November 13, 2020

Assol Kubeisinova
Technical Advisor, NWB
P.O. Box 119
Gjoa Haven, NU X0B 1J0

RE: Baffinland Response to Comments
2019 QIA & NWB Annual Report for Operations
Mary River Project, Type 'A' Water Licence - 2AM-MRY1325 - Amend. No. 1

Baffinland Iron Mines Corporation (Baffinland) has reviewed the comments and recommendations received from the Nunavut Water Board (NWB)[1], Crown Indigenous Relations and Northern Affairs Canada (CIRNAC)[2] and Environment and Climate Change Canada (ECCC)[3] in regard to Baffinland's 2019 QIA & NWB Annual Report for Operations.

Baffinland thanks all parties for their comments and reviews of the 2019 QIA & NWB Annual Report for Operations. Baffinland's responses to the comments required by November 13, 2020 are provided in Attachment 1 of this letter. Remaining comments will be addressed within the timeline established by the NWB.

Please do not hesitate to contact the undersigned should you have any remaining questions or comments.

Regards,

Christopher Murray
Environmental & Regulatory Compliance Manager

Attachments:

Attachment 1: Baffinland Response to Comments
Attachment 2: Mine Site Long-Term Water Management Plan – Progress Report
Attachment 3: Government of Canada Outstanding Technical Concerns – Baffinland Letter on Waste Rock Management, Mary River Project Phase 2 Proposal

Cc: Karén Kharatyan (NWB)
Chris Spencer, Jared Ottenhof (QIA)
Bridget Campbell, Godwin Okonkwo (CIRNAC)
Gabriel Bernard-Lacaille, Anna Graham, Anne Wilson (ECCC)
Megan Lord-Hoyle, Lou Kamermans, Tim Sewell, Shawn Stevens, Connor Devereaux, Aaron MacDonell, Amanda McKenzie (Baffinland)

[1] NWB (2020) Re: Licence No: 2AM-MRY1325 Type "A"; Mary River Project, Baffinland Iron Mines Corporation; 2019 Annual Report Review. Letter dated Aug 28, 2020
[2] CIRNAC (2020) Re: Crown-Indigenous Relations and Northern Affairs Canada Review Comments on the 2019 Annual Report for the Mary River Project, Water Licence No. 2AM-MRY1325 – Amendment No. 1. Letter dated July 24, 2020
[3] ECCC (2020) RE: 2AM-MRY1325 – Baffinland Iron Mine Corporation – Mary River – 2019 Annual Report. Letter dated August 29, 2020

Baffinland

Attachment 1

Baffinland Response to Comments

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
CIRNAC Comments			
R-01	Indicate where Non-PAG waste rock has been used as construction material in 2019 and earlier. Open pit mining operations during 2019 resulted in the generation of a total of approximately 4.3 Mt of waste rock. Waste rock geochemistry was assessed and waste rock was classified as Potentially Acid Generating (PAG) or Non-Acid Generating (Non-PAG) material. This classification is based on operational testing protocols outlined in the Project's Phase 1 - Waste Rock Management Plan (Appendix E.5.1), is discussed in Section 9.6 of the 2019 Annual Report, and is provided in the Waste Rock Geochemistry Analytical Sampling Results (Appendix E.6). All PAG waste rock generated from mining operations in 2019 was deposited at the Waste Rock Facility (WRF) and Non-PAG waste rock was used for construction or deposited at the WRF. Table 5.6 provided the monthly and annual quantities of waste rock generated, deposited at the WRF and used for construction purposes. As shown in the table, of the approximately 4.3 Mt, based on the pre-existing 2019 classification criteria that use a cutoff of total Sulphur content of 0.2 wt% as S, approximately 1.116 Mt (29%) was classified as Non-PAG and was used for construction, approximately 2.116 Mt (49%) was classified as Non-PAG and placed in the WRF, and approximately 1.106 Mt (25%) was classified as PAG and placed in the WRF. However, based on the proposed new classification criteria for waste rock that use both a total sulphur content of 0.2 wt% as S and a paste pH of 6 to distinguish between Non-PAG and PAG, some of the Non-PAG material used previously in construction may reclassify as PAG.	(R-01) CIRNAC recommends that BIMC indicate where Non-PAG waste rock has been used as construction material in 2019 and earlier.	When assessing waste rock generated by mining operations at Deposit No. 1, Baffinland employs the screening criteria outlined in the Phase 1 Waste Rock Management Plan (BAF-PH1-830-P16-0029). In 2020, Baffinland amended the screening criteria of 0.2% total Sulphur to include the results of paste pH analyses. In addition, select samples are submitted for a full suite of acid-base accounting (ABA) testing. Waste rock that is screened as non-PAG is suitable for use as construction material, as determined by the Mine Manager. A significant quantity of suitable construction material is located within the former D1Q1 quarry location, within the ultimate Deposit 1 pit limits, and is frequently used as construction material at the Mine Site. Once material is deemed non-PAG using the approved screening criteria described above, it is deemed appropriate for use as construction material. Baffinland does not track material used for construction purposes, as the material is approved for use.

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
	The report provided no information on where Non-PAG waste rock was used for construction and no information on actual waste rock handling and placement activities at the WRF during 2019. As such, it is not possible to assess if these activities were carried out in accordance with the mine plan and waste rock management plan and to track where Non-PAG materials have been placed during construction activities.		
R-02	Update the amount of actual vs. planned waste rock placement in the Waste Rock Facility (WRF) in 2019.	(R-02) CIRNAC recommends that BIMC provide an update on the actual verses planned waste rock placement in the Waste Rock Facility in 2019.	For 2019, total forecasted waste rock placement in the WRF was 2,940,000 tonnes. As reported in the 2019 QIA-NWB Type A Annual Report, total actual waste rock deposited in the WRF was 3,222,458 tonnes. Refer to Table 5.6 Monthly and Annual Quantities - Deposit No. 1 Waste Rock Management.
R-06	Provide the expected timeline for the development of the Long Term Improvements Plan.	(R-06) CIRNAC recommends that BIMC provide the expected timeline for the development of the Long Term Improvements plan.	Currently, Baffinland is reviewing proposed measures and actions to address the issues identified from the initial desktop review and site visit, which include operational improvements, remedial measures, and new water management structures. The plan will be provided for regulatory review upon completion. A progress report was issued to CIRNAC on November 3, 2020, and is enclosed as Attachment 2.
R-07	The Annual Report noted that water management and erosional issues are related to the Mine Haul Road. The 2019 Inspection of Milne Inlet Tote Road and Associated Borrow Sources Report (Appendix C.4), completed by Tetra Tech on behalf of BIMC, also highlights the significant water management erosional issues existing	(R-07) CIRNAC recommends that BIMC provide the bi-annual inspection of the Mine Haul Road, or clarify the rationale for excluding the Mine Haul Road from the recent bi-annual inspection.	Baffinland agrees to include the Mine Haul Road under the scope of the bi-annual inspections starting in 2021.

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
	along the Mine Haul Road. BIMC noted that addressing these issues for the Mine Haul Road will be quite challenging given the location and setting of the road (steep slopes, etc.). As a result, BIMC has developed a two pronged approach; first BIMC will undertake short term mitigation plans for the 2020 freshet, and second BIMC will develop a long term water management plan using a third party consultant by Q3 of 2020. BIMC is required to conduct bi-annual inspections of the of earthworks and geological and hydrological regimes of the Project, including the Mine Haul Road, as required by Part D, Item 18 of Licence 2AM-MRY1325 Amendment No. 1. Given the context of erosional and water management issues on the Mine Haul Road, it is not clear as to why this major component was not assessed as part of the bi-annual inspections. In reviewing the two Geotechnical Reports, CIRNAC found no reference to inspection notes, comments, or observations with respect to the Mine Haul Road.		
R-16	During 2019, CIRNAC inspection observations noted variances in 'as constructed" features at the Mine (e.g. the location of the crusher ore pad ditch, some of the ditching and grading, etc.) and at the Milne Port (e.g. missing south east (SE) portion of the perimeter ditch) and the use of materials different from the materials specified in the approved civil designs (e.g. poor ore). Given the extensive framework for design approval, construction oversight and development of construction reports, it is concerning that communications of construction changes are not being reported as appropriate and prior to or during the inspection of	(R-16) CIRNAC recommends that BIMC provide information on all locations where poor ore has been used in the past.	Baffinland does not use poor ore as construction material. Observations of visible ore during CIRNAC inspections are related to operational activities after construction is complete. Construction material is sourced from the quarries onsite or non-PAG waste rock deemed suitable for use as construction material, as determined by the Mine Manager. When assessing whether aggregate from approved quarries is Potentially Acid Generating (PAG), the

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
	facilities where known material changes have occurred. Failure to do so results in unnecessary confusion and delays in resolving whether these changes are acceptable or if revisions need to be implemented. In addition to known changes such as the ditch at the mine crusher and the use of poor ore for the Milne Port ore pad discussed above, it is also concerning that any portion of an approved water management design control feature, such as the SE portion of the perimeter ditch at the Milne Port ore pad, has not been constructed. There are two aspects to this concern; in the first case it is possible that BIMC was not aware of this omission, and in the second case it is possible that BIMC had knowledge of this omission and did not communicate that this portion of the approved water management work had not been constructed. In either case, changes of this nature reflect poorly on BIMC's construction management, as well as BIMC's construction oversight and the contractor that carried out the work.		screening criteria used by the Project is a sulphur concentration greater than 0.20%. Material that has a sulphur concentration less than 0.20% is considered Non-Potentially Acid Generating (non-PAG) material and is deemed appropriate for construction rock. If the total Sulphur is greater than 0.2%, comparison of the neutralization potential ratio (NPR) can be completed to additionally classify the material, and if found to have an NPR value greater than 2 the material is classified as non-PAG.
R-17	Provide a rationale for its past use of poor ore as construction materials and where such materials could be used in the future.	(R-17) CIRNAC recommends that BIMC provide a rationale for its past use of poor ore as construction materials and where such materials could be used in future.	Baffinland does not use poor ore as construction material. Observations of visible ore during CIRNAC inspections are related to operational activities after construction is complete. Baffinland will continue to construct ditches using approved construction materials only.
R-18	Carry out a review of its protocols for approval and communication of construction changes to avoid future issues related to field changes to approved designs and plans of water management features.	(R-18) CIRNAC recommends that BIMC carry out a review of its protocols for approval and communication of construction changes to avoid future issues related to field changes to approved	Baffinland will enhance the change management processes to address and communicate field changes to approved designs and plans of water management features upon review of as built drawings and construction completion reports.

