if and when the spring migration of the Beverly/Ahiak herd is likely to cross the winter ice road.

Figure 7.2-1
Potential Monitoring Locations and Viewscape for Wildlife Monitoring

ERM



Triggers for Monitoring

The near real-time collar monitoring program will be in operation during periods when caribou are most sensitive to disturbance (calving and post-calving); during periods when caribou are more likely to be in the area surrounding the Project site (summer); and during operation of the winter ice road. Near real-time monitoring will occur during Construction, Operations and Reclamation/Closure.

Methods

Collar data will be acquired from the GNWT and GN for the Bathurst and Beverly/Ahiak herds.

Triggering a Site Alert

The Environment Manager will monitor collar data from the Bathurst and Beverly/Ahiak caribou herds to determine if groups of caribou are approaching the Project site.

Beverly/Ahiak Spring Migration

The winter ice road that connects the Goose PDA and MLA is planned to be active from December through the end of April. A proportion of the Beverly/Ahiak caribou spend the winter to the west of the winter ice road. This herd has been monitored using collars from 2001 to 2015. An analysis of these data indicate that Beverly/Ahiak caribou cross the proposed route of the winter ice road very infrequently during the winter (0.5% of caribou). Of the 365 spring migration events recorded by collars, approximately 1.3% of spring migrations crossed the winter ice road route, starting in mid-April. During spring migration, the Environment Manager will review the collar locations of wintering Beverly/Ahiak caribou to determine the timing and path of the spring migration relative to the winter ice road in April.

Triggers for Adaptive Management

The most common ZOI reported in the literature is in the range of 4 km (reviewed in Wolfe, Griffith, and Gray Wolfe 2000; Johnson C. et al. 2005; Weir et al. 2007; Johnson and Russel 2014). A recent study by Boulanger et al. (2012) reported an 11 to 14 km ZOI for the Ekati-Diavik mining complex in NWT. However, it should be noted that the Ekati-Diavik complex is 5 to 10 times larger than the proposed Project. Nevertheless, to be protective of caribou, the trigger distance for the near real-time collar monitoring will be 14 km or greater to ensure that caribou are outside any possible ZOI when ground-based monitoring is triggered. This distance will alert wildlife monitors and trigger active caribou monitoring (Section 7.2.1.3) and a site alert. Note that this trigger is not a hard trigger. The Environment Manager will be tracking caribou collar movements as the data becomes available and proactively preparing the environment staff for the future arrival of caribou as needed. The biologically-based trigger distance will then be expanded to account for any logistical delays in delivery of the collar data using the average daily movement rate of caribou as a guide.

Sabina will also be conducting regional monitoring of caribou that will use satellite collars to examine any potential ZOI for caribou (Section 7.2.2.4). The results of this monitoring plan will be used to update the biologically-based trigger distance.

Should caribou occur within the trigger distance, the following will be conducted:

1. Should collars indicate that caribou are approaching (see above) the Goose Project site during calving, post-calving, or early summer, the Environment Manager will trigger a site alert and alert wildlife monitors that caribou are approaching.

2. During the early spring migration, when collar data indicates that the Beverly/Ahiak caribou will begin crossing the winter ice road, the Environment Manager will trigger monitoring and mitigation on the winter ice road (Section 7.2.1.1).

Reporting

Results of the near real-time collar monitoring program will be reported in the annual WEMP Report.

7.2.1.3 Active Caribou Monitoring by Wildlife Monitors

Objective

The objective of active caribou monitoring is to reduce any potential disturbance effects on caribou due to Project activities. This program is designed to identify when caribou are in the vicinity of the Project and trigger mitigation if caribou are 1) within the trigger distance, 2) of a sufficient group size, and 3) present during the designated season.

The objective of this monitoring is also to be able to view both within and at greater distances than the proposed trigger distances (i.e., 4 km).

Triggers for Monitoring

Active monitoring will occur during Construction, Operations and Reclamation/Closure. Active caribou monitoring will be triggered:

1. during the periods of the year when caribou are most sensitive to disturbance (calving and post-calving) and when they are most likely to interact with the Project (summer);
2. when caribou are reported within the trigger distance set by the near real-time collar monitoring program; and
3. in response to incidental observations of caribou near the Project site by pilots, drivers, or on-site personnel.

Methods

Staffing and Training

Project personnel will be trained for the role of wildlife monitor. These personnel can come from any department, however, efforts will be made to use members of the environmental department. Wildlife monitors will primarily be regular full time staff of the Project with wildlife monitoring added to their responsibilities. In certain cases, additional, non-permanent staff may be utilized. Sufficient staff with the appropriate training will be on-site at all times of year to conduct wildlife monitoring. Efforts will be made to utilize local Kitikmeot Inuit or representatives of other aboriginal groups to act as wildlife monitors.

Sabina will develop a Wildlife Monitoring Training Program for wildlife monitors. Details of the training program will be shared with the KIA and GN prior to construction of the Project. Training will include:

- the roles and responsibilities of the environment monitor;
- safety considerations for the role;
- the triggers and management actions should caribou be observed on or near site;
- wildlife identification and management actions should other wildlife species be observed on or near site;

- identification of caribou sex and age classes;
- caribou behaviour to enable behavioural surveys of caribou (Section 7.2.2.2); and
- data entry and reporting.

Monitoring Locations

Three proposed locations are presented in the WMMP Plan that provide an uninterrupted view of the surrounding tundra. The Umwelt Lake observation point is west of Umwelt Lake and has a view to the west and north of the northwest portion of the Project (Figure 7.2-1). The Airstrip observation point is south of the airstrip and has a view north, east, and south of the Project footprint (Figure 7.2-1). The third monitoring location is located on the ridge to the west of the project to maximize the view of the tundra to the west of the Project.

Options for Monitoring

Three options are presented for caribou monitoring. The objective is to use Option 2, the tower cameras for the life of the Project. Options 1, observation blinds, and 3, vehicle-based monitoring, are proposed here until the towers can be installed and tested and as a backup in the event of a failure of the tower cameras.

Option 1: Observation Blinds

An observation tower with a blind at the top will be constructed at the observation points. When active monitoring is triggered, wildlife monitors will visit the observation blind during daylight hours and conduct a scan for caribou. The distance to caribou will be estimated using markers or a laser rangefinder. Group size and composition, including the presence of calves, will be recorded. These data will be sent to the Environment Manager, who will signal a site alert that caribou are in the vicinity.

Monitoring frequency will be dependent on:

1. the time of year and the number of caribou expected in a particular season determined through monitoring the seasonal ranges of caribou (Section 7.2.1.1);
2. the results of near real-time collar monitoring (Section 7.2.1.2); and
3. in response to incidental observations of caribou (Section 7.1.2.4).

During seasons when caribou are not expected to be on site, then monitoring will be conducted less frequently (i.e., twice per day). When caribou are more sensitive to disturbance (calving and post-calving) or are expected to be on site (i.e., summer and early fall), this monitoring frequency will increase to four times per day. Should near real-time collar data indicate that collared caribou are approaching the site, the monitoring frequency will increase to four times per day if it is not already at that frequency. Caribou monitoring may be triggered by incidental observations of caribou if the caribou are observed near site and at the discretion of the Environmental Manager.

Testing will be conducted to determine if observers can see caribou within and beyond the trigger distances for management actions, and the results of this testing will be reported to the KIA and GN.

Option 2: Tower Cameras

The second option for monitoring is a remote-controlled camera, which will be placed on a tower at the observation posts. The camera will have the ability to observe caribou out to the trigger distance. The controls and camera feed will be located in the Project Control Room. In this option, control room operators would be trained as discussed above to identify group size and composition.

Sabina has conducted research to ensure that the technology exists to support caribou monitoring using tower cameras. Several firms produce cameras that can fill the requirements for observing caribou at distances beyond the trigger distance. One example is from Infinity Optics, which produces surveillance cameras (http://www.infinitioptics.com/). An example of the image from their product is provided in Plate 7.2-1.

Plate 7.2-1. Image of Elk grazing at 1 km using an Infinity Optics remote camera.

This camera technology will be tested to ensure that it can identify caribou within and beyond the proposed trigger distances. The results of this testing will be reported to the KIA, GN and GNWT.

Option 3: Vehicle-Based Monitoring

Wildlife monitors will survey the tundra from vehicles on Project on-site roads at vantage points that allow a good view of the surrounding tundra. Methods will follow those for the observation blinds.

Triggers for Adaptive Management

The following triggers will be used for adaptive management:

- During the calving, post-calving, and summer seasons, if groups of caribou (25 or more) are observed within 4 km of the Project pits, then blasting will be delayed until caribou have moved through the area.
- During calving, post-calving and early summer, if medium-sized groups of caribou (25 or more) are observed within 1 km of the Project site, then the use of heavy mobile equipment outdoors will be delayed until caribou have moved through the area. The trigger distance will be 500 m at all other times of year.

Reporting

Data from the active caribou monitoring program will be reported in the annual WEMP report.

7.2.1.4 Incidental Observations

Objectives

The general objectives of the incidental wildlife observation program include:

- recording general wildlife activity in the Project area, including along roads;
- identifying unexpected conflicts or potential conflicts posed by existing Project facilities for wildlife, for example:
  - documenting wildlife-vehicle collisions;
  - identifying sections of the road that might be at risk for collisions (e.g., adjacent to high quality forage and near movement corridors);
- triggering additional monitoring and mitigation;
- identifying opportunities for adaptive management if a new risk to wildlife is identified; and
- assessing effectiveness of mitigation measures over time.

Triggers for Monitoring

The incidental observation monitoring program will be in place throughout construction and operations of the Project.

Methods

All personnel will be asked to report observations of wildlife species interacting with Project facilities to the Environment Department. Wildlife activity along the winter ice road will be recorded in a road wildlife log.

Environment staff will routinely inspect all Project facilities to check for signs of wildlife interaction or conflict, including:

- storage facilities and buildings that may serve as refuge; and
- areas where chemicals may have been applied (e.g., dust suppressants).

When wildlife are observed the following information may be recorded:

- location, date, and time;
- type of interaction (e.g., attraction, nesting);
- species, number of animals, age, and sex (if possible);
- behaviour (e.g., feeding, resting);
- condition (e.g., limping, wounded, salivating); and
- any damage to or interaction with mine property.

Prior to construction of the Project, a detailed SOP will be produced for recording incidental observations of wildlife. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

Triggers for Adaptive Management

Five activities may be triggered by the observation of caribou on or near the Project site:

1. Personnel will alert the Environment Department, which may trigger active monitoring or behaviour monitoring by wildlife monitors.
2. Should helicopter pilots observe caribou (and other wildlife) while flying, pilots will avoid the caribou (and other wildlife) as described in Section 6.5; Aircraft Management for Wildlife.
3. Should drivers observe caribou (and other wildlife) within 500 m of the road, they will slow down or stop, depending on how close caribou are to the road, and alert Dispatch who will alert the Environment Department. The distance of 500 m is used because that is seen as a reasonable distance over which a driver can scan the surrounding area for wildlife.
4. Should unexpected observations be made of wildlife in distress (injured, etc.), then the Environment Department and the appropriate will be regulator notified.
5. In addition, observations of wildlife mortality including caribou along the road will be documented, and may in turn trigger additional mitigation as described in Section 7.1.7.

Reporting

Incidental observations and monitoring responses will be reported in the annual WEMP report.

7.2.1.5 On-site Camera Monitoring

Objectives

Two camera programs are proposed, an on-site program to examine wildlife interactions with the site and a regional program to evaluate ongoing wildlife activity in areas around the site (e.g., grizzly bears, muskox and wolverine, Sections 8.2.2.2 and 9.2.2.2). The objective of the on-site camera program is to monitor caribou (and other wildlife VECs) activities around Project infrastructure, including:

1. locations that are not staffed for long periods of time (e.g., on roads, camps, MLA);
2. areas with and without mitigation structures or activities to evaluate the efficacy of mitigation activities (e.g., at-road crossing structures); and
3. the time of year when caribou use the Project site.

Triggers for Monitoring

The on-site camera monitoring program will be in place throughout construction and operations of the Project.

Methods

Motion-triggered cameras will be placed in the following locations:

1. caribou road crossing ramps compared to road side locations without ramps (to assess road crossing by caribou);
2. waste management facilities (to assess activity of caribou, grizzly bear, wolverine);
3. Goose camp (to assess activity around camp);
4. Marine Laydown Area (to assess activity in the MLA);

5. tailings impoundment facility (to assess use of the TIA by caribou and migratory waterfowl); and
6. other sites as the need arises.

Monitoring will use motion-triggered all-weather cameras that will record both timed and triggered photos. Cameras accessible by road will be checked regularly such that adaptive management can be triggered in a timely manner. Remote cameras will be checked twice per year. Cameras may be repositioned as deemed necessary pending results of the photo data. All methods will follow those reported in the 2015 Back River Camera Report.

Across years, data analysis will evaluate 1) the timing of caribou presence, 2) activity around Project facilities, and 3) the use of road crossing structures. Changes in activity at these sites may trigger adaptive management.

Triggers for Adaptive Management

Observations of caribou using the Project site in a way that may be harmful to caribou will be adaptively managed.

Reporting

Data and analyses will be reported in the annual WEMP report.

7.2.1.6 Over the Horizon Monitoring

Should on-site behaviour monitoring or regional monitoring using satellite collars indicate that there is a need to monitor for caribou at distances greater than can be observed from the Umwelt Lake and Airstrip observation points, then the over-the-horizon monitoring program will be triggered. This monitoring would be implemented, if-triggered, during the Construction, Operations and Reclamation/Closure Phases of the Project.

Sabina will investigate methods for over-the-horizon monitoring that can detect caribou, but which do not disturb caribou in the process. Note that the proposed long-distance camera monitoring program (Section 7.2.1.3) will likely address the objective of over the horizon monitoring.

7.2.1.7 Human Activity Monitoring

Background and Trigger for Monitoring

The FEIS evaluated the potential effects of new access to the Project site along the winter ice road from the MLA and determined there was a negligible potential for increased access. To mitigate any potential effects, the winter ice road will be closed to the public. Human activity monitoring will evaluate whether people are using the winter ice road and whether measures to control access have been effective. Human activity monitoring will occur in each year that the winter ice road is active. The results of human activity monitoring will be used for adaptive management measures to prevent further usage of the winter ice road.

Objectives

The objective of human activity monitoring is to evaluate whether measures to prevent people from using the winter ice road have been successful.

Monitoring Methods

Incidental observations of people using the winter ice road will be reported to environment staff, including:

- type of vehicles used for access (e.g., snowmobile, quad, truck, etc.);
- number of individuals;
- purpose of access (e.g., hunting, recreational use); and
- outcome of any interactions with Project personnel.

Prior to construction of the Project, a detailed SOP will be produced that will include training requirements for staff, methods for monitoring, and data sheets.

Data Analysis

All observations will be collated into a database and evaluating for any changes from year to year.

Triggers for Adaptive Mitigation

Observations of people using the winter ice road will immediately lead to the local manager/team leader contacting the person and explaining the use policy. Should more than five groups of people be seen in a calendar year, then enhanced management will be implemented to further limit use of the winter ice road (Section 7.1.6), and a more direct monitoring program such as remote cameras of people using the winter ice road will be triggered and reported as part of the Socio-Economic Monitoring Report to NIRB. If triggered, Sabina will liaise with the relevant HTOs to discuss possible options for enhanced management to limit hunter use of the winter ice road.

A harvest study will be conducted in nearby communities should there be extensive or increasing use of the winter ice road. Sabina will consult with the caribou technical advisory committee should a harvest study be required.

Reporting

Observations of people using the winter ice road and any corrective actions taken will be reported in the annual WEMP report. This reporting will include the date, group size, types of vehicle, purpose of access, and results of any interactions with Project personnel. Data will be provided as a table in the WEMP report.

7.2.1.8 Traffic Monitoring on the Winter Ice Road

Objectives

The objective of traffic monitoring on the winter ice road is to record the number of Project vehicles using the winter ice road.

Triggers for Monitoring

Traffic monitoring on the winter ice road will occur in all years that the winter ice road is active.

Methods

Vehicle dispatch will record the number of vehicles using the winter ice road in a vehicle log book. Data on use by non-Project vehicles will be gathered from the Human Activity Monitoring program (WMMP, Section 7.2.1.7).

Triggers for Adaptive Management

Should the recorded traffic levels exceed those used in the FEIS in each of three consecutive years, and if deemed required by the NIRB, then Sabina will conduct an assessment of road effects on caribou and submit this report to the NIRB.

Reporting

The total and average frequency of traffic using the winter ice road will be reported in the annual WEMP Report.

7.2.1.9 Aircraft Monitoring

Objectives

The objective of air traffic monitoring is to record the number of aircraft trips to and from the Project site.

Triggers for Monitoring

Aircraft monitoring will occur in all years that aircraft are used.

Methods

The Logistics Manager will record the number and type of aircraft visiting the Project.

Triggers for Adaptive Management

Should the recorded traffic levels exceed those used in the FEIS in each of three consecutive years, and if deemed required by the NIRB, then Sabina will conduct an assessment of road effects on caribou and submit this report to the NIRB.

Reporting

The total number of aircraft visiting the Project will be reported in the annual WEMP Report.

7.2.1.10 Caribou Monitoring on the Winter Ice Road

Objectives

The objective of caribou monitoring on the winter ice road is to determine if any caribou are moving towards the road or attempting to cross the road.

Triggers for Monitoring

Should the winter ice road remain operational after April 15th, then on-site wildlife monitors would conduct caribou monitoring along the winter ice road.

Methods

An on-site wildlife monitor will drive the winter ice road a minimum of twice per day, recording any caribou observations along the way. Observations will be recorded on data sheets, entered in a log and reported to the Environment Manager.

Triggers for Adaptive Management

All observations of caribou will be immediately reported to the Environment Manager. Should the wildlife monitor record a group of caribou attempting the cross the road or lingering on or adjacent to the road, the Environment Manager will instruct the wildlife monitor to stay and observe the caribou and will close the road to new traffic.

Reporting

Results of winter road caribou monitoring, and any management actions taken to close the winter ice road will be reported in the in the annual WEMP Report.

7.2.1.11 Caribou Monitoring to Determine Group Size Thresholds

Objectives

During the final hearing (May 2017) Sabina committed to refining the number of caribou in a group used to guide mitigation.

Triggers for Monitoring

In the first three years of the project's life (i.e. starting at construction) an aerial-based study will be conducted to collect data on caribou group sizes during summer and fall seasons (as defined in the WMMP) that are representative of the herds interacting with the Project.

Methods

The study design will be developed in conjunction with Caribou Technical Advisory Group and the surveys will be conducted by the members of the group or experienced caribou biologists.

Triggers for Adaptive Management

Data from these studies will be used to update the group size threshold for triggering the Staged Reduction in Project Activities (Level 4 response). The updated threshold will be set at a level such that 75% of the individuals are subject to a level 4 response. This group size threshold value will be reviewed periodically in conjunction with the Caribou Technical Advisory Group based on available information."

Reporting

Results of this survey will be reported in the WEMP Report.

7.2.2 Caribou Monitoring to Measure Predicted Effects

Caribou monitoring to evaluate predicted effects will be undertaken at three different scales: local, regional, and cumulative.

Local-scale monitoring programs include:

1. footprint monitoring (monitoring for habitat loss);

Regional-scale monitoring programs include:

1. behaviour monitoring program (monitoring for disturbance);
2. stress hormone study (monitoring for disturbance);

3. regional collar-monitoring program to examine avoidance of the site (monitoring for disturbance/ avoidance);
4. noise monitoring (monitoring for disturbance/avoidance);
5. dust monitoring (monitoring for disturbance/avoidance); and
6. regional camera monitoring.

Cumulative scale monitoring includes:

1. Collaborative, herd-scale monitoring with government (i.e., participation in the range planning process).

7.2.2.1 Footprint Monitoring

Background and Trigger for Monitoring

This monitoring program will track the as-built size of the Project, compared to the size presented in the FEIS. Monitoring will occur in each year of the Project, including reclamation/closure and as needed in post-closure to track the reclamation of the site.

Objectives

The objective of footprint monitoring is to quantify habitat losses for caribou due to construction and clearing of areas for Project infrastructure, site roads, mine sites, and camps.

Monitoring Methods

The as-built footprint will be compared to the previous year's footprints, the planned footprint, and wildlife habitat maps on a yearly basis. The yearly footprint will be taken from engineering drawings for the site as provided by the Project engineering staff. Areas available for progressive reclamation will be identified and recorded separately.

Data Analysis

A GIS analysis will be conducted to overlay the constructed footprint area with the habitat suitability mapping for caribou and all other VEC species conducted during baseline studies. Maps and a table of habitat loss will be produced.

