APPENDIX 6E

BIRDS BASELINE REPORT

Mary River Project
Bird Baseline Report

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2011 ENVIRONMENTAL EMPLOYER OF THE YEAR

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EXECUTIVE SUMMARY

The Mary River Project is a proposed iron ore mine and associated facilities located on north Baffin Island, in the Qikiqtani Region of Nunavut. This report details baseline studies conducted on marine and terrestrial birds and was prepared in support of an Environmental Impact Statement (EIS) to be submitted to the Nunavut Impact Review Board (NIRB).

Baseline studies for marine and terrestrial birds in the Project area consisted of a review of regional literature and existing data sources, discussions with biologists, Inuit Qaujimajatuqangit (IQ) studies, field surveys, and habitat classification and modeling for key indicator species (Snow Goose, Common and King Eider, Red-throated Loon, Peregrine Falcon). Thick-billed Murre and Lapland Longspur were also selected as key indicator species for the baseline report, however, modeling was not completed for these species.

Baseline studies indicated that the marine and terrestrial bird communities of north Baffin Island are generally reflective of those expected in the eastern Canadian Arctic. Waterbirds (including seabirds, geese, ducks, loons, eiders, terns and gulls) are the dominant species present throughout the area, but significant numbers of raptors, songbirds, shorebirds, and other terrestrial species are also present. Field surveys documented 54 bird species within the marine and terrestrial RSAs. Species of conservation concern include Peregrine Falcon (a common breeder within the terrestrial RSA), Short-eared Owl (documented very infrequently in the north Baffin Island region) Ivory Gull, Ross's Gull and Harlequin Duck (all detected within the marine RSA, but no nesting sites were located). One additional Species at Risk, the Red Knot, has the potential to be found within the Project Area, but was not detected during baseline surveys.

Twenty-five species were also confirmed to breed throughout the marine and terrestrial RSAs. No large, conspicuous seabird nesting colonies were recorded during project surveys; however, several are known to exist within and adjacent to the marine RSA, particularly on Bylot Island, in Foxe Basin, and along Hudson Strait. Marine surveys did locate a large Snow Goose colony (>5,000 individuals) on the southwestern shores of Steensby Inlet.

IQ surveys conducted in the surrounding communities indicated that the marine and terrestrial RSAs contain several areas that are used seasonally by large numbers of various bird species. Community elders indicated that most bird species in the area are migratory and typically arrive in late-April, May, and June, and start leaving in August. Breeding occurs throughout the area: most of the islands within the RSA are used as nesting grounds by various species of seabirds, gulls, terns and waterfowl, and some large colonies of seabirds and gulls are known along cliff habitats. Species such as geese, eiders, loons and ducks can be found nesting along area coastlines or inland along freshwater lakes. Fall migration occurs between early August to late October depending on the species and the sex as male birds and non-breeders for some species leave the area much earlier than adult females with young. Some birds such as Common Raven, ptarmigan, and sometimes Snowy Owl winter in the area and some seabirds, such as the Black Guillemot, also remain in the area year-round using the shore leads in the winter.

ACKNOWLEDGEMENTS

EDI Environmental Dynamics Inc. (EDI) has been involved in the Mary River Project since 2007. Initially retained by Knight Piésold Ltd. to lead the terrestrial wildlife component in late 2007, in 2010, EDI was hired by Baffinland Iron Mines Corp. to complete the wildlife baseline and terrestrial impact assessment. The baseline and impact assessment work completed by EDI is based on the work of previous consultants, as well as input from the local Inuit Qaujimajatuqangit, and experts with the Qikiqtani Inuit Association, the Canadian Wildlife Service and the Government of Nunavut.

Baseline surveys for marine and terrestrial birds at the Mary River Project were commenced in 2006 by Dr. Matthew Evans. Dr. Evans completed three years of field surveys (2006–2008) within the project area and prepared several unpublished reports summarizing this work including the initial baseline reports which were released by Knight Piésold and AMEC in 2010 as part of the Draft Environmental Impact Statement (DEIS). The results of that work, as well as portions of the original reports, are incorporated into the current baseline report.

Traditional knowledge from Inuit Qaujimajatuqangit and current local knowledge on birds within the Mary River Project Area was collected by Knight Piésold Ltd. in three local communities (Pond Inlet, Arctic Bay, and Igloolik). Forty-five interviews were conducted with community members (16 in Pond Inlet, 13 in Arctic Bay, and 16 in Igloolik). Knowledge gathered during these interviews was recorded on maps and in discussion transcripts. Details relevant to the Mary River Project and its relationship to the birds on north Baffin Island and the surrounding marine environments are used in this report. We appreciate being able to use the information local experts were willing to share.

Alastair Franke (Adjunct Academic, Canadian Circumpolar Institute, University of Alberta) provided updates to the raptor nest database and Alexandre Anctil conducted the cliff nesting raptor verification survey in early August 2011. Hilde-Marie Johansen provided the cover photo.

This report was prepared for Oliver Curran, Baffinland Iron Mines Corp.

AUTHORSHIP

This report was prepared by the EDI Environmental Dynamics Inc. Some of the material was based in part on earlier baseline reports prepared by Dr. Matthew Evans.*

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* Previous Editions

Evans, M. 2010. Appendix 6E-1: Mary River Project, 2006–2008 Avian Surveys Environmental Baseline Study Report. *In* Mary River Project Environmental Impact Statement, Volume 6: Terrestrial Environment. Unpublished report for Baffinland Iron Mines Corporation. Knight Piésold Consulting.

Evans, M. 2010. Appendix 6E-2: 2006–2008 Marine Birds Environmental Baseline Study Summary Report, Mary River Project. *In* Mary River Project Environmental Impact Statement, Volume 6: Terrestrial Environment. Unpublished report for Baffinland Iron Mines Corporation. AMEC Earth and Environmental.

NOTE

The following report replaces the previous baseline reports on birds for the Mary River Project released by Knight Piésold Consulting and AMEC Earth and Environmental in 2010 (see above). No additional fieldwork has been completed since the release of the previous reports, and much of the data presented in the current report was collected during 2006 – 2008 by Dr. Matt Evans. Sections of the previous reports have been incorporated into the current document; however, the results presented are based on the current project team's re-analysis of Dr. Evans survey data. Based on this re-analyses, we determined that the initial bird baseline reports submitted as a component of the DEIS should be disregarded, and that the information provided below is a better estimate of bird presence and distribution based on available data.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PHOTOS

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1 INTRODUCTION

The Mary River Project (the Project) is a proposed iron ore mine and associated facilities located on north Baffin Island, in the Qikiqtani Region of Nunavut. The Project involves the construction, operation, closure, and reclamation of an 18-million tonne-per-annum (Mt/a) open pit mine that will operate for 21 years. The high-grade iron ore will be extracted from Deposit No. 1 and is suitable for direct shipment after crushing and screening with no secondary processing or concentrating required. The Project will also involve the construction of a railway connecting the mine site to Steensby Inlet, and the development of an all-season deep-water port and ship-loading facility at Steensby Inlet. During the construction period, construction equipment and materials will be received at both Milne Inlet and Steensby Inlet, however, Milne Port will operate only during the open-water season, while Steensby Inlet will be used year-round. Once Steensby Port is operational, Milne Port will only be used occasionally for the delivery of oversized equipment to the Mine Site. The construction of the railway and the Port facilities at Steensby Inlet are expected to take four years. Upon completion, iron ore will be transported via railway from the mine site to Steensby Port, where shipping will occur year-round and will require specialized vessels with ice-breaking capabilities.

This baseline study report on terrestrial and marine birds was prepared in support of an Environmental Impact Statement (EIS) for the Project, to be submitted by Baffinland to the Nunavut Impact Review Board (NIRB). Field surveys for birds were conducted from 2006 to 2008 by Dr. Matthew Evans, under contract to Knight Piésold Ltd. and with assistance from LGL Ltd. (for the marine bird studies). EDI Environmental Dynamics Inc. was retained by Baffinland in 2010 to revise the terrestrial and marine bird baseline study report and impact assessment. Terrestrial mammal surveys, marine mammal surveys, and ecological land classification were separate study components and are described in separate reports. This report summarizes current knowledge and baseline information for terrestrial and marine birds in the Project area.

1.1 STUDY OBJECTIVES

The purpose of baseline studies for terrestrial and marine birds in the Mary River Project Area was to characterize the local avian populations and their habitat use patterns to document the pre-development environmental conditions within the Project area. The main objectives of these studies were to:

- determine species occurrence, abundance, distribution, and diversity within the Project Area;
- document the presence of any Species at Risk within the Project Area;
- determine bird densities by habitat types; and
- determine the seasonal occurrence and habitat requirements of species migrating through the area and/or breeding in them.

This information will provide input into the planning, design and implementation of the Mary River Project. In particular, it will provide the basis for an environmental impact assessment which will identify any potential impacts of the Project on marine and terrestrial bird species and their habitats. Subsequent to that, mitigation plans will be created in an attempt to eliminate or minimize any potential Project impacts, and a detailed monitoring program will be produced to measure the effectiveness of the mitigation plans and procedures, and/or to detect any unanticipated impacts.

1.2 PROJECT AREA

The proposed Mary River Project is located on northern Baffin Island. The proposed Project footprint will be centered on the Mary River mine site, located approximately 160 km southwest of Pond Inlet. It will also include a railway connecting the mine site to a port on Steensby Inlet to the south, port facilities at Steensby Inlet, and a shipping lane from Steensby Inlet to Davis Strait (through Foxe Basin and Hudson Strait), as well as a road connecting the mine site to the port on Milne Inlet to the north, port facilities at Milne Inlet, and an infrequently used shipping lane from Milne Inlet to Baffin Bay (through Eclipse Sound).

The terrestrial regions of the Project Area are situated in the eastern part of the Northern Arctic Ecozone which is the coldest and driest landscape in Canada. Daily temperatures average below -30°C in winter and only creep above freezing in July and August, while mean annual precipitation ranges from 10–20 cm. This precipitation is often in the form of snow which is present as ground cover for 10 months of the year (September to June). This area is composed mainly of Precambrian granitoid bedrock, and tends to consist of plateaus and rocky hills. Permafrost is continuous and can extend to depths of several hundred metres. Cryosolic soils (i.e., those affected by permafrost-related processes) predominate (Environment Canada 2011, Marshall and Schut 1999). Cold temperatures, a short growing season, high winds, shallow soils, and limited precipitation result in sparse and dwarfed vegetation in this area. Vegetative cover consists of grasses, herbs, shrubs, and lichens, but the diversity of vegetation is relatively low. Plant growth and diversity is greatest along coastal lowlands, sheltered valleys, and river banks where moisture and nutrients are more abundant. Upland areas tend to have limited vegetation as these areas are exposed to the harsher environmental conditions common in the area during most of the year.

Topography varies considerably across the Project Area. Milne Inlet, in the northern part of the Project Area, consists of a relatively broad, deep and flat sand beach enclosed by steep fiord walls measuring from 60–600 m above sea level (asl). Moving inland, the Milne Inlet Tote Road follows the Phillip's Creek valley which starts near sea level at Milne Inlet and rises to 188 m asl at the Mary River mine site. The Phillip's Creek valley is confined by hills or mountains on both sides. West of the Phillip's Creek valley is mountainous terrain with some occurrence of glaciers. At Mary River, Deposit No. 1 (Nulujaak) rises quickly to 679 m asl from the fairly flat and sandy outwash plain where the exploration camp is currently located. Nulujaak (Deposit No. 1) is part of a ridge trending approximately north–south and is a major landmark for Inuit travelling on the land. The land west of Deposit No. 1 is equally mountainous with some minor coverage of glaciers. East of Deposit No. 1 the land is somewhat rolling with several elevated

plateaus formed by horizontal sedimentary deposits. South of the Mary River mine site the undulating outwash plains end near the Ravn River. South of the Ravn River the land is quite flat and poorly drained and begins to drop steeply toward the Cockburn Lake valley, which is bounded by steep cliffs that range from 360–380 m asl. From Cockburn Lake south to Steensby Inlet becomes flatter with mainly undulating bedrock and boulder landforms.

Marine habitats within the Project Area are located mostly within the Arctic Archipelago Marine Ecozone, although the eastern-most sections along Hudson Strait overlap the Northwest Atlantic Marine Ecozone. The Arctic Archipelago Marine Ecozone is comprised of a patchwork of interconnecting bays, fjords, channels, straits, sounds and gulfs rather than vast, open seascapes. Water depths of 150 to 500m are typical within this area with deeper waters occurring where this ecozone merges with the Northwest Atlantic Ecozone (Environment Canada 2011). During the winter, sea ice creates a solid sheet over the waters of the Ecozone with the exception of localized areas where currents and upwellings create areas of open water called polynyas. During the brief spring and summer seasons, the sea ice will break up and by September, most of the sea ice will have either melted or drifted away on southerly currents; however, some ice can persist throughout the year, particularly in the northwestern parts of the Ecozone (Environment Canada 2011).

The coastline topography within the Project Area varies considerably. In the north, Milne Inlet is a long narrow fjord in the western portion of Eclipse Sound, characterized by steep sidewall slopes and deep waters with depths reaching more than 100 m within a few hundred metres of the coastline. Steensby Inlet is a wide bay within Foxe Basin, characterized by shallow water and gentle terrestrial relief around most of its perimeter. Foxe Basin itself is a broad, shallow basin within the Canadian Shield which is characterized by water depths of less than 100 m, particularly in the northern and eastern sections of the basin (Prisenberg 1986 *in* North/South Consultants 2010). Hudson Strait is a steep-sided U-shaped trough which is generally between 200 to 400 m deep (North/South Consultants 2010).

Due to the inherent differences in studying marine and terrestrial birds, separate study areas were delineated for the marine and terrestrial studies. Each set of study areas consisted of a local study area (LSA) that was selected to include the habitats within and adjacent to the project footprint and which will likely be subject to both direct and indirect effects of the Project, and a regional study area (RSA) that was selected to include the region that may be subject to the indirect effects of the Project. In some cases, the RSA may also provide data control sites beyond the range of Project impacts.

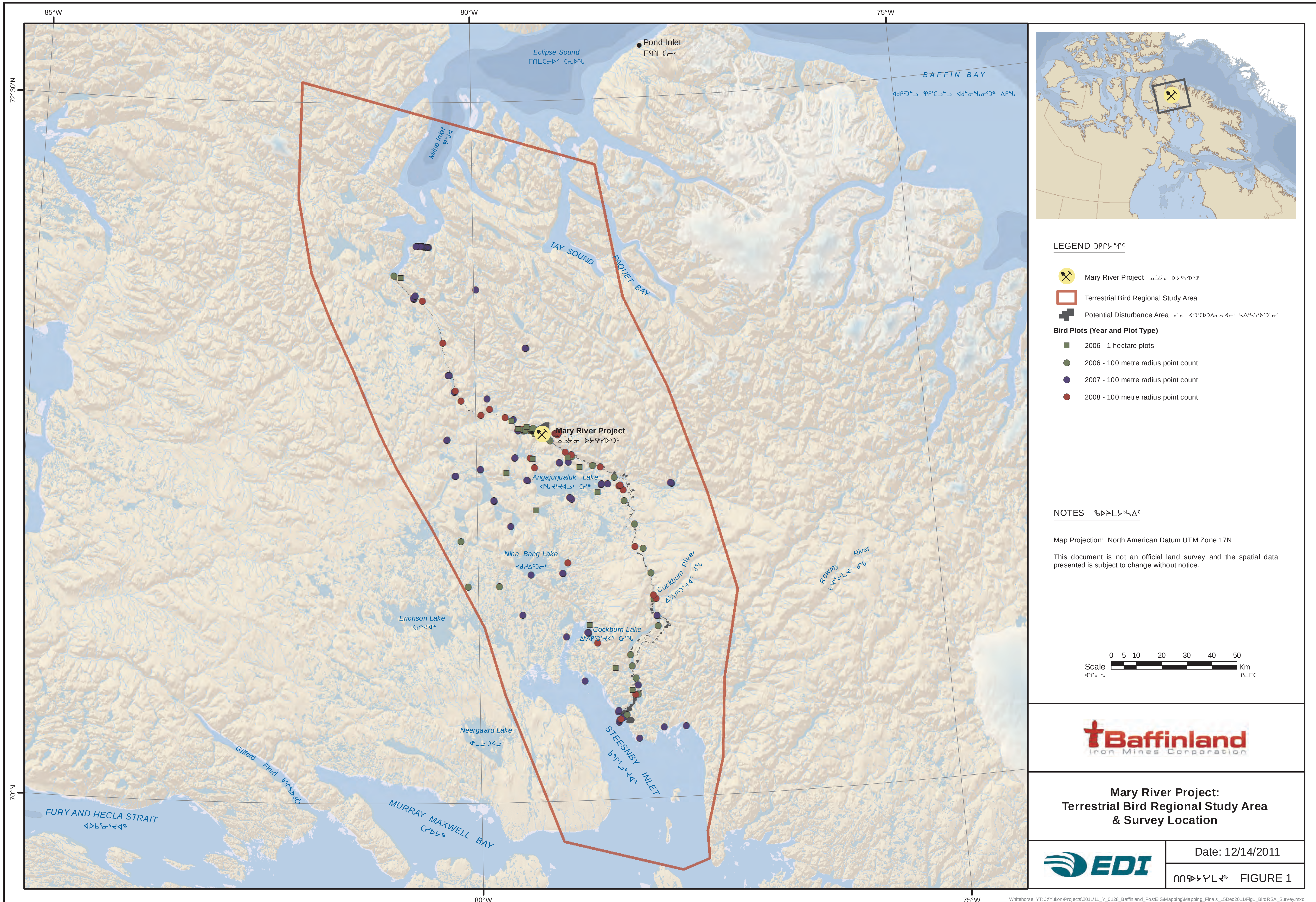
1.2.1 Terrestrial Study Area

The terrestrial local study area (LSA) includes the proposed Project footprint and 1 km on either side of all proposed Project infrastructure. The terrestrial regional study area (RSA) is a 30,719 km^2 area extending from Milne Inlet in the north following an approximately 50 to 80-km wide corridor centered on the Milne Inlet Tote Road, Mary River mine site, and the proposed railway alignment from Mary River to Steensby

Inlet (Figure 1). The terrestrial RSA used for the bird studies is not the same as the RSA used for the terrestrial wildlife work, but it is equivalent to the study area used for the Ecological Land Classification (Mary River Project, Environmental Impact Statement, Volume 6: Terrestrial Environment, Appendix 6D) that was used to characterize bird habitat.

1.2.2 Marine Study Area

The local and regional study areas defined for assessment of marine species are identical to that described in the Marine Mammal baseline (Appendix 8A-2 of the DEIS). The local study area (LSA) includes all port facilities and shipping lanes as well as a 1 km buffer on either side of the Project footprint. The regional study area (RSA) for the marine studies consisted of a 50-km buffer on either side of the Project footprint. For the southern route, this includes all coastal and open water areas of Steensby Inlet, the central part of Foxe Basin, and the northern and central parts of Hudson Strait. For the northern route, this includes the southern half of Navy Board Inlet, Eclipse Sound, and all inlets and sounds south of it, Pond Inlet, and the water inside the Nunavut Settlement Area Boundary from Cape Walter Bathurst, Bylot Island, to Cape Jameson, Baffin Island. For both the northern and southern routes, the RSA is bounded by the Nunavut Settlement Area Boundary (Figure 2).


85°W
80°W
75°W
72°30'N
70°N
Eclipse Sound
Pond Inlet
BAFFIN BAY
Milne Inlet
TAY SOUND
PAQUET BAY
Mary River Project
Angajurjualuk Lake
Nina Bang Lake
Cockburn River
Rowley River
Erichson Lake
Cockburn Lake
Neergaard Lake
STEENSBY INLET
Gifford Fiord
FURY AND HECLA STRAIT
MURRAY MAXWELL BAY
LEGEND
Mary River Project
Terrestrial Bird Regional Study Area
Potential Disturbance Area
Bird Plots (Year and Plot Type)
2006 - 1 hectare plots
2006 - 100 metre radius point count
2007 - 100 metre radius point count
2008 - 100 metre radius point count
NOTES
Map Projection: North American Datum UTM Zone 17N
This document is not an official land survey and the spatial data presented is subject to change without notice.
Scale
0 5 10 20 30 40 50
Km
Baffinland
Iron Mines Corporation
Mary River Project:
Terrestrial Bird Regional Study Area
& Survey Location
EDI
Date: 12/14/2011
FIGURE 1
Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig1_BirdRSA_Survey.mxd

LEGEND

- Mary River Project
- Terrestrial Bird Regional Study Area
- Marine Local Study Areas
- Marine Regional Study Areas

NOTES

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 25 50 100 150 200 Km

Baffinland Iron Mines Corporation

Mary River Project
Marine and Terrestrial Study Areas

EDI

Date: 12/14/2011

FIGURE 2

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig2_Marine_Terrestrial_StudyAreas.mxd

2 METHODS

Baseline studies for marine and terrestrial birds in the Project Area consisted of a review of regional literature and existing data sources, discussions with regional biologists, Inuit Qaujimajatuqangit (IQ) studies, field surveys, and habitat classification and modeling for key indicator species. The majority of this work was completed by Dr. Matthew Evans and Knight Piésold between 2006 and 2008.

To guide the baseline studies and in anticipation of the impact analysis, several key species were selected as key indicator species for portions of the baseline. These species were selected based on input from regional biologists, the IQ studies, field observations and the professional judgment of project biologists. Six key indicator species/species groups were selected including: Peregrine Falcon, Snow Goose, Common and King Eider, Red-throated Loon, Thick-billed Murre, and Lapland Longspur. A brief description of the rationale for each species selections is provided below (Table 1). The distribution and abundance of these species in the Project area are discussed below.

Table 1. Key Indicator Species Selected for the Mary River Bird Studies

Key Indicator Species	Rationale for Designation as a Project Key Species
Peregrine Falcon	• Listed as a species of 'Special Concern' under COSEWIC (2011) • Abundant and widespread within the terrestrial RSA • Will serve as a representative for other cliff-nesting raptors such as Rough-legged Hawks and Gyrfalcons
Snow Goose	• Local breeder and abundant migrant within the Project Area, the terrestrial RSA also overlaps an important moulting area for the species • IQ studies indicated that Snow Geese are an important harvest species for North Baffin communities
Common and King Eider	• Although not listed by COSEWIC or SARA, both species have recently been identified as a 'Species of Interest' by the Canadian Wildlife Service because of an unexplained nationwide decline observed over the past decade (Suydam, 2000) • Abundant migrant within the Project Area • IQ studies indicated that Eiders are an important harvest species
Red-throated Loon	• Loons are good indicators of high quality aquatic habitats and are relatively sensitive to environmental change (Strong, 1990; Dickson, 1992) • Red-throated Loons were the most abundant and widely distributed species of loon found during field surveys • Although IQ studies did not indicate that loons are culturally or economically important to local Inuit communities, a 1992 study on Igloolik Island found that 73% of all Red-throated Loon eggs laid within the 10 km² study site over two breeding seasons were collected by residents of Igloolik (Forbes et al., 1992)

Key Indicator Species	Rationale for Designation as a Project Key Species
	• Will serve as a representative for all four species of loons in the RSA, as well as other similar species of waterfowl (e.g., Long-tailed Duck)
Thick-billed Murre	• Commonly detected species during marine studies with large, well-known colonies in portions of the marine study area • Exhibits a unique, flightless migration which may interact with project shipping routes • Will act as a key indicator for other seabirds
Lapland Longspur	• Most commonly detected species of songbird and shorebird during field studies • Will serve as an indicator species for other songbird species

2.1 EXISTING INFORMATION

A literature review of bird studies focusing on the northern Baffin Island region was conducted to gather historical and current background information on marine and terrestrial bird species diversity, abundance, and habitat use within the proposed Project Area. Based on this information, an initial bird species list was compiled for the RSA.

Government of Nunavut biologists and the Canadian Wildlife Service (CWS; Vicky Johnston, Mark Mallory, Myra Robertson) who were familiar with the region and Nunavut as a whole, were also contacted at various times throughout the duration of the study. Information and advice from these experts assisted in the compilation of baseline information for this report and will be used in the environmental impact assessment.

2.2 INUIT QAUJIMAJATUQANGIT (IQ) STUDIES

Traditional knowledge or Inuit Qaujimajatuqangit (IQ) studies were conducted by Knight Piésold Ltd. to in part learn more about birds in the RSA. IQ studies were initiated in Pond Inlet in 2006, expanded to Igloolik and Arctic Bay in early 2007, and to Hall Beach and Clyde River in 2008. Studies were introduced in those communities with the closest ecological and cultural ties to the Project first, and then expanded to the other potentially affected communities, modifying the study methodology based on the experiences in the initial communities. The overall objective of the Mary River Project IQ studies was to obtain local knowledge of wildlife, land use, and areas of cultural value to support Project planning and decision making and to assist the social and environmental impact assessment processes.

A total of 45 individual surveys were conducted with elders and several workshops were held within the five communities. In March, 2008 a five-day meeting was held in Arctic Bay involving BIMC executives and the IQ working groups from all five communities.

During the surveys elders were asked the following questions with respect to birds, and were asked to identify important bird areas on maps:

1. Which birds arrive first in the spring?
2. Which birds are commonly seen in the summer? Please indicate on the map where these birds are commonly seen.
3. Which birds nest along the ocean? Please indicate on the map where these birds nest.
4. Can you show me on the map where the tundra wetlands are that ducks and geese use in large numbers?
5. Are there many cliffs in your land use area? Are any of those cliffs used by nesting raptors (e.g., falcons and hawks)?
6. In the fall which birds are first to migrate south?
7. Are there any birds that winter in your area? Why do birds use these areas in the winter?
8. Do you know of any places inland that are important for birds? Please indicate on the map where these areas are. Why do birds use these areas?
9. Where do you go to hunt birds or to collect their eggs? Please indicate on the map.

2.3 FIELD SURVEYS

Field surveys were conducted from 2006 to 2008. A confirmation survey of cliff-nesting raptor sites was conducted in 2011. The surveys were conducted to supplement information gathered from the literature review, consultation with regional biologists, and IQ studies. Information gathered from these sources helped guide the development and/or modification of the field program as surveys were designed to detect species that are important in that area or to survey habitat that may also have previously been determined to be important to the area. The purpose of the baseline surveys was to confirm the presence/absence and habitat use of birds within the marine and terrestrial RSAs during their fall migration, breeding season, and spring migration. Particular attention was paid during the field work to any federally listed Species at Risk.

2.3.1 Terrestrial Field Studies

Terrestrial avian field surveys were conducted within the terrestrial RSA between early-June and late-August, 2006–2008. Both aerial and ground-based surveys were conducted each year in late-May to early-June, mid- to late-June, mid- to late-July, and mid- to late-August. Surveys were conducted as close to the same time each year as possible; however, survey dates between years varied slightly due to different snow-melt dates, which influenced some breeding phenologies. Ultimately, sampling times were chosen to allow comparisons

between years at the various life stages (e.g., number of breeding pairs, number of nests initiated, number of young fledged, etc.). Songbirds and shorebirds were an exception to this and were only surveyed during the breeding season (mid- to late-June and July) when these birds were engaged in conspicuous courtship and territorial behaviours that made them easy to census using point-count surveys and transect plots.

2.3.1.1 Aerial Surveys

Aerial reconnaissance surveys were conducted by helicopter on a regular basis within the RSA, concentrating on the Project Footprint and other areas within the LSA. These surveys focused on locating the waterfowl and raptor species using the area and collecting information relating to reproduction and migration.

All wetlands, streams, rivers, and lakes within the LSA were surveyed for waterfowl during the spring migration, breeding season, and fall migration periods. All birds observed were counted and classified based on age (adult, juvenile, or duckling), sex, and whether they were alone, paired, or in a group. If a nest was located, data relating to the stage of development (e.g., eggs, nestlings) and the number of young present was recorded if known. The location of all observations was recorded by a handheld Geographic Positioning System (GPS).

Cliff-nesting habitat within the RSA was surveyed by helicopter each year to locate both active and inactive nests for Peregrine Falcons, Gyrfalcons, Rough-legged Hawks, and Common Ravens. There was no consistent attempt to determine territory occupancy and productivity of the sites. Sites were identified individually with a numeric code for database entry and presentation.

Beginning in 2010, Baffinland supported an independent raptor research team's study of raptors in Steensby Inlet. In 2011 the study was expanded to include verification of sites located from 2006–2008. A confirmation survey of cliff-nesting raptor sites in the RSA was conducted in early August 2011 to confirm nest site status from the 2006–2008 data. This survey was too late to locate active Gyrfalcon sites, so final results for Gyrfalcons may be under-represented. Territory activity was classified to species and status codes to summarize the reproductive status of each site.

2.3.1.2 Ground Surveys

Songbird and shorebird surveys were conducted each year between the end of May and the end of June. Data were collected using 100 m radius point-count surveys (n=174) and 1 ha transect plot surveys (n=26). Surveys were conducted throughout the daylight hours (i.e., 24 hours a day), but were not conducted on days that would affect the bird's behaviour and an observer's ability to detect them such as on windy or rainy days. Survey locations were chosen within the proposed mine site area, along the transportation

corridors, and in other areas of the RSA to survey for birds in a variety of habitats. Point counts were not replicated within or among years.

Point-count surveys were focused on songbirds and the transect plots were focused on shorebirds, but all species seen or heard were recorded during both survey types. At each survey location one observer (M. Evans) counted and recorded all birds present through visual and auditory cues (e.g., singing, calling) within 100 m for point counts, or within the 1 ha plots. Bird observations were classified based on age (adult, juvenile, young of the year), sex grouping (alone, paired, in a group) and behaviour.

Point Count Surveys

Point Count surveys consisted of circle plots with a radius of 100 m (area = 3.14 ha). The location of the survey plot was recorded using a GPS unit. A total of 174, 5-minute point-count surveys were conducted (2006 =50, 2007 = 93, and 2008 = 31; Figure 1). Survey efforts in 2008 were intentionally reduced due to perceived low songbird and shorebird densities from previous years, logistical constraints, and the fact that songbirds and shorebirds were not being identified as species of concern during Baffinland's community meetings. Additionally, there was little interaction of species of conservation concern with proposed terrestrial project activities.

Plot Surveys

Survey plots were 1 ha in size (100 m X 100 m) compared to the 12 ha plot recommended by the Program for Regional and International Shorebird Monitoring (PRISM) protocol (Bart et al. 2005, Canadian Wildlife Service 2006). The 1 ha plots were chosen due to the immense size of the RSA causing both time and personnel constraints. A total of 26 plots were surveyed in 2006 (Figure 1). Plots were not conducted in 2007 and 2008 due to the length of time taken to complete each plot (45 to 90 minutes) and the low density of birds encountered in 2006. A compromise was to increase sample size and coverage of point counts in 2007.

Incidental Sightings

Plots contained very few shorebird species; therefore, incidental sightings of songbird and shorebird species present within the RSA were also recorded outside of the designated plot surveys. Species presence was recorded during other wildlife survey work (e.g., while conducting habitat work, walking around wetlands counting waterfowl, during aerial surveys for waterfowl or aerial coastal surveys in Steensby and Milne).

Density Estimates

Density estimates were completed for songbirds and shorebirds within the terrestrial RSA. Overall density of songbirds and shorebirds was calculated for six of the species observed within the RSA survey areas. Distribution of species among different habitat types identified in the RSA was also calculated.

