SLAVE MÉTIS ALLIANCE

PO Box 2301 Yellowknife, NT X1A 2P7

August 7, 2019

Joanne Deneron
Chairperson
Mackenzie Valley Review Board
200 Scotia Centre, 5102-50th Ave
Yellowknife, NT X1A 2N7
Email: jdeneron@reviewboard.ca

Dear Ms. Deneron:

Re: North Slave Metis Alliance Technical Report for Diavik EA1819-01

Diavik Diamond Mines Inc ("DDMI") submitted an amendment request to Water Licence (#WL2015L2-0001) on June 1, 2018, to the Wekeezhii Land and Water Board. The primary purpose of this request was to allow the option of placing processed kimberlite ("PK") material from the process plant into the mine workings. On February 26, 2019, on its own motion, Mackenzie Valley Environmental Impact Review Board ("Review Board") referred DDMI's proposed changes to an Environmental Assessment ("EA").

The North Slave Metis Alliance ("NSMA") is an intervener in the Review Board's EA for this project. The NSMA participated actively in the EA throughout the EA process, including our response to the Review Board's Information Request, submitted on July 4, 2019 (PR#75).

With the above in mind, the NSMA is pleased to submit the attached Technical Report for EA1819-01 for your consideration. We appreciate your willingness to grant us additional time to submit our intervention.

We thank you for the opportunity to provide our input into the process.

Sincerely,

William A. Enge
President

CC: Gord Macdonald, DDMI

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North Slave Métis Alliance Technical Report for EA1819-01 Depositing Processed Kimberlite in Pits and Underground at Diavik Diamond Mine

Submitted to:
Mackenzie Valley Environmental Impact Review Board
200 Scotia Centre
PO BOX 938, 5102 – 50th Avenue
Yellowknife, NT X1A 2N7

August 7, 2019

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Introduction

North Slave Metis Alliance ("NSMA") represents s.35 Aboriginal-right bearing Indigenous Metis people of the Great Slave Lake area. NSMA is the only Indigenous group in the Northwest Territories that has received judicial recognition of its members' common law Aboriginal rights as Métis. NSMA's very *raison d'etre* is to advocate for the rights of the Métis of the Great Slave Lake area. NSMA members are a distinct constituency of the contemporary Métis collective of the Great Slave Lake area, a constituency which aspires to exercise and protect its Métis practices and customs on traditional Métis lands to the north of Great Slave Lake. The historical record is clear that the community of Métis of the Great Slave Lake area hunted and trapped over a wide-ranging area in the NWT. NSMA members continue to exercise their collectively held, unextinguished Aboriginal rights as Métis people to the north and the south, east and west of Great Slave Lake, including in the area of Lac de Gras.

NSMA was an intervener in Rio Tinto's Diavik Diamond Mines project original Environmental Assessment in 1998. NSMA has continued its active engagement with the project as a signatory to the Environmental Agreement, as well as through various regulatory processes over the years. As an active intervener in the current EA1819-01, we participated in the EA in the following stages:

Reviewing DDMI's water licence amendment application (W2015L2- 0001) to the WLWB (June 2018-February 2019);
Participating in the scoping session (March 2019);
Reviewing the scoping document and workplan (March 2019);
Submitting and responding to IRs (June-July 2019);
Providing relevant documents to the Review Board for filing on the public registry.

This Technical Report reflects our remaining concerns with the proposed project, and includes the following main components:

1. Significance thresholds for water quality
2. Significance thresholds for wildlife
3. AEMP Benchmark for zinc
4. Climate change impact oh meromictic condition
5. Project interactions with fish and fish habitat
6. Presence of fish species below 40m depth in pit lakes
7. Nitrite concentration of pit water

Issue 1: Significance Thresholds for Water Quality (SIS Section 4)

Overview:

DDMI sets AEMP significance thresholds based on the Comprehensive Study Report (1999), which characterizes it as "a high probability of a permanent or long-term effect, of high magnitude, within the RAA, that cannot be technically or economically mitigated" (CEAA 1999).