Triggers for Adaptive Mitigation

If the constructed footprint exceeds the planned PDA area, then this area will be reported in the WEMP report.

Reporting

Footprint monitoring will be reported in the annual WEMP report during years that the footprint has increased in size. The report will contain maps of the Project footprint and the areas of habitat removed.

7.2.2.2 Behaviour Monitoring Program

Objective

The objective of behaviour monitoring is to test the FEIS prediction that caribou may be disturbed by Project activities, principally noise. This program will determine what behavioural responses caribou display in reaction to potential stressors at the Project site, including aircraft, vehicles, and blasting. The goal is a minimum of 10 behaviour samples per year.

Trigger for Monitoring

The behaviour monitoring program will be triggered in each year of construction and operations where there are caribou near the Project footprint.

Methods

Both focal and scan sampling will be used to record the behaviour of individual caribou and groups of caribou in the vicinity of the Project. The necessary technician skills include the ability to distinguish gender and age, classify behaviours, identify habitat types, and operate GPS and rangefinder equipment.

Below is an outline of the proposed monitoring protocols. Sabina will liaise with the GNWT and the GN (if they have also have a behaviour monitoring program) to determine the final methods of behaviour monitoring such that methods are comparable across projects and regions.

Focal Survey

The purpose of a focal survey is to capture the behaviour of caribou at the individual level to create an activity budget for each segment of the population. It is important to capture the entire demographics of the caribou population; therefore, whenever possible, focal surveys should alternate between capturing the behaviour of males, cows, and cows with calves. Every attempt will be made to complete focal surveys at a variety of locations around site to assess the potential effects of each area and its associated activities on individual behavior.

When a herd has been located, the survey will begin at least five minutes after the arrival of the wildlife monitors. Surveyors should work in teams of two, with one person recording data/timing and the other person verbally calling changes in behavior and potential stressors that are detected (visual or audio). During this time, the following information will be recorded: date and arrival time, weather, insect harassment, habitat type, description of location relative to the mine, UTM coordinates, herd composition count/number, GPS location, estimated distance (m) to the herd (with a rangefinder) and cardinal direction (eight cardinal directions) to the caribou group from the waypoint.

The following rules will be used to select an individual from the herd for focal observation: for every 10 animals in the herd, focal surveys will be conducted on 2 different animals. If the herd group is a mixed group (bulls and cows), one survey on one cow and one survey on one bull will be conducted. If the herd is all cows, a survey will be conducted on two different cows. If herd is all bulls, a survey will be conducted on two different bulls.

Insect harassment will be assessed by watching one focal animal for two minutes. The number of times the animal demonstrates headshakes, skin shakes/shudders, and scratches will be recorded. During the remainder of the focal observation, any other insect avoidance behaviours, such as bolting, aberrant running, rigid standing, or jumping will be recorded. If the caribou are too far away to see skin shakes or shudders, insect abundance at the monitor's location will be used to index insect harassment.

Surveys will be conducted whenever caribou are observed in the vicinity of the Project area. The length of a focal survey is at least 30 minutes, assuming the focal individual remains within the surveyor's view for the entirety of the survey. The following behaviours will be recorded: bedding, feeding, standing, alert, walking, trotting, running, and sparring. Only one behavior type should be recorded per time period per individual being surveyed during the focal survey. If the individual is engaged in two behaviors at the same point in time (i.e., alert while standing), the dominant behavior is recorded (i.e., alert) for that point in time.

In the event that a stressor occurs at any point during a focal survey, the observers will record the time that the stressor occurred, the duration of the stressor from start to finish, and the response of caribou to the stressors. The minimum estimated distance from the stressor to the focal individual will also be estimated by using a rangefinder, and the behaviour of the caribou from the first indication of the stressor is recorded. Potential stressors include aircraft (helicopter and airplane), blasting, and three categories of vehicles: light (e.g., pick-up truck), medium (e.g., water truck, bus), and heavy truck (e.g., haul truck). Observers will watch the animal for at least 15 minutes following a stressor event to record the time it took to return to a non-alert behaviour (bedding or feeding).

Scan Survey

The purpose of a scan survey is to characterize the predominant behaviour of caribou groups in relation to Project activities. It is important to capture different demographics of caribou populations; therefore, whenever possible, scan surveys should attempt to capture bachelor herds, nursery groups, mixed herds and rutting groups. Every attempt should be made to complete scan surveys at a variety of locations around site to monitor the potential impact of each area and its associated activities on herd behavior.

Observers will wait at least five minutes before commencing the survey. During that time, information on group location and insect harassment, weather, site location, herd composition, GPS location, estimated distance in metres (with a rangefinder) and cardinal direction to the caribou group from the waypoint will be recorded. Surveyors should work in teams of two, with one person recording data/timing and the other person verbally calling changes in behavior and potential stressors that are detected (visual or audio).

Insect harassment will be assessed by recording the number of times the group being surveyed demonstrates headshakes, skin shakes/shudders, and scratches in the space of a four-minute interval. During the rest of the scan survey, any other insect-avoidance behaviours such as bolting, aberrant running, rigid standing or jumping will be recorded. If the caribou are too far away to see skin shakes or shudders, insect abundance at the monitor's location will be used to index insect harassment.

Surveys will be conducted whenever caribou are observed in the vicinity of the Project area. On groups up to 25 animals, all animals will be included in the scan. For larger groups, a sub-sample of 20 to 25 animals will be observed. There may be multiple observations from a single large group, consisting of several consecutive scans on different sub-groups. If additional personnel are available, focal and scan observations may proceed concurrently. Data may be supplemented with the use of video recordings. The length of a scan survey is 32 minutes, and a scan observation will be conducted every 4 minutes. A scan sample consists of recording the number of individuals exhibiting the following behaviours: bedding, feeding, standing, alert, walking, trotting, running, and sparring.

In the event that a stressor occurs at any point during a scan survey (i.e., between the four-minute scan periods), the observers will record the time that the stressor occurred (i.e., the time that the stressor is first observed by surveyors), the duration of the stressor from start to finish, and the response of caribou to stressors as either exhibiting no reaction, or a reaction (caribou look towards disturbance; caribou walk away; caribou trot or run away). The minimum estimated distance from the stressor will also be

estimated by using a rangefinder, and the behaviour of the caribou from the first indication of the stressor will be recorded. Potential stressors include aircraft (helicopter and airplane), blasting, and three categories of vehicles: light (e.g., pick-up truck), medium (e.g., water truck, bus), and heavy truck (e.g., haul truck). Following a stressor event, the scan survey will resume on the four-minute interval; the duration between each scan survey will always be four minutes, regardless of the frequency or number of stressor events.

Triggers for Adaptive Management

Should the behaviour monitoring program determine that caribou are having negative behavioural responses to Project activities outside of the current planned trigger distances for mitigation, then these mitigation distances will be reviewed and adjusted accordingly (Section 7.2.1). Mitigation will be adjusted in two ways, based on the types of reactions expressed by caribou:

- For behaviours which are measured as activity budgets, the review of mitigation measures will occur as part of the annual WEMP report, which will detail the behavioural change observed and the proposed change in mitigation. The WEMP report will be circulated to the KIA, GN and GNWT for comments.
- For behaviours which are overt and observable following a disturbance (getting up, startle and stare, or trotting/running away), the wildlife monitor will alert the Environmental Manager, who will adaptively manage the response of the project to minimize disturbance to caribou. Any changes in the mitigation will be reported to the KIA, GN and GNWT.

Reporting

The results of the behaviour monitoring program will be reported in the annual WEMP Report.

7.2.2.3 Stress Hormone Study

Objective

The objective of the stress hormone study is to test the FEIS prediction that caribou may be disturbed by activities near the Project site. This program will determine what physiological responses caribou have to the Project site.

Trigger for Monitoring

The stress hormone study will occur once during operations of the Project when there are caribou on or near the Project site. If possible, this study will occur in the first two years of operations.

Methods

This study will examine the level of stress hormones at a variety of distances from the Project site. Fecal pellets from caribou will be recovered at distances from 500 m to 30 km. The distance of 30 km will be used because it is twice the largest ZOI reported for caribou in the literature and so provides a good control area. A sufficient number of replicates will be used such that the program has the power to detect change in stress hormones with distance from the mine.

Fecal pellets will be collected in the fall, when only Beverly/Ahiak caribou are present and the recent fecal pellets are obvious against the snow. Samples will be swabbed for DNA, and DNA amplified using polymerase chain reaction (PCR) to test for female (X/X) and male (X/Y) caribou following methods from Wasser et al. (2004); Wasser et al. (2011). Samples will then be extracted and analyzed for progesterone, glucocorticoid (GC; cortisol), and the thyroid hormone triiodothyronine (T3) following standard methods. These data will provide pregnancy rate and stress levels of caribou at various distances from the Project site.

Sex ratio, pregnancy rate and stress hormone concentration will be compared to 1) distance from the Project site, 2) habitat type, 3) selection metrics for or against habitats from the resource selection function conducted as part of the DEIS, 4) noise data, and 5) dust data using simple linear regression. More detailed field and analysis methods will be circulated to the KIA, GN and GNWT for comment prior to implementation of the study.

Triggers for Adaptive Management

Should the stress hormone study determine that caribou are having negative physiological responses to Project activities, then potential Project stressors will be adaptively managed (Section 7.2.1).

Reporting

The results of the stress hormone study will be reported in the annual WEMP Report in the year during which the study is conducted.

7.2.2.4 Regional Collar Monitoring for Zone of Influence

Objective

The objective of the regional collar monitoring program is to investigate whether caribou alter their regional distribution following construction of the Project. This program will evaluate whether either the Bathurst or the Beverly/Ahiak caribou herds are 1) avoiding the Project site, 2) not avoiding the Project, but moving more quickly through the Project area, or 3) there is no change compared to baseline conditions. This analysis will be conducted separately for the Goose site and the winter ice road. Analysis for the winter ice road will be contingent on there being sufficient satellite collar data available to conduct this analysis for the winter ice road.

Trigger for Monitoring

The regional collar monitoring program for zone of influence will be conducted every three years during Construction, Operations, Temporary Closure, Care and Maintenance, Reclamation/Closure and Post-Closure phases of the Project.

Methods – Zone of Influence

The analysis will be conducted separately for the Bathurst and Beverly/Ahiak caribou. Note that during the last 20 years, the Bathurst caribou have not overlapped the Goose site, so this analysis will be used to test the prediction that no effect on distribution will occur. The Beverly/Ahiak herd overlaps the Project site during summer and to a lesser degree during fall and winter. The FEIS predicted that caribou would avoid the Project site to some degree and this analysis will test for 1) a change in distribution, and 2) the magnitude of that change.

This analysis will follow the methods used by Boulanger et al. (2012) to examine the density of caribou surrounding the Project site using existing caribou collar data, or updated methods as they become available. This analysis will have one major difference, however, because there are almost 20 years of caribou collar data prior to construction. Hence, this analysis will be a Before-After-Control-Impact (BACI) design using collar data before and after construction of the Project with a dose-response calculation used by Boulanger et al. (2012) to define treatment and control.

To test for a ZOI, the density of caribou collar points before and after construction of the Project will be compared at various distances from the Project, grouped into 1-km bands. Models with a range of cut-points will be fit to determine the ZOI. The fit of each model will be compared by assessing its log-likelihood relative to the other models. The log-likelihoods should increase to a maximum at the most

probable distance for the ZOI and then decrease thereafter. In addition, the estimated coefficient of the best-fit ZOI term will be used to determine an odds ratio for the ZOI. The odds ratio (OR) is an index of the probability of detecting caribou relative to the ZOI. For example, an OR of 2 would suggest that caribou are twice as likely to be observed beyond the ZOI as within it.

Habitat data will be included as predictors of caribou abundance in the regression models. These variables will be used to investigate possible mechanisms for any calculated ZOI surrounding the Project, including:

1. vegetation class;
2. habitat preference or avoidance score—taken from the resource selection function already completed for the Bathurst caribou post-calving and summer ranges as part of the DEIS; and
3. lake cover.

Project effects will also be assessed to determine if the ZOI is related to any of the following:

1. predicted noise from the Project (infrastructure, blasting and aircraft);
2. measured noise from the Project;
3. predicted dustfall from the Project; and
4. measured dustfall from the Project.

Collar data for this program will be sourced from the GNWT and GN. Sabina is already in possession of the habitat data and will be collecting noise and dustfall data through monitoring programs.

In consultation with the GN, the Proponent shall revise the WMMP to more clearly define the technical specifications and requirements of the proposed collar-based regional monitoring programs designed to monitor Project effects on caribou (i.e., the ZOI monitoring), and to monitor caribou range use for the purpose of mitigation (i.e., seasonal ranges use monitoring), including details on required statistical power, sample size, sampling schedule and frequency of data acquisition.

Prior to construction, Sabina will also update the WMMP to: 1) confirm that data suitable to meet these technical specifications and monitoring needs are available, 2) demonstrate that relevant data-sharing agreements are in place with government data suppliers, and 3) provide the minimum number of collars that would need to deployed on the relevant herds in order to calculate a ZOI. The revised WMMP shall be submitted to NIRB for review.

Methods – Movement Rate

This analysis will be conducted for both the Bathurst and Beverly/Ahiak caribou. The objective is to measure whether caribou increase their movement near the Project site after construction. Methods for this analysis will follow those for the ZOI analysis, but instead of comparing density of caribou at different distances from the Project site, this analysis will examine step length (the km per day moved) by caribou. Tests for predictive variables such as dust and noise will be conducted in the same manner as the ZOI analysis. This analysis has the same data requirements as the ZOI analysis.

Triggers for Adaptive Management

Should the regional collar monitoring program determine that caribou are avoiding the Project site more than predicted in the FEIS by 2 to 4 km, Sabina will investigate possible mechanisms for this avoidance and adaptively manage its activities.

Reporting

The results of the regional collar monitoring program will be reported in the annual WEMP Report during the years when the analysis is conducted.

7.2.2.5 Noise Monitoring

Objective

The objective of the noise monitoring program is to measure the amount of noise produced by the Project at various distances from the Project footprint to meet compliance requirements for personnel health and safety and to test the predictions of the FEIS. One objective of this noise monitoring will be to measure the noise produced by blasts.

Trigger for Monitoring

Noise monitoring was conducted during baseline studies and is proposed once during construction, every third year of operations and once during reclamation and closure. Monitoring will also be triggered by significant changes in the Project Operations. If there is a major change between and within Project phases, then the frequency will be reviewed and adjusted (i.e., before and after a major change (e.g., going in to or coming out of care and maintenance, starting an open pit). Additional blasting-specific surveys may be warranted to gain additional information on construction and open-pit blasting setback distances.

Methods

Noise monitoring will be conducted in winter (approximately March) and summer (approximately June) at 10 sites to address potential effects on:

1. birds: along the 45 dBA contour, 1 km and 3 km;
2. caribou: at 1 km, 3 km, 5 km, 14 km; and
3. at a control site at a distance greater than 14 km from the site.

The exact locations of the sites will be determined based on the final Project specifications and the predominant wind directions. Sound meters will make noise measurements every minute for 24 consecutive hours at a height of 1.5 m above ground. A B&K Model 2250 (or similar) sound level meter will be used; this is a Type 1 instrument with an operating range that captures low sound levels that are typical for an undisturbed wilderness area, measuring:

- L_{Aeq} (equivalent continuous sound pressure level in dBA);
- L_{Amax} (absolute maximum in dBA);
- L_{Amin} (absolute minimum in dBA); and
- L_{Ceq} (the C-weighted equivalent continuous sound pressure level in dBC).

A-weighting is the most commonly used parameter when a single-number overall sound level is needed, since it approximates the human perception of sound. C-weighting is used to evaluate sounds containing strong low-frequency components. To evaluate both the aesthetic appeal and speech interference of noise, 1/3 band octave data will be collected once per Project stage, and if noise levels exceeding Project criteria are found, the primary source requiring mitigation will be located.

Field notes will include a description of the monitoring site, time, calibration, surface type, noise sources, distance from obstacles, location, type of meter and weather. Preferred weather conditions are wind speeds less than 20 km/h, relative humidity less than 90%; no precipitation (rain or snow), and temperatures within the manufacturer's specifications.

Data Analysis

Analysis will follow those conducted in the noise baseline (FEIS Appendix V4-2A).

Triggers for Adaptive Mitigation

Noise levels exceeding noise-monitoring thresholds for human safety will trigger mitigation that will also act to reduce potential effects on wildlife receptors.

Reporting

Noise monitoring data will be reported as a stand-alone report and referenced in the WEMP.

7.2.2.6 Dust Monitoring

Objective

The objective of the dust monitoring program is to measure the amount of dust produced by the Project and deposited on the surrounding tundra at various distances from the Project footprint.

Methods

Please see Section Volume 10, Chapter 17; The Air Quality Monitoring and Management Plan, for a complete description of this program including triggers, methods, adaptive management, and reporting.

Triggers for Adaptive Management

Mitigation will be triggered should dustfall exceed applicable standards, predictions in the FEIS, or if there is a trend through time that indicates reason for concern.

Reporting

The results of the dustfall monitoring will be reported in the annual Air Quality Monitoring Report.

7.2.2.7 Collaborative Herd-scale Monitoring

Sabina is proposing to collaborate with government agencies from the NWT and NU to conduct collaborative, herd-scale monitoring for cumulative effects during construction and operations of the Project. This monitoring program would occur during Construction, Operations, Temporary Closure, Care and Maintenance, Reclamation/Closure and Post-Closure. Sabina will work with the GN and the GNWT in the following ways:

1. Sabina will participate in the GNWT-led Bathurst Range-Planning process by sending a representative.
2. Sabina will coordinate with the GNWT and the GN to contribute to government or industry-led cumulative effects monitoring for the Bathurst and/or the Beverly/Ahiak caribou herds. Examples include:
    a) financial (e.g., purchasing satellite collars);
    b) in-kind support (e.g., providing fuel, airstrip, and accommodation for a caribou survey); or
    c) collaborative (e.g., where Sabina provides data or personnel to accomplish a monitoring goal).

Sabina will report its contribution to cumulative effects monitoring in the annual WEMP report.

7.2.2.8 Regional Camera Monitoring Program

Please see section 8.2.2.2, Regional Monitoring of Muskox with Motion-Triggered Cameras, for information on the regional camera monitoring program to be used for caribou, muskox and grizzly bear. This monitoring program would occur every 3 years during Construction, Operations and Post-Closure, if triggered.

8. Muskox

8.1 MITIGATION AND MANAGEMENT FOR MUSKOX

8.1.1 Overview of Potential Effects to Muskox

Seven potential effects of the Project on muskox were evaluated in the FEIS: habitat loss, disturbance, disruption of movement, direct mortality, indirect mortality, attraction, and exposure to contaminants. Mitigation and management measures to reduce the potential for these effects to result in residual effects on muskox are discussed in this section.

In addition, reduction in productivity was considered to evaluate the potential for synergistic effects on muskox. Limiting the potential for synergistic effects will be achieved by implementing the mitigation and management measures for the seven direct effects listed above.

Habitat loss will occur in the Project footprint where natural vegetation is removed for the construction of the Project, and habitat loss was rated as a residual effect in the FEIS. Habitat loss will be minimized by reducing the Project footprint and carrying out reclamation activities.

Indirect habitat loss caused by disturbance, measured as the potential for muskox to avoid the Project site, was rated as a residual effect in the FEIS. A variety of mitigation and management activities are proposed, including design mitigation to limit noise, fixed and rotary-winged aircraft management, and management of traffic on on-site roads and winter ice roads should muskox be observed near the site.

The potential for the disruption of muskox movement patterns due to the winter ice road was evaluated. With mitigation, including traffic management, this potential effect was not rated as a residual effect.

The potential for direct mortality due to vehicle collisions and altered predator-prey relationships was evaluated for muskox. With mitigation, including setting speed limits, maintaining the right of way for all wildlife, and compliance with Sabina's waste management practices, this effect was not rated as a residual effect.

The potential for indirect mortality was evaluated as the potential for increased access for hunters to the Project area. With mitigation, which includes closing the winter ice road to the public and prohibiting employees from bringing firearms to the site and hunting while at work, this was not rated as a residual effect.

The potential for muskox to be attracted to the Project site, in particular the winter ice road for ease of travel, was evaluated in the FEIS. Mitigation measures for wildlife encounters on all Project roads, such as setting speed limits and giving wildlife the right of way on the road, will ensure that should muskox be attracted to winter ice roads for ease of travel, this should not result in an increase in vehicle-muskox interactions. Therefore, no residual effects of attraction are expected for muskox following mitigation.

