PROJECT # 1009-002-12 GIS # HB-23-088b January 09 2012

430000 435000 440000 445000

7540000 7535000 7530000 7525000 7520000

N

Kolguk River

Map A

Map B

Map C

Muskox Rutting / Fall

Habitat Suitability Rating

- High Value
- Moderate Value
- Low Value
- Nil
- Phase 2 Project Local Study Area
- Camp

Doris North Existing and Future Infrastructure (Phase 1)

- Underground Portal
- Existing Road
- Existing Infrastructure
- Future Road
- Future Infrastructure
- Tailings Impoundment
- Existing Quarry

Windy Road Infrastructure

- Doris/Windy Road

Phase 2 Project Potential Infrastructure

- Underground Portal
- Potential All-Weather Road (Boston-Windy) - EBA Alignment, 1997 (2010 Work Plan)
- Potential All-Weather Road (Boston-Windy) - PND Engineers, 2009
- Potential Other Road
- Potential Open Pit
- Potential Tailings Storage
- Potential Waste Rock Storage
- Potential Infrastructure
- Portable Exploration Camp
- Potential Quarry

1:70,000

0 1,000 2,000

Metres

Projection: UTM13, NAD83

Figure 4.3-2b

NEWMONT NORTH AMERICA

Muskox Fall (Rutting) Suitability Model - Map B

Figure 4.3-2b

Rescan Engineers & Scientists

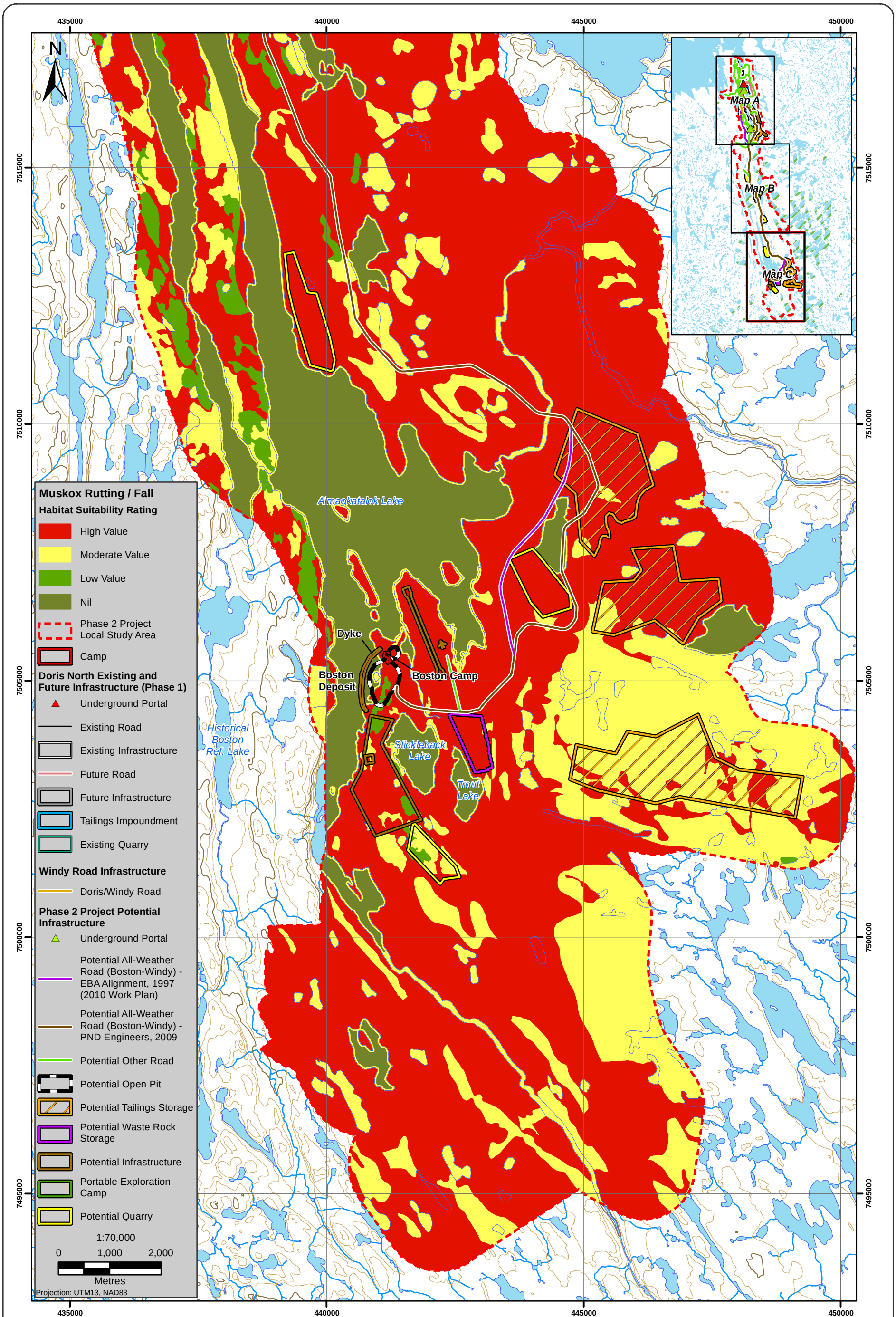

Figure 4.3-2c

NEWMONT NORTH AMERICA

Muskox Fall (Rutting) Suitability Model – Map C

Figure 4.3-2c

Rescan Engineers & Scientists

Table 4.3-2. Area and Proportion of High, Moderate, Low, and Nil-rated Habitat within the LSA for Muskox

Suitability Rating	Amount of Habitat	
	Area in LSA (ha)	Percent of LSA (%)
Late Winter/Early Spring		
High	7,327.5	13.0%
Moderate	29,901.9	53.1%
Low	11,962.1	21.3%
Nil	7,085.5	12.6%
Fall (Rutting)		
High	34,729.1	61.7%
Moderate	10,982.1	19.5%
Low	4,157.9	7.4%
Nil	6,407.9	11.4%

