Crown-Indigenous Relations and Northern Affairs Canada
Relations Couronne-Autochtones et Affaires du Nord Canada

Water Resources Division
Nunavut Regional Office
Iqaluit, NU X0A 0H0

Your file - Votre référence
2AM-MRY1325

November 23, 2018

Our file - Notre référence
CIDM#1231950

Mr. Richard Dwyer
Manager of Licensing
Nunavut Water Board
Gjoa Haven, NU X0B 1J0

Sent via email: licensing@nwb-oen.ca

Re: Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) Information Requests to Baffinland Iron Mines Corporation (BIMC) for the Phase 2 Amendment of the Mary River Project under Type "A" Water Licence No. 2AM-MRY1325 Amendment No. 1

Dear Mr. Dwyer,

Thank you for the invitation received on October 12, 2018 to interested parties to submit Information Requests to the proponent as part of a completeness review of the application for Phase 2 of the Mary River Project (the Application), which requires an amendment to the Type "A" Water Licence No. 2AM-MRY1325 Amendment No. 1.

CIRNAC reviewed the Application and provided Information Requests pursuant to its mandated responsibilities from the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Department of Indian Affairs and Northern Development Act*.

Phase 2 of the Mary River Project is being assessed through a coordinated Environmental Assessment (EA) and regulatory licencing process administered by the Nunavut Impact Review Board (NIRB) and Nunavut Water Board (NWB), respectively. Section 1 of this submission summarizes a set of Information Requests (IRs) for submission unique to the Nunavut Water Board and includes a total of six (6) IRs in the following subject areas:

- CIRNAC IR #1: Incremental Mining Activities Associated with Increased Production Rate
- CIRNAC IR #2: Waste Rock Management
- CIRNAC IR #3: Closure Planning
- CIRNAC IR #4: Borrow Material and Rock Cut Characterization
- CIRNAC IR #5: Updates to Management Plans
- CIRNAC IR #6: Surface Water Monitoring

CIRNAC is also providing Information Requests to the NIRB as part of the EA process,

some of which are also relevant for the NWB submission. These IRs are submitted as Section 2 of this submission and are in the following subject areas:

- CIRNAC IR #7 – 11: Groundwater and Surface Waters (NIRB IRs #8 – 12)
- CIRNAC IR #12 – 14: Landforms, Soils, and Permafrost (NIRB IRs #13 – 15)
- CIRNAC IR #15 – 16: Waste Management (NIRB IRs #16 – 17)

CIRNAC Water Resource Division understands that the information requested through the EA process will be available in BIMC's submission to the NIRB. Even though this submission will be reviewed by CIRNAC's Impact Assessment Division CIRNAC requests that BIMC also provide this submission to the NWB so it is available on the NWB Public Registry.

As indicated in the following IRs, CIRNAC considers the information provided to be insufficient. CIRNAC considers the Acid Rock drainage/Metal Leachate (ARD/ML) and closure issues to be of critical importance to the environmental management of the project. However, BIMC has indicated that the updated Waste Rock Management Plan and Interim Closure and Reclamation Plan (ICRP) will not be submitted for review until 60 days after licence issuance. This represents an important gap during the current licensing process for Phase 2 and will affect our ability to assess the potential environmental impacts, mitigations and long-term liabilities associated with the amendment.

To mitigate this issue, CIRNAC recommends to the NWB that the management plans be updated and reviewed before the water licence amendment is approved and Phase 2 implemented. Doing so would provide CIRNAC with a higher degree of confidence that the overall environmental management strategy for the site is appropriate.

If you have any questions or require further information with respect to this matter, please contact me at (867) 975-4282 or email bridget.campbell@canada.ca.

Regards,

Bridget Campbell
Water Resources Coordinator, Nunavut Regional Office

INFORMATION REQUESTS

Section 1: Information requests Specific to the NWB

Information Request Number	**CIRNAC IR#: 1**
To	The Proponent - Baffinland Iron Mines Corporation
Subject	Incremental Mining Activities Associated with Increased Production Rate
Reference(s)	Mary River Project – Phase 2 Proposal: Application to Amend Type A Water Licence 2AM-MRY1325 (Knight Piésold, 2018)
Issue/Concern	In 2012, NIRB issued Project Certificate No. 005 which provided approval for Baffinland to mine 18 million tonnes per annum (Mtpa) of iron ore to be shipped south by rail to Steensby Port. The Project Certificate was subsequently amended to allow the maximum production and shipment of 4.2 Mtpa of ore to the north by tote road to Milne Port during the Early Revenue Phase (ERP). BIMC was recently approved to mine and transport up to 6.0 Mtpa to the north by tote road. The Phase 2 proposal involves increasing the ore production and shipment rate further to a total of 12 Mtpa to the north by rail to Milne Port, thereby ending the ERP and permitting a total production rate of 30 Mtpa: 12 Mtpa shipped north by rail to Milne Port and 18 Mtpa shipped south by rail to Steensby Port. The amendment application identifies the need to construct and operate new facilities to support the increased mine production rate. This includes new transportation infrastructure, ore storage capacity, camp facilities, etc. However, based on our review to date, the application does not explicitly describe the incremental mining activities that will be required to achieve the increased ore production rate. To illustrate, Table 1.1 of the application does not describe the increased rate of blasting, handling and trucking of ore that will occur within the production areas. Similarly, while the application indicates that "*The production of waste rock will be accelerated with the development of Phase 2*", we have not seen details describing the accelerated waste rock production rate. Without this information, we are unable to confirm the full scope of the application and, by extension, are unable to confirm whether the proposed environmental management processes are appropriate.