The potential for muskox to be exposed to contaminants was evaluated in the FEIS through a risk assessment, which found that muskox would not be at risk of uptake of hazardous chemicals. A series of standard management plans for chemicals was provided in the FEIS, including fuel, spill response, marine

spills, and management of hazardous materials. After management, exposure to contaminants was not rated as a residual effect for muskox.

8.1.2 Mitigation and Management for Habitat Loss for Muskox

The following mitigation and management measures will be conducted during the construction, operations, and closure phases of the Project to reduce the potential for habitat loss for muskox:

- Sabina will design the Project footprint to be as small as possible.
- Dust will be managed on the Project site by setting and enforcing speed limits on all-season on-site roads and applying dust suppressants where and when needed. Dust suppressants will be non-toxic for wildlife. Dust deposition rates and potential effects on vegetation will be monitored as described in the Air Quality Monitoring and Management Plan (Volume 10, Chapter 17).
- Areas of the Project will be reclaimed progressively during operations and at closure to minimize the area of disturbance to wildlife as described in the Mine Closure and Reclamation Plan (Volume 10, Chapter 29). Post-closure environmental monitoring will continue until it has been verified that reclamation has successfully met closure and reclamation objectives.

8.1.3 Mitigation and Management for Disturbance of Muskox

A series of mitigation and management strategies will be in place to reduce the potential for disturbance to muskox.

8.1.3.1 Design Mitigation

The following mitigation measures will be designed into the Project to limit disturbance to muskox:

- Project equipment will be chosen to limit the continuous noise produced by equipment such as generators, heavy trucks and other mobile equipment. All Project equipment will be fitted with appropriate mufflers and silencers and will be well maintained.
- Project facilities will be designed to limit the amount of noise that emanates from the Project, such as housing static noise sources (e.g., the crushers, mill and generators) in buildings and using acoustic screening such as wall or berms to muffle noise.

8.1.3.2 Fixed Wing Aircraft Management

The following management actions will be applied to fixed-wing aircraft during all Project phases to limit disturbance to muskox:

- Fixed-wing pilots will remain above 610 m local ground level at all times, except when landing or taking off from the Marine Laydown Area (MLA) or the Goose Airstrip.
- Prior to aircraft landing on the airstrip, a visual inspection will be conducted to identify the presence of any wildlife on the airstrip. If possible, the wildlife will be escorted off the airstrip; the flight crew will be notified by radio that such action is taking place and aircraft will not be approved to land until the airstrip is clear. If the wildlife cannot be escorted from the airstrip within a reasonable length of time, the flight crew will be instructed to divert to another location.

8.1.3.3 Helicopter Management

The following management actions will be applied to helicopters during all Project phases to reduce potential disturbance to muskox:

- As part of pilot induction, pilots will be informed of their responsibilities to monitor, report, and avoid groups of muskox.
- Pilots will avoid groups of muskox by 300 m elevation except where low-elevation surveys are required.
- Pilots will report all incidental sightings of muskox to the Environment Department.

8.1.3.4 Blasting Management

The following management actions will be applied during the construction and operations phases to limit any disturbance due to blasting on muskox:

- When groups of more than 10 muskox are observed by wildlife monitors or are observed incidentally at 1 km from the site, a site notification (Level 2 response) will be called and wildlife monitors will conduct behaviour monitoring on selected muskox groups.
- When groups of more than 10 muskox are observed within 1 km of the open pits, a site alert will be called and blasting will be halted until muskox move off. Only one other northern mining Project has an established blasting setback distance for muskox, which is 500 m. The proposed 1 km setback is twice this distance. A review of seven permitted and/or operating Arctic mining projects indicated that only one project is halting blasting when muskox are within a specified distance; the Meadowbank project halts blasting when a group of 10 or more animals are within 500 m of a blasting site.
- During all seasons, if any muskox are within the blast safety areas—the area potentially affected by fly rock or debris—then the blast will be delayed until the muskox move out of the area. The blast safety area is part of the personnel safety requirements and is determined prior to each blast.
- If muskox become acclimated to the site and have not moved off within 1 day, then blasting may resume as long as muskox are outside of the blasting safety zone. This is also the management for resumption of blasting at the Meadowbank project.

8.1.3.5 Heavy Equipment Management

Heavy mobile equipment (e.g., dump trucks) will follow the rules for traffic outlines in Section 8.1.4.

8.1.4 Mitigation and Management for Disruption of Movement of Muskox

Mitigation and management for disruption of movement of muskox focuses on management of the winter ice road between the Goose site and the MLA, and on all-season, on-site Project roads.

The following mitigation will be designed into the Project winter ice roads:

- The winter ice road will be constructed each winter such that it is not a barrier to movement for muskox; the height of snowbanks will be limited and snow plowing will be conducted in such a way as to limit the vertical height and angle of the snowbank edge.

The following management actions will be conducted whenever on-site roads and the winter ice road are in use:

- Traffic on all roads will be managed and monitored through a central dispatch.
- In order to reduce the frequency of traffic on the winter ice road that may deter muskox from crossing, trucks may be grouped into convoys.
- If a driver observes a group of more than 10 muskox (or individual grizzly bear, wolves and wolverine) within 500 m of any road, the driver will slow to 40 km/hr.
- Trucks will stop when groups of muskox (also grizzly bears, wolves and wolverine) are crossing the road.
- If an individual or small group of wildlife (also grizzly bears, wolves and wolverine) are standing on the road, then the driver will stop for up to 20 minutes, then proceed slowly to encourage the wildlife to move off the road.

8.1.5 Mitigation and Management for Direct Mortality and Injury of Muskox

Mitigation and management to prevent direct mortality and injury of muskox focuses on management of roads and aircraft at the landing strip to prevent any vehicle-muskox collisions, including:

- Speed limits will be monitored and enforced, and set at 60 km/h for winter ice roads and on all-season on-site roads.
- Wildlife will have the right-of-way on all Project roads. See section on disruption of movement for muskox.
- Any wildlife mortalities on Project roads will be recorded through a reporting system and this information will be distributed to drivers. If a location is found where more than one wildlife mortality has occurred, then this location will be relayed to drivers and site-specific mitigation may be conducted, such as additional signage to alert drivers of speed limits, and identified wildlife movement corridors.
- The Project will conduct regular road and camp cleanups to ensure that no hazardous substances, wires, or loose materials are present to endanger wildlife, and to ensure proper storage and disposal of wastes and hazardous wastes as per the Waste Management Plan (Volume 10, Chapter 10).
- Should muskox become acclimated to the Project site, and should their safety be at risk, then the Project may deter muskox. Examples of acceptable reasons to deter muskox include:
  - muskox have become acclimated to the camp and are posing a safety risk to Project personnel;
  - muskox are attracted to the TSF or other feature as a salt source, but TSF water quality does not meet wildlife guidelines; and
  - an individual or small group of muskox are occupying the airstrip and have the potential to be alarmed and run into the airstrip during landing or takeoff.
- The objective of deterrence is to encourage the muskox to leave the area, while not startling the muskox and causing them to exhibit defensive behaviours or to run away. Experience at other Arctic projects indicates that the presence of a light pickup truck or person near the muskox is all that is required to encourage muskox to leave the area.

8.1.6 Mitigation and Management for Indirect Mortality of Muskox

Mitigation and management to limit indirect mortality for muskox due to increased access and hunting will be the same as those used for caribou in (Section 7.1.6):

- No-hunting policy for Project personnel on-site; and
- closure to the public of the winter ice road to the MLA.

8.1.7 Mitigation and Management for Attraction of Muskox

Muskox are not expected to be attracted to the Project site unless they are using the winter ice road as a travel corridor. See Sections 8.1.4 and 8.1.5 for mitigation and management for disruption of movement and direct mortality on the winter ice road.

8.1.8 Mitigation and Management for Exposure to Contaminants for Muskox

The following mitigation and management actions will be conducted during all Project phases:

- Fuel will be managed safely to ensure fuels do not enter the environment and that wildlife, including muskox, are not exposed to fuels, as per the Fuel Management Plan (Volume 10, Chapter 4).
- Should a fuel spill occur, the fuel will be contained and cleaned up such that wildlife, including muskox, are not exposed to the fuel, on land as per the Spill Contingency Plan (Volume 10, Chapter 5) and in the marine environment as per the Oil Pollution Emergency Plan (Volume 10, Chapter 6).
- Hazardous materials will be stored and handled safely so that wildlife, including muskox, are not exposed to hazardous materials as per the Hazardous Materials Management Plan (Volume 10, Chapter 12).
- The Project will conduct regular road and camp cleanups to ensure that no hazardous substances, wires, or loose materials are present to endanger wildlife, and to ensure proper storage and disposal of wastes and hazardous wastes as per the Waste Management Plan (Volume 10, Chapter 10).
- Sabina's fuel management plan and spill response plans are discussed in Section 6.1.3.

8.2 MONITORING FOR MUSKOX

This section describes monitoring and mitigation activities to minimize potential effects of the Project on muskox that will be included in the WEMP; it is divided into two subsections, 1) monitoring that will trigger management, and 2) monitoring to evaluate the predicted Project effects on muskox.

Monitoring to trigger management for muskox include:

1. monitoring for use of Project infrastructure using motion-triggered cameras;
2. incidental observations; and
3. monitoring for muskox in relation to blasting.

Monitoring to test the predictions of the FEIS on muskox include:

1. footprint monitoring to measure habitat loss in the Project footprint;
2. regional monitoring for muskox using remote motion-triggered cameras to measure avoidance;
3. behaviour monitoring; and
4. contributions to regional GN monitoring.

8.2.1 Muskox Monitoring to Trigger Mitigation

8.2.1.1 On-site Camera Monitoring

Objectives

The objective of the on-site camera program is to evaluate how muskox (and other wildlife VECs) interact with the Project site, and will be achieved by:

1. monitoring the Project site to examine how muskox interact with Project facilities (e.g., on roads, pits);
2. monitoring areas identified as important for muskox from land user knowledge (e.g., eskers, windswept benches) and at points with high numbers of muskox identified during baseline studies (e.g., the hilly area west of the MLA); and
3. recording the times at which muskox use the area near the Project during the year in order to guide mitigation activities.

Triggers for Monitoring

The on-site camera monitoring program will be in place throughout construction and operations of the Project.

Methods

Methods and analysis will follow those for the on-site camera monitoring for caribou (Section 7.2.1.5).

Triggers for Adaptive Management

Observations of muskox being attracted to and interacting with the Project site in ways that may cause harm to muskox or employees will trigger adaptive management to review the causes for why muskox are attracted and to provide mitigation.

Reporting

Data and analyses will be reported in the annual WEMP Report.

8.2.1.2 Incidental Observations

Objectives

For muskox, the objectives of the incidental observation program are to collect information that will be used to trigger suitable mitigation, including:

1. alerting the environmental personnel that muskox (and other wildlife) are on site;
2. managing the avoidance of muskox by pilots;
3. triggering vehicles to stop when muskox are on the on the Project site and winter ice roads; and
4. recording unexpected interactions with the Project.

Triggers for Monitoring

The incidental observation monitoring program will be in place throughout construction and operations of the Project.

Methods

Incidental observations of muskox will be recorded by all Project personnel, including environmental monitors, pilots, drivers on on-site and winter ice roads, and other Project personnel and recorded in a wildlife log. More details are available in Section 7.2.1.4, Incidental Observations (for caribou).

Triggers for Adaptive Management

Five activities may be triggered by the observation of muskox:

1. A spike in the number of muskox observed at site will trigger adaptive management.
2. Should pilots observe muskox (and other wildlife) while flying, pilots will avoid muskox.
3. Should drivers observe muskox on or adjacent to the road, they will give muskox the right of way.
4. Should muskox be observed within prescribed distances of active blasting, then monitoring will be conducted blasting schedules may be modified (see Section 8.2.1.3).
5. Should unexpected observations be made of wildlife in distress (injured, other.), then the Environment Department will be notified and the appropriated regulator notified.

Reporting

Data, analyses, and adaptive management actions will be reported in the annual WEMP report.

8.2.1.3 Monitoring for Muskox in Relation to Blasting

Objectives

The objective of this monitoring program is to trigger appropriate mitigation measures should muskox be observed within a certain distance of above-ground blasting (Section 8.1.3.4).

Triggers and Methods

When wildlife monitors are conducting scans for caribou (Section 7.2.1.3), muskox sightings will also be recorded. This monitoring will be conducted during the Construction, Operations, and Reclamation/Closure phases of the Project.

Triggers for Adaptive Management

If muskox are observed within 1 km of the location of above-ground blasting, then a site alert will be called and adaptive management will be triggered and muskox behaviour will be recorded. If muskox are observed within 500 m, then blasting will be halted until muskox move away.

Reporting

Data, analyses, and adaptive management actions will be reported in the annual WEMP report.

8.2.2 Muskox Monitoring to Measure Predicted Effects

8.2.2.1 Footprint Monitoring

Objective

The objective of footprint size monitoring is to measure the actual habitat lost within the constructed Project footprint for each wildlife VEC.

Methods, Analysis, and Reporting

The methods, analysis and reporting for footprint monitoring will follow the footprint monitoring methods for caribou (Section 7.2.2.1).

8.2.2.2 Regional Monitoring of Muskox with Motion-triggered Cameras

Objective

The FEIS predicted that muskox may avoid the Project mine site (the Goose site) due to disturbance. The objective of the regional camera monitoring program is to determine if muskox are avoiding the Goose site.

The regional camera monitoring program described here will also be used for grizzly bears and wolverine/ furbearers (Section 9.2.2.2).

Trigger for Monitoring

The regional monitoring program using cameras will be triggered every third year of Construction, Operations and Post-Closure, if triggered, of the Project.

Methods

Remote motion-triggered cameras are a reliable method for examining wildlife habitat associations in the Arctic due to the landscape's short vegetation and features such as eskers and river crossings that direct wildlife movement through the landscape (Cutler and Swann 1999; Noel et al. 2006).

The regional camera monitoring program will be designed as a Before-After -Control-Impact (BACI) study, using the existing camera data from 2012 to 2015 as the before category. The existing camera study was arranged in five transect lines that run from southwest to northeast, perpendicular to the planned winter ice road (Figure 8.2-1; Rescan 2013, 2014). The five transects were monitored year-round during 2012 and 2013. Most cameras were recovered at the end of 2013, with the two southern transects monitored again in 2015.

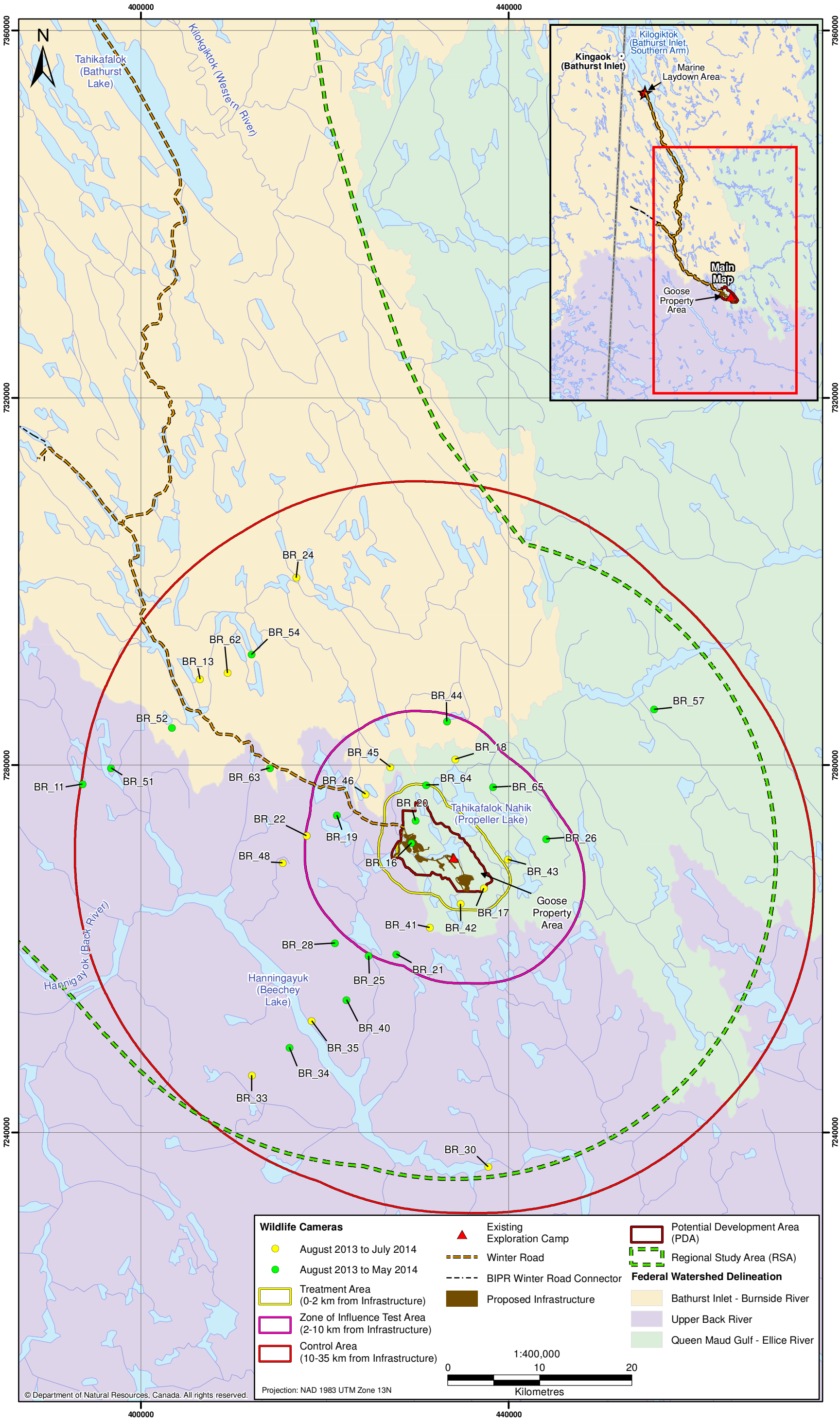
Cameras will be placed in the field during the construction and operations phases of the Project. To evaluate ZOI-type effects, the cameras were grouped into three "zones" (Figure 8.2-1):

1. treatment, with cameras arrayed within 2 km of the Project site;
2. zone of influence (ZOI), with cameras arrayed between 2 and 10 km; and
3. control, with cameras arrayed outside of 10 km of the Project site.

4. In as many cases as possible, cameras will be re-deployed into their original positions so that the before and after data is comparable. Newly installed cameras will be calibrated against cameras that are being replaced in previous monitoring locations. Treatment cameras will be deployed at and within 2 km of the Goose site. Zone of influence and control and ZOI cameras will be deployed at baseline conditions and at additional locations such that ZOI and control cameras are placed in each cardinal direction from the Goose site. In order to control for potential effects of habitat, during baseline studies cameras were predominantly placed in areas of heath tundra. New cameras will also be placed in heath tundra and an analysis will be conducted using baseline data, prior to deployment, to determine the power to detect a ZOI given the number of cameras and using baseline data. Candidate locations for cameras will be chosen from vegetation maps prior to camera deployment, with final camera positioning conducted by a biologist in the field.
5. Since wind direction is an important component that can determine the distance that noise and smells travel from the Project, cameras will be placed in both upwind and downwind locations in the treatment, ZOI and control areas. Note that the predominant wind direction in the RSA is from the north-west.
6. To improve independence, cameras will not be in line of sight of each other, and will preferably be a minimum of 2 km apart. Camera separation distances within ZOI and control zones will be similar to treatment cameras to minimize differences due to clustering, although some clustering of treatment cameras is unavoidable. Cameras will be oriented to ensure the area within 40 m in front of the camera is clear so that cameras are equal in their 'trigger zone' field of view.
7. Baseline studies were conducted with 60 cameras in five transects. These cameras will be distributed evenly, with 20 each in treatment, ZOI, and control groups. Camera locations will remain fixed over the foreseeable future to allow comparability between years and to improve power over time. Each camera will be deployed over all 12 months of the year. Camera data will be collected daily using triggered photos. Statistical tests and models will be carried out on monthly data. In order to ensure that camera effort is accounted for, each camera will also take timed photos which will be examined to obtain the number of days it is active and unobscured in each month. Thus, the camera program will include approximately n=20 cameras in each of g=3 zones with m=12 months of replicate data.
8. Cameras will be mounted in a security enclosure on a wooden tripod, which will be secured with rocks and covered with a plywood cap to deter birds from landing on the camera. In some cases, cameras will be protected with plywood sides to prevent excessive snow infiltration. Lithium batteries will be used to maintain camera performance at low temperatures.
9. Cameras will be programmed to take two types of photos: timed photographs and motion-triggered photographs. During winter, timed photos will be taken from 10 am to 5 pm to conserve batteries during dark periods. Cameras will take motion-triggered photos whenever there is movement in the field of view (about 25 to 30 m). Cameras will take 10 photos at one-second intervals with each trigger. Each image records the photo type (i.e., timed [T] or motion triggered [M]), the camera number, date, time, temperature, and, for motion-triggered photos, the number from the triggered series of photos taken (i.e., 1/10 to 10/10).

