NORTH SLAVE MÉTIS ALLIANCE

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July 14, 2017

Michael Conway
Regional Superintendent
North Slave Region
Department of Infrastructure
Government of the Northwest Territories
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Dear Mr. Conway,

RE: Tlicho All-Season Road (TASR) Information Requests

North Slave Métis Alliance (NSMA) received the Developer's Adequacy Statement Response (DASR) on April 26, 2017. NSMA reviewed the DASR and our questions are attached below.

NSMA is thankful to the GNWT-DOI for being flexible with the submission date.

Should you require any clarifications about our submissions, please do not hesitate to contact Shin Shiga, shin.shiga@nsma.net.

Sincerely,

Shin Shiga
Manager, Environment

CC: Mark Cliffe-Philipps, Review Board
Katie Rozestraten, GNWT-DOI

TOPIC	COMMENT	RECOMMENDATION/QUESTIONS
1. Increased hunting access to wildlife. Wildlife Management and Monitoring Plan (WMMP), Section 4.1, Page 6, Table 2 Habitat Loss and/or Alteration Mitigation Measures. WMMP, Section 5, Page 19. DASR, Section 4.7 monitoring and Follow-up, Page 4-226.	The WMMP demonstrates that employee training will include a review of wildlife policies (i.e., no feeding, no harassment, no hunting, and no trapping) however, this does not indicate a policy for how transgressions would be handled. The WMMP also indicated that access roads to borrow sources will be closed to prevent recreational users from using the roads in the future. The way in which these roads will be closed to prevent use should be clarified, as hunters may find ways around traditional barriers and other methods of keeping vehicles off site. In the DASR, Golder states that "*options for moving the GNWT-ENR check station to a new location to continue monitoring harvest of caribou and wildlife activity will be explored*". Many studies have demonstrated that human infrastructure and a resulting increased ease of access to new locations by hunters, can be a factor explaining caribou (*Rangifer tarandus*) declines and effects on other species are also expected. For example, Plante *et al*. (2017) evaluated the impacts of various human disturbances, especially those that cause direct mortality (*e.g*., sport hunting) on Arctic caribou in northern Quebec. These authors used resource selection functions to describe habitat selection of 223 caribou and 87 hunters. They then characterized over 169,000 caribou harvest sites, recorded over 17 years, by the relative probability of co-occurrence between caribou and hunters, the relative probability of occurrence of hunters only, or the characteristics of the landscape (e.g., distance to human infrastructures, elevation, land cover type). These authors demonstrated that caribou were more vulnerable to harvest in areas with good accessibility (near roads) or where caribou were easily detectable (lakes, smoother terrain), despite *relative* avoidance of these features by both caribou and hunters. Another study by Guiliazov (1998) also looked at causes of mortality in reindeer within the Lapland Biosphere nature reserve in Russia's Arctic Kola	1. How will the employees be managed to prevent violations of wildlife policies (e.g., no hunting) beyond initial training? What will the consequences be for hunting and how will these be communicated to employees? 2. Consider re-organising hunting -related mitigation into one clear location within the WMMP, as it is one of the key issues with road construction. 3. Will increased access/ evidence of hunting by non-personnel or beyond the construction phase, be monitored? How will monitoring of unregulated hunting be completed? How will hunting restrictions be enforced? 4. The GNWT was contemplating moving the ENR check station. Has the GNWT decided whether they will move the ENR

	peninsula. This author showed that, in areas surrounding the reserve, illegal hunting facilitated by road access, accounted for approximately 18% of reindeer deaths. We note these studies and their conclusions mainly to emphasize the importance of effective access and access control on preventing overharvest and illegal hunting. While mitigation can be applied to control hunting during construction itself, and personnel may be trained, clear policy is needed. It may also be difficult to control access by roads to off-road locations for the purposes of increased harvest. Increased hunting is likely to remain an important issue in this area beyond construction into the operations phase and by non-personnel.	check station? If the GNWT decides not to move the existing ENR check station, will they add another one to monitor harvest during road operation? This could affect the conclusions of the wildlife sections of the EA adaptive management, and the presence or lack of an ENR check station should be clearly indicated in the next version of the DASR and WMMP.
2. Developer's Adequacy Statement Response (DASR), Appendix C	Traffic rate estimates are very important for accurately predicting impacts to wildlife, particularly ungulates. Appendix C provides more information on how Golder arrived at vehicle estimates of 20-40 vehicles per day. There are several key assumptions used in these traffic projections: • That monthly ADT values collected for the Tłı̨chǫ winter road can be used to estimate the monthly vehicles year-round; • That only 8 additional vehicles per day can be expected on the road due to increased access (all-weather road development versus winter road only), population growth, and diversion of air traffic into vehicle traffic; • 9.5 commercial loads are expected per day once the NICO mine is operational; • 9 vehicles per day are expected by Fortune Minerals for the NICO project; and • Estimated traffic rates assume a relatively even distribution of road use by vehicles among months; in reality, some months of year will likely experience more traffic than during other times of the year. Depending on when those peaks are, wildlife could be impacted differently.	1. Will mine staff that live in Yellowknife be restricted from driving back to Yellowknife on weekends or after their shift ends, for example, or have such vehicles not been considered? 2. Do the traffic estimates included for the NICO mine include vehicles beyond commercial and haul trucks? For example, are pickup trucks used for monitoring, maintenance, and workers included?

	Some of the assumptions used to arrive at traffic estimates along the proposed AWR do not seem conservative. For example, in 2015, 547 passengers per month flew between Yellowknife and Whati. If the majority of these decide to drive rather than fly, this could add more traffic (18 more vehicles per day). Increased road use, population growth and passenger selection to drive rather to fly, however, is only projected to add 8 vehicles all together. Further, it appears that the numbers provided for the NICO project include only commercial loads and haul trucks. The number of vehicles cited (9) does not seem sufficient for a mine when commuting, monitoring and maintenance work, and other tasks using non-haul vehicles need to be considered.	3. Based on answers in #2, can the proponent include a second, conservative traffic estimate to illustrate "worst case" scenario traffic rates, and evaluate the impacts of those traffic levels on boreal caribou, barren ground caribou, wood bison, and moose? 4. Can the GNWT commit to doing traffic rate monitoring along the road, and to re-evaluating the effects of the road and required mitigation should the number of vehicles exceed the predicted traffic rates? 5. Does the proponent make the assumption that resupply vehicles to Whati will remain the same over time?
3. Hydrology alterations. WMMP, Section 4.1, Page 7, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	In Appendix B, Table 2.4, Row 2.4, Golder states that they will "*remove beaver dams that cause water ponding and the possibility of grade damage due to water seepage or the potential of a grade washout*." Beavers modify stream and wetland morphology significantly by building dams. These dams retain sediments and organic matter in the channel, create and maintain wetlands, alter nutrient cycling and decomposition dynamics,	1. Please provide a map showing the current beaver dams that may need to be removed to protect road washout.

DASR Appendix B, Table 2.5, Row 2.4 "Beaver Dam Removal"	and modify the structure and dynamics of the riparian zone. These changes influence the characteristics of water and materials transported downstream, and ultimately influence plant and animal community composition and diversity of the larger region (Naiman *et al*. 1988). Since beaver dams can have significant impacts on the landscape, the impacts of their removal must be interpreted over broad spatial and temporal scales. Removal of beaver dams will likely change local hydrology, nutrient dynamics, and distribution and movement of species associated with water, including moose. If a dam is destroyed without killing the beaver that built it, it will rebuild the dam, often the same day, using new trees. If a dam and associated beaver are destroyed, other beaver will move into the site to rebuild the dam, which can, over time, lead to the need to kill a large number of beavers, which are also valued by Metis and First Nations. Overall, dam removal can lead to changes that can destroy hunting, trapping, travel, and food /medicine gathering areas, and impacts of beaver dam removal should be assessed where its need is anticipated.	2. Please indicate how the impacts of beaver dam removal on surface hydrology and habitat for ungulates such as moose have been considered in the adequacy statement response and provide mitigation details in the WMMP.
4. References to Barren Ground Caribou. DASR, Table 4.1-2 and Section 4.2.2.2, Page 4-26.	The Bathurst herd numbered approximately 470,000 animals in 1986 and is now down to as low as 16,000 animals (~8,000 breeding cows) in 2015. Calf recruitment has been lower than needed for stable populations and cow survival rates have been poor, which suggest a rapid rate of herd decline. The recently released Bathurst Range Plan document does not appear to have been considered in this DASR, though it is relevant to the assessment. Although the DASR states that the project is outside of the core range of the Bathurst herd, it is still within the seasonal winter and annual range distributions according to the Bathurst Caribou Range Plan: Interim Range Assessment and Technical Methods Report (March, 2017). This report shows that the project site is within the Bathurst Range Planning Area, Area 4 (Page 6, Figure 2), which is part of the winter range that already has the highest level of human land use and road infrastructure; road creation in this area could also cause increased access and disturbance to other areas around it.	1. Will the GNWT be considering the Bathurst Caribou Range Plan, along with information and recommendations therein, when assessing project impacts and cumulative impacts on barren ground caribou? 2. Can Golder comment on the current state of the winter range for the Bathurst caribou, and whether increased infrastructure and

