CUMBERLAND
RESOURCES LTD.

MEADOWBANK GOLD PROJECT

TERRESTRIAL ECOSYSTEM MANAGEMENT PLAN

JANUARY 2005

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DESCRIPTION OF SUPPORTING DOCUMENTATION

Cumberland Resources Ltd. (Cumberland) is proposing to develop a mine on the Meadowbank property. The property is located in the Kivalliq region approximately 70 km north of the Hamlet of Baker Lake on Inuit-owned surface lands. Cumberland has been actively exploring the Meadowbank area since 1995. Engineering, environmental baseline studies, and community consultations have paralleled these exploration programs and have been integrated to form the basis of current project design.

The Meadowbank project is subject to the environmental review and related licensing and permitting processes established by Part 5 of the Nunavut Land Claims Agreement. To complete an environmental impact assessment (EIA) for the Meadowbank Gold project, Cumberland followed the steps listed below:

1. Determined the VECs (air quality, noise, water quality, surface water quantity and distribution, permafrost, fish populations, fish habitat, ungulates, predatory mammals, small mammals, raptors, waterbirds, and other breeding birds) and VSECs (employment, training and business opportunities; traditional ways of life; individual and community wellness; infrastructure and social services; and sites of heritage significance) based on discussions with stakeholders, public meetings, traditional knowledge, and the experience of other mines in the north.

2. Conducted baseline studies for each VEC and compared / contrasted the results with the information gained through traditional knowledge studies (see Column 1 on the following page for a list of baseline reports).

3. Used the baseline and traditional knowledge studies to determine the key potential project interactions and impacts for each VEC (see Column 2 for a list of EIA reports).

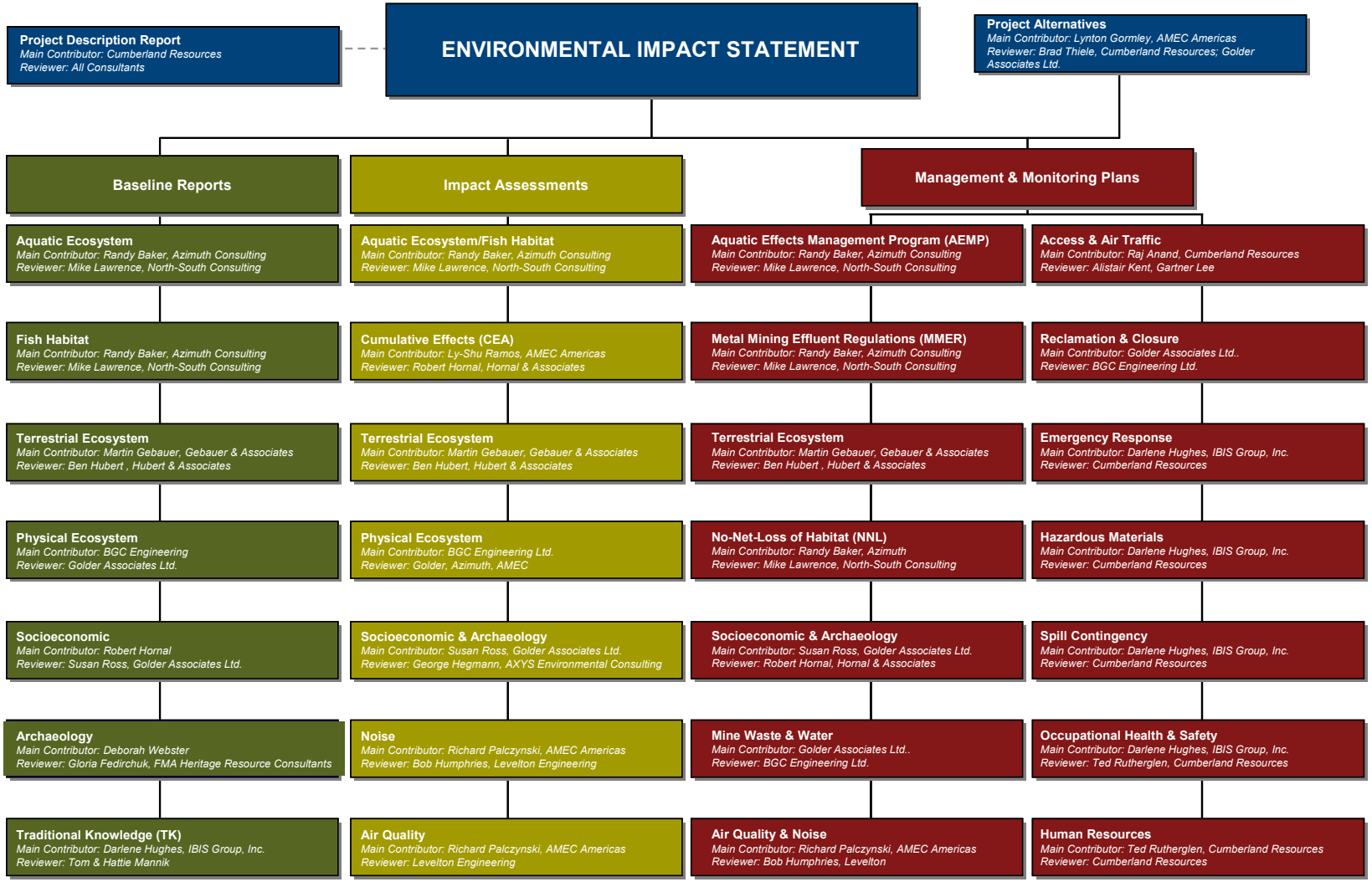
4. Developed preliminary mitigation strategies for key potential interactions and proposed contingency plans to mitigate unforeseen impacts by applying the precautionary principle (see Column 3 for a list of management plans).

5. Developed long-term monitoring programs to identify residual effects and areas in which mitigation measures are non-compliant and require further refinement. These mitigation and monitoring procedures will be integrated into all stages of project development and will assist in identifying how natural changes in the environment can be distinguished from project-related impacts (monitoring plans are also included in Column 3).

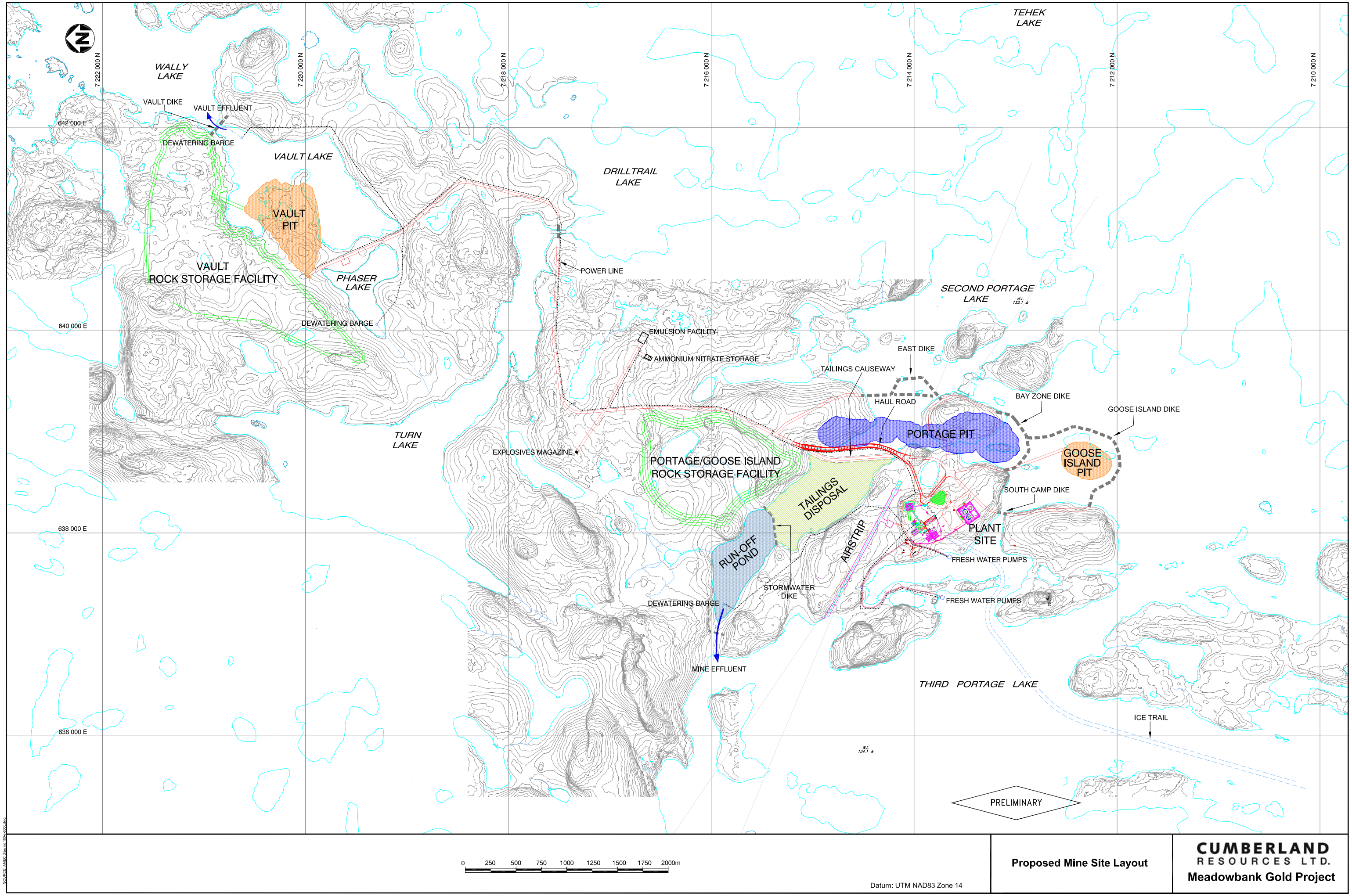
6. Produce and submit an EIS report to NIRB.

As shown on the following page, this report is part of the documentation series that has been produced during this six-stage EIA process**.**

EIA DOCUMENTATION ORGANIZATION CHART



PROJECT LOCATION MAP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VAULT DIKE
VAULT EFFLUENT
DEWATERING BARGE
VAULT LAKE
DRILLTRAIL LAKE
VAULT PIT
VAULT ROCK STORAGE FACILITY
PHASER LAKE
POWER LINE
SECOND PORTAGE LAKE
DEWATERING BARGE
EMULSION FACILITY
AMMONIUM NITRATE STORAGE
EAST DIKE
TAILINGS CAUSEWAY
HAUL ROAD
BAY ZONE DIKE
GOOSE ISLAND DIKE
PORTAGE PIT
GOOSE ISLAND PIT
TURN LAKE
EXPLOSIVES MAGAZINE
PORTAGE/GOOSE ISLAND ROCK STORAGE FACILITY
TAILINGS DISPOSAL
SOUTH CAMP DIKE
PLANT SITE
AIRSTRIP
FRESH WATER PUMPS
RUN-OFF POND
STORMWATER DIKE
FRESH WATER PUMPS
DEWATERING BARGE
MINE EFFLUENT
THIRD PORTAGE LAKE
ICE TRAIL
PRELIMINARY
0 250 500 750 1000 1250 1500 1750 2000m
Datum: UTM NAD83 Zone 14
Proposed Mine Site Layout
CUMBERLAND RESOURCES LTD.
Meadowbank Gold Project

SECTION 1 • EXECUTIVE SUMMARY

This report provides a preliminary and general Wildlife Management Plan (WLMP) for the Cumberland Resources Ltd. (Cumberland) Meadowbank Gold project (the project). The project is located approximately 70 km north of Baker Lake, 300 km inland from the northwest coast of Hudson Bay. The Meadowbank area is above the treeline near the Arctic Circle in an area of permanently frozen ground (permafrost) that extends to a depth of 400 to 500 m. The local physiography is characterized by numerous lakes and low, rolling hills covered mainly by heath tundra.

The purpose of the WLMP is to manage the interaction between the project and the terrestrial ecosystem so that residual impacts (i.e., effects that remain after mitigation has been implemented) to vegetation, wildlife, and wildlife habitats are acceptable.

The WLMP has been written in association with the Terrestrial Ecosystem Impact Assessment (EIA), which identified potential residual effects to vegetation and wildlife. (NOTE: Unless otherwise specified, all references to an EIA in this document refer to the "Terrestrial Ecosystem Impact Assessment" and not the overall Project Environmental Impact Assessment.) The EIA is based on a system of matrices that tabulate project components cross-referenced with potential effects, assessment of unmitigated effects, proposed mitigation, assessment of residual effects, and monitoring and management. Separate matrices have been prepared for each of seven terrestrial valued ecosystem components (i.e., vegetation, ungulates, predatory mammals, small mammals, raptors, waterfowl, and other breeding birds) for each of the three primary project phases (i.e., construction, operations, and closure and post-closure). Detailed matrices were not developed for the exploration, temporary closure, and long-term shutdown phases, but potential impacts during these phases are discussed within the EIA text.

The WLMP follows the same basic format as those used in developing the matrices. For each potential unacceptable impact (described in detail in the EIA), mitigation measures are proposed to ensure that residual impacts (i.e., after mitigation) are acceptable. To ensure that residual impacts are indeed acceptable, a preliminary monitoring plan is presented which evaluates the response of vegetation communities and wildlife populations to the effects of the mine and mine-related activities. Where monitoring determines that unacceptable residual impacts exist, an adaptive management approach will be undertaken to ensure that further impacts are acceptable. Additional mitigation measures will be the most likely means by which this will be accomplished. Adaptive management is an ongoing process that evolves throughout the life of the mine as better and more effective ideas are introduced in a process that is designed to be continually improving. A review of the WLMP by regulatory agencies, technical reviewers, and stakeholders will further ensure that local and regional concerns have been adequately addressed.

The general approach of the WLMP can be categorized in five steps:

1. describe the key valued ecosystem components (VECs)
2. describe spatial and temporal boundaries
3. summarize key potential project interactions for each VEC

4. develop mitigation strategies for key potential interactions and propose contingency plans to mitigate unforeseen impacts quickly and effectively
5. develop long-term monitoring programs for wildlife habitat, and wildlife behaviour, movement, distribution, and abundance.

The mitigation and monitoring procedures identified in this WLMP will be integrated into all stages of the project to ensure that development can proceed as scheduled while accommodating wildlife management needs. The WLMP will also assist in identifying how natural changes in the environment can be distinguished from project-related impacts.