Bird point and plot coordinates were plotted in a Geographic Information System (GIS) with the habitat (ELC) layer to determine the habitat class that was sampled. The bird plots and points fell within eight different habitat types: wet sedge – graminoids and bryoids, tussock graminoid tundra, moist to dry non-tussock graminoid/dwarf shrub tundra: 50–70% cover, prostrate dwarf shrub - dryas/heath, sparsely vegetated till-colluvium, sparsely vegetated bedrock, bare soil with cryptogram crust - frost boils, and barren). Detailed descriptions of each of the eight habitat classes are provided in Appendix 6D.

Densities of songbirds and shorebirds were calculated as the mean number of birds per plot type (100 m radius and 1 ha plots) by habitat type. These data were then extrapolated and combined to be presented as the mean number of birds per square kilometer by habitat type. Density estimate calculations should be interpreted with caution as the survey methods were not initially designed to calculate density (e.g., various ELC units did not contain equal numbers of sample plots — summarized below in Results).

2.3.2 Marine Field Studies

Marine field studies consisted of systematic aerial transect surveys using both helicopter (n = 13 surveys) and fixed-wing aircraft (n = 63 surveys). In addition, ground-based surveys of marine habitats along Steensby Inlet and Milne Inlet were completed as part of the terrestrial studies — see the above section for survey details. The focus of the marine field studies was seabirds, waterfowl, gulls and terns. Only two species of shorebirds were surveyed in the marine study (Red-necked Phalarope and Red Phalarope) as all other shorebird species were covered in the terrestrial bird studies. This was primarily due to the fact that the aerial surveys conducted in this study are not an effective or accurate way of surveying shorebirds. Red-necked Phalaropes and Red Phalaropes were exceptions because large groups of these two species were seen in the open water areas during the marine bird surveys discussed in this report.

2.3.2.1 Helicopter Surveys

Helicopter surveys were conducted in either a Bell 206 Long Ranger or a Bell A-Star. All but four of these surveys (August 20–23, 2006) were conducted without floatation devices and were therefore confined to a maximum distance of 50 m from shore. As a result, surveys conducted in helicopters are referred to as 'coastal surveys' that followed the contours of the shorelines flying 50 m from shore at a height of 100 m above sea level at 100 km/hour. Additionally, due to fuel restrictions, Foxe Basin and Hudson Strait were never surveyed by helicopter.

During helicopter surveys, an observer was located on both sides of the aircraft and birds seen both in the water and on land were recorded to a distance of 200 m perpendicular to the flight path (marked on the glass of the observation window using a clinometer). Birds passing directly below the aircraft were recorded by an observer sitting in the front seat. Groups of birds large enough to be observed more than 200 m from the helicopter (typically groups consisting of >10 individuals) were identified as best as possible (e.g., 'unidentified eiders' or 'unidentified gulls', etc.) and were recorded as 'off transect'.

Thirteen (13) helicopter surveys were conducted (4 in 2006, 4 in 2007, and 5 in 2008; Table 2). Track logs from hand held GPS devices (Garmin 76) were kept for all surveys and provide a detailed record of aircraft height, speed and flight path. In each survey, approximately 60 km of coastline was surveyed in Milne Inlet, 180 km in Eclipse Sound, and 130 km in Steensby Inlet, for a total coverage area of 24 km^2, 72 km^2, and 52 km^2, respectively (based on a transect width of 400 m).

Table 2. Summary of marine bird surveys conducted by helicopter

Year	Date(s)	Shipping Route	Survey Location
2006	Aug 20, 21	Northern	Milne Inlet and Eclipse Sound
	Aug 22, 23	Southern	Steensby Inlet
2007	Aug 3, 5, 13	Southern	Steensby Inlet
	Aug 16	Northern	Milne Inlet
2008	June 28	Southern	Steensby Inlet
	June 29	Northern	Milne Inlet
	July 23	Northern	Milne Inlet
	July 24	Southern	Steensby Inlet
	Aug 23	Southern	Steensby Inlet

2.3.2.2 Fixed-wing Aircraft Surveys

Marine bird data were collected opportunistically by LGL Ltd. and North/South Consultants Inc. while conducting marine mammal surveys within the RSA. For a detailed description of the methods used for those surveys see the *Marine Mammal Environmental Baseline Study Summary Report*. These surveys used line transects over open water in all five of the main marine Projects areas (Milne Inlet, Eclipse Sound, Steensby Inlet, Foxe Basin, and Hudson Strait).

In 2006 and 2007, surveys were conducted in a Shorts Skyvan flying at 300 m above sea level and at 220 km/hour. In 2008, surveys were conducted in a Dehavilland Twin Otter at 150 m and 220 km/hour. Additional shoreline surveys were conducted in 2008 around Steensby Inlet, Koch Island, Rowley Island, and part of Bray Island in a Twin Otter at 90 m and 220 km/hour.

A total of 63 fixed-wing surveys were conducted (1 in 2006, 19 in 2007, and 43 in 2008; Table 3). Track logs from hand held GPS devices (Garmin 76) were kept for all surveys and provide a detailed record of aircraft height, speed and flight path.

Table 3. Summary of marine bird surveys conducted by fixed-wing aircraft.

Year	Date(s)	Shipping Route	Survey Location	Notes: Ship Traffic
2006	Sept 23	Southern	Steensby Inlet	
2007	Aug 4, 7, 8, 10, 12, 30, 31	Northern	Milne Inlet and Eclipse Sound	Ship came into Milne Inlet July 31, and left Aug 7.
	Sept 1, 3, 8, 9, 10, 13, 14, 15, 17, 18	Northern	Milne Inlet and Eclipse Sound	Ship into Milne Inlet Sept 9, and left Sept 15.
	Sept 12, 20	Southern	Steensby Inlet and Foxe Basin	
2008	April 26, 27	Southern	Foxe Basin	
	April 28, 29	Southern	Hudson Strait	
	June 11, 12, 13, 15	Southern	Foxe Basin and Hudson Strait	
	July 29, 30, 31	Southern	Foxe Basin and Hudson Strait	
	Aug 1, 2, 3	Southern	Foxe Basin and Hudson Strait	
	Aug 4, 5, 7, 10, 21, 22, 23, 24, 25, 26, 29, 31	Northern	Milne Inlet and Eclipse Sound	Ship came into Milne Inlet Aug 5, left Aug 9. Ship came in Aug 25, left Aug 26. Ship came in Aug 31, left Sept 2.
	Aug 23	Southern	Steensby Inlet	
	Sept 1, 2, 3	Northern	Milne Inlet and Eclipse Sound	
	Sept 7, 8, 10, 11, 12	Southern	Foxe Basin and Hudson Strait	
	Oct 3, 9, 11, 12	Southern	Steensby Inlet	
	Oct 16, 18, 19, 20	Southern	Foxe Basin and Hudson Strait	

2.4 HABITAT CLASSIFICATION AND MODELING

Habitat suitability modeling and mapping was conducted as a component of the baseline studies on birds within the terrestrial RSA. Modeling was completed for Peregrine Falcon (nesting and foraging), Red-throated Loon, Snow Goose, and Eiders was completed by Knight Piésold Ltd. in cooperation with M. Evans. The results of this work are documented in the FEIS Appendix 6D – Ecological Land Classification – Appendix B – Bird Habitat Suitability Report (Knight Piésold Ltd. 2010). For convenience, the results of this work are also summarized here and in Section 5.

Habitat suitability modeling for Peregrine Falcon, Red-throated Loon, Snow Goose, and Eiders was created based on the ecological land classification (ELC) conducted by Knight Piésold Ltd. and habitat suitability ratings developed by Dr. Matthew Evans. Suitability ratings were developed for terrestrial habitat variables including plant species/guilds (e.g., avens, lichens, mosses), vegetation cover types (e.g., wetlands, tussock graminoid tundra), and physical habitat characteristics such as slope, elevation and moisture. These ratings were then applied to the ELC model to generate a terrestrial habitat suitability model. In the case of Red-throated Loon, Snow Goose, and Eiders, an aquatic habitat component was built into the ELC to incorporate use of aquatic habitats by these species. The aquatic component included larger freshwater bodies (lakes and rivers) classified into five size categories, one category for marine areas, and an area of shoreline, with suitability ratings applied to each of these categories. In the habitat suitability modeling process used for the Draft Environmental Impact Statement (DEIS), the habitat suitability model results were then categorized into Nil, Low, Medium and High quality habitat suitability classes based on equal area allocation of all habitat suitability values.

Following the creation of the habitat suitability maps, the models were evaluated for accuracy using the field data collected during the bird baseline surveys. This was done by quantifying the number of field observations within each of the habitat suitability classes (nil, low, medium and high), each class representing approximately 25% of the RSA. The higher the percentage of observations within the Medium and High class areas, the more accurate the model was deemed to be. The analysis indicated that the Red-throated Loon, Snow Goose, and Eider models were relatively accurate (over 80% accurate); however, the Peregrine Falcon nesting and foraging models were less accurate. To increase the accuracy of the Peregrine Falcon models, a binary logistic regression analysis was conducted on the field data to identify which terrestrial habitat variables contributed significantly to Peregrine Falcon foraging and nesting. The results of this analysis were then used to create a linear model of Peregrine Falcon foraging and nesting habitat (R. Elliott, GIS Analyst, LGL Ltd., pers. comm.).

Upon review of the habitat suitability models, biologists at EDI decided that equal area allocation was not an appropriate way of representing the modeling results for an assessment of habitat availability or for future impact analysis. No changes were made to the modeling outcomes; however, the results were reclassified from equal area allocation (i.e., where high, medium, low and nil each represent approximately 25% of the RSA) to a rating scheme in which each rating (high, medium, low and nil) is assigned a specific range of values (Table 4).

Table 4. Rating Scheme used by EDI in the Reclassification of Habitat Suitability Models (Based on a Scale of Values from 0 to 100)

Ratings Class	Habitat Suitability Value
High	75.1 — 100
Medium	25.1 — 75
Low	5.1 — 25
Nil	0 — 5

2.4.1 Snow Goose

The Snow Goose model considered moisture, distance to lakes and rivers, vegetation cover types and plant species/guilds as terrestrial habitat variables. It also considered aquatic habitat variables including: distance to shore for various freshwater and marine habitats (Table 5).

Table 5. Summary of Habitat Suitability Ratings for the Snow Goose Habitat Suitability Model.

Habitat Variable	Weighting in Model	Summary of Ratings[1]
Moisture	100	'Moisture' looked at the presence of water not included in 'Lakes' and 'Rivers' (e.g., streams, ponds etc). Habitat values increased as the amount of 'Moisture' increased.
Lakes	100	'Lakes' rated terrestrial habitats based on their distance to lakes of various sizes. Habitats were rated highest if they were within 100 m of a lake (of any size). Ratings decreased with increasing distance from lakes.
Vegetation Cover Types	80	'Vegetation Cover Types' rated the land cover types within the RSA. High value cover types included: Tussock Graminoid Tundra, Wet Sedge, Wetlands, Moist to Dry Non-Tussock, Water, and Dry Graminoid.
Rivers	50	'Rivers' rated terrestrial habitats based on the distance to rivers. Habitats within 50 m of a river were rated highest, with ratings decreasing with increasing distance.
Plant Species/Guilds	40	'Plant Species/Guilds' rated the major plant communities within the RSA. Plant communities that were rated as high value included: Darkbrown Sedge (*Carex atrofusca*), Northern Singlespike Sedge (*Carex scirpoidea*), Cotton Grasses and Rushes, Grasses and Sedges, Northern Wood Rush (*Luzula confusa*), Arctic Wood Rush (*Luzula nivalis*), and mosses.

Habitat Variable	Weighting in Model	Summary of Ratings[1]
Distance to Shoreline	Applied Separately	'Distance to Shoreline' rated aquatic habitats based on the type and size of the water body and the distance to shore. All river habitats were weighted as 50, all freshwater lakes were weighted as 100, and marine habitats were weighted as 100 within 200m of shore and decreased with further distance from shore.

[1] For a full list of the Habitat Variables and the habitat suitability ratings see the Bird Habitat report in Appendix 6D – Ecological Land Classification.

2.4.2 King and Common Eider

The Eider model was based mostly on the 'distance to shoreline' (an aquatic habitat variable), moisture, lakes, vegetation cover types, and plant species/guilds (terrestrial habitat variables). However, additional terrestrial habitat variables included slope, terrain roughness, elevation, and rivers, were also considered (Table 5).

Table 6. Summary of Habitat Suitability Ratings for the Eider Habitat Suitability Model.

Habitat Variable	Weighting in Model	Summary of Ratings[1]
Lakes	100	'Lakes' rated terrestrial habitats based on their distance to lakes of various sizes. Habitats were rated highest if they were within 50 m of a lake (of any size). Ratings decreased with increasing distance from lakes.
Vegetation Cover Types	90	'Vegetation Cover Types' rated the land cover types within the RSA. High value cover types included: Wet Sedge, Wetlands, and Water. Tussock Graminoid Tundra, Prostrate Dwarf Shrub, and Moist to Dry Non-Tussock were also rated but at lower values.
Plant Species/Guilds	70	'Plant Species/Guilds' rated the major plant communities within the RSA. No plant communities were rated as high value. Communities rated as moderate to low included: Darkbrown Sedge (*Carex atrofusca*), Northern Singlespike Sedge (*Carex scirpoidea*), Cotton Grasses and Rushes, Grasses and Sedges, Mosses, Mountain Sorrel (*Oxyria digyna*), Willows, Purple Mountain Saxifrage (*Saxifraga oppositifolia*) and Blueberry (*Vaccinium uliginosum*). All other plant communities were considered to be of no value to Eiders.
Slope	30	The model assumed that Eiders restricted their use of habitats to those with a slope of 10% or less.

Habitat Variable	Weighting in Model	Summary of Ratings[1]
Terrain Roughness Index (TRI)	30	The TRI looked at the elevation change between any point on a grid and its surrounding area. Habitat values increased within increasing TRI until 0.189 and then decreased.
Rivers	30	'Rivers' rated terrestrial habitats based on the distance to rivers. Habitats within 50 m of a river were rated highest, with ratings decreasing with increasing distance.
Elevation	20	The model rated habitats below 332m ASL as the highest value to Eiders, habitats between 332 and 498m ASL were rated as moderate, and habitats at elevations above 498m ASL were assumed not to be used.
Distance to Shoreline	Applied Separately	'Distance to Shoreline' rated aquatic habitats based on the type and size of the water body and the distance to shore. All river habitats were weighted as 25. Weightings for freshwater lakes varied by size and distance to shore — the highest weighted habitats (weighted as 100) were all areas within lakes between 1 and 5 hectares in size, and areas within 200m of shore within lakes greater than 5 ha in size. Marine habitats were weighted as 100 within 200 m of shore with and decreased with further distance from shore.

[1] For a full list of the Habitat Variables and the habitat suitability ratings see the Bird Habitat report in Appendix 6D – Ecological Land Classification.

2.4.3 Red-throated Loon

The Red-throated Loon model considered distance to lakes and rivers, vegetation cover types, plant species/guilds, moisture, and slope as habitat variables. It also considered aquatic habitat variables including: distance to shore for various freshwater and marine habitats (Table 7).

Table 7. Summary of Habitat Suitability Ratings for the Red-throated Loon Habitat Suitability Model.

Habitat Variable	Weighting in Model	Summary of Ratings[1]
Lakes	100	'Lakes' rated terrestrial habitats based on their distance to lakes of various sizes. Habitats were rated highest if they were within 50m of a lake (of any size). Ratings decreased with increasing distance from lakes.
Vegetation Cover Types	100	'Vegetation Cover Types' rated the land cover types within the RSA. High value cover types included: Wetlands, and Water. Tussock Graminoid Tundra, Wet Sedge, Prostrate Dwarf Shrub, Moist to Dry Non-Tussock, and Dry Tussock were also assumed to be used but were considered to be of lower value.

Habitat Variable	Weighting in Model	Summary of Ratings[1]
Slope	100	The model assumed that Red-throated Loons only used habitats with a slope of 1% or less.
Plant Species/Guilds	80	'Plant Species/Guilds' rated the major plant communities within the RSA. Plant communities that were rated as higher value included: Mosses and Willows. Darkbrown Sedge (*Carex atrofusca*), Northern Singlespike Sedge (*Carex scirpoidea*), Cotton Grasses and Rushes, Grasses and Sedges, Labrador Tea (*Ledum palustris*), Northern Wood Rush (*Luzula confusa*), Arctic Wood Rush (*Luzula nivalis*), Mountain Sorrel (*Oxyria digyna*), Purple Mountain Saxifrage (*Saxifraga oppositifolia*) and Blueberry (*Vaccinium uliginosum*) were also considered to be used but were of lower value.
Moisture	50	'Moisture' looked at the presence of water not included in 'Lakes' and 'Rivers' (e.g., streams, ponds etc). Habitat values increased as the amount of 'Moisture' increased.
Rivers	50	'Rivers' rated terrestrial habitats based on the distance to rivers. Habitats within 50 m of a river were rated highest, with ratings decreasing with increasing distance.
Distance to Shoreline	Applied Separately	'Distance to Shoreline' rated aquatic habitats based on the type and size of the water body and the distance to shore. All river habitats were weighted as 30. Weightings for freshwater lakes varied by size – lakes less than 0.25 hectares in size were rated the highest (100), followed by lakes between 0.25 to 1 hectare in size (80), and lakes greater than 1 hectare (60). Marine habitats were weighted as 100 within 500 m of shore and were considered to have no value beyond 500 m.

[1] For a full list of the Habitat Variables and the habitat suitability ratings see the Bird Habitat report in Appendix 6D – Ecological Land Classification.

2.4.4 Peregrine Falcon

Two habitat suitability models were created for Peregrine Falcon: one for foraging habitat, and the other for nesting habitat. As discussed above, the modeling process for Peregrine Falcon habitat suitability differed from that of the other species in that:

1. It was based solely on terrestrial habitat variables (no aquatic habitat variables were include), and
2. It was based on the results of a logistic regression analysis of field data.

The resulting foraging model was based primarily on vegetation cover types and plant species/guilds, with input relating to slope, elevation and distance to lakes (Table 8).

The final nesting model for Peregrine Falcon was structured somewhat differently from the rest of the habitat suitability models. Following the completion of the binary logistic regression analysis, a logistic

regression model of Peregrine Falcon nesting habitat was constructed based on the existing field data. An analysis of the model against the terrestrial habitat variables used in other models revealed that slopes was the only variable positively related to habitat suitability while a couple other variables such as elevation, and distance to lakes and rivers were negatively related to habitat suitability.

Table 8. Summary of Habitat Suitability Ratings for the Peregrine Falcon Foraging Habitat Suitability Model.

Habitat Variable	Weighting in Model	Summary of Ratings[1]
Plant Species/Guilds	100	'Plant Species/Guilds' rated the major plant communities within the RSA. Plant communities that were rated as high value included: Avens (*Dryas integrifolia*), Non-rock Lichens, Mosses, and Mountain Sorrel (*Oxyria digyna*).
Vegetation Cover Types	100	'Vegetation Cover Types' rated the land cover types within the RSA. High value cover types included: Tussock Graminoid Tundra, Moist to Dry Non-Tussock, and Dry Graminoid. Wetlands, Wet Sedge and Water were considered moderately valuable to foraging Peregrine Falcons.
Slope	50	All slopes were considered to be used as foraging habitat, however, slopes of 10% or greater were considered to be of higher value than more gradual slopes.
Elevation	50	Elevations below 332 m asl were rated as higher value habitat than those at higher elevations.
Lakes	50	'Lakes' rated terrestrial habitats based on their distance to lakes of various sizes. Habitats were rated highest if they were within 50m of a smaller lake ($\leq$ 1 ha). Ratings decreased with increasing distance from these lakes.

[1] For a full list of the Habitat Variables and the habitat suitability ratings see the Bird Habitat report in Appendix 6D – Ecological Land Classification.

2.4.5 Lapland Longspur

Habitat suitability modeling was not completed for Lapland Longspur or any other songbird species. So in order to assess habitat availability for these species and to provide a basis for future impact analysis, a map of Lapland Longspur habitat was created by EDI based on observed and estimated densities by habitat type. The analysis of songbird and shorebird survey data (Section 4.1.3), produced a table of songbird densities by species and ELC habitat classification. To create the map of Lapland Longspur habitat use, the observed densities of Lapland Longspur were extracted from this table, grouped into classes of High, Moderate, Low and Nil, and applied to the ELC map layers. Some of the habitat types included in the ELC were not surveyed during field surveys; for these, densities were estimated based on documented densities at other

study areas in the Canadian Arctic, and the professional judgment of project biologists. Table 9 outlines the density ratings used in the mapping of Lapland Longspur habitat.

Table 9. Density classes used for mapping Lapland Longspur habitats within the Mary River Terrestrial RSA.

ELC Label	Habitat Type	Estimated Density of Lapland Longspur per km^2 ± S.D.	Density Class[3]
10	Tussock Graminoid Tundra	13 ± 23	Moderate
30	Wet Sedge - Graminoids and Bryoids	34 ± 73	High
60	Prostrate Dwarf Shrub - Dryas/Heath, Usually on Bedrock	21 ± 58	Moderate
70	Wetlands	Not surveyed. Estimated at 11.4[1].	Moderate
80	Moist to Dry Non-Tussock Graminoid/Dwarf Shrub Tundra: 50–70% Cover	33 ± 78	High
100	Sparsely Vegetated Bedrock	9 ± 33	Low
110	Sparsely Vegetated Till-Colluvium	4 ± 16	Low
120	Barren	18 ± 71	Moderate
130	Ice/Snow	Not surveyed. Assumed to be nil.	Nil
140	Water	Not surveyed. Assumed to be nil.	Nil
170	Dry Graminoid Prostrate Dwarf Shrub Tundra: 70-100% Cover	Not surveyed. Estimated at 57.3[2].	High
180	Bare Soil with Cryptogram Crust - Frost Boils	42 ± 112	High

[1] Based on Latour et al. 2005: densities at sedge marsh habitat = 9.7/km^2, densities at sedge wetland habitat = 13/km^2

[2] Based on Henry and Mico 2002: densities in graminoid – dwarf shrub tundra = 57.3/km^2

[3] Densities were classes as: Nil (<1/km^2), Low (1 – 10/km^2), Moderate (11 – 30/km^2), and High (>30/km^2).

3 EXISTING KNOWLEDGE

The following sections outline the existing knowledge on marine and terrestrial birds within the Mary River area based on the combined results of the literature review, consultation with regional biologists, and IQ studies.

3.1 LITERATURE REVIEW

Prior to the commencement of baseline surveys for the Mary River Project in 2006, no comprehensive avian surveys had been conducted in the terrestrial RSA, nor had any comprehensive marine bird studies previously been conducted within Milne Inlet. However, the remainder of the marine RSA (Eclipse Sound, Pond Inlet, Foxe Basin, and Hudson Strait) has been well studied.

Bylot Island to the north of the RSA, and the adjacent regions of northern Baffin Island including Brodeur Peninsula, Eclipse Sound, Pond Inlet, Navy Board Inlet and Lancaster Sound have perhaps the most well studied avifaunas in the Canadian High Arctic and have been studied by many of Canada's foremost ornithologists (e.g., Tuck 1961; Nettleship and Gaston 1978; Renaud et al. 1979, 1981; Bradstreet 1982; McLaren 1982; Zoltai et al. 1983; Alexander et al. 1991; Nettleship 1994, 1996; Lepage et al. 1998; Gauthier et al. 2004; Mallory and Fontaine 2004). Long-term studies continue on Bylot Island, including areas along the shores of Eclipse Sound (e.g., Gauthier et al. 2004; Gilles Gauthier, pers. comm. with M. Evans). From these studies it was concluded that Bylot Island and the surrounding marine environment, including Eclipse Sound, have among the greatest abundance and diversity of birds in the Canadian High Arctic (see Alexander et al. 1991; Lepage et al. 1998). Even 19th century explorers in search of the Northwest Passage commented on the abundance and diversity of birds in the region (Ross 1819, Parry 1821, M'Clintock 1859). More than 74 species of birds (both marine and terrestrial species) were documented in the area including the world's largest greater Snow Goose colony (over 669,000 individuals in 1996), and large colonies of Thick-billed Murres, Black-legged Kittiwakes, and Northern Fulmars (Batt 1998; Lepage et al. 1998). Ivory Gull also breeds in this region on Brodeur Peninsula (Alexander et al. 1991; Mallory et al. 2008).

Foxe Basin and Hudson Strait's nutrient-rich cold waters, numerous islands, and vast diversity of habitat types that range from wide low-lying coastal flats to steep coastal cliffs, also make them important regions for many species of seabirds, shorebirds, geese, ducks, eiders and loons (Ellis and Evans 1960; Reed et al. 1980; Gaston et al. 1986; Alexander et al. 1991; Forbes et al. 1992; Bechet et al. 2000; Johnston and Pepper 2009). The Great Plain of the Koukdjuak on the southwestern shores of Baffin Island has the world's largest goose colony, with over two million birds, 75% of which are lesser Snow Geese and the remainder Canada Geese and Brant (Important Bird Areas Canada 2010). Foxe Basin is thought to be the main North American stronghold of the Sabine's Gull, with some 10,000 pairs nesting here (Important Bird Areas Canada 2010). Several hundred thousand Thick-billed Murres breed on the cliffs of Digges Sound and Coats Island in the south, and large numbers of Black Guillemots, Arctic Terns, Glaucous and Herring Gulls also breed here. Several hundred thousand shorebirds and ducks also breed in or migrate through Foxe Basin.

Johnston and Pepper (2009) recently recommended that Prince Charles Island and Air Force Island be protected under the *Canada Wildlife Act* (1973) regulations for National Wildlife Areas.

Table 10 shows a list of the species expected in the Mary River study areas based on the results of other studies within or adjacent to the Mary River study areas. Some of the studies used reported on the findings of several years of study and some of the birds documented were recorded only once during the study period (e.g., studies have been conducted on Bylot Island since the early 1900s, and although Least Sandpiper is included on the list of species detected on Bylot Island in LePage et al. (1998) it has only been observed once in decades of study (LePage et al 1998). Therefore, to compile a reasonable list of bird species expected in the area, any bird species that were reported in only one study area and were considered a rare or accidental visitor in those studies were excluded. The resulting species list includes 62 marine and terrestrial bird species that could be expected within the marine and terrestrial RSAs.

3.1.1 Waterfowl, Seabirds, and Related Species

The north Baffin Island region, and particularly the surrounding marine environments, supports a great diversity and abundance of birds. Approximately 17 species of waterfowl and seabirds, and 14 species of gulls, terns, skuas and jaegars are expected to be found in the Mary River marine and terrestrial RSAs (Table 10). Large nesting colonies of Snow Geese, Brant, Common Eider, Thick-billed Murre, Black-legged Kittiwake, Northern Fulmar, Black Guillemots, Arctic Terns, Sabine's, Glaucous and Herring Gulls, and other species have previously been documented in the area. Potential species at risk within this group include Harlequin Duck, Ivory Gull and Ross's Gull; all are discussed in greater detail in Section 3.3.

3.1.2 Raptors

There are four raptor species expected to be found in the north Baffin Island region, including Snowy Owl, Rough-Legged Hawk, Gyrfalcon, and Peregrine Falcon. Additionally, Short-eared Owl may be observed in the area in response to high density of small mammal prey (Therrien 2010), but the Arctic islands are generally considered outside of their breeding distribution (Wiggins et al. 2006). For the purposes of this baseline report, we also include Common Raven in this group because they are cliff nesters and surveys for cliff-nesting raptors will also locate Common Raven nests.

The two owls are ground nesters in open tundra, and the two falcons and the hawk are cliff nesters (Table 11). Foraging habitat is similar for all species in open tundra habitats. Peregrine Falcon preys on smaller songbirds while the Gyrfalcon generally preys on the larger ptarmigan and Arctic hare. The owls and Rough-legged Hawk generally forage on fluctuating numbers of lemmings.

The governments of Nunavut and the Northwest Territories maintain a database of cliff-nesting raptor sites. Prior to baseline work for this project, there was only one confirmed nests site in the Regional Study Area

— a Peregrine Falcon nest (nest GN/GNWT # 621) first located in June 1967, at the northern limit of the RSA in the Milne Inlet area. There are no known follow-up records of that site. There was no local knowledge specific to raptors collected during community visits or individual interviews.

3.1.3 Songbirds and Shorebirds

Due to the harsh climates of the eastern Arctic, the diversity of passerines and other terrestrial species that breed in this area is somewhat limited. Approximately 16 species of shorebirds, 7 species of songbirds, 2 species of ptarmigan, and Sandhill Crane are expected to be found in the Mary River study area (see Table 10). These species are expected to use a variety of terrestrial habitats, but particularly wetlands, vegetated tundra, marine coastlines, and freshwater shorelines. Only one potential species at risk, the Red Knot, is found in this group. This species is discussed in further detail in Section 3.3.5.

Table 10. Bird Species Documented in Previous Studies within or adjacent to the Mary River Marine and Terrestrial RSAs.