On Table 4-4, the proponent defines "long-term" as beyond 30 years, "high magnitude" as 20% over AEMP benchmarks, and RAA as areas inclusive of "the PDA and LAA and encompasses the entirety of the Lac de Gras watershed to the outlet of Lac de Gras at the Coppermine River (Figure 4-1). The RAA includes the Diavik Mine and the Misery and Jay Operations of the Ekati Mine" (SIS 4.1.4.1).

In other words, unless a model prediction exceeds a contaminant concentration that is more than 20% the AEMP benchmark, lasting for over 30 years, and somewhere outside of the Local Assessment Area (>1km), the DDMI does not consider the effect as significant.

Developer's conclusions:

DDMI defined significance thresholds based on the 1999 CSR. The Developer defined the magnitude guideline in relation to the water quality guidelines rather than baseline, given that the guidelines represent conservative and scientifically defensible levels above which adverse effects may occur (as noted, a ten-fold safety margin is typically incorporated in the guidelines, providing additional protection).

The proponent set the magnitude ratings qualitatively to provide a framework for examining predicted concentrations and their consequences. The high magnitude rating was set at 20% above benchmarks to reflect concentrations that could approach the values used to define the threshold (i.e., toxicity values closer to the values used to derive guidelines). The negligible rating was set at 5% above benchmarks to reflect natural variability and accuracy associated with measured concentrations. The low and moderate ratings were set at intervals to reflect increasing concentrations and potential effects.

NSMA's Conclusion:

DDMI acknowledges that the AEMP benchmarks (based on CWQG PAL and GCDWG) are higher than baseline levels in Lac de Gras for many parameters and that effects of the Project would need to result in a change from baseline levels before the benchmarks are reached.

DDMI's response to our initial concern is predicated by their interpretation that formal aquatic guidelines are superior to baseline concentrations as benchmarks. Further, the proponent clarified that the high magnitude rating requires a 20% exceedance above the AEMP benchmark (based on CWQG PAL and GCDWG).

Typically, an effect would be considered significant if the following criteria are met: 1. water quality guidelines are exceeded, and 2. baseline conditions are exceeded by a certain percentage. Guideline values should be used, wherever possible, as the delineation between significance and non-significance, because anything above guideline values could result in an effect to the endpoint user.

We continue to have concerns about the definitions used to determine significance, as 1. the formal aquatic guideline values used as AEMP benchmarks are above the baseline levels for many COPCs in the system (sometimes by a factor of 400 for barium for example); 2. Only a high magnitude rating (20% above formal AEMP benchmarks) will lead to a significance rating for effect, which is an even larger percentage above baseline conditions relative to guidelines; It is important to understand that aquatic guidelines include a safety factor to make them more conservative, to ensure the protection of aquatic life. Therefore, in a system that is not adapted to exceedances, water quality guidelines should not be exceeded, or there is a risk of a significant impact; 3. The effect will need to last for 30 years before considered long-term; and 4. The effect needs to be detected more than 1km from the project.

We remain unclear about the scientific rationale and justification used by the proponent in defining magnitude ratings as percentage exceedances above aquatic guideline values. We recognize that there are cases whereby background levels are very close to, or above, formal water quality guidelines and in such cases, there is some flexibility in developing site-specific water quality objectives and magnitude criteria that are some percentage above a formal guideline (as even the baseline conditions would exceed guidelines). For example, where metals are naturally elevated in a system due to surrounding bedrock influences, aquatic organisms may be adapted or selected to tolerate such conditions, and therefore site-specific and modified criteria can make sense. In such instances, scientifically defensible methods (e.g., by use of developing Site Specific Water Quality Objectives based on local conditions) could be used. In the case of this project, however, it appears inappropriate to define magnitude based on a percentage exceedance above the formal CWQG PAL and GCDWG, without considering that baseline conditions are below these criteria to begin with.

