

February 28, 2022

The Honorable George Heyman  
Minister of Environment and Climate Change Strategy  
PO Box 9047, Stn Prov Gov  
Victoria BC V8W 9E2

Dear Minister Heyman,

Since 2017, when I started teaching a university course on Earth Resources, I have been following the attempts by Pacific Booker Minerals to open a mine on their Morrison property. I am a disinterested observer in the sense of having no financial stake in this endeavor. However, as a beginning geology student in the 1960s, I worked on the property, gaining valuable experience. Now, I have been using the Morrison Project as an example of how lengthy the mining approval process can be. The project is particularly interesting as a teaching example because of the nature of the provincial government and First Nations interventions, at first favorable but later unfavorable to the proponent.

This letter addresses the three shortcomings identified in your February 7, 2022 rejection of the Morrison Project environmental certificate application and my concern as to why they justify the rejection. I have tried to understand the basis for these findings, as a former research scientist with the Geological Survey of Canada and professor of geotechnical engineering at Queen's University. In reviewing the voluminous literature leading up to the latest rejection, I cannot understand the contrast between the initial favourable BC Environmental Assessment Office (BCEAO) findings and the subsequent back-and-forth correspondence re the Supplemental Application Information Requirements (SAIR). That the proponent repeatedly asked for clarification of the scope for the required information is perfectly understandable, given the environmental assessment work that the proponent had already done, including work subsequent to the original 2012 rejection. I am aware that the BCEAO pointed out the clarity of their requirements. However, in my experience as an intervening reviewer of several mining proponent applications, I am equally at a loss to understand how the proponent was to interpret the SAIR, given the generality of the information requirements.

Regarding your findings:

1. There is potential to affect a unique wild sockeye salmon population that contributes to the Skeena River sockeye

It is my understanding from both the general interest and scientific literature that all watershed salmon populations are genetically distinct. This distinctness goes hand-in-hand with the ability of a salmon population to find its spawning habitat. Alexandra Morton, fisheries biologist, in her recent book 'Not on My Watch', notes "The fish had adapted themselves to the river. Their unique DNA was their key to survival; as the river changed, so would they." In Beachem et al. (2014), 'Skeena Sockeye Population Structure and Timing' (North American Journal of Fisheries Management), distinct salmon populations are identified in 27 sub-watersheds of the Skeena system. Effectively, certificate rejection is because the watershed surrounding the mine has salmon.

Another recent analysis, Price et al. (2020) 'Portfolio simplification arising from a century of change in salmon population diversity and artificial production' (Journal of Applied Ecology), indicates that wild salmon stocks in the Skeena watershed have been heavily reduced by commercial harvesting and industrial activity before mining ever occurred on Babine Lake. Since the 1960s, the commercial harvest has been almost completely supported by enhancement in Babine Lake. This is in the face of two decommissioned open pit metal mines at near-shore locations beside Babine Lake.

In terms of assessing the project's potential for lake contamination, the two mines on Babine Lake serve as a useful comparison with the Morrison Project. The Bell and Granisle mines ceased production three and four decades ago, respectively. These mines have most recently been the subject of a SkeenaWild Conservation Trust-commissioned study (Ongoing Legacy of Metal Mines on Babine Lake, 2021) that reports dissolved metal levels in Babine Lake. Copper is considered the most problematic for salmon. The waste rock dumps and tailings from these two mines as sources for leached metals are the focus of the report. It is interesting to note that the tailings from these two mines are quite close to the lake, less than one-half km and quite elevated, about 50 m. The tailing storage facility (TSF) for Morrison would be about 3 km from and about 200 m above Morrison Lake. Thus the seepage gradient would be less than for the Babine Lake tailings. Unlike the Babine facilities, the TSF for Morrison will be poly-lined so that the seepage potential from the Morrison TSF will be considerably less.

The Granisle mine has waste rock placed right in Babine Lake and both mines have rock on elevated terrain near the open pits. Morrison will have its waste rock placed in the completed open pit, filling it almost to the level of Morrison Lake. While concern was expressed by the BCEAO over the possibility of seepage from the filled Morrison pit into Morrison Lake, the final large flat area of the pit at almost the same elevation as Morrison Lake will result in very low hydraulic gradients, if any, between the two bodies. Compared with the Babine Lake mines, the considerable setback of the Morrison TSF from Morrison Lake and filling of the open pit to bring the filled level almost coincident with the water level in Morrison Lake presents a much reduced potential for contaminant movement via seepage.

Various reports examining the toxicity of dissolved metals to salmon note copper as the most problematic. The BC Water Quality Guideline for copper is 3.6 ug/l (micrograms per liter or parts per billion) while the Canadian Council of Ministers of the Environment sets the guideline at 4.0 ug/l. BC water quality requirements to ensure non-lethality of copper to salmon are 2 ug/l averaged over 30 days with the highest value not to exceed 5 ug/l. Copper levels appear to have responded to the presence of the Babine Lake mines, based on a 1995 Department of Fisheries and Oceans review. During the mid-1970s, copper levels are reported as averaging 4.2 ug/l for sampling sites near the mines, compared with an average of 2.2 ug/l for the main body of the lake. By the mid-1980s copper values had increased to as high as 41 ug/l near the Bell Mine with averages around 10 ug/l. However, by the early 1990s, when seepage control measures were initiated, values had dropped to averages of 4.0 to 5.8 ug/l, depending on sampling location.