Common name	Latin name	Foxe Basin[1]	Hudson Strait[2]	Prince Charles & Air Force Islands[3]	Arctic Bay, Baffin Island[4]	Igloolik Island[5]	Bylot Island[6]
Snow Goose	*Chen caerulescens*	S	--	B	B	Abundant Migrant, Uncommon Breeder	Common Breeder
Cackling Goose	*Branta hutchinsii*	S	--	B	--	--	--
Canada Goose	*Branta canadensis*		--	--	--	Uncommon Migrant	Rare Breeder
Brant Goose	*Branta bernicla*	S	--	B	--	Rare Breeder	Rare Visitor and Accidental Breeder
Tundra Swan	*Cygnus columbianus*	S	--	S	--	Rare Visitor	Rare Breeder
Northern Pintail	*Anas acuta*	S	--	S	--	--	Accidental Visitor
King Eider	*Somateria spectabilis*	S	--	B	S	Abundant Migrant, Uncommon Breeder	Common Breeder
Common Eider	*Somateria mollissima*	S	S	S	S	Occasional Visitor	Common Visitor and Rare Breeder
Long-tailed Duck	*Clangula hyemalis*	S	--	B	B	Abundant Migrant, Common Breeder	Common Breeder
Red-breasted Merganser	*Mergus serrator*	S	--	--	--	--	Rare Breeder
Rock Ptarmigan	*Lagopus muta*	--	--	S	B	Rare Breeder	Uncommon Breeder
Willow Ptarmigan	*Lagopus lagopus*	--	--	B	--	--	--
Red-throated Loon	*Gavia stellata*	S	--	B	B	Abundant Breeder	Common Breeder
Pacific Loon	*Gavia pacifica*	S	--	B	--	Uncommon Breeder	Rare Breeder
Yellow-billed Loon	*Gavia adamsii*	--	--	--	--	--	Rare Visitor

Common name	Latin name	Foxe Basin[1]	Hudson Strait[2]	Prince Charles & Air Force Islands[3]	Arctic Bay, Baffin Island[4]	Igloolik Island[5]	Bylot Island[6]
							and Possible Rare Breeder
Northern Fulmar	*Fulmarus glacialis*	--	S	S	S	Rare Visitor	Common Visitor
Rough-legged Hawk	*Buteo lagopus*	--	--	--	B	--	Rare Breeder
Gyrfalcon	*Falco rusticolus*	--	--	S	S	Rare Visitor	Rare Breeder
Peregrine Falcon	*Falco peregrinus tundris*	--	--	S	--	Rare Visitor	Rare Breeder
Sandhill Crane	*Grus canadensis*	S	--	S	--	Rare Visitor	Uncommon Breeder
Black-bellied Plover	*Pluvialis squatarola*	--	--	B	S	Uncommon Breeder	Uncommon Breeder
American Golden-Plover	*Pluvialis dominica*	--	--	B	B	Uncommon Breeder	Common Breeder
Semipalmated Plover	*Charadrius semipalmatus*	--	--	S	--	Rare Breeder	--
Common Ringed Plover	*Charadrius hiaticula*	--	--	--	B	--	Uncommon Breeder
Hudsonian Godwit	*Limosa haemastica*	--	--	--	--	Rare Breeder	--
Ruddy Turnstone	*Arenaria interpres*	--	--	B	S	Common Migrant, Uncommon Breeder	Rare Breeder
Purple Sandpiper	*Calidris maritima*	--	--	S	--	Uncommon Breeder	Rare Breeder
Red Knot	*Calidris canutus*	--	--	S	S	Rare Visitor	Rare Breeder and Uncommon Visitor
Dunlin	*Calidris alpina*	--	--	B	--	Occasional Migrant	Accidental Visitor
Sanderling	*Calidris alba*	--	--	--	--	--	Rare Breeder

Common name	Latin name	Foxe Basin[1]	Hudson Strait[2]	Prince Charles & Air Force Islands[3]	Arctic Bay, Baffin Island[4]	Igloolik Island[5]	Bylot Island[6]
Semipalmated Sandpiper	*Calidris pussilla*	--	--	B	--	Uncommon Breeder	--
White-rumped Sandpiper	*Calidris fuscicollis*	--	--	B	B	Abundant Breeder	Common Breeder
Baird's Sandpiper	*Calidris bairdii*	--	--	S	B	Occasional Breeder	Common Breeder
Pectoral Sandpiper	*Calidris melanotos*	--	--	S	B	Rare Visitor	Rare Breeder
Red-necked Phalarope	*Phalaropus lobatus*	--	--	B	--	--	Accidental Visitor
Red Phalarope	*Phalaropus fulicarius*	--	--	--	S	Abundant Breeder	Uncommon Breeder
Ross's Gull	*Rhodostethia rosea*	--	--	B	--	--	Accidental Visitor
Herring Gull	*Larus argentatus*	S	--	B	--	Common Breeder	--
Glaucous Gull	*Larus hyperboreus*	S	S	S	B	Abundant Migrant, Rare Breeder	Common Breeder
Iceland Gull	*Larus glaucoides*	S	--	--	--	--	Accidental Visitor
Thayer's Gull	*Larus thayeri*	S	--	S	B	Rare Breeder	Uncommon Breeder
Great Black-backed Gull	*Larus marinus*	--	--	--	--	--	Accidental Visitor and Possible Breeder
Black-legged Kittiwake	*Rissa tridactyla*	--	S	--	--	Rare Visitor	Common Breeder
Sabine's Gull	*Xema sabini*	S	--	B	--	Locally Common Breeder	Rare Breeder
Ivory Gull	*Pagophila eburnea*	S	--	--	B?	Off shore Migrant	Uncommon

Common name	Latin name	Foxe Basin[1]	Hudson Strait[2]	Prince Charles & Air Force Islands[3]	Arctic Bay, Baffin Island[4]	Igloolik Island[5]	Bylot Island[6]
							Visitor
Arctic Tern	*Sterna paradisaea*	S	--	B	--	Locally Uncommon Breeder	Uncommon Breeder
Great Skua	*Stercorarius skua*	--	--	--	--	Rare Visitor	Uncertain Status – Possible Accidental Visitor
Pomarine Jaeger	*Stercorarius pomarinus*	--	--	B	--	Occasional Visitor	Uncommon Visitor and Probable Breeder
Parasitic Jaeger	*Stercorarius parasiticus*	S	--	B	--	Rare Breeder	Uncommon Breeder
Long-tailed Jaeger	*Stercorarius longicaudus*	--	--	B	B	Occasional Breeder	Common Breeder
Dovekie	*Alle alle*	--	S	--	--	Abundant Visitor	Common Visitor
Thick-billed Murre	*Uria lomvia*	--	S	--	--	Uncommon Visitor	Common Breeder
Black Guillemot	*Cepphus grylle*	--	S	--	S	Uncommon Visitor	Uncommon Resident, Breeder
Snowy Owl	*Bubo scandiacus*	--	--	B	S	Periodic Breeder	Uncommon Breeder
Common Raven	*Corvus corax*	--	--	--	B	Uncommon Visitor	Common Resident, Breeder
Horned Lark	*Eremophila alpestris*	--	--	S	B	Rare Breeder	Common Breeder

Common name	Latin name	Foxe Basin[1]	Hudson Strait[2]	Prince Charles & Air Force Islands[3]	Arctic Bay, Baffin Island[4]	Igloolik Island[5]	Bylot Island[6]
Northern Wheatear	*Oenanthe oenanthe*	--	--	--	--	--	Rare Breeder
American Pipit	*Anthus rubescens*	--	--	S	B?	--	Uncommon Breeder
Lapland Longspur	*Calcarius lapponicus*	--	--	B	B	Abundant Breeder	Common Breeder
Snow Bunting	*Plectrophenax nivalis*	--	--	B	B	Common Breeder	Common Breeder
Common Redpoll	*Carduelis flammea*	--	--	--	--	--	Uncertain Status – Possible Breeder
Hoary Redpoll	*Carduelis hornemanni*	--	--	--	B?	--	Rare Breeder

* Symbology - B = Confirmed breeder, S = present but not confirmed breeding

Citations: 1. Dickson et al., in prep; 2. McKinnon et al. 2009; 3. Johnston and Pepper 2009; 4. Renaud et al. 1979; 5. Forbes et al. 1992; 6. LePage et al. 1998

Table 11. Raptors, general habitat characteristics, and breeding dates for species expected to found in the north Baffin Island region.

Species	Latin Name	Conservation Status		Primary nesting habitat	Primary nest type	Primary foraging habitat	Typical range of breeding dates[2]
		COSEWIC Status[1]	Nunavut General Status[1]				
Snowy Owl	*Bubo scandiacus*	Not at Risk	Secure	Ground	Bare ground	Tundra	Mid May to Late July
Short-eared Owl	*Asio flammeus*	Special Concern	Sensitive	Ground	Bare ground	Tundra-Wetland	Early May to Late July
Rough-legged Hawk	*Buteo lagopus*	Not at Risk	Sensitive	Cliff	Stick	Tundra	Early May to Late August
Gyrfalcon	*Falco rusticolus*	Not at Risk	Sensitive	Cliff	Ledge	Open tundra	Mid March to Late August
Peregrine Falcon	*Falco peregrinus tundrius*	Special Concern	Secure	Cliff	Ledge	Tundra-wetland	Early April to Late august
Common Raven	*Corvus corax*	Not Assessed	Secure	Cliff	Stick	Ubiquitous	Mid February to Mid July

[1] Nunavut General Status Ranks for 2011, www.wildspecies.gc.ca

[2] Breeding dates include time when birds may establish breeding territories through to fledging of chicks from nests.

3.2 INUIT QAUJIMAJATUQANGIT (IQ) STUDIES

Information from IQ surveys was collected in Pond Inlet, Igloolik, Arctic Bay, Hall Beach and Clyde River Residents of all five communities indicated that harvesting of birds and their eggs is still important to them but much less so than in the past. Ducks and geese of all species are important to the Inuit for the harvest of the eggs and the use of various parts of the bird for ceremonial and practical purposes; however, the species that were most commonly harvested are snow geese, common and king eiders, Arctic terns (eggs only) and long-tailed ducks. The birds, eggs, and Eider down are all used: down (sometimes with the birds' skin) is used for pillows or clothing, wings are used for sweeping tents, feathers are used for fletching on arrows, skin from the feet is used for making waterproof baskets, and the hollow bones have a variety of uses (Jacob Peterloosie).

Results from the IQ surveys in Pond Inlet, Igloolik, Arctic Bay, Hall Beach and Clyde River indicated that the marine and terrestrial RSAs contain several areas that are used seasonally by large densities of various

bird species (seabirds, geese, eiders, ducks, terns and gulls; Figure 3). Community elders indicated that most bird species in the area are migratory and typically arrive in late-April, May, and June, and start leaving in August. They indicated that murres, Northern Fulmars, gulls and eiders are the first species to arrive (in April), and that Long-tailed Ducks, Snow Geese and other species typically arrive in June. Fall migration occurs between early August to late October depending on the species and the sex as the male birds and non-breeders for some species leave the area much earlier than adult females with young. Some birds, such as the Black Guillemot, remain in the area year-round using the shore leads in the winter.

IQ surveys provided little information on migration corridors but did note that "lots" of geese and eiders fly over Foxe Basin and Steensby Inlet during the spring and fall migration. Thousands of Snow Geese migrate over the RSA and/or use the area for migratory stop-over sites in the spring and fall as moulting and foraging locations prior to fall migration. Included in these, are vast areas of tundra and wetland habitat within the terrestrial RSA from Steensby Inlet, stretching north-west along the west side of the rail alignment all the way to Milne Inlet, a distance of approximately 150 km. Ishmael Katsak and Theresa Maktar (MRICKS, 2008) of Pond Inlet noted several large areas within the southwest portion of the terrestrial RSA has being important to Snow Geese and other waterfowl as nesting and foraging habitat (Figure 3). These same areas were observed by Knight Piésold scientists as becoming snow-free early in the spring due to the abundance of water, and are believed to be an important stopover area during spring migration.

Most elders indicated that seabirds nest on many of the islands in the area (Bylot Island and the various islands in Foxe Basin) and that some nest in very large colonies on cliffs (e.g. murres and kittiwakes) while some nest on the ground along the coastlines. Geese, eiders, loons and ducks also nest on the ground along coastlines or inland along freshwater lakes.

Bylot Island was known by most interviewees to be a very good area for nesting murres, Snow Geese, eiders, and other species but one Pond Inlet resident said that the number of birds on Bylot Island has dropped dramatically since scientists started studying them, particularly the Snow Geese.

Most of the many islands in Foxe Basin (e.g., Nirlirnartuuq, Siuraq, Naluqqajarvik, Manirtulik, Qaiqsu and Qikiqtani) were identified by residents of Igloolik and Hall Beach as good nesting areas and are frequented by them for egg harvesting. Common and King Eiders and Arctic Terns were still popular species for egg harvesting in these areas, primarily because of the abundance of nests on islands close to these communities. Elders also indicated that there were more birds nesting on islands closer to the originally proposed western shipping route (that would have come along the west side of Rowley Island, close to Igloolik and Hall Beach) compared to the eastern route, and many voiced a personal preference to have ships travel along the eastern route, further from these islands and their communities. Elders also pointed out that many of the species such as geese, eiders, loons, ducks, terns and gulls nested in the same areas each year so residents always knew where to go for egg harvesting.

The following is a summary of other comments made by community Elders on the natural history of various local species:

Murres and Black Guillemots — Murres nest along the shoreline and on cliffs and start egg-laying in June. Murres are known to nest near Ingruraaluk and on the eastern side of Bylot Island. Black Guillemots often lay eggs in rocks crevices, but in some areas, such as Arctic Bay, they nest only on cliffs.

Gulls, Terns, Jaegers, and Fulmars — Gulls nest near the shoreline, on cliffs or near lakes and ponds. They are the first to arrive to Pond Inlet in the summer and remain until the ice begins to form in the fall. IQ studies identified large gull nesting areas at Appat, Annirut, Aulattivik, Sullukuluk and Pinguq. Arctic terns also nest near the shoreline or on lowlands around lakes and ponds. Tern nesting areas identified by elders include the Arctic Bay area, Qikirtaarjuk, Ikirasak, Qaiqsu, Amittuarju and Qurvingnaarjuk, and most of the islands in Foxe Basin. IQ studies indicated that Long-tailed Jaegers nest near Arctic Bay at Ikirasaarjuk, and fulmars nest on the cliffs in Arctic Bay Inlet and at Ikpikittuarjuk and Nuajaakuluk. Fulmars have also been seen nesting in Pond Inlet but no fulmars have been seen nesting near Igloolik.

Geese, Eiders, and Ducks — IQ surveys indicated that geese, eiders, ducks nest in very large numbers throughout the RSA on most of the islands, along the coastlines, and inland near wetlands and lakes on the tundra. All the residents of Pond Inlet and Arctic Bay were very familiar with the large snow goose colony on Bylot Island and indicated that although they still harvest these birds and their eggs, they do so less and less every year. One Elder mentioned that all the snow geese "…*were tagged by the scientists*" and she didn't like harvesting them anymore. Areas near Arctic Bay that have a lot of snow geese and eiders are Nunasaarut, Niaquartalik, Ikpikittuarjuk, and Angugaattiartalik. Eiders nest on most of the islands near Igloolik and Arctic Bay but most of the Pond Inlet Elders thought that there were no nesting areas near Pond Inlet aside from Bylot Island. Nesting areas identified by Arctic Bay Elders included Qikiqtaukkat, Kangiq, Tasiujaq, Mitilik ("Place of Eider Ducks") and Nirlirngnaqtuuq. Nesting areas identified near Igloolik included Siuraq, Manirtulik, Nirluriaq, Tasiujaq, Uglit and Kiguit. Several residents reported seeing eiders feeding at floe edges in the spring. Long-tailed Ducks were reported to nest along shorelines and inland near lakes and ponds, including many at Tugaq Lake.

Loons — Loons were reported to prefer to nest in lowlands, near wetlands and along lakeshores. Elders from Pond Inlet commented that Pacific loons and Common Loons often occupy the same nesting and feeding areas and that loons are found wherever there are small lakes, especially around Aulattivik. One interviewee from Arctic Bay said that Pacific loons can be found nesting around the edges of rivers where they like to fish.

Although, the elders described species they encountered from a harvest perspective and the focus of the questions was definitely to gather this type of information, they also recognized and acknowledged other species and the timing of their movements as indicators for historical and seasonal changes. These include weather patterns and seasonal fluctuations as witnessed by Ishmael Katsak, in the earlier arrivals of Canada Geese in the spring indicating a general warming trend and anthropogenic sources of pollution (airplanes landing and taking off) affecting their feeding grounds (Ishmael Katsak).

One Elder has recently observed Ivory Gulls in Igloolik and stated that they were not normally seen there. Murres are also commonly seen in Igloolik in the spring and summer now, but used to only be seen in the

winter. In Pond Inlet, fewer gulls are present than in the past and in Arctic Bay one Elder believes that the "white gull" (Ivory Gull) is becoming extinct in the area.

As mentioned above, one resident of Pond Inlet felt that snow goose population numbers on Bylot Island have declined since scientists started studying these birds.

A graphical representation of the IQ collected on birds for the Mary River area is presented in (Figure 3). Only in the northern portion of the RSA around Milne Inlet and Milne Inlet Tote Road and outer islands is species specific information from the interviews coded by colour. The rest of the RSA, including the Mary River mine site, the proposed Steensby Port location and surrounding lands west of the proposed rail line are located in the figures as areas important for birds in general.

8,250,000
8,125,000
8,000,000
7,875,000
7,750,000
7,625,000
7,500,000
250,000
375,000
500,000
625,000
750,000
N
ARCTIC BAY
POND INLET
IGLOOLIK
HALL BEACH
ABV
IGV
SCALE 25 12.5 0 25 50 75 100 125 km

LEGEND:
- PTARMIGAN LOCATION
- SPRING LOCATION
- SUMMER LOCATION
- WINTER LOCATION
- FALL LOCATION
- NESTING GROUNDS FOR DIFFERENT BIRDS
- EGG GATHERING LOCATION
- HUNTING LOCATION
- IMPORTANT LOCATION
- DUCKS AND GEESE NESTING LOCATION
- RAPTOR NESTING LOCATION
- SEA BIRD NESTING LOCATION
- MILNE INLET TOTE ROAD
- PROPOSED RAILWAY ALIGNMENT
- NOMINAL SHIPPING ROUTE
- TERRESTRIAL RSA

NOTE: ARCTIC BAY & IGLOOLIK INTERVIEWEES UNDERSTOOD THE QUESTION PERTAINING TO "NESTING GROUNDS FOR DIFFERENT BIRDS' TO ONLY BE ABOUT MIGRATORY BIRDS.

NOTES:

1. BASE MAP: © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA, DEPARTMENT OF NATURAL RESOURCES (2004). ALL RIGHTS RESERVED.
2. UTM (NAD83) ZONE 17 AND IS IN METRES.
   COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. THIS MAP WAS PRODUCED FROM INFORMATION COLLECTED DURING INUIT QAUJIMAJATUQANGIT INTERVIEWS WITH LOCAL RESIDENTS. THIS INFORMATION SHOWS PATTERNS OF LAND USE AND LOCAL KNOWLEDGE OF THE LAND. THE MAP IS NOT INTENDED TO BE A COMPLETE REPRESENTATION OF WHAT IS KNOWN.

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	CHK'D	APP'D
0	15DEC'11	ISSUED WITH TRANSMITTAL	MLT	ASM	PAQ	KDE

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

BIRD LOCATIONS FROM THE INUIT KNOWLEDGE STUDY MARINE AND TERRESTRIAL

Knight Piésold CONSULTING

P/A NO.	REF NO.
NB102-181/30	NB11-00528

FIGURE 3 REV 0

SAVED: I:\1\02\00181\30\A\GIS\Figs\B90_r0.mxd: Dec 15, 2011 1:39 PM; amoore

3.3 SPECIES AT RISK

The status of wildlife populations within Nunavut is assessed by the Nunavut Department of Environment (Wild Species 2010; CESCC, 2011) and, in some cases, by the Canadian Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The Canada Species At Risk Act (SARA) groups species at risk into one of three Schedules: Schedule 1 (the official list of species at risk in Canada, includes species that are either extirpated, endangered, threatened or of special concern), Schedule 2 (species designated as endangered or threatened, but that have yet to be re-assessed by COSEWIC under the revised criteria), and Schedule 3 (species designated as special concern, but that have yet to be re-assessed by COSEWIC under the revised criteria). There are six federally-listed Species at Risk that could occur in the Mary River RSA (Table 12).

Table 12. Status of Avian Species at Risk and Potentially Found in the Mary River RSA

Species	Conservation Status		
	Nunavut[1]	COSEWIC[2]	SARA[3]
Harlequin Duck eastern population	Sensitive	Special Concern	Special Concern (Schedule 1)
Ivory Gull	At Risk	Endangered	Endangered (Schedule 1)
Peregrine Falcon *tundris* subspecies	Secure	Special Concern	Special Concern (Schedule 3)
Ross's Gull	At Risk	Threatened	Threatened (Schedule 1)
Red Knot	At Risk	*Islandica* ssp. – Special Concern, *Rufa* ssp. – Endangered	*Islandica* and *Rufa* ssp. - No Status
Short-eared Owl	Sensitive	Special Concern	Special Concern (Schedule 3)

[1] CESCC 2011, [2] COSEWIC 2011, [3] Environment Canada, SARA 2011

3.3.1 Harlequin Duck Eastern Population

Harlequin Ducks are not common to Canada's Arctic regions and are not found east of Baffin Island (Environment Canada 2007a). Most of their breeding grounds are located in Labrador, Quebec; however, they are known to breed on the southern third of Baffin Island (mostly along Frobisher Bay and the eastern sections of Hudson Strait) and have been seen in small flocks in southern Foxe Basin and Hudson Strait (Environment Canada 2007a, Mark Mallory, CWS, pers. comm.). They nest along fast moving streams and rivers, but are often found foraging along rocky coastlines during other times of the year. Wintering habitat consists of rocky coastlines, exposed headlands and sub-tidal ledges off the southwest coast of Greenland or the eastern coast of North America from Newfoundland south to Maryland (Environment Canada 2007a).

Canada's eastern population of harlequin, which is mostly concentrated in Labrador and Quebec, was listed as endangered by COSEWIC in 1990 but was upgraded to a species of special concern (COSEWIC 2011, Environment Canada, SARA 2011). Threats to this population include habitat loss and anthropogenic disturbances (e.g., hydroelectric dams, logging) at their nesting grounds (Robertson and Goudie 1999), overhunting, and fishing nets, aquaculture developments, boating activities, and oiling on their wintering and moulting grounds (Thomas and Roberts 2001 *in* Environment Canada 2007a).

3.3.2 Ivory Gull

Very little is known about the Endangered Ivory Gull and its general biology (COSEWIC 2011, Mallory et al. 2008) and they have only been observed occasionally in the marine RSA in the past ten years (in Foxe Basin and Eclipse Sound, Mark Mallory, CWS, Personal Communication). Ivory Gulls are known to nest on Brodeur Peninsula on northern Baffin Island as well as in the eastern Lancaster-Jones Sounds regions close to Bylot Island (Mallory et al. 2008). Some ivory gulls are thought to migrate through Foxe Basin and Hudson Strait each year as a few individuals have been seen migrating through Igloolik and Cape Dorset, outside of the RSA to the west (Mark Mallory, CWS, pers. comm., Theo Ikummaq, MRIKS, 2008, Forbes et al. 1992). However, the majority of Ivory Gulls that nest on Brodeur Peninsula are believed to winter either north of Bylot Island or in southwestern Baffin Bay and Davis Strait (Renaud and McLaren 1982, Mallory et al. 2008) and migrate there through Lancaster Sound or Eclipse Sound (Renaud and McLaren 1982). Three hundred and seventy-five individuals were seen in the floe edges near Pond Inlet during spring migration in 1979 (Renaud and McLaren 1982) and 75 were seen in this same location in the spring of 1994 (Lepage et al. 1998). It therefore appears that portions of the RSA may be used as a migratory pathway by this species but very little else is known about the life history of this species.

3.3.3 Peregrine Falcon *tundris* subspecies

Peregrine Falcon is considered a species of *Special Concern* by COSEWIC, but populations across northern Canada have been recovering from near extinction in the late 1960s (Cade et al. 1988, Bromley 1992, Enderson et al. 1995, COSEWIC 2007a). *Tundrius* Peregrine Falcons breed from the north slope of the Yukon, east across the Low Arctic Islands and Nunavut, north to Baffin Island, Hudson Bay, Ungava and northern Labrador (COSEWIC 2007a). They are generally considered abundant and widespread throughout most of their recognized breeding range in Nunavut (CESCC 2011). Peregrine Falcon breeding habitat is typically limited by the presence of suitable nest sites (usually on a cliff ledge or crevice) near good foraging areas with a sufficient prey base. Peregrine Falcons prey primarily on other bird species such as colonial seabirds, shorebirds, waterfowl, other waterbirds, ptarmigan, and songbirds (COSEWIC 2007a). Although in some areas, small mammal species such as lemmings and juvenile arctic ground squirrels (*Spermophilus parryii*) also comprise a major portion of the diet (Court et al. 1988).

3.3.4 Ross's Gull

Ross's Gull is one of the rarest breeding gulls in North America and is considered a Threatened species in Canada (COSEWIC 2007c, Environment Canada, SARA 2011). Although very little is known about this species and no long-term studies exist for it in Arctic Canada, they have been recorded nesting in four locations in Canada, one of which is on Prince Charles Island in Foxe Basin (the other three locations are: Cheyne Islands, Nunavut; an unnamed island in Penny Strait, Nunavut; and Churchill, Manitoba; Environment Canada 2007b). A single pair of breeding Ross's Gulls was discovered on Prince Charles Island in 1984 by Tony Gaston (CWS) and in 1997 by both Vicky Johnson (CWS) and Bechet et al. (2000). Despite intensive surveys on Prince Charles and neighbouring Air Force Island in 1996 and 1997, no additional birds were found (Johnston and Pepper 2009, Vicky Johnston, CWS, pers. comm., Mark Mallory, CWS, pers. comm). As well, a single adult Ross's gull in breeding plumage was recorded on Bylot Island in 1979 by both Renaud et al. (1981) and Lepage et. al (1998), independently. Ross's Gull breed in a variety of habitats including marshy wetlands, boreal, subarctic and high arctic tundra, and gravel reefs, but require open access to water at the nest site (COSEWIC 2007c). Most of the world's population of Ross's Gulls is thought to breed in northeastern Siberia and Canada's Ross's Gulls are thought to spend the winter in the Chukchi Sea, between Alaska and Russia (COSEWIC 2007c, Environment Canada's Canadian Wildlife Service Fact Sheet).

3.3.5 Red Knot

Red Knot populations are well studied in North America, with three subspecies present in Canada (COSEWIC 2007b); of these, two have the potential to be located in the Mary River RSAs. The breeding range of the *islandica* subspecies (*Calidris cantus islandica*) is found in the High Arctic regions of northeastern Canada and Greenland, including parts of Bylot Island and the northwestern end of Baffin Island. The breeding range of the *rufa* subspecies (*Calidris cantus rufa*) is located entirely within the Central Canadian Arctic and includes areas within Foxe Basin and southern Baffin Island (COSEWIC 2007b). Previous studies in the region have documented Red Knot on Prince Charles and Air Force Islands (Johnston and Pepper 2009), Igloolik Island (Forbes et al. 1992), Arctic Bay, Baffin Island (Renaud et al. 1979), and Bylot Island (LePage et al. 1998); however, only the Bylot Island studies found evidence of breeding. Nesting habitat for Red Knots typically consists of barren areas (often with less than 5% vegetation cover) such as windswept ridges, slopes or plateaus, generally at elevations less than 150 m above sea level and less than 50 m form the coast (COSEWIC 2007b). Although, during the breeding season, they will forage in damp or barren habitats up to 10 km from the nest site (COSEWIC 2007b). Wintering areas used by the *islandica* knots are located on the European seaboard, while the winter range of *rufa* knots is located mostly in Tierra del Fuego (COSEWIC 2007b).

3.3.6 Short-eared Owl

Short-eared Owl is considered a species of Special Concern by COSEWIC. They are found throughout most of Canada, except parts of the high Arctic (Wiggins et al. 2006, COSEWIC 2008). In Nunavut, they are widely distributed with higher concentrations in coastal tundra areas during years of lemming outbreaks (COSEWIC 2008). To the best of the author's knowledge, they have not previously been documented on north Baffin Island; however, their breeding range is believed to likely include south Baffin Island (Wiggins et al. 2006). Short-eared Owls typically inhabit open habitats such as grasslands, tundra, bogs, marshes, and agricultural areas, and feed primarily on small mammals (Wiggins et al. 2006, COSEWIC 2008). In Arctic regions, they are usually found in arctic tundra and estuaries (Sinclair et al. *in* COSEWIC 2008). The primary limiting factor affecting Short-eared Owls is habitat loss and alteration (COSEWIC 2008). Austen et al. (1994) suggested the decline in Short-eared Owl populations is mostly related to habitat loss and degradation on their wintering grounds, with continuing habitat loss and degradation on their breeding grounds in southern Canada. Short-eared Owls are irruptive breeders and nesting success appears to be, in part, a response to local small mammal populations (COSEWIC 2008).

3.4 PROTECTED AREAS AND KEY HABITAT SITES

3.4.1 National Parks

At the northern end of the Project study area, outside of the Project boundaries but adjacent to the marine environment study area is Sirmilik National Park and Bylot Island Bird Sanctuary. Sirmilik National Park and Bylot Island have one of the most diverse and well-studied avifaunas in the Canadian Arctic (e.g., Tuck 1961, Nettleship and Gaston 1978, Renaud et al. 1979, 1981, Bradstreet 1982, McLaren 1982, Zoltai et al. 1983, Alexander et al. 1991, Nettleship 1994, 1996, Lepage et al. 1998, Menu et al. 2002, Gauthier et al. 2004, Mallory and Fontaine 2004). The area contains more than 74 species of birds (both marine and terrestrial species) including the world's largest greater Snow Goose colony (over 669,000 individuals in 1996), and large colonies of Thick-billed Murres, Black-legged Kittiwakes, and Northern Fulmars (Batt et al. 1998, Lepage et al. 1998). The endangered Ivory Gull also breeds in this region on Brodeur Peninsula (Alexander et al. 1991, Mallory et al. 2008). Both areas are considered to be sensitive to disturbance (e.g., from shipping and tourism), and to marine pollution (Alexander et al. 1991), and have special federal and international protection under the *Migratory Birds Sanctuary Regulations* (1997), the *Migratory Birds Convention Act* (1994), and *Canada's National Parks Act* (2000). Long-term studies continue on Bylot Island, including areas along the shores of Eclipse Sound (e.g., Gauthier et al. 2004, and Gilles Gauthier, pers. comm. with M. Evans).

3.4.2 Key Migratory Bird Habitat Sites and Important Bird Areas

Environment Canada's Canadian Wildlife Service (CWS), Bird Studies Canada (BSC), and Nature Canada (NC) identify, monitor and conserve areas that provide key habitat for bird populations across Canada. In Nunavut, CWS has identified 32 Key Marine Habitat Sites (*KMHS*; Mallory and Fontaine 2004) and 60 Key Terrestrial Habitat Sites (*KTHS*; Alexander et al. 1991, Latour et al. 2008) for migratory birds in Nunavut. BSC and NC have also designated 56 areas in Nunavut as Important Bird Areas (IBAs; CEC 1999, Bird Studies Canada 2010). These designations are used by CWS, BSC, and NC to identify areas that may require special conservation measures but they do not provide any legislated protection status.

No areas within the terrestrial RSA are listed as Key Habitat Sites or Important Bird Areas, although, this may be due, at least in part, to the lack of research that has taken place within the terrestrial RSA (specifically, within Milne and Steensby Inlet and the terrestrial areas between these two sites). In contrast, the marine RSA overlaps or borders several Key Habitat Sites or IBAs (Figure 4).

Berlinguet Inlet (#NU20, IBANU066) is an area outside of the RSA in the northwestern portion of Steensby Inlet (southern part of the RSA), is an area that has been designated as 'Key Migratory Bird Habitat' by the Canadian Wildlife Service (Alexander et al. 1991). This long, narrow stretch of low lying tundra reaches west to Berlinguet Inlet and Bernier Bay and is used by thousands of breeding Snow Geese and Canada Geese (Reed and Dupuis 1980, Giroux et al. 1984), seabirds, sea ducks, shorebirds, and Peregrine Falcons (Reed and Dupuis 1980). Key Migratory Bird Habitat may require special conservation measures in the future, but currently, this area has no special protection status (Alexander et al. 1991).

Cape Hay (*KMHS* #12*, KTHS* #NU21, *IBA* #NU004) is located on the northwestern tip of Bylot Island, protruding into Lancaster Sound. The area is characterized by tall, steep coastal cliffs, rocky shores, and areas of low-lying coastal tundra. There are large colonies of Thick-billed Murres (approximately 140,000 pairs presently, but this is down from 400,000 pairs in 1957; Gaston and Hipfner 2000) and Black-legged Kittiwakes (20,000 pairs, down from 50,000 pairs in 1957) nesting here and the area is used by thousands of Northern Fulmars and Dovekies, and hundreds of Black Guillemots (Mallory and Fontaine 2004, Important Bird Areas Canada 2010).

Southwest Bylot Plain (*KTHS* #NU22, *IBA* #NU013) is a lush glacial fluvial plain located in the southwestern corner of Bylot Island along the north shores of Eclipse Sound. It is home to the world's largest known breeding colony of greater snow geese and large colonies of Thick-billed Murres, Black-legged Kittiwakes, and Northern Fulmars nest on nearby cliffs (Batt et al. 1998; Lepage et al. 1998; Important Bird Areas Canada 2010).

