GNWT Response to:
GoC ECCC IR#6 (ID8)

Topic
Boreal Caribou – Habitat Connectivity – Recovery Strategy for the Woodland Caribou, Boreal Population, in Canada (PR#38)

Comment
The federal Recovery Strategy states that "connectivity of habitat both within a range and between ranges is essential for Boreal Caribou persistence on the landscape." The federal Recovery Strategy adds that any activity resulting in the fragmentation of habitat by human-made linear features is likely to result in the destruction of critical habitat. The likelihood of the destruction of critical habitat is increased if there is reduced connectivity within a range. The Proponent provides qualitative descriptions of the distribution of available Boreal Caribou habitat within NT1 at base case, application case and reasonable foreseeable development case. However, no quantitative measurement of Boreal Caribou habitat connectivity is provided to support conclusions for each of these cases.

Recommendation
ECCC requests that the Proponent provide quantitative assessments of Boreal Caribou habitat connectivity within NT1 for each of the assessed cases (base case, application case and reasonable foreseeable development case) using recognized metrics and methods.

GNWT Response
Figures 4.2-3, 4.4-1, and **4.4-6** of the ASR (PR#110) show the distribution of suitable boreal caribou habitat in the Base Case, Application Case, and Reasonably Foreseeable Development (RFD) Case, respectively. All undisturbed habitat is considered to be suitable habitat. These have been appended to this IR response for convenience. As requested, an additional quantitative analysis was conducted using these data to inform this response. Specifically, changes in boreal caribou habitat connectivity were determined numerically within a GIS platform using the program FRAGSTATS (Version 4.2; McGarigal et al. 2002, internet site).

To complete the FRAGSTATS analysis, each raster cell in a 20 metre resolution SPOT 4/5 landcover dataset in the NT1 range was assigned to either 1) undisturbed habitat, 2) habitat disturbed by fire, or 3) habitat within developed areas, including a 500 m buffer around development. Due to the size of the NT1 Range, data resampling was undertaken to a 60 m resolution in order for FRAGSTATS to run efficiently. Land cover type assignment at the larger 60 m scale used the nearest neighbour rule in ArcGIS (version 10.4, Redlands, CA). The nearest neighbour rule during resampling searches for the assigned class of the nearest pixel centroid at the 20 m resolution and assigns that land cover class to the pixel at the 60 m resolution. The largest difference in areas of habitat types between the 20 m resolution and the 60 m resampled resolution was an increase of 3.5% for buffered disturbance. All other habitat areas at the 60 m resolution were within less than 0.01% of areas at the original 20 m resolution.

Table 1 provides the results for the Base Case, Application Case and RFD Case for number of patches, mean patch area and mean nearest neighbour distance and associated coefficients of variation. Larger coefficients of variation (CV) values indicate a greater degree of variability. Table 2 provides the absolute and relative changes in the number of patches, mean patch area and mean nearest neighbour distance associated with the Application Case relative to the Base Case. Table 3 provides the results for the RFD Case relative to the Base Case. A CV is presented for each mean value and describes variability standardized to the mean. The CV was calculated by dividing the standard deviation (population formula) by the mean and multiplying this value by 100 to express the result as a percentage.

Results for the Base Case indicate that the largest number of habitat patches consist of undisturbed habitats (90,839 patches) followed by fire disturbance (4,320 patches) and buffered development (1,212). Mean patch size is largest for buffered development (3,051 ha) followed by fire disturbance (2,352 ha) and undisturbed habitat (307 ha). Thus, development and fire occur in large, spatially separated patches, whereas undisturbed habitat is associated with a larger number of smaller and well-connected patches. Most of these smaller patches occur south and west of Highway 1 as a result of high density linear developments, or are remnant patches within large burned areas (**Figure 4.2-3**).

Coefficients of variation at the Base Case indicate that there is a high degree of variation in mean patch area for all habitat types, but especially for undisturbed habitat (Table 1). This is because, in addition to large numbers of very small patches of habitat within burns and areas of high density linear development, very large patches of contiguous undisturbed habitat are present in the northern part of the NT1 range, especially east of Highway 1 (**Figure 4.2-3**).

The mean nearest neighbour distance between similar patch types was largest for buffered developments (2,422 m), followed by fire disturbance (965 m) and then undisturbed habitat (277 m). The coefficients of variation for nearest neighbour distance indicate that fire and undisturbed habitats are more clustered on the landscape than buffered developments, which are relatively more evenly distributed throughout the NT1 range (**Figure 4.2-3**). Nagy (2011) estimated the minimum daily movement of boreal caribou in any season was 1.9 km per day. Therefore, mean distance between patches of natural habitat in the Base Case (277 m) is within the daily range of space use of boreal caribou.

