

Sharon Ehaloak
Executive Director
Nunavut Planning Commission
Cambridge Bay, NU
Sent electronically: sehaloak@nunavut.ca

April 11, 2014

Dear Ms. Ehaloak,

WWF is pleased to provide the enclosed ArcGIS shapefiles and reports as follow-up to the written submission on the draft Nunavut Land Use Plan (February 2014). In this email I only include the covering letter with description of GIS files. In a separate email I will provide a dropbox link to Mike Townsend to download the geodatabase and reports.

NOTE: All shape files provided to the Nunavut Planning Commission (NPC) may not be shared and should only be used for NPC's deliberations in revising the draft plan.

Following this covering letter is a list with description (metadata) of all submitted shape files.

It was not possible to obtain all the shape files referred to in the WWF submission due to timing and the availability of key personnel. But it is possible for NPC to directly request these files.

In regards to an in person presentation of the WWF submission to NPC we are prepared to travel to Cambridge Bay to do so at a pre-arranged date and time.

If you have questions or require clarification regarding the files do not hesitate to contact me by email (vsahanatien@wwfcanada.org) or by telephone (867-979-7298). Please note that I will be out of the office from 22 April to approximately 15 May. From 22-26 April I will have limited email access and then from 27 April – 15 May no email access as I will be at a remote research cabin.

Best regards,

Vicki Sahanatien
Senior Officer, Government & Community Relations
Iqaluit, NU

cc A. Boyd, M. Townsend, M. McGinnis, J. Savoy

Description of ArcGIS Geodatabase provided to the Nunavut Planning Commission

This is a description of the shape files in the submitted geodatabase: WWF_submission_NLUP.gdb

I have also included notes about information that is not included but can be accessed by directly by NPC through a request to the data holder.

1. Caribou

The WWF written submission emphasized protection of calving, post-calving, water and sea ice crossings and Peary caribou habitat. In addition to providing shape files for those areas we have also included shape files for other important caribou habitat (core winter, summer and breeding habitat and migration corridors) because the health of caribou populations is contingent on providing conservation measure throughout their core ranges.

All mainland caribou habitat shape files, except the Historic Calving Areas, were created and provided by the Nunavut Department of Environment.

- *Calving Core Range*

A series of density maps (based on a kernel analysis) were developed to identify locations key to nine major life cycles or seasons (spring migration, calving, post-calving, summer, late summer, fall migration/pre-breeding, rut/breeding, fall migration post-breeding, and winter) for each of the caribou subpopulations within Nunavut (Ahiak, Bathurst, Beverly, Bluenose East, Bluenost West, Lorillard, Qamanirjuaq and Wager Bay). The density maps were derived from caribou collar telemetry data collected at various times between 1993 and 2012. The seasonal density datasets were analysed to identify seasonal home ranges (the area each subpopulation occupies within a specified date range). Within each seasonal range, Core areas were identified for each of the seasons by examining the utilization distributions within each range - the probability of finding a caribou within the range within the specified season. The core areas represent those locations where there is a 95% probability of caribou being present. The calving season data range for each subpopulation is as follows: - Ahiak: 13 - 25 Jun - Bathurst: 2 - 16 Jun - Beverly: 6 - 19 Jun - Bluenose East: 28 May - 20 Jun - Bluenose West: 29 May - 23 Jun - Lorillard: 29 May - 25 Jun - Qamanirjuaq: 9 - 22 Jun - Wager Bay: 30 May - 25 Jun

- *Post-Calving Core Range*

A series of density maps (based on a kernel analysis) were developed to identify locations key to nine major life cycles or seasons (spring migration, calving, post-calving, summer, late summer, fall migration/pre-breeding, rut/breeding, fall migration post-breeding, and winter) for each of the caribou subpopulations within Nunavut (Ahiak, Bathurst, Beverly, Bluenose East, Bluenost West, Lorillard, Qamanirjuaq and Wager Bay). The density maps were derived from caribou

collar telemetry data collected at various times between 1993 and 2012. The seasonal density datasets were analysed to identify seasonal home ranges (the area each subpopulation occupies within a specified date range). Within each seasonal range, Core areas were identified for each of the seasons by examining the utilization distributions within each range - the probability of finding a caribou within the range within the specified season. The core areas represent those locations where there is a 95% probability of caribou being present. The post-calving season date range for each subpopulation is as follows: - Ahiak: 26 Jun - 12 Jul - Bathurst: 17 - 28 Jun - Beverly: 20 Jun - 8 Jul - Bluenose East: 21 Jun - 3 Jul - Bluenose West: 24 Jun - 3 Jul - Lorillard: 26 Jun - 13 Jul - Qamanirjuaq: 23 Jun - 3 Jul - Wager Bay: 26 Jun - 12 Jul

