Expert Comments on the Environmental Impact Assessment Report for the Sisson Project (Tungsten and Molybdenum Mine), New Brunswick
CEAR #11-03-63169

re: EIA Report Section 8.10 – Labour and Economy

CCNB Action Inc.
180 St. John Street
Fredericton, N.B., E3B 4A9

506-458-8747
info@conservationcouncil.ca

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1. Introduction

1.1 Background to CCNB Action Inc.'s comments on the Environmental Impact Assessment Report for the Sisson Project

Northcliff Resources Ltd. (the proponent) has proposed to construct and operate a 30,000 tonnes per day tungsten and molybdenum mine approximately 60 kilometres northwest of Fredericton, New Brunswick (the Sisson Project). As described in the project's environmental impact assessment (EIA) report, the project would consist of a 145 hectare open pit mine, a 751 hectare tailings impoundment, numerous water management ponds, an ore crushing and processing plant, a water treatment plant, an ore storage area(s), a transmission line to bring power to the project site, and use of provincial roads. As proposed, the construction and operation of the mine will require the destruction of portions of streams that are headwaters of the Nashwaak River. The Nashwaak River, a tributary of the St. John River, is a main refuge for the endangered St. John River population of Atlantic salmon. The Villages of Napadogan and Stanley are located approximately 10 km and 20 km respectively from the proposed mine.

As the Sisson Project will have environmental impacts on areas of both federal and provincial constitutional jurisdiction, it is subject to two environmental assessment processes, one under the *Canadian Environmental Assessment Act* (*CEAA*), and another under the New Brunswick *Environmental Impact Assessment Regulation - Clean Environment Act* (*NB EIA Reg.*). Because the project commenced under the *CEAA,* the federal environmental assessment of the project will continue under that act rather than the *Canadian Environmental Assessment Act, 2012,* which repealed and replaced the *CEAA.* Due to the amount of ore to be processed, the Sisson Project is subject to a "comprehensive study" type of environmental assessment under the *CEAA* (rather than a "screening"). Provincially, the Minister of Environment has determined the Sisson Project is subject to a "comprehensive review" under the *NB EIA Reg*. A provincial comprehensive review sets out a number of steps in the environmental assessment process, such as the development of terms of reference for the EIA report, the writing and filing of the EIA report, and the holding of a public meeting(s) by the Minister of Environment.

The provincial and federal governments have agreed to conduct a "harmonized" environmental impact assessment process for the Sisson Project. The EIA report describes the harmonized process as being:

> "Under this approach, both levels of government have agreed to cooperate in the carrying out of the EIA to meet the requirements of their respective legislation, beginning with Terms of Reference being issued jointly to define the scope of the EIA federally and how Northcliff will meet the Final Guidelines provincially. They have also agreed that a single EIA Report prepared by the Proponent to meet the requirements of the Terms of Reference would suffice to fulfill the respective provincial and federal EIA requirements. The CEA Agency will then prepare its comprehensive study report (CSR), relying upon the EIA Report and the results of the review process." (at p. 4-4).

On August 30, 2013, the Canadian Environmental Assessment Agency (CEA Agency) released the proponent's EIA report for the Sisson Project to the public for review and comment. The public has 45 days (to October 14, 2013) to submit its comments to the Agency, after which the Agency will consider them before writing its CSR for the project. At present, there is no official period of public review and comment under the provincial process although it is expected that comments made under the federal environmental assessment process will be forwarded to New Brunswick regulators for consideration.

The CEA Agency sometimes provides participant funding to individuals, not-for-profit organizations, and Aboriginal groups, to assist them in participating in a federal environmental assessment process, such as the comprehensive study for the Sisson Project. CCNB Action Inc. applied for and received participant funding. The main purpose of this funding was for CCNB Action to hire experts to review and provide comments on sections of the Sisson Project EIA report and later, the comprehensive study report for the project written by the CEA Agency. Funding is not available under the New Brunswick environmental assessment process to assist groups in their review of EIA Reports. *The purpose of this report is to document the findings of CCNB Action's expert reviewers about the EIA report for the Sisson Project and to detail CCNB Action's position as to whether the construction, operation, and closure of the project should receive federal approval.*

1.2 Expert reports commissioned by CCNB Action Inc.

CCNB Action Inc. had experts review and comment on various sections of the EIA report and on some of the different technical studies completed by the proponent in support of the EIA report. The reviewers were asked to focus their reviews primarily on:

- the methods used by the proponent to gather baseline information,
- the methods used by the proponent to conduct environmental effects analyses for the project alone and cumulatively,
- conclusions reached by the proponent, in particular those dealing with the significance of the environmental effects of the project, and
- various technical aspects of the project such as the design of the tailings dam.

Reviewers were asked *not* to comment on the merits of the project.

In order of their appearance in this final report, the experts' reports are:

1. Impacts of the project on the VEC - Atmospheric Environment, re: air quality.
   - Ms. Inka Milewski and Mr. Lawrence Wuest

2. Impacts of the project on the VEC - Public Health with a focus on the methodology used for the baseline public health assessment.
   - Ms. Inka Milewski

3. Impacts of the project on the VEC – Water Resources, re: ground water and ecological water availability.
   - Dr. André St.-Hilaire

4. Impacts of the project on the VEC – Water Resources,
   The VEC – Aquatic Environment (focus on fish and fish habitat),
   The VEC - Accidents, Malfunctions and Unplanned Events, and
   General comments on Executive Summary, Project Description, Summary of Key Predictive Studies.
   - Dr. Allen Curry

5. Comments on Section 3 Project Description (particularly water management and the design of the tailings storage facility),
   Impacts of the project on the VEC – Aquatic Environment,
   The VEC - Accidents, Malfunctions and Unplanned Events,
   Comments on the proposed Follow-Up and Monitoring Program, and
   Comments on the Conceptual Decommissioning, Closure, and Reclamation Plan.
   - Dr. David Chambers and Mr. Stu Levit, M.S., J.D. (Center for Science in Public Participation (CSP2))
   - Note: The report from CSP2 was commissioned by CCNB Action. CSP2 submitted their review directly to the CEA Agency on October 7, 2013, but it has also been included in this report for convenience.

6. Impacts of the project on the VEC – Terrestrial Environment.
   - CCNB Action (primarily the project's impacts on birds)
   - Ms. Tracy Glynn, M.E.S. (primarily the project's impacts on rare forests and wildlife)
   - Mr. Lawrence Wuest (primarily the project's impacts on protected natural areas)

7. Impacts of the project on the VEC – Vegetated Environment.
   - Ms. Tracy Glynn, M.E.S. (primarily the project's impacts on rare forests)

8. Impacts of the project on the VEC – Wetland Environment.
   - Ms. Stephanie Merrill, M.Sc.F. (primarily the project's impacts on regulated wetlands)

9. Impacts of the project on the VEC – Labour and Economy.
   - Dr. Rob Moir

10. General comments on the proposed water management plans for the project during operation and closure.
    - Mr. Roy Parker, M.E.S.

Finally, this report also includes comments on general EIA report requirements such as a discussion of the need for the project and its role in sustainability. These comments were provided primarily by Mr. Ramsey Hart, M.Sc.

1.3 Summaries of experts' main concerns about the EIA report

1.3.1 Summary of the reviewers' main comments about the EIA report: Atmospheric Environment

- Not enough data/information has been collected to say accurately what is the trace metal content of the ore, pit walls, waste rock, overburden, etc. Without this information, the types and amounts of air contaminants released by the project cannot be determined.
- Using the limited trace metal data that is provided in background studies for the EIA report, the reviewers calculate there is more arsenic in the project's ore than what is reported (EIA report = 41 mg/kg of arsenic; Reviewers = 64.8 mg/kg of arsenic).
- The use of 41 mg/kg of arsenic (vs. 64.8 mg/kg) in modeling for predicted air quality results in the under-estimation of the release of this contaminant. Also, the EIA report only uses arsenic concentrations from the ore in its modeling. This is the lowest concentration of arsenic for any of the potential pathways of air contaminants, other than soil. For example, the EIA report provides the mean arsenic concentration in the overburden as 143.3 mg/kg, which was not used in the report's calculation of trace metal air emissions. Arsenic concentrations are significantly higher in all emission pathways than the value used to estimate arsenic releases from the project.
- The drill core assays used to calculate trace metal content were not taken from random locations or locations that are representative of the entire mine site.
- Wind data provided in the EIA report does not reflect prevailing conditions and it was not collected from the highest point of the mine where tailings beaches will be located.
- Emissions of particulate matter (dust) from the site are under-estimated.
- The EIA report does not provide information on how much hydrogen sulfide and other pollutants the ammonium paratungstate (APT) plant will emit. Based on the reviewers' investigation of the predicted releases from an ATP plant in New York, it is clear the Sisson Project ATP plant will be a significant source of air pollutants.
- The Sisson Project will not contribute to the Canadian Council of Minister of the Environment's nationally-supported goal of "keeping clean areas clean".
- No environmental monitoring for future air quality is proposed for the project despite evidence that mines can release annually 5 to 30 times more dust than predicted in an EIA report.

1.3.2 Summary of the reviewer's main comments about the EIA report: Public Health

- The main concerns raised about the EIA report's section on the Atmospheric Environment are also applicable to the Public Health section. Additional concerns follow below.
- The most serious deficiency is that the EIA report did not evaluate the non-cancer health risk of the most common route of exposure to arsenic - ingestion of soil, water and food and dermal contact with soil. The human health risk assessment (HHRA) has incorrectly assumed that the health risks related to ingesting or inhaling arsenic are cancer-related only and that there are no toxicological reference values for non-cancer health effects via the oral or dermal route for adults or toddlers. As a result, the baseline (and project-related) human health risk assessment via ingestion of soil, water and food and dermal contact with soil has not been assessed for arsenic.
- The HHRA modeling domain is too small and does not cover the entire project Local Assessment Area (LAA). As a result, HHRA receptor locations in the community of Napadogan, and other locations at the edges of the LAA where people from Williamsburg, Currieburg, Boyds Corner, Fredericksburg and Stanley may spend recreation time, are not covered by the HHRA.

- Emissions of particulate matter and metals during the construction phase of the project and the potential seepage of metals from overburden piles during the construction phase have been excluded from the assessment.
- The Project + Baseline assessment of maximum acute and chronic human health risks from inhaling PM_{10} emissions are incomplete and inaccurate.
- Particulate emission estimates during the operational phases of the project are significantly underestimated.
- Arsenic emission estimates during operational phases of the project are significantly underestimated.
- Sulphur dioxide (and other) emission estimates from the Project's ammonium paratungstate (APT) facility are significantly underestimated.
- Characterization of health risks for on-site workers are not reported or discussed.
- A sensitivity analysis of the HHRA results has not been done.
- Public and occupational health follow-up or monitoring will not be done.

1.3.3 Summary of the reviewer's main comments about the EIA report: Water Resources

- In spite of the fact that the analyses could benefit from some potential methodological improvements and specifications mentioned above, the assessments provided appear to be technically and scientifically sound. Some (probably small) risks associated with local, perhaps short term, changes in the hydrological budget and water routing for wetlands and aquatic life are scarcely treated.

1.3.4 Summary of the reviewer's main comments about the EIA report: Water Resources

- The EIA report is incomplete in many critical areas. For example, the EIA report was written before the all-important Metal Leaching/Acid Rock Drainage Potential Report (ML/ARD Report) was completed. The EIA report was submitted to the CEA Agency on July 31, 2013, while the ML/ARD was not completed until August 2013.
- This mine will need a water treatment plant (WTP) and this plant is the core of the mine's water management plan. However, the WTP is poorly described and the plans for it are not in the actual EIA report.
- The WTP was designed to deal with arsenic and antimony only, not the other many chemicals that will be in the tailings pond.
- Details for all water management at the mine site are not provided. For example, water management ponds are to collect and pump back any seepage or other surface water to the tailings pond. How will this be managed (e.g., secure pumping when required, overflow conditions) is not made clear in the EIA report.
- There are no plans to put a liner in the tailings pond to prevent seepage. Tailings pond seepage is a major source of acid rock drainage.
- Models used by the proponent do not model natural variability. The proponent uses averages where it has some information, yet the proponent knows and discusses variability in several places. Confidence limits are best estimated to be +- 100% of the average.
- The EIA report speaks to potential outcomes, but gives no probability values of such as would be expected in an objective report on such an operation. Where risk is presented, it is consolidated into just a few categories. These risks are also the proponent's "judgment"; probabilities (%) need to be presented.

- There is no adequate proposal of environmental funding to deal with the water issues for such massive landscape features of the open pit and TSF post-operations. $50M may clean up the site (no details are provided for how this figure was arrived at), but it will never come close to handling the volumes of water in perpetuity.
- A breach of the tailings dam is not assessed in the EIA report. Although the chances of such may be small, they are not insignificant, and the impacts of such a breach on downstream water quality could be catastrophic. This needs to be assessed.

1.3.5 Summary of the reviewer's main comments about the EIA report: Aquatic Environment

- The main concerns raised about the EIA report's section on Water Resources are also applicable to the Aquatic Environment section. Additional concerns follow below.
- Not enough basic field work was done and where done, not always interpreted properly.
- Atlantic salmon in the St. John River are soon to be an endangered species and the Nashwaak River is officially recognized as the critical river for their survival, yet there is no planning for the risk of loss if any/some/all of the water management plans fail.
- The toxicity of water releases from the tailings pond to Sisson Brook has not been addressed fully.
- The EIA report says that fish habitat loss will be compensated by the removal of the Lower Lake Dam. The proponent has been told repeatedly by locals and scientists that this is not needed and as such it should not be proposed as the most likely habitat compensation scenario.
- A breach of the tailings dam is not assessed in the EIA report. Although the chances of such may be small, they are not insignificant, and the impacts of such a breach on downstream water quality could be catastrophic. This needs to be assessed.