Because much more mine-specific detail will need to be added to this WLMP once the permit is granted (e.g., detailed contingency plans), and because adjustments, refinements, and revisions are expected to occur over the life of the mine, this document should be considered to be a work in progress. The document provides a framework for the more site-specific plan required prior to mine development.

SECTION 2 • WILDLIFE MANAGEMENT PLAN

2.1 GENERAL APPROACH

The purpose of the Wildlife Management Plan (WLMP) is to manage the interaction between the project and the terrestrial ecosystem so that residual impacts (i.e., effects that remain after mitigation has been implemented) to vegetation, wildlife, and wildlife habitats are acceptable. Because much more mine-specific detail will need to be added to this WLMP once the permit is granted, and because adjustments, refinements, and revisions are expected to occur over the life of the mine, this document should be considered to be a work in progress.

The general approach of the WLMP will be to:

- *Describe the terrestrial valued ecosystem components (VECs)* – VECs were determined based on discussions with stakeholders, public meetings, traditional knowledge, and the experience of other mines in the north, and are described in detail in the "Baseline Terrestrial Ecosystem Report." The VECs chosen through this process include: vegetation, ungulates, predatory mammals, small mammals, raptors, waterfowl, and other breeding birds.

  Each VEC contains a number of key species representing that VEC. For example, ungulates are represented by caribou and muskox, and predatory mammals are represented by grizzly bear, wolverine, and wolf.

- *Describe spatial and temporal boundaries* – For the purposes of the baseline studies, three spatial boundaries were defined: (a) the local study area (LSA), an area comprising 91 km^2, and including a 5 km radius area centred on the field camp (at the main mine site), and a 2 km radius area centred on the Vault gold deposit; (b) the regional study area (RSA), a 100 km x 100 km area (10,000 km^2), centred on the field camp at the main mine site; and (c) a 5 km wide survey corridor centred on the proposed winter road between Baker Lake and the mine development site.

  At the VEC level, spatial boundaries were defined on a species-by-species basis, because some species have home ranges thousands of times larger than others do, while others are migratory, and some are sedentary.

- *Summarize key potential project interactions for each VEC* – A detailed discussion on project effects and residual impacts is provided in the impact matrices and text of the EIA. A summary of these effects and project interactions is provided for each VEC in this WLMP. Potential project interactions are discussed in terms of sensitivity and vulnerability of the resource in question (e.g., raptors), existing information at the Meadowbank project site, available literature, and experiences at other mines.

- *Develop preliminary mitigation strategies for key potential interactions and propose contingency plans to mitigate unforeseen impacts quickly and effectively* – Proposed preliminary mitigation strategies for each VEC at each project phase are discussed in Section 3 of this report.

Unforeseen impacts are often difficult to mitigate simply because they are by definition unanticipated. In this respect, objectives and limitations are discussed and an adaptive management approach is taken. In cases where impacts are found to be unacceptable despite existing mitigation measures, additional, more robust mitigation measures will be undertaken, or possibly a new innovative approach will be implemented that reduces residual effects to an acceptable level.

- *Develop long-term monitoring programs for wildlife habitat, and wildlife behaviour, movement, distribution, and abundance* – Preliminary monitoring programs are presented in Section 4 of the report for each VEC. Monitoring programs are designed to identify residual effects and areas in which mitigation measures are non-compliant and require further refinement. Due to the inherent uncertainties of impact prediction, monitoring will also be used to verify anticipated effects on wildlife habitat, wildlife behaviour, movement, distribution, and abundance. Monitoring programs presented in this WLMP are subject to refinement and change due to the iterative approach taken.

The WLMP's mitigation and monitoring procedures will be integrated into all stages of the project to ensure that development can proceed as scheduled while accommodating wildlife management needs. The WLMP will also assist in identifying how natural changes in the environment can be distinguished from project-related impacts.

2.2 OBJECTIVES

The primary objectives of this WLMP are to:

- Elaborate mitigation strategies proposed in the EIA to reduce the potential for residual impacts.
- Develop a monitoring strategy capable of detecting changes in vegetation communities and wildlife populations in the vicinity of the mine site.
- Where monitoring activities identify unacceptable impacts to the distribution, abundance, integrity, and/or viability of vegetation communities or wildlife populations, describes an adaptive management approach (i.e., further mitigation measures) necessary to alleviate the impact.

2.3 SELECTION OF VALUED ECOSYSTEM COMPONENTS

Key VECs were selected through consultation with regulatory and governmental authorities, discussions with members of the local community, and a review of VECs identified in other northern mine projects. Selection of VECs was further refined through the application of one or more of the following criteria: conservation status, relative abundance within the Meadowbank study areas, importance in subsistence lifestyle and economy, importance in predator-prey systems, habitat requirement size and sensitivity, and contribution to local area concerns.

Based on this selection process, the key terrestrial VECs were determined to be: vegetation, ungulates, predatory mammals, small mammals, raptors, waterfowl, and other breeding birds. Key wildlife species that are associated with each of these VECs are shown in Table 2.1.

Table 2.1: Valued Ecosystem Components in the Meadowbank Study Area

VEC	Common Name	Scientific Name
Vegetation	N/A	N/A
Ungulates	Barren-ground caribou	*Rangifer tarandus ssp. Groenlandicus*
	Muskox	*Ovibos moschatus*
Predatory Mammals	Grizzly bear	*Ursus arctos*
	Wolverine	*Gulo gulo*
	Wolf	*Canis lupus*
Small Mammals	Arctic hare	*Lepus arcticus*
	Arctic ground squirrel	*Spermophilus parryi*
	Collared lemming	*Dicrostonyx groenlandicus*
	Northern red-backed vole	*Clethrionomys rutilis*
Raptors	Peregrine falcon	*Falco peregrinus ssp. Tundrius*
	Gyrfalcon	*Falco rusticolus*
	Rough-legged hawk	*Buteo lagopus*
	Snowy owl	*Nyctea scandiaca*
Waterfowl	Canada goose	*Branta canadensis*
	Long-tailed duck	*Clangula hyemalis*
	Loons	*Gavia spp.*
Other Breeding Birds	Ptarmigan	*Lagopus spp.*
	Passerines	*Various*
	Shorebirds	*Various*

2.4 BOUNDARIES

2.4.1 Spatial Boundaries

For the purposes of baseline studies, the Regional Study Area (RSA) was defined as a 100 km by 100 km area (10,000 km^2) centred on the main mine site. The local study area (LSA) was defined as a 5 km radius buffer around the main mine facilities and a 2 km radius buffer around the Vault Lake facilities. The LSA and the RSA were initially established as study areas within which wildlife and vegetation surveys were conducted; however, for the purposes of assessing the significance of project effects and VECs, spatial boundaries were established separately for each VEC depending on variables such as home range size, distribution, and densities. For example, the collared lemming has a much smaller home range than the barren-ground caribou. Other species, such as geese, are primarily migratory and may travel thousand of kilometres from the project area, while other animals, such as the wolverine and grizzly bear, have large home ranges that may extend well beyond the 100 km x 100 km RSA (as defined for baseline survey and monitoring purposes). Accordingly, unique spatial boundaries have been established for each VEC (see Table 2.2).

The primary sources of impacts (e.g., direct impacts) are expected to occur within the LSA. These potential sources have been broken down into the following spatial components: main facilities, Vault facilities, winter road, and Baker Lake facilities (see impact matrices in the EIA). (NOTE: Unless otherwise specified, all references to an EIA in this document refer to the “Terrestrial Ecosystem Impact Assessment” and not the overall Project Environmental Impact Assessment.)

Table 2.2: Spatial boundaries for VECs of the Meadowbank Gold Project

VEC	LSA	RSA	Justification
Vegetation	100 m	2 km	Vegetation is sedentary and vulnerable primarily to activities in close proximity
Ungulates	5 km	Mainland Nunavut	Caribou individuals from several herds, including Ahiak, Boothia Peninsula, Beverly, Qamanirjuak, Lorillard, and Wager Bay are known to be present in winter. Muskox are wide-ranging and have been thought to be moving northeast out of the Thelon River valley.
Predatory Mammals	5 km	100 km	Grizzly bear, wolverine, and wolf are wide-ranging species with large annual home ranges[1]. They occur at very low densities within the study area.
Small Mammals	500 m	5 km	Small mammals are quite resilient (i.e., easily habituated) to human activity. Arctic hare are the widest ranging (4 to 20 hectares[2])
Raptors	1 km	50 km	Birds nesting in close proximity to mine facilities may be disturbed during the nesting season. Nesting birds may forage considerable distances away from nesting areas. Some species (e.g., rough-legged hawk) are migratory and undergo long distance movements.
Waterfowl	1 km	50 km	Birds nesting in close proximity to mine facilities may be disturbed during the nesting season. Species may be wide-ranging during the breeding season. All species are migratory, moving long distances to wintering grounds.
Other Breeding Birds	500 m	5 km	Passerines are quite resilient (i.e., easily habituated) to human activity. During breeding season, most species are restricted to home ranges < 1 km^2.

Note: Boundaries are radii, centred on project facilities. **1**. For males in Arctic habitats – grizzly bears: 6,000 to 7,000 km²; wolverines: 100 to 900 km²; and wolves: > 60,000 km². **2**. Macdonald 1995.

2.4.2 Temporal Boundaries

As specified in the Meadowbank project EIS Guidelines, the establishment of temporal boundaries will have two aspects. The aspect is the time-horizon that will be used in predicting change, which must be a function of the anticipated duration of the project, from construction to post-closure. Each stage of the project will have its own temporal boundaries. Wildlife management recommendations and practices are based on the impact matrices, which have been developed uniquely for each VEC and for each stage of the project (see the EIA). The greatest impacts on the terrestrial environment are most likely to occur during the construction phase of the project.

The second temporal aspect as specified in the EIS Guidelines refers to “the temporal variability and periodicity that characterize the predicted impacts.” This refers in part to global warming. The guidelines note, for example, that the western Arctic has experienced a warming trend in the past 50 years. This could affect the home ranges or migration patterns of various species, and is an element that must be separated from project-related impacts.

The WLMP as it applies to temporal boundaries will also be applied to seasonal or life-cycle patterns of the VECs listed in Table 2.1. For example, the natural population cycles of voles and lemmings (Ehrlich et al., 2001) and their role as prey species for numerous predators (Reid et al., 1995) would have to be taken into account as a background variable in assessing predator movement, behaviour,

abundance, and health, apart from project-related causes. Many of the VECs follow seasonal migration patterns (e.g., caribou), while other territorial species may travel extensive distances as juveniles in the process of establishing their home ranges (e.g., wolverines; RWED 1997). For small mammals such as the Arctic ground squirrel, northern red-backed vole, and collared lemming, individuals may spend an entire life cycle within the footprint of the mine site[1], while others, such as waterfowl and raptors are seasonal visitors and possibly breeders during the open water season.

2.5 RESIDUAL IMPACTS

Residual impacts are project effects that remain after implementation of all mitigation measures. A comprehensive assessment of the expected residual effects of various project components on vegetation and wildlife has been provided in the EIA. In order to assess the accuracy of the environmental assessment, the effectiveness of mitigation programs, and the significance of residual effects on vegetation and wildlife, monitoring programs, as outlined in this document, will be implemented. Where monitoring determines that unacceptable residual impacts exist, an adaptive management approach will be taken to ensure that further impacts are acceptable. Additional mitigation measures will be the most likely means by which this will be accomplished.

Certain impacts, such as habitat lost to roads, open pits and other permanent structures such as buildings with concrete foundations and dikes, will be unavoidable. As well, scavengers or predators such as grizzly bears, wolverines, and foxes may be attracted to the mine site despite every effort to incinerate garbage and bear-proof all refuse containers; however, it is important to emphasize the distinction between habituation, in which animals become used to a certain level of noise and activity, and food conditioning, in which animals become dependent on humans as a source of food. An animal that has become food conditioned, particularly a predator such as a grizzly bear or a wolverine, is a much greater problem, and is much more likely to result in the destruction of the animal, than is the case in which an animal has simply become habituated to the disturbances associated with the proximity of a mine and its ancillary facilities (MacHutchon, 1996).

Ongoing monitoring programs will be essential in distinguishing natural changes in the environment from project-related impacts.

2.6 CUMULATIVE EFFECTS

The reduction of cumulative effects, both temporal and spatial, is an integral goal of the WLMP. Despite the small footprint of the mine in a very large, mostly undeveloped area, future developments in the area and certain unrelated additive effects that only become measurable when combined, cannot always be anticipated. A case in point for weighing cumulative effects at an early stage is the intensive exploration and development of diamond projects and mines in the Slave Geological Province over the past 10 years in an area that had previously seen relatively little development, and where the mining-related impacts on wolverines in the Lac de Gras area represent a cumulative effect on the local population (BHP Billiton, 2002).

[1] Unless the lemmings or voles are born during a 'dispersal phase' – see Section 3.6.1, "Small Mammals – Summary of Environmental Effects"

Ongoing monitoring programs associated with the Meadowbank Gold project, as well as monitoring programs at existing mines (e.g., EKATI and Diavik) and proposed future mines (e.g., Snap Lake, Hope Bay, and Jericho), will be essential in determining whether an additive effect on any component of the terrestrial environment is occurring. Potential cumulative effects are most likely to first be observed on wide-ranging sensitive species such as grizzly bear and wolverine, which are particularly vulnerable to human encroachment into pristine habitats. A more detailed discussion on cumulative effects on wildlife is provided in the report, “Cumulative Effects Assessment,” which is included as part of this documentation series under separate cover.

SECTION 3 • MITIGATION MEASURES

3.1 MITIGATION APPROACH

The purpose of mitigation in the context of the WLMP is to minimize the disturbance of all wildlife and wildlife habitat in the project area through all project phases (i.e., exploration, construction, operations, closure/ post-closure, temporary closure, and long-term shutdown). A summary of mitigation measures recommended to minimize potential unacceptable project effects has been provided in the impact matrices within the EIA. Elaborations of mitigation measures that have already been implemented during the design phase of the project and those that will be implemented during the various project phases are provided in this document.