- *Summer Core Range*

A series of density maps (based on a kernel analysis) were developed to identify locations key to nine major life cycles or seasons (spring migration, calving, post-calving, summer, late summer, fall migration/pre-breeding, rut/breeding, fall migration post-breeding, and winter) for each of the caribou subpopulations within Nunavut (Ahiak, Bathurst, Beverly, Bluenose East, Bluenose West, Lorillard, Qamanirjuaq and Wager Bay). The density maps were derived from caribou collar telemetry data collected at various times between 1993 and 2012. The seasonal density datasets were analysed to identify seasonal home ranges (the area each subpopulation occupies within a specified date range). Within each seasonal range, Core areas were identified for each of the seasons by examining the utilization distributions within each range - the probability of finding a caribou within the range within the specified season. The core areas represent those locations where there is a 95% probability of caribou being present. The summer season date range for each subpopulation is as follows: - Ahiak: 13 Jul - 12 Aug - Bathurst: 29 Jun - 17 Aug - Beverly: 9 Jul - 12 Aug - Bluenose East: 4 Jul - 12 Aug - Bluenose West: 4 Jul - 2 Aug - Lorillard: 14 Jul - 12 Aug - Qamanirjuaq: 4 Jul - 22 Aug - Wager Bay: 13 Jul - 12 Aug

- *Late Summer Core Range*

A series of density maps (based on a kernel analysis) were developed to identify locations key to nine major life cycles or seasons (spring migration, calving, post-calving, summer, late summer, fall migration/pre-breeding, rut/breeding, fall migration post-breeding, and winter) for each of the caribou subpopulations within Nunavut (Ahiak, Bathurst, Beverly, Bluenose East, Bluenose West, Lorillard, Qamanirjuaq and Wager Bay). The density maps were derived from caribou collar telemetry data collected at various times between 1993 and 2012. The seasonal density datasets were analysed to identify seasonal home ranges (the area each subpopulation occupies within a specified date range). Within each seasonal range, Core areas were identified for each of the seasons by examining the utilization distributions within each range - the probability of finding a caribou within the range within the specified season. The core areas represent those locations where there is a 95% probability of caribou being present. The late summer season date range for each subpopulation is as follows: - Ahiak: 13 Aug - 21 Sep - Bathurst: 18 Aug - 6 Sep -

Beverly: 13 Aug - 11 Sep - Bluenose East: 13 Aug - 6 Sep - Bluenose West: 3 - 22 Aug -
Lorillard: 13 Aug - 21 Sep - Qamanirjuaq: 23 Aug - 16 Sep - Wager Bay: 13 Aug - 21 Sep

- *Winter Core Range*

A series of density maps (based on a kernel analysis) were developed to identify locations key to nine major life cycles or seasons (spring migration, calving, post-calving, summer, late summer, fall migration/pre-breeding, rut/breeding, fall migration post-breeding, and winter) for each of the caribou subpopulations within Nunavut (Ahiak, Bathurst, Beverly, Bluenose East, Bluenost West, Lorillard, Qamanirjuaq and Wager Bay). The density maps were derived from caribou collar telemetry data collected at various times between 1993 and 2012. The seasonal density datasets were analysed to identify seasonal home ranges (the area each subpopulation occupies within a specified date range). Within each seasonal range, Core areas were identified for each of the seasons by examining the utilization distributions within each range - the probability of finding a caribou within the range within the specified season. The core areas represent those locations where there is a 95% probability of caribou being present. The winter season date range for each subpopulation is as follows: - Ahiak: 16 Dec - 5 Apr - Bathurst: 1 Dec - 9 Apr - Beverly: 16 Dec - 9 Apr - Bluenose East: 26 Dec - 9 Apr - Bluenose West: 1 Dec - 24 Apr - Lorillard: 16 Dec - 4 Apr - Qamanirjuaq: 16 Dec - 14 Apr - Wager Bay: 16 Dec - 31 Mar

