Baffinland Iron Mines Corporation

Interim Closure and Reclamation Plan

BAF-PH1-830-P16-0012

Rev 6

Prepared By:	Elisabeth Luther
Department:	Sustainable Development
Title:	Senior Manager, Regulatory Affairs
Date:	November 1, 2024
Signature:	

Approved By:	Megan Lord-Hoyle
Department:	Sustainable Development
Title:	Vice President, Sustainable Development
Date:	November 1, 2024
Signature:	Megan Lord-Hoyle

This document provides revisions to:

Rev 6

DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
06/07/2013	0	AG	EM	Approved for Use (H349000-1000-07-126-0012)
03/10/2014	1	JM	EM	Approved for Use (BAF-PH1-830-P16-0012)
06/27/2014	2	JM	EM	Approved for Use *Note Change in Title from Interim Abandonment and Reclamation Plan*
03/19/2015	3	AG	EM	Approved for Use
10/15/2015	4	AG	EM	Approved for Review
10/30/2015	4	AG	JM	Approved for Review
03/31/2016	4	AG	JM	Approved for Review
05/31/2016	5	AG	JM	Approved for Review
08/01/2016	5	AG	JM	Approved for Review
10/06/2016	5	AG	WM	Approved for Review
29/06/2018	5	CM	MLH	Approved for Review
19/10/2018	5	RS, CM	MLH	Approved for Conditional Use
04/21/2021	6	CM	MLH	Approved for Review
03/28/2022	6	RAC	CD, SB	Issued for regulatory review
11/01/2024	6	EL	MLH	Issued for regulatory review

All staff members are responsible to ensure the latest version is used; these are available at: https://www.baffinland.com/media-centre/document-portal/.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

FOREWORD

The Interim Closure and Reclamation Plan (ICRP) builds on the Preliminary Closure and Reclamation Plan (PCRP) which was reviewed and approved by the Nunavut Impact Review Board (NIRB) under Project Certificate 005, and by the Nunavut Water Board (NWB) with the issuance of Type A Water Licence 2AM-MRY1325. The ICRP reflects the requirements of Qikiqtani Inuit Association (QIA) Commercial Lease No. Q13C301 and requirements of Part J, Item 2 of the Type A Water Licence, 2AM-MRY1325 which requires the March 2015 ICRP to be updated 60 days after the issuance of the amended Licence, taking into consideration the items listed in Part J, Item 2.

The development of the PCRP and subsequent development of the ICRP is based on Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC, formerly AANDC) guidelines [1] which envisage three primary stages in the development of a Mine Closure and Reclamation Plan (or A&R Plan):

- A Preliminary Closure and Reclamation Plan
- An Interim Closure and Reclamation Plan
- A Final Closure and Reclamation Plan

The ICRP considers the complete development of the Project and describes expected closure activities at the end of the Project Life. The ICRP is thus a conceptual benchmark for the intended reclamation and closure activities associated with all components of the Mary River Project approved under Project Certificate No. 005. The ICRP will be updated as required throughout the life of the Project.

As per Type A Water Licence 2AM-MRY1325 and QIA Commercial Lease No. Q13C301, the Final CRP will be developed and submitted no later than one (1) year, or earlier if possible, before scheduled permanent closure or immediately after notification of an unplanned closure (within 120 days) to provide greater detailed descriptions of the proposed reclamation activities in such a manner that they can be subsequently implemented. If future revisions of referenced Project authorizations were to require this to change, this timeframe will be adjusted accordingly.

1 MVLWB/AANDC, Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories, November 2013

1.0 PLAIN LANGUAGE SUMMARY

1.1 PROJECT AND CLOSURE SUMMARY

The Mary River Project is an open pit iron ore mine located in the Qikiqtani Region of Nunavut on northern Baffin Island, approximately 160 kilometers south-southwest of the nearest community of Pond Inlet (Mittimatalik) and 1,000 kilometers north-northwest of the territorial capital of Iqaluit. The Mary River iron ore deposit on North Baffin Island is considered to be one of the largest and highest quality iron ore open pit deposits in the world. The Mary River Project is currently the largest private employer in the Qikiqtani Region and is one of four operating mines in Nunavut. The Project currently comprises an operating open pit iron ore mine and deep water port (Milne Port) that is operated by Baffinland and jointly owned by ArcelorMittal and Nunavut Iron Ore.

Once fully developed the Project will consist of an open pit iron ore mine exploiting Deposit No. 1 at Mary River, the Milne Inlet Tote Road, Milne Port capable of transporting and exporting ore to markets over an extended open water season, and a 149-km Steensby Railway and Steensby Port capable of transporting and exporting ore to markets year-round. When the Steensby Railway is operational the Tote Road will be only used as required for site operations and will be decommissioned as an ore hauling route. The current mine operation under SOP2 is expected to last for up to 8 years, plus 21 years for the Steensby Component as originally proposed.

Project-related facilities have been designed and constructed to minimize their footprint. These design and construction considerations have facilitated reclamation plans and minimized the engineering required to support the complete decommissioning and reclamation of the site.

Three closure scenarios and their associated closure and reclamation activities are described in this ICRP:

- Short-term temporary care and maintenance
- Long-term temporary closure
- Final closure

In addition to these scenarios, progressive reclamation measures have been proposed to facilitate temporary and final closures measures.

Short-term temporary care and maintenance or long-term temporary closure, occurs when the Project ceases operation with the intent of resuming activities in the future. During temporary closure, Baffinland will maintain all operating facilities and programs necessary to protect humans, wildlife, and the environment, including necessary environmental monitoring. Short-term temporary care and maintenance activities will occur if the Project ceases operation for a period of less than one (1) year with the intent of resuming activities in the future. Long-term temporary closure will occur if the Project ceases operation for a period of greater than (1) year with the intent of resuming activities in the future.

In short-term temporary care and maintenance, all facilities and equipment would be secured and de-energized. An inventory of all hydrocarbon products, chemicals, hazardous wastes, and explosives would be carried out and all effluents would be monitored. Personnel necessary, including environmental personnel, to maintain site security and project monitoring requirements would remain on site.

During long-term temporary closure the Project sites will be maintained in a secure condition, and all facilities and equipment would be de-energized and winterized. Hazardous waste and explosives would be removed from the site. Personnel necessary, including environmental personnel, to maintain site security and project monitoring requirements would remain on site.

Final closure and reclamation will occur when there is no foreseeable intent by Baffinland to return to active mining. Final closure and reclamation will include removing relevant infrastructure, equipment and materials into an on-site landfill, the Mine Pit, quarries and/or other approved disposal location(s) for disposal of inert, non-hazardous, non-combustible materials. All other infrastructure, equipment and materials will be sent off-site to an approved disposal location. Arrangements will be made with a sealift contractor to collect materials and equipment at Milne Port and Steensby Port to ship material destined for off-site transport. The airstrips will be closed and retained to provide emergency/rescue landing spots for regional aircraft and access for post-closure monitoring. Permanent dock structures will be left in place at Milne Port and Steensby Port, but all surface equipment and materials will be removed. Disturbed areas would undergo contouring of ground or granular surfaces as required to maintain stability, and natural drainage patterns will be re-established, if required, as reasonably possible. During final closure and reclamation, project components will be inspected to ensure specific closure objectives of project components are achieved and closure principles of long-term safety of the site, no long-term active care requirements, physical stability, and chemical stability have been met.

There will be several long-term landform changes once final closure measures have been implemented, including: the creation of the Waste Rock Facility (WRF), which is currently in Phase 1and described within Section 5.3.2, and the creation of a mine pit lake where previously there had been a hilltop, and several small quarries that will be visible landforms. Currently the pit and pit lake do not yet exist and are not anticipated to be a feature until 2034 and are described within Section 5.3.1 of this plan.

The final closure and reclamation activities are expected to last a period of three (3) years based on the estimated duration and level of effort required for identified closure activities[2], which has been estimated based upon predictions made within the FEIS and monitoring and modelling results from on site activities (see Baffinland Annual Reports for years 2019, 2020, 2021, 2022, 2023, 2023). Post-closure monitoring will continue until closure principles of long-term safety of the site, no long-term active care requirements, physical stability, and chemical stability have been shown to be met by monitoring results. These activities may be periodic. It is currently estimated post-closure monitoring and follow-up inspections will be conducted for a period of fifteen (15) years based on impact assessment determinations described in the Mary River Project Final Environmental Impact Statement.

An outline of major reclamation activities for each mine area, and the envisioned post-closure landscape is presented in Table 1.1.

1.2 PREDICTIONS FOR POST-CLOSURE CONDITIONS

Following reclamation, all Project areas are expected to be physically and chemically stable. Excluding the open pit and WRF areas, water quality is predicted to return to pre-disturbance levels, and wildlife may begin to safely access the area again. Changes to water quality and fish and fish habitat in Mary River and Camp Lake (including tributaries) downgradient from the open pit and WRF are an ongoing research priority of Baffinland.

2 Estimated duration and level of effort required for identified closure activities is described in ‘Annual Security Review (ASR)’ documentation required under Section 9.2 of the Commercial Lease, No. Q13C301, and under Part C and Schedule C of the Type A Water Licence No. 2AMMRY1325.

Disturbed areas will be graded to re-establish natural drainage pathways where practical, and natural revegetation will be promoted in priority areas by scarifying the surface materials to assist recovery. The revegetation process is expected to take many years and may never return to baseline conditions in certain locations. Baffinland has committed to ongoing discussions with the QIA on the fate of the Tote Road, airstrip and docks post-closure. Section 2.4 details the proposed forward approach to engagement with QIA and Appendix E describes historical discussions that have occurred with with communities to date. Baffinland has also committed to conducting monitoring programs, which is laid out in Project permits (i.e., NIRB Project Certificate, NWB Type A Water Licence). Where possible, Baffinland will also adaptively manage operations and mitigation strategies to minimize post-closure residual effects. Monitoring results will be reported to government agencies and the QIA for review and comment on an ongoing basis. In addition, working groups have been established to monitor Terrestrial and Marine effects during mining and to avoid unforeseen impacts post-closure. Ongoing mine closure planning will also be informed by community engagement feedback and focus studies, as described in the proposed engagement strategy found in Section 2.4.

1.3 FOCUS OF THIS REVISION

The main objectives of an ICRP are to set out the objectives and criteria for the successful closure and reclamation of the site, develop options for the reclamation of various areas on site, and to plan research efforts to address uncertainties with respect to closure. The aim of this revision is to:

- Update and streamline the presented information as required;
- Further develop engagement planning and participation to support closure planning;
- To address historical commitments from the annual security review (ASR) process;
- To update Reclamation Research Plan given site conditions and information gathered; and,
- Adjust closure criteria as required to address comments and concerns from stakeholders and regulators.

TABLE 1.1 OUTLINE OF MAJOR RECLAMATION ACTIVITIES AT EACH MINE AREA

Area	Project Operations	Major Reclamation Activities	Post-Closure Landscape
Milne Port and Steensby Port	Deep water port operation, with ore dock, ship loading facilities, ore stockpiles and, sedimentation ponds. Other primary infrastructure includes a freight dock, accommodations with sewage treatment plant, power plant, warehouse/garages, fuel storage, landfarm and hazardous waste storage area, polishing ponds, and quarry/borrow areas.	Decommissioning of all relevant infrastructure, removal of building materials and hazardous waste from site. Selected Port deep water dock components and abutments will be left and stabilized if required. Ore stockpiles removed. All equipment and supplies will be removed. Assessment and potential removal of contaminated soils. Grading of earthen structures and disturbed areas to re-establish natural drainage pathways where acceptable, and scarification as appropriate.	No visible foreign building materials will remain. Deep water docks will remain in place. Disturbed areas will be graded to establish stable drainage pathways that do not require maintenance. Natural recovery of vegetation will occur over many years. Surface materials will be scarified to accelerate recovery in priority areas. Ship traffic associated with the Project will stop. Travel to site for post-closure monitoring will be via aircraft only.
Tote Road	Ore hauling road from the Mine site to Milne Port. Approximately 100 km long, all-season gravel road. The road includes over a hundred water crossings consisting of culverts and four bridges. Ore is hauled by truck and trailer assembly, with payload of roughly 150 tonnes. Water intake infrastructure from permitted sources for dust suppression. Quarries and borrow areas exist along the road. Upon completion of the Steensby Railway (see below), the Tote Road will no longer be the primary route for the transportation of ore.	Removal of all water crossing structures, water intakes, and equipment associated with quarries and borrow areas. Assessment of bridge abutments for long-term physical stability, and potential removal of fill. Streambed and banks will be assessed for physical stability and alterations will be made as necessary. Grading at quarries and borrow areas to re-establish natural drainage pathways where possible, and scarification as appropriate.	Remaining sections of the road adjacent to former water crossings will be shaped to maintain long-term stability. Tote Road traffic associated with mining will stop. No further maintenance of the road will be completed by BIM. Remaining sections of the road may be used by land users. At former water crossings, banks will be graded to provide access for ATVs. Natural recovery of vegetation will occur over many years. Surface materials will be scarified to accelerate recovery in priority areas.

Area	Project Operations	Major Reclamation Activities	Post-Closure Landscape
Steensby Railway	A 149km heavy gauge railway between the Mine Site and Steensby Port to transport ore for shipment to worldwide markets from Steensby Port	Removal of all steel water crossing structures, and equipment associated with quarries and borrow areas. Removal of rail superstructure and grading of remaining rail embankments as required to achieve stability (will be informed by research) Bridge abutments will stay in place and will be stabilized if required. Streambed and banks will be assessed for physical stability and alterations will be made as necessary. Grading at quarries and borrow areas to re-establish natural drainage pathways where possible, and scarification as appropriate.	Rails will be removed for onsite disposal or offsite recycling. Disturbed areas will be graded to establish stable drainage pathways that do not require maintenance. Natural recovery of vegetation will occur over many years. Surface materials will be scarified to accelerate recovery in priority areas.
Mine Site	Mining operations commencing on a hill crest outcrop, progressing to open pit mining in year 20 of mining (2034) based on historic and forecasted mining rates. A haul road exists from the orebody to the ore crushing/loading facilities and WRF. Supporting infrastructure includes the airstrip and helipad, utilities (power, water, sewage), warehouses/garages, offices, accommodations camp, landfill, explosives storage and emulsion plant, sedimentation and polishing ponds, quarries and borrow areas.	The final open pit will be flooded by natural inflows and active pumping. An engineered spillway will be constructed to discharge overflowing water to a tributary of the Mary River. During operations, there will be progressive placement of a 4 m thick cover of non-potentially acid-generating (non-PAG) rock over the WRF. Decommissioning of all infrastructure, removal of building materials and hazardous waste from site. Ore at crushing/loading facilities removed. All mobile equipment and supplies will be removed. Assessment and onsite treatment or potential removal of contaminated soils. Grading of earthen structures and disturbed areas to re-establish natural drainage pathways where acceptable, and scarification as appropriate.	Current estimates for the final open pit include a footprint of approximately 1 km by 1.75 km wide with roughly 200 m average depth. The WRF will be approximately 250 m high at its highest point. Actual dimensions of these areas are irregular and may change based on the orebody and market conditions. Water treatment is not expected to be required at the open pit and WRF. No visible foreign building materials will remain. Disturbed areas will be graded to establish stable drainage pathways that do not require maintenance. Natural recovery of vegetation will occur over many years. Surface materials will be scarified to accelerate recovery in priority areas.

2.0 INTRODUCTION

2.1 BACKGROUND AND INTRODUCTION

The Mary River Project (the Project) is located on north Baffin Island, in the Qikiqtani Region of Nunavut. The Project is wholly owned by Canadian mining company Baffinland Iron Mines Corporation (Baffinland). The scope of the Project is defined by Project Certificate No. 005 and Type A Water Licence 2AM--MRY1325. The Project's Interim Mine Closure and Reclamation Plan (ICRP) is a "living" document, which is refined regularly throughout the life of mine until a Final Closure and Reclamation Plan is prepared. Ongoing iterations to the ICRP will address issues such as notable changes to the Project and refinements to the closure design based on findings from operational data collection (e.g., community engagement, environmental monitoring, research studies, etc.). This version (version 6) of the ICRP builds on the initial Preliminary Mine Closure and Reclamation Plan (PMCRP) (H337697-0000-07-126-0014) presented in Volume 3, Appendix 3B, Attachment 10 of the Mary River Project Final Environmental Impact Statement (FEIS) and the Interim Closure Reclamation Plan (ICRP), version 5 (BAF-PH1-830-P16-0012) (Baffinland 2018).

This ICRP document has been developed in accordance with applicable requirements from numerous regulatory instruments and guidelines, including the following primary sources:

- Conditions applying to security and abandonment, closure and reclamation or temporary closure in Type A Water Licence 2AM-MRY1325.
- Conditions applying to closure and reclamation set forth in Commercial Lease No. Q13C301.
- Terms and conditions of Project Certificate No. 005
- Qikiqtani Inuit Association's (QIA's) Abandonment and Reclamation Policy for Inuit Owned Lands (Version 3.0; QIA, 2024).
- Mackenzie Valley Land and Water Board (MVLWB)/Aboriginal Affairs and Northern Development Canada (AANDC; now CIRNAC) Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the NWT (MVLWB/AANDC, 2013).

2.2 DOCUMENT ORGANIZATION

The ICRP follows the recommended template provided in the MVLWB/AANDC Guidelines (MVLWB/AANDC, 2013) referenced in Section 1.1, as requested by the QIA. This ICRP includes the following major topics of discussion:

Section 2	Provides the purpose, scope, and goal of the ICRP, outlines the closure and reclamation planning team, details the approach for engagement, and summarizes regulatory instruments (permits, authorizations, and agreements) for closure and reclamation
Section 3	Describes pre-disturbance (baseline) conditions for the atmospheric, physical (terrestrial), biological and socio-economic environment
Section 4	Provides a detailed description of the Mine, including the location and access, project history, site geology, and high-level project summary
Section 5	Provides a detailed description for the permanent closure of each of the Project components, including the expected final conditions. This Section contains the bulk of available detail for how the Mine will be closed, the reclamation targets Baffinland seeks to achieve (closure objectives and criteria) and the other key components of the closure design (e.g., performance monitoring, uncertainties, contingency planning)
Section 6	Provides a description of planned and completed progressive reclamation at the Mine Site

Section 7	Discusses planning for short-term temporary mine closure and long-term mine closure and suspension of activities
Section 8	Provides a schedule for the planned closure activities
Section 9	Provides a post-closure site assessment that summarizes how the residual environmental impacts of the Mine will be assessed once the selected closure activities have been completed
Section 10	Discusses the estimated costs associated with closure and reclamation activities
Section 11	Glossary of terms, acronyms, and abbreviations
Section 12	References
Appendix A	Provides the Preliminary Mine Closure and Reclamation Plan drawings
Appendix B	Provides a tabulated summary of concordance with mine closure and reclamation planning guidelines, regulations, and lease requirements
Appendix C	Presents recent photos of major operational areas
Appendix D	Discusses the Reclamation Research Plan developed to address items such as pit water quality, waste rock seepage quality and natural revegetation
Appendix E	Provides a record of engagement on closure issues
Appendix F	Discusses lessons learned from other sites applicable to the closure and reclamation of this Project
Appendix G	Summarizes predicted residual effects predictions
Appendix H	Summarizes FEIS Freshwater Quality Predictions (Based on FEIS and its Addendum, Volume 7, Section 3.4, and Phase 2 Proposal TSD 13)

2.3 UPDATES TO THE CLOSURE PLAN

Closure planning is an ongoing activity and this ICRP will be updated as the project progresses considering lessons learned, the results of research and monitoring data, input from stakeholders, and changes to how the site is operated.

To account for interim closure and reclamation security adjustments to reflect project development phases until such a time planned closure commences, an updated determination of Project closure and reclamation security is currently captured on an annual basis in the Annual Security Review (ASR) process to account for any planned construction activities. This is done incrementally and reflects closure requirements if Baffinland is not able to reach its planned closure phase. The ASR process is conducted in accordance with Part C and Schedule C of Type A Water Licence 2AM-MRY1325 and Section 9.2 of the Commercial Lease No. Q13C301 and includes engagement with landowners and other key stakeholders. The results of this ASR process should be considered on the interim basis to assess Project closure and reclamation liability for the end of the upcoming year until such time planned closure commences. In all cases, closure and reclamation liability estimates adhere to required closure and reclamation guidelines including, but not limited to, the QIA Abandonment and Reclamation (QIA, 2024) Policy guiding principles and stated assumptions.

As per Type A Water Licence 2AM-MRY1325 and QIA Commercial Lease No. Q13C301, the Final Mine Closure and Reclamation Plan (Final CRP) will be developed and submitted at least one year before a scheduled permanent closure or within 120 days of the notification of an unplanned closure. The Final Mine Closure and Reclamation Plan will also be issued to relevant stakeholders including the Land Use Engineer of CIRNAC (Territorial Land Use Regulations, Sections 33 and 35). The Final Mine Closure and Reclamation Plan will provide more detailed descriptions of the proposed reclamation activities in such a manner that they can be subsequently implemented. If future revisions of referenced Project authorizations were to change, this timeframe will be adjusted accordingly.

Prior to closing out the Project, Baffinland will consult with the Landlord and surrounding communities regarding transfer of ownership of structures that may be utilized by the surrounding communities during harvests, camping, and other recreational uses or relocated to local hamlets.

2.4 PURPOSE AND SCOPE OF ICRP

Interim Closure and Reclamation Plans (ICRP) are documents prepared during the life of the mine that describe the current state of closure planning. Several updates or versions of an ICRP may be necessary over the life of the mine. This version of ICRP (version 6) therefore represents interim planning that builds on the previous version (version 5) and the Preliminary Closure and Reclamation Plan that was developed during the initial mine design phase. The expectation is that each version of the ICRP will be a step toward the Final Closure Reclamation Plan.

Mine closure and reclamation for the Project is regulated under Baffinland’s Commercial Lease No. Q13C301, Type A Water Licence 2AM-MRY1325, and Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) Land Lease 47H/16-1-2 and Lease Amendment 47H/16-1-5 (Section 2.6). In cases, if any, where there was conflict between Type B Water Licence 2BE-MRY2131 and the amended Type A Water Licence, Baffinland will adhere with the terms and conditions of the Type A Water Licence. In cases where the term ‘Abandonment and Reclamation (A&R)’ is used in authorizations, regulations, and other forms of communication, Mine Closure and Reclamation (MCR) is synonymous for the purpose of the Mary River Project.

This document is version 6 of the ICRP and it outlines the closure goal, principles, objectives, criteria, and activities associated with the final closure and reclamation of the Project as approved under Project Certificate No. 005 issued by the Nunavut Impact Review Board (NIRB). This ICRP is an update of the previously approved 2018 ICRP Version 5.0 (Baffinland 2018). It considers the complete development of the Mary River Project (the Project) and describes expected closure activities at the end of the Project Life based on updated information as well as updated reclamation research work plans. It also addresses technical comments received from various agencies during the technical review of Baffinland’s application to amend its Type A Water Licence for the Phase 2 Proposal (KP, 2021), the requirements of QIA’s Abandonment and Reclamation Policy (QIA, 2024) and historical comments made during the ASR processes by relevant stakeholders and regulators.

Based on current planning, temporal boundaries of the projected Project lifecycle are as follows:

- Construction (Early Revenue Phase [ERP]; 2014 to 2015)
- Operation (2016 to 2051)
- Closure and post-closure (2051 to 2069, 3 years closure and 15 years post closure monitoring)

Given the current stage of development, the ICRP is thus a conceptual benchmark for the intended reclamation and closure activities associated with all components of the Mary River project approved under Project Certificate No. 005. It does not include detailed engineering plans for preferred final closure options. The ICRP will be updated as required throughout the life of the Project.

As per Type A Water License 2AM-MRY1325 and QIA Commercial Lease No. Q13C301, the Final Closure and Reclamation Plan (Final CRP) will be developed and submitted no later than one (1) year, or earlier if possible, before scheduled permanent closure or immediately after notification of an unplanned closure (within 120 days) to provide greater detailed descriptions of the proposed reclamation activities such a manner that they can be subsequently implemented. If future revisions of referenced Project authorizations were to change, this timeframe will be adjusted accordingly.

Key changes between Version 5.0 (2018) and Version 6.0 (2024) of the ICRP including the following:

- Incorporating knowledge developed through operational monitoring and reclamation research studies
- Inclusion of updated Global Security Estimate
- Updates to the engagement section
- Updates to the Reclamation Research Plan (Appendix D)
- Inclusion of a new Environmental Site Assessment and Landfarm Research Program (Appendix D)

2.5 ICRP GOAL AND PRINCIPLES

It is expected that closure and reclamation techniques and methodologies for site reclamation will continue to evolve over the life of the Project with changes to the understanding of the Project site, stakeholder's views, and technologies for cost effective and practical reclamation in northern conditions. Planning for mine site reclamation is iterative and will be based on the protection of human health and the environment and remain dynamic to consider the results of ongoing and future studies and identified best practices.

