July 18, 2025

Subject: **Makivvik Comments on the Draft Tailored Impact Statement Guidelines for the Shaakichiuwaanaan Mining Project**

This document presents Makivvik's comments on the draft Tailored Impact Statement Guidelines for the Shaakichiuwaanaan Mining Project. For each section, comments may refer to:

- the section as a whole,
- a specific sub-section, or
- a particular sentence or part of a sentence.

When comments relate to a specific sentence/word, that text is identified to clearly show what the comment addresses.

The comments presented in this document are the results of the analysis led by the technical staff of Makivvik's Department of Environment, Wildlife and Research and are without prejudice to any other views held by Makivvik's leadership.

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Comments on Section 1: Introduction

Section 1.2: Selection of Valued Components

General Comment: In addition to consulting Indigenous groups on the selection of valued components (VCs), Indigenous groups should also be consulted on identifying appropriate indicators for each VC, as well as determining thresholds for these indicators (when no thresholds already exist under applicable legislation).

Section 1.4: Format and Accessibility

General Comment: The proponent should submit a summarized version of the impact statement translated in Inuktitut so that everyone who could be impacted by the project, if approved, be able to understand the summary.

Comments on Section 3: Fish and Their Habitat

General Comment: Lithium (Li) is increasingly recognized as an emerging environmental contaminant due to its widespread use in lithium-ion batteries and pharmaceuticals. Laboratory studies have demonstrated that Li can have a range of adverse effects on fish health, reproduction, and survival. Lithium exposure disrupts ion regulation (Tkatcheva et al., 2015), enzyme activity (Jing et al., 2021), and membrane stability (Tkatcheva et al., 2007b), leading to impaired osmoregulation and cellular metabolism (Tkatcheva et al., 2007a, Jing et al., 2021), and has also been associated with inhibited growth (Yuan et al., 2022, Bai et al., 2017, Harvey et al., 2015), impaired metabolic function, and histopathological alterations (Yuan et al., 2022, Fraga et al., 2022, Jing et al., 2021). Documented changes to Na^+/K^+-ATPase activity (Tkatcheva et al., 2007b, Guerri et al., 1981, Tkatcheva et al., 2015) and oxidative stress markers (Jing et al., 2021, Yuan et al., 2022, Gong et al., 2025) further indicate interference with energetic homeostasis and detoxification mechanisms. There is also increasing concern regarding the Li's neurotoxic implications (Gong et al., 2025, Waring, 2006) and its potential to impair reproductive functions (Martins et al., 2022, Duan et al., 2025). However, existing research in this area is limited, and the consequences for reproductive success, embryonic development, and long-term population viability remain poorly understood. Furthermore, data on Li-induced behavioral changes (e.g., alterations in feeding behavior or predator avoidance) are scarce (Gong et al., 2025).

A key limitation of the current state of research is the use of laboratory species, such as Rainbow trout and Fathead minnow, under controlled, short-term exposure conditions (Tkatcheva et al., 2015, Tkatcheva et al., 2007a, Tkatcheva et al., 2007b). There is a critical lack of data on Li toxicity in wild or cold-adapted species, particularly Arctic fish such as Arctic charr. These species have unique physiological traits and often inhabit low-salinity environments that may enhance susceptibility to Li toxicity (Wright, 1995, Pouil et al., 2020). Moreover, little is known about Li's interactions with other environmental stressors (e.g., temperature, salinity, co-contaminants) or its potential for trophic transfer and bioaccumulation in aquatic ecosystems.

Given these knowledge gaps, it is essential the proponent acknowledge the current scientific uncertainties. They should recognize that the full extent of potential ecological impacts, particularly in Arctic freshwater systems, may not be fully known at this time. It is strongly recommended that impact assessments draw on the most ecologically relevant data available, including studies that reflect environmental conditions similar to those expected at the project site (e.g., water temperature, salinity, and appropriate fish species).

Section 3, line 5 "irrefutably indicate"

Are there potential ways to confirm the absence of fish/habitat?

<u>Section 3.1: Groundwater and surface water baseline conditions as a pathways of effects to fish and fish habitat</u>

Line 1: The proponent should clearly differentiate between natural baseline conditions and the current altered state resulting from large-scale hydroelectric development in the region, as such modifications have had significant impacts on local hydrology.

<u>Section 3.2: Baseline conditions for fish and fish habitat</u>

Line 2 "fish and fish habitat": Who will perform this baseline assessment?

