MEMORANDUM

TO Rick Schryer - Fortune Minerals Limited **DATE** 13 April 2012

CC Jen Gibson

FROM John Virgl, Damian Panayi, Cam Stevens **PROJECT No.** 09-1373-1004.9600

INFORMAL UNDERTAKING
DISTURBANCE TO BATHURST CARIBOU FROM FUTURE DEVELOPMENT AT MULTIPLE SPATIAL SCALES

Following the Technical Meetings for the NICO Project, the Mackenzie Valley Environmental Impact Review Board asked Fortune Minerals Limited (Fortune) to follow-up on some potential undertakings using "off-line" discussions with the Government of the Northwest Territories (GNWT) (Jan Adamczewski) and Yellowknives Dene First Nation (YKDFN) (Todd Slack). The intent of these discussions was to determine a course of action for analyzing the predicted amount of direct and indirect disturbance to the Bathurst caribou herd from future development on the winter and annual ranges. The Developer's Assessment Report (DAR) assessed the effects from the NICO Project (including the NICO Project Access Road [NPAR]) at the local scale, and the cumulative effects from the NICO Project and other previous, existing, and reasonably foreseeable developments at the scale of the winter range. However, the Tłı̨chǫ Government, YKDFN, and GNWT requested that the analysis of effects to the Bathurst caribou herd should include the annual range. In addition, the YKDFN (Todd Slack) requested that additional reasonably foreseeable developments be incorporated into the analysis.

This response to these discussions (or 'informal undertakings') followed email correspondence between John Virgl (Golder) and Jan Adamczewski (GNWT), as well as the minutes of a meeting held on 7 February 2012 with Todd Slack (YKDFN), Cam Stevens (Golder), and Damian Panayi (Golder). The minutes for the meeting with Todd Slack, Cam Stevens, and Damian Panayi was summarized and posted at http://www.reviewboard.ca. The objective of this technical memorandum is to complete the following analyses.

1) Implement a future assessment case that includes additional potentially foreseeable developments based on suggestions from YKDFN (Todd Slack).

2) Provide the area disturbed by direct and indirect effects (i.e., area in zone of influence) from developments for the future case on the winter and annual ranges.

3) Calculate the density of developments using point sources (e.g., exploration camps) and linear features (all-season and winter roads [km per km^2]) for the future case on the winter and annual ranges.

4) Assess the effects from fragmentation on caribou for the future case within the winter and annual ranges.

Future Density of Developments at Annual and Seasonal Scales (Analyses 1, 2, and 3)

As requested, Fortune undertook the task of calculating the relative density of development across the winter and annual ranges for the Bathurst caribou herd under a future scenario with the NICO Project (which includes the NPAR) on the landscape, as well as additional reasonably foreseeable developments.

The approach for this undertaking is similar that described in Section 8.5 of the DAR. The annual and seasonal ranges were delineated using collar data collected from the Bathurst herd since 1996. The annual range overlapped with existing operating mines that were classified as active mines and with a 15 kilometre (km) zone of influence, including the Ekati, Diavik and Snap Lake mines. A 5 km zone of influence was applied to exploration sites, winter and all-season roads, and transmission lines. Non-active mines and exploration sites were included in the cumulative effects assessment using the physical footprint, which were conservatively classified as permanent features on the landscape.

Reasonably foreseeable developments that were analyzed quantitatively in the DAR included the Proposed Tłı̨chǫ Road Route and the Taltson Hydroelectric Expansion Project. A qualitative analysis was also completed on the following reasonably foreseeable developments:

- North Arm National Wildlife Area;
- East Arm National Park;
- Nailii Hydro Project
- Yellowknife Gold Project;
- Nechalacho Project; and
- Damoti Lake Gold Project.