The Project is being designed with closure and reclamation considerations in mind in compliance with the Baffinland Sustainable Development Policy (Baffinland, 2016). The main goals and underlying principles of the ICRP are to:

- Apply the principles of pollution prevention and continuous improvement to minimize ecosystem impacts and facilitate biodiversity conservation.
- Use energy resources, raw materials and natural resources efficiently and effectively.
- Engage with governments, employees, local communities and the public to create a shared understanding of closure and reclamation issues and take their views into consideration in making decisions.
- Return the Project affected and viable sites (Milne Port, Mine Site, and Quarries) to "wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and human activities" (NRCan 1994).
- Where practicable, undertake reclamation of affected areas in an ongoing and progressive manner to reduce the environmental risk once the mine ceases operation (INAC, 2002; Northwest Territories [NWT] Water Board, 1990; QIA, 2013).
- Provide for the reclamation of affected sites and areas to a stable and safe condition and restore altered water courses to near their original alignment and cross-section. Where practical, affected areas will be returned to a state compatible with the original undisturbed area (Territorial Land Use Regulations).
- Restore altered water courses to their original alignment and cross-section (Territorial Land Use Regulations).
- Reduce the need for long-term monitoring and maintenance by designing for closure and instituting progressive reclamation, when possible.
- Provide for mine closure using currently available proven technologies in a manner consistent with sustainable development.

- Provide sufficient detail such that adequate scopes of work can be developed for the execution of reclamation work. Where insufficient details exist, monetary allowances should be included in the reclamation security cost estimate to account for additional engineering and planning. Identification of the specific aspects of closure planning requiring refinement to reach a Final CRP and the corresponding reclamation security amounts are determined as part of the ASR process.

Regulatory instruments, legislation and additional guidelines that have been used in the preparation of this ICRP are described in Section 2.6.

2.5.1 SITE ABANDONMENT GOAL

In accordance with the above Sustainable Development Policy, the site abandonment goal of the final closure activities is to return project sites and affected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities[3].

2.5.2 CLOSURE PRINCIPLES TO ACHIEVE SITE ABANDONMENT GOAL

To achieve the site abandonment goal, closure objectives and criteria have been selected for Project components (Section 5) based on the following closure principles:

- Ensure the safety of the abandoned sites for wildlife and human users.
- Ensure physical stability of abandoned Project sites and remaining physical features (open pit, WRF, quarries, road and railway embankments, stream crossings).
- Ensure chemical stability of the mine open pit, WRF, quarries, and other Project disturbed areas.
- Reclamation should result in a site which is aesthetically and environmentally compatible with the surrounding undisturbed landscape.
- Site-specific reclamation requirements should be consistent with locally valued ecosystem components and regional planning objectives, including land use plans.
- Incorporate Inuit Qaujimajatuqangit (IQ) and considerations for future land use of Project sites in final closure planning (to be informed over time by the Mine Closure Technical Advisory Group (formerly Mine Closure Working Group; Section 2.4).
- International best practices for arctic conditions, as well as federal and territorial legislation, regulations and guidelines, will be employed in the planning and carrying out of reclamation (Section 2.5).
- Research will be undertaken to be able to meet reclamation objectives (Appendix D)
- Achieve the “Recognized Closed Mine” status in as minimal duration as reasonably practical, as defined by Part (4) of the Metal and Diamond Mining Effluent Regulations (MDMER, formerly the Metal Mining Effluent Regulations) SOR/2002-222 dated 1 June 2018 and ensure no requirements for long-term active care.
- Implement reclamation in a progressive, ongoing manner during the life of the Project and restore sites as soon as an area is no longer required for operations to limit the need for long-term maintenance and monitoring.
- Reclaim disturbed Project areas such that no long-term active care is required.

3 Based on alignment with Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVWLB/AANDC, 2013)

- Post-closure monitoring will be undertaken to confirm reclamation objectives have been achieved.
- Reclamation should result in a site that enables the exercise of Inuit rights and cultural practices.
- Reclamation activities pay particular attention to locally valued ecosystem components through avoidance, additional mitigation measures, and/or greater compensation.

The objectives and criteria proposed for implementing Final Closure and achieving the stated goal and principles are discussed in Section 5.2 of this ICRP.

2.6 CLOSURE AND RECLAMATION PLANNING TEAM

Currently, closure planning related to the Project is the responsibility of the Sustainable Development Department at Baffinland with the support of consultants as needed. Nunami Stantec has provided input on this revision of the ICRP.

The responsibility for the development, maintenance, adaptive management, research and planning for closure and reclamation is shared among departments and individuals within Baffinland. The organization chart below (Figure 2.1) displays responsibilities for conducting these closure related activities.

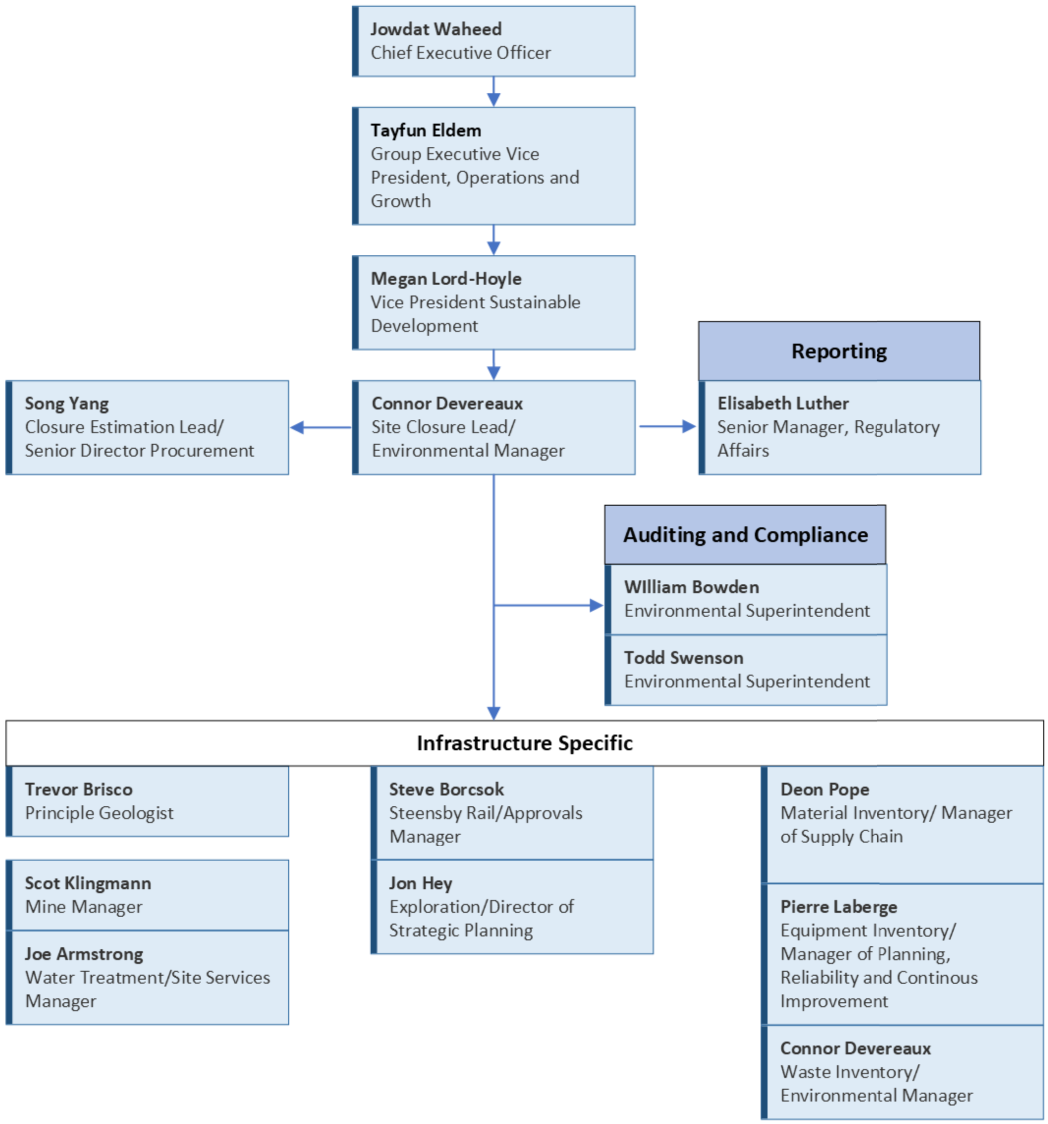


FIGURE 2.1 CLOSURE RESPONSIBILITY ORGANIZATIONAL CHART

As the Project proceeds, Baffinland plans to encourage participation of local communities and other stakeholders in the consideration of alternative reclamation activities to safeguard community values. Further information on engagement activities related to closure planning are outlined in Section 2.4.

2.6.1 CLOSURE PLAN PROGRESSION

The closure plan development was initiated at the planning stage with the creation of the Preliminary Mine Closure and Reclamation Plan (PCRP). This was followed by the development of the ICRP. The subsequent sections detail the progression and key developments associated with these plans.

2.6.1.1 PRELIMINARY MINE CLOSURE AND RECLAMATION PLAN

A PCRP (H337697-0000-07-126-0014) was prepared for Baffinland in support of the regulatory approval process, including the Final Environmental Impact Statement (FEIS) for the Project, and was based on available Project design information which was at a conceptual level. The PCRP assumes that the reader has access to and is familiar with the FEIS content.

The purpose of the PCRP was to provide an initial closure and reclamation plan for the Mary River Project, at a conceptual level, in accordance with the regulatory framework established by the Designated Inuit Organization, and Federal and Territorial governments.

2.6.1.2 INTERIM MINE CLOSURE AND RECLAMATION PLAN

The ICRP builds on the PCRP which was reviewed and approved by NIRB under Project Certificate 005, and by the Nunavut Water Board (NWB) with the issuance of Type A Water Licence 2AM-MRY1325. The ICRP reflects the requirements of Commercial Lease No. Q13C301, Federal Land Lease 47H/16-1-2 and Lease Amendment 47H/16-1-5, and Part J, Item 2 of the Type A Water Licence, 2AM-MRY1325 which required the PCRP to be updated to an ICRP 60 days prior to the commencement of the mining operations.

The Mary River Project ICRP was developed to increase the detail of the closure criteria and planning presented in the PCRP. It addresses progressive rehabilitation undertaken to date and addresses temporary care and maintenance and long--term closure as well as final cessation of operations. Public health and safety is considered throughout all stages of progressive rehabilitation, closure, and post-closure. The ICRP has undergone several revisions, the two previous revisions include Revision 4.0 (Baffinland, 2015), approved by the NWB September 19, 2016, and Revision 5.0 (Baffinland, 2018), conditionally approved by the QIA in 2018 and conditionally re-approved by the QIA May 15, 2024.

The ICRP does not constitute a Final Mine Closure and Reclamation Plan. The ICRP reflects the level of advancement of development on site and what is expect in future development.

2.6.1.3 UPDATES TO THE INTERIM MINE CLOSURE AND RECLAMATION PLAN

It is anticipated the ICRP will be reviewed and updated regularly throughout the life of the Project, as per the terms and conditions of the Commercial Lease No. Q13C301, Type A Water Licence 2AM-MRY1325, and Federal Land Lease 47H/16-1-2 and Lease Amendment 47H/16-1-5. Once the Project reaches full planned operation, and site activities and infrastructure have stabilized, less frequent updates may be discussed with QIA. Parties reserve the right to request an update, if warranted, and any changes to the existing ICRP update schedule would require QIA approval. Updates to the ICRP are primarily expected to focus on the refinement and elaboration of the specific performance indicators and commitments and incorporating any reclamation strategy changes based on reclamation research.

Baffinland expects ICRP updates to mainly coincide with the development of the Annual Work Plans as ICRP updates will primarily be required when an Annual Work Plan calls for the construction and operation, or reclamation, of components of the Project that have not been adequately addressed previously or further information has become available, or the Annual Work Plans notes material changes to project activities which would require consideration to closure and reclamation strategies. The update would also include any outcomes of the previous year's reclamation research, when available[4]. If a previously not considered activity or project component is proposed in an Annual Work Plan, the closure strategy will be detailed in the respective Work Plan and/or its supporting documentation.

When updates to the ICRP are required, Baffinland proposes the following timetable[5]:

- By November 1 of a given year, Baffinland will submit the Annual Work Plan, including any updates to the ICRP, to the Landlord and all other relevant stakeholders
- By December 1 of a given year, Baffinland expects review and comments on the updates to the ICRP from relevant stakeholders including the Landlord
- By December 31 of a given year, Baffinland will provide a revised ICRP, if required, to the Landlord for review
- By January 31 of the subsequent year, the Landlord will provide any further review and comments on the revised ICRP
- By February 28 of the subsequent year, the Landlord will approve the revised ICRP
- By March 31 of the subsequent year, Baffinland will distribute the current version of the ICRP to all relevant stakeholders.

2.6.1.4 FINAL CLOSURE AND RECLAMATION PLAN

As per Type A Water Licence 2AM-MRY1325 and QIA Commercial Lease No. Q13C301, the Final CRP will be developed and submitted no later than one (1) year, or earlier if possible, before scheduled permanent closure or immediately after notification of an unplanned closure (within 120 days) to provide greater detailed descriptions of the proposed reclamation activities such a manner that they can be subsequently implemented. If future revisions of referenced Project authorizations were to change, this timeframe will be adjusted accordingly. The Final CRP will include a schedule for the implementation of work; any additional appropriate closure criteria based on completed reclamation research and site monitoring; and fully describe the level of detail and certainty surrounding post-closure monitoring and contingency planning.

2.6.1.5 FINAL MONITORING AGREEMENT

As per Section 12.3 and 12.4 of the QIA Commercial Lease No. Q13C301, Baffinland will submit a Final Monitoring Agreement within twelve (12) months prior to the completion of Operations. The Final Monitoring Agreement shall include, but not be limited to, provisions detailing the implementation of the contents of the Final CRP in respect of post-closure monitoring. The Final Monitoring Agreement will be entered into and determined with Baffinland and the Landlord before Baffinland submits the Final CRP or any other monitoring plans in respect thereof to other regulatory agencies.

4 The results of any reclamation research that occur during a given year will first be reported to relevant stakeholders in that year's NWB and QIA Annual Report.

5 Proposed schedule of ICRP updates will be revisited if the frequency of the ASR process changes and/or based on the outcomes of the water licence amendment process for the Phase 2 proposal.

2.6.1.6 EXPLORATION ABANDONMENT AND RECLAMATION PLAN

The Exploration Abandonment and Reclamation Plan (BAF-PH1-830-P16-0038) is a distinct and separate plan from the ICRP that describes the closure and reclamation activities and costs for the Mary River Exploration Project regulated under Baffinland's Type "B" Water Licence No. 2BE-MRY2131. In the event Mary River Exploration Project activities occur on Inuit Owned Lands, Baffinland's IOL Commercial Lease (No. Q13C301) conditions will also then apply, and the Exploration Abandonment and Reclamation Plan would be required to be reviewed and approved by the QIA. If exploration liability did occur on IOL, it is expected closure goal, principles, objectives, and criteria would apply for similar components.

2.7 ENGAGEMENT AND POST-CLOSURE LAND USE

Meaningful and substantive Inuit, community, and Stakeholder engagement is valued by Baffinland as a means of building and maintaining community relationships and maximizing benefits from the Project. Baffinland's approach to engagement emphasizes the importance of informing Inuit, affected communities, and other stakeholders, as well as establishing effective dialogue, and collecting feedback and resolving issues and concerns (Figure 2.2). A summary of engagement to date is located in Appendix E. Baffinland understands that Inuit engagement must occur in a manner that is appropriate to the Nunavut and Qikiqtani regional context. Baffinland has made every effort to provide Inuit employees, individuals, communities, and Inuit organization groups with practical opportunities to engage in meaningful dialogue in the format of their choosing, and in a way that would meet their objectives and values.

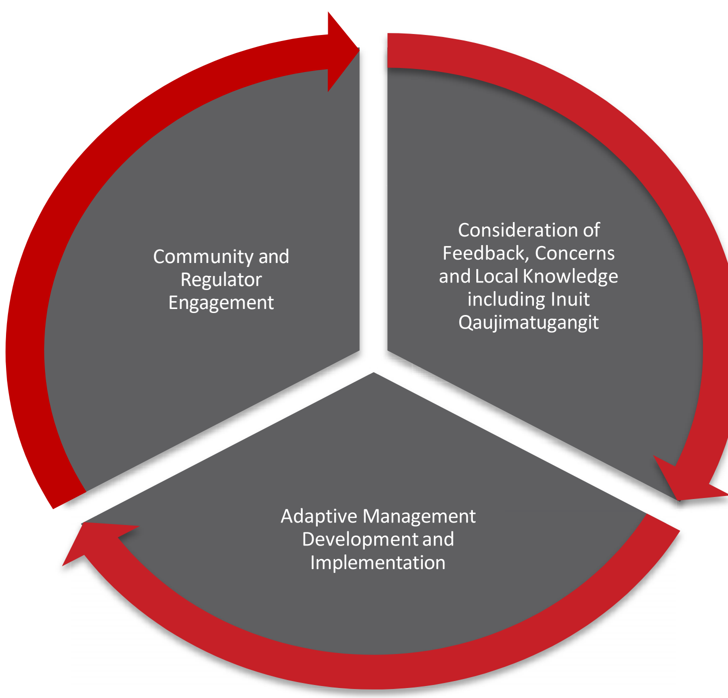


FIGURE 2.2 BAFFINLAND'S APPROACH TO ENGAGEMENT

In support of achieving the engagement objectives defined for the Project, Baffinland implements a variety of engagement mechanisms as part of its Community and Stakeholder Engagement Plan (CSEP, BAF-PH1-830-P16-0025) that are intended to ensure that a broad and comprehensive approach to the identification of stakeholders and that the creation of enhanced opportunities for dialogue and input are executed. Baffinland plans future updates to the CSEP to respond to feedback by communities on the Mary River Project.

2.7.1 EVOLUTION OF ENGAGEMENT FOR CLOSURE

Over recent years, Baffinland has carried out extensive engagement activities in relation to ongoing operations through the PIP (2018), PIPE (2020), PIP Renewal (2022), SOP (2023), and most recent SOP2 (2024) that have shaped the Approved Project as it has operated between 2018 and 2024. Ongoing engagement will continue to influence planning for shipping and other Approved Project activities beyond 2024. A summary of Project-related engagements from 2018 to 2023 are provided in Baffinland's annual reports to the NIRB (see Baffinland Annual Reports years 2019, 2020, 2021, 2022, 2023, 2023).

In the PCRP and previous versions of the ICRP (Version 4.0 and 5.0) (Baffinland 2012, 2015, 2018), a Mine Closure Working Group (MCWG) was proposed to be established as the key forum to facilitate integration of community representation and technical expertise by drawing on Inuit knowledge, arctic experience for similar mining operations, and discussion of alternative uses for decommissioned facilities into the reclamation options for various Project components. The MCWG was proposed to be established following the Phase 2 Proposal regulatory process.

Although the Phase 2 Proposal did not proceed, as part of the Phase 2 Proposal, in 2020, Baffinland made the commitment to support and fund the establishment of the Inuit Stewardship Plan (ISP) under the Inuit Certainty Agreement. The ISP is led by QIA, and currently under development. The Inuit Committee and the Inuit Social Oversight Committee for the Mary River Project provide input into the ISP. As part of the ISP, QIA will develop separate "terms of reference" for an Inuit Committee and an Inuit Social Oversight Committee. These "terms of reference" will address the selection and appointment of committee members, the function and operation of each committee, and a code of conduct for committee members. Communities shall nominate members to both committees. QIA shall be the party responsible for confirming appointments to each committee and overall administration of each committee. Baffinland will be responsible to fund the ISP for the life of the Mary River Project.

The ISP will describe how Inuit monitoring activities tie into the adaptive management system and other management, mitigation, and monitoring plans, and, how Inuit monitoring will relate to the protection and promotion of Inuit rights defined under the *Nunavut Agreement* and described under legal agreements with Baffinland related to management and stewardship of Inuit owned lands and resources. The ISP will be the framework for Inuit-led monitoring of impacts and changes within communities and on the land, waters, and ice because of the Project. The ISP will embed a "boots on the ground" approach to monitoring whereby Inuit will be hired and trained as professional monitors for monitoring under the ISP. Through the ISP, Inuit will govern the use of Inuit knowledge and observations regarding the Project. Figure 2.3 displays the general format of the ISP.

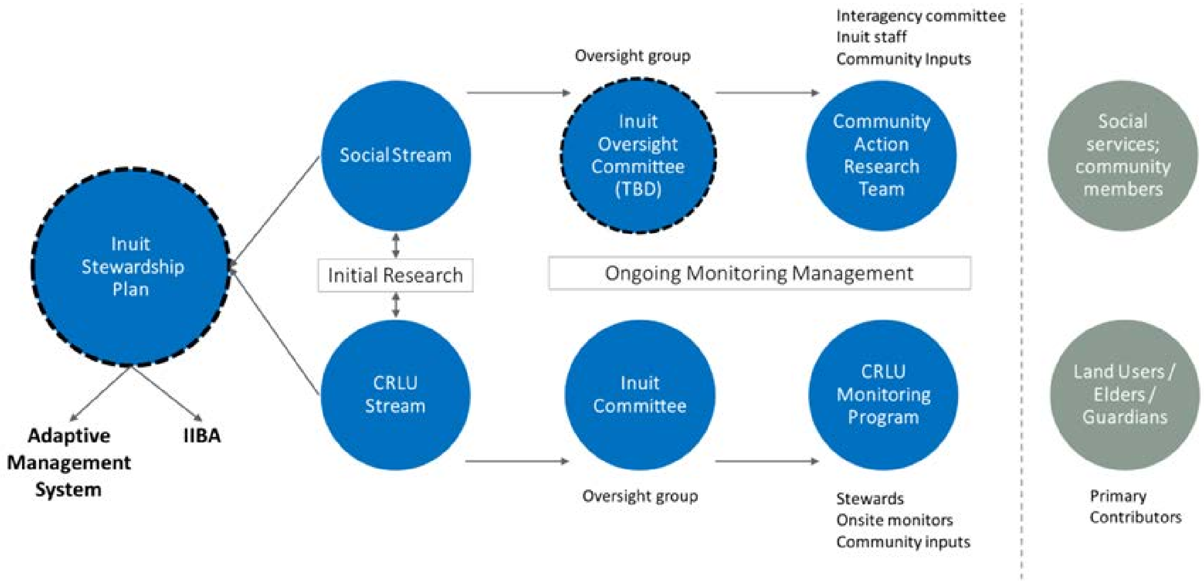


FIGURE 2.3 INUIT STEWARDSHIP PLAN FORMAT

As a result of this work and engagement, Baffinland has identified a need to revise how Inuit engagement is considered and integrated within the framework of closure and closure planning. Given the current stage of development of the Approved Project and extensive engagement related to ongoing operations, there has been limited need or availability to engage on technical and socio-economic aspects of mine closure planning amongst other priorities related to the Project phase and issues directly raised by Inuit in the communities. Section 2.4.1 outlines Baffinland's plan to continue to engagement with QIA and Inuit Stakeholders as the ICRP continues to evolve and develop through the operational life of the Mary River Project.

As the Project advances, Baffinland is committed to engagement with stakeholders regarding closure and reclamation issues. These issues include, but are not limited to:

- Inuit engagement in all facets of ICRP planning, including closure and reclamation objectives and, where appropriate, criteria based on desired future land use (aesthetics and values) of Project areas.
- Additional or modified reclamation research activities (Appendix D), and integration where appropriate, of Inuit-led observational monitoring parameters and programs associated with the implementation of the ICRP reclamation activities.
- Through engagement, establishing areas of heightened importance for Inuit and desired end land use states for those locations, noting that:
  - these areas can apply to terrestrial, aquatic, marine and riparian environments
  - not all areas that are or will be impacted by the Project have necessarily the same use value to Inuit (though all are important)
- Addressing opportunities (overall and for Inuit) in progressive reclamation, such as how will Inuit and QIA be involved in determining appropriate targets, schedules, processes, and measures of success, and implementation and reporting of progressive reclamation.
- Requirements to address identified uncertainties and determine the appropriateness of existing action levels (Section 5.2).
- Whether there will be any interest in maintaining the bulk fuel storage facilities and/or sealift landing areas for use by the local community, assuming responsibility for the operation and maintenance of the facilities would be transferred to the local interested party.

- Transfer of responsibility of the Tote Road water crossings to the local community and if the Tote Road will be left completely intact assuming road operation and maintenance responsibility would then be transferred to another party. Implications for liability will need to be discussed with QIA in advance of this transfer.
- Transfer of responsibility of the South rail infrastructure including all water crossings and bridges, assuming rail operation and maintenance responsibility would then be transferred to another party. Implications for liability will need to be discussed with QIA and the Crown in advance of this transfer.
- Transfer of responsibility of airstrip (including airstrip lighting) to the local community assuming the airstrip is left intact and operation and maintenance responsibility would then be transferred to another party. Implications for liability will need to be discussed with QIA in advance of this transfer.
- Whether there will be any interest in transfer of salvageable materials and buildings for local community use assuming responsibility would be transferred to another party.

2.7.2 ENGAGEMENT STRATEGY

Baffinland's approach to engagement emphasizes the importance of informing stakeholders, establishing effective communication strategies, and collecting feedback from them on potential issues and concerns. To achieve the engagement objectives defined for the Project, Baffinland implements a variety of engagement mechanisms as part of its Stakeholder Engagement Plan (BAF-PH1-830-P16-0025) that are intended to ensure the execution of a comprehensive approach to identify stakeholders and the creation of enhanced opportunities for dialogue and input.

Although no closure specific community engagement has been initiated to support the development of this ICRP, during engagement activities with the North Baffin communities, the QIA and other stakeholders related to the Early Revenue Phase (ERP), ongoing operations and the Phase 2 Proposal, several questions have been raised about Project closure and reclamation. These have been mainly concerned with responsibility for who would be cleaning up potential Project-related spills as proponents of past projects created fuel spills, which may have affected marine mammals. Some community members wondered what would happen to Project infrastructure and equipment post-closure and others asked about the status of the ICRP. Stakeholder comments and Baffinland responses related to closure and reclamation are provided in Appendix E.