1.3.6 Summary of the Center for Science in Public Participation's (CSP2) main comments and recommendations on the EIA report and proposed mine plans

Note: CSP2 submitted their comments on the project directly to the Agency on October 7, 2013, and are reproduced in Section 2.5 below for convenience.

- Regarding design of the tailings storage facility (TSF), CSP2 recommends "*A more sound approach in terms of controlling seepage would be to remove the native soils for use in reclamation, and to compact the remaining material to a specified density.*"
- CSP2 raises concerns about how the tailings dam response to earthquakes has been modeled. They recommend "*If pseudo-static modeling was used to test for seismic stability, then a numerical model should be used to test the dam under seismic loading.*" Their reason for this recommendation is that "It is especially important that dynamic modeling be performed since the dam design has incorporated a modified centerline-type construction (which has an upstream-type component built on seismically unstable tailings). Today, few US regulatory agencies accept pseudostatic methods for seismic design of new dam projects."
- Regarding the issue of alternatives for the design of the tailings dam, CSP2 states, "The EIA does not explain whether the use of cycloned tailings for dam construction, which would probably require downstream-type construction, would provide better seismic stability than for the modified centerline design chosen as the preferred alternative." It subsequently recommends "*It would be appropriate to have a full explanation of why a modified-centerline rockfill dam is better than a downstream dam constructed of tailings.*"

- Like other reviewers, CSP2 discusses the incompleteness of the acid base accounting for the project: "*The overburden should be sampled for sulfur and carbonate to insure that no acid drainage will emanate from the overburden."*
- The EIA report is not clear about how much surplus water will need to be treated. "The TSF will have approximately 2 million m3/year of surplus water starting at about Year 8." (p.3-123) and; "Approximately 6 million m3/year of TSF pond water will be pumped to the WTP during Operation starting in Year 8 under average conditions." (p. 7-80) This is a discrepancy of 4 million m3/year."
- Like other reviewers, CSP2 discusses the cost of future water treatment. "… the volumes possible at Sisson Brook could require a financial surety in the $100's millions. … By failing to declare, whether through lack of information or analysis, it must be assumed that a financial surety for water treatment in perpetuity needs to be established. However, the financial analysis of this outcome is also not addressed in the EIA. Because of the financial risk it places on the public, this is a major omission in the EIA."
- CSP2 is particularly critical of the EIA report's failure to assess the impacts of a tailings dam breach. "Tailings dam failure is a low probability event, but also an event with high consequences. These consequences have never been ignored in any other EIS/EIA I have reviewed. To in essence assert that 'my engineering' could not possibly fail, in light of existing statistics, is arrogantly assuming that it is always the other guy (or gal) that will make a mistake – but not me. This is exactly the attitude that leads to accidents…"
- Regarding the proponent's plan for quarterly water quality monitoring, CSP2 states "Quarterly monitoring is not adequate to capture surface water variations. Weekly sampling is typical at most mines."
- "The [Conceptual Decommissioning, Reclamation and Closure Plan] should be completed at the mine-proposal stage, and certainly prior to permitting, to a sufficient degree to reasonably determine water treatment costs, reclamation costs, and assess the short and long term social, health, and economic impacts from the mine (including post-closure)."
- The CSP2 review contains other recommendations, such as those dealing with groundwater monitoring, determining the cost of the closure bond, and steps for reclaiming the site.

1.3.7 Summary of the reviewer's main comments about the EIA report: Terrestrial and Vegetated Environments

- Overall, sampling for wildlife other than birds is inadequate.
- From the bird surveys done, there are several Threatened Species in the project area whose protection needs to be addressed before the project proceeds: Common Nighthawk, Olive Sided Flycatcher, and Canada Warbler.
- The EIA report does not discuss the importance of insects to the ecosystem and makes no mention of rare butterfly species such as the early hairstreak, hoary elfin and hoary comma.
- How the project will affect the national recovery strategy for long eared bats (Myotis spp.) is not discussed in the EIA report.
- The impacts of habitat fragmentation are downplayed in the EIA report, especially when one considers the cumulative impacts of human activity in that area, the overall declining health of the Acadian forest type in New Brunswick, and the large vegetated area that the project is impacting.
- The project`s impacts on lynx cannot be rated as "not significant" when no numbers are provided about how many lynx may die because of the project and the number of lynx in NB is not provided.

- The EIA report fails to acknowledge how the cumulative environmental effects of the project will contribute to deforestation and forest degradation at a time when the diversity of the Acadian forest should be restored.
- The EIA report fails to describe the potential effects of ecosystems and changes in the biota of terrestrial and freshwater ecosystems as a result of climate change in the future.
- The EIA report fails to develop a systematic approach to documenting how the project's environmental effects, such as to the atmospheric or aquatic environment, overlap with, and consequently impact on, candidate protected natural areas (PNAs). Many of the project's environmental effects will travel outside of the 1.5 km local assessment area chosen by the proponent to predict the impacts of the project on candidate PNAs.
- The EIA report does not assess the economic benefits of candidate PNAs as economic alternatives to the project, or the impact of PNAs as part of the environment's impact on the project.

1.3.8 Summary of the reviewer's main comments about the EIA report: Wetland Environment

- There is an over reliance on adhering strictly to the current provincial wetlands management policy which (as the proponent clearly states) does not regulate a large proportion of wetlands in the project development area, the local assessment area, and the regional assessment area. This leads to an underestimation of impacts due to a lack of requirements for compensation for this loss and an underestimation of the cumulative impacts, particularly when considered with future forestry activity which has the most impact on the unregulated wetlands (forested wetlands).
- The proponent does not go into detail about their proposed wetland compensation approach for mitigating the loss of wetlands functions of government regulated wetlands.
- The proponent relies heavily on future work to identify compensation measures. With a lack of detail it is impossible to comment on such things as watershed thresholds for wetland function loss and appropriate compensation to reflect the watersheds thresholds. This modeling should be undertaken.

1.3.9 Summary of the reviewer's main comments about the EIA report: Labour and Economy

- The EIA report is only dedicated to describing the economic benefits of mine, not its costs.
- The reviewer questions the use of an economic impact model (EIM) used to calculate the benefits of the project. Under EIMs, all expenditures by the project are a benefit. This includes the money spent to clean-up spills and floods of tailings.
- Even if one accepts the use of an EIM in the EIA report, the economic benefits of the mine have likely been over-estimated.
- A traditional cost-benefit analysis should have been used to improve our knowledge about the economic impacts of the mine.
- No details are provided about how the $50 million in closure costs were estimated. The reviewer believes this amount to be a serious under-estimation.
- Based on the proponent's sensitivity analysis, the reviewer states that mineral price movements, especially in the price of APT, will have a significant effect on the viability of this project. He also notes that current prices for molybdenum are far below the proponent's assumed price of $15/lb.

1.3.10 Summary of the reviewer's main comments about the EIA report: comparing the project to other mines

- From the parts of the EIA report the reviewer read, it is his view that overall the EIA report was very thorough and quite well done. He did raise some concerns about the project's plans for water management and the tailings storage facility (TSF). These follow below.
- A condition for allowing the project to proceed should be the requirement of a detailed plan to deal with emergencies such as a power failure, a pump(s) malfunction, and excessive precipitation.
- The EIA report does not provide a description of the spillway on the TSF or describe the design criteria for that spillway.
- It is not clear from the EIA report whether all of the water management components (WMP, pumps, pipes, and spillways) are designed to deal with these types of extreme rainfall events.
- Annual or at a minimum biannual inspections should be carried out to ensure the integrity of the dams surrounding the TSF versus the five year inspection period proposed by the proponent.
- It is not clear to the reviewer whether $50 million is adequate to properly close the mine.
- The reviewer notes that very few mines commence operation and run uninterrupted for the predicted full operational life of the mine. Metal prices, technical problems and labour disputes can all result in temporary or premature closure of a mine. This issue is not discussed in the EIA. The reviewer asks that should an interruption in production occur, how will that affect the water management plan, the operation of the TSF and the treatment of the waste water?

1.3.11 Comments on the failure of the EIA Report to address Need for and Sustainability of the Project

- The business case for the mine is weak, therefore the proponent has failed to demonstrate a clear need for the project in its basic purpose – supplying tungsten.
- The EIA report does not explain how the project supports sustainable development today and meets the needs of future generations.
- The proponent's, Northcliff Resources, relationship with HDI is unclear, i.e., it seems as though HDI is the proponent. Other environmental assessments have raised serious concerns about the quality of the EIA reports for different HDI projects, such as the Prosperity Mine in BC.

1.4 Five significant shortcomings of the EIA report

CCNB Action's reviewers identified many ways the EIA report needs to be improved. However, after CCNB Action's own review, after reading our experts' reports and discussing the EIA report with them, and hearing from the public, CCNB Action has identified five overarching "themes" about the inadequacy of the EIA report. (Many of these same concerns were raised during the federal review panel's hearing for the EIA report for the New Prosperity Mine in B.C., an HDI (the partner of Northclfiff Resources in the Sisson Project) project (see **Appendix F** of this report)).

1.4.1 The EIA report is fundamentally incomplete

There are many examples of how the Sisson Project EIA report is incomplete and as such needs to be revised before any further consideration of approving the project can take place. Some of the most glaring and vital are discussed below.

1.4.1.1 Acid Base Accounting for many potential sources of metal leaching and acid rock drainage were not complete at the time the EIA report was written

Metal leaching and acid rock drainage are two of the biggest and most obvious environmental effects of a metal mine. The assessment of these effects is fundamental to understanding the impacts of the Sisson Project. As such, they should have been top of mind when it came to completing the EIA report. Clearly they were not as the SRK 2013 ML/ARD Potential Characterization Report was not completed until August 2013, while the EIA report was submitted to the Agency on July 31, 2013. How any work or information from the ML/ARD report could have been included in the EIA report is unclear.

Further to this point, even the acid base accounting work in the ML/ARD report is incomplete. For example:

- **SRK ML/ARD Sec. 3.5:** "Additional overburden sampling is planned as part of geotechnical investigations in early fall 2013 and acid-base accounting analyses will be performed at that time."

- **SRK ML/ARD Sec. 4.5:** "Additional geotechnical investigations are planned for the fall of 2013 and ARD characterization is expected to occur at that time."

  "Additional work will be required to understand the mobility of arsenic from overburden. These studies are planned for the fall of 2013. "

Regarding ML/ARD, the Terms of Reference for the EIA Report required that:

> *The discussion of ML/ARD should demonstrate that Northcliff has the necessary understanding, site capacity, technical capability and intent to identify, avoid, mitigate and/or manage ML/ARD in a manner which protects the environment through the life of the mine and after closure of the mine.*

Given the proponent's cavalier treatment of the issue of ML/ARD in the EIA report, it is clear Northcliff has done none of this.

1.4.1.2 Details and statements regarding seepage from the tailings storage facility are either lacking or unsupportable

At pages 7-79 and 7-80, the EIA report states:

> **7.6.2.2.1.3 TSF Embankment Drainage and Seepage Collection**
>
> Steady-state seepage analyses were completed using the finite element computer program SEEP/W to estimate the amount of seepage through the TSF embankments. It was assumed that a portion the embankment drainage and seepage will be captured by the embankment seepage collection system or intercepted and collected by groundwater pump-back wells downstream of the TSF. A small fraction of the total seepage was assumed to bypass the seepage collection systems and be lost to the environment downstream of the TSF.

Nowhere in the EIA report or supporting studies are the results of these analyses or actual rates of seepage provided. What is a "small fraction" is not quantified. Evidence that this information is not shared with the public or decision-makers can be seen in EIA report Figure 3.4.9 (at page 3-124) "Schematic of Mine Operational Water Balance". The legend figure states the source of the figure is Samuel Engineering 2013. However, closer inspection shows the figure was supplied on March 27 to the proponent by Knight Piesold. While similar, Samuel Engineering did not use this figure. Rather, this figure comes from the reference Knight Piésold 2013b. (Sisson Project – Feasibility Study Monthly Operational Water Balance. Prepared for Northcliff Resources Ltd. dated March 27, 2013.) This Feasibility Study was not placed on the CEAR website for this project.

Dr. Chambers (CSP2) 1-2 highlights the need for this information:

> It is noted in the Knight Piesold Baseline Hydrogeology Report that:
>
> "● Till: Surficial geology mapping has identified basal and ablation tills up to about 10 m in the project area. The till is comprised of varying composition of sand, silt, gravel and clay. The ablation till may be more permeable than the basal till.
> ● Shallow, weathered bedrock: The presence of this zone in the upper 10 m to 20 m of rock is based on regional mapping as well as drilling in the project area."
>
> With up to 10 m of till, potentially on top of fractured bedrock that could be an additional 20 m in depth, the likelihood of seepage under the starter (and fully constructed) tailings dam seems probable in some locations.

1.4.1.3 Hydrometeorology data is missing or seemingly ignored

- **Baseline Hydrometeorology Report Sec. 6.0:** A reasonable amount of hydrological and meteorological data has been collected at the project site. However, periods of limited or missing data exist within the records. The most notable of these is the lack of winter precipitation data at the Sisson climate station, as well as limited May freshet runoff data and winter discharge data. It is therefore suggested that ongoing data collection be continued and that the estimated values in this report be reviewed and updated once additional data become available.

- **Baseline Studies: KP hydrogeology Sec. 4:** The rate of groundwater recharge was estimated as about 8 % of the MAP (1350 mm) based on a watershed model for the project that was calibrated to regional streamflows at Narrows Mountain Brook (KP 2012e). The regional stream flow data currently provides the best approximation of the long-term distribution and volume of flow at the site. As additional precipitation and streamflow measurements (especially low flow measurements) are collected on site, the modelling work may be revised to use site data for calibration. Short warming periods in the winter result in a component of the winter snowmelt and therefore winter low flows may reflect both surface runoff and groundwater discharge.

