Opinion on Issues Related to Caribou, Moose and Furbearers (Kudz Ze Kayah Project)

Prepared For
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The contents of this report reflect the experience and professional judgement of EDI, based on the review of the noted chapters/responses, and not the Project Proposal (BMC Minerals (No.1) Ltd [BMC] 2017) in its entirety and other relevant documentation, as submitted by BMC for Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee Screening. EDI submits that the responses provided are based on the information reviewed, and not an exhaustive review of the scientific information and research related to the questions and issues raised, as that effort would have been beyond EDI's scope and budget.

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1 INTRODUCTION

EDI Environmental Dynamics Inc. (EDI) was retained by the Yukon Environmental and Socio-economic Assessment Board (YESAB) to assist with their review of the BMC Minerals (No.1) Ltd. (BMC) Kudz Ze Kayah (the Project) Project Proposal (BMC 2017). EDI was requested to review: Chapter 13 — Wildlife and Wildlife Habitat; Appendix E6 — Vegetation Baseline Report; Appendix E8 — Wildlife Baseline Report; Response to YESAB Adequacy Review (ARR1 Response, July 2017); and Response #2 to YESAB Adequacy Review (AAR2 Response, November 2017); and to:

1) Describe potential effects of the Kudz Ze Kayah project on the demographics of the Finlayson Caribou Herd (FCH), including:

    a) A validating, qualifying, or countering of the proponent's effects prediction.

    b) A description of the Finlayson Caribou Herd's dependence, or lack of, on the Project area in relation to the full range, for different life stages.

    c) A description of potential effects, or range of effects, to the Finlayson Caribou Herd's demographics, including recruitment that may be reasonably predicted given the Project description.

2) Describe potential effects of the Kudz Ze Kayah project on the demographics and distribution of moose in areas near the Project site, including:

    a) A validating, qualifying or countering of the proponent's effects prediction.

    b) A description of the regional moose population's dependence, or lack of, on the Project area in relation to the region.

    c) A description of potential effects, or ranges of effects, to regional moose populations that may be reasonably predicted given the Project description.

3) Describe potential effects of the Kudz Ze Kayah project on regional populations of furbearers, including:

    a) A description of the anticipated spatial extent of any sink effects for different species.

    b) Anticipated zones of influence or degrees of habitat degradation in proximity to the Project site.

EDI's responses to these questions are presented in this document in the same order, for ease of review.

2 INITIAL DOCUMENT FAMILIARIZATION

To prepare and present an informed response to YESAB, EDI read the following sections to provide context for the Project, environmental baseline data collection and environmental assessment (EA) methodology.

Project Description (Chapter 4)

To gain an understanding of the scope of the Project, EDI read Section 4 — Project Description, to determine all the components of the Project, as different disturbance types and activities may have different effects on wildlife during construction, operations and/or decommissioning.

Effects Assessment Methods (Chapter 5)

Reading Chapter 5 — Effects Assessment Methods was considered important, as it relates to the terminology used, the definitions of criteria used, and the assessment process. In EDIs opinion, the effects assessment approach (e.g., describing the baseline environmental conditions, identifying environmental valued components [VCs], identifying Project interactions with the VCs and associated potential effects, application of mitigation measures, identification of residual effects, prediction of significance of the identified residual effects, and cumulative effects assessment) used by BMC follows accepted environmental assessment protocol.

Vegetation Baseline Report

Appendix E-6 (2015–2016 Vegetation Baseline, including the Terrestrial Ecosystem Map Report) was reviewed to gain an understanding of the habitat types within the described study areas, and the relationship between the available habitat and the identified wildlife species potentially using those habitat types on a seasonal or year-round basis.

Wildlife Baseline Report

Appendix E-8 (Wildlife Baseline Report, including the Habitat Suitability Index models) was reviewed to understand the habitat conditions, historic population dynamics and trends, and the field programs and surveys completed to support the Project, to gain an understanding of the relationship of wildlife-habitat-Project. As requested, EDI focused on caribou, moose and furbearers.

ARR1 and ARR2 Responses

EDI focused on the YESAB questions and the BMC responses that related to caribou, moose and furbearers.

3 FINLAYSON CARIBOU

3.1 Effects Prediction

BMC (2017; page 13-91) states that "Residual Project effects on caribou are considered not significant for all residual effects because they are low magnitude and local." EDI agrees with this conclusion.

The EA discusses the FCH range and habitat (e.g., see Figure 3-1 and the Habitat Suitability Index (HSI) maps in Appendix B Caribou Habitat Suitability Report of the Baseline Report). To inform the environmental assessment, BMC (2017; Chapter 13, page 13-35) focused on caribou rut and post-calving habitat. This approach was adopted because the rutting period is when most interaction between the Project components/activities and caribou are predicted to occur, with some interaction with post-calving habitat. Figure 13-8, Figure 13-9, Figure 13-10 and Figure 13-11 (Chapter 13 — Wildlife and Wildlife Habitat) show the Project in relation to rut and post-calving habitat. EDI agrees that this approach is reasonable and defendable, based on the information reviewed.