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
		designs and plans of water management features.	
R-20	Appendix E.9.1 presents the 2019 Core Receiving Environment Monitoring Program (CREMP) Report. CIRNAC notes that the 2019 CREMP does not include monitoring of the receiving environment at Milne Port where treated effluent from the east and west surface water management ponds associated with the Ore Stockpile Facility is discharged to Milne Inlet, and where the Project has significantly increased port traffic. In Section 7.7 of the Annual Report BIMC notes that the Aquatic Effects Monitoring Plan (AEMP) has been modified to take into account discussions and feedback received at the 2017 Freshwater Workshop on the CREMP, and that BIMC resubmitted a modified version of the AEMP (Revision 2) in May 2019 to regulators and stakeholders through the Phase 2 Proposal water licence amendment, for review and approval. It is not clear whether the revisions made to the AEMP expand the scope of the CREMP to include monitoring at Milne Port.	(R-20) CIRNAC recommends that BIMC clarify what revisions were made to the AEMP and CREMP, and if the CREMP now includes monitoring at the Milne Port.	Baffinland's proposed revisions to the AEMP under the Phase 2 review process do not include expanding the CREMP to include Milne Port. The AEMP is designed to address the freshwater receiving environment, and all discharges at Milne Port are to the marine environment. Monitoring in the marine environment is addressed in the Marine Environmental Effects Monitoring Program (MEEMP). The Surveillance Network Program (SNP) is inclusive of all surface water quality and hydrology monitoring at Milne Port, however there are currently no significant changes proposed to the SNP for Phase 2, as the infrastructure footprint and associated Port Site Water Management Plan does not differ significantly from the current disturbance to surface water flow.
R-23	The results of the waste rock geochemical investigation conducted in 2019 (appended to the updated Phase 1 Waste Rock Management Plan, Rev 2 dated 31 December 2019, Appendix E.5.1 of 2019 Annual Report) lead to a recommendation from Golder to modify the current waste rock classification criteria that delineate Non-Acid Generating (NAG) and Potentially Acid Generating (PAG) materials for disposal purposes. The criteria, which provide a threshold for NAG materials	(R-23) CIRNAC recommends that BIMC immediately begin to use the modified waste rock classification criteria incorporating paste pH, if this has not already been implemented.	Waste rock classification using the revised methodology including paste pH was fully implemented starting in March 2020. Baffinland continues to monitor the results of this test work and will provide these results as well as the confirmatory SFE and ABA test work program (1 sample per 40,000 tonnes of waste mined) in the Annual Report. The next update to the WRMP will include continued analysis to

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
	based on a total sulphur cutoff of <0.20 wt% as S, were consequently modified to include paste pH as follows: PAG – Total sulphur >0.20 wt% as S PAG - Total sulphur <0.20 wt% as S and paste pH <6. NAG - Total sulphur <0.20 wt% as S and paste pH >6. The modified criteria reclassify materials with low sulphur content (<0.2 wt%) and low pH (<6) resulting from stored acidity in sulphate minerals from NAG to PAG. Golder also recommended that select blasthole samples of both NAG and PAG are submitted on an ongoing basis for acid base accounting (ABA) and shake flask analysis (SFE) (as opposed to just PAG samples). These recommendations are presented in the 2019 Phase 1 Waste Rock Management Plan Rev 2. However, in reviewing the 2019 Annual Report Section 9.6, CIRNAC noted that the modified waste rock classification system to delineate NAG and PAG materials was not implemented in 2019. BIMC indicates that they will be implementing the use of paste pH testing in compliment to current blast hole geochemical testing to be rolled out in early 2020, for the purpose of screening material that may contain soluble sulfide material to aid in characterizing and identifying PAG/NAG materials within the deposit. Implementation of the modified waste rock classification criteria and methods will need to be verified in the 2020 Annual Report. While CIRNAC agrees with the modification to the waste rock classification criteria to incorporate paste pH on low sulphur samples (total sulphur <0.20 wt% as S) to manage waste rock during the operational phase, some fundamental issues remain regarding the identification		determine the applicability of the waste rock screening criteria.

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
	and management of ARD/ML materials, especially with respect to long-term storage and closure. Specifically, use of a 0.2% total sulphur threshold (an analogue for an NPR of 2) to differentiate between PAG and NAG materials does not account for an absence of Calcium/Magnesium (Ca/Mg) carbonate mineral content which significantly reduces effective neutralization capacity. Golder's testwork noted above confirmed that the waste rock on average has only 39% of neutralizing potential (NP) contributed from Ca/Mg carbonate minerals. This suggests that the NP is mainly contributed by other buffering minerals such as aluminosilicates whose reaction kinetics at pH >6 (NAG samples) maybe slower than that of carbonate compounds and thus may not provide effective buffering capacity as assumed with the NAG classification. Also, there are samples in the geochemical dataset included in Table 4 (ABA Results) of Appendix A of the WRMP Rev. 2 that have an NPR < 2 despite having a total S of <0.2 wt% (e.g. sample S684262; NRP = 1.8, total S = 0.11%), suggesting that the total sulphur threshold would need to be lower to reliably achieve an NPR > 2.		
R-25	Review the adequacy of the 0.2% total sulphur cut-off and conduct a sensitivity analysis to determine the potential effect of the uncertainty on the projected volumes of PAG and non-acid generating (NAG or non-PAG) waste rock and implications in the design and operation of the WRF and potential closure of the WRF.	(R-25) CIRNAC recommends that BIMC review the adequacy of the 0.2% total sulphur cut-off and conduct a sensitivity analysis to determine the potential effect of the uncertainty on the projected volumes of PAG and NAG waste rock and implications in the design and operation of the WRF and potential closure of the WRF.	Baffinland continues to evaluate the performance of the current waste rock characterization methodology. Baffinland intends to continue the previously described additional sampling program (1 sample per 40,000tonnes of mined waste rock) on representative waste rock that will be submitted for ABA and SFE testing. This testing will be used to further develop Baffinland's geochemical database. The results of this program will be integrated in the next revision of the WRMP and will be

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
			used to validate the performance of the current criteria and potentially influence the projections of NAG/PAG volumes longer-term. The overall design and concept for the WRF (thin lift deposition and freezing/ encapsulation of PAG within WRF) remains valid. This is demonstrated by the thermal monitoring to date that has shown the WRF is frozen, with the exception of a seasonal active layer. Encapsulation of the WRF with Non-PAG material in closure will eliminate any potential for PAG to be exposed in the seasonally thawed layer and thereby mitigate the potential for ARD/ML. Continued monitoring and management will be required to ensure this closure scenario remains valid, and will be evaluated on an on-going basis.
R-26	CIRNAC recommended that either the neutralization potential ratio (NPR) be adjusted to a value greater than 2 to account for a lack of Ca/Mg carbonate minerals, or suitable supplementary test work be undertaken to validate that there is effective neutralization capacity above pH 6.	(R-26) CIRNAC recommends that BIMC account for a lack of Ca/Mg carbonate minerals by either adjusting the neutralization potential ratio (NPR) to a value greater than 2, or undertake suitable supplementary test work to validate that there is effective neutralization capacity above pH 6.	Baffinland intends to complete supplementary test work in 2021 to further validate that effective neutralization capacity exists using an NPR > 2 cut-off above pH 6 given the relatively low Ca/Mg carbonate content in the waste rock in Deposit 1. Supplementary test work will be completed on a range of possible samples (5 to 10) that have low NP as well as some with typical NP derived from Ca/MG Carbonate minerals relative to that derived from silicate minerals. The samples would be subject to removal of the Ca/Mg Carbonate minerals through an appropriate leach process followed by subsequent humidity

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
			cell testing to demonstrate the resulting chemistry. The timing of this test work would be on the order of 6 to 12 months following initiation of testing to develop meaningful relationships between silicate mineral content and available NP.
Environment and Climate Change Canada Comments			
7	Water chemistry within the Mary River showed no distinct and/or consistent spatial gradients with progression downstream, with the exception of sulfate and nitrate, which were elevated at Mary River Tributary F. Based on the temporal analysis provided in Figure 5.2, elevated levels of nitrate and sulfate have not been observed in previous years and represent a large increase compared to previous sampling data. Although the concentrations presented do not exceed water quality guidelines, the sudden jump in concentration may be due to mine influences. The report does not provide any discussion or analysis of the sudden increases in nitrate and sulfate or examine any potential causes.	ECCC recommends the proponent provide a discussion of potential causes of the sudden increases in nitrate and sulfate at the confluence of Mary River Tributary F.	Nitrate and sulphate data collected at Mary River Tributary F in spring and summer of 2020 were in line (nitrate) or lower (sulphate) than concentrations observed in previous years, and thus do not suggest a notable, continued increase in concentrations of these parameters within the tributary. Therefore, higher concentrations of nitrate and sulphate that were suggested at Mary River Tributary F in fall 2019 compared to previous years may reflect anomalous results. Because seasonal changes in water quality are generally evident within watercourses near the Project, water quality monitoring information collected at Mary River Tributary F in fall 2020 will be used to assess whether an empirical elevation in nitrate and/or sulphate concentrations has occurred within this watercourse, or whether the fall 2019 results were anomalous. Discussion regarding potential causes of an increase in nitrate and/or sulphate in fall 2019 and fall 2020 or whether the fall 2019 data were anomalous will be provided in the 2020 Annual Report as per the results of the 2020 sampling

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
			program. Trends in parameter concentrations between years will continue to be evaluated, an analysis that will gain confidence as the monitoring record increases with time.
9	The Proponent stated that, "One of the conclusions from the thermal assessment review is that if no internal heat source is present, the models indicate that the entire waste rock layer deposited in summer would freeze within a year, with or without additional deposition of waste rock in winter, and the extent of the thawed zone in the interior of the pile would be very limited." In section 8: WRF DEVELOPMENT STRATEGY, the Proponent further states, "Further expansion of the WRF is in the planning stages in order to accommodate future waste rock quantities and ensure compliance to the above guidelines." Section 5.2 Thermal Model Calibration of the Waste Rock Management Plan, for 2020 through 2021 by Golder, states, "Calibration models were run for the period between March 15, 2019 and September 11, 2019, with temperature profiles predicted along boreholes BH1, BH2 and BH3 and horizontal thermistor T3. The purpose of the calibration models was to validate the model input parameters until the predicted temperature profiles generally agreed with the temperature profiles provided by the thermistors.	Given the above statements, it is not clear how the calibration of the model with the addition of heat flux (30 KJ/day) will impact the placement of successive waste rock lifts and deposition strategy guidelines (section 8.2). The need to include the heat flux implies that there is an internal heat source that could potentially create or cause a thawed zone. ECCC requests clarification as to whether further expansion of the WRF will assume or manage an internal heat source and potential thawed zone.	Baffinland previously responded to this comment in our September 10, 2020 submission to ECCC and CIRNAC regarding outstanding technical issues related to waste rock management under the Phase 2 Proposal review process. This letter and associated memo from Golder Associates is enclosed as Attachment 3. It should be noted that recent improvements in classification, deposition and encapsulation practices were demonstrated by the elimination of acidic runoff from the WRF, as captured in the Waste Rock Pond, in 2020. As a result, no pH adjustment or water treatment was required for any WRF runoff in 2020. These results will be presented in the 2020 Annual Report for Operations. Baffinland will be implementing additional thermistor instrumentation in the recently expanded footprint of the WRF in early 2021 which will serve to further evaluate the performance of the current deposition guidelines and material classification.