Information Request	CIRNAC recommends that the Proponent identify and describe the incremental mining activities that will be required to achieve the proposed increase in ore production rate from the Project.

Information Request Number	**CIRNAC IR#: 2**
To	The Proponent - Baffinland Iron Mines Corporation
Subject	Waste Rock Management
Reference(s)	Mary River Project – Phase 2 Proposal: Application to Amend Type A Water Licence 2AM-MRY1325 (Knight Piésold 2018) Phase I Waste Rock Management Plan (BIMC, 2014) Life of Mine Waste Rock Management Plan (BIMC, 2014)
Issue/Concern	Since mid-2017, Baffinland has identified water quality issues associated with the waste rock facility (WRF). These issues are reportedly being addressed as part of current operations under the conditions of the Licence, including the implementation of an Interim Waste Rock Management Plan over the short-term. Further, a revised Phase 1 Waste Rock Management Plan is under development. The revised Phase 1 Waste Rock Management Plan will reportedly address both the water quality issues addressed by the Interim Waste Rock Management Plan and the higher production rate associated with the Phase 2 Proposal. Based on the above, waste rock characterization and Acid Rock Drainage (ARD) predictions conducted in support of Phase 1 were inadequate. To ensure subsequent waste rock management processes avoid similar issues, the revised Phase 1 Waste Rock Management Plan (which also applies to Phase 2) will need to include significant modifications to the waste rock management strategy for the site. However, the plan is not yet available for review. As a consequence, CIRNAC lacks the information needed to comment on the adequacy of the waste rock management approach for Phase 2.
Information Request	CIRNAC recommends that the revised Waste Rock Management Plan undergo a comprehensive review and approval process prior to approving the licence and initiating any Phase 2 waste rock production.

Information Request Number	**CIRNAC IR#: 3**
To	The Proponent - Baffinland Iron Mines Corporation
Subject	Closure Planning
Reference(s)	Mary River Project – Phase 2 Proposal: Application to Amend Type A Water Licence 2AM-MRY1325 (Knight Piésold 2018) Interim Closure and Reclamation Plan (BIMC 2016)
Issue/Concern	In many respects, potential impacts associated with the operational phase are well understood, are of limited duration and/or are readily mitigated through active interventions. In contrast, uncertainties regarding the post-closure performance of a site can result in unintended and difficult to mitigate impacts. While we appreciate that closure is not scheduled to begin until 2036, the Interim Closure and Reclamation Plan (ICRP) is needed also for reasons such as temporary project shut down, and so it is critical that closure concepts be fully integrated into the mine planning and development processes that are ongoing. On this basis, there is a need to focus on potential concerns related to the post-closure phase of a proposed undertaking. This usually involves a comprehensive review of the proposed Closure and Reclamation Plan for the site. However, in the current case, the revised ICRP will not be submitted for review until 60 days following approval of the requested water licence amendment. As a consequence, CIRNAC is currently unable to confirm the adequacy of the ICRP to address the incremental infrastructure and activities associated with Phase 2. Further, in the absence of the ICRP, CIRNAC is unable to develop an accurate closure cost estimate.
Information Request	CIRNAC recommends that the revised ICRP be provided for review during the current water licence amendment process. The revised ICRP should propose a well-supported method of permanently reclaiming the pit and data to back up the decision. If this is not feasible, BIMC should provide a summary of all anticipated changes to the ICRP that will be required to address the incremental infrastructure and activities associated with Phase 2.