Matching HSR values are not available for the RSA. The habitat modelling done in 2005 (Miramar 2005) used suitability estimates, but lacked data to create detailed mapping. The RSA was determined to contain 60.9% high value habitat, no moderate value habitat, 6.3% low value habitat and 32.8% nil value habitat (Miramar 2005). These values were not broken down by season or life requisites; therefore, comparisons to the LSA mapping results cannot be made.

4.4 GRIZZLY BEAR

4.4.1 Background

Grizzly bears occur throughout the Southern Arctic Terrestrial Ecozone (Wiken 1986) and are known to occur in the RSA and LSA from satellite-collar data and observations made during baseline studies (Rescan 2011b; Plate 4.4-1). Nationally, grizzly bears are a species of special concern (particularly sensitive to human activities or natural events but not endangered or threatened; COSEWIC 2009). In Nunavut and the Northwest Territories (NWT), grizzly bears have been designated as sensitive (CESCC 2006; Working Group on General Status of NWT Species 2006). Grizzly bears have low ecological resiliency, are sensitive to human activity and are frequently displaced by industrial developments (McLellan 1990; Weaver, Paquet, and Ruggiero 1996; Ross 2002). Bears living in the central Canadian Arctic may be at relatively elevated risk of disturbance because they naturally occur at low densities and because they may be more vulnerable to disturbance on the open tundra landscape (Ross 2002).

There have been numerous studies investigating the effects of development, specifically roads, on the movements and ecology of grizzly bears (Benn and Herrero 2002; Wielgus, Vernier, and Schivatcheva 2002; Johnson, Boyce, Schwartz, et al. 2005; Waller and Servheen 2005). In the Rocky Mountains, roads were found not to have a severe effect on grizzly bear movements, but roads placed in high quality habitat, such as berry patches used for foraging, could increase human and vehicle interactions with bears (McLellan and Shackleton 1989).