Baffinland

Table 1-1: Baffinland Responses to 2019 QIA-NWB Annual Report for Operations

No.	Intervener Recommendation / Concern	Recommendations	Baffinland Response
10	In comment ECCC-2, ECCC recommended that the Proponent provide adaptive management measures and evaluate potential effects of hot spots within the waste rock pile.	ECCC is of the view that the adaptive management actions described propose further studies or investigation without having identified potential mitigation options to eliminate or manage the hot spots within the waste rock pile. Therefore, it is not clear whether adaptive management options would include avoidance or elimination of segregation practices that may have caused the misclassification of PAG and non-PAG rock that would have created the hot spots in the first place. ECCC requests clarification.	Baffinland previously responded to this comment in our September 10, 2020 submission to ECCC and CIRNAC regarding outstanding technical issues related to waste rock management under the Phase 2 Proposal review process. This letter and associated memo from Golder Associates is enclosed as Attachment 3.

Baffinland

Attachment 2:
Mine Site Long-Term Water Management Plan – Progress Report

November 3, 2020

Jonathon Mesher
Water Resources Officer, CIRNAC
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Sent via email

RE: Mine Site Long-Term Water Management Plan – Progress Report

Baffinland Iron Mines has retained Knight Piésold Ltd. (KP) to prepare a Long-Term Water Management Plan for the Mary River Mine Site. The objective of this long-term water management plan is to minimize sediment laden water from entering nearby water bodies. The temporal scale selected for this plan is five (5) years, from 2021 through 2025.

An initial desktop review was completed upon retaining KP to review relevant documentation describing historical surface water runoff issues (related to surface water quantity and/or quality) and mitigation measures, which were implemented, including applicable point source measures. On September 3rd -11th, 2020, KP's Senior Engineer conducted a site inspection to review current mining activities and infrastructure. The objective was to observe surface water runoff flows in the mine site catchments along with existing water management practices, erosion and sedimentation control measures, and potential sources of sediment laden runoff.

Currently, Baffinland is reviewing KP's proposed measures and actions to address the issues identified from the desktop review and Mary River Mine site visit, which include operational improvements, remedial measures, and new water management structures. Details on the desktop review, site inspection and next steps in developing this plan are described in Attachment 1.

Should you require further information, please feel free to contact the undersigned at (647) 253-0596 Ext. 6016.

Prepared by:

Connor Devereaux

Environmental Superintendent

Reviewed by:

Shawn Stevens

Manager Health, Safety, Environment, Security and Training

Cc: Tim Sewell, Aaron MacDonell, Megan Lorde-Hoyle, Lou Kamermans, Christopher Murray (Baffinland)

Attachments

Attachment 1: Mine Site Long-Term Water Management Plan – Progress Report

Attachment 1: Mine Site Long-Term Water Management Plan – Progress Report

MEMORANDUM

Date:	October 30, 2020	**File No.:**	NB102-00181/63-A.01
		Cont. No.:	NB20-00859
To:	Connor Devereaux and Aaron MacDonell		
Copy To:			
From:	Deena Duff		
Re:	**Mary River Project - Mine Site Long-Term Water Management Plan - Progress Report**		

1.0 INTRODUCTION

Baffinland Iron Mines Corporation (Baffinland) retained the services of Knight Piésold Ltd. (KP) to prepare a Long-Term Water Management Plan for the Mine Site at the Mary River Project.

The objective of the Water Management Plan is to minimize sediment laden water from entering nearby water bodies, specifically to meet the requirements of Water Licence 2AM-MRY1325. The temporal scale selected for this plan is five (5) years, or from 2021 through 2025. It has been assumed that the Phase 2 Proposal currently in the environmental review process will be constructed and operating during this time. As such, consideration of the Phase 2 infrastructure will be made in the development of the plan.

This memo has been prepared to briefly describe the progress made to date on the development of this Plan.

2.0 DESKTOP REVIEW

A desktop review has been completed of the relevant documentation describing historical surface water runoff issues (related to surface water quantity and/or quality) and any mitigation measures which were implemented, including applicable point source mitigation measures. Documentation reviewed included spill reports, regulator communications, regular monitoring reports, design reports and as-built reports. These documents are listed in Table 1.

As part of the desktop review, the Mine Site was divided into three key areas, each selected based on the receiving water body and contributing catchment areas. These three areas are presented as follows:

- **Area 1 - Mary River and Tributaries:** This area includes the Active Mining Area, Waste Rock Facility (WRF) (including Water Treatment Plant (WTP) and pond), Mine Haul Road (MHR) (including the Hillside Road, culvert crossings and laydown areas), and Explosive Magazine Area.
- **Area 2 - Sheardown Lake and Tributaries:** This area includes the Mine Site Complex (MSC), Mobile Maintenance Pad, Crusher Pad, Sailivik Camp and laydown area, Emulsion Plant Road, Effluent Road, Mine Site access roads and various adjacent undisturbed areas.
- **Area 3 - Camp Lake and Tributaries:** This area includes the Weatherhaven Camp, Airstrip and Apron, access roads, various Site Services areas, Quarry QMR2, Snow Stockpile Area and Camp Lake Jetty area.

3.0 SITE VISIT

KP's Senior Engineer Deena Duff conducted a site visit from September 3 to 11, 2020. The purpose of the site visit was to refamiliarize KP staff with the current mine site arrangement, observe surface water runoff flows in the mine site catchments and visit locations prone to erosion and potential sources of sediment laden runoff. KP staff observed existing water management and erosion and sedimentation control measures. Interviews with key Baffinland personnel were also held to help gain a better understanding of the current surface water management practices and erosion and sediment issues that have occurred.

The key findings of the desktop review and site visit are summarized as follows:

Area 1 - Mary River and Tributaries

- **Active Mining Area:** Generally, effective water management is underway, with area runoff and Deposit 1 inflow water being collected and pumped to the WRF pond for treatment.
- **WRF:** Runoff originating within the WRF footprint is managed by perimeter ditches and a pond prior to being sent to the WTP. Non-contact waters are currently entering the WRF catchment that could be diverted. Design of the pond needs to account for the additional water being pumped there from the Active Mining Area. When the WRF footprint is expanded as per the approved design this will be reviewed and taken into account.
- **MHR:** Runoff from the MHR generally reports to ditches along the inside of the road and then drains by culvert to the downstream environment at various locations along the road. Occasionally, swales are cut through the safety berm to drain runoff from the road surface and directly to the downstream side. Observed issues include exposed slopes subject to erosion at some locations along the MHR and Hillside Road where cut slopes have not been stabilized with riprap or downstream of the MHR culverts; grader practices that could be improved to reduce the placement of loose, fine-grained material at the road's edge; and erosion at culvert inlets and outlets. Some of the existing water management features (i.e., check dams, MHR ditches) are not adequately sized to accommodate the flows present in this area during freshet and significant rain events.

Sheardown Lake and Tributaries

- **Crusher Pad:** Surface water runoff does not drain by gravity from all parts of the pad to the perimeter ditches or Crusher Pad stormwater pond (MS-06) and therefore the water must be collected in sumps and then pumped to the pond or additional swales must be excavated to route the water to the pond. Beginning in 2019, Baffinland staff observed seepage from the toe of the Crusher Pad perimeter ditching. Investigations are ongoing to determine the source, however it is likely that the seepage originated from the surface of the Crusher Pad. During the open water season this water is being collected by a temporary sump and is being pumped to the stormwater pond (MS-06).

Camp Lake and Tributaries

- **Access Road:** The presence of finer grained material on the road banks and over culverts results in erosion of road material, blockage of culverts and possible sediment being washed downstream of the culverts.
- **Airstrip and Apron**: Erosion is evident at some locations along the apron side of the airstrip.

Site Wide

- **Dust Generation:** Dust is generated from the crusher operations and from planes taking off and landing. This dust falls on localized undisturbed tundra or other areas and has the potential to be carried to the natural receiving waterbodies rather than being captured by sediment control measures.
- **Snow Stockpiles:** Soil and rocks are picked up during snow removal activities and deposited in snow stockpile areas. Once the snow melts, these areas are left with deposited material which can be carried to downstream tributaries/water courses and therefore could contribute to elevated TSS levels. Runoff from snow stockpiles is mitigated by local control measures including silt fencing.

4.0 WATER MANAGEMENT OPTIONS DEVELOPMENT

In order to address the issues identified during the desktop review and site visit, proposed measures/actions are currently being developed for each area. These proposed measures/actions have been divided into three categories as follows:

- **Operational Improvements:** These consist of minor improvements to operational practices at the Mine Site, such as changing grader practices and implementing dust source control.
- **Remedial Measures:** These consist of measures which could be relatively easy to incorporate into existing mine site infrastructure. Examples include placing riprap in ditches, stabilizing select cut slopes with riprap, regrading the Crusher Pad and other areas as required.
- **New Water Management Structures:** These consist of more significant water management measures that would need to be designed and constructed. Examples include containment ponds, sediment ponds and large engineered check dams.