EDI notes that BMC (2017) also discusses and considers FCH winter habitat and migration routes, including information within the EA, as well as in the ARR1 and ARR2 responses (e.g., Appendix R2-L; R2-85 Figure 13-7 [FCH late winter presence], Figure 13-8 [FCH post-calving presence], and Figure 13-9 [FCH rut presence). Potential Project interactions with FCH are discussed and appropriate mitigation is proposed.

The Measurable Parameters (MPs) used for the EA for the FCH subcomponent of the Wildlife and Habitat VC as presented in the Project Proposal (BMC 2017) are: change in suitable habitat from baseline conditions (including both direct and indirect habitat loss); change in wildlife movement/change in population distribution; change in wildlife mortality directly from Project activities (i.e., vehicle collisions and hunting); and health condition. By definition, a MP is a parameter associated with an ecological component (in this case the FCH) to which Project-related changes can be detected and measured. In EDI's opinion, the MPs selected provide adequate consideration to the amount of habitat altered or lost, and changes in abundance through direct, indirect or induced mortality resulting from Project-related effects, as addressed in the Project Proposal, and the ARR1 and ARR2 responses.

In EDIs opinion, the assessment endpoints/threshold criteria defined for the EA in Table 13-3 of the Wildlife and Wildlife Habitat Chapter 13 (BMC 2017) for each of the MPs are reasonable (e.g., including the adjustment to the Assessment Endpoints/Threshold Criteria for health condition for caribou [R190]). The RSA is the appropriate spatial context for the criteria to be applied (e.g., change in RSA moderate-high to high suitability rut or post-calving habitat). EDI noted that adding moderate habitat to the assessment did not alter the EA predictions for caribou. EDI notes that the MPs (i.e., change in wildlife movement/change in population distribution; and, health condition) which had qualitative endpoints/threshold criteria were addressed in the responses to YESAB requests.

EDI agrees with the approach of Chapter 13 of the Project Proposal that "loss of suitable habitat was the primary focus of the assessment for most wildlife species" and "the area loss of highly suitable habitat from direct and indirect sources was compared to a threshold found in the literature to quantify the magnitude of

the habitat loss and contributes to determining the significance of the effect." EDI agrees with the approach of overlaying the disturbance footprint and LSA of the Project with the habitat suitability index model maps that were developed, to determine an estimate of the habitat loss (i.e., extent of the adverse effect), and to inform the prediction of the significance of the residual effects.

For the calculation of total habitat loss, indirect habitat loss was weighted as 50% equivalent to direct habitat loss. EDI considers this approach to be appropriate for the assessment of Project effects on caribou. For example, Dyer et al. (2001) found that open habitat beyond 250 m from roads was not significantly avoided (i.e., an avoidance "filter" does not present a complete "loss" of habitat).

The EA (BMC 2017) reaches the residual effects significance prediction by considering the baseline conditions for the FCH within their home range, presenting and evaluating the Project components/activities within the FCH home range, identifying the expected interactions of each of the Project components with caribou, determining potential effects on caribou, proposing general wildlife and caribou-specific mitigation, and identifying which of the potential effects are residual (i.e., those effects remaining after the application of mitigation). The residual effects are then evaluated with the use of defined criteria to determine significance. BMC (2017) states "A significant residual effect is considered to occur if it is adverse, of high magnitude, and extends across the regional study area. Alternatively, it is adverse, of high magnitude, in the local study area, and occurs over the long term." The results of this assessment process for caribou are presented in Table 13-31 where all residual effects were found to be adverse in direction, low in magnitude, local in geographic extent and long-term in duration. Considering the definition of significance, all residual effects of the Project on caribou were predicted by BMC (2017) to be not significant. EDI agrees with this approach and the conclusions. EDI noted that the ARR1 and ARR2 responses related to considering changes to the HSI model and the consideration of moderate habitat did not affect the conclusions of the EA for caribou.

To validate, qualify, or counter the BMC (2017) EA prediction, EDI used a slightly different EA approach that was used on other projects that considered project effects on caribou (e.g., Nalcor 2012). EDI evaluated the Project effects on the FCH using the home range of the FCH as the Regional Study Area (RSA), and the same criteria descriptors (e.g., Low magnitude = <10% change in moderate-high to high suitability rut or post calving habitat within the RSA) used by BMC (2017). EDI used a definition of significance that incorporates the principles of sustainability. This addresses the concept that habitat to support all life requisites of the FCH must be available/maintained within their home range if the herd is to remain sustainable.

At the home range level, EDI suggests that the Project effects on the FCH are:

- Adverse in direction (e.g., potential loss of high suitability rutting and post-calving habitat, potential disturbance of movement between the Pelly River lowlands and the alpine areas around the Project, potential direct mortality from collisions with vehicles, and potential disturbance from flights using the Finlayson Lake airstrip — as identified by BMC [2017]);

- Low in magnitude (i.e., 0.83% of rut and 0.85% post-calving habitat would be affected by the Project within the RSA (i.e., FCH home range); this considers the revised values presented in R254 and R2-88 for the update that includes the moderate habitat class);
- Local to Regional in geographic extent (i.e., an effect on caribou could be interpreted as extending beyond the LSA into the RSA — such as an alteration of a movement corridor, or avoidance of a portion of the rut or post-calving habitat);
- Long-term in duration (i.e., some effects may extend into the Post-closure Phase of the Project);
- Reversible in the short- to long-term (except if there is a mortality — but the cause could likely be mitigated); and
- High environmental and socio-economic context based on the importance of the FCH.