Line 4 "identification": Will Indigenous Knowledge be applied to identify/describe the fish species/habitats?

Line 4 "description of fish": Does this description indicate only a taxonomical description or the physiological and pathological baseline description of fish at the time of assessment? Subsampling of fish (and other aquatic species) is important to assess their health conditions, as this would provide an important baseline for future references.

Line 6: For all seasons as well (e.g. summer vs. overwintering behaviour).

Line 10 "list of aquatic species": What happens if critical/rare/endangered species are found? Are there any special considerations as to how the Project will proceed with regards to the finding of critical species as compared to common species?

Line 12 "location and description of these species' habitat": If data could be retrieved, a trend analysis of how these habitats have been changing over the last decades would be crucial to assess how the mining would affect this natural trend.

<u>Section 3.3: Effects on groundwater and surface water as a sequence of effects on fish and fish habitat</u>

General Comment: The following effects on ground and surface water should be evaluated:

1. Lowering of groundwater tables, which may alter baseflow contributions to nearby streams, wetlands, and lakes. Reduced streamflow can diminish habitat availability, disrupt spawning grounds, and elevate water temperatures beyond thermal tolerances of cold-water fish (e.g., brook charr, lake sturgeon). Desiccation of critical wetland habitats and small tributaries that support fish rearing or invertebrate prey populations can also occur.

2. Isolation and diversion of surface waters may modify of lake hydrodynamics, including water residence time, flow direction, and seasonal levels. This has the potential to sever connections from downstream aquatic ecosystems causing habitat fragmentation, impeding fish migration

and access to spawning, feeding, or overwintering habitats. Altered temperature can also lead to reduced habitat suitability.

3. The effects of tailings and waste rock storage. Seepage of leachate into groundwater and/or adjacent surface water can potentially carrying lithium, arsenic, sulfates, and other contaminants to other aquatic environments. Generation of acid mine drainage in the presence of sulfide-bearing waste materials can also occur. Chronic toxicity in fish due to elevated metal concentrations can lead to impaired growth, reproduction, and survival (Couture and Pyle, 2008, Smith et al., 2001), while bioaccumulation of contaminants in aquatic food webs pose risks to fish health and human consumption safety (Zhao et al., 2013, Ikemoto et al., 2008). Loss of benthic invertebrate communities, which are essential to fish diets and ecosystem function, can also occur.

4. Water treatment discharges may result in altered chemical and physical characteristics (e.g., temperature, pH, salinity, trace contaminants), which may stress aquatic biota, especially in low-flow or ice-covered conditions or disrupt fish sensory cues due to water quality changes.

5. Increased surface runoff and sedimentation from mine infrastructure (e.g. roads) may accelerate overland water flow, especially during precipitation events or spring melt and may mobilize fine sediments into nearby streams and lakes. This increases turbidity and sediment deposition which have many subsequent negative implications for fish health and survival.

6. Cumulative effects with regional hydrological modifications (extensive hydroelectric development (e.g., La Grande Complex) and additional mining activity (e.g., Adina project)) can compound to induce further and unexpected changes in watershed-scale hydrology, including cumulative impacts on flow regime, sediment dynamics, and thermal profiles. This leads to loss of ecological resilience in fish populations.

Line 5 "hydrogeological": Is hydrogeological modelling alone sufficient? Consideration should also be given to atmospheric dispersion modelling to assess the potential deposition of dust and other particulates, as these can pose significant risks to fish health and survival through pathways such as gill irritation, contamination of aquatic habitats, and accumulation of toxic substances in sediments.

Section 3.4: Effects to fish and fish habitat

Line 4 "fish populations": Will there be an assessment of how potential changes in water parameters might favor the growth/proliferation of invasive species or alters the species distribution within the water masses?

Line 9 "potential effects on the life cycle of the fish species": A historical analysis of other mining projects in species and habitat is a must.

Line 3 "survival": Risk of spills, leaks, or structural failures of tailings dams or pipelines. The effects of contaminant uptake affecting fish survival, reproduction, or behavior (both acute and chronic) must be thoroughly documented.

Elevated nutrient levels, leading to eutrophication and oxygen depletion (hypoxia) and subsequent effects on fish health and survival.

Thermal pollution from water treatment discharges or dewatering, potentially exceeding thermal tolerance thresholds for cold-water fish species and subsequent effects on fish health and survival.

Changes in pH, turbidity, and total suspended solids that impair fish respiration, foraging, and egg survival.