	Caribou occupy winter habitat for the longest period (140 days) relative to other seasons, and this is the season when cows are pregnant and gestating, with higher energetic demands and less calorically rich foods available. This is also the habitat wherein which the Bathurst herd would interact to the greatest degree with infrastructure and human disturbances. Disturbances in winter habitat can lead to reduced female survival and spontaneous miscarriage. Jouko *et al.* (1997) demonstrated that reindeer productivity decreased with the continuing deterioration of winter range. The results revealed that reproduction and productivity of reindeer in the study area are largely regulated by density-dependent factors related to the quantity and quality of the winter ranges. Although the winter season is described by the Bathurst Caribou Range Plan as a season wherein caribou have a" low or very low" sensitivity to disturbance, this does not match what is known about the link between ungulate winter range, pregnancy success, and cow survival. A consideration of the Interim Range Assessment for the Bathurst herd and link between growing winter range disturbances and declining calf recruitment of calves and survival of cows should potentially be considered as part of this assessment.	development could be linked with the declines in cow survival and calf recruitment seen in recent surveys of Bathurst caribou?
5. Statement about sensory disturbance not affecting boreal caribou herd productivity. DASR, Section 4.4.2.2, Page 4-1777.	The DASR states, when referencing sensory disturbances and impacts to caribou, that: "Bergerud *et al.* (1984) contend that there is little to no evidence that sensory disturbance activities affect herd productivity". Thus, noise or visual stimulus from traffic will be periodic and unlikely to result in permanent barrier effects that will reduce survival and reproduction. This paper was written over 23 years ago, and concluded, at the time, that "*there were no examples where physical features of corridors or associated disturbance have affected numbers or productivity of caribou*". It is not surprising that no examples existed as disentangling the underlying processes from observed spatial patterns can be challenging, particularly when spatial patterns originating from several processes co-occur and have confounding effects. Further, it is impossible to disentangle sensory effects from one another (for example, the noise versus visual perception of a vehicle). However, the fact that an anthropogenic feature, with co-existing sensory disturbances associated with it, is avoided beyond the immediate footprint is typically sufficient to propose, using the precautionary principle, that the	1. Has the proponent considered results of studies other than Bergerud *et al*. (1984) for arrival at the conclusion that sensory disturbance does not impact herd productivity? If so, which other studies/results were considered?

	sensory disturbance plays a role in the avoidance. If the avoidance leads to indirect habitat loss of areas that would normally be preferred, particularly in areas where habitat may be limiting, we can infer that vital rates may be impacted. A study by Beguin *et al*. 2013 tested three competing hypotheses to explain the distribution of boreal caribou: 1. Climate-driven selection, which postulates their selection for certain habitat classes as a function of proximity to roads; 2. Road-driven selection, which proposes that boreal caribou adjust their selection for certain habitat classes as a function of proximity to roads, and 3. As additive effect of both roads and climate. The results of this study strongly supported road-driven selection over climate influences, and the study concluded that direct human alteration of the landscape drives boreal caribou distribution. See also the example of aircraft sensory disturbance and its effect on caribou calf survival in the comment "Aircraft mitigation for wildlife"	
6. Surface Blasting Mitigation; DASR, Table 4.3-1, Page 4-114 and Appendix M-Draft Wildlife and Wildlife Habitat Protection Plan.	The mitigation provided for blasting during road construction includes suspending blasts when caribou and Species at Risk are within a 'danger zone'. Appendix M, the Wildlife and Wildlife Habitat Protection Plan, states that this area will be 500m. The DASR also provides information that suggests that more borrow sites will be needed than originally anticipated, meaning that blasting during construction could impact a wider range of habitats and areas. Boreal and barren ground caribou, bison, and moose are all known to be sensitive to noise. There is limited information on the effects of blast-specific noise on ungulates; however, there are numerous other noise studies from which predictions about the effects of noise at certain thresholds. Reimers and Colman (2006) provided a review of the effects of noise, vehicles and aircraft on caribou and reindeer. Maier *et al.* (1998) reported that low level overflights by jet fighters 1-1.5 times per day in Alaska, producing Sound Exposure Levels	1. What level of noise (dBA) will be reached at 500 m from the average blast required during road construction? This information is needed to predict the residual impact of the safety zone applied around blasting. 2. Is this noise level known to cause energetic distress to moose, bison, boreal or barren ground caribou (or in the absence of information on these, close taxonomic relatives)?

	(SEL) of 96-106 dBA, caused caribou to spend more time active and to move greater distances. Other studies of overflights on caribou reported startle responses to overflights at volumes of (115 to 127 dB) (Lawler *et al.* 2005 and Harrington and Veitch 1991). Weisenberger *et al.* (1996) used simulated jet aircraft noise on desert ungulates and reported that heart rate increased following disturbance across a spectrum of noise levels (85-108 dBA).	3. How do the anticipated blast sizes (in dBA) compare to those proposed for use during construction of the Doris North mine and propose Hope Bay Phase 2 project, which uses setback distances of 2.2 (Doris North) and 2.8 km (proposed for Hope Bay based on noise model results) for larger groups, respectively? 4. As the GNWT supported the use of larger danger zone areas for group sizes of > 30 for the Nunavut projects such as Back River and Doris North/Hope Bay, would they be willing to support similar enhanced mitigation for large groups of caribou or other ungulates in association with the Tłı̨chǫ All-Weather Road Construction?
7. Snowbank heights and snow fences. DASR, Appendix B	Appendix B provides a list of typical gravel road maintenance requirements. For the winter months, this list includes snow removal, and snow fence installation, inspection, repair and maintenance.	1. What snow depths are anticipated along road sides during the winter and shoulder seasons? Will they be less than 55 cm to allow

And WMMP, Section 4.1, Page 8, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	Snow fences are typically constructed using pure polymer strand, polymer grid, or polymer-coated steel wire strand (BC Ministry of Agriculture (BCMoA), 2015a). The expected snowfall and wind conditions in the area will determine the required storage capacity of the fence and the distance that the fence must be placed back from the road (BC MoA, 2015b). Snow fence design (height, material, density) will affect the amount of snow drift accumulation on the windward and leeward sides. In addition to these factors, snow fence design needs to consider wildlife movements. Typical mitigation measures include reducing fence height or using nylon ribbon on top to provide deer and moose a visual height they can safely jump (BC MoA, 2015a). The WMMP mitigation includes a provision that snow banks within the proposed TASR footprint will be kept "low" and escape points will be ploughed out for wildlife crossing every 300 metres. However, the proponent has not provided any information on the anticipated depth of snow berms, or how various snow depths will impact the ungulate species assessed, or committed to snow bank management below those heights. The maximum depth implied by "low" should be clarified to ensure that it remains sufficiently protective for ungulates (such as caribou, bison, and moose) which may be affected by snow banks. Further evidence to support the creation of gaps as crossing points every 300 m was not provided, and it may be prudent to shorten that distance to 100 m. Both movement and direct or indirect mortality of ungulates can be impacted by the creation of unbroken snowbanks along roads. Ensuring that snow banks do not increase mortality risk or inhibit movement is important, as this will cause ongoing impacts to wildlife for the life of the road. As ungulates may preferentially travel along snow-cleared, low traffic roads in the winter due to the relative ease of movement compared to the surrounding landscape, they can be impacted by traffic via: 1. Being struck by vehicles due to not being able to clear the road in sufficient time, 2. Running along the road due to the noise or visual stimuli from an oncoming vehicle heard at a distance, leading to winter exhaustion, indirect mortality or later impacts on reproductive success due to energetic effects during pregnancy; or 3. The	Caribou and Bison calf passage? 2. What evidence suggests that snow cleared crossings every 300 m will be sufficient? 3. If snow bank heights cannot be retained to depths below the minimum known to impact ungulates in the area (50-55 cm), can the GNWT commit to creating frequent gaps in the snowbanks (every 100 m)? 4. For snow fences and guiderails, please provide information about construction materials, height, length of continuous sections and gaps. Are there any anticipated barrier effects?