Baffinland had previously proposed to establish the MWCG to incorporate considerations for post-closure land use of the Project site. Based on the current operations and feedback from stakeholders, Baffinland is proposing to establish a Mine Closure Technical Advisory Group (MCTAG), which would provide opportunities to integrate feedback from relevant members of ISP committees and obtain input from Inuit on closure considerations and concerns directly from Inuit.

The role of the MCTAG will be to facilitate the integration of community representation and technical expertise by drawing on Inuit knowledge, and arctic experience for similar mining operations. It would also provide opportunities to discuss alternative uses for decommissioned facilities into the reclamation options for various Project components. Baffinland expects an early priority for the MCTAG will be to provide technical input in the reclamation research activities (Appendix D) applicable to the Project to help address identified uncertainties and review existing action levels (Section 5.3).

Before the initial MCTAG meeting, Baffinland proposes to develop a mandate for the group, in collaboration with QIA. The mandate will include details on group membership and stakeholder priority for topics to be discussed.

The MCTAG will allow incorporation of stakeholder knowledge for post-closure land use of the Project area.

Based on discussions with QIA and relevant stakeholders, Baffinland anticipates that the MCTAG will be a key part of the engagement for the ICRP, but not the only part. The ISP is an important pathway to obtain IQ from community members and elders, in addition to the feedback from the MCTAG. An overview of how these groups may interact is displayed in Figure 2.4 below.

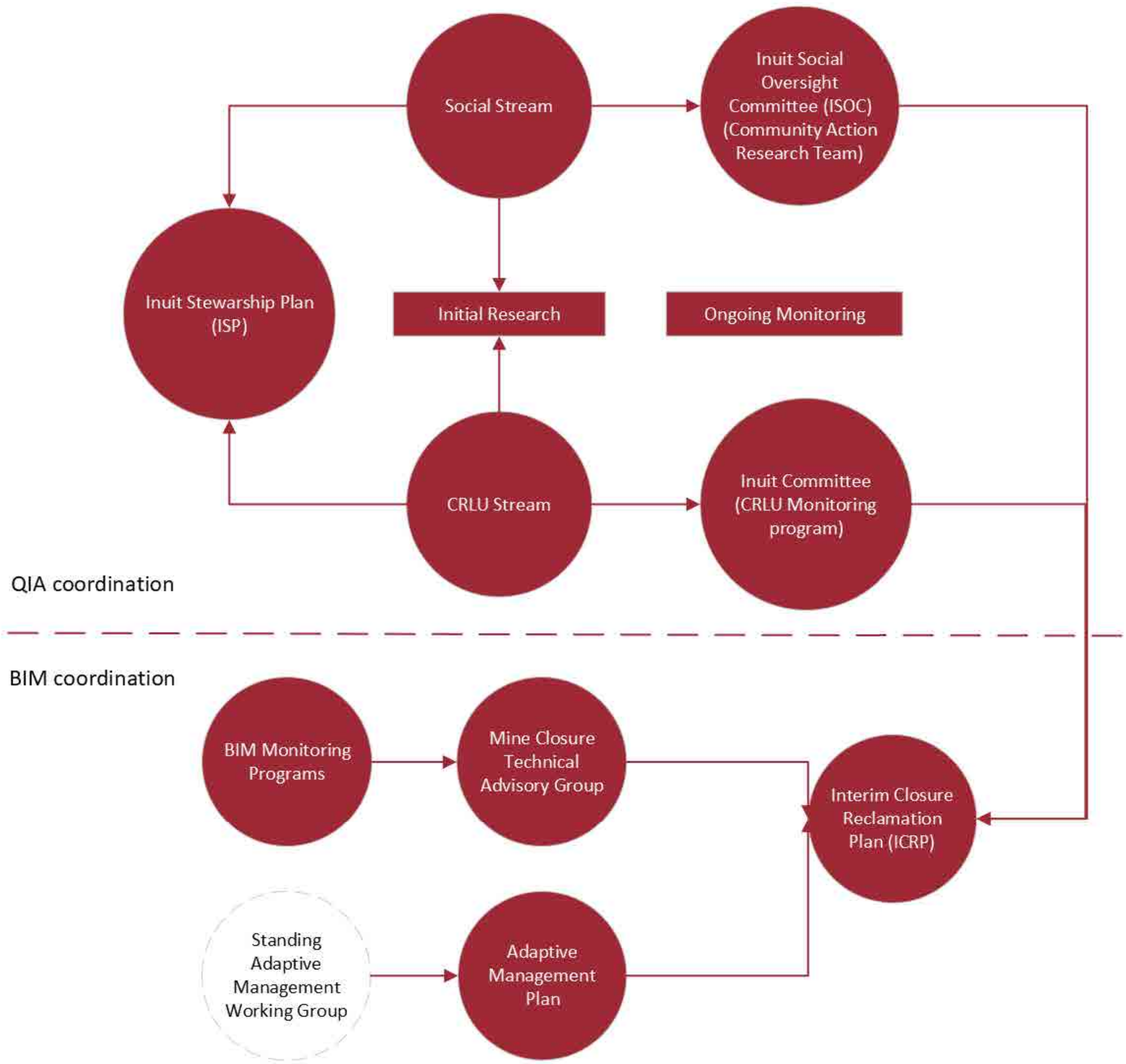


FIGURE 2.4 ICRP ENGAGEMENT FORMAT

Moving forward, Baffinland plans to kick off the MCTAG to provide input in conjunction with input from the ISP Inuit committees, which will have a central role in closure engagement and the development closure objectives, ongoing adaptive management and research planning. Baffinland has and will continue to consider Inuit Qaujimaningit to assess the accuracy of impact predictions, when designing or interpreting the effectiveness of impact reduction activities, and the need to modify such activities including, but not limited to, socio-economic elements, such as Inuit

Human Resource planning. Baffinland has made multiple project modifications as a direct result of Inuit Qaujimaningit shared with it and the results of engagement with Inuit. In 2022, Baffinland directly hired Inuit Knowledge Holders in each of the five impacted communities as well as Community Resource Guides. These roles are seen as critical to guiding Baffinland's senior management in its decision making, facilitating knowledge transfer within and between community members and Baffinland staff, and guiding the collection and use of IQ. Baffinland notes that IQ is and will continue to be collected through several formal and informal mechanisms. Table 2.1 identifies the opportunities that Baffinland has explored to incorporate Inuit Qaujimaningit into the ICRP. It should be noted that the Inuit Committee is an independent committee under the ISP. As such, Baffinland will work closely with QIA and the Inuit Committee to enable their involvement in management plan updates, inclusive of the ICRP, on matters related to adaptive management and Inuit OITR. Baffinland will incorporate input from the Inuit Committee if it is provided.

TABLE 2.1 INUIT QAUJIMANINGIT AND KEY ICRP COMPONENTS

Element	Description
Environmental sensitivities and receptors	Confirmation required with Inuit through the MCTAG; Inuit objectives, indicators, thresholds and responses (located in Table 5.1) to be identified in the ICRP and subject to later revision through the ISP and AMP reviews on a scheduled basis
Objectives, Indicators, Thresholds, Responses	Confirmation required with Inuit through the MCTAG; Inuit objectives, indicators, thresholds and responses (located in Table 5.1) to be identified in the ICRP and subject to later revision through the ISP and AMP reviews on a scheduled basis. Indicators can include, but are not limited to: consideration of mixture of native plants, presence (or lackthereof) of invasive species, density of plant cover, plant quality, total area for the regrowth.
Mitigation measures	Confirmation required with Inuit through the MCTAG
Monitoring	Confirmation required with Inuit through the MCTAG
Adaptive management	Confirmation required with Inuit through the MCTAG
Validation of IQ Integration	To be verified by Inuit Committee
Management review	To be verified by Inuit Committee

An important aspect of integrating Inuit Qaujimaningit is validating such integration with Inuit. For this reason, only potential opportunities for Inuit Qaujimaningit integration have been identified. A more fulsome effort to incorporate Inuit Qaujimaningit into the ICRP will be undertaken in the future, based on feedback from the Inuit Committee (to be established) and the proposed Baffinland-QIA Adaptive Management Working Group, consistent with the draft Adaptive Management Plan (Baffinland, 2020). The adaptive management process as it relates to closure planning is described in more detail below.

2.7.3 ADAPTIVE MANAGEMENT IN CLOSURE PLANNING

Adaptive management is a planned and systematic process for continuously improving environmental management practices by learning about their outcomes (Canadian Environmental Assessment Agency, 2016). Adaptive management provides flexibility to identify and implement new mitigation measures or to modify existing ones during the life of a project. For each management plan there may be several regulatory authorities and/or interested parties with technical expertise that contribute to the development of adaptive management components, including setting thresholds. In some cases, there may also be supporting working groups, that have mandates provided for under the terms of approval. For the Mary River Project, the three formal working groups established to support specific monitoring and management objectives, including the Terrestrial Environment Working Group, the Marine

Environment Working Group, and the Mary River Socio-Economic Working Group have a key role to play in adaptive management. It is anticipated that the Inuit Committees (currently defined in the draft AMP), will also participate in the development of closure objectives, ongoing adaptive management and research planning, and be an important additional body for supporting monitoring and management objectives. The Inuit Committee is an independent committee under the ISP. Baffinland will work closely with QIA and the Inuit Committee to enable their involvement in management plan updates, inclusive of the ICRP, on matters related to adaptive management and Inuit OITR. Baffinland will incorporate input from the Inuit Committee if it is provided. Advice and submissions from these groups shall be appropriately considered in any process to establish or modify relevant thresholds and associated responses.

Baffinland has developed a draft Adaptive Management Plan (AMP) that provides the framework by which adaptive management is to be incorporated into Project operations and which will be used to develop and implement a single set of objectives, indicators, thresholds and response actions for each sub-plan, based on an appropriate weighting of Inuit Qaujimaningit and western science (Baffinland, 2020). The Project-wide adaptive management process begins with a planning phase, followed by iterative phases of implementing and monitoring the actions included in the plan(s), evaluating the effectiveness of actions included in the plans based on results of monitoring and other feedback mechanisms, and adjusting management strategies and actions and responses based on monitoring. The cycle begins anew with implementation and monitoring of a revised plan, which integrates the outcomes of the previous cycle. This cycle can occur, in real-time or over an extended period according to the nature of the situation or area of focus. In this way, a well designed and well-implemented adaptive management process progressively diminishes uncertainty, as management strategies and processes are refined throughout a project’s operational lifecycle. Ongoing communication with community members and stakeholders as outlined in the amended Inuit Impact and Benefit Agreement, and Community and Stakeholder Engagement Plan (BAF-PH1-830-P16-0025) may result in updates to management and monitoring plans throughout Project operations.

Longer term review of and response to monitoring data is addressed in the review of plan effectiveness which includes comparison of project effects against impact predictions made in the Final Environmental Impact Statement (FEIS; Baffinland, 2012) and the addendums (Baffinland 2013, 2018). The result of the reviews of environmental monitoring, management, and operational plans will be incorporated into this plan as closure objectives, indicators and thresholds are set.

Implementation of the AMP is proposed to be overseen by a Baffinland-QIA Adaptive Management Working Group. Ongoing inputs from the Inuit Stewardship Plan as well as Baffinland’s ongoing project monitoring programs will also form the basis of amendments and refinements to the objectives, indicators, thresholds, and response requirements over time.

Section 2.4 of the AMP states that with the QIA’s approval of Baffinland’s AMP and management plans, that implementation of pre-determined responses to effects as described in the management plan does not require additional approval by the QIA. Baffinland will communicate response actions to QIA prior to implementation unless this is not possible due to the expediency required by the circumstance. If, however, a new response not previously considered is proposed, QIA approval will be sought.

2.7.4 ICRP ADAPTIVE MANAGEMENT CHECKLIST

As outlined in the AMP, an Adaptive Management Checklist has been developed to facilitate the identification of adaptive management mechanisms, identify gaps and areas of improvement, and increase transparency about the level of adaptive management for each management or monitoring plan operating under the Environmental Management System. Table 2.2 presents adaptive management checklist for the ICRP, identifying how adaptive management has been incorporated into the current revision of the plan.

TABLE 2.2 INCORPORATION FOR ADAPTIVE MANAGEMENT IN THIS PLAN

Adaptive Management Phases	Components	Proposed Adaptive Management Mechanisms	Status of Management Plan
Plan	Objectives	Are objectives clear and key desired outcomes defined? Do they include Inuit objectives?	<u>In Progress</u> Closure objectives are presented in Section 5.2. Inuit objectives are not discussed explicitly; however, it is acknowledged that input is required to define aesthetic objectives as well as end land use. The Inuit Committees are to provide this input. Short term closure objectives will rely on those developed for the related environmental management plans.
	Indicators	Are performance indicators adequately identified? Do they include Inuit defined indicators?	<u>In Progress</u> Closure criteria are presented in Section 5.2, which provide context for the indicators, however criteria should be considered as thresholds. Inuit defined indicators are not discussed separately, but it is acknowledged that these need to be developed by the Inuit Committees and receive updates through the MCTAG or other engagement on closure objectives and end land use. Short term closure criteria indicators will rely on those developed for the related environmental management plans.
	Identification of Thresholds	Are thresholds for specific responses identified (e.g., early warning triggers, action levels, quantitative metrics or qualitative descriptions)?	<u>In Progress</u> Short term closure thresholds will rely on those developed for the related environmental management plans. Reclamation and closure thresholds that relate to the objectives and criteria listed in Section 5.2 have not been developed. Many of the thresholds for closure (closure criteria) will be refined over the life of the Project and through reclamation research programs and engagement activities.

Adaptive Management Phases	Components	Proposed Adaptive Management Mechanisms	Status of Management Plan
	IQ Integration / Influence	Are mechanisms for IQ integration/influence identified?	In Progress Section 2.4 discusses engagement on closure to date and the development of the ISP in addition to the MCTAG to facilitate the integration of Inuit perspectives and IQ.
Implement and Monitor	Management Strategies and Responses	Are management strategies and response options clearly identified?	In Progress Management options and methods related to closure and reclamation are described throughout Section 5.2.
	Resourcing	Are all phases of the adaptive management cycle properly resourced (in accordance with Inuit Agreements) to be fully implemented?	In Progress Roles and Responsibilities are briefly described in Section 2.3
	Monitoring	Does the monitoring program provide the information needed to determine the effectiveness of management strategies and responses?	In Progress Post-closure monitoring is discussed in Section 9. The monitoring programs, similar to those implemented during the operations phase, will assess the effectiveness of the closure strategy to meet the objectives and criteria defined in the ICRP and ultimately the Final Closure and Reclamation Plan.
	Timeline for implementation	Is the possibility that rapid response may be necessary, considering the implementation plan/process?	In Progress Rapid response options for short term closure will be defined in the relevant environmental management plans, as noted above.
Evaluate and Learn	Review Data and Feedback	Is the process for reviewing and evaluating management effectiveness (based on monitoring data and feedback) articulated?	In Progress Section 9 describes the post-closure monitoring and reporting requirements. These are presented as conceptual in nature at this stage of the Project life (initial phased operations). As the project advances a more detailed study design for assessing residual environmental impacts following completion of reclamation activities will be developed.

Adaptive Management Phases	Components	Proposed Adaptive Management Mechanisms	Status of Management Plan
	Additional Mitigation	Are mechanisms for determining the need for additional mitigation described?	In Progress Management options are described throughout Section 5.2 and Section 7. Mitigation is described at a conceptual level at this stage of the Project life.
	Input of IQ Holders	Are opportunities identified for IQ holders to review results and provide input into adaptive management responses / mitigations?	In Progress The Inuit Committee established through the Inuit Stewardship Plan, as well as the MCTAG, will facilitate the integration of community representation and technical expertise by drawing on Inuit knowledge, arctic experience for similar mining operations, and discussion of alternative uses for decommissioned facilities into the reclamation options for various Project components.
Adjust	Unanticipated Effects or Issues	Is it apparent how unanticipated effects or issues will be actioned and resolved?	Pending Approval Unanticipated environmental effects or issues are managed through the relevant environmental monitoring and management plans noted above.
	Reporting	Are reporting mechanisms for new / revised strategies and response actions established?	Pending Approval Section 9 describes the post-closure monitoring and reporting requirements. These are presented as conceptual in nature at this stage of the Project life (initial phased operations). As the project advances a more detailed study design for assessing residual environmental impacts following completion of reclamation activities will be developed.
	Scheduled Updates	Is the frequency of scheduled updates to the management plan identified?	Pending Approval Section 2.3.1.3 describes when the plan would be updated based on defined criteria.

2.8 CONCORDANCE TO REGULATORY INSTRUMENTS, REGULATIONS AND CLOSURE PLANNING GUIDELINES

Baffinland is committed to, and will be responsible for, carrying out the closure and rehabilitation measures in a phased, ongoing (progressive) manner as reviewed and agreed with the Landlord, regulatory agencies and impacted communities.

This current revision of the ICRP has been developed as per the Type "A" Water License 2AM-MRY1325 - Amendment No. 1 Part J, Item 2, in accordance with the Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVWLB/AANDC, 2013); and the Abandonment and Reclamation Policy for Inuit Owned Lands (QIA, 2024).

The permits, licences, authorizations, and agreements that Baffinland currently operates with or is expected to require are presented in Table 2.3.

The Territorial Land Use Regulations pursuant to the *Territorial Lands Act* (Minister of Justice, 2022) also specify legal requirements relevant to closure. ICRP concordance to these regulations is presented in Appendix B.

Several mine closure guidelines have been adopted to assist in the development of this ICRP:

- Abandonment and Reclamation Policy for Inuit Owned Lands (QIA, 2024)
- Guidelines for the Preparation of an Environmental Impact Statement for Baffinland Iron Mines Corporation's Mary River Project (NIRB, 2015)
- Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVWLB/AANDC, 2013)
- Mine Site Reclamation Guidelines for the Northwest Territories (AANDC, 2007)
- Mine Site Reclamation Policy for Nunavut (AANDC, 2002)
- Mine Reclamation in the Northwest Territories and Yukon (DIAND, 1992)
- Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories (NWT Water Board, 1990)

ICRP concordance to these guidelines is also presented in Appendix B.

A Glossary of Terms, Acronyms and Abbreviations used throughout this document and the applicable guidelines and regulations can be found in Section 11.0.

TABLE 2.3 APPLICABLE PERMITS, LICENCES, AUTHORIZATIONS AND AGREEMENTS

Authorization	Regulatory Authority and Project Activity	Issued Date	Expiry	Applicable Scope of the Project	Applicable Legislation/ Agreements
Nunavut Planning Commission (NPC) Nunavut Agreement, and the Nunavut Planning and Project Assessment Act					
Amendment No. 1 to NBLUP	Required to establish a railway transportation corridor within the NBRLUP for the portion of the Steensby Railway located in its boundary	Recommended for approval by NPC in 2013 and in 2023; approval issued in 2024	No Expiry	Steensby Railway	Nunavut Agreement, Article 11 Nunavut Planning and Project Assessment Act
Amendment No. 2 to NBRLUP (Appendix P to the North Baffin Regional Land Use Plan)	Required to intensify use of Tote Road for Early Revenue Phase	2014	No Expiry	Early Revenue Phase	Nunavut Agreement, Article 11 Nunavut Planning and Project Assessment Act
Amendment No. 3 to NBRLUP (Amendment to Appendix R to the North Baffin Regional Land Use Plan)	Required to establish a railway transportation corridor within the NBRLUP for the proposed North Railway (included in Phase 2 Proposal, which was ultimately rejected by Minister in 2022)	2017	No Expiry	Phase 2 Proposal (Appendix R continues to permit trucking along the corridor)	Nunavut Agreement, Article 11 Nunavut Planning and Project Assessment Act
Nunavut Impact Review Board (NIRB) Nunavut Agreement, and the Nunavut Planning and Project Assessment Act					
Project Certificate No. 005	Required under Article 12 of the Nunavut Agreement to obtain the requisite permits and approvals to proceed with the Project.	2012	No Expiry	Entire Project	Nunavut Agreement, Article 12
Project Certificate No. 005 (Amendment No. 01)	Required under Article 12 of the Nunavut Agreement to obtain the requisite permits and approvals to proceed with the Project.	2014	No Expiry	Entire Project	Nunavut Agreement, Article 12

Authorization	Regulatory Authority and Project Activity	Issued Date	Expiry	Applicable Scope of the Project	Applicable Legislation/ Agreements
Project Certificate No. 005 (Amendment No. 02)	Required under Article 12 of the Nunavut Agreement to obtain the requisite permits and approvals to proceed with the Project.	2018	No Expiry[6]	Entire Project	Nunavut Agreement, Article 12 Nunavut Planning and Project Assessment Act
Project Certificate No. 005 (Amendment No. 03)	Required under Article 12 of the Nunavut Agreement to obtain the requisite permits and approvals to proceed with the Project.	2020	No Expiry	Entire Project	Nunavut Agreement, Article 12 Nunavut Planning and Project Assessment Act
Project Certificate No. 005 (Amendment No. 04)	Required under Article 12 of the Nunavut Agreement to obtain the requisite permits and approvals to proceed with the Project.	2022	No Expiry	Entire Project	Nunavut Agreement, Article 12 Nunavut Planning and Project Assessment Act
Project Certificate No. 005 (Amendment No. 05)	Required under Article 12 of the Nunavut Agreement to obtain the requisite permits and approvals to proceed with the Project	2023	No Expiry	Entire Project	Nunavut Agreement, Article 12 Nunavut Planning and Project Assessment Act

[6] It should be noted that the 'no expiry' designations for Amendments No. 002 to 005 indicate the transportation limits modified in TC's 179 (a) and 179 (b) reset after one to two years. However, the Project Certificate remains current and does not expire.

