A Review of the 2018 Diavik Diamond Mine Wildlife Monitoring Report

Prepared for

Environmental Monitoring Advisory Board

July 2019

Prepared by

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Executive Summary

Summary and Recommendations

In this review on behalf of the Environmental Monitoring Advisory Board (EMAB or the Board), Management and Solutions in Environmental Science (MSES) assesses the procedures and results of the 2018 Wildlife Monitoring Report (WMR; Golder 2019). The annual data collection is mandated to follow a Wildlife Monitoring Program (WMP), developed in 2002, which determined the testable questions and the objectives that need to be addressed through the life of the project. The WMP is a requirement of the Diavik Environmental Agreement which is an agreement between Diavik Diamond Mine Inc. (DDMI), local Indigenous groups and the federal and territorial governments that formalizes Diavik's environmental protection commitments. Review of the WMRs assists the Board in partially fulfilling its mandate as outlined in the Diavik Environmental Agreement. Since 2004, MSES reviewed the WMRs to evaluate how the WMP was and is adhered to. In the course of 2010, MSES participated in several communications with DDMI and other parties where a number of recommendations were discussed in workshops and other venues to adapt the data collection in light of the information available at the time (Handley 2010). These recommendations, in part, altered the objectives of the 2002 WMP which are now reflected in the WMRs since 2011. Specific to grizzly bear, the monitoring objective was revised once again at a March 2013 Wildlife Monitoring Workshop hosted by the GNWT (GNWT 2013). Below we have summarized our key review findings for the 2018 WMR.

The overall area of disturbance (km^2) remained at or below predicted levels in 2018, with six out of 12 vegetation types (Ecological Land Classifications (ELC)), riparian shrub, esker complex, bedrock complex, boulder complex, birch seep and shrub, and heath tundra, at or slightly exceeding the predicted loss.

Direct loss of caribou habitat is still in line with the original predictions. Indirect loss of caribou habitat was addressed in Appendix A of the 2018 WMR. Low/nil suitability caribou habitat increased from 62% to 71% within the 14 km ZOI. DDMI suggests that indirect loss of caribou habitat through changes in vegetation next to the Mine site are likely to be limited because of the amount of habitat that is of low/nil suitability within 14 km of the mine prior to consideration of indirect effects and the limited amount of time caribou are present in the area.

The mean population size of the Bathurst caribou herd has decreased between 1996 (349,000) and 2018 (8,200) resulting in fewer caribou monitoring opportunities over time relative to the Diavik mine site. The population decrease also corresponds with changes in Bathurst caribou seasonal range patterns including an overall contraction of their range and a delay in their southern (fall) migration to below treeline. Caribou from the Beverly/Ahiak herd are also reported in the Diavik study area in more recent years. Aerial surveys for caribou have not been completed since 2012. Based on previous detailed analyses, there appears to be a zone of influence (ZOI) for caribou occurrence, where caribou are more likely to occur at about 14 km from the Mine than closer to the Mine. In the 2018 SGP Wildlife Monitoring Workshop, an approach to ZOI analysis was presented which evaluates ZOI on an annual basis using GPS collar data. This approach may offer new insight or opportunity into uncovering a mechanism for the ZOI, which could lead to improvement of effect mitigation. A ZOI Draft Guidance Document was developed in March 2015 that outlines the conditions under which monitoring ZOI is technically appropriate. We expect that

ENR will recommend that in 2019, ZOI monitoring will resume given that Diavik planned to begin aboveground mining in the A21 pit in 2018.

Caribou behaviour data were collected but not analyzed in the 2018 WMR. DDMI will not undertake additional analyses of ground-based behavioural data until they deem that sufficient data are available. A comprehensive analysis of caribou behaviour data was last completed in 2011. Diavik and Ekati are cooperating on behavioural data collection. We understand that Ekati will be shifting their data collection to include more group scans in future years which will improve data compatibility. There is now a six-year gap in caribou behavioural data analysis (2012-2018) due to insufficient data. We are awaiting a summary of sample sizes of caribou behavioural data including categories for mine operator, type of scan, season, distance from mine, and year.

Analysis of caribou collar data with respect to seasonal movement was included in the 2018 WMR. In 2018, male and female caribou distribution followed the predicted pattern for the northern (deflected west of East Island), but not for the southern migrations (also, and contrary to prediction, deflected west of East island). Over the long-term, caribou are following the predicted pattern for the northern migration; however, not for the southern migration. DDMI has concluded that the prediction in the Environmental Effects Report (EER) was inaccurate but conservative and that there is no evidence of an ecological effect of population fragmentation due to changes in the southern migration. In essence, the monitoring has confirmed that there has been a shift in the southern migration, but there is uncertainty regarding the primary driver of the observed change in caribou migration: is it a project effect, cumulative effect, or natural phenomenon linked with the population decline? We recommend that the question of the influence of mining on caribou distribution remains "on the table" through the annual collection and evaluation of GPS-collar data.

For grizzly bears, both mortality and habitat loss remain at or below the levels predicted. The 2018 incidental data seem to suggest that the occurrence of grizzly bears near the Mine is increasing over time. However, it appears as though a single bear is responsible for the majority of the observations and has a home range that includes the mine. Given that grizzly bear mortality predictions have not been exceeded and DNA results suggest a stable or increasing population, project-specific impacts of the mine on grizzly bears are likely minimal.

For wolverine, there appears to be support for the prediction that mining related mortalities are not expected to alter wolverine population parameters in the Lac de Gras area. The 2018 WMR reported zero mortalities, relocations, and deterrent actions for wolverine on-site. Snow track surveys for wolverine were completed in 2018. A comprehensive analysis of wolverine track data was last completed in 2017 which showed that the probability of wolverine occurrence has increased over time in the Diavik mine study area. An analysis of wolverine hair snagging data (Efford and Boulanger 2018), found that wolverine apparent survival across study areas is similar and that the wolverine population growth rate through time across study areas is relatively stable. Mine-related wolverine mortalities are unlikely to be influencing wolverine population parameters.

There do not appear to be any new findings or changes of note regarding the presence and productivity of falcons. One active peregrine nest was observed in 2018. Project-specific effects on peregrine falcons are likely minimal.

In 2018, observations of wildlife (fox and wolverine) were highest for the Waste Transfer Area (WTA) and the number of misdirected food items was highest for the WTA. However, misdirected attractants (food and food packaging) appear to be lower in 2018 compared to 2017 levels on the WTA, the Landfill area, the A21 Area, and Underground. The overall effect of waste management on site appears to be positive.

As expected, there was no new information regarding the abundance and species composition of waterfowl and shorebirds in the 2018 WMR. It had been agreed that the waterfowl monitoring program be discontinued in December 2013, but CWS did recommend that DDMI re-start the waterbird/shorebird monitoring program at the Mine reclamation stage.

As expected, no wind farm associated bird mortality information was presented in the 2018 WMR. Given the low likelihood of avian-turbine strikes, due to location and size of the wind farm, and the absence of bird mortalities in 2013, we agreed with DDMI's recommendation to discontinue monitoring the wind farm using 2013 methods and to instead monitor for bird mortalities as part of the overall site compliance monitoring program.

In the past, the measurements have adequately addressed the predictions at hand and the analysis of the data yielded a great deal of credible information about the effectiveness of mitigation measures. However, there are some widening gaps in data collection, analysis, and reporting, particularly relating to caribou. Below, we present some highlights for the Boards' consideration. We recommend that the following issues be addressed:

1. Please continue to discuss how the information gained from various caribou datasets could be used in terms of mitigation and adaptive management for the Diavik Mine in particular and for other future projects in the region in general. When more information on potential mechanisms for the 14 km ZOI, for deflections around Diavik for the southern migration, or for any observed changes in caribou behaviour becomes available, we anticipate discussions regarding the implementation of new mitigation measures to manage any project-related effects.
2. In the 2018 SGP Wildlife Monitoring Workshop, an approach to ZOI analysis was presented which evaluates ZOI on an annual basis using GPS collar data**.** We recommend that EMAB review this approach once more information is available, as it may offer new insight or opportunity into uncovering a mechanism for the ZOI, which could lead to improvement of effect mitigation (adaptive management). Given that aboveground mining in the A21 pit was planned to begin in 2018, Diavik should resume ZOI monitoring in 2019. Diavik has committed to confirm and discuss the appropriate methods of ZOI monitoring with EMAB.
3. There is now a six-year gap in caribou behavioural data analysis (2012-2018) due to insufficient data. Ekati and Diavik are cooperating on data collection. We emphasize the importance of these data in understanding the influence of the Mine on caribou and the mechanism that lead to the avoidance of the Mine vicinity. To gain a better understanding of where sample sizes are most limiting, we ask DDMI to reconcile caribou behaviour data sample size information into a single format (it has been provided in multiple formats in the past) that can be updated annually and easily referenced for future discussions. This should include information on:

i. Mine operator (Ekati vs Diavik)
ii. Type of scan (focal vs group)
iii. Season
iv. Distance from mine
v. Year

4. In future detailed analysis of caribou occurrence and behavioural data, we recommend DDMI provide a discussion regarding patterns in behaviour and how they do or do not change with distance to the mine (i.e., does behaviour change with distance as occurrence does?). We also recommend that the information gained from caribou analyses be used to adjust or develop mitigation measures, as necessary.
5. Please explore opportunities and options to mitigate dust deposition, which may be influencing caribou migration patterns according to the TK. This could include a coordination of best management practices for all mining operations in the vicinity.
6. Please provide responses to the detailed questions and comments (presented in bold font) in the body of this review report.
7. Except for our recommendations listed above, we are in agreement with the recommendations listed in the 2018 WMR and do not recommend any actions additional to providing the information requested above.
8. We recommend that the Board accept the 2018 WMR with the understanding that the above listed questions and recommendations will be addressed in a timely fashion via communications and workshops by DDMI in the coming year. The responses to our questions and recommendations are necessary to maintain and improve the understanding of the effects of the Mine on wildlife. Furthermore, we understand that detailed data analyses are required, as identified in our review, and that these analyses will be conducted in the near future.