Direct loss of terrestrial habitat will occur as a result of the excavation of the open pits, the development of waste rock piles, and the development of tailings impoundments (loss of shoreline and riparian habitat), the construction of buildings and roads, and other ancillary facilities. These habitats currently provide foraging, nesting, burrowing, and possibly denning opportunities for all of the terrestrial VECs. Mitigation of these effects is limited to minimizing the size of facility footprints, and controlling access around facilities. In addition, during all project phases, there will be disruption of wildlife occurring in the immediate vicinity of project facilities as a result of construction noises, blasting, operations, vehicle traffic, and machinery. Strategic efforts will be made in reducing these effects on wildlife.

One other consideration is that some species will adapt more readily to disturbance (e.g., presence of buildings and humans) than others will. Experience at other mines indicates that most of the smaller Arctic species such as Arctic fox, Arctic hare, and most bird species, readily habituate to mine-related activities (BHP Diamonds, 2000). Buildings and associated structures may also provide improved living conditions for some species (e.g., Arctic ground squirrel living under buildings), and mine sites may provide a refuge from predators for species such as ptarmigan. Ptarmigan at the Meadowbank Gold project camp site have been observed flying under buildings when chased by a gyrfalcon. There is also anecdotal evidence that caribou congregate near buildings and areas of human activity to avoid predators such as wolves, which are more wary of human presence, to avoid insects (e.g., on roads and open cleared areas), and to use shading provided by buildings.

3.2 GENERAL MITIGATION MEASURES

General mitigation principles that will be adhered to in and around the project facilities for all project temporal phases include the following:

- All employees will participate in an environmental awareness program to familiarize them with an ecologically responsible code of ethics regarding wildlife and wildlife habitat. The program will also emphasize the value of the project area to wildlife species and the importance of adhering to established mitigation strategies, and may be reinforced with booklets, posters, and incentives/disincentives. Bear safety procedures will form an integral part of the employee training program. The details of this employee orientation program will be provided prior to completion of the permitting phase.

- Access in and around the mine facilities will be restricted to designated roads and trails to avoid unnecessary degradation of wildlife habitats.

- Hunting and harassment of any wildlife species will be prohibited. Nesting birds (protected under the *Migratory Bird Convention Act*) and small mammal habitat will be left undisturbed to the maximum extent possible. Wildlife, including small mammals, has the right-of-way on all roads and the airstrip. Vehicle traffic will be minimized and speed limits will be imposed.

- Feeding of wildlife will be prohibited.

- All road kills and other dead animals within the LSA will be reported immediately to project environmental staff and removed to avoid attracting scavengers, especially predatory mammals. Animals that have died for no apparent reason (i.e., obvious depredation, vehicle collision, or disease) will be examined by the environmental supervisor, and a necropsy ordered if deemed necessary. Other animals killed by vehicle collisions, depredation, or other natural causes will be removed to at least 10 km from the mine site to prevent attracting scavengers (following the example for carcasses found at EKATI). Carcasses of small mammals will be incinerated. For all animals killed on the road, drivers will be required to fill out a vehicle/animal collision report to document the conditions and circumstances surrounding the incident. There will be a reporting requirement by GN-DSD on collisions and other on-site mortality.

- The incinerator will be housed in a module connected directly to the mess hall or cooking facility so that it will not be necessary to expose the odours of domestic waste to the open air and so add to the risk of attracting predators or scavengers.

- A wildlife reporting system (e.g., wildlife log) will be maintained by mine staff to document sightings of individuals and aggregations of species such as caribou. Where human safety or wildlife well-being is an issue, employees will be notified regarding procedures. Examples include: (a) the presence of a grizzly bear in or near camp, or (b) a group of caribou resting on the airstrip. In both examples, both human safety and the well-being of the animals are of concern. A bear response contingency plan will be provided prior to completion of the permitting phase. This plan will include a staff organizational chart indicating who has responsibility for dealing with bear-human interactions, and the procedures to be followed in any given situation.

- All spills will be immediately cleaned up or isolated to minimize the potential for exposure to wildlife or degradation of the surrounding environment. A detailed spill contingency and reporting plan will be provided during the permitting phase.

3.3 VEGETATION

3.3.1 Summary of Environmental Effects

The potential habitat loss due to the development of various project components can be divided into three major categories: main site, Vault Site, and Baker Lake site. Project components for which VEC impact matrices were developed are described in the EIA.

Project components will not all be developed concurrently; instead, they will follow a predetermined schedule. For example, the main site pits will be developed during the construction phase, while the Vault pit will be developed during the operations phase.

All terrestrial habitats provide some value to wildlife VECs. Consequently, loss or degradation of any of these habitats may have resultant negative effects on wildlife (see the EIA). Any given wildlife species is likely to be associated with more than one type of habitat, and some species, such as caribou, follow seasonal migration patterns that cross entire ecozones, while predatory mammals such as wolf, grizzly bear and wolverine are more closely associated with the movements of caribou than with any specific habitat, except when they are denning.

3.3.2 Proposed Mitigation Measures

3.3.2.1 Objectives & Limitations

The vegetation or habitat VEC is the only terrestrial VEC that will remain stationary for the life of the mine. Unlike most wildlife VECs, which can be displaced from an area of impact, vegetation is susceptible to localized removal and degradation. Loss of vegetation within the footprint of mine facilities is unavoidable, and the EIA quantifies this loss. The primary objectives of a mitigation strategy for vegetation is to minimize the amount of habitat directly affected by mine development, and to maintain the integrity of remaining vegetation.

3.3.2.2 Mitigation Measures Applicable to All Development Phases

The following mitigation measures can be implemented throughout the life of the mine to minimize loss and degradation of vegetation primarily within the LSA.

- Where appropriate, the use of dust suppressants (see Cumberland's "Air Quality and Noise Management Plan"), off-road access control measures (see the "Access and Air Traffic Management Plan"), habitat reclamation, washing of vehicles, maintenance of natural drainage patterns, and restoration of contours after closure will be undertaken.

- Stripped materials and suitable waste rock will be used for road and other construction to the greatest extent possible (see the 'Mine Waste and Water Management Plan").

- Containment berms will be maintained around fuel storage areas, and hazardous materials handling guidelines (see the "Hazardous Materials Management Plan") and spill contingency guidelines (see the "Spill Contingency Plan") will be followed.

- The number of take-offs and landings will be minimized (see the "Access and Air Traffic Management Plan").

- Vehicle traffic and speeds will be minimized and monitored (see the "Access and Air Traffic Management Plan").

- Designated trails and activity areas will be provided.
- Windswept areas will be built up on winter roads with snow and ice to avoid disturbance of underlying vegetation communities (see the "Access and Air Traffic Management Plan").

3.3.2.3 Mitigation during Design Phase

Efforts to minimize the amount of vegetation directly affected by mine development included:

- minimizing the footprint of mine facilities (i.e., plant, storage areas, tailings impoundments, waste rock piles, camp sites)
- consolidating main mine facilities in one area
- avoiding high suitability habitats
- reducing the number of access roads and minimizing their length and width
- minimizing the length and width of the airstrip.

3.3.2.4 Mitigation during Exploration Phase

Employees involved in the exploration phase were cognizant of the potential impacts of exploration activities on vegetation. Mitigation measures implemented during this phase included:

- clustering of tents and other facilities
- installing wooden pallets in areas frequently traversed by foot
- constructing helicopter landing pads
- constructing tents and other temporary buildings above ground to facilitate light and moisture penetration
- providing containment berms around fuel storage areas, and following hazardous materials handling guidelines and spill contingency guidelines.

3.3.2.5 Mitigation during Construction Phase

The greatest potential direct impacts to vegetation are likely to occur during the construction phase, when topsoil stripping and land preparation activities are underway. Facility development will result in direct removal of vegetation, and uncontrolled vehicle access and improperly stored building materials can lead to unnecessary and unacceptable habitat degradation. Mitigation measures that will be implemented during the construction phase are provided below.

Measures Applicable at all Facilities

- Vehicles will be restricted to designated roads and trails as much as is feasible.
- Temporary workspace and material laydown areas will be designated and clearly delineated.

- Pallets, mats, and other similar means will be used to minimize potential habitat degradation.
- Vehicles will be maintained in good condition to prevent habitat degradation due to fumes and leaks.
- Littering by camp workers and unnecessary scattering of material and parts will be prohibited, and all uncategorized or scrap material will be picked up and stored in designated storage or disposal areas.
- As noted in the "Reclamation and Closure Plan," there will be a landfill area within the Portage waste rock storage facility for inorganic solid waste such as concrete, metal, rubber and plastic. All other materials considered unsuitable for landfill deposition will be packaged for shipment and disposed off-site. Any solid inorganic waste will be backfilled immediately, and no aromatic materials (i.e., empty paint, oil, or lubricant cans, asphalt, etc.), solid or otherwise, will be deposited in the landfill. No organic or domestic waste will be deposited at the landfill.

Measures along Winter Road

- Road will be constructed on snow and ice, and not on exposed or bare land.
- Approaches to lakes, streams, and rivers will be built up with snow and ice to achieve desirable grades.
- Where necessary, road integrity will be maintained with the use of water sprays and freezing. Windswept areas will be built up with snow and ice to avoid disturbance of underlying vegetation communities.
- Alignment of winter road will be clearly designated, and will be consistent between years.
- Road edges will be clearly marked in order to avoid errant vehicles from disturbing adjacent vegetation.
- Road will only be utilized during winter periods when snow and ice are present and stable.

Measures at Baker Lake Facilities

- A barge unloading ramp will be built in order to localize impacts to vegetation, facilitate barge unloading activities, and minimize impacts to beach vegetation.
- A containment berm will be constructed around fuel storage area. Hazardous materials handling guidelines and spill contingency guidelines will be followed.
- Spill emergency equipment and personnel will be stationed in close proximity to the landing facilities to ensure effective response times for spills, fires, or explosions.

3.3.2.6 Mitigation during Operations Phase

By the operations phase, much of the anticipated vegetation loss will have already occurred. Efforts during this project phase include minimizing encroachment into habitats adjacent to designated and established facilities, and minimizing the potential for habitat degradation through fugitive dust fall and

spills. Mitigation measures specific to the winter road and Baker Lake facilities are similar to those outlined in Section 4.3.2.5 above.

Measures Applicable at all Facilities

- Dust control measures will be implemented as required for various project components (e.g., process plant activity, roads, airstrip, tailings retention facilities, waste rock storage facilities).
- Use of stripped materials and suitable waste rock from sources other than stripped overburden and borrow pits, will be maximized for road and other construction during the operations phase.

3.3.2.7 Mitigation during Closure/Post-Closure Phase

The closure and post-closure phase is the first significant opportunity to initiate major reclamation of areas lost during the construction and operations phases. Removal of project facilities, reclamation of tailings and waste rock facilities, and the deactivation of permanent roads and associated reclamation activities will result in the natural revegetation of many previously affected areas of the project (see the “Closure and Reclamation Plan”).

Measures Applicable at all Facilities:

Certain facilities will be reclaimed progressively during the life of the mine, such as camps, temporary workspace, marshalling yards, and storage areas. Other facilities will be reclaimed during the closure and post-closure phase of the project. General reclamation measures, and mitigation measures for various project components are outlined below:

Reclamation & Revegetation – Some disturbed areas will be allowed to recover naturally, while vegetation will be established in others. The ability to induce revegetation will be constrained by the limited resources available for revegetation, as well as the limited areas that are suitable for revegetation. In some cases, revegetation of an area may be a combination of both artificial and natural revegetation. In other cases, the surface may be prepared to (e.g., scarified, recontoured, slopes stabilized, natural drainage patterns restored) to provide a suitable environment for plant growth to take place.

Areas where facilities have been removed, waste rock piles, tailings impoundments, and areas where vegetation has been disturbed will be considered for revegetation. Native soils will be stockpiled whenever and wherever possible. Lakebed sediments, organic soils, and other biosolids will also be used. Tailings will not be used due to their contaminant content. Native-grass cultivars and forbs (e.g., nitrogen-fixing legumes) will be used. Seeds, sprigs, cuttings and transplanted shrubs of indigenous species will also be used, but likely to a lesser extend due to their slower propagation rates observed in experiments at northern mines (BHP Diamonds, 2000).

Reclamation and revegetation will be a progressive process that will continue throughout the life of the mine as soon as opportunities present themselves to reclaim decommissioned facilities. NIRB and the KIA will be consulted during this process, and the experiences of reclamation and revegetation of other northern mines (e.g., EKATI and Diavik) will be drawn upon, if possible.

Pilot projects will be set up as soon as possible to determine which plant types and substrates are the most successful for various facilities to be revegetated. These plots will be compared to plots that have been allowed to revegetate naturally.

According to recent correspondence from the Department of Sustainable Development related to the Jericho project, a list of potential indigenous plants suitable for reclamation may include: *Calamagrostis neglecta, Poa pratensis, Poa alpina, Descurainia sophoides, Agropyron latiglume, Festuca rubra, Phleum alpinum, Deschampsia caespitosa, Eriophorum scheuchzeri, Puccinellia pumila, Care aquatilis, Carex rotundata*, and *Carex bigelowii*. This list will be revised prior to reclamation activities. A primary objective is to ensure that non-native plant species are not introduced to the site. As well, a review of reclamation activities and successes at other northern mines will be conducted.

Pits – Emergent vegetation may grow along the edge of flooded pits if a littoral zone is established around the edges of the pits, and terrestrial riparian vegetation may become established in shoreline areas; therefore, consideration will be given contouring pit slopes to enhance recolonization of emergent vegetation and shoreline vegetation.

Tailings Disposal Facilities – Compacted areas will likely need to be ripped, and surfaces may need to be recontoured and stabilized. If vegetation does not take hold and dust is an ongoing issue, consideration may be given to covering the tailings with a coarser material.

Waste Rock Piles – Mitigation measures will include: stabilizing slopes, capping with finer potentially non-acid-generating (non-PAG) material, and testing capping material for levels of inorganic elements. Because dust suppression and erosion may be issues, waste rock piles will be recontoured and revegetated with local plant species or allowed to revegetate naturally.

Dikes – Terrestrial area(s) created by dikes will be contoured, and erosion by wind and water will be minimized by providing proper drainage. Shoreline areas encroached upon by dikes will be restored.

Fuel Storage Areas – If applicable, all contaminated soil will be removed, foundations will be dismantled, and the area will be recontoured (e.g., berms flattened) to encourage regrowth of natural vegetation.

Camps – Camps and associated infrastructure will be removed and the site recontoured if necessary, and natural drainage patterns will be restored.