Authorization	Regulatory Authority and Project Activity	Issued Date	Expiry	Applicable Scope of the Project	Applicable Legislation/ Agreements
Qikiqtani Inuit Association (QIA) Agreements entered into with Baffinland pursuant to Articles 6, 20 and 26 of the Nunavut Agreement					
Inuit Owned Land (IOL) Commercial Lease Q13C301	Mine development activities on Inuit-Owned Land (IOL); Compliance with the lease is outlined in the *2023 QIA and NWB Annual Report for Operations* and the *2023 QIA and NWB Annual Report for Geotechnical Drilling,* submitted March 31, 2023	2013	December 31, 2043	Areas of the Project on Inuit-Owned Land, including Milne Port, the Milne Inlet Tote Road (except the Crown Land portion at KM60), Mary River Mine Site, Steensby Railway (KP 0 to approximately KP 26)	N/A
Inuit Impact and Benefit Agreement (IIBA)	Required under Article 26 of the *Nunavut Agreement* to proceed with Project - concluded first in September, 2013, subsequently amended in October, 2018 to account for the Production Increase Proposal; Compliance with the agreement is outlined in the Annual Inuit Impact and Benefit Agreement (IIBA) Implementation Report submitted by March 31st of each year.	2013, amended and restated 2018	No Expiry	Entire Project	Nunavut Agreement, Article 26
Wildlife Compensation Agreement	Wildlife Compensation required under Article 6 of the *Nunavut Agreement,* with the regime set out in IIBA.	2013	No Expiry	Entire Project	Nunavut Agreement, Article 6

Authorization	Regulatory Authority and Project Activity	Issued Date	Expiry	Applicable Scope of the Project	Applicable Legislation/ Agreements
Quarry Concession Agreement	Required to extract specified substances (quarried rock and borrow sand and gravel) on Inuit Owned Land under the Commercial Lease	2013	Not Applicable	Quarries and Borrow Sources on Inuit-Owned Land	N/A
Water Compensation Agreement	Required under Article 20 of the *Nunavut Agreement* to provide compensation to Inuit for water use by the project or impact to water use.	2013	N/A	Areas of the Project on Inuit-Owned Land, including Milne Port, the Milne Inlet Tote Road (except the Crown Land portion at KM60), Mary River Mine Site, Steensby Railway (KP 0 to approximately KP 26)	Nunavut Agreement, Article 20
Nunavut Water Board (NWB) Water Licences issued under the Nunavut Agreement (Article 13), the Nunavut Waters and Nunavut Surface Rights Tribunal Act, and the Nunavut Water Regulations					
Type 'A' Water Licence 2AM-MRY1325 Amendment No. 1	Water use and waste disposal associated with the mine; In good standing; no amendments were issued by the NWB in 2023. Compliance with the Licence is outlined in the 2023 QIA and NWB Annual Report for Operations, submitted March 31, 2023	2013 (amended 2015)	June 10, 2025[7]	Entire Project	Nunavut Agreement, Article 13 Nunavut Waters and Nunavut Surface Rights Tribunal Act

[7] Renewal application for Type 'A' Water Licence 2AM-MRY1325 is with the Nunavut Planning Commission (NPC) as of May 22, 2024

Authorization	Regulatory Authority and Project Activity	Issued Date	Expiry	Applicable Scope of the Project	Applicable Legislation/ Agreements
Type 'B' Water Licence 2BE-MRY2131	Regional exploration activities, including exploration drilling; In good standing; a licence renewal application was approved in 2021. Compliance with the Licence is outlined in the 2023 QIA and NWB Annual Report for Geotechnical Drilling, submitted March 31, 2023	April 17, 2021	April 16, 2031	Exploration Activities for the Mary River Project	Nunavut Agreement, Article 13 Nunavut Waters and Nunavut Surface Rights Tribunal Act
Crown Indigenous Relations and Northern Affairs Canada (CIRNAC) Mineral Leases and Land Leases, Land Use Permits, and Quarry Permits on Crown Land, issued under the Territorial Lands Act and associated Canadian Mining Regulations and Territorial Land Use Regulations					
Foreshore Lease 47H/16-1-2 Lease Amendment 47H/16-1-5	Supersedes historical Class A Land Use Permit N2014X0012; Use of foreshore area for current Milne Port Ore Dock; In good standing.	August 22, 2018	June 30, 2035	Milne Port area below high-water mark within Milne Inlet (Ore Dock, Freight Dock, Barge Landing)	N/A
Tote Road and Borrow Area Land Use Permit N2019Q0011	Land use permit for the section of Milne Inlet Tote Road on Crown Land, associated quarries and infrastructure.	June 30, 2019	June 29, 2026	Milne Inlet Tote Road portion on Crown Land at KM 60	Territorial Lands Act
Land Use Permit Bruce Head: N2019J0010	Land use permit for the summer marine monitoring camp at Bruce Head, in Milne Inlet.	June 30, 2019	June 29, 2026	Bruce Head Camp in Milne Inlet	Territorial Lands Act
Land Use Permit Steensby: N2019C0009	Land use permit for the Infrastructure and activities on Crown Land at Steensby Port.	June 30, 2019	June 29, 2026	Steensby Port area	Territorial Lands Act

Authorization	Regulatory Authority and Project Activity	Issued Date	Expiry	Applicable Scope of the Project	Applicable Legislation/ Agreements
Mineral Leases #2483, #2484 and #2485	Rights to extract minerals, Lease No. 2484 covers Deposit 1 (currently being mined)	August 27, 1971	August 27, 2034	Lease #2483 – Deposit No.4 Lease #2484 – Deposit No.1 Lease #2485 – Deposits No.2 and 3	Canada Mining Regulations
Fisheries and Oceans Canada (DFO) Authorizations and Letters of Advice issued under the Fisheries Act					
Letters of Advice (various)	Prior to 2021, DFO issued Baffinland various letters of advice in regard to Project crossings along the Tote Road, culvert extensions and replacements, laydown construction, and for stockpile expansion and barge landing expansion work at Milne Port.	Various	No Expiry	Water Crossings on Milne Inlet Tote Road Milne Port Ore Stockpile Milne Port Barge Landing	Fisheries Act
Fisheries Authorization 14-HCAA-00525	Authorization to construct the Milne Port Ore Dock in fish habitat; DFO reviewed final monitoring report and closed file on May 31, 2021.	June 30, 2014	Not applicable	Milne Port Ore Dock	Fisheries Act
Fisheries Authorization 18-HCAA-00160	Authorization to construct the Freight Dock in fish habitat; The Year 2 monitoring report for the Milne Port Freight Dock was submitted to DFO on March 18, 2023, in accordance with regulated timelines. A revised amendment application for the Freight Dock was also submitted by Baffinland on March 3, 2023	March 21, 2019	Not applicable; Request for amendment TBD	Milne Port Freight Dock	Fisheries Act

Authorization	Regulatory Authority and Project Activity	Issued Date	Expiry	Applicable Scope of the Project	Applicable Legislation/ Agreements
Transport Canada (TC) **Approvals of in-water works under the Navigable Waters Protection Act (NWPA; now the Canadian Navigable Waters Act); and Marine Facility Approval under the Marine Transportation Security Act and Regulations**					
Approvals: 8200-07-10273, 8200-07-10267, 8200-07-10269, 8200-07-10268, 8200-07-10274, 8200-07-10272, 8200-07-10266, 8200-07-10271	Approvals to interfere with navigation within navigable waters along the Tote Road at crossings: CV-040, BG-50, CV-128, CV-223, CV-072, BG-17, CV-217, and CV-099. In good standing, no changes from previous year.	Various	No Expiry; Until complete	Water Crossings on Milne Inlet Tote Road	Canadian Navigable Waters Act
Statement of Compliance of a Marine Facility # 1000000660	Approval for the Milne Inlet Marine Facility to conduct iron ore operations.	November 9, 2020	May 27, 2025	Milne Port	Marine Transportation Security Act and Regulations
National Resources of Canada **Licensing of Explosives Manufacture and Storage Facilities under the *Explosives Act***					
Division 1 Factory Licence #F76068/E	Issued to Baffinland's explosives contractor to manufacture explosives for the mine.	2013	No expiry	Emulsion Plant at Mary River Mine Site	Explosives Act
Governor in Council ***Territorial Lands Act***					
Order-in-Council 2013-0953	Required for authority for Crown Indigenous Relations and Northern Affairs Canada to issue lease for Steensby Railway lands located on federal lands, per *Territorial Lands Act*	2013	No expiry	Portion of Steensby Railway located on Federal Lands	Territorial Lands Act

2.9 ANNUAL SECURITY REVIEW

On an annual basis, to account for interim closure and reclamation security adjustments to reflect project development phases until such a time planned closure commences, an updated determination of Project closure and reclamation security is captured through the Annual Security Review (ASR) process should Baffinland not be able to reach its planned closure phase. The ASR process is conducted in accordance with Schedule C of Type A Water Licence 2AM-MRY1325 and Section 9.2 of the Commercial Lease, No. Q13C301, agreed to between Baffinland and the Landlord and includes engagement with landowners and other key stakeholders.

2.10 PROJECT UPDATES AND REPORTING

Since 2007, Baffinland has provided annual reports to the Nunavut Impact Review Board (NIRB) summarizing the site work completed, and the work planned for the following year for the activities previously screened and approved by NIRB. These reports also provide a synopsis of compliance performance with explorations licences, permits, approvals and commitments, and include the results of monitoring activities. An update on the existing environmental conditions and progressive reclamation activities are also contained in these reports. The reports are publicly available through NIRB (http://www.nirb.ca/) and the Baffinland Document Portal (www.baffinland.com) and results of the monitoring activities described in these annual reports which have an impact or influence on the goals, objectives, criteria, or strategy of the ICRP will be considered in future revisions of the ICRP.

Appendix C provides photographs of current conditions onsite.

3.0 PROJECT ENVIRONMENT

A summary description of the atmospheric, bio-physical terrestrial and socio-economic environments at the Project site locations are outlined in the following sections. A comprehensive description of the baseline social, physical, biological and chemical conditions at the Project Location and impact area, with supporting documentation, are presented in Volumes 4 to 8 of the Mary River Project Final Environmental Impact statement (FEIS; Baffinland 2012), and the Addendum to the FEIS for the ERP (Baffinland, 2013), as well as the FEIS Addendum for the Sustaining Operations Proposal 2 (Baffinland, 2024a), available through the NIRB website (http://www.nirb.ca/).

Baffinland's monitoring programs provide feedback on effects predictions and mitigation effectiveness and alert Baffinland to any previously unidentified risks. Baffinland continues to implement a comprehensive environmental management system that has applied to seven consecutive years of 6 Mtpa activity levels (2018-2024). Baffinland commits to incorporating IQ and scientific knowledge in monitoring. Table 3.1 summarizes current monitoring programs and management plans. Recent results of monitoring and mitigation plans, particularly for species identified as of heightened importance to Inuit (e.g., narwhal, seal, caribou and Arctic char), are incorporated into the following sections where applicable.

TABLE 3.1 SUMMARY OF MONITORING AND MITIGATION/MANAGEMENT PLANS

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
Atmospheric Environment		
Climate Change		
GHG Emissions	GHG emissions are tracked and calculated from fuel combustion and other sources annually for Milne Port and the Mine Site and reported as per Environment and Climate Change Canada's GHG Emissions Reporting Program and National Pollutant Release Inventory (NPRI).	Climate Change Strategy (Baffinland 2023a) Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002)
Air Quality		
Ambient Air Quality	Continuous ambient air quality monitoring at Milne Port and the Mine Site monitors SO_2 and NO_2. Equipment to measure TSP and $PM_{2.5}$ was installed in late 2021 at each site and has operated since 2022. Concentrations are compared to the Nunavut Ambient Air Quality Standards (NAAQS), and the Canadian Ambient Air Quality Standards (CAAQS).	Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002)
Dust Emissions	The Dustfall Monitoring Program is performed annually with sampling stations established at the Mine Site, Milne Port, along the Milne Inlet Tote Road and at reference sites located at various distances from Project operations. In 2021, 14 new dustfall monitoring stations were added to the existing monitoring program. During 2021, 2022 and 2023 there were 53, 53 and 49 dustfall monitoring stations, respectively.	Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002) Roads Management Plan (BAF-PH1-830-P16-0023) Dust Management Protocol Third-party Independent Dust Audit
Incineration Emissions	Stack testing completed on the Mine Site Incinerator and Milne Port Incinerator units was completed in 2013 upon commissioning of the units, and demonstrated compliance with the applicable emissions standards. Baffinland committed to conduct routine stack tests for dioxins, furans and mercury every five years, in accordance with comments made by NIRB following the 2018 Annual Report. Stack testing of the incinerators is conducted annually in compliance with ECCC. In 2021, Baffinland implemented a real-time monitoring system on the network, to monitor incinerator operating parameters during burns to identify abnormal operating conditions.	Waste Management Plan (including incineration) (BAF-PH1-830-P16-0028)

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
Noise and Vibration		
Noise and Vibration Emissions	Baffinland conducts noise and vibration monitoring in relation to human health and safety twice per year, at each receptor location (Milne Port and Mine Site).	Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002)
Terrestrial Environment		
Ground/Permafrost Stability		
Ground and Permafrost Stability	Monitoring of thermal conditions of the waste rock facility through thermistors to maintain the waste rock in a perpetually frozen state.	Phase I Waste Rock Management Plan (BAF-PH1-830-P16-0029)
Vegetation		
Vegetation Health • Vegetation abundance and composition • Metal Concentrations in soil and vegetation	Vegetation health monitoring includes vegetation abundance and composition, and metal concentrations in soil and vegetation. Long-term monitoring plots were established in a habitat-type selected to represent caribou forage, and are located near Project infrastructure and in control areas. Vegetation health monitoring involves the collection of soil and vegetation tissue samples for analysis of select chemicals of potential concern (CoPC) by an accredited laboratory. Sample sites are situated at varying distances from Project infrastructure and in control areas.	Terrestrial Environment Mitigation and Monitoring Plan (BAF-PH1-830-P16-0027) Roads Management Plan (BAF-PH1-830-P16-0023)
Invasive Species	Exotic invasive vegetation monitoring is focused on surveying previously disturbed areas within and adjacent to the Project footprint. Presence/absence sampling is used to search for exotic invasive vegetation where invasive plants could be found. Exotic invasive vegetation and natural regeneration monitoring are scheduled every three to five years or triggered by observations of exotic invasive plant species	Terrestrial Environment Mitigation and Monitoring Plan (BAF-PH1-830-P16-0027)
Terrestrial Wildlife and Wildlife Habitat		
Height of Land	Height of Land surveys are reconnaissance surveys conducted annually to determine i) if calving caribou are using sites within the PDA, ii) to provide a consistent index of wildlife use of the PDA, and iii) results are used as a trigger for further surveys if required.	Terrestrial Environment Mitigation and Monitoring Plan (BAF-PH1-830-P16-0027)

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
Caribou Distribution	Using collar data (GN-led effort) to assess caribou distribution in the Regional Study area (RSA) relative to the mine and infrastructure. As required (based in part on observations from Height of Land surveys, recurring caribou observations, hunter observations, expected population growth of the recovering north Baffin Island caribou herd), aerial surveys of the RSA surveys to assess caribou distribution and density. An aerial survey of the RSA was conducted in March 2023.	Terrestrial Environment Mitigation and Monitoring Plan (BAF-PH1-830-P16-0027)
Caribou Forage	Long-term vegetation abundance monitoring was established in 2014 to measure the percent plant cover and composition by plant group of available caribou forage within the RSA to track potential changes at varying distances from the edge of the PDA. Vegetation health and dustfall monitoring also contribute to evaluations of caribou forage.	Terrestrial Environment Mitigation and Monitoring Plan (BAF-PH1-830-P16-0027)
Wolf Active Dens, Habitat, Abundance, and Distribution	Wolves were identified for follow-up monitoring as a Project Term and Condition. Wolf monitoring is not feasible due to low numbers (none detected within 10 km of Project Infrastructure in eight years). Wolf monitoring would include monitoring for active wolf dens within a 10 km radius of the mine site, estimating available esker habitat within the RSA/PDA, and tracking abundance and distribution.	Terrestrial Environment Mitigation and Monitoring Plan (BAF-PH1-830-P16-0027)
Birds and Bird Habitat		
Active Migratory Bird Nest Surveys	Active nest surveys are conducted when new site disturbances are required during the breeding bird season. If nests are located, no-disturbance buffers are established to protect the nests and their contents.	Terrestrial Environment Mitigation and Monitoring Plan (BAF-PH1-830-P16-0027)
Cliff-Nesting Raptor Occupancy and Productivity Surveys	Known nest sites were surveyed annually from 2011 through 2022. As part of these surveys, crews also located new nest sites in suitable areas. Spring occupancy surveys (indicates the number of pairs that attempt to breed) and summer productivity surveys (to measure nesting success by counting the number of young that reach fledging age) are used to collect demographic information on raptor populations. The surveys were discontinued in 2022 after analyses showed no Project-related effects.	Terrestrial Environment Mitigation and Monitoring Plan (BAF-PH1-830-P16-0027)

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
Freshwater Environment		
Freshwater Quantity		
Water Withdrawal	Under the authorization of the Type 'A' Water Licence, freshwater is withdrawn to sustain three key activities at the Project: potable water supply (domestic), dust suppression, and for miscellaneous (industrial) uses. Daily volumes are documented and compared to daily limits.	Fresh Water Supply, Sewage and Wastewater Management Plan (BAF-PH1-830-P16-0010)
Water Balance	Water balance model at the WRF, which takes into account climate and hydrologic variability to understand the risks to current and planned water management strategies at the WRF Pond.	Phase I Waste Rock Management Plan (BAF-PH1-830-P16-0029)
Water and Sediment Quality		
Effluent	The Water Licence requires the reporting of monthly and annual volumes of effluents and wastes discharged by the Project, as well as discharge quality criteria applicable to the various effluents generated by the Project. Effluent quantity and quality together provide loadings data for downstream receiving environments. Periodic acute toxicity testing for end of pipe effluent discharge locations provides data on possible acute impacts to effluent exposure areas. Testing of treated effluent is required by the licence to confirm that the effluent is not acutely toxic.	Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039) Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026) Fresh Water Supply, Sewage and Wastewater Management Plan (BAF-PH1-830-P16-0010) Surveillance Network Program
Water Infrastructure	Routine inspections of water crossings at the Project are conducted throughout the year to ensure water crossings are not obstructed and are working as designed. Fish bearing water crossings at the Project are, at a minimum, assessed annually to ensure that surface water flows and fish passage is not being hindered or altered at Project fish bearing water crossings.	Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026) Roads Management Plan (BAF-PH1-830-P16-0023)
Surface Water Quality Tote Road Monitoring Program	Baffinland continued to implement the Surveillance Network Program (SNP) outlined in Schedule I of the Type 'A' Water Licence, analyzing effluents (i.e. treated sewage, treated oily stormwater) discharged to the receiving environment and monitoring surface water quality within specific Project areas (i.e. surface water runoff downstream of Project areas).	Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026) Roads Management Plan (BAF-PH1-830-P16-0023)

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
Sediment Quality	The Core Receiving Environment Monitoring Program (CREMP) includes an evaluation of potential mine-related influences on sediment quality within aquatic environments near the Mine Site. Receiving aquatic environments near the Mine Site are monitored during several periods throughout the year and include the Camp Lake, Sheardown Lake and Mary Lake Systems, as well as Reference Lake 3 and several reference tributaries.	Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039)
Lake Sedimentation	The Lake Sedimentation Monitoring Program monitors dust and sediment deposition rates in Sheardown Lake NW in an effort to better understand and evaluate potential mine-related influences on biota (e.g. fish larvae hatching success). Currently, the Lake Sedimentation Monitoring Program is conducted annually and involves the deployment and retrieval of submerged sediment traps to determine sediment deposition rates, density and thickness during ice-cover and open water periods.	Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039)
Groundwater Quality	A groundwater monitoring program in in place involving the installation of shallow groundwater wells downgradient the landfill and hazardous waste berms areas at the Milne Site. The 2022 and 2023 groundwater monitoring program sampled wells at the Landfill and Mine Site Hazardous Waste Berm Facilities to assess down-gradient groundwater quality.	Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026)
Freshwater Biota and Habitat		
Fish and Fish Habitat • Milne Inlet Freshwater Fish Health Assessment • Fish and Fish Assessments in Freshwater Lakes, Rivers and Streams	The objective is to evaluate the potential effects of the Baffinland Milne Port site operations on the health of Arctic char from freshwater systems that flow into Milne Inlet based on various physical measures and fish tissue chemistry. A before-after study approach was determined appropriate for evaluating whether the health of Arctic char from the Tugaat, Qurluktuk, and Ikaluit freshwater systems differ from historical data collected by DFO (before 2015) and 2021. Methodology followed is similar to methods used for environmental effects monitoring under the Metal and Diamond Mining Effluent Regulations (MDMER). Baffinland conducts annual fish population assessments for Arctic char in Camp Lake, Sheardown Lake, Mary Lake and Reference Lake 3 near the Mine Site as part of the Project's CREMP. Under the CREMP, condition of Arctic char populations within monitored lakes are assessed. The Project is subject to the MDMER under the Fisheries Act. The MDMER outline requirements for routine effluent and water quality monitoring and for biological monitoring, collectively referred to as Environmental Effects	Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039)

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
	Monitoring (EEM). The EEM Program is established to determine whether mine effluent is causing an effect on the fish populations, the use of fisheries resources, and/or fish habitat (benthic invertebrate communities) in the receiving environment. It is implemented on a three year cycle and the first three studies have been completed in effluent-exposed areas of the Mary River system and appropriate reference areas.	
Marine Environment		
Marine Water and Sediment Quality		
• Marine Water Quality • Marine Sediment Quality	The Marine Environmental Effects Monitoring Program (MEEMP) includes systematic monitoring of marine sediment and water quality at Milne Port to evaluate potential Project-related effects on these key indicators. The monitoring design has been developed to verify predictions made in the FEIS (Baffinland 2012) and the ERP FEIS Addendum (Baffinland 2013) and to assess the effectiveness of Project mitigation measures. Project effect pathways evaluated as part of this monitoring include potential changes in marine water and sediment quality due to site drainage and discharges, ore dust dispersion, and propeller wash from Project vessels. Marine water quality is monitored at two marine discharge points at Milne Port associated with site drainage (i.e., run-off), treated effluent discharge and settlement pond discharge from the iron ore stockpiles. Multiple sampling events occur over the peak open-water season corresponding with late July to August. Indicators for marine water quality include metals, total suspended solids (TSS), hydrocarbons, and nutrients. Marine sediment quality is monitored at up to 63 sampling stations at Milne Port to monitor for Project effects related to site drainage, ore dust dispersion from stockpiles and during ore loading at the ore dock, propeller wash from Project vessels, and AIS/NIS introductions (benthic infauna only). Sampling for marine sediment quality and benthic infauna is based on a 60-station radial gradient (RG) design, comprising four transects extending out from the port infrastructure. The radial pattern is designed to detect potential Project-related changes along the transects, two alongshore (i.e., East, West) and two offshore (i.e., Northeast and Northwest) with increasing distance from the port infrastructure (i.e., point source). Fifteen stations are sampled per transect. Sampling currently takes place once every three years, during the open-water season.	Marine Monitoring Plan (BAF-PH1-830-P16-0046) – formerly titled 'Marine Environmental Effects Monitoring Plan' Shipping and Marine Wildlife Management Plan (BAF-PH1-830-P16-0024)

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
	In 2023, eight stations were designated as monitoring stations for effects of large (Capesize and Baby Cape) ore carriers. All but three of these stations are also included in the 60-station radial sampling design. These eight stations will be monitored for three years following the initial arrival of large ore carriers, which took place in 2023 following the conclusion of the monitoring program. After three years of sampling, requirements for further sampling will be re-assessed. Indicators for marine sediment quality include particle size distribution, organic and inorganic carbon, total petroleum hydrocarbons, volatile organic compounds, polycyclic aromatic hydrocarbons, and trace metals.	
Marine Habitat and Biota		
• Benthic Infauna • Macroflora and Epifauna • Fish Community • Fish Health • Body Condition • Fish Tissue Chemistry	The Marine Monitoring Plan includes systematic monitoring of marine habitat and biota at Milne Port to evaluate potential Project-related effects on the following key indicators: benthic infauna, macroflora, epifauna, fish community and fish health. The monitoring design has been developed to verify predictions made in the FEIS (Baffinland 2012) and the ERP FEIS Addendum (Baffinland 2013) and to assess the effectiveness of Project mitigation measures. Project effect pathways evaluated as part of this monitoring include potential changes in Marine Habitat and Biota due to site drainage and discharges, ore dust dispersion, propeller wash from Project vessels, and AIS/NIS introductions. The benthic infaunal monitoring program follows the same RG design as described above for marine sediment quality. Benthic infaunal samples are collected from 15 sampling stations (co-located with marine sediment sampling) along each of four transects, with sampling stations established at increasing distance from the ore dock infrastructure. Similarly, the eight benthic infaunal monitoring stations associated with effects of large ore carriers are co-located with the stations for sediment quality monitoring. The sampling schedules associated with benthic infaunal sampling are the same as those for sediment quality. Four endpoints are adopted as effect indicators for benthic infauna: total density, taxa richness, and Simpson's diversity and evenness indices. Benthic macroflora and epifauna monitoring is based on a Before-After/Control-Impact (BACI) study design, comprising quadrat sampling in an established exposure area (13 permanent quadrats at Milne Port) and established reference area (13 permanent quadrats outside the direct zone of influence in Milne Port). Divers conduct biophysical surveys in each quadrat, recording substrate type (particle size categories, quantified by percent cover); macroalgae (identified to lowest practical level, quantified via percent cover), sessile invertebrates	Marine Monitoring Plan (BAF-PH1-830-P16-0046) – formerly titled 'Marine Environmental Effects Monitoring Plan' Shipping and Marine Wildlife Management Plan (BAF-PH1-830-P16-0024)

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
	(identified to lowest practical level, quantified via percent cover); motile invertebrates and fish (identified to lowest practical level and enumerated). Indicators include relative abundance (i.e., density or % cover), taxa richness (number of taxa present), and Simpson's diversity and evenness indices. Fish community metrics (taxa richness and catch-per-unit-effort (CPUE)) are monitored through a comprehensive fish sampling program undertaken annually during the open-water season at Milne port. Fish are captured using angling, gill net, hoop net and trawling collection methods. Results are compared to previous years and/or refer to a departure from background conditions (direct Project footprint vs. indirect Project footprint areas) to determine existence of a Project-related change. For fish health, Fourhorn Sculpin and *H. arctica* (Wrinkled Rock-borer clam) serve as sentinel (i.e., indicator) species for fish body condition, and are monitored for the following performance indicators: measures of energy use (i.e., growth, reproduction), energy storage (i.e., condition) and survival, in addition to supporting endpoints (as appropriate for each species) such as length, body weight, external condition, internal condition, organ weights, stomach fullness, parasite presence/absence, sex, life stage and state-of-maturity. For fish tissue chemistry, concentrations of total metals and polycyclic aromatic hydrocarbons (PAH) are measured for three species (i.e., opportunistic captures of Arctic char and targeted collection of Fourhorn Sculpin and *H. arctica*). Both body condition indicators and fish tissue chemistry are compared to data from previous years within the port area and to samples obtained from reference areas (Koluktoo Bay and Milne Inlet near Tugaat River). Historic data available for comparison varies for each species, with data extending back for Arctic char intermittently to 2010, and *H. arctica* and Fourhorn Sculpin to 2018. In addition, tissue concentrations of mercury and selenium are compared to applicable tissue quality guidelines; specifically, mercury concentrations are compared to Health Canada's Maximum Levels for Chemical Contaminants in Foods mercury consumption guideline of 0.5 mg/kg ww (Health Canada, 2015) while selenium concentrations are compared to the British Columbia Ministry of Environment (BC MOE) fish tissue guidelines of 4 mg/kg dry weight (dw; BC MOE, 2014).	
Non-indigenous Species / Aquatic Invasive Species (NIS/AIS) Monitoring Program	Baffinland's NIS/AIS Monitoring Program was developed in 2015 as part of the MEEMP to detect potential NIS/AIS introduced to Milne Inlet via high-risk Project related vectors such as ballast water discharges or hull biofouling. NIS/AIS surveys target lower trophic levels, including zooplankton, benthic infauna,	Marine Monitoring Plan (MMP) (BAF-PH1-830-P16-0046) – formerly titled 'Marine Environmental Effects Monitoring Plan'