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1.0 Introduction

The Environmental Monitoring Advisory Board (EMAB or the Board) for the Diavik Diamond Mine Inc. (DDMI) Project requested that Management and Solutions in Environmental Science Inc. (MSES) review and assess the procedures and results of the 2018 Wildlife Monitoring Report (WMR; Golder 2019). A WMR is completed annually while a Wildlife Comprehensive Analysis Report (WCAR) has been completed every three years and submitted as a separate report. In the future, comprehensive analyses will be completed every three years but included within the annual WMR rather than as a stand-alone document. The WMR communicates the findings of surveys conducted during 2018 as well as DDMI's recommendations for future activities.

The annual data collection is mandated to follow a Wildlife Monitoring Program (WMP), developed in 2002, which determined the testable questions and the objectives that need to be addressed through the life of the project. The WMP is a requirement of the Diavik Environmental Agreement which is an agreement between DDMI, local Indigenous groups and the federal and territorial governments that formalizes Diavik's environmental protection commitments. Review of the WMRs assists the Board in partially fulfilling its mandate as outlined in the Diavik Environmental Agreement. Since 2004, MSES reviewed the WMRs and WCARs to evaluate how the WMP was and is adhered to. In the course of 2010, MSES participated in several communications with DDMI and other parties where a number of recommendations were discussed in workshops and other venues to adapt the data collection in light of the information available at the time (Handley 2010). These recommendations, in part, altered the objectives of the 2002 WMP which are now reflected in the WMRs since 2011.

Based on its annual reviews of past WMRs and detailed data analyses (WCARs), MSES submitted numerous recommendations for EMAB and DDMI to consider. The present report takes past recommendations and discussions as well as the altered WMP objectives into account. Here, we review how DDMI addressed the above discussions and previous recommendations in the 2018 WMR.

In our review below, for the ease of identifying our recommendations and requests, we highlight the **text in bold** where we specifically request actions from DDMI or where a commitment has been made by DDMI.

2.0 General Observations

2.1 Objectives of the Wildlife Monitoring Program

The objectives of the WMP v.2 were developed in 2002 and DDMI has anchored its monitoring reports on these objectives. For more clarity, below we re-state the objectives set forth in the WMP v. 2 of 2002 to emphasize that these objectives are the foundation and focus of our review, and that the methods and results in the 2018 WMR, are reviewed in light of these objectives, as amended in 2010.

"The objectives of the wildlife monitoring program are to:

a. Verify the accuracy of the predicted effects determined in the Environmental Effects Report (Wildlife 1998) and the Comprehensive Study Report (June 1999); and

b. Ensure that management and mitigation measures for wildlife and wildlife habitat are effective in preventing significant adverse impacts to wildlife."

A number of specific questions that have been tested in the course of the years of monitoring have been found to be either largely answered or ineffective for the testing of mitigation effectiveness, prompting discussions about adapting the objectives of data collection in light of current information (Handley 2010). Specific to grizzly bear, the monitoring objective was revised once again at a March 2013 Wildlife Monitoring Workshop hosted by the GNWT (GNWT 2013). The new grizzly bear and wolverine objectives are to provide estimates of grizzly bear and wolverine abundance and distribution in the Diavik Wildlife Study Area over time. The new barren ground caribou monitoring program objectives are to determine whether the zone of influence changes in relation to changes in Mine activity and whether caribou behaviour changes with distance from the mines. The new objectives of the falcon monitoring program are to contribute data to the Canadian Peregrine Falcon Survey (CPFS), identify any pit wall or infrastructure nesting sites, determine nest success and deterrent effectiveness, and determine cause of any Mine-related raptor mortalities.

2.2 The State of Current Information

The 2018 WMR includes a discussion of effects on wildlife from the previous year. Detailed analyses for barren-ground caribou and wolverine were last completed in 2017 (WCAR; Golder 2017a); however, DDMI will not undertake other analyses until they deem that sufficient data are available (e.g. caribou behaviour). Other programs have had data collection suspended (e.g., caribou aerial surveys or evaluating Zones of Influence (ZOI)) or have adopted an alternative study design (e.g. grizzly bear hair snagging for evaluating abundance and distribution). Grizzly bear and wolverine hair snagging programs are not intended to assess specific Mine-related effects. An updated grizzly bear population assessment was provided (Appendix J; ERM 2018).

For the reader of this review, however, we re-state some of the highlights in the previous years' reviews, in addition to results from the current review, as this is the currently best available information on trends and data quality:

- The detailed analyses conducted in past years were generally well presented and informative. We would like to note that some of the recommendations made in previous years have been incorporated into subsequent analyses. We would like to commend the authors for including more detail in the analytical results when sufficient data were available.
- Caribou habitat loss remains at or below the levels predicted. With respect to caribou movement, based on previous detailed analyses, the general findings for caribou remain relatively unchanged, namely that there appears to be a ZOI for caribou occurrence (presence-absence data) where caribou are more likely to occur at about 14 km from the mine than closer to the mine. In the 2018 SGP Wildlife Monitoring Workshop, an approach to ZOI analysis was presented which evaluates ZOI on an annual basis using GPS collar data. This approach may offer new insight or opportunity into uncovering a mechanism for the ZOI, which could lead to improvement of effect mitigation. As far as caribou behaviour is concerned, based on previous detailed analyses, a potentially important finding was that caribou groups with calves spend less time feeding and resting within 5 km of the mine than farther away (Golder 2011). This suggests that caribou

behaviour and potentially the energy balance of young caribou is affected within that distance. DDMI will not undertake additional analyses of ground-based behavioural data until they deem that sufficient data are available. Finally, regarding caribou distribution, caribou migration patterns are continuing as predicted for the northern migration; however, over the long-term, the southern migration appears to have occurred further west and more recently has remained further north than anticipated. DDMI has suggested that deflection monitoring is not necessary because an adverse ecological effect is not evident.

- For grizzly bears, both mortality and habitat loss remain at or below the levels predicted. Incidental observations suggest there may be an increasing number of grizzly bear occurrences, number of days with bear visitations, and number of days with deterrent actions over time. Given that grizzly bear mortality predictions have not been exceeded and DNA results suggest a stable or increasing population (ERM 2018), project-specific impacts of the mine on grizzly bears are likely minimal.
- For wolverine, mortality due to the Mine remains low. A comprehensive analysis of wolverine track data was last completed in 2017 which showed that the probability of wolverine occurrence has increased over time in the Diavik mine study area. An analysis of wolverine hair snagging data (Efford and Boulanger 2018), found that wolverine apparent survival across study areas is similar and that the wolverine population growth rate through time across study areas is relatively stable. As such, DDMI concluded that mine-related wolverine mortalities are unlikely to be influencing wolverine population parameters.
- In 2018, observations of wildlife (fox and wolverine) were highest for the Waste Transfer Area (WTA) and the number of misdirected food items was highest for the WTA. However, misdirected attractants (food and food packaging) appear to be lower in 2018 compared to 2017 levels on the WTA, Landfill area, A21 Area, and Underground. In general, the number of wildlife observations in these four waste collection areas is lower in 2018 compared 2017.
- For falcons, the new objectives (in 2010) aiming at contributing data to the Canadian Peregrine Falcon Survey (CPFS) seemed reasonable as they potentially contribute to a better regional understanding of falcon populations. However, the CPFS was discontinued in the NWT in 2015; therefore, DDMI will no longer be providing nest site occupancy and productivity data to the Canadian Wildlife Service (CWS). Pit walls and other infrastructure are still monitored for nesting raptors and nest monitoring data are still contributed to ENR every 5 years.

DDMI provided responses to our recommendations and questions from 2018 (Appendix A, 2018 WMR). Table 1 summarizes the current status of our 2018 recommendations. See Appendix A for a record of requests that have been addressed in previous years.

Table 1: Actions by DDMI in Response to Recommendations that were developed in 2018 or carried over from previous years.

Recommendations/Questions in 2018	Action by DDMI
Vegetation and Wildlife Habitat	

The 2013 Comprehensive Vegetation and Lichen Monitoring Program report stated that mercury concentrations were statistically lower near the Mine than farther away in both 2010 and 2014 [typo: should read 2013]. No discussion on this finding was presented. Please discuss possible causes of this pattern in mercury concentrations and what effects this may have on caribou ingesting lichen far from the Mine.	DDMI indicated that the results have not changed over time. Looking back at the 2013 Comprehensive Vegetation and Lichen Monitoring Program report, the statement in the report (Section 3.3.2.2) does not appear to match the data presented in Figure 3.3-3. Mercury looks to be statistically similar between near and far field in both 2010 and 2013. **This issue is satisfied**.
The information collected through the vegetation monitoring program is used to test and evaluate the predicted effects of the Mine. One prediction is that community level richness is predicted to decrease by 14% and species diversity and richness is predicted to decrease by 44%. Vascular plant species richness was actually 54% higher on heath tundra plots and 9% higher on shrub Mine plots. The report does not suggest any strategies that could mitigate these unanticipated effects. Please discuss if and how these potential project effects could be mitigated.	DDMI responded that the ecological relevance of the results is uncertain, and that current mitigation appears to be effective at minimizing adverse effects to vegetation (Golder 2017b). Changes in vegetation structure may be a contributing factor to the observed caribou ZOI (14km) and there may be cumulative changes over time to vegetation structure. In lieu of additional mitigation measures during operations, the topic should be addressed in the Mine closure plan and proposed reclamation activities with particular attention focused on ensuring that forage species palatable to caribou be part of the mix of species (at a natural ratio) in the reclaimed landscape. DDMI has indicated that vegetation monitoring post-closure will include reference sites to determine whether reclaimed areas provide similar ecological function to that of similar, undisturbed areas. However, we understand that reclamation will be applied to areas within the direct disturbance footprint, rather than areas indirectly affected by mine operations. It would be interesting to see how indirectly affected caribou habitat recovers post-closure. **Please clarify if reclamation activities will be restricted to the project footprint.**
Barren-Ground Caribou	
Caribou Habitat Loss	
We suggest that an analysis of the indirect (in addition to the currently presented direct) footprint effect on caribou habitat may be useful for understanding the true effects on caribou and for determining future mitigation measures.	DDMI indicated that the ZOI analysis for caribou captures the effect of indirect habitat loss (22 February 2018 conference call). In the 2018 WMR (Appendix A, Table 4), DDMI provided additional information on changes in the area of high, moderate, low, and nil suitability caribou habitat assuming that sensory disturbance reduced habitat suitability by one level. DDMI stated that the area is of marginal quality in the absence of indirect changes and that ecological impacts are likely to be limited considering the limited amount of time caribou are present in the area. **Opportunities for improvement of existing mitigation measures that alleviate noise, dust, light, sounds, smell, and human presence may arise with technological advances and should be**