EDI's approach predicted the overall effect on the FCH after consideration of all the predicted residual effects on the FCH.

In EDI's opinion, based on the information presented in the Project Proposal (BMC 2017) and the AAR1 and AAR2 responses, the predicted residual effects of the Project, relative to baseline conditions, are not likely to affect the viability of the FCH within their home range in Yukon (i.e., the population is not expected to be affected on a regional scale). Maintenance of a sustainable FCH population would be expected to allow for the continued ecological, cultural and economic role of the FCH within their home range into the future.

EDI agrees with the statement on page 13-46, "If mortality factors such as wolf predation and hunting are managed, caribou may be able to co-exist with well managed developments." Section 13.4.2 discusses proposed mitigation measures that "BMC will implement to eliminate, minimize and/or reduce Project effects resulting from interactions between wildlife and Project activities."

EDI notes that one of the main opportunities for mitigation is project siting (i.e., limiting overlap or avoiding) in relation to sensitive wildlife habitat. Based on the Project description and considering the location of the resource to be mined for a viable project, it appears that BMC is using existing disturbances (i.e., the Tote Road and the exploration area have been disturbed) and limiting/avoiding the disturbance of identified important FCH habitat, to the extent practical.

3.2 Caribou Dependence on The Project Area

Based on the evidence presented in the BMC (2017) Project Proposal, the Wildlife Baseline Report (BMC 2016) and the responses in ARR1 and ARR2, EDI suggests that some caribou within the FCH home range use the available habitat in the general area of the Project, primarily during rutting and the early winter period, but that the regional FCH population does not appear to be dependant on the habitat within the Project area (i.e., caribou use suitable habitat throughout their range; see Figure 13-5 and Figure 13-16 in ARR2 R202; and Figure 13-7, Figure 13-8, Figure 13-9 in ARR2 R2-85). The habitat types that are predicted to be affected as a result of the Project are present and available throughout the RSA and do not appear to be limiting.

Based on the evidence presented in the BMC (2017) Project Proposal, and the responses in ARR1 and ARR2, EDI predicts that the areas currently used by the FCH will continue to be used by FCH during the development and operation of the Project. This considers the variability of areas used within their home range over the last several decades (e.g., before the Project). For example, EDI notes this variability as shown in ARR2, R2-85; Figure 13-7 [FCH late winter presence], Figure 13-8 [FCH post-calving presence], and Figure 13-9 [FCH rut presence] in ARR2 R2-85.

EDI agrees with the potential Project effects on FCH as outlined in Table 13-7, Table 13-8 and Table 13-9 (BMC 2017). In EDI's opinion, the focus on habitat for the EA has adequately identified potential effects, which has allowed specific and appropriate mitigation to be proposed.

The Project Proposal (BMC 2017) shows the juxtaposition of the core post calving and rutting range, and the core winter range (Figure 3-1 in the baseline report). EDI notes that the access route extends to the south from the Robert Campbell Highway, and along the Finlayson Creek valley to the Geona Creek valley. The mine footprint (i.e., direct effect) will be primarily constructed and operated in the valley and subalpine habitat on the valley sides, largely avoiding the alpine habitat to the west, south and east (i.e., moderately high and high suitability rut and post-calving habitat for caribou). EDI agrees that indirect disturbance (e.g., decreased habitat value resulting from human disturbance) will likely occur, but is expected to be limited due to the location of the Project near the northern extent of the modelled core habitat and the use of previously disturbed areas.

EDI notes that the Project is an upgrade of existing disturbances (e.g., upgrading the Tote Road to an all-weather Access Road; developing the mine infrastructure where exploration activities have been completed), and is not entirely a new disturbance footprint within the FCH home range. Considering this and a review of the baseline data (e.g., survey results for 2015 and 2016; BMC 2017) effects are expected to, in EDI's opinion, reflect the FCH response to human activity within a portion of their home range.

Considering this, and the predictions made in the Project Proposal, the effects of the Project on caribou use of the Project Area, including along the Access Road and around the mine infrastructure, are expected to be low and localized. This considers the natural variability of seasonal habitat use (i.e., see R2-85 maps), FCH migration routes, the effect of snow depth, and considers the maintenance of habitat connectivity and some level of likely habituation of caribou to non-threatening human disturbance.

Individuals displaced by the Project will likely move into other habitats and may expand their home range, as observed in Quebec in response to logging activity (Courtois et al. 2007). Dyer et al. (2001) and Dyer (1999) examined caribou avoidance by determining their use of a series of different sized buffers around several types of disturbance. The construction phase of the Project is most similar in nature to "road development in open coniferous wetland" (Dyer et al. 2001; Dyer 1999). Although the 0 to 100 m buffer around roads received little use, and habitat from 100 to 250 m was significantly avoided, there was no significant avoidance beyond 250 m from the road edge (Dyer 1999), indicating that the disturbance from roads dissipated beyond this point. The available data suggest that avoidance behaviour may occur up to 500 m from roads, but the relationship was not significant due to the reduced strength of the response and the limited sample size.