  This flow condition observed during this packer test indicates that the higher take is likely not indicative of the bulk permeability of the test interval. Given the uncertainty with the high take tests, the following was recommended:
  o Identify the packer tests as high take without assigning an actual hydraulic conductivity value, until there is greater certainty regarding the validity of the testing.
  o If required, carry out additional and more than one type of hydraulic testing (e.g. constant head, falling head, lugeon) to better constrain whether the high take results are indicative of the site conditions or were influenced by the testing tool or method.
  o Recognize the implications of potentially high hydraulic conductivity values within the deposit area on engineering and environmental studies until additional testing is completed to gain a better understanding of the hydraulic conductivity values.

From the above quote, is appears as though the proponent chose to ignore results it didn't like and wait for better data. There is no evidence that further testing was done to determine the mine site's hydraulic conductivity values and as such it is unclear how the proponent reached conclusions regarding the rate of groundwater flow for the project.

1.4.1.3 Understanding the toxicity of water released to Sisson Brook

In the EIA report, the water quality at a node for Sisson Brook is not discussed (at page 7-92) despite it being the receiving waters for the water from the TSF and later, open pit. Instead, the closest water quality node that is discussed is at Napadogan Brook 5 (NAP 5), which is below the confluence of Sisson and Napadogan Brook. At NAP 5, the toxicity of Sisson Brook is diluted by Napadogan Brook, thereby not providing the public and decision-makers of what is the final water quality of Sisson Brook. This information is key if we are to understand the impacts of the project on water quality and fish and fish habitat.

The failure to discuss a water quality node at Sisson Brook provides another example of the poor quality of the background work done for the EIA report. The Predictive Water Quality study treats NAP 5 as an effluent discharge point. For example (at Predictive Water Quality Study page 5):

> Beginning in Year 8, 6,000,000 m^3/yr of excess water from the TSF is pumped to a water treatment plant (WTP) and discharged post-treatment to Napadogan Brook at the confluence with Sisson Brook. The WTP discharge rate is generally proportional to the baseline hydrograph of at the point of discharge. The discharge is further reduced during low flow months in late summer and mid-winter.

Everywhere else in the EIA report it is made clear that water will be discharged to Sisson Brook. Why the Predictive Water Quality Study used a different discharge is unclear. This lack of consistency results in vital information being lost to the EIA report.

Finally, the proponent's assertions that it will do future work to address gaps in data and analyses are not in keeping with the Agency's own guidelines regarding the completion of an EIA report:

> "A commitment to implementing adaptive management measures does not eliminate the need for sufficient information regarding the environmental effects of the project, the significance of those effects and the appropriate mitigation measures required to eliminate, reduce or control those effects. Where additional information collection or studies are needed over the life-cycle of the project, such studies in themselves should not be considered "mitigation measures"." (CEA Agency's 2009 Operational Policy Statement, *Adaptive Management Measures under the Canadian Environmental Assessment Act* at page 4, emphasis added)

The spirit of the 2009 OAP is that EIAs are not complete until all necessary baseline data is collected. Without this, the effects of a project cannot be fully assessed.

Recommendation:

- That the CEA Agency require the proponent to revise the EIA report to address all the concerns identified by CCNB experts and in this report.

1.4.2 No economic cost-benefit analysis

Common sense tells us that large open pit mining operations that dig up acid generating and metal leaching rock, emit contaminated dust, destroy the headwaters of clean and ecologically important rivers, fragment terrestrial landscapes, and have massive tailings ponds and dams, cause harm to the environment. These negative environmental effects also impact communities located near these mines. If these impacts and harm are significant, then these projects should not be approved by the public and environmental assessment decision-makers. However, sometimes they are when it is believed the economic benefits of a mine outweigh or justify the damage it causes to the environment and communities. Implicit in these decisions though is that the economic benefits of a mine are large enough to outweigh its environmental and social costs.

As has been detailed by Dr. Moir (see Section 2.9 below), without a cost-benefit analysis we don't have an accurate picture of the economic benefits, if any, of the Sisson Project. As Dr. Moir notes, the use of an economic impact model, like the one used by the proponent, for a different project showed that the project created a positive economic benefit, while using a true cost-benefit analysis showed this same project generated a negative economic loss to the community. Therefore, without an economic cost-benefit analysis for the Sisson Project, the public and decision-makers cannot make an informed decision about whether the economic benefits of the project justify the damage it will cause to the environment. Making this determination becomes even more difficult when the true closure costs of the Sisson Project are not known.

Recommendations:

- In consultation with Dr. Moir, have the proponent prepare an economic cost-benefit analysis for the Sisson Project for inclusion in a revised EIA report.

- Have the proponent provide a fully costed estimate of the long term closure costs of the Sisson Project for inclusion in a revised EIA report.

1.4.3 No assessment of the failure of the tailings dam

As will be detailed more fully below, and as much as the proponent would like this fact to go away, tailings dams fail! The failure of the Sisson tailings dam could release millions of tonnes of tailings and millions of cubic metres of supernatant water into the ecologically valuable Nashwaak watershed. While understated, the EIA Report does recognize the harm such a failure would cause. "At Sisson, a failure of the TSF embankment and resultant tailings or process water release could significantly affect downstream watercourses and habitats that have substantial ecological and societal value …" (EIAR page 3-25, emphasis added). Despite a tailings dam failure posing the project's biggest acute threat to the environment, the proponent chose not to assess its impacts.

> 8.17.2.1.1 Loss of Containment from Tailings Storage Facility (TSF)
>
> "With the application of these standards and rigorous construction methods to ensure the structural integrity of the TSF embankments and components, the implementation of adaptive management measures as necessary over the life of the mine, and the legislated regulatory oversight, the possibility of a structural failure of a TSF embankment is so unlikely that it cannot reasonably be considered a credible accident or malfunction, and is thus not considered further in this EIA Report." (EIAR page 8-698, emphasis added)

In his review of the EIA report for the Sisson Project (see Section 2.5 below), Dr. Chambers, who has 20 years of experience as an advisor on the environmental effects of mining projects both nationally and internationally, clearly explains why the above thinking is flawed.

> This is the first time I have seen this glaringly overconfident statement made in an EIS/EIA.
>
> In the 10 years since the ICOLD 2001[1] report the failure rate of tailings dams has remained at roughly one failure every 8 months (i.e. three failures every two years).[2] These dam failures are not limited to old technology or to countries with scant regulation. Previous research pointed out that most tailings dam failures occur at operating mines, and that 39% of the tailings dam failures worldwide occur in the United States, significantly more than in any other country.[3]
>
> Tailings dam failure is a low probability event, but also an event with high consequences. These consequences have never been ignored in any other EIS/EIA I have reviewed. To in essence assert that 'my engineering' could not possibly fail, in light of existing statistics, is arrogantly assuming that it is always the other guy (or gal) that will make a mistake – but not me. This is exactly the attitude that leads to accidents – as has been proven many times in the aviation world. (emphasis added)

[1] Tailings Dams, Risk of Dangerous Occurrences, Lessons Learnt from Practical Experiences, Bulletin 121, International Commission on Large Dams, 2001.

[2] Data from http://www.wise-uranium.org/mdaf.html "Chronology of major tailings dam failures" as of March 22, 2011.

[3] Reported tailings dam failures, A review of the European incidents in the worldwide context, M. Rico, G. Benito, A.R. Salgueiro, A. D´ıez-Herrero, H.G. Pereira, Journal of Hazardous Materials 152 (2008) p. 848.

Recommendation:

- Have the proponent complete a detailed environmental effects analysis of the failure of the tailings dam for the Sisson Project for inclusion in a revised EIA report. The assessment would include a modeling of the most likely worst case disaster scenario for such a failure describing, for example, the toxicity of the tailings and supernatant water, how much tailings and supernatant water would escape from the tailings storage facility, how far and to what depth the tailings and supernatant water would travel downstream, and what damage this would cause to communities in the watershed and the environment, including Atlantic salmon habitat, and for how long.

1.4.4 The closure plan is missing significant details

Several CCNB Action reviewers discussed the serious deficiencies of the proponent's closure plan. Mines with acid rock drainage and metal leaching leave long term environmental liabilities that must be managed. Without an understanding of the long term future environmental, social, and economic costs of the Sisson Project, we cannot make a fair determination of whether the project is sustainable, i.e., does it meet the needs of today without damaging the opportunities of future generations. Several of the key deficiencies of the closure plan are discussed below.

1.4.4.1 There is no accurate description of how much contaminated water will have to be managed after closure

The EIA report first states "the TSF will have approximately 2 million m^3/year of surplus water starting at about Year 8" (EIAR page 3-123). It then reports, "Approximately 6 million m^3/year of TSF pond water will be pumped to the WTP during Operation starting in Year 8 under average conditions" (EIAR page 7-80). Finally, the SRK (2013) Metal Leaching and Acid Rock Drainage Potential Characterization then describes in Appendix I (conceptual water treatment plant design) that the TSF, and after closure, the open pit will have an annual discharge of 1,280 m^3/hr (or 11 million m^3/year). This wide variation in water that will have to be treated after closure is never explained.

1.4.4.2 There is no accurate description for how long contaminated water will have to managed after closure

The EIA report provides no details about how long post-closure that water will need to be treated, only that it will be treated for "as long as necessary" (EIAR page 143). Is this 1 year, 10 years, 100 years, or more? This is not an idle question, for as Mr. Parker points out (Section 2.10 below), we already have closed mines in New Brunswick whose waste water requires long-term treatment. The lack of detail in the EIA report obviously does not assist in decision-making about the project.

1.4.4.3 Significant details about the conceptual water treatment plant are missing

The water treatment plant (WTP) is the key component of the closure plan for the mine, yet it is not described in any detail in the actual EIA report. Without the WTP, the environmental effects of the project post-closure on the aquatic environment will not be mitigated, in turn increasing their significance. Given the limitations of the conceptual design for the WTP, at present there is *no water treatment plant* for the Sisson Project. As the SRK 2013 report states:

> In the event that water treatment for sodium or fluoride is required … then the water treatment process proposed here will not be adequate. (SRK 2013 Appendix I, emphasis added)

The EIA report shows (at page 7-98) that post-closure, fluoride levels in water from the mine will be 2 to 3 times the CCME FAL guidelines (for the protection of aquatic life). The proponent can have no expectation that this continual exceedence, amongst others, will be permitted in the future. As a result, there is no actual plan for a WTP in the EIA report and a new conceptual WTP needs to be designed. The consequence of this is that any of the proponent's environmental effects analysis that relied on the existence of the flawed conceptual WTP much be redone, and if not redone, then without the mitigation of a WTP, the adverse environmental effects of the project on the aquatic environment must be considered to be significant.

1.4.4.4 The Terms of Reference regarding closure have not been met

> At a minimum, the discussion of alternative means of carrying out the Project shall include a consideration of the following: …
> • alternative options for reclamation and closure. (TOR at page 22-23)

In response to this requirement, the EIA report (at page 3-77) states, "Northcliff has considered various options to achieve decommissioning, reclamation and closure of the Project site at the end of mine life." No details of these other options are provided. Clearly this is not enough information for the public and decision-makers to weigh these alternatives. It is also not in keeping with Environment Canada's 2011 *Guidelines for the Assessment of Alternatives of Mine Waste Disposal*:[4]

> The alternatives assessment should objectively and rigorously consider all available options for mine waste disposal. It should assess all aspects of each mine waste disposal alternative throughout the project life cycle (i.e., from construction through operation, closure and ultimately long-term monitoring and maintenance). (at page 7)

Recommendations:

- Any plan for the decommissioning and closure of the project should be completed at the mine-proposal stage, and certainly prior to permitting, to a sufficient degree to reasonably determine water treatment costs, i.e., how much water and what is in the water, reclamation costs, and assess the short and long term social, health, and economic impacts from the mine (including post-closure).
- Prior to permitting the proponent should identify what long term and permanent water quality treatment may be necessary at the mine site. This includes but not be limited to discharges from the pit (including from pit walls that will not be submerged and pit discharges to groundwater).
- Permanent treatment should be avoided. The closure plan should more fully evaluate this and identify alternatives to perpetual treatment.

[4] Available at: http://www.ec.gc.ca/Publications/default.asp?lang=En&xml=5ECBCE8B-7E50-49E3-B7AD-8C21A575E873.

1.4.5 Costs of closure are not explained

Regarding this issue, Dr. Chambers writes

> If there is surplus pit water that will require treatment it is reasonable to anticipate that this treatment will be required in perpetuity - forever. That presents clear long-term liabilities and costs to the Crown, Province, and public. These liabilities and costs should be fully evaluated and discussed … (Section 2.5 below).

Similar concerns are raised by Dr. Curry (Section 2.4), Dr. Moir (Section 2.9), Mr. Parker (Section 2.10), and Mr. Hart (Section 3.0 Sustainability).

The proponent provides no details about how it arrived at a figure of $50 million to cover the costs of decommissioning, reclamation, and closure of the project. In addition, all of the above reviewers believe this amount to be very inadequate for a project of this size. The average operational costs of water treatment for mines are estimated to be $1.54 per m^3.[5] Accepting the proponent's figure of the project having 6 million m^3 of surplus water/year, one arrives at roughly $9 million/year being required to treat this water. The proposed $50 million would be depleted in less than 6 years, without including reclamation costs such as for revegeatating the site.

Recommendation:

- Have the proponent provide a fully costed estimate of the long term closure costs of the Sisson Project for inclusion in a revised EIA report.

[5] Zinck, J. and W. Griffith. 2013. Review of Mine Drainage Treatment and Sludge Management Operations. MEND Project: 603054. Report: CANMET-MMSL 10-058(CR).