	animal will attempt to clear the road into deep snowbanks that inhibit their motion and leads to higher rates of predation by wolves and other predators. Crossings of barren-ground caribou, for example, are unimpeded at snow depths of < 0.5 m, but Rescan (2011) found that caribou deflected from roads when snow berms exceeded 1.6 m. Boreal caribou, likewise, tend to move into areas with lower snow depth to maintain the ease of moving through and feeding in these areas (Fuller and Keith, 1981). Moose are affected at shallower depths, as they adjust their behaviour and move to avoid areas of snow deeper than 90 cm (Peek *et al.,* 1982). While there is limited information on bison's movements, previous studies suggest a general consensus on bison mobility through deep snow (NWT Species at Risk Committee, 2016). In general, 50-60 cm impedes calf movement (Van Camp, 1997; Reynolds and Peden, 1987), while 65-70 cm impedes adult movement (Van Camp, 1975). Studies from 1-25 cm (Rouys, 2003) and 27 cm (Fortin *et al*., 2003) showed no limitations on movement, and 38 cm showed some limitations in movement (Fortin *et al*., 2003). In another study, sites of 127 cm were also avoided (Meagher, 1971). We suggest that the use of 55 cm as the maximum snow depth for wood bison as adults should be expected to be able to move through these depths. Calves may have more difficulty moving through 55 cm of snow, but it is still within their range for movement. Wood Bison are known to travel long distances and frequently use established trails between favoured places, even congregating along roads and becoming traffic hazards in some areas (NWT Species at Risk Committee, 2016). Hence, this species may be particularly susceptible to roads.	
8. Surveys for wildlife features of species at risk. WMMP, Section 4.1, Page 6, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	Habitat loss mitigations include contacting ENR and/or EC if a key wildlife feature of a species at risk is discovered resulting in suspension of activity pending consultation with these agencies. However, it is unclear what methodology for surveying for these features would be used, the search intensity, and how far in advance of construction these surveys would take place. If a method of stumbling upon a feature during construction is used, there is a much higher likelihood of missing these features. Also, some	1. How will the GNWT determine the presence of key wildlife features? 2. What methodology will be used, and when will these surveys take place?

	features may not be apparent at one time of year, so surveys would need to be far enough in advance, that they would be present.	
9. Winter road reclamation. WMMP, Section 4.1, Page 6, Table 2 Habitat Loss and/or Alteration Mitigation Measures and Section 2, page 5, Map 1.	The mitigation options in the WMMP include reclamation of the terrestrial portions of the current Tłı̨chǫ winter road (KM 0-60), as it is suggested to offset some of the new habitat loss. However, it is unclear where this reclamation would be, when it will occur, how it will be completed, and what the end goals are in terms of habitat type and suitability for the ungulate species assessed.	1. Please identify the area within which the proposed reclamation of the current winter road is planned in the maps provided. 2. Please provide additional information describing the proposed reclamation of the road. As the habitat and forage requirements of the ungulates in the area are quite different, which of the ungulate species will the restored habitat provide the suitable habitat and forage for? Will reclamation be monitored? When might this reclamation be started, and completed?
10. Non-native/invasive species monitoring. WMMP, Section 4.1, Page 6 and 7, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	It is important that invasive species not be allowed to colonize and spread, as this can impact ungulate forage and habitat over time. Mitigation options for habitat loss state that if non-native/invasive species are identified within the corridor due to construction, a response plan will be prepared. It is unclear how this monitoring will be completed, and how long monitoring will occur for. As reclamation and natural regeneration can be a very slow process it may be necessary to monitor for invasive species for a minimum of five years, or at intervals over a longer period.	1. Please provide more information about the planned methods for monitoring for invasive species and timeline of monitoring. 2. Please develop a long-term, invasive plant management

	The WMMP noted that invasive species will be monitored annually during each year of construction and if non-native/invasive species are identified due to construction, a response plan will be prepared. This does not include the operations phase which may also experience invasive species issues. Roads affect both abiotic and biotic landscape components including sedimentation, light, dust, soil water content, soil temperature, drainage, run-off pattern, air and water chemistry (Coffin, 2007; Trombulak and Frissell, 2000). These physical changes can directly influence biotic components, particularly vegetation. Road dust can affect vegetation and plant communities growing at considerable distance from unpaved road edges. Dust can cover vegetation and affect photosynthesis, respiration, and transpiration and can lead to introduction of phytoxic pollution into plant tissues through increased adsorption (Coffin, 2007). Although dust effects are often limited to within 20 m of road edges, measurable effects have been observed as far as 200 m on the downwind side (Forman and Alexander, 1998). Road edges also provide conditions that encourage establishment of plants that are adapted to disturbance, including some introduced and invasive plants (Forman and Alexander, 1998). For example, Nitrogen from vehicle exhaust, and resultant nutrient enrichment of surrounding area, was observed to change vegetation within 100 to 200 metres of roads (Forman and Alexander, 1998; Angold, 1997). Road effects resulting in increased nutrient availability and higher pH have been shown to promote colonization of non-native, highly competitive plants in tundra ecosystems. This spread is often exacerbated by slope (Mullerova *et al*., 2011). Introduced plant species can spread and cause harm to natural habitats, out-competing native plant species, and degrading habitat quality for ungulates and other species. Climate model projections show an Arctic-wide end of century increase of 13 Celsius in late fall and 5 Celsius in late spring for a business-as-usual emission scenario (Overland *et al*., 2013). These temperature increases can change ecological conditions	plan that can help ensure the quality of wildlife habitat into the operations phase. While it may not be feasible to monitor for invasive plants indefinitely, some monitoring during the first five years of operation, (or alternating years for longer) and adaptive management if needed, would help to minimize the risks of the project to wildlife.

	significantly, making conditions less severe, and permitting establishment invasive species. Between 2005 and 2010 the number of alien plant species in the NWT increased from 94 to 116. These are mostly found in or near communities, near roads and along disturbed areas such as cut-lines, pipelines and mine sites (NWT, 2015). This trend may correlate with observed trends in climate and human activity. Certain introduced plant species have succeeded in spreading in some Arctic habitats, mostly those already disturbed by human activities (NWT, 2015). The maintenance of roadside vegetation, and monitoring for invasive species beyond the four years of construction and into the operations phase is needed to help ensure appropriate habitat quality for wildlife such as caribou, bison and moose.	
11. Borrow pit reclamation. WMMP, Section 4.1, Page 7, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	Although borrow pits will be closed when they are no longer required, and reclaimed, there is also the need to monitor this reclamation process, which is not indicated here. As discussed in Hugron *et al*. (2011), recovery of borrow pits in the Canadian boreal forest is exceedingly slow. They determined that the borrow pits studied were still undergoing primary succession processes several decades after abandonment. Given that the more recent version of the developer's statement has included up to 13 borrow sites, which is farther north than areas studied by Hugron *et al.* (2011), in areas with slower succession time, sufficient monitoring and reclamation is an important consideration to minimize wildlife habitat loss.	1. Will borrow site reclamation be monitored and modified/enhanced as needed? 2. What are the key details on the reclamation process as it relates to habitat targeted for wildlife?
12. Rare plants, rare communities, community surveying and moose habitat setbacks. WMMP, Section 4.1, Page 7, Table 2 Habitat	The WMMP indicates that setbacks will be used around wetlands, rare plant populations and rare ecological communities. However, it is unclear what the anticipated setback distances will be. Wetland areas are an important feeding site and habitat for moose. A scientifically supported setback distance from wetland areas would help protect moose that may be in the area and mitigate against impacts to moose and moose habitat during construction and operation of the road.	1. What are the anticipated setback distances for development and construction nearby each of wetlands, rare plants, and rare communities? 2. Can the GNWT commit to conducting rare plant and