Risk of non-native or invasive aquatic species introduction via vehicle washing, equipment transport, or ballast discharge.

Pathogen transmission (e.g., parasites, fungi, or viruses) linked to increased human activity or water transfers.

Interactions with other regional stressors, such as: (1) hydroelectric development (e.g., altered flow regimes and sediment transport in the La Grande watershed); (2) forestry and other mining operations; (3) and climate-induced hydrological changes.

Effects on these potential impacts on population viability and genetic diversity as well as the potential effects when combined with pre-existing pressures (e.g. hydroelectric development).

Potential for bioaccumulation of metals and contaminants in aquatic invertebrates and fish, with implications for human consumption and ecosystem health.

Alteration of trophic structure (e.g., reduction in benthic invertebrate populations) affecting fish diet and growth

Line 4 "movement": Barriers to fish passage, including culverts, watercourse diversions, or flow obstructions affecting migratory pathways (e.g., lake sturgeon, brook trout) and subsequent effects on fish health and survival.

Line 4 "habitat alteration or destruction": Loss or fragmentation of aquatic habitat, including spawning, nursery, rearing, feeding, and overwintering areas and subsequent effects on fish health and survival.

Hydromorphological changes (e.g., riverbed scouring, bank erosion, sediment deposition) and subsequent effects on fish health and survival.

Modifications to streamflow or water levels in rivers, lakes, and wetlands resulting from water withdrawals, mine dewatering, or altered drainage patterns and subsequent effects on fish health and survival.

Changes in ice cover duration, thickness, and breakup timing due to altered hydrology or thermal regimes.

Line 6 "ichtyological": Ichthyological and other aquatic (e.g. invertebrate) species.

Line 11 "sensitive periods for fish": Assess impacts during the following periods when fish are most vulnerable:

Spawning season (e.g., spring/summer for brook charr, fall for lake sturgeon).

Egg incubation and early larval development – exposure to fine sediments and contaminants during this phase can cause high mortality.

Migration windows, both upstream and downstream (including post-spawning dispersal).

Overwintering, particularly in isolated waterbodies or slow-flow refuges.

Effects on species that overwinter under ice and rely on stable flow and oxygen conditions (e.g., burbot, whitefish).

Line 12 "the potential effects of noise and vibrations": A need to evaluate the following:

Temporary or permanent hearing damage in fish (especially species with swim bladders connected to the inner ear (e.g. Burbot and Northern Pike (modified connection)).

Behavioral avoidance, habitat abandonment, or disrupted spawning.

Ground vibration from blasting or drilling near aquatic habitats and subsequent effects on fish health and survival.

Artificial light at night near watercourses, which can alter fish circadian rhythms, predator-prey interactions, and spawning behaviors. While not a potential effect of noise and vibration, it falls within a similar category.

Line 13-14 "lake sturgeon": Potential adverse effects of the project on Lake Sturgeon, including its ecological functions as well as its subsistence and cultural importance to Indigenous communities must be thoroughly assessed, documented, and appropriately mitigated to ensure the protection of both the species and the traditional practices it supports.

Comments on Section 4: Migratory Birds

General Comment: The ecotoxicological effects of Li on birds remain poorly understood, with a limited number of peer-reviewed studies available (Banerji et al., 2001, Banerji et al., 1999). Lithium may enter terrestrial and aquatic ecosystems via dust emissions, effluents, or leachate from mine sites. Under experimental conditions, Li salts have shown low to moderate toxicity in domestic birds at high doses (Martins et al., 2022, Duan et al., 2025). Reported effects include reduced growth, behavioral alterations, and changes in serum electrolytes, though data remain sparse and often limited to agricultural species under laboratory conditions. Until more definitive thresholds are established, impact assessments should prioritize baseline tissue sampling, dietary pathway analysis, and wetland sediment monitoring.

Line 4 "select birds or groups of birds": How will this be carried out in the most effective way? In the context of biosecurity, there are certain hardy pathogens whose absence indicates the absence of all other common pathogens. Using the same analogy, are there 'tough' bird species whose deviation from normality indicates all other species in that habitat are likely affected?

Section 4.1: Baseline Conditions

Line 3 "their habitats": Mapping of potential new habitats nearby in case the current habitats are seriously affected?

Lline 15 "risk": There are various kinds of risks in this context: physiological, injury-related, reproductive failure, zoonosis. It is not just about habitat destruction but an array of other effects.