Therefore, it is EDIs opinion that although individual caribou may be disturbed by the Project, this disturbance will be of low magnitude and localized, and the area around the Project will continue to be used by caribou within the FCH home range. This effect has been assessed in the Project Proposal (BMC 2017), and assessed appropriately in the RSA, with the consideration of a 50% reduction in the use of LSA by caribou from the FCH.

3.3 Project Effects on Regional Caribou Population

In EDI's opinion, the Project Proposal (BMC 2017) appropriately evaluates the Project effects (i.e., direct and indirect effects) that could affect the FCH demographics, including recruitment. EDI agrees that for population-level effects to occur to the FCH, demographic parameters such as adult mortality would have to increase and/or calf recruitment decrease.

Considering the Project description and the baseline information on the FCH and their use of the habitat within their home range (including information provided in ARR1 and ARR2 on historical habitat use variability — as shown in maps provided for R2-85), EDI agrees that the potential residual effects on the FCH include loss of high suitability rutting and post-calving habitat, disturbance of movement corridors between the Pelly River lowlands and the alpine areas around the Project, direct mortality from collisions with vehicles, and disturbance from flights using the Finlayson airstrip. These residual effects, which include consideration of direct and indirect effects, either individually or separately, could influence the demographics of the FCH through various pathways (e.g., increased stress, increased predation) that could result in localized and limited (i.e., for a small number of animals) lower productivity or mortality. The Project Proposal (BMC 2017) noted that rutting to early winter period has the most potential for Project interactions, and calving caribou were not found within the Project footprint.

Considering the information in the Project Proposal (BMC 2017) and EDI's experience, habitat does not appear to be the limiting factor for the FCH. Predation and hunting have a demonstrable effect on the FCH population and appear to be key limiting factors on the FCH (i.e., the response to wolf control from 1983 to 1989 was noted).

The Wildlife Baseline Report (Appendix E-8; BMC 2017) states that the average recruitment rate from 1990 to 2015, was lower than the stable recruitment threshold ratio of 26 calves per 100 cows as outlined by Farnell (2009). EDI notes that ratios showed considerable yearly variation during this time period, with the reduced calf:cow ratio that occurred expected to be caused by wolf/bear predation.

EDI contacted Kelsey Russell (Yukon Caribou Biologist, pers. comm. 2019) to determine the preliminary findings of the March 2017 caribou survey. The report has not been released yet (i.e., an internal draft report awaiting finalization); however, a summary of the findings include:

- The March 2017 survey included both a composition survey and population estimate;
- The survey was conducted using stratified random block methodology — most caribou herds in Yukon are surveyed using mark re-sight methods; however, there are currently no collars on the FCH to use for mark re-sight; and

- The population estimate from the 2017 survey is 2,712 animals. This is down slightly from the previous estimate of just over 3,000.

This suggests to EDI that the current stressors (e.g., mortality due to predation or otherwise) on the FCH demographics continue to act on the population, effectively preventing the herd from growing.

In EDI's opinion, the Project Proposal (BMC 2017) appropriately considers the interactions of the Project with the FCH, by focussing on potential effects on rutting habitat (i.e., related to breeding success based on the number of bulls available to breed the cows) and post-calving habitat (i.e., the number of calves per 100 cows as a measure of recruitment). Considering the low levels of caribou habitat loss predicted in the Project Proposal (i.e., 0.9% loss of rut habitat of moderately high and high suitability; 0.7% loss of post-calving habitat of moderately high and high suitability; and considering the changes to the assessment discussed in R254 and R2-88) and the limited potential for mortalities to occur as a result of collisions with Project vehicles, it is EDIs opinion that the Project is expected to have a limited effect on the demographics of the FCH that is likely to be within measures of natural variability.

EDI suggests that the mitigation proposed by BMC related to limiting habitat loss, traffic management to reduce the potential for collisions, and restricting public access from the Robert Campbell Highway will limit adverse effects of the Project on the FCH, limiting the potential for adverse effects on the sustainability of the herd. In EDI's opinion, these factors have been appropriately considered in the EA within the Project Proposal, and any adverse effects of the Project on recruitment and/or mortality are not expected to measurably affect the FCH population within their home range.

The monitoring programs being proposed are expected to allow for adaptive management to be exercised by BMC. This is expected to allow the gathering of additional information on caribou/Project interactions, and timely response to either add or enhance mitigation options, as appropriate.

4 MOOSE

4.1 Effects Prediction

The Project Proposal (BMC 2017; page 13-93) states that "Residual Project effects on moose are considered not significant for all residual effects because they are low magnitude and local." EDI agrees with this conclusion.