5.0 NEXT STEPS

The proposed next steps in the development of the Long-Term Water Management Plan are briefly described below:

- Confirm proposed operational improvements and remedial measures with Baffinland personnel to determine effectiveness and feasibility of implementation
- Develop risk-based design criteria for new water management structures considering Hatch's civil design philosophy (Hatch, 2018) and Golder Associates Ltd.'s (Golder) modified design criteria for the WRF pond (Golder, 2018), as well as considering the site specific situations for water management on the MHR and at site in general
- Identify potential locations for new water management structures, including options where feasible to do so based on conceptually estimated sizes
- Develop conceptual layouts for the preferred option(s) for each new water management structure
- Prepare an Interim Water Management Plan report in draft for review by Baffinland
- Complete geotechnical site investigations to confirm new water management structure locations and to provide foundation and permafrost information to help define the structure arrangements
- Conduct particle size testing of surface soils and fill materials to estimate settling times for suspended solids; this will assist in the sizing of ponds
- Prepare the Long-Term Water Management Plan based on preferred and viable water management options

It is expected that geotechnical conditions along the MHR and at other locations will be a key factor in establishing the viability of locations for placement of engineered water management structures. As such, an Interim Water Management Plan will present conceptual options that will then be validated and confirmed in the Long-Term Water Management Plan.

6.0 SUMMARY

The development of the Long-Term Water Management Plan is an ongoing effort and it will take some time to prepare a conceptual plan for the Mine Site.

We trust this progress report provides you with a suitable update of the current status of the plan and the proposed actions moving forward.

7.0 REFERENCES

Golder Associates Ltd. (Golder), 2018. *WRF Pond Expansion Drainage System*. 1790951 DOC028 Rev. 0. June 15.

Hatch, 2018. *Civil Design Philosophy*. Mary River Expansion Project H353004-00000-200-210-0001, Rev. 2. March 12. Mississauga.

Yours truly,
Knight Piésold Ltd.

Prepared:

Deena Duff, P.Eng.
Senior Engineer

Reviewed:

Steven R. Aiken, P.Eng.
Manager, Environmental Services

Approval that this document adheres to the Knight Piésold Quality System:

Attachment:

Table 1 Rev 0	List of Documents Reviewed
Figure 1 Rev 0	Mine Site Layout (With Phase 2 Infrastructure)

/dd

Knight Piésold CONSULTING

TABLE 1

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

MINE SITE LONG-TERM WATER MANAGEMENT PLAN
LIST OF DOCUMENTS REVIEWED

Print Oct/30/20 16:38:32

Area	Document Title	Reference Number	Date	Company
Area 1 - Mary River Catchment	5 Year Mine Plan Active Mining Area Extents	-	Late August 2020	Baffinland Iron Mines Corporation
	5 Year Mine Plan Waste Rock Facility Extents	-	Late August 2020	Baffinland Iron Mines Corporation
	Mine Haul Road Issued For Construction Drawings	H349000-4221-10	8/23/2013	Hatch
	Mine Haul Road Upgrades Issued for Construction Drawings Rev 0	1649295	4/1/2016	Golder Associations Ltd.
	Mine Haul Road Upgrades Specifications Rev 0	1649295	4/1/2016	Golder Associations Ltd.
	Mine Haul Road Upgrades As-Built Drawings Rev 1	1649295	4/15/2016	Golder Associations Ltd.
	Mine Haul Road Drainage Improvement Project Phase 1 Construction As-Built Report	1649295 (DOC008)	8/29/2016	Golder Associations Ltd.
	Construction Notification Mine Haul Road Parts 1, 2 and 3-ILAE	2AM-MRY1325 - Amend. No. 1	2/12/2019	Baffinland Iron Mines Corporation
	Mine Haul Road and Cross Cut Acceptance of Construction Notification - OAKE	2AM-MRY1325 - Amend. No. 1	3/6/2019	Baffinland Iron Mines Corporation
	Issued for Construction Drawings Submission - Revised Run of Mine Stockpile and Sedimentation Pond	2AM-MRY1325 - Amend. No. 1	6/24/2019	Baffinland Iron Mines Corporation
	License No. 2AM-MRY1325; Notification for Construction by Baffinland Iron Mines Corporation of the km 106 Revised Run-of-Mine Stockpile and Sedimentation Pond - Nunavut Water Board Response	2AM-MRY1325 / D2	8/1/2019	Nunavut Water Board
	Quarry D1Q2 Closure Memo Final-ILAE	2AM-MRY1325	6/4/2020	Baffinland Iron Mines Corporation
	2020 Water Management Plan Figure with Culvert Locations	-	4/22/2020	Baffinland Iron Mines Corporation
	Modification Request No. 8 - Waste Rock Facility Sedimentation Pond - Mary River Project, Water License 2AM-MRY1325 - Amendment No. 1, Parts 1 and 2	2AM-MRY1325	6/26/2018	Baffinland Iron Mines Corporation
	ECCC No Comments On Modification #8 for 2AM-MRY1325	2AM-MRY1325	7/11/2018	Nunavut Water Board
	Crown-Indigenous Relations and Northern Affairs Canada's comments on Baffinland Iron Mines Corporation's Modification Request No. 8 Waste Rock Facility Pond, Water License 2AM-MRY1325 - Amendment No. 1	2AM-MRY1325	7/16/2018	Crown-Indigenous Relations and Northern Affairs Canada
	Mary River Project - Waste Rock Facility Sedimentation Pond Modification Request No. 8. Water License 2AM-MRY1325 - Qikiqtani Inuit Association's Response	2AM-MRY1325	7/16/2018	Qikiqtani Inuit Association
	Crown-Indigenous Relations and Northern Affairs Canada's comments on Baffinland Iron Mines Corporation's Notification of Planned Construction Work, Mary River Mine Site Fuel Storage Facility and 15ML Arctic Diesel Tank	2AM-MRY1325	8/10/2018	Crown-Indigenous Relations and Northern Affairs Canada
	Response to Comments Waste Rock Facility Pond Expansion - Modification Request No. 8 Mary River Project, Type 'A' Water License - 2AM-MRY1325 - Amend. No. 1, including: - WRF Pond Expansion Technical Specifications, Rev 0 (1790951-S), August 17, 2018 - Design Criteria for 2018 to 2019 Waste Rock Management Pile, Mary River Project (1665556-1000/1790951-2000), August 24, 2018	2AM-MRY1325	8/27/2018	Baffinland Iron Mines Corporation
	License No. 2AM-MRY1325 Type "A"; Mary River Project, Baffinland Iron Mines Corporation; Modification No. 8 - Waste Rock Facility Sedimentation Pond Expansion - Nunavut Water Board Response	2AM-MRY1325	9/12/2018	Nunavut Water Board
	Construction Summary Report - Mine Site Waste Rock Facility Pond Expansion and Drainage System	-	5/1/2020	Baffinland Iron Mines Corporation
	Construction Summary Report Waste Rock Water Treatment Plant	-	5/21/2020	Baffinland Iron Mines Corporation
	Interim Waste Rock Management Plan	1790951 (DOC 022_Rev0)	3/29/2018	Golder Associations Ltd.
	Phase 1 Waste Rock Management Plan, Rev 2	BAF-PH1-830-P16-0029	12/31/2019	Baffinland Iron Mines Corporation
	Interim Waste Rock Management Plan	1790951 (DOC 022_Rev1)	2/1/2018	Golder Associations Ltd.
	Phase 1 Waste Rock Management Plan - Revision 3 Mary River Project, Type 'A' Water License - 2AM-MRY1325 - Amend. No. 1	2AM-MRY1325 - Amend. No. 1	6/16/2020	Baffinland Iron Mines Corporation
	Waste Rock Management Plan Rev 3; Type "A" Water License No: 2AMMRY1325, Mary River Project; Baffinland Iron Mines Corporation - Nunavut Water Board Response	2AM-MRY1325 / B14, F3	8/17/2020	Nunavut Water Board
	Email: Pond Capacity and Dump Footprint	-	9/28/2020	Golder Associations Ltd.
Area 2 - Sheardown Lake Catchment	2017 Mine Site Crusher Pad Expansion (Modification Request) Water License 2AM-MRY1325 - Amend. No. 1	2AM-MRY1325	4/24/2017	Baffinland Iron Mines Corporation
	Indigenous and Northern Affairs Canada's (INAC) comments on Baffinland Iron Mines Corporation's modification request for expanding crusher pad under water license #2AM-MRY1325 Amendment #1 - Mary River Project	2AM-MRY1325	5/9/2017	Indigenous and Northern Affairs Canada
	License No. 2AM-MRY1325 - Modification Request	2AM-MRY1325 – Amendment No. 1/G1	5/16/2017	Nunavut Water Board
	Baffinland Iron Mines Corporation's (Baffinland) response to INAC comments regarding Baffinland's modification request for expanding the Mine Site Crusher Pad under Type "A" Water License 2AM-MRY1325 - Amend. No. 1	2AM-MRY1325	5/19/2017	Baffinland Iron Mines Corporation
	License No. 2AM-MRY1325, Type "A" - Modification Request by Baffinland Iron Mines Corporation to Expand the Mary River Mine Site Crusher Pad and Associated Structures	2AM-MRY1325/G 1 Modification	5/26/2017	Nunavut Water Board
	Mary River Project - Mine Site Crusher Pad Expansion Modification Request No. 1	2AM-MRY1325	5/29/2018	Baffinland Iron Mines Corporation
	Modification Request - Mine Site Accommodations Camp Upgrade Water License 2AM-MRY1325 - Amend. No. 1	2AM-MRY1325 - Amend. No. 1	7/26/2017	Baffinland Iron Mines Corporation
	Baffinland Iron Mines Corporations, Mary River Project, Modification Requests for Milne Port and Mine Site Accommodation Camp Upgrades and Milne Inlet Fuel Storage Facility	-	7/31/2017	Qikiqtani Inuit Association
	Indigenous and Northern Affairs Canada's (INAC) comments on Baffinland Iron Mines Corporation's modification request for the Mine Site Accommodation Camp Upgrade under water license #2AM-MRY1325 Amendment #1 - Mary River Project	2AM-MRY1325 - Amend. No. 1	8/18/2017	Indigenous and Northern Affairs Canada
	Type "A" Water License No. 2AM-MRY1325 - Amendment No. 1; Approval of Modification No. 4 Application from Baffinland Iron Mines Corporation for Proposed Upgrade to Accommodations Camp at Mary River Project' Mine Site	2AM-MRY1325 - Amendment No. 1/G1	9/20/2017	Nunavut Water Board
	Mary River Project - Mine Site Crusher Pad Sedimentation Pond Expansion (Modification Request) Water License 2AM-MRY1325 - Amend. No. 1	2AM-MRY1325 - Amend. No. 1	9/27/2017	Baffinland Iron Mines Corporation
	2AM-MRY1325 Mine Site Crusher Pad Sedimentation Pond Expansion Modification Request - Qikiqtani Inuit Association Response	2AM-MRY1325 Amendment no. 1	11/7/2017	Qikiqtani Inuit Association
	Indigenous and Northern Affairs Canada's (INAC) comments on Baffinland Iron Mines Corporation's modification request for the Mine Site Crusher Pad Sedimentation Pond Expansion under water license #2AM-MRY1325 Amendment #1 - Mary River Project	2AM-MRY1325 Amendment no. 1	11/10/2017	Indigenous and Northern Affairs Canada
	2AM-MRY1325 Mine Site Crusher Pad Sedimentation Pond Expansion (Modification Request)	2AM-MRY1325 Amendment no. 1	11/14/2017	Indigenous and Northern Affairs Canada
	Crusher Pad Sedimentation Pond Expansion (Modification Request) - Response to Comments - Type "A" Water Licence 2AM-MRY1325 - Amend No. 1	2AM-MRY1325 Amendment no. 1	11/17/2017	Baffinland Iron Mines Corporation
	Mary River Project - Mine Site Crusher Pad Expansion Modification Request No. 1	2AM-MRY1325	5/29/2018	Baffinland Iron Mines Corporation
	Mary River Project - Mine Site Crusher Pad Expansion Modification Request No. 1 Water Licence 2AM-MRY1325 - Qikiqtani Inuit Association Response	-	6/12/2018	Qikiqtani Inuit Association
	2AM-MRY1325 Mine Site Crusher Pad Expansion Modification No. 1	-	6/13/2018	Indigenous and Northern Affairs Canada
	Baffinland Crusher Pad Expansion Design	-	7/3/2018	Nunavut Water Board
	180628 2AM-MRY1325 Revised Distribution Review and Comment Request (BIMC) Modification No. 5 Mine Site Crusher Pad Sediment Pond Expansion Qikiqtani Region-OAAE	-	7/5/2018	Nunavut Water Board
	Crown-Indigenous Relations and Northern Affairs Canada's comments on Baffinland Iron Mines Corporation's modification request #5 for the Mine Site Crusher Pad Sedimentation Pond Expansion under water licence #2AM-MRY1325 Amendment #1 - Mary River Project	CIDM#1222907	7/11/2018	Crown-Indigenous Relations and Northern Affairs Canada
	As Built Drawing: Crusher Pad Expansion Type 'A' Water License 2AM-MRY1325, Modification Request No. 1	2AM-MRY1325 Amendment no. 1	8/13/2018	Baffinland Iron Mines Corporation
	Response to Comments Mary River Project - Crusher Pad Pond Expansion - Modification Request No. 5 Type 'A' Water License - 2AM-MRY1325 - Amend. No. 1	-	8/14/2018	Baffinland Iron Mines Corporation
	Mary River Project - Crusher Pad As Built Documentation - Modification Request No. 1 - Nunavut Water Board Email	-	8/15/2018	Nunavut Water Board
	Licence No. 2AM-MRY1325 Type "A" - Amendment No. 1; Modification No. 5 Application by Baffinland Iron Mines Corporation for Crusher Pad Sedimentation Pond Expansion at the Mary River Project	MRY1325 - Amendment No. 1 - Modification	8/16/2018	Nunavut Water Board
	Mary River Project - Modification Request No. 7 - 2018 Upgrades at the Mine Site and Milne Port (Water License 2AM-MRY1325 - Amendment No. 1) (Parts 1 - 6)	2AM-MRY1325 Amendment no. 1	3/8/2018	Baffinland Iron Mines Corporation