Relative to the Base Case, fragmentation metrics for the Application Case indicate the Project will divide one patch of fire disturbance at the Base Case into two patches, result in no division of development patches and remove forty-three small patches of undisturbed habitat (Table 2). The Project does not increase the number of patches of development from the Base Case because it overlaps existing linear disturbance. Mean patch area of fire disturbance will be reduced by 1.72 ha (0.07%) in the Application Case, but mean buffered development patch size will increase by 0.05 ha (0.13%) and mean undisturbed habitat patch size will increase by 0.13 ha (0.04%) because several small patches of undisturbed habitat will be replaced by development patches from the project. Distances between patches of similar habitat types in the Application Case are changed by less than 0.6 m.

Overall, the Project will result in very small changes to the number of patches, patch size, variation in patch size, and distances between similar patches relative to the Base Case (Table 2). Similar to the qualitative results described in the ASR, the quantitative analysis indicates the Project mostly results in fragmentation changes to fire and development disturbance. The small changes to the distribution of undisturbed habitat are not predicted to adversely affect caribou.

Fragmentation metrics for the RFD Case indicate that cumulative development will increase the number of fire disturbance patches by 26 (0.60%), reduce the number of buffered development patches by 22 (1.82%) and reduce the number of undisturbed patches by 11 (0.01%) relative to Base Case (Table 3). Overall, changes to fragmentation metrics in the RFD Case are small relative to the Base Case (i.e., less than 1% change for all metrics for fire disturbance and undisturbed habitat).

The reason that the number of disturbance patches decreases in the RFD Case is because RFDs are located on existing small patches of development, resulting in fewer but larger patches (i.e., mean area of buffered development increases by 3.99%; Table 3). Similarly, the reason that the number of patches of undisturbed habitat declines by 43 in the Application Case and 11 in the RFD Case is because fragmentation caused by RFDs other than the Project increases the number of patches on the landscape, reversing some of the reduction in patch number caused by the Project. These examples highlight the importance of careful interpretation of FRAGSTATS outputs.

The fragmentation analysis provides quantitative measures of changes in the number of suitable habitat patches, mean patch area and mean nearest neighbour distance and associated variability of these metrics across the NT1 range. However, these metrics do not provide spatially explicit information about how caribou connectivity changes in the NT1 range. For example, similar levels of fragmentation occurring in the core of a species range may have greater implications to connectivity than if they occur near the boundary of the range. Fragmentation in the core may affect more individuals or divide a population, which may influence access to key seasonal habitats for food, refuge and/or reproduction.

Understanding the spatial context of changes in fragmentation and connectivity still requires use of a map to illustrate where changes are taking place (See **Figures 4.2-3, 4.4-1**, and **4.4-6** appended to this response). It is for this reason that the ASR did not use fragmentation metrics and focussed instead on visually evaluating habitat distribution (connectivity) for boreal caribou and other wildlife VCs based on habitat mapping. The evidence from the analysis of fragmentation metrics does not change the conclusions provided in the ASR.

Table 1: Fragmentation Metrics of Number of Patches, Mean Patch Area and Nearest Neighbour Distance (NND) in the NT1 Range for the Base Case, Application Case and Reasonably Foreseeable Development (RFD) Case

Habitat Suitability	Base Case					Application Case					RFD Case				
	Number of Patches	Mean Patch Area (ha)	Mean Patch Area CV	Mean NND (m)	NND CV	Patch Number	Mean Patch Area (ha)	Mean Patch Area CV	Mean NND (m)	NND CV	Patch Number	Mean Patch Area (ha)	Mean Patch Area CV	Mean NND (m)	NND CV
Fire disturbance	4,320	2,352	2,116.66	965	0.04	4,322	2,350	2,117.44	965	0.04	4,346	2,333	2,124.65	957	0.04
Buffered developments	1,212	3,051	2,038.96	2,422	0.00	1,212	3,054	2,040.71	2,422	0.00	1,190	3,172	2,076.83	2,447	0.00
Undisturbed habitat	90,839	307	17,291.65	277	0.10	90,796	307	17,288.14	277	0.10	90,828	306	17,298.11	277	0.10

CV = coefficient of variation (standard deviation ÷ mean x 100); NND = nearest neighbour distance (m); m = metre; ha = hectares; RFD = Reasonably Foreseeable Development

