GN INFORMATION REQUEST 18:

Accordingly the GN requests the following:

- *Clarification whether 2015-16 collaring data from Dolphin and Union caribou were used in the analyses of movements and range use as part of the baseline characterization.*
- *If the 2015-16 data were used in the above analyses, separate baseline analyses of range use and movements are requested for each time period (pre and post 2009) for the Dolphin and Union. Similar analyses are also requested for the Beverly herd.*
- *Maps showing the core (50%) and 95% winter range of the Dolphin and Union caribou herd for each of the two time periods (pre and post 2009).*
- *An assessment of whether the seasonal overlap between each herd and the Project (LSA and RSA) has changed significantly between these two time periods.*
- *Recognizing the substantial overlap between the Project and the core winter range of the Dolphin and Union herd, along with the herds listed status under SARA, a residency time analyses is also requested as part of the baseline characterization of range use and movements. This should use collar data to examine the proportion of collar locations during the winter that occurred within the Project's LSA and RSA. This should be done separately for each time period (pre and post 2009) to assess how baseline range use may have changed.*

TMAC RESPONSE ON MARCH 17:

GN-IR18 is requesting clarification and additional GIS analysis for the Dolphin and Union caribou.

- TMAC notes that all available collar data was used in the calculation of seasonal ranges for the Dolphin and Union caribou, including both 1999-2004 and 2015-16 collar data and displayed in Volume 4, Figures 9.2-1, 9.2-7, 9.2-8, 9.2-9, 9.2-10 and 9.8-2 which reference this data. The text of Section 9.2.6.2 Baseline Data will be updated with the clarification in the FEIS.
- In response to the GN reviewer's request to conduct a separate analysis pre and post 2009 for the Dolphin and Union herd, TMAC notes that prior to conducting the GIS analysis to map seasonal range for the Dolphin and Union caribou, TMAC had discussions with regional biologists responsible for this herd. These biologists requested that the 2015-2016 data not be analyzed separately because the low number of collars and the fact that collars were on animals for less than two years increases the chances of producing erroneous results.

- Distribution maps for each year for the Beverly/Ahiak caribou are being produced in response to GN-IR16.
- In response to the GN request for a residency time analysis, TMAC is willing to conduct this analysis, but notes that it is of a technical nature. Due to the large amount of GIS processing required for this analysis, these results along with interpretation of the data will be supplied on March 31, 2017; however, TMAC notes that this additional work goes beyond what is typically considered to be an IR, and the analysis is of a technical nature, thereby enabling the technical review period to commence upon the receipt of this IR package on March 17.

TMAC ADDITIONAL INFORMATION PROVIDED ON MARCH 31:

As requested, TMAC conducted a residency analysis of Dolphin and Union [Island] caribou during the winter period. During winter, these caribou use the north coast of the Nunavut mainland within approximately 200 km of the Arctic Ocean coast. Satellite collar data are available for the periods of 1999-2004 and 2015-2016. During winter, Dolphin and Union caribou are observed at the Doris Project site and are expected to co-exist with the proposed Madrid-Boston development.

During the four month winter period, between December 1 and April 24, satellite collars were active for a total period of 243,912 hours. Satellite collars recorded locations every one to five days, depending on the year, collar type and settings.

The duration of time spent in the Regional Study Area (RSA), 4 km buffer around the Project, Local Study Area (LSA) and Project Development Area (PDA) were calculated to determine the residency time in these areas. Analysis was conducted in ARCGIS 10 to calculate the path taken by each collared caribou. These paths were divided into segments and the length of each segment was calculated within the four study areas and then converted into a duration based on the time between collar locations for each segment. This analysis method is more accurate than simply calculating the proportion of collar locations in the study areas because it includes the time spent traveling through the study area even if collar locations are located outside the study area (i.e., a caribou crossed the study area between collar fixes).

This analysis indicated that the average caribou spends 11.6 days within the RSA, a rectangle measuring 4,904 km^2, and approximately 60 km X 100 km with the northern end following the coastline. The average caribou spends 1.09 days per winter in the LSA which is 563 km^2, 0.18 days per winter inside the 4 km buffer surrounding the Project used in the analysis of disturbance, and 0.039 days per winter in the PDA, which extends on average of 1 km from the Project footprint.