- *Fall Migration Pre-Breeding Corridors*

A series of density maps (based on a kernel analysis) were developed to identify locations key to nine major life cycles or seasons (spring migration, calving, post-calving, summer, late summer, fall migration/pre-breeding, rut/breeding, fall migration post-breeding, and winter) for each of the caribou subpopulations within Nunavut (Ahiak, Bathurst, Beverly, Bluenose East, Bluenost West, Lorillard, Qamanirjuaq and Wager Bay). The density maps were derived from caribou collar telemetry data collected at various times between 1993 and 2012. The seasonal density datasets were analysed to identify seasonal home ranges (the area each subpopulation occupies within a specified date range). Within each seasonal range, Core areas were identified for each of the seasons by examining the utilization distributions within each range - the probability of finding a caribou within the range within the specified season. The core areas represent those locations where there is a 95% probability of caribou being present. The date ranges for fall, pre-breeding migration varies between subpopulations and have been fine-tuned based on a yearly analysis, but generally are the following: - Ahiak: 22 Sep - 22 Oct - Bathurst: 7 Sep - 16 Oct - Beverly: 12 Sep - 20 Oct - Bluenose East: 7 Sep - 11 Oct - Bluenose West: 23 Aug - 12 Oct - Lorillard: 22 Sep - 22 Oct - Qamanirjuaq: 17 Sep - 18 Oct - Wager Bay: 22 Sep - 22 Oct

- *Fall Migration Post-Breeding Corridors*

A series of density maps (based on a kernel analysis) were developed to identify locations key to nine major life cycles or seasons (spring migration, calving, post-calving, summer, late summer, fall migration/pre-breeding, rut/breeding, fall migration post-breeding, and winter) for each of

the caribou subpopulations within Nunavut (Ahiak, Bathurst, Beverly, Bluenose East, Bluenost West, Lorillard, Qamanirjuaq and Wager Bay). The density maps were derived from caribou collar telemetry data collected at various times between 1993 and 2012. The seasonal density datasets were analysed to identify seasonal home ranges (the area each subpopulation occupies within a specified date range). Within each seasonal range, Core areas were identified for each of the seasons by examining the utilization distributions within each range - the probability of finding a caribou within the range within the the specified season. The core areas represent those locations where there is a 95% probability of caribou being present. The date ranges for fall, post-breeding migration varies between subpopulations and have been fine-tuned based on a yearly analysis, but generally are the following: - Ahiak: 9 Nov - 15 Dec - Bathurst: 1 - 30 Nov - Beverly: 4 Nov - 15 Dec - Bluenose East: 5 Nov - 25 Dec - Bluenose West: 8 - 30 Nov - Lorillard: 9 Nov

- *Spring Migration Corridors*

A series of density maps (based on a kernel analysis) were developed to identify locations key to nine major life cycles or seasons (spring migration, calving, post-calving, summer, late summer, fall migration/pre-breeding, rut/breeding, fall migration post-breeding, and winter) for each of the caribou subpopulations within Nunavut (Ahiak, Bathurst, Beverly, Bluenose East, Bluenost West, Lorillard, Qamanirjuaq and Wager Bay). The density maps were derived from caribou collar telemetry data collected at various times between 1993 and 2012. The seasonal density datasets were analysed to identify seasonal home ranges (the area each subpopulation occupies within a specified date range). Within each seasonal range, Core areas were identified for each of the seasons by examining the utilization distributions within each range - the probability of finding a caribou within the range within the the specified season. The core areas represent those locations where there is a 95% probability of caribou being present. The date ranges for spring migration varies between subpopulations and have been fine-tuned based on a yearly analysis, but generally are the following: - Ahiak: 6 Apr - 12 Jun - Bathurst: 20 Apr - 1 Jun - Beverly: 10 Apr - 5 Jun - Bluenose East: 10 Apr - 27 May - Bluenose West: 25 Apr - 28 May - Lorillard: 5 Apr - 28 May - Qamanirjuaq: 15 Apr - 8 Jun - Wager Bay: 1 Apr - 29 May

- *Historic Caribou Calving Areas*

Caribou Calving Areas on the NWT mainland and islands. The NA_mainland and NA_calving shapefiles were produced as part of the International Arctic Science Committee project: "Human role in reindeer/caribou systems". A. Gunn and B. Fournier (Department of Resources, Wildlife and Economic Development, Government of the Northwest Territories, 2000.