Table 2: Absolute and Relative Changes in Fragmentation Metrics of Number of Patches, Mean Patch Area and Nearest Neighbour Distance (NND) in the NT1 Range for the Application Case relative to the Base Case

Habitat Suitability	Base Case					Changes in the Application Case									
	Number of Patches	Mean Patch Area (ha)	Mean Patch Area CV	Mean NND (m)	NND CV	Patch Number	% Change	Mean Area (ha)	% Change	Mean Area CV	% Change	Mean NND (m)	% Change	NND CV	% Change
Fire disturbance	4,320	2,352	2,116.66	965	0.04	2	0.05	-1.72	-0.07	0.77	0.04	0.06	0.01	0.00	0.00
Buffered developments	1,212	3,051	2,038.96	2,422	0.00	0	0.00	3.73	0.12	1.74	0.09	0.00	0.00	0.00	0.00
Undisturbed habitat	90,839	307	17,291.65	277	0.10	-43	-0.05	0.13	0.04	-3.50	-0.02	0.05	0.02	<0.01	-0.10

CV = coefficient of variation (standard deviation ÷ mean x 100); NND = nearest neighbour distance (m); m = metre; ha = hectares; RFD = Reasonably Foreseeable Development.

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Table 3: Absolute and Relative Changes in Fragmentation Metrics of Number of Patches, Mean Patch Area and Nearest Neighbour Distance (NND) in the NT1 Range for the Reasonably Foreseeable Development (RFD) Case relative to the Base Case

	Base Case					Changes in the RFD Case									
Habitat Suitability	**Number of Patches**	**Mean Patch Area (ha)**	**Mean Patch Area CV**	**Mean NND (m)**	**NND CV**	**Patch Number**	**% Change**	**Mean Area (ha)**	**% Change**	**Mean Area CV**	**% Change**	**Mean NND (m)**	**% Change**	**NND CV**	**% Change**
Fire disturbance	4,320	2,352	2,116.66	965	0.04	26	0.60	-18.26	-0.78	7.98	0.38	-8.26	-0.86	0.00	0.74
Buffered developments	1,212	3,051	2,038.96	2,422	0.00	-22	-1.82	121.62	3.99	37.87	1.86	25.64	1.06	0.00	0.00
Undisturbed habitat	90,839	307	17,291.65	277	0.10	-11	-0.01	-0.62	-0.20	6.47	0.04	0.27	0.10	0.00	0.00

CV = coefficient of variation (standard deviation ÷ mean x 100); NND = nearest neighbour distance (m); m = metre; ha = hectares; RFD = Reasonably Foreseeable Development.