GN INFORMATION REQUEST 21:

Accordingly the GN requests the following information:

1. *Maps showing the travel routes (tracks) of individual collared Dolphin and Union caribou during the spring and fall migrations. These maps should also show the Project, its LSA and RSA, including existing roads and proposed road alignments. Separate maps are requested for collar data collected prior to 2009 and after 2009.*
2. *Analyses of available collar data for Dolphin and Union caribou (1999-2006 and 2015-2016) summarizing the routes taken by collared individuals in relation to the Project's regional and local study areas during the spring and fall migrations. The analyses should be conducted separately for the periods 1999-2006 and 2015-16 since these two time periods represent different stages the development of the Hope Bay project. The analyses should include metrics such as: (1) the proportion of collared individuals that crossed the PDA, LSA and RSA during any point in their migration; (2) the proportion of collared individuals whose track crossed the current existing road alignments (i.e. Doris to Roberts Bay, Doris to Madrid) at any point in their migration (regardless of whether those roads were present at the time of crossing); (3) the proportion whose track crossed proposed road alignments such as the Boston road at any point in their migration; (4) The number of times each collared individual crossed the PDA, LSA, RSA, existing roads and proposed road alignments during migration; (5) the locations where collared animals moved from land to sea-ice or from sea-ice to land during migration (as defined by a straight line between two successive locations; one on land the other on sea-ice).*
3. *Analyses of collar data to summarize the locations where migrating caribou cross the PDA, LSA, RSA, existing roads and proposed road alignments to illustrate the distribution of crossing points. This may serve to identify commonly used routes where mitigation measures such as road crossing structures could be placed. Separate analyses are requested for the two periods 1999-2006 and 2015-2016. Maps and other figures to illustrate the results of these analyses are requested. For telemetry tracks that intersect the Boston road, a frequency distribution curve presented with 5 km bins to summarize the points along the road (e.g. @ km 2, 10, 17)where individuals cross is requested.*
4. *With respect to the movements of Dolphin and Union caribou on their winter range, analyses of available collar data (1999-2006 and 2015-2016) summarizing the following: (1) the proportion of collared individuals whose track crossed existing road alignments at any point during the winter (regardless of whether those roads were present at the time of crossing); (2) the proportion whose track crossed proposed road alignments such as the Boston road at any point during the winter; (3) The number of times each*

collared individual crossed an existing road or proposed road alignment during the winter. The analyses should be conducted separately for the periods 1999-2006 and 2015-16 since these two time periods represent different stages the development of the Hope Bay project. An analysis similar to that outlined in item 3) above is also requested for the winter period but for crossings of existing and proposed roads only.

TMAC RESPONSE ON MARCH 17:

The DEIS concludes that the Project will not adversely disrupt caribou movements. The DEIS summarizes and provides information to allow for an assessment of effects of the Project on terrestrial wildlife. Data has been summarized by wildlife biologists and in some cases generalizations have been made as appropriate for the assessment. Hence, the movement of caribou through the RSA has been summarized between different types of data for the DEIS.

The GN is requesting a detailed analysis of collar data to determine the routes taken by individual caribou through the RSA. TMAC is conducting this analysis. Due to the large amount of GIS processing required for this analysis, these results along with interpretation of the data will be supplied on March 31, 2017. TMAC notes that this additional work goes beyond what is typically considered to be an IR, and the analysis is of a technical nature, thereby enabling the technical review period to commence upon the receipt of this IR package on March 17, 2017.

TMAC RESPONSE ADDITIONAL INFORMATION ON MARCH 31:

The following response provides additional detail on the movements of Dolphin and Union caribou during spring and fall migration and during winter, relative to the Doris project and proposed Boston road.

Satellite collar data is available for the Dolphin and Union [Island] caribou for the periods of 1999-2004 and 2015-2016. Through discussions with the GN biologist responsible for the Dolphin and Union herd, TMAC was requested to display these data as a combined dataset. Moreover, only three crossing events were recorded for the existing Doris roads, with all data combined, which is too few to conduct the detailed before-after analysis requested by the GN. It should be noted that the collaring program on the east side of Bathurst Inlet during 2015 and 2016 was based from the Doris Site and collared caribou at distances proximal to Doris. Therefore the data for 2015 and 2016 are more likely to be from animals who occupied the winter habitat near the Project, thereby potentially increasing the encounter rate between collared caribou and Project infrastructure reported here.