Line 18-19 "different stages of the bird's life cycle": The proponent should assess the following:

Effects on nesting and brood-rearing as habitat disturbance during this period can cause nest abandonment or failure.

Effects on staging and migration as wetland and shoreline disruption may reduce stopover habitat quality.

Effects on moulting periods as flightless waterfowl are especially vulnerable to disturbance.

Section 4.2: Effects to Migratory Birds

General Comment: The proponent should assess the following:

1. The potential of Li bioaccumulation through terrestrial or aquatic food webs and subsequent effects on bird health, reproduction, and survival.

2. The effect of increased predation and nest parasitism as road networks may facilitate access by generalist predators (e.g., foxes, ravens).

3. The effect of habitat fragmentation increasing edge effects, which have subsequent negative implications for reproductive success.

4. The effects of increased collision and mortality risks as elevated structures (e.g., towers, lines) may pose collision hazards, especially under low visibility conditions.

5. The cumulative effects with other regional development (extensive hydroelectric development (e.g., La Grande Complex) and additional mining activity (e.g., Adina project)) and climate change, as these stressors can compound to induce further and unexpected changes affecting landscape-scale habitat suitability.

Line 1 "habitats": The proponent should assess the following:

1. Effects of direct clearing of tundra, taiga, wetland, and riparian habitats, including shrubland and muskeg, which provide nesting, foraging, and staging areas on bird habitat, health, and survival.
2. Indirect effects from dust deposition, hydrological changes, and vegetation alteration around the mine site and access roads on bird habitat, health, and survival.

Line 8 "disturbance": The proponent should assess the following as chronic noise exposure from blasting, trucking, and machinery may interfere with:

1. Acoustic communication (e.g., mate attraction, territorial defense).

2. Foraging and predator detection.

3. Vibration impacts during nesting may increase egg breakage or stress.

4. Artificial light at night can disorient nocturnal migrants and increase collision risks.

Comments on Section 5: Indigenous Peoples

General Comment: Will there be funding and support provided to the Indigenous groups to be involved during the impact assessment? It will most likely necessitate a strong involvement from the communities and they will most likely need support in order to engage fruitfully in the assessment process. It might be relevant to indicate that the proponent should provide information about the support provided to allow the communities to engage in these processes that require a significant amount of time and energy.

Line 10: We recommend removing ''Where relevant'' as it is always relevant to collaborate with Indigenous groups to incorporate information from or about them into the assessment of effects on VCs. We recommend that it be mandatory to collaborate with Indigenous groups (if the Indigenous groups agree to) for this purpose.

Section 5.5.2: Impacts on rights of Indigenous Peoples

Line 5: We recommend assessing all potential impacts on Indigenous Peoples, not just residual impacts. Residual impacts are those that remain after mitigation measures have been implemented. However, mitigation measures often do not work as intended. If the assessment focuses only on residual impacts, there is a risk that the proponent will dismiss certain potential impacts on Indigenous Peoples based on the assumption that mitigation measures will be fully effective, when in reality they may not be.

Comments on the Appendix

Section 1: Methodology

Cumulative Effects Assessment

General Comment: As for the effects assessment, the proponent should also identify VCs, indicators for each VC (to assess the condition and potential impact of the VC), spatial boundaries for each VC, temporal limits for each VC, threshold for each VC and assessment of cumulative effects on each VC. It should be highlighted in the guidelines.

It should also be mentioned that Indigenous Peoples must be engaged in the selection of VCs and indicators. A poor selection of indicators may not capture the actual condition of the VC and thus lead to wrong conclusions and Indigenous Peoples should be engaged in that process.
Indigenous Peoples should also be consulted for the identification of spatiotemporal boundaries as they have knowledge on the history of the condition of specific VCs as well as all the other activities and natural stressors that have impacted and are impacting these VCs.

Line 3: And climate change and natural stressors such as forest fires, landslides, increased population of a predator specie, etc. All the potential stressors, not only human projects and activities, should be included in the assessment of cumulative effects.

Line 8: The proponent should engage with Indigenous communities to identify VCs for the CEA.

Section 5: Impact Statement Summary

General Comment: We request that it be mandatory for the summary to be translated in Indigenous languages so that everyone who could be affected by the project if it is approved—including Cree and Inuit communities—can read and understand it.

General Comment: Information about the thresholds identified for each VC should be presented as well as the predicted impacts compared to the thresholds. Most of the time, it is easier to understand the significance of an impact when compared to a set threshold (e.g. for contaminants/heavy metals released in the environment).

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