Loss and/or Alteration Mitigation Measures. WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	While it is beneficial that the project footprint will be surveyed by a qualified biologist/botanist for the presence of rare plant species and communities, it is also crucial for the effectiveness of the survey that the surveys occur at the correct time of year to fully capture and allow for identification of rare plants and communities. For example, where construction activities are indicated within the fall and winter months, pre-construction surveys will not be effective for identifying vegetation.	community surveys at correct time of year (*i.e.*, during the growing season)?
13. Sensory disturbances to Caribou in sensitive periods. WMMP, Section 4.1, Page 8, Table 2 Habitat Loss and/or Alteration Mitigation Measures. Section 4.2.3, Page 11, Table 5 Caribou-Specific Mitigation Measures. Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions	The WMMP indicates that certain aspects of construction, such as blasting, would be ceased when caribou are identified within a 'danger zone' (500 m) area year-round. A setback of 250 m is given for winter snowmobiles. While time periods are noted for species such as migratory birds, wherein extra caution and mitigation would be exercised, there did not appear to be any seasonal commitments for other potentially sensitive periods such as caribou calving (May or early to mid-June) or the rut (in late September or early October) for boreal caribou. The recommended sensitive period guideline for caribou is from May 15 – Oct. 15 with a setback distance of 10 km for woodland caribou (for water crossings near blasting or seismic activity) (AANDC *et al*. 2012). Although barren-ground caribou are not generally present from may-15 to Oct 15 at the project site, AANDC et al. 2012 guidelines prescribe a setback distance of 1 km during this period for barren-ground caribou (for water crossings). Although there is no general guidance on activities away from water crossings for boreal caribou during sensitive periods. We suggest the proponent work with stakeholders to develop enhanced distance setbacks for sensitive periods. As there is uncertainty associated with the range of the effect of blasting on boreal caribou and how far the danger zone should extend, an adaptive management approach such as monitoring for behavioural responses of	1. Would the GNWT please consider extending the 'danger zone' during sensitive times of the year? 2. Can the GNWT commit to avoiding blasting during the calving period for boreal caribou? (particularly if the answer to question #1 is no)?

and Setback Distances.	caribou at various distances from blasts, and further increasing the calving danger zone if adverse responses are observed, may also be needed. Alternatively, in the boreal caribou specific section of the WMMP, a no blasting policy during the calving season is mentioned as a "possibility". Committing to no blasting during this seasonal period would be much more effective and straightforward to implement, and it would greatly reduce the uncertainty around the effectively of safety zones during this period. A commitment for avoiding blasting during the calving season (and rutting/other sensitive periods) would ideally be included under sensitive periods within this section.	
14. Sensitive period for Bison. WMMP, Section 4.1, Page 8, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	The sensitive period for bison is defined in the guidelines as from Mar. 1 – Jul. 15 resulting in a setback of 0.5km (AANDC *et al*. 2012). However, there is no discussion of the sensitive period for bison with the other speciesdiscussed in Table 2 of WMMP.	1. Has the GNWT considered the sensitive period setback for bison?
15. Sensory disturbances effect on moose and other large mammals. WMMP, Section 4.1, Page 8, Table 2 Habitat Loss and/or Alteration Mitigation Measures. WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas,	The WMMP includes some protection against sensory disturbances for ungulates (species at risk and barren ground caribou) and bovids (wood bison) as construction activities will be temporarily suspended when these species are observed within 500 m of construction activities. This protection would apply to species such as boreal caribou, bison, barren-ground caribou. However, for other species of management concern, such as Moose, which are of importance to local harvesters, would seemingly have no protection. A broad mitigation to suspend construction and/or blasting for all large mammals when observed within a minimum of 250 m should also be used to prevent injury or excessive distress to these important species. Likewise, there are also no setback distances for moose (and other large mammals in general) indicated in Appendix B. In the guidelines for sensitive periods it is recommended for all wildlife and birds, in the general Breeding and birthing seasons to have a setback of 0.25 km (AANDC *et al.* 2012). For example, for	1. Please define mitigation to minimize sensory disturbance for other large mammals that may not be species at risk, but are of management concern. 2. Please include setback distances that would apply to moose (and other large mammals that do not fit under other categories) in the table in Appendix B.

Page 1, Table B – Timing Restrictions and Setback Distances.	moose the rut occurs in late September to mid-October and May is the typical calving season. During these times, a setback of 250 m would be important.	3. Has the proponent considered sensitive periods for other wildlife such as moose?
16. Wildlife Monitors. WMMP, Section 4.1, Page 8, Table 2 Habitat Loss and/or Alteration Mitigation Measures.	Construction mitigation includes wildlife monitors which will be on site to monitor wildlife and manage risks, but the qualifications of such personnel are unclear. The risk of unqualified personnel, missing wildlife or key species features and behaviours is a concern.	1. What are the minimum qualifications for wildlife monitors?
17. Wildlife attraction to salt. WMMP, Section 4.2.1, Page 10, Table 3 General Wildlife Disturbance, Mortality and Wildlife-Human Interaction Mitigations. DASR, Appendix B, Row 5.5, Stockpiling winter sand.	A number of wildlife mitigation activities have been outlined in the WMMP to limit wildlife attraction to the site, particularly for waste and bears. Another potential issue is the use of road salts, which may attract ungulates such as caribou and moose to the road, or sites where it is used during construction. Many studies have documented the attraction of various ungulates and bovids to road salts including caribou (Brown *et al.* 2000), moose (Grosman *et al*. 2011), elk (Poll, 1989), bighorn sheep (Poll, 1989), as well as white tailed deer and mule deer (Kelting and Laxson, 2010). Modifications to road salting policies have also been suggested as a way to reduce the threat of roads to wood bison (ECCC 2016) although less is known about the attraction of road salts for this species. In the DASR Golder states: "*The stockpiling of winter sand includes … c) blending with chemicals or freeze drying the aggregate*."	1. Will the use of road salts be avoided as a mitigation measure to limit the attraction of ungulates such as caribou and moose to the site? 2. Please clarify whether "chemicals" used in this statement are a salt compound (e.g. calcium chloride, sodium chloride, etc.). If these are going to be used, have their impacts as attractants been considered/assessed within the DASR (effects assessment)? 3. If salts will be mixed with sand and applied to the road, can the GNWT commit to using other

		methods for keeping the roads safe, so that they do not attract big game?
18. Wildlife traffic protection speed reduction. WMMP, Section 4.2.3, Page 11, Table 5 Caribou-Specific Mitigation Measures. And Section 4.2.4, Page 12, Table 6 Bison-Specific Mitigation Measures.	The WMMP includes mitigation which stipulates that the presence of caribou in areas of construction and access roads will be communicated to other drivers and all construction vehicles will stop or reduce speeds when caribou are within 500 m of the road. Similar to the case noted for blasting, the 500 m 'danger zone' may be too small, resulting in disturbance to caribou beyond this distance. Further, the mitigation could also be more specific; for example, what will speeds be reduced to? At what point would traffic stop? The WMMP also indicated that, when bison are present within 500 m of the road in construction areas, drivers will stop or reduce vehicle speeds. However, this is open to interpretation and drivers may be unsure about how much to reduce their speeds. Wood bison are listed as Threatened in NWT, the Mackenzie subpopulation is already in decline, and there is virtually no probability of dispersal from elsewhere to re-populate this population (NWT Species at Risk Committee, 2016), making this group particularly vulnerable. As vehicle collisions with bison have been identified as one of their major threats to the species (NWT Species at Risk Committee, 2016), we need clear guidance for drivers.	1. What noise levels are expected at 500m from the construction areas and access roads, and Is this noise level known to cause distress to boreal, barren ground caribou or bison? 2. Please clarify this mitigation to set clear limits for drivers and construction vehicles to reduce speeds to a predetermined level (such as 20 km/h) when caribou or bison are within the 'zone' and set another, shorter distance, for vehicles to stop (such as when caribou or bison are within 10 m of the road). Be clear about cases in which vehicles should stop versus reduce speed.
19. Wildlife traffic speed enforcement. WMMP, Section 4.2.3, Page 11, Table 5 Caribou-Specific Mitigation Measures.	The WMMP states that "vehicle speeds during construction will be 50 km/h to reduce the potential of caribou mortality due to collisions" and "vehicle speeds during construction will be 50 km/h to reduce the potential of bison mortality due to collisions". A site-wide speed reduction should protect more wildlife, but only if is actually followed. It is unclear how this guideline would be monitored or enforced.	1. How will traffic speeds be monitored and enforced?