	implemented to help minimize indirect impacts on caribou habitat. DDMI also stated that vegetation monitoring post-closure will include reference sites to determine whether reclaimed areas provide similar function to similar, undisturbed areas. However, we understand that reclamation will be applied to areas within the direct disturbance footprint, rather than areas indirectly affected by mine operations. It would be interesting to see how indirectly affected caribou habitat recovers post-closure and this information may be useful for other mining operations. **Please clarify if reclamation activities will be restricted to the project footprint.**
Caribou Movement	
Discuss the implications of a larger than expected effect on caribou (ZOI: predicted 3-7 km; observed 14 km) for future environmental management.	DDMI responded that there was uncertainty regarding the original prediction based on the level of knowledge available at the time (1998). DDMI indicated that the mechanism that causes the pattern is unclear because all sources of sensory disturbance operate simultaneously (noise, dust, light, sounds, etc). DDMI indicated that "A larger observed effect than predicted does not necessarily mean that mitigation for sources of sensory disturbance are not effective because there was uncertainty with the prediction." **Opportunities for improvement of existing mitigation measures that alleviate noise, dust, light, sounds, smell, and human presence may arise with technological advances and should be implemented to help minimize indirect impacts on caribou habitat.** In March 2019, EMAB made the recommendation that "Diavik should include a description of its adaptive management activities and an evaluation of how well they are working as a sub-section for each program component in the 2018 WMP Report and have this as a regular section in future annual WMP Reports" (EMAB 2019a). DDMI has included an "*Adaptive Management and Recommendations*" section for each species. When more information on potential mechanisms for the 14 km ZOI becomes available, we anticipate discussions regarding the implementation of new mitigation measures to manage any project-related effects and that this information appear in these report sections in the future
What is the actual size of the larger caribou ZOI, 14 or 28 km?	Boulanger et al. (2012) conclude a zone of influence of 14 km. In the 2018 SGP Wildlife Monitoring Workshop, an approach to ZOI analysis was presented which evaluates ZOI on an annual basis using GPS collar data. This approach could be used to analyze ZOI for the 2018 season for the Diavik mine.

	DDMI indicated that the amount of variation in the results of this approach suggests that there is a high degree of uncertainty in whether a ZOI exists, that the duration of an effect is periodic, or that caribou may become habituated to mine activity. DDMI concludes that the year-to-year variation indicates there is little value in ZOI monitoring for mitigation effectiveness. **We recommend that EMAB review Boulanger's new approach once more information is available.** Boulanger's approach may offer new insight or opportunity into uncovering a mechanism for the ZOI, which could lead to improvement of effect mitigation.
If ENR recommends the new GPS collar analysis approach to ZOI evaluation (as presented by Boulanger during the 2018 SGP Wildlife Monitoring Workshop), we recommend Diavik consider evaluating covariates in the analysis to reflect changing mine activity over time (i.e., does mine activity influence ZOI between years?).	DDMI responded that temporal mine activity indices were included as covariates in 2011, 2014, and 2017 analyses with no significant relationships between mine activity and indirect effects being detected (2018 WMR, Appendix A). **We recommend that EMAB review Boulanger's new approach once more information is available.**
What plans does DDMI have regarding adaptive management actions relating to the caribou ZOI? • We recommend ENR evaluate if it is possible to coordinate mitigation measures between mines and use monitoring results from other mines to help in the prioritization of future monitoring efforts? • Please consider the use of Traditional Knowledge (TK) to help uncover causes for unanticipated impacts on caribou and to develop adaptive mitigation measures.	DDMI stated that the mechanism of caribou ZOIs is unknown at this time and therefore cannot be adaptively managed. DDMI indicated that it incorporates TK into the identification of effects, monitoring, and mitigation design. A TK study noted that caribou will avoid using areas close to the mine during migration because dust on forage will alter its taste or smell (Section 2.0, 2018 WMR). This suggests that a mechanism for the caribou ZOI is dust. **Are there opportunities for improvement of existing mitigation measures that alleviate dust to help minimize indirect impacts on caribou?** **DDMI did not comment on the potential for coordination of mitigation measures between mines to improve current effect mitigation.**
What is the effect of Mine closure on caribou range re-establishment? Are data collected to date sufficient to show a change of caribou distribution in light of the uncertainty of the size of the large ZOI? Also, current baseline (pre-disturbance) information is poor, rendering conclusions on changes from pre- to post-disturbance inconclusive. Does DDMI believe that the current data quality is sufficient to show a potential reversal of the effects after closure?	The issue was discussed verbally in 2013 and DDMI admitted that it is possible that the currently observed ZOIs (14 km; Boulanger et al. 2012) may have always existed. DDMI confirmed that true baselines do not exist. Using TK instead was suggested for discussion. DDMI responded that vegetation monitoring during post-closure, that includes reference sites, will determine whether reclaimed areas provide similar ecological function of vegetation communities for caribou and other wildlife. Some features of Diavik such as waste rock storage areas will not be reclaimed so complete reversal of effects is unlikely. Given that pre-disturbance data cannot be improved, the commitment by DDMI to use reference sites in post-closure monitoring is sufficient. **This issue is satisfied**.

We recommend that the ideas to evaluate caribou health and to ask traditional knowledge holders about the behaviours that should be included in the observation protocol should be carefully considered, particularly from the point of view that the health of wide ranging animals are a result of many factors that occur in the region through which they range. Future discussions about these ideas could be fruitful.	DDMI responded that they regularly engage communities about the WMP. Diavik highlighted a few instances of community involvement in caribou monitoring. DDMI has also included a section in the 2018 WMR that discusses community engagement and traditional knowledge as it relates to Diavik's WMP. **This issue is satisfied**.
Regarding the 2014 WCAR (Golder 2014): A common concern with GPS collar data is that multiple samples from the same individual may not be statistically independent of each other. That is, one response from an individual affects the probability of another response from that same individual. Clarification is needed on how caribou GPS data independence was achieved.	DDMI indicated that they did not make any assumptions about or evaluate whether caribou observations from the same individual were independent. The mixed model analysis they discuss and propose to do moving forward is a reasonable approach to addressing the non-independence of the data. **This issue is satisfied.**
What plans does DDMI have to address the caribou movement objective while they wait for guidance from ENR? Diavik should continue to monitor and verify the accuracy of the predictions in the environmental assessment and the effectiveness of mitigation measures (Article 1, 1.1(b), Diavik Environmental Agreement (2000)).	We expect that ENR will recommend that in 2019, formal ZOI monitoring will resume given that Diavik was planning for aboveground mining in the A21 pit in 2018 (GNWT 2017). Based on the 22 February 2018 conference call, we expect that monitoring will occur using geo-fence collar data and not aerial surveys given the small number of caribou that occur within the study area in recent years and the increasing sample size from GPS collars over time (currently 50 collars – 40 female, 10 male). **DDMI committed to determine and discuss the appropriate method of ZOI monitoring when required.**
We recommend DDMI provide a more detailed explanation and justification as to why they propose postponement of aerial surveys "in favour of other studies". DDMI should also indicate what "other studies" would examine regarding mechanisms that may cause caribou to avoid the mine.	DDMI previously listed (Golder 2016) other studies that would contribute to our understanding of a mechanism that may cause caribou to avoid the mine, including behavioural scanning observations, increasing the number of caribou with collars, research on winter range resource selection, the NWT wolf project, and support for the deployment of geo-fenced collars on Bathurst caribou. **This issue is satisfied.**
While waiting for the ENR to determine best approaches to ZOI monitoring, will DDMI use all available caribou collar data to re-evaluate the ZOI associated with the Diavik Mine specifically?	During the 2018 SGP Wildlife Monitoring Workshop, an approach to ZOI analysis that evaluates ZOI on an annual basis using GPS collar data was presented. Given that aboveground mining in the A21 pit was planned to begin in 2018, we anticipate that Diavik will resume ZOI monitoring in 2019. DDMI responded that they will determine whether collar, aerial survey data or an alternative method will be used for ZOI monitoring when required. **DDMI committed to discuss this with EMAB at that time**.
There are a number of reasons to assume that the data used in the caribou density analysis do not meet the normality assumption of linear regression. We recommend that DDMI present information on the	DDMI indicated that a new analysis that considers habitat and population size, among other factors, is underway and will be reported when complete (Golder 2017b). DDMI responded that linear