Information Request Number	**CIRNAC IR#: 4**
To	The Proponent - Baffinland Iron Mines Corporation
Subject	Borrow Material and Rock Cut Characterization
Reference(s)	Mary River Project – Phase 2 Proposal: Application to Amend Type A Water Licence 2AM-MRY1325 (Knight Piésold 2018) Quarry Geochemical Evaluation (Hatch 2017) Borrow Pits and Quarry Management Plan (BIMC 2014)
Issue/Concern	Table 2.2 of the Project Proposal presents a summary of approved and proposed quarries that are required to support the Project. The cumulative volume of rock to be quarried is 6.6 Mm^3 from a footprint of approximately 510 hectares. In addition to quarry development, the proposed amendment will involve cut/fill operations to construct key infrastructure components (e.g., the new railway to the Milne Port). Rock excavated from quarries and cuts will be exposed to physical and chemical weathering. Depending on the geochemical characteristics of the rock and environmental conditions, there is a potential that some rock types will generate Acid Rock Drainage and/or Metal Leaching (ARD/ML). Given the large volumes of rock and the potential for environmental impacts, the geochemical properties of quarry sources and rock cut/fill should be adequately characterized prior to development. Supporting documentation for the Phase 2 application includes a Quarry Geochemical Evaluation (Hatch 2017). That document concluded that: a) the excavated rock is unlikely to be a source of ARD/ML; b) and no further geochemical testing was required. However, we note that the assessment was based on screening level static geochemical assessments conducted on only three samples. The level of effort used to characterize the geochemical properties of rock excavations appears to be inconsistent with magnitude of the rock excavations. Specifically, static geochemical testing of only three samples is likely insufficient to adequately characterize the ARD/ML potential from more than 6.6 Mm^3 of rock excavation throughout a corridor that spans approximately 110 km.
Information Request	Given the potential environmental risks associated with ARD/ML from quarried rock and cut/fill excavations, CIRNAC recommends

	that BIMC present an in-depth description justifying their conclusion that additional geochemical characterization is not warranted.

Information Request Number	**CIRNAC IR#: 5**
To	The Proponent - Baffinland Iron Mines Corporation
Subject	Plan Updates
Reference(s)	Mary River Project – Phase 2 Proposal: Application to Amend Type A (Knight Piésold 2018) Emergency Response Plan (BAF-PH1-840-P16-0002, February 2016) Spill Contingency Plan (BAF-PH1-830-P16-0036, March 2016) Surface Water, Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026, March 2016) Freshwater Supply, Sewage, and Wastewater Management Plan (BAF-PH1-830-P16-0010, March 2016) Waste Management Plan (BAF-PH1-830-P16-0028, March 2016) Phase 1 Waste Rock Management Plan (BAF-PH1-830-P16-0029, April 2014) Hazardous Materials and Hazardous Waste Management Plan (BAF-PH1-830-P16-0011, March 2016) Borrow Pits and Quarry Management Plan (BAF-PH1-830-P16-0004, March 2014) Blasting Management Plan Environmental Protection Plan (BAF-PH1-830-P16-0008, April 2016) Quarry Management Plan QMR2 (BAF-PH1-830-P16-0040, January 2012)
Issue/Concern	Section 8.1 of the Application summarizes the status of the management plans required under the Type A Water Licence. According to the table, the following plans require updates for the Phase 2 Proposal: • Emergency Response Plan • Spill Contingency Plan • Surface Water, Aquatic Ecosystem Management Plan • Freshwater Supply, Sewage, and Wastewater Management Plan • Waste Management Plan

	• Phase 1 Waste Rock Management Plan • Hazardous Materials and Hazardous Waste Management Plan • Borrow Pits and Quarry Management Plan • Blasting Management Plan • Environmental Protection Plan • Quarry Management Plan QMR2 In addition, several new quarry sources have been proposed (32 based on Table 2.2) for which quarry-specific management plans will be prepared and submitted to the NWB prior to their development. BIMC also indicates that, although not prescribed by the current Licence, it will update the Snow Management Plan as it identifies measures to mitigate the release of sediment to watercourses from meltwater originating from snow piles. In Section 8 of the Application, BIMC indicates that it "will provide all of the updated management plans following the scheduled technical meeting, which should occur by February 28, 2018, and may provide interim updated management plans before February 28, 2018 as necessary to support the technical review. TSD 28 Management and Monitoring Plans provides a detailed description of the proposed edits to the management plans prescribed by both the Water Licence and by NIRB" (EIS preparation guidelines for Mary River Project). Other than the updated water management plans, which have been included as Attachment 10 of the Application, updated versions have not been included in the Application for any of the management plans listed above that should be supporting the technical review. In addition, TSD 28 outlining the anticipated changes has also not been provided with the Application. If the management plans contain relevant technical information that needs to change as a consequence of the Phase 2 Proposal then this information should be reviewed at the technical review stage and not following approval.
Information Request	Given any relevant technical information to the Phase 2 Proposal that may be contained in the various management plans, BIMC should provide updated versions of all of the affected management plans, or at least provide TSD 28 containing detailed descriptions of the proposed edits to the management plans prescribed by both the Water Licence and by NIRB" (EIS preparation guidelines for Mary River Project).