And Section 4.2.4, Page 12, Table 6 Bison-Specific Mitigation Measures.		
20. Caribou traffic protection for large groups. Wildlife WMMP, Section 4.2.3, Page 11, Table 5 Caribou-Specific Mitigation Measures.	The WMMP mitigation includes work stoppages during periods of high caribou presence should observations indicate a need (e.g. when large numbers of caribou (>10) are in the vicinity of the road alignment or winter access routes). When caribou have moved >500 m from the activity or are no longer visible activities may resume. However, if the majority of caribou are in smaller groups they may not be sufficiently protected by this measure.	1. Based on local information, what proportion of caribou are in groups >10 (during the time of year of construction)? 2. Do typical group sizes recorded for boreal and barren-ground caribou differ during the season of construction? Is it reasonable to use to the same group sizes (>10) for both species? 3. What proportion of animals within the relevant area and season would be protected by this group size trigger?
21. Caribou and bison behavioural reactions. WMMP, Section 4.2.3, Page 12, Table 5	An important mitigation strategy is to report sightings and movements of caribou and bison, including their behavioural responses, to the development activities, which has been included in the WMMP. If behavioural responses are significant and problematic these observations should also feed back into and inform an adaptive management approach; however, no feedback of these behaviour data into adaptive management is noted.	1. How is behavioural response information to be used by wildlife monitors? 2. Can the GNWT commit to using the behavioural

Caribou-Specific Mitigation Measures. And Section 4.2.4, Page 13, Table 6 Bison-Specific Mitigation Measures.		information recorded to inform adaptive management?
22. Pushing caribou and bison. WMMP, Section 4.2.3, Page 12, Table 5 Caribou-Specific Mitigation Measures. And Section 4.2.4, Page 13, Table 6 Bison-Specific Mitigation Measures. Appendix A: Statutory requirements relevant to wildlife and wildlife habitat, Page 1, Table A – Summary of territorial and federal prohibitions pertaining to wildlife and wildlife habitat.	The WMMP notes that: "*If it is clear that caribou will likely remain in the development area for extended periods the Wildlife Monitor may gently encourage individual or small numbers of caribou to move away from the area using methods pre-approved by ENR*". The same mitigation is proposed for bison. However, this practice needs further clarification as it has the risk of potential for misuse. The phrase "*will likely remain in the development area*" could easily be misinterpreted and should be replaced with "have been in the development area". This will remove the need to guess how long caribou will be present, and the ushering method can then be used with confidence after some given time interval of excessive loitering at the site. The term "extended periods" also needs further clarification. As noted in Appendix A, the NWT *Wildlife Act,* section 52, states that "Subject to section 17, no person shall, unless authorized by a licence or permit to do so, (a) engage in an activity that is likely to result in a significant disturbance to big game or other prescribed wildlife; or (b) unnecessarily chase, fatigue, disturb, torment or otherwise harass game or other prescribed wildlife." Mitigation states that pushing methods will be preapproved by the ENR; however, it will be important to avoid chasing or disturbing caribou, making it extremely difficult to move them. The use of this method could violate section 52 of the NWT Wildlife Act.	1. Please consider making this practice more standardized as it has the potential for misinterpretation. 2. Please rephrase this mitigation to change the trigger from guessing future behaviour to using behaviour that has occurred. Would several hours be considered an "extended period"? 3. How will this activity be possible without violating the terms of the NWT *Wildlife Act*?

23. Adaptive wildlife traffic protection during operations. DASR, Section 4.2.3.4, Page 4-64. WMMP	It is reiterated throughout the DASR that the Project is unlikely to increase wildlife mortality through collisions because of the low speed limit and low predicted traffic volume. Golder cites that reported vehicle collisions with Mackenzie bison are highest through the late summer and fall seasons (i.e., Aug-Nov). Monitoring wildlife traffic collisions and adaptive management of speed limits may help to mitigate the risk of wildlife injury and mortality during TASR operation. During periods of greater wildlife risk, temporary seasonal speed restrictions or additional wildlife signs may also be effective (Poll 1989) and should be considered in adaptive management for the operations phase.	1. Will the GNWT consider monitoring and adaptive management for speed limits?
24. Bison protection for large groups. WMMP, Section 4.2.4, Page 13, Table 6 Bison-Specific Mitigation Measures.	Vehicle speeds during construction will be 50 km/h to reduce the potential of bison mortality due to collisions. Work stoppages may be required during periods of high bison presence should observations indicate a need (e.g. when large numbers of bison (>10) are in the vicinity of the road alignment or winter access routes). Activities may resume after these groups of bison have moved >200 m from the activity or are no longer visible. What rationale supports these group sizes and distances?	1. What evidence supports group sizes of >10 as a trigger for mitigation? How often would bison be expected to be in these group sizes in this area? 2. What is the rationale for using >200 m as the distance from Bison, whereby activities may resume? 3. In another mitigation, it was indicated that bison within 500 m of the road or construction equipment would trigger other protections, so should this be 500 m as well?
25. Aircraft mitigation for wildlife. WMMP, Section 4.2.3, Page 11,	Project mitigation indicates that flight paths will be altered as necessary to avoid important areas, especially during sensitive periods (for caribou and bison). But, it is unclear where these paths are and how effective they will be.	1. Please provide a map showing typical flight paths, sensitive areas, and

Table 5 Caribou-Specific Mitigation Measures. WMMP, Section 4.2.4, Page 13, Table 6 Bison-Specific Mitigation Measures.	Although the startle response of caribou may appear to be temporary, flights can have population level consequences. For example, calf survival is negatively correlated with a female's average level of exposure to overflights (Harrington and Veitch, 1992). As Harrington (2001) explains, female caribou are most sensitive to stimuli associated with threats during the calving period. Typically, a female that detects a predator will be better off by moving to a new area. However, if a female mistakes a benign stimulus (i.e., overflight noise) for a predator, the noise becomes a signal to the female and her avoidance movements increase. This movement increases her calf's risk of predation as they are more likely to become noticed the more they move around. This is particularly a concern for boreal environments, where predator density is greater. Potentially adverse impacts can be minimized by avoiding specific areas during the calving period (Harrington and Veitch, 1991). Flight altitude guidelines also suggest that "caribou calving grounds should be avoided whenever possible" (Environmental Impact Screening Committee (EISC), 2012).	where flight paths may be altered. 2. Will flight paths and altitudes be logged to test the degree of flight path compliance? • We note that within the bison specific table, there is a typo where it refers to "Project-related aircraft flights over caribou". This should say bison.
26. Adaptive management for wildlife. WMMP, Section 5, Page 17.	There is no adaptive management discussed in the WMMP section titled adaptive management.	1. Please include an adaptive management framework .
27. Critical bison and caribou habitat WMMP, Appendix A: Statutory requirements relevant to wildlife and wildlife habitat, Page 4,6, Table A – Summary of	There are three main protected areas for wood bison in the Northwest Territories: Mackenzie Bison Sanctuary, Nahanni National Park and Wood Buffalo National Park. The Mackenzie bison sanctuary is located south of the project area, but nearby and contains a distinct population that is not yet affected by diseases affecting other bison populations. The designated habitat for wood bison will be studied and defined from 2016-2021 (ECCC, 2016) but would likely be focused on these same areas.	1. How has critical habitat for these two species at risk (boreal caribou and wood bison) been considered? 2. Is there any potential for the project to impact, through direct or indirect means, the quality of

territorial and federal prohibitions pertaining to wildlife and wildlife habitat.	Critical habitat for boreal caribou in NWT has been identified over the majority of western NWT, including the project area. Here, the goal of maintaining at least 65% undisturbed habitat has been identified. The Woodland Caribou, Boreal population, is also legally protected on federal land and water within Nahanni National Park Reserve of Canada (NPRC). Specific range plans are still in development (ECCC, 2012). COSEWIC has designated barren-ground caribou as "threatened," but they have not been federally listed and so critical habitat has not been formally designated. Appendix A of the WMMP includes reference to the *Species at Risk (NWT) Act,* which states that the Commissioner may make regulations respecting the conservation of designated habitat or prohibiting activities that may adversely affect the designated habitat. The federal *Species at Risk Act* also states that "no person shall destroy any part of the critical habitat of any listed endangered species or of any listed threatened species…". It is unclear from the WMMP if critical habitat areas have been taken into consideration.	critical habitats identified nearby for these species?
28. Bison setbacks. WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	Bison setbacks are missing from the table.	1. Will setbacks apply to bison for general development and snowmobiles, similar to caribou mitigation?