Knight Piésold CONSULTING

TABLE 1

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

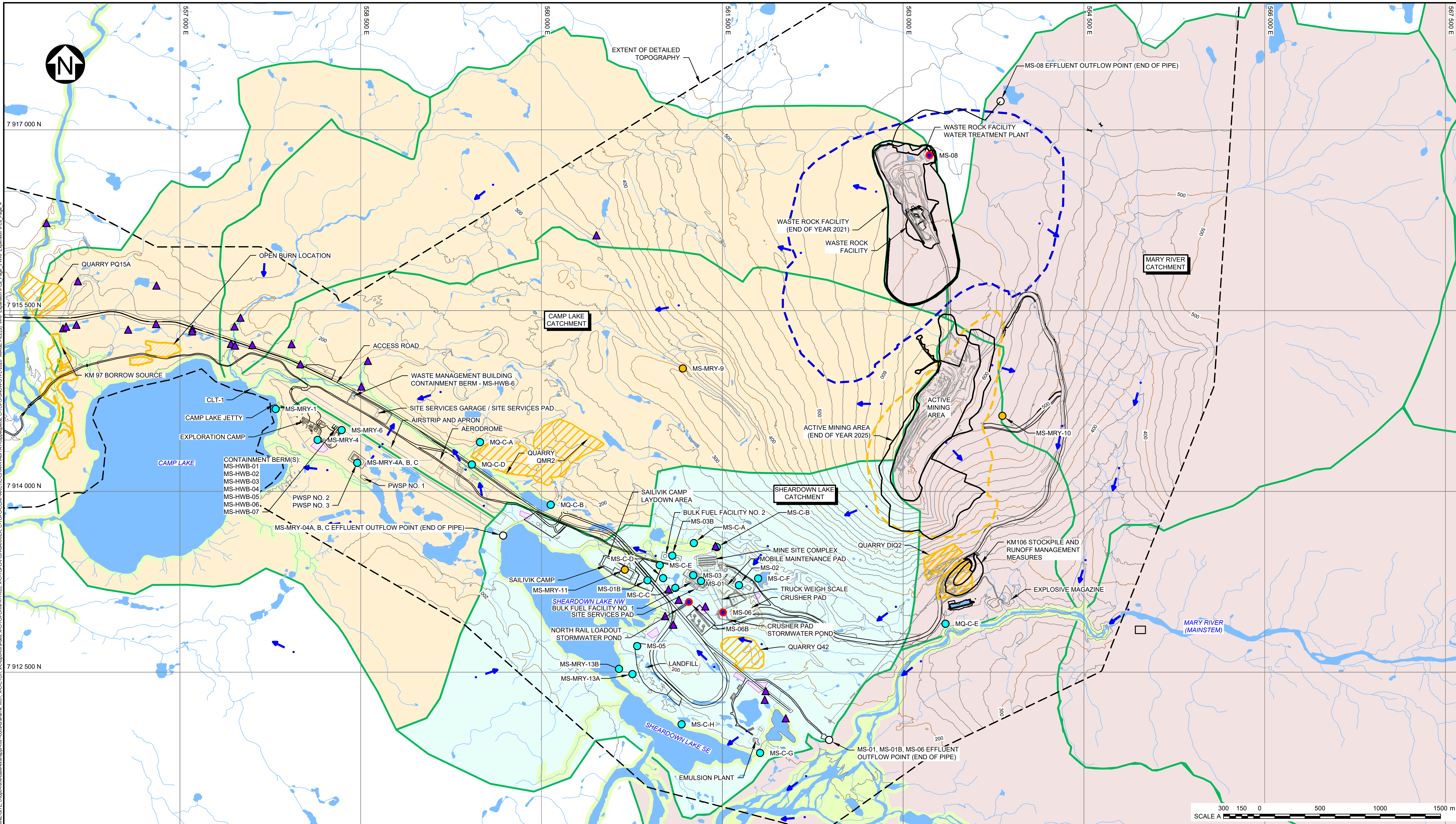
MINE SITE LONG-TERM WATER MANAGEMENT PLAN
LIST OF DOCUMENTS REVIEWED

Print Oct/30/20 16:38:32

Area	Document Title	Reference Number	Date	Company
Area 2 - Sheardown Lake Catchment	Baffinland Iron Mines Corporation's Mary River Project Modification Request No. 7 - 2018 Upgrades at the Mine Site and Milne Port	-	3/29/2018	Qikiqtani Inuit Association
	Mary River Project: Modification Request No. 7 under Part G of the Type "A" Water Licence 2AM-MRY1325	CIDM#1216162	4/11/2018	Indigenous and Northern Affairs Canada
	Response to Comments - Mary River Project - 2018 Work Plan - Modification Request No. 7 Type "A" Water Licence - 2AM-MRY1325 - Amend. No. 1	-	7/10/2018	Baffinland Iron Mines Corporation
	Crown-Indigenous Relations and Northern Affairs Canada's follow up to response to comments on Baffinland Iron Mines Corporation's Modification Request No. 7 - 2018 Upgrades at the Mine Site and Milne Port (Water Licence 2AM-MRY1325 - Amendment No. 1)	CIDM#1224362	8/1/2018	Crown-Indigenous Relations and Northern Affairs Canada
	2AM-MRY1325 Distribution Review & Comment Request Response to Comments on Modification No. 7 Qikiqtani Region-OLAE	07-HCAA-CA7-00050	8/1/2018	Fisheries and Oceans Canada
	Response to Comments - Mary River Project - 2018 Work Plan - Modification Request No. 7 Type "A" Water Licence - 2AM-MRY1325 - Amend. No. 1	-	8/1/2018	Qikiqtani Inuit Association
	Response to Comments - Mary River Project - 2018 Work Plan - Modification Request No. 7 Type "A" Water Licence - 2AM-MRY1325 - Amend. No. 1	-	8/2/2018	Baffinland Iron Mines Corporation
	Modification No. 7 Review Comments Resolution	-	8/3/2018	Crown-Indigenous Relations and Northern Affairs Canada
	Licence No. 2AM-MRY1325 Type "A" - Amendment No. 1; Modification No. 7 Application by Baffinland Iron Mines Corporation for Proposed Upgrades to Mine Site and Milne Port at the Mary River Project	-	8/10/2018	Nunavut Water Board
	Modification No. 10 - Upgrades at the Mary River Mine Site Mary River Project, Water License 2AM-MRY1325 - Amendment No. 1 Parts 1 and 2	2AM-MRY1325 Amendment no. 1	9/5/2018	Baffinland Iron Mines Corporation
	Mary River Project - Modification No. 10 - Mine Site Upgrades - Emails	-	9/7/2018	Nunavut Water Board
	Licence No. 2AM-MRY1325 Type "A"; Mary River Project, Baffinland Iron Mines Corporation; Modification No. 10 - Upgrades at the Mine Site - Approval	-	10/16/2018	Nunavut Water Board
Area 3 - Camp Lake Catchment	As Built Documentation Submission - Camp Lake Sediment and Erosion Control Measures - Mary River Project - Type 'A' Water License 2AM-MRY1325 - Amend. No. 1	2AM-MRY1325 - Amend. No. 1	2/14/2020	Baffinland Iron Mines Corporation
Design Criteria for Phase 2 Proposal	Design Basis Memorandum Waste Rock Pile Water Treatment Facility	1665556 (DOC001_Rev 0)	1/31/2018	Golder Associations Ltd.
	Civil Design Philosophy, Rev 2	H353004	3/12/2018	Hatch
	Railway Design Criteria and Design Rational, Rev 0	H35004	11/28/2017	Hatch
	Geotechnical Design Basis, Rev 0	H35004	7/5/2018	Hatch
Non-Area Specific	CIRNAC Inspection Report	2AM-MRY1325	9/19/2019	Crown-Indigenous Relations and Northern Affairs Canada
	QIA HTO CIRNAC NIRB Site Inspection Corrective Action Register	2AM-MRY1325	11/1/2019	Crown-Indigenous Relations and Northern Affairs Canada
	RE: Water Licence 2AM-MRY1325 September 2019 Inspection	2AM-MRY1325	12/16/2019	Baffinland Iron Mines Corporation
	Sedimentation Mitigation Action Plan, Rev 1	1661774 (5000)	9/29/2016	Golder Associations Ltd.
	Dust Mitigation Action Plan Rev 1	1661774 (5000)	9/29/2016	Golder Associations Ltd.
	Completion Report: Environment and Climate Change Canada Fisheries Act Direction (File: 4408-2016-05-10-001) and INAC Letter of Non-Compliance (NWB Licence 2AM-MRY1325)	4408-2016-05-10-001	9/29/2016	Baffinland Iron Mines Corporation
	Freshet 2017 Biweekly Report No. 1	-	6/15/2017	Baffinland Iron Mines Corporation
	2018 Mary River Freshet Preparedness Presentation	-	2018	Baffinland Iron Mines Corporation
	2018 Freshet Monitoring Report, Parts 1 and 2	-	3/31/2019	Baffinland Iron Mines Corporation
	Freshet 2019 Monitoring Report	-	3/2/2020	Baffinland Iron Mines Corporation
	2020 Mary River Freshet Preparedness	-	4/1/2020	Baffinland Iron Mines Corporation
	Various NT-NU Spill Reports from 2016, 2017 and 2018	-	Various	Baffinland Iron Mines Corporation
	Re: Follow-up to Spill #17-253 - Reported on July 13th, 2017 Mary River Project - Water Licence No. 2AM-MRY1325	-	8/31/2017	Baffinland Iron Mines Corporation
	Re: Follow-up to Spill #18-180 - Reported on May 18, 2018, Mary River Project - Water Licence No. 2AM-MRY1325	-	6/15/2018	Baffinland Iron Mines Corporation
	Re: Follow-up to Spill #18-182 - Reported on May 19, 2018, Mary River Project - Water Licence No. 2AM-MRY1325	-	6/16/2018	Baffinland Iron Mines Corporation