distribution of the data and the residuals from the model.	regression is robust against the violation of the normality assumption, particularly when sample sizes are large, such as in this case (n>142,000). **DDMI indicated that the new analysis that is underway assumes a negative binomial distribution and DDMI agreed and intends to include additional factors such as habitat and population size in the new analysis.** We look forward to seeing the new analysis.
We have concerns about the use of a simple linear regression to examine the relationship between caribou density and distance from the mine footprint. Along with the background information on the data used in the analysis, we recommend that DDMI also provide additional details on why they chose the statistical methods they did so we can better understand the reasoning and justification underlying the analysis.	
It is highly likely that the determinants of caribou presence/absence and abundance are much more complicated than simply the distance to the mine footprints, making the detection of a ZOI more nuanced than simply linear distance from the mine. We recommend that future analyses using caribou density also include other potential confounding factors such as habitat associations, changes in mine activity over time, and the gregarious nature of caribou. We also recommend that DDMI evaluate the potential for non-linear relationships.	
Caribou Behaviour	
Please clarify whether or not Ekati and Diavik are using the same behavioural data collection methods and, if so, indicate when the mines began coordinating their methods.	Diavik and Ekati use the same methods for collecting group-level behaviour data, which was verified in the June 2018 (14 June 2018 conference call[1]) meeting with EMAB and ENR. **This issue is satisfied.**
Testing the changes in caribou behaviour will be critical for the new approach to testing the effects within the ZOI that was predicted in the Environmental Effects Report (EER; 3-7 km). Please provide an analysis of the behavioural data and comment on whether or not behavioural data collected previously can be used. How can the information on behaviour be used to adapt management actions at the Mine and in the region? A detailed technical side-bar discussion may be useful for us to better understand the assumptions and expectations by DDMI.	DDMI provided a summary of behaviour data collected in the regional study area, within and beyond 15 km and relative to Bathurst caribou data collected by other researchers (Appendix D, 2018 WMR). The data included information on feeding behaviour only. The dataset provided was a summary and we cannot know the sample size for some of the categories, such as season or by year. DDMI responded that behaviours observed other than feeding time include time spent bedded, trotting, running, walking and alert and that a summary of these behavioural types is provided in annual WMP reports and in Golder (2011). **Please provide a summary of rates of each caribou behavioural activity, particularly those activities with high energetic costs, also categorizing information by year and season (similar format to the information provided in Appendix D).**
Upon our review of DDMI's Response (14 June 2018) to EMAB's Letter regarding the Establishment of Wildlife Monitoring Program Terms of Reference, we recommend that DDMI provide summaries for activities other than just feeding time, particularly activities with a high energetic cost.	

[1] Participants included representatives from Diavik mine, EMAB, MSES, Ekati mine, IEMA, Golder, and ENR.

	In the 2018 WMR (Appendix A), DDMI provided references to 4 separate locations where behavioural sample sizes are provided: Golder (2018), Table 2.6-1 (Golder 2011), Figure 2 (Golder 2019), and Figure 3 (Golder 2019). Based on the multiple sources and formats of the information, it is challenging to understand exactly what the sample sizes are for the different caribou activities, seasons, years, near and far from the mine. It would be helpful to have information on samples by season, year, and distance to evaluate this claim. An annual update to such information would provide transparency and clarity on the status of behavioural data. **These information sources should be reconciled into a single file that can be updated annually and easily referenced for future discussions.**
Given that the feeding data presented by DDMI (DDMI's Response on 14 June 2018) do not appear to show the same pattern, we recommend DDMI comment on why there might be a difference in the pattern between 2011 and 2018 and discuss whether they implemented a change to mine protocol that may have minimized the impacts on caribou behaviour. [For reference: In 2011, DDMI found that for caribou groups with calves: "Time spent feeding and feeding/resting increased among groups that were further from the mines". In this case, behavioural responses appeared to be influenced within approximately 5 km from the mines. This suggests that caribou behaviour and potentially the energy balance of young caribou is affected within that distance. In 2018, DDMI concluded that feeding behaviour is generally consistent across spatial and temporal strata (Percent Time Feeding ranged between 40.2-46.6), but no statistical analysis was completed.]	DDMI explained that the data were not evaluated in the same way in 2011 and 2018. The 2011 analysis considered behaviour by nursery and non-nursery group status, while the 2018 analysis did not. The 2011 analysis used 10 distance categories while the 2018 analysis used 2. This could account for the differing results. **This issue is satisfied.** We look forward to seeing behavioural data analyses once sufficient data are available.
Given that the two mines have agreed to cooperate, please provide the current sample sizes for behavioural data, perhaps in Table format, including information on: • Mine operator (Ekati vs Diavik) • Type of scan (focal vs group) • Season • Distance from mine • Year	DDMI has committed to provide the requested summary table in the next WMR report. **We await the table.**
Please describe if and how non-parametric statistics have or could be used in the analysis of the behavioural data.	DDMI responded that "*A number of different analyses could be used including non-parametric statistics; however, the approach used is consistent with methods used in the scientific literature (e.g., Duquette and Klein 1987). Golder (2018) also summarized behaviour data among different distance strata as requested by EMAB in February, 2018. Non-parametric statistics were not used in this analysis.*"

	(Appendix A, Table 1, 2018 WMR). We are trying to determine whether there are other angles from which the data can be analyzed that might be useful. DDMI is intent on using a parametric approach. **This issue is satisfied with the suggestion that non-parametric approaches may be an alternative option for consideration in future analyses.**
During the 2018 SGP Wildlife Monitoring Workshop, ENR presented information on their caribou behaviour pilot project. The intention was for the government to standardize protocols, share/pool datasets on behaviour, and coordinate field efforts; however, no timelines were provided for the development of guidelines / protocols. In the absence of standardized protocols, we recommend Ekati and Diavik independently move forward on collaboration and coordination of efforts, including both data collection and analysis, on the caribou behaviour monitoring program. In particular, to avoid bias in behavioural data, please ensure that Ekati and Diavik are coordinating their methods for duration of group scans such that they cover the average caribou activity cycle. In general, it appears there will be more consistency between data collected by Ekati and Diavik in the future.	Diavik and Ekati use the same methods for collecting group-level behaviour data, which was verified in the June 2018 (14 June 2018 conference call) meeting with EMAB and ENR. **This issue is satisfied.**
Please consider the use of TK to help uncover causes for unanticipated impacts on caribou behaviour and to develop adaptive mitigation measures	DDMI responded that they regularly engage communities about the WMP. Diavik highlighted a few instances of community involvement in caribou monitoring. DDMI has also included a section in the 2018 WMR that discusses community engagement and traditional knowledge as it relates to Diavik's WMP. We anticipate this participation will continue once new analyses on caribou behaviour are available. **This issue is satisfied**.
Given that analyses of change in behaviour with distance are still planned for the future, we re-state, for the record, that analyses of data should address the following: • Clearly state the assumption of no yearly variation in caribou behaviour if the data are insufficient to detect annual variation. • In the event that collaboration on/sharing of behaviour data between operators occurs, please be explicit about all assumptions made in future analyses. • Reconcile behavioural observations with the occurrence of caribou: does behaviour change with distance as occurrence does, i.e. is behaviour "normalized" past the zone of influence of 14 km? • How can the information gained from the various caribou analyses be used to adjust or	• DDMI responded that the EER assumed that adverse effects would be continuous. Analyses from 2011 detected intermittent annual effects, implying that duration of effects is periodic and less than assumed in the EER. Data used in the 2011 analyses appear to be sufficient to detect annual variation. **This issue is satisfied, and we expect DDMI to report information on annual variation in future analyses**. • **DDMI committed to include assumptions related to future analyses**. • DDMI responded that patterns in behaviour cannot be reconciled with patterns in occurrence at different distance categories due to differences in the scale of the studies. **We look forward to seeing the future behavioural analyses and will revisit this topic at that point in time, as necessary**.

develop mitigation measures if there is a larger than predicted effect of the Mine on caribou?	Interpretation of the results may be challenging given that no pre-development data (baseline) on caribou behaviour are available to compare against. An effect could have existed prior to the Mine. Alternatively, the mine may influence caribou behaviour. • DDMI responded that mitigation would have to measurably reduce the effect of the Mine on caribou and that a strong link between an activity and the change in caribou behaviour is needed. **We await results of future analyses to evaluate this link.**
Caribou Distribution	
The analysis used by DDMI to test the hypotheses about caribou movement during the northern and southern migrations is potentially flawed. We recommend that DDMI provide more information on the pool of collared caribou used over the course of this study. How many separate caribou were collared? How many times did collaring occur? How many times do the same animals appear in annual counts? We recommend that DDMI utilize statistical techniques that account for the independence (or lack of independence) of samples and interannual variation in migration movements.	DDMI provided information on the collared caribou used in the study and details regarding their mixed model logistic regression. The mixed model analysis they discuss is a reasonable approach to addressing the non-independence of the data. **This issue is satisfied.**
We request that DDMI discuss their adaptive management process and their response action in light of this unanticipated, potential effect of the Project [regarding the southern migration – caribou deflect west instead of east of East Island].	DDMI responded that Section 1.0 of the 2017 WMP report included a discussion of the adaptive management process, including examples. DDMI reported on monitoring components that have been suspended or removed through adaptive management and the evolution of the WMP in response to changes to objectives, study designs, and methods. DDMI indicates that EMAB (MSES) committed to recommending adaptive management strategies to mitigate caribou deflections around Lac De Gras (June 2018 meeting). Given our restricted level of involvement in the mining operation itself, we can only make general recommendations that we suggest DDMI discuss with their project engineers. **We recommend that DDMI explore opportunities and options to mitigate dust deposition, which may be influencing caribou migration patterns according to TK. This could include a coordination of best management practices for all mining operations in the vicinity. We have suggested some mitigation in the past as well, such as scheduling of air traffic mitigation and blasting around periods of caribou migration.** In addition, the predicted maximum dust deposition rate (125 mg/dm2/y) has been exceeded (DDMI 2018). The average deposition that occurred between 2000-2016 on near-mine sites is 470 mg/dm2/y (measured >