Figure 8.2-1

Remote Camera Baseline Study Design (dots) and Proposed Sampling Design (circles)



Data Analysis

Camera data will be analyzed to detect differences between muskox detections at increasing distances from the Goose site by fitting a spline, using a dose-response method (Boulanger et al. 2012) or other distance-dependent methods. If there is insufficient power using these methods, then a generalized linear mixed model (GLMM) will be used to detect differences in the treatment, ZOI and control areas, which will be chosen at distances established from avoidance studies in the literature. The model will include covariates for treatment, month, and a random effect for camera. A binomial distribution was used to model the proportion of days of effort with at least one muskox detected. If more powerful tests are developed or adapted to test these data, then these methods will be used in lieu of those above.

Power will also be calculated using the *simr* package (Green and MacLeod 2016) to carry out a simulation-based power of the GLMM to detect treatment effects of 0.4, 0.7 and 1.0. These effect sizes equate to odds of 1.5, 2.0 and 2.7 respectively. The number of cameras will be set between 14 and 29 per group. Type I errors (alpha) of 0.05 and 0.10 will be assessed.

8.2.2.3 Behaviour Monitoring

Objective

The objective of behaviour monitoring for muskox is to determine the effects of potential stressors (aircraft, blasting, vehicles) on muskox.

Methods, Analysis and Reporting

Behaviour monitoring for muskox will be conducted by wildlife monitors if muskox are observed within 1 km of the Project site. The methods, analysis and reporting for behaviour monitoring will follow the behaviour monitoring methods for caribou (Section 7.2.2.2).

8.2.2.4 Contributions to Regional/Collaborative Programs with GN

Should the GN develop a regional monitoring program for muskox that will also test the FEIS prediction that muskox will avoid the Goose site, then Sabina will consider contributing to this program in lieu of the proposed regional camera monitoring program.

9. Grizzly Bear and Wolverine

9.1 MITIGATION AND MANAGEMENT FOR GRIZZLY BEAR AND WOLVERINE

9.1.1 Overview of Potential Effects to Grizzly Bear and Wolverine

Seven potential effects to VECs grizzly bear and wolverine/furbearers were evaluated in the FEIS; these included habitat loss, disturbance, disruption of movement, direct mortality, indirect mortality, attraction, and exposure to contaminants. Due to the similarities in the residual effects predicted for both VECs (i.e., grizzly bear and wolverine/furbearers), mitigation and management measures are discussed together in this section.

In addition, reduction in productivity was considered, to evaluate the potential for synergistic effects on grizzly bears and wolverine/furbearers. Limiting the potential for synergistic effects will be achieved by implementing the mitigation and management measures for the seven direct effects listed above.

Habitat loss will occur in the Project footprint where natural vegetation is removed for the construction of the Project, and habitat loss was rated as a residual effect for grizzly bears and wolverine/furbearers in the FEIS. Habitat loss will be minimized by reducing the Project footprint and carrying out reclamation activities.

Indirect habitat loss caused by disturbance, measured as the potential for grizzly bears and wolverine/furbearers to avoid the Project site, was rated as a residual effect in the FEIS. A variety of mitigation and management activities are proposed, including design mitigation to limit noise, fixed and rotary-winged aircraft management, and blasting management should grizzly bears, wolverine, and other furbearers be observed near the site.

The potential for the disruption of grizzly bear and wolverine/furbearer movement patterns due to Project roads was evaluated. With mitigation, including setting speed limits and giving all wildlife the right of way, this effect was not rated as a residual effect.

The potential for direct mortality due to vehicle collisions was evaluated for grizzly bears and wolverine/furbearers. With mitigation, including setting speed limits and giving all wildlife the right of way, this effect was not rated as a residual effect.

The potential for indirect mortality was evaluated as the potential for increased access for hunters to the Project area. With mitigation, which includes closing the winter ice road to the public and prohibiting employees from bringing firearms to the site and hunting while at work, this was not rated as a residual effect.

The primary effect evaluated for grizzly bears and wolverine/furbearers was attraction to the Project area, and this was considered a residual effect for both grizzly bears and wolverine. A variety of mitigation and management activities are proposed to limit the attractiveness of the site to wildlife such as grizzly bears, wolverine, and other furbearers, including management of wastes, constructing and maintaining buildings to exclude bears and wolverines, and monitoring for and carrying out appropriate responses to problem animals.

The potential for grizzly bears and wolverine/furbearers to be exposed to contaminants was evaluated in the FEIS through a risk assessment, which found that grizzly bears and wolverine/furbearers would not

be at risk of uptake of hazardous chemicals. A series of standard management plans for chemicals was provided in the FEIS, including fuel, spill response, marine spills, and management of hazardous materials. After management, exposure to contaminants was not rated as a residual effect for grizzly bears and wolverine/furbearers.

Unless otherwise specified, mitigation and management actions for grizzly bears and wolverine will also be conducted for other furbearers such as wolves and foxes.

9.1.2 Mitigation and Management for Habitat Loss for Grizzly Bear and Wolverine

The following mitigation and management measures will be conducted during the construction, operations, and closure phases of the Project to reduce the potential for habitat loss for grizzly bears and wolverine:

- Sabina will design the Project footprint to be as small as possible.
- Dust will be managed on the Project site by setting and enforcing speed limits on all-season on-site roads and the application of dust suppressants where and when needed. Dust suppressants will be non-toxic for wildlife. Dust deposition rates and potential effects on vegetation will be monitored as described in the Air Quality Monitoring and Management Plan (Volume 10, Chapter 17).
- Areas of the Project will be reclaimed progressively during operations and at closure to minimize the area of disturbance to wildlife as described in the Mine Closure and Reclamation Plan (Volume 10, Chapter 29). Post-closure environmental monitoring will continue until it has been verified that reclamation has successfully met closure and reclamation objectives.
- The maternal dens of wolverine will be avoided, as well as the winter dens of grizzly bears.

9.1.3 Mitigation and Management for Disturbance of Grizzly Bear and Wolverine

A series of mitigation and management strategies will be in place to reduce the potential for disturbance to grizzly bears and wolverine/furbearers. These strategies are outlined below.

9.1.3.1 Design Mitigation

The following mitigation measures will be designed into the Project to limit disturbance to grizzly bears and wolverine:

- Project equipment will be chosen to limit the continuous noise produced by equipment such as generators, heavy trucks, and other mobile equipment. All Project equipment will be fitted with appropriate mufflers and silencers and will be well maintained.
- Project facilities will be designed to limit the amount of noise that is emanated by the Project, such as housing static noise sources (e.g., the crushers, mill and generators) in buildings and using acoustic screening such as wall or berms to muffle noise.

9.1.3.2 Construction Management

The following management actions will be applied during the construction phase of the Project:

- Carnivore (wolverine, wolf and fox) dens within 2 km of the Project footprint will be identified prior to construction and avoided where possible.
- Eskers containing known carnivore dens will not be used as a source of quarry material within an appropriate buffer.

- Construction activities will be avoided within 1 km of active wolf, fox, and wolverine dens during the active season, wherever possible. Note that this is for planned activities based on results of existing baseline surveys for wildlife. If unforeseen dens are observed during pre-construction surveys, appropriate mitigation and monitoring will occur, which may include establishing a buffer distance to limit disturbance. See Section 9.1.3.7 for additional detail on avoidance of dens during construction of the winter ice road.
- If work must be conducted near or at a den site during the active season, then Sabina will liaise with the GN prior to conducting the work.
- If a wildlife feature that is legislatively protected (carnivore den) is found within the slated Project footprint, then a buffer will be established and the feature will be avoided until such time as the wildlife has completed the use of the feature (Table 9.1-1). Following wildlife leaving the site, activities within the buffer will resume and the feature may be removed from within the stated Project footprint.
- If a wildlife feature that is legislatively protected (carnivore den) is found within a buffer of 1.0 km of construction activities, then the feature will be monitored for the duration of the season and the breeding success of the wildlife VEC will be reported in the following WEMP report.

Table 9.1-1. Wildlife Sensitive Periods Applicable for Grizzly Bear and Wolverine/Furbearers to the Project

VEC	Activity	Sensitive Period
Grizzly bear dens	Denning Cub rearing	October 15 to May 7 May 7 to October 15
Wolverine dens	Denning Early pup rearing	February 21 to May 7 May 7 to July 1
Wolf dens	Natal Denning Early pup rearing	May 1 to September 15 September 15 to October 31

9.1.3.3 Operations Management

The following management actions will be applied during the operations phase of the Project:

- If a special habitat feature (active carnivore den) is located within 1.0 km or within the Project footprint during active operations, the feature will be monitored until the cubs leave the den or nest, and den success will be reported in the WEMP report.

9.1.3.4 Fixed-wing Aircraft Management

The following management actions will be applied to fixed-wing aircraft during all Project phases to limit disturbance to grizzly bears and wolverine:

- Fixed-wing pilots will remain above 610 m local ground level at all times, except when landing or taking off from the Marine Laydown Area (MLA) or the Goose Airstrip.

9.1.3.5 Helicopter Management

The following management actions will be applied to helicopters during all Project phases:

- As part of pilot induction, pilots will be informed of their responsibilities to monitor, report, and avoid grizzly bear and wolverine/furbearers and dens. Maps will be provided to pilots that identify important habitat areas for wildlife to be avoided, such as dens that are repeatedly used between seasons, such as wolf, fox, and wolverine dens.

- Pilots will adhere to the required minimum altitude limit of 300 m for aircraft flight (with the exception of take-off and landing and where low elevation surveys are required).
- Pilots will report all incidental sightings of grizzly bears and furbearers to the Environment Department.

9.1.3.6 Blasting Management

The following management actions will be applied during the construction and operations phases to limit any disturbance due to blasting on grizzly bears (not applied to other furbearers). When grizzly bears are observed by wildlife monitors (Section 7.2.1.3) or are incidentally observed (Section 9.2.1.2), the following mitigation will be triggered:

- When grizzly bears are observed by wildlife monitors or are observed incidentally at less than 2 km from the site, a site alert will be called (see Section 9.1.7.4 – Protocol for Responding to Observations of Grizzly Bear and Wolverine).
- When grizzly bears are observed within 1 km of the open pits, then blasting will be ceased until the bear moves off. Note, that a review of seven operating and/or permitted mines in the Canadian Arctic indicates that there is no precedent for setting a distance at which blasting will be halted for bears. Typically, management for bears is to prevent them from being attracted to mines and exploration camps, rather than managing disturbance to bears. The Meadowbank project uses a 500 m buffer to trigger blasting management for muskox.
- Note that mining projects in the Canadian Arctic report that grizzly bears can easily become acclimated to mining operations. If a bear is observed for more than 24 hours in proximity of the Project, then blasting may resume as long as the bear is out of the blast safety area.
- During all seasons, if any bears are within the blast safety areas—the area potentially affected by fly rock or debris—then the blast will be delayed until caribou move out of the area. The blast safety area is part of the personnel safety requirements and is determined prior to each blast.

9.1.3.7 Winter Ice Road Management

The winter ice road to the MLA will be built across lakes and portages and on the sea ice of southern Bathurst Inlet. The FEIS evaluated the potential for construction of the road to remove or disturb grizzly bear dens in the tundra and concluded that this potential effect was very unlikely because the areas preferred for denning (e.g., eskers) are not preferred for winter ice roads. During the DEIS review, the GNWT requested that pre-construction surveys be conducted for grizzly bear dens.

Considering the above, the following mitigation strategies will be implemented prior to construction of the winter ice road:

- The road portages between lakes will be planned to avoid areas with a higher chance of supporting grizzly bear denning (e.g., eskers).
- If the planned portages occur in areas preferred by grizzly bears as den sites, then pre-construction surveys will be conducted (Section 9.2.1.5).
- The following actions will be taken if a likely grizzly bear den is discovered during pre-construction surveys in order to reduce the chance of disturbance or mortality of bears:
  - marking the location of the bear den with a GPS;
  - communicating the location of the den to construction personnel;
  - avoiding the bear den by 1 km; and

- under special circumstances, implementing an exception to the 1 km buffer for logistical reasons following consultation with the GN.

9.1.4 Mitigation and Management for Disruption of Movement of Grizzly Bear and Wolverine

Mitigation and management for disruption of movement of grizzly bears and wolverine/furbearers focuses on management of the winter ice road (only for wolverine) and on-site Project roads.

The following management actions will be conducted whenever on-site roads and the winter ice road are in use:

- Traffic on all roads will be managed and monitored through a central dispatch.
- In order to reduce the frequency of traffic on the winter ice road that may deter wildlife from crossing, trucks may be grouped into convoys.
- All wildlife will be given the right of way on Project roads.

9.1.5 Mitigation and Management for Direct Mortality and Injury of Grizzly Bear and Wolverine

Mitigation and management to prevent direct mortality and injury of grizzly bears and wolverine focuses on management of roads to prevent any vehicle-wildlife collisions. Management for problem wildlife encountered at the Project is described in Section 9.1.7 Mitigation and Management for Attraction of Grizzly Bear and Wolverine/Furbearers.

The mitigation and management strategies outlined for caribou in Section 7.1.5, Mitigation and Management for Direct Mortality and Injury of Caribou are applicable for grizzly bear and wolverine/ furbearers, and will serve to reduce the potential for direct mortality and injury of grizzly bears and wolverine/furbearers.

9.1.6 Mitigation and Management for Indirect Mortality of Grizzly Bear and Wolverine

The mitigation and management strategies outlined for caribou in Section 7.1.6, Mitigation and Management for Indirect Mortality of Caribou with regards to no hunting policies and access management and human activity monitoring along site roads are applicable to grizzly bears and wolverine/furbearers and will serve to reduce the potential for indirect mortality for these species.

9.1.7 Mitigation and Management for Attraction of Grizzly Bear and Wolverine

Mitigation and management to prevent attraction of grizzly bears and wolverine/furbearers focuses on management of wastes and infrastructure design to prevent wildlife from accessing the Project. A series of mitigation and management strategies will be in place to reduce this potential effect, as outlined below.

9.1.7.1 Design Mitigation

- Design buildings to exclude wildlife (e.g., construct vents to prevent small mammals and birds from entering and install skirting around the bottom of buildings to exclude bears and wolverine).
- If wildlife are able to access buildings through damaged skirting, then skirting will be repaired immediately.
- If wildlife are able to access buildings through vents, windows, or by other means, then measures will be taken to exclude wildlife.

9.1.7.2 Wildlife Attractant Management

- Wildlife attractants will be managed to reduce the attractiveness of the site to bears and wolverines.
- If wildlife (i.e., grizzly bears and wolverine) are found to use elements of the Project infrastructure (e.g., the waste management facility), then a review of waste management activities will be triggered.
- If grizzly bears and wolverine persist in using infrastructure components despite updated waste management and site audits, then other exclusion infrastructure may be used (e.g., fencing).
- All attractants and wastes (garbage, food waste) will be stored at temporary (construction) and permanent site infrastructure in bear-proof storage containers. Bear-proof containers must be tightly secured at all times. Standard procedures for waste containers that are considered effective at preventing bears from accessing wastes will be implemented.
- Regular road and camp cleanups will be conducted to ensure that no hazardous substances, wires, or loose materials are present to endanger wildlife and to ensure proper storage and disposal of hazardous wastes.
- Waste will be removed from collection sites regularly, incinerated in an approved incinerator or stored in wildlife-proof areas and wildlife-proof buildings until incineration.
- All waste which should not be incinerated will be disposed at an approved disposal site as soon as possible.
- Landfills will be used only for disposal of non-wildlife attracting waste.

9.1.7.3 General Mitigation and Management to Reduce Human-Wildlife Interactions

- Implement facilities design and maintenance to exclude grizzly bears and wolverines, as described in 9.1.7.1.
- Ensure management of attractants, particularly wastes, as described in 9.1.7.2.
- Implement a policy of no feeding and no intentional attraction of wildlife, as well as a no littering policy.
- Disseminate protocol for human-wildlife Interactions to all employees and contractors as part of their orientation.
- Lead management responses undertaken by identified supervisors.
- Ensure all field and outdoors staff receive training on responding to grizzly bear and wolverine encounters, including identification of grizzly bear behaviour, emergency communications protocols, and the use of deterrents.
- Ensure personnel do not disturb wildlife that avoid humans and show normal feeding behaviour.
- Inform employees about and enforce disciplinary consequences of disregarding measures taken to manage problem wildlife (e.g., area closures).
- Identify appropriate personnel (i.e., environmental monitor, wildlife biologist) to monitor and evaluate human-wildlife conflicts using the protocol for human-wildlife interactions to determine whether animal should be considered a problem animal and to identify an appropriate course of action.

- Avoid destruction of wildlife unless no other recourse is possible. Grizzly bears or other wild animals that cause injury to humans as a result of natural defensive or protective behaviour (e.g., protecting its young during a startling encounter) should not be destroyed or translocated.

9.1.7.4 Protocol for Responding to Observations of Grizzly Bear and Wolverine

This section provides guidance to Project personnel for responding to grizzly bears, and to a lesser extent, wolverine, should they be observed on or near site.

The philosophy of responding to grizzly bears and wolverine can be summarized as:

1. Reduce risk to Project personnel through training and immediate response to possible grizzly bear/wolverine interactions.
2. Dissuade grizzly bears and wolverines from the Project site through management activities (managing wastes, eliminating wildlife attractants, maintaining skirting and fencing, etc.) to make the site less appealing to wildlife.
3. Only if #2 above has been implemented and if grizzly bears or wolverine persistently approach the site, or Project personnel are at risk, would any action towards the animal be taken.

The following mitigation and management actions will be conducted during all Project phases for responding to observations of grizzly bears and wolverine:

- All incidental observations of grizzly bears and wolverine (Section 9.2.1.2) from pilots, drivers, and on-site and field personnel will be immediately reported to the Environment Department.
- The Environment Department will keep a log of all grizzly bear and wolverine sightings and will communicate these sightings to field and on-site crews immediately if there is a safety concern or daily as part of morning toolbox safety meetings. Information on bear and wolverine observations will also be posted and made available to all staff.
- All field crews will scan the immediate area, either by helicopter or from the ground, prior to leaving the safety of helicopters or vehicles to conduct work.
- Field crews will regularly scan the areas around their work site approximately every five minutes.
- If field crews (i.e., those working without a vehicle or helicopter) observe a grizzly bear, they will contact the Environment Department and immediately arrange the removal of the field crew, irrespective of the distance to the grizzly bear. Note: if a grizzly bear is visible to a field crew, then the bear is already sufficiently close that procedures should be taken to remove/protect the field crew.
- The distance to the Project site will partially determine the response to a bear, including:
  - a grizzly bear observed at more than 4 km from site will be recorded, but will not trigger any management;
  - a grizzly bear observed at less than 4 km from site will trigger monitoring and a site-wide notice to alert personnel a bear is in the area;
  - a grizzly bear observed at less than 2 km from site will result in the mobilization of ground monitoring crews, prepared with appropriate deterrence options, if necessary. The helicopter may be put on notice as a deterrent option;
  - a grizzly bear observed at less than 1 km from site will result in vacating personnel from that part of the Project site, or to moving personnel indoors;

  - a grizzly bear observed less than 1 km from site and approaching camp will trigger the protocol for management responses, as outlined in Table 9.1-2.

- If personnel working on-site or near vehicles, aircraft or buildings observe a grizzly bear, personnel will immediately remove themselves from danger (e.g., take shelter in a vehicle, in a building, or leave the site) and then contact the Environment Department to report the sighting.
- If personnel working in the field or on-site observe a wolverine, wolf, or fox or if there is a problem animal reported on-site, the crew will immediately communicate the observation to the Environment Department and remove themselves from the area if the animal appears aggressive. If the animal does not appear aggressive and there are no reports of problem or habituated wolverine on-site, the crew may continue to observe the animal.
- If a grizzly bear or wolverine is observed in camps, or are repeatedly observed near camps (e.g., two or three times within a week), then this will trigger:
  - a review of waste management activities to ensure that these animals are not being attracted to site;
  - a review of camp facilities management to ensure that skirting and fencing are in good condition, and repair of any structures that may allow access for these animals;
  - an update to all personnel that a potentially habituated animal may occur on-site and that appropriate safety protocols should be implemented (e.g., post warnings, conduct area closure, etc.).
- If a grizzly bear or wolverine is observed routinely at camp, or animals are behaving in a habituated or aggressive fashion, then the Protocol for Management of Problem Wildlife (Section 9.1.7.5) will be triggered.