Information Request Number	**CIRNAC IR#: 6**
To	The Proponent - Baffinland Iron Mines Corporation
Subject	Surface Water Monitoring
Reference(s)	Mary River Project – Phase 2 Proposal: Application to Amend Type A (Knight Piésold 2018)
Issue/Concern	In Section 4.4 of the Application it is stated that larger stockpiles and rail loading/unloading facilities at both the Mine Site and Milne Port will necessitate additional water management facilities to be installed. Table 4.1 identifies the new infrastructure and associated Surveillance Network Program (SNP) stations and proposed changes for the Phase 2 Proposal. The table indicates that new SNP stations will be established for new features in new locations including Stormwater Monitoring Ponds No. 3 and 4 and Lump Ore Stockpile Perimeter Ditching East and West at Milne Port and Ore Staging Area Stormwater Pond along the Northern Transportation Corridor (at km 57). No maps or figures have been identified showing the locations of the proposed new SNP stations in relation to the new water management facilities and their relation to watercourses. It is also not clear if any changes would be needed to the other surface water/aquatic environment monitoring programs (i.e., AEMP and MDMER EEM) without understanding these programs. As such it is difficult to ascertain the effectiveness of the SNP and other monitoring programs in monitoring for environmental impacts from the mining activities. Given the environmental impacts that could potentially arise from the new stockpiles and rail facilities it is important to ensure that these facilities are effectively monitored through the SNP and aquatic monitoring programs.
Information Request	We request that BIMC provide additional information on the SNP and other aquatic monitoring programs and proposed changes to these stations including figures/maps describing monitoring stations in relation to new facilities and nearby watercourses.

Section 2: Information Requests also sent to the NIRB

IR Number:	**CIRNAC IR# 7: (submitted to NIRB as IR#: 8)**
IR Directed To:	The Proponent - Baffinland Iron Mines Corporation
Subject	Groundwater and Surface Waters - Railway Cut Material ARD/ML Potential
Reference(s)	▪ TSD-02 Project Description ▪ TSD-13 Surface Water Assessment
Issue/Concern	Section 3.2.9.1 of TSD-02 states "*material from cuts within the railway right-of-way that will also be used in construction*". This section further goes on to state that "N*ew sources will be tested geochemically in accordance with the Protocol for the Assessment for the Potential for Acid Rock Drainage (Appendix B of the Borrow Pits and Quarry Management Plan)*". Section 3.5.3 of TSD-13 states that as a " *As a precautionary measure, quarries and rock cuts within the granitic and diabase rock materials will be subject to geochemical testing to confirm that the material is geochemically suitable*." Regarding mitigation of ARD/ML encountered at rock cuts, the Proponent states "*There may be less flexibility if ARD/ML issues are identified at rock cuts. If rock cut areas are found to be acid generating through testing, avoidance will be considered where practical. Alternatively, rock cuts may be managed in consideration of site conditions (e.g., use of non-acid generating materials (non-PAG) over the acid generating material; limestone placement; disposal management. Options may range from do-nothing (if exposed faces are limited and/or runoff from the faces is not of adverse quality) to covering the exposed faces with non-PAG/ML material to placing limestone within seepage paths to increase pH of the runoff and precipitate metals*". It is not clear whether any geochemical testing of rock cut areas of the proposed North Railway alignment have been undertaken to-date by the Proponent or if a detailed assessment has been undertaken of the geology expected to be encountered along the North Railway based on quarry/borrow area investigations. Clearly, avoidance of ARD/ML rock would be the most desirable approach hence geochemical testing before detailed design of the final railway alignment progresses too far would be warranted. Rock characterization can be undertaken using a combination of static tests, kinetic tests and mineralogical characterization. This testing is important to identify and segregate PAG and non-PAG rock and support

	the use of these materials in construction. The data is also useful for input to models to simulate long term behaviour from the relatively short term tests. Additionally, Section 3.5.1 of TSD-13-states "*Unrelated to the Phase 2 Proposal, non-compliant discharges occurred in 2017 from the existing WRF stormwater pond (final discharge point MS-08). […]. The pH of the effluent dropped below the mine effluent MDMER and Type A Water Licence discharge limits, possibly due to the unexpected onset of weakly acidic conditions in the WRF. Batch treatment in the pond using sodium carbonate was undertaken in August 2017, and an Interim Waste Rock Management Plan was prepared (Golder, 2018a).*" It is CIRNAC's contention that the non-compliant WRF stormwater pond discharges are in fact related to the Project. This is because the possibility of an unexpected onset of acidic conditions in the rock material used in the construction of the railway would pose a potential problem over a wide geographic area and would not be readily mitigated after the fact. Despite having a Waste Rock Management Plan in the past, the onset of ARD/ML conditions appears to have not been adequately anticipated. The terminology "possibly due to" used in the above quote does not suggest the problem is fully understood. CIRNAC needs assurances that North Railway construction materials will be free of ARD/ML so as not to create a long term legacy problem.
Information Request	CIRNAC requests that the Proponent provide: a) Geochemical testing of rock cut areas in the North Railway area. b) Information available on the risk of encountering ARD/ML material in the North Railway construction materials and how this can be mitigated effectively to avoid unexpected problems in the long term.