Cape Graham Moore (*KMHS* #15*, KTHS* #NU23, *IBA* #NU068) is located on the southeastern tip of Bylot Island near the community of Pond Inlet (70 km to the southwest). It is characterized by steep coastal cliffs and rocky shores and has large colonies of Thick-billed Murres (30,000 pairs) and Black-legged Kittiwakes (3,000 pairs; Gaston and Hipfner 2000, Important Bird Areas Canada 2010). Northern Fulmars, Black Guillemots and Dovekies are also numerous in this area. Ivory Gull has been known to use the floe

edge here during migration and in October 1979, 375 Ivory Gulls were seen near here (Renaud and McLaren 1982).

Lancaster Sound Polynya (*KMHS* #10*, IBA* #NU058). Polynyas (discussed further in Section 3.4.3) are recurrent sources of open water within the frozen sea ice and are essential resting and feeding areas for migrating and breeding marine birds. The Lancaster Sound polynya at the entrance of Lancaster Sound, between Bylot Island and Devon Island is thought to support between 1.5 – 3 million Dovekies each year in May on their spring migration to Greenland (Johnson et al. 1976, Brown and Nettleship 1981, Renaud et al. 1982).

Foxe Basin Islands (*KMHS* #22*, KTHS* #NU031, *IBA* #NU011) are located in east-central Foxe Basin and consist of Prince Charles Island, Air Force Island, and Foley Island. Over 40 bird species have been observed on these islands, and 26 of these species are known to breed here (Important Bird Areas Canada 2010). This site supports globally and nationally significant populations of at least 11 bird species including Brant, lesser Snow Geese, Cackling geese, Sabine's gulls (50% of the Canadian population), and the *Threatened* Ross's Gull. The Sabine's Gull population is estimated to be over 40,000 birds and is considered the largest concentration of this species in the world (Important Bird Areas Canada 2010).

Prince Charles Island and Air Force Island are also considered major breeding sites for many species of shorebirds and together contain an estimated 272,500 breeding pairs and 626,000 individuals, including the largest known concentration of red phalaropes (approximately 120,000 pairs; Johnston and Pepper 2009). Other species common to these islands include Common and King eiders, Long-tailed Ducks, and Herring Gulls. The islands are also important stop-over sites for many species migrating further north. Johnston and Pepper (2009) recommended that Prince Charles Island and Air Force Island be protected under the *Canada Wildlife Act* (1973) regulations for National Wildlife Areas.

North Spencer Island (*KTHS* #NU32) is located in northern Foxe Basin approximately halfway between Prince Charles Island and Melville Peninsula. A large Brant goose colony is located on the island and many other birds have been observed on the island including large numbers of Sabine's Gulls, Arctic Terns, Long-tailed Ducks, and Pacific Loons.

The Great Plain of the Koukdjuak (*KTHS* #NU30, *IBA* #NU078) is a 15 km long tidal zone located on the south-eastern shore of Foxe Basin on Baffin Island. The lush low-lying coastal tundra at this site supports the largest goose colony in the world, numbering over two million geese, 75% of which are lesser Snow Geese. This is approximately 33% of all snow geese in the world (Important Bird Areas Canada 2010). Over 100,000 Cackling geese are also found here, representing about 35% of the world's population. Large numbers of Brant, Long-tailed Ducks, Common and King Eiders also inhabit this site, and more than 1,500 Sabine's Gulls nest here. Many species and abundant numbers of shorebirds are also found here. Protected areas at this site include the Dewey Soper Migratory Bird Sanctuary and the Bowman Bay Wildlife Sanctuary (Important Bird Areas Canada 2010).

Turton Island (*KTHS* #NU33, *IBA* #NU021) is a small, flat island located on the southwestern shores of Foxe Basin, just off the southeast coast of Melville Peninsula. The island's lush tundra is home to a large

eastern Arctic's largest Common Eider colony (~4,000 individuals). Other bird species that nest here include Tundra Swans, Canada geese, Brant, Black Guillemots, Herring Gulls, and Arctic Terns.

East Bay/Native Bay (*KMHS* #24*, KTHS* #NU44, *IBA* #NU023) is a 50 km long inlet in southern Foxe Basin on the southeast coast of Southampton Island. Forty-one species of birds have been recorded in this area and Mitvik Island is home to the largest Common Eider colony in Arctic Canada, varying between 7,000 – 12,000 individuals (Abraham and Ankney 1986, Mallory and Fontaine 2004). In 1997, 157,000 lesser snow geese and 40,000 Brant were recorded nesting in the lowland tundra areas here. The area also has some of the highest breeding densities of shorebirds in the High Arctic, including red phalaropes that have been recorded at densities of 30 birds/km^2. Protected areas in this location include the East Bay Migratory Bird Sanctuary, and the community of Coal Harbour lies a few kilometers to the west.

Digges Sound (*KMHS* #27*, KTHS* #NU47, *IBA* #NU001) is located in the southwestern portion of Hudson Strait, at the northern opening to Hudson Bay, 17 km north of the community of Ivujivik. The Sound is lined with over 12 km of granite cliffs and has one of the largest concentrations of Thick-billed Murres in Canada (~300,000 pairs or 20% of the Canadian population; Gaston et al. 1985, Gaston and Hipfner 2000). There are also small-moderate sized breeding populations of Black Guillemots, Glaucous Gulls, Iceland Gulls, Herring Gulls, Arctic Terns, and Atlantic Puffins here. The Government of Quebec has proposed turning the mainland portion of this site into a provincial park (Mallory and Fontaine 2004).

Fraser Island (*KTHS* #NU46, *IBA* #NU024) is a small island located at the west end of Hudson Strait at the juncture with Foxe Basin. Up to 3,000 pairs of Common Eiders nest on the island.

Markham Bay (*KMHS* #25*, KTHS* #NU48, *IBA* #NU101) is a complex of islands and coastline located on the southern-most coast of Baffin Island, in northern Hudson Strait. Surveys in 1997 and 1998 recorded 44,500 Common Eiders and 8,000 nests (Gilchrist et al. 1998, 1999). The site also supports large numbers of Iceland Gulls and Black Guillemots.

Hantzsch Island (*KTHS* #NU49, *IBA* #NU025) is a small island located off the southern-most tip of Baffin Island, in the mouth of Frobisher Bay. Although it is only 1 km in diameter it is important habitat for more than 15 species of birds. In 1982, a colony of 50,000 pairs of Thick-billed Murres was observed here. Also breeding on the Island are 5,000 pairs of Black-legged Kittiwakes, Glaucous Gulls, and possibly Northern Fulmars and Black Guillemots.

Button Islands (*KMHS* #29) are a series of small islands in the eastern entrance of Hudson Strait, 10 km north of Torngat Peninsula, northern Labrador. Thousands of seabirds forage in the vicinity of these islands including Northern Fulmars, Black-legged Kittiwakes, Thick-billed Murres, and Ivory Gull (Mallory and Fontaine 2004).

Akpatok Island (*KMHS* #30*, KTHS* #NU50, *IBA* #NU007) is located in northwestern Ungava Bay, 70 km north of Quebec. The largest colony of thick-billed murres in Canada is found here (600,000 pairs or 40% of the Canadian population; Gaston and Hipfner 2000). These murres are found in two colonies that

cover nearly 30 km of coastline. Other species that nest on these steep cliffs include Black Guillemots, Glaucous Gulls, Peregrine Falcons, and Gyrfalcons.

The Ungava Bay Archipelagos (*KMHS* #31*, KTHS* #NU51, *IBA* #NU027, NU028, and NU029) is a group of more than 850 Nunavut islands in Ungava Bay and includes coastal areas along Ungava Bay, Quebec. This complex of Important Bird Areas collectively provides nesting habitat to approximately 6% (~17,900 pairs) of Canada's Common Eider population (Mallory and Fontaine 2004).

3.4.3 Polynyas and Shore Leads

Polynyas and shore leads are recurrent areas of open water in the frozen sea ice that are biologically productive, supporting a rich and abundant marine life of plankton, algae, and fish, even in the winter (Stirling 1997). They are caused by a variety of factors including tides, local currents and upwellings. Large numbers of overwintering birds rely on these predictable pockets of open water as foraging grounds and they are even known to influence migration pathways by providing valuable migratory stop-over sites where birds can rest and replenish energy supplies (Stirling 1997). These rich accessible feeding grounds are also essential to Arctic breeding colonies in the spring when most of the ocean is still frozen, and extensive reproductive failures have occurred at colonies when polynyas and shore leads have failed to form or have appeared late in the season (Robertson and Gilchrist 1998, Brown and Nettleship, 1981). In fact, there is no major seabird colony in the eastern Canadian Arctic that is not adjacent to a reliable polynya (Brown and Nettleship, 1981).

According to the literature, there are no known polynyas or recurring shore leads in Milne or Steensby Inlet, nor in Eclipse Sound. The Lancaster Sound Polynya (Canadian *Important Bird Area* #NU058, discussed above) is a large recurring polynya at the entrance of Lancaster Sound, north of Bylot Island (outside of the RSA; see Figure 2 in Mallory and Fontaine 2004), and is thought to support up to 3 million dovekies each year in May on their spring migration to Greenland (Johnson et al. 1976, Brown and Nettleship 1981, Renaud et al. 1982). There is another polynya at the entrance to Pond Inlet and in the spring and early summer there are also recurrent shore leads at the entrances to Pond Inlet and Navy Board Inlet.

Four reliable polynyas exist in Foxe Basin (two along Melville Peninsula, one north of Prince Charles Island, and one north of Foxe Peninsula) along with lengthy floe edges along both the east and west coasts of the Basin. Hudson Strait is also known to have recurring floe edges along its northern shoreline and a large polynya occurs regularly in nearby Frobisher Bay (Mallory and Fontaine 2004).

LEGEND

- Mary River Project
- Key Marine Habitat Site
- Key Terrestrial Habitat Site
- Important Bird Areas
- Migratory Bird Sanctuary
- National Wildlife Area
- National Park
- Marine Local Study Area
- Marine Regional Study Area
- Terrestrial Bird Regional Study Area

NOTES

The following shapefiles are provided courtesy of Canadian Wildlife Service (CWS): Key Terrestrial Sites, Key Marine Areas, National Wildlife Areas and Migratory Bird Sanctuaries.

Important Bird Areas (IBA) data were provided by Bird Studies Canada (November 2011).

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 25 50 100 150 200 Km

Baffinland Iron Mines Corporation

Mary River Project
Conservation Areas, Important Bird Areas (IBAs) & Key Habitat Sites

EDI

Date: 12/14/2011

FIGURE 4

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig4_KeyHabSites_IBAs.mxd

4 FIELD STUDY RESULTS: 2006–2008, 2011

4.1 TERRESTRIAL BIRD SURVEY RESULTS

Terrestrial bird surveys and incidental observations in the Mary River Terrestrial Regional Study Area (RSA) between 2006 and 2008 recorded 29 species plus unconfirmed species of ptarmigan, phalarope and jaeger (Table 13), of which, 19 species were confirmed to breed in the RSA. Two of the bird species detected are considered Species at Risk at the territorial and/or federal level (Table 12): both Peregrine Falcon and Short-eared Owl are listed as species of Special Concern under COSEWIC (2011) and SARA (Environment Canada, SARA 2011). Short-eared Owl is also considered a Sensitive species within Nunavut (CESCC 2011). Both species are discussed in greater detail below.

Table 13. Bird species observed within the Mary River Project Terrestrial Regional Study Area, 2006 – 2008.

Species	2006	2007	2008
Snow Goose	B	B	B
Brant	S	-	-
Canada Goose	B	B	B
Tundra Swan	-	-	B
King Eider	B	B	B
Common Eider	S	S	S
Long-tailed Duck	B	B	B
Red-breasted Merganser	B	B	B
Unspecified Ptarmigan	-	-	S
Red-throated Loon	B	B	B
Pacific Loon	B	B	B
Common Loon	B	B	B
Yellow-billed Loon	B	B	B
Northern Fulmar	S	-	-
Rough-legged Hawk	B	B	B
Gyrfalcon	B	B	B
Peregrine Falcon	B	B	B
Sandhill Crane	B	B	B
American Golden-Plover	S	S	S
Common Ringed Plover	S	-	-
Baird's Sandpiper	S	S	S
Unspecified Phalarope	-	-	S
Glaucous Gull	-	B	B

Species	2006	2007	2008
Arctic Tern	-	S	S
Unspecified Jaeger	-	-	B
Snowy Owl	B	B	B
Short-eared Owl	-	-	S
Common Raven	S	S	B
Horned Lark	S	S	S
American Pipit	S	S	S
Lapland Longspur	S	S	S
Snow Bunting	S	S	S

4.1.1 Waterfowl and Related Species

Within the RSA, there are abundant wetlands, streams, rivers, and waterbodies of various sizes, ranging from small shallow ponds up to large deep lakes. These habitats are utilized by a variety of waterbirds including loons, ducks, and geese during both breeding, and spring and fall migration. The timing of these activities varied somewhat over the survey period, mostly relating to the timing of the spring thaw. Snow melt was earliest in 2008, which was approximately one week earlier than in 2006 and two to three weeks earlier than in 2007 (although the early snow melt in 2008 did not translate into an early loss of ice on the local waterbodies). In general, the bulk of spring migration occurred between late May and early June (although some species arrived prior to this), and fall migration began in late August and continued on through October although this varied by species and year.

Thousands of Snow Geese, as well as lesser numbers of Canada Geese and Brant Geese were observed migrating through the terrestrial RSA. Most of these birds are believed to be travelling to and from nesting grounds on Bylot Island. During the 2006–2008 field surveys, several thousand Snow Geese moved through the area in late-May to mid-June, some stopping to rest and to forage before continuing their spring migrations northwards. From mid-July to late August, thousands of geese returned to the area to rest, forage, and to moult their feathers before continuing their fall migration south. The majority of the moulting observations made during the Mary River baseline surveys were located in the southwest section of the RSA, south of the Mary River mine site and west of the proposed rail alignment (Figure 5). This area encloses several large lakes, including Angajurjualuk, Inuktorfik, Quartz, Nina Bang, and Erichson Lakes, as well as numerous small lakes and rivers. The topography of the area is flat to rolling, rising gradually from sea level at Steensby Inlet to 100 to 300 m asl.

In comparison to the thousands of geese observed migrating through and moulting here, a relatively small number of Snow Geese appear to nest within the bulk of the RSA (although a large colony of breeding Snow Geese was observed in the southern-most sections of the terrestrial RSA along the southwest shore of Steensby Inlet — see section 4.2). A total of 268 nests were located during terrestrial surveys (Figure 6); the

observed Snow Goose nests were located throughout the terrestrial RSA, but were most concentrated in lowland areas, in well-vegetated areas, often around small to mid-sized waterbodies and/or wetlands. Most of the Snow Goose nests were located on the ground, but a few cliff nests were also found. Canada Geese and Tundra Swan were also found to nest within the terrestrial study area, but were less abundant than the Snow Geese. A total of 42 Canada Goose nests were located during the survey period and only one Tundra Swan nest was found.

Breeding loons were common in the RSA, with at least one pair present on most lakes. Four species of loon were observed during the 2006–2008 field surveys including Red-throated Loon, Pacific Loon, Yellow-billed Loon, and Common Loon (in order of decreasing abundance). A total of 41 Red-throated Loon nests were located over the three survey years (compared to 6 Common Loon, 6 Yellow-billed Loon and 10 Pacific Loon). These were scattered throughout the RSA, but were nearly always associated with lake or pond habitats, where the nests were typically found along or in close proximity to the shoreline and were often found on islands.

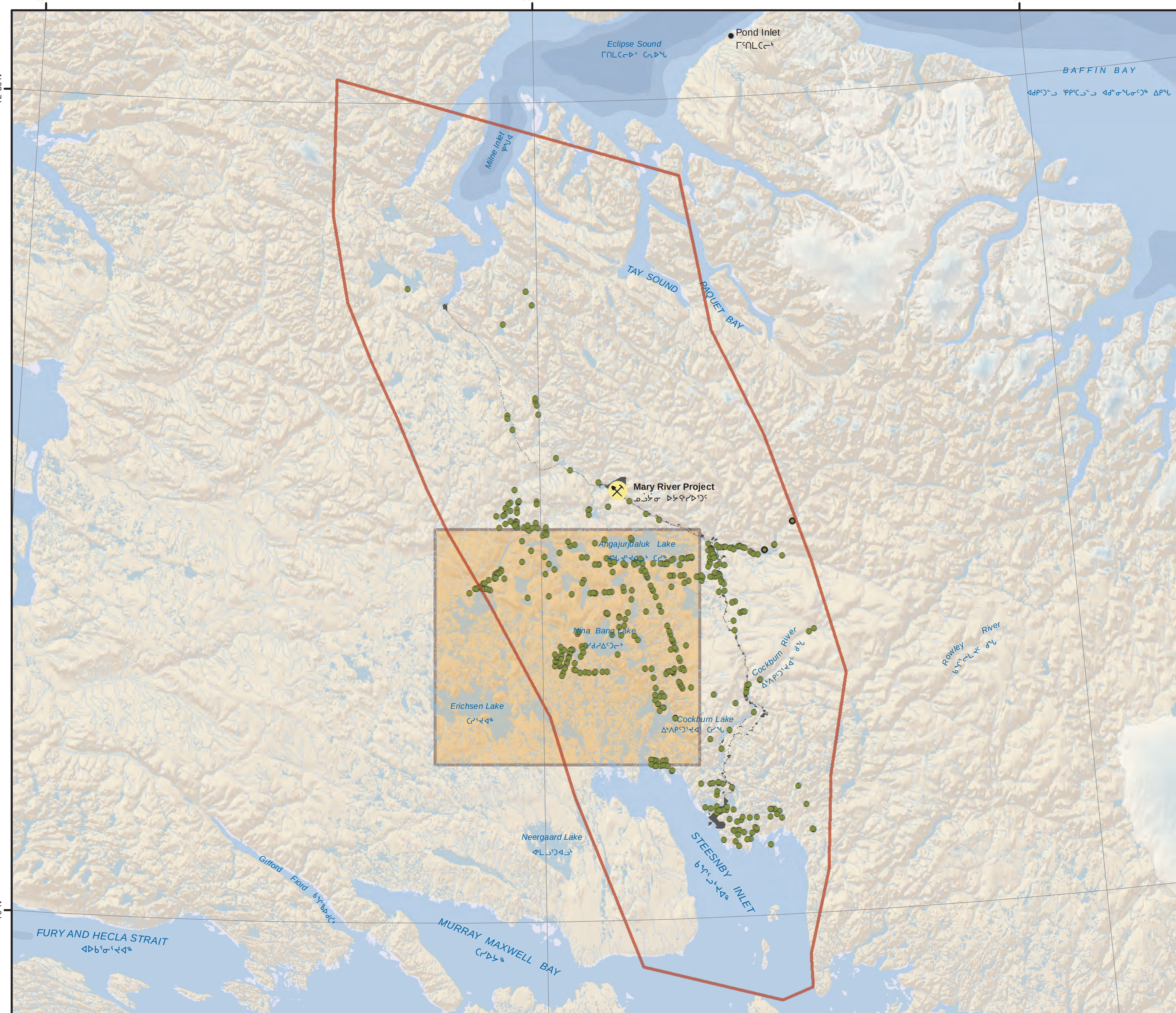
Eiders were observed occasionally within the Mary River terrestrial RSA, although the majority of the eiders sighted were King Eider. This is not surprising, however, given that Common Eider are usually closely tied to marine habitats and tend to nest on coastal islands or islets (Goudie et al 2000), while King Eiders typically nest inland from the arctic coastline, often along freshwater lakes and ponds (Suydam 2000). A total of four King Eider nests were located over the three year study period (1 in 2007, and 3 in 2008). Of these, three were located near Angajurjualuk Lake, while the forth was located in an area of abundant ponds and small lakes approximately 8 km north of the western end of Steensby Inlet (Figure 6). No Common Eider nests were located during the 2006–2008 field studies; however, three Common Eider nests were reported in the study area by other researchers in 2011. The three reported Common Eider nests are all located along the coastline on the north side of Steensby Inlet — two near the proposed port site, and one in a bay to the east (Figure 6, Alexander Anctil, pers. comm. to EDI, 2011).

Other waterfowl observed in the terrestrial RSA included Long-tailed Ducks which were commonly observed within the RSA and Red-breasted Mergansers which were observed along rivers. Both species were considered local breeders, although no Red-breasted Merganser nests were located during field studies. Red-breasted Mergansers were however, observed in the study area with young in both 2007 and 2008 (less than a dozen each year). Four Long-tailed Duck nests were documented during the study period, all in the interior of the RSA and adjacent to smaller water bodies such as ponds, small lakes, and rivers.

Glaucous Gulls, Arctic Terns and an unspecified Jaeger species were all documented within the Mary River terrestrial RSA. Glaucous Gulls were observed regularly during field surveys, and a minimum of 130 nest sites were located within the terrestrial RSA during the study period. These nest sites were located along both coastlines (Milne Inlet and Steensby Inlet) and along interior waterbodies throughout the RSA. In contrast, Arctic Terns and jaegers were observed only infrequently during the terrestrial surveys. No Arctic Terns nests were located in the study area, and only two jaeger nests were documented. The jaeger nests were both recorded in 2008 and were both located near Angajurjualuk Lake. Surveyors were unable to confirm species identification at either of the nests, although the location of the nests at a large inland lake

suggests that they may have been Parasitic Jaegars (see Wiley and Lee 1998, 1999, 2000). In addition to the above species, numerous observations of unidentified gull species were recorded during the terrestrial field studies. These may all have been Glaucous Gulls; however, the marine field surveys (see Section 4.2) documented 10 different gull species within the marine RSA and it is likely that some of these species are found at least occasionally within the terrestrial RSA.

Sandhill Cranes were observed both migrating through and breeding in the terrestrial RSA but were most common south of the Mary River Mine Site, particularly between Mary River and Angajurjualuk Lake and between Cockburn Lake and Steensby Inlet. Eleven (11) nests were located incidentally during the 2006–2008 survey period and all of these occurred south of the Mary River Mine.



LEGEND

- Mary River Project
- Snow Goose Moulting Observation
- Proposed Management Area (Environment Canada)
- Terrestrial Regional Study Area
- Potential Disturbance Area

NOTES

The proposed Special Management Area was digitized by EDI using study area description by Canadian Wildlife Service (CWS), Reed et al 1993.

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 5 10 20 30 40 50 Km

Baffinland Iron Mines Corporation

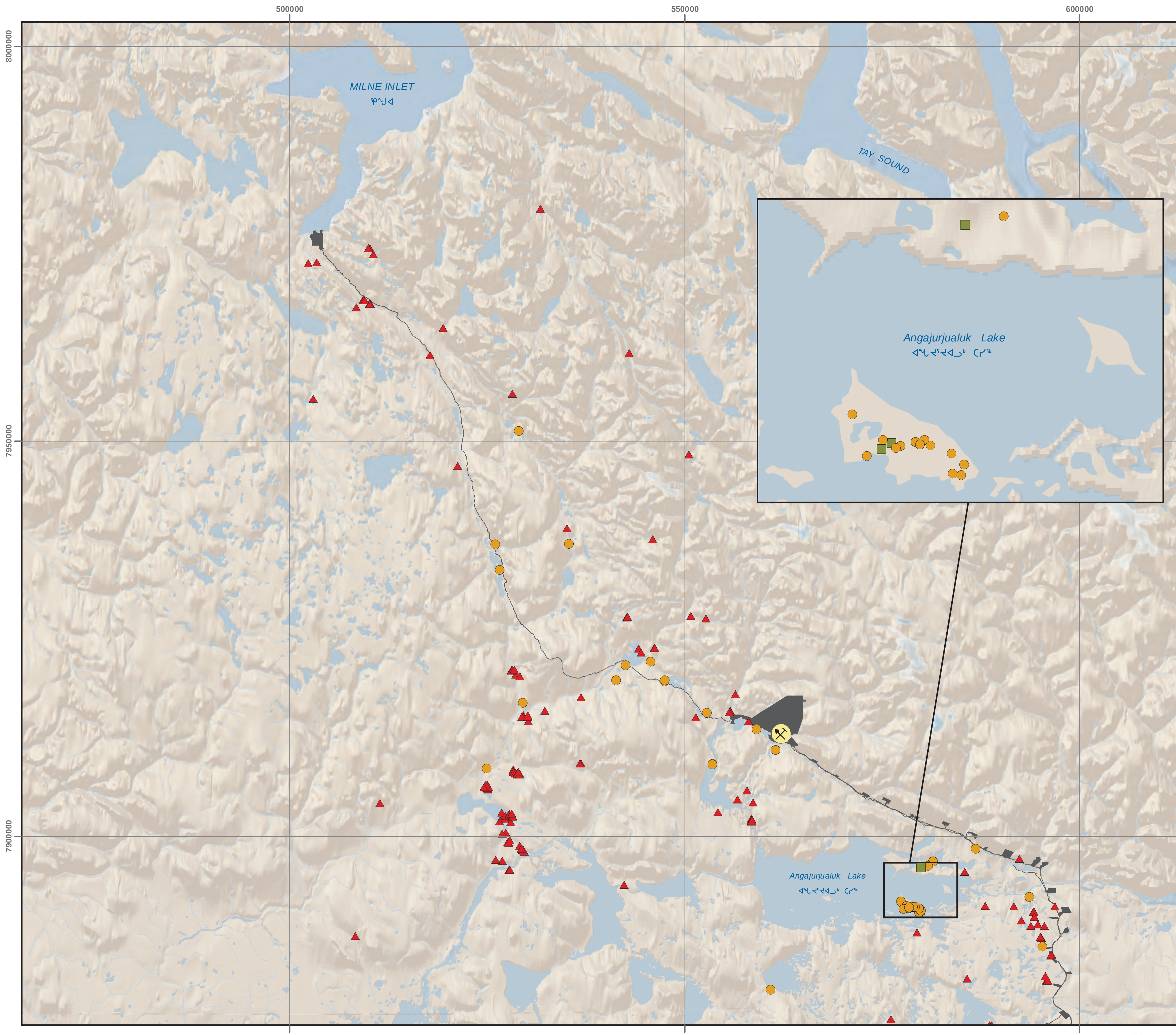
Mary River Project:
Snow Goose Moulting Observations

EDI

Date: 12/14/2011

FIGURE 5

Path: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig5_SNGO_MoultingObs.mxd



LEGEND

- Mary River Project
- Potential Disturbance Area
- King Eider Nest Site
- Red-throated Loon Nest Site
- Snow Goose Nest Site

NOTES

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2.5 5 10 15 20 25 Km

Baffinland Iron Mines Corporation

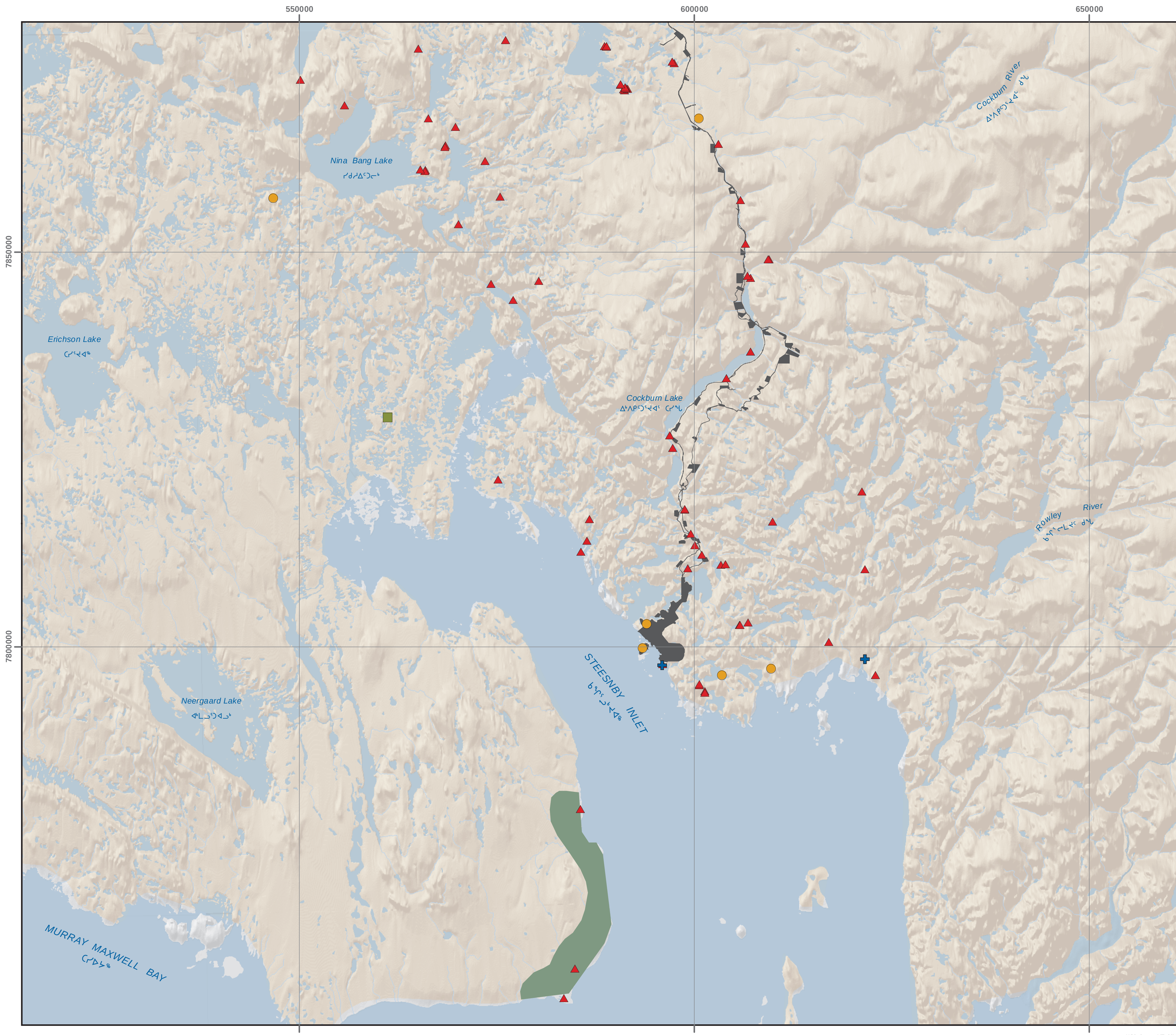
Mary River Project - North Region: Red-throated Loon, Eider and Snow Goose Nest Locations 2006-2008.

EDI

Date: 12/14/2011

FIGURE 6

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig6_North_RTLO_KIEI_SNGO_Nest.mxd



LEGEND

- Mary River Project
- Potential Disturbance Area
- King Eider Nest Site
- Red-throated Loon Nest Site
- Snow Goose Nest Site
- Common Eider Nest Site
- Snow Goose Nesting Colony (estimated extent)

NOTES

Nest site data for Common Eider obtained November 22, 2011 via email from Alexandre Anctil (Sherbrooke University).

Snow Goose colony (estimated extent) was based on a total of three points representing thousand of individual birds found along a section of coastline; the polygon is a representative estimate only.

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2.5 5 10 15 20 25 Km

Baffinland Iron Mines Corporation

Mary River Project - South Region: Red-throated Loon, Eider and Snow Goose Nest Locations 2006-2008.