1.4 CCNB Action's position on the EIA report and adverse environmental effects of the Sisson project

CCNB Action's report below shows that the need for the proposed tungsten and molybdenum mine has not been proven adequately. In addition, CCNB Action's expert reviewers collectively are of the opinion that because of missing vital data or data of poor quality, and inadequate sampling, methodology, and modeling done by the proponent, a large number of the Sisson Project's environmental effects cannot actually be determined. As a result, the EIA report does not fulfill the requirements for the conducting and reporting of the environmental assessment for the project as set out in the project's EIA terms of reference. CCNB Action experts are also of the opinion that based on the data that is available in the EIA report, in many instances the proponent has under-estimated the environmental effects of the project and mischaracterized the significance of these impacts, i.e., CCNB Action experts believe these adverse environmental effects of the project should be rated as significant.

From a reading of our report below, it is evident the presently inadequate and incomplete EIA report for the project must be redone so that fundamental questions about the project can be answered, such as what is the actual trace mineral content of the ore, what is the acid generating potential of the mined rock, and what are the true economic benefits of the project? Based on the fact the EIA report is incomplete, our experts' findings that many of the project's adverse environmental effects are significant, and the application of the precautionary principle, it is CCNB Action's position that the adverse environmental effects of the project must be accepted as being significant. Given all of this, it is clear that at present the obvious risks posed to the environment by the proposed mine, such as the release of air contaminants, the physical destruction of valuable fish habitat, and metal leaching and acid rock drainage, substantially outweigh the unsubstantiated need for or benefits of the project. For this reason, it is the position of CCNB Action the project should not receive the approval of decision-makers until such time as fundamental errors and oversights in the EIA report are adequately addressed. It is only after the EIA report is properly completed that the public and regulators can return to the question of whether the project should receive approval.

Following from the above, we will be requesting that the Minister use her authority under s. 23(2) of the old *CEAA* and/or the CEA Agency use its authority under s. 23(2) of *CEAA 2012* to require the proponent, Northcliff Resources Inc., to redo and revise the EIA report so that the information gaps in it identified by CCNB Action's experts are filled. We will also ask that the current public comment period not be ended and that it be extended for 45 days following the submission of a revised EIA report by the proponent. If these revisions are not made, then CCNB Action will stand by its position that the adverse environmental effects of the Sisson Project must be deemed to be significant and because of the unsubstantiated need for the project, that these effects cannot be justified. As such, we will ask the CEA Agency to conclude in its comprehensive study report (CSR) for the project, "That even with the implementation of mitigation measures, the Sisson Project is likely to cause significant adverse environmental effects and that these effects cannot be justified."

2.9(a) Review of EIA Report for the Sisson Project (Tungsten and Molybdenum Mine) - New Brunswick, CEAR #11-03-63169

Valued Environmental Component: Labour and Economy
EIA Report Section: 8.10
Date: October 3, 2013

Rob Moir, PhD.
UNB Saint John, Dept. of Social Sciences (Economics)

1. Summary

I have reviewed *Sisson Project: Environmental Impact Assessment Report* (CEAR #11-03-63169), Section 8.10 concerning the Valued Environmental Component: Labour and Economy filed in July 2013. For the purposes of this review, I shall refer to this document as EIAR. In reviewing the EIAR it is necessary for me to review and refer to three other filed documents – the *Baseline Socioeconomic Technical Report* filed 1 June 2012 (referred to as BSTR), *Economic Benefits Arising From the Construction and Operation of the Sisson Project* produced in February 2013 by the consulting firm EcoTec (referred to as EcoTec), and the *Conceptual Decommissioning, Reclamation and Closure Plan* (referred to as CDRCP). To help further understand the economics of the project, I also have reviewed the Canadian National Instrument 43-101 Technical Report on the Sisson Project, effective date January 22, 2013. The review of the National Instrument follows this review of EIA report Sec. 8.10.

I make a number of recommendations based upon my review of the EIAR and supporting documents. Highlights of these recommendations include:

- The proponent should use cost-benefit analysis instead of economic impact modeling to analyze the economics of this project.
- To ensure that economic benefits accrue to the Province, the proponent should voluntarily and explicitly limit access to the temporary foreign workers program.
- The proponent should explicitly identify how the $50 million financial security used to fund decommissioning and reclamation will be funded.
- Given that Northcliff Resources Inc. owns Sisson Brook as its only project, the company should be required to have a financial surety or insurance against catastrophic failure. It may be possible to link the size of this surety to risks of catastrophic events occurring.

2. Review of methods used by the proponent to study existing conditions (EIA Report Section 8.10.2)

The existing socioeconomic conditions are outlined in EIAR section 8.10.2 pages 8-468 through 8-480 which are essentially a summary of the BSTR. Data has been gathered using traditional methods; through reference to publicly available census data and contact with local officials. I believe the methodology used here is reasonable, but have a few recommendations.

Recommendations

1. Given the later-than-expected filing of the EIAR, it would be reasonable to expect that this baseline data could be updated using the 2011 Census.

2. Provide baseline data on population health (unless gathered elsewhere) both for areas local to the project and for areas likely to provide labour to the project. The BSTR only lists access to health facilities and programs and availability of resources (pp. 48-56).
3. Provide baseline data on local housing prices and rental rates in the EIAR. These data are available in the BSTR (pp. 40-45) but they do not make it to the EIAR. Moreover, the BSTR provides these data for 2006 and this should be updated.
4. Provide baseline data on well-water quality for local properties (unless reported elsewhere).
5. Provide baseline data on local alternative land/resource uses (specifically forestry, hunting, fishing, and other recreational use). These data are glossed over in the BSTR (p. 63).

Reasoning: If the goal of this section of the EIAR is to provide a baseline for existing economic conditions then it should address the productive capacity of individuals (health – recommendation 2), stored wealth (property values – recommendations 3 and 4), and alternative uses of the land which might be crowded-out by the project (recommendation 5).

Overall the methods used in Section 8.10.2 of the EIAR are reasonable but I recommend the updating of data and the reporting of additional data to provide a complete baseline before the project begins.

3. Review of results of studies of existing conditions

Section 8.10.2 of the EIA amounts to recording and reporting baseline data. In Section 2 of this review, I have made specific recommendations for the updating of the data reported in this section of the EIAR and the reporting of additional data. The data should be updated as soon as new data becomes available – typically a year or two after the Census – with these data made publicly available, both in print and through electronic access.

Recommendations

1. Update expanded baseline data on a regular basis.
2. Make the data publicly available, both in print and through electronic access.

4. Review of Potential Project-VEC Interactions (EIA Report Section 8.10.3)

As an economist, I find it odd that labour and the economy are considered to be valued environmental components (VECs). I also consider it odd that for a project with considerable negative economic externalities (social costs in excess of private costs), I am not directly commenting on any of these issues. I will return to this in Sections 5 through 7 and 10 of this review.

That said, I now turn to the issue as presented in the EIA report. Rather than consider the individual impacts of activities during the construction, operation and decommissioning phases of the mine, the proponent gathers all of the employment and expenditures associated with these activities and lists them as a category for each phase in the mine's life (see EIAR Table 8.10.4 pp. 8-480 to 8-481). This seems reasonable as the employment and expense associated with any single activity is likely to have a very small effect on either labour or the economy but in combination during any phase, might have a non-trivial effect. The proponent rates the effect upon labour as a 1 in all phases and the effect upon the economy as a 2 in all phases.

I would expect, and believe that the proponent demonstrates by virtue of space devoted to making their case, that in terms of the effect upon labour a rating of 2 should be given during the construction and decommissioning phases.

Specifically during the construction phase there is the potential to suddenly increase demand in construction-related markets (labour, materials, equipment, etc.). While the proponent dismisses this as a concern right now due to current unemployment rates, should this project proceed it may do so at a time when the market is much tighter. This could very well occur if the Energy East Pipeline Project proceeds, if the re-purposing of the Canaport LNG Plant as a production facility proceeds, if the province proceeds with shale gas development, if other major mining projects occur on the East Coast, or if the Province decides to proceed with refurbishment of the Mactaquac dam.

In the decommissioning phase, both the public and the proponent have pointed out the worry that this could be a "boom and bust" situation with respect to labour (EIAR p. 8-486). The proponent seems to dismiss this rather cavalierly. Indeed, it is notable that in Section 8.10.3 the proponent considers current unemployment to be a positive, noting that, "[t]he Project is not likely to create a highly competitive labour market that would cause greater wage increases …," (EIAR p. 8-482) during the construction phase. However, in the decommissioning phase as people are released from employment and re-enter the workforce, thereby increasing unemployment, this is too viewed as a positive: "minor positive environmental effects to a Change in Labour as skilled workers return to the available work force, resulting in greater availability of skilled labour for other Projects and economic sectors" (EIAR pp. 8-482 to 8-483). While it is true that released workers will perhaps have a greater (and potentially in-demand) skill set, the benefit in both phases accrues to potential employers as wages aren't predicted to rise. This seems a bit biased and is symptomatic of a benefits analysis.

For the above stated reasons, I would recommend the Change in Labour be rated as 2 in Table 8.10.4 of the EIAR (pp. 8-480 to 8-481) for the construction and decommissioning phases. I would like to see the proponent be more explicit in how they propose to mitigate these potential impacts. I would also like to see a statement by the proponent that it will not quickly turn to the Temporary Foreign Workers program in any phase of the mine's history. This seems to happen somewhat frequently in the Canadian mining sector and is a method of artificially reducing the wage bill which would decrease economic activity in the Province.

Recommendations

1. Rate potential project environmental effects to VEC-Labour as a 2 in both the Construction and Decommissioning phases of the mine. Adjust the EIAR accordingly.
2. The proponent should explicitly state that they would limit access to the Temporary Foreign Workers program until all other avenues of hiring have been documented to lead to production shortfalls. An independent board should scrutinize all such documentation.

5. Review of assessment of project-related environmental effects (EIA Report Section 8.10.4)

The proponent's list of project-related environmental effects is limited to Change in the Economy because of Employment and Expenditure activities (see Table 8.10.5, EIAR pp. 8-484 to 8-485). The proponent limits analysis to this single VEC because they rated all potential project effects on Labour as a 1. As I argue in Section 4 above, I believe this is incorrect. A careful examination of the mitigation measures in Table 8.10.5 reveals that the first 2 of the 6 in-total measures are specifically aimed at

Labour (hiring and training, EIAR p. 8-484). The second 2 measures are really backhanded mitigations amounting to "we will help local businesses and business groups to enhance their ability to capitalize on the many benefits we will bring to them." While this is laudable and an issue I will expand upon later, this seems to be a bit like marketing. In subsequent sections, I will delineate a different methodology that would more appropriately identify interactions.

At this point, I have to depart somewhat from the format used by the proponent in section 8.10 of the EIA report and the format suggested by the review coordinator. In Section 5.1 of my review, I will provide a general description of economic impact modeling used by EcoTec to draw general predictions in EIAR section 8.10.4.1. In Section 5.2 of this review I will then describe the shortcomings of this modeling technique and relate it to the predicted residual effects in EIAR section 8.10.4.3. In Section 5.3 I will then address the proponent's mitigation strategies for predicted residual effects, and make my own recommendations.

5.1 Review of environmental effects assessment re: Potential Project Environmental Effects Mechanisms (EIA Report Section 8.10.4.1)

In EIA report Sec. 8.10.4, the proponent makes reference to the EcoTec Report. In EIA report Sec. 8.10.4.1, the EcoTec Report is not directly mentioned, but elements of the basic model used by EcoTec are alluded to in the summary. For that reason, I will attempt to highlight the key features used in the EcoTec model.

The EcoTec report is generated using internal expense figures generated by Northcliff Resources, baseline data mostly from Statistics Canada (see BSTR for example), an economic impact model developed and owned by EcoTec which was peer-reviewed by Wade Locke Economic Consulting.

At this point, I will provide a general overview of economic impact models (EIMs). In Canada, EIMs are typically calibrated using Statistics Canada Input/Output tables and adjusted for local relationships and the particulars of a project. Key to the functioning of the model is the concept of an expense multiplier. Simply put, new spending in a region either through a project or through government spending turns into income for other parts of an economy. This income sometimes goes to individuals who themselves have a propensity to consume and can also generate new hires which leads to additional income for individuals who have a propensity to consume.

Key to EIMs are assumptions about how additional sales might affect hiring and the fraction of a new dollar received by an individual that actually goes to new spending in the time-period it was received and in the province it was received.

EcoTec's EIM does ***not*** make the assumption that sales-employment elasticity is fixed at 1 – i.e., they do ***not*** assume that a 1% increase in sales leads to a 1% increase in employment. This is a sensible correction. It seems that they permit sales elasticities to vary (e.g., be less than 1), but the specifics of this variation are not identified (EcoTec p. 21). I would expect that the elasticities are permitted to vary across industrial classification and perhaps across provinces, but not across companies within an industrial classification, and likely not as a function of sales (e.g., I suspect all construction heavy-equipment companies in New Brunswick have a sales-employment elasticity of, say, 0.68 and while this may vary according to province of location, it does not vary across companies and it is the same whether sales increase by 1% or 8%).

Likewise, the marginal propensity to consume (mpc) – the fraction of a new dollar that is spent in the manner delineated above – has been adjusted to a value less than 1. According to EcoTec (p. 22) downward adjustments are made to account for taxes ("[s]ubtracting both federal and provincial income tax from earned income …") and payroll taxes ("employee contributions to Employment Insurance, pension funds and RRSP, etc."). Suppose the mpc is 0.8. The multiplier works in the following way: the government hires me and pays me $100 of which I spend $80 (i.e., 0.8 x $100) which you receive and spend $64 (i.e., 0.8 x $80) which another person receives and spends $51.20, etc., etc. until the $100 in newly injected spending turns into a total increase of $500 – the direct increase of $100 and an additional $400 of induced spending. In other words, in this example, the multiplier is 5. The formula for this type of multiplier is M=[1/(1-mpc)]. It is simple to verify that the closer the mpc is to 1, the higher the multiplier. Thus EcoTec's stated adjustments (p. 22) serve to lower the mpc, consequently lowering the multiplier "[i]n order to ensure that induced impacts are not overestimated …" (p. 22).