	Re: Follow-up to Spill #19-198 - Mary River Project - Water Licence No. 2AM-MRY1325	-	6/6/2019	Baffinland Iron Mines Corporation
	Re: Follow-up to Spill #19-226 - Mary River Project - Water Licence No. 2AM-MRY1325	-	6/29/2019	Baffinland Iron Mines Corporation
	Re: Follow-up to Spill #20-141 - Mary River Project - Water Licence No. 2AM-MRY1325	-	6/15/2020	Baffinland Iron Mines Corporation
	Re: Follow-up to Spill #20-179 - Mary River Project - Water Licence No. 2AM-MRY1325	-	7/14/2020	Baffinland Iron Mines Corporation

I:\1\02\00181\63\A\Correspondence\NB20-00859 Memo-Progress Report\[ElectronicDocumentList.xlsx]Table

REV	DATE	DESCRIPTION	PREP'D	RVW'D
0	30OCT'20	ISSUED WITH MEMO NB20-00859	ATP	DMMD



N
557 000 E
558 500 E
560 000 E
561 500 E
563 000 E
564 500 E
566 000 E
567 500 E
7 917 000 N
7 915 500 N
7 914 000 N
7 912 500 N
EXTENT OF DETAILED TOPOGRAPHY
MS-08 EFFLUENT OUTFLOW POINT (END OF PIPE)
WASTE ROCK FACILITY WATER TREATMENT PLANT
MS-08
WASTE ROCK FACILITY (END OF YEAR 2021)
WASTE ROCK FACILITY
MARY RIVER CATCHMENT
CAMP LAKE CATCHMENT
QUARRY PQ15A
OPEN BURN LOCATION
KM 97 BORROW SOURCE
ACCESS ROAD
WASTE MANAGEMENT BUILDING CONTAINMENT BERM - MS-HWB-6
CLT-1
MS-MRY-1
CAMP LAKE JETTY
SITE SERVICES GARAGE / SITE SERVICES PAD
AIRSTRIP AND APRON
AERODROME
MS-MRY-6
EXPLORATION CAMP
MS-MRY-4
MQ-C-A
QUARRY QMR2
CAMP LAKE
CONTAINMENT BERM(S): MS-HWB-01 MS-HWB-02 MS-HWB-03 MS-HWB-04 MS-HWB-05 MS-HWB-06 MS-HWB-07
MS-MRY-4A, B, C
MQ-C-D
PWSP NO. 1
PWSP NO. 2
PWSP NO. 3
MS-MRY-9
ACTIVE MINING AREA
ACTIVE MINING AREA (END OF YEAR 2025)
MS-MRY-10
SHEARDOWN LAKE CATCHMENT
SAILIVIK CAMP LAYDOWN AREA
MQ-C-B
BULK FUEL FACILITY NO. 2
MS-C-B
MS-03B
MS-C-A
MS-MRY-04A, B, C EFFLUENT OUTFLOW POINT (END OF PIPE)
QUARRY DIQ2
KM106 STOCKPILE AND RUNOFF MANAGEMENT MEASURES
MINE SITE COMPLEX
MOBILE MAINTENANCE PAD
MS-C-D
MS-C-E
MS-02
MS-03
MS-C-F
SAILIVIK CAMP
MS-01
MS-MRY-11
MS-01B
TRUCK WEIGH SCALE
MS-C-C
CRUSHER PAD
EXPLOSIVE MAGAZINE
SHEARDOWN LAKE NW
BULK FUEL FACILITY NO. 1
SITE SERVICES PAD
MS-06
MQ-C-E
MARY RIVER (MAINSTEM)
NORTH RAIL LOADOUT STORMWATER POND
MS-06B
CRUSHER PAD STORMWATER POND
QUARRY Q42
MS-05
LANDFILL
MS-MRY-13B
MS-MRY-13A
MS-C-H
SHEARDOWN LAKE SE
MS-C-G
MS-01, MS-01B, MS-06 EFFLUENT OUTFLOW POINT (END OF PIPE)
EMULSION PLANT
300 150 0 500 1000 1500 m
SCALE A

LEGEND:

- EXISTING BORROW AREA
- WATER
- ULTIMATE DEPOSIT NO. 1 PIT LIMITS
- ULTIMATE WASTE ROCK STOCKPILE LIMITS
- CONTOUR
- CAMP LAKE CATCHMENTS
- SHEARDOWN LAKE CATCHMENTS
- MARY RIVER CATCHMENTS
- SNOW STOCKPILE
- ARCTIC CHAR HABITAT
- 2020 NSC FISH BARRIER LOCATION
- SURVEILLANCE NETWORK PROGRAM (SNP) STATION
- SNP STATION / METAL AND DIAMOND MINING EFFLUENT REGULATIONS (MDMER) FINAL DISCHARGE POINT
- INACTIVE SNP
- EFFLUENT OUTFLOW POINT (END OF PIPE)
- DRAINAGE DIRECTION

NOTES:

1. COORDINATE GRID IS UTM NAD83, ZONE 17.
2. DETAILED WATER FROM EAGLE MAPPING (2019). CONTOUR PROVIDED BY BAFFINLAND (2019) INTERVAL IS 5 m.
3. CURRENT MINE AREA FROM THE WASTE DUMP TO THE CRUSHER PAD, AND DITCHES ALONG THE HAUL ROAD PROVIDED BY BIM (MARCH 12, 2018).
4. 2021 WASTE ROCK FACILITY AND 2025 ACTIVE MINING AREA PROVIDED BY BAFFINLAND IRON MINES CORP. (OCT 9, 2020).
5. MINE HAUL ROAD AS-BUILT PROVIDED BY BAFFINLAND IRON MINES CORP. (AUGUST 28, 2020).
6. ALL OTHER SITE INFRASTRUCTURE PROVIDED BY HATCH (AUGUST 2, 2016). AND SIMPLIFIED BY KP STAFF (JAN, 2018).

REV	DATE	DESCRIPTION	DESIGNED	DRAWN	REVIEWED
0	30OCT'20	ISSUED WITH MEMO	DMMD	AS	RAC

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

MINE SITE LAYOUT (WITH PHASE 2 INFRASTRUCTURE)

Knight Piésold CONSULTING

P/A NO.	REF NO.
NB102-181/63	NB20-00859

FIGURE 1 REV 0

Attachment 3:
Government of Canada Outstanding Technical Concerns – Baffinland Letter on Waste Rock Management, Mary River Project Phase 2 Proposal

Baffinland

September 10, 2020

Felexce Ngwa
Manager, Impact Assessment
Crown Indigenous Relations & Northern Affairs Canada
P.O. Box 2200
Iqaluit, NU X0A 0H0

Anna Graham
Environmental Assessment Coordinator
Environment & Climate Change Canada
351, boul. Saint-Joseph, 17th Floor, Office 17075
Gatineau, Quebec K1A 0H3

Re: Government of Canada Outstanding Technical Concerns – Waste Rock Management
Mary River Project Phase 2 Proposal

Baffinland Iron Mines Corporation (Baffinland) provides the following commitments and attached responses to comments received from the Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)[1] and Environment and Climate Change Canada (ECCC)[2] regarding outstanding technical issues in relation to the impact assessment for the Phase 2 Proposal, currently under consideration by the Nunavut Impact Review Board (NIRB) as an amendment to Project Certificate No. 005. Baffinland has addressed the comments provided as detailed in Attachment 1, with supporting documentation provided as Attachment 2.