A significant effect, as defined for this project, requires the project to cause an exceedance of 20% above the formal guideline values. In the case of a system where water quality parameters naturally fall below formal guidelines, assumptions about adaptation should not be made, and it should not be assumed that the community can tolerate contaminant levels up to 20% above guidelines without potentially experiencing a significant impact. Further, the necessary scientific justification is not provided for why aquatic life would be significantly impacted at only an exceedance of 20% or above guideline values. If this assumption is made, it needs to be qualified by scientific evidence or additional studies that support a loosening of conservative measures for rating significance at such a percentage above the level of formal water quality guidelines.

Recommendations:
Due to the current proposed water quality thresholds being much higher than the baseline water quality, the Review Board should consider more conservative definitions for water quality significance thresholds.

Issue 2: Significance Threshold for Wildlife (SIS Section 7)

Overview:

Magnitude ratings for effects on wildlife are set to the following criteria: Negligible: no measurable change in parameter Low: parameter changes by less than 1% from baseline Moderate: parameter changes between 1% and 10% from baseline High: parameter changes by more than 10% from baseline. Significance is defined by a parameter having a High (>10%) magnitude rating.

In the recent Environmental Assessment of the Jay Project (EA1314-01) the Review Board concluded that for the Bathurst caribou's current state, "any [reduction of] calving success at a time when the herd is in a precarious state is a significant impact." (p.115, Review Board, 2016). The proponent's proposed magnitude rating of >10% change in measurable parameters is too permissive.

Developer's Conclusions:

DDMI concludes that the high magnitude definition used to characterize effects to wildlife represents a conservative approach to assessing a potential change in a measurable parameter from baseline conditions, with moderate, low and negligible ratings set at intervals to reflect decreasing levels of potential Project effects, and that changing these criteria would not change the assessment conclusions for wildlife.

NSMA's Conclusions:

NSMA acknowledges that the impacts being assessed in the proceeding is limited to those arising from changes in water quality. It appears that any potential for a negative effect from the project on Bathurst caribou may be captured in an assessment of the impacts of the closure phase of the Diavik mine project at large on caribou, as much of the PK water quality work will be conducted in conjunction with the closure phase (and larger-scale activities encompassed therein). Having that said, as shown in a previous analysis (Zoetica 2018) and in the Jay Project Report of Environmental Assessment (Review Board, 2016), the population can not even sustain impacts that affect as little as 0.01% of the population, which is at the individual caribou level. We still disagree with the magnitude ratings as described in the DAR, as they do not reflect the current lack of resiliency of Bathurst caribou to absorb any additional impacts.

We are not convinced that sufficient information exists on the impacts of water quality to caribou to derive the magnitude ratings relating water quality changes to caribou health, as done in this application.

Recommendations:

NSMA recommends the Review Board to make a significance determination based on magnitude ratings that are supported by evidence, and considers the current state of Bathurst caribou and not solely based on the 1999 CSR.

Issue 3: AEMP Benchmark – Zinc (SIS Section 4)

Overview:

Water Quality magnitude ratings are set to the following criteria: Negligible (<5% above AEMP benchmark); Low (5 to 10% above AEMP benchmark); Moderate (10 to 20% above AEMP benchmark; and High (>20% above AEMP benchmark). A significant ratings includes consideration of only the high magnitude rating (>20% above AEMP benchmark). Under the CCME, the guideline for zinc has been reduced from 30 µg/L to 7 µg/L. However, the zinc benchmark remains at 30 µg/L, the reasoning stated as to maintain consistency with previous water quality monitoring.