EDI

Date: 12/14/2011

FIGURE 7

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig7_South_RTLO_KIEI_SNGO_Nest.mxd

4.1.2 Raptors

Five species of raptors were observed in the terrestrial RSA during field surveys, including cliff-nesting Peregrine Falcons, Rough-legged Hawks, Gyrfalcons, ground-nesting Snowy Owls, and ground-nesting Short-eared Owls. Cliff-nesting raptors are known to be limited primarily by the availability of suitable nesting ledges and by the availability of adequate nearby foraging habitat (Newton 1979). The RSA has an abundance of seemingly suitable cliff-nesting habitat with productive tundra foraging habitat nearby, particularly in the eastern and southern areas. In 2011, nests located around the Steensby Inlet area were monitored more frequently by Alastair Franke's independent research project, and Peregrine Falcons, Gyrfalcons, Snowy Owls, and Rough-legged Hawks all experienced reproductive success.

Cliff-nesting raptors — Surveys from 2006–2008 found all cliff-nesting raptor species breeding successfully within the RSA. Across all years, Peregrine Falcon and Rough-legged Hawk were the most commonly observed cliff-nesting raptors. Gyrfalcon were less common; however, cliff surveys were primarily conducted later in the summer, when Gyrfalcons may have already abandoned nesting sites (Photo 1). A total of 43 occupied territories of raptors were observed during surveys in 2006, 26 in 2007, 113 in 2008, and 139 in 2011 (Table 14; Figure 8). Increased numbers of active raptor sites were likely a result of survey intensity, cumulative nest site knowledge, and increased familiarity with the study area.

Photo 1. Two white morph Gyrfalcon chicks at nest site no. 284, located on August 8, 2011 (photo credit: Alastair Franke).

Table 14. Number and status[1] of cliff-nesting raptor nests located during field surveys, Mary River RSA, 2006 to 2011.

Species	Year	Total Occupied	OE	OY	OT	V
Gyrfalcon	2006	4	1		3	
	2007	3			3	
	2008	5	2		3	
	2011	6		6		
Peregrine Falcon	2006	34	4	8	22	
	2007	16	2	1	13	
	2008	47	15	1	31	
	2011	64	6	52	6	
Rough-legged Hawk	2006	5	1	1	3	
	2007	7	2	1	4	
	2008	61	34		27	
	2011	69	4	62	3	
Inactive Nests	2006					21
	2007					
	2008					1
	2011					34

1 OE = occupied with eggs; OY = occupied with young; OT = occupied, nest not seen, unknown if productive; V = vacant (unoccupied) site, but nest ledge observed.

Although a formal productivity survey was not conducted within the RSA, clutch and brood size was recorded at every active nest located and is summarized for cliff-nesting raptors in Table 15. The number of known productive sites for Gyrfalcon appeared low, but due to early spring phenology, nestlings may have already fledged by the time the surveys were conducted (early August).

Table 15. Nesting of cliff-nesting raptors within the Mary River RSA, 2006–2011.

Species	Year	No. occupied Sites	No. known productive sites	Mean clutch size (n)	Mean brood size (n)	Productivity
Gyrfalcon	*2006*	4	1	4 (1)	-	-
	2007	3	0	-	-	-
	2008	5	2	4 (2)	-	-
	2011	6	6	-	2.17 (6)	2.17
Peregrine Falcon	*2006*	34	12	3.25 (4)	2.33 (8)	0.82
	2007	16	3	2 (1)	2 (1)	0.38
	2008	47	7	2.73 (6)	2 (1)	0.30
	2011	64	57	3.5 (6)	3.25 (51)	2.89
Rough-legged Hawk	*2006*	5	2	2 (1)	1 (1)	0.40
	2007	7	3	2 (2)	2 (1)	0.86
	2008	61	34	2.97 (34)	-	-
	2011	69	66	3.89 (6)	3.96 (62)	3.79

Snowy Owl – A few Snowy Owls observations were made within the RSA in 2006 (27) and in 2007 (nine), but no nests were recorded in either year. In 2008, Snowy Owls were observed in great abundance with over 400 observations and 64 nests, suggesting a large increase in the abundance of prey availability, particularly lemmings. The nests found in 2008 were primarily distributed south of the Mine site and almost exclusively west of the Railway. Gilles Gauthier from the University of Laval, leads the Bylot Island ecological studies, and visited the Mary River site briefly in 2008 to track four female Snowy Owls that were tagged with radio transmitters in 2007 on Bylot Island. Dr. Gauthier located these female owls and their respective nest sites. He then set lemming traps in the vicinity and reported a very high density of lemmings in the Mary River area, indicating that high lemming populations facilitated an increase in the Snowy Owl population in 2008 (Gauthier, pers. comm. with M. Evans).

In 2011, most survey effort was spent on cliff-nesting species, but on-site researchers took advantage of a Snowy Owl irruption finding 19 owl nests (A. Franke, pers. comm., November 2011). Twenty five Snowy Owl nestlings were banded in early August and an adult male was captured and fitted with a GPS transmitter on August 5th. According to the GPS data, the owl had moved northeast of the deposit but was still on Baffin Island in late October.

Short-eared Owl – Three Short-eared Owls were seen in both 2007 and 2008 (none were seen in 2006) but no nests were found. These Owls are not typically found as far north as the Mary River RSA, although a few individuals have also been observed just north of the RSA on Bylot Island. Currently, however, there have

been no confirmations of them breeding in the area (Lepage et al. 1998, Gilles Gauthier pers. comm. with M. Evans).

Common Raven – Common Raven were observed throughout all survey years, but active nests were only recorded in 2008 (seven nests with young) and 2011 (two nest sites). Most surveys were conducted too late in the summer to successfully locate active Common Raven nests due to their early breeding season (the 2008 surveys estimated that hatching dates ranged from May 20 – June 13).

4.1.3 Songbirds and Shorebirds

Seven species of songbirds and shorebirds were found during the point count and transect plot surveys within the Mary River RSA. The most commonly sighted species, in order of abundance, were Lapland Longspur, Horned Lark, Baird's Sandpiper, Snow Bunting and American Pipit (Table 16). American Golden Plover and Common Ringed Plover were observed infrequently. A total of 485 individual birds were observed in the 200 point count and transect plot surveys conducted. Outside of the point count and transect plot surveys, only one additional species of songbird or shorebird was observed — an unidentified phalarope species noted as an incidental sighting in 2008. No songbird or shorebird nests were found in the Mary River Project RSA during the 2006 to 2008 surveys.

General observations made by M. Evans during the field studies indicated that although densities of songbirds and shorebirds seemed relatively low, the RSA provided an abundant supply of suitable habitat for these species. He indicated that birds seemed most predominant in the various lowland habitats within the RSA (such as those found along river deltas, coastal plains, tundra and near wetlands) which offered an abundant source of insects and vegetation for foraging and nesting habitat. Bird densities appeared lower in and around upland areas.

Overall density of songbirds and shorebirds was calculated for six of the species observed within the RSA survey areas. Based on data collected in the point count and transect plot surveys, the average density of songbirds and shorebirds was 18 ± 75 birds/km^2 (mean ± S.D.; Table 17). Snow Bunting and Lapland Longspur occurred in the highest densities (28 ± 131 and 24 ± 72 birds/km^2, respectively), while American Golden Plover and American Pipit occurred in the lowest densities (4 ± 43 birds/km^{2}and 11 ± 35 birds/km^2, respectively).

Bird density (birds/km^2) was also calculated for each of the eight habitat classes identified during the 200 survey plots (Table 17). Tussock graminoid tundra contained the greatest density of birds/km^2 (36 ± 149), which were predominately Snow Bunting, Baird's Sandpiper and American Golden Plover (107 ± 291, 44 ± 155, and 40 ± 155, respectively). Sparsely vegetated till-colluvium and barren habitats contained the lowest density of birds (5 ± 15 and 10 ± 43, respectively). The single observation of Common Ringed Plover was made in moist to dry non-tussock graminoid/dwarf shrub tundra: 50–70% cover.

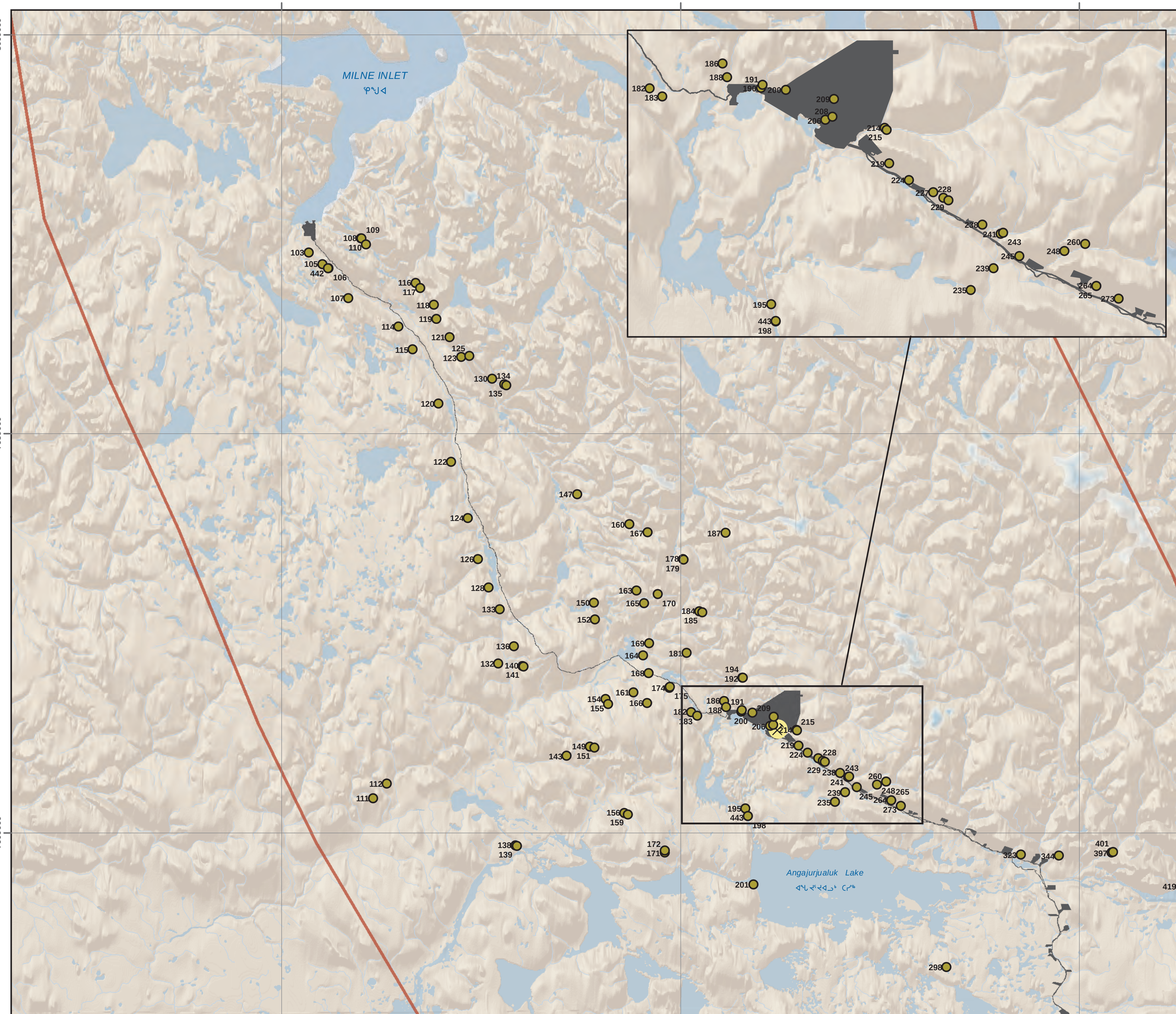
Density estimate calculations should be interpreted with caution as the survey methods were not initially designed to calculate density (e.g., various habitat units did not contain equal numbers of sample plots). The standard deviations presented for density are large, most likely due to the low sample size for plots and/or sampling error. Sample plot selection appeared to be random, with no systematic selection (**Error! Reference source not found.**). The raw data contained an uneven number of sample plots per habitat class. In addition, some sample plots overlapped (i.e., were less than 200 m apart) and were not included in analyses, further decreasing plot numbers.

Table 16. Total number of birds (most common summarized) observed during 100 m radius and 1 ha plot surveys (n = 200 plots).

Total number of birds observed, 2006–2008 Surveys						
American Golden Plover	Baird's Sandpiper	Horned Lark	American Pipit	Lapland Longspur	Snow Bunting	Total
11	90	111	56	129	87	485

Table 17. Density estimates (birds/km^2 ± S.D.) for songbirds and shorebirds located in Baffin Island, NU. Densities are presented for eight habitat classes identified within the region.

Habitat type	No. of Sample Plots	Estimated density of birds per km^2 ± S.D.						
		American Golden Plover	Baird's Sandpiper	Horned Lark	American Pipit	Lapland Longspur	Snow Bunting	Total
Wet Sedge - Graminoids and Bryoids	17	4 ± 15	21 ± 51	4 ± 15	7 ± 24	34 ± 73	4 ± 15	12 ± 40
Tussock Graminoid Tundra	15	40 ± 155	44 ± 155	2 ± 8	8 ± 19	13 ± 23	107 ± 291	36 ± 149
Moist to Dry Non-Tussock Graminoid/ Dwarf Shrub Tundra: 50-70% Cover	39	0	24 ± 42	21 ± 49	13 ± 40	33 ± 78	14 ± 30	18 ± 47
Prostrate Dwarf Shrub - Dryas/heath, usually on Bedrock	29	1 ± 6	4 ± 14	38 ± 100	16 ± 38	21 ± 58	12 ± 40	15 ± 54
Sparsely Vegetated Till-Colluvium	16	0	4 ± 11	6 ± 17	4 ± 16	4 ± 16	10 ± 19	5 ± 15
Sparsely Vegetated Bedrock	27	4 ± 19	11 ± 40	20 ± 78	6 ± 22	9 ± 33	24 ± 79	12 ± 51
Bare Soil with Cryptogram Crust - Frost Boils	37	1 ± 5	41 ± 78	29 ± 73	20 ± 55	42 ± 112	53 ± 225	31 ± 114
Barren	20	0	10 ± 31	21 ± 62	0	18 ± 71	11 ± 31	10 ± 43
Combined Total	**200**	**4 ± 43**	**21 ± 62**	**21 ± 65**	**11 ± 35**	**24 ± 72**	**28 ± 131**	**18 ± 75**



LEGEND

- Mary River Project
- Potential Disturbance Area
- Raptor Nest Location
- Terrestrial Regional Study Area

NOTES

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2.5 5 10 15 20 25 Km

Baffinland Iron Mines Corporation

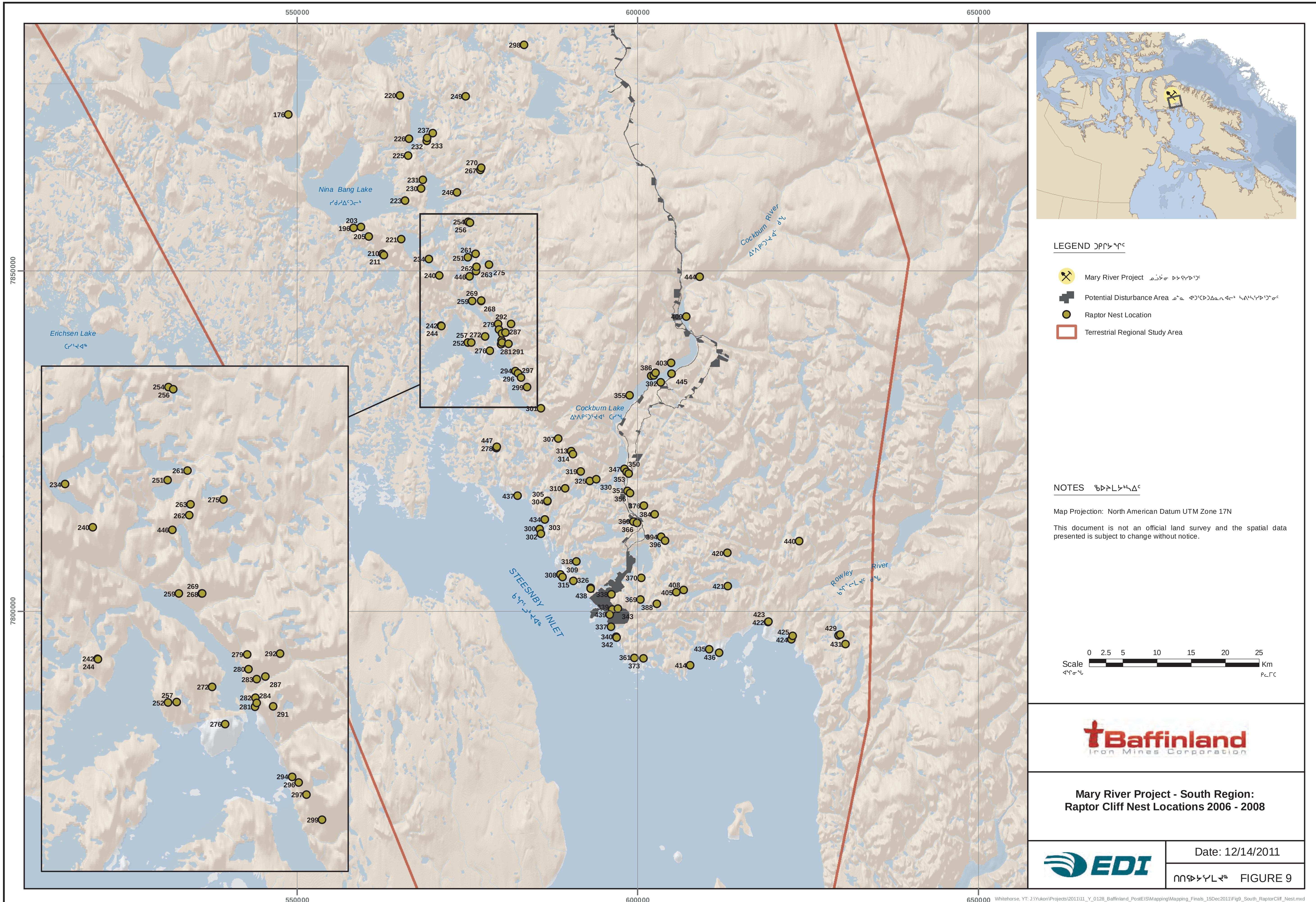
Mary River Project - North Region: Raptor Cliff Nest Locations 2006 - 2008

EDI

Date: 12/14/2011

FIGURE 8

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig8_North_RaptorCliff_Nest.mxd



550000
600000
650000
7850000
7800000
Nina Bang Lake
Erichsen Lake
Cockburn Lake
Cockburn River
STEESNBY INLET
Rowley River
LEGEND
Mary River Project
Potential Disturbance Area
Raptor Nest Location
Terrestrial Regional Study Area
NOTES
Map Projection: North American Datum UTM Zone 17N
This document is not an official land survey and the spatial data presented is subject to change without notice.
Scale
0 2.5 5 10 15 20 25
Km
Baffinland
Iron Mines Corporation
Mary River Project - South Region:
Raptor Cliff Nest Locations 2006 - 2008
EDI
Date: 12/14/2011
FIGURE 9
Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig9_South_RaptorCliff_Nest.mxd

4.2 MARINE BIRDS

The marine field surveys completed within the Mary River Marine RSA documented 45 species: 33 of these species were seabirds, waterfowl, gulls and associated marine species which were the focus of the marine studies, additionally 5 shorebird species were detected, and 7 terrestrial species (raptors, songbirds etc). Sixteen of the marine species detected were confirmed to breed within the survey area (Figure 2). Two species at risk were included in the species observed during marine studies: Ivory Gull, and Ross's Gull. Both of these species are listed in Schedule 1 of SARA (Environment Canada, SARA 2011), and are considered Endangered and Threatened respectively under COSEWIC (COSEWIC 2011). Further details on observations relating to these species are found below.

In addition to the species observed during the marine bird surveys, two additional species were reported to project biologists during the survey period from marine mammal surveys within the RSA: Red-necked Phalarope were observed in Steensby Inlet in 2007 and 2008, and on April 28, 2008, marine mammal surveys documented a group of three Harlequin Ducks in Hudson Strait. The Harlequin Duck is listed in Schedule 1 of SARA (Environment Canada, SARA 2011), and is considered a species of Special Concern under COSEWIC (COSEWIC 2011).

Table 18. Bird species observed within the Mary River Marine Regional Study Area by Area (North – Milne Inlet/Eclipse Sound, South – Steensby Inlet/Foxe Basin/Hudson Strait), 2006 – 2008

Species	2006		2007		2008	
	North[1]	South[1]	North[1]	South[1]	North[1]	South[1]
Greater White-fronted Goose						S
Snow Goose (Lesser + Greater)	S	S	B	B	B	B
Ross's Goose						B
Canada Goose		S	S	B		B
Brant			S	S	S	B
Tundra Swan			B		B	B
King Eider	B	S	S	S		S
Common Eider			S	S	S	S
Black Scoter						S
Long-tailed Duck	S	S	S	S	S	B
Red-breasted Merganser		S		S	S	S
Red-throated Loon	S	S		B		B
Pacific Loon		B	S	S	S	B
Common Loon					S	B
Yellow-billed Loon			B	B	S	B
Northern Fulmar	S		S		S	S

Species	2006		2007		2008	
	North[1]	South[1]	North[1]	South[1]	North[1]	South[1]
Rough Legged Hawk	S			S		B
Gyrfalcon			S		S	S
Peregrine Falcon			S			S
Sandhill Crane		S	B		B	B
Black-bellied Plover					S	S
Ruddy Turnstone						S
Purple Sandpiper						S
White-rumped Sandpiper						S
Red Phalarope						S
Ross's Gull						S
Herring Gull						B
Glaucous Gull			S	B	B	B
Iceland Gull					S	S
Thayer's Gull			S	S	S	S
Lesser Black-backed Gull						S
Great Black-backed Gull			S		S	S
Black-legged Kittiwake			S		S	S
Sabine's Gull					S	B
Ivory Gull			S		S	S
Arctic Tern			S	S	S	S
Pomarine Jaeger						S
Parasitic Jaeger					S	S
Long-tailed Jaeger						S
Dovekie			S		S	S
Thick-billed Murre			B		B	B
Black Guillemot			S		S	B
Snowy Owl					S	S
Common Raven	S	S	S			S
Snow Bunting						S

Marine Bird Distribution and Density

Based on the results of the fixed-wing surveys, as well as other bird observations made during marine mammal surveys, LGL completed a brief analysis of marine bird distributions and densities within each of the six main survey areas (Milne Inlet, Eclipse Sound, Steensby Inlet, West Foxe Basin, East Foxe Basin, and Hudson Strait).

Overall, Foxe Basin (West and East Foxe Basin combined) had the highest species diversity although this is not surprising considering that it is the largest of the six survey areas. Steensby Inlet had the second highest species diversity despite being the second smallest of the six areas. Milne Inlet (the smallest survey area) and Eclipse Sound had the lowest species diversity. Species diversity within each of the survey areas was as follows:

- Milne Inlet: 20 species were recorded, of these, 7 species (Brant, Common Eider, Glaucous Gull, King Eider, Long-tailed Duck, Pacific Loon and Snow Goose) were seen in all three of the survey years;
- Eclipse Sound: 20 species were recorded, of these, 6 species (Common Eider, Glaucous Gull, King Eider, Long-tailed Duck, Northern Fulmar and Snow Goose) were seen in all three years;
- Steensby Inlet: 26 species were recorded, 11 of which (Arctic Tern, Brant, Canada Goose, Common Eider, Glaucous Gull, King Eider, Long-tailed Duck, Pacific Loon, Red-breasted Merganser, Red-throated Loon, and Snow Goose) were seen in all three of the survey years;
- Foxe Basin was only surveyed in 2007 and 2008, but had a total of 28 different species (West Foxe Basin and East Foxe Basin combined);
    - West Foxe Basin alone, had 27 species, Brant, Common Eider, King Eider, and Snow Goose were all seen in both of the survey years;
    - East Foxe Basin alone, had 22 species, Brant, Common Eider, King Eider, and Snow Goose were all seen in both of the survey years; and
- Hudson Strait was only surveyed in 2008 and 21 species were recorded.

Ten of the 33 marine species recorded were seen in all six areas (Arctic Tern, Black Guillemot, Canada Goose, Common and King Eiders, Glaucous Gull, Iceland Gull, Long-tailed Duck, Snow Goose, and Thayer's Gull).

Marine bird densities were highest in Foxe Basin (largest survey area) and Steensby Inlet (second smallest survey area), and were lowest in Hudson Strait. The overall average density of marine birds (# of individuals per 100 km^2, for all species combined) for the Marine RSA was 43.7 individuals per 100 km^2 (0.43/km^2). The average densities in each of the six survey areas were:

- Milne Inlet: 30.5 birds/100 km^2
- Eclipse Sound: 17.2 birds/100 km^2
- Steensby Inlet: 47.3 birds/100 km^2
- Foxe Basin (West Foxe Basin and East Foxe Basin combined): 73.9 birds/100 km^2
    - West Foxe Basin alone: 26.7 birds/100 km^2
    - East Foxe Basin alone: 121.1 birds/100 km^2
- Hudson Strait: 19.5 birds/100 km^2

Seasonal densities were highest in the months of June and August due to large groups of snow geese migrating from Bylot Island just north of the RSA. Large groups of migrating common and king eiders and long-tailed ducks were also seen throughout the area in August.

The five most abundant species (highest average densities across all surveys and all three years) were, in descending order: Snow Geese, eiders (Common and King Eiders combined as they were often difficult to distinguish during fixed-wing surveys), Brant, Arctic Terns and Long-tailed Ducks. Most of these species used the marine coastal waters of Steensby Inlet as staging grounds during their spring and fall migrations and dozens of eiders used these coastal waters to raise their young. The terrestrial portion of the RSA has an abundant supply of tundra wetlands, streams, rivers, and waterbodies of various sizes, offering a large supply of seemingly suitable nesting habitat for all five of these species.

Seabirds

No large, conspicuous seabird nesting colonies were recorded in this study although several are known to exist along the edges of the RSA, particularly on Bylot Island, in Foxe Basin, and along Hudson Strait. However, the fixed-wing surveys conducted in this study did not cover the shoreline areas where these colonies are known to exist as these surveys were designed to survey marine mammals, and marine birds were only surveyed opportunistically. The surveys did record several seabird species including Dovekie, Thick-billed Murre, Black Guillemot, and Northern Fulmar. These species were observed throughout the Marine RSA, but were most common in the northern sections of the study area (Milne Inlet, and Eclipse Sound) and along Hudson Strait. Thick-billed Murre, a focal species for the baseline assessment, were observed numerous times during Marine bird surveys, particularly in Hudson Strait (over 2000 observations just in 2008), but also in Eclipse Sound and Navy Board Inlet in the north of the RSA, see Figure 10.

Waterfowl

Marine surveys located numerous species of geese, swans, loons, mergansers, eiders and sea ducks migrating through and breeding in the marine RSA. As previously discussed, Snow Geese, Common and King Eiders, Brant, and Long-tailed Ducks were some of the most abundant species detected during the marine bird surveys. Additional species observed included Greater White-fronted Goose, Ross's Goose, Canada Goose, Tundra Swan, Black Scoter, Red-breasted Merganser, Red-throated Loon, Pacific Loon, Common Loon, and Yellow-billed Loon. Greater White-fronted Goose and Black Scoter, were both only observed once in Foxe Basin and Hudson Strait respectively, Ross's Goose was detected several times, but only in Foxe Basin and Steensby Inlet, and the remaining species were found in generally low densities throughout the Marine RSA.

Each year tens of thousands of Snow Geese were seen using the RSA for spring and fall migratory stop-overs and it is believed that most of these birds were travelling to and from nesting grounds on Bylot Island. These stop-over locations were most heavily concentrated in the Steensby Inlet region, especially within the

marine waters and low-lying tundra areas adjacent to the Steensby coastline (inland to approximately 10 km). Additionally, the 2008 surveys located a nesting colony of more than 5000 individuals along the southwestern shore of Steensby Inlet, in the southwest corner of the terrestrial RSA. The colony is located over approximately 26 kilometers of shoreline; it is unknown how far the colony extends inland.

Brant were often seen migrating in large flocks through Steensby and Milne Inlets, and like the Snow Geese discussed above, were believed to be headed to and from nesting grounds on Bylot Island. However, the largest densities of Brant were also seen in East Foxe Basin where numerous large colonies have been reported by other studies.

Common and King Eiders were also seen in large migratory flocks in the coastal waters of the marine RSA during their spring and fall migrations, and dozens of females were seen raising broods in Steensby Inlet around the proposed port facilities

Long-tailed Ducks also migrated through the Project area in large numbers in all three years of the study and most inland freshwater lakes had at least one nesting pair. Their highest concentrations were found in West Foxe Basin and Steensby Inlet during their fall migration in August.

Gulls and Associated Species

Marine surveys documented ten species of gulls, plus three species of jaeger and Arctic Tern. Two of the gulls species (Ivory and Ross's Gull) are listed as Species of Concern and are discussed below. Of the remaining species:

- Arctic Terns were one of the most commonly observed species detected during the marine bird surveys and were consistently seen foraging right across the RSA in both the marine and terrestrial environments;
- Black-legged Kittiwake were regularly observed in the northern sections of the RSA, but were uncommon along the southern routes;
- Glaucous Gull were commonly observed throughout the RSA in both marine and terrestrial environments, and two breeding moderately-sized colonies (<100 individuals) of Glaucous Gulls were observed on the cliffs in Milne Inlet;
- Great Black-backed Gull were seen only a couple of times within the northern sections of the RSA (total of five observations);
- Herring Gull were seen in significant numbers in the southern portions of the RSA, but were not observed in the north;
- Iceland gulls were seen predominantly in the southern regions of the RSA, but were also observed in the northern sections;
- Lesser Black-backed Gull were observed only once in the southern sections of the RSA;

- Sabine's Gull were seen regularly, occasionally in large groups, in the southern sections of the RSA, but were rarely observed in the north;
- Thayer's Gull were observed throughout the RSA; and
- Jaegers were mostly observed within the southern sections of the RSA – all three species of Jaegers were documented during marine surveys, but Long-tailed and Parasitic Jaegers were the most common.