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
	epifauna, macroflora and fish, using direct sampling methods (i.e., NIS/AIS targeted surveys of zooplankton, fouling species on settlement substrates, DNA sampling of benthic biota in areas where taxa of interest have been previously observed) in addition to considering all species collected during the MEEMP sampling. A comprehensive inventory of aquatic species occurring at Milne Port was established starting with baseline studies (2008, 2012, 2013 and 2014) and updated during subsequent MEEMP and NIS/AIS monitoring undertaken from 2014 to 2023. This growing taxonomic inventory, along with available global and domestic NIS/AIS databases, are used to screen all species documented at Milne Port across all monitoring components. Taxa identified in samples are cross-checked against the taxonomic inventory for Milne Inlet and, if it is newly observed (i.e., not listed), it is checked for NIS/AIS status through a detailed literature review of species descriptions and collection records to determine the documented and presumed ranges as well as compared against various databases listing NIS/AIS. Any taxa flagged as potential NIS/AIS, or with uncertainties in their ranges, are sent for independent verification of the taxonomic identification. Any taxa that are not determined to be “no risk” undergo a detailed information gathering stage and, ultimately, are either placed on a “Watch List” or “Trigger List”. The Watch List is comprised of taxa that are considered to be low risk (i.e., not listed on AIS databases, but the Canadian Arctic is not part of accepted range on record) to high risk (i.e., listed on AIS databases and/or Canadian Arctic not part of accepted range on record) but not demonstrating invasive behaviours in the Project area while the Trigger List is comprised of high risk taxa showing invasive behaviours in the Project area or with a history of invasive behaviours in comparable ecosystems. NIS/AIS monitoring is focused on areas with highest potential for marine invasions, notably the Milne Port infrastructure. Monitoring includes studies at a surveillance level and the threshold is detection of a single occurrence of a non-indigenous species.	Shipping and Marine Wildlife Management Plan (BAF-PH1-830-P16-0024)
Ballast Water Monitoring Program	Ballast water exchange has been shown to be an effective method for preventing the introduction of NIS/AIS in Milne Inlet under current shipping volumes. As part of its shipping operations, Baffinland requires all ore carriers to undertake both exchange and treatment (in that order, for vessels that have a ballast water management system onboard in anticipation of requirements for meeting the D-2 standard) prior to discharge. The sequential ballast water exchange followed	Ballast Water Management Plan (BWMP) (BAF—PH1-830-P16-0050)

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
	by ballast water treatment exceeds requirements of Canadian ballast water regulations and is an additional precautionary measure put in place by Baffinland. The objective of Baffinland's ballast water monitoring program is to verify that each ore carrier calling to Milne Port has appropriately undertaken a proper exchange of their ballast water prior to entering the RSA. In support of this, Baffinland conducts ballast water compliance monitoring in one randomly sampled ballast tank on all ore carriers arriving at Milne Port (prior to being authorized to discharge) as a part of compulsory ship inspections to verify the vessel's compliance with the federal Ballast Water Regulations and International Maritime Organization's (IMO's) D-1 standard (ballast water exchange standard). The D-1 standard requires that ballast water exchange must be undertaken within open ocean areas, defined as waters >200 nautical miles from land and in seas >2,000 m deep or in a designated alternate ballast water exchange area. The indicator used for the D-1 standard is a salinity measurement of 30 parts per thousand or higher.	
Marine Mammals		
Marine Mammals • Bruce Head Shore-Based Monitoring Program • Marine Mammal Aerial Survey Program (MMASP) • Ringed Seal Aerial Survey Program (RSASP) • Narwhal Tagging Program • Ship-based Observer (SBO) Program • Acoustic Monitoring Program	The objective of the Bruce Head Shore-based Monitoring Program is to investigate and characterize narwhal behavioural responses to shipping along the Northern Shipping Route. Effect indicators monitored as part of the Bruce Head Shore-based Monitoring Program include changes in narwhal relative abundance, distribution, group composition and behaviour. The objective of the Narwhal Tagging Program is to investigate and characterize narwhal behavioural responses to shipping along the Northern Shipping Route. Effect indicators monitored as part of Narwhal Tagging Program include changes in narwhal habitat use, dive behaviour (i.e., surface time, dive rate, bottom dives, time at depth, dive duration and descent speed) and surface behaviour (turning angle, travel orientation, horizontal displacement, habitat reoccupation and travel speed). The objective of the MMASP is to evaluate changes in narwhal distribution and abundance in the RSA relative to shipping and icebreaking operations. The MMASP comprises three separate survey types (Leg 1, Leg 2 and Leg 3), each with its own specific monitoring objectives. The objective of the Leg 1 surveys is to characterize the presence/absence and distribution of marine mammals (all species) in the RSA relative to ice conditions during the early shoulder season prior to the start of, and during initial shipping operations. The objective of the	Marine Monitoring Plan (MMP) (BAF-PH1-830-P16-0046) – formerly titled 'Marine Environmental Effects Monitoring Plan' Shipping and Marine Wildlife Management Plan (BAF-PH1-830-P16-0024) Narwhal Adaptive Management Response Plan (new in 2022)

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
	Leg 2 surveys is to obtain an annual abundance estimate for the Eclipse Sound and Admiralty Inlet narwhal summer stocks (and the combined Admiralty/Eclipse stocks) during the peak open-water season. The objective of the Leg 3 surveys is to monitor for narwhal entrapment events in the RSA following completion of Baffinland's annual shipping operations along the Northern Shipping Route each season. Survey design and data collection protocols follow survey methods previously developed by Fisheries and Oceans Canada (DFO) (Matthews et al. 2017; Marcoux et al. 2016; Doniol-Valcroze et al. 2015; Asselin and Richard 2011) and implemented by Golder Associates Ltd. (amalgamated in January 2023 under WSP Canada Inc.) in 2019 (Golder 2020a), 2020 (Golder 2021a), 2021 (Golder 2022a), 2022 (WSP 2023a) and 2023 (WSP 2024a), allowing for interannual comparison of the annual narwhal abundance estimates. The objective of the RSASP is to monitor for changes in ringed seal density and distribution in the RSA relative to shipping operations. Ringed seal density estimates are calculated using two different methods (strip-transect and line-transect analysis) (Golder 2022a) to allow for comparison with ringed seal aerial surveys undertaken by DFO in the North Baffin region in 2016 and 2017 (Young et al. 2019), prior to the start of Project icebreaking in the RSA in 2018. The objective of the SBO Program is to monitor for potential ship strikes on marine mammals in the RSA and to evaluate potential changes in the relative abundance, distribution and behaviour of marine mammals (all species) in relation to icebreaking and shipping operations in the RSA. The objective of the Acoustic Monitoring Program is to document and characterize ambient and anthropogenic underwater noise levels recorded at multiple representative locations in the RSA; to acoustically characterize the temporal and spatial occurrence of all marine mammal species in the RSA; to evaluate Project-shipping noise levels in relation to established marine mammal acoustic thresholds for injury and disturbance; to compare measured sound levels from shipping activities to those predicted through acoustic modelling conducted in support of the environmental effects assessment; to characterize the contribution of different vessel classes (including Capesize ore carriers) to the local underwater soundscape; and to estimate the extent of Listening Range Reduction (LRR) associated with Project vessel movements in the RSA relative to existing ambient noise levels.	

Monitoring Commitments	Description of Monitoring Programs	Applicable Monitoring and Mitigation / Management Plan(s)
Seabirds Ship-based Observer Program	The objective of the SBO Program is to monitor for potential ship strikes on seabirds in the RSA and to evaluate potential changes in the relative abundance and distribution of seabirds in the RSA in relation to icebreaking and shipping operations.	Marine Monitoring Plan (MMP) (BAF-PH1-830-P16-0046) – formerly titled 'Marine Environmental Effects Monitoring Plan'
Socio-economic Environment		
Population Demographics; Education and Training; Livelihood and Employment; Contracting and Business Opportunities; Human Health and Well-Being; Community Infrastructure and Public Services; Resources and Land Use; Economic Development and Self-Reliance; and Benefits, Royalty and Taxation		
Socio-economic Monitoring	The monitoring program has identified a number of indicators to evaluate residual effects of several Valued Components, or as requested through a Project Certificate term or condition. Data for these indicators are either tracked by Baffinland, government agencies, or Inuit agencies such as NTI and QIA. Some indicators are tracked through the QSEMC process and Baffinland's community engagement program.	Socio-economic Monitoring Plan (BAF-PH1-830-P16-0051) Community and Stakeholder Engagement Plan (BAF-PH1-830-P16-0025) Human Resources Management Plan (SD-SEMP-003) Inuit Human Resources Strategy Procedure (BAF-PH1-700-PRO-0005) Inuit Procurement and Contracting Strategy (BAF-PH1-230-P16-0001)
Cultural Resources		
Cultural Resources Monitoring	Monitoring of cultural resources is completed though annual Archaeology Status update Reports.	Socio-economic Monitoring Plan (BAF-PH1-830-P16-0051) Cultural Heritage Resource Protection Plan (BAF-PH1-830-P16-0006)
Cultural Well-Being; and Governance and Leadership		
None identified	No monitoring required. No residual effects identified in the FEIS.	Socio-economic Monitoring Plan (BAF-PH1-830-P16-0051)

3.1 ATMOSPHERIC ENVIRONMENT

The following section provides an overview of the regional and local climate setting, temperature, and precipitation statistics for the Mary River Mine site and Milne Port, based on the project-specific climate stations. It also provides a general description of regional and site air quality conditions. Baffinland undertakes various monitoring programs to better understand project-related effects on the atmospheric environment as per the Air Quality and Noise Abatement Management Plan (Table 3.2).

In addition to Baffinland led monitoring programs, Baffinland has committed to resource the QIA to establish Inuit-led monitoring programs, covering VCs of the environment such as dustfall. The Inuit Stewardship Plan will establish the mechanisms needed to allow Inuit observations to influence mitigation measures and test appropriate Adaptive Management Plan structures, which are demonstrably responsive to Inuit Objectives Indicators Thresholds and Responses. Baffinland has committed to supporting the development of a snow quality metric, integrating traditional knowledge, as part of the development of Inuit OITR's related to dust. It is also likely additional programs will be developed under the Inuit Stewardship Plan related to the atmospheric environment and its relationship with Culture, Resources and Land Use. Baffinland will work with the QIA to ensure progress towards the development of these programs is reported to NIRB on a reasonable basis.

3.1.1 CLIMATE

The Project is situated in the Northern Arctic Ecozone. The climate is semi-arid with relatively little precipitation. Monthly mean temperatures at long-term Environment and Climate Change Canada (ECCC) climate stations range from approximately -34ºC in February at Pond Port to about 7ºC in July at Igloolik. Mean monthly precipitation at long-term ECCC climate stations range from 4 mm in February at Pond Port, Hall Beach and Nanisivik, to about 64 mm in August at Dewar Lakes. Variability in precipitation at the long-term ECCC stations ranges from about 5 mm in January to about 30 mm in August.

Generally, snow melt occurs in late June and frost–free conditions last until late August. In 2017, the onset of snow melt began around mid to late June where temperatures were consistently above 0ºC. Following the onset of snow melt, air temperatures rise and the amount of daylight increases, triggering plant growth and green-up.

Visual observations at the Mary River Site indicate that snow drifts across the open terrain and accumulates in valleys and against obstacles, while most of the flat terrain is swept free. Some of the mountain regions have mini-glaciers, snow-covered year-round, and some of the valleys might have snow most of the year. During winter 60 % of the total land area has snow cover. From June to September, snow covers less than 5 % of the area around Mary River, exposing dirt.

A meteorological baseline report was included in the FEIS Volume 5, Appendix 5A Meteorological Report and Meteorological Instrument Report which includes a summary the collection of baseline meteorological data at each Project site and incorporates long-term meteorological data from regional EC stations. Meteorological data is currently continuously collected from the meteorological stations at the Mine Site and Milne Port, and this information is made publicly available for Mary River and Milne Inlet through The Weather Network and on the Baffinland website. A third station is located along the Haul Road at KM 110 to support internal local tracking.

Mean monthly air temperatures at the Mine Site and Milne Port during 2021 to 2023 were consistent, both in terms of timing and average temperature, with baseline and post-baseline periods. Wind speed and direction at the Mine Site were also consistent with past years (generally a southeast wind). In late June 2021 the wind direction sensor orientation was corrected at the Milne Inlet meteorology station and the predominant wind directions are from the north-northwest and southwest. Generally, the onset of snow melt began around mid to late June where temperatures were consistently above 0°C.

At present meteorological data at the Project sites is continuously being collected internally. Baffinland are required under their Project Certificate to report on climate change, and to provide weather information publicly on the Baffinland website.

3.1.2 AIR QUALITY

The Project is in a remote location with no existing local sources of air pollutants other than the Project which introduces new, local sources of air contaminants such as particulate matter (TSP, PM_{10}, and $PM_{2.5}$), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and carbon monoxide (CO) to the Project area.

To identify air quality baseline conditions, Baffinland did some ambient monitoring to assess the background air quality in the areas where project activities would occur. The monitoring results were supplemented with long--term ambient air quality data that exists for other monitoring stations in the north. Parameters monitored for include:

- Total suspended particulate (TSP)
- Inhalable particulate matter (PM_{10})
- Total particulate deposition (dustfall)
- Sulphur dioxide (SO_2)
- Nitrogen dioxide (NO_2)
- Ozone (O_3)
- Dust deposition
- Metals deposition

Baffinland's 2007 baseline ambient air quality monitoring program had two components: an active and a passive monitoring program:

Active Monitoring Program: Measured ambient concentrations of TSP. Samples were collected simultaneously from two locations near the Mine Site over 72 hours using battery powered Airmetrics "MiniVol" samplers. Sampling time was increased from 24 hours to ensure adequate capture of particulate and to increase the accuracy of the measurements, as low particulate levels were anticipated. A Dust Track monitored particulate matter with aerodynamic diameters less than 10 µm (i.e., PM_{10}).

Passive Sampling Program: Collection of SO_2, NO_2, and O_3 samples simultaneously at two different locations near the Mine Site. Passive monitors (duplicate monitors for each contaminant) were installed at each location for 49 days. This program also involved collection of particulate deposition (dustfall), including metals at the same locations also over the same period. FEIS Volume 5, Section 2 identifies existing air quality conditions in the project area and describes potential effects of the Project on air quality.

Baseline air quality conditions prior to Project development based on short-term ambient monitoring within the PDA in July 2007 (FEIS, Volume 5) indicated that measured baseline concentrations of air contaminants and metal deposition rates are extremely low compared to values in southern Canada. Summary Tables 3.2, 3.3 and 3.4 below (FEIS Volume 5, Tables 5-2.1, 5-2.2 and 5-3.3) provide the baseline air quality conditions for the Project. Additional details on the air quality monitoring program and baseline conditions refer to FEIS Volume 5, Appendix 5C-1 Baseline Air Quality Report.

TABLE 3.2 MEASURED BASELINE CONCENTRATIONS

Parameter	Baseline Concentration ($\mu g/m^3$)
24-hour TSP	7.0
24-hour PM_{10}	3.8
30-day SO_2	0.262
30-day NO_2	0.188
30-day O_3	52.8

TABLE 3.3 BASELINE DUSTFULL DEPOSITION RATES

Parameter	Baseline Deposition Rate ($mg/100cm^2$/30-day)
Total Dustfall	0.398

TABLE 3.4 BASELINE METAL DEPOSITION RATES FOR SELECT METALS

Parameter	Baseline Deposition Rate ($\mu g/100cm^2$/30-day)
Al	26.9
Co	0.5
Cr	0.3
Fe	30.6
Mg	23.9
Mn	1.7

NOTE:
Source: Tables 5-2.1, 5-2.2 and 5-2.3, Section 2.2, Mary River FEIS Volume 5.

Air quality monitoring conducted since Project operation in 2014 has included ambient air quality monitoring of gaseous constituents at the Mine Site and Milne Port, and dust fall monitoring along the Tote Road, at Mine Site and Milne Port. Ambient monitoring for sulphur dioxide and nitrogen oxides continued to be carried out at the Mine Site and Milne Port. Monitoring throughout 2015 concluded that all results were well below the Government of Nunavut (2011) Ambient Air Quality Standards, resulting in the discontinuation of the monitoring program in 2016. To ensure compliance with Project Certificate Term and Condition No. 7 and collect additional data over multiple shipping seasons, the monitoring program resumed at Milne Port in March 2017 and at the Mine Site in November 2017; both programs are still in place. Results of the monitoring conducted in 2023 were compared to the Nunavut Ambient Air Quality Standards and indicate that concentrations were below the Nunavut Air Quality Standards for NO2 and SO2 (Nunami Stantec 2023). Ambient air concentrations were generally greater in winter and lower in summer, consistent with previous years. Ambient monitoring for sulphur dioxide and nitrogen oxides continues to be carried out at the Mine Site and Milne Port.

In 2020, Baffinland retained expert support to evaluate the implementation of continuous particulate matter (PM) monitoring stations, a commitment made to Environment and Climate Change Canada through the PIP technical review. The stations were installed at both the Mine and Port site in late 2021. The monitors were initiated and calibrated in February-March 2022 and began active recording in late April 2022. Results from the continuous PM monitoring in 2023 indicate that the measured 24-hour average PM2.5 concentrations at the Mine Site Complex (MSC) were greater than the Nunavut 24-hour Air Quality Standard for PM2.5 (30 µg/m³) for nine days. Six of the nine occurrences were associated with a single event from April 8 to 18, 2023. The remaining three occurrences were recorded on September 29 to 30 and October 24, 2023. Results from the continuous PM monitoring in 2023 indicate that the measured 24-hour average PM2.5 concentrations at the and Port Site Complex (PSC) were less than the Nunavut 24-hour Air Quality Standard for PM2.5 (30 µg/m³), except for two days (April 20 and 21, 2023). The measured 24-hour average TSP concentrations at the MSC were above the Nunavut 24-hour Air Quality Standard for TSP (120 µg/m³) for 167 days in 2023, with the majority of the exceedances occurring in April and May. The measured 24-hour average TSP concentrations at the PSC were above the Nunavut 24-hour Air Quality Standard for TSP (120 µg/m³) for 17 days, with the majority of the exceedances occurring in the spring and summer months (April, May, July, August and September, some of these are transitional months with freezing conditions that limit the ability to apply dust suppressants).

The 2023 measured concentrations for ambient PM2.5 and TSP can also be compared to predictions from the numerical air dispersion modeling. The maximum measured 24-hour average PM2.5 concentrations at the MSC (53.60 µg/m³) and at the PSC (32.4µgm³) were below the maximum predicted 24-hour average PM2.5 concentrations by the atmospheric dispersion model (see Baffinland 2024a, Appendix 11: 6 Mtpa Isopleth Modelling) at the MSC (64.3 µg/m³) and at the PSC (64.0 µg/m³), respectively. The maximum measured 24-hour average TSP concentrations at the MSC (647 µg/m³) and at the PSC (304 µg/m³) were below the maximum predicted 24-hour average TSP concentrations by the atmospheric dispersion model at the MSC (2,293 µg/m³) and at the PSC (1,583 µg/m³), respectively. The atmospheric dispersion model overpredicted the measured 24-hour average PM2.5 and TSP concentrations at the MSC by approximately a factor of 2 and 4, respectively, and overpredicted the measured 24-hour average PM2.5 and TSP concentrations at the PSC by approximately a factor of 3 and 5, respectively. The use of US EPA emission factors for estimating fugitive dust emissions for the Project is a conservative assumption. The US EPA fugitive dust emission factors are known to be overly conservative and atmospheric dispersion models relying on the application of the US EPA fugitive dust emission factors overpredict fugitive dust concentrations by as much as an order of magnitude (Pace 2005). Therefore, the model-predicted ambient PM concentrations are considered conservative with a bias of overprediction.

Dustfall monitoring, community observations and remote sensing analysis is showing that the spatial extent of dust deposition, particularly along the Tote Road, is greater than predicted by air dispersion modelling in the FEIS and ERP FEIS Addendum. Baffinland continues to invest in expanded monitoring efforts and dust control (mitigation) measures. In 2021, further expansions were made to Baffinland's passive dustfall monitoring program. Fourteen new dustfall monitoring stations were installed: four additional monitors at Milne Port; four new monitors along the section of the proposed North Railway that departs the Tote Road to define baseline conditions; and, in response to requests from the MHTO and the QIA, six dustfall monitors were installed to collect dust at 0.5 m above the ground surface as a pilot study to investigate the variability between dustfall sampling at the standardized height of 2.0 m and that closer to ground level. During 2021 there were 53 dustfall monitoring stations. The 2021 and 2022 results show very little difference between dustfall levels at 0.5 and 2.0 m. During 2022 and 2023 there were 53 and 49 dustfall monitoring stations used, respectively.

From 2014 to 2016, dustfall across the PDA increased, corresponding with the increase in Mine production. In 2016, production increased from 0.5 Mtpa to 2.5 Mtpa, corresponding with increased dustfall; however, from 2016 to 2020, dustfall generally plateaued with only modest increases in some Project areas. Post-2016 decreases in dustfall appear to correspond with the implementation of additional dustfall mitigation strategies, though there continues to be some 'noise' that is believed to be associated with climate variations, specifically the number of days with measurable rainfall. Dustfall deposition in 2023 was within the ranges observed in previous years across the Project area (Baffinland 2024b). The Mine Site dustfall monitoring station DF-M-01 has recorded variable dustfall throughout all monitoring years. An increasing trend that was observed from 2019 to 2021 was followed by a decrease in 2022 and again in 2023. Dustfall at DF-M-02 and DF-M-03 has remained relatively consistent from 2018 to 2021, increased in 2022 and then decreased substantially in 2023. The 2022 increase was likely associated with dry summer conditions while the 2023 decrease was likely associated with increased precipitation days. Dustfall deposition at the Milne Port monitoring sites has remained relatively constant since 2020. Dustfall at DF-P-05 decreased from 2018 to 2021, and increased slightly from 2022 to 2023. Dustfall has remained consistent at DF-P-04, DF-P-06 and DF-P-07 and DF-P-08. Dustfall along the Tote Road at the North Crossing (km 28) monitoring stations has remained relatively constant since 2019. Dustfall along the Tote Road at the South Crossings (km 78) monitoring stations 30 m from the road has been variable over the years but shows no consistent increasing or decreasing trends. Dustfall at monitoring stations 100 m from the road has been consistent since 2015, the first full year of dustfall monitoring during operations (EDI 2024).

Baffinland also expanded the dustfall satellite imagery analysis to include undeveloped areas of the Project at Steensby, which facilitate an enhanced comparative analysis to a 'reference' site. Additionally, as discussed earlier, in 2021, Baffinland commissioned a third-party Dust Audit, which includes the establishment of an independent Dust Audit Committee comprised of representatives from the five North Baffin communities. As part of this work, the Dust Audit Committee undertook an on-site investigation in October 2021, and additional engagement activities were conducted during 2022. An interim Dust Audit report was issued to the Baffinland Iron Mines community liaison officers and the communities in September 2022. The results of the audit have been captured in a Final Recommendations Report that was submitted to NIRB on February 16, 2023 (NIRB Registry No. 342950). Baffinland regularly evaluates the feasibility of implementing the recommendations of the independent Dust Audit Committee. In 2023 there were three Dust Audit Committee meetings to review recommendations to reduce dust emissions. A third on-site investigation for the Dust Audit Committee occurred in April 2024. The site visit in April 2024 was a follow-up to the 16 recommendations provided in 2023 and Baffinland's response to the recommendations submitted to NIRB in August 2023. During the site visit, a member of the Committee indicated that they had noticed improvements since Baffinland has started listening to communities about the dust. The Committee was able to discuss a number of the recommendations with Baffinland, including the status of each recommendation, and completed site tours to see the dust suppression spray on trial at Crusher Line C, as well as where the new PurpleAir devices have been deployed to help identify the dust sources. The Dust Audit Committee remains interested in understanding more about dust mitigation implemented by Baffinland, and has reiterated their concerns for dust and its potential effects. The second annual Dust Audit report will be submitted to NIRB in 2024.

3.1.3 NOISE AND VIBRATION

A detailed noise baseline assessment was conducted in 2007 (FEIS Volume 5, Appendix 5D-1). The basic procedure to establish baseline noise levels consisted of:

- Conducting measurements and recording sound levels at Milne Port, the Mine Site, and Steensby Port.
- Validating the data based on the recordings and weather information.

- Calculating the resulting validated sound level data.

Prior to the development and operation of the Approved Project, baseline noise monitoring indicated noise levels within the PDA would be described as faint, with background noise levels typical of remote areas, ranging from about 25 to 35 dBA (Baffinland 2012; Table 3.5). Noise observed consisted mainly of wind, insect, and small animal and bird noise. Flowing water and breaking waves contribute to the baseline noise levels at the port sites. Differences observed between daytime and night-time sound levels are generally small. Table 3.5 shows the measured ambient noise values at each site.

TABLE 3.5 BASELINE NOISE MONITORING RESULTS

Site	Leq (24 h)	Leq (Day, 15h)	Leq (Night, 9h)	Minimum Leq (1 h)	Maximum Leq (1 h)
	(dBA)	(dBA)	(dBA)	(dBA)	(dBA)
Mine Site	25	25	26	20	34
Steensby Port	29	31	26	23	35
Milne Port	30	31	29	21	35

NOTE:

1. Source: Mary River FEIS, Appendix 5, Table 5-3.1.

For the Approved Project, during operation, the maximum sound levels at 1.5 km from the Mine Site PDA was predicted to be 45 dBA (1-hour Leq) and the indoor sound level at the Worker Accommodation Building was predicted to be Balanced Noise Criterion (NCB) 29, below the recommended level of NCB 33 (Baffinland 2012). During operation the maximum sound levels at 1.5 km from the Milne Port PDA was predicted to be 40 dBA (1-hour Leq) and the indoor sound level at the Worker Accommodation Building was predicted to be NCB 42 (Baffinland 2012).