However, to respond to this informal undertaking, the analysis incorporated the anticipated footprints and associated zones of influence for the following additional reasonably foreseeable developments:

- Gahcho Kué Project and Winter Access Road;
- the Bathurst Inlet Port and Road (BIPR) Project, part of which is a 211 km all-season road from Bathurst Inlet to Contwoyto Lake (NIRB 2012);
- the High Lake Project and related access roads have been added as an active operating mine even though this project is currently under suspension until 2013 (NIRB 2012);
- the Jericho Diamond Mine was assumed to be operational; and
- the Taltson Hydroelectric Expansion Project was included to the assessment even though the development is on hold at the request of the developer (MVRB 2012).

The relative density of development was re-evaluated using four assessment cases described below. All assessments on the winter range scale included winter roads (Assessments 1 and 2). But the assessment at the annual range scale included a winter road case (Assessment 3) and a case without winter roads (Assessment 4). The winter road case was deemed the most conservative of the two (i.e., overestimates the effects). The analysis included the following assessments:

Assessment 1) the winter range below the treeline (i.e., effects study area used in the DAR);
Assessment 2) the entire winter range;
Assessment 3) the annual range with winter roads; and

Assessment 4) the annual range without winter roads.

Four landscape metrics were used to describe the relative abundance of development for each assessment. One of the metrics (Metric 2) captured the effects of the phenomenon of behavioural avoidance of human developments, often described as the zone of influence (ZOI). The ZOI for the various development activities in the DAR and this informal undertaking are described in Table 8.5-6 of the DAR (Section 8.5). Disturbance from development was described using the following four landscape metrics:

Metric 1) proportion (%) of range physically disturbed by development footprints (i.e., direct disturbance);
Metric 2) proportion (%) of range disturbed by physical footprint plus zone of influence (i.e., direct and indirect effects);
Metric 3) density of exploration camps measured as camps (x1000) per square km (km^2); and
Metric 4) density of linear features measured as km (x1000) per km^2.

Density of exploration camps and linear features (e.g., roads and transmission lines) were multiplied by 1000 for illustration purposes given the relatively low number of developments on the landscape.

The results from the additional analyses indicate that the proportion of land cover directly influenced by previous, existing, and reasonably foreseeable developments (Metric 1) was highest at the scale of the annual range when including winter roads (see Figure 1). The assessment with the lowest direct disturbance was the annual range without winter roads. But the proportion of direct disturbance to the annual range was negligible at 0.26% and similar to the winter range (0.25%) and the winter range below the treeline (0.22%). Stated differently, less than 0.5% of the annual range of the Bathurst is covered by mines, exploration sites, roads, and other types of development. In the DAR, the proportion of the winter range disturbed by the physical footprints of previous, existing, and reasonably foreseeable developments was predicted to be 0.20%.

Trends in the proportion of available land cover directly disturbed by development (Metric 1) were similar to trends for available cover under the footprint plus the ZOI (Metric 2). The proportion of footprint plus ZOI was highest at the scale of the annual range (with winter roads), but only slightly higher than that determined for the entire winter range and for the winter range below the treeline (Figure 1). For example, at the scale of the annual range with winter roads, the proportion of land cover directly and indirectly influenced by development was calculated to be 10.7%. The proportion of land cover within the ZOI of development was 10.5% and 9.4% for the entire winter range and the winter range below the treeline, respectively.

In the DAR, cumulative changes from the NICO Project and other developments decreased preferred caribou habitat (high and good quality) by 6.1% on the winter range (below the treeline). Although these values from the DAR represent the relative influence from development on the changes in the amount of quality habitat on the winter range, they are not directly comparable to the values for Metric 2 in Figure 1. Metric 2 values assume that all land cover within the footprint plus ZOI is removed from the landscape (i.e., overestimates the effect from development), while values in the DAR represent a predicted change in habitat effectiveness within the ZOI (habitat is available, but supports fewer individuals).