- *Water Crossings*

No shape file is included for caribou water crossings because NPC will have shape files for the Soper, Thelon and Kazan Heritage Rivers.

- *Peary Caribou trans-island movements Somerset Prince of Wales Island*

Peary caribou presence data on Somerset Island, Prince of Wales Island, and the Boothia Peninsula in the mid-1960s to mid-1970s. Digitized by WWF Global Arctic Programme from Fig 4.1 of: Taylor, Alexandra D.M. 2005. Inuit Qaujimajatuqangit about Population Changes and Ecology of Peary Caribou and Muskoxen on the High Arctic Islands of Nunavut. Masters Thesis. Queens University, Ontario

- *Peary Caribou and Dolphin Union caribou herd trans-island movements*

Trans-island movements of island caribou on the sea ice. For the Bathurst Island Complex, the data are from Jenkins and Lecomte (2012). Movements between Prince of Wales and Somerset Island are from Miller et al. (2005). Paths between Victoria Island and the continent are from M. Dumond (Government of Nunavut) and Poole et al. (Poole et al. 2010), a possible intermediate zone between barren-ground and the Peary Caribou.

See provided report by Jenkins and LeComte for additional information.

- *Peary Caribou range in the Canadian Arctic*

Digitized by WWF Global Arctic Program from Fig. 1 from: Jenkins et al. 2011. Recent trends in abundance of Peary Caribou (*Rangifer tarandus pearyi*) and Muskoxen (*Ovibos moschatus*) in the Canadian Arctic Archipelago, Nunavut. Department of Environment, Government of Nunavut, Wildlife Report No. 1, Pond Inlet, Nunavut. 184 pp.

See provided report by Jenkins et al 2011 for all survey observations of Peary caribou.

- *Example of Inuit knowledge of Peary caribou distribution*

Peary caribou presence data on Somerset Island, Prince of Wales Island, and the Boothia Peninsula in the mid-1960s to mid-1970s. Digitized by WWF Global Arctic Programme from Fig 4.1 of: Taylor, Alexandra D.M. 2005. Inuit Qaujimajatuqangit about Population Changes and Ecology of Peary Caribou and Muskoxen on the High Arctic Islands of Nunavut. Masters Thesis. Queens University, Ontario

See provided thesis (Taylor_PearyCaribouthesis.pdf) for additional map information.

- *Shape files not included but NPC can request:*

Nunavut Department of Environment completed analyses of Peary caribou distribution and abundance. The reports are provided but due to logistical reasons it is not possible to provide the shape files at this time (biologist has been away). NPC can request the shapefiles that are in the reports.

2. Marine Habitat: Ecologically and Biologically Sensitive Areas (EBSA)

One (1) shape file is included that was derived from the Department of Fisheries and Oceans (2011) report: Identification of Ecologically and Biologically Significant Areas (EBSA) in the Canadian Arctic. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2011/055.

3. Polynyas

One (1) shape file is included.

The purpose of this project was to expand on previous polynya studies using daily MODIS satellite image data to detect open water features with high spatio-temporal frequency over the period July 2002 to June 2013 for the Canadian Arctic. Using sea ice temperature (MOD29/MYD29), polynyas were identified as locations that exhibit a probability of open water greater than 20% over the 11 year period. The map submitted describes the polynyas observable for the week beginning May 5. The grid cell size is 4x4 km. This map was produced in raster format and then vectorized in ArcMap by Selina Abayani and reviewed by Vicki Sahanatien. Data created for WWF Global Arctic Programme by David Currie, P.Eng. Canatec Associates International Ltd. January 2012.

Due to the grid cell size (4x4km), most small, coastal polynyas were not detected, in particular: Fury and Hecla Strait, Bellot Strait, Franklin Strait, Lambert Channel, Bathurst Island, Karluk Booman, and Flager Bay (see Barber and Masson 2007 and Hannah et al. 2009). These smaller polynya are also important wildlife habitat and should be considered for protection by the NPC.