	predicted). **We recommend DDMI provide a list of adaptive management measures that they have put in place to mitigate the higher than anticipated dust deposition associated the mine.**
DDMI should discuss the triggers for adaptive management (e.g., 12 out 22 years without support for a prediction, with more deviations occurring in recent years, has not triggered a response action specific to the southern migration).	DDMI responded that there is no evidence of an ecological effect of population fragmentation due to changes in the southern migration. DDMI concludes that the prediction in the ERR was inaccurate but conservative. DDMI also suggests that "*caribou may be more resilient to migration movements around Lac de Gras than previously assumed. Based on the principal of adaptive management, deflection monitoring is not necessary because an adverse ecological effect is not evident*" (Appendix A, 2018 WMR). Considering this information, the population may remain connected, but then does this mean that the prediction and test in the WMR that is intended to evaluate the change in caribou distribution is not appropriate? If the monitoring results do not follow the prediction but one can still conclude the population is connected, then it seems that an incorrect test is being applied in the WMRs.
DDMI responded that there is no need for adaptive management because there is no permanent fragmentation effect of the Bathurst caribou herd and, based on Virgl et al. (2017), the herd demonstrates high seasonal range fidelity (Golder 2017b). Monitoring data have demonstrated that for 12 of the 22 years monitored, the prediction for the southern migration was not accurate. The Virgl et al. (2017) research does not consider the presence of the diamond mines in its analyses other than to conclude that the caribou range contraction would result in fewer encounter rates with the mine. Overall, there is uncertainty regarding the primary driver of the observed change in caribou migration – is it a project effect, cumulative effect, or natural phenomenon linked to the population decline? Regardless, uncertainty should not absolve DDMI from implementing a response action to an identified deviation from a prediction. The discussion on adaptive management is still open.	In essence, the monitoring has confirmed that there has been a shift in the southern migration, but this shift is not necessarily linked with the Mine**. There is uncertainty regarding the primary driver of the observed change in caribou migration: Is it a project effect, cumulative effect, or natural phenomenon linked with the population decline (though DDMI largely attributes it to natural range contraction (Table 3, DDMI 2018))?** . **We recommend that the question of the influence of mining on caribou distribution remains "on the table" through the annual collection and evaluation of GPS-collar data.**
Please consider the use of TK to help uncover causes for unanticipated changes to the caribou southern migration and to develop adaptive mitigation measures. Traditional Knowledge may also provide insight into why some caribou routes may have traveled past Lac de Gras, then turned around and traveled back to the opposite side of Lac de Gras.	DDMI responded that TK has identified the importance of Lac De Gras narrows to caribou movements. In Section 2.0 of the 2018 WMR, DDMI reported information from a 2013 TK study in which elders noted that caribou will avoid using areas close to the mine during migration because dust on forage will alter its taste or smell. Based on the principles of

	adaptive management, DDMI should explore any new opportunities and options to mitigate dust deposition, which in turn may be influencing caribou migration patterns. **Are there any technological advancements for dust suppression or techniques being used by other mine operations in the NWT that could be implemented at the Mine site?**
Grizzly Bear	
We recommend that the hair sampling program be continued, even if other mines do not commit to it.	DDMI highlighted that the objective of the grizzly bear hair snagging program is to evaluate cumulative effects of development on grizzly bear populations, rather than a mine-specific effect. Results of the 2012, 2013, and 2017 data collection were provided in Appendix J of the 2018 WMR and the population is stable or increasing. The long-term monitoring frequency will be discussed at the next wildlife monitoring workshop. **We await the outcome of this future discussion.** In March 2019, EMAB made the recommendation that "GNWT-ENR should continue to provide direction on the grizzly bear and wolverine hair snagging surveys to ensure regional objectives and predictions are being tested. GNWT-ENR should confirm the schedule for future hair snagging surveys for both grizzly bear and wolverine" (EMAB 2019b).
Please give careful consideration to the possibility that bears may be becoming habituated and their presence on the site may be on the rise. Given the increase in grizzly bear observations near the Mine, DDMI should increase vigilance and future years of data collection should be used to evaluate whether the re-instated deterrent system is effective at reducing grizzly bear presence near the Mine. In terms of grizzly bear management, we recommend DDMI investigate if there is something in particular that is attracting grizzly bears to the site that could be determined by evaluating the location and timing of the incidental observations and, in turn, whether some mitigation could be applied to remove any attractants	Although there appears to be an increasing trend in the number of incidental grizzly bear observations and a corresponding increase in deterrent actions, grizzly bear mortality predictions have not been exceeded and there does not appear to be any population-level effect. We recommend DDMI investigate if there is something in particular that is attracting grizzly bears to the site that could be determined by evaluating the location and timing of the incidental observations and, in turn, whether some mitigation could be applied to remove any attractants. DDMI responded that all incidents are reported and investigation by the Environment Department. A single bear appears to be responsible for the majority of the incidental observations and has been interacting with the site since it was a cub. Despite relocation, it returned to the site. Grizzly bear mortality predictions have not been exceeded, DNA results suggest a stable or increasing population, mitigation measures and deterrent actions have been implemented. Grizzly bears appear to be well-managed. **This issue is satisfied.**
Wolverine	
Regarding the 2014 WCAR (Golder 2014), it was not clear why caribou herd size was related to wolverine occurrence and how this specifically relates to	DDMI responded that the analysis was designed to test effects predictions and to place mine-related effects into context of natural factors. Caribou could

objective of the WCAR "to examine indirect Mine-related effects". We recommend a brief explanation be provided.	influence the regional abundance and distribution of wolverine. **This issue is satisfied.**
The WMP evaluates the prediction that Mine-related mortalities, if they occur, are not expected to alter wolverine population parameters in the Lac de Gras area. We recommend DDMI elaborate on how they are testing this particular prediction given the absence of data on population size.	DDMI responded that results from Efford and Boulanger (2018) indicated a stable wolverine population growth rate through time across study areas, except for Daring Lake, which showed a slight decline. Apparent survival was similar across study areas. DDMI concluded that this information supports the prediction that mine-related wolverine mortalities are unlikely to be influencing population parameters. **This issue is satisfied**.

3.0 Specific Observations

3.1 Vegetation and Wildlife Habitat

There was an increase in the Project footprint in 2018 of 0.31 square kilometres (km^2), resulting in a total footprint area of 11.62 km^2. The predicted vegetation loss due to the mine footprint was 12.67 km^2. The additional disturbance in 2018 occurred at the south end of the project footprint at the South Country Rock Pile. Only the south country rock pile is anticipated to expand during the remainder of operations. The overall disturbance of vegetation types remained at or below predicted levels in 2018, with six (increased from four last year) out of 12 individual ELC types, riparian shrub, esker complex, bedrock complex, boulder complex, birch seep and shrub, and heath tundra, at or slightly exceeding the predicted loss (disturbed ELC Type excluded from count).

3.2 Barren-Ground Caribou

3.2.1 Habitat Loss

The 2018 WMR indicates that direct summer caribou habitat loss (2.90 habitat units (HU)) remains at or below predicted levels of 2.965 HUs.

DDMI presented additional information regarding indirect caribou habitat loss in the 2018 WMR (Appendix A, Table 4). Changes in the area and percent of high, moderate, low, and nil suitability caribou habitat were presented under the assumption that sensory disturbance reduced habitat suitability by one level within a 14 km zone of influence around the Diavik-Ekati mines. Low/nil suitability caribou habitat increased from 62% to 71% within the 14 km ZOI. DDMI stated that the area is of marginal quality in the absence of indirect changes and that ecological impacts are likely to be limited considering the limited amount of time caribou are present in the area and their large seasonal ranges. **Opportunities for improvement of existing mitigation measures that alleviate noise, dust, light, sounds, smell, and human presence may arise with technological advances and should be implemented to help minimize indirect impacts on caribou habitat.** DDMI has indicated that vegetation monitoring post-closure will include reference sites to determine whether reclaimed areas provide similar function to similar, undisturbed areas. This should help ensure that forage species palatable to caribou are a part

of the mix of species (at a natural ratio) in the reclaimed landscape. However, we understand that reclamation will be applied to areas within the direct disturbance footprint, rather than areas indirectly affected by mine operations. It would be interesting to see how indirectly affected caribou habitat recovers post-closure and this information may be useful for other mining operations.

3.2.2 Movement

Caribou aerial surveys used to gather data to evaluate a zone of influence have not been completed since 2012 because ZOI requirements for the caribou monitoring program were omitted in 2013. No new information is presented in the 2018 WMR on changes to caribou movement and caribou movement was not analyzed in the most recent WCAR (Golder 2017a).

The aerial survey schedule, three continuous years followed by two years off, was designed to test whether or not caribou occurrence (zone of influence) changes with changes in Mine activity. Boulanger et al. (2012) concluded that there was a zone of influence of 14 km for caribou. A comprehensive analysis of caribou data was completed in 2014 (2014 WCAR; Golder 2014) and DDMI presented results relating to caribou GPS collar data with a focus on movement patterns. Ekati and Diavik mines requested to omit the ZOI requirement for caribou monitoring in 2013. The request was approved by ENR and aerial surveys were last conducted in 2012.