Between years, satellite collars recorded the tracks of over 100 caribou, providing a good sample size to describe caribou movement for the Dolphin and Union herd.

Movements and wintering areas of collared caribou followed migration routes and winter habitat identified by Inuit TK (see below). In general, few collared caribou interacted with either the existing Doris infrastructure, or the alignment of the proposed Boston road.

Figure GN-IR21-1 displays the satellite collar tracks made by Dolphin and Union caribou over their entire spring migration area, on both east and west sides of Bathurst Inlet. Satellite collars recorded a total of 108 spring migration events.

Figure GN-IR21-2 displays the satellite collar tracks made by Dolphin and Union caribou during the spring migration in the project Regional Study Area (RSA). This figure indicates that caribou generally follow a south to north movement pattern, generally parallel to the proposed Boston road. As discussed in the DEIS, concentrations of caribou migrated north along the Kent Peninsula Isthmus, and across Melville sound anywhere that travel distances were decreased by the presence of peninsulas, or islands in the sound. Since Melville Sound is frozen during spring migration, caribou can proceed directly north on the mainland, cross Melville Sound and the Kent Peninsula and proceed to Victoria Island. These data indicate that Roberts Bay is not an area where a concentration of northward migration occurs.

Satellite collar data indicate that a total of three collared caribou have crossed the existing Doris infrastructure roads, and a further five caribou have crossed the proposed Boston road (Figure GN-IR21-2). One caribou (PTT 22876) spent several days on the Doris site in 2003, leaving a cluster of tracks on the Doris site in Figure GN-IR21-2. One caribou crossed both the proposed Boston road and the existing Doris road during spring migration. These crossing represent 7% of northward spring migrations recorded by satellite collars.

Figure GN-IR21-3 displays the satellite collar tracks made by Dolphin and Union caribou over the entire fall migration area, on both east and west sides of Bathurst Inlet. Satellite collars recorded a total of 96 fall migration events. This map indicates that the vast majority of satellite collared caribou that use the east side of Bathurst Inlet migrate from Victoria Island to the Kent Peninsula and then south along the Kent Peninsula Isthmus (Etibliakyok), as described in TK.

Figure GN-IR21-4 displays the satellite collar tracks made by Dolphin and Union caribou during the fall migration in the RSA. Zero collared caribou used Roberts Bay or crossed the existing Doris roads during fall migration. Nine collared caribou crossed the proposed Boston road, which represents 9% of the southern fall migrations recorded by satellite collars.

Figure GN-IR21-5 displays the 112 satellite collar tracks made by Dolphin and Union caribou during the winter. During winter, caribou follow short-scale movements on the landscape, without the relatively rapid, directional movements associated with

spring and fall migrations. During winter, one collared caribou crossed the existing Doris roads, and five additional caribou crossed the route of the proposed Boston road, which represents 5% of the winter collared caribou.

The winter distribution of collared Dolphin and Union caribou closely matches the habitat areas identified by TK and displayed in Volume 4, Figure 9.8-1 of the DEIS, with concentrations of caribou observed south of the Kent Peninsula Isthmus, an area starting approximately 20 km south of Boston and an area inland from Omingmaktok to the west of the Project.

As part of GN-IR21, the GN requested a detailed analysis of the locations where crossings occurred for satellite collared caribou. Figures GN-IR21-2 and GN-IR21-4 illustrate that during the spring and fall migrations, that caribou are moving relatively quickly and satellite position fixes are relatively far apart (5-10 km). These data are unsuitable for the detailed analysis proposed by the GN. In addition, analysis of Dolphin and Union collar data identified only 14 caribou crossing events (of existing Doris and proposed Boston roads) during fall, winter and spring combined and it does not appear that there were any patterns to the locations where caribou chose to cross the proposed Boston road.