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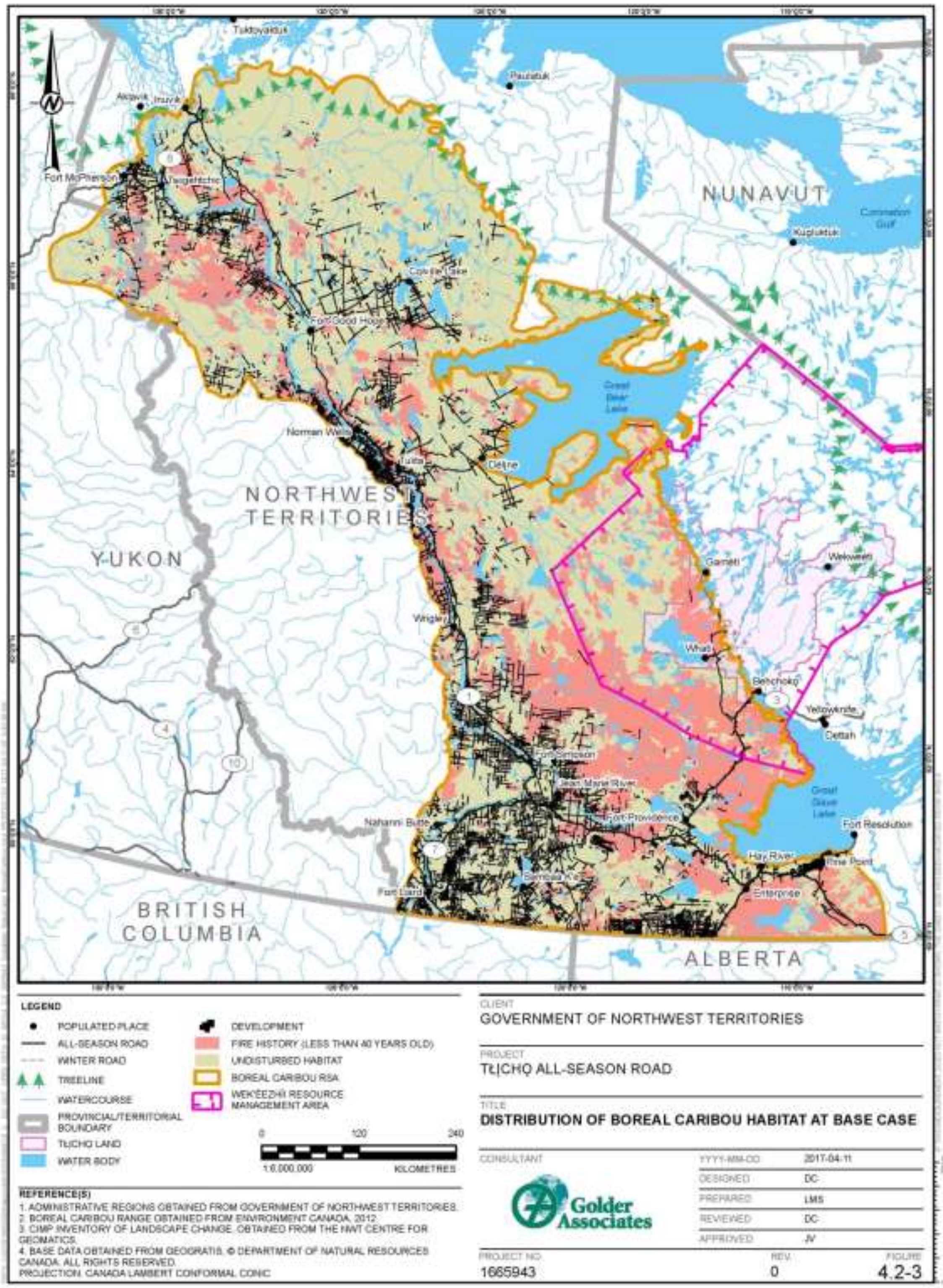
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Paulatuk
Aklavik
Inuvik
Fort McPherson
Tsiigehtchic
NUNAVUT
Coronation Gulf
Kugluktuk
Colville Lake
Fort Good Hope
Great Bear Lake
Norman Wells
Tulita
Délı̨ne
NORTHWEST TERRITORIES
YUKON
Gamètì
Wekweètì
Wrigley
Whatì
Behchokǫ̀
Yellowknife
Dettah
Fort Simpson
Jean Marie River
Fort Providence
Great Slave Lake
Fort Resolution
Nahanni Butte
Hay River
Pine Point
Fort Liard
Enterprise
BRITISH COLUMBIA
ALBERTA
LEGEND
POPULATED PLACE
ALL-SEASON ROAD
WINTER ROAD
TREELINE
WATERCOURSE
PROVINCIAL/TERRITORIAL BOUNDARY
TŁICHO LAND
WATER BODY
DEVELOPMENT
FIRE HISTORY (LESS THAN 40 YEARS OLD)
UNDISTURBED HABITAT
BOREAL CARIBOU RSA
WEKʼÈEZHÌI RESOURCE MANAGEMENT AREA
0
120
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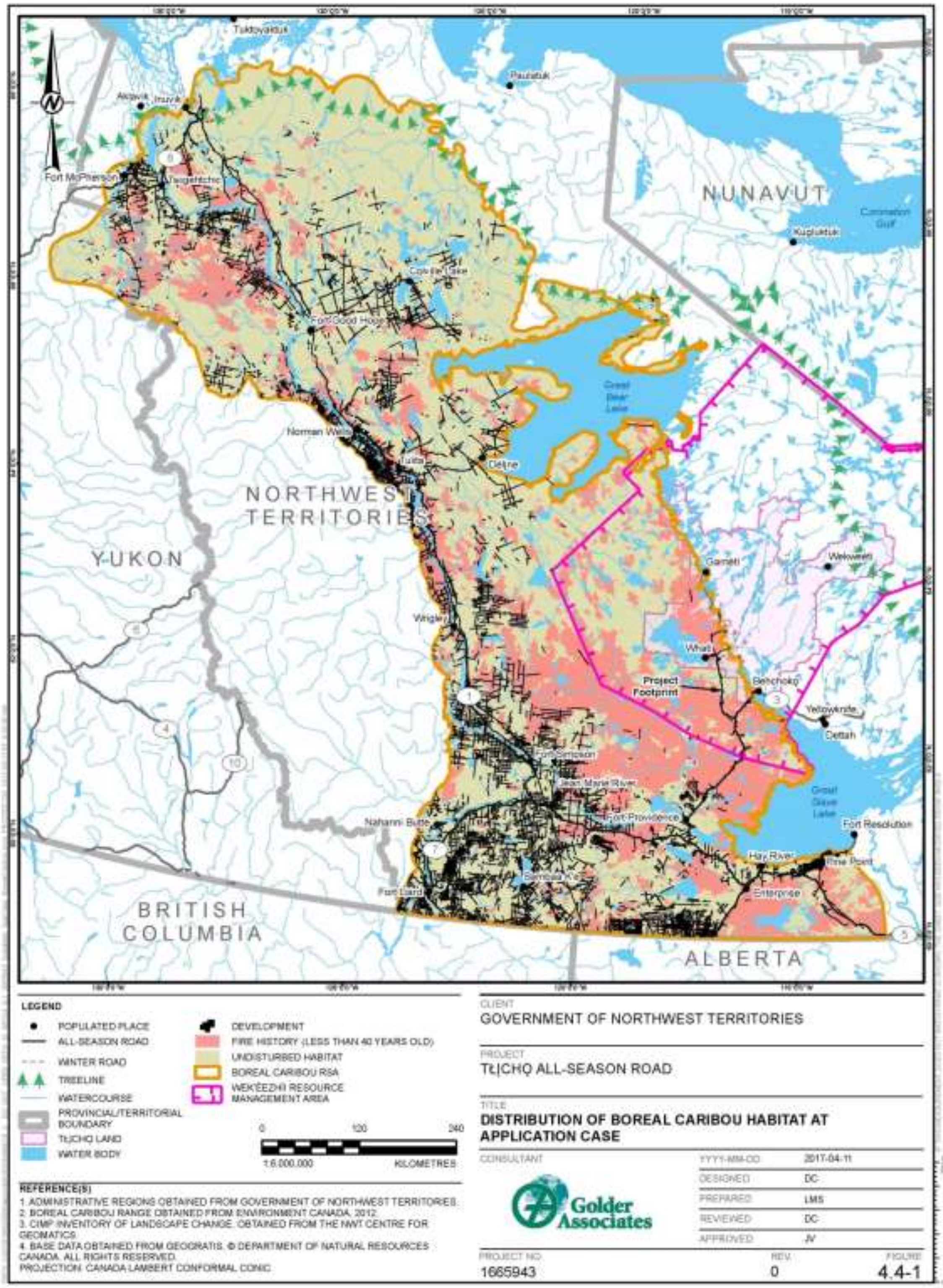
1:6,000,000
KILOMETRES
REFERENCE(S)
1. ADMINISTRATIVE REGIONS OBTAINED FROM GOVERNMENT OF NORTHWEST TERRITORIES.
2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012
3. CIMP INVENTORY OF LANDSCAPE CHANGE. OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
4. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: CANADA LAMBERT CONFORMAL CONIC
CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES
PROJECT
TŁICHO ALL-SEASON ROAD
TITLE
DISTRIBUTION OF BOREAL CARIBOU HABITAT AT BASE CASE
CONSULTANT
Golder Associates
YYYY-MM-DD 2017-04-11
DESIGNED DC
PREPARED LMS
REVIEWED DC
APPROVED JV
PROJECT NO. 1665943
REV. 0
FIGURE 4.2-3