The Project Proposal discusses Game Management Subzone (GMS) 10-07 (e.g., Figure 2-3 in the Baseline Report) as the RSA for wildlife. Appendix C of the Baseline Report provides the HSI model developed for moose, with the associated maps showing the Project footprint, LSA and RSA overlap with the mapped habitat suitability. This overlap is also shown in Figure 13-12 and Figure 13-13 in the EA. To inform the EA, BMC (2017; Chapter 13) focused on the post-rut habitat and the late winter habitat for moose. Figure 13-12 and Figure 13-13 show the Project in relation to modelled post-rut and late winter habitat. EDI agrees that this approach is reasonable and defendable, based on the information reviewed. Also, using GMS 10-07 as the RSA is appropriate for discussing the moose population on a regional basis, in EDI's opinion. This would address the concept that habitat to support all the life requisites for moose must be maintained within a given area (Management Unit) if the population in that area is to remain sustainable.

EDI notes that BMC (2017) also discusses and considers moose movement corridors, direct mortality from collisions, and disturbance from flights using the Finlayson Lake airstrip, including information within the EA, as well as in the ARR1 and ARR2 responses.

The MPs used in the Project Proposal (BMC 2017) are: change in suitable habitat from baseline conditions (including both direct and indirect habitat loss); change in wildlife movement/change in population distribution; change in wildlife mortality directly from Project activities (i.e., vehicle collisions and hunting); and health condition. In EDI's opinion, the MPs selected for moose provide adequate consideration to the amount of habitat altered or lost, and changes in abundance through direct, indirect or induced mortality resulting from Project-related effects, as addressed in the Project Proposal, and the ARR1 and ARR2 responses.

In EDI's opinion, the assessment endpoints/threshold criteria defined for the EA in Table 13-3 of the Wildlife and Wildlife Habitat Chapter 13 (BMC 2017) for each of the MPs for moose are reasonable. The RSA is the appropriate spatial context for the criteria to be applied (e.g., change in RSA moderate-high to high suitability rut or post-calving habitat). EDI noted that adding moderate habitat to the assessment did not alter the conclusions of the EA. The MPs (i.e., change in wildlife movement/change in population distribution; and, health condition) which had qualitative endpoints/threshold criteria were addressed in the responses to YESAB requests.

EDI agrees with the approach of Chapter 13 of the EA that "loss of suitable habitat was the primary focus of the assessment for most wildlife species" and "the area loss of highly suitable habitat from direct and indirect sources was compared to a threshold found in the literature to quantify the magnitude of the habitat loss and contributes to determining the significance of the effect." EDI agrees with the approach of

overlaying the disturbance footprint and LSA of the Project with the habitat suitability index model maps that were developed, to determine the amount of overlap, and to inform the prediction of the significance of the residual effects.

For the calculation of total habitat loss, indirect habitat loss was weighted as a 50% equivalent to direct habitat loss. EDI considers this approach to be appropriate for the assessment of Project effects on moose, as they are typically considered a species that can use edge habitat.

The EA (BMC 2017) reaches a residual effects significance prediction by considering the baseline conditions for moose within the RSA (GMS 10-07), presenting and evaluating the Project components/activities within the RSA, identifying the expected interactions of each of the Project components with moose, determining potential effects on moose, proposing general wildlife and moose-specific mitigation, and identifying which of the potential effects are residual (i.e., those effects remaining after the application of mitigation). The residual effects are then evaluated with the use of defined criteria to determine significance. BMC (2017) states — "A significant residual effect is considered to occur if it is adverse, of high magnitude, and extends across the regional study area. Alternatively, it is adverse, of high magnitude, in the local study area, and occurs over the long term." The results of this assessment process are presented for moose in Table 13-3 where, all residual effects were found to be adverse in direction, low in magnitude, local in geographic extent and long-term in duration. Considering the definition of significance, all residual effects of the Project on moose were predicted by BMC (2017) to be not significant. EDI agrees with this approach and the conclusions. The ARR1 and ARR2 responses related to considering changes to the HSI model and the consideration of moderate habitat did not affect the conclusions of the EA for moose.

To validate, qualify, or counter the Project Proposal (BMC 2017) prediction, EDI used the same approach described in Section 3.1 of this report and used to verify the BMC effects predictions for caribou. At the RSA level, EDI suggests that the Project effects are:

- Adverse in direction (i.e., potential loss of high suitability post rut and late winter habitat, potential disturbance of movement between the Finlayson Lake lowlands and the montane areas around the Project, potential direct mortality from collisions with vehicles, and potential disturbance from flights using the Finlayson Lake airstrip);
- Low in magnitude (i.e., 4% of post-rut and 3.9% of late winter habitat would be affected by the Project in the RSA (i.e., GM 10-07); this considers the revised values presented in R254 and R2-101 for the update that includes the moderate habitat class);
- Local to Regional in geographic extent (i.e., an effect on moose could extend beyond the LSA into the RSA — such as a change in movement corridor, or avoidance of post-rut or late winter habitat);
- Long-term in duration (i.e., some effects are expected to extend into the Post-closure Phase);
- Reversible in the short- to long-term (except if there is a mortality — but the cause could be addressed and mitigated); and
- High environmental and socio-economic context based on the importance of moose.