29. Setback distances. WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	Throughout the table numerous different setback distances are given without any references or rationale being provided.	1. What is the scientific rationale for the setback distances used?
30. Setback distances for salt licks WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	The WMMP indicated a setback distance for mineral/salt licks of 1km year-round from all development activities. However, it is unclear how the presence of salt licks will become known without prior surveying efforts or additional TK information being collected.	1. Have surveys been completed for salt licks, or are they been planned in advance of construction? 2. If locations of salt/mineral licks are known, please include on suitable habitat map(s).
31. Setback distances for water crossings. WMMP, Appendix B: Timing restrictions and setback distance guidelines for wildlife and wildlife areas, Page 1, Table B – Timing Restrictions and Setback Distances.	AANDC (2012) also recommends set backs for water crossings for caribou as they are an important habitat area.	1. Have any water crossings been identified in the project area?

32. Assessing capability vs. suitability of wildlife habitat. DASR, Table 4.3-1: Pathways Assessment for Wildlife VCs. Figures 4.2-1 through 4.2-5, Habitat Mapping.	In Table 4.3-1, and throughout the DASR, Golder states that "*the current layout of the Project footprint will minimize the amount of new disturbance by primarily following the existing Old Airport Road route to Whati and intersecting areas previously burned*." The habitat identified as "nil to low" suitability in Figs. 4.2-3, 4.2-4, 4.2-5 for boreal caribou, barren-ground caribou, and moose, respectively, matches reasonably well with the fire history mapping in Fig. 4.2-1. While the recently burnt areas may currently be unsuitable habitat, this does not account for habitat *capability*. *Suitability* refers to be the ability of the habitat in its current condition to provide the life requisites of a species. *Capability*, on the other hand, refers to the ability of the habitat, under optimal natural conditions, to provide the life requisites of a species, irrespective of current condition. Thus, given that the TASR will be operating indefinitely, the effects of the Project on wildlife habitat may be greater than expected.	1. Have the proponents considered Project impacts on habitat capability (potential habitat suitability in the future), particularly for moose and wood bison, both of which may favor early seral stage vegetation as an important part of their seasonal diets?
33. Proportion of undisturbed boreal caribou habitat in NT1 range in RFD Case Results. DASR, Section 4.4.3.1, Page 4-193.	Golder predicts that construction of the TASR, in conjunction with three Reasonably Foreseeable Developments (RFDs), will still yield 66.6% of undisturbed habitat in the NT1 boreal caribou range (from Base Case of 66.8%), exceeding the minimum threshold of 65% needed for self-sustaining populations. The GNWT (2017) Boreal Caribou Recovery Strategy estimates that severe fires in 2014 and 2015 burned 2.3 million hectares and reduced the percentage of undisturbed habitat in the NT1 range from 69% to 66%. Assuming these estimates are correct, construction of the TASR and RFDs will result in 65.8% undisturbed habitat, only 0.8% above the threshold. This percentage converts to approximately 61,300 ha. According to the latest NWT State of the Environment Report (GNWT ENR 2015), there are an average of 274 fires and 600,000 ha burned every year in the Northwest Territories. The Canadian Wildland Fire Information System shows that the North Slave Region has a moderate fire weather index (fire danger). Additional developments and/or forest fires in the future could	1. Does the percentage of undisturbed habitat that remains after construction of the TASR and RFDs leave enough of a "buffer" to absorb the effects of additional developments and/or future fires? 2. Will the GNWT consider habitat compensation in accordance with maintaining or exceeding the 65% minimum threshold as outlined in the Boreal Caribou Recovery Strategy?

	conceivably reduce the percentage of undisturbed boreal caribou habitat below the sustainable threshold.	
34. Boreal caribou habitat availability in Wek'èezhìı portion of NT1 range. DASR, Section 4.2.3.1, Page 4-41; Table 4.2-16 for Base Case. Section 4.4.3.1, Page 4-193; Table 4.4-7 for Reasonably Foreseeable Developments (RFD) Case.	In the Wek'èezhìı portion of the NT1 boreal caribou range, Table 4.2-16 of the DASR shows that at Base Case, there is 60.0% undisturbed habitat. Golder reasons that "*the disturbance thresholds identified by ECCC at the NT1 range scale are not necessarily applicable at different spatial scales. This is because patterns of habitat selection are scale-dependent due to varying availability of different habitats across space and time*." Both the federal (EC 2012) and GNWT (2017) recovery strategies identify and accept the 65% undisturbed habitat threshold to support a self-sustaining boreal caribou population. While variation in habitat and population conditions may justify different management decisions, GNWT (2017) states that "*the NWT does not currently have strong evidence to support changing the threshold, and the minimum threshold of 65% disturbance applies to the NWT range*." Furthermore, the NWT recovery strategy estimates only **55%** of undisturbed habitat in Wek'èezhìı as of autumn 2015 due to severe fires in 2014 and 2015. Hence, the Wek'èezhìı portion of the NT1 range is already 5-10% below the cited threshold for supporting a self-sustaining population. The Project is expected to <u>directly</u> reduce the undisturbed habitat by 0.1% (Table 4.4-7). However, we note that <u>indirect</u> habitat loss through potential avoidance of the TASR and adjacent, disturbed vegetation, as well as potential competition with increased moose and bison, will further reduce the amount of undisturbed habitat available for boreal caribou. Both direct and indirect habitat loss may further hinder the boreal caribou recovery plan.	1. Can the GNWT commit to habitat compensation <u>in the Wek'èezhìı portion</u> of the NT1 boreal caribou range, in accordance with the NWT boreal caribou recovery strategy?
35. Moose densities that will impact boreal caribou populations in NWT. DASR, Section	Golder cites a study by Bergerud and Elliot (1986) when they state that moose densities of approximately 0.11 moose/km^2 would be required to support wolf densities of 6.5 wolves/1000km^2 to destabilize boreal caribou populations. Golder then describes how moose densities in the North Slave Region are half this value; hence they conclude that moose populations could	1. How do the densities of boreal caribou, moose, and wolves compare between the Project area and northern BC in the mid

4.2.3.1, Pages 4-45 to 4-46. Lack of assessment and mitigation plans for indirect effects of moose on caribou. DASR, Sections 4.4.2.1, 4.4.2.2, 4.4.2.3.	not support sufficient wolf numbers to destabilize the boreal caribou population. However, the Bergerud and Elliot (1986) study was conducted in northern BC, which may support higher densities of all, or some of these, species (moose, wolves, and boreal caribou) compared to the NWT. For example, if the location (or time when the research was conducted) of the Bergerud and Elliot (1986) study supported a higher density of boreal caribou than at present and near the proposed AWR, then high numbers of moose and wolves would also be needed to destabilize that particular British Columbia population. The results of Bergerud and Elliot (1986) may, therefore, have no bearing on the impact of moose and wolves on boreal caribou in the project area. as the population dynamics derived from this paper may not be applicable to the Project area. An evaluation of possible effects due to interspecific interactions between moose and caribou is lacking in the DASR. Golder identifies that moose can impact boreal (Section 4.4.2.1, Page 4-172) and barren-ground caribou (Section 4.4.2.2, Page 4-176) by attracting wolves and increasing predation pressure on caribou, and that "*moose may be attracted to regenerating vegetation along the TASR*" (Section 4.4.2.3, Page 4-187), yet there are no formal assessments or mitigation plans.	1980s (location and time period associated with Bergerud and Elliot (1986) study? Could the caribou population around the Project area be destabilized by a potential increase in moose and resulting wolf densities? 2. Please explain the rationale for excluding the assessment of potentially higher moose densities due to the construction of the TASR on the survival and reproduction of boreal and barren-ground caribou due to increased wolf predation pressure.
36. Sensory disturbance at key times of the year for caribou, young calves. DASR, Section 4.2.3.1, Page 4-46.	Golder provides background information on how "*sensory disturbance is most detrimental at key times of the year, such as late winter periods, when animals tend to be in poor physical condition, and during the reproductive season (spring/early summer) when caribou are raising young*," and how "*although these effects may seem minor, displacement and increased wariness may affect energetic expenditures and survival*, *particularly for young calves*."	1. Given the knowledge and awareness of when caribou are most sensitive to sensory disturbance, please explain why impacts of sensory disturbance during relevant sensitive seasons were not assessed for ungulates (barren ground and boreal caribou) and bovids (wood bison).