Developer's conclusions:

A 30 microgram/L (µg/L) zinc benchmark threshold for the protection of aquatic life was used to maintain consistency with the 1998 assessment and the 2017 AEMP. Since the submission of the SIS, the zinc predictions for the different scenarios were compared with the updated and draft lower CCME guideline of 7 µg/L. The proponent states that predicted maximum zinc concentrations (Table 4-7 to 4-9) remains well below the 7µg/L in most scenarios, except for scenario A21 3a, where maximum zinc concentration at the surface (5.4 µg/L) is below the draft CWQG, but the maximum at 40 m depth (17 µg/L) is above the draft CWQG and would be considered a high magnitude, long-term effect on water quality within the Project Development Area (PDA) for Project and cumulative effects. The proponent suggests that the reassessment of the zinc benchmark threshold would have no impact, and thus would not be necessary, on the assessment because A21 3a has already been identified as having this characterization at 40 m depth associated with the predictions for nitrite, nitrate, and molybdenum (higher than AEMP benchmarks by 133%, 37%, and 5%, respectively).

NSMA's conclusions:

Using the updated water quality guideline for zinc against which future monitoring of water quality would be measured would be more appropriate and is based on more up-to-date science. In addition, different COPCs may have different effects to organisms, thus the importance in addressing the potential effects from zinc independently. If the chemocline were to become compromised, for example, due to climate change-related impacts not yet considered (see comment below), measuring zinc levels against scientifically defensible thresholds will be important.

Recommendations:

The Board should require DDMI update their zinc benchmark threshold to match the current CCME guideline, to utilize up-to-date scientific information and ensure the best ecological protection available.

Issue 4: Climate Change Impact on Meromictic Condition (SIS Section 4)

Overview:

Sensitivity analyses were conducted to increase the confidence in the water quality modeling results and indicated that "increased air temperatures as a result of future climate change are not anticipated to result in a change in pit lake water temperature or water quality predictions." Climate change may have other potential indirect influences on lake systems, including the thaw of permafrost under lakes that can cause chemical, biological and physical changes in lake systems (Drake et al. 2019). In addition, as organic matter is supplied to lakes via permafrost thaws, greenhouse gases such as methane may be released in greater amounts (Sepulveda-Jauregui et al. 2015), and in turn may cause upwelling of nutrients in Arctic lakes, furthering changes in nutrient dynamics within the lake system over time.

Developer's Conclusions:

DDMI expects that increased geochemical yield and biological productivity in arctic lakes resulting from receding shoreline permafrost, as a result of climate change, could theoretically increase stabilization of the pit lakes. The water quality modeling assumes that the only source of geochemical loading to the benthic waters is PK pore water. The modeling does not include the accumulation and decomposition of in situ and allochthonous sources. The Developer expects these sources would continue to add dissolved elements to the monolimnion of a pit lake helping to maintain a chemocline. DDMI argues that, if these sources increased over time as a result of climate change, in theory, they could contribute to a stronger chemocline, and if future water quality in the pit lakes were determined to be harmful to fish and fish habitat a decision could be taken to block the passageway connecting the pit lakes with Lac de Gras and preventing fish from accessing the area. DDMI recognizes this as extreme mitigation that would only be implemented if water quality was very different from what is expected.

NSMA's Conclusions:

NSMA recognizes that there exists the possibility of an extreme mitigation measure of re-segregation of the pit from Lac ee Gras. We think the project will benefit from additional modeling that takes into account the range of conditions that could be expected in consideration of the influences of climate change on upwelling, similar to the phenomena highlighted in Drake et al. (2019) and Sepulveda-Jauregui et al. (2015). As this closure strategy will be precedent-setting in terms of reconnection of a PK pit to an existing lake, it is important that sensitivity analyses be done to predict and prevent all potential outcomes and to ideally prevent any adverse effects to this important ecosystem.

Recommendations:

NSMA recommends additional modeling that takes into account the range of conditions that could be expected in consideration of the influences of climate change on upwelling. The modeling results should be provided to the WLWB prior to the approval of the Type A Water Licence (W2015L2- 0001).