NUNAVUT
NORTHWEST TERRITORIES
YUKON
BRITISH COLUMBIA
ALBERTA
Great Bear Lake
Great Slave Lake
Project Footprint
Fort McPherson
Norman Wells
Fort Good Hope
Colville Lake
Délįne
Tulita
Gamètì
Wekweètì
Whatì
Behchokǫ̀
Yellowknife
Dettah
Wrigley
Fort Simpson
Jean Marie River
Fort Providence
Nahanni Butte
Fort Liard
Hay River
Enterprise
Fort Resolution
Kugluktuk
Paulatuk
Tuktoyaktuk
LEGEND
POPULATED PLACE
ALL-SEASON ROAD
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4. BASE DATA OBTAINED FROM GEOGRATIS. © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
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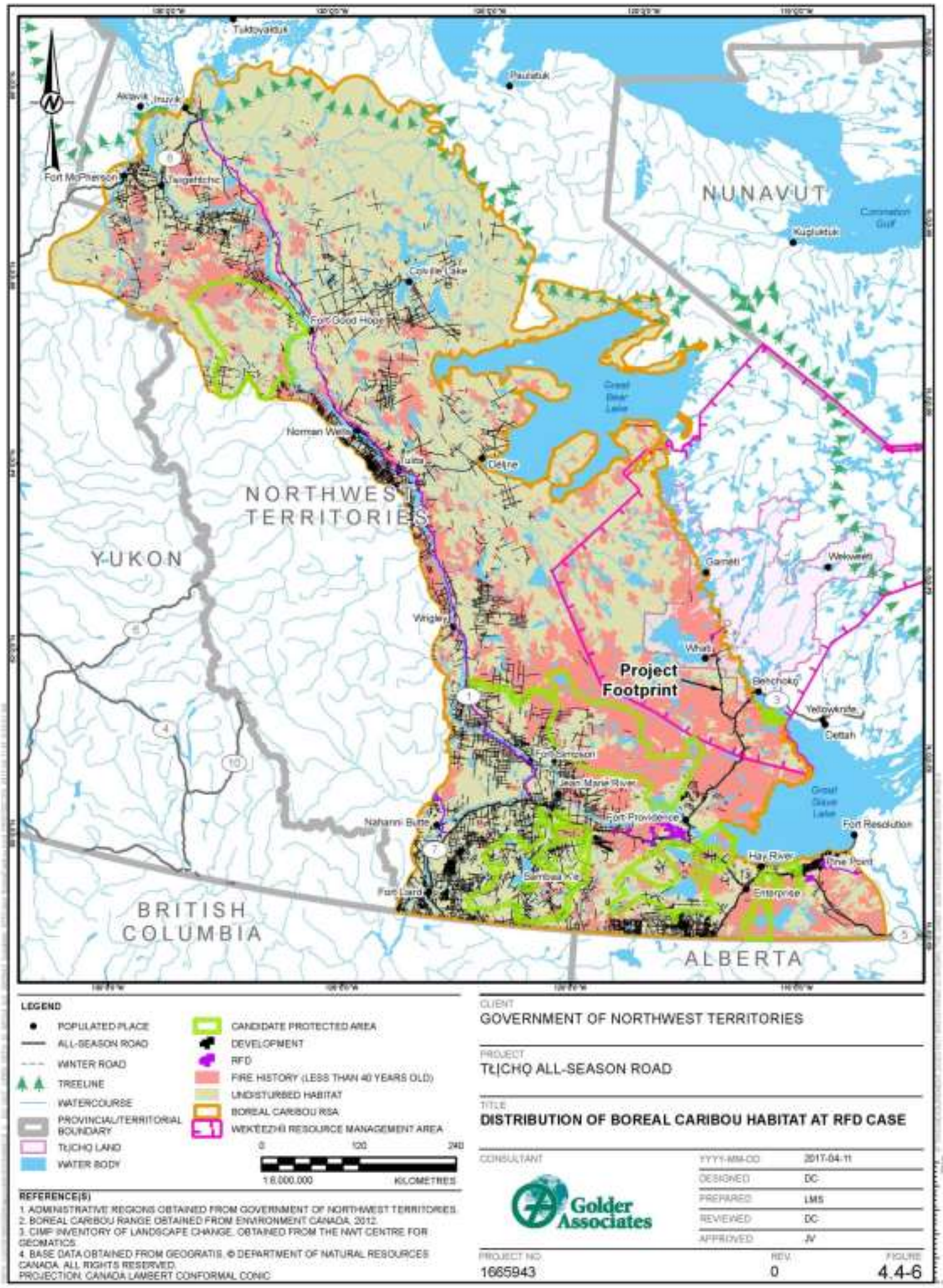
GOVERNMENT OF NORTHWEST TERRITORIES
PROJECT
TŁICHǪ ALL-SEASON ROAD
TITLE
DISTRIBUTION OF BOREAL CARIBOU HABITAT AT APPLICATION CASE
CONSULTANT
Golder Associates
YYYY-MM-DD 2017-04-11
DESIGNED DC
PREPARED LMS
REVIEWED DC
APPROVED JV
PROJECT NO. 1665943
REV. 0
FIGURE 4.4-1