Process Plant Site – Any contamination from around the plant will be removed. Building structures and foundations will be dismantled, terrain stabilized and recontoured, and original drainage patterns will be restored to the greatest extent possible.

To minimize dust during closure activities, dust sources (e.g., roads, tailings ponds, waste rock piles, and other sources) will be addressed by watering. Emissions from plant processing activities, vehicles, incinerator, etc., during closure will be minimized.

Intake & Discharge Pipelines – Structures and facilities will be removed and vegetation will be allowed to recolonize the area, or revegetation will be undertaken to enhance re-establishment of vegetation communities.

Airstrip – The airstrip will likely be retained in a usable condition for long-term safety and future industrial activity considerations. Efforts will be made to ensure that the airstrip interferes as little as possible with local drainage patterns and allowable growth boundaries for recolonizing vegetation will be determined. In the event that the airstrip is decommissioned near the end of the closure phase, restoration activities will include, removing culverts, recontouring fill slopes for wildlife access, and scarifying the gravel surface of the airstrip to facilitate natural revegetation. A covering (e.g., large grain gravel) may be required for erosion and dust control.

Roads – All permanent and temporary mine roads will be scarified, culverts removed, drainage patterns restored, and slopes stabilized. Consideration will be given to rehabilitating roads to imitate esker habitats. Dust suppressants (e.g., watering) will be used as necessary during reclamation activities. Disturbance to near-shore vegetation will be minimized during removal of culverts (e.g., Turn Lake Crossing).

Fuel Storage Facilities & Explosives Magazines – Foundations will be removed, as will all contaminated soil, if applicable, and the site will be recontoured and stabilized to encourage regrowth of natural vegetation.

Measures along Winter Road

Maintenance protocols, as described earlier (e.g., building up windswept areas with snow and ice to avoid disturbance of underlying vegetation communities) will be maintained during the closure / post-closure phase (see Section 4.3.2.5). Minimal reclamation and revegetation activities are expected if road maintenance protocols are adhered to; however, once the winter road is no longer in use, the entire route will be surveyed to identify areas where reclamation and revegetation measures may be necessary (e.g., rutted areas, areas where vegetation has been removed or degraded). Recontouring, replanting, seeding, or other reclamation measures will be implemented as appropriate.

Measures at Baker Lake Facilities

Revegetation and rehabilitation will only be conducted on a local level, as the Baker Lake facilities will remain for Hamlet of Baker Lake and other industrial uses following mine closure. The winter road to the mine will be closed down and partial decommissioning of in-town staging facility, the explosives magazine, and the tank farm may be necessary, depending on future demand for these facilities. In addition, decontamination of these sites will be undertaken if necessary.

3.3.2.8 Mitigation during Temporary Shutdown

Depending on the length of the shutdown, some revegetation and reclamation of locally disturbed areas may be undertaken. Ecological Land Classification units which have high suitability ratings for wildlife species, or which may help reduce erosion are among areas that could be considered a

priority for reclamation. There may also be areas where progressive reclamation is ongoing, and a decision would have to be made whether to continue with those mitigative processes.

All structures will be retained. Any waste with the potential to attract wildlife will be removed. Hazardous and contaminated waste materials will be taken off-site, and non-hazardous waste materials will be recycled, buried in the waste rock piles, or incinerated. Natural drainage patterns will be restored wherever practical.

3.4 UNGULATES

3.4.1 Summary of Environmental Effects

Caribou and muskox are susceptible to habitat loss and disturbance associated with project facilities and activities. The potential for direct impacts such as vehicle/animal collisions, injury, or death related to project facilities (e.g., vehicle collisions), and increased hunting pressure are concerns, as well as indirect effects related to contaminated water and vegetation.

The experience of large mines in the NWT suggests that caribou readily habituate to the presence of buildings, related structures, roads, and human presence. Animals within the mine facilities may be injured, sick, or trying to hide from predators. Healthy, fit animals are not likely to remain within the facilities for very long. They may have become temporarily disoriented and should soon find their way out; however, individuals that remain within the facilities are displaying abnormal behaviour, and chasing them out is not likely to be helpful. In such cases, the animal should be observed closely but left alone.

In 2001, a total of seven caribou mortalities were recorded on site at the EKATI mine facilities. This was reported as an abnormally high number (BHP Billiton, 2002). Three of the caribou mortalities occurred near the Long Lake containment facility, and all were associated with a large movement of caribou past the mine during the last week of July (BHP Billiton, 2002). These carcasses were moved at least 10 km from the mine, to prevent the attraction of other wildlife, following RWED recommendations. One adult female caribou, which had spent several days in an unused culvert in a storage area near the accommodations building, died from an infected wound. An adult male, also in the vicinity of accommodations, was observed repeatedly trying to stand up, but was unable to do so and did not move for several days. Following consultation with RWED, the caribou was destroyed, the carcass necropsied, and disposed of in the waste rock pile. All necropsies performed indicated death from natural causes (BHP Billiton, 2002).

Another concern is the potential for caribou or muskox to drink contaminated water from the tailings impoundments or possibly runoff from the waste rock piles. Ungulates will be strongly discouraged from this behaviour by the use of bear bangers, bullhorns, vehicle horns, herding, or other aversive methods.

Although muskox are not considered a species at risk, their low reproductive rate, sedentary disposition, and tendency to stand their ground when threatened make them vulnerable to disturbance and over-hunting. This species, therefore, requires careful management and monitoring of any adverse effects from mine development and operation within their range (JWEL, 2001). A

small herd of muskox has been associated with the Lupin gold mine, at the south end of Contwoyto Lake, for several years.

During an aerial survey conducted in September 2001, a small herd of 10 or more muskox was observed about 10 km south of the Lupin mine site (S. Wilbur, pers. comm., 2003) and Lupin mine employees have reported a muskox herd in the areas since about 1995. These observations suggest that muskox can tolerate mining activity within at least 10 km.

3.4.2 Proposed Mitigation Measures

3.4.2.1 Objectives & Limitations

The primary objectives of mitigation measures for ungulates are to avoid injury and death of individuals, ensure that the health of individuals is maintained by minimizing contamination of water and vegetation, avoid barriers to movement, and maintain the integrity and viability of local and regional populations.

Mitigation measures to avoid interaction between project components and effects and ungulates are not always successful because caribou are known to habituate to human presence and may be inclined to reside for days or weeks within the mine site. Limiting access to potential hazards or sources of contamination may be more difficult in these circumstances.

Caribou, particularly those that occur in the Meadowbank in fall and spring, are highly migratory and may only be within the Meadowbank LSA for a few days during these seasons. In addition, wintering animals appear to be transient in nature. This high mobility may make it be difficult to monitor caribou health or any potential effects that the mine or a given project component has on them.

3.4.3 Mitigation Measures Applicable to All Development Phases

Impact mitigation measures for ungulates applicable to all development phases include:

Noise & Activity – Minimizing blast noises, engine noises, maintaining and ensuring vehicles are properly muffled, establishing speed limits, and establishing blasting windows if possible (see the “Air Quality and Noise Management Plan” and “Access and Air Traffic Management Plan.” Behavioural studies at the EKATI mine indicated that caribou did not undergo significant movements following blasting, suggesting that caribou quickly became habituated to the noise.

Pits – Based on discussions with Baker Lake residents (Baker Lake Impact Workshop, 24 to 26 March 2003), the consensus was clear that the use of fences for restricting caribou travel was undesirable. Rather, local residents wanted caribou to be able to travel uninhibited, wherever they wanted. This recommendation of Baker Lake residents would preclude the placement of any fences or berms around open pits.

Waste Rock Piles – Minimizing footprint of waste rock storage facilities, ensuring structural stability, minimizing dust, and capping progressively with non-PAG material.

Tailings Impoundments – Ungulates may drink contaminated water from tailings ponds or runoff from waste rock dumps, or may become stuck in unstable materials. Bear bangers, bullhorns, loud noises or other aversive techniques will be utilized to chase them off, where appropriate.

Roads & Traffic – Minimizing vehicular traffic and speeds, and reporting all vehicle/ungulate collisions to project environmental staff (see the "Access and Air Traffic Management Plan"), and filling out a report on the interaction. At the Baker Lake Impact Workshop (24 to 26 March 2003), it was noted by Joe Niego, Mayor of Baker Lake, member of CLARC, and wildlife officer, that the stopping distance for a loaded truck when encountering caribou is 60 m or more, and proposed to have deer whistles on trucks to chase/scare wildlife off the roads. Mr. Niego also suggested limiting speed in poor visibility situations.

Airstrip & Air Traffic – Minimizing the number of take-offs and landings, and filling out a report on all aircraft/ungulate collisions (see the "Access and Air Traffic Management Plan"). Monitoring of ungulate occurrence in the vicinity of the airstrip prior to aircraft landings and departures. Joe Niego (Baker Lake Impact Workshop (24 to 26 March 2003) noted that Western Mines found that caribou liked to lie on gravel runways, and that loud bangers were used to scare them off when planes needed to use the runway.

Mine Plant & Associated Facilities – Adhering to emissions and fugitive dust control protocols (see the "Air Quality and Noise Management Plan"). Minimizing noise, picking up all debris, scrap and uncategorized items and storing them in designated facilities (see the "Mine Waste and Water Management Plan").

Fuel Storage – Complying with hazardous materials guidelines (see the "Hazardous Materials Management Plan"), ensuring contingency plans are in place for any spill or emergency (see the "Spill Contingency Plan"), and conducting regular monitoring.

Emulsion/AN Storage/ Explosives Magazines – Maintaining containment berms around storage areas, isolating and fencing off explosives magazines, and complying with hazardous materials handling and storage guidelines and spill contingency guidelines.

Sewage & Solid Waste Disposal Facilities – Incinerating all garbage and food waste immediately. Securely fencing any food or attractants stored temporarily outside.

Winter Road & Traffic – Avoiding berming of roads, limiting use of winter road to mine employees, prohibiting mine employees from hunting, enforcing speed limits, yielding right-of-way to ungulates and all wildlife, and confining traffic to winter road (see Section 3.3.2.5).

Measures Applicable on All Temporary, Permanent & Winter Roads

The highest potential for interactions between ungulates and vehicles exists along the winter road. Surveys to date have shown that considerable numbers of caribou may be present along the winter road during the hauling window. Extra consideration has been given to developing protocols and mitigation measures to reduce the potential for road kills. The following recommendations will also be beneficial for all other wildlife VECs occurring in the area.

- All drivers will undergo informational and training sessions regarding the potential for ungulate/vehicle collisions. The benefits of adhering to protocols established for reducing interactions will be emphasized.

- All permanent and temporary roads will have posted speed limits (e.g., <50 km/h) to ensure that interactions between ungulates and vehicles can be avoided. Speed limits will be strictly enforced by the environmental manager and other designated employees.

- The location of herds of caribou and muskox or individual animals observed in the vicinity of mine facilities will be immediately reported to the on-site environmental supervisor who will inform all potentially affected mine employees of their presence. This ongoing communication system will ensure that unexpected encounters between animals and vehicles are minimized. Trucks will be equipped with radios so that drivers can alert each other of caribou and other wildlife approaching or crossing roads.

- When animals are present on or moving/migrating across roads, they will be given the right-of-way. Herding of animals will only be considered when they are located on the airstrip and an incoming flight is expected. According to Joe Niego, the mayor of Baker Lake, Western Mines used loud bangers to scare animals off the airstrip (Baker Lake Impact Workshop – 24 to 26 March 2003). Herding may involve the use the use of bullhorns and cracker shells.

- Roads will be watered as necessary to reduce dust, and vehicles will be maintained in good condition to minimize contaminant loading of roadside/downwind vegetation.

- Daily logs of ungulates, locations, numbers, sex, and direction of travel will be kept.

- A wildlife kill report will be filled out by the driver for every animal (from ungulates to small mammals) that is killed along haul roads related to the project. This information will be analyzed on an annual basis to determine whether changes to mitigation measures are warranted.

Other Mitigation Measures

- Every effort will be made to enforce a no-hunting zone of 1 km on either side of the winter road to reduce mine-related impacts on ungulates in the area and to protect the safety of mine employees utilizing the road. Consultations will be held with Baker Lake residents to emphasize the importance of these measures, and with Government of Nunavut and INAC as they relate to land use issues in the region . Signs will be posted along roads.

- Mine employees will not be permitted to carry firearms or hunt while they are working. Only certain, authorized personnel will be allowed to carry firearms.

- Protocols will be established for relaying any important information about caribou and other wildlife to a central wildlife registry that contains all information reported about wildlife. This will be administered by the environmental supervisor on site. A staff organizational chart will developed later. The environmental supervisor will also be familiar with procedures in the event of a potentially dangerous or uncontrolled situation involving wildlife.

- General flight altitudes in caribou habitat will be limited to above 300 m, except for approaches and take-offs in the vicinity of the airstrip.

- Snowmobile and ATV use will be limited in areas where unacceptable stresses to ungulates may result.

3.4.3.1 Mitigation during Design Phase

- To reduce the potential for ungulates falling into pits, the slope angles were graduated to diminish the likelihood of slippage near the edge of pits.

- Road were designed to have a low profile, which minimizes the presence of potential barriers to caribou and muskox movement, although Baker Lake Residents indicated that CBD could route roads wherever they wanted and could apply whatever cross section they wanted because it would not be a barrier to caribou.

- The footprint of all facilities was minimized to mitigate the removal of suitable foraging habitat for caribou.

- Berms were designed around fuel storage areas and explosives magazines to deflect movement away from these facilities and to protect adjacent habitats from potential spills, explosions, and degradation.

- Communication was initiated with local, regional, territorial, and federal agencies regarding research on caribou and muskox herds in the Kivalliq region.

- Terrestrial baseline studies of caribou and muskox were conducted to determine distribution and abundance.

3.4.3.2 Mitigation during Exploration Phase

- Caribou or muskox observed during helicopter flights were noted, the information communicated to other pilots, and an effort made to avoid disturbance on future flights (i.e., by maintaining flight heights over animals).

3.4.3.3 Mitigation during Closure/Post-Closure Phase

Measures Applicable at all Facilities

See reclamation measures for vegetation, which will benefit ungulates (Section 4.3.2.7).

Wildlife access will be provided at suitable intervals along the mine haul road by regrading the embankment shoulder to flatter slope conditions.

Measures Associated with Winter Road

The winter road will be used to haul materials removed during closure activities. The same protocols as indicated earlier will be in place (Section 4.3.2.7). The winter road will not be active during the post-closure phase.