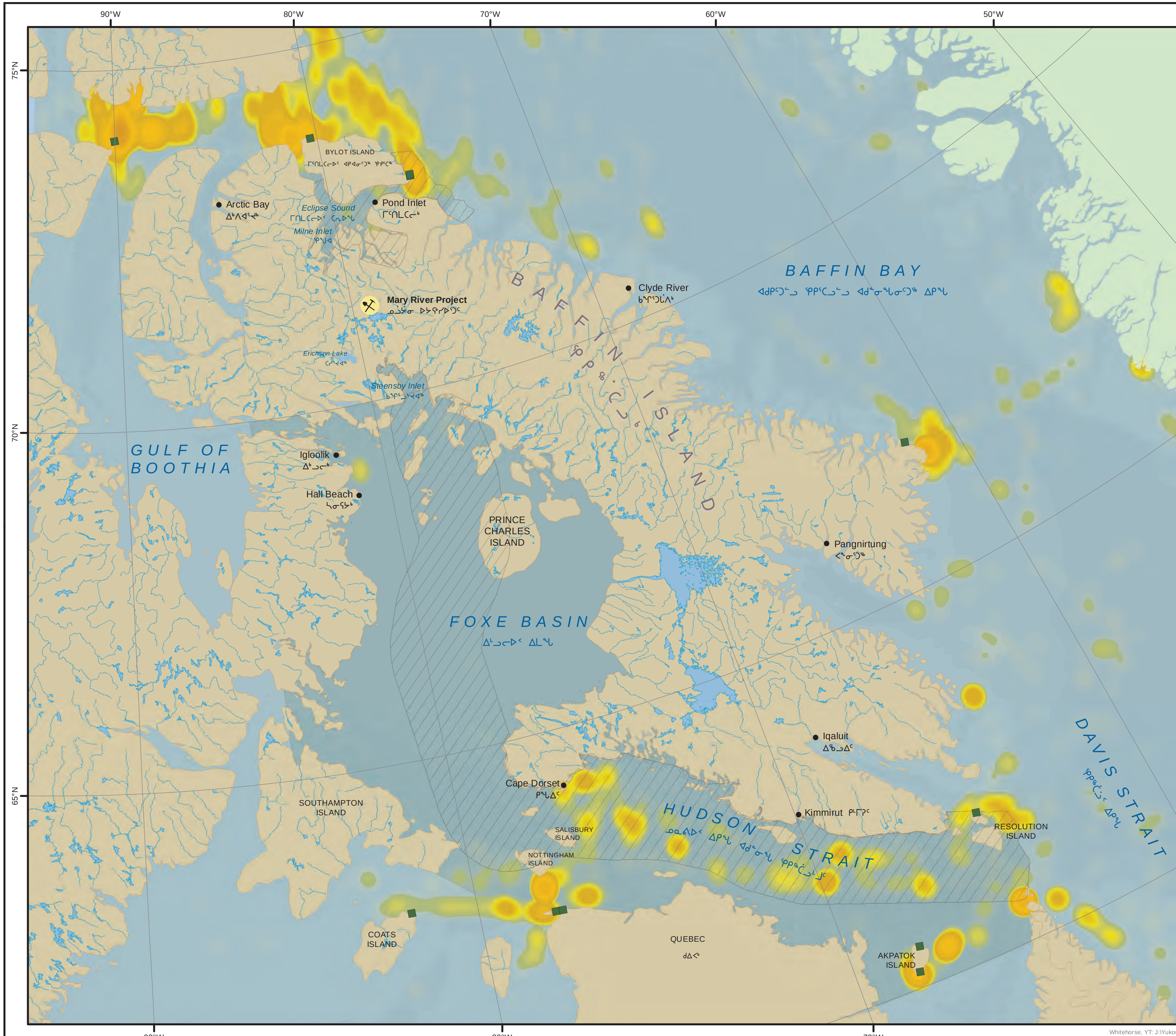
4.2.1 Species at Risk

As mentioned above, two Species at Risk (Ross's Gull and Ivory Gull) were detected during marine surveys, and a third (Harlequin Duck) was reported within the Marine RSA during the study period. Harlequin Duck was only seen once in Hudson Strait, the Ivory gull was seen in five of the six main study areas (not seen in Steensby Inlet), and Ross's gull was seen in the three contiguous survey areas along the southern shipping route (Steensby Inlet, West Foxe Basin, and East Foxe Basin). These three species were recorded in the following areas, on the following dates:

- Harlequin duck:
  - Three individuals were seen in Hudson Strait in April, 2008.
- Ivory gull:
  - One individual was seen in Milne Inlet in September, 2007;
  - One individual was seen in Hudson Strait in April, 2008;
  - Five individuals (2 adults, 3 juveniles) were seen in Milne Inlet in August, 2008;
  - One individual was seen in western Eclipse Sound in August, 2008;
  - Three individuals were seen in West Foxe Basin in October, 2008 (one north of North Spicer Island, and one north of South Spicer Island);
  - One individual was seen in East Foxe Basin in October, 2008 (between South Spicer Island and Prince Charles Island); and
  - One individual was seen in Hudson Strait in October 2008.
- Ross's gull:
  - One individual was seen in Steensby Inlet in August, 2008;
  - Seventeen individuals were seen in a group in West Foxe Basin in September, 2008 (along the west coast of Rowley Island); and
  - A minimum of twenty-six individuals were seen in West Foxe Basis in October, 2008 (on October 16 - a group of 3 was seen between North Spicer Island and the Melville Peninsula, and a single individual was seen on the west coast of Rowley Island; on October 18 – 22 Ivory Gulls (a group of 12, a group of 8 and a group of 2) were seen north of North Spicer Island, and 4

individuals were seen between Igloolik and Jens Munk Island, and between Jens Munk Island and Rowley Island).

See Figure 11 for a map of the Species at Risk observations.



LEGEND ᑐᑭᓯᒋᐊᕐᑦ

Mary River Project

Thick-billed Murre Colony Location

Marine Local Study Areas

Marine Regional Study Areas

Thick-billed Murre Density

High Density

Low Density

NOTES ᖃᐅᔨᒪᔾᔪᑎᑦ

Thick-billed Murre Density Analysis produced by EDI using project survey data and observations (vessel-based surveys at sea) data provided by PIROP - Northwest Atlantic 1965 - 1992. Data obtained online: OBIS-SEAMAP http://seamap.env.duke.edu/datasets)

Thick-billed Murre colonies obtained by report review of Mallory M.L. and A.J. Fontaine, 2004, Key Marine Habitat Sites for Migratory Birds in Nunavut and the Northwest Territories. Canadian Wildlife Service Occasional Paper Number 109. Environment Canada, Ottawa, Ontario.

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 25 50 100 150 200 Km

Baffinland Iron Mines Corporation

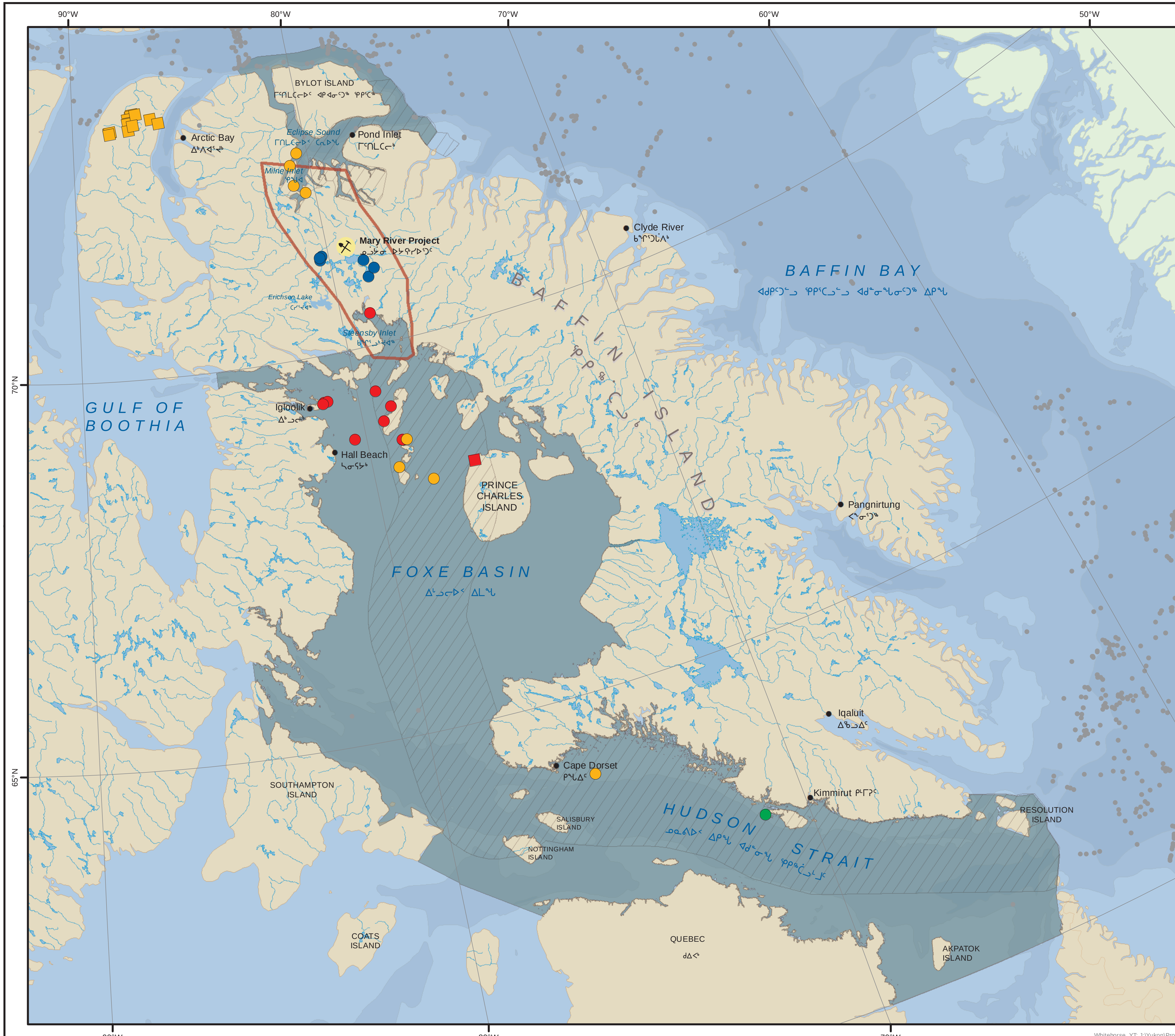
Mary River Project: Thick-billed Murre Observations in the Marine RSA

EDI

Date: 12/14/2011

FIGURE 10

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig10_TBMU_Density_Obs.mxd



LEGEND

- Mary River Project
- Ivory Gull Observation (PIROP - Northwest Atlantic 1965-1992)
- Ivory Gull Nesting Site (COSEWIC, 2006)
- Ivory Gull Observation (Mary River Project Observation)
- Ross's Gull Nesting Site (COSEWIC, 2007)
- Ross's Gull Observation (Mary River Project)
- Harlequin Duck Observation (April 28, 2008)
- Short-eared Owl Observation (Mary River Project Observation)
- Terrestrial Regional Study Area
- Marine Local Study Areas
- Marine Regional Study Areas

NOTES

Ivory Gull Observations (vessel-based surveys at sea) data provided by PIROP - Northwest Atlantic 1965 - 1992. Data obtained online: OBIS-SEAMAP http://seamap.env.duke.edu/datasets).

Ivory Gull Nesting Sites: Assessment and Status Report on the Ivory Gull (COSEWIC, 2006). Ross's Gull Nesting Site: Assessment and Status Report on the Ross's Gull (COSEWIC, 2007).

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 25 50 100 150 200 Km

Baffinland Iron Mines Corporation

Mary River Project
Species at Risk Observations,
Mary River Marine RSA

EDI

Date: 12/14/2011

FIGURE 11

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig11_MarineRSA_SpeciesAtRisk.mxd

5 HABITAT CLASSIFICATION AND MODELING

Habitat suitability modeling was completed for Peregrine Falcon (nesting and foraging), Red-throated Loon, Snow Goose, and Eiders by Knight Piésold Ltd. The results of this modeling were reclassified by EDI into High, Moderate, Low and Nil as described in Section 2.4. Table 19 outlines the results of the habitat suitability modeling process for these species. More details on the results of habitat mapping for each of the key indicator species are detailed below.

Table 19. Habitat Suitability Modeling Results for Snow Goose, Eiders, Red-throated Loon, and Peregrine Falcon

Habitat Suitability Model	High		Moderate		Low		Nil	
	Area (km^2)	Percent of RSA*	Area (km^2)	Percent of RSA*	Area (km^2)	Percent of RSA*	Area (km^2)	Percent of RSA*
Snow Goose	1,187	3.9%	25,897	84.7%	3,326	10.9%	152	0.5%
Eiders	20,283.8	66.4%	920	3.0%	9263	30.3%	94	0.3 %
Red-throated Loon	5,893	19.3%	1,546	5.1%	9187	30.1%	13,935	45.6%
Peregrine Falcon – Nesting	1,686	7.1%	22,087	92.8%	16	0.1%	1	<0.1%
Peregrine Falcon - Foraging	5,486	22.6%	13,683	56.3%	5,145	21.2%	0	0%

* Total area considered was different for the models that included aquatic habitats (i.e. Snow Goose, Eiders, Red-throated Loon) and those that only looked at terrestrial habitats (i.e. Peregrine Falcon): total areas were 30,560 km^2 and 24,314 km^2 respectively.

Snow Goose — Approximately 4% of the terrestrial RSA is high quality Snow Goose habitat, while 85% is considered moderate (Table 19). The high value habitats generally included freshwater lakes and ponds, as well as terrestrial habitats in close proximity to freshwater bodies, and marine shorelines. High value habitats were most concentrated in the southwest sections of the RSA, extending from Angajurjualuk Lake south to Steensby Inlet, and west of the proposed rail alignment (Figure 12).

King and Common Eider — Approximately 66% of the terrestrial RSA functions as high quality habitat for Eiders (Table 19).. The high value habitat included a variety of terrestrial habitats, smaller freshwater bodies, and shoreline habitats at lower elevations and level to gentle slopes (Figure 13).

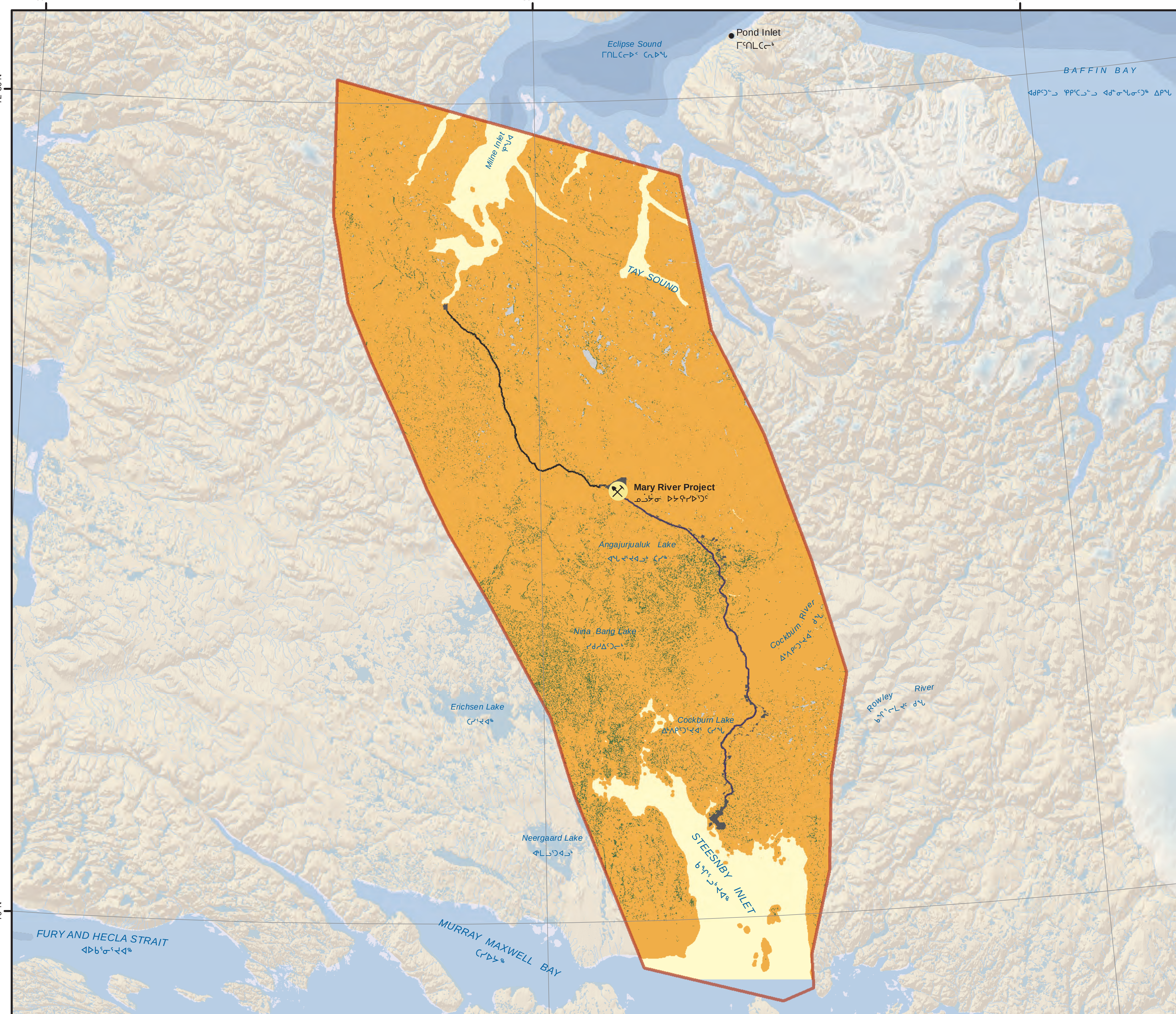
Red-Throated Loon — Approximately 19% of the terrestrial RSA is high quality Red-throated Loon habitat (Table 19). High quality habitat consists of smaller freshwater bodies and terrestrial habitats in close proximity of marine and freshwater bodies at lower elevations within the RSA. In general, high value habitats were much more predominant on the west side of the existing road to Milne Inlet and the proposed rail alignment. Since Red-throated Loons are limited to the aquatic environment and near shoreline for nesting and foraging, 74% of the terrestrial RSA is considered Nil habitat (Figure 15).

Peregrine Falcon — Approximately 7% of the RSA is considered high quality Peregrine Falcon nest habitat (Table 19). There is abundant suitable cliff-nesting habitat, particularly in the eastern and southern areas, with adjacent productive tundra foraging habitat. The availability of nesting habitat for Peregrine Falcons and other cliff-nesting species does not appear to be limiting (Figure 17). The model result that ~93% of the RSA contains moderate quality habitat is probably a model error because it is difficult to distinguish "cliffs" from rugged steep terrain. The project's bird biologist (M. Evans) estimated that up to 35% of the RSA contained suitable cliff nesting habitat (M. Evans, pers. obs.). Most of these cliffs are located in close proximity to seemingly productive tundra hunting grounds. Approximately 23% and 56% of the RSA contains high and moderate (respectively) quality Peregrine Falcon foraging habitat (Table 19; Figure 18).

Lapland Longspur — Habitat suitability was not modeled for Lapland Longspur. However, to assess habitat availability and provide a basis for future impact analysis, a map of Lapland Longspur habitat was created based on observed and estimated densities by habitat type. This process found that approximately 21.7% of the terrestrial RSA can be expected to host high densities (>30 birds/km^2) of Lapland Longspurs (Table 20; Figure 20).

Table 20. Results of the Density Map for Lapland Longspur

Density Class	Area (km^2)	% RSA
High	6,679	21.7%
Moderate	9,649	31.4%
Low	7,218	23.5%
Nil	7,165	23.3%



LEGEND

- Mary River Project
- Potential Disturbance Area
- Terrestrial Bird Regional Study Area

Snow Goose Habitat Suitability

- High Suitability
- Moderate Suitability
- Low Suitability
- Nil

NOTES

Proposed Rail Alignment provided by Canarail Consultants Inc. January 2010. Canarail Consultants Inc.

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 5 10 20 30 40 50 Km

Baffinland Iron Mines Corporation

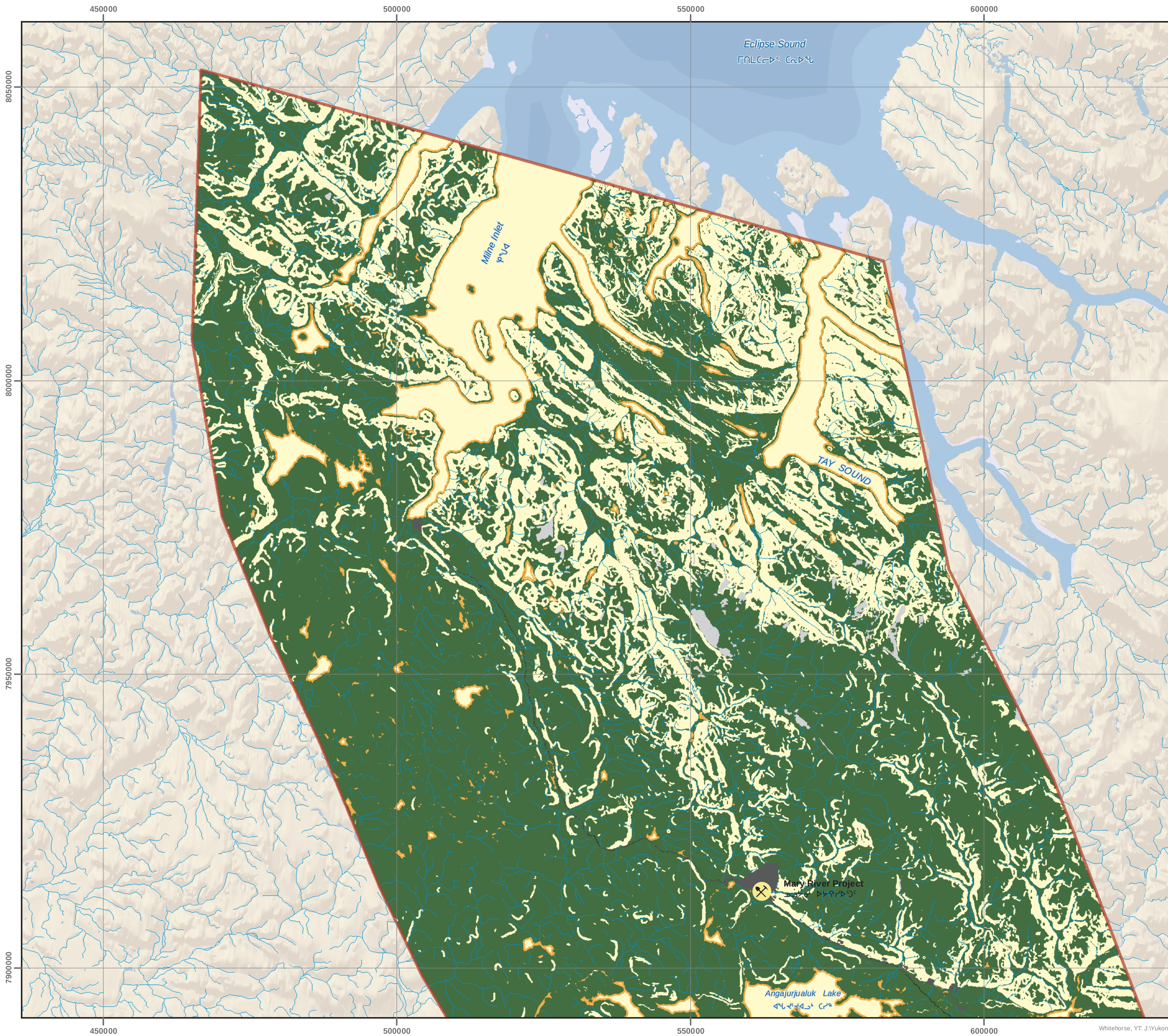
Mary River Project: Snow Goose Habitat Suitability

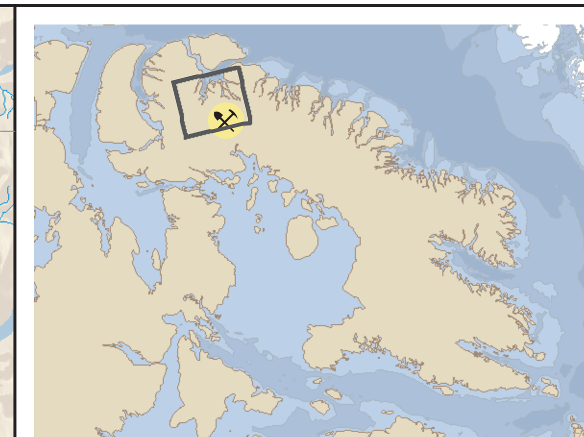
EDI

Date: 12/14/2011

FIGURE 12

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig12_SNGO_Hab_Suitability.mxd





LEGEND

- Mary River Project
- Potential Disturbance Area
- Terrestrial Regional Study Area

Eider Habitat Suitability

- High Suitability
- Moderate Suitability
- Low Suitability
- Nil

NOTES

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2.5 5 10 15 20 25 Km

Baffinland Iron Mines Corporation

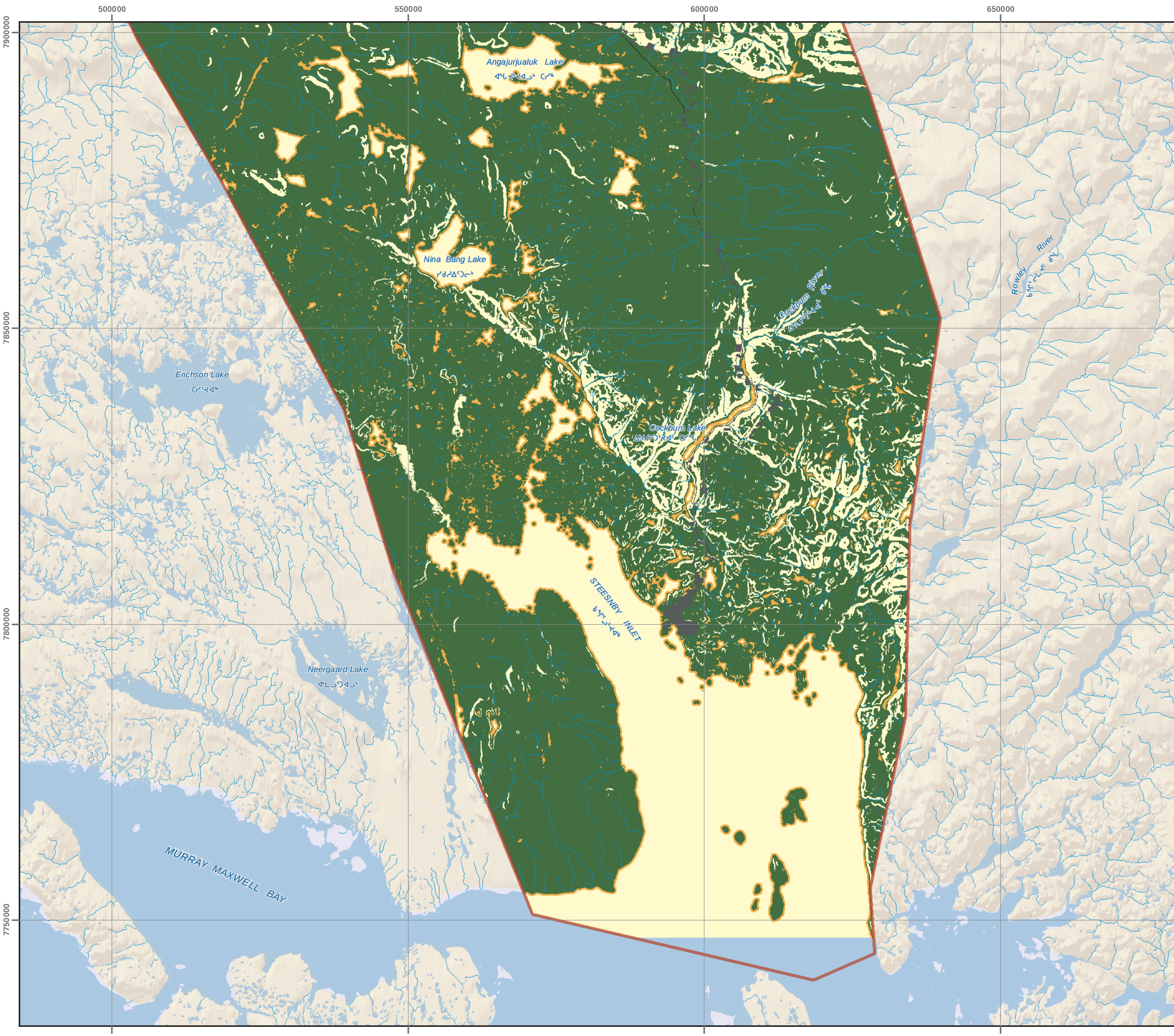
Mary River Project: North Region Eider Habitat Suitability

EDI

Date: 12/14/2011

FIGURE 13

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig13_KEIEnorth_Habitat.mxd



LEGEND

- Mary River Project
- Potential Disturbance Area
- Terrestrial Regional Study Area

Eider Habitat Suitability

- High Suitability
- Moderate Suitability
- Low Suitability
- Nil

NOTES

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2.5 5 10 15 20 25 Km

Baffinland Iron Mines Corporation

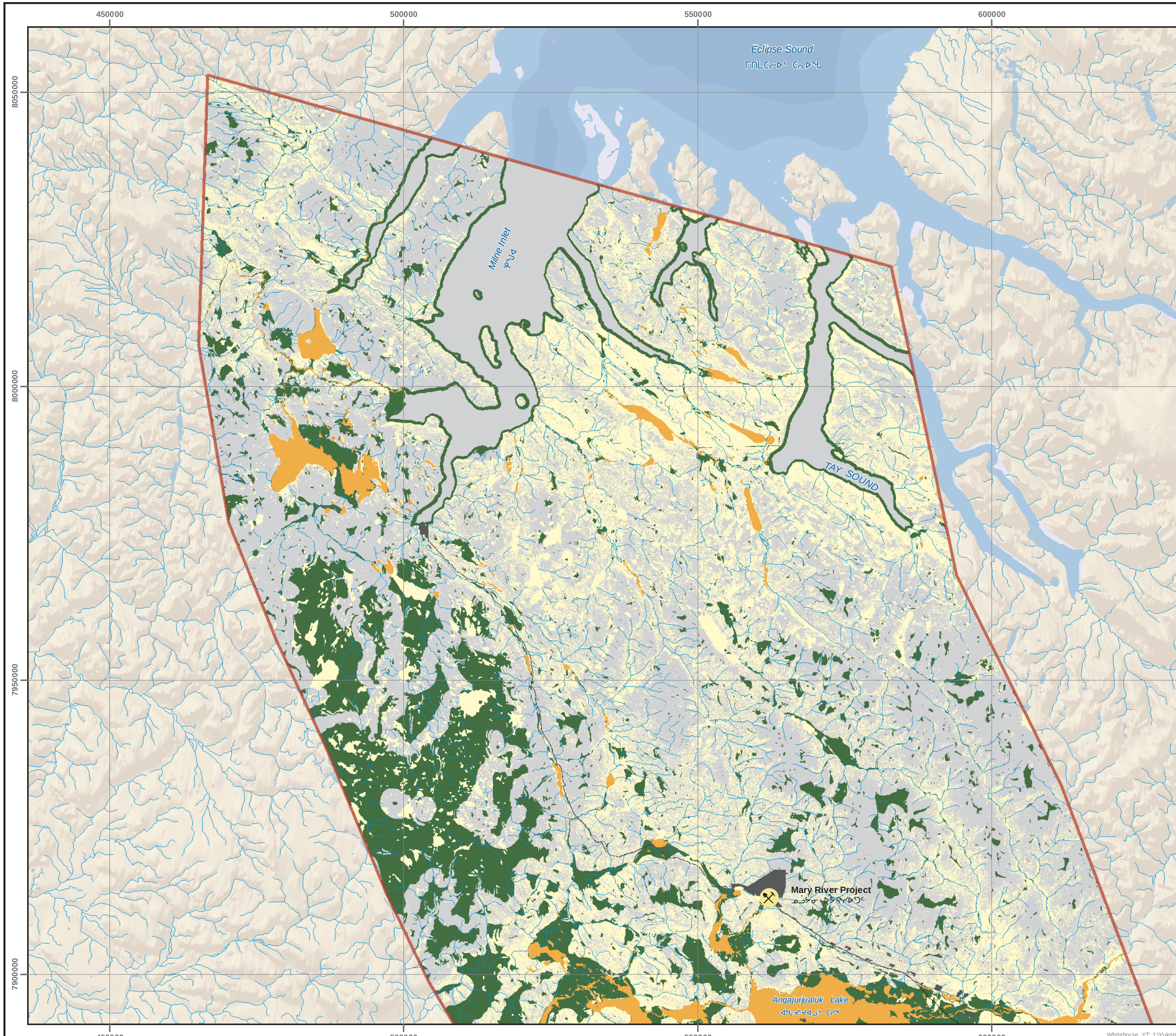
Mary River Project: South Region Eider Habitat Suitability