Tuktoyaktuk
Paulatuk
Aklavik
Inuvik
Fort McPherson
Tsiigehtchic
NUNAVUT
Kugluktuk
Coronation Gulf
Colville Lake
Fort Good Hope
Great Bear Lake
Norman Wells
Tulita
Déline
NORTHWEST TERRITORIES
YUKON
Gamètì
Wekweètì
Wrigley
Whatì
Project Footprint
Behchokò
Yellowknife
Dettah
Fort Simpson
Jean Marie River
Great Slave Lake
Fort Providence
Nahanni Butte
Fort Resolution
Hay River
Pine Point
Sambaa K'e
Fort Liard
Enterprise
BRITISH COLUMBIA
ALBERTA
LEGEND
POPULATED PLACE
ALL-SEASON ROAD
WINTER ROAD
TREELINE
WATERCOURSE
PROVINCIAL/TERRITORIAL BOUNDARY
TŁĮCHǪ LAND
WATER BODY
CANDIDATE PROTECTED AREA
DEVELOPMENT
RFD
FIRE HISTORY (LESS THAN 40 YEARS OLD)
UNDISTURBED HABITAT
BOREAL CARIBOU RSA
WEKÈEZHÌI RESOURCE MANAGEMENT AREA
0 120 240
1:8,000,000 KILOMETRES
REFERENCE(S)
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2. BOREAL CARIBOU RANGE OBTAINED FROM ENVIRONMENT CANADA, 2012.
3. CIMP INVENTORY OF LANDSCAPE CHANGE, OBTAINED FROM THE NWT CENTRE FOR GEOMATICS.
4. BASE DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: CANADA LAMBERT CONFORMAL CONIC
CLIENT
GOVERNMENT OF NORTHWEST TERRITORIES
PROJECT
TŁĮCHǪ ALL-SEASON ROAD
TITLE
DISTRIBUTION OF BOREAL CARIBOU HABITAT AT RFD CASE
CONSULTANT
Golder Associates
YYYY-MM-DD 2017-04-11
DESIGNED DC
PREPARED LMS
REVIEWED DC
APPROVED JV
PROJECT NO. 1665943
REV. 0
FIGURE 4.4-6