Measures at Baker Lake Facilities

The Baker Lake facilities will not be removed following mine closure, but will be available to the Hamlet of Baker Lake and other potential development operations in the area.

3.4.3.4 Mitigation during Temporary Shutdown

- Means of improving mitigation during construction or operation will be investigated prior to restarting of the mine, and methods for mitigating previously unanticipated effects will be developed.

- On-site staffing will be maintained at a minimal level to ensure that ungulates are averted from tailings ponds and other potentially contaminated water sources.

3.5 PREDATORY MAMMALS

3.5.1 Summary of Environmental Effects

Grizzly bears and wolverines are particularly vulnerable to mine development. Due to their wide-ranging and scavenging natures, they are drawn to mine sites where waste and garbage may be readily available. Once they have been attracted and habituated to a site, they may be difficult to avert and may eventually become a human safety concern. Experience at active mines in the NWT suggests that this may be one of the most challenging wildlife issues facing a new mine. For example, during the MVEIRB (2003) Technical Sessions for De Beers Snap Lake Diamond project in Yellowknife in January 2003, it was pointed out by RWED that between 1998 and 2002, 16 wolverines had been killed or removed from mines in the Lac de Gras area. BHP acknowledged that the loss of 16 wolverines represented a cumulative effect on the local population. Wolverines had been seen on three separate occasions at the domestic landfill at the EKATI, and one had become so desensitized to human presence that not even bear bangers or rubber bullets could drive it off. Eventually, it had to live trapped and destroyed. Although no direct link could made between the wolverines seen at the landfill and the wolverine that was destroyed, the possibility that the landfill may have contributed to death of the wolverine cannot be dismissed (BHP Billiton, 2002).

Other potential impacts to grizzly bears and wolverines, such as changes in prey abundance, distribution, or health, are of lesser concern. Mitigation measures to ensure that the viability and integrity of prey populations is maintained (e.g., ungulates) will also mitigate the potential impact to their predators. Cumberland recognizes the importance of working with other government and non-government agencies to conduct scientific and traditional wildlife studies on local, regional, or territorial scales.

3.5.2 Proposed Mitigation Measures

3.5.2.1 Objectives & Limitations

The primary objective of mitigation measures related to large predators at the Meadowbank Gold project is to avoid human-induced mortality. Careful storage and handling of food and food wastes and prohibition of hunting by mine employees will ensure that the potential for this impact is minimized.

There has been a suggestion by some authorities that some scavengers are attracted to project sites irrespective of the adequacy of mitigation measures in place. Alternatively, it can be argued that predators would not become desensitized to human presence at a project to the point that destruction is necessary if enough preventative measures had been taken in the first place. According to Misery staff in January 2001, an estimated four wolverines were frequenting the Misery camp, and had somehow gained access to the area beneath some trailers, possibly attracted by leaking sewage and electrical wires (BHP, 2002). It was thought that food waste awaiting incineration may also have acted as an attractant. As well, the behaviour of some Arctic foxes in the area indicated that they had likely been fed by mine workers. RWED staff live-trapped and relocated one wolverine, and destroyed a second. Nine foxes that became habituated to human activity were also destroyed. It is difficult to justify the destruction of these animals when it is the failure of mitigation measures that led to their habituation and ultimate destruction. More rigorous enforcement of rules and designs may have prevented these problems.

3.5.2.2 Mitigation Measures Applicable to All Project Phases

Measures in addition to those described for ungulates above and relevant specifically to predatory mammals are described below.

Measures Applicable at all Facilities

- A safety education program for all personnel on procedures for dealing with bear-human interactions, and avoiding interactions with wildlife in general will be implemented. Measures that will be discussed will include management of food, food wastes, and garbage, (e.g., incineration of all food wastes) and maintaining safe distances from wildlife. Strict prohibition of all contact with wildlife, especially Arctic foxes and Arctic ground squirrels, which easily become dependent on humans for food, will be emphasized. Nine foxes that became habituated to human activity at the EKATI mine had to be destroyed. A fed animal is a dead animal; every effort will be made to avoid this potential negative effect.

- A bear and wolverine response plan will be developed in order to manage individuals of these species that make their way into the mine site or are observed in close proximity.

- All garbage and food wastes will be disposed of by incineration. The mine will provide back-up incineration capacity for garbage to ensure that equipment failure does not result in attracting scavengers to the mine. At the Lupin Mine, a breakdown of the incinerator led to a build up of refuse and attraction of a female grizzly bear and two cubs. These bears eventually had to be destroyed.

- All field crew will be required keep their lunches safely locked in their vehicles (except when eating meals). The use of perfume and cologne will be strongly discouraged in the field.

- A management strategy for animals that persist in frequenting construction areas will be developed (a bear response contingency plan will be developed prior to mine construction).

  Once animals such as wolverines, grizzly bears, foxes, etc., become habituated to human activity, experience at other mines has shown that they have to be either relocated or destroyed (BHP Billiton, 2002). Experience at EKATI has shown that at least one wolverine had become desensitized to humans and it was thought that the landfill may have contributed to the frequent presence of the wolverine on site, and ultimately to the death of the animal. The Meadowbank mine will have no landfill for domestic waste, which should help avoid such incidents.

- All large predators occurring in the vicinity of the mine facilities will be reported to the environmental manager, who will disseminate information to all employees. All kills or carcasses in close proximity to mine facilities will be reported and carcasses will be removed to at least 10 km from mine facilities (based on EKATI practices) or buried within the waste rock storage facility or other suitable location.

- All edible products or even inedible but aromatic products such as oil and paint will be stored in sealed, bear-proof trailers or compounds. Skirts (i.e., sheet metal sheathing) will be placed along the base of these facilities to prevent animals such as wolverines from gaining access from beneath. Sheathing will also be necessary on other facilities that may contain substances that have the potential to attract scavengers.

- Protocols for vehicle use on roads will be implemented as has been described previously (see Section 3.4.3).

- Safety and specialty training for persons expected to undertake response actions in the event of a carnivore in camp (a bear response contingency plan will be developed).

Measures along Winter Road

Grizzly bears will be hibernating during the period when the winter road is in use; therefore, mitigation measures specific to bears are not anticipated. Interactions between vehicles and wolverine or wolf are unlikely but possible. Posted speed limits, reporting of all wildlife, and giving animals the right-of-way will ensure that the potential for vehicle/ predator collisions is minimized.

Every possible effort will be made to enforce a no-hunting zone of 1 km on either side of the winter road to reduce potential impacts on predators in the area and for the safety of mine employees utilizing the road. Mine employees will not be permitted to carry firearms or hunt while they are working. Only certain, authorized personnel will be allowed to carry firearms.

3.5.2.3 Mitigation during Design Phase

A priority during design phase was to ensure that incineration facilities were capable of completely incinerating waste, without any residue that would attract predators or scavengers. Domestic waste facilities were designed to be tightly sealed tight and to trap all odours.

3.5.2.4 Mitigation during Exploration Phase

No interaction occurred, therefore no mitigation was necessary.

3.5.2.5 Mitigation during Temporary Shutdown

Efforts will be made to ensure that no attractants are available to scavengers (see methods described previously). The 2001 Wildlife Effects Monitoring Program at the EKATI mine (BHP Billiton, 2002), divided attractants into three categories: food and packaging (such as drink boxes and lunch bags), oil products (such as grease, oily rags, and paint), and other (such as aerosol cans and batteries). Predatory mammals attracted to the landfill included wolverines, wolves, and foxes. Wolverines and possibly other predatory mammals are attracted to the odour of oil and paint. All containers of paint, oil, lubricants, and other aromatic compounds will be tightly sealed in their own containers and stored in sealed bear-proof compounds (not exposed to open air) at all times, including during short-term shutdowns. All trailers containing food or other aromatic compounds will be skirted to prevent animals like wolverines from gaining access from beneath.

3.6 SMALL MAMMALS

3.6.1 Summary of Environmental Effects

Because the home ranges of small mammals are relatively small, local populations could be affected by loss of significant habitat within existing home ranges. Much of the habitat loss (i.e., footprint of mine facilities and roads) is unavoidable; however, degradation of existing habitats can be minimized. Maintenance of high quality habitats even in close proximity to buildings is of importance since small mammals are easily habituated to the presence of structures and humans and are likely to utilize all available habitats.

The most substantial impact to small mammals in the Meadowbank project area will occur during the construction phase. The major impacts include loss and disturbance of breeding and foraging habitat, displacement, reduced habitat effectiveness due to noise and activity, mortality due to collisions with traffic or contamination, degradation of health and habitat due to toxic spills and contaminant loading from dust and exhaust, and habitat fragmentation.

Declines in local populations of small mammals, particularly voles and lemmings are expected. The increase or decline of populations in other small mammal species is more difficult to determine. Arctic hare may be attracted to project facilities because of the protection from natural predators these structures afford. Similarly, increased denning opportunities will exist for Arctic ground squirrels under buildings and in roadbanks and other facilities.

The major areas of impact will be the plant site and ancillary facilities, open pits, roads, waste rock disposal facilities, and the airstrip. It is likely that the voles, lemmings, and Arctic ground squirrels will

be more directly affected by the development of the mine and its facilities than will be the Arctic hare, due to the ground squirrel's reduced ability to avoid mobile machinery, earth-moving machinery, and blasting. As well, rodents instinctively burrow when a threat is perceived, whereas Arctic hares either freeze momentarily or flee.

3.6.2 Proposed Mitigation Measures

3.6.2.1 Objectives & Limitations

The primary objective is to maintain high quality habitats wherever possible, even in close proximity to project facilities, so that small mammals can continue to use these areas.

Removal and disturbance of some habitat is unavoidable and localized impacts to some small mammal populations will occur; however, this will be offset by the ability of small mammals to exploit micro-habitats (e.g., voles and lemmings) and their ability to reproduce rapidly. As noted above, small mammals can also exploit man-made structures as habitat and as refuge from predators.

3.6.2.2 Mitigation Measures Applicable to All Development Phases

Measures Applicable at all Facilities

Small mammals (like large mammals) will be given the right-of-way on roads. This will be part of the informational and training session regarding animal/vehicle collisions described in Section 3.4.3 Microtine rodents and possibly Arctic ground squirrels may inhabit roadsides, which would make them particularly vulnerable to being run over by vehicles. Drivers should be aware of this behaviour so that interactions can be avoided without endangering themselves or their loads.

Roads will be watered as necessary to reduce dust, and vehicles will be maintained in good condition to minimize contaminant loading of roadside/downwind vegetation, which will be inhabited by small mammals.

Known habitats of voles, lemmings, and Arctic ground squirrels will be avoided in development areas wherever and whenever possible.

Measures along Winter Road

Measures indicated in previous sections are also applicable to small mammals. Additional considerations are listed below.

- Arctic ground squirrels will be hibernating during operation of the winter road and are unlikely to be affected by winter road use.
- Speed limits will reduce the potential for Arctic hare and vehicle collisions.
- Small mammals are subnivean during the winter (i.e., under the snow) and have the potential to be crushed under the weight of vehicles. Winter road maintenance such as building up low snow areas with snow, using water spray to ice roads etc. will minimize the potential for this impact.

3.6.2.3 Mitigation during Exploration Phase

No specific mitigation measures were employed for small mammals during the exploration phase.

3.6.2.4 Mitigation during Operations Phase

Measures Applicable at all Facilities

- The possibility of creating habitat for microtine rodents on the slopes of waste rock storage facilities either during operations or during closure and post-closure will be explored (see Section 3.6.2.6).

- Speed restrictions will minimize the potential for small mammals such as Arctic hare and Arctic ground squirrel of being struck by vehicles. Arctic ground squirrels and possibly microtine rodents may be particularly vulnerable to road-kill because they may be attracted to burrowing opportunities on road banks and fill areas.

- To avoid dependence of small mammals (e.g., Arctic ground squirrel) on human foods, feeding will be prohibited, food will be properly and securely stored, and all food wastes will be incinerated.

3.6.2.5 Mitigation during Closure/Post-Closure Phase

Measures Applicable at all Facilities

- The possibility of creating esker-like habitat from the roads once they have been scarified will be explored (see Section 3.3.2.7).

- The possibility of creating habitat for microtine rodents on the slopes of waste rock storage facilities either during operations or during closure and post-closure will also be explored. Microtine rodents prefer microhabitats as well as ridge crest, avens, and heath tundra habitats. If rock size and angularity, and interstitial spaces can be duplicated, even if the slope face is disturbed, voles and lemmings may inhabit these spaces as long as they are stable and properly drained, and especially if and when the areas begin to revegetate with edible plant species. The establishment of vegetation will also provide insulation and help stabilize slopes and prevent erosion.

- If waste rock substrates contain relatively high concentrations of certain inorganic elements, they may accumulate in plants that are eaten by small mammals and bioaccumulate to unacceptable risks in predators. If this is found to be the case, it would not be beneficial to create small mammal habitats on the slopes of waste rock dumps. Ongoing monitoring of contaminant levels will provide direction in this regard.

- Other opportunities to exploit microhabitats and refugia in and around the mine site (e.g., around buildings) will be investigated.

- Areas where facilities have been removed, waste rock piles, tailings, roads, and other areas where vegetation has been disturbed will be considered for revegetation. A more detailed discussion has previously been described in Section 4.3.2.7.

3.6.2.6 Mitigation during Temporary Shutdown

Small mammals are likely to readily adapt to temporary changes in their environment; however, if the temporary shutdown occurs during winter, small mammals, which have found habitat under heated buildings, may perish if the heat is turned off. Predators may also move into the mine facilities and prey on the otherwise protected animals. Small mammals may also create habitats in areas that would otherwise be high-use areas (e.g., along roadsides or near machinery). This could be fatal to some animals once the mine resumed operations; however, there may be little that can be done to mitigate these kinds of effects.

3.7 RAPTORS

3.7.1 Summary of Environmental Effects

Available data suggests that few raptors nest in the vicinity of the Meadowbank site; therefore, direct impacts to breeding birds are expected to be very low. Ongoing monitoring (see Section 4.7) will ensure that active nests will be documented if they are present within the Meadowbank LSA.

Other potential impacts include changes in abundance, distribution, and health of prey populations due to project activities, and attraction of raptors to artificial nest structures (e.g., pit walls and buildings). Mitigation measures to minimize the removal of vegetation (see Section 3.3.2) will ensure that habitat is available to support local small mammal populations.