The maximum predicted vibration levels at the Mine Site during operation were predicted as 2.5 mm/s peak particle velocity at 1.5 km from the PDA and at the Worker Accommodation Building. No major sources of vibration were associated with Milne Port or Steensby Port operations.

Monitoring during operation has been limited to the interior monitoring of the Worker Accommodation Buildings at the Mine Site and Milne Port. Measured indoor noise at worker accommodations at the Mine Site in 2016 and summer of 2017 were below 40 dBA; however, this level was exceeded slightly at Milne Port (50.3 dBA in 2016; 42.6 dBA in 2017; average noise level) but remained within the acceptable range. Vibration at worker accommodations have generally been not measurable by the equipment.

The 2022 Noise Monitoring Study results indicate that the Project generates impulsive anthropogenic sound events in all Project areas. Ambient noise was typically below the operational threshold of 40 dBA at 1.5 km from all Project areas and below 40 dBA at 3 km from all Project areas. Project-related noise was typically not audible at 3 km from the Project.

3.2 PHYSICAL (TERRESTRIAL) ENVIRONMENT

The following section on the physical environment at the Project includes an overview of the regional and local topography, extent and distribution of permafrost, surficial and bedrock geology, geological hazards, soil composition, and hydrology and hydrogeology.

3.2.1 TOPOGRAPHY

Superficial landforms and deposits in the Mary River Project area are associated with widespread glaciation on Baffin Island. Surface geology consists of locally abundant sediment deposits from glaciers and rivers. Occasional outcrops of granitic and sedimentary rock formations occur. The North Baffin region containing the Mary River area lies within the Committee Belt, a granite-greenstone terrain mixed with sedimentary and volcanic rock. The mountains to the east are older than 540 million years old, and the lowland plateaus to the west are about 250 to 540 million years old.

Topography varies considerably across the Project area. The shoreline of Milne Inlet in the northern part of the Project area is situated on a relatively broad, deep, and flat sand beach. Milne Inlet itself is enclosed by steep fiord walls measuring 60–600 m above sea level (asl). Moving inland, the Milne Inlet Tote Road follows the Phillip's Creek valley that starts near sea level at Milne Inlet and rises to 188 m asl at the Mine Site. The Phillip's Creek valley is confined by hills or mountains on both sides. West of the Phillip's Creek Valley is mountainous terrain with some occurrence of glaciers.

At the Mine Site, Nulujaak (Deposit No. 1) rises quickly to 679 m asl from the flat and sandy outwash plain where the airstrip is located. Nulujaak is a landmark for Inuit travelling on the land and is part of a ridge trending approximately north–south. The land to the west is equally mountainous with some minor coverage of glaciers. East of Deposit No. 1 the land is somewhat rolling with several elevated plateaus formed by horizontal sedimentary deposits.

South of Mary River the undulating outwash plains end near the Ravn River. South of the Ravn River the land is quite flat and poorly drained and begins to drop steeply toward the Cockburn Lake valley, which is bounded by steep cliffs that range from 360–380 m asl. The land south of Cockburn Lake to Steensby Inlet becomes flatter with mainly undulating bedrock and boulder landforms. Figure 6-2.1 - Relief Map of the Northern Baffin Region, found in FEIS Volume 6, Section 2.1.1.1, shows the relief across North Baffin Island, and the topography as it relates to Project features starting in the north at Milne Inlet and extending towards Steensby Port in the south.

Additional details on topography can be found in FEIS Volume 6.

3.2.2 PERMAFROST

Permafrost is defined as soil or rock that remains below 0°C for at least two years. The Project is in a zone of continuous permafrost which extends to depths of several hundred metres. Cryosolic soils (i.e., those affected by permafrost-related processes) predominate. The active layer through the Project area typically ranges from approximately 1 to 2 m but may be greater in areas where there is loose, sandy soil at the edges of lakes or ponds and less in areas with a substantial surface layer of wet organics. Unfrozen taliks can exist within areas of continuous permafrost below lakes, under large rivers or near the coast.

Permafrost thickness in and around the Regional Study Area (RSA) is deep, ranging from 400–700 m depth (Knight Piésold, 2010a). In 2007, a 400 m deep thermistor installed into Deposit No. 1 showed that the depth to permafrost is predicted to extend to 610 m at this location, which is well below the planned depth of mining.

Between 2006 and 2008 more than fifty ground temperature monitoring instruments (thermistor cables) were installed and sporadically monitored to determine ground temperatures in the overburden soils and bedrock across the RSA. Many were installed to depths sufficient to define the typical stable temperatures in the permafrost soils below the depth of zero annual amplitude. The depth of zero annual amplitude in temperature fluctuation appears to exist at depths of between 10 and 15 m in the valleys. At that depth, the "typical" permafrost temperature is roughly -10°C. Permafrost is not actively monitored as part of the terrestrial environmental monitoring program. However, based on collection of baseline data, the Deposit No. 1 open pit is not expected to develop significant groundwater inflow below the active layer. This is further supported by the fact that the open pit is developed in relatively high-quality bedrock, with minimal faulting. The has also generally colder mean temperatures, is topographically higher, and has a deep permafrost zone of more than 500m. In addition, site geologists have reported that ground ice is present in fractures in the rock. Details on permafrost are described in FEIS Volume 6, Section 2.1.1.4. Additional detail related to the potential implications of climate change on the permafrost and recommended design measures is provided in FEIS Volume 9, Section 2.2.

3.2.3 SURFICIAL AND BEDROCK GEOLOGY

The surficial geology of the area generally consists of locally abundant Holocene glacio-lacustrine sediments, alluvial sediments (alluvial deposits), marine and glacio-marine deltaic sediments and end moraine till, with occasional outcrops of pre-Quaternary bedrock and sedimentary rock formations. FEIS Volume 6, Figure 6-2-2 - Surficial Geology in the RSA shows the surficial geology of the Project area. This information is supplemented by TSD 08 of the Phase 2 Addendum.

The following sections provide some more specific observations associated with the surficial geology at some existing and proposed project infrastructure locations/sites.

Mine Site - The Project is in a glaciofluvial outwash deposit in what appears to be a classic U-shaped valley. There are some direct glacial deposits consisting of kames, moraines, and eskers in and around the southeastern portion of Sheardown Lake. The outwash valley is essentially a relatively flat plane with very little local relief, the primary exceptions being along water bodies, esker deposits and adjacent to valley edges. Valley walls are generally steep and abrupt, often with distinct terraces.

Milne Port - The dominant landforms in the Milne Inlet area are typically a result of glacial activity, marine and mechanical forms in various degrees. Glacial activity is not overly apparent on the immediate Port site but is more pronounced in the higher elevations south of the site. Marine and mechanical features are most predominant with terraces and strand (beach) lines formed by marine action which have been cut by mechanical features, some of which may be attributed to permafrost. Wind appears to have been responsible for some drifting on the finer grained soils on the lower part of the site. Recently deposited colluvium is present on many of the slopes and side hills in the area. The action of surface water has produced numerous sharp gullies along waterways. Marine clays were also noted at some locations at the site.

Southern Transportation Corridor - The topography of the Southern Transportation Corridor from the mine site to Steensby Port is generally quite hilly, except for the Ravn River area which is relatively flat. Glaciated valleys are evident along a significant portion of the alignment. The surficial geology of the corridor is also characterized by the relatively recent glacial activity of Baffin Island. Surficial geology consists of several types of deposits including glacio-lacustrine sediments, alluvial sediments (alluvial deposits), end moraine till, and till veneers and blankets. Occasional outcrops of pre-Quaternary bedrock and sedimentary rock formations are also common along the southern section of the RSA.

Steensby Port - Near surface bedrock is dominant in the Steensby Port area. Limited overburden is in the form of marine sediments and localized deposits of till. Most of the overburden is in depressions between the numerous bedrock outcrops and is typically overlain by a layer of vegetation and boulders.

For additional details on site specific baseline conditions refer to FEIS Volume 6, Section 2.1.1.2 Surficial Geology.

3.2.3.1 SURFICIAL SOILS COMPOSITION

A soils evaluation was carried out in 2007 and 2008 by an Arctic soils specialist (Veldhuis, 2010). Project area soils were classified based on the Canadian System of Soil Classification (Soil Classification Working Group, 1998), and included primarily Cryosols (permanently frozen soils or soils with permafrost within 100–200 cm of soil surface) and Brunisols (soils with weak B horizon development). In general, Project-area soils all showed weakly developed horizons, with a general lack of organic material accumulation. Fine- to medium-textured soil materials were generally cryoturbated, and patterned ground phenomena related to permafrost and freeze-thaw cycling were also commonly observed throughout the RSA. Soils throughout the RSA were generally poor in nutrients. Soil sampling completed as part of the revegetation survey and reclamation trials (Appendix D5) support this, with control (undisturbed) and disturbed sites demonstrating poor fertility as indicated by low available nutrients, low electrical conductivity (EC) and adsorption potential with little incorporated organic matter (EDI, 2024). This factor, in combination with the depressed level of pedogenic development in the area and thinness of soils where present, generally make local soils unsuitable for stockpiling for revegetation purposes.

Regionally, soil formation is controlled and limited by year-round low soil temperatures, low precipitation rates and near-surface permafrost. Soil formation occurs in the thin layer overlying the permafrost that is subject to seasonal thawing, known as the active layer. The thickness of the active layer varies substantially across the region with topography, depth to bedrock, and vegetative or water cover but is typically between 1 to 2 m thick in the Project area depending on the local soil cover. In locations where well drained, dry sand and gravels are present, thaw depth can extend to 2 to 4 m depth.

3.2.3.2 BEDROCK GEOLOGY

The baseline information available on bedrock geology in the Project area is based on field geological exploration programs conducted by Baffinland geologists from 2004 to 2008 and summarized by Aker Kvaerner (2008).

The North Baffin Island region and Mary River area lie within the Committee Belt, a granite-greenstone terrane mixed with rift basin sediments and volcanic rocks. The belt lies within the Churchill Province, extending from Baker Lake to Greenland, and is divided into five main assemblages: the Archean, the Mary River Group, the Piling Group, the Bylot Supergroup, and the Turner Cliffs-Ship Formation.

The Mary River iron deposits are located within the Mary River Group, an assemblage of Late-Archean (2.76 to 2.72 Ga) metasedimentary to metavolcanic rocks that have been folded and preserved in greenstone belts. The Mary River Group greenstone belts are present as fragmented remnants stretching from Bylot Island south to Eqe Bay. Refer to Figure 6-2.5 – Bedrock Geology in the RSA shown in Volume 6 of the Mary River Project FEIS, Primary sequences within the Group consist of a lower series of metavolcanic rocks and an upper series of turbidite pelitic-greywacke; the stratigraphic position of iron formation, quartzite, conglomerate, minor marble, and volcanic breccia units within the belts, which varies across the region. The Mary River Group is part of the regional Committee Belt, an Archean-aged (2.9 to 2.5 Ga) assemblage of granite-greenstone terranes, granitic migmatites gneissic granitic intrusions, and clastic and carbonate sedimentary units reworked during the Paleo-Proterozoic (2.5 to 1.6 Ga). For additional details on site specific baseline conditions refer to FEIS Volume 6, Section 2.1.2.

3.2.4 HYDROLOGY AND DRAINAGE

A Baseline Hydrology Report for the Project is found in FEIS Volume 7, Appendix 7A. Hydrologic information within the Project area was obtained from site-specific stream gauges and regional data. Field specific data was obtained for locations along the PDA including areas around the Mine Site, Tote Road, and Milne Port. In combination, field and regional hydrologic information was used as the basis for in assessing aspects of engineering design and environmental assessment of Project activities. The key findings within the Baseline Hydrology Report pertain to four main hydrometric parameters: timing of runoff, magnitude of runoff, spatial variability of timing and magnitude of runoff, and long-term runoff estimates. Runoff in the vicinity of the Mary River Project is characterised as follows:

- Streamflow typically commences in early to mid-June as temperatures climb above 0°C, and ends in late September to late October, depending upon watershed characteristics.
- The annual hydrograph is dominated by a nival (snowmelt) freshet, which occurs between late June and the end of July, followed by a period of low baseflows driven by permafrost melt and shallow subsurface flow. Baseflows are punctuated by precipitation events through July to early September.
- Precipitation runoff events are usually quite large, and flows increase rapidly as interception, infiltration, and evapotranspiration are minimal due to shallow permafrost, cool temperatures, and lack of vegetative cover.

The drainage pathways for the Mary River Project are defined by catchments as shown in the following figures in FEIS Volume 7:

- Figure 7-1.1 - Freshwater Regional Study Area
- Figure 7-1.2 - Milne Port Local Study Area and Milne Tote Road Local Study Area
- Figure 7-1.3 - Mine Site Local Study Area
- Figure 7-1.4 - Railway Corridor Local Study Area and Steensby Port Local Study Area

Stream flow within the Project area usually begins in early to mid-June as temperatures climb above 0°C, and ends in late-September to late-October. Runoff increases very rapidly given that a relatively low proportion of precipitation is lost to infiltration, evaporation or transpiration as it makes its way into the channels. Shallow permafrost, cool temperatures and lack of vegetative cover increase this effect. In catchments with large or numerous lakes, these events are attenuated, producing lower peaks and longer duration flow events.

The proportion of lakes within a watershed has a substantial effect on water flows. Lakes attenuate rapid runoff events as well diurnal fluctuations in runoff, resulting in lower intensity and longer lasting storm event runoff and overall, more steady flows. Lakes also act to evaporate larger volumes of water than does the surrounding land, therefore lowering the mean annual runoff in catchments with large lake components. Furthermore, because the lakes are still free of ice when precipitation begins to fall as snow and permafrost melt ends, rivers fed by lakes freeze up approximately a month later than systems that do not include lakes.

The Project's Surveillance Network Program (SNP) focuses on detecting short-term project related effects and was established to measure and document the surface water flow volumes and water quality at or near discharge locations authorized and regulated by the Type 'A' Water License. A hydrometric monitoring network consisting of nine monitoring stations at or near existing SNP monitoring stations was established in 2014. Monitoring in 2022 and 2023 completed at SNP Hydrometric Stations at Milne Port and at the Mine Site found that flows (presented as daily discharge) were consistent with past trends (North Water 2023 and 2024).

Monitoring of stream discharge in the Project area is also conducted under the AEMP Hydrometric Monitoring Program. This Hydrometric Monitoring Program consists of seven monitoring stations, at which water level (stage) and discharge are measured. In 2022 and 2023, daily stream discharge patterns were consistent within years across all monitoring stations (North Water 2023 and 2024). Assessment of inter-annual flow variability under the AEMP is focuses on Station H05, positioned on Camp Lake Tributary CLT-1, due to its close proximity to the mine, its relatively small drainage area, its stable rating relationship, and a complete flow record dating back to 2006. In 2022, the total annual runoff at Station H05 was the lowest recorded since the program began in 2006. A possible explanation for this was that the majority of the spring freshet runoff occurred prior to June, before the ice free period, and was therefore not recorded. Summer flows in 2022 were similarly below average and presented relatively few high magnitude events. In 2023, however, the total annual runoff recorded at Station H05 was the third highest recorded from 2006 to 2023 for concurrent periods of record. The flow measured in 2023 was above normal in June (indicating that the majority of the spring freshet had been captured). The volume of flow measured during summer in 2023 (mid-July to mid-August) was below average with few high magnitude flow events, though the volume of flow during late August and September was higher than average.

Hydrometric monitoring, while capturing interannual and seasonal variability in flows, indicates that discharge in monitored streams is consistent with trends over the period of record. Additional details on drainage can be found in FEIS Volume 7, Section 2.

Baffinland also inspects fish bearing water crossings at the Project, at a minimum, annually by a third-party Professional Fisheries Biologist. The assessment focuses on ensuring that surface water flows and fish passage is not being hindered or altered at Project fish bearing water crossings. Baffinland continues to work with DFO to refine permanent crossing plans for crossings identified with fish passage issues from the assessments (Baffinland 2024b). Detailed engineering and extensive engagement has occurred on this Project to date.

The mining footprint remains small relative to the fully developed project, and hence water diversions associated with the project footprint are minor in scale.

3.3 CHEMICAL ENVIRONMENT

The following section on the chemical environment at the Project includes an overview of the surficial soil chemistry, surface water and sediment quality, snow and ground water quality and geochemistry.

3.3.1 SURFICIAL SOIL CHEMISTRY

Project area soils were classified based on the Canadian System of Soil Classification (National Research Council, 1998), and included primarily Cryosols (permanently frozen soils or soils with permafrost within 100-200 cm of soil surface) and Brunisols (soils with weak B horizon development). In general, Project-area soils all showed weakly developed horizons, with a general lack of organic material accumulation. Fine to medium-textured soil materials were generally cryoturbated, and patterned ground phenomena related to permafrost and freeze-thaw cycling were also commonly observed throughout the region. Soils throughout the region were generally poor in nutrients (Table 3.6). This factor, in combination with the depressed level of pedogenic development in the area and thinness of soils where present, generally make local soils unsuitable for stockpiling for revegetation purposes (Veldhuis, 2010). For further information regarding surficial soils composition, see FEIS Volume 6, Section 2.1.1.3.

TABLE 3.6 TOTAL AMOUNTS OF ORGANIC MATTER AND PRIMARY NUTRIENTS IN PROJECT AREA SOILS

Parameter	Concentration Range per Horizon, %			
	B Horizon (sandy)	C Horizon (sandy)	B and C Horizons (loamy)	A Horizon
Organic Matter	0.83 (0.17 - 2.21)	0.34 (0.17 - 0.51)	2.81 (0.17 - 5.44)	13.72 (2.38 - 26.00)
Nitrogen	0.04 (0.02 - 0.08)	0.03 (0.02 - 0.04)	0.15 (0.012 - 0.36)	0.93 (0.09 - 1.14)
Phosphorous	0.03 (0.01 - 0.09)	0.07 (0.04 - 0.11)	0.04 (0.02 - 0.10)	0.06 (0.06 - 0.11)
Potassium	0.13 (0.05 - 0.36)	0.15 (0.09 - 0.25)	0.47 (0.16 - 0.69)	0.08 (0.06 - 0.11)
Sulphur	< 0.01	< 0.01	0.02 (0.01 - 0.05)	0.06 (0.01 - 0.10)

NOTE:

1. From Veldhuis, 2010.

3.3.2 SURFACE WATER AND SEDIMENT QUALITY

A baseline water quality program was carried out over the period of 2005 through 2008 which included up to 74 surface water sampling sites distributed throughout the study area. Three lakes in the vicinity of the Mine Site with the potential to be affected by Project-related components and activities were sampled in 2006 through 2007: Camp Lake, Sheardown Lake and Mary Lake. In 2008, lake water sampling extended to the Steensby Inlet area, the Rail Camp area, and the current railway alignment. A follow-up water and sediment quality monitoring program was carried out in summer 2011 to update the dataset and to obtain water and sediment quality data from candidate long-term water monitoring locations. Sediment samples were collected from various lake, stream, and river locations. The complete water and sediment quality baseline data are provided in FEIS Volume 7. Freshwater quality measurements in the Mary River area indicate naturally elevated concentrations of dissolved oxygen, turbidity, aluminum, and iron. Some average values for pH exceeded the Canadian Council of Ministers of the Environment guidelines (CCME 2002) as did average values for cadmium and mercury at most sites. Selenium routinely was reported at the CCME guideline. When all areas for stream sampling were compared based on Water Quality Index values, the sampling locations within the area between Camp Lake and Milne Port indicated the highest value of 99.5, or “excellent” water quality.

Surface water quality in streams and lakes in the Project area has been evaluated on an on-going basis over the period of mine operation as part of multiple monitoring programs. The Project is subject to the Metal and Diamond Mining Effluent Regulations (MDMER) under the Fisheries Act. The MDMER outline requirements for routine effluent and water quality monitoring and for biological monitoring, collectively referred to as Environmental Effects Monitoring (EEM). The objective of the Project EEM is to determine whether mine effluent is causing an effect on the fish populations, the use of fisheries resources, and/or fish habitat (benthic invertebrate communities) in the receiving environment. The third EEM biological study at the Project was implemented in 2023, focusing on the evaluation of effects at effluent-exposed areas of two watercourses, Mary River Tributary F and the Mary River over the study period from 2021 to 2023 (Minnow 2024). In accordance with MDMER requirements, effluent and water quality monitoring data were summarized in the 2023 EEM interpretive report. Effluent from the Project primary discharge (monitoring location MS-08), which discharges to a tributary to the Mary River (i.e., Mary River Tributary-F), met MDMER monthly limits from 2021 to 2023 except for total suspended solids (TSS) that marginally exceeded the maximum grab sample limit in a single sample in September 2023. Water chemistry at effluent-exposed areas of Mary River Tributary-F showed slightly elevated specific conductance and concentrations of chloride and TSS and highly elevated concentrations of nitrate, sulphate, and selenium compared to reference conditions during EEM biological sampling in 2023, but concentrations of these parameters were well below applicable water quality guidelines (WQG) within the watercourse. Estimated concentrations of MS-08 effluent in Mary River Tributary-F at benthic invertebrate community study stations averaged 13.6% at the time of the third EEM biological study. Within the effluent-exposed area of Mary River, specific conductance and nitrate were slightly elevated relative to a reference area in the Angijurjuk Lake Tributary during EEM biological sampling in August 2023 but all parameter concentrations at the Mary River effluent-exposed area were below applicable WQG. The proportion of MS-08 effluent at the Mary River effluent-exposed fish study area at the time of fish sampling was estimated as 1.7%.

The Core Receiving Environment Monitoring Program (CREMP) is designed to detect Project-related effects at temporal and spatial scales that are ecologically relevant (i.e., on a basin spatial scale). The CREMP encompasses a larger geographic extent than the EEM program and is intended to monitor potential effects to the aquatic environment via pathways other than effluent such as dust deposition or changes in water flow due to diversions. The CREMP monitors aquatic VCs and key indicators including water quality, sediment quality, and freshwater biota (phytoplankton and benthic invertebrate indicators [Section 3.4.2] and Arctic Char [Section 3.4.2.1]) for potential mine site aquatic effects in the Mary River, Camp Lake, Sheardown Lake and their associated tributaries as well as Mary Lake which is the ultimate receiving water for these drainage areas.

The results of the 2023 CREMP indicated mine-related influences on water and sediment quality at some of the primary receiving systems (Minnow 2024b). As of 2023, potential mine-related influences on water quality have been identified through CREMP monitoring in tributaries to Camp Lake, Sheardown Lake, and the Mary River (i.e., Mary River Tributary-F). At Camp Lake Tributary 1, concentrations of iron, sulphate, molybdenum, sodium, and uranium were elevated compared to both reference and baseline conditions in 2023, suggesting a mine-related influence. A mine-related influence was also suggested at Sheardown Lake Tributaries in 2023 based on concentrations of nitrate, chloride, sulphate, cadmium, lithium, magnesium, manganese, potassium, strontium, and uranium (Sheardown Lake Tributary 1) and concentrations of ammonia, nitrate, and TKN (Sheardown Lake Tributary 9) that were elevated relative reference and baseline conditions. At Mary River Tributary-F, concentrations of nitrate and sulphate were elevated compared to reference conditions and have increased over time since the baseline period suggesting mine-related influences from effluent discharged to this tributary from the MS-08 final discharge point. As of 2023, mine-related influences on water quality in lakes in the Project area have been identified through CREMP monitoring based on increasing trends in concentrations of nitrate, sulphate, molybdenum, and uranium in the northwest and southeast basins of Sheardown Lake and chloride in the northeast basin only over the mine operations period. Despite these indications of mine-related influences on water quality, no ecologically relevant, adverse, mine-related effects to biota were identified in 2023 CREMP monitoring at any of the receiving waterbodies, relative to applicable reference and/or baseline conditions. Further, water quality at all CREMP waterbodies and watercourses in 2023 conformed to the significance ratings for magnitude of effects on water quality predicted in the FEIS and ERP FEIS Addendum (Baffinland 2012 and 2013). All water quality parameter concentrations in 2023 were also within applicable significance ratings for magnitude such that FEIS and ERP FEIS Addendum predictions for (absence of) effects on Arctic Char health and condition were also met (Baffinland 2012 and 2013).

The Surveillance Network Program (SNP), outlined in Schedule I of the Type ‘A’ Water Licence, analyzes effluents (i.e. treated sewage, treated oily stormwater) discharged to the receiving environment and monitors surface water quality within specific Project areas (i.e. surface water runoff downstream of Project areas). Based on a review of 2022 SNP results (Baffinland 2024b), exceedances of applicable discharge criteria in 2021, 2022, and 2023 involved mainly surface water runoff and effluents with elevated TSS. In each case, appropriate control measures were implemented to restore TSS levels below applicable discharge criteria. Baffinland continues to assess and implement the appropriate corrective and mitigation measures to address ongoing sedimentation concerns at the Project. A Mine Site Water Management Plan (Knight Piésold Ltd. 2021a) was approved by the Nunavut Water Board in 2021. In 2021 and 2022, Baffinland constructed the KM 105 dam to contain runoff from the mine haul road and ongoing upgrades and improvements to the KM 105 surface water management system have been implemented in 2023 and are planned in 2024. In 2022, permanent sediment and erosion control measures were implemented in the Camp Lake jetty area. Work is also ongoing in 2023 and 2024 to design and construct other elements of the water management plan.