As part of the Doris Project, TMAC worked with the Inuit Advisory Committee to visit site and identify areas with an increased caribou trail density and where elders felt that caribou more likely to cross the road. Road crossing structures were then constructed at these locations. As part of the DEIS, TMAC has indicated that it will continue to work with the Inuit Advisory Committee to identify areas where caribou may cross the Boston road and identify where sloped banks could be created at points along the road similar to the existing sloped banks on other portions of the AWR.

Figure GN-IR21-1
Spring Migration Travel Paths of Dolphin and Union Caribou in the Region Surrounding the Project, 1999 to 2004 and 2015 to 2016

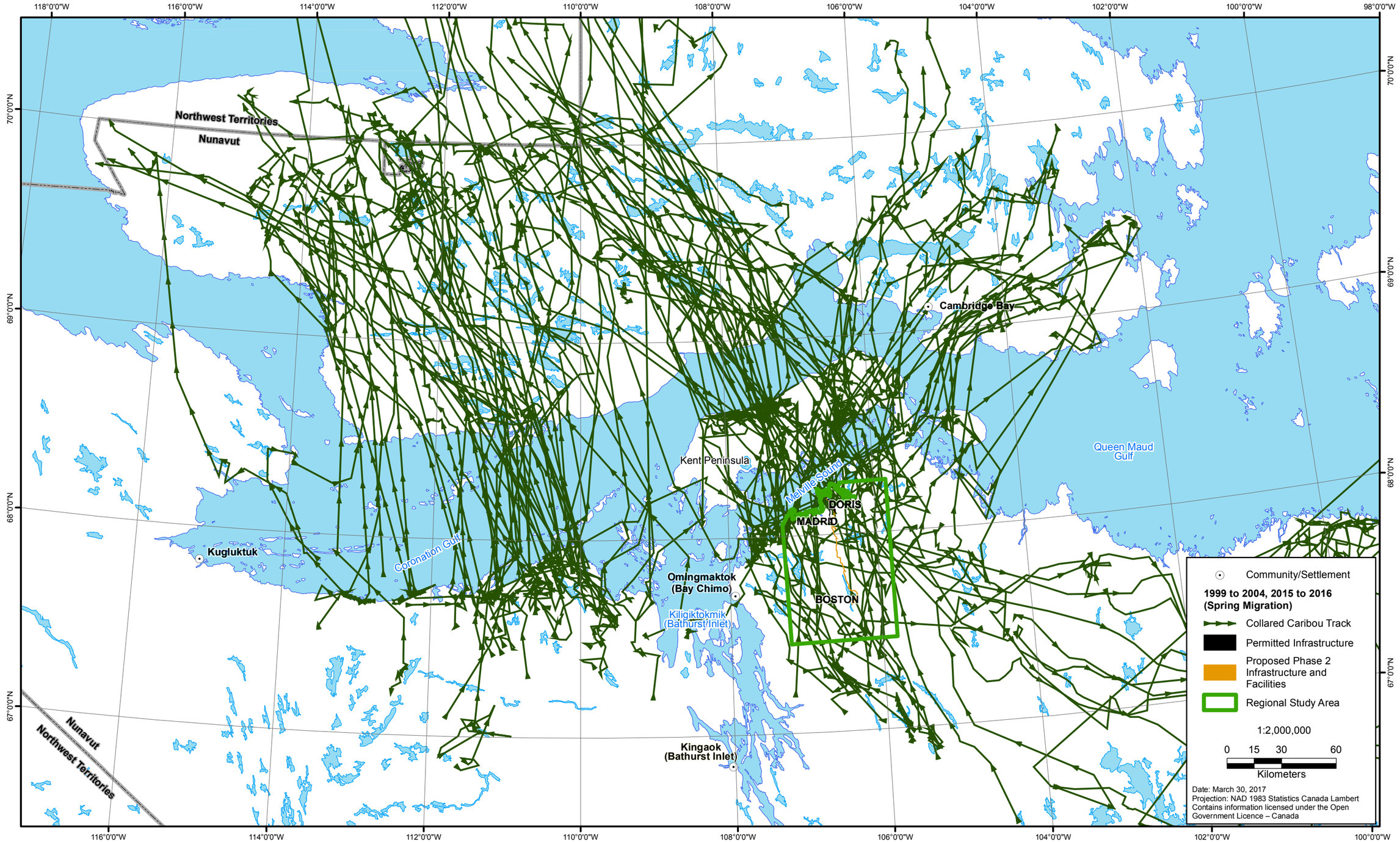


Figure GN-IR21-2
Spring Migration Travel Paths of Dolphin and Union Caribou in relation to the Project, 1999 to 2004 and 2015 to 2016