IR Number:	**CIRNAC IR#: 8 (submitted to NIRB as IR#: 9)**
IR Directed To:	The Proponent - Baffinland Iron Mines Corporation
Subject	Groundwater and Surface Waters - Characteristics of Seepage and Runoff from Waste Rock Storage Facility
Reference(s)	▪ TSD-28 Management Plans, Appendix H - Phase 1 Waste Rock Management Plan ▪ TSD-28 Management Plans, Appendix I - Interim Waste Rock Management Plan
Issue/Concern	In Phase I Waste Rock Management Plan, surface water diversion and sediment and erosion contingencies assumed onset of ARD-ML would not

	occur before permafrost establishes (estimated to take 5 years), and the water quality model assumes Non-PAG loadings from kinetic test work. In Section 7.2, the Proponent states that "*Phase 1 period is not expected to contain concentrations of metals in excess of discharge requirements based upon the Metal Mining Effluent Regulations" and the* main contingency is "*water treatment facilities […] will be constructed and operated for as long as required*". However, in Section 5.3.2 of the Golder Interim Waste Rock Management Plan, initial seepage data set reports water that is acidic in some cases and requires neutralization. This implies that some of the key modeling assumptions regarding the non-acidic drainage from PAG rock may not be valid and therefore the mitigation measures of the Waste Rock Management Plan should be adjusted. There is lack of detail regarding up to date site wide water quality predictions of seepage and run-off (i.e. not just around the waste rock storage facility but also in the open pit considering exposed PAG materials on the pit walls).
Information Request	CIRNAC requests the Proponent provide the following: c) Summary of mine site water quality monitoring data; and d) Updated water quality predictions of seepage and run-off incorporating monitoring data.

IR Number:	**CIRNAC IR#: 9 (submitted to NIRB as IR#: 10)**
IR Directed To:	The Proponent - Baffinland Iron Mines Corporation
Subject	Groundwater and Surface Waters - ARD/ML Characterization from Quarry Material and Pit Walls
Reference(s)	▪ TSD-28 Management Plans, Appendix B - Borrow Pit and Quarry Management Plan
Issue/Concern	Appendix B presents a general statement of low potential of ARD/ML based upon an Interim ML/ARD Assessment report. The document does not include details of geology, rock types, areas of mineral enrichment nearby or any ARD/ML data. Particularly, there is no prediction of short and longer term drainage water quality from disturbance of the quarried rock provided. The Proponent concluded generally that the likelihood of ARD/ML issue is low, but no data is provided to support this statement. Quarry material and rock ARD/ML characterization is required to ensure waste rock, tailings and ore will be managed in the long term in an environmentally acceptable manner. Additionally, collection of data supports the development of Environmental Management Plans for each material taking into account projected chemical reactivity and physical properties. ARD/ML data is needed to identify potential release of

	contaminants to the receiving environment and any subsequent treatment requirements, to project long term chemical reactivity in closure scenarios, and to provide an improved understanding of ARD/ML allowing for simplified surrogate relationships that can be used to assist in waste rock segregation during operations.
Information Request	CIRNAC requests the Proponent provide the following: a) Interim ML/ARD Assessment of Railway Quarry Rock Samples. Baffinland Mary River Project (December 2010); and b) Additional geochemistry reports and data sets that may be relevant to the quarry areas.

IR Number:	**CIRNAC IR#: 10 (submitted to NIRB as IR#: 11)**
IR Directed To:	The Proponent - Baffinland Iron Mines Corporation
Subject	Groundwater and Surface Waters - Snow Management and Stockpile Locations
Reference(s)	▪ TDS-28 Management Plans, Appendix E - Snow Management Plan
Issue/Concern	The Snow Management Plan (TSD-28 Appendix E) states that designated snow stockpiles are to maintain a 31m separation from the water bodies to prevent unplanned or accidental spread of snow dump extending closer to water bodies. The physical area where this snow stockpiling is taking place is not indicated in the Snow Management Plan. The procedure by which the physical delineation of the 31 m boundary from water bodies is also not provided. Understanding the locations of snow stockpiles will support the reviewers' assessment of the management of contaminated snow and determine if proper management is in place to avoid potential for the contamination of water bodies. Updates regarding the snow stockpile locations and areas at Milne Port and along the Tote Road as proposed in TSD 28 should be provided for review.
Information Request	CIRNAC requests that the Proponent provide the following: a) The proposed areas of snow stockpiles at Milne Port and along the Tote Road; b) Details on the physical delineation of 31 m boundary from water body in the Snow Management Plan; and c) Description of methods used in the field to delineate these areas.