At this point, I remind the reader that the devil is in the details. In the body of EcoTec's report, the marginal propensity to consume (and hence the multiplier) is implied to have been downwardly adjusted for, "leakages such as imports, taxes and savings …" (p. 10). However, in EcoTec's direct statement of the EIM's assumptions (see p. 22), no mention is made of adjusting for imports (both international and out-of-province-but-within-Canada) nor are personal savings mentioned. Moreover, no mention is made for the timing of spending (does it happen within the same fiscal year as the income was earned?), whether the mpc adjusts according to the size of the change in income, or whether the mpc is dependent upon people's assessment of their income change as a windfall gain (for which the mpc is typically lower – see Kinnaman (2011, p. 1243 referencing Thaler (1990)) or a more permanent increase to an income stream.

Before making my recommendations, I note that it can be rare as a reviewer to receive internal reports such as EcoTec's from proponents such as Northcliff. I do not know if obtaining the report was difficult, but I think it is imperative for reviewers to have access to such reports in order to do their jobs as assumptions matter. I thank Northcliff for its cooperation.

Recommendations

1. Assuming the Board of Northcliff receiving this EIA (and associated comments) and the proponent continues with economic impact assessments (see comments in Section 5.2 of this review), then consultants using the EIM should be much more explicit about the assumptions used in calculating both the sales-employment elasticity and the marginal propensity to consume.
2. Inasmuch as EcoTec cares about the accuracy of its EIM and improvements that might be made to it, Northcliff and EcoTec should monitor data on employment creation and business expansion.

5.2 Review of environmental effects assessment re: Characterization of Residual Project Environmental Effects (EIA Report Section 8.10.4.3)

In this section of my review I will highlight the problems associated with EIMs. I draw heavily upon peer-reviewed and published research produced by Kinnaman (2011) used to dispute the EIMs used in non-peer-reviewed publications to promote shale gas development in the United States. However, there are additional concerns.

First, the results of the EIM are critically dependent upon the mpc used. As described above, it is not clear that EcoTec adjusted for consumers' propensity to import, their propensity to use personal savings, or the timing of their spending (see Kinnaman throughout but especially p. 1244 for implications). **This means that despite EcoTec's attempts, the multiplier is likely overstated thus overstating the economic benefits of the Sisson Project.** Second, while the sales-employment elasticity has been adjusted in a sensible manner, as described in Section 5.1 of my review, it quite likely has not been adjusted enough, again contributing to an overestimation of economic impacts.

Third, there is ongoing theoretical discussion about the long-term effects of expenditure multipliers. Multipliers are expected to work in a Keynesian world of significant under-employment. However, as an economy nears full-employment, expenditure by one entity (industry/government) crowds-out expenditure made by other entities (see Kannaman, p. 1247). EcoTec (pp. 2-3), BSTR (pp. 22-30), and EIAR (8-467, 8-477 to 8-483) all attempt to convince us that there is no scarcity in New Brunswick's labour market. This permits the proponent to claim that virtually all employment created by this project is brand new employment. Suppose a new job paying $65,000 is created by this project. This employed person adds to GDP, spends money which has multiplied effects through the economy, and pays taxes. However if this new job hires a person away from her forestry job (paying $58,000) then the real benefit generated by the project is the $7,000 in extra salary.

Fourth – and this might be because of the combined effects of the above three problems – a "theoretical weakness of this method of measuring impact is the lack of economy-wide logical consistency" (Kinnaman, p. 1247). If an EIM was conducted today for each industry in the New Brunswick economy, we would estimate more economic activity in the economy than is actually taking place.

Consequently the impacts arising from an EIM are very likely to be overstated. Essentially, EIMs go looking for benefits and find them. A new mine is a benefit. Paying people is a benefit. Buying/leasing equipment is a benefit. Decommissioning a mine is a benefit. A catastrophic release of tailings would be a benefit as it would add to spending in the province. Indeed, the very title of the EcoTec report, *Economic Benefits Arising …*, speaks to this bias. Perhaps this is just a misfortunate title choice, but a very simple textual analysis of section 8.10 of the EIAR reveals that variants upon the word "benefit" appear 46 times compared to "cost" appearing twice ("adverse" appears 24 times, but this is still significantly less than 46 for "benefit"); "positive" appears 22 times while "negative" does not appear at all. Indeed, this makes the EcoTec report and section 8.10 of the EIAR sound more like a marketing document than a review.

As it is, the claims in the EIAR section 8.10.4.3 regarding predicted effects (which are often classified as "benefits") on VECs are seriously questionable and subject to overestimation. That said, one could conclude that if adjustments were made, EIM would be redeemed: "Sure, we can accept that the benefits are a bit overstated, but they are very large, so even if they are reduced a little bit, they are still large." However, there are serious questions as to whether EIM does the job required from an economic sense. First, EIM is designed to study small (marginal) changes but is typically applied to large changes (Kinnaman, p. 1244) as it is in this instance if one is to believe news coverage and government excitement over the Sisson Brook Project. The problem is that large changes can alter input-output relationships, in the sales-employment elasticity and in the marginal propensity to consume, and these dynamics are difficult if not impossible to model. Second, we have at our disposal much better methods of analysis. For instance, one could turn to social and economic impact analysis (see Esteves, Barclay, and Brereton 2011) or better yet, traditional cost-benefit analysis as performed by an environmental

economist used to dealing with environmental externalities (see Kinnaman, pp. 1247-1248). To see the potential for bias, consider the study by Taks *et al.* (2011). A direct comparison was made between an economic impact assessment and cost-benefit analysis of the 2005 Pan-American Junior Athletic Championships in Windsor, Ontario. The EIM suggested a net increase of economic activity in Windsor of $5.6 million while the cost-benefit analysis indicated a ***negative*** net benefit of $2.4 million.

This is not to say that the EIM is a useless methodology. Indeed, the use of input-output tables to highlight where changes may take place is quite useful. It is especially useful to examine direct and indirect effects of expenditures on GDP and identify potential leakages. *Nevertheless, economic analysis of a project should be conducted using the proven method of cost-benefit analysis.*

Recommendation

1. Use cost-benefit analysis to analyze this project.

5.3 Review of described mitigation measures (EIA Report Section 8.10.4.2)

The above recommendation, if implemented, would significantly alter the effects and potential mitigation strategies. Rather than reject the mitigation recommendations outright, I here seek to suggest changes to the recommendations as they appear in EIAR section 8.10.4.2.

First, as mentioned previously, I would like to see the proponent formally and explicitly limit its recourse to the temporary foreign workers program. This would augment the first and second bullet points (EIAR p. 8-487). Second, I would recommend that the proponent visit with local and provincial businesses to jointly identify potential supply chains which could be strengthened. The visits should have already begun to allow business to consider infrastructure investment. This would augment the third bullet point (EIAR p. 8-487). Finally, using the EIM already conducted it is clear from a comparison of Tables 7 and 12 in EcoTec (pp. 5 and 9) that the input-output tables predict significant leakages of expenditures from the New Brunswick economy in the construction phase. I would recommend that the proponent identify the potential sources of these leakages in the supply chain and work with companies and the province to see if these leakage points might be stoppered.

Recommendations

1. Formally and explicitly limit recourse to the temporary foreign workers program.
2. Meet with the government and potential members of the supply chain to identify links and shortcomings in the supply chain. Such meetings should not simply take place with existing potential supply chain members, but also seek to identify where local businesses could be expanded or new industries created which would enhance the local supply chain and limit leakages.

6. Review of cumulative environmental effects assessment (EIA Report Section 8.10.5)

It would be nice in this section of the EIAR to see the proponent explicitly make the links that they tabulate in Table 8.10.12 (p. 8-492). I think the directionality is wrong. In its current form it seems to suggest how other projects impact upon the VECs whereas it should be how the changes in VECs potentially impact other uses.

When I look at this section and try to understand what might be meant, I recall my comments made in Section 2 of this review. Specifically I refer to the need to record and monitor housing prices, well-water quality, and alternative land use (industrial, forestry, and recreational use). This Project, if it proceeds, will have an impact on the VECs of Labour and the Economy. If these VECs change then there is potential to affect alternative land uses – you can't build a house where a mine pit is dug; you can't fish in an acidified stream.

The current land and resource use are sparsely presented in the BSTR (pp. 63-64). I am not qualified and cannot speak to uses past, present or future of the land and resources by Aboriginal Persons; evidently this is true even for the authors of the BSTR (p. 64). I can accept that there is no current industrial land use at the proposed site (but I have not travelled the area). The BSTR claims there are rental cabins in the area which may see less use if a mine moves in and limits recreational use. Nearby stores and restaurants might see an expansion of business if the project proceeds. It does not look like the mine will directly affect the community of Napadogan (i.e., cause houses to move), but there may be indirect effects including increased housing construction (necessitating infrastructure construction), damage to water supplies, increased traffic, etc.. The proponent already accepts that there is ongoing recreational land and resource use and these will be negatively affected if a mine opens up because of noise, traffic, land space devoted to the mine, and the potential for degraded water quality which might last decades beyond the life of the mine.

Future use in all categories, with the exception of Aboriginal Persons as mentioned earlier, is likely to be permanently affected, although it is possible that some of the negative effects might be mitigated. Where there is an open pit mine, there cannot be a forest or a community, etc.. Likewise for a tailings storage facility, especially if it might leak.

Recommendations

1. I believe that Table 8.10.12 (EIAR p. 8-492) should be re-coded as below:

Other Projects	VEC – Change in Labour	VEC – Change in Economy
Past / Present		
Industrial	1	1
Forestry/Agriculture	~~1~~ 2	~~1~~ 2
Traditional Aboriginal Persons	~~0~~ ?	~~0~~ ?
Recreational	~~1~~ 2	~~1~~ 2
Residential	~~1~~ 2	~~1~~ 2
Future		
Industrial	~~1~~ 2	~~1~~ 2
Forestry/Agriculture	~~1~~ 2	~~1~~ 2
Traditional Aboriginal Persons	~~0~~ ?	~~0~~ ?
Recreational	~~1~~ 2	~~1~~ 2
Residential	~~1~~ 2	~~1~~ 2

   The proponent should then be required to plan appropriate mitigation techniques.

2. As for mitigation efforts, one might want to explore the following strategies which are in no sense meant to be considered exhaustive.

Present

a) Meet with the community (leaders, business owners, and the general public) in Napadogan to discuss changes that might occur in their community with the construction of this mine. These meetings should be public and operated as a meeting, not as a drop-in information session.
b) Meet with cabin owners to discuss how the mine might affect their business.
c) Meet with local foresters to discuss how the mine might affect their activities

I suspect that through meetings, people will suggest effective mitigation strategies.

d) As mentioned earlier, the BSTR should get more complete data on current use; these data should be updated regularly and made publicly available for analysis.

Future

a) Design all on-site industrial and support buildings and associated infrastructure so that they can be adapted for re-use by a new company post-closure if a suitable owner can be found. I note that this recommendation would augment plans described in CDRCP (p. 26) and is not meant to replace them.
b) The current plan for a TSF (CDRCP p. 31) leaves the company and the Province with a legacy which must be managed for decades if not centuries. Alternatively both the company and the province might want to explore high density thickened tailings (HDTT) storage (http://www.tailings.info/disposal/thickened.htm). As I understand it, such storage might be reclaimed as usable land post closure. This land could eventually be used for industry, residences, forestry, parkland, hunting, etc.. Moreover, the low leaching potential for HDTT storage post-closure would minimize future impact on recreational fisheries. Furthermore, HDTT storage would reduce the risk of catastrophic release of tailings into the watershed during the operational phase of the mine.
c) The company and the province might also want to research alternative uses of the tungsten and molybdenum tailings perhaps as a substitution material for cement (see Choi *et al*. 2009). If this is possible it would decrease the remaining tailings, become a salable byproduct of production, and increase production within the province.

7. Review of Determination of Significance (EIA Report Section 8.10.6)

7.1 Review of definition of "Residual Environmental Effects Significance Criteria"

At no point does the proponent define significance. Within section 8.10.6 of the EIAR (pp. 8-493 to 8-494), variants of the word "significant" appear 7 times (one of which is in the section title). When the proponent deems a project effect to be positive, the effects are deemed to be significant in two of three cases. In all three instances where the proponent deems a project effect to be negative, the effects are classified as not significant.

I believe the reason for this classification is twofold. First, it is a byproduct of using an EIM framework that goes looking for benefits. Costs are simply not considered. Second, perhaps by virtue of the environmental assessment itself or perhaps because of the use of the EIM, the "environment" was not really considered at all in section 8.10 of the EIAR. Anything that a regular person would typically identify as part of the environment (air/water quality, wildlife, plants, human health, etc.) is ignored.

Consequently, I have not discussed the proponent's financing of the decommissioning bond, valuing impacts upon the environment, the need for a financial surety/insurance to cover catastrophic tailings-water release, etc..

7.2 Determination of Significance

Staying within the definition of VECs as used in this EIAR, I have argued that there are potentially significant effects to Labour in the Construction and Decommissioning phases (see EIAR Table 8.10.4, pp. 8-480 to 8-481, and Table 10.5, pp. 8-484 to 8-485; see my comments in Sections 4 and 5 of this review). Likewise, I have argued that interactions identified in Table 8.10.12 (EIAR p. 8-492) should be rated as significant (see Section 6 of this review). I have also argued that many of the positive effects as identified by the proponent through the use of an EIM are in fact overstated (see Section 5 of this review) and may not be as significant as the proponent believes.

8. Review of Follow-up and Monitoring (EIA Report Section 8.10.7)

The proponent suggests no follow-up and no monitoring. I have suggested a great deal of recommendations throughout this review. My recommendations will be re-listed in the conclusion. Most germane to this sub-section would be my recommendations regarding updating and expanding the data collected in the BSTR, collecting this data on a regular basis, and making this data publicly available for analysis and for calibration of the EIM.