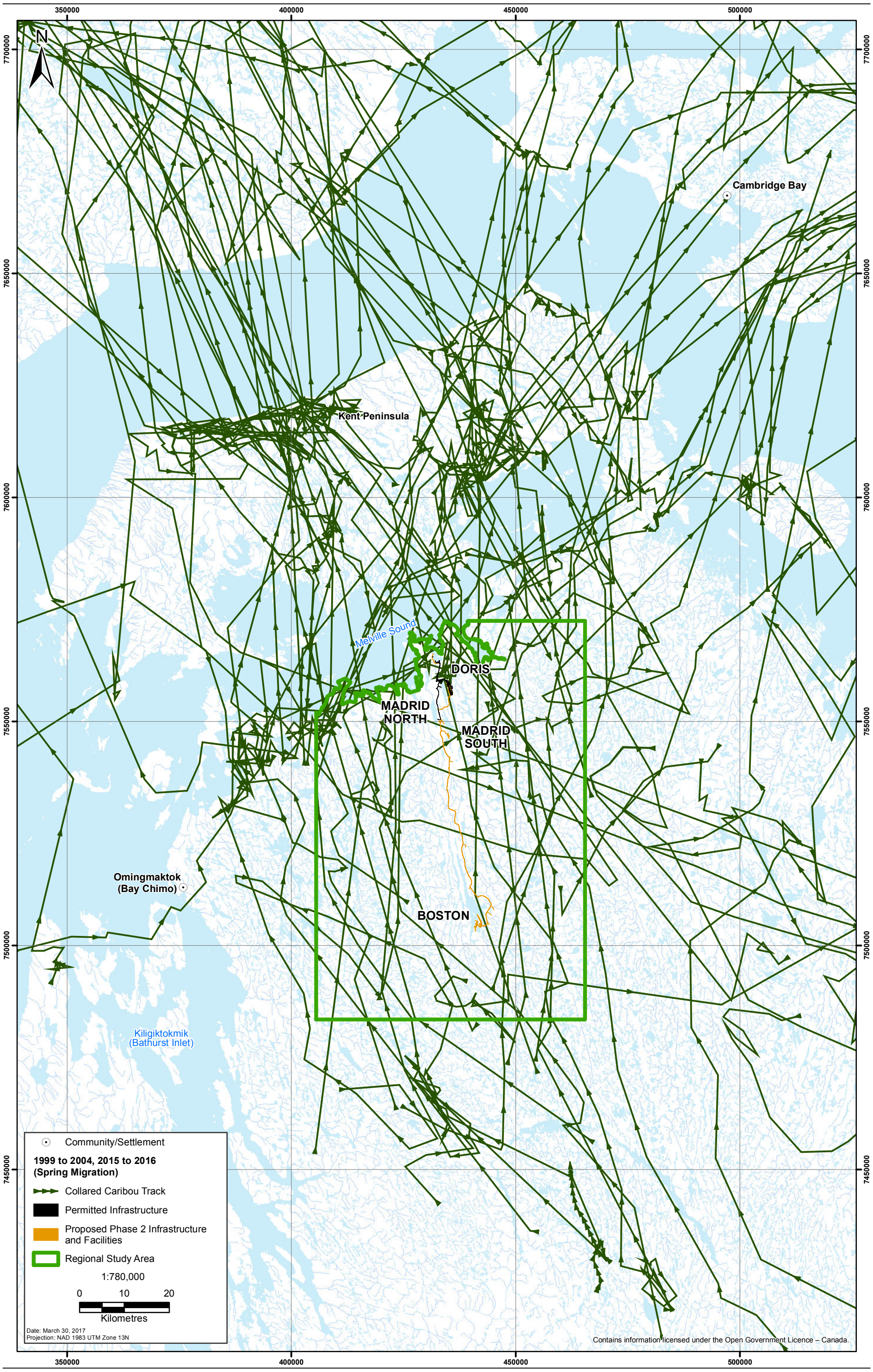


Figure GN-IR21-3
Fall Migration Travel Paths of Dolphin and Union Caribou in the Region Surrounding the Project, 1999 to 2004 and 2015 to 2016