It appears that DDMI is still waiting for the recommendations and direction from ENR regarding caribou aerial surveys. A ZOI Draft Guidance Document was developed in March 2015 that outlines the conditions under which monitoring ZOI is technically appropriate (Caribou ZOI TTG 2015). ENR is treating this March 2015 guidance document as a "living" document that represents the best current advice of the ZOI Technical Task Group (TTG; GNWT 2017).According to this ZOI Guidance Document, "Projects for which ZOI monitoring is deemed appropriate are advised to produce an initial estimate of ZOI during the operations phase of their project. Repeat monitoring should be conducted when the Project is expected to change due to a major shift in the project (e.g. mine phase change, expansion, switch from above to underground mining etc.), change in mitigation practices or other cause." (p.3). We expect that ENR will recommend that in 2019, formal ZOI monitoring will resume given that Diavik planned to begin aboveground mining in the A21 pit in 2018 (GNWT 2017). Further to this point, EMAB recommended that **"GNWT-ENR should also follow through on its commitment to recommend that Diavik resume ZOI monitoring, in accordance with the ZOI Guidance Document, in 2019" (EMAB 2019b).** We also expect that monitoring will occur using geo-fence collar data and not aerial surveys given the small number of caribou that occur within the study area in recent years and the increasing sample size from GPS collars over time (currently 50 collars – 40 female, 10 male) (22 February 2018 conference call). **DDMI committed to determine and discuss the appropriate methods of ZOI monitoring with EMAB, when required (2018 WMR, Appendix A).** We suggest that GPS collars may be the better option, as compared to aerial surveys, to ensure timely data collection and analysis of the caribou ZOI. An approach to ZOI analysis that evaluates ZOI on an annual basis using GPS collar data is being evaluated by Boulanger (2018 SGP Wildlife Monitoring Workshop). **We recommend that EMAB review this approach once more information is available.** Boulanger's approach may offer new insight or opportunity into uncovering a mechanism for the ZOI, which could lead to improvement of effect mitigation (adaptive management). It is our understanding that the approach presented by Boulanger is being considered for publication in a peer-reviewed journal.

3.2.3 Behaviour

The ground-based behavior survey was designed to test changes in caribou behaviour as a function of distance from the Mine. In accordance with recommendations from a workshop in 2009 with ENR and other mines and monitoring boards (Handley 2010), DDMI adapted its monitoring program for caribou in 2010 by coordinating with BHP-Billiton's Ekati mine and implementing ground observations of caribou behaviour for 2010. In 2018, between February 6 and December 23, observations were collected on 56 caribou groups from 0 to 2.2 km from the Mine and observations were collected from 4 caribou group at 80 km from the Mine. No new analyses are presented in the 2018 WMR on changes in caribou behaviour because there are still insufficient data (# groups) available to detect a 15% change in behaviour. **DDMI has committed to provide a table summarizing sample sizes of caribou behavioural data including categories for mine operator, type of scan, season, distance from mine, and year in the next WMR. Please organize the information on distance from mine into categories of less than and greater than 15km from the mine (please see the example table below of a suggested format).** The purpose of the table is to understand behavioural data availability and whether there are enough data to conduct analyses by specific categories or by pooling data from different categories (e.g. season, time period, etc.). In addition, EMAB recommended that **"Diavik should continue to focus on conducting far-from-mine behavioural group scans to ensure data are balanced between Ekati's near-mine scans and far-field scans, and to be in line with the original intent of this WMP component."** (EMAB 2019a). **Please explain why only 4 samples were collected far-from-mine in the 2018 season.**

Year	Mine Operator	Type of Scan	Season	Distance from Diavik Mine		Distance from Diavik-Ekati Mines	
				<15km	>15km	<15km	>15km
1998	Ekati	Focal	post-calving	number of groups	number of groups	number of groups	number of groups
2003	Diavik /Ekati	Group	post-calving	number of groups	number of groups	number of groups	number of groups
….							

DDMI provided a summary of caribou behavioural data sample sizes inside and outside of the Diavik study area from 1998-2017 and provided information on distance to mine and percent of time feeding (Table 1, Appendix D). DDMI concluded that feeding behaviour is generally consistent across spatial and temporal strata (Percent Time Feeding ranged between 40.2-46.6), but no statistical analysis was completed. The table includes information on feeding behaviour only. **We recommend that DDMI provide summaries for other activities, particularly activities with a high energetic cost**. We emphasize the importance of these data in understanding the influence of the Mine on caribou and await future detailed analyses of behaviour data.

3.2.4 Distribution

To evaluate changes in caribou distribution due to mining activities, DDMI used daily data on the geographic location of collared males and females as provided by ENR. Collars on male caribou were added in 2015; prior to this, only female caribou were collared. Using data collected from 1996-2018,

DDMI statistically compared the proportion of caribou that moved west versus east of Lac de Gras; this was done separately for both the northern (28 April through 30 June) and southern (1 July to 30 November) migrations. The methods used for the analysis changed in 2017, including an extension of the southern migration period from 31 October to 30 November to accommodate the shift in the timing of the southern migration, and the use of north-south and east-west oriented reference lines to assist in classification of collared caribou movements. The use of the reference lines changed some historical collar data classifications for the southern migration in 1996, 1998, and 2007 since previous classifications were only based on visual examination. A north-south oriented reference line across Lac de Gras determined whether movements were east or west, while an east-west oriented reference line across Lac de Gras determined whether movements were north or south.

In 2018, collared caribou distribution followed the predicted pattern for the northern (spring) migration; most caribou deflected west of East Island (6 W vs. 5 E). In 2018, collared caribou distribution did not follow the predicted pattern for the southern migration; most caribou deflected west of East Island (17 W vs. 1 E). Across all years, DDMI found that significantly more caribou moved west past Lac de Gras during the northern migration (77%; 255 W vs. 76 E) and during the southern migration (57%; 170 W vs. 127 E). Over the long-term, caribou are following the predicted pattern for the northern migration, but not for the southern migration.

In previous years, we requested that DDMI discuss potential causes for this departure from predictions and whether or not any response action is warranted for this departure from predictions. DDMI responded that, based on recent research (Virgl et al. 2017), there is no evidence of an ecological effect of population fragmentation due to changes in the southern migration. DDMI concludes that the prediction in the EER was inaccurate but conservative. DDMI also suggests that "*caribou may be more resilient to migration movements around Lac de Gras than previously assumed. Based on the principal of adaptive management, deflection monitoring is not necessary because an adverse ecological effect is not evident*" (Appendix A, 2018 WMR). DDMI recommended that analysis of collared caribou deflections during the northern and southern migrations be discontinued. **Please provide a discussion regarding the original intent behind the predictions regarding the northern and southern migrations (i.e. please clarify if the original prediction related to the connectedness of the herd, change in the movement (and thus energetics) of the herd, or any other concepts). Please explain why a deflection test was selected to test predictions regarding caribou distribution since predictions were not followed but DDMI can still conclude no effect of the Mine.**

Considering this information, the population may remain connected, but then does this mean that the prediction and test in the WMR that is intended to evaluate the change in caribou distribution is not appropriate? If the monitoring results do not follow the prediction but one can still conclude the population is connected, then it seems that an incorrect test is being applied in the WMRs. In essence, the monitoring has confirmed that there has been a shift in the southern migration, but this shift is not necessarily linked with the Mine**.** There is uncertainty regarding the primary driver of the observed change in caribou migration: Is it a project effect, cumulative effect, or natural phenomenon linked with the population decline (though DDMI largely attributes it to natural range contraction (Table 3, DDMI 2018))? **We recommend that the question of the influence of mining on caribou distribution remains "on the table" through the annual collection and evaluation of GPS-collar data. Please provide ideas on how DDMI can continue to monitor changes in herd distribution specifically**

in relation to the Diavik mine using collar data, if DDMI is proposing to remove the deflection test.

DDMI indicated that Section 1.0 of the 2017 WMR report included a discussion of their adaptive management process, including examples. DDMI reported on monitoring components that have been suspended or removed through adaptive management and the evolution of the WMP in response to changes to objectives, study designs, and methods. DDMI indicates that EMAB (MSES) committed to recommending adaptive management strategies to mitigate caribou deflections around Lac De Gras (June 2018 meeting). Given our restricted level of involvement in the mining operation itself, we can only make general recommendations that we suggest DDMI discuss with their project engineers. **We recommend that DDMI explore opportunities and options to mitigate dust deposition, which may be influencing caribou migration patterns according to TK. This could include a coordination of best management practices for all mining operations in the vicinity. Are there any technological advancements for dust suppression or techniques being used by other mine operations in the NWT that could be implemented at the Mine site?** We have suggested some other mitigation options in the past as well, such as scheduling of air traffic and blasting around periods of caribou migration.

3.2.5 Mortality

As far as caribou mortality is concerned, the effect remains at or below predicted levels, which is that Mine-related caribou mortality is expected to be low. The methods applied for this part of monitoring are adequate. Overall, the mean population size of the Bathurst caribou herd has decreased between 1996 (349,000) and 2018 (8,200). To support recovery of all barren-ground caribou herds, the 2011 to 2015 NWT Barren-ground Caribou Management Strategy was developed. A new management strategy for 2018 to 2022 is under development. In addition, ENR has developed a draft Bathurst Caribou Range Plan (GNWT 2018) to address issues related to cumulative land disturbance.

3.2.6 Advisory

Incidental observation of caribou ranged from 1 to 85 individuals on the East Island in 2018. As the caribou remained away from haul roads, no deterrent actions or elevation from "No Advisory" was required in 2018. There were no reported incidents involving caribou in 2018 and there was no need for herding of caribou away from hazardous areas.

3.3 Grizzly Bears

The 2018 WMR indicates that direct terrestrial grizzly bear habitat loss remains below the predicted level of 8.67 km^2 and mortalities associated with mining activities remain below the predicted range of 0.12 to 0.24 bears per year. The methods applied for this part of monitoring are adequate.

The monitoring objective for grizzly bear presence and distribution was revised from:

> *To determine if Mine-related activities influence the relative abundance and distribution of grizzly bears in the study area over time* (Handley 2010),

to:

> *To provide estimates of grizzly bear abundance and distribution in the study area over time* (GNWT 2013).

A grizzly bear hair snagging program is jointly completed by Ekati, Snap Lake, Gahcho Kue and Diavik mines to address this new objective. Sampling first occurred in 2012 and 2013 and occurred again in 2017. Decisions regarding program frequency were anticipated to be determined collaboratively during wildlife monitoring workshops hosted by ENR in 2016; however, decisions were postponed, and discussions will now occur at the next wildlife monitoring workshop. Results of the 2012 and 2013 hair snagging program can be found in ERM Rescan (2014) and results of 2012, 2013, and 2017 can be found in ERM (2018) (Appendix J of 2018 WMR). The objectives of the DNA program are to:

- "estimate the density of grizzly bears in the Regional DNA Study Area (RDSA) to support the management of grizzly bears in the Northwest Territories, including cumulative effects assessment on potential changes to grizzly bear populations in the SGP in response to development;
- describe the spatial and temporal distribution of grizzly bears in the RDSA; and,
- provide recommendations regarding a standard grizzly bear monitoring protocol for the Northwest Territories." (ERM 2018).