To address the outstanding concerns expressed by CIRNAC and ECCC, Baffinland commits to the following;

- Continuing the thermal monitoring program at the Waste Rock Facility (WRF) initiated in 2018 throughout the life of mine. Results from the thermal monitoring program will be provided in annual reports to the NWB and NIRB, and will be utilized to update thermal models generated for future updates to the Waste Rock Management Plan.
- Continuing to evaluate the efficacy of the 0.2% total sulphur and paste pH screening criteria for Potential Acid Generating (PAG) waste rock. Baffinland will continue to collect total sulphur and paste pH, as well as full ABA testing on select quantities of waste rock, in an effort to further characterize material, evaluate the presence of soluble sulphates and the use of the 0.2% total sulphur value as an analogue for NPR to classify waste rock.
- Develop numerical values for closure criteria in the Interim Closure and Reclamation Plan (ICRP). The ICRP is a living document that will be continually updated throughout the life of mine, up to the development of the Final Closure Plan. Waste rock geochemistry and thermal data collected over the operational period of the mine will form the basis of the reclamation research required to determine numerical values for closure.

[1] CIRNAC (2020) Re: Crown-Indigenous Relations and Northern Affairs Canada Reply to Baffinland Iron Mines Corporation request for unresolved concerns for the Phase 2 Mary River Project Proposal. Letter dated Aug 25, 2020.
[2] ECCC (2020) RE: 2AM-MRY1325 – Baffinland Iron Mine Corporation – Mary River – 2019 Annual Report. Letter dated August 20, 2020

We trust that the attached responses provide additional clarification on the concerns raised regarding Waste Rock Management through the Phase 2 Proposal review process, and in combination with the above commitments resolves any outstanding issues before the NIRB for the Phase 2 Proposal.

Regards,

Christopher Murray

Environmental & Regulatory Compliance Manager

Cc: Alexandre Chaikine, Bridget Campbell, Godwin Okonkwo (CIRNAC)
Anne Wilson, Reg Ejeckam, Jody Small, John Olyslager (ECCC)
Megan Lord-Hoyle, Lou Kamermans, Tim Sewell, Shawn Stevens, Connor Devereaux, Aaron MacDonell, Simon Fleury, Daniel Janusauskas (Baffinland)

Attachments

Attachment 1: Baffinland Response to Comments

Attachment 2: Golder Associates Memo

Baffinland

ATTACHMENT 1

Baffinland Response to Comments

Baffinland

Table 1 – Baffinland Responses Phase 1 Waste Rock Management Plan Revision 3 Comments

#	Description of Concern or Finding	Status	Baffinland Updated Response – Sept. 2020
Comment ID: CIRNAC-01 Thermal Model and Key Infrastructure.			
1	BIMC submitted Thermal Model Memorandum in the updated Waste Rock Management Plan, Appendix A2, December 2019. CIRNAC Requested: 1 - Internal heat generation- Provide a heat balance and relationship of the heat generation associated with the exothermic reaction of PAG waste rock deposited and soluble sulphates. 2 - Oxygen consumption - Perform an Oxygen balance and correlate it with soluble sulphates significantly lower oxygen demand, and ARD. 3 - Vibrating Wire Piezometers (VWP) data - Assess if water balance reflects the dry piezometers are a result of infiltration rainfall through the waste rock or poor functioning of the VWP. 4 - Continued monitoring – Additional relevant instrumentation and update the thermal model to 3D, particularly if WRF design needs to be modified. 5 - Develop a detailed site wide program to monitor the thaw consolidation and soil deformation under Phase 2 structures. Compare results with the FEIS Addendum and identify mitigation measures.	1 and 2 – **Not Resolved**. The model shall connect the observed parameters with any chemical reaction related to Potentially Acid Generating (PAG) rock and soluble sulphates in the waste rock pile. CIRNAC requests to further develop the thermal model in the future to show correlation with the oxidation and soluble sulphates. 3 – **Resolved** 4 - **Resolved** for EA purpose. CIRNAC recommends updating the thermal model to 3D for WRF design purposes. 5 - **Resolved** for EA purpose.	1 and 2 - A unit heat flux value of 30 kJ/day was defined after several attempts as the calibrated value that produced model results that were closer to what has been measured along BH-2 and BH-3. Although this modelling exercise did not attempt to assess the impact of oxidation of any specific sulphide type, a 30 kJ/day heat flux would be associated, for instance, with the oxidation of waste rock containing up to 0.75% pyrite (actual measured values from deposit show lower sulphide content), and using an average oxidation rate between $3x10^{-9}$ mole/m^2/s and $9x10^{-8}$ mole/m^2/s, with the higher oxidation rate requiring microbial activity to be attained (this likely would not be consistently obtained due to freezing conditions). Any refinement to this would require the type and % content sulphide in the waste materials. The model is considered appropriate for the existing conditions as calibrated to the current waste rock pile. Ongoing thermal modeling as part of operational monitoring/reporting should be conducting using the observed concentrations of sulphide based on operational monitoring of ore and waste materials. It is recommended that this be conducted as more information is available (i.e. during the water license process) or should observed sulphide content differ from that of the current waste rock pile, at which time it would be appropriate to more closely link the observed conditions to heat generation. 3, 4 and 5 - No further commitment or response required
Comment ID: CIRNAC-2 ARD/ML Potential of Railway Cut Material, Quarry and Pit Walls			
2	1. Confirm the origin of elevated concentrations of aluminum, mercury and copper in Shake Flask Extraction test results for rock materials sourced from quarry and borrow pits for road / railway construction, and develop and implement an appropriate water quality monitoring and management strategy for railway corridor rock quarries. 2. Compare the monitoring results with the FEIS Addendum predictions, identify and implement the appropriate mitigation measures.	1, 2 **Resolved** for EA purpose	No further commitment or response required.

#	Description of Concern or Finding	Status	Baffinland Updated Response – Sept. 2020
Comment ID: CIRNAC-3 ARD/ML Characterization within Ore and Waste Rock from Deposit 1			
3	CIRNAC recommends that Baffinland: 1- Demonstrate the origin of the soluble sulphates, estimate possible spatial extent and a tonnage estimate of waste rock containing significant soluble sulphates. 2-Demonstrate that waste rock associated with the greater life of mine deposit does not have significant soluble sulphate content. 3- Provide further justification for the retention of 0.2% total sulphur cut-off threshold for identification of Non-PAG waste rock and using NPR of 2 as a cut-off for PAG identification considering the absence of Calcium /Magnesium carbonate mineral content. 4- Provide information on the variation and uncertainty in ARD/ML behavior of the different types of waste rock. 5- Develop effective criteria for identification of potentially acid generating rock following industry best practice and incorporate these criteria in an updated Waste Rock Management Plan and Interim Closure and Reclamation Plan. 6- Confirm adequate capacity of the WRF pond, including the sufficient contingency within the pond to prevent a potential of uncontrolled/untreated discharge to the environment.	1 and 2 – **Partially Resolved**. 3 - **Not Resolved**. 4 - **Not Resolved**. 5 - **Not Resolved**. 6- **Resolved**.	1 and 2 - Substantial information was collected as part of the initial EA and additional investigations which showed that the majority of the waste materials that will be encountered in the future have limited potential for soluble sulphates based on ABA, paste pH and Shake Flask Extraction (SFE) pH values (AMEC 2012, AMEC 2014 and Golder 2019), however Baffinland is collecting additional samples over the course of 2020, and throughout the life-of-mine as part of their waste rock segregation program, as outlined in the WRMP. The data will be reviewed and will assist with further delineating soluble sulphates within the deposit. 3. The 0.2% cutoff will continue to be assessed as additional data is collected and the criteria for segregation of wastes now considers potential for soluble sulphate occurrence through inclusion of paste pH evaluation. If deemed necessary based on operational monitoring of ARD potential and water quality, the cutoff will be updated and adjusted. 4. See response to #1. Additional sample collection and testing will occur throughout the life-of-mine at an appropriate level and scale to evaluate uncertainty related to materials encountered. The uncertainty related to material encountered will be re-evaluated as part of routine reporting, and can be reviewed as part of the water licence process. 5. It is considered that the current segregation criteria follows appropriate industry standards, and has been recently revised to consider possible soluble sulphate sources. It is recommended that operational monitoring data continue to be collected and that the revised segregation criteria presented in the current WRMP be reviewed on an ongoing basis as additional waste rock samples are collected and analyzed and, following a review of results, if deemed necessary, the criteria can be re-adjusted. 6. No further commitment or response required
ECCC – 9 Waste Rock Management Plan – Thermal Assessment			
9	The Proponent stated that, “One of the conclusions from the thermal assessment review is that if no internal heat source is present, the models indicate that the entire waste rock layer deposited in summer would freeze within a year, with or without additional deposition of waste rock in winter, and the extent of the thawed zone in the interior of the pile would be very limited.” In section 8: WRF DEVELOPMENT STRATEGY, the Proponent further states, “Further expansion of the WRF is in the planning stages in order to accommodate future waste rock quantities and ensure compliance to the above guidelines.” Section 5.2 Thermal Model Calibration of the Waste Rock Management Plan, for 2020 through 2021 by Golder, states, “Calibration models were run for the period between March 15, 2019 and September 11, 2019, with temperature profiles predicted along boreholes BH1, BH2 and BH3 and horizontal thermistor T3. The purpose of the calibration models was to validate the model input parameters until the	**Not Resolved**	Given that the model that was used in the development of the WRMP included a heat source, it is expected that this will be appropriate for future planning should the sulphide content remain consistent or lower than that used in the model (up to 0.75% pyrite). Baffinland will continue to monitor the thermal condition of the pile and will adjust the deposition strategy should conditions differ from those predicted. As outlined in Section 12 – Adaptive Management of the WRMP (Rev. 3), should the potential for thawed material in the WRF be identified, Baffinland will assess the potential for impacts to long term WRF performance, conduct an investigation to identify the cause, and if necessary implement remedial actions (e.g. adjustments to lift placement strategy, excavation/exposure of thawed materials to promote freeze back, excavation