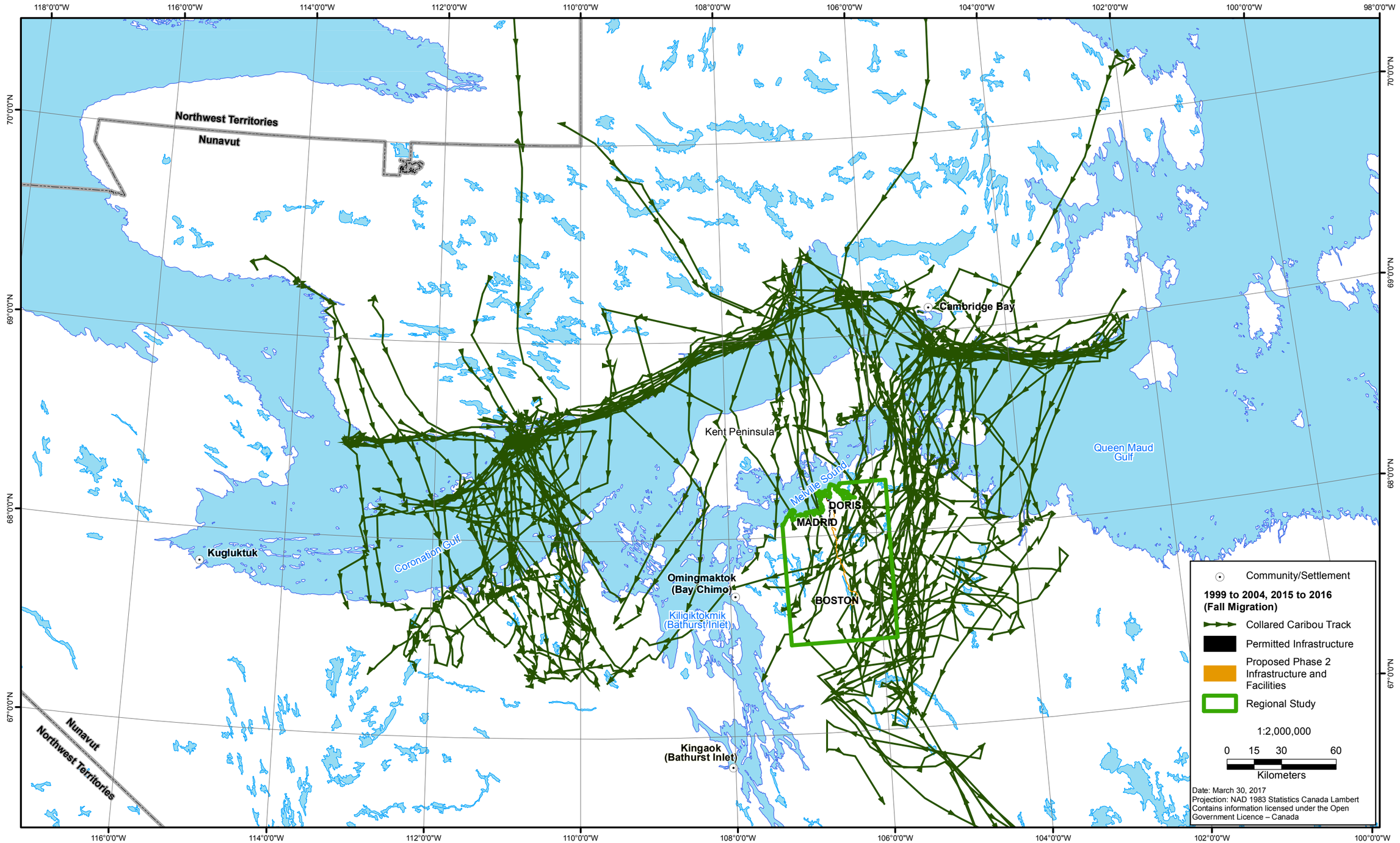


Figure GN-IR21-4
Fall Migration Travel Paths of Dolphin and Union Caribou in relation to the Project, 1999 to 2004 and 2015 to 2016