9. Conclusion and recommendations

I have made recommendations throughout this report. I gather them below. Then I add a few additional considerations that do not seem to fit elsewhere.

RECOMMENDATIONS

From Section 2 of this review

1. Given the later-than-expected filing of the EIAR, it would be reasonable to expect that this baseline data could be updated using the 2011 Census.
2. Provide baseline data on population health (unless gathered elsewhere) both for areas local to the project and for areas likely to provide labour to the project. The BSTR only lists access to health facilities and programs and availability of resources (pp. 48-56).
3. Provide baseline data on local housing prices and rental rates in the EIAR. These data are available in the BSTR (pp. 40-45) but they do not make it to the EIAR. Moreover, the BSTR provides these data for 2006 and this should be updated.
4. Provide baseline data on well-water quality for local properties (unless reported elsewhere).
5. Provide baseline data on local alternative land/resource uses (specifically forestry, hunting, fishing, and other recreational use). These data are glossed over in the BSTR (p. 63).

From Section 3 of this review

1. Update expanded baseline data on a regular basis.
2. Make the data publicly available, both in print and through electronic access.

From Section 4 of this review

1. Rate potential project environmental effects to VEC-Labour as a 2 in both the Construction and Decommissioning phases of the mine. Adjust the EIAR accordingly.
2. The proponent should explicitly state that they would limit access to the Temporary Foreign Workers program until all other avenues of hiring have been documented to lead to production shortfalls. An independent board should scrutinize all such documentation.

From Section 5.1 of this review

1. Assuming the Board receiving this EIA (and associated comments) and the proponent continue with economic impact assessments (see comments in Section 5.2 of this review), then consultants using the EIM should be much more explicit about the assumptions used in calculating both the sales-employment elasticity and the marginal propensity to consume.
2. Inasmuch as EcoTec cares about the accuracy of its EIM and improvements that might be made to it, Northcliff and EcoTec should monitor data on employment creation and business expansion.

From Section 5.2 of this review

1. Use cost-benefit analysis to analyze this project.

From Section 5.3 of this review

1. Formally and explicitly limit recourse to the Temporary Foreign Workers program.
2. Meet with the government and potential members of the supply chain to identify links and shortcomings in the supply chain. Such meetings should not simply take place with existing potential supply chain members, but also seek to identify where local businesses could be expanded or new industries created which would enhance the local supply chain and limit leakages.

From Section 6 of this review

1. I believe that Table 8.10.12 (EIAR p. 8-492) should be re-coded as below:

Other Projects	VEC – Change in Labour	VEC – Change in Economy
Past / Present		
Industrial	1	1
Forestry/Agriculture	~~1~~ 2	~~1~~ 2
Traditional Aboriginal Persons	~~0~~ ?	~~0~~ ?
Recreational	~~1~~ 2	~~1~~ 2
Residential	~~1~~ 2	~~1~~ 2
Future		
Industrial	~~1~~ 2	~~1~~ 2
Forestry/Agriculture	~~1~~ 2	~~1~~ 2
Traditional Aboriginal Persons	~~0~~ ?	~~0~~ ?
Recreational	~~1~~ 2	~~1~~ 2

Residential	~~1~~ 2	~~1~~ 2

The proponent should then be made to develop appropriate mitigation techniques.

2. As for mitigation efforts, one might want to explore the following strategies which are in no sense meant to be considered exhaustive.

Present

a) Meet with the community (leaders, business owners, and the general public) in Napadogan to discuss changes that might occur in their community with the construction of this mine. These meetings should be public and operated as a meeting, not as a drop-in information session.
b) Meet with cabin owners to discuss how the mine might affect their business.
c) Meet with local foresters to discuss how the mine might affect their activities

I suspect that through meetings, people will suggest effective mitigation strategies.

d) As mentioned earlier, the BSTR should get more complete data on current use; these data should be updated regularly and made publicly available for analysis.

Future

a) Design all on-site industrial and support buildings and associated infrastructure so that it can be adapted for re-use by a new company post-closure if a suitable owner can be found. I note that this recommendation would augment plans described in CDRCP (p. 26) and is not meant to replace them.
b) The current plan for a TSF (CDRCP p. 31) leaves the company and the Province with a legacy which must be managed for decades if not centuries. Alternatively both the company and the province might want to explore high density thickened tailings (HDTT) storage (http://www.tailings.info/disposal/thickened.htm). As I understand it, such storage might be reclaimed as usable land post closure. This land could eventually be used for industry, residences, forestry, parkland, hunting, etc.. Moreover, the low leaching potential for HDTT storage post-closure would minimize future impact on recreational fisheries. Furthermore, HDTT storage would reduce the risk of catastrophic release of tailings into the watershed during the operational phase of the mine.
c) The company and the province might also want to research alternative uses of the tungsten and molybdenum tailings perhaps as a substitution material for cement (see Choi *et al*. 2009). If this is possible it would decrease the remaining tailings, become a salable byproduct of production, and increase production within the province.

In addition to these recommendations, I include a few points for consideration.

a) The proponent has never really addressed environmental issues in section 8.10 of the EIAR. If you did a poll and asked people, “Are labour and the economy part of the environment?” I suspect the majority of the respondents would say “No.” Likewise, if you asked them, “What do you think about when you think about the environment?” virtually no one would say labour/jobs and the economy.

b) Neither in the National Instrument (*Canadian National Instrument 43-101 Technical Report on the Sisson Project*) nor in the EIAR section 8.10 is any mechanism described for funding the $50M financial security for reclamation. The greatest detail on this financial security within the many documents associated with the EIA is provided in two paragraphs and one graph in the CDRCP (p. 39). The CDRCP (p. 39) suggests that the fund will begin "one year before mine-start-up" and states that there will be enough money in the account to deal with "decommissioning, reclamation, and closure" but does not detail the initial injection of funds, the real expected rate of return on those funds, nor the expected costs of decommissioning, reclamation, and closure at any point in the mine's operations. Indeed, it is odd to see that the graph (CDRCP Figure 6.1, p. 39) is non-monotonic in shape, even falling in some years. It is important to note that the CDRCP and the $50 million financial security do not account for any costs associated with catastrophic damages.

c) There is no mention of a financial surety or insurance in the case of a catastrophic outcome (e.g., an unexpected release from the TSF) at the mine. Even renters are required to provide landlords with a damage deposit. The need for such a surety is enhanced by the fact that the relationship between Hunter Dickinson Inc. (HDI) and Northcliff Resources Inc., is not straightforward ownership. Northcliff is a "discrete public company" (http://www.hdimining.com/s/HDICompanies.asp) for which HDI, "a private mining group," provides "management and technical services" (http://www.hdimining.com/s/AboutHDI.asp). Northcliff "wholly-own[s]" the Sisson Project (http://www.northcliffresources.com/s/Home.asp) and does not have any other holdings beyond Sisson Brook. If something goes wrong at Sisson Brook, Northcliff might declare bankruptcy and leave the Province (and the environment) with the bill; this happened with the Montreal, Maine and Atlantic Railway in the *Lac-Mégantic rail* disaster. A sensible surety/insurance policy would be linked to level of risk of catastrophic failure (e.g., it would be tied to the level of risk associated with various tailings management technologies).

10. References cited by Reviewer (I do not include references to documents used in the EIA report.)

Choi, W. C., Kim, Y. J., Choi, O., Lee, K. M., & Lachemi, M. (2009). Utilization of tailings from tungsten mine waste as a substitution material for cement. *Construction and Building Materials*, 23, 2481-2486.

Esteves, A. M., Barclay, M., & Brereton, M. (2011). Integrating social and economic impact assessment into local procurement strategy. *First International Seminar on Social Responsibility in Mining (SR Mining 2011)*.

Kinnaman, T. C. (2011). The economic impact of shale gas extraction: A review of existing studies. *Ecological Economics*, *70*(7), 1243-1249.

Taks, M., Kesenne, S., Chalip, L., & Green, C. B. (2011). Economic Impact Analysis versus Cost Benefit Analysis: The Case of a Medium-Sized Sport Event. *Int. Journal of Sport Finance*, *6*(3), 187-203.

11. Biography of Reviewer

Rob Moir

B. Arts&Sci (Hons. Economics), McMaster; MA (Economics), Queen's; PhD (Economics), McMaster.

Associate Professor of Economics, UNB Saint John (initial appointment, January 1996) and Chair of Social Sciences.

2.9(b) Comments on Canadian National Instrument 43-101 Technical Report
Effective Date: 22 Jan. 2013

Valued Environmental Component: N/A
Factor/Subject Area: Overall Economics of the Project
Date: August 19, 2013

Rob Moir, Associate Professor of Economics
University of New Brunswick – Saint John, Dept. of Social Sciences

1. Executive Summary

As an academic economist, I have reviewed the Canadian National Instrument 43-101 Technical Report on the Sisson Project, effective date January 22, 2013 (hereafter referred to as NI; unattributed page references are from NI). I did not limit my role to simply the business aspects of the project as the project may also have external costs and benefits accruing to those not directly involved in the mine. For the most part, it is in the company's best interest to correctly state the business case and to emphasize the potential external benefits as this strengthens the case for the project. Consequently, I will highlight some potential external costs which may not be as apparent. Overall, while there seems to be a solid business case put forward for the mine, there are economic concerns which should be addressed.

2. Basic Economics of the Project

Most companies are interested in making a profit, and I suspect Northcliff Resources Inc., fits into this category. Consequently, barring any attempts to willfully misguide investors such as artificially inflating stock prices, it is in the best interest of the company to build a relatively truthful business case for a project.

The Sisson Project involves building an open pit mine, tailings storage facility (TSF), associated treatment facilities and an APT plant (used to process tungsten to ammonium paratungstate or APT) to extract and to varying degrees process molybdenum (Mo) and tungsten (WO_3). Located in the Nashwaaksis watershed, Northcliff Resources Inc. estimates a net present value (NPV) of $714 M (before tax) and $418 M after-tax – this is after paying for all costs (which includes capital, operating, and clean-up/site secure). They project this value over an expected 27 years of operation. Using these figures, Northcliff calculates an internal rate of return (IRR) of 20.4% (pre-tax) and 16.3% (post-tax), both of which exceed the assumed discount rate of 8%. **In other words, this is more profitable than their next best investment.** The discount rate might be thought of as an outside alternative investment for the money used to purchase the capital. (*Aside:* The lower the discount rate, the higher the NPV as future revenues are counted more closely equal to current expenses. While this makes mega-projects more desirable, it also means that future environmental damage and other costs weigh more equally in the equation. As it stands, Northcliff has not seemed to put much weight on environmental and social costs.) Finally, the payback time is estimated to be 4.1 years (4.5 post-tax); Northcliff is stating that for the remaining 22.9 years (22.5 post-tax) of the expected mine's life, the initial investment and past and future operating costs have been paid off and they are making money.

The above is the business case Northcliff Resources has filed. I would cautiously suggest that the business case is reasonably solid. That said, in seeking investors a company will necessarily attempt to put an optimistic spin on the figures. The worry with a project like this is that there is potential for

serious environmental, and to a lesser degree social, impact. If production results are less than expected, if ore prices fall, or if operating costs increase, then in order to meet investor agreements shortfalls must somehow be accounted for. It often seems to be the case that these shortfalls are made up by cost-cutting those factors of production that have little voice in operations – local workers might be replaced by temporary foreign workers, and cuts to environmental maintenance and/or remediation efforts are "easy" as the "environment" (a resource owned by us all) does not have a seat at the negotiating table.

I now turn to specific issues that I think need greater exploration. In section three, I identify some discrepancies in the document that stood out upon an initial reading. I then turn to some of the economic assumptions made in the document with the hope that we might seek greater clarification. Finally, I present additional considerations that I think may affect the social and environmental impact of this project and make some recommendations for further study and discussion. These are areas which I believe need addressing and deserve careful scrutiny in the environmental impact assessment.

3. Discrepancies in the Document

I had some difficulty in reconciling Tables 1.2 and 1.3. For instance in Table 1.2, $W0_3$ % is listed as 0.072 for the "Measured" while in Table 1.3 it is listed as 0.069 for the "Proven." Likewise in Table 1.2, $W0_3$ % is listed as 0.067 for the "Measured+Indicated" while in Table 1.3 it is listed as 0.066 for the "Total." Perhaps this is due to difference in the meanings of the two tables, but it seems odd that other percentages align themselves exactly. Similarly, why is a net smelter return cut-off grade of $US9/t used in Table 1.2 yet it is $8.83/t in Table 1.3? Is this just a different exchange rate (i.e., $1 CDN = $1.0193 US) or perhaps rounding? I note that electricity prices are estimated at $0.065/kWh on page 22 but are $0.066/kWh on page 227. Mineral prices assumptions are listed for WO_3 in some places (pp. 24, 271) but it is clearly stated that the price for APT is actually what is meant (pp. 249-251). **While none of these discrepancies are likely important on their own, it suggests some carelessness and may play a role in sensitivity analysis.**

4. Economic Assumptions

On page 262 of the submitted NI, Northcliff lists a series of *General Risk Factors* and follows with the statement, "No allowance has been made in the capital cost for any of the potential risk items discussed" (p. 263). Where possible, I will link my comments below to specific risk factors (RF) as identified by Northcliff (these will be highlighted by the use of italics).

4.1 Labour and Capital Costs

Labour and capital costs are, insofar as I can judge, reasonable. I note that the capital cost of $579M has a contingency allowance of approximately 15% (p. 33) which suggests that Northcliff is preparing for cost overruns. Indeed, New Brunswick has very recently seen a very significant cost overrun in the Point Lepreau Nuclear Power Station retro-fit – well in excess of 15%. It is unlikely that such a significant cost overrun will occur in the development of a new open pit mine but cost overruns are quite possible. Sources of potential cost overruns in the near future include increasing fuel prices (as a general trend that will increase when some form of carbon pricing comes in – *RF: Global inflation*), higher than expected electricity costs (see below), the start-up of mega-projects such as an East-West bitumen pipeline or a new refinery which would increase both labour and capital costs (*RF: Escalation of local materials and labour*), and the potential for higher interest rates in the future (*RF: Global inflation*).