IR Number:	**CIRNAC IR#: 11 (submitted to NIRB as IR#: 12)**
IR Directed To:	The Proponent - Baffinland Iron Mines Corporation

Subject	Groundwater and Surface Waters - Snow Management and Capacity Snow Stockpiles
Reference(s)	▪ TDS-28 Management Plans, Appendix E - Snow Management Plan
Issue/Concern	In the Snow Management Plan (TSD-28, Appendix E), the Proponent is not presenting the monitoring data and details on collected volumes of snow and ice from previous and current operations. It is expected that the Proponent should have such details of contaminated snow and ice collected volumes from their operational experience and this information should be used to assess the current capacities of the snow stockpiles and any required modification of it to meet the requirements for the proposed activities.
Information Request	CIRNAC requests that the Proponent provide the following: a) Details on contaminated snow and ice collected volumes from previous and current operations at site: and b) Details on projected volumes and requirements.

IR Number:	**CIRNAC IR#: 12 (submitted to NIRB as IR#: 13)**
IR Directed To:	The Proponent - Baffinland Iron Mines Corporation
Subject	Landforms, Soils, and Permafrost - Risk of Excessive Settlement of Railway Embankment
Reference(s)	▪ TSD-06 Climate Change Assessment ▪ TSD-08 Landforms, Soil and Permafrost ▪ AMEC Earth & Environmental (AMEC), 2010a. Baffinland Mary River Project - Trucking Feasibility Study Tote Road Design Considerations - Rev. 0. October 19. Ref. No. TC101510, Memo# 015. ▪ Hatch Ltd. (Hatch), 2017a. Baffinland Iron Mines Corporation - Mary River Expansion Study - Stage II - Preliminary Geotechnical Recommendation for Railway Embankment (Between Milne Inlet and Mine Site). January 10. Rev. 2. ▪ Hatch Ltd. (Hatch), 2017b. Site Visit Report - September 7 to 14, 2016. April 21. Mississauga, Ontario. Reference No.: H352034-1000-220-068-0001, Rev 0. ▪ Hatch Ltd. (Hatch), 2017c. Baffinland Iron Mines LP - Mary River Expansion Stage 3 - Definitive Study Report. May 1. Ref. No. H353004-00000-100-146-0001-SE07, Rev. 0. ▪ Hatch Ltd. (Hatch), 2018. Baffinland Iron Mines Corporation - Mary River Expansion Project - 2016/2017 Rail Geotechnical Investigation Factual Data Report. May 22. Mississauga, Ontario. Reference No.: H352034-10000-229-230-0005, Rev 0.
Issue/Concern	As acknowledged by the Proponent in TSD-06, the potential for permafrost warming due to a warming climate increases the risk of permafrost

	degradation. Comprehensive geotechnical site investigations help identify areas where the risk associated with excessive settlement is the greatest. Geotechnical site investigations were completed along the North Railway alignment in 2010, 2016 and 2017 (AMEC, 2010a, Hatch, 2017a, Hatch, 2017b, and Hatch, 2018) and the North Railway embankment designs were established as part of a feasibility study completed for the Phase 2 Proposal (Hatch, 2017c). A summary of relevant sections of these reports is not provided in the FEIS Addendum or the relevant TSDs. There is concern that the permafrost degradation will generate ground disturbance and geotechnical unstable conditions, which should be minimized to the extent possible. Comprehensive geotechnical investigations predicting whether infrastructure designs will meet performance requirements accounting for climate change are required for a complete assessment of the Proponent's conclusions. Additional geotechnical information would be needed to confirm the validity of design assumptions in terms of freeze-back, active-layer depth, required cover thickness, permafrost aggradation, seepage control, stabilization of berms, as well as the deposits and foundations of tailings and other mine wastes. According to the Table of Content of the Interim Waste Rock Management Plan, a Geotechnical Evaluation seems to be planned for December 2018. This information would be required to support the performance of the infrastructure, the North Railway, and related components.
Information Request	CIRNAC requests that the Proponent provide the following: c) A summary of the investigation reports mentioned above describing the geological conditions and geotechnical investigations along the Railway alignment; and d) A summary of the feasibility study mentioned above regarding the North Railway embankment designs (Hatch 2017c).