37. Mitigation strategies for avoiding, minimizing and rehabilitation of impacts to vegetation and topography. DASR, Table 4.3-1, Page 4-112, first Effect Pathway.	For the Effect Pathway of the site preparation, construction, and operation of the TASR on habitat availability, use, and connectivity, the last bullet point of the mitigation plan states that mitigation strategies recommended by the *Northern Land Use Guidelines* "*will be considered*". These guidelines include best practices for avoiding, minimizing, and rehabilitation of impacts to vegetation and topography.	1. Will the GNWT commit to following the *Northern Land Use Guidelines*?
38. Guidelines for cleaning and inspection to avoid the spread of invasive plant species. DASR, Table 4.3-1, Page 4-117, third Effect Pathway.	Mitigation plans for minimizing the introduction and spread of noxious and invasive plants are briefly described, but without reference to specific guidelines for how to clean and inspect vehicles and equipment.	1. Please provide a reference to the specific guidelines for controlling the spread of invasive plant species, if available.
39. Use of TASR and converted habitat by prey and predators not expected to decrease survival and reproduction of prey. DASR, Section 4.3.2.2, Page 4-122; Table 4.3-1, Page 4-116, first Effect Pathway.	Golder argues that (on Page 4-122) because the proposed TASR footprint will primarily follow the Old Airport Road route and burned habitat, the amount of new linear disturbance will be small relative to existing conditions; and that design features and mitigation measures will have "*negligible net residual effects*" on the survival and reproduction of prey species. Table 4.3-1 for this Effect Pathway (Page 4-116) does not provide information on design features or mitigation measures to address the potential effects on prey survival and reproduction. The DASR also fails to consider that the all-season gravel road may be a more attractive travel corridor than the current winter road, and that the all-weather road may be favoured by some wildlife as a movement corridor year-round. This could result in increased wildlife traffic and predator-prey interactions.	1. Will the TASR result in increased use of the corridor by wildlife for travel (due to its selection for ease of movement) and foraging (roadside vegetation), and could this result in residual shifts in predator-prey interactions? 2. Please clarify the design features and mitigation measures that will result in negligible net residual effects on the survival and reproduction of prey

	In addition, the maintenance of roadside vegetation at an early seral stage can lead to selection of forage vegetation along the edges of roads by predators and/or prey, which can change the population dynamics. Bears, for example, may forage along roads for favored vegetation and for roadkill and garbage, which can bring them into more frequent contact with ungulates and bovids that may also be selecting road verges for vegetation or that are using the road as a travel corridor (Roever *et al*., 2008; Dussault *et al*., 2012; Bastille-Rousseau *et al*., 2011). Dussault, Leblond, and others have measured road impacts on habitat selection by bears and on the vitality rates of caribou through indirect predator-prey dynamics. They determined that when caribou calves occupied areas with few deciduous trees, they were more likely to die from predation if the local road density was high (95% of predation was by black bear). Mature coniferous stands, and roadsides offer relatively high vegetation biomass consumed by black bears, increasing the likelihood of predator interactions and calf mortality. Given that less than 50 per cent of the calves survived more than two months, there can be strong fitness consequences for a caribou cow's inability to select safe habitats, and potentially population level sufficient amounts of safe habitats are not available. Leblond *et al*. (2013) similarly showed that adult caribou that established their home range in areas with high road densities had a much higher probability of dying by predation throughout the year. This is likely because roads increase the efficacy of wolves in their search for large prey (100% of adult predation was by wolves).	species due to shifts in predator-prey interactions that may occur due to the project.
40. Risk of wildlife-vehicle collisions predicted to be low; minor changes expected from existing conditions. DASR, Section 4.3.2.2, Pages 4-121 to 4-122; Section 4.2.3.4, Page 4-64.	On Page 4-121, Golder cites GNWT-DOT data for reported collisions involving animals from 2010-2014: a total of 113 collisions, 95% of which occurred on highways, 5% in communities, and none in rural areas. The existing Old Airport Road is a winter use (rural) road. However, the proposed Tlicho All-Season Road will be available for use year-round, overlapping with migration times; and will experience increased traffic (DASR, Appendix C). Thus, a higher probability of wildlife-vehicle collisions may be expected compared to other rural roads, particularly if they are winter-only roads.	1. Is the predicted risk of wildlife-vehicle collisions on the TASR considered low because it is considered to be a "rural" road? Are the other rural roads used for comparison generally winter roads only, or are they all weather roads?

	On Page 4-64, Golder cites 270 reported collisions involving bison in a 27-year period between 1989-2015 (Mackenzie Bison Management Plan) – an average mortality rate of 10 bison/year. From the 113 reported collisions mentioned above, 65% (73) involved bison – an average of 14 bison were killed per year from 2010-2014. In addition, on Page 4-64 Golder cites an average of 22 bison killed in vehicle collisions per year on Highway 3 since 2005. While the data sources are not the same, these results indicate a 1.4-2.2x increase in road mortality rates in recent years. Unless the population of bison is increasing proportionally, such that the ratio of population growth: mortality remains the same, increasing collisions with bison will further contribute to population decline.	2. Could higher traffic on the TASR relative to the existing Old Airport (winter/rural) road, and the fact that the road will be used year-round, result in "highway"-type wildlife mortality rates? 3. Please provide data on bison population abundance *vs.* bison-vehicle collisions over time, if this information is available.
41. Interaction strength between primary pathways and valued components for Bison. DASR, Table 4.3-2, Page 4-127.	All Project effects on bison are expected to be weak interactions in Table 4.3-2. However, the anticipated interaction strength for the following three effect pathways noted within this table are inconsistent with knowledge of bison movements and behaviour with respect to roads: 1. Altered movement patterns, including any changes to interactions with other caribou herds. 2. Increase in public access could affect wildlife survival and reproduction through vehicle strikes, and/or legal and illegal hunting. 3. Use of linear corridors by bison may lead to range expansion and affect moose and caribou habitat. From the Wood Bison Species Status Report (GNWT SARC, 2016): Wood bison may establish trails along human-made linear disturbances, such as roads, and will use them continuously over long periods of time. Bison do not avoid roads unless there is heavy hunting pressure; they will graze on early seral stage roadside grasses and sedges. Hence, we would expect an interaction for bison for the pathway #1 noted above.	1. Please explain why the TASR effects on bison are considered to be weak, considering wood bison are often found to travel and forage near roads.

	Wood bison easily become habituated to human presence and infrastructure and have a tendency to congregate along roads, often becoming a traffic hazard. (See comment and question above re: bison-vehicle collision predictions) Hence, we would expect an interaction for bison for the pathway #2 noted above. The Mackenzie population of wood bison has been expanding north toward Whati in recent years, possibly due to new road and trail construction. As the wood bison's range begins to overlap with other species, they may compete with boreal caribou for slow-growing lichens, and with moose for willow. Hence, we would expect an interaction for bison for pathway #3 noted above.	
42. Performing land clearing during winter to reduce disturbing boreal caribou during sensitive periods. DASR, Section 4.4.2.1, Page 4-171; Appendix B, Tentative Construction Schedule	Golder proposes to minimize Project effects on boreal caribou during sensitive periods, *e.g.* calving and post-calving, by performing land clearing procedures primarily during the winter. All blasting work in the tentative construction schedules in Appendix B of the DASR begin in mid-January, when the length of day at northern latitudes is very short. Darkness may inhibit Golder's mitigation measure of restricting blasting to when caribou and bison are >500 m away (TASR WMMP, Tables 5 and 6).	1. Can the GNWT confirm that wildlife monitors will be able to see animals in the dark at the proposed mitigation distances?
43. Negligible effect on barren-ground caribou due to low presence in Project area. DASR, Section 4.4.2.2, Page 4-175; Section 4.2.3.2, Page 4-47; Appendix G, Bathurst Annual Density map.	Golder argues that the TASR will have minimal effect on barren-ground caribou because the Regional Study Area is outside of both Bathurst and Bluenose-East herd core ranges, and individuals have not been seen in the Project area since the late 1990s, when there was a peak abundance of barren-ground caribou. The annual density map of the Bathurst herd in Appendix G shows that as of 2015, the 100% Utilization Distribution is outside of the RSA. However, the Project area is within the historical annual home range. Mitigation plans need to consider the Bathurst caribou recovery plan and future range expansion into suitable habitats. Caribou numbers are at all time lows, and should they recover, we need to anticipate range expansions into historic range, and the need for retaining sufficient capable habitat.	1. How does the TASR fit into the GNWT's Draft Bathurst Caribou Range Plan?