The analysis considered two other indicators of development activity not included in the DAR: density of exploration camps and density of linear features. The density of exploration camps, although relatively low across all assessments (less than 0.01 camps per km^2), was highest at the scale of the annual range (Metric 3 in Figure 1). The density of linear features was similar for the annual range with winter roads, the entire winter

range, and the winter range below the treeline (about 0.01 km per km^2) (Metric 4 in Figure 1). These linear density estimates for annual and winter ranges are much lower than observed values for effects to wildlife (0.7 to 1.5 km per km^2) (Nielsen et al. 2007; Frair et al. 2008). It should be noted that these density estimates for predicted effects to wildlife were obtained for forested environments, where linear features facilitate access for predators and humans. Linear features likely have less effect to wildlife in more open tundra landscapes.

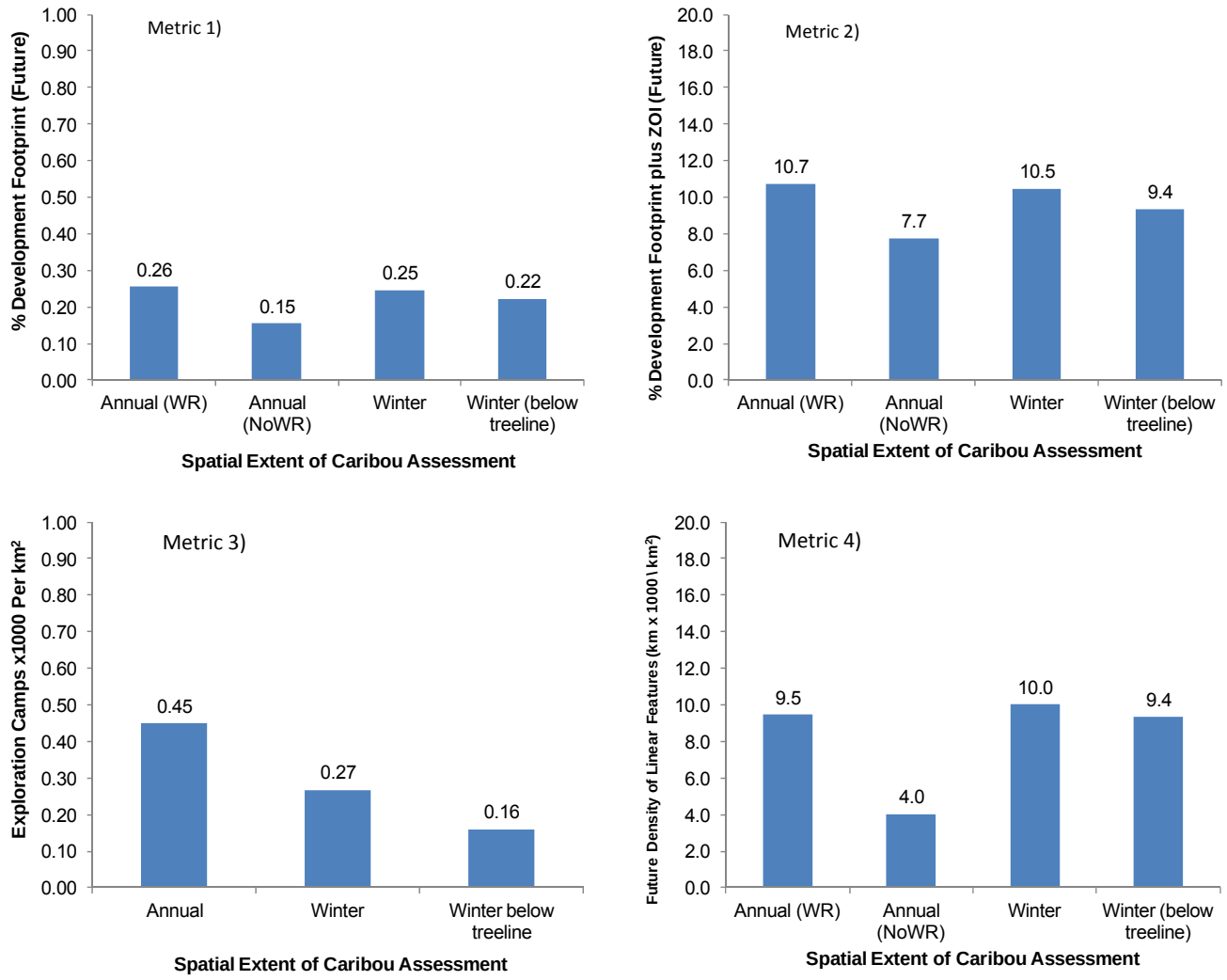

Figure 1: Landscape Metrics Describing Future Density of Development for the Winter and Annual Ranges for Bathurst caribou (WR = Winter Roads; NoWR = No Winter Roads; ZOI = Zone of Influence)

Effects from Fragmentation on Caribou (Analysis 4)

The results from the additional analysis indicate that the predicted effects to caribou from habitat fragmentation should be negligible, which was also predicted in the DAR (Section 8.7.2). The amount of the landscape that has been directly disturbed by development is less than 0.5% of the winter and annual ranges of the Bathurst herd. The magnitude of disturbance is well below the screening value (i.e., 20%) used in the DAR to identify potential

significant effects (Section 8.7.1), and ecological thresholds for human disturbance that have been proposed for the management of wildlife by other agencies (e.g., 35%; EC 2011). The calculated levels of disturbance on caribou seasonal and annual ranges are also well below the ecological threshold of 40 to 60% that was proposed by Swift and Hannon (2010) for identifying effects of habitat fragmentation, specifically non-linear declines in population size. In other words, as habitat loss progress beyond 40 to 60% of what was historically available, the remaining habitat is increasingly fragmented and/or the fragments are increasingly isolated, which can compound the effects of habitat loss. In contrast, the seasonal and annual ranges of the Bathurst herd are intact, and long-term monitoring has shown that direct mine-related mortality rate results in a negligible effect on caribou abundance.