Maintenance of a sustainable moose population would be expected to allow for the continued ecological, cultural and economic role of moose in GMS 10-07. In EDI's opinion, based on the information presented in the Project Proposal (BMC 2017) and the AAR1 and AAR2 responses, the predicted residual effects of the Project on moose, relative to baseline conditions, are not likely to affect the viability of moose within GMS 10-07 in Yukon (i.e., the population is not expected to be affected on a regional scale).

Section 13.4.2 discusses proposed mitigation measures that "BMC will implement to eliminate, minimize and/or reduce Project effects resulting from interactions between wildlife and Project activities." EDI notes that one of the main opportunities for mitigation is project siting (i.e., limiting overlap or avoiding) in relation to sensitive wildlife habitat. Based on the Project description and considering the location of the resource to be mined for a viable project, it appears that BMC is using existing disturbances (i.e., the Tote Road and the exploration area have been disturbed) and limiting the disturbance of identified moose habitat, to the extent practical.

4.2 Moose Dependence on the Project Area

Based on the Project Proposal (BMC 2017; Appendix E-8 Wildlife Baseline Report) and the responses in ARR1 and ARR2, EDI suggests that some moose within GMS 10-07 use the available habitat within the area of the Project, but that the regional moose population does not appear to be dependant on the habitat within that area (i.e., moose use suitable habitat throughout the RSA; see Figure 4-1 Wildlife Baseline Report; BMC 2017; Figure 13-17 in ARR2 R205). The habitat types that are predicted to be affected as a result of the Project are present and available throughout the RSA and do not appear to be limiting.

The Project Proposal (BMC 2017), the Wildlife Baseline Report (Appendix E-8), and the responses to ARR1 and ARR2 characterize and describe the available moose habitat in GMS 10-07, using habitat mapping, appropriately conducted and timed surveys, incidental observations and traditional knowledge. This information shows the available habitat within the Project footprint and LSA and throughout the RSA (GMS 10-07), and the use of that habitat by moose during the post-rut and late winter. This information was used to predict the effect of the Project, as discussed in Section 4.2 of this report.

Based on the BMC (2017) Project Proposal, and the responses in ARR1 and ARR2, EDI predicts that the areas currently used by moose in GMS 10-07 will continue to be used during the development and operation of the Project. This is based on the results of the various surveys, which show that moose continue to use the habitat available, even with the presence and use of the Tote Road and the exploration activities. Project area habitat use by moose is expected to be affected by the presence and operation of the Project, but the effects of predation and deep snow depths in the RSA would be expected to be the more influential aspect related to habitat use. Suitable habitat for moose does not appear to be limiting in GMS 10-07.

EDI notes that the Project is an upgrade of existing disturbances (e.g., upgrading the Tote Road to an all-weather Access Road; developing mining infrastructure where exploration activities have been completed), and is not entirely a new disturbance within GMS 10-07. Considering this, the findings in the Wildlife Baseline Report (BMC 2016; e.g., survey results for 2015 and 2016) are expected to, in EDI's opinion,

reflect the response of the existing moose population to human activity within GMS 10-07. Considering this, and the predictions made in the EA (BMC 2017), the effects of the Project on moose movements are expected to be of a low magnitude and local in geographic extent. This considers the natural variability of moose movements within their traditional migration routes, and the effect of snow cover, and considers the maintenance of habitat connectivity and some level of likely habituation by moose to human disturbance.

4.3 Project Effects on Regional Moose Population

In EDI's opinion, the Project Proposal (BMC 2017) appropriately identifies and evaluates the Project effects (i.e., direct and indirect effects) that could affect the regional moose population. EDI agrees that, as noted for caribou in section 3 of this report, for population-level effects to occur, adult mortality would have to increase and/or calf recruitment decrease.

Considering the Project description and the baseline information on moose and their distribution in the GMS 10-07, EDI agrees that the potential residual effects on moose include the loss of high suitability post-rut and late winter habitat, disturbance of movement corridors between the Finlayson Lake lowlands and the montane areas around the Project, direct mortality from collisions with vehicles, and disturbances from flights using the Finlayson airstrip. All these residual effects, which include consideration of direct and indirect effects, either individually or separately, could influence the demographics of moose through various pathways (e.g., increased stress, increased predation) that could result in localized and limited (i.e., for a small number of animals) lower productivity or mortality.

In EDI's opinion, the Project is expected to have a not significant effect on the demographics of the moose population in GMS 10-07. Considering the information presented, habitat is not the limiting factor for moose in GMS 10-07. It appears that mortality (e.g., by predation, hunting) have a demonstrable effect on moose populations and appear to be key limiting factors on moose populations in GMS 10-07.

In EDI's opinion, the effects assessment appropriately considers the interactions of the Project with moose, by focussing on potential effects to post-rut habitat and late-winter habitat. Considering the low amounts of moose habitat loss predicted by AEG (2016) (i.e., 4.9% loss of post rut habitat of moderately high and high suitability; 3.8% loss of late winter habitat of moderately high and high suitability) and the limited potential for mortalities to occur as a result of collisions with Project vehicles, it is EDIs opinion that the Project is expected to have a limited effect on the demographics of the moose population in GMS 10-07.