In the 2001 Wildlife Effects Monitoring Program (BHP Billiton, 2002), the occupancy rate and productivity of peregrine falcons and gyrfalcons in the EKATI study area were compared with an undisturbed area (Daring Lake) during 2001. They found that the productivity at EKATI was lower compared to Daring, but that site occupancy at EKATI was higher. The study also found that monitoring since 1998 confirmed that constant and productive populations of peregrine falcons and gyrfalcons had persisted in the study since the development of the mine. It was also noted that gyrfalcons during the study produced more offspring than did the peregrines. Factors cited that directly affected raptor productivity were prey abundance, weather, and disturbance. The most sensitive stage of the reproductive period of many raptor species was considered to be the initial stages of territory selection, prior to egg-laying. Disturbance at this stage may result in a failure to reproduce. It was the conclusion of the EKATI study that the low productivity of the raptors was due to regional influences, since it was found both inside and outside the study area (BHP Billiton, 2002).

3.7.2 Proposed Mitigation Measures

3.7.2.1 Objectives & Limitations

The primary objective of mitigation measures for raptors is to avoid any impact to nesting birds. Effort will also be expended in minimizing loss of habitat (as described earlier) that supports prey for raptor

species. Ongoing monitoring for active raptor nests within the LSA will ensure that project activities do not result in inadvertent impacts to nesting birds.

Where raptors attempt to nest on project facilities or structures (e.g., pit walls and buildings), avoidance of unacceptable effects may be difficult once birds have established nests. Making these sites unattractive to raptors is the best strategy to minimize potential impacts (see Section 3.7.2.2). As noted above, the most sensitive time in a raptor's reproductive cycle is during the initial stages of territory selection, prior to egg laying. Disturbance at this time can result in failure to reproduce; therefore, it would be better to make any artificial sites unattractive to raptors well in advance of their arrival in the area in May.

Limitations of mitigation of effects on raptors include the schedule of mine development and the ability to identify all active, previously used, or new raptor nesting sites in the LSA and RSA.

3.7.2.2 Mitigation Measures Applicable to All Development Phases

- Where active raptor nests are identified, a nest-specific management plan will be developed to ensure that nesting success is not affected during development activities. The management plan will address proximity, timing, and scope of activities.

- Where raptors are observed establishing nests on artificial structures, pit walls, or other facilities, nesting will be discouraged during the courtship and nest-building phase. If eggs have already been laid, a nest-specific management plan will need to be developed to ensure that the integrity of the nest is maintained; however, there have been no reports of raptors nesting on man-made structures or pit walls at EKATI mine since 1998. It is unlikely that raptors will nest in these areas due to high levels of noise and disturbance.

- Disturbance and removal of terrestrial habitats will be minimized wherever feasible. All terrestrial habitats support prey species of the four key raptor species.

- Strictly enforced speed limits will ensure that encounters between raptors and vehicles are minimized. The only raptors likely to be present along the winter road are snowy owl and gyrfalcon, and densities are expected to be very low. Rough-legged hawk and peregrine falcon winter to the south of the study area.

- The use of above-ground power lines poses a risk to raptors of electrocuting themselves. Marking of overhead wires would reduce the risk.

- Blasting and other loud noises from mine activity may negatively affect actively nesting raptors. Blasting windows and distances will be established with the cooperation of the NWMB and presented in a nest-specific management plan. Specific blasting protocols will be developed in more detail prior to project approval.

3.8 WATERFOWL

3.8.1 Summary of Environmental Effects

Waterfowl species are most often associated with wetlands with emergent vegetation, which are a relatively rare type of habitat in the Arctic, and particularly in the Meadowbank area. During the five years of baseline data collection in the Meadowbank area, no nesting waterfowl were seen, although it is likely that they do breed in the area in low numbers.

Flooded portions of the tailings impoundment areas may be used briefly by waterfowl for resting or roosting purposes during the summer and the migratory period; however, residence times are not expected to be long due to the lack of emergent and littoral vegetation, and the absence of fish (removed during the dewatering phase) in the tailings impoundment areas.

Waterfowl at the EKATI mine continued to use lakes adjacent to the Panda pit, infrastructure, and roads, to within 225 m (BHP Diamonds, 2000). BHP Diamonds (2000) also reported that a 1999 WEMP study indicated that the distribution and number of loon territories adjacent to the mine was remaining stable.

The possibility of waterfowl foraging on contaminated vegetation exists (e.g., vegetation that has been contaminated by fugitive dust fall from the processing plant, tailings impoundment, waste rock storage facilities, or vehicles). Contaminated vegetation may also be a potential problem when the tailings facility and waste rock dump begin to support vegetation that assimilates contaminants.

Transmission wires may also pose a risk to low-flying waterfowl; however, the likelihood of this is diminished because of the lengthy or continuous periods of daylight in the Meadowbank area during the waterfowl breeding season. There is no evidence at other Arctic mines that waterfowl collisions with transmission lines have occurred.

3.8.2 Proposed Mitigation Measures

The Reclamation and Closure Plan for the Meadowbank mine involves capping the waste rock piles and tailings impoundments with non-acid-generating rockfill. This capping material, providing it is suitable for the growth of native species of vegetation, would protect against waterfowl and other herbivorous animals eating contaminant-bearing vegetation that could potentially grow on these substrates.

Because of the size of the proposed tailings pond, it will be difficult to prevent waterfowl from landing on the flooded portion of the tailings facility. Several options do exist and these are described in more detail below; however, even if waterfowl land on the tailings ponds, the potential impact is likely to be minimal, because the individuals would likely only be resting or roosting on the ponds and will not be feeding on any emergent vegetation or fish. All fish will have been removed during the construction phase during dewatering.

The likelihood of collision with transmission wires would also be minimal, because waterfowl would be in the area during periods of lengthy or continuous daylight, and visibility would be good. In addition, there have been no reports of birds colliding with above ground power lines at other northern mine

sites. An inexpensive method for averting bird strikes on power lines would be to place coloured streamers, flashers, or flags on the lines to make them more visible.

3.8.2.1 Objectives & Limitations

The objectives of mitigation measures for waterfowl are the same as for raptors and other breeding birds: to avoid any impact to nesting birds, and to minimize direct impacts to waterfowl and waterfowl habitat.

As noted above, no nesting waterfowl have been observed in the Meadowbank study area since baseline studies began in 1998. In addition, previous studies have indicated that there is no critical or significant waterfowl habitat in the Meadowbank region; however, some breeding by loons and other waterfowl is likely, and ongoing baseline studies will continue to monitor breeding waterfowl within the LSA.

Mitigation objectives will be limited by the fact that the development of certain facilities, such as the tailings impoundment, may conflict with or remove waterfowl habitat.

3.8.2.2 Mitigation Measures Applicable to All Development Phases

The following measures are applicable to all development phases.

- Disturbance and removal of waterfowl habitats will be minimized wherever feasible.
- Water that has the potential to come into contact with the mining activities will be intercepted, contained, analyzed (if required), and treated if required, prior to discharge to the receiving environment.
- In the event that contaminated snow is gathered and dumped, leading to the presence of a possible contaminated pond in the spring, mine staff will ensure that structures or actions are implemented to make the meltwater ponds inaccessible (e.g., netting or aversive techniques) to migrating waterfowl.
- All dust control water will be uncontaminated and will be able to meet requisite CCME or equivalent guidelines for livestock (or aquatic life if the spray will be returned to different water bodies).
- Where active waterfowl nests are identified in close proximity to mine activities, a nest-specific management plan will be developed to ensure that nesting success is not affected. The management plan will address proximity, timing, and scope of activities.
- Strictly enforced speed limits will ensure that encounters between waterfowl and vehicles are minimized.
- To minimize the impacts of blasting on nesting waterfowl, common blasting windows and distances may need to be established with the cooperation of the NWMB.

- Mine employees will be prohibited from hunting at or in the vicinity of mining facilities (i.e., main site, Vault site, and Baker Lake facilities).

3.8.2.3 Mitigation during Construction Phase

Measures Applicable at all Facilities

- The use of above-ground power lines poses a small risk to waterfowl of electrocuting themselves or colliding with poorly marked wires. Consideration will be given to avoiding placement of transmission lines underground in close proximity to high value waterfowl habitats, and marking wires to increase their visibility.

- Known habitats of waterfowl will be avoided in development areas wherever and whenever possible.

- Noise levels and activity will be minimized as is practical (see Air Quality and Noise Management Plan).

- The number of roads, road dimensions, and vehicle traffic and speeds will be minimized.

3.8.2.4 Mitigation during Operations Phase

Measures Applicable at all Facilities

- Waste rock storage facilities and tailings impoundments will be capped with non-acid-generating materials. This capping material, providing it is suitable for the growth of native species of vegetation, would mitigate waterfowl foraging on contaminant-bearing vegetation that could potentially grow on these substrates.

- Tailings ponds, reclaim ponds, and storm water retention ponds will be monitored on a regular basis to ensure that waterfowl have not landed on these waterbodies. In cases where waterfowl have landed on ponds, aversive tactics, including the use of bear bangers, cracker shells, and other loud, sudden noises, will be used to scare them away. Because the period of potential exposure is short (i.e., the ice-free period between approximately the middle of June and the middle of October), exposure to potential contaminants is expected to be of short duration and unlikely to result in harmful effects. Birds are also unlikely to remain on these ponds for extended periods of time, because no emergent vegetation or fish will be available for foraging.

- Vegetation adjacent to mining facilities may have the potential to be contaminated by fugitive dust. As well, vegetation growing on waste rock storage facilities and dry tailings may have the potential to assimilate contaminants. If, through ongoing monitoring activities, previously described mitigation measures (e.g., capping with uncontaminated material) are not effectively addressing a contamination problem, other means to minimize the use of terrestrial vegetation by waterfowl will be implemented. Scare tactics, using tactics described previously, or other more innovative methods (e.g., use of methiocarb on vegetation which when ingested by waterfowl

results in short-term nausea leading to negative conditioning; waterfowl ingesting these substances suffer no harmful physiological effects).

- The likelihood of collision with transmission wires is expected to be minimal, because waterfowl would be in the area during periods of lengthy or continuous daylight, and visibility will generally be good. As mentioned earlier for the construction phase, placement of coloured streamers, flashers, or flags on the lines will increase their visibility of the lines to waterfowl.

3.8.2.5 Mitigation during Closure/Post-Closure Phase

Measures Applicable at all Facilities

- Reclamation and revegetation will be undertaken for all project facilities that are removed during the closure and post-closure phase. Native vegetation will be allowed to reestablish naturally, or reestablishment will be facilitated by distributing seeds, planting plugs, or transplanting specimens from areas where vegetation is well established. Re-established vegetation will provide foraging opportunities for waterfowl, particularly geese, over the long term.
- Transmission lines will be removed, thus preventing the potential for wire/bird collisions in the long term.
- Where monitoring activities have identified high levels of contaminants in vegetation, reclamation activities will be undertaken to ensure that levels are acceptable to waterfowl in the long term.
- Although aquatic habitats at Second Portage Lake (i.e., used for tailings impoundment) will be permanently lost to waterfowl, flooding of the Portage and Vault pits at closure will result in new aquatic habitats for waterfowl. Management of slopes and eventual water depths in the near-shore zone for fish (see the "Aquatic Environmental Management Plan") will also ensure that additional near-shore emergent vegetation and fish foraging opportunities are available.
- Tailings ponds will be completely pumped dry by closure (or filled with dry or frozen tailings) and all contaminated water will have been treated prior to discharge to the receiving environment.
- Removal of portions of the dikes (e.g., Goose Island dike will result in isolation of some sections and the creation of large islands in Third Portage Lake. These islands will likely provide high suitability nesting habitats for waterfowl such as loons because of their isolation from mainland areas where predators such as Arctic fox are more common.

Measures Associated with Winter Road

- Once the winter road usage has been terminated, the entire length of the alignment will be surveyed to assess whether habitat destruction or degradation, particularly to wetlands with emergent vegetation, has occurred. Major disturbance is not expected because winter road maintenance (i.e., use of ice and snow) should ensure that underlying vegetation is not greatly affected. In the event that disturbance is identified, reclamation and revegetation activities will be undertaken to return these sites to natural conditions.

3.8.2.6 Mitigation during Temporary Shutdown

- On-site staff will monitor waterfowl use of potentially contaminated areas (e.g., tailings pond) and use aversive strategies to reduce potential exposure to contaminants.
- On-site staff will maintain transmission line markers to minimize the potential for wire/ bird collisions.
- Where practical, degraded or disturbed habitats will be restored to natural conditions.

3.9 OTHER BREEDING BIRDS

3.9.1 Summary of Environmental Effects

The greatest impact to breeding birds (e.g., songbirds) is the removal or degradation of nesting habitat. Virtually all terrestrial habitats within the study area provide foraging or nesting habitats for one or more species. Some species prefer rockier terrain (e.g., snow bunting), others are found primarily in open tundra (e.g., Lapland longspur), whereas others are restricted to wet meadows (e.g., semipalmated sandpiper).

Another potential environmental effect is the reduced habitat effectiveness due to mine-associated activity, although passerines appear to habituate to human activities readily compared to larger species such as raptors and waterfowl. Collisions with windows on mine structures that result in death is another potential negative effect, although the use of windows, particularly large windows, is expected to be limited at the mine site due to the need to conserve energy during the long, cold winters.

Buildings, pits, hydro poles, and other facilities will provide new perching opportunities and possibly nesting opportunities for raptors. The potentially higher densities of raptors in the area, and potentially increased depredation rates on passerines, are possible negative impacts of the project.

3.9.2 Proposed Mitigation Measures

3.9.2.1 Objectives & Limitations

Minimizing the amount of vegetation that is removed or degraded is a primary objective of the Meadowbank project. Where vegetation has been degraded, and no further development or activity is anticipated, reclamation will be initiated immediately. Another important objective will be to ensure that nesting birds are not disturbed. Destruction, disturbance, or harassment of nesting birds is an offence under the Migratory Bird Convention (i.e., Regulation 12 (1) (ii) under the *Migratory Bird Convention Act*, 1994).

3.9.2.2 Mitigation Measures Applicable to All Development Phases

Many of the mitigation measures previously described for the vegetation VEC will also benefit members of the other breeding birds VEC (see Section 3.3.2).

Other potential measures to mitigate impacts to other breeding birds are listed below.