Much of the physical disturbance to caribou seasonal and annual ranges is associated with point sources (i.e., mine and mineral exploration sites), which results in little habitat fragmentation effects. Alternately, roads can fragment landscapes (and populations) through physical presence, sensory disturbance (noise, smells, and lights) and vehicle-animal collisions. It is likely that caribou exhibit predator avoidance behaviour and limit their distribution around winter roads considering that harvesting from roads is permitted (with the exception of current harvesting ban along the Tibbitt-to-Contwoyto Winter Road). However, the recorded caribou mortality from vehicle collisions is low, and would result in a negligible (non-measurable) change to caribou abundance. Road density on winter and annual ranges is also well below the values that have resulted in observed effects to wildlife (Nielsen et al. 2007; Frair et al. 2008).

Fragmentation effects from winter roads will also depend on the location and movement rate of animals. For example, during the operational period of winter roads (late January to early April), caribou daily movement rate is lower than other seasons and the potential for interactions with vehicles and the road will partially depend on the distribution of animals (i.e., caribou encounter rate with winter roads likely decreases with increasing distance from annual late winter distribution of the herd). Caribou migration to the calving grounds begins after closure of winter roads, and physical barrier effects should become negligible with the deterioration of road berms, particularly on the tundra.

The YKDFN has criticized the use of the Swift and Hannon (2010) paper as a meaningful source for helping to evaluate the effects of direct and indirect habitat changes on wildlife, specifically that the paper does include research on *Rangifer* spp and is therefore not applicable to the assessment of caribou. We agree that the meaning and utility of a critical threshold must be interpreted carefully and in relation to the species ecology. However, many researchers have applied thresholds of about 40% as a useful means for identifying assessment and conservation targets for habitat retention. Swift and Hannon (2010) synthesized 24 simulation studies and over 20 empirical studies that include a diversity of taxa ranging from mammals, birds, amphibians and insects, and explain that the variability in threshold levels should not preclude the use of ecologically relevant generalizations. Species with similar daily and seasonal movement rates, dispersal or migration distances, and levels of habitat disturbance within the population range would likely have similar effects thresholds.

References

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