EDI suggests that the mitigation methods proposed by BMC related to limiting habitat loss, traffic management to reduce the potential for collisions, and restricting public access from the Robert Campbell Highway will limit adverse effects of the Project on moose, thereby limiting the potential for adverse effects on moose demographics, and the population's sustainability in GMS 10-07. Natural predation and harvesting by humans are expected to be key limiting factors for the moose population in GMS 10-07.

The monitoring programs being proposed are expected to allow for adaptive management to be exercised by BMC. This is expected to allow the gathering of additional information on moose/Project interactions, and timely response to either add or enhance mitigation options, as appropriate.

5 FURBEARERS

The Wildlife Baseline Report (Appendix E-8; BMC 2017) indicates that there are many known and suspected furbearing species present in the LSA, including wolf (*Canis latrans*), wolverine (*Gulo gulo*), red fox (*Vulpes vulpes*), lynx (*Lynx canadensis*), coyote (*Canis latrans*), marten (*Martes Americana*), mink (*Mustela vison*), muskrat (*Ondatra zibethicus*), river otter (*Lontra canadensis*), weasel (*Mustela nivalis*) and beaver (*Castor canadensis*; discussed separately in Chapter 9); the wolf, wolverine, red fox and beaver are discussed in detail. Chapter 13 Wildlife and Wildlife Habitat (BMC 2017) identifies the grey wolf and wolverine as subcomponents of the Wildlife and Wildlife Habitat VC.

5.1 Spatial Extent of Sink Effects

EDI notes that the Project Proposal (BMC 2017) predicts adverse effects of the Project on wolf (i.e., reduced prey availability due to ungulate habitat loss; direct mortality from collisions with vehicles), and wolverine (i.e., habitat avoidance from road density). These effects were predicted to be primarily low to moderate in magnitude and local in geographic extent and not significant. Although the Project may adversely affect a limited number of individuals in a localized area within the vicinity of the Project, these effects are expected to not affect the regional population of a furbearer species.

Effects of the Project (e.g., direct or indirect effects on furbearer species populations) are may result in not significant numbers of individuals being "pulled away" from more distant habitat within the RSA, and thereby creating a depression in population density for a given species over a larger area. This considers the habitat loss (i.e., direct and indirect) related to the Access Road and mine footprint, and the continued presence of natural, undisturbed habitat throughout the RSA.

Source-sink dynamics is a theoretical model used by ecologists to describe how variation in habitat quality may affect the population growth or decline of organisms. Pulliam (1988) noted "…*that animal and plant populations often occupy a variety of local areas and may experience different local birth and death rates in different areas. When this occurs, reproductive surpluses from productive source habitats may maintain populations in sink habitats, where local reproductive success fails to keep pace with local mortality. For animals with active habitat selection, an equilibrium with both source and sink habitats occupied can be both ecologically and evolutionarily stable. If the surplus population of the source is large and the per capita deficit in the sink is small, only a small fraction of the total population will occur in areas where local reproduction is sufficient to compensate for local mortality. In this sense, the realized niche may be larger than the fundamental niche. Consequently, the particular species assemblage occupying any local study site may consist of a mixture of source and sink populations and may be as much or more influenced by the type and proximity of other habitats as by the resources and other conditions at the site.*"

EDI approached the discussion on "sink effects" in relation to habitat in the RSA, because habitat (i.e., types and amounts) and the predicted effects of the Project can have an effect on prey availability (e.g., caribou and moose populations), avoidance (e.g., source of annoyance), mortality (e.g., vehicle collisions) and health condition (e.g., increased stress levels). These were the MPs used in the Project Proposal (BMC

2017 Chapter 13). The discussion includes adverse residual effects that are either direct (e.g., habitat loss through clearing) or indirect (e.g., habitat avoidance due to human disturbance).

Another aspect of a "sink" is the creation of habitat or condition that attracts an animal, but in so doing, exposes that animal to dangerous conditions (e.g., bear falling into excavations) or alters its natural life cycle (e.g., foxes attracted to camps) that can affect that animal's potential for survival.

The spatial extent of sink effects would be expected to be related to the home range of a given species, which can be variable depending on habitat quantity and quality, and the condition of the life requisites of that species within the range. The zone of influence (ZOI) used in the Project Proposal (BMC 2017; Chapter 13), are appropriate in EDI's opinion, in that the 1.5 km buffer along the Access Road, and the 3 km buffer around the mine infrastructure (i.e., the LSA), are expected to capture the extent of indirect effects (e.g., noise, dust deposition, visual disturbance and light annoyance). The 50% use of the habitat assumption used, is also considered appropriate, as these buffers are not completely avoided by animals, with the level of reduced use or the avoidance distance being species- and even individual-specific.

EDI noted that in the Project Proposal (Chapter 8 of the Wildlife Baseline Report; BMC 2017) that winter track count surveys were established in habitat types that commonly occur within the LSA to assess habitat use in the area potentially affected by the Project. EDI notes that the transects were placed within existing disturbances (i.e., the exploration area or along the Tote Road). For this discussion, EDI would expect that similar habitat types within the RSA would support these same species.