44. Uncertainty regarding winter road access and climate change on barren-ground caribou. DASR, Section 4.4.2.2, Page 4-181.	Golder acknowledges the uncertainty of predicting the effects of the TASR on winter access roads and hunting of barren-ground caribou. They predict that the TASR will result in a 10-14 day earlier opening and closing of the winter roads, which would allow hunters to access wintering caribou, but then posits that "*earlier access for trucks with snowmobiles may be temporary*" due to climate change. Golder also argues that Bathurst caribou begin their migration to northern calving areas in mid-April, so longer winter road access past mid-April may not increase harvest. As mentioned above, if population recovery and range expansion of Bathurst caribou occurs in the future, there may be more implications of increased winter road access.	1. Please define "temporary" in the context of this statement, and with regard to the rate of climate change. i.e., Will climate change alter the earlier winter road opening/ connections quickly enough to render this impact negligible to current caribou herds? 2. How long does it take to impact caribou populations at their current population sizes, and given their trajectories, if this effect of earlier opening and closing of winter roads did occur? 3. Please provide predictions for the effects of increased road access on barren-ground caribou harvest with and without climate change and the period over which increased road access could be expected before being circumvented by climate change.
45. Ability of barren-ground populations to	Golder states that "*caribou begin to use post-fire areas 40 to 50 years later when lichens are available, so habitat loss from fire is temporary and*	1. Given the current population trajectories for

rebound in 40-50 years. DASR, Section 4.4.3.2, Page 4-199.	*reversible*." In NWT between 1989-2016, the Bathurst and Bluenose-East barren-ground caribou populations declined by 96% and 89%, respectively, and the declines are believed to be continuing (Porcupine Caribou and Barren-ground Caribou Species Status Report, GNWT SARC, 2017).	barren-ground caribou in the NWT, will impacts that exacerbate population decline allow for rebound in this time frame?
46. Definitions to predict residual effects to wildlife VCs. DASR, Section 4.6.1, Table 4.6-1, Page 4-209.	In Table 4.6-1, Golder categorizes the Duration criteria as Short-term, Medium-term, Long-term, and Permanent. Long-term is described as "within a defined length of time during operation". It is unclear what the defined length of time is, and whether the definition is species-specific. The Magnitude of impact may be underestimated if the analyses used the proposed 500 m setback distance (WMMP, Tables 5 and 6). As mentioned elsewhere, Golder is aware of sensory disturbance distances of up to 9 km (for logging operations) affecting boreal caribou (Page 4-41).	1. Please provide more information about how Residual Effects Analyses were conducted. 2. Please define "long-term" duration for each species (boreal caribou, barren-ground caribou, moose, bison), since the self-sustainability of a population may be dependent on time. 3. Please re-assess the magnitude of effects using greater setback distances.
47. Seasonal movement and rut sites maps. DASR, Section 5.2.10, Page 5-13; Appendix G.	Golder provides maps of suitable habitat and traditional knowledge data of habitat (if available) for boreal caribou, barren-ground caribou, moose, bison in Appendix G. It would be very informative to help evaluate the impact of the TASR if seasonal habitat use/movement data and rut sites of these species were provided.	1. Please provide seasonal habitat use/movement and rut sites on maps, if data are available.
48. Beverly and Ahiak herd effects. DASR, Section 5.4.3.2, Page 5-49.	Golder states that "*Tłı̨chǫ harvesters stated that increased development in the barren-grounds have disrupted caribou migration into the Whatì area, which is a concern since they now have to travel further north towards Grandin Lake and Gamètìto be able to hunt barren-ground caribou (p. 38 PR#28; PR#97 IR*	1. Has the GNWT considered possible impacts on the Beverly/Ahiak herd from this project?

	2). The GNWT (PR#7 page 5-10) anticipates that a Whatì community access road will extend the winter road season to Gamètì and Wekweètì by approximately 4 weeks, which may also extend access to barren-ground caribou habitat for non-Tłı̨chǫ harvesters." Disruption of migratory routes of Bathurst and Bluenose-East herds may force them to come into the contact with the Beverly/Ahiak herd, as some collared Beverly/Ahiak caribou have been shown to overwinter in the area near Wekweètì.	
49. Contradictory citation data regarding sensory disturbance distances. DASR, Section 4.1.3.1, Page 4-5; Section 4.2.3.1, Page 4-41; Section 4.4.2.1, Page 4-171.	Golder cites multiple sensory disturbance distances for wildlife throughout the document, ranging from 5 km for mammals (Page 4-5); 4 km for boreal caribou around an active mine site, and 9 km around active logging operations (Page 4-41). Given these numbers, the key boreal caribou habitats identified by TK approximately 5-10 km west of the Project (Page 4-171) may be affected by the project.	1. Please clarify which sensory disturbance distances Golder feels are most appropriate for boreal and barren-ground caribou, moose, and bison. 2. Are the numbers from Point 1 the most conservative values in the DASR? 3. How have the above values been used to assess sensory disturbance and to inform mitigation?
50. Residual Effects on Barren-ground Caribou DASR, Section 4.5.2.2, page 4-217	Golder concludes that "incremental and cumulative changes to measurement indicators from the Project and other developments should have no significant adverse effect on self-sustaining and ecologically effective barren-ground caribou populations." Mackenzie Valley Environmental Impact Review Board (MVEIRB), in its Report of EA for the Jay Project, concluded that Bathurst caribou are not a self-sustaining and ecologically effective population, and that any adverse effect on this population should be considered significantly adverse. The GNWT Minister of Lands approved and signed the recommendations by the MVEIRB,	1. Please explain how Golder believes that effects classification of the Project should be different from that of the Jay Project, as judged by the MVEIRB and the GNWT Minister of Lands.

	including the board's conclusion that the Jay Project would have significant adverse effects on Bathurst caribou due to the herd's current perilous status. Golder agrees in DASR that there would be residual adverse effects on Bathurst caribou from various sources. Given that Bathurst caribou is not a self-sustaining and ecologically effective population, Golder conclusion in DASR contradicts with the recent finding by the MVEIRB and the GNWT Minister of Lands.	
51. GNWT-ENR Response to Jay Measure 6-6	On May 18, 2017, GNWT-ENR submitted "Caribou Management Measure 6-6" to the MVEIRB. Measure 6-6 was a result of the Dominion Diamond Ekati Corporation's Jay Project Environmental Assessment. The Measure directed GNWT-ENR to: A) Investigate and report on the causes for the current population change; B) Complete and implement an interim management plan for the Bathurst caribou herd; and C) (develop a) Interim Strategy for the Recovery of the Bathurst caribou herd Although GNWT-ENR promises that it "will continue to ensure that measures and recommendations directed at GNWT by the Review Board related to mitigating significant impacts on the Bathurst herd are met", NSMA observes a number of initiatives where the GNWT-ENR has fallen short. For example, the Wolf Management Feasibility Assessment is well behind recommended schedule by the Wekeezhii Renewable Resources Board. Similarly, the Bathurst Caribou Advisory Committee progress is slow. The NSMA only this week (July 11, 2017) received meeting minutes for the meeting that was held in March of 2017. This delay significantly impacts the momentum needed to move this important plan forward. The Bathurst Caribou Range Plan, on the other hand, may be on schedule to be completed, but there is no articulation about the implementation mechanism, without which the plan will have no effect.	1. GNWT-ENR, please explain in what ways you intend to overcome challenges you are facing that are preventing you from meeting directions and recommendations by the co-management boards in a timely manner.

	It appears to NSMA that, despite best efforts, GNWT-ENR has fallen short of meeting directions and recommendations that are made by various co-management boards (e.g. WRRB and MVEIRB) over the years.	
52. Unclear link between effects and mitigation. Socio-Economic Effects. Table 5.3-1. Page 5-18.	Golder identifies that a land use plan for public lands in the Wekeezhii Management Area (WMA) would mitigate potential impacts on time spent for traditional activities and consumption of country food. At present, GNWT has not set scope of the land use plan. Without clearly knowing what the land use plan will contain and achieve, it is unclear how the linkage is made between the said effects and mitigation.	1. Please clarify how a WMA land use plan would mitigate potential effects on time spent on traditional activities and consumption of country food.

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