Table 9.1-2. Protocol to Determine Appropriate Management Responses to Human-Animal Interactions

Type of Human-Animal Interaction	Management Response Options				
	Monitor	Post Warning	Area Closure	AVCD	Destroy
1. Animal sighting or sign reported	X	X			
2. Animal showing normal feeding behaviour and avoids people	X	X			
3. Animal reacting defensively following surprise or provoked encounter (defensive aggression)	X	X	X		
4. Animal tolerates people but ignores them and their facilities (no threat present)	X	X	X	X	
5. Animal shows repeated interest in people and/or human facilities, which will likely result in food-conditioning or close approaches (habituated)	X	X	X	X	
6. Animal receives minimal or low-level reinforcement to unnatural food sources (mildly food-conditioned)	X	X	X	X	
7. Animal is heavily habituated to people and has repeatedly obtained unnatural foods (food-conditioned)	X	X	X	X	
8. Animal has previously been relocated and is unlikely to change its behaviour		X	X	X	X
9. Animal displays aggressive, offensive, or predatory behaviour and is an imminent threat to human safety		X	X	X	X

9.1.7.5 Protocol for Management of Problem Wildlife

If an animal has been identified as a "problem animal", then this protocol is triggered. The Protocol is written to address problem bears and wolverine; however, it can be modified to address other problem wildlife if necessary.

The following management options are meant to ensure the safety of personnel, and dissuade habituated or aggressive grizzly bears or wolverine from visiting the site. Ideally, this list of options would be followed sequentially as a situation develops, but managers may choose to escalate the actions taken in response to an aggressive, predatory, or injured animal as described in Table 9.1-2. Options include:

1. Monitoring: report and record wildlife sightings and signs.
2. Post warnings: provide accurate and current information of all potentially dangerous wildlife in the area.
3. Area closures: restrict worker access to areas with problem wildlife, pending suitable controls.
4. Adverse conditioning (AVCD): apply AVCD activities to problem wildlife to prevent or reverse habituation.
5. Destruction: undertake (with authorization from appropriate wildlife management authority) only when an animal is considered to pose an unacceptable hazard to human safety.

The measures taken, and their efficacy, will be evaluated and reported to the GN on an ongoing basis until the situation has been resolved, and summarized in the annual WEMP report.

The objective for this section is to result in zero injuries or mortalities to grizzly bears or wolverine. Exceedance of this objective will result in a thorough review of on-site wildlife attractant management and waste management programs. It should be noted that a wildlife injury or mortality is not required to trigger the review of these programs. As discussed above, a review of wildlife attractant and infrastructure monitoring policies is also triggered by the repeated observation of grizzly bears or wolverine on-site.

9.1.8 Mitigation and Management for Exposure to Contaminants for Grizzly Bear and Wolverine

The mitigation and management strategies outlined for muskox in Section 8.1.8, Mitigation and Management for Exposure to Contaminants for Muskox are applicable for grizzly bears and wolverine/furbearers, and will serve to reduce the potential for exposure to contaminants of these species. Sabina's fuel management plan and spill response plans are discussed in Section 6.1.3.

9.2 MONITORING FOR GRIZZLY BEAR AND WOLVERINE

This section describes monitoring and mitigation activities to minimize potential effects of the Project on grizzly bears and wolverine/furbearers that will be included in the WEMP, primarily those related to attraction to the Project. Monitoring is divided into two sections: 1) monitoring to trigger management, and 2) monitoring to evaluate the predicted effects of the Project on grizzly bears and wolverine/furbearers.

There are six types of monitoring that will trigger management:

1. monitoring for use of waste and other facilities using cameras;
2. incidental observations;
3. skirting and building monitoring;

4. waste management monitoring;
5. pre-construction surveys for grizzly bear dens on the winter ice road; and
6. monitoring for grizzly bear in relation to blasting.

Three monitoring programs are proposed for grizzly bears and wolverine/furbearers to test the predictions of the FEIS:

1. footprint monitoring to measure habitat loss in the Project footprint;
2. regional monitoring for grizzly bears and wolverine/furbearers using remote motion-triggered cameras to measure avoidance or attraction; and
3. contributions to regional GN monitoring initiatives if they will adequately test the FEIS predictions.

9.2.1 Grizzly Bear and Wolverine Monitoring to Trigger Mitigation

9.2.1.1 On-site Camera Monitoring

Objectives

The objective of the on-site camera program is to evaluate how grizzly bears and wolverine/furbearers (and other wildlife VECs) interact with the Project site; actions include:

1. monitoring the Project site to examine how grizzly bears and wolverine/furbearers interact with Project facilities (e.g., on roads, camps) particularly at locations that are not staffed for long periods of time (such as the MLA);
2. monitoring the Project site at areas with and without mitigation structures or activities to evaluate the efficacy of mitigation activities (e.g., at road-crossing structures vs. without); and
3. recording the times at which grizzly bears and wolverine/furbearers use the Project site during the year.

Triggers, Methods and Reporting

The on-site camera monitoring program will be in place throughout construction and operations of the Project.

Methods

Please see Section 7.2.1.5, On-site Camera Monitoring (for caribou) for details on the methodology and analysis for the on-site camera monitoring program.

Triggers for Adaptive Management

Observations of grizzly bears being attracted to and interacting with the Project site in ways that may cause harm to bears or employees (e.g., frequenting the waste management facility) will trigger adaptive management to review the causes for why bears are attracted and to provide mitigation.

Reporting

Data and analyses will be reported in the annual WEMP Report.

9.2.1.2 Incidental Observations

Objectives

For grizzly bear and wolverine/furbearers, the objectives of the incidental observation program are to collect information on the timing and occurrence of these carnivores on the Project site, trigger suitable management, and to record unusual or unexpected interactions between these animals and the Project.

Triggers for Monitoring

The incidental observation monitoring program will be in place throughout construction and operations of the Project.

Methods

Incidental observations of grizzly bears and wolverine/furbearers will be recorded by all Project personnel, including environmental monitors, pilots, drivers on on-site and winter ice roads, and other Project personnel. More details are available in Section 7.2.1.4, Incidental Observations (for caribou).

All observations will be recorded by the Environment Department in the wildlife log.

Triggers for Adaptive Management

Six activities may be triggered by the observation of grizzly bears:

1. A spike in the number of bears observed at site will trigger adaptive management.
2. Should grizzly bears be observed near the site, personnel will alert the Environment Department, which may trigger monitoring by environment personnel and mitigation actions.
3. Should pilots observe grizzly bears (and other wildlife) while flying, pilots will avoid bears.
4. Should drivers observe grizzly bears on or adjacent to the road, they will give bears the right of way.
5. Should grizzly bears be observed within prescribed distances of active blasting, then monitoring will be conducted and blasting schedules may be modified (see Section 9.2.1.6).
6. Should unexpected observations be made of wildlife in distress (injured, etc.), then the Environment Department and the appropriate regulator will be notified.

Reporting

Data, analyses, and adaptive management will be reported in the annual WEMP Report.

9.2.1.3 Skirting and Building Monitoring

Objective

The objective of skirting and building monitoring is to evaluate whether mitigation measures to exclude bears and wolverine/furbearers from Project buildings and other infrastructure has been successful and to trigger appropriate management.

Methods

Environmental staff will monitor skirting and fencing on a monthly basis. Monitors will walk the perimeter of the skirting/fencing looking for damage, downed fencing, animals, or animal sign inside the fence.

Cases where the fence/skirting has been damaged or breached will be recorded in an inspection log, and may include the following information:

- damage to the fencing or materials that may be causing the fence to be ineffective (i.e., snow, vegetation); and
- any wildlife observed accessing through the fencing/skirting.

Prior to construction of the Project, a detailed SOP will be produced and distributed to the NIRB and the KIA for review and comment. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

Data Analysis

The results of the regular infrastructure monitoring and any management actions taken will be collated into a database and tracked for changes between years and whether any changes are related to specific activities or mitigation actions.

Triggers for Adaptive Mitigation

Damaged skirting and fencing will be reported to maintenance staff and trigger either immediate repair or installation of new/additional skirting and fencing.

Reporting

Results of regular infrastructure monitoring and any triggered management will be reported in the annual WEMP report.

9.2.1.4 Waste Management Monitoring

Objective

The objective of waste management monitoring is to evaluate if waste management is being effective and not producing an attractant for wildlife, such as grizzly bears and wolverines.

Methods

Waste monitoring is divided into four parts:

1. incidental observations of misdirected wastes;
2. regular surveys of waste facilities;
3. records of observations of wildlife at waste facilities; and
4. an annual audit of waste management and camps.

All staff will be responsible for recording incidental observations of misdirected wastes or inappropriate waste storage. All personnel will report to the Environment Department when they observe waste disposed of in a manner that could attract wildlife (i.e., littering, misdirected waste, uncontained waste, wildlife accessing waste). Waste disposal facilities will be monitored weekly by environmental or operations staff to ensure that wastes are being properly disposed of and inspected for signs of wildlife activity (e.g., chew marks on waste, wildlife-mediated waste dispersion, wildlife scat or tracks).

Cases of misdirected waste or wildlife-waste interaction will be recorded in a waste inspection log, which will include the location, date, and time; type and amount of waste; and any damage to mine property.

Any incidents where wildlife have accessed wastes will be reported to environment personnel. Problem wildlife may be evaluated by environment personnel and corrective measures implemented in consultation with the Nunavut Department of Environment.

In addition, an annual audit will be conducted of the various camps and facilities to evaluate any opportunities for improvement in the handling of wastes and wildlife attractant management. Prior to construction of the Project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

Data Analysis

The results of the regular waste management measures and the annual audit of the site will be collated into a database and tracked for changes between years and whether any changes are related to specific activities or mitigation actions.

Triggers for Adaptive Mitigation

- Waste management activities may be triggered by observations of misdirected wastes.
- Incidental observations of grizzly bears, wolverines or foxes on the site will trigger waste management monitoring.
- Repeated observations of grizzly bears, wolverines or foxes, which are known to be attracted to camps and facilities, will trigger waste management monitoring (including a site audit if there are several observations in a month) and a review of the wildlife attractant management measures (Section 9.1.7.2).

Reporting

Results of regular waste monitoring, the annual audit, any mitigation that has been conducted, and the success of that mitigation will be reported in the annual WEMP report.

9.2.1.5 Pre-Construction Surveys for Grizzly Bear Dens on the Winter Ice Road

Objectives

The objective of bear den monitoring is to reduce the chance of direct bear mortality due to construction of the winter ice road on locations where bears may have built dens.

Monitoring Methods

Monitoring methods will follow a four-step process:

1. The types of places where grizzly bears choose to den are relatively well understood. Bears are thought to choose areas of deep, dry soil and woody vegetation to coalesce the roof of the den – such as the lower slopes of eskers. The first step in identifying dens will be to identify the locations where the proposed road overlaps areas most likely to support denning, using terrain data from Terrestrial Ecosystem Mapping conducted in the Local Study Area for the DEIS.
2. During the detailed engineering and planning phase for the winter ice road to the MLA, engineers and biologists will use the data provided in step #1 and conduct a detailed field inspection of the road route. Field observations will be used to supplement the areas identified in #1 above.
3. Where possible, the road route will be altered to avoid these areas identified in #1 and #2 to reduce the chance of affecting a bear den.

4. If it is not possible to avoid an area where grizzly bears may den, then pre-construction surveys will be conducted using Forward Looking Infrared (FLIR) or other applicable methods as technology and success of the program determines.

Data Analysis

Maps of higher likelihood denning sites, along with the results of pre-construction surveys, will be recorded in a database and maintained throughout the life of the Project.

Triggers for Adaptive Mitigation

If monitoring identifies a bear den, then a suitable buffer will be set up for the den (Section 9.1.3.7).

Reporting

All reports of bear dens will be included in the annual WEMP report.

9.2.1.6 Monitoring for Grizzly Bear in Relation to Blasting

Objectives

The objective of this monitoring program is to trigger appropriate mitigation measures should grizzly bears be observed close to the pits during above-ground blasting (Section 9.1.3.6).

Triggers for Monitoring

Monitoring will be conducted prior to blasts (Section 7.2.1.3).

Methods

As wildlife monitors are conducting pre-blast surveys, they will record any grizzly bears. See Section 7.2.1.3 for detailed methods.

Triggers for Adaptive Management

If any number of grizzly bears are observed within 1 km of the location of above-ground blasting, then adaptive management will be triggered (Section 9.1.3.6). If grizzly bears are observed closer to the site of the blast (within 500 m), then an additional set of adaptive management will be triggered.

Reporting

Data, analyses, and adaptive management actions will be reported in the annual WEMP report.

9.2.2 Grizzly Bear and Wolverine Monitoring to Measure Predicted Effects

9.2.2.1 Footprint Monitoring

Objective

The objective of footprint size monitoring is to measure the actual habitat lost within the constructed Project footprint for each wildlife VEC.

Methods

See Section 7.2.2.1, Footprint Monitoring (for caribou) for a description of this Program, including triggers, methods, adaptive management and reporting.

9.2.2.2 Regional Monitoring of Grizzly Bears with Motion-triggered Cameras

The FEIS predicted that grizzly bears and wolverine/furbearers may avoid the Project mine site (the Goose site) due to disturbance, or may be attracted to the Goose site. The objective of the regional camera monitoring program is to determine if grizzly bears and wolverine/furbearers are avoiding or attracted to the Goose Site. This program will be the same as that used for muskox (Section 8.2.2.2).

9.2.2.3 Contributions to Regional Programs with GN

Should the GN develop a regional monitoring program for grizzly bears and wolverine that they can show will also test the FEIS prediction that grizzly bears and wolverine/furbearers will be either attracted to or avoid the Goose site, then Sabina will consider contributing to this program in lieu of the proposed regional camera monitoring program.

10. Raptors

10.1 MITIGATION AND MANAGEMENT FOR RAPTORS

10.1.1 Overview of Potential Effects to Raptors

Potential effects to raptors were evaluated in the FEIS; these included habitat loss, disturbance, disruption of movement, direct mortality, indirect mortality, attraction, and exposure to contaminants. Mitigation and management measures to reduce the potential for these effects to result in residual effects on raptors are discussed in this section.

In addition, reduction in productivity was considered to evaluate the potential for synergistic effects on raptors. Limiting the potential for synergistic effects will be achieved by implementing the mitigation and management measures for the seven direct effects listed above.

Habitat loss will occur in the Project footprint where natural vegetation is removed for the construction of the Project, and habitat loss was rated as a residual effect in the FEIS. Habitat loss will be minimized by reducing the Project footprint and carrying out reclamation activities.

Indirect habitat loss caused by disturbance was rated as a residual effect for raptors in the FEIS. A variety of mitigation and management activities are proposed, including design mitigation to limit noise, management of construction and operations activities to limit disturbance, and fixed and rotary-winged aircraft management to limit disturbance to raptors, particularly those nesting near the Project.

Disruption of movement for raptors due to the Project was not considered a residual effect in the FEIS because there will be no tall structures in the Project design that may impede movements of raptors on their home ranges, and migratory movements are typically done at high altitudes well above the Project.

The potential for direct mortality due to collisions with vehicles and aircraft, in addition to blast rock, was rated as a residual effect in the FEIS. A variety of mitigation and management activities are proposed, including blasting management and mitigation to limit disturbance to reduce the potential for mortality of raptors nesting near the Project.

The potential for indirect mortality was evaluated as the potential for increased access for hunters to the Project area. The lack of hunting for raptors, along with mitigation measures that include prohibiting employees from bringing firearms to the site and hunting while at work, this was not rated as a residual effect.

The potential for raptors to be attracted to the Project site, in particular for nesting opportunities in open pits and quarries, was rated as a residual effect in the FEIS. A variety of mitigation and management activities are proposed to reduce the chances of successful nesting within open pits and quarries, such as tactics to dissuade or deter raptors from establishing nests in areas of active work.

The potential for raptors to be exposed to contaminants was evaluated in the FEIS through a risk assessment, which found that raptors would not be at risk of uptake of hazardous chemicals. A series of standard management plans for chemicals was provided in the FEIS, including fuel, spill response, marine spills, and management of hazardous materials. After management, exposure to contaminants was not rated as a residual effect for raptors.

10.1.2 Mitigation and Management for Habitat Loss for Raptors

The mitigation and management strategies outlined for muskox in Section 8.1.2 Mitigation and Management for Habitat loss for Muskox are applicable for raptors, and will serve to reduce the effects of habitat loss on this VEC.

10.1.3 Mitigation and Management for Disturbance of Raptors

A series of mitigation and management strategies will be in place to reduce the potential for disturbance to raptors. These strategies are outlined below.

10.1.3.1 Design Mitigation

See Section 7.1.3.2 Design Mitigation (for caribou) for design measures to limit disturbance from Project infrastructure and activities applicable to all wildlife.

10.1.3.2 Construction Management

All raptor nesting sites in the LSA were identified as part of baseline studies. There are no raptor nesting sites within the proposed footprint area and only two nesting sites within 1.5 km of the Project site. The following management actions will be applied during the construction phase of the Project:

- Situate Project infrastructure to avoid active raptor nests, where possible.
- Schedule construction activities, where possible, to avoid disturbance of known raptors nests within 1.0 km during the nesting period: April 15 to August 15.
- During ground clearing, if it is not possible to avoid the nesting period, then conduct pre-construction surveys for raptor nests.
- If a raptor nest is found during pre-clearing surveys within the slated Project footprint, then the Environment Manager will set up a buffer with an objective of 1.5 km, but of at least 100 m, around the nest site. The nest will be monitored and the breeding success of the raptor will be reported in the WEMP (Section 10.2.1.2).
- The results of pre-construction surveys and the mitigation actions taken, including the exact buffer distance employed for any nest sites recorded during pre-clearing surveys, will be reported in the next Wildlife Mitigation and Monitoring Program Report or directly to appropriate regulators on a case-by-case basis to advise on the management response, if necessary.
- Prior to removal or deterrence of raptors, the Proponent will contact the GN to discuss proposed mitigation options as listed in the WMMP Plan, and will obtain the required permit prior to undertaking any activity that can lead to the destruction of raptor nests or the deterrence of raptors from nesting sites.

10.1.3.3 Operations Management

The following management actions will be applied during the operations phase of the Project:

- Project infrastructure (e.g., buildings, towers, etc.) will be constructed and maintained in such a way as to limit the attractiveness as a nesting site to raptors.
- Raptors can become acclimated to human activities and will build nests on infrastructure. If a raptor builds a nest on Project infrastructure (e.g., building, towers, etc.) then normal operations at that site can continue. The Environment Manager will manage the area surrounding the nest such that no new activities will be conducted within 100 m of the active raptor nest, but existing

activities can continue. The nest will be reported to the GN and monitored to determine the nest success, which will be reported in the WEMP.

10.1.3.4 Fixed Wing Aircraft Management

See Section 7.1.5.6 Fixed Wing Aircraft Management (for caribou) for measures to limit disturbance from fixed-wing air traffic applicable to all wildlife.

10.1.3.5 Helicopter Management

The following management actions will be applied to helicopters during all Project phases:

- As part of pilot induction, pilots will be informed of their responsibilities to monitor, report, and avoid raptors. Maps will be provided to pilots that identify areas with concentrations of wildlife during certain seasons, including areas with raptor nests.
- Pilots will avoid raptor nests by at least 650 m.
- Pilots will report all incidental sightings of raptors and raptor nests to the Environment Department.

10.1.4 Mitigation and Management for Disruption of Movement of Raptors

The Project is not expected to disrupt the movements of raptors within their territory during the breeding season nor during annual migratory movements.

10.1.5 Mitigation and Management for Direct Mortality and Injury of Raptors

Mitigation and management to prevent direct mortality and injury of raptors focuses on management of roads and aircraft at the landing strip to prevent any vehicle-raptor collisions, as well as blasting management for raptors that may choose to nest in open pits and quarries.

Management to prevent direct mortality of raptors on roads will include:

- Road-kill will be removed from the road and disposed using approved methods (i.e., incineration or transport away from the Project site) to avoid attracting carrion feeders to the roadside.