In 2014, an effluent treatment plant was installed at the Bell Mine. The SalmonWild Conservation Trust report includes recent water quality analyses (2013-2019). Discharge from the Bell Mine treatment plant averages 4.0 ug/l with lake water in the vicinity of the discharge averaging 1.7 ug/l copper. However, surface flows from the Granisle Mine average as high as 174 ug/l. Presumably, these are being effectively diluted in Babine Lake to produce the lake water averages noted above.

Water quality for copper in Morrison Lake presently stands at about 1.0 ug/l, based on Pacific Booker's background environmental assessment. Copper in the discharge from the Morrison Project water treatment plant will be 7 ug/l, with dilution in Morrison Lake calculated to achieve a copper level of 1.9 ug/l. Based on the apparent effectiveness of reclamation measures invoked at the Babine Lake mines and the fact that the Babine Lake salmon enhancement program continues to supply most of the Skeena River commercial fishery, it seems evident that the Morrison Project will have no significant detrimental effects to the salmon population of either Morrison or Babine lakes.

2. The potential for long-term liability for the province and risk to the environment were not acceptable in this case

Considering that any mine is a potential post-closure liability for a government jurisdiction, it is unclear why this reason has been given for the Morrison denial. The proponent recognizes the conditions that could lead to the liability as well as the bonding amount required for mitigating that risk. While mining is in progress, waste rock would be stockpiled immediately adjacent the open pit, the most cost-effective location prior to the proposed open pit reclamation. However, the Ministry of Energy and Mines instead suggests stockpiling the waste rock along with tailings in the TSF. I would presume that the potential acid generation (PAG) from the waste rock would be the same, no matter where it is stored. However, the extra cost invoked by a major double handling of the waste rock contributes an unnecessary extra bonding cost. By this suggestion, one of your government's departments is contributing to the potential liability. The proponent logically favours dealing with the waste rock PAG close to the open pit where the waste rock can then most cost-effectively be returned to the pit upon mine closure.

3. There is insufficient data about the behaviour of the lake, and the potential diminished long-term water quality in Morrison Lake is not an acceptable risk.

The proponent has stated that, treated or untreated, water discharges into Morrison Lake will be maintained at or below water quality guidelines. For copper, the treated or untreated concentration is expected to be 7 ug/L. While this level is approximately twice the BC Water Quality Guideline, this is the level being initially introduced into the lake. Employing the proponent's measured bathymetry of Morrison Lake, an expected annual discharge volume of 0.5 million m<sup>3</sup> (using the proponent's expected water treatment plant flow of 55 m<sup>3</sup>/hr) would be introduced into 30 million m<sup>3</sup> of lake water if discharge from the pipe were distributed along its 2,000 m underwater length. Based on Water Survey of Canada stream flow data for water exiting the lake, this volume of lake water would flow through the lake about every 3 months. Given that proponent-funded research has determined that Morrison Lake loses its thermal stratification twice per year, the attendant mixing would achieve the assumed dilution factor of 100:1.

A major design change intended to reduce the risk of contaminant migration into Morrison Lake is the poly-lining of the TSF. It is unfortunate that inaccurate commentary by a former Environment Minister regarding the efficacy of this measure may have influenced public perception of this risk. This commentary was made, despite the already presented statement from the Ministry of Energy and Mines that lining is a widely and successfully applied method, including in BC. The proponent's major consultant subsequently submitted a lengthy list of world-wide liner installations. Furthermore, their consultant states in the same letter that they are actively partnered with Queen's University on major research into tailings lining design. Even assuming a lack of care in liner installation, seepage rates from the planned TSF might reach 1 cubic m per day with developed liner technology, one tenth of the

estimate in Pacific Booker's 2011 Environmental Assessment Certificate application. It is evident the proponent is taking advantage of the time elapsed in the approval process to update mitigation technology.

In summary, it is difficult for this commentator to understand the rationale for your denial of an environmental certificate in the light of the information available and the risk that can be ascertained from the study of this information. Two decommissioned open pit mines exist in settings similar to the proponent's, with the major differences that 1) the decommissioned open pit water and waste rock levels are at elevations considerably above the potential contaminant-receiving water body (Babine Lake) and 2) the proponent's tailings facility will be poly-lined. These differences alone indicate a significantly reduced risk of long-term contamination of Morrison Lake by the Morrison Project.

Here we have a British Columbia enterprise which stands to become a major supplier of two metals identified by Natural Resources Canada (<https://www.nrcan.gc.ca/our-natural-resources/minerals-mining/critical-minerals/23414>) as critical to progress in decarbonizing our economy. Instead, we have a preliminary certification stage denied for shortcomings which simply do not follow from the lengthy and ongoing environmental impact assessment carried out by the proponent.

Sincerely,

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cc. Honorable John Horgan, Premier of British Columbia  
Honorable Brice Ralston, Minister of Energy, Mines and Carbon Innovation