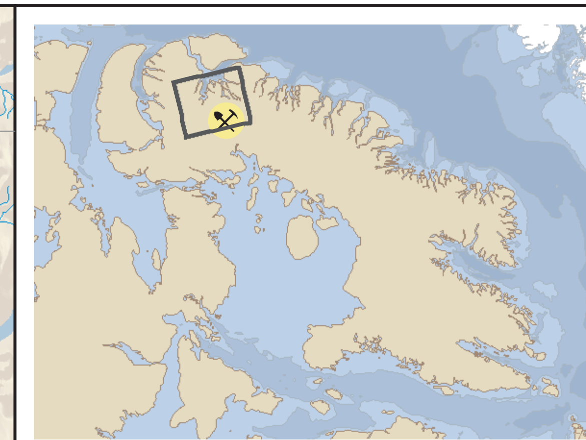
EDI

Date: 12/14/2011

FIGURE 14

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig14_KEIEsouth_Habitat.mxd





LEGEND ᑐᑭᓯᔾᔪᑎᑦ

Mary River Project ᓄᓘᔾᔨᓂ ᐅᔾᔪᕐᓯᐅᕐᑐᑦ
Potential Disturbance Area ᓄᓇ ᐊᑦᑐᕐᑕᐅᑐᐃᓇᑎᐊᓕᒃ ᓴᕕᒃᓴᕐᓯᐅᕐᑐᓂᑦ
Terrestrial Regional Study Area

Red-throated Loon Habitat Suitability

- High Suitability
- Moderate Suitability
- Low Suitability
- Nil

NOTES ᖃᐅᔨᒪᔾᓴᐃᑦ

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale ᐊᖏᓂᖓ 0 2.5 5 10 15 20 25 Km ᑭᓚᒥᑕ

Baffinland Iron Mines Corporation

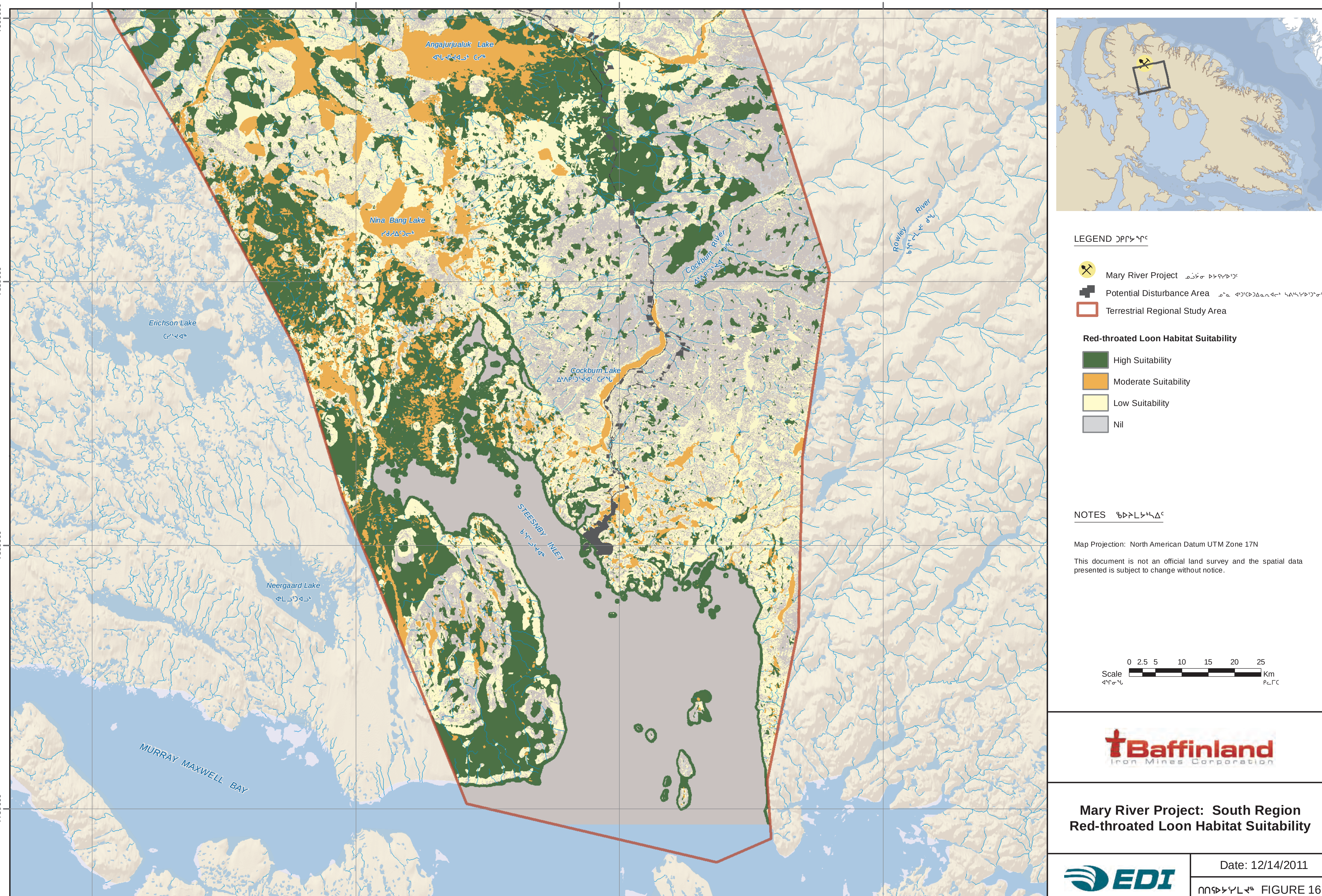
Mary River Project: North Region Red-throated Loon Habitat Suitability

EDI

Date: 12/14/2011

ᑎᑎᕋᐅᔭᕐᓯᒪᔪᖅ FIGURE 15

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig15_KRTLOnorth_Habitat.mxd



NOTES

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Baffinland Iron Mines Corporation

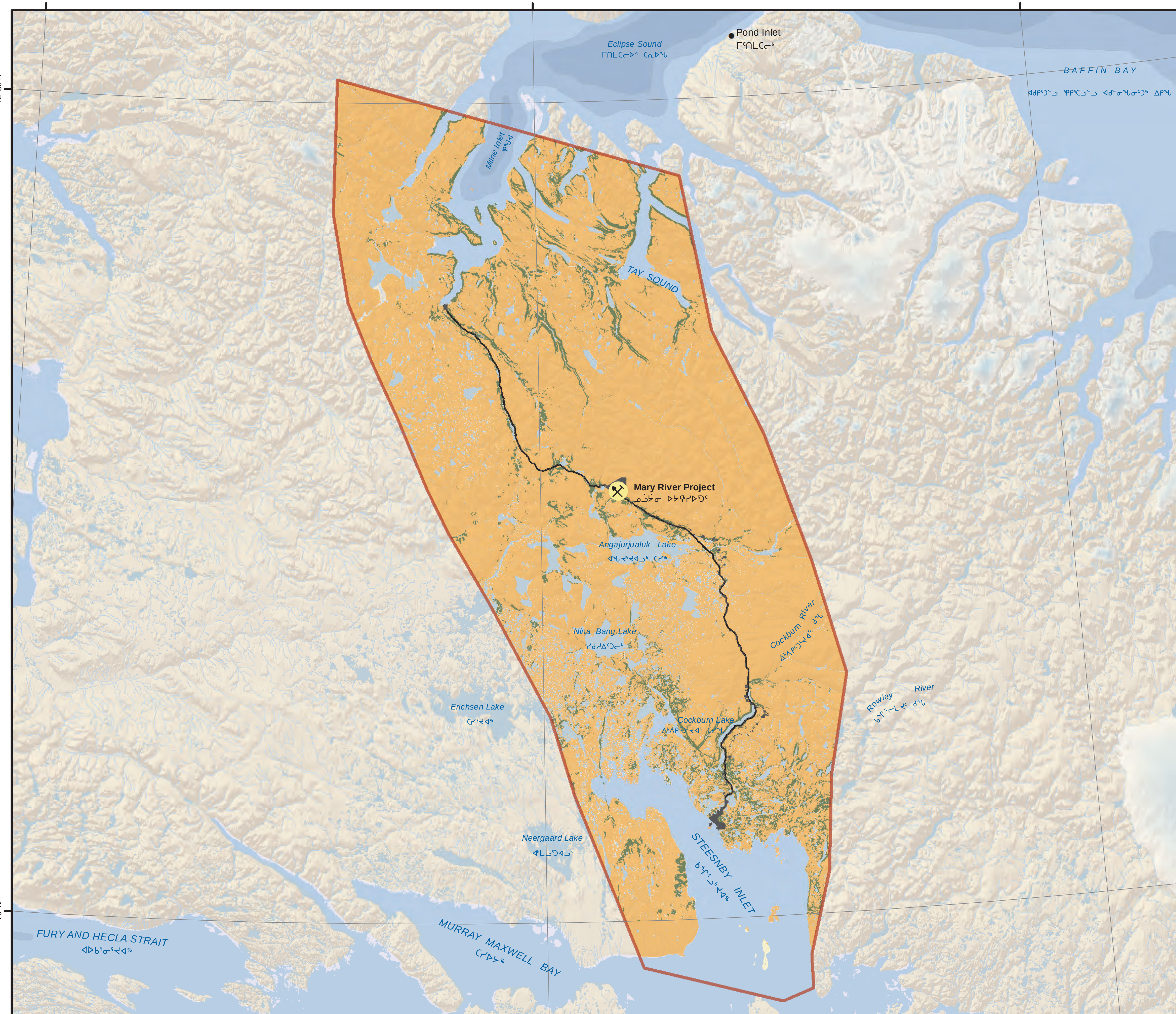
Mary River Project: South Region
Red-throated Loon Habitat Suitability

EDI

Date: 12/14/2011

FIGURE 16

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig16_RTLOsouth_Habitat.mxd



LEGEND

- Mary River Project
- Potential Disturbance Area
- Terrestrial Bird Regional Study Area

Peregrine Falcon Nesting Habitat Suitability

- High Suitability
- Moderate Suitability
- Low Suitability
- Nil

NOTES

Proposed Rail Alignment provided by Canarail Consultants Inc. January 2010. Canarail Consultants Inc.

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 5 10 20 30 40 50 Km

Baffinland Iron Mines Corporation

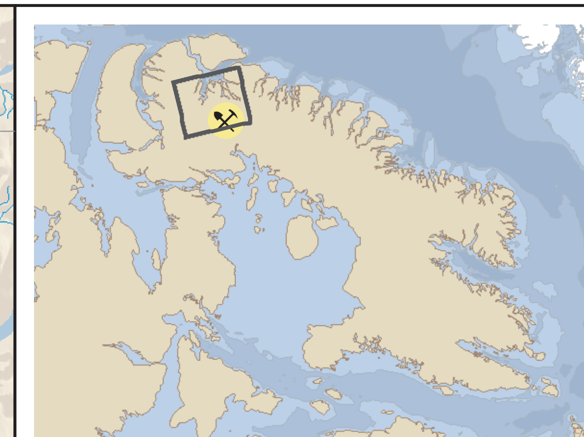
Mary River Project: Peregrine Falcon Nesting Habitat Suitability

EDI

Date: 12/14/2011

FIGURE 17

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig17_PEFAnest_Hab_Suitability.mxd



LEGEND

Mary River Project

Potential Disturbance Area

Terrestrial Regional Study Area

Peregrine Falcon Foraging Habitat Suitability

High Suitability

Moderate Suitability

Low Suitability

Nil

NOTES

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2.5 5 10 15 20 25 Km

Baffinland Iron Mines Corporation

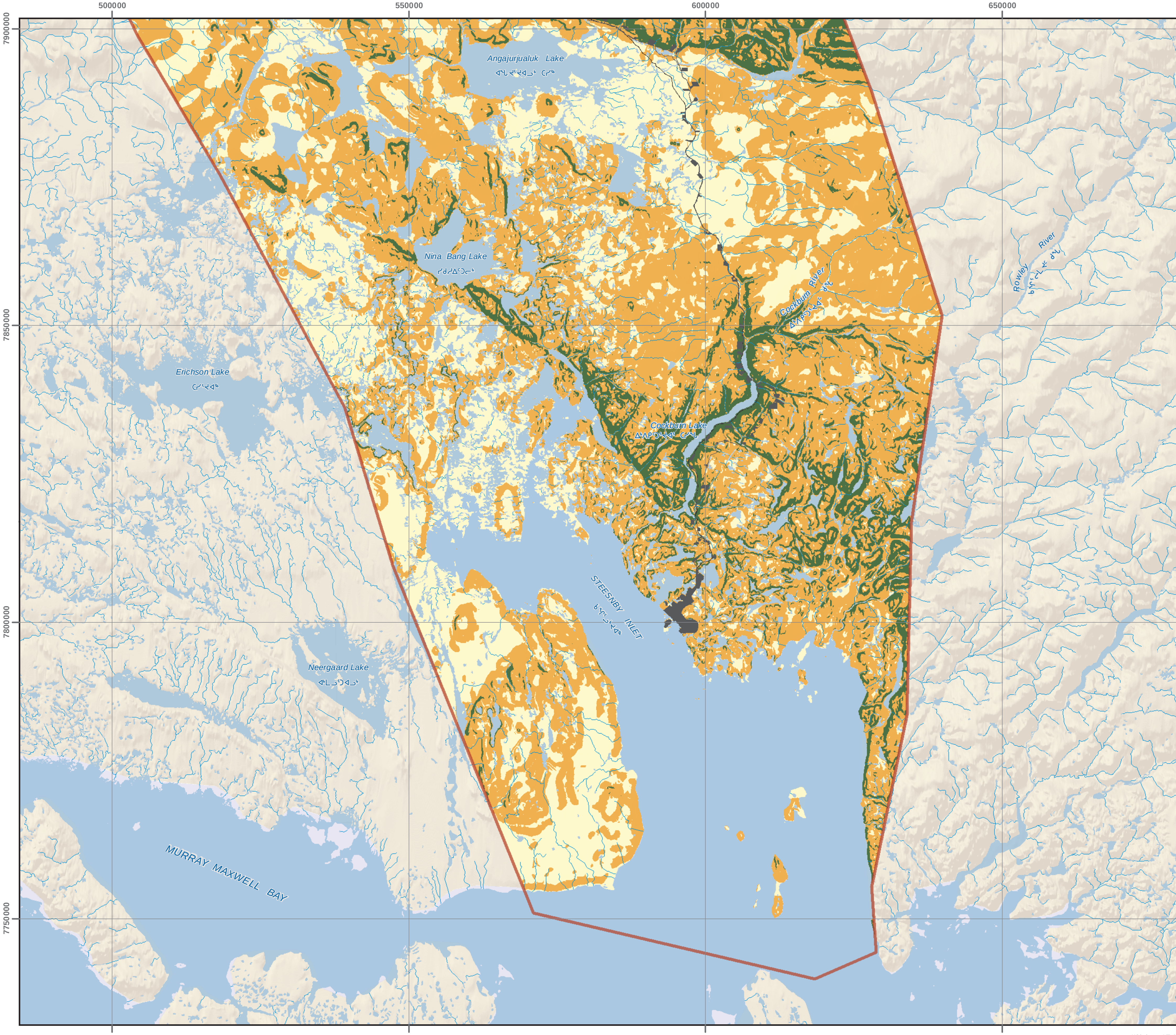
Mary River Project: North Region
Peregrine Falcon
Foraging Habitat Suitability

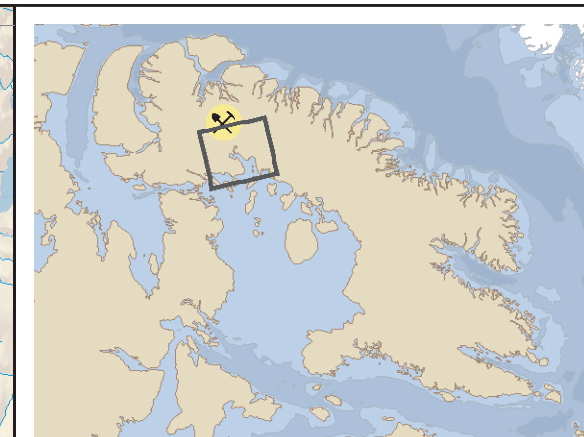
EDI

Date: 12/14/2011

FIGURE 18

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig18_PEFAforaging_north_Habitat.mxd





LEGEND

- Mary River Project
- Potential Disturbance Area
- Terrestrial Regional Study Area

Peregrine Falcon Foraging Habitat Suitability

- High Suitability
- Moderate Suitability
- Low Suitability
- Nil

NOTES

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2.5 5 10 15 20 25 Km

Baffinland Iron Mines Corporation

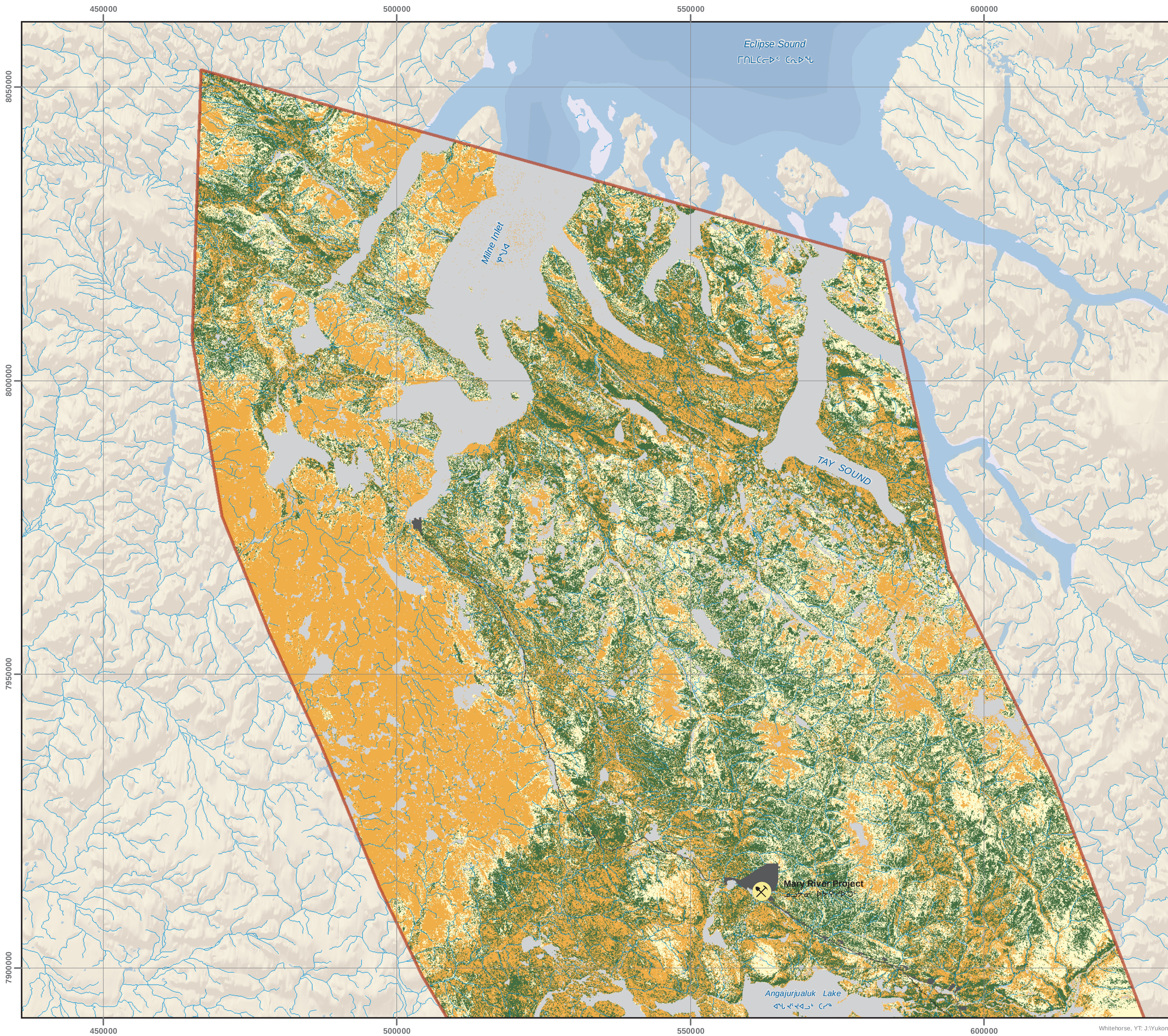
Mary River Project: South Region
Peregrine Falcon
Foraging Habitat Suitability

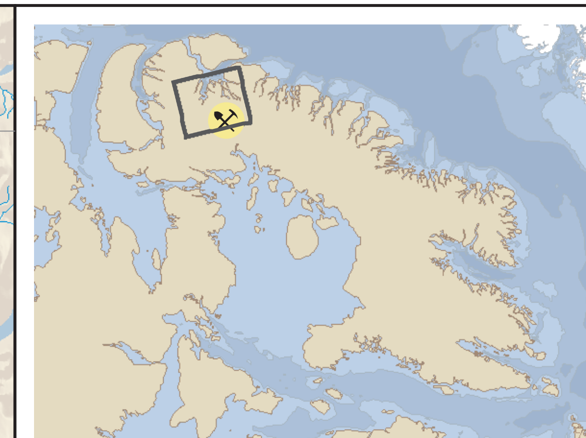
EDI

Date: 12/14/2011

FIGURE 19

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig19_PEFAforaging_south_Habitat.mxd





LEGEND

- Mary River Project
- Potential Disturbance Area
- Terrestrial Regional Study Area

Lapland Longspur Density

- High Density
- Moderate Density
- Low Density
- Nil

NOTES

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2.5 5 10 15 20 25 Km

Baffinland Iron Mines Corporation

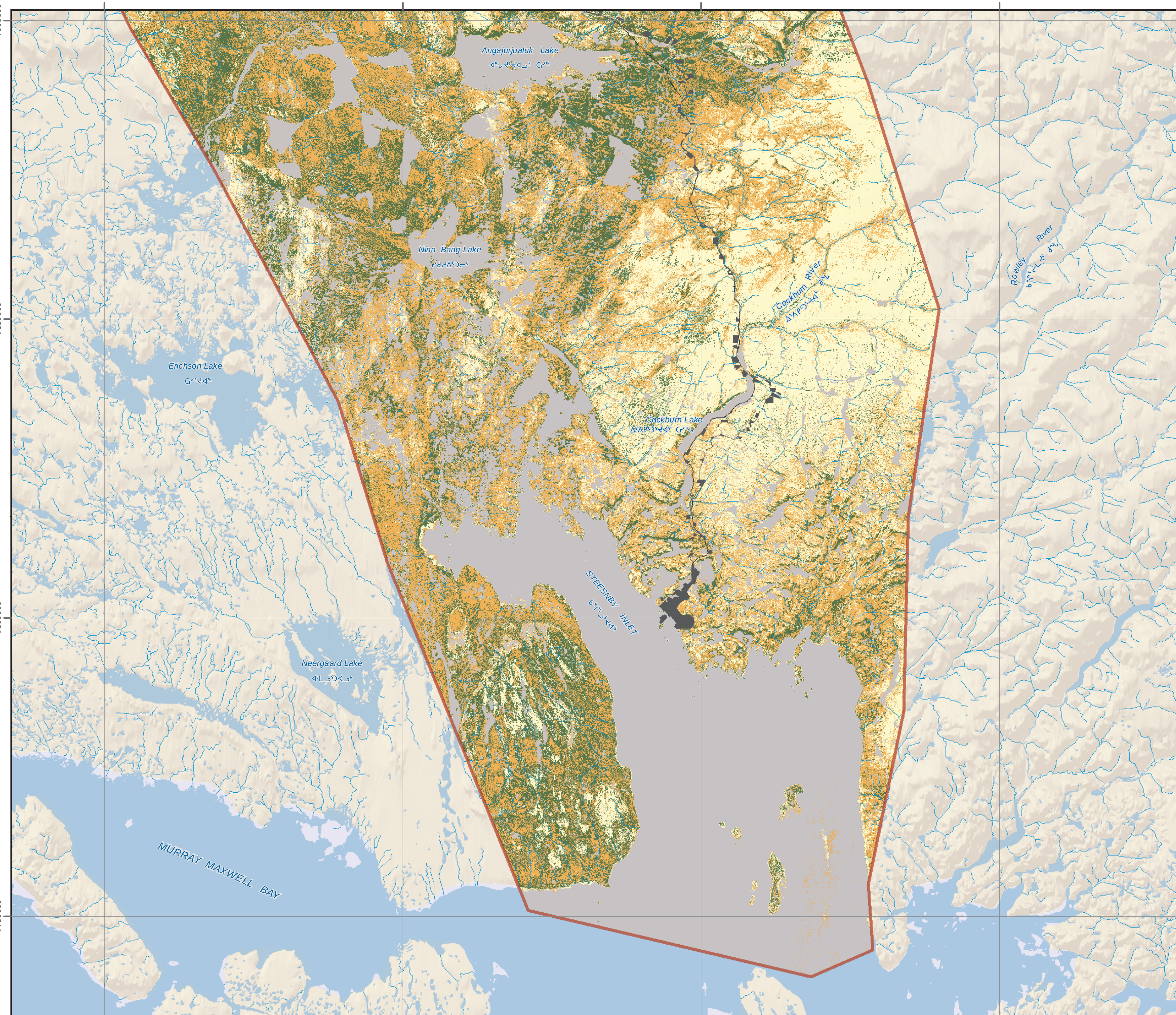
Mary River Project: North Region Lapland Longspur Density

EDI

Date: 12/14/2011

FIGURE 20

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig20_LALOnorth_Density.mxd



LEGEND

- Mary River Project
- Potential Disturbance Area
- Terrestrial Regional Study Area

Lapland Longspur Density

- High Density
- Moderate Density
- Low Density
- Nil

NOTES

Map Projection: North American Datum UTM Zone 17N

This document is not an official land survey and the spatial data presented is subject to change without notice.

Scale 0 2.5 5 10 15 20 25 Km

Baffinland Iron Mines Corporation

Mary River Project: South Region Habitat Suitability for Lapland Longspur

EDI

Date: 12/14/2011

FIGURE 21

Whitehorse, YT: J:\Yukon\Projects\2011\11_Y_0128_Baffinland_PostEIS\Mapping\Mapping_Finals_15Dec2011\Fig21_LALOsouth_Density.mxd

6 DISCUSSION

The terrestrial bird surveys at Mary River documented 29 species plus unconfirmed species of ptarmigan, phalarope and jaeger, while the marine bird surveys recorded 45 species. Combined, the two programs observed 52 bird species plus unconfirmed species of ptarmigan within the Mary River terrestrial and marine RSAs. Of these, 25 species were confirmed to breed within the marine and terrestrial RSAs. Two additional species, Harlequin Duck and Red-necked Phalarope, were reported within the marine RSA during the survey period but was not detected during the marine and terrestrial bird surveys.

Comparing the list of species observed during the Mary River surveys to the list of 62 species expected in the Mary River Marine and Terrestrial RSAs, 16 of the species expected within the Mary River RSAs were not detected. Of these, eight are sandpipers or related species (Semipalmated Plover, Hudsonian Godwit, Red Knot, Dunlin, Sanderling, Semipalmated Sandpiper, Pectoral Sandpiper, and Red-necked Phalarope), three are passerines (Northern Wheatear, Common Redpoll, and Hoary Redpoll), two are waterfowl (Cackling Goose and Northern Pintail), and two are ptarmigan (Rock Ptarmigan and Willow Ptarmigan — however, the terrestrial surveys did note unconfirmed species of ptarmigan, which should have been either one or both of these species). Most of the expected species not detected at Mary River were considered rare or uncommon in the studies they were reported in (Section 3.1). Additionally, six species not expected within the Mary River RSAs based on the literature review, were detected. These include: Greater White-fronted Goose, Ross's Goose, Black Scoter, Common Loon, Lesser Black-backed Gull, and Short-eared Owl. With the exception of Common Loon, these unexpected species were rare within the surveys. Common Loon, however, was detected numerous times during both the marine and terrestrial work and was confirmed to breed within the terrestrial RSA.

6.1 SPECIES AT RISK

Based on the literature review completed for the Mary River study, six Species at Risk (SAR) had the potential to be found within the Mary River RSAs (Harlequin Duck, Ivory Gull, Peregrine Falcon, Ross's Gull, Red Knot, and Short-eared Owl, see Table 12), although not all were expected to be found based on previous studies in the surrounding areas (see Table 10). No species-specific surveys were conducted for SAR in the Mary River RSAs; however, if present, these species were expected to be detected during surveys aimed at larger species groups. Any SAR inhabiting the marine environment (e.g., Harlequin Duck, Ivory Gull, Ross's Gull) were expected to be found in low numbers within the marine RSA, and because of the immense size of the study area, it was determined that these species would be best surveyed while conducting general systematic aerial transect surveys throughout the RSA (non-species specific aerial surveys designed to census all marine bird and mammal species). Within the terrestrial RSA, Peregrine Falcon were expected to be captured during surveys for cliff-nests raptors, while Short-eared Owl and Red Knot, if present, were expected to be located during the ground-based surveys (e.g., point counts, transect plot surveys etc.). The 2006–2008 Mary River field surveys located five of the six potential SARs: Harlequin

Duck, Ivory Gull, Peregrine Falcon (discussed in the Raptor section below), Ross's Gull, and Short-eared Owl.

Both Ivory Gull and Ross's Gull were previously documented in the area. Ivory Gulls are known to nest on Brodeur Peninsula on northern Baffin Island as well as in the eastern Lancaster-Jones Sounds regions close to Bylot Island (Mallory et al. 2008), and some of these birds are thought to migrate through Foxe Basin and Hudson Strait each year (Mark Mallory, CWS, pers. comm., Theo Ikummaq, MRIKS, 2008, Forbes et al. 1992). Ross's Gull has been recorded nesting on the northwest corner Prince Charles Island in Foxe Basin (one of only four recorded nesting locations in Canada); however, despite intensive surveys on Prince Charles and neighbouring Air Force Island (e.g., Johnston and Pepper 2009, Vicky Johnston, CWS, pers. comm.), observations here have been limited to a single pair of breeding gulls discovered in 1984 by Tony Gaston (CWS) and in 1997 by both Vicky Johnson (CWS) and Bechet et al. (2000). During the Mary River surveys, Ivory and Ross's Gull were only detected during marine aerial surveys. Ivory gull was observed in five of the six main survey areas (Milne Inlet, Eclipse Sound, West Foxe Basin, East Foxe Basin, and Hudson Strait), while Ross's Gull was seen in only three of the southern surveys areas (Steensby Inlet, West Foxe Basin, and East Foxe Basin). Observations of Ivory Gulls were all single individuals or family groups with fledged young; however, observations of Ross's Gull included a couple of larger groups in West Foxe Basin (one of 17 individuals in along the west coast of Rowley Island in September, 2008, and three groups totaling 22 gulls north of North Spicer Island in October, 2008). These observations constitute the largest ever observation of Ross's Gulls in Canada (M. Mallory, CWS, pers. comm.) and suggest the continued and possibly increased presence of the species in the region. The observations of Ivory Gull observations were somewhat wide spread, but were within the range of previous observations from earlier marine bird surveys (e.g., Programme intégré de recherches sur les oiseaux pélagiques — PIROP Northwest Atlantic database with observations from 1966–1992).