IR Number:	**CIRNAC IR#: 13 (submitted to NIRB as IR#: 14)**
IR Directed To:	The Proponent - Baffinland Iron Mines Corporation
Subject	Landforms, Soils, and Permafrost - Thermal Modelling on Key Infrastructure
Reference(s)	▪ TSD-06 Climate Change Assessment ▪ TSD-08 Landforms, Soil and Permafrost ▪ TSD-28 Management Plans, Appendix H - Phase 1 Waste Rock Management Plan
Issue/Concern	The site has been described as continuous permafrost with massive ground

	ice. These soil conditions highlight the thaw sensitivity as a concern that should be addressed when constructing infrastructures like the North Railway, docks, railway embankments, bridges, and other relevant components. However, no thaw consolidation data or thaw strain predictions have been included under various infrastructures, thus it is unclear how the Proponent will avoid thaw strains to sensitive landforms. Moreover, no thermal modelling or monitoring of permafrost degradation due to infrastructure and climate change has been presented by the Proponent in the FEIS Addendum or the relevant TSDs. In Table 2 of Section 1.2.1 (TSD-28), the Proponent states thermal modelling will be conducted as designs of infrastructures are developed, but thermal models are required during the technical review period to assess assumptions presented on components designs and performances. Additionally, the freezing aspect of the climate is also used as a construction technique for encapsulation of PAG waste rock to perpetuity. Thermal modelling and monitoring for sustaining permafrost conditions incorporating climate change are also required to ensure performance through service life of the existing and proposed cover infrastructure. Section 10.1 of the Phase 1 Waste Rock Management Plan states that "*Baffinland will carry out thermal modeling of the waste rock stockpile when suitable data is available to demonstrate the robustness of the proposed waste rock stockpile design and confirm that frozen conditions are maintained in the waste rock stockpile*". Clear timelines for conducting thermal modelling are essential, especially for components such as the waste rock storage facility where frozen non-PAG encapsulation is used as containment strategy and uncertainty remains on seepage water quality. Furthermore, project site specific meteorological information and its related manifestations (such as temperature, rainfall, runoff, snow accumulation etc.) have been collected by the Proponent for many years since the initiation of mining activities in the area. This site-specific information should be compiled and incorporated into the climate change assessment in addition to the regional data and the modelling should be updated accordingly. Given that climate change impacts on permafrost are likely to alter hydrologic cycles, groundwater flow networks and surface water supplies, the ongoing refinement of models using site-specific information is essential. CIRNAC therefore concludes that thermal modelling or analysis must be conducted to account for thaw sensitivity due to infrastructure and climate change, regular updates of models as monitoring data is collected, and site-specific meteorological information.
Information Request	CIRNAC requests that the Proponent provide the following: a) Thermal modelling or analysis and monitoring plans for the entire service life of the infrastructure and related facilities such as the North Railway, docks, railway embankments, bridges, and other

	relevant components, as well as for the waste rock storage facility; b) Incorporate the site-specific meteorological information in its climate change assessment and update the relevant modelling accordingly; c) Clarification as to when the Proponent expects suitable data to become available for updating thermal modelling; and d) Thaw consolidation data or thaw strain predictions for various infrastructures, namely North Railway, docks, railway embankments, bridges, and other relevant components.

IR Number:	**CIRNAC IR#: 14 (submitted to NIRB as IR#: 15)**
IR Directed To:	The Proponent - Baffinland Iron Mines Corporation
Subject	Landforms, Soils, and Permafrost - Mine closure management strategies for ARD/ML materials
Reference(s)	▪ TSD-28 Appendix H, Phase 1 Waste Rock Management Plan, Section 8 ▪ TSD-28 Appendix I, Interim Waste Rock Management Plan
Issue/Concern	Regarding the closure of the WRF, in Section 8.1 of the Phase 1 Waste Rock Management Plan (TSD-28 Appendix H), the Proponent mentions that: "*Studies of waste rock in permafrost demonstrate that permafrost forms an effective long-term barrier to water and oxygen, thereby preventing significant oxidation of sulphidic waste rock located below the surficial active zone. The surficial "active" zone, which will be subject to seasonal freeze-thaw, will not reach a 50 m thickness of non-PAG material in the long-term (within 200 years) under the influence of current climate change criteria*." The Phase 1 Waste Rock Management Plan states that during closure, the presence of Non-PAG material up to 50 m thick will ensure that PAG remains frozen, supported by runoff monitoring until objectives are met and then the run-off ponds would be decommissioned. There is a general statement around adequacy of Non-PAG cover in terms of probable active zone. A similar statement is made in the Golder Interim Waste Rock Management Plan. These statements appear to be assumptions as there is a lack of site specific short and long term thermal modelling predictions to support the Proponent's conclusions (see CIRNAC-IR#14). As such, uncertainty in PAG material containment remains and the Proponent should provide additional contingencies beyond water treatment to mitigate longer term potential ARD/ML issues. Additional details on contingencies and adaptive management are particularly needed as current monitoring data identified unexpected acidic seepage. The Phase 1 Waste Rock

	Management Plan should be updated to include monitoring results and present additional contingencies. According to the Table of Content of the Interim Waste Rock Management Plan, a Thermal Evaluation is planned to be completed by December 2018. The Thermal Evaluation is required to support this analysis.
Information Request	CIRNAC requests that the Proponent provide the following: a) Relevant updates to the Phase 1 Waste Rock Management Plan on closure strategies based on thermal modelling in light of climate change; b) Additional short and long term contingencies for managing potential ARD/ML concerns; and c) Comparison to other relevant mine sites in similar climatic conditions using the strategy establishing and maintaining permafrost in order to encapsulate PAG material within a waste rock storage facility.