4. Polar Bear Habitat

Five (5) shapes files are included and are a combination of Inuit knowledge and scientific studies.

- *Summer Retreat Foxe Basin*
Polar Bear density data based on the expert judgment of Seth Stapleton (University of Minnesota) based on the aerial survey sampling and sightings data collected during 2009 - 2010. Regions categorized as high-density generally aligned w/ regions post-stratified as high-density during abundance estimation analysis. For more information, see the Foxe Basin aerial survey report to the GN.
- *Summer Retreat GNDoe*
Dept. of Environment, Government of Nunavut. Provided to the WWF Global Arctic Programme by Markus Dyck. See attribute table for sources.
- *Winter Concentrations GNDoe*
Dept. of Environment, Government of Nunavut. Provided to the WWF Global Arctic Programme by Markus Dyck. See attribute table for sources

- *Denning Peterson et al 2013*
Data from: Stephen D. Petersen, Jeff W. Higdon, and Heather Penner. 2013. Polar bear den monitoring the Canadian Arctic. Report prepared for WWF-Global Arctic Programme. See attribute table for sources
 - *Denning GNDoe*
Dept. of Environment, Government of Nunavut. Provided to the WWF Global Arctic Programme by Markus Dyck. See attribute table for sources
 - *Predicted Polar Bear Habitat 2020, 2030 and 2040*
These maps were developed by Stephen Hamilton and Laura Castro de la Guardia, University of Alberta for the WWF - Global Arctic Programme. The purpose was to use high resolution (18x18km grid size) sea ice projections (MITgcm model run at RCP8.5 forcing (business as usual scenario)) to model future polar bear sea ice habitat. The sea ice projection model was completed by Huard and Tremblay 2013. Stephen and Laura completed the polar bear habitat modeling (2013).
 - *Shape files not included but NPC can request:*
Nunavut Department of Environment completed analyses for land use planning that mapped polar bear distribution and described important sea ice habitats. These maps are provided in pdf format but not the shape files. NPC can request the shapefiles.
- 5. Sea ice Habitat of the Canadian Arctic Archipelago**
- Two (2) shape files are included. Additional pertinent shape files in this submission are: Peary caribou habitat and ice crossing, future polar bear habitat, oil and gas and hydrocarbon potential.
- *Predicted 2040 Sea Ice CCSM3*
Predicted minimum sea ice extent in 2040 (NCAR, 2007)
 - *Last Ice Area Boundary*
The Arctic Region that is expected to retain its summer sea ice habitat until 2050. The delineation of the boundary loosely based on various climate projections such as (but not excluding) the CCSM3.
 - *Shape files not included but NPC can request:*
 - Environment Canada information on migratory bird habitat and colonies
 - Nunavut Department of Environment information on the proposed boundaries for the Fosheim Peninsula–Axel Heiberg Island High Biodiversity Area

6. Minerals, Oil and Gas

Three (3) shape files are included

- *Sedimentary Basins of Canada*

This data shows the underlying sedimentary basins that influence the 19 exploration regions of northern Canada. The definition of “basin” here is deliberately loose and may not conform with a rigorous technical definition. It recognises that structural or geographic discontinuities separating areas with common petroleum geology subdivide the territories into theatres of operation where costs bear a consistent relationship to exploration risk and potential reward. The rigour of treatment of individual basins varies according to perceived potential: basins with low potential are summarized briefly, with more detailed treatment reserved for basins with high potential. Source: INAC, 1995.

- *Nunavut Hydrocarbon Potential*

This data shows play fairways for ultimate risked hydrocarbon potential in the Arctic Islands. Archean rocks have no potential while the Sverdrup Basin has the highest hydrocarbon potential. The higher potential regions define fairways where 16 hydrocarbon resources are most likely to be found. These are the areas that would be the focus of future exploration activities and would have the greatest impact on the Last Ice Area.

- *Arctic Oil and Gas Licenses*

This dataset is a compilation of past and current oil and gas licences/permits within the Arctic Region. This dataset includes both production and exploratory licences, as well as applications for licenses, calls for bids, or areas identified in current licensing rounds. This shape for unknown reasons does not include the Bent Horn site.