- Attempts will be made to discourage raptors from nesting on mine structures or facilities.

- Some birds are likely to attempt nesting on mine structures or equipment. Mine structures and equipment must be checked on a regular basis to ensure that nests are not initiated in or on structures that will result in future destruction. Where birds attempt to nest on facilities where minimal disturbance is anticipated, nesting can be permitted to continue. Where birds attempt to nest on equipment that is used on a regular basis, nesting must be discouraged before eggs are laid. A recent example is of common redpolls observed nesting on heavy machinery parked near the Baker Lake airport in June 2003. Some passerines have also been known to nest in stacked lengths of pipe of certain diameter. Passerines that are found nesting on or near human habitations should be left alone if possible (e.g., passerines nesting in wooden pallets that will not be used any time soon).

- If windows, transmission lines, or other structures or components of buildings are resulting in bird collisions and death, measures, such as placement of streamers on wires, and silhouettes of raptors on windows, will be taken.

- Every effort will be made to avoid disturbance of nesting birds by timing land clearing/ stripping and construction activities outside the breeding bird window (i.e., 1 May to 31 July). Where vegetation removal is required within this window, a detailed nest survey will be conducted to ensure that nesting birds will not be affected. If nests are located, a nest management plan will be developed that will include the feasibility of an avoidance option. Once a nest is identified, its location will be marked to make it known to mine staff. A buffer zone will be established around the nests to avoid disturbance. The nests will be monitored to determine hatching success.

- Activities of human investigators around nest sites can attract predators (either by scent or sight), and thus, cause nest depredation. All personnel, including baseline collection personnel, will avoid disturbing nest sites of passerines, shorebirds, and ptarmigans as much as possible, so as not to leave attractants for predators.

- All issues that arise with birds at the mine site (e.g., success of nests in high traffic areas) will be described and discussed in an annual wildlife monitoring report.

Measures at Baker Lake Facilities

- Similar issues exist at the Baker Lake facilities as for all facilities described above; however, species of potential management concern (e.g., parasitic jaeger) have been observed nesting in close proximity to the Baker Lake facilities. Nest management plans will be necessary if nesting birds are observed on or adjacent to proposed development areas. Parasitic jaegers are more susceptible to human disturbance than smaller birds such as Lapland longspur. In June 2003, jaegers nesting at Baker Lake dive-bombed a researcher more than 50 m from an active nest.

3.9.2.3 Mitigation during Closure/Post-Closure Phase

Measures Applicable at all Facilities

See recommended measures for vegetation in Section 3.3.2 above.

- Care must be taken during the removal of structures and facilities that birds are not currently actively nesting.

3.9.2.4 Mitigation during Temporary Shutdown

- During temporary shutdown, consideration may be given to boarding up windows to reduce the potential for birds striking windows.

SECTION 4 • MONITORING

4.1 MONITORING APPROACH

Wildlife monitoring is an important tool in protecting wildlife resources at the Meadowbank Gold project. Because of uncertainties in impact prediction and the effectiveness of mitigation, monitoring will allow for verification of conclusions of the impact assessment, fine-tuning and refinement of mitigation measures, and documentation of significant impacts on abundance and distribution of wildlife populations. Several variables that define the well-being of wildlife populations will be monitored. A summary of the general approach is provided below. Specific monitoring initiatives for wildlife VECs will be discussed in more detail in Section 5.2.

4.1.1 Habitat Distribution

Habitat, including vegetation, rocks, rock crevices, and eskers, is required by all wildlife species. Each wildlife species or wildlife VEC have varying needs for habitat units classified under the Ecological Land Classification (ELC). As a result, the availability (i.e., % cover within the LSA; habitat loss relative to availability in the LSA) of all ELC habitat units will be assessed on an annual basis during the life of the mine. Extent of habitat loss will be determined and mapped from ground investigations and aerial surveys. Newly disturbed areas will be delineated using GPS and mapping capabilities. Where unnecessary and unplanned habitat degradation is documented, measures will be taken to reclaim or rejuvenate these areas.

4.1.2 Wildlife Distribution

Various monitoring programs will be in place to assess the distribution of wildlife within the LSA and RSA. Ongoing ground surveys of the LSA will also provide information on the distribution of larger species, as well as small mammals such as Arctic hare. Because many species utilizing the area are migratory and/or transient, changes in distribution will not necessarily be an accurate indicator of population changes resulting from mine-related activities. Details on monitoring programs designed for particular VECs are described in separate sections below.

4.1.3 Wildlife Abundance

Wildlife abundance is likely a better indicator than distribution of the potential effects of mine activities on wildlife utilizing the area. Both increases and decreases in populations may be observed. For example, caribou may be attracted to the mine site because of the safety from predators that the mine and its human inhabitants afford. Increased numbers of caribou in the LSA may be documented by ongoing LSA ground surveys.

It will also be important to document other mineral exploration activities being conducted in the Meadowbank area. Since predators such as grizzly bears and wolverines have such large home ranges, particularly juveniles that are seeking out their own home ranges or hungry animals following caribou migration routes, it is possible that predators from another project will enter the Meadowbank project area.

It is also possible that these animals will have already become at least partially habituated to humans and human structures from previous contact. It would be prudent to contact all mineral exploration projects in the region and discuss their problems with wildlife, because it is possible, though unlikely, that some animals they have relocated may become imported problems for the Meadowbank project.

4.1.4 Wildlife Health

The health of wildlife utilizing the mine site and environs will be difficult to determine directly because of the migratory and transient nature of all larger, long-living animals and the difficulty in obtaining samples for analysis. The approach Meadowbank will take is to sample soil and vegetation such as lichens, which are known to assimilate metals and other substances in their environment, and which are basic foods for herbivores such as caribou, particularly in winter.

Plants (e.g., sedge, grass, and willow) and soil samples may also be collected from potential foraging sites (e.g., near fuel storage areas, AN/explosives storage/ fuel plant, roads, and airstrip) of ungulates, waterfowl, small mammals, and certain passerines, and be analyzed for inorganic elements, petroleum hydrocarbon constituents, and other contaminants. The results will be compared to data for vegetation collected pre-development and in control areas.

Animals may die of unknown causes in the proximity of the mine site. For example, in 2001, seven caribou died at the EKATI mine site (BHP Billiton, 2002), but only two were necropsied, neither of which were among the three found in the vicinity of the tailings impoundment. If any VECs (i.e., large animals or large numbers of animals) should die of unknown causes at the Meadowbank mine site, the NWMB and/or GN-DSD will be consulted to determine if a necropsy should be performed.

4.1.5 Adaptive Management

Within each wildlife management approach or method, there is a certain level of uncertainty or unpredictability. The general purpose of monitoring is to determine if mitigation measures have been successful. Residual effects are effects that persist after mitigation measures have been implemented. For example, it may be determined that waste management practices are not effective in keeping predatory mammals away from the mine site. The residual effect would be that predatory mammals continue to return to the mine site, increasing the risk that animals would need to be destroyed. Adaptive management measures would be implemented, such as recommendations to reduce the availability of animal attractants at the landfills, wrapping sewage lines with steel, and placing metal skirting around the base of buildings (BHP Billiton, 2002), to reduce potentially unacceptable impacts.

Adaptive management is an ongoing process that evolves throughout the life of the mine as better and more effective ideas are introduced in a process that is designed to be continually improving.

4.2 GENERAL MONITORING MEASURES

All monitoring programs will evaluate mitigation measures on a periodic basis to determine their effectiveness. Monitoring programs will be modified to the type of mitigation that is being carried out. For example, the effectiveness of the environmental awareness program is something that can be monitored and enforced if necessary on a daily basis (e.g., speed limits, harassing wildlife).

It can also be assessed on a monthly or semi-annual basis and adjustments can be made where necessary. Feedback may be solicited from mine employees, residents of Baker Lake, or recommendations made by monitoring officers who visit the mine site on a regular basis. Incentives or disincentives, as the case may be, may need to be enforced more vigorously.

Monitoring measures will also examine mitigation measures against objectives or as compared to baseline conditions. Objectives or schedules for meeting objectives may be unrealistic, and adjustments can be made, or mitigation objectives may not be met due to improper methodology or poor workmanship.

Monitoring technicians or surveillance officers from the NWMB, NIRB, KIA, GN-DSD or other agencies may arrive unannounced to examine the facilities, wildlife logs, landfills, or reclamation sites. It is therefore incumbent on the mine site manager/environmental supervisor and the people responsible for the monitoring programs to ensure that all monitoring programs are up to date and that reporting remains current.

An environmental supervisor will be on-site at all times. Detailed reporting protocols (e.g., in the event of a dangerous animal frequenting the site) for environmental staff and a staff chart detailing staff responsibilities will be developed prior to mine construction.

4.3 VEGETATION

4.3.1 Objectives & Limitations

The objectives of monitoring vegetation will be to ensure that mitigation measures to minimize the amount of vegetation and wildlife habitat lost to mine construction and operations are effective. Opportunities for reclamation or habitat creation will be monitored throughout the life of the mine, and residual effects will be assessed.

Monitoring will also ensure that vegetation that has become contaminated is removed (or isolated from wildlife) at the earliest possible opportunity, that the contaminated area is restored to its natural state, and that disturbed sites are recontoured, stabilized, and drainage patterns restored. Limitations to the decontamination or rehabilitation of sites will be the availability of engineered landfills and stripped overburden/topsoil that is suitable for regrowth of vegetation in disturbed sites. Limitations will also be temporal: in cases where there are permanent structures it will be necessary to wait until the site is decommissioned before complete reclamation can be undertaken.

Certain facilities will be decommissioned and the sites reclaimed progressively throughout the life of the mine. Lessons learned from the reclamations of these sites can be put to use during the closure and post-closure phases.

4.3.2 Existing & Ongoing Monitoring Activities

Ongoing monitoring activities include the ELC/DSD verification of vegetation communities in the LSA and RSA, and ongoing plant collection for VECs in the LSA and RSA, which will be used in assessing the health, distribution, abundance, habitat requirements, and habitat suitability of key wildlife species in relation to ELC units.

Phenology studies were initiated in 2003 and will be ongoing through the life of the mine to determine potential changes in phenology due to mine activities. Results will be compared to control sites.

4.3.3 Proposed Monitoring Activities

Vegetation (e.g., lichens) will be sampled for contaminants on a regular basis within the study area (i.e., areas potentially affected by mine activities), and outside the area (i.e., control where project effects are unlikely to occur) both prior to and during the life of the mine. Pre-development sampling will be undertaken to gather information on baseline conditions on the site.

If progressive revegetation is attempted at the tailings impoundment and waste rock storage facilities, these sites will be monitored for success throughout the life of the mine, including closure and post-closure. In addition, pilot programs will test different species of vegetation on small plots using different types of organic soil, sediments, biosolids, etc. and testing them for success, as outlined in Section 3.3.2.7. These will also be tested against plots that have been allowed to revegetate naturally.

Roads will be scarified and recontoured, with thought given to creating esker-like habit. Trails will, however, be prepared for regrowth and revegetated artificially. These sites will be monitored for revegetation as possible foraging habitat for herbivores, burrowing rodents, and foraging habitats for predators.

4.4 UNGULATES

4.4.1 Objectives & Limitations

Experience at other northern mines has shown that caribou may pass through mine sites on their migration routes and become partly habituated to human presence, activities, and structures (BHP Billiton, 2002). Monitoring these animals is difficult because of their large numbers and extensive ranges; however, it is the goal of monitoring programs to ensure that the health, abundance, and fitness of both caribou and muskox population are not negatively affected by the Meadowbank mine, and that the closure and post-closure phases leave the affected environment in as suitable a state as possible for use by ungulates and other terrestrial wildlife.

The highest potential for interactions between ungulates and vehicles exists along the winter road. The potential for interaction would also exist along haul roads at the Vault, Main, and Baker Lake sites; however, no caribou have been killed or injured as a result of collisions with vehicles between 1998 and 2000, and after 17 years at the Lupin mine, only three caribou were killed by vehicles (BHP Diamonds, 2000). Caribou distribution and abundance along roads will be monitored during the life of the mine by reporting in wildlife logs and conducting regular surveys.

There is also the risk that caribou may become stuck in the tailings impoundment, or drink the water in the runoff or tailings pond. In 2001, three dead caribou were found in the vicinity of the Long Lake containment facility at EKATI, although no connection was ever made between their deaths and the tailings impoundment. Regular monitoring of caribou and muskox in the vicinity of the tailings pond and impoundment will be conducted, and if risks to animal health are perceived, efforts will be made to scare or herd animals away from potentially hazardous conditions.

4.4.2 Existing & Ongoing Monitoring Activities

Although no caribou calving grounds are found within the RSA, individuals or groups from as many as five herds may be found the Meadowbank area, including the Beverly, Qamanirjuaq, Lorillard, Wager Bay, Ahiak, and Boothia Peninsula. Aerial surveys conducted in February 2004 reported several thousand caribou in the Meadowbank area (D. Power, pers. comm., 2004). The patterns of seasonal abundance observed to date (based on five surveys of the RSA between 1999 and 2004) indicate that the Meadowbank area does not provide critical habitat for caribou during spring migration, calving, or summer post-calving; however, the project area does appear to provide habitat for the northern ranges of the Beverly herd during their spring and fall movements, and wintering habitat for several herds including Wager Bay and Lorillard. These observations were supported by Elders and traditional knowledge, as well as by studies by ISL (1978).

4.4.3 Proposed Monitoring Activities

Caribou play a vital role in the subsistence economy in the Baker Lake area. They are also an important food source for carnivores. Due to the large geographic range of the caribou herds, effective monitoring of caribou herd health and well being is best conducted on a scale that matches the range of these animals. Cumberland would prefer to assist, where practical, caribou monitoring programs sponsored by the Government of Nunavut and other governments and industry. Ongoing collaboration with government researchers and review of government radio-collaring programs will provide further information on the movement patterns and herd origins of caribou found in the Meadowbank area.

Consideration will be given to conducting occasional aerial surveys of the RSA and LSA, as have already been conducted on five occasions between 1999 and 2004, to assess the distribution and abundance of various caribou herds.

Necropsies will be performed on all ungulates that die from unknown causes within the project area to ascertain whether contamination or other mine-related activities or sources have resulted in death.