Essentially, the hair snagging program is intended to provide a baseline to support the management of grizzly bears in the NWT. The 2012, 2013, and 2017 data analysis indicated a stable or increasing abundance of grizzly bears around the Ekati and Diavik mines, as compared to monitoring information from the late 1990s[2]. We support DDMI's involvement in the grizzly bear hair-snagging program which is designed to address the new, regional scale question about the bear population and distribution. In March 2019, EMAB made the recommendation that "**GNWT-ENR should continue to provide direction on the grizzly bear and wolverine hair snagging surveys to ensure regional objectives and predictions are being tested. GNWT-ENR should confirm the schedule for future hair snagging surveys for both grizzly bear and wolverine**" (EMAB 2019b). **We await the outcome of future discussions regarding long-term grizzly bear monitoring frequency.**

There appears to be an increasing trend in the number of incidental grizzly bear observations over time, the number of days with bear visitations to East Island over time, and the number of days that deterrent actions were utilized over time (data from Tables 7 & 8 of the 2018 WMR). DDMI has indicated that the number of incidental observations of grizzly bears does not appear to be influenced by the number of people on site (2018 WMR, Section 5.3.2). This suggests that bear sightings are simply increasing over time. It appears as though a single bear is responsible for the majority of the observations and has a home range that includes the mine. Unfortunately, incidental information provides little insight into changes in grizzly bear presence, abundance, or distribution because the information is not collected systematically.

[2] "The 2017 density of both males (3/1,000 km^2) and females (4.7/1,000 km^2) continued to show an increasing trend in comparison to the previous monitoring years. These results of this regional study indicate a stable to growing population in the central barrens of the Northwest Territories relative to estimates for het Slave Geological Province in the late 1990's (3.5 grizzly bear/1,000 km2)" (Erm 2018).

Given that grizzly bear mortality predictions have not been exceeded and DNA results suggest a stable or increasing population, project-specific impacts of the mine on grizzly bears are likely minimal.

3.4 Wolverine

The most recent objective of the WMP related to wolverine is:

> *To provide estimates of wolverine abundance and distribution in the study area over time* (Handley 2010).

Wolverine presence around the Mine is monitored using snow track surveys, hair-snagging, and incidental observations.

Snow track surveys for wolverine were completed in 2018. Since 2015, each winter track transect is surveyed twice instead of only once, as was done in previous years. Data collected in this manner confirmed that snow track detection rates vary through time. Surveys should continue to be completed twice per transect so that the probability of snow track occurrence can be adjusted to reflect temporal variation in weather conditions. No detailed analyses of wolverine track data were completed in the 2018 WMR. The most recent comprehensive analysis (Golder 2017a) reported that the probability of wolverine track occurrence is positively correlated with time and transect length (occurrence of snow tracks increased through time from 2003 to 2016). It also reported that the wolverine track density index decreased as the Bathurst caribou herd size increased[3] and the amount of waste rock hauled increased. The next comprehensive analysis of wolverine track data is expected to occur in 2020.

An analysis of data from 2004 – 2015 from the wolverine DNA hair snagging program (mark-recapture sampling) was completed in 2018 (Efford and Boulanger 2018). The previous analysis was completed in 2014. The long-term frequency of this program has not been determined. Decisions regarding program frequency are anticipated to be determined collaboratively once a data summary analysis report from ENR is complete and reviewed. In March 2019, EMAB made the recommendation that "**GNWT-ENR should continue to provide direction on the grizzly bear and wolverine hair snagging surveys to ensure regional objectives and predictions are being tested. GNWT-ENR should confirm the schedule for future hair snagging surveys for both grizzly bear and wolverine**" (EMAB 2019b). The DNA hair snagging study found that the average wolverine density at the three northern sites (Daring Lake, Diavik and Ekati) declined over time (2005-2014). The most prominent decline occurred at the Daring Lake site with a weaker decline over time for Diavik study area alone. Efford and Boulanger (2018) made recommendations about future sampling (e.g., grid size, post spacing, sampling frequency, synchronous sampling) in order to maximize power to detect change in wolverine density. A challenge with the program is that the large home range sizes of wolverines and the close proximity of the grids (sharing a border in some cases) makes it difficult or impossible to rigorously separate the population into components associated with each mine grid (or the Daring Lake grid). This makes it difficult to interpret the results in terms of project-specific impacts. However, understanding trends in overall abundance of wolverine can help with the interpretation of project-specific wolverine monitoring results.

[3] "Correlation analysis indicated a moderate negative association between interpolated annual estimates of Bathurst caribou herd size and measure of wolverine TDI during 2003 to 2016 (r = -0.59, P = 0.05; Figure 4.3-1)" (Golder 2017a).

The 2018 WMR reported zero mortalities, relocations, and deterrent actions for wolverine on-site (Table 11). There were 23 days with wolverine visitations on East Island; this measure has been decreasing since 2015. We commend Diavik for their ongoing efforts to mitigate impacts on wolverine and the reduction in wolverine visitations despite the increase in track occurrence over time (2013-2016; track occurrence has decreased since 2016).

The WMP also evaluates the prediction that mine-related mortalities, if they occur, are not expected to alter wolverine population parameters in the Lac de Gras area. Given that there have only been five wolverine mortalities reported since 2000, there appears to be support for the prediction that mining related mortalities are not expected to alter wolverine population parameters in the Lac de Gras area. In addition, the most recent evaluation on the status of wolverine in the NWT concluded that they are Not at Risk (Species at Risk Committee 2014). DDMI concluded that mine-related wolverine mortalities are unlikely to be influencing wolverine population parameters based on the similarity of apparent survival across study areas and the stable wolverine population growth rate through time across study areas, as reported in Efford and Boulanger (2018) (Appendix A; 2018 WMR).

3.5 Falcons

Monitoring of raptor nest occupancy and success in the study area were removed from the WMP in 2010. However, DDMI contributes nest monitoring data to ENR every five years and last collected these data in 2015; the next survey is scheduled for 2020. DDMI also remains focused on data collection and mitigating effects to raptors nesting in open pits and on Mine infrastructure. One active peregrine falcon nest was observed and was located at the Site Services Building. Three nestlings were observed in the nest.

We support DDMI's continued Pit Wall/Mine Infrastructure monitoring for nesting raptors. DDMI will discuss options with ENR for future monitoring. The Canadian Peregrine Falcon Survey (CPFS) was discontinued in the NWT in 2015; therefore, DDMI no longer provides nest site occupancy and productivity data to the Canadian Wildlife Service (CWS).

3.6 Waste Management

In 2018, the misdirected attractants (food and food packaging) appear to be lower than 2017 levels in the Waste Transfer Area (WTA), the Landfill area, the A21 Area, and Underground. In 2018, there appeared to be a high number of misdirected food items for the WTA (relative to the other inspected areas) and observations of wildlife (fox and wolverine) were highest for the WTA (2018 WMR, Table 14). However, in general, the number of wildlife observations in these four waste collection areas was lower in 2018 compared 2017. The overall outcome of waste management appears to be positive. We commend DDMI for its efforts which probably led to the low attraction effect on wildlife and we concur with their commitment to continue to carry out employee education programs related to waste handling to decrease misdirected waste.

3.7 Waterfowl

As expected, no waterfowl information was presented in the 2018 WMR. In past years, DDMI has evaluated predictions relating to waterfowl habitat loss, presence, and habitat utilization. The 2012 WMR recommended a review and evaluation of the current waterfowl program to see if any improvements could be implemented. A meeting was held between DDMI and the Canadian Wildlife Service (CWS) in December 2013 to discuss the waterfowl program. It was agreed that the waterfowl monitoring program would be discontinued at this time, but CWS did recommend that DDMI re-start the waterbird/shorebird monitoring program at the Mine reclamation stage.

We are in agreement with the recommendation to discontinue the waterbird/shorebird monitoring program and concur with the CWS recommendation regarding reinstating the waterbird/shorebird monitoring program at the Mine reclamation stage.

3.8 Windfarm

As expected, no windfarm associated bird mortality information was presented in the 2018 WMR. Given the low likelihood of avian-turbine strikes, due to location and size of the wind farm, and the absence of bird mortalities in 2013, we agreed with DDMI's recommendation to discontinue monitoring the wind farm using 2013 methods and to instead monitor for bird mortalities as part of the overall site compliance monitoring program.

4.0 Closure

The review of the 2018 WMR reported herein presents the conclusions arrived at by MSES. DDMI included responses to all previous recommendations and requests (Appendix A, 2018 WMR). We appreciate the time and effort spent providing the responses to our questions and recommendations, as the information is necessary to maintain and improve the understanding of the effects of the Mine on wildlife (see Appendix A for a record of requests that have been addressed in previous years). Some of our recommendations may be best addressed during detailed data analyses using multiple years of new data. We hope that future communications will lead to further clarification on several details of the 2018 WMR. Our views are submitted to EMAB for its consideration of potential recommendations and actions.

5.0 References

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Appendix A

Table 1: Actions by DDMI in response to recommendations that were developed in previous years.