Cliff-nesting raptors can be attracted to mining pits as nesting sites. Management to prevent mortality to raptors in open pits and quarries include:

- The open pits will be monitored for raptor nesting (Section 10.2.1.1).
- If a raptor nest is observed being constructed in a pit, but the raptor has not yet laid eggs, then the nest will be removed by environment personnel.
- If locations are found that are frequently used as nests, then appropriate mitigation will be used to dissuade raptors from using this area (e.g., netting, bird spikes, etc.).
- If a raptor persist in attempting to nest in the pits despite the mitigation listed above, then raptors will be excluded from the pits using auditory or visual hazing methods (e.g., bear bangers, bright lights, playback of raptor calls, flashers, models of raptors, etc.).
- Sabina will contact the GN to discuss the proposed mitigation options and obtain an appropriate permit prior to conducting any of these activities.

10.1.6 Mitigation and Management for Indirect Mortality of Raptors

The mitigation and management strategies outlined for caribou in Section 7.1.8 Mitigation and Management for Indirect Mortality of Caribou with regards to no-hunting policies, access management, and human activity monitoring along site roads are applicable to raptors and will serve to reduce the potential for indirect mortality for this VEC.

10.1.7 Mitigation and Management for Attraction of Raptors

Monitoring and management for raptors attracted to the open pits as nesting sites is discussed in Section 10.1.7 and management for raptors attracted to nest on Project infrastructure is discussed in Section 10.1.3.3.

10.1.8 Mitigation and Management for Exposure to Contaminants for Raptors

The mitigation and management strategies outlined for muskox in Section 8.1.8, Mitigation and Management for Exposure to Contaminants for Muskox are applicable for raptors, and will serve to reduce the potential for exposure to contaminants of these species. Sabina's fuel management plan and spill response plans are discussed in Section 6.1.3.

10.2 MONITORING FOR RAPTORS

This section describes monitoring and mitigation activities to minimize potential effects of the Project on raptors that will be included in the WEMP.

This section is divided into two subsections, the first describing the monitoring that will be conducted to trigger mitigation activities designed to minimize impacts to raptors, and the second describing monitoring to evaluate the potential effects of the Project on raptors.

Three types of monitoring have been proposed that will trigger mitigation activities designed to minimize impacts to raptors. These monitoring programs are:

1. pit and quarry wall nest monitoring;
2. pre-clearing surveys for raptor nests; and
3. incidental observations.

Two types of monitoring of raptors to measure predicted effects will be carried out:

1. measurement of habitat loss in the Project footprint; and
2. regional monitoring for raptors (aerial nest surveys).

10.2.1 Raptor Monitoring to Trigger Mitigation

10.2.1.1 Pit and Quarry Wall Nest Monitoring

Objectives

The objective of the pit and quarry wall nest monitoring is to identify active raptor nests at risk of disturbance from blasting activities, and implement mitigation to exclude raptors prior to nest building.

Trigger for Monitoring

Nest monitoring at pit and quarry sites will be conducted during the raptor nesting period if blasting is planned, to ensure that adults are excluded from the pit and cannot nest build.

Monitoring Methods

Nest surveys will be conducted in pit and quarry areas scheduled for blasting during the raptor breeding period by qualified personnel (i.e., biologists trained in bird identification and behaviour) on a weekly or bi-weekly basis. Standard methods will include a two-person team: one scans the pit walls for roosting raptors or nest-building while the other scans the sky for raptors.

Observations of birds, nests, and nesting activity such as nest construction, copulations, incubation, perching, food deliveries, and territorial displays will trigger deterrents. Additional monitoring will be conducted to confirm that deterrents were successful and the raptor has left the pit, or to trigger additional deterrents. Deterrents can include bear bangers, air cannons, and call playback device. Fencing may also be placed over a nesting site to exclude raptors from a particular location. Additional monitoring may be triggered when raptors are observed returning to the pit after deterrents have been used. Monitoring may then be conducted several times per day.

In all instances, environment staff will identify opportunities for protecting established nests. In some cases, raptors may attempt to nest in areas of the pit sufficiently removed from blasting locations that there is little chance of raptor injury or disturbance by blasting. In these cases, and after informing GN, the raptors may be left to nest in the pit or quarry location. These raptors would then be monitored until the chicks have fledged the nest.

Prior to construction of the Project, a detailed SOP will be produced and distributed to the NIRB and the KIA for review and comment. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

Data Analysis

Records of pit nest monitoring, including the dates monitored, the identity of the crew, the results of monitoring, any management actions taken and the success of these methods will be collated into a database.

Triggers for Adaptive Mitigation

Observations of raptors attempting to nest in the pit will trigger adaptive management measures, as listed in the methods section above.

Reporting

Results of monitoring, including the dates, personnel, observations, use of deterrents and effectiveness of deterrents, will be recorded and reported in the annual WEMP report.

10.2.1.2 Pre-clearing Surveys for Raptor Nests

Objectives

The objective of pre-clearing surveys for nests is to identify active bird (i.e., raptor, waterbird, upland bird, and marine bird) nests that are at risk of disturbance from construction activities and thereby trigger appropriate management (Section 10.1.3).

Trigger for Monitoring

Pre-clearing surveys would be triggered whenever vegetation clearing is planned during the bird breeding season, which for raptors spans April 15 to August 15. It should be noted that pre-clearing surveys for raptor nests is largely directed towards species that nest on the ground, which would include short-eared owl, snowy owl, and northern harrier. All other raptor species that occur at the Project are cliff-nesting species and would not be at risk from ground-clearing activities.

Monitoring Methods

During the DEIS review, the Canadian Wildlife Service (CWS) requested that disturbance due to nest searches be minimized. This will be accomplished in three ways: 1) clearing work will avoid the bird breeding season, 2) should clearing work be required in the bird breeding season it will be focused (where possible) in vegetation communities that support lower densities of birds (thereby removing the need to conduct surveys in higher density nesting areas), and 3) survey methods that minimize disturbance to nests will be used. Note that the methods described below were designed for all bird species but some methods may not be directly applicable to one specific group (e.g., breeding behaviour cues are largely based on behaviours exhibited by upland birds and are not applicable to raptors).

Baseline surveys indicated that wetland and shrubby vegetation communities supported approximately 50% higher densities of nesting birds than did upland, dry lichen habitats. Where there are options, work will avoided in wetland and shrubby areas and focused on dry upland areas. Thus, the higher density of nests in wetland and shrubby areas can be preserved without the need for nesting surveys.

Nest surveys will be conducted within an appropriate period (suggested 14 days) in areas scheduled to be cleared for construction using standard observation techniques by qualified personnel (i.e., biologists trained in bird ecology and behaviour). Several survey methods are available for nest searching which trade off accuracy and the amount of disturbance to nesting birds. The choice of methods will be left to the discretion of the surveyors based on the habitat type, season, and topography with the proviso that they will reduce disturbance to birds as much as possible. As a guide, surveyors will walk transects through the area slated for clearing, each following a transect 15 m apart from the adjacent surveyor. Observers will stop every 25 m and note all birds within a 50-m radius.

To be as non-intrusive as possible, observers will record all evidence of potential breeding behaviour for all species observed; this could include observations of singing males, territorial and courtship displays, copulation, alarm calls, or detections of birds carrying nest material or food. Observers will note the approximate location of the nest, taking precautions to avoid approaching the nest as much as possible, and trigger the applicable work setback distances. Observers will not mark the nest with flags or tape, such that predators are not alerted to the presence of the nest. Observers will use a GPS to mark bird territories and nest sites.

Prior to construction of the Project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

Data Analysis

Records of pre-clearing surveys conducted (e.g., the locations, date, GPS track of surveyors, etc.) and the results of the surveys (birds observed, status, evidence of nests) along with any mitigation that has been triggered will be collated into a database.

Triggers for Adaptive Mitigation

The observation of a nesting bird in an area slated for development will trigger communications with the GN (raptors) or CWS (upland breeding birds), depending on the species, and will trigger adaptive management, in the form of setting a work buffer around the nest, as described in Section 10.1.3.

Reporting

The results of pre-clearing surveys for nests and the corrective action taken will be reported in the annual WEMP report.

10.2.1.3 Incidental Observations

Incidental observations of wildlife will be recorded by all Project personnel, including environmental monitors, pilots, drivers on on-site and winter ice roads, and other Project personnel during the construction and operations of the Project. Further details on the incidental wildlife program, including methods, are described in Section 7.2.1.4, Incidental Observations (for caribou).

There will be one adaptive management trigger if raptors are observed on or near the Project site. Incidental observations of raptors in the pits or quarries will trigger Pit and Quarry Wall Nest Monitoring (Section 10.2.1.1), and may in turn trigger mitigation to exclude the raptors (also described in Section 10.2.1.1)

In addition, any incidental observations of raptors that have chosen to nest on Project infrastructure will be reported to the Environment Department. On-site environmental monitors will monitor the nest and determine the nest success, which will be reported in the WEMP report

10.2.2 Raptor Monitoring to Measure Predicted Effects

10.2.2.1 Footprint Monitoring

Objective

The objective of footprint size monitoring is to measure the actual habitat lost within the constructed Project footprint for each wildlife VEC.

Methods

See Section 7.2.2.1, Footprint Monitoring (for caribou) for a description of this Program, including triggers, methods, adaptive management and reporting.

10.2.2.2 Regional Surveys for Raptors

Objective

The objective of regional monitoring for raptors is to evaluate if raptors are disturbed by Project activities, resulting in lower nesting success.

Trigger for Monitoring

The raptor monitoring program is proposed for every three years of construction and operations.

Methods

Raptor nests in the RSA will be monitored to determine distribution, occupancy, and productivity, following methods used during baseline surveys (Rescan 2013, 2014). Surveys will include two groups of nests: 1) nests within 1.5 km of Project infrastructure (the test group), and 2) nests in undisturbed reference areas within 10 km of the Project site.

The nests to be monitored will be determined during the first year of study. Surveyors will return to nests identified and monitored during baseline surveys and will evaluate each nest for safety of the survey crew. In some cases, baseline surveys indicated that nests were located on cliffs above lakes, which can be a safety concern for helicopter-based surveys. Surveyors will rate the safety of each nest and determine which nests to include in the long-term monitoring program. The number of nests will be determined through a power analysis to be conducted on existing baseline data prior to the first monitoring survey. Detailed methods will be described in the WMMP Plan prior to construction of the Project.

Data Analyses

Data analyses will be conducted to determine trends over time in the distribution, occupancy rate, and productivity rate of raptors in test sites (within 1.5 km of mine infrastructure) and at reference sites. An analysis will also be conducted to determine if a ZOI is detectible at various distances from the Project site.

Triggers for Adaptive Mitigation

Results indicating lower breeding success by raptors near the Project site will trigger a review of Project activities to identify if there are adaptive management activities that can reduce any potential disturbance to raptors.

Reporting

Data and the results of analyses will be reported in the annual WEMP report.

11. Waterbirds

11.1 MITIGATION AND MANAGEMENT FOR WATERBIRDS

11.1.1 Overview of Potential Effects to Waterbirds

Seven potential effects to waterbirds, which includes ducks, coots, and loons, were evaluated in the FEIS; these included habitat loss, disturbance, disruption of movement, direct mortality, indirect mortality, attraction, and exposure to contaminants. Mitigation and management measures to reduce the potential for these effects to result in residual effects on waterbirds are discussed in this section.

In addition, reduction in productivity was considered to evaluate the potential for synergistic effects on waterbirds. Limiting the potential for synergistic effects will be achieved by implementing the mitigation and management measures for the seven direct effects listed above.

Habitat loss will occur in the Project footprint where natural vegetation is removed for the construction of the Project, and habitat loss was rated as a residual effect in the FEIS. Habitat loss will be minimized by reducing the Project footprint and carrying out reclamation activities.

Indirect habitat loss caused by disturbance was rated as a residual effect for waterbirds in the FEIS. A variety of mitigation and management activities are proposed, including design mitigation to limit noise, and fixed and rotary-winged aircraft management to limit disturbance to waterbirds.

Disruption of movement for waterbirds due to the Project was not considered a residual effect in the FEIS because waterbirds typically migrate at higher altitudes and there will be no tall structures in the Project design.

The potential for direct mortality due to collisions with vehicles and aircraft was evaluated in the FEIS. With mitigation, including setting speed limits and giving all wildlife the right of way, this effect was not rated as a residual effect.

The potential for indirect mortality was evaluated as the potential for increased access for hunters to the Project area. With mitigation, which includes prohibiting employees from bringing firearms to the site and hunting while at work, this effect was not rated as a residual effect.

The potential for waterbirds to be attracted to the Project site, in particular to man-made waterbodies such as the TSF, and to be exposed to chemicals of potential concern, was evaluated in the FEIS. With mitigation, including monitoring of water quality within Project ponds (constructed for the collection of runoff water and as a cap on the TSF) and implementing exclusion measures if waterbirds are using Project ponds where water quality does not wildlife guidelines, this effect was not rated as a residual effect.

The potential for waterbirds to be exposed to contaminants was evaluated in the FEIS through a risk assessment, which found that waterbirds would not be at risk of uptake of hazardous chemicals. A series of standard management plans for chemicals was provided in the FEIS, including fuel, spill response, marine spills, and management of hazardous materials. After management, exposure to contaminants was not rated as a residual effect for waterbirds.

11.1.2 Mitigation and Management for Habitat Loss for Waterbirds

Mitigation and management to reduce potential effects of habitat loss for waterbirds includes:

- Sabina has designed the Project footprint to be as small as possible and outside of sensitive areas for waterbirds, including identified staging areas from TK and baseline studies.
- Dust will be managed on the Project site by setting and enforcing speed limits on all-season on-site roads and the application of dust suppressants where and when needed. Dust suppressants will be non-toxic for wildlife. Dust deposition rates and potential effects on vegetation will be monitored as described in the Air Quality Monitoring and Management Plan (Volume 10, Chapter 17).

11.1.3 Mitigation and Management for Disturbance of Waterbirds

A series of mitigation and management strategies will be in place to reduce the potential for disturbance to waterbirds. These strategies are outlined below.

11.1.3.1 Design Mitigation

The following mitigation measures will be designed into the Project to limit disturbance to waterbirds:

- Project buildings will be constructed and equipment will be chosen to limit the continuous noise produced by equipment such as generators, heavy trucks and other mobile equipment.

11.1.3.2 Construction Management

The following management actions will be applied during the construction phase of the Project:

- Construction and operations activities will be scheduled, where possible, to avoid disturbance to waterbirds and upland breeding birds during the nesting period of May 15 to August 15.
- If construction is planned in waterbird habitat (lake margins and wetlands) or upland breeding bird during the nesting period, then Sabina will conduct pre-construction surveys for nests within 7 days prior to clearing. Surveys will be repeated if clearing activities do not occur within 7 days of the original survey.
- If a waterbird nest is found during pre-clearing surveys then the Environment Manager will set up a buffer surrounding the nest, and the nest will be monitored for breeding success, which will be reported in the WEMP.
- The results of pre-construction surveys and the mitigation actions taken, including the exact buffer distance employed for any nest sites recorded during pre-clearing surveys, will be reported in the WEMP report.
- The objective of the Environment Manager will be to use the species-specific buffers suggested by Environment and Climate Change Canada (ECCC) in Table 11.1-1 and will endeavor to do so in all cases. Should the Environment Manager feel that the minimum buffer distance is inoperable, then the Environment Manager will contact ECCC for advice on mitigation activities. If the suggested buffer cannot be implemented for logistical reasons, the Environment Manager will ensure that a minimum buffer of at least 30 m will be enforced.
- If a nest must be removed for logistical reasons, Sabina will contact ECCC prior to removing the feature.

Table 11.1-1. Recommended Buffer Distances for Waterbird Nest Sites Found during Pre-clearing Surveys

Species Group	Suggested Buffer (m)
Gulls and Terns	300
Ducks*	150
Geese*	500
Loons, Tundra swan, and Sandhill crane*	750 - 1000

** range is dependent on species-specific guidelines advised by Environment and Climate Change Canada (2016)*

11.1.3.3 Fixed-wing Aircraft and Helicopter Management

See Section 7.1.3.4 Fixed-sing Aircraft Management (for caribou) for measures to limit disturbance from fixed-wing air traffic applicable to all wildlife. In addition to these measures, the following management actions will be applied specifically for waterbirds:

- As part of pilot induction, pilots will be informed of their responsibilities to monitor, report, and avoid waterbirds. Maps will be provided to pilots that identify areas with concentrations of waterbirds during certain seasons, including areas such as lakes used for staging by waterbirds.
- Reduce disturbance to colony-nesting birds and important staging areas during sensitive periods by maintaining an aircraft flight altitude of at least 650 m during horizontal (point to point) flights. The two waterbird staging areas closest to the Project are on Beechey Lake, approximately 35 km south of the Goose site, and at an unnamed lake approximately 15 km north of the George site.
- Reduce disturbance to known colonies of nesting, feeding, or moulting birds or known staging areas by maintaining a distance of 3 km from colonies of birds. TK and baseline surveys did not identify any colony nesting sites for waterbirds in the RSA.
- Pilots will report all incidental sightings of significant aggregations of waterbirds to the Environment Department.

11.1.4 Mitigation and Management for Disruption of Movement of Waterbirds

The Project is not expected to disrupt the movements of waterbirds during annual migratory movements.

11.1.5 Mitigation and Management for Direct Mortality and Injury of Waterbirds

Mitigation and management to prevent direct mortality and injury of waterbirds includes:

- pre-clearing surveys for nests prior to ground clearing during the breeding season (Section 11.2.1.2); and
- management of the airstrip to prevent any aircraft-bird collisions, such as surveying the airstrip prior to aircraft landing and taking off.

11.1.6 Mitigation and Management for Indirect Mortality of Waterbirds

The mitigation and management strategies outlined for caribou will also reduce the potential for indirect mortality for waterbirds, including the no-hunting policy for Project personnel and the closure of the winter ice road to the public (Section 7.1.6).

11.1.7 Mitigation and Management for Attraction of Waterbirds

Mitigation for attraction of waterbirds to Project ponds and exposure to water that may not meet wildlife guidelines is described in the following section.

11.1.8 Mitigation and Management for Exposure to Contaminants for Waterbirds

Standard mitigation and management strategies to prevent all wildlife from being exposed to contaminants is outlined for muskox in Section 8.1.8. Should waterbirds be attracted to the Tailings Storage Facility (TSF), monitoring and management to reduce any potential exposure of waterbirds to contaminants will include:

- Sabina will monitor the quality of water in the TSF, as described in the Site Water Monitoring and Management Plan (FEIS, Volume 10, Chapter 7).
- If the water in the TSF does not meet wildlife guidelines for waterbirds, then the TSF will be monitored to determine if waterbirds use the TSF during staging and breeding periods (Section 11.2.1.1).
- If the TSF contains water that does not meet wildlife guidelines and waterbirds are actively using the TSF, then adaptive management will be undertaken to exclude waterbirds from the TSF.
- The choice of exclusion methods will be an evolving process. Guidance will be taken from: Cassady St. Clair, 2014. *Final Report of the Research on Avian Protection Project* (2010-2014). Prepared for Alberta Justice, Edmonton, Canada.
- Sabina's fuel management plan and spill response plans are discussed in Section 6.1.3.

11.2 MONITORING FOR WATERBIRDS

This section describes monitoring activities for waterbirds to 1) trigger mitigation, and 2) evaluate potential effects of the Project on waterbirds. Three types of monitoring have been proposed that will trigger mitigation activities designed to minimize impacts to waterbirds. These monitoring programs are:

1. waterbird monitoring in ponds;
2. pre-clearing surveys for waterbird nests; and
3. incidental observations.

Two types of monitoring will measure predicted effects:

1. footprint monitoring to measure habitat loss in the Project footprint; and
2. regional monitoring for waterbirds (aerial and ground surveys).

Prior to construction, or first shipment, for the Project, Sabina will meet with ECCC and other interested parties, on the regional monitoring priorities, objectives and methods for Waterbird and Marine Bird VECs.

11.2.1 Waterbird Monitoring to Trigger Mitigation

11.2.1.1 Waterbird Monitoring on Project Ponds

Objectives

The objective for waterbird monitoring in on-site ponds is to determine if waterbirds are using the TSF, and thereby trigger management to exclude waterbirds.

Background and Trigger for Monitoring

If the water quality of the ponds does not meet wildlife guidelines, then waterbird monitoring will be undertaken at these ponds during all Project phases. This monitoring will be conducted weekly during Construction, Operations and Reclamation/Closure and twice yearly during Temporary Closure and Care and Maintenance as described below:

- Monitor the quality of water in on-site project ponds, as outlined in the Site Water Monitoring and Management Plan;
- If the water in project ponds does not meet wildlife guidelines for waterbirds, then monitor these ponds for waterbirds during staging and breeding periods; and
- If ponds contain water that does not meet wildlife guidelines and waterbirds are actively using these ponds, waterbird exclusion measures will be employed.

Monitoring Methods

Waterbird activity within the TSF and other Project contact or saline water storage areas, such as open pits infilled with contact or saline water or the Saline Water Pond, will be monitored.