References

McGarigal K, Cushman S A, Neel MC, Ene E. 2002. FRAGSTATS: Spatial Pattern Analysis Program for Categorical Maps. Computer software program produced by the authors at the University of Massachusetts, Amherst. Available at: http://www.umass.edu/landeco/research/fragstats/fragstats.html.

Nagy JA. 2011. Use of Space by Caribou in Northern Canada. Ph.D. thesis. Department of Biological Sciences, University of Alberta, Edmonton, AB.

GNWT Response to:
GoC ECCC IR#8 (ID10)

Topic
Boreal Caribou – Habitat Offsetting

Comment
The Proponent repeats throughout Table 2 of the Wildlife Management and Monitoring Plan (WMMP) that reclamation of the terrestrial portions of the current Tłı̨chǫ winter road (KM 0 60) will eventually offset some of the new habitat loss.

Recommendation
ECCC requests that the Proponent provide clarification regarding: a) what reclamation activities are being proposed for kilometers 0 to 60 of the current Tłı̨chǫ winter road; and b) how the Proponent will ensure and monitor the effectiveness of reclamation activities so that the habitat can be used for offsetting.

GNWT Response
As per section 19.8.1 of the Tłı̨chǫ Agreement, the Government of the Northwest Territories only has a right of free access to the Tłı̨chǫ winter road's right of way in order to establish, build, manage, control, vary and close up the Tłı̨chǫ winter road. Any reclamation activities planned for the terrestrial portions of the Tłı̨chǫ winter road (KM 0-60) will be managed and addressed jointly by the Tłı̨chǫ Government and the GNWT by way of a bilateral agreement. The draft Wildlife Management and Monitoring Plan that was submitted with the water licence and land use permit applications is being updated to reflect these changes.

References
Tłı̨chǫ Government. 2003. Land Claims and Self-Government Agreement among the Tłı̨chǫ and the Government of the Northwest Territories and the Government of Canada. http://www.tlicho.ca/sites/default/files/documents/government/T%C5%82%C4%B1%CC%A8cho%CC%A8%20Agreement%20-%20English.pdf

GNWT Response to:
GoC ECCC IR#9 (ID11)