Issue 5: Project Interactions with Fish and Fish Habitat (SIS Section 6)

Overview:

Changes in water quality as a result of diamond mining activities have been observed to cause a shift in phytoplankton and rotifer communities in lakes downstream of mining activities (at the Ekati mine) and results suggest a possible progression of shifts up the food web (bottom-up progression) (St.-Gelais et al., 2018). Trophic level shifts at Ekati were limited to the phytoplankton and rotifer communities over a 19-year span, and no observed changes in crustacean zooplankton communities were observed. However, the authors suggested that this may be due to phytoplankton concentrations that were under or close to the lowest concentration limit for the expected highly competitive crustacean zooplankton (large, filter-feeding cladocerans) to dominate (St.-Gelais et al., 2018). Lac de Gras is currently considered an oligotrophic lake and levels of nitrogen in the form of nitrite and nitrate are low relative to CCME guidelines (an order of magnitude lower - see Table 4-4 of SIS).

While we recognize that the ring dike will not be breached until AEMP benchmarks are met for various forms of nitrogen, concentrations of these parameters in pit water, if close to benchmark concentrations, could have the potential to cause shifts in the N:P ratio of the lake once breached. If nitrogen is further increased in Lac de Gras relative to baseline, potential changes in community structure could occur with greater potential effects up the food web. Natural causes of nitrification such as climate change may result in additional changes in community composition of northern lakes, resulting in further changes up the food web. Therefore, even a small increase in nitrogen in Lac de Gras could potentially have indirect effects on fish.

Developer’s Conclusions:

DDMI concludes that, because Lac de Gras, during operations, has been receiving approximately 1,000 kg/y nitrite, 40,000 kg/y nitrate and 5,000 kg/y ammonia annually (Golder 2018) and has not experienced plankton or benthic invertebrate community composition changes that have been detrimental to the fish population in Lac de Gras, it is unlikely that future nitrogen loadings from the pit lakes would interact with the effects of climate change to an extent that would influence the fish community.

NSMA’s Conclusions:

NSMA appreciates the information regarding the loading during operations. Based on this information, NSMA is in agreement that nitrification of Lac de Gras from nitrite and nitrate loading is unlikely. NSMA is interested in reviewing details of and providing input to the

monitoring program to ensure that any potential changes to the phytoplankton and benthic invertebrate community will be captured should they occur.

Recommendations:

N/A.

Issue 6: Presence of fish species below 40m depth in pit lakes (SIS Section 6)

Overview:

Section 6.2.2 notes that of the fish species inhabiting the water bodies near the project, "some species (e.g., slimy sculpin) are expected to be able to complete all of their life history requirements in the pit lakes once a food supply has been established". Studies on slimy sculpin conducted in other areas indicate that slimy sculpin can inhabit depths from 0.5m to 150m (Bradbury et al., 1999). Indigenous participants in the AEMP TK Study sessions indicated that "fish go where food and nutrients can grow, and for some species, such as lingcod and sculpin, that can be very deep" (Thorpe Consulting 2018).

When the pit lakes are reconnected with Lac de Gras and fish habitat is established within these areas, there could be potential for slimy sculpin to access deep waters within these pits (specifically in all three scenarios of A21 and in scenario 3a in A418 (see Table 2-5 for predicted depth of freshwater cap)). The assessment stipulates that the AEMP benchmark and significance threshold concentrations (listed in Table 4-3) pertain to the top 40m of surface water, as it is anticipated there is limited use of the pit lake by aquatic receptors (i.e., fish) at depth below 40m (DDMI 2019).

Developer’s Conclusions:

The proponent insists that slimy sculpin will not inhabit the deeper waters of the pits. They state that while slimy sculpin in lakes has been reported to inhabit deeper waters in Canada, slimy sculpin prefers shallower depths and have more limited mobility in northern locations. The Developer’s research attests that temperature appears to be a critical factor determining slimy sculpin distribution in deeper water (as well as available habitat) and that they prefer cold, well-oxygenated habitats where they feed on benthic invertebrates.