Monitoring will be conducted using 1) stationary wildlife cameras, or 2) by a qualified person trained in bird ecology and behaviour. Camera studies would use cameras stationed on the rim of the TSF, programmed to take motion-triggered and timed photos. The ability to identify birds on the TSF using cameras would be ground-truthed prior to implementation of this program.

Monitoring by a person in the field would be conducted daily during the spring migration (late May) and weekly during the rest of the waterbird season. Surveys will be a fixed-duration scan sample using binoculars. Prior to construction of the Project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

Data Analysis

Records of the monitoring actions (location, methods, personnel, etc.) and the results of pond monitoring will be collated into a database and tracked for changes between years and whether any changes are related to specific activities or mitigation actions.

Triggers for Adaptive Mitigation

Observations of waterbirds in Project ponds where the water quality does not meet wildlife water quality guidelines will trigger mitigation to exclude the wildlife from the Project ponds (Section 11.1.7).

Reporting

All incidental observations of waterbirds using Project ponds, and management actions taken and their success will be reported in the annual WEMP report.

11.2.1.2 Pre-clearing Surveys for Waterbird Nests

Pre-clearing surveys for waterbird nests will use the same methods as for raptor pre-clearing surveys (Section 10.2.1.2) during the waterbird nesting season, May 15 to August 15.

11.2.1.3 Incidental Observations

Incidental observations of waterbirds will be recorded by all Project personnel, including environmental monitors, pilots, drivers on on-site and winter ice roads, and other Project personnel during the

construction and operation of the Project. Further details on the incidental wildlife program, including methods, are described in Section 7.2.1.4, Incidental Observations (for caribou).

11.2.2 Waterbird Monitoring to Measure Predicted Effects

11.2.2.1 Footprint Monitoring

Objective

The objective of footprint size monitoring is to measure the actual habitat lost within the constructed Project footprint for each wildlife VEC.

Methods

See Section 7.2.2.1, Local Scale: Footprint Monitoring (for caribou) for a description of this Program, including triggers, methods, adaptive management and reporting.

11.2.2.2 Regional Monitoring for Waterbirds

Objective

The objective of regional monitoring for waterbirds is to determine if waterbirds are disturbed or otherwise affected by the Project near the Project site, resulting in reduced density or breeding success.

Triggers for Monitoring

Regional monitoring for waterbirds is planned for every three years during construction and operations of the Project.

Methods

Waterbird monitoring will consist of two types of surveys: 1) surveys to assess Project-related changes in the distribution of waterbirds in the RSA during staging periods, and 2) surveys to assess the effect of the Project on resident breeding waterbirds in the RSA. Analyses will be conducted to determine trends over time in the distribution (i.e., a Zone of Influence [ZOI]), and productivity of waterbirds in relation to mine infrastructure.

At the moment, there is no consensus in the scientific literature or from CWS on the best way to measure a ZOI on waterfowl distribution during staging and breeding. As such, two monitoring programs will be conducted and compared for their power to detect change in waterbird distribution and reported in the WEMP report. The two methods being trialed are 1) grid surveys, which are a continuation of the baseline survey methodology, and 2) total counts at individual ponds.

Grid surveys will follow a BACI study design, following the field design and methods conducted as part of baseline studies described in the 2012 and 2013 wildlife baseline reports (Rescan 2013, 2014). Baseline surveys used three survey blocks, 1) Goose block, 2) Goose control, 3) an MLA block. Monitoring surveys will use the Goose block and MLA blocks.

Staging Surveys

Aerial grid surveys will be conducted during spring and fall staging periods following established protocols described by the CWS and the USFWS (CWS and USFWS 1987) and will be continued on a three-year schedule while the Goose site and MLA are active.

The second monitoring method will be ground-based counts of all wetlands within a 5 km radius of the Project infrastructure. Ponds will be surveyed every three years from the ground for staging waterfowl during the spring and fall staging periods. Detailed methods will be described in the WMMP Plan prior to construction of the Project.

Breeding Surveys

The survey plan for breeding surveys will parallel that of the staging surveys, with two possible methods being trialed and compared during the first year of migratory bird surveys. Aerial surveys will be conducted to record waterbird breeding in the terrestrial RSA as per the methods reported in (Rescan 2013) and (Rescan 2014). Data gathered during these baseline surveys indicated that evidence of breeding was low in the Project area. A limited number of broods were observed in the waterbird survey blocks in the terrestrial RSA in 2011 and 2012. However, it is not clear whether the limited number of broods detected in the RSA was a function of survey platform, or whether the Project area is an area which supports limited breeding for waterbirds.

The second method to be used will be ground-based surveys of ponds within 5 km of Project infrastructure in the Goose site and the MLA. Detailed methods will be described in the WMMP Plan prior to construction of the Project.

Data Analysis

Data analysis will focus on comparing the two methods for monitoring a ZOI (grid surveys vs. total counts at individual ponds/lakes). Following this analysis and reporting of the results to ECCC and the KIA, the method with the greater power to detect a ZOI will be chosen for future monitoring by the Project. Following selection of the monitoring methodology, surveys will be repeated every three years for the life of the Project.

Triggers for Adaptive Mitigation

Results indicating fewer waterbirds near the Project site will trigger a review of Project activities to identify if there are adaptive management activities that can reduce any potential disturbance to waterbirds.

Reporting

Data and the results of analyses will be reported in the annual WEMP report.

12. Upland Birds

12.1 MITIGATION AND MANAGEMENT FOR UPLAND BIRDS

12.1.1 Overview of Potential Effects to Upland Birds

Seven potential effects to upland birds were evaluated in the FEIS: these included habitat loss, disturbance, disruption of movement, direct mortality, indirect mortality, attraction, and exposure to contaminants. Mitigation and management measures to reduce the potential for these effects to result in residual effects on upland birds are discussed in this section.

In addition, reduction in productivity was considered to evaluate the potential for synergistic effects on upland birds. Limiting the potential for synergistic effects will be achieved by implementing the mitigation and management measures for the seven direct effects listed above.

Habitat loss will occur in the Project footprint where natural vegetation is removed for the construction of the Project, and habitat loss was rated as a residual effect in the FEIS. Habitat loss will be minimized by reducing the Project footprint and carrying out reclamation activities.

Indirect habitat loss caused by disturbance was rated as a residual effect for upland birds in the FEIS. A variety of mitigation and management activities are proposed, including design mitigation to limit noise and management of construction activities to reduce disturbance to upland birds.

Disruption of movement for upland birds due to the Project was not considered a residual effect in the FEIS because there will be no tall structures in the Project design that may interfere with the daily or annual migratory movements of upland birds.

The potential for direct mortality due to collisions with vehicles and aircraft was evaluated in the FEIS. With mitigation, including setting speed limits and giving all wildlife the right of way, this effect was not rated as a residual effect.

The potential for indirect mortality was evaluated due to increased access and hunting of ptarmigan, the only hunted upland bird species. Mitigation includes a no-hunting and no-firearms policy for personnel on site. The potential for foxes and other furbearers to be attracted to the Project and increase nest predation was also evaluated. The area where upland birds may experience increased predation pressure was limited to an area 300 m from Project infrastructure, an area that was already considered lost to the Project PDAs. Considering the above, this effect was not rated as a residual effect.

The potential for upland birds to be attracted to lighting on the Project site was evaluated in the FEIS. With design mitigation to limit stray light, this effect was not rated as a residual effect.

The potential for upland birds to be exposed to contaminants was evaluated in the FEIS through a risk assessment, which found that upland birds would not be at risk of uptake of hazardous chemicals. A series of standard management plans for chemicals was provided in the FEIS, including fuel, spill response, marine spills, and management of hazardous materials. After management, exposure to contaminants was not rated as a residual effect for upland birds.

12.1.2 Mitigation and Management for Habitat Loss for Upland Birds

Mitigation and management to reduce potential effects of habitat loss for upland birds includes:

- Sabina has designed the Project footprint to be as small as possible and outside of sensitive areas for upland birds from TK and baseline studies.
- Dust will be managed on the Project site by setting and enforcing speed limits on all-season on-site roads and the application of dust suppressants where and when needed. Dust suppressants will be non-toxic for wildlife. Dust deposition rates and potential effects on vegetation will be monitored as described in the Air Quality Monitoring and Management Plan (Volume 10, Chapter 17).

12.1.3 Mitigation and Management for Disturbance of Upland Birds

A series of mitigation and management strategies will be in place to reduce the potential for disturbance to upland birds including:

- See Section 7.1.3.2, Design Mitigation (for caribou) for design measures to limit disturbance from Project infrastructure and activities applicable to all wildlife. In addition to these measures, buildings will be designed in order to exclude wildlife (e.g., construct vents to prevent small mammals and birds from entering) and if wildlife are able to access buildings through vents, windows, or by other means, then measures will be taken to exclude wildlife.
- Construction management measures for waterbirds will also apply to upland birds (Section 11.1.3.2) with suggested buffer sizes of 100 m for songbirds and 100 to 300 m for shorebirds.

12.1.4 Mitigation and Management for Disruption of Movement of Upland Birds

The Project is not expected to disrupt the daily nor annual movements of upland birds.

12.1.5 Mitigation and Management for Direct Mortality and Injury of Upland Birds

Mitigation and management to prevent direct mortality and injury of upland birds includes pre-construction nest searches, discussed in Waterbirds Section 11.1.3.2.

12.1.6 Mitigation and Management for Indirect Mortality of Upland Birds

The mitigation and management strategies outlined for caribou in Section 7.1.8, Mitigation and Management for Indirect Mortality of Caribou with regards to no-hunting policies, are applicable to upland birds (in particular ptarmigan, the only hunted upland bird species) and will serve to reduce the potential for indirect mortality for this VEC.

12.1.7 Mitigation and Management for Attraction of Upland Birds

The following mitigation and management measures will be conducted during the construction, operations, and closure phases of the Project to reduce attraction of upland birds to Project lighting:

- Directed lighting will be used rather than broad lighting, whenever possible.
- All lighting will be directed into the facility and toward the ground to limit stray light as a visual disturbance.
- The design avoided the use of tall towers requiring the use of solid and pulsating red lights , which seem to be more attractive to birds at night during inclement weather conditions than are white strobe lights (Erickson et al. 2002).

12.1.8 Mitigation and Management for Exposure to Contaminants for Upland Birds

The mitigation and management strategies outlined for muskox in Section 8.1.8, Mitigation and Management for Exposure to Contaminants for Muskox are applicable for upland birds, and will serve to reduce the potential for exposure to contaminants of this VEC. Sabina's fuel management plan and spill response plans are discussed in Section 6.1.3.

12.2 MONITORING FOR UPLAND BIRDS

This section describes monitoring activities to for upland birds to 1) trigger mitigation, and 2) evaluate potential effects of the Project on waterbirds. Two monitoring programs will trigger mitigation activities to minimize effects on upland birds:

1. pre-clearing surveys for upland bird nests; and
2. incidental observations.

Two types of monitoring will measure predicted effects on upland birds:

1. footprint monitoring to measure habitat loss in the Project footprint; and
2. regional monitoring for upland birds (point count and PRISM surveys).

12.2.1 Upland Bird Monitoring to Trigger Mitigation

12.2.1.1 Pre-clearing Surveys for Upland Bird Nests

Pre-clearing surveys for nests may be triggered during the construction process. The process for pre-clearing surveys, including triggers for monitoring, methods, and triggers for adaptive mitigation, are described in detail in the monitoring section for raptors (Section 10.2.1.2) during the breeding season for upland birds, May 15 to August 15.

12.2.1.2 Incidental Observations

Incidental observations of wildlife will be recorded by all Project personnel, including environmental monitors, pilots, drivers on on-site and winter ice roads, and other Project personnel during the construction and operation of the Project. Further details on the incidental wildlife program, including methods, are described in Section 7.2.1.4, Incidental Observations (for caribou). There will be one adaptive management trigger if upland birds are observed on or near the Project site. In the event that upland birds are accessing buildings, then measures will be taken to exclude upland birds from entering to ensure both worker and wildlife safety (Section 12.1.3).

12.2.2 Upland Bird Monitoring to Measure Predicted Effects

12.2.2.1 Footprint Monitoring

Objective

The objective of footprint size monitoring is to measure the actual habitat lost within the constructed Project footprint for each wildlife VEC.

Methods

Please Section 7.2.2.1, Local Scale: Footprint Monitoring (for caribou) for a description of this Program, including triggers, methods, adaptive management and reporting.

12.2.2.2 Regional Monitoring for Upland Birds

Objective

The objective of regional monitoring is to determine if upland birds are avoiding the Project site.

Trigger for Monitoring

Regional monitoring is planned for upland birds every two years during construction and operations.

Methods

A combination of variable radius point-count surveys and PRISM plots will be used to monitor potential effects of the Project on upland birds every two years, with continued focus on areas near Goose site and the Marine Laydown Area. A suite of approximately 50 PRISM plots at varying distances from mine infrastructure within the RSA will be revisited and/or established. The plots will be distributed amongst representative cover types, and each plot will be located in a single cover type following standard CWS PRISM methods. Detailed methods will be described in the WMMP Plan prior to construction of the Project.

The number and locations of PRISM plots and point counts will be reviewed prior to each biennial survey, and they may change as data become available to ensure that changes in breeding bird density and species richness can be accurately assessed relative to the mine site. These surveys contribute data on density, richness, and diversity of other upland nesting species in the Arctic. Two trained biologists will conduct the survey according to established CWS guidelines. Incidental bird observations will also continue to be recorded on and near the mine site.

Data Analysis

A review of all available upland breeding bird data collected to date via PRISM plot surveys will be conducted to assess differences from baseline patterns in species density and richness. This analysis will be based on the most current analytical techniques and based on advice from the CWS.

Triggers for Adaptive Mitigation

Results indicating fewer upland birds near the Project site will trigger a review of Project activities to identify if there are adaptive management activities that can reduce any potential disturbance to upland birds.

Reporting

Data and the results of analyses will be reported in the annual WEMP report.

13. Seabirds and Seaducks (Marine Birds)

13.1 MITIGATION AND MANAGEMENT FOR MARINE BIRDS

13.1.1 Overview of Potential Effects to Marine Birds

Five potential effects to VEC seabirds and seaducks (here referred to as marine birds) in the marine RSA, which encompassed Bathurst Inlet, were evaluated in the FEIS; these effects included habitat alteration, disturbance, direct mortality, indirect mortality, and exposure to contaminants. Mitigation and management measures to reduce the potential for these effects to result in residual effects on marine birds are discussed in this section. Effects to marine birds outside of the assessment area for the FEIS were considered in a separate report, the Shipping Sensitivity Report (Appendix V7-6A of the FEIS). Mitigation and management to limit any potential effects is described below.

In addition, reduction in productivity was considered to evaluate the potential for synergistic effects on marine birds. Limiting the potential for synergistic effects will be achieved by implementing the mitigation and management measures for the five direct effects listed above.

Habitat alteration will occur in the Project footprint, specifically the Lightering Barge Terminal in Bathurst Inlet at the Marine Laydown Area (MLA), which may restrict access for marine birds to near-shore foraging habitat. Habitat alteration due to the Lightering Barge Terminal will be temporary each year. A residual effect was expected to occur VEC marine fish/aquatic habitat but not for VEC marine fish community by construction and operation of the Lightering Barge Terminal (Volume 7, Chapters 4 and 5). Therefore, it appears that there may be some small measurable change in forage availability (e.g., fish, bivalves) for marine birds in the area of the MLA, though species are expected to forage over a wide area and are not expected to exclusively use the terminal area for foraging. Therefore, habitat alteration was not anticipated to result in a residual effect.

Indirect habitat loss caused by disturbance was rated as a residual effect for marine birds in the FEIS. A variety of mitigation and management activities are proposed, including ship and fixed-winged aircraft management to reduce disturbance to marine birds.

The potential for direct mortality due to collisions with ships and aircraft was evaluated in the FEIS. With mitigation, including ship and fixed-wing aircraft management, this effect was not rated as a residual effect.

The potential for indirect mortality was evaluated as the potential for increased access for hunters to the Project area. With mitigation, which includes prohibiting employees from bringing firearms to the site and hunting while at work, this effect was not rated as a residual effect.

The potential for marine birds to be exposed to contaminants was evaluated in the FEIS through a risk assessment, which found that marine birds would not be at risk of uptake of hazardous chemicals. A series of standard management plans for chemicals was provided in the FEIS, including fuel, spill response, marine spills, and management of hazardous materials. After management, exposure to contaminants was not rated as a residual effect for marine birds.

13.1.2 Mitigation and Management for Habitat Alteration for Marine Birds

The primary mitigation and management strategies to minimize the effects of marine habitat alteration for marine birds are addressed by the design of the Project, including:

- There are no permanent in-water works associated with the terminal construction. The Lightering Barge Terminal will consist of a metal ramp laid upon natural substrate and designed to be removed at the end of each sealift season and reinstalled prior to the arrival of the first sealift vessel the following year.

13.1.3 Mitigation and Management for Disturbance of Marine Birds

Mitigation and management to prevent disturbance to marine birds focuses on Project design and construction measures, as well as management of shipping and air traffic in Bathurst Inlet and along the common shipping lane through the Northwest Passage.

13.1.3.1 Design Mitigation

See Section 7.1.3.2 Design Mitigation (for caribou) for design measures to limit disturbance from Project infrastructure and activities applicable to all wildlife.

13.1.3.2 Construction Management

Mitigation and management for marine birds is described under construction management for waterbirds (Section 11.1.3.2). Marine birds have the same nesting period and proposed nest buffers (Table 11.1-1) as for waterbirds.

13.1.3.3 Shipping Management

Mitigation and management actions to reduce potential effects on marine birds due to shipping include:

- Ships crews will monitor for large groups of marine birds (Section 13.2.2).
- Ships will avoid large groups of birds observed on the ocean surface except where the safety of the ship is in concern.
- Ships will avoid any known colonies of marine birds by a buffer distance to reduce the chance of ship-bird collisions, except where the safety of the ship is in concern. Colonies of marine birds were recorded from TK and during baseline surveys in the islands at the north end of Bathurst Inlet.
- If monitoring indicates that ships are striking a significant number of birds or marine mammals, then adaptive mitigation will be triggered.
- Ships will avoid the large colony of marine birds on King Leopold Island by a buffer distance of 30 km, except where the safety of the ship is in concern.
- Ships will adhere to marine setback distance of 500 m from sea duck colonies, moulting aggregations of sea ducks, and waterfowl while transiting through the Bathurst Inlet/Elu Inlet and Lambert Channel Key Marine Habitat Sites, except where the safety of the ship is in concern (FEIS, Volume 7, Chapter 6, Figure 6.11-1).

13.1.3.4 Fixed-wing Aircraft and Helicopter Management

The following mitigation and management actions will be applied to fixed-wing aircraft and helicopters during all Project phases:

- As part of pilot induction, pilots will be informed of their responsibilities to monitor, report, and avoid marine birds. Maps will be provided to pilots that identify areas with concentrations of wildlife during certain seasons, such as lakes used for staging by marine birds.
- Aircraft will maintain a minimum of 610 m flight altitude above colony-nesting birds and important staging areas during sensitive periods.
- Aircraft will reduce disturbance to known colonies of nesting, feeding, or moulting birds or known staging areas by maintaining a distance of 3 km from colonies of birds.
- Pilots will report all incidental sightings of marine birds to the Environment Department.

13.1.4 Mitigation and Management for Direct Mortality and Injury of Marine Birds

Mitigation and management strategies to prevent disturbance to marine birds, as outlined in the previous section, will be the main mitigation and management strategies to reduce the potential for direct mortality and injury to marine birds, i.e., to minimize the likelihood of ship or aircraft-marine bird collisions.

13.1.5 Mitigation and Management for Indirect Mortality of Marine Birds

The mitigation and management strategies outlined for caribou in Section 7.1.6 Mitigation and Management for Indirect Mortality of Caribou with regards to no-hunting policies are applicable to marine birds and will serve to reduce the potential for indirect mortality for this VEC.

13.1.6 Mitigation and Management for Exposure to Contaminants for Marine Birds

The mitigation and management strategies outlined for muskox in Section 8.1.8, Mitigation and Management for Exposure to Contaminants for Muskox are applicable for marine birds, and will serve to reduce the potential for exposure to contaminants of this VEC. Sabina's fuel management plan and spill response plans are discussed in Section 6.1.3.

13.2 MONITORING FOR MARINE BIRDS

This section describes monitoring for marine birds in three sections: 1) to trigger mitigation, 2) to measure predicted effects, and 3) shipboard monitoring requested by the GN and Environment Canada during the review of the DEIS.