#	Description of Concern or Finding	Status	Baffinland Updated Response – Sept. 2020
	predicted temperature profiles generally agreed with the temperature profiles provided by the thermistors. To improve model calibration at BH2 and BH3, internal heat generation was included by adding a heat flux boundary (30 kJ/day) to waste rock parcels adjacent to the BH2 and BH3 thermistor strings at depths where the existence of PAG waste rock was identified (Golder, 2019b). Inclusion of the 30 kJ/day heat flux boundary improved model calibration to the measured temperatures at BH2 and BH3." **ECCC Recommendation(s)** Given the above statements, it is not clear how the calibration of the model with the addition of heat flux (30 KJ/day) will impact the placement of successive waste rock lifts and deposition strategy guidelines (section 8.2). The need to include the heat flux implies that there is an internal heat source that could potentially create or cause a thawed zone. ECCC requests clarification as to whether further expansion of the WRF will assume or manage an internal heat source and potential thawed zone.		and replacement of material in thin lifts to promote freezing, etc.). While calibration of the thermal model required the addition of heat, all thermistor data to date indicates freezing condition in the pile.
ECCC – 10 Adaptive Management			
10	In comment ECCC-2, ECCC recommended that the Proponent provide adaptive management measures and evaluate potential effects of hot spots within the waste rock pile. In response, the Proponent indicated that adaptive management has been included in an updated revision to the 2019 WRMP (Section 12). Item 1b in the list of general steps that will be taken to assess the potential for the thawed material to impact the WRF long-term performance, proposes to "Identify if thawing was the result of construction practices or exothermic reaction and (b). If the thawed zone developed from an exothermic reaction or the reason cannot be determined, then additional investigation may be required. The extent of the investigation (desktop study vs. field investigation) will be assessed on a case-by-case basis." **ECCC Recommendation(s)** ECCC is of the view that the adaptive management actions described propose further studies or investigation without having identified potential mitigation options to eliminate or manage the hot spots within the waste rock pile. Therefore, it is not clear whether adaptive management options would include avoidance or elimination of segregation practices that may have caused the misclassification of PAG and non-PAG rock that would have created the hot spots in the first place. ECCC requests clarification.	**Not Resolved**	The WRMP (Rev. 3) included the Adaptive Management framework to assess, mitigate and if necessary remediate potential issues associated with placement of waste rock at the WRF. ECCC is correct that Step 1 of the process is to identify if observed thawing was the result of construction practices or exothermic reaction. Step 2 of this process is to develop a remediation plan, if required. Here the WRMP clearly lays out potential actions that may be taken. As stated in Section 12 (Page 33); a. As noted under Item 1aii, remediation may not be required under certain circumstances. b. Potential remediation strategies are itemized below and may vary significantly depending on the extent of thawed material and mechanism resulting in the thawed conditions. The appropriate actions to be undertaken can only be determined following a detailed review of the thawed zone in the context of the overall waste rock management plan. Such actions may include but are not limited to: i. Adjustment of subsequent lift placement strategies to promote more rapid freeze-back (e.g. revised lift thickness, exposure time prior to covering over, etc.) ii. Adjustment of waste rock placement locations and/or modification to the WRF development plan. iii. Exposure of thawed materials to promote rapid freeze-back. iv. Excavation of thawed material for re-deposition into thinner lifts and/or further encapsulation with NAG material Step 3 of this process is to update waste rock placement guidelines and procedures to reduce the potential for further development of thawed zones, and to update the instrumentation plan and water quality sampling program to address any gaps.

#	Description of Concern or Finding	Status	Baffinland Updated Response – Sept. 2020
ECCC – 11 WRF Closure			
11	Comment The Proponent states, “When monitoring shows that runoff meets water quality objectives for closure the runoff management, ponds will be decommissioned and runoff will be discharged directly to the environment.” **ECCC Recommendation(s)** ECCC would like to re-emphasize that as long as the Mary River Iron Ore mine is subject to the Metal and Diamond Mining Effluent Regulations, all discharges from the mine would have to go through a final discharge point (FDP), and effluent sampling and reporting through MERS will continue until the mine achieves recognized closed mine (RCM) status.	**Not Resolved**	Baffinland acknowledges that the Waste Rock Facility is subject to MDMER, and per the regulation will be required to achieve recognized closed mine (RCM) status in final closure. Baffinland’s Interim Closure and Reclamation Plan (ICRP, Rev. 5) identifies RCM status as a criterion for closure of the WRF in Table 5.1, and closure strategy discussed in detail in Section 5.2.2.

Baffinland

ATTACHMENT 2

Golder Associates Memo

GOLDER

TECHNICAL MEMORANDUM

DATE September 09, 2020 **Project No.** 1790951/10000/10002

TO Christopher Murray, Environmental & Regulatory Compliance Manager
Baffinland Iron Ore Mines Corp. (Baffinland)

CC Michelle Tyldesley

FROM Dan LaPorte, Fernando Junquiera and Ken DeVos **EMAIL mtyldesley@golder.com**

RESPONSE TO OUTSTANDING REGULATOR COMMENTS (CIRNAC 01; CIRNAC 03; ECCC 9)
BAFFINLAND MARY RIVER PROJECT

As requested in our meeting of September 3rd, 2020 we have reviewed the potential unresolved comments from CIRNAC (01 and 03) and ECCC -9 and have provided below our initial interpretation and recommended responses based on the materials received.

CIRNAC-01

Comments on Baffinland responses:

1 and 2 – Not Resolved - Baffinland did not provide answers to thermal model internal heat generation and oxygen consumption. The model shall connect the observed parameters with any chemical reaction related to Potentially Acid Generating (PAG) rock and soluble sulphates in the waste rock pile. CIRNAC requests to further develop the thermal model in the future to show correlation with the oxidation and soluble sulphates.

A unit heat flux value of 30 kJ/day was defined after several attempts as the calibrated value that produced model results that were closer to what has been measured along BH-2 and BH-3. Although this modelling exercise did not attempt to assess the impact of oxidation of any specific sulphide type, a 30 kJ/day heat flux would be associated, for instance, with the oxidation of waste rock containing up to 0.75% pyrite (actual measured values show lower sulphide content), and using an average oxidation rate between $3x10^{-9}$ mole/m²/s and $9x10^{-8}$ mole/m²/s with the higher oxidation rate requiring microbial activity to be attained (this likely would not be consistently obtained due to freezing conditions).

Any refinement to this would require the type and % content sulphide in the waste materials. The model is considered appropriate for the existing conditions as calibrated to the current waste rock pile. Ongoing thermal modeling as part of operational monitoring/reporting should be conducting using the observed concentrations of sulphide based on operational monitoring of ore and waste materials. It is recommended that this be conducted as more information is available (i.e. during the water license process) or should observed sulphide content differ from that of the current waste rock pile, at which time it would be appropriate to more closely link the observed conditions to heat generation.

Golder Associates Ltd.
6925 Century Avenue, Suite #100 Mississauga, Ontario, L5N 7K2 Canada T: +1 905 567 4444 +1 905 567 6561

CIRNAC-03

1 Demonstrate the origin of the soluble sulphates, estimate possible spatial extent and a tonnage estimate of waste rock containing significant soluble sulphates.

Substantial information was collected as part of the initial EA and additional investigations which showed that the majority of the waste materials that will be encountered in the future have limited potential for soluble sulphates based on ABA paste pH and Shake Flask Extraction pH values (AMEC 2012, AMEC 2014 and Golder 2019), however BIM is collecting additional samples over the course of 2020, and throughout the life-of-mine in active mining zones as part of their waste rock segregation program, as outlined in the WRMP. The data will be reviewed and will assist with further delineating soluble sulphates within the deposit.

2 Demonstrate that waste rock associated with the greater life of mine deposit does not have significant soluble sulphate content.

See response to #1.

3 Provide further justification for the retention of 0.2% total sulphur cut-off threshold for identification of Non-PAG waste rock and using NPR of 2 as a cut-off for PAG identification considering the absence of Calcium-Magnesium carbonate mineral content.

The 0.2% cutoff will continue to be assessed as additional data is collected and the criteria for segregation of wastes now considers potential for soluble sulphate occurrence through inclusion of paste pH evaluation. If deemed necessary based on operational monitoring of ARD potential and water quality the cutoff will be updated and adjusted.

4 Provide information on the variation and uncertainty in ARD/ML behaviour of the different types of waste rock.

See response to #1. Additional sample collection and testing will occur throughout the life-of-mine at an appropriate level and scale to evaluate uncertainty related to materials encountered. The uncertainty related to material encountered will be re-evaluated as part of routine reporting, and can be reviewed as part of the water licence process.

5 Develop effective criteria for identification of potentially acid generating rock following industry best practice and incorporate these criteria in an updated Waste Rock Management Plan and Interim Closure and Reclamation Plan.

It is considered that the current segregation criteria follows appropriate industry standards, and has been recently revised to consider possible occurrence of soluble sulphates. It is recommended that operational monitoring data continue to be collected and that the revised segregation criteria presented in the current WRMP be reviewed on an ongoing basis as additional waste rock samples are collected and analyzed and, following a review of results, if deemed necessary, the criteria can be re-adjusted.

ECCC Comment 9:

ECCC requests clarification as to whether further expansion of the WRF will assume or manage an internal heat source and potential thawed zone.

Given that the model that was used in development of the WRMP included a heat source, it is expected that this will be appropriate for future planning should the sulphide content remain consistent or lower than that used in the model. BIM will continue to monitor and will adjust deposition strategy if necessary should conditions differ from those predicted.

We trust that this meets your needs at this time.

Dan LaPorte, MSc, PGeo
Hydrogeochemist

Ken DeVos, MSc, PGeo
Principal, Geochemist

DFL/FJ/ms

https://golderassociates.sharepoint.com/sites/22103g/technical work/phase 10000 task 10002/1790951 responses to regulators 09sept 2020_rev 0.docx