4.5 PREDATORY MAMMALS

4.5.1 Objectives & Limitations

Like caribou, grizzly bears, wolverines, and wolves are far-ranging animals, but unlike caribou, they are non-migratory, although they will follow caribou herds. Grizzly bears and wolverines are particularly vulnerable to human development due to their often bold and curious natures, and highly developed sense of smell. Once they become desensitized to humans (i.e., lost their natural fear of humans) and conditioned to human food, they are very difficult to intimidate. The fact that they are naturally rare in the environment and slow to reproduce compounds their vulnerability.

One of the main objectives of the wildlife monitoring program in the Meadowbank area will be to evaluate the success of preventative programs designed to proactively avoid the occurrence of problem animals, as opposed to reactively trying to manage them by relocation or destruction.

It is possible, however, that even clean-burning incinerators will attract predators, especially those who may have had previous experience with humans and human structures; however, while

preventative mitigation and monitoring efforts may have little control over simple habituation to human noise, activity, and structures, the results may have commensurately little or no effect on the fitness of an animal. Alternatively, early efforts to prevent desensitization and food conditioning are much more likely to be effective, and their failure or absence is much more likely to have a harmful or fatal effect on the animal.

4.5.2 Existing & Ongoing Monitoring Activities

Large predators have been surveyed from aerial surveys of the RSA and LSA on five occasions (different seasons) between 1999 and 2004. Consideration will be given to conducting occasional aerial surveys of the RSA and LSA, as have already been conducted on five occasions between 1999 and 2004, to assess the distribution and abundance of large predators.

Wildlife logs, of both sightings and interactions, will be kept on an ongoing basis to document the sightings of large predators in the vicinity of the mine facilities. These records will be one of the core elements for the site-specific monitoring plan and will provide support for actions required to prevent critical situations. Regular analyses of these data may provide solutions by way of adaptive management.

4.5.3 Proposed Monitoring Activities

Cooperative programs will be discussed with the NWMB and representatives from Baker Lake to devise means to develop population estimates for grizzly bears, wolverines and wolves. If applicable, potential or existing den sites will also be identified and monitored for use throughout the life of the mine.

To avoid attracting scavengers such as grizzly bear and wolverine, the mine site will be monitored on a regular basis for cleanliness. Grizzly bears have been known to eat insulation and styrofoam, plastic, rubber, foam, cloth gloves, and coffee grounds.

Because polar bears have been reported on rare occasions in the Baker Lake area (Baker Lake Impact Workshop, 24 to 26 March 2003), this species will also be watched for during aerial surveys and other monitoring activities.

4.6 SMALL MAMMALS

4.6.1 Objectives & Limitations

Habitat fragmentation is likely to pose a greater risk for impacts on small mammal populations in the Meadowbank project than to other wildlife species due to their limited mobility (with the exception of Arctic hares). Roads, open pits, the airstrip, and waste rock dumps would present significant barriers. Small mammals may also colonize roadsides, which would increase the likelihood of collisions with vehicles.

Small mammal populations in Arctic environments tend to be cyclic, exhibiting great fluctuations varying from 10 to 50 times peak values compared to lows values, generally occurring on a regular basis of three to four years (BHP Diamonds, 1995, cited in BHP Diamonds, 2000). Because of these

fluctuations, it will be difficult to determine whether changes in abundance are due to natural fluctuations or due to mine-related effects. Small mammal fluctuations can also influence the population dynamics of numerous predator species including predatory mammals and raptors, as well as affect the availability of food for herbivores such as caribou and muskox. During a peak year for small mammals, lemmings utilized about 15% of the vegetative standing crop at Baker Lake (Krebs, 1964, cited in BHP Diamonds, 2002).

The primary objective of monitoring programs will be to determine if mitigation measures to minimize the fragmentation of small mammal habitat are effective, and to evaluate the success of mitigation measures to provide high-quality habitat for small mammals wherever possible. In addition, because small mammals play such an important role in the behaviour, habitat selection, and population dynamics of some raptor species and predatory mammals, it will be important to monitor changes in their abundance, distribution, and habitat suitability and effectiveness throughout the life of the mine. Limits will be imposed by large natural variations in population levels and their effects on vegetation, as well as the behaviour and population dynamics of herbivorous and predatory species.

4.6.2 Existing & Ongoing Monitoring Activities

Ongoing monitoring of small mammals within the LSA will supplement the baseline data that is presented in the "Baseline Terrestrial Ecosystem Report." Data collection will become more targeted, and will help focus mitigation measures. In addition, monitoring will help fine-tune mitigation approaches and methods to minimize mortality, habitat loss, and habitat fragmentation, while providing opportunities to create new habitat and progressively restore habitat during the mine life.

4.6.3 Proposed Monitoring Activities

If possible, population level indicators for small mammals will be monitored throughout the life of the mine. Other monitoring activities include:

- monitoring the trail system to ensure no bandit trails have developed
- assessing reports of pilots and vehicle operators who will be required to document all collisions and near misses with small mammals, and maintaining a log book that includes wildlife sightings
- maintaining all fuel storage areas and explosives magazines on a regular basis.

4.7 RAPTORS

4.7.1 Objectives & Limitations

To date, active nests of raptors have not been found within the LSA. The objectives of ongoing surveys for nesting raptors will be to avoid potential inadvertent negative effects on nesting birds. Nest-specific management plans for nesting birds will reduce the potential for birds to abandon nests due to high noise or activity levels.

Although raptors are large birds, raptor nests are often difficult to spot due to their inaccessible locations. At the EKATI mine, only one or two additional raptor nests were discovered each year between 1997 and 2000 (BHP Billiton, 2002).

4.7.2 Existing & Ongoing Monitoring Activities

The Meadowbank most likely provides better foraging habitat for raptors than it does nesting habitat. Changes in ELC composition, particularly those that support terrestrial prey species, may alienate raptors from the area, or cause them to prey on other species, such as waterfowl. Some raptors (e.g., snowy owl) have evolved to adapt to the natural three-to-four year cycles of small mammals living in the Arctic; however, they have not adapted to anthropogenic changes. One nesting peregrine falcon was observed by camp personnel along the Meadowbank River in 1998, and another inactive nest site was observed within 2.5 km of the field camp in 1999. This indicates that raptors likely nest within the LSA, and monitoring programs are required to identify any active nesting sites that may be affected by mining activities.

4.7.3 Proposed Monitoring Activities

Maintenance of a wildlife sighting and activity log for the project site, and continued annual monitoring of raptor nesting patterns and numbers in relation to the proximity of mining activities will be undertaken. Mitigation measures to prevent raptors and other birds from flying into power lines, such as tying brightly coloured banners onto the lines will also be monitored for their success.

Raptors may also scavenge road kills (e.g., small mammals) and are susceptible to collisions with vehicles. Speed limits on all project roads will be posted and enforced.

4.8 WATERFOWL

4.8.1 Objectives & Limitations

Nesting waterfowl have not been observed in the Meadowbank study area since baseline studies began in 1999. In addition, government studies have indicated that there is no critical or significant waterfowl habitat in the Meadowbank region.

Several species of waterfowl do, however, use the Meadowbank area for resting and feeding, and some nesting is likely. Monitoring programs will be similar to those designed for raptors. The primary objectives will be to monitor the effectiveness of mitigation efforts to prevent or reduced impacts from mine activities, including loss of habitat, impacts on abundance and distribution in the LSA and RSA, habitat suitability and effectiveness, and mortality.

The loss of some aquatic and foraging habitat will be inevitable, but the flooding of the pits will create aquatic habitat with possible littoral and emergent vegetation.

4.8.2 Existing & Ongoing Monitoring Activities

Surveys will be continued annually in the LSA to determine the location of actively nesting waterfowl. The focus will be on wetlands and lake islands located in close proximity to mine facilities that are considered suitable for nesting. Where active nests are located, nest-specific management plans will be developed.

4.8.3 Proposed Monitoring Activities

Maintenance of a wildlife sighting and activity log for the project site and continued annual monitoring of waterfowl nesting patterns and numbers in relation to the proximity of mining activities will be undertaken.

4.9 OTHER BREEDING BIRDS

4.9.1 Objectives & Limitations

The primary objective of the monitoring program for ptarmigan, shorebirds, and passerines, is to evaluate the success of measures to minimize the amount of vegetation that is removed or degraded by the project, and to determine whether mine activities have resulted in reduced habitat effectiveness. Breeding bird surveys according to standard methodologies used to date will allow this objective to be met. Another objective will be to determine more effective ways to prevent disturbance to nesting birds based on feedback from mitigation measures and observations. Destruction, disturbance, or harassment of nesting birds is an offence under the Migratory Bird Convention.

4.9.2 Existing & Ongoing Monitoring Activities

Breeding bird densities and habitat use may be monitored on a yearly basis by conducting similar surveys as those outlined in the “Baseline Terrestrial Ecosystem Report.” Wildlife observation log books will be maintained and mine staff will be encouraged to record notable sightings (e.g., arrival and departure dates, large flocks).

4.9.3 Proposed Monitoring Activities

Ongoing breeding bird surveys will provide more information on populations, habitat use, distribution, and breeding behaviour of other breeding birds in the Meadowbank project area. Mitigation procedures for breeding birds will be assessed and areas of non-compliance will be identified. Mitigation procedures will be adjusted and modified where possible.

SECTION 5 • CONCLUSIONS

The primary function of the WLMP is to prevent or minimize direct and indirect project-related impacts to terrestrial wildlife and wildlife habitat. The primary mechanisms through which this is to be achieved is the mitigation of impacts, either through avoiding project-related impacts altogether or by reducing unavoidable impacts to the maximum extent possible. The means by which the effectiveness of these mitigation measures will be gauged is through monitoring programs, which will determine whether the post-mitigation impacts or residual effects are acceptable. If the impacts are not acceptable, further mitigation measures will be applied. This method of adaptive management is an iterative method designed to develop increasingly better ways for mitigating impacts during the course of the mine life.

The Meadowbank Gold project, when it has developed into its full operations stage, will be a very small centre of activity in a remote Arctic region of Canada. Cumberland is committed to ensuring that the footprint of the mine remains as small as possible, and that the post-closure appearance of the mine site and that the environmental health of the project area will be as close to its pre-development state as possible. In keeping with this overall strategy, the WLMP has been designed to ensure that wildlife abundance, wildlife health, wildlife habitat, and wildlife movement are disturbed to the least extent possible during all phases of the mine life.

Mitigation and monitoring procedures will be implemented in accordance with mine development schedules, and progressive reclamation programs for terrestrial wildlife habitat will be undertaken at every available opportunity. A wildlife monitoring report, which will summarize wildlife management and monitoring issues and results, will be provided to regulatory agencies on an annual basis.

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SECTION 7 • GLOSSARY

Reclamation and Closure – Upon mine closure, the minimization of surface area disturbance through recontouring of disturbed areas to be consistent with the surrounding topography and to stabilize slopes but encourage runoff, encourage or establish revegetation, and return the land to post-mining uses for traditional pursuits and wildlife habitat.

Adaptive Management – A systematic process for continually improving management policies and practices by learning from the outcomes of operational programs.

Closure and Post-Closure Phase – The stage in mine development when exploitable ore reserves have been exhausted, and the decommissioning of mine structures, buildings, and equipment begins. Abandonment and restoration also begin at this stage.

Construction Phase – The stage in mine development (referring to the Meadowbank Gold project) when the major mine structures, such as processing plant and ancillary facilities, open pit, waste rock storage facility, and tailings impoundment, are developed.

Cumberland – Cumberland Resources Ltd., the company proposing to develop the Meadowbank Gold project.

Cumulative Impact – Changes to the environment that are caused by an action in combination with other past, present and future actions.

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

Ecology – The study of the interactions between organisms and their environment.

Ecosystem – A community of interacting organisms considered together with the chemical and physical factors that make up their environment.

ELC – Ecological Land Classification, a land classification system based on terrain, soils, and vegetation, in which areas of similar ecology are identified and mapped within a hierarchy of ecosystems where broad to specific levels of detail are presented on a series of maps.

LSA – Local Study Area. Local spatial boundaries determined for each VEC based on their respective characteristics and interactions with project components. LSA for the baseline studies for this report was a 5 km radius circle around the main mine facilities and a 2 km wide circle around the Vault facilities.

Microtine Rodent – A vole or lemming.

Mitigation – An action taken against an impact in order to control its effect.

Monitoring – The assessment of mitigation in order to determine its effectiveness.

Oligotrophic – Relating to water bodies with low nutrient inputs and low organic production.

Operations Phase – The stage in mine development when major facilities have been developed and ore is being extracted from the ground and either processed on-site or shipped off-site for processing.

PAHs – Polynuclear aromatic hydrocarbons (example source: degraded petroleum)

Passerine – Perching birds that are mostly small and living near the ground with feet having four toes arranged to allow for gripping a perch; most are songbirds.

PCBs – Polychlorinated biphenyls (example source: transformer)

Permafrost – Permanently frozen ground.

Predatory Mammal – Mammals that survive by catching living prey or opportunistically scavenging on the prey of other animals.

Raptor – A bird that hunts by snatching its prey.

Residual Effect – An effect that persists after mitigation measures have been implemented.

RSA – Regional Study Area. Regional spatial boundaries determined for each VEC based on their respective characteristics and interactions with project components. RSA for the baseline studies for this report = 100 km x 100 km = 10,000 km^2.

Shutdown, Temporary & Long-Term – The cessation of mining activities for an arbitrary length of time that may vary from days to years.

Subnivean – Beneath the snow.

Tailings – Ground waste material and water (slurry) rejected from a mill or process plant after most of the valuable minerals have been extracted.

Traditional Knowledge – The knowledge people have gained over the years from the environment and the world around them. Traditional knowledge is gained both by personal experience and by passing on information from one generation to the next.

Ungulate – A wide taxonomic group of hoofed mammals (e.g., caribou).

VEC, Valued Ecosystem Component – Environmental attributes or components selected through consultation with regulatory and governmental authorities, discussions with members of the local community, and a review of VECs identified in other northern mine projects. This selection process can be further refined through the application of one or more of the following criteria: conservation status, relative abundance within the project area, importance in subsistence lifestyle and economy, importance in predator-prey systems, habitat requirement size and sensitivity, and contribution to local area concerns. Other considerations include scientific and aesthetic values.

Waste Rock – Barren rock or rock too low in grade to be mined or processed economically.

Waterfowl – Freshwater-dependent, swimming aquatic birds.

WLMP – Wildlife Management Plan