Therefore, in Lac de Gras (and the filled pits at closure in particular) slimy sculpin would be expected to migrate to deeper waters only if (1) well-oxygenated water of adequate temperature, (2) prey items (i.e., benthic invertebrates), and (3) suitable habitat (i.e., rocky or gravel substrate) were all available in the deeper waters of the pit lakes. Such habitat is not expected to exist at depth inside the pit lakes and oxygen concentrations are expected to be less in the deeper waters of the pit than in the main basin of Lac de Gras due to limited mixing and established/stable meromixis in the pit lakes.

The proponent explains that benthic invertebrate communities are not expected to establish themselves within the pit lakes with adequate density to support a resident slimy sculpin

population because of anoxic conditions at depth and an expected lack of suitable habitat for colonization (i.e., steep walls and low sedimentation rates).

Finally, the preferred habitat for slimy sculpin is not expected to be present inside the pit lakes; the walls of the pits will be relatively steep slopes with little opportunity for sedimentation and limited gravel or rocky substrate.

NSMA's Conclusions:

The NSMA agrees that slimy sculpin would not be expected to occur for prolonged periods of time where oxygen concentrations, prey items, and habitat conditions are not suitable. We do, however, note that slimy sculpins have been the subject of very extensive respiration research on their ability to tolerate hypoxic conditions (i.e., the shortage of dissolved O_2). Sculpins are known to be very well adapted, or adaptable, to low to zero oxygen conditions for periods of time, as well as to large fluctuations in temperature. While northern, inland slimy sculpins have been less well studied in this regard, marine sculpins show phylogenetically independent correlations between hypoxia tolerance, and species' depth ranges, as indicated by maximum recorded depth (Madic et al., 2009).

Normal oxygen concentrations are typically considered 9–10 mg O_2 L^{-1} for freshwater environments, depending on temperature (Diaz and Breitburg, 2009). These simple thresholds are attractive to regulators because they represent an easily quantified value and protect the most sensitive fish species in the environment. However, these thresholds do not take into account natural variation in hypoxia tolerance among fish species.

Vaquer-Sunyer and Duarte showed that environmental thresholds for sublethal responses to hypoxia ranged from 2 to 10 mg O_2 L^{-1} among numerous fish species (Vaquer-Sunyer and Duarte, 2008). To define O_2 limitation from an on species or population-specific basis, Connett et al. suggested defining O_2 limitations at four interrelated levels of biological organization: one environmental and three physiological–biochemical, each defined by its own term (Connett et al., 1990). When this has been done by researchers, slimy sculpins have shown a robust ability and sophisticated mechanisms to tolerate extremely low to zero oxygen conditions (e.g., Richards, 2011). While we still agree that it is unlikely that slimy sculpin would descend to below the chemocline and stay there (due to insufficient food), they likely have the physiological capacity to do so for shorter periods of time, which may be adaptive for avoiding predation during certain times of the day.

Recommendations:

In order to confirm the potential use and impacts of the >40m zone of the pits by sculpins and any other deep-dwelling fish species, the Board should recommend the proponent design a study focused on the abiotic zone of the pits (below 40m). This study could include the following:

- Abiotic parameters below 40m depth;
- Camera documentation of fish species presence below 40m depth;
- The impacts of the >40m environment on fish species health (e.g., effects of PK on gill function of slimy sculpins);

- Possible adaptive management options based on the results of this study.

Issue 7: Nitrite Concentration of Pit Water (SIS Section 4 and 6)

Overview:

Nitrite can be toxic to living organisms (Kroupova et al. 2018). Given that nitrite concentrations are approaching or exceeding water quality benchmarks under several pit scenarios before breaching of the ring dike, it is imperative that all potential interaction effects are considered to ensure that levels do not impact species that may come into contact with pit water prior to the breaching of the ring dike (which will occur after water quality guidelines are met).