One type of monitoring is proposed to trigger management: pre-clearing surveys for nesting marine birds. Two types of monitoring are proposed to measure predicted effects:

1. footprint monitoring to measure habitat loss in the Project footprint; and
2. regional monitoring for marine birds (aerial and ground surveys).

Shipboard monitoring is also proposed for marine birds by ships in Nunavut waters.

Sabina commits to further discuss the marine bird monitoring program with ECCC prior to the commencement of shipping. Prior to construction, or first shipment, for the Project, Sabina will meet with ECCC and other interested parties, on the regional monitoring priorities, objectives and methods for Waterbird and Marine Bird VECs.

13.2.1 Marine Bird Monitoring to Trigger Management

13.2.1.1 Pre-clearing Surveys for Marine Birds

Pre-clearing surveys for marine birds are described in detail in the section on pre-clearing surveys for raptor nests (Section 10.2.1.2) within the marine bird breeding period of May 15 to August 15.

13.2.2 Marine Bird Monitoring to Measure Predicted Effects

13.2.2.1 Footprint Monitoring

Objective

The objective of footprint size monitoring is to measure the actual habitat lost within the constructed Project footprint for each wildlife VEC.

Methods

Please Section 7.2.2.1, Local Scale: Footprint Monitoring (for caribou) for a description of this Program, including triggers, methods, adaptive management and reporting.

13.2.2.2 Regional Monitoring for Marine Birds

Objective

The objective of the regional marine bird monitoring program is to evaluate potential effects of the Project on the local population of these species, measured as a Zone of Influence (ZOI) of altered numbers of staging breeding birds and/or breeding success surrounding the Project site.

Methods

A marine bird monitoring program every three years is proposed for the WEMP when the MLA is active. Marine bird monitoring will consist of two types of surveys: i) surveys to assess Project-related changes in the distribution of marine birds in the RSA during staging periods, and ii) surveys to assess the effect of the Project on resident breeding marine birds in the RSA. Methods and analyses follow those developed for waterbirds and are described in Section 11.2.2.2, Regional Monitoring for Waterbirds.

13.2.2.3 Marine Bird Monitoring during Project Shipping

Objective

The objective for marine bird monitoring during Project shipping is to 1) trigger avoidance of large groups of birds by ships, and 2) record birds in the Northwest Passage.

Triggers for Monitoring

Marine bird monitoring will be conducted by all Project ships in each Project stage when shipping is occurring, including Construction, Operations, Care and Maintenance, and Reclamation/Closure.

Methods

Seabird monitoring will be conducted as incidental observations by the ship's bridge crew. Sabina will produce a simplified SOP, following the basic methods provided in the protocol outlined in Eastern Canada Seabirds at Sea (ECSAS) standardized protocol for pelagic seabird surveys from moving and stationary platforms (Gjerdrum, Fifield, and Wilhelm 2012).

This seabird observer methodology will allow for the identification of seabird species present and provide an estimation of seabird densities along the shipping route. Detailed methods will be described in the WMMP Plan prior to construction of the Project. Data analysis will be conducted to quantify bird distribution and abundance. Data and the results of analyses will be reported in the annual WEMP report.

The results of monitoring activities will be reported in the WEMP report. In addition, Sabina commits to working with relevant parties, including ECCC, on relevant research on the cumulative effects of shipping including marine birds, by sharing all monitoring data collected during shipping activities. Discussions will include migratory bird monitoring priorities and proposed surveys and objectives in the WMMP.

Triggers for Adaptive Management

Ships will avoid large groups of birds observed on the ocean surface except where the safety of the ship is in concern. If bird strikes are occurring, then adaptive management will be undertaken, as described in Section 13.1.3.

Reporting

Data analysis will be conducted to quantify bird distribution and abundance. Data and the results of analyses will be reported in the annual WEMP report.

14. Ringed Seals (Marine Mammals)

14.1 MITIGATION AND MANAGEMENT FOR MARINE MAMMALS

14.1.1 Overview of Potential Effects to Marine Mammals

Ringed seal was chosen as a representative species for the marine mammal community in the FEIS, because TK and baseline surveys indicated that this species was the primary species to occupy habitats within the assessment area of the FEIS. The following potential effects to ringed seals were evaluated: habitat alteration, disturbance, direct mortality, indirect mortality, and exposure to contaminants. Mitigation and management measures to reduce the potential for these effects to result in residual effects on ringed seals are discussed in this section. These mitigation and management measures were developed with the intention to safeguard all marine mammals, although some were created specifically for interactions anticipated to occur between ringed seals and the Project (e.g., seal lairs constructed along the winter ice road).

In addition, reduction in productivity was considered to evaluate the potential for synergistic effects on ringed seal. Limiting the potential for synergistic effects will be achieved by implementing the mitigation and management measures for the five direct effects listed above.

Effects to ringed seals and other marine mammals outside of the assessment area for the FEIS were considered in a separate report, the Shipping Sensitivity Report (Appendix V7-6A of the FEIS). Mitigation for these effects to marine mammals (including ringed seals) are included below.

Habitat alteration will occur in the Project footprint, specifically the Lightering Barge Terminal at the Marine Laydown Area (MLA) and the portion of the winter ice road that transits across Bathurst Inlet. Neither the barge nor winter ice road are expected to result in a residual effect of habitat alteration for the following reasons: 1) the small amount of habitat that may be altered, 2) the low density of seals expected to occur in southern Bathurst Inlet in both the summer and winter, and 3) the temporary nature of the Lightering Barge Terminal, which is unlikely to alter the marine fish community in the area (Volume 7, Chapter 5), and by extension, unlikely to prevent seals from accessing prey.

Indirect habitat loss caused by disturbance was evaluated for ringed seals in the FEIS. With mitigation, including ship and fixed-wing aircraft management to reduce disturbance to ringed seals, this effect was not rated as a residual effect. This mitigation to limit disturbance will be in place to reduce disturbance to other marine mammals along the common shipping route through the Northwest Passage.

The potential for direct mortality due to collisions with ships and aircraft was evaluated in the FEIS. With mitigation, including ship and fixed-wing aircraft management, this effect was not rated as a residual effect.

The potential for indirect mortality was evaluated as the potential for increased access for hunters to the Project area. With mitigation, which includes prohibiting employees from bringing firearms to the site and hunting while at work, this effect was not rated as a residual effect.

The potential for ringed seals to be exposed to contaminants was evaluated in the FEIS through a risk assessment, which found that ringed seals would not be at risk of uptake of hazardous chemicals. A series of standard management plans for chemicals was provided in the FEIS, including fuel, spill response, marine

spills, and management of hazardous materials. After management, exposure to contaminants was not rated as a residual effect for ringed seals.

14.1.2 Mitigation and Management for Habitat Alteration for Marine Mammals

The primary mitigation and management strategies to minimize the effects of marine habitat alteration for marine mammals are addressed by the design of the Project, including:

- There are no permanent in-water works associated with the terminal construction. The Lightering Barge Terminal will consist of a metal ramp laid upon natural substrate and designed to be removed at the end of each sealift season and reinstalled prior to the arrival of the first sealift vessel the following year.

14.1.3 Mitigation and Management for Disturbance of Marine Mammals

Mitigation and management to prevent disturbance to ringed seal and other marine mammals focuses on management of shipping and fixed-wing aircraft traffic in Bathurst Inlet and along the common shipping lane through the Northwest Passage, as well as management of the winter ice road.

14.1.3.1 Shipping Management

Mitigation and management actions to reduce potential disturbance of ringed seals and other marine mammals include:

- Ships will avoid any groups of marine mammals observed on the ocean surface except where the safety of the ship is in concern.

14.1.3.2 Fixed-wing Aircraft Management

See Section 7.1.3.4 Fixed Wing Aircraft Management (for caribou) for measures to limit disturbance from fixed-wing air traffic applicable to all wildlife.

14.1.3.3 Winter Ice Road Management

The winter ice road to the Marine Laydown Area will be built on the sea ice of southern Bathurst Inlet during December each year. Seals build lairs under snowbanks or pressure ridges in late February and should not be affected by the construction of the winter ice road. If new construction of winter ice roads or airstrips is planned on the sea ice of Bathurst Inlet during the seal pupping period of February 15 to April 15, then:

- Sabina will conduct pre-construction surveys for seal lairs (Section 14.2.1).
- If a seal lair is observed in the planned construction area then the position of the lair will be recorded and communicated to construction personnel, who will avoid the seal lair by at least 50 m.

14.1.4 Mitigation and Management for Direct Mortality and Injury of Marine Mammals

Mitigation to prevent mortality of ringed seals is discussed for seal lairs in the proceeding section. If a ringed seal is found on land in the MLA infrastructure area, the KIA will be contacted prior to any action being carried out.

14.1.5 Mitigation and Management for Indirect Mortality of Marine Mammals

The mitigation and management strategies outlined for caribou in Section 7.1.8 Mitigation and Management for Indirect Mortality of Caribou with regards to no-hunting policies are applicable to marine mammals and will serve to reduce the potential for indirect mortality for this VEC.

14.1.6 Mitigation and Management for Exposure to Contaminants for Marine Mammals

The mitigation and management strategies outlined for muskox in Section 8.1.8, Mitigation and Management for Exposure to Contaminants for Muskox are applicable for ringed seals and other marine mammals, and will serve to reduce the potential for exposure to contaminants to all marine mammal species. Sabina's fuel management plan and spill response plans are discussed in Section 6.1.3.

14.2 MONITORING FOR MARINE MAMMALS

This section describes monitoring for marine mammals in two sections: 1) to trigger mitigation, and 2) shipboard monitoring requested by the GN and Environment Canada during the review of the DEIS.

Following a review of baseline data, a regional monitoring program has not been proposed for ringed seals to measure predicted effects. A monitoring program will only be effective if there are sufficient animals observed to be able to compare pre- and post-construction. Prior to construction, baseline surveys observed few to no lairs and seal pups in the Project location (south of Kingaok). In 2012, no large sea ice cracks, no lairs and only two seal pups were reported south of Kingaok. In the rest of Bathurst Inlet, lairs were typically found associated with large sea ice cracks. With no cracks in the sea ice south of Kingaok, it is likely that southern Bathurst Inlet is not high-quality habitat for lairs. With few observations of sea ice cracks, lairs and seal pups south of Kingaok, it was determined that a) there is likely little to no effect of the Project winter ice roads on ringed seals, and b) that the ability to detect an effect on the seal population there would be highly unlikely. Hence, no surveys for ringed seals are planned as part of the monitoring program for the Project.

14.2.1 Ringed Seal Monitoring to Trigger Mitigation

14.2.1.1 Pre-Construction Surveys for Seal Lairs

Objectives

The objective of on-ice monitoring is to determine the location of, and avoid, seal lairs when constructing the winter ice road and airstrip on the sea ice at the MLA.

Trigger for Monitoring

Pre-construction surveys will be conducted for seal lairs if on-ice construction is planned during the seal pupping season, February 15 – April 15, during Construction, Operations, Care and Maintenance, and Reclamation/Closure.

Monitoring Methods

Monitoring methods may include working with an Inuit hunter or using a thermal-vision camera. Sabina will work with relevant parties, including Fisheries and Oceans Canada (DFO) to determine the most effective methodology should construction be proposed during the seal pupping period and structures that may support lairs (ice ridges and snow banks) be unavoidable. Prior to construction of the Project, a detailed SOP will be produced. The SOP will include training requirements for staff, methods for monitoring, and data sheets.

Data Analysis

Records of the monitoring actions (location, methods, personnel, etc.) and the results of on-ice monitoring will be collated into a database.

Triggers for Adaptive Mitigation

On-ice operations will be moved based on locations of lairs to provide a 50-m buffer between on-ice operations and lairs as described in Section 14.1.3.

Reporting

The results of on-ice monitoring for seal lairs, if triggered by road construction during the seal pupping period, management actions taken and their success will be reported in the annual WEMP report.

14.2.2 Marine Mammal Monitoring during Project Shipping

Objective

The objective for marine mammal monitoring during Project shipping is to 1) trigger avoidance of marine mammals, and 2) record marine mammals in the Northwest Passage.

Triggers for Monitoring

Marine mammal monitoring will be conducted by all Project ships in each Project stage when shipping is occurring, including Construction, Operations, Care and Maintenance, and Reclamation/Closure.

Methods

Marine mammal surveys will be conducted as incidental observations by the ship's bridge crew. Sabina will produce a simplified SOP, following the basic methods provided in the protocol outlined in *Recommended Seabird and Marine Mammal Observational Protocols for Atlantic Canada* (Moulton and Mactavish 2004).

Triggers for Adaptive Management

Ships will avoid marine mammals except where the safety of the ship is in concern.

Reporting

Data analysis will be conducted to quantify marine mammal species occurrence, distributions and abundance. Survey effort will be clearly documented. Data and the results of analyses will be reported in the annual WEMP report. In addition, Sabina commits to working with relevant parties on relevant research on the cumulative effects of shipping including marine mammals by sharing all monitoring data collected during shipping activities.

15. Polar Bears

15.1 MITIGATION AND MANAGEMENT FOR POLAR BEARS

15.1.1 Overview of Potential Effects to Polar Bears

The potential effects to polar bears from the Project were evaluated in the FEIS in the Shipping Sensitivity Report (Appendix V7-6A of the FEIS). The assessment on polar bear consisted of an evaluation of the worst- and best-case scenarios for polar bear populations should a fuel release or spill event occur in the marine environment along the western and eastern shipping route. The assessment considered the overall density of polar bears along the proposed routes, provided context for the potential spill scenarios along the routes, and identified the locations where a potential fuel release or spill event has the potential to affect the largest number of bears (worst-case scenario) and the fewest (best-case scenario).

Overall, there were two polar bear subpopulations, both of which overlap the eastern shipping route that could be affected should a spill occur: the Lancaster Sound subpopulation and the M'Clintock Channel subpopulation. It appears that the Lancaster Sound subpopulation has the greater sensitivity to a potential spill event relative to the M'Clintock Channel subpopulation. Existing data indicates that the Lancaster Sound subpopulation has the highest overall density of bears and the highest number of identified summer retreats within the subpopulation area. Summer retreats are areas where polar bears are known to congregate during the summer, and include marine habitats where sea ice cover is known to persist during summer (e.g., multi-year ice in Victoria Strait) and terrestrial habitats on islands. Specifically, the areas of the greatest concern within the Lancaster Sound subpopulation area for a potential fuel release or spill event are the northern and western coasts of Somerset Island, where a number of summer retreats occur (Appendix V7-6A of the FEIS; Figure 5-1). The best case scenario would be a potential fuel release or spill event in any of the areas along the Northwest Passage that are not adjacent to polar bear summer retreats (see Appendix V7-6A of the FEIS; Figure 5-1). This constitutes the majority of the shipping route.

Mitigation and management for polar bears will focus on reducing the potential effects to the species should a fuel release or spill event occur in the marine environment, as well as reducing the potential for ship-polar bear collisions (i.e., direct mortality and injury).

15.1.2 Mitigation and Management for Polar Bears in Relation to Accidental Fuel Release or Spill Event in the Marine Environment

Sabina's fuel management plan and spill response plans are discussed in Section 6.1.3.

15.1.3 Mitigation and Management for Direct Mortality and Injury of Polar Bears

Mitigation and management actions to reduce potential effects on polar bears due to shipping include avoiding any groups of marine mammals, including polar bears, observed on the ocean surface except where the safety of the ship is in concern.

15.2 MONITORING FOR POLAR BEARS

Objective

Monitoring will be conducted specifically to document the occurrence of polar bears during Project shipping as requested by the GN and Environment Canada during the review of the DEIS.

Triggers for Monitoring

Polar bear monitoring will be conducted by all Project ships in each Project stage when shipping is occurring, including Construction, Operations, Care and Maintenance, and Reclamation/Closure.

Methods

Marine mammal surveys will be conducted as incidental observations by the ship's bridge crew. Sabina will produce a simplified SOP, following the basic methods provided in the protocol outlined in *Recommended Seabird and Marine Mammal Observational Protocols for Atlantic Canada* (Moulton and Mactavish 2004).

Triggers for Management

Ships will avoid any groups of marine mammals, including polar bears, observed on the ocean surface except where the safety of the ship is in concern.

Reporting

Data analysis will be conducted to quantify marine mammal species occurrence, distributions and abundance. Survey effort will be clearly documented. Data and the results of analyses will be reported in the annual WEMP report. The results of monitoring activities will be reported in the WEMP report. In addition, Sabina commits to working with relevant parties on relevant research on the cumulative effects of shipping including marine mammals by sharing all monitoring data collected during shipping activities.

16. Mitigation and Adaptive Management

The WMMP Plan describes actions that are intended to reduce Project-related effects on wildlife. This plan is intended to ensure wildlife habitats and populations are maintained in the area that will be influenced by Project development, while taking into account operational requirements and the safety of Project employees.

Unless otherwise indicated, measures described in the Plan apply to all Project components for the life of the Project. This Plan is designed to be adaptive, effective, and achievable in both the short and long term, and includes measurable objectives that will be evaluated in the Wildlife Effects Monitoring Program.

The results of mitigation activities will be reported regularly, as will the results of focal-species monitoring programs. This circle of mitigation activities, monitoring and evaluation, and new mitigation activities will adaptively manage wildlife issues identified and arising as a result of the Project.

17. Checking and Corrective Action

Checking and corrective action evaluates the predicted effects of the Project on wildlife VECs, and evaluates the compliance of the Project with issued licences and permits (e.g., Project Certificate). Evaluation of predicted effects will be conducted through a combination of facility-specific monitoring and focal-species monitoring depending on the scale of the predicted effect. If checks and monitoring identify issues with human safety due to wildlife interactions or non-compliance with issued licenses or permits, then corrective action will be taken.

18. Record Keeping

Record keeping will be conducted by Sabina and its subcontractors. Data will be entered into suitable electronic databases (e.g., MS Access), checked for quality control, and stored with subcontractors responsible for monitoring and with Sabina. Data will be entered in a format and program that allows for comparison between years, and storage in a single file format for each type of survey or monitoring activity. Data will be appended to each report and the compilation of all years of data will be transferred for storage with the GN. Data may also be shared, upon request, with ECCC and the GNWT for inclusion in regional monitoring programs.

19. Environmental Reporting

The WEMP will be reported during construction, operations, care and maintenance, and closure (excluding periods of temporary closure and post-closure). The periodicity of reporting for the closure and post-closure phases will be agreed upon prior to closure commencing. The WEMP report will include monitoring data from the facility-specific and focal species monitoring programs. Results from both monitoring programs will be analyzed with comparisons to findings from earlier years (i.e., baseline and annual monitoring) and recommendations for change to the wildlife monitoring and management practices or new adaptive management measures (if any) will also be included.

Reporting on mitigation and management activities, including performance as evaluated by mitigation plan key performance indicators will be included in an Appendix to the WEMP.

The WEMP report will be delivered to regulatory agencies and stakeholders, including:

- the Government of Nunavut;
- the Kitikmeot Inuit Association or designate; and
- any monitoring partners involved in the collaborative effects assessment.

20. Plan Effectiveness

As part of environmental reporting, Sabina will distribute copies of the WEMP report to stakeholders and collaborate with the Kitikmeot Inuit Association to report on mitigation, management, and monitoring activities. Sabina will also conduct an evaluation (as necessary) of the efficacy of mitigation and management activities and of monitoring activities using relevant methods, such as power analyses. Should new, more sensitive, monitoring methods be introduced, or existing methods be found to lack statistical power or a robust design, updated methods will be proposed to the stakeholders in a revised Wildlife Mitigation and Monitoring Program Plan.

This Plan may be updated as frequently as every year, or not at all, if the mine plan and methods for mitigation and monitoring are robust. The new Wildlife Mitigation and Monitoring Program Plan will be implemented following review by stakeholders and an opportunity for response by Sabina.

21. QA/QC

Quality assurance and quality control (QA/QC) measures will be undertaken at three key stages in monitoring activities: 1) during field data gathering, 2) during data entry and analysis, and 3) through reporting and reassessment of methods as part of the evaluation of Plan effectiveness.

The process of data gathering in the field will be quality-controlled through the use of qualified wildlife biologists and a system of pre- and post-field checks to ensure that consistent, repeatable data is being gathered. Checks will be carried out by a second qualified biologist. QA/QC of data entry will be conducted via a process of standard data entry templates, and checking data through either double-entry data or feedback entry, where entered data is checked back to the field cards. QA/QC of data analysis will be conducted through a process of clear, written instructions for data analysis and pre- and post-analysis checks by a second qualified biologist. Finally, the efficacy of the methods as a whole will be evaluated through repeated scrutiny of the data using power analysis and through review by stakeholders.

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