The EDI discussion on furbearers/sinks considers GMS 10-07 as the RSA, to provide a regional perspective on furbearer populations and potential interactions with the Project. The estimated home ranges of wolf (1,000 km^2; Baer 2010, Baer 2011, Yukon Environment 2019), wolverine (100–600 km^2; Banci 1987), red fox (295 hectares [ha]; Yukon Environment 2019), beaver (2.5 to 20.5 ha; Nagorsen 2005), marten (5 km^2; Archibald and Jessup 1984, Yukon Environment 2019), weasel (7–15 ha for males and 1–4 ha for females; Hatler et al 2008) and red squirrel (0.3 to 0.5 ha; Yukon Environment 2019) were used to inform this discussion. EDI did not see any mention of trapping concessions within the RSA in the Wildlife Baseline Report, or Chapter 13 of the Project Proposal.

EDI expects that the Project and related activities will result in habitat loss and human activity that will result in avoidance of the Project footprint by most furbearer species. However, some species may be attracted to the Project as a result of the creation of a food source (e.g., camp; landfill) and the creation of alternative habitat (e.g., shelter at the camp; water management system or culverts). EDI considered the results of the various surveys summarized in the Wildlife and Wildlife Habitat Chapter 13 (BMC 2017), in relation to the above species and noted:

- Wolves — common and observed throughout the RSA; it was hypothesized that exploration activities in 1995 resulted in wolves avoiding the area;
- Wolverine — noted only occasionally, most observations of sign notes in alpine and subalpine habitats;
- Red fox — common, frequently observed at the exploration camp;

- Beaver — sign in the area is sparse and typically old or in poor repair;
- Marten — noted more in the mine footprint than along the Tote Road;
- Weasel — noted more in the mine footprint than along the Tote Road; and
- Red squirrel — not observed in the mine footprint, only along the Tote Road.

The Project is expected to result in the direct and indirect loss of habitat and/or mortality. The Project construction and operation are expected to result in limited, localized conditions that may attract a limited number of individuals of the above-noted species (e.g., red fox, beaver, red squirrel). In EDI's opinion, the potential for the Project to result in a "sink" for furbearers is low and is not expected to jeopardize the sustainability of regional populations. Individuals outside the ZOI and with home ranges that overlap with the LSA are expected to continue to avoid the disturbed areas of the Project, and not be a "source" for the "sink" — as the affected areas are not expected to create preferred habitat that attracts these species, considering that effective mitigation options (e.g., waste management, no feeding of animals) are applied.

In EDI's opinion, the populations of the furbearer species noted above are not expected to be affected at the RSA level.

5.2 Anticipated Zones of Influence

EDI notes that the Project will be an upgrade of the Tote Road to an all-weather Access Road and the exploration area to an operating mine. Considering this, EDI suggests that the animals, including furbearers that have home ranges that overlap the LSA and RSA have been exposed to habitat loss and disturbance. This suggests that there could be a level of habituation of some of these animals to the existing disturbances. Berger (1995) noted that the magnitude of positive and negative habitat effects depended on the adaptability of the species to environmental change. It could be argued that the "upgrade" activities for the Project may result in less disturbance (i.e., decreased ZOI) on animals that have been exposed to the Tote Road and exploration activities (i.e., existing disturbance), than if those same animals were being exposed to a "new" disturbance within an undisturbed, natural ecosystem.

The ZOI are the spatial extent within which the adverse effects of the Project affect a given species. The ZOI used in the Project Proposal (BMC 2017; Chapter 13) are appropriate in EDI's opinion, in that the 1.5 km buffer along the Access Road, and the 3 km buffer around the mine infrastructure, are expected to capture the extent of indirect effects (e.g., noise, dust deposition, visual disturbance and light annoyance). The 50% use of the habitat assumption used, is also considered appropriate, as these buffers are not completely avoided by animals, with the level of reduced use or the avoidance distance being species- and even individual-specific.

The extent of the ZOI, and potential for furbearers to be drawn (i.e., attracted) into the ZOI (i.e., closer to, or into the Project infrastructure) are expected by EDI to be limited and localized, and species and individual animal-specific. The Project Proposal indicates that foxes have been observed around the camp and exploration areas, presumably attracted by food. Mitigation that prevents the feeding of animals and that precludes foraging opportunities for species like foxes, wolves and wolverine, are expected to limit the

extent and magnitude of these potential effects. The natural, undisturbed habitat within the RSA, along with the general avoidance of human disturbance and activities by wildlife, is expected to allow the furbearer populations to remain viable at the regional level.

Although the Project may adversely affect a limited number of individuals in a localized area within the vicinity of the Project, these effects are not expected to affect the regional population of a furbearer species. Using the EA approach used above for caribou and moose, maintenance of a sustainable furbearer population would be expected to allow for the continued ecological, cultural and economic role of furbearers in GMS 10-07.

In EDI's opinion, based on the information presented in the Project Proposal (BMC 2017) and the AAR1 and AAR2 responses, the predicted residual effects of the Project on furbearers, relative to baseline conditions, are likely to not affect the viability of furbearers in GMS 10-07 in Yukon (i.e., the population is not expected to be affected on a regional scale).

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