Bears may avoid habitats up to 500 m from roads, particularly in areas with high traffic frequency (Wielgus, Vernier, and Schivatcheva 2002; Waller and Servheen 2005). A major source of grizzly bear mortality in Banff and Yoho National Parks from 1971 to 1998 occurred near roads (i.e., within 200 m) with vehicle-bear interactions accounting for 19% of all deaths (Benn and Herrero 2002). Destroying problem bears was the greatest cause of mortality for this study (71%), a problem associated with increased access

to pristine habitats. Roads can increase access and create opportunities for illegal hunting (McLellan and Shackleton 1988). Details of the distribution, movement, habitat, and demographics of grizzly bears in the RSA and how they relate to the suitability modelling are provided in Appendix 4.

Plate 4.4-1. Grizzly bear observed in the LSA during the spring season, May 2010.

4.4.2 Habitat Suitability Model Development

Grizzly bears are omnivorous and opportunistic feeders that select habitat largely based on seasonal availability of forage (McLellan et al. 1999; Wellwood 2003). Table 4.4-1 presents the seasonal life requisites for grizzly bears used to develop HSRs. HSRs focused on living requisites for spring, summer, and fall seasons, based on an assessment of the ecosystem units' abilities to produce forage species. Vegetation phenology was used to rate ecosystem units for target forage species for a given season (e.g., blueberries are absent in the spring, ripen during the summer, and die off during the fall). Prey sources (mainly Arctic ground squirrel [*Spermophilus parryii*]) that are strongly associated with specific ecosystem units) were included in the ecosystem unit HSRs. Sources of high value food (such as Arctic char) were assessed as an additional habitat feature separate from the ecosystem unit ratings.

Table 4.4-1. Seasonal Life Requisites of Grizzly Bear

Season	Date	Life Requisite	Habitat Preference
Spring	May - June	Living	Esker, crowberry, blueberry, sedge, riparian shrub, caribou, ground squirrel
Summer	June - September	Living	Esker, blueberry, sedge, riparian shrub, ground squirrel
Fall	September - October	Living	Esker, blueberry, sedge, riparian shrub, caribou, ground squirrel

4.4.2.1 Model Assumptions

The assumptions developed for grizzly bear were based on literature reviews, suitability mapping completed for similar projects in Nunavut and the NWT, and field assessments. The main assumptions are that grizzly bears target a variety of vegetation, but are strongly influenced by the availability of caribou, and in specific areas, Arctic char and lake trout. The HSRs for the ecosystem units are described in Appendix 4 (Table 4-3).

Spring

Spring habitat provides grizzly bears their first opportunity to feed after emerging from winter hibernation. Important habitat includes areas that become snow-free early, and ecosystem units that contain last season's over-wintered berries, Arctic ground squirrel burrows, winter-weakened ungulates, and early vegetation (MacHutchon and Wellwood 2003; Gau et al. 2002). The following general assumptions were made to define spring HSRs:

- High ratings were assigned to three ecosystem and terrain units that provide early season food sources: dry carex-lichen, dwarf shrub-heath and rivers. Dry carex-lichen, dwarf shrub-heath and eskers are upland areas that are generally windswept resulting in low snowpack. Over-wintered berries from the previous season are available in these areas, as are Arctic ground squirrels. River corridors were also considered to have high habitat values due to opportunities for scavenging and accessing early vegetation such as horsetails along river edges.
- Moderate ratings were given to nine ecosystem units: beach materials, betula-ledum-lichen, dry willow, dryas-herb mat, emergent marsh, wet meadow, polygonal ground, pond, and riparian willow. Beach and marine ecosystems provide scavenging opportunities and willow and dwarf birch-dominated ecosystem units, wetland ecosystems, and small ponds provide a high occurrence of early forage production, as well as winter weakened caribou and caribou calves.
- Low ratings were given to five ecosystem units: betula-moss, blockfield, eriophorum tussock meadow, lakes, and shallow open water. Ratings were lower for these ecosystem types due to a lack of prey opportunities and limited early season vegetation in these habitats.
- Nil ratings were assigned to six ecosystem units: exposed soil and barren ground, rubble, and rock outcrops (lack of vegetation), low bench floodplains (flooded or frozen in the spring), disturbance features (camps, old mines), and salt water (ocean).