The primary objective of the Tote Road Monitoring Program is to assess Project - related impacts to surface water resulting from sedimentation and erosion events. The program, jointly developed with the QIA, evaluates upstream and downstream concentrations of total suspended solids in surface water proximal to the Tote Road at select crossings considered representative of the respective catchment areas, where crossings of fish -bearing waters have been identified, and near other potential sources of sedimentation such as snow stockpiles and historic borrow sources. Data from the Tote Road Monitoring Program indicate variable TSS results from 2017 to 2020. In 2021, Baffinland reported a total of six sampling events where a Project-related effect was concluded (based on greater than 50 mg/L increase in TSS concentrations in the downstream sample when upstream concentrations are less than 250 mg/L or greater than 20% increase in TSS concentrations in the downstream sample when upstream concentrations are greater than 250 mg/L). In 2022 and 2023, there were seven and four sampling events indicating a Project-related effect on TSS, respectively. In all three years, sampling events that had downstream TSS concentrations greater than the screening criteria occurred prior to June 20, when freshet conditions resulted in elevated sediment loading into the affected watercourses over a short period of time. Following this period, all results demonstrated that there were no Project related changes to water quality as a result of the operation of the Tote Road.

3.3.3 SNOW QUALITY

The BIM Snow Sampling Program involves the collection of snow to understand the potential health impacts of dustfall deposition on the snow in locations where there may be traditional use and where snow may be collected for the purposes of consumption. The program is intended to assess the “quality” of the snow and its potential to affect the health of individuals who rely on it for drinking purposes. Samples are collected near the Mine Site, along Tote Road and at Milne Port.

There are four sampling locations proximal to Milne Port (1 km upstream of HTO, adjacent to HTO, west shore of Milne Inlet and Assumption Harbour), three locations where there may be traditional use proximal to the Mary River Mine site (Adjacent to Mine HTO at outflow from Camp Lake, Discharge Lake, Mary Lake South) and at two locations along Tote Road, in areas where individuals may travel and use snow as a source of meltwater.

In 2022, samples were collected in triplicate at each of the snow sampling locations and sent for analysis at ALS Laboratories, a CALA (Canadian Association of Laboratory Accreditation) accredited lab with locations across Canada. Because the focus of the Program was on the quality of the snow and the potential impacts to human health, the concentrations of total metals were analyzed. Total metals analysis includes both dissolved and suspended particulate matter, both of which could be consumed during drinking.

The mean total metals concentrations were compared to the Canadian Drinking Water Quality Guidelines (CDWQG) (Health Canada, 2022). The basis of the CDWQG is an assumed consumption rate of 1.5 L of water per day over a lifetime (70 years) (Health Canada, 2022). The CDWQG are either health based and are listed as Maximum Acceptable Concentrations (MAC) or based on aesthetic considerations and are classified as Aesthetic Objectives (AO). For a few parameters, operational guidelines (OG) are included. The MACs are guidelines intended to prevent harm through water consumption. Elevated levels of a parameter with a stated AO do not necessarily indicate potential for harm, rather it means that the elevated levels are undesirable and can potentially affect the acceptance of the water by the consumer (e.g., the water may taste "off" or have an unusual colour). Constituent values outside or higher than OG may impact the performance of water treatment of distribution systems but are not a health or aesthetic concern. In cases where CDWQG were not available, standards from the Ontario Ministry of Environment for potable groundwater consumption were used (MOE, 2011).

The findings of the snow sampling program indicated that the concentrations of metals in sampled snow meltwater were below the health-based maximum acceptable concentrations as detailed in the CDWQG and Ontario potable groundwater guidelines for sampled traditional use locations; however, in many cases the measured concentrations of aluminum, iron, manganese, total dissolved solids (TDS) and pH exceeded the operational guidelines or aesthetic objectives for water quality. As noted, aesthetic objectives are based on taste or discoloration, while operational guidelines or objectives are provided to maximize effectiveness of water distribution systems.

Snow is subject to variations in colour and taste in areas of higher traffic resulting in increased dust deposition, such as the Mine site, Tote Road, and Milne Port. Based on the data evaluated in the snow sampling program, the potential taste and colour changes are not associated with an elevated health risk when making tea from snow while on the land in areas removed from active project areas.

Snow samples are also collected in the Project Development Areas and metal concentrations in snow samples are correlated with those in co-located dustfall monitors to determine overall impacts from deposition. More information is presented in the recent SOP2 FEIS Addendum (Baffinland 2024a).

3.3.4 GROUNDWATER QUALITY

Permafrost in the region is on the order of 500 m deep, and the active layer of the permafrost is approximately 1 m to 2 m deep. As a result, groundwater infiltration and storage is minimal, and transport is limited to shallow subsurface flow. A Groundwater Monitoring Program was established to monitor groundwater quality and quantity at both the Landfill Facility (monitoring established in 2017), located to the east of Sheardown Lake, and the Hazardous Waste Berm (HWB) Facility (monitoring established in 2021) located adjacent to the Camp Lake Airstrip. Groundwater monitoring conducted from 2017 to 2021 found variable groundwater quality with elevated chloride, sulphate, and some metals downgradient of the Landfill Facility, as well as hydrocarbon parameters downgradient of the HWB facility (Tetra Tech 2022). Results suggested that landfill operations have impacted the groundwater quality at monitoring locations in the immediate vicinity of the Landfill Facility and suggested the potential presence of groundwater impacts due to hazardous waste storage but limited to the central portion of the HWB area. Groundwater monitoring in 2022 downgradient of the Landfill Facility revealed concentrations of select parameters in leachate (i.e., sulphate, iron, manganese, chloride, fluoride, and boron) that were generally elevated compared to Federal Interim Groundwater Quality guidelines (FIGQ; Knight Piésold Ltd, 2023). Monitoring downgradient of the HWB Facility also revealed one or more stations with concentrations of several parameters that were above FIGQ guidelines (i.e., chloride, iron, nitrite, copper, and manganese), though some of these parameters also exist in concentrations which exceed FIGQ guidelines at upgradient locations (copper, manganese, and nitrate), suggesting that some parameters may be naturally elevated in groundwater. Additionally, several PHC and PAH parameters at one monitoring station downgradient of the HWB were also elevated relative to guidelines, though because these were not found to be elevated at other downgradient monitoring stations it is currently unclear whether these elevated concentrations are the result of the HBW, or another source.

Future groundwater monitoring will be completed with the objectives of confirming and/or determining the extent of Landfill and HWB facility-related influences. Permanent monitoring wells are planned to be installed and the addition new monitoring sites is planned to support evaluation of leachate composition and groundwater flow direction near the Landfill and HWB facilities. Additional data collected downgradient of the Landfill Facility is expected to assist in developing a Contaminant Transport Model to aid in determining if/when groundwater seepage/leachate may reach nearby Sheardown Lake. Collection of soil samples has been recommended to assist in the determination of hydraulic conductivity and, in light of evidence that the Landfill Facility may be generating leachate, recommendations for a waste audit to better understand the chemical composition of the leachate have also been made.

3.3.5 MARINE WATER/ICE AND SEDIMENT QUALITY

Milne Inlet oceanography is similar to other neighbouring Arctic inlets, with full ice cover and no freshwater input during the winter. Open-water and ice-cover seasons typically start in June and early October, respectively. In the winter, the water column is relatively mixed, with relatively consistent temperature and salinity. During the openwater season, large freshwater inputs create a strong stratification in the water column with a typical pycnocline depth of 5 m to 10 m. Currents in Milne Inlet are mostly driven by tides and are generally small.

Water quality parameters and major ion concentrations in Milne Inlet recorded during the open-water season in 2008 and 2010 were typical for a stratified water column, with brackish (mean salinity 18 PSU) water layer, 8 m to 10 m in depth from the surface, and a more saline (30 PSU) water mass below. During the ice-cover season, salinity was higher than during the open-water season (approximately 32 PSU) and relatively uniform throughout the water column. Water was clear, with turbidity ranging from 0.3 NTU to 0.6 NTU, and with low levels of dissolved solids and concentrations of nutrients, indicative of mesotrophic conditions. Nutrient concentrations were higher at depth than near the surface, particularly during the open-water season. Several metals, including cadmium and iron, in water samples collected during the 2008 and 2010 baseline studies were generally below the detection limits. Mercury concentrations exceeded the CCME guidelines in two samples in June 2008. In 2014 and 2015, water samples collected during open-water season were brackish (14-20 PSU), with low total suspended solids, low turbidity, and low colour. Most metals were below DL, except for aluminum, boron, mercury, strontium, and uranium. Mercury concentrations (0.023 µg/L to 0.025 µg/L) exceeded the CCME guideline (0.016 µg/L) in all samples during the third sampling event in August. Hydrocarbons were not detected in any water samples. In comparison, both mercury and hydrocarbons were below DL in 2016 (SEM 2017a). Since the start of shipping operations at Milne Port, effluent and wastewater discharges to the marine receiving environment have met requirements of the Type A Water License. Monitoring results for marine water quality measured as part of the annual MEEMP program at Milne Port remain below thresholds of harm for marine biota (WSP 2024a).

A detailed summary of sea ice baseline conditions along the Northern Shipping Route is provided in the Ice Conditions Report for Milne Inlet prepared by Fednav Ice Services (Fednav 2023, included as Appendix 13), with a brief summary presented below. During the landfast break-up period in Navy Board Inlet, Eclipse Sound, Pond Inlet and Milne Inlet, the sequence of ice clearing events during early summer can be quite rapid. The area goes from thick landfast ice cover to open-water conditions over a relatively short period. Although melting begins in June on the surface of the ice, first signs of break-up generally appear in mid-July. Within three to four weeks, the majority of all sea ice has broken out and/or melted away. In cold years, fracturing and breakup within Milne Inlet and Eclipse

Sound may be delayed as late as mid-August. Once break-up is complete, typically by August 10 at the latest, these sheltered inland waterways remain under open-water conditions until early October (Enfotec 2011, 2016).

The sequence of freeze-up events in the RSA during the fall shoulder season is similarly very rapid. Lancaster Sound is generally the first area where ice forms in the fall, due to lingering floes that trigger ice growth more rapidly than open-water. Navy Board Inlet tends to freeze-up slightly earlier than Milne Inlet and Pond Inlet, also due to the presence of drifting ice originating from Lancaster Sound. In Milne Inlet, freeze-up typically occurs in early October and results in level fast ice (Enfotec 2011). Ice freeze-up in Baffin Bay typically follows the freeze-up period for the Northern Shipping Route and adjacent waterways (e.g. Navy Board Inlet). New ice (<10 cm) normally begins to appear along the Northern Shipping Route during the second week of October and can expand rapidly. The transition into grey-white ice (15-30 cm) typically occurs during the first week of November, transitioning into thin first-year ice (30-70 cm) around November 15, and becoming landfast ice shortly thereafter. The timing between initial ice freeze-up and landfast ice formation in Milne Inlet and Pond Inlet varies from year to year and is subject to local weather conditions. Fast ice in this region is typically established by mid to late November. Ice in Eclipse Sound is likely to show more ice shear ridges than ice in Milne Inlet to the south. Mean ice thickness in Milne Inlet and Eclipse Sound reaches approximately 1.6 m in most years, with maximum ice thickness occurring in May. In some years, ice as thick as 2 m has been measured.

There is agreement between elders in Pond Inlet (and in other communities further south) that sea ice is thinner and weaker than it has been historically (Gérin-Lajoie et al. 2016; Wilson et al. 2021). Generally, multi-year ice (sea-ice that has survived at least one melting season) is stronger than first-year ice, suggesting that elders are observing more first-year sea-ice now than in the past. The International Panel on Climate Change (IPCC) summarizes that the annual Arctic Sea ice extent decreased over the period 1979 to 2012 by about 3.5 to 4.1% per decade (0.45 to 0.51 million km2 per decade) (IPCC 2014). The perennial sea ice extent (summer minimum) decreased between 1979 and 2012 at 11.5 ± 2.1% per decade (0.73 to 1.07 million km2 per decade) and the multi-year ice (that has survived two or more summers) decreased at a rate of 13.5 ± 2.5% per decade (0.66 to 0.98 million km2 per decade). The average winter sea ice thickness within the Arctic Basin decreased between 1.3 and 2.3 m between 1980 and 2008. These observations support observations shared by elders from the local communities (Gérin-Lajoie et al. 2016; Wilson et al. 2021). Predictions from General Circulation Model (GCM) simulations agree that the Arctic sea ice cover will continue to shrink and thin all year round during the 21st century as the annual mean global surface temperature rises (IPCC 2014). Under the Representative Concentration Pathways (RCP) 8.5 high emission scenario, it is projected that the Arctic Ocean will become nearly ice-free in September before the middle of the century. More seasonally detailed quantitative predictions were unavailable. It is reasonable to assume that the trends that have been recently observed by elders will continue, such as earlier ice break-up in the spring, later freeze-up in the fall/winter, and thinner and weaker winter ice. The specifics will depend on factors that are difficult to quantify such as future anthropogenic greenhouse gas emissions, natural variability, and additional regional factors such as wind speed and wind direction.

Sediment samples for baseline and effect monitoring studies were collected in Milne Inlet during the open-water seasons in 2008, 2010, and from 2013 through 2016. Sediment samples collected in Milne Inlet throughout the sampling years were dominated by either sand or sand and silt and had low nutrient levels. Concentrations of some metals (aluminum, arsenic, calcium, chromium cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, strontium, and vanadium) were correlated with silt content and were higher in samples with greater proportion of silt. None of the detected metals or hydrocarbons exceeded CCME guidelines for sediments, except for arsenic and zinc in seven samples during the 2014-2016 samples. Results of ANCOVA analysis of percent fine particles and concentration of iron, as indicators of Project effects on sediments, did not suggest Project related effects, since no significant differences were found between the baseline year and consecutive years in content of fines and iron concentrations (SEM 2017a). Monitoring results for marine sediment quality measured as part of the annual MEEMP program at Milne Port remain within predictions of the FEIS and subsequent addenda, which forecasted the potential for minor and localized sediment disturbance associated primarily with propeller wash from shipping operations in Milne Port, with stabilization expected over time (WSP 2024b).

3.3.6 GEOCHEMISTRY

Deposit No.1 occurs at the nose of a syncline plunging steeply to the northeast (Aker Kvaerner, 2008). The iron formation occupies the nose and two limbs of this feature with a 1,300 m long northern portion and a 700 m long southern portion. For the LOM characterization, waste rock was subdivided based on broad geo-structural categories about the iron ore zone, mainly by hanging wall and footwall zones.

- The iron ore deposits at the Mary River project represent high-grade examples of Algoma-type iron formation and are composed of hematite, magnetite and mixed hematite-magnetite-specular hematite varieties of ore (Aker Kvaerner, 2008). The iron deposits consist of several lensoidal bodies that vary in their proportions of the main iron oxide minerals and impurity content of sulphur and silica in the ore. The massive hematite ore is the highest-grade ore and has the fewest impurities, which may indicate it was derived from relatively pure magnetite or that chert, quartzite and sulphides were leached and oxidized during alteration of the iron formation.
- The footwall to the iron formation mainly consists of gneiss with minor schist, psammitic gneiss (psammite) and amphibolite. The footwall mainly consists of quartz-feldspar-mica gneiss with lesser meta-sediment (greywacke) and quartz-mica schist. Microcline and albite are the predominant feldspars within the gneiss and biotite is generally more abundant than muscovite.
- The hanging wall is primarily composed of schist and volcanic tuft with lesser amphibolite and metasediment. The hanging wall primarily encompasses chlorite--actinolite schist and garnetiferous amphibolites. Metavolcanic tuftis also a significant lithology identified in the hanging wall.

Metal leaching and acid rock drainage (ML/ARD) characterization studies in support of the Life of Mine (LOM) pit waste rock are provided in the LOM Waste Rock Management Plan. Additional investigations have been completed specifically for the 5-year open pit and in response to observed acidic conditions within the current waste rock facility (WRF; AMEC, 2014 and 2017; Golder 2019a and 2019b, WSP 2024b).

A total of 776 Acid-base Accounting (ABA) samples and 376 minerology samples were selected to provide representative samples of the waste rock categories and broad spatial coverage of non-ore mine rock in the vicinity of the LOM open pit development. All 776 ABA samples were analyzed for modified Sobek acid base accounting (ABA), NAG pH, and elemental content. Subsets of drill core samples were also analyzed for downhole variability, NAG leachate, short-term metal leaching, whole rock elemental content, detailed mineralogical analysis, and long-term kinetic testing.

Results of ABA testing from the LOM characterization determined that the waste rock is generally characterized as having low neutralization potentials (NP) and low acid potentials (AP). Data suggests that the waste rock is dominated by noncarbonate sources of NP (e.g., silicates) with lesser NP derived from carbonate sources. Sulphide was the primary form of sulphur; however, further review of the geochemical database notes that sulphates may also contribute to total sulphur contents.

- Approximately 85% of waste rock samples had neutralization potential ratios (NPR) greater than 2 and are classified as non-potentially acid generating (non-PAG) and are unlikely to generate acidic drainage.
- Approximately 10% of the samples had NPR values of less than 1.
- Approximately 5% of the samples were classified as having uncertain acid generating potential (1 < NPR < 2).

Extrapolating these results to the project waste rock model, indicates that approximately 11% of the LOM in-pit waste rock is expected to have NPR <2 and is considered potentially acid generating (PAG). Proximity to ore appears to correlate to increased PAG quantities (defined as NPR <2), as the hanging wall schist (HWS) and footwall schist (FWS) zones were identified with the greatest proportion of PAG of the major waste units. The proportion of LOM PAG waste rock was estimated to be 14% as part of the baseline studies and FEIS, representing a larger proportion than current projections.

The current Waste Rock Management Plan is the Phase 1 Waste Rock Management Plan (Baffinland, 2024c), which defines the following operational screening criteria for PAG vs Non-AG material in the excerpted table below:

TABLE 3.7 WASTE CLASSIFICATION CRITERIA

Acid Generation Potential	Criteria*
PAG	Total sulphur ≥ 0.20 wt% as S or paste pH ≤ 6
Non-AG	Total sulphur < 0.20 wt% as S and paste pH > 6

*Total sulphur measured by XRF or LECO method, as supported by WSP, 2024b

The following is excerpted (and modified for inclusion within this report) from WSP, 2024b:

> *For the BIM Mary River Deposit 1 the current field methodology for geochemical characterization involves testing of drillhole cuttings from each blasthole and measuring the paste pH and total sulphur content. The field classification system was updated in 2019 to consider the possible presence of soluble sulphate minerals (e.g., melanterite) that were observed in portions of the deposit (Golder 2019b) by adding paste pH as an additional criterion.*
>
> *The 2023 geochemistry update report provides a review of results of geochemical sampling completed from 2020 through 2022. The current evaluation includes review of 8603 blasthole drill cutting samples with measurements of total sulphur and paste pH from on-site as well as review of results from a subset of 395 split samples that underwent both field testing (pH and total sulphur) and analytical laboratory testing which also included acid-base accounting (ABA) analysis. In particular the use of total sulphur, as well as the combination of total sulphur plus sample pH (or paste pH) was evaluated for use in on site classification as compared to the Neutralization Potential Ratio (NPR) developed through full ABA test work. Site water quality measurements were also reviewed for potential metal leaching and acidity trends.*

Key conclusions from the completed review and analysis are as follows:

Field vs. Analytical results:

- *A review of sample results from on-site analysis and analytical laboratory testing shows very good agreement for total sulphur analysis and paste pH analysis between field analysis and off-site analytical analysis, indicating that the results of field analysis of total sulphur and paste pH are reasonable for decision making purposes. It is also considered that x-ray fluorescence (XRF) for analysis of total sulphur is a valid method for use in classifying the waste materials in the field.*

Total Sulphur and ABA results/ review of sample representativeness I uncertainty:

- *Considering the dataset of 8603 on-site analysis of paste pH, of the 8603 samples 0.4% of samples (33 samples) had some associated acidity (paste pH values of less than 6) and were distributed near the ore zones. Possible causes of low pH in the absence of elevated total sulphur include stored oxidation products, or soluble sulphate minerals.*

This information is part of Baffinland's ongoing assessment of the geochemistry regime within the ore body, and will continue to be updated as per the research schedule in Appendix D3 and the Phase 1 Waste Rock Management Plan.

Humidity cells

Humidity cell tests (HCT) are long-term kinetic tests in which leachate from subsequent wetting and drying cycles on samples of waste rock is collected and analysed to evaluate potential for geochemical weathering and resulting drainage quality. Ten HCTs were run for 53 weeks in 2008 and 2009. Nineteen were initiated in 2011 and 2014, including nine standard humidity cells, two standard humidity cells with mineralized waste, and eight carbonate depleted humidity cells. These HCTs were run between 170 and 356 weeks.

Humidity cells initiated in 2011 and 2014 mostly exhibited pH between 5.5 and 7, though 3 had slowly declining pH to minimums of 4.5 and 5 after about two years. Metal and sulphate release were found to be low, though concentrations of Cd, Co, Cu, Ni, Pb and Zn were highest in HCTs with pH less than 5. Most PAG HCTs presented weakly acidic leaching (e.g., 6 > pH > 4.5) within 20 to 30 weeks of initiation.

Observed metals that produced elevated concentrations in the HCTs were consistent with the observed elevated metals in the WRF runoff water quality at Site between 2017 and 2019, however the concentrations are not in agreement with concentrations of some metals (e.g., Nickel) being higher in the WRF runoff compared to the HCT results. In addition, the WRF runoff was observed to have elevated sulphate and iron that has not been observed in the HCT data. Due to the inconsistencies, the remaining active HCTs were terminated, and a field-based monitoring approach was developed in 2019 as detailed in Golder (2019).

3.4 BIOLOGICAL ENVIRONMENT

The following section on the biological environment at the Project provides a summary of the baseline conditions that existed before the Project along with information collected through aquatic, terrestrial and marine data collection and monitoring programs.

3.4.1 VEGETATION

The Project area falls within three ecoregions: Borden Peninsula Plateau, Baffin Island Uplands, and Melville Peninsula Plateau; the Project area is mainly within the Melville Peninsula Plateau. The Borden Peninsula Plateau covers a small portion in the northwestern tip of the Project area around Milne Inlet. The Baffin Island Uplands covers a small portion on the eastern edge of the Project area. Most of the Project area falls within the Melville Peninsula Plateau ecoregion which is an area of non-mountainous terrain characterized by major land components such as dry, rugged uplands, rolling plains, and lowland features with some standing water. The area is underlain by continuous permafrost and sparsely distributed vegetation cover including dwarf shrubs, forbs, grasses and sedges, mosses, and lichens.

Land cover maps of northern Canada and Arctic ecosystems can be described by Northern Land Cover (NLC) classes derived from medium resolution (~30 x 30 m) satellite images (i.e., Landsat imagery; (Olthof et al. 2009). These land cover maps provide the highest level of detail available to assess vegetation cover spatially in the Arctic (Olthof et al. 2009).

There are 13 NLC classes that are recognized under five broad categories including graminoid (i.e., grasses and sedges) dominated, shrub dominated (> 25% cover), sparsely distributed vegetation (2-10% cover), wetlands, and non-vegetated (< 2% cover). The most common NLC class in the Project area is the sparsely vegetated bedrock cover type which contains 2–10% vegetation cover and generally consists of graminoids and prostrate dwarf shrubs (Appendix 6H, FEIS, Baffinland 2012). This indicates relatively high rock and low vegetation cover across the Project area. The second most common NLC class is the prostrate dwarf shrub cover type which typically contains > 25% vegetation cover and is made up of prostrate dwarf shrubs, graminoids, and < 10% lichen and moss (Appendix 6H, FEIS, Baffinland 2012). The abundance of other cover types is relatively similar, but discontinuous across the Project area.

Baseline vegetation surveys were conducted in the Project area starting in 2005; monitoring work has been ongoing since 2012. Vegetation surveys completed in the Project area as part of baseline and project monitoring include inventory of: vegetation species, communities, abundance, composition and rare plants; vegetation and soil trace metals; revegetation by native plant species; IQ based traditional plant use studies; and exotic invasive vegetation.

Vegetation of the study areas was generally consistent with flora of Arctic regions and was characterized by short plant heights growing on rocky, sandy or silt soils of low nutrient content. Percentage of cover was dependant on slope aspects substrate and moisture regimes. A total of 126 vascular plant species were observed in the northern portion of the Project area during 2014 and 2016 vegetation abundance monitoring. Combined, all baseline vegetation surveys (2005-2016) recorded 184 vegetation species (and associated subspecies), including vascular and non-vascular plants. During field surveys, incidental observations of the horned dandelion (*Taraxacum ceratophorum*), a territorial "May Be At Risk" species for Nunavut, were made in 2014 and 2016. Horned dandelion is a native dandelion species in Nunavut not previously reported in northern Baffin Island. Horned dandelion was found near the Mine Site and along the Tote Road from km 84.6 to km 85.2. Metals analysis of soil and vegetation was conducted from 2012 to 2016; all results have been within the expected range and below thresholds, following the resampling of two stations in 2017 that were confirmed to be outliers. Vegetation and exotic plant surveys to date have not recorded exotic or invasive species near the PDA.

Results for of the Vegetation Baseline Report for the project, including selected metals in plant species foliage are summarized and detailed in FEIS Volume 6, Appendix 6C Vegetation Baseline Report. In that baseline report, Figure 2 Terrestrial Regional Study Area shows the vegetation plot locations in the regional study area.

Vegetation monitoring work has been ongoing since 2012. Baffinland already monitors and investigates potential trends in increased dustfall generation with soil contamination in the various mine site areas. A long-term vegetation and soil base metals monitoring program was initiated in 2012, as described in the Terrestrial Environment Mitigation and Monitoring Plan (TEMMP) (BAF-PH1-830-P16-0027). The objectives of the vegetation and soil base metals monitoring program are to monitor metal concentrations in vegetation and soil, particularly caribou forage (i.e., lichen), and verify that metal concentrations are within the acceptable range for established soil quality guidelines and relevant vegetation indicator values.