Likewise, with lower-than-national-average literacy, there may be a shortage of skilled labour in that part of New Brunswick (*RF: Shortage of skilled labour*). A tighter-than-normal market for physical capital may also play a role; this is the Irving influence on local construction equipment rental prices (*RF: Escalation of local materials and labour*).

I find the sentence, "No provision has been included in the capital cost to offset future escalation" (p. 259) to be worrying. I am not sure what they mean by "future escalation." Might this been an escalation of mining activities or could it be future increases in capital prices?

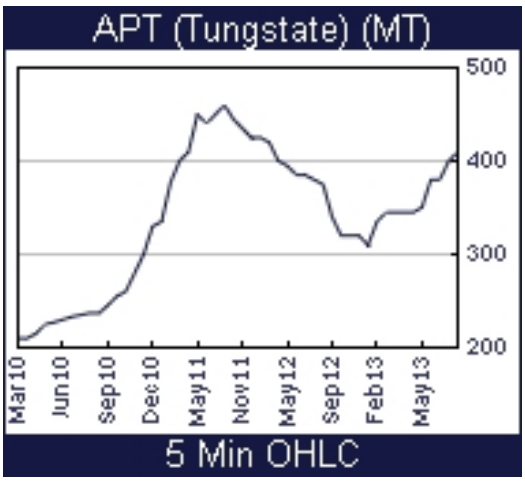
4.2 Electricity Prices

The Sisson Project will become a large industrial user of power according to NB Power. In consultation with an academic familiar with electricity pricing we found that under current rules, the mine could not operate as a small industrial user and expect to achieve average electricity rates of $0.066/kWh. As a large industrial user, the average price would be $0.064/kWh in year 1 assuming the new load incentive rate is applied. Without the incentive rate, the average price would be $0.0711/kWh. Assuming the rate book rules are followed, the price would start at $0.064/kWh in year 1 and rise to the higher price in year 6. Moreover, given the very significant cost overruns and time delays associated with the Lepreau retro-fit and the likely shift of generating facilities in New Brunswick toward higher-cost renewable energy generation, these electricity charges may in fact increase (*RF: Escalation of local materials (energy prices?) and labour*). Any increase in electricity rates will affect the operating costs of the mine and lower the NPV presented in the submitted NI document.

4.3 Mineral Prices

Core to the economic analysis of the project are the minerals themselves – molybdenum (Mo forecast to be $US15/lb) and tungsten ($WO_3$ and its upgraded product APT forecast to be $US350/mtu). Of the two, tungsten is expected to be found in greater quantity at this site.

As noted earlier, there is some confusion in the submitted NI document over whether it is WO_3 or APT prices used. This confusion seems to exist in the market too with WO_3 and APT used somewhat interchangeably. However, it is eventually made clear that Northcliff means APT prices. While the current price (14 August 2013) of $430 is above the $350 used in the analysis, historical prices have not always been this close (see http://www.northernminer.com/investing/metalcharts.aspx). Nominal prices exceeded $350 from early-2011 until the summer of 2012. It dipped below $350 until early-spring of 2013. However, prior to 2011, prices were significantly lower than $350. Chinese tungsten production accounted for nearly 85% of worldwide amounts in 2012 (http://minerals.usgs.gov/minerals/pubs/mcs/2013/mcs2013.pdf) and for nearly 60% of reserves. China is also the largest tungsten consumer. The Chinese government seems to use its market power to shift prices in its favour. It should be noted that the ramp-up of production at the Mactung mine in the Yukon and the Sisson Brook facilities might put downward pressure on APT prices (*RF: Commodity price volatility*).



(*Source:* http://www.northernminer.com/investing/metalcharts.aspx accessed 19 August 2013)

The current price of Mo is $9.34 (16 August 2013, http://www.infomine.com/investment/metal-prices/molybdenum-oxide/5-year/). This is well-below the low range (-25% or $11.25) of Mo prices used in the sensitivity analysis. While the price used to be over $40 in 2005, prices in the last year have not exceeded $14.29 and have been trending lower (*RF: Commodity price volatility*). While molybdenum production is concentrated in China (42% in 2012 along with a 39% share of reserves – http://minerals.usgs.gov/minerals/pubs/mcs/2013/mcs2013.pdf), the market is fairly competitive. The addition of production from the Sisson Brook project will not likely affect prices.

(*Source:* http://www.infomine.com/investment/metal-prices/molybdenum-oxide/5-year/ accessed 19 August 2013)

Mineral prices are posted in US dollars. Assuming a constant mineral price, an appreciation of the Canadian dollar against the US dollar will necessarily decrease revenues. Capital imported from the US will become cheaper with an appreciation of the Canadian dollar, but ongoing capital costs are significantly lower than revenues from mineral production so profits would be negatively affected.

While there are a number of factors affecting the exchange rate between the Canadian and US dollars, there is also a fairly strong link between the price of a barrel of oil and the strength of the Canadian dollar. This is not surprising given Canada's resource production, especially oil, and our export of energy products to the United States. Northcliff's assumption of a depreciating Canadian dollar (Table 22.3, p. 271) in the face of ever-increasing oil prices is questionable (*RF: Global inflation*, *RF: Currency exchange rate swings*). We continue to go through a protracted worldwide recession which started with the financial crisis of 2008 and there is continued uncertainty in global recovery, yet, with the exception of an initial price drop, the price of a barrel of oil has steadily risen. Continuing in this vein, the slow and very uncertain economic recovery from the 2008 financial crisis would cause one to wonder if the prediction of strong mineral demands will continue into the future (*RF: Commodity price volatility*).

4.4 Environmental Costs

An open pit mine in a relatively undisturbed watershed will have environmental impact. These environmental impacts have very real associated costs. It may be the case that society as a whole bears these costs, but this does not diminish their impact and their importance in assessing the project. I find it disconcerting that in a 300+ page document, there are only 4 pages associated with environmental impacts and associated costs. It is clear that Northcliff is worried about the potential effects on fish and fish habitat and damage from acid-generating rock and metal leaching (p. 254). In some cases, acid generation is expected to continue for several decades – well beyond the life of the mine (p. 254).

Tracking environmental expenses in the NI is, to say the least, difficult. For instance, a category of "Environmental Monitoring" is included as part of Owner Cost in the Capital Costs estimates (mine start-up costs). Trying to track costs for the "TSF & Environmental" from table 21.1 (p. 258) to Table 21.2 (p. 252) is extremely difficult. Likewise, the statement that, "Environmental facilities contractor indirects … are estimated to be 8% of the direct costs" (p. 260) does not make it clear exactly how much is being spent on environmental monitoring and protection. I note too that in this section, reclamation bond funding has been specifically excluded (p. 259).

Ongoing environmental costs must be incurred for monitoring and water treatment – "[d]uring operations, any surplus water from the TSF and open pit will be discharged to the environment, treated if necessary …" (p. 255). These costs are not always clearly identified. For instance, Waste and Water Management Operating Costs seems to include mining as part of its costs (Table 2.16, p. 267) and costs for the Environmental staff (no mention of the number of staff or their responsibilities) is embedded within General and Administrative Costs (p. 268)

A financial security, estimated to be $50M at the time of mine closing, is to be created and used to close the mine and begin reclamation. As noted earlier, it is not clear how funding for this financial security is being accounted for (p. 259). **Moreover, while the security will be used for funding mine closure and reclamation, there is potential for very long-term costs for water treatment as waste and barren rock in the TSF and the pit walls have delayed acid-generating potential lasting several decades (p. 254).** In the submitted NI, Northcliff states, "… post-closure, any necessary treatment of surplus water discharged to the environment will be continued until water quality meets discharge standards" (p. 255). This could very well double the expected cost of the $50M financial security. For instance, using the costing data in Table 21.6 (p. 267) and assuming water treatment at the TSF and water-filled pit lasts as long as the life of the mine – not unreasonable given the acid-generating potential of several decades – this cost would be an additional $57.1M. More importantly, these costs will come at a time long after the mine has stopped generating revenues. At this point, owners and shareholders will have an

incentive to avoid costs or might use these costs as a method of profit reduction and tax avoidance in future projects.

4.5 Sensitivity Analysis

I was glad to see a sensitivity analysis included in the NI. Looking at Figures 22.3 and 22.4 (p. 278) we see that the project's business case is negatively affected by (in order of most sensitive to least sensitive):

- lower recoveries
- appreciation of the Canadian dollar relative to the US dollar
- lower tungsten (APT) prices
- higher operating costs
- higher capital (start-up) costs
- lower molybdenum (Mo) prices

It should be noted that the current price of Mo ($US9.34/lb) is 37.7% below the assumed price of $15, putting us off the edge of the graphs in the two figures. While I appreciate the inclusion of the sensitivity analysis, I note that the events are treated as independent. Tables 22.11 and 22.12 (p. 279) attempt to correct for this by examining co-movements in mineral pricing. Neither of these tables includes the current price of Mo as part of its range. Extrapolating from Table 22.12, and forecasting at current mineral prices (Mo=9.34 and APT=$430), the post-tax NPV is approximately $593M as compared to the base projection of $418M. However, when I looked at these prices on 9 May 2013 (Mo = $11.50 and APT=$355) the extrapolated post-tax NPV was $347M. Mineral price movements, especially in the price of APT, will have a significant effect on the viability of this project.

It is beyond the scope of this review to look for all possible correlations in key variables in this project, but it could be very important. Consider the following scenario. Current fuel price trends along with the possibility of carbon pricing suggest higher fuel prices in the future. At the same time the increase in fuel prices has kept the Canadian dollar strong relative to its US counterpart. The ongoing fuel price increase has occurred despite global economic uncertainty and a very slow and tenuous recovery. This recovery has largely been fueled through monetary stimulus and historically low interest rates during which consumer and government debt has risen considerably. Eventually interest rates will rise if for no other reason than to rationalize debt holdings and to curb inflation stemming from fuel price increases. Rising fuel costs also contribute to slow growth in aggregate demand, depressing demand for minerals. In this pessimistic (but not unrealistic) scenario higher fuels prices and increasing interest rates will decrease NPV as will the appreciation of the Canadian dollar and lower mineral prices. None of these effects have to be large on their own, but the combined effect would negatively affect the business case for the project. [To see that this is a possibility, see the *Telegraph Journal*'s Business section from 9 July 2013 (included)].

5. Additional Considerations/Recommendations

5.1 Labour

While not included in this NI submission, mega-projects like these are often locally marketed based on perceived social benefits. Typically this means mentioning jobs created, income tax paid, and corporate/mineral taxes gathered. Here I will focus on the creation of jobs.

Project proponents often count all jobs at the project as new jobs. This is incorrect if the so-called new jobs simple shift employed individuals from one job to another. A Target store opening where a Zellers used to be creates no new employment or income if all the old Zellers workers are hired by Target and paid their old wages. Given New Brunswick's high unemployment rate, it is not likely the case for this project. That said, if the proponents fail to train or otherwise improve skillsets and employ New Brunswick residents then the local gains are significantly diminished. Recently we have seen a number of news reports on the (ab)use of the Temporary Foreign Workers (TFW) program. The first reported case was the hiring of Chinese miners for a B.C. mining project. Inasmuch as possible, Northcliff should be required to invest in local labour training, especially in identified chronically unemployed groups. Likewise, the company should be required to limit or perhaps even eliminate access to the TFW for this project.

5.2 Toxicity and Health Effects

I note that there is research suggesting molybdenum dust is toxic (see footnotes 66, 79, and 80 at http://en.wikipedia.org/wiki/Molybdenum). This issue should be addressed, not only for on-site workers, but also for residents near the mine. Similarly, the effects of molybdenum mining on local wildlife should be mitigated. Tungsten might be an irritant (http://www.clean.cise.columbia.edu/msds/tungsten.pdf) but toxicological effects seem to be rare. It seems that tungsten decreases bacteria in soil and can enter the food chain. I would recommend additional research on this topic and study of this process (see Strigul et al., 2005).

5.3 Environmental Issues

I think it is important to once again comment upon the brevity of environmental management plans listed in the NI document – the entire 300+ page document contains about 4 pages devoted to environmental issues. Society has come to realize that business activity often has environmental (and social) impact. This does not mean that business activity has to cease but it is important to account for these impacts. While I realize that Northcliff will be submitting a full environmental impact assessment, the minimal information contained in the NI and the difficulty of tracing the accounting for environmental expenses is cause for worry.

For instance, consider the financial security held to pay for reclamation and mine closure. It is estimated to be $50M, but does not seem to be accounted for in the financial analysis (p.259). As noted earlier, the cost of reclamation and closure could quite easily double once post-closure water monitoring and treatment is factored in. Indeed, according to Diamond (2005), "The actual and indirect costs of cleanup and restoration have typically proved to be 1.5 to 2 times mining industry walkaway estimates for mines without acid drainage, and *10 times those estimates for mines with acid drainage*" (italics added; p.455). This raises a number of questions regarding the security. How will it be funded? Will Northcliff be required to set aside funding at the beginning of the project? Will the necessary funds be subject to market forces (i.e., swings in stock valuation)? Will these funds be accessible to the proponent in the way that pension plans can sometimes be skimmed? It is often the case that security bonds of these types go underfunded and at the time of closure, reclamation and/or decommissioning is scaled back. I would like to see greater detail on the valuation of the closure and reclamation security and on its funding and management in a future document.