Topic
Avian Species at Risk - Suitable Habitat

Comment
The Proponent used Landsat SPOT 4/5 imagery data to estimate habitat availability and distribution for wildlife Valued Components (VCs). Based on habitat descriptions obtained from scientific literature for VCs, each of land cover class was assigned into one of two categories: moderate to high suitability or low to nil suitability. This approach is commonly used in impact assessments when baseline data is not collected or information is not available from other sources at an appropriate spatial and temporal scale. However, it does present challenges and have limitations for species such as birds. Migratory birds, including avian species at risk, are mobile and select breeding habitat based on the assemblage or mosaic of habitats near a nesting site in addition to particular habitat associations and preferences. This is difficult to account for and was not thoroughly captured in the provided estimates of habitat availability and distribution for avian species at risk VCs. For example, Bank and Barn Swallow breeding habitat should also include land cover codes 6 (Young Forest), 11 (Bryoid) and 12 (Barren) when near waterbodies, wetlands and streams. Common Nighthawk breeding habitat should also include land cover codes 3 (Evergreen conifer, low density), 6 (Young forest), 13 (Sparse conifer lichen) and 16 (Water). Most land cover classes constitute breeding habitat for Olive-sided Flycatcher in adjacency to mature coniferous stands, with the exception of 4 (Mixed forest), 5 (Deciduous forest) and 15 (Ice). The most important habitat feature for this species is the strong edge effect created between contrasting habitat types. Similarly, Rusty Blackbird breeding habitat includes most land cover classes adjacent to waterbodies, wetlands and slow moving streams, with a few exceptions (land cover codes 4, 5, 12 and 15). In ECCC's comments on the draft Terms of Reference and draft Adequacy Statement (ECCC#7), ECCC suggested the use of existing monitoring datasets to inform and refine the impact assessment. ECCC believes the impact assessment would have benefited, at a minimum, from the inclusion of available migratory bird monitoring datasets. The Proponent may wish to consider data from ECCC monitoring along HWY 3 between Behchokǫ̀ and Fort Providence and, if available, data collected related to the NICO mine project. Bird monitoring data would provide estimates of species' relative abundance, densities and use by habitat type, allowing a more thorough and confident assessment of effects related to habitat loss and alteration, as well as habitat use influencing avian species at risk abundance and distribution.

Recommendation

ECCC requests that the Proponent provide clarification on why they did not incorporate available migratory bird monitoring data in the effects assessment related to avian species at risk VCs, or consider re-doing the effects assessment with available monitoring data.

GNWT Response

As committed to during the June 9, 2017 meeting between the GNWT and ECCC (PR#132), analysis of the migratory bird data collected on Highway 3 will be considered upon receipt of the data from ECCC. These data were not available to the GNWT prior to the release of the Adequacy Statement Response (ASR) but were provided by ECCC on June 30, 2017 so that the GNWT can review the avian monitoring conducted by ECCC along Highway 3. The GNWT will assess the data provided by ECCC and update the effects assessment related to avian species at risk with the data incorporated, or provide an explanation as to why the data will not be included.

Data from the NICO Project are not especially relevant for the ASR (PR#110). The NICO Project is located in the Taiga Shield Ecozone whereas the Project occurs in the Taiga Plains Ecozone. Baseline studies for the NICO project included surveys of over 550 upland bird point-count surveys between 2005 and 2009 (Golder 2010). Migratory bird communities and abundances in these Ecozones are not expected to be the same (although 44 point counts were completed in 2007 on Taiga Plains habitat near the NICO Project and Taiga Shield boundary).

Of the upland bird species included as valued components in the ASR, only common nighthawk (one individual), olive-sided flycatcher (eight individuals) and rusty blackbird (four individuals) are represented in the NICO data, and none of these species were detected on the Taiga Plains Ecozone point counts.

The habitat occurrences of these species documented in Golder (2010) used a different land cover classification to the ASR, but the results indicated preference for the same habitats as were used in the ASR to describe suitable habitat. The single common nighthawk was observed in bedrock-open conifer habitat, corresponding to the barren or herb-shrub land cover in the ASR (Table 4.2-9). Olive-sided flycatcher were observed in burn, coniferous spruce, mixedwood and treed fen habitats, corresponding to the burns, evergreen conifer and mixed forest land covers in the ASR (Table 4.2-10). Rusty blackbird were observed in shrubland, corresponding to the herbaceous wetland land cover in the ASR (Table 4.2-12). While the sample size is low and the observations are from a different ecozone, the results of the upland bird baseline studies for the NICO Project support the habitat preferences defined in the ASR for these three valued component species.

References

Golder Associates Ltd. 2010. Baseline Wildlife and Wildlife Habitat for the Proposed NICO Project. Prepared for Fortune Minerals Ltd. http://www.reviewboard.ca/upload/project_document/EA0809-004_Annex_D_NICO_WILDLIFE_Baseline.PDF