Recommendations/Questions in 2017	Action by DDMI
Vegetation and Wildlife Habitat	
The 2013 Comprehensive Vegetation and Lichen Monitoring Program report concludes that "*the Mine may be having local-scale effects on plant species composition*". The report does not suggest any strategies that could mitigate these effects. Please consider if and how these potential project effects could be mitigated.	A comprehensive analysis of vegetation and lichen data was last completed as an Appendix of the 2016 WMR. The same conclusion was reported. DDMI responded that impacts are within the range predicted because of mitigation they've already implemented – i.e. mitigation is successful (Golder 2017a). If the initial prediction is accurate, then additional mitigation is not required. **This request is satisfied.**
DDMI concluded that "*given that the majority of metals concentrations have decreased below concentrations reported in the 2010 risk assessment, a follow up risk assessment based on 2016 data is not required*". The risk assessment did not include information on any changes in the concentrations of metals present in caribou and humans pre- and post-exposure or how these levels of metals relate to the health of either caribou or humans. We recommend DDMI provide additional information that would support their conclusion that concentrations of metals in lichen are safe for caribou.	It was agreed between EMAB and MSES that it does appear that health risks to caribou are low, particularly given that the 2016 concentrations are said to be lower than previously measured and given that the caribou do not stay long in the near-field where metal concentrations are higher. Our past comments questioned some of the methods, but in the big picture, even with a potential for measurement error, the exposure risk may well be low. **This request is satisfied.**
DDMI has recommended that vegetation and lichen monitoring frequency should be reduced from once every three years to once every five years, with the exception that if dust deposition values exceed 400 mg/dm^2/y, then sampling frequency may resume on a 3-year cycle. Given that above-ground mining is anticipated at the A21 Area in 2018, dust deposition and metal concentrations in lichen are likely to increase again. We recommend that the established three-year timeframe be continued in order to capture changes in vegetation and lichen parameters. In addition, we recommend DDMI provide further justification for setting 400 mg/dm^2/y as a trigger for changing monitoring frequency as compared to using a trigger associated with dust deposition rates for reference stations.	During a conference call (22 February 2018), DDMI explained that the trigger is based on average deposition that occurred between 2000-2016 on near-mine sites, which is 470 mg/dm2/y. They use a conservative 400 mg/dm2/y trigger based on this information. However, they are saying there are "no impacts" at 400 mg/dm2/y and that there is not much deviation between mine and reference sites. They noted that they do see small changes <400 but that doesn't mean there is an ecological impact on caribou. We do not agree that there are "no impacts" with a metal deposition of 400 mg/dm2/y. As long as values near the mine are above the range of "baseline" (reference station) values, there is potential for associated impacts. They are either not ecologically measurable or they are not being measured (incorrect response variables are being measured). A trigger associated with original predictions or literature regarding impacts to vegetation and lichen would be more appropriate. Golder agreed to look into the original prediction and include the information in the next WMR, including any literature that may be relevant. Confirmation of this action was also requested by EMAB (EMAB 2018).

	During a 6 June 2018 teleconference, DDMI indicated that the trigger for changing vegetation and lichen monitoring frequency has been changed to reference station values for dust deposition. **This request is satisfied.**
Barren-Ground Caribou	
DDMI recommended a reduced survey frequency for the assessment of caribou occurrence relative to the Mine site, roads, rock piles, and Processed Kimberlite Containment (PKC). We suggest that these surveys continue at least bi-weekly to ensure no caribou are present in areas that are visually obstructed to on-site staff.	DDMI recommended reducing survey frequency because of the ineffectiveness of the surveys at detecting caribou at the Mine that were not already detected by other employees and pilots. In 2017, incidental observations of caribou ranged from 1 to ~2,150 individuals on East Island. There were no reported incidents. It appears that caribou presence near the Mine is being adequately captured. **This issue is satisfied.**
Has the ZOI guidance document been finalized? If so, please provide the document to EMAB for their review. If not, please have ENR explain why not and when it is expected.	ENR is treating the March 2015 guidance document as a "living" document that represents the best current advice of the ZOI TTG (GNWT 2017). **This request is satisfied.**
A regression analysis evaluated the relationship between caribou density and nearest distance to the Ekati or Diavik Mine footprint. The results showed that distance to a mine footprint explained very little of the variation in caribou density. To confirm this result, we recommend that DDMI present information on the power of the data to detect an effect.	DDMI provided a power analysis and concluded there is sufficient power and sample size to detect an effect (Golder 2017a). **This request is satisfied.**
If Ekati has sufficient data near-mine, please analyze a DDMI-Ekati combined dataset to test how caribou behaviour changes as a function of distance from the Mine. If data are still deemed to be insufficient, please present a power analysis indicating the target sample size for near-mine observations.	A power analysis in the 2017 WMR concluded that 55 different caribou groups are required for both near and far from mine categories in order to statistically detect a change in feeding activity. **This request is satisfied.**
Given the insufficient Diavik-data near-Mine, will DDMI collect data outside of autumn and use GPS collar information to collect data opportunistically? If this is already being done, please provide a summary of how much additional data have been collected using this protocol both near and far from the Mine.	DDMI has been collecting caribou behaviour monitoring data when caribou are present in the study area, including outside of autumn. Observations on 32 groups were collected in 2017 in the winter season within 0 to 2.7km of the Mine. **This request is satisfied.**
Please explain what triggers/criteria are used to initiate the collection of far from mine caribou behavioural observations.	During the 22 February 2018 conference call, DDMI indicated that collar locations and incidental observations of caribou can trigger the collection of far from mine caribou behavioural observations. **This request is satisfied.**
There was some discussion in the past about the Cumulative Impacts Monitoring Program (CIMP) leading a behaviour monitoring task group but given the lack of information on the status of this group, we recommend DDMI continue with its own monitoring, coordination with Ekati, and data analysis until such a working group is established and operational.	ENR will not be setting up a dedicated behaviour monitoring group (GNWT 2017). However, during the 2018 SGP Wildlife Monitoring Workshop, ENR presented information on their caribou behaviour pilot project. The intention was for the government to standardize protocols, share/pool datasets on behaviour, and coordinate field efforts; however, no timelines were provided for the development of

	guidelines / protocols. In the absence of standardized protocols, we recommend Ekati and Diavik independently move forward on collaboration and coordination of efforts, including both data collection and analysis, on the caribou behaviour monitoring program. In general, it appears there will more consistency between data collected by Ekati and Diavik in the future (14 June 2018 conference call). **This request is satisfied.**
Given the delayed southern migration in recent years, please redo the statistical analysis including data up to the end of November or later, if warranted.	DDMI provided an analysis of caribou distribution including data up the end of November in the 2017 WMR. Over the long-term, caribou are following the predicted pattern for the northern migration, but not for the southern migration. **This request is satisfied.**
The 2016 WMR mentions that caribou that are most likely from the Beverly/Ahiak herd were present in the study area. Please explain how the presence of caribou from the Beverly/Ahiak herd is managed during the collection and analysis of all caribou data.	DDMI indicated that caribou will be monitored if they fall within the Diavik mine study area regardless of which herd they belong to (Golder 2017a). This includes caribou movement and behaviour monitoring programs. Golder mentioned the presence of caribou from the different herds in the study area in the data collection for the 2017 WMR. It appears as though only Bathurst caribou are analyzed when testing the caribou distribution predictions. **This request is satisfied.**
Wolverine	
Please give careful consideration to the possibility that wolverine may be becoming habituated and their presence on the site may be on the rise.	The 2017 WCAR (Golder 2017b) presented detailed analyses that found that wolverine occurrence has increased over time. An analysis of data from 2004 – 2015 from the wolverine hair snagging program was completed in 2018 and found a weak decline in average wolverine density at the Diavik Mine over time. A possible explanation is that that wolverines are attracted to the mine area because of the new more northerly distribution of caribou due to their recent range contraction, or alternatively, the mine may be attracting wolverines. DDMI's ongoing monitoring of wolverine track density and mortality, along with the regional research on the wolverine population, will inform DDMI of whether adaptive management is required to minimize impacts on wolverine. **This request is satisfied.**
The wolverine hair snagging program was not completed in 2015 or 2016. It was last completed in 2014. Last year DDMI anticipated that the next wolverine hair snagging survey would occur in 2017, though the long-term frequency of this program has not been determined. ENR should indicate when they expect to complete the 2014 wolverine hair snagging data analysis. If more data collection and analysis is not anticipated for 2017, DDMI should describe	An analysis of data from 2004 – 2015 from the wolverine hair snagging program was completed in 2018 (Efford and Boulanger 2018). Decisions regarding program frequency are anticipated to be determined collaboratively once the 2018 report has been reviewed. We support DDMI's continued involvement in this program. **This request is satisfied.**

alternative plans for evaluating wolverine abundance in the study area.	
There may be opportunities for more systematic site surveys/checks for wolverines and waste management to mitigate instances of wolverines in waste bins. For instance, could waste collection bin checks be included in already scheduled waste inspections at the Waste Transfer Area (WTA) and Landfill?	DDMI responded that they currently include waste bin checks as part of waste bin inspections of the WTA and landfill (Golder 2017a). We have no further mitigation recommendations for wolverine at this time. **This request is satisfied**.
Waste Monitoring	
While fox observations looked to be steadily increasing in the WTA since 2009, they appear to have levelled off in 2013 (the tabular presentation of data in the 2013 WMR makes it difficult to confirm). We recommend DDMI evaluate whether this levelling-off of fox observations in the WTA persists in future years.	In 2017, there appeared to be a high number of misdirected food items for the WTA and Landfill Areas relative to the other inspected areas and observations of fox and wolverine were highest for the WTA. DDMI should explore reasons for the higher levels of misdirected food waste in the WTA in 2017 as this may be contributing to wildlife presence and possible habituation near the Mine site. DDMI responded that the results are reviewed as part of an adaptive management process and that they will continue employee education programs. This appears to have been effective because fox and wolverine numbers are lower in 2017 compared to 2016 at the A21 Area. **This request is satisfied**.
DDMI should explore the reasons for the higher levels of misdirected food waste in the A21 Area as this may be contributing to wildlife (particularly wolverine) presence and possible habituation near the Mine site.	