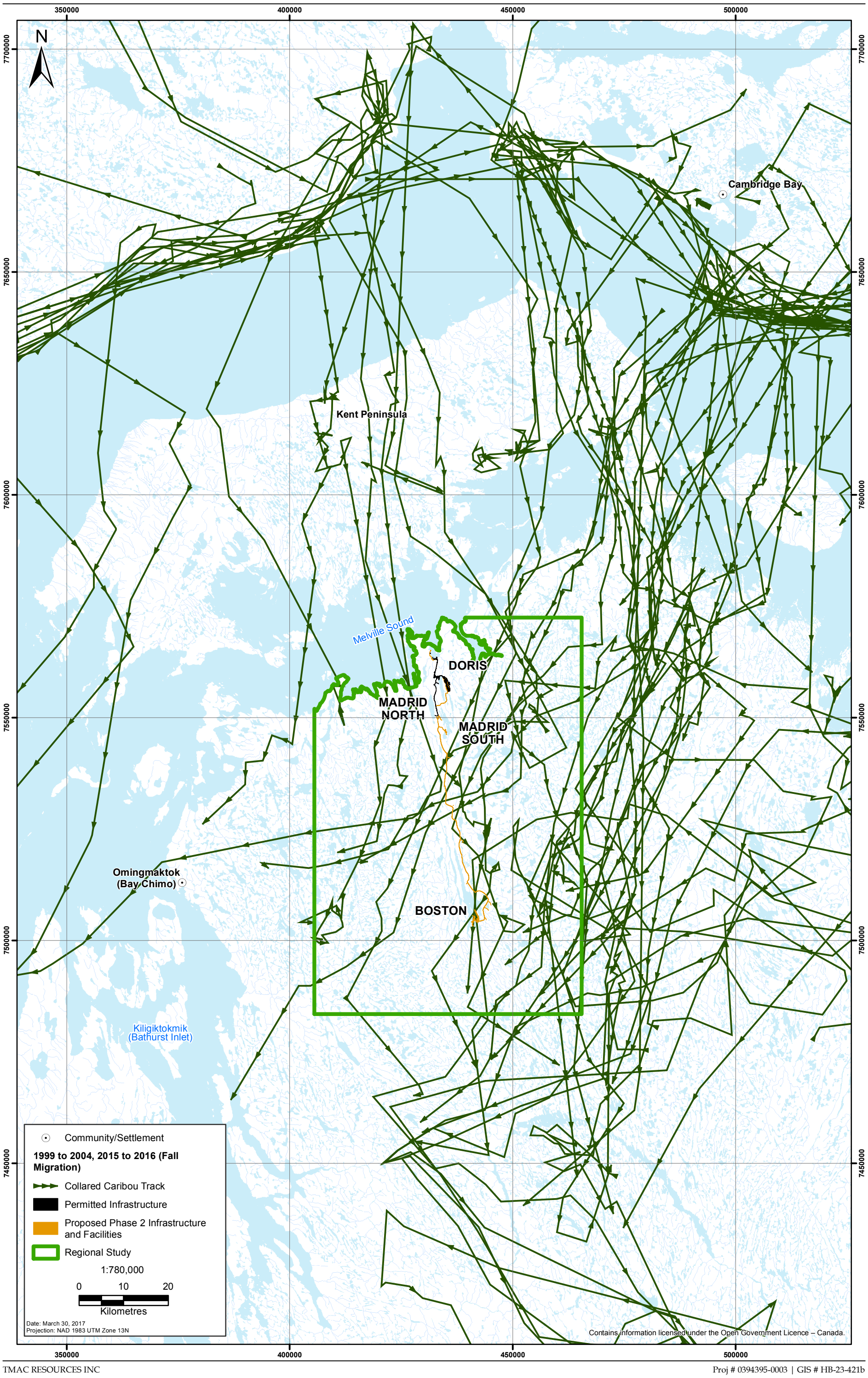
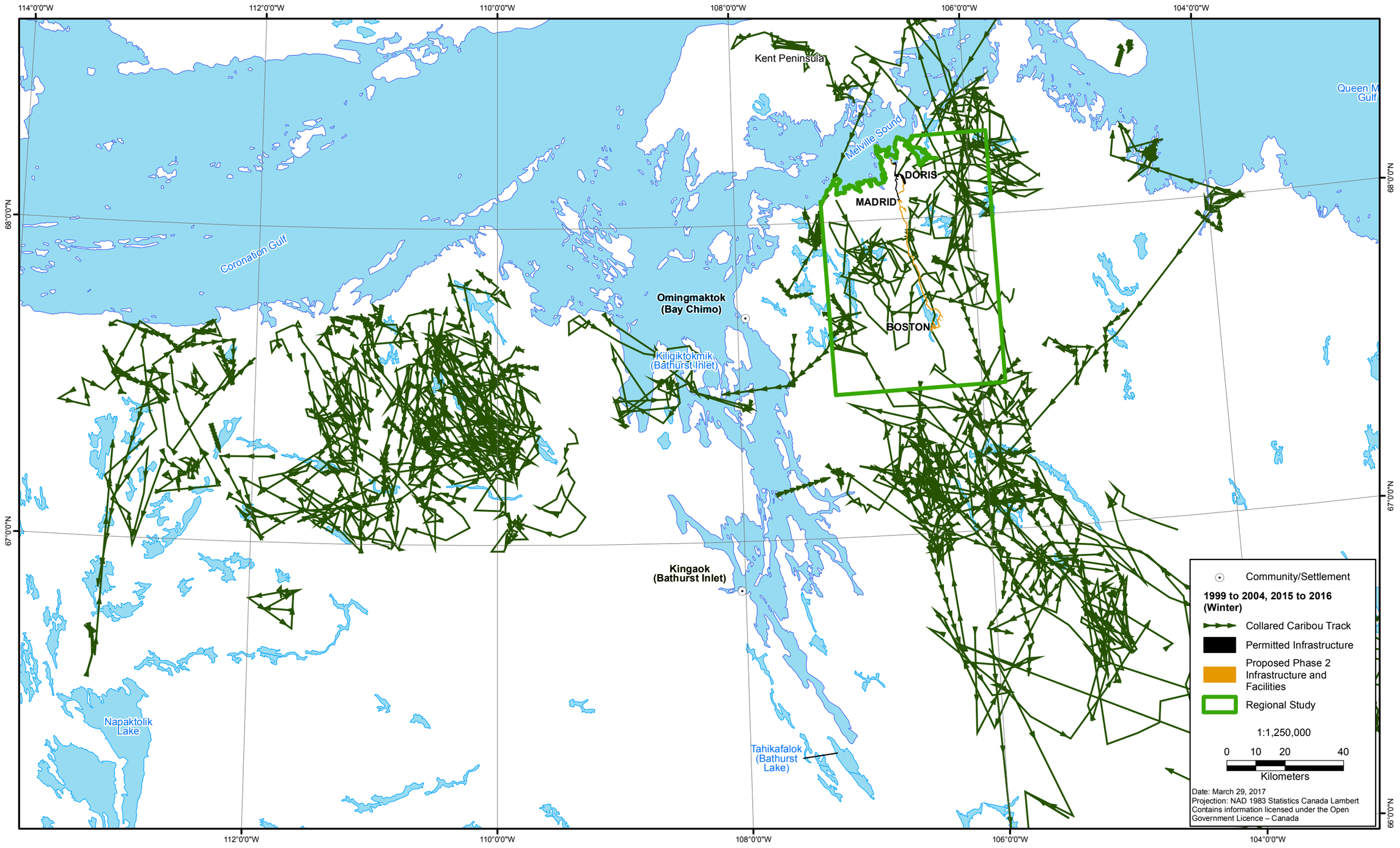


Figure GN-IR21-5
Winter Travel Paths of Dolphin and Union Caribou, 1999 to 2004 and 2015 to 2016



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