Over the last 100 years, tailings dams failure rates are "more than two orders of magnitude higher than the failure rate of conventional water retention dams" (Azam and Li, 2010: p.50). This may be because a TSF represents a cost to a mining company rather than an asset to a community in the case of a water retention dam. "Unusual rain" is often identified as a cause in these failures (Azam and Li, 2010: p.51). In this regard, it would be useful to note in the NI how the average climactic change was calculated and over what time-period (pp.241-242). Has the proponent tested for a moving average? When failures occur (see for example, a large number of cases reported in peer-reviewed and other sources at http://www.infomine.com/conferences/online/tailingsdamfailures/ and at http://www.wise-uranium.org/mdaf.html) some companies go bankrupt and even transfer assets to corporations owned by the same individuals (see Diamond, 2005, pp. 455-457). In some instances, of tailings storage facility failures and subsequent bankruptcy, "cleanup costs have proved to be up to 100 times the mining company estimates" (p.457).[6] This is especially of concern as the only mining project in which Northcliff Resources Ltd. is involved is Sisson Brook – a major environmental incident or a collapse of either tungsten or molybdenum prices could quite easily drive the company to bankruptcy.

Azam and Li further note that the majority of failures have occurred in TSF of the upstream variety up to 30m high (2005: p.53). While the modified centerline construction identified by the proponent is an improvement (p.253), it seems that "high density tailings" or "high density thickened tailings (HDTT) storage" might mitigate much of the risk associated with leakage from a traditional TSF (Fourie, 2009; also http:// www.tailings.info/disposal/thickened.htm). Consequently, the New Brunswick government might want to explore the use of a financial surety, distinct from the financial security for reclamation and closure, to guard against catastrophic environmental failure and/or bankruptcy-before-expected-closure given the proponent's limited explanation of the funding of the financial security for reclamation and closure (as a start, see Miller, 1998, http://www.abandoned-mines.org/pdfs/PolicyFrameworkCanforMinClosureandMgmtLiabilities.pdf, and more generally http://www.abandoned-mines.org/publications-e.htm for discussion).

It is beyond the scope of this review to suggest the size of this financial surety. However, it might make sense to make the size and funding of this surety contingent upon the proponent's tailings storage mechanism. Ideally a formula could be constructed to take into account the probability and potential impact of failure. Then a company could compare the costs of various environmental protection strategies of both mining and tailings storage to the cost of surety funding. Such a surety in the case of HDDT storage would likely be cheaper than if an upstream TSF was used, the storage and surety decision would ultimately be at the proponent's discretion based upon its perceived costs.

5.4 Sensitivity Analysis

Mineral pricing data is expensive as are research costs. As it is in Northcliff's and its prospective investors' best interest, I recommend that a more robust sensitivity analysis be completed that considers correlated movements in key variables.

[6] While the concept of declaring bankruptcy following a disaster seems distasteful if not dishonest, it is an issue currently under scrutiny. Following the Lac-Mégantic rail disaster of July 2013, Montreal, Maine & Atlantic Railway filed for bankruptcy in Maine and Québec.

6. Conclusion

I have conducted an expanded economic analysis of the NI submission for the Sisson Brook Project submitted by Northcliff. It is generally in the company's interest to submit a truthful but also an optimistic document so as to encourage investment without willfully misguiding investors. My ability to analyze claims is limited as much of the data is industry-specific and provided by the company. I cautiously suggest that the business case is reasonably solid but I would like to see a more robust sensitivity analysis. As an economist, I worry about social benefits through job creation and environmental and health effects. I would like to see a plan developed that enhances skills of New Brunswick labour and limits or eliminates access to the temporary foreign worker program. I would also like to see how Northcliff intends to deal with the potential effects of molybdenum dust and a study of the potential environmental effects of tungsten. Finally, the company should be required to file carefully valued financial security plans for both site closure and reclamation and in the event of a catastrophic event.

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8. Biography of Reviewer

Rob Moir

B. Arts&Sci (Hons. Economics), McMaster; MA (Economics), Queen's; PhD (Economics), McMaster.

Associate Professor of Economics, UNB Saint John (initial appointment, January 1996) and Chair of Social Sciences.

Appendix F – Article from Vancouver Sun, September 6, 2013

Government experts raised red flags on proposal to build mine: summary of concerns

(Available at: http://www.vancouversun.com/business/2035/Government+experts+raised+flags+proposal+build+mine+summary+concerns/8880799/story.html.)

The following is a summary of the concerns raised by federal and provincial government experts during the Canadian Environmental Assessment Agency review of Taseko Mines' New Prosperity Mine proposal.

1. Deteriorating Fish Lake Water Quality & Unproven "Aquarium" Lake Recirculation

Environment Canada

"The Proponent's modelling suggests water quality in Fish Lake may be marginal for the protection of aquatic life." (EC Panel Submission, July 25, 2013, CEAR #738, p. 10).

"There are few, if any, examples of lake recirculation at the scale proposed by the Proponent" (EC Panel Submission, July 25, 2013, CEAR #738, p. 11).

"Environment Canada is concerned that the recirculation mitigation measure proposed to manage water quality and the biological productivity of Fish Lake is unproven at this scale … the high level of uncertainty regarding the Proponent's recirculation scheme is a particular concern given the stated goal of preserving Fish Lake." (EC Panel Submission, July 25, 2013, CEAR #738, p. 12).

Natural Resources Canada

"The Proponent has estimated from the base of the TSF [Tailings Storage Facility] during the post-closure period at 760 m3/day. NRCan considers this value to be unrealistically low for a 12 km3 impoundment … NRCan estimated seepage through the base of the TSF to be approximately 8250 m3/day or 11 times the value estimated by the proponent". (NRCan Panel Submission, July 4, 2013, CEAR #587, p. 27, confirmed in NRCan's closing remarks, CEAR #1123, August 21, 2013).

Department of Fisheries and Oceans

"The Proponent's mitigation and adaptive management plan to preserve the functioning of Fish Lake using a recirculated closed system uses unprecedented and untested technology … DFO is

not aware of any examples of wilderness lakes or watersheds that have been subject to a recirculation program." (DFO Panel Submission, July 23, 2013, p. 14, CEAR #691).

"The New Prosperity Mine configuration was modified by from the original plan to prevent the immediate destruction of Fish Lake to create a tailings pond. In the New Prosperity Mine configuration, the Fish Lake watershed could be extensively altered, requiring intensive engineering efforts to maintain flows and lake levels. While Fish Lake itself would not be directly destroyed, as noted by the Proponent in the 2012 EIS, the lake is predicted to experience eutrophication and contamination with development of the mine." (Supplemental DFO Panel Submission, August 4, 2013, CEAR #886, p. 15).

Ministry of Energy and Mines

"MEM believes that in the context of preserving Fish Lake and its tributaries there remain uncertainties around the ability to limit and collect the expected volumes of seepage from the TSF, and the ability to effectively treat water to maintain water quality in Fish Lake and its tributaries. This leads MEM to conclude that, as detailed in the EIS and supporting documents, the ability to prevent adverse effects to Fish Lake and its tributaries from a water quality perspective is uncertain." (MEM Panel Submission, August 6, 2013, CEAR #873, p. 3).

"Taseko has proposed relying on adaptive management including water treatment to mitigate adverse effects to Fish Lake water quality and to conclude no significant adverse effects to Fish Lake. Since the effectiveness of the proposed treatment processes to decrease metal concentrations to the design specifications has not been fully provided, MEM believes that Taseko's conclusion of their ability to prevent adverse effects to Fish Lake is also uncertain." (MEM Panel Submission, August 6, 2013, CEAR #873, p. 2).

"Recirculation of Fish Lake flows in an effort to preserve the ecological values of Fish Lake and its tributaries is a very significant commitment. Fresh water diversion and flow augmentation through pumping and piping are sometimes applied at BC minesites, however not typically at this scale or for this length of time." (MEM Panel Submission, July 19, 2013, CEAR #655, p. 16).

"The predicted average model results indicate BC fresh water aquatic life water quality guidelines will be exceeded in Fish Lake, Upper Fish Creek, and Tributary 1 for aluminum, cadmium, iron, lithium, selenium, silver and thallium. Predicted average pit lake concentrations also exceed guidelines for antimony, arsenic, cobalt, mercury and zinc." (MEM Panel Submission, July 19, 2013, CEAR #655, p. 20).

"MEM notes that the proposed membrane water treatment, sulphide reduction, and ion exchange water treatment technologies are not widely used in mining applications, and none are currently in use at British Columbia minesites. The information provided on water treatment in the supplemental response provides very high level concepts but does not provide design level information that demonstrates that target objectives can be met. Water treatment is a primary mitigation strategy for this project and it should be demonstrated to be feasible at the EA phase, especially since it is key to conclusions on project related effects." (MEM Comment on

Adequacy of June 5, 2013 Supplemental Information, Submitted June 14, 2013, CEAR #541, p. 2).

"Seepage from the TSF is a very significant management issue for the Prosperity project, given the directive to protect the integrity of Fish Lake. There is large uncertainty regarding the spatial extent and hydraulic conductivity of the TSF till foundation materials and the current assumptions of its effectiveness to limit seepage have not been justified are considered potentially not conservative. Sensitivity analyses show that significantly higher seepage rates than used in the water quality loading models could occur." (MEM Panel Submission, July 19, 2013, CEAR #655, pp 14-15).

Ministry of Environment (Forests, Lands and Natural Resource Operations)

"Concerns have been raised … over the possibility of deteriorating water quality in the Fish Lake system. This could result in the loss or reduction of the productive capacity of the lake and unsuitable water quality for other uses including wildlife habitat use. These concerns stem from the high degree of uncertainty surrounding the capability and feasibility of the water quality mitigation measures (i.e. mixed levels of success for treatment and the lack of previous experience combining treatments on a lake) to treat water so as to avert irreversible impacts to water quality and aquatic life. Should such a scenario play out, there is a substantially greater risk of irreversibly damage to the Fish Lake ecosystem and the wildlife use of the system either directly by exposure to algal bloom toxins or indirectly by avoidance of the area due to poor water quality." (BC Environmental Assessment Office Panel Submission, July 19, 2013, p. 16/56 of PDF, CEAR 654).

2. Long-term Liabilities to Taxpayers & Questionable Economics of the Project

Ministry of Energy and Mines

"While detailed costing is reviewed at the Mines Act permitting stage when setting the financial security requirements, the full costs of treatment should be fully evaluated by the Proponent at the EA stage as it has the potential to affect the economics of a project. MEM expects that the amount of financial security that could be required to fund this scale of long-term liability would be very high and are likely unprecedented in the province." (MEM Panel Submission, July 30, 2013, CEAR #787, p. 5).

"In addition to the requirements for Fish Lake water treatment, the open pit lake may require water treatment before spilling at Year 48. The potential additional treatment requirements and costs associated with it have not been scoped in the EA or in these review comments." (MEM Panel Submission, July 30, 2013, CEAR #787, p. 5).

"An assessment of the potential effects to predicted water quality in Fish Lake, Fish Lake Tributaries, and the pit lake are documented in the Impact Assessment starting on pages 761, 764, and 769, respectively. The summary water quality effects assessment for Fish Lake, Fish Lake tributaries, adjacent streams and rivers and adjacent lakes all conclude that water quality

conditions could become significantly adverse (pages 793-796) if left unmitigated." (MEM Panel Submission, July 19, 2013, CEAR #655, p. 21).

"MEM concludes it is reasonable to assume that TSF water will need to be relayed to the open pit in the long term and Fish Lake may require re-circulation for at least 100 years, and perhaps in-perpetuity." (MEM Panel Submission, July 19, 2013, CEAR #655, p. 21).

"Based on preliminary cost information submitted for project configuration T2 (IR#4a), it appears that the costs for water treatment and for some aspects of water management, may not have been fully factored into the project. Water treatment is a significant undertaking, and the current proposed water treatment systems are known to be very expensive. The proponent should consider the full costs of these environmental protection requirements, as they have the potential to significantly affect the economics of the project." (MEM Panel Submission, July 19, 2013, CEAR #655, p. 27).

3. Risks to Taseko River & Other Nearby Lakes

Environment Canada

"Environment Canada is concerned that the Proponent may have underestimated the potential impacts of the Project on water quality in Wasp Lake, Little Onion Lake and Big Onion Lake. Given that these lakes drain to the Taseko River, Environment Canada is also concerned that the Proponent may have underestimated impacts on water quality in the Taseko River." (EC Panel Submission, July 25, 2013, p. 19, CEAR #738).

Department of Fisheries and Oceans

"Natural Resources Canada recently expressed concern that Taseko's seepage rate estimates for the TSF [Tailings Storage Facility] may be 11 times higher than those modelled in the EIS [Environmental Impact Statement] … as a result, groundwater seepage estimates that were modelled in the EIS may be underestimated. If actual baseline groundwater seepage contributions into Taseko River are significantly higher than those modelled, then development of the Project could result in impacts to Taseko River that have not been considered by the Proponent." (DFO Panel Submission, July 23, 2013, p. 13, CEAR #691).

B.C. Ministry of Environment

"There are concerns regarding the modelling of groundwater movement and the lack of on-site monitoring wells. Furthermore the mitigation method of recycling the water back from intercepting wells downslope may not be effective because the pathways for groundwater movement are not completely understood. There exists the potential for the movement of contaminated groundwater from the mine site into other surrounding watersheds downslope including the Taseko River" (BC Environmental Assessment Office Panel Submission, page 7/56 of PDF, CEAR 654).

"Water from the seepage ponds are to be discharged to Big Onion Lake and Wasp Lake. These lakes are expected to see deteriorating water quality. Creeks leading from these lakes go to Beece Creek and Taseko River, highly valuable fish streams. Pit Water is expected to be discharged to Fish Creek long after the mining is completed. This water will receive little dilution in Fish Creek before it enters Taseko River" (BC Environmental Assessment Office Panel Submission, page 35/56 of PDF, CEAR 654).

*NOTE: This document does not try to provide a comprehensive list of comments on impacts to Tsilhqot'in culture, rights and use.

Read more:
http://www.vancouversun.com/business/2035/Government+experts+raised+flags+proposal+build+mine+summary+concerns/8880799/story.html#ixzz2hjpkxf1q