IR Number:	**CIRNAC IR#: 15 (submitted to NIRB as IR # 16)**
IR Directed To:	The Proponent - Baffinland Iron Mines Corporation
Subject	Waste Management - Comparison of the Approved Project to the Phase 2 Proposal
Reference(s)	▪ Baffinland FEIS Addendum Mary River Project Phase 2 Proposal, Section 1.1
Issue/Concern	Table 1-1 of the FEIS Addendum provides a summary of the differences between the approved project and the Phase 2 Project Description. With regard to waste management and hazardous materials management, the differences between approved project and Phase 2 are not clear. Reference is made to environmental management plans, instead of a clear statement on expected increases on waste/hazardous materials quantities to be managed, and the location and capacity of additional infrastructure required. In order to understand the potential waste and hazardous materials to be managed, a description of quantities and types of waste and hazardous materials to be generated by Mary River Phase 2 Project is needed. Furthermore a comparison with the FEIS estimates for the currently approved activities and a description of the modifications to the Waste Management Plan and waste management facility design is required.
Information Request	CIRNAC requests that the Proponent provide an updated Table 1-1 including: d) Clear description of expected changes in quantities and types of waste (including sewage) that would be required to be managed

	under Phase 2; e) Locations and capacities of key management infrastructure such as landfills, incinerators and sewage treatment plants; and f) Details related to expected changes in quantities and type of hazardous materials associated with Phase 2 and their expected management, particularly those associated with fuel and explosive agents.

IR Number:	**CIRNAC IR#: 16 (submitted to NIRB as IR#: 17)**
IR Directed To:	The Proponent – Baffinland Iron Mines Corporation
Subject	Waste Management - ARD-ML Characterization of Ore and Bedrock within Deposit
Reference(s)	▪ NIRB Amended EIS Guidelines for the Mary River Phase 2 Development Proposal, Sections 6.5.3.1, 6.5.3.2, 6.5.3.3 and 6.5.13 ▪ TSD-02 Project Description ▪ TSD-28 Management Plans, Appendix H - Phase 1 Waste Rock Management Plan, Section 5.3 ▪ TSD-28 Management Plans, Appendix I - Interim Waste Rock Management Plan
Issue/Concern	The EIS Guidelines request a detailed description of the overburden and waste rock disposal, including monitoring results from mine sites located in comparable climatic conditions. The Project Description provided in Section 2.1 of the TSD-02 mentions that "*waste rock was tested in 2014 (AMEC 2015a), and humidity cell (kinetic) testing of representative waste rock samples has been ongoing for several years (AMEC 2015b; 2016).*", and *"A treatment program was initiated in 2017. As a requirement of the Type A Licence MRY 2AA-1325, ongoing plans for addressing acid runoff from the Waste Rock stockpile were submitted and approved by the NWB in 2018."* The results of the tests are needed to understand and evaluate the plans developed by Baffinland to address the ARD from waste rock storage facility. Furthermore, the appendices of the Phase 1 Waste Rock Management Plan and the Interim Waste Rock Management Plan do not have the latest geochemical characterization reports and associated data sets and no geochemical reports or data sets on mine sites located in comparable climatic conditions are provided. The current geochemistry report appended to the Waste Rock Management

	Plan is dated 20 January 2012. Up to date information is required regarding ARD-ML characterization of waste rock and technical mitigation measures in mining, transport and processing, long term ARD-ML characteristics of waste rock and materials used for construction. Provision of monitoring data of comparable mines and methods, test frequencies, static and kinetic test work, as well as management implications for the waste rock storage facility should be presented. The ARD-ML characterization of waste rock will identify potential for release of contaminants to the receiving environment, any subsequent treatment requirements, and establish the Project's long term chemical reactivity. Mitigation measures should be updated according to the findings and clearly identified in the Waste Rock Management Plan.
Information Request	CIRNAC requests that the Proponent provide the following: g) The 2014 version of Mine Rock ML/ARD Characterization Report Deposit 1, Mary River Project, as appended to the Life-of-Mine Waste Rock Management Plan; h) Detailed results from the blast hole data completed in 2017, referred to in the Interim Waste Rock Management Plan; i) Detailed results from 2018 Geochemical Evaluation, referred to in the Interim Waste Rock Management Plan; and j) Geochemical reports or data sets from mine sites in comparable climatic conditions.