Summer

Summer habitat use by grizzly bears is highly variable. Grizzlies primarily feed on horsetails, sedges, and cottongrass in the early summer when caribou are scarce, as well as berries if they are available. Caribou calves and Arctic ground squirrels are considered to be their primary prey sources in mid-summer (Gau et al. 2002). Late summer use focuses on areas with high berry production. The following general assumptions were made to define summer HSRs:

- High ratings were given to five ecosystem units: dry willow, emergent marsh, wet meadow, polygonal ground, and riparian willow. Important forage in these ecosystem units include berries, cottongrass, and sedges which are critical vegetative food sources when caribou are absent from the region.
- Moderate ratings were assigned to six ecosystem units that provide berry production and forage as well as opportunities to scavenge for prey. These units include: rivers, beach materials, betula-ledum-lichen, betula-moss, dwarf shrub-heath, and eriophorum tussock meadow.

- Low ratings were assigned to four ecosystem units with limited forage opportunities: blockfield, dryas-herb mat, low bench floodplain, and ponds.
- Nil ratings were given to eight ecosystems where suitable spring forage is limited or absent: disturbance features (camps, old mines), dry carex-lichen, lakes, salt water, rubble, shallow open water, rock outcrop, and exposed soil and barren areas.

Fall

The fall season is critical for grizzly bears as they must gain weight rapidly in order to survive the winter. Fall habitat selection is focused on areas of high caribou occurrence (Johnson, Boyce, Schwartz, et al. 2005), berry availability, and streams that provide Arctic char for foraging grizzly bears. The following general assumptions were made to define fall HSRs:

- High ratings were given to four ecosystem units that retain late season berries and have a relatively high abundance of caribou: Betula-ledum-lichen, dry carex-lichen, dry willow, and riparian willow.
- Moderate ratings were assigned to seven ecosystem units: beach materials, betula-moss, dwarf shrub-heath, emergent marsh, wet meadow, polygonal ground, and eriophorum tussock meadow due to limited berry availability and forage such as cottongrass and sedges in these habitats, relative to high value habitat.
- Low ratings were given to five ecosystem units that were considered to have low forage potential and are not preferred habitat for prey species: blockfield, dryas-herb mat, low bench floodplain, pond, and river.
- Nil ratings were given to seven ecosystem units: exposed soil and barren areas, lakes, rock outcrops, rubble, disturbance features, salt water, and shallow open water (due to a lack of forage and prey).

Important Habitat Features

In addition to the HSRs assigned to polygons, field surveys suggest that grizzly bears using the LSA supplement their diet with Arctic char and anadromous lake trout. While published literature on Arctic grizzly bear feeding patterns provides limited evidence for fish comprising a significant component of their diet (Gau et al. 2002; Pearson 1976), the well documented opportunistic feeding nature of grizzly bears suggest that Arctic char may provide an important local food source (Rescan 2011b).

The major spawning runs of Arctic char and anadromous lake trout occur in Roberts Outflow, Little Roberts Outflow, Glenn Outflow and the Koignuk River. Smolts run from the lakes down to the sea from mid-July to early August (mostly the last 2 weeks of July). The main run of returning adults is in mid-August or early September. In low water years, the boulder gardens (discontinuous streams though boulder-dominated areas) in Roberts and Little Roberts Outflow become prime grizzly bear feeding areas due to the number of large adult fish stranded among the boulders. In higher flow years, it is assumed that grizzly bears would use all sections of the aforementioned streams (Rescan 2011d).

The previously mentioned streams and rivers were given a 100 metre buffer with a GIS platform. The resulting buffer polygons were included on the suitability maps and considered to have high HSRs for the summer season and moderate HSRs for the fall season (Figures 4.4-1, 4.4-2, and 4.4-3).