Harlequin ducks were not detected in any of the reviewed published surveys for the region around the Mary River Project (Table 10). However, they are known to breed on the southern third of Baffin Island (mostly along Frobisher Bay and the eastern sections of Hudson Strait) and have been seen in small flocks in southern Foxe Basin and Hudson Strait (Environment Canada 2007a, Mark Mallory, CWS, pers. comm.). This is consistent with the single project observation of three Harlequin Ducks observed in Hudson Strait in late April of 2008. Harlequin Ducks nest along fast moving streams and rivers, and when not on their nesting grounds are often found foraging along rocky coastlines (Environment Canada 2007a).

The Mary River Study Area is north of the known breeding range for Short-eared Owl (Wiggins et al. 2006); however, the species is an irruptive breeder and nesting success appears to be, in part, a response to local small mammal populations (COSEWIC 2008). In Nunavut, they are widely distributed with higher concentrations in coastal tundra areas during years of lemming outbreaks (COSEWIC 2008). During the terrestrial field surveys at Mary River, three observations of Short-eared Owls were made each in 2007 and 2008 (all observations were of single birds with no indication of nesting). Interestingly, in 2008, Short-eared Owls were also observed on Bylot Island (to the north of the terrestrial RSA) for the first time in over 20 years of study (Therrien 2010). Throughout the summer of 2008, a pair of Short-eared Owls were observed displaying territorial behavior indicative of nesting (although no nest was ever located, Therrien 2010).

Snowy Owl surveys conducted on Bylot Island, indicated that 2008 was a year of very high lemming densities on Bylot Island (Therrien 2010) and in the Mary River area (surveyors followed a couple of female Snowy Owls that were tagged with radio transmitters in 2007 over to the Mary River RSA in 2008 and set up lemming traps in the vicinity of their nests, Gauthier pers. comm. with M. Evans). In June 2009, a pair of Short-eared Owls were again seen on Bylot Island; however, they did not display territorial behavior and were not seen later in the summer; lemming abundance on Bylot Island in 2009 was low (Therrien 2010). Based on these observations, it appears likely that the Mary River RSA may be used by breeding Short-eared Owls, at least during years of lemming outbreak; however, densities are expected to be very low. In Arctic regions, Short-eared Owls typically nest in arctic tundra and estuaries (Sinclair et al. *In* COSEWIC 2008), this is not expected to be a limiting factor on Baffin Island.

6.2 WATERFOWL AND MARINE BIRDS

Waterfowl and marine birds observed during the study were reflective of those expected in the eastern Canadian arctic. The species distribution and abundance was generally consistent with other studies from the area.

The IQ studies conducted for the Mary River project indicated that ducks and geese of all species are important to the Inuit for the harvest of the eggs and the use of various parts of the bird for ceremonial and practical purposes. However, the species that are most commonly harvested are Snow Geese, Common and King Eiders, Arctic Terns (eggs only) and Long-tailed Ducks. All of these species are plentiful in the Mary River area; in fact, analysis of the marine bird survey data by LGL indicated that Snow Geese, Common and King Eiders, Arctic Tern and Long-tailed Ducks are four of the five most common bird species detected within the marine RSA (the other being Brant). Two of these species/species groups (Snow Goose and Common and King Eiders) were selected as focal species for this baseline report. Two other species of waterfowl and seabirds (Red-throated Loon and Thick-billed Murre) were also chosen as focal species. All four of these species are discussed in greater detail below.

The Mary River marine and terrestrial RSAs see abundant use by Snow Geese throughout the spring, summer and fall seasons. Thousands of Snow Geese migrate through the area, using the RSAs for migratory stop-over sites in the spring and fall. These stop-over locations are most heavily concentrated in the Steensby Inlet region, especially within the marine waters and low-lying tundra areas adjacent to the Steensby coastline (inland to approximately 10 km). During the breeding season, a relatively small number of Snow Geese appear to nest within the bulk of the terrestrial RSA (these are mostly concentrated in well-vegetated lowland areas, often around small to mid-sized waterbodies and/or wetlands). However, in the southwest section of the terrestrial RSA, aerial surveys located a breeding colony of over 5,000 Snow Geese on the southwest shore of Steensby Inlet. Also, from mid-July to late August thousands of geese return to the RSA to rest, forage, and to moult their feathers before continuing their fall migration south. The majority of the moulting observations made during the Mary River baseline surveys were located in the southwest section of the RSA, south of the Mary River mine site and west of the proposed rail alignment.

This roughly corresponds to an area surveyed by CWS in July 1993 (Reed et al 1993). The CWS survey yielded an estimated total of 22,145 moulting Greater Snow Geese for the 7,200 km^2 block, including 20,280 adults of which 94.3% were not accompanied by young (Reed et al. 1993). The low percentage of successful breeders observed in the survey block, suggests that the areas serves mainly as a moulting grounds for sub adults and failed breeders (Reed et al. 1993). Based on the results of the 1993 survey, Environment Canada has proposed this area (bounded by the 1993 survey block) be designated as a Special Management Area in the Nunavut Land Use Plan currently under development (James Hodson, CWS, pers. comm.).

The presence of Snow Geese within the north Baffin region is well documented. Previous surveys have documented large numbers of geese within the area (e.g. waterfowl surveys in Foxe Basin in 2002 and 2003 documented >150,000 individual Snow Geese, with numerous more observations where individuals in colonies were too numerous to count; Dickson et al., in prep.). Several large nesting colonies are known in the region including Bylot Island (over 669,000 Greater Snow Geese in 1996, LePage et al. 1998), Great Plains of the Koukdjuak (nesting population of >1.7 million Lesser Snow Geese, Latour et al. 2008), Prince Charles and Air Force Island (140,000 Lesser Snow Geese, Latour et al. 2008), Bay of God's Mercy, Ell Bay and Bear Cove on Southampton Island, Dewey Soper Migratory Bird Sanctuary, and North Spicer Island (Dickson et al., in prep.) among others. In some parts of the eastern Canadian Arctic, including portions of the Mary River marine RSA, Snow Goose numbers have increased dramatically in recent decades (LePage et al. 1998, Dickson et al., in prep.) leading to concerns regarding the potential impacts on local habitats (Dickson et al., in prep.).

Eiders are widespread throughout the north Baffin area and are known to breed throughout the region (e.g. LePage et al. 1998, Dickson et al., in prep.). The Mary River bird studies documented large migratory flocks of Common and King Eiders in the coastal waters of the marine RSA during their spring and fall migrations. They also recorded four King Eider nests within the terrestrial RSA (three near Angajurjualuk Lake and one north of Steensby Inlet), and females Eiders seen raising broods in Steensby Inlet. These observations are consistent with other studies from the area. No Common Eider nests were located by project surveys, however, three were reported along the north coast of Steensby Inlet by other researchers in 2011 (Alexander Anctil, pers. comm.). Common Eiders often nest in colonies on coastal islands or islets (Goudie et al. 2000). No Common Eider colonies are known in the Steensby Inlet area; however, documented colonies are present in other parts of the marine RSA including Turton Island and Southampton Island in Foxe Basin, and Fraser Island and Markham Bay within Hudson Strait (Latour et al. 2008).

Breeding loons were common in the terrestrial RSA, and all four North American species of loon were present; however, Red-throated Loon was the most common. A total of 41 Red-throated Loon nests were found over the three study years and were nearly always associated with lake or pond habitats where they were usually found along the shoreline or on islands. Red-throated Loon has been noted as a common breeder in other areas throughout the region including Bylot Island (LePage et al. 1998), Igloolik Island (Forbes et al. 1992), and the Great Plains of the Koukdjuak (Caswell et al. in prep, *in* Dickson et al. in prep).

Thick-billed Murre were observed numerous times during the Mary River marine bird surveys, particularly in Hudson Strait (over 2,000 observations just in 2008), but also in Eclipse Sound and Navy Board Inlet in the north of the RSA. Several well-known colonies are located within or nearby the Marine RSA including colonies on the northeast and northwest ends of Bylot Island, Coats Island in north Hudson Bay, Digges Sound at the west end of Hudson Strait, Hantzsch Island at the east end of Hudson Strait, and the north and south end of Akpatok Island in northwestern Ungava Bay (Mallory and Fontaine 2004).

6.3 RAPTORS

Generally, observations of raptors in the study area were expected for the eastern arctic. Gyrfalcon, Rough-legged Hawk and Snow Owl were expected in the frequency and abundance in which they were observed. Snowy Owl numbers increased in response to lemming population increases. A few individual Short-eared Owl were observed in 2008 also likely in response to increases in lemming abundance that year relative to 2006 and 2007.

Peregrine Falcon are generally considered to be abundant and widespread throughout most of their recognized breeding range in Nunavut (CESCC 2011). The Mary River surveys found them to be widespread throughout the terrestrial RSA. In 2011 (when the most intensive surveys for cliff-nesting raptors were conducted), a total of 64 occupied nesting territories were located within the RSA. The number of Peregrine Falcons observed in the area was unexpectedly high. North Baffin Island was generally considered to not be part of their breeding range and generally beyond the northern extent of their breeding range (e.g., the COSEWIC status report (COSEWIC 2007a) does not acknowledge north Baffin Island as being within its breeding range). Studies conducted for the Mary River Project confirms that north Baffin Island is a part of their breeding range, and appears to provide abundant nesting and foraging habitat.

6.4 SONGBIRDS AND SHOREBIRDS

Between the marine and terrestrial studies, eight species of shorebirds (American Golden-Plover, Black-bellied Plover, Common Ringed Plover, Baird's Sandpiper, Ruddy Turnstone, Purple Sandpiper, White-rumped Sandpiper, and Red Phalarope) and four species of songbirds (Snow Bunting, Lapland Longspur, Horned Lark, and American Pipit) were detected within the Mary River RSAs. One additional shorebird species (Red-necked Phalarope) was reported in the marine mammal surveys. These species were not a focal species for the marine work and were not consistently detected in this work, so most of the analysis of these species was conducted based on the terrestrial surveys.

The four most abundant songbirds and shorebirds found in the terrestrial RSA were Snow Bunting, Lapland Longspur, Horned Lark and Baird's Sandpiper. This is similar to what was observed on the east-central coast of Ellesmere Island where the most abundant bird species observed during breeding bird surveys (conducted in 1980–1982, 2003 and 2008) were Snow Bunting, Lapland Longspur and Baird's Sandpiper

(Trefry et al., 2010). Breeding bird surveys conducted on Bylot Island between 1979 and 1997 also reported similar species present in higher numbers including Lapland Longspur, American Golden Plover, and Baird's Sandpiper (LePage et al., 1998).

American Golden Plover, Baird's Sandpiper and Horned Lark densities for the current study are higher than those witnessed in other areas of the Arctic; however, similar densities are reported for American Pipit and Lapland Longspur (Table 22). Snow Bunting density is higher than reported for birds surveyed on Somerset Island, NU (Latour et al., 2005) and the northwestern Ungava Peninsula, QC (Andres, 2006), but is similar to what is reported by Freedman and Svoboda (1982) for Ellesmere Island, NU. Bird density by habitat class for the current study was also compared with other bird surveys conducted in Canadian Arctic environments (Table 23). Density is variable between habitat classes and species for all studies. This information is presented for very general comparisons as the definition of habitats varied between all studies (see Appendix A Tables A1–A4).

Although the general trend for species presence and abundance appears to be similar between studies, the overall songbird and shorebird densities for the current study appear to be lower than those reported in other regions of the Canadian Arctic (Table 21). This is likely due to a higher number of species detected in other studies as compared to the Mary River work. As mentioned above, several species of shorebirds and passerines that were expected in the study area were not detected during field surveys. This may have been a result of the number, type and timing of surveys carried out or may be a factor of species distributions within the area.

Table 21. Density estimate comparisons for shorebirds and passerines at various locations in the Canadian Arctic.

Site	Density Estimates (birds/km^2)			Source
	Shorebirds	Passerines	Total	
South Creswell Bay, Somerset Island, NU	12.5	-	-	Latour et al. 2005
Ekati Diamond Mine, NWT*	-	-	240.8	Smith et al. 2005
Prince Charles Island and Air Force Island, Foxe Basin, NU	148.2 (1996 plots); 81.5 (1997 plot)	-	-	Johnston and Pepper 2009
Mary River, Baffin Island, NU	12.5	21	18.1	current study

* density reported for mine site only

Table 22. Density estimates (birds/km2) for songbirds and shorebirds at various locations in the Canadian Arctic region

Species	Site	Location	Years	Survey Months	Plot Sizes	Individuals /km^2	Pairs /km^2	Sources
American Golden-Plover	Prince Charles Island and Air Force Island, Foxe Basin, NU*	67°N	1996	late-June to mid-July	400 m^2 (n = 34)	1.2	0.2	Johnston and Pepper 2009
			1997		400 m^2 (n = 51)	2.1	1.7	
	Ekati Diamond Mine, NWT**	64°N	1996 - 2003	early to mid-June	25 ha (n = 140)	2 (control), 2 (mine)		Smith et al. 2005
	South Creswell Bay, Somerset Island, NU	72°N	1997	mid-June to mid-July	400 m^2 (n = 30)	0.6		Latour et al. 2005
	Northwestern Ungava Peninsula, QC	60°N	2002	early to mid-June	10 ha (n =100)	0.1		Andres 2006
	Baffin Island, NU	70°N - 79°N	2006 - 2008	late May to mid-June	100 m radius (n = 174); 1 ha (n = 26)	4		current study
Baird's Sandpiper	Alexandra Fjord, Ellesmere Island, NU	79°N	1980	late June to late July	12 km^2		1	Freedman and Svoboda 1982
			1981				0.8	
	Prince Charles Island and Air Force Island, Foxe Basin, NU*	67°N	1996	late-June to mid-July	400 m^2 (n = 34)	2.6	0.5	Johnston and Pepper 2009
			1997		400 m^2 (n = 51)	0	0	
	Ekati Diamond Mine, NWT**	64°N	1996 - 2003	early to mid-June	25 ha (n = 140)	0.8 (control), 0.4 (mine)		Smith et al. 2005
	South Creswell Bay, Somerset Island, NU	72°N	1997	mid-June to mid-July	400 m^2 (n = 30)	0.2		Latour et al. 2005
	Baffin Island, NU	70°N - 79°N	2006 - 2008	late May to mid-June	100 m radius (n = 174); 1 ha (n = 26)	21		current study

Species	Site	Location	Years	Survey Months	Plot Sizes	Individuals /km^2	Pairs /km^2	Sources
Horned Lark	Ekati Diamond Mine, NWT**	64°N	1996 - 2003	early to mid-June	25 ha (n = 140)	6.4 (control), 11.2 (mine)		Smith et al. 2005
	South Creswell Bay, Somerset Island, NU	72°N	1997	mid-June to mid-July	400 m^2 (n = 30)	1.7		Latour et al. 2005
	Northwestern Ungava Peninsula, QC	60°N	2002	early to mid-June	10 ha (n =100)	4.9		Andres 2006
	Baffin Island, NU	70°N - 79°N	2006 - 2008	late May to mid-June	100 m radius (n = 174); 1 ha (n = 26)	21		current study
American Pipit	Ekati Diamond Mine, NWT**	64°N	1996 - 2003	early to mid-June	25 ha (n = 140)	1.6 (control), 2 (mine)		Smith et al. 2005
	Northwestern Ungava Peninsula, QC	60°N	2002	early to mid-June	10 ha (n =100)	11.1		Andres 2006
	Baffin Island, NU	70°N - 79°N	2006 - 2008	late May to mid-June	100 m radius (n = 174); 1 ha (n = 26)	11		current study
Lapland Longspur	Alexandra Fjord, Ellesmere Island, NU	79°N	1980 1981	late June to late July	12 km^2		0.5 0.4	Freedman and Svoboda 1982
	Ekati Diamond Mine, NWT**	64°N	1996 - 2003	early to mid-June	25 ha (n = 140)	82.8 (control), 105.6 (mine)		Smith et al. 2005
	South Creswell Bay, Somerset Island, NU	72°N	1997	mid-June to mid-July	400 m^2 (n = 30)	10.5		Latour et al. 2005
	Northwestern Ungava Peninsula, QC	60°N	2002	early to mid-June	10 ha (n =100)	30.7		Andres 2006
	Baffin Island, NU	70°N - 79°N	2006 – 2008	late May to mid-June	100 m radius (n = 174); 1 ha (n = 26)	24		current study

Species	Site	Location	Years	Survey Months	Plot Sizes	Individuals /km^2	Pairs /km^2	Sources
Snow Bunting	Alexandra Fjord, Ellesmere Island, NU	79°N	1980 1981	late June to late July	12 km^2		9.8 10.6	Freedman and Svoboda 1982
	south Creswell Bay, Somerset Island, NU	72°N	1997	mid-June to mid-July	400 m^2 (n = 30)	0.2		Latour et al. 2005
	northwestern Ungava Peninsula, QC	60°N	2002	early to mid-June	10 ha (n =100)	0.7		Andres 2006
	Baffin Island, NU	70°N - 79°N	2006 - 2008	late May to mid-June	100 m radius (n = 174); 1 ha (n = 26)	28		current study

* Only shorebird species were reported.
**Birds/km^2 were calculated from data presented (birds/0.25 km^2) for active mine and control sites.

Table 23. Density estimates (birds/km^2) for songbirds and shorebirds by habitat class for surveys conducted in Arctic environments.

Habitat Type	Area	Estimated Density of Birds per km^2					Source
		American Golden-Plover	Baird's Sandpiper	Horned Lark	Lapland Longspur	Snow Bunting	
Wet vegetated areas							
Wet sedge meadow	Northern Banks Island, NWT	0.6	5.1	0.3	41.4	-	Henry and Mico 2002
Wet sedge - graminoids and bryoids	Baffin Island, NU	4	21	4	34	4	current study

Habitat Type	Area	Estimated Density of Birds per km^2					Source
		American Golden-Plover	Baird's Sandpiper	Horned Lark	Lapland Longspur	Snow Bunting	
Sedge marsh	North Creswell Bay, Somerset Island, NU*	0	0	0	9.7	-	Latour et al. 2005
Wet graminoid/moss lowlands	Prince Charles Island and Air Force Island, NU**	2.1	0	-	13.9	0	Johnston and Pepper 2009
Sedge wetland	North Creswell Bay, Somerset Island, NU*	0	0.5	0	13	-	Latour et al. 2005
Moderately wet vegetated areas							
Tussock graminoid tundra	Baffin Island, NU	40	44	2	13	107	current study
Graminoid tundra	Northern Banks Island, NWT	11.1	6.7	1.6	477.7	-	Henry and Mico 2002
Moist to dry non-tussock graminoid/dwarf shrub tundra: 50-70% cover	Baffin Island, NU	0	24	21	33	14	current study
Graminoid-dwarf shrub tundra	Northern Banks Island, NWT	10.2	1.9	5.4	57.3	-	Henry and Mico 2002
Prostrate dwarf shrub - dryas/heath, usually on bedrock	Baffin Island, NU	1	4	38	21	12	current study
Dwarf shrub tundra	Northern Banks Island, NWT	0	5.4	3.8	38.2	-	Henry and Mico 2002
Mixed dwarf shrub tundra	north Creswell Bay, Somerset Island, NU*	0.9	0	1.7	16.6	-	Latour et al. 2005
Hummocky tundra	Northern Banks Island, NWT	1.3	5.7	5.4	70.1	-	Henry and Mico 2002

Habitat Type	Area	Estimated Density of Birds per km^2					Source
		American Golden-Plover	Baird's Sandpiper	Horned Lark	Lapland Longspur	Snow Bunting	
Drier, sparsely vegetated areas							
Sparsely vegetated till-colluvium	Baffin Island, NU	0	4	6	4	10	current study
Sparsley vegetated ground	Northern Banks Island, NWT	0.3	2.5	3.2	20.7	-	Henry and Mico 2002
Sparsely vegetated bedrock	Baffin Island, NU	4	11	20	9	24	current study
Sparse herbaceous tundra	north Creswell Bay, Somerset Island, NU*	2.1	0	0.7	5.6	-	Latour et al. 2005
Dry vegetated tundra	Prince Charles Island and Air Force Island, NU**	4.6	0	-	12	4.5	Johnston and Pepper 2009
Dwarf shrub-lichen barrens	Northern Banks Island, NWT	1.6	3.8	5.4	28.3	-	Henry and Mico 2002
Unvegetated areas							
Bare Soil with Cryptogram Crust - Frost Boils	Baffin Island, NU	1	41	29	42	53	current study
Barren	Baffin Island, NU	0	10	21	18	11	current study
Unvegetated/barren tundra	Prince Charles Island and Air Force Island, NU**	3	0	-	2	2.8	Johnston and Pepper 2009

§ for detailed descriptions of habitat types for each study see Appendix 1

7 SUMMARY:BIRDS

Terrestrial Birds

- The diversity of breeding birds in the terrestrial RSA is reflective of eastern Canadian arctic habitats found in the area.
- The distribution and abundance of terrestrial birds is within reported densities of birds in similar arctic studies.
- Cliff-nesting raptors are abundant in the study area and Peregrine Falcon (a species at risk) will be a key indicator species that will be considered in an effect assessment of the Mary River Project.
- One additional species at risk (Short-eared Owl) was observed in the terrestrial RSA, but that species is expected only accidentally in the region. Due to low numbers from baseline surveys they will not be considered specifically for impact assessment.
- Lapland Longspur were found relatively frequently and will be key indicator species for passerines within the study area.
- Red-throated Loons, Snow Geese, and King and Common Eider were observed relatively frequently within the study area and will act as key indicator species for migratory birds breeding and foraging in aquatic and upland habitats.

Marine Birds

- The diversity of breeding seabirds in the marine RSA is reflective of eastern Canadian arctic marine waters.
- Three species at risk were observed within the marine RSA (Ivory Gull, Ross's Gull, and Harlequin Duck). Most of these observations were of individuals or small groups flying or foraging; however, a couple of larger groups of Ross's Gull were observed. Nesting sites/colonies were not observed for any of these species and are not expected to directly interact with project activities. Regardless, Ivory Gull and Ross's Gull will be key indicator species considered for effects assessment.
- Thick-billed Murre was observed numerous times throughout marine surveys, particularly in Hudson Strait, and will act as a key indicator species for seabirds breeding in and migrating through marine and near-shore habitats.

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8.2 PERSONAL COMMUNICATION

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APPENDIX A COMPARISON OF THE HABITAT CLASSIFICATION DESCRIPTORS USED AT MARY RIVER WITH HABITAT CLASSIFICATION DESCRIPTORS USED IN OTHER ARCTIC STUDIES

Table A1. Habitat Classification Descriptors for Current Study: Mary River, Baffin Island, NU

Wet sedge – graminoids and bryoids	This refers to Non-tussock sedge associations and Sedge-moss wet meadow, as well as mossy shorelines. The terrain is quite wet, often with a slow flow of water, and the dominant vegetation is arctic cotton (*Eriophorum angustifolium*) or Carex sedges.
Tussock graminoid tundra	This includes the Tussock sedge association, which occurs on wet soil, usually without standing water. Tussocks in the north Baffin area are of cottongrass (Eriophorum vaginatum). In drier areas, these are often being invaded by heaths (blueberry), mountain avens, willows (Salix arctica, S. reticulata, and S. richardsonii). Mosses and aquatic sedges (mostly Carex aquatilis) grow between the tussocks. There is relatively little of this on the project.
Moist to dry non-tussock graminoid/dwarf shrub tundra: 50 – 70% cover	This includes the Blueberry heath tundra, Cassiope heath tundra, and Mixed heath tundra, which often includes Labrador tea (Ledum). In these areas, there is little flow of water, although the water table may be seasonally high. Moisture varies considerably. Dominant shrubs include Vaccinium uliginosum, Cassiope tetragona, and in the south, Ledum palustre decumbens , often Salix arctica and sometimes Empetrum nigrum, south of the Mary River.
Prostrate dwarf shrub – dryas/heath, usually on bedrock	Includes the Avens – xeric sedge association on bedrock ledges in the slot canyon complexes, or on open bedrock ledges along escarpments, sometimes on simple outcrops. Dryas integrifolia is almost always accompanied by two sedges, Carex rupestris and C. nardina on bedrock.
Sparsely vegetated till-colluvium	2–10% vegetation cover on nonacidic and calcareous bedrock and ice-deposited materials. This group includes the Avens and Avens-xeric sedge barrens on glaciofluvial terraces and on the centres of megapolygons on the uplands. (The frost fissures of these polygons usually bear a heath tundra association, occasionally sedges or mixture of sedges and arctic or Richardson's willows.) Thin mat of vegetation with relatively few heaths.
Sparsely vegetated bedrock	Vegetation averages 2 – 10% vascular plant cover on acidic, igneous bedrock. This includes several Lichen- rock associations, including lichens on bedrock, on boulder fields and felsenmeer, and, sometimes on cliff ledges. Rock accounts for more than 60% of the substrate, and crustose lichens like map, sunburst, and rock tripe are common on acidic rocks. Lichen species vary with the chemical makeup of the rock. Rooted plants become established in lichen mats or in crevices in the rock and often include Saxifraga tricuspidata, Potentilla nivea, fragrant shield ferns, grasses like Hierochloe alpina, and Poa sp.
Bare soil with cryptogam crust/frost boils	Includes the Forb barrens, scattered mats and clumps of vegetation on calcareous soils to the west of the Philip's Creek valley near Milne Inlet. Usually shows considerable cryoturbation or soil movement, and 2-10% vegetation cover with grasses and xeric sedges plus non-vascular plants like lichens.
Barren	<2% vegetation cover on nonacidic and calcareous parent material. On the uplands, this includes the Purple saxifrage barrens, scattered tufts of vegetation, sheet flow of water across the land, active soil movement. Also includes Avens – xeric sedge associations and Luzula associations on the uplands. Purple saxifrage, Saxifraga caespitosa, poppies, woodrushes, and mountain avens are common here.

Table A2. Habitat Classification Descriptors from Henry and Mico (2002): Aulavik National Park, Banks Island, NWT

Wet sedge meadows	Occurs on level, hydric lowlands. Usually covered by shallow (<10 cm) water and a nearly continuous cover of sedges, especially *Carex aquatilis* var. stans and other hydrophobic species.
Graminoid tundra	Occupies mesic to hygric sites in lowlands and on gentle slopes, with continuous cover of graminoids species and sometimes dwarf shrubs (Salix species). Plant growth is most luxuriant on gentle slopes downslope from snowbeds.
Graminoid/dwarf shrub tundra	This type is intermediate between graminoid tundra and dwarf shrub tundra in terms of moisture and vegetation. Vegetation cover, characteristically between 75-100%, is a mosaic with graminoids and mosses dominate in moist depressions and herbs and dwarf shrubs dominate on the drier hummocks.
Dwarf shrub tundra	Occurs on moist, well-drained, middle and upper slopes as well as solifluction loves and terraces. Vegetation cover, characteristically 50–75%, is dominated by dwarf shrubs especially *Salix arctica* and *Cassiope tetragona*. Small non-sorted polygons as well as cryoturbated surfaces are often present.
Hummocky tundra	This type is non-sorted earth hummocks covering small to extensive area. Narrow furrows and cracks separating the hummocks supports mosses, lichens, herbs, and sometimes dwarf shrubs. The tops and sides of hummocks are dry and often free of vegetation.
Sparsely vegetated ground	Characterized by less than 10% vascular plant cover. This type occurs on cutbanks, mudflats, sand and gravel bars, uplands, windblown sites, sand dunes, frost-shattered bedrock, debris-mantled slopes and bare sandstone.
Dwarf shrub/lichen barrens	This variable type occurs at all elevations on windblown sites. Typically sites are rapidly drained, consisting of silty to stoney soils. Vegetation, characteristically 25–50% cover, is dominated by mat and cushion plants.

Table A3. Habitat classification description table for Latour et al. (2005): Creswell Bay, Somerset Island, NU.

Habitat type	Surface type	Dominant vegetation	% Vegetation cover	Moisture	% Standing water
Sedge marsh	Tussock tundra	Sedge (*Carex* spp)	100	100% saturated	10–35
Sedge wetland	Tussock/hummock tundra	Mainly sedge with some cotton grass (*Eriophorum* spp.)	100	60% saturated, 40% moist	< 10
Mixed dwarf shrub tundra	High/low centred polygons, finely patterned bare ground, scattered tussocks/hummocks	Willow (*Salix* spp) and dryas (*Dryas* spp) with scattered sedge and moss	60–80	10% saturated tundra, 50% moist, 40% dry	< 10
Evergreen/deciduous shrub tundra	High/low centred polygons, scattered tussocks/hummocks	Heath (*Cassiope* spp) and willow with scattered sedge	60–80	20% moist, 80% dry	< 5
Sparse herbaceous tundra	Bare ground/rock, scattered tussocks and saxifrage (*Saxifraga* spp)	Saxifrage, grasses and herbs (e.g., *Papaver* spp)	<10	10% moist, 90% dry	< 2

Table A4. Habitat classification description table for Johnston and Pepper (2009): Prince Charles Island and Air Force Island, NU.

Habitat type	Combined habitat class	% vegetation	Dominant vegetation type	Moisture	Other
Grassland	Wet graminoid/Moss lowlands	Most: > 80%	Grasses ≥ moss	Saturated to standing	
Sedge marsh	Wet graminoid/Moss lowlands	> 50%	Sedges ≥ moss	Saturated to standing	Can be hummocky
Wet graminoid marsh	Wet graminoid/Moss lowlands	Most: > 80%	Graminoids ≥ moss	Saturated to standing	
Saltmarsh	Wet graminoid/Moss lowlands	> 50%	*Puccinellia, Carex ursine, Stellaria humifusa*	Most saturated	
Wet moss marsh	Wet graminoid/Moss lowlands	> 80%	Mosses at least 25% > graminoids	Saturated to standing	
Dry graminoid tundra	Dry vegetated tundra	Most: > 80%	Graminoids ≥ moss	Moist	
Dry moss tundra	Dry vegetated tundra	> 50%	Mosses at least 25% > graminoids	Moist to dry	
Vegetated tundra	Dry vegetated tundra	≥ 50%	Dwarf shrub dominant, occasional graminoids or moss	Moist to dry	Often on ridge slopes
Unvegetated/rocky tundra	Unvegetated/Barren tundra	> 20%	Dwarf shrub, moss	Mixed	
Beach ridge top	Unvegetated/Barren tundra	< 20%	Dwarf shrub	Dry	
Barrens	Unvegetated/Barren tundra	< 20%	Dwarf shrub	Dry	
Mudflats	Unvegetated/Barren tundra	< 20%	Grasses, dwarf shrub	Mixed	