The most recent soil-metal concentration data, collected in 2022 at the Project, predominantly indicated no significant change relative to baseline values. Concentrations were below or within an acceptable range for soil-metal concentrations. Further, it was noted that there was a significant negative relationship between metal concentrations in dustfall and metal concentrations in soil for all CoPCs except cadmium; for all CoPCs, this appeared to be mediated by a significant positive relationship with soil pH. No unifying trend has been drawn from the analysis (EDI 2023).

Baffinland is committed to monitoring the potential effects of the Mary River Project on vegetation, specifically vegetation abundance and composition (i.e., caribou forage species) and vegetation health (i.e., soil-metal and lichen-metal concentrations) as indicators of change. Monitoring will be conducted in alignment with the committed monitoring frequency of three to five years delineated in the Terrestrial Environment Mitigation and Monitoring Plan (BAF-PH1-830-P16-0027). Vegetation monitoring data collection started in 2014. In 2023, a multi-year trend analysis was conducted using data from all available monitoring campaigns (i.e., 2014, 2016 to 2019, and 2023) to evaluate year-over-year trend comparisons (EDI 2024). Analysis of vegetation abundance data were also evaluated and interpreted in relation to soil moisture characterization. There have been no measured effects on vegetation abundance outside of the PDA. Results of those analyses are provided in the inter-annual trends sections of the Terrestrial Environmental Annual Monitoring Reports.

Metals analysis of soil and vegetation was conducted from 2012 to 2016; all results have been within the expected range and below thresholds, following the resampling of two stations in 2017 that were confirmed to be outliers. Vegetation and exotic plant surveys to date have not recorded exotic or invasive species near the PDA.

Many mean lichen-metals concentrations across Project areas and sample distances show no significant changes with baseline values. However, discrete increases in CoPCs in soil (i.e., copper, zinc) and lichen (i.e., arsenic, cadmium, copper, lead, selenium) were recorded at the Mine Site, Milne Port and along the Tote Road, with some individual values at or above indicator values. Indicator values were established as early values of potential changes in vegetation health. Whereas some increases and exceedances were attributed to occasional 'spikes' in metal concentration and sample variability, other CoPC increases appeared due to proximity to Project operations. Should these values continue to increase or result in continued (year-over-year) exceedances of threshold values, it may be necessary to re-evaluate and refine potential triggers and corrective actions. Ancillary analysis of dust-deposited metals on lichen and examination of the relationship between metals in dustfall versus soil-metal and lichen-metal were also completed to cross-reference potential trends from the passive dustfall monitoring program.

No unifying trends of deposited metals on lichen have been observed, nor has there been a relationship between metals in dustfall versus soil-metal and lichen-metal.

3.4.2 AQUATIC WILDLIFE

A freshwater aquatic baseline study was completed for the Project from 2005 and 2011. The results of this report are presented in FEIS Volume 7, Appendix 7C and summarized at a high level in the sections below.

Freshwater biota and aquatic habitat components include aquatic habitat (streams and lakes), primary producers (e.g., phytoplankton), secondary producers (e.g., zooplankton and invertebrates), fish populations and their movements. Only two fish species have been captured in freshwater study areas near the Project – Arctic char (*Salvelinus alpinus*) and ninespine stickleback (*Pungitius pungitius*). Both species are generally abundant and widespread in distribution; however, ninespine stickleback are absent from the freshwater lakes and streams that have been surveyed near the Milne Inlet coast. All streams with the possible exception of large rivers freeze solid in winter. Lakes provide the only overwintering habitat for fish.

All streams with the possible exception of large rivers freeze solid in winter. Lakes provide the only overwintering habitat for both species. Lakes also provide spawning habitat for Arctic char across the study areas. Many streams provide rearing and foraging habitat and potential protection from predators for juvenile Arctic char. Most of the drainage basins that support Arctic char either contain barriers preventing anadromous migrations and/or are distant from the coast and most populations in the five study areas are land locked. Nearshore zones of larger lakes also provide rearing and foraging habitat and potential protection from predators for juvenile Arctic char, foraging and, in some cases, spawning habitat for adult Arctic char, and overwintering habitat for all life stages. Mercury concentrations in Arctic char muscle exceeded guidelines for human consumption in some fish captured, although concentrations were similar to those reported for other land-locked char populations..

In general, the lower trophic level communities near the Project are similar to other areas of the Canadian Arctic. As is typical of Arctic ecosystems, the freshwater environment is relatively nutrient-poor and primary productivity is relatively low. In general, Arctic freshwater ecosystems are characterized by relatively low diversity of zooplankton communities due to low temperatures and nutrients. Characterizations of Mine Site area lakes, prior to the initiation of operations were consistent with this generalization. The benthic invertebrate communities in the Mine Site area are generally moderately diverse and are dominated by chrionomids, although higher diversity is found in some small tributaries.

The objective of the Tote Road Fish Habitat monitoring program is to assess the presence of fish, habitat quality, and upstream accessibility through installed culverts at fish-bearing sites along the Tote Road corridor (and identify water crossings that may require remediation to fish habitat or passage through culverts). Among 41 assessed crossings in 2023, 21 stream crossings with potential issues requiring remediation were identified, some of which had been identified prior to 2023 (Baffinland 2024b). Factors contributing to potential passage impediment at these crossings included perched culverts, high culvert water velocities, and/or sedimentation issues. Appropriate remedial actions, once approved by DFO, will be implemented to address these issues. This includes replacing existing culverts with larger diameter culverts and/or embedding culvert(s) by 40%, which will improve conditions for fish passage and reduce the risk of perched culverts in the future. Baffinland is also reviewing the feasibility of alternative crossing designs to corrugated steel pipe (CSP) culverts. Remediation actions may also include armouring of road embankments to reduce potential erosion and address sedimentation issues. These remedial measures are planned to be implemented in 2024.

The EEM benthic invertebrate community survey, completed as part of the Third EEM biological study in 2023 (Minnow 2024a), indicated no statistically significant differences in the primary metrics of density, and family level richness, Simpson's Evenness, and Bray Curtis Index between the effluent-exposed and reference areas of Mary River Tributary-F (EDI 2024). Significant differences in supporting response variables including Simpson's Evenness at lowest practical level taxonomy and the percent composition of major taxonomic groups (i.e., Chironomidae and Simuliidae), FFG, and HPGs suggested that effects on the benthic invertebrate community of Mary River Tributary-F associated with exposure to the MS-08 effluent, if any, were very subtle. There were no consistent differences in benthic invertebrate community metrics among the first three EEM studies, suggesting that any influence of MS-08 effluent on the benthic invertebrate community was limited and potentially associated with subtle differences in the proportion of taxonomic and/or functional feeding groups. Overall, no effects of MS-08 effluent on the benthic invertebrate community were demonstrated in 2023 based on evaluation of EEM effect indicators.

No mine-related influences on sediment quality have been identified through CREMP or Lake Sedimentation Monitoring Program to date but the emergence of a potential mine-related influence on iron in sediment at Sheardown Lake NW is being further investigated (Minnow 2024b). As of 2023, no adverse mine-related effects on phytoplankton productivity (as chlorophyll-a concentration) or benthic invertebrate community composition in the Mary River, Camp Lake, Sheardown Lake, Mary Lake, and their associated tributaries have been identified through the CREMP based on comparison to AEMP benchmarks, reference conditions, and/or baseline conditions.

Regular monitoring of runoff from the WRF in 2017 identified unexpected low pH water, which necessitated adaptive management including the installation of a water treatment plant, additional geochemical evaluations, and modifications to the waste rock disposal strategy. At the Mine Site, while lake sedimentation rates in Sheardown Lake NW exceed baseline but they remained within the range for arctic lakes, and monitoring of the biological communities (i.e., phytoplankton, benthic macroinvertebrates, and Arctic Char) conducted to date have not indicated adverse mine-related influences on the biota of the Mine Site waterbodies and watercourses (Minnow 2022). Some issues regarding fish passage and condition of stream crossings along the Tote Road have been noted in the annual surveys conducted since 2009; as a result, Baffinland has implemented various mitigation measures to correct issues identified and will apply experience gained and lessons learned to ongoing monitoring and management.

3.4.2.1 ARCTIC CHAR

Arctic char is one of only two fish species (the other being ninespine stickleback) that have been captured in the freshwater environment near the Project. Arctic char are generally abundant and widespread in distribution. Many streams provide rearing and foraging habitat and potential protection from predators for juvenile Arctic char. Nearshore zones of larger lakes also provide rearing and foraging habitat and potential protection from predators for juvenile Arctic char. Lakes also provide foraging and, in some cases, spawning habitat for adult Arctic char, and overwintering habitat for all life stages. Most of the drainage basins near the Project that support Arctic char either contain barriers preventing anadromous migrations and/or are distant from the coast and most populations near the Project are land-locked. Mercury concentrations in Arctic char muscle captured during baseline studies exceeded guidelines for human consumption in some of the fish captured, although concentrations were similar to those reported for other land-locked char populations.

The most recent EEM fish population survey (Third EEM biological study in 2023; Minnow 2024a) indicated no substantial differences in community species composition or Arctic Char abundance at the Mary River effluent-exposed area compared to the reference area (Angijurjuk Lake Tributary). Mary River non-YOY juvenile arctic charr had lengths and weights that were significantly lower and condition that was significantly higher than for Angijurjuk Lake Tributary reference area non-YOY juvenile Arctic Char. Differences in these endpoints between the effluent-exposed and reference areas were not at absolute magnitudes of difference above the Critical Effect Size of 25% for length and weight and 10% for condition suggesting that they were not ecologically meaningful. Mary River Arctic Char also tended to be younger than Angijurjuk Lake Tributary Arctic Char, though the difference, based only on the lethally sampled subset of fish, was not statistically significant. There were no significant differences in Arctic Char growth or relative liver size between the Mary River effluent-exposed area compared to reference. Factors unrelated to effluent exposure have the potential to have contributed to significantly smaller size (i.e., length and weight) of Arctic Char at the Mary River effluent-exposed area compared to the Angijurjuk Lake Tributary reference area, including fish age. Further, greater condition of Arctic Char at the Mary River effluent-exposed area and no difference in EEM effect indicators related to energy storage (i.e., relative liver size) indicated no or minimal influence of the MS-08 effluent on the health of Arctic Char at the Mary River effluent-exposed area in 2023. There were no consistent significant differences in fish community composition, fish relative abundance, or non-YOY Arctic Char health endpoints between the Mary River effluent-exposed and reference areas from 2020 to 2023, indicating no effects of the MS-08 effluent on the health of Arctic Char residing in the Mary River based on EEM effect indicators.

As of 2023, no adverse mine-related effects on the relative abundance or health of Arctic Char in the Mary River, Camp Lake, Sheardown Lake or Mary Lake have been identified through the CREMP based on comparison to AEMP benchmarks, reference conditions, and/or baseline conditions (Minnow 2024b).

A Lake Sedimentation Monitoring Program (LSMP) has been included as a special investigation component of the Project AEMP since 2013. The objective of this monitoring program is to track sedimentation and evaluate the potential for adverse influences on resident Arctic Char populations due to sedimentation influences on incubating eggs at a representative lake (the northwest basin of Sheardown Lake; i.e., Sheardown Lake NW) within the immediate area of mine influence. The LSMP is a year-round sampling program that measures the sedimentation rate at Sheardown Lake NW separately over ice cover and open water periods. Sheardown Lake NW is expected to receive the highest particulate input through dust deposits and site runoff compared to other waterbodies near the Project and therefore this lake has served as the focus for lake sedimentation monitoring. Monitoring was initiated in 2013, with data collected from fall 2013 to fall 2014 serving as a baseline for one full ice cover period (September to June) and one full open water period (June to September). Lake sedimentation monitoring at the Mine Site in 2023 suggested limited potential to affect Arctic Char reproductive success at Sheardown Lake NW as the result of sedimentation rates/accumulation thickness over the 2022 to 2023 egg incubation/larval pre-emergence period (Minnow 2024c). Sedimentation rates during the open water period at Sheardown Lake NW habitat likely to be used for Arctic Char spawning were significantly different in 2023 compared to baseline but annual sediment accumulation thickness estimated for Sheardown Lake NW for the 2022 to 2023 combined ice cover and open water periods was within the range of annual estimates for Arctic lakes of comparable size and/or depth. The mean sediment accumulation thickness estimated for the 2022 to 2023 Arctic Char egg incubation/larval pre-emergence period at three monitoring stations in Sheardown Lake NW did not exceed the Trigger Action Response Plan (TARP) Low Action threshold of 0.15 mm, and was approximately 8 to 15% of the threshold level of 1 mm of sediment accumulation thickness purported to affect egg incubation success (which was also the FEIS threshold predicted to result in negligible effects on the direct mortality of Arctic Char; Baffinland 2012). The sampling station determined to be the most relevant area to Arctic Char egg incubation, had the lowest sediment accumulation thickness during the egg incubation/larval pre-emergence period in 2022/2023 of 0.8 mm, or 53% of the TARP Low Action threshold value. Sedimentation rate and sediment accumulation thickness data were not significantly correlated with dustfall data from 2013 to 2023 in Sheardown Lake NW. This suggests that aerial dustfall deposition was not a strong indicator of sedimentation rates or sediment accumulation thickness in Sheardown Lake NW over this period.

The Milne Inlet Freshwater Fish Health Assessment program was designed in coordination with community members representing the MHTO, the QIA, and the Hamlet of Pond Inlet to monitor the health of Arctic Char populations proximate to Baffinland's Milne Port Operations. The program included assessment of water, sediment, and adult Arctic Char health and tissue quality in three lakes along river systems that flow into Milne Inlet, including Qurluktuk, Tugaat, and Ikaluit lakes. Sampling was completed in 2021 and 2022 in collaboration with community members from the Mittimatalik Hunters and Trappers Organization, the Qikiqtani Inuit Association, and the Hamlet of Pond Inlet (Minnow 2023). Results of this program were presented in the 2021 and 2022 Annual Reports to the NIRB (Baffinland 2022 and 2023b). The program continues to find that Arctic Char sampled at these lakes remain in similar health to fish sampled in DFO programs carried out prior to the construction of the Project.

Data collected in 2022 from Tugaat, Qurluktuk, and Ikaluit river-lake systems, which support migratory populations of Arctic Char, revealed mixed sub-populations of resident and anadromous individuals co-existing in the freshwater environments of the three river-lake systems. Condition in male Arctic Char was not significantly different between lakes in 2022; however, females were significantly heavier at length in Tugaat Lake compared to both Qurluktuk and Ikaluit lakes and Qurluktuk fish were significantly heavier at length than Ikaluit Lake fish. Comparison to historical data for both Qurluktuk and Tugaat lakes indicated that both male and female Arctic Char sampled in 2022 were significantly younger, shorter, and lighter than Arctic Char described in the historical data, though this difference may have been an artifact of historical data being biased towards migrating individuals (older and faster growing). For all lakes, mean mercury concentration in muscle tissue was below Health Canada's Human Health guideline for fish (0.5 mg/kg dw; CFIA 2019), and across lakes was highest in Qurluktuk Lake, followed by Ikaluit Lake and then Tugaat Lake. Total mercury concentrations in Arctic Char muscle relative to length demonstrate the relationship of increasing mercury concentrations with size/age and that individuals identified as likely to be resident Arctic Char in 2022 (characterized by slower growth rates) in Qurluktuk Lake also had the highest concentrations of muscle tissue mercury. Of all the other analytes assessed, arsenic and cadmium concentrations in both muscle and liver tissue, and cadmium, copper, and selenium concentrations in liver only, were above Health Canada consumption benchmarks for screening level risk assessments (Health Canada 2010), based on average consumption values for fishing subsistence populations (70g/day; USEPA 1997). Arsenic concentrations are often elevated in marine biota in the form arsenobetaine and this relatively non-toxic form of arsenic poses little risk to organisms or their consumers. Cadmium, copper, and selenium liver concentrations also exceed the calculated consumption benchmarks and represent current, non-impacted conditions within these lakes.

3.4.3 TERRESTRIAL WILDLIFE

The Project is in an area where animal diversity and abundance is generally lower than the mainland portions of Nunavut and possibly cyclic with long periods between years of abundance. Terrestrial wildlife on north Baffin Island are described in the Mary River Project FEIS, Volume 6, Appendix 6F - Terrestrial Wildlife Baseline Report and more recently in SOP2 FEIS Addendum, Section 8 – Terrestrial Environment (Baffinland 2024a). Caribou (*Rangifer tarandus groenlandicus*) is considered a focal species for the Project as it is the only ungulate on Baffin Island and an important food source for local communities. Other terrestrial mammals found in the Project area include wolf (*Canis lupus manningi*), Arctic fox (*Vulpes lagopus*), brown lemming (*Lemmus trimucronatus*), Peary Land (northern) collared lemming (*Dicrostonyx groenlandicus*), Arctic hare (*Lepus arcticus*) and ermine (*Mustela erminea*). Documented occurrences of wolverine (*Gulo gulo*) and red fox (*Vulpes vulpes*) are rare or uncommon. Baseline wildlife studies were completed for the Mary River Project from 2006 –2017 including those targeting caribou, large and small carnivores, and rodents.

3.4.3.1 CARIBOU

A key terrestrial wildlife species (to both humans and within the broader ecology) is the North Baffin Island caribou. The Terrestrial baseline report found in FEIS Volume 6, Appendix 6F is the most extensive and thorough summary of north Baffin Island caribou currently in existence. It summarizes and synthesizes the history of government surveys, local harvest, IQ, habitat use, and terrestrial wildlife surveys funded by Baffinland, and is one of the most in-depth analyses of caribou habitat selection completed in Nunavut.

During caribou inventories prior to Project development, there were infrequent observations, suggesting very low abundance in the RSA. Most caribou were observed south and east of the Mary River camp. Height-of-Land caribou surveys initiated in 2013 have detected relatively few caribou. While eight (8) caribou were recorded in 2013, no caribou were observed during Height-of-Land surveys from 2014–2016. The lack of observations during Height-of-Land surveys coincides with very few incidental caribou sightings between the Mine Site and Milne Port.

North Baffin Island caribou have a 60 to 70-year population cycle of abundance believed to be related to availability of forage. Caribou abundance has declined by 90% since their last peak ended in the mid-1990s. Caribou are currently at a "low" in the population cycle. Their numbers are expected to gradually increase in the Mary River region but might not recover to historical high abundance until the 2050s. Barren-ground caribou (including the north Baffin Island herd) are listed as threatened by COSEWIC (COSEWIC 2016) but as of October 2022, not yet included on schedule 1 of the Species at Risk Act.

Caribou occur and have historically been found throughout the RSA. Caribou in the RSA are currently nonmigratory with no large-scale seasonal movements, and daily movements averaging below 4 km/day throughout the year. They used to concentrate around Angajurjualuk Lake and probably up to Milne Inlet and around Steensby Inlet. This is consistent with high-density trails concentrated around Steensby Inlet and east and south of Angajurjualuk Lake. Current local residents indicate caribou are now found in mountains north of the Project and around Barnes Ice Cap. Caribou also calve throughout the RSA mostly located more northwards and in elevated areas for protection against predators and mosquitoes. There are no identifiable calving grounds where caribou are known to congregate.

In 2019, North Baffin Island caribou were at a low point in their 60 to 80-year population cycle (Government of Nunavut 2019), and caribou observations from site personnel are recorded infrequently, incidentally or during surveys. The current survey methods and frequency are appropriate for low caribou densities; if/when caribou densities increase, the frequency of surveys will be increased accordingly. The recent results from the March 2023 aerial survey (112 caribou observations in 36 groups observed; EDI 2024) surpassed the threshold (>350 caribou or >35 groups of caribou), indicating that a caribou collaring program to address a Zone of Influence study may be appropriate. Initiating that study requires cooperation with the Government of Nunavut and the community Hunter and Trapper Organizations.

While caribou distribution and numbers were substantially reduced due to the natural population cycle before the mining started, caribou are expected to return to the Project area as numbers increase and caribou begin to occupy more of their historical range. The QIA states that caribou distribution has been affected by the Project activities.

Baffinland has a memorandum of understanding with the Government of Nunavut to access caribou collar and survey data. Caribou observations are occasional as expected given low regional abundance estimates provided by the Government of Nunavut. Remote wildlife cameras were installed at some Height of Land (HoL) stations to address questions from the TEWG on whether short-term height of land surveys missed caribou observations the rest of the year. As no caribou were spotted in the over 42,000 photos captured from the 12 cameras (in 2021, as an example), Baffinland remains confident that the results of the HoL surveys are related to the low regional abundance of caribou.

Baffinland's site-specific monitoring activities (e.g., HoL, snow track surveys and incidental observations) and a March 2023 aerial survey show caribou distribution and numbers possibly increasing, starting in the southern portion of the PDA, agreeing with traditional knowledge of caribou recovery shared with Baffinland during the preparation of the FEIS. Annual monitoring continues following the schedule identified in the TEMMP and identified as priority issues by the TEWG.

3.4.3.2 MARINE AND TERRESTRIAL BIRD COMMUNITIES

The marine and terrestrial bird communities of north Baffin Island are described in the Bird Baseline Report found in FEIS Volume 6, Appendix 6E.

The terrestrial and aquatic bird species found on north Baffin Island are generally reflective of those expected in the eastern Canadian Arctic. Most bird groups such as raptors, seabirds, shorebirds, songbirds, waterbirds, and waterfowl are represented by at least a few species found throughout the area. Field surveys and incidental observations documented 64 bird species within the TRSA and MRSA, of which 45 species were observed or reported breeding. This includes six Species at Risk listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2023) or the Species At Risk Act including Harlequin Duck, Red-necked Phalarope, Red Knot, Short-eared Owl, Ivory Gull, and Ross's Gull.

Migratory birds are present in the Project Area from late May to early September in the TRSA and into October in the MRSA; however, a few species are known to overwinter in open water areas such as leads and polynyas in the region. Staging and breeding habitats for numerous bird species are found in the Project area including but not limited to Red-throated Loon, Canada and Cackling Goose, Common and King Eider, Peregrine Falcon, Rough-legged Hawk, Rock Ptarmigan, Baird's Sandpiper, Glaucous Gull, Thick-billed Murre, Lapland Longspur, and Snow Bunting. The TRSA also includes part of an important moulting area for Snow Geese prior to fall migration. Other than a small Glaucous Gull colony found in Milne Inlet, no seabird nesting colonies were recorded during project surveys within the TRSA.

Relatively low densities of songbirds and shorebirds have been recorded throughout the Terrestrial RSA compared to other studies on mainland Nunavut and Northwest Territories. Very few of these species were found foraging or nesting in or around the Mine Site during baseline surveys. Exceptions were Snow Buntings and American Pipits observed in low densities. Higher densities and diversity levels of songbirds and shorebirds were found in low-lying tundra and wetlands found along the Tote Road.

Prior to the commencement of baseline surveys for the Mary River Project in 2006, no comprehensive avian surveys were conducted in the terrestrial RSA, nor had any comprehensive marine bird studies previously been conducted in Milne Inlet. However, the remainder of the marine RSA has been relatively well studied.

IQ surveys conducted in the surrounding communities indicated that the marine and terrestrial habitat contains several areas that are used seasonally by large numbers of various bird species. Community Elders indicated that most bird species in the area are migratory and typically arrive in late-April, May, and June, and start leaving in August. Breeding occurs throughout the area: most of the islands within the RSA are used as nesting grounds by various species of seabirds, gulls, terns and waterfowl, and some large colonies of seabirds and gulls are known along cliff habitats. Species such as geese, eiders, loons, and ducks can be found nesting along coastlines or inland along freshwater lakes. Fall migration occurs between early August to late October depending on the species and the sex. Some birds, such as Common Raven, ptarmigan, and sometimes Snowy Owl, winter in the area, and some seabirds, such as Black Guillemot, also remain in the area year-round using the open shore leads in the winter.

Along the northern shipping route, Bylot Island and the adjacent regions of northern Baffin Island, including the Brodeur Peninsula, Eclipse Sound, Pond Inlet, Navy Board Inlet and Lancaster Sound, have perhaps the most well studied avifauna in the Canadian High Arctic and have been studied by many of Canada's foremost ornithologists (Nettleship and Gaston 1978, Renaud et al. 1979, 1981, Bradstreet 1982, McLaren 1982, Zoltai et al. 1983, Lepage et al. 1998, Gauthier et al. 2004, 2011, Mallory and Fontaine 2004, Latour et al. 2008). The Great Plain of the Koukdjuak on the southwestern shores of Baffin Island has the world's largest goose colony, with over two million birds, 75% of which are lesser Snow Geese and the remainder Canada Geese and Brant (Important Bird Areas Canada 2010). Foxe Basin is thought to be the main North American stronghold of the Sabine's Gull with some 10,000 nesting pairs (Important Bird Areas Canada 2010). Several hundred thousand Thick-billed Murre breed on the cliffs of Coats Island, Digges Islands, and Akpatok Island in Hudson Strait. Large numbers of Black Guillemots, Arctic Terns, Glaucous, Iceland and Herring Gulls also breed at these colonies. Several hundred thousand shorebirds and ducks also breed in or migrate through Foxe Basin.

Long-term studies continue on Bylot Island, including areas along the shores of Eclipse Sound (Gauthier et