Developer's Conclusion:

DDMI does not expect adverse health effects to wildlife because CCME water quality guideline for nitrite-nitrogen for protection of livestock (10 mg/L) is also greater than the AEMP benchmark (for drinking water; 1 mg/L). DDMI expects the predicted maximum nitrite concentrations to be below the guideline for protection of livestock (10 mg/L), the AEMP benchmark for drinking water (1 mg/L) and observed effects concentrations for swine, chickens, and turkeys. Therefore, monitoring to deter animals from contact with pit water is not required. A wildlife risk assessment has not been conducted to determine the effects of nitrite on wildlife that may access the pit.

NSMA's Conclusion:

NSMA is concerned that DDMI has not taken into account the potential risks of wildlife, particularly migratory waterfowls, using the open water formed over deposited PK before the ring dike are connected to Lac de Gras. Considering that significance is dependent on a 20% increase in Nitrite concentration relative to AEMP benchmarks and CCME guidelines, more information is needed on how nitrite affects species that may interact with the pit water (e.g., waterfowl, ungulates). As nitrite may remain close to or below significance levels (20% above AEMP benchmarks), the proponent must ensure that no effects on species interacting with the pit water will occur and that adequate deterrence mechanisms will be utilized, and monitored for effectiveness, to keep susceptible species away.

Recommendations:

When conducting the environmental assessment, MVEIRB should acknowledge the potential for the PK disposal to affect wildlife habitat and health during the operational period and consider these effects in the assessment. To mitigate potential effects, MVEIRB should require development/refinement of management plans to incorporate specific requirements for wildlife monitoring and response protocol related to waterfowl and wildlife use of pits during the operational period.

Issue 8: Community-Based Monitoring

Overview and Recommendations:

There exists significant interest from the community members for ongoing, extended, community-based monitoring of the closure and post-closure conditions. Providing opportunities and capacities to the indigenous community members would build public confidence in DDMI and other industrial development projects in the North.

NSMA recommends the Review Board to require DDMI to facilitate and fund a community-based monitoring program of the closure operations and post-closure conditions of the mines.

Summary of Recommendations

- Due to the current proposed water quality thresholds being much higher than the baseline water quality, the Review Board should consider more conservative definitions for water quality significance thresholds.

- NSMA recommends the Review Board to make a significance determination based on magnitude ratings that are supported by evidence, and considers the current state of Bathurst caribou and not solely based on the 1999 CSR.

- The Board should require DDMI update their zinc benchmark threshold to match the current CCME guideline, to utilize up-to-date scientific information and ensure the best ecological protection available.

- NSMA recommends additional modeling that takes into account the range of conditions that could be expected in consideration of the influences of climate change on upwelling. The modeling results should be provided to the WLWB prior to the approval of the Type A Water Licence (W2015L2- 0001).

- When conducting the environmental assessment, MVEIRB should acknowledge the potential for the PK disposal to affect wildlife habitat and health during the operational period and consider these effects in the assessment. To mitigate potential effects, MVEIRB should require development/refinement of management plans to incorporate specific requirements for wildlife monitoring and response protocol related to waterfowl and wildlife use of pits during the operational period.

- In order to confirm the potential use and impacts of the >40m zone of the pits by sculpins and any other deep-dwelling fish species, the Board should recommend the proponent design a study focused on the abiotic zone of the pits (below 40m). This study could include the following:
    - Abiotic parameters below 40m depth;
    - Camera documentation of fish species presence below 40m depth;
    - The impacts of the >40m environment on fish species health (e.g., effects of PK on gill function of slimy sculpins);
    - Possible adaptive management options based on the results of this study.

- NSMA recommends the Review Board to require DDMI to facilitate and fund a community-based monitoring program of the closure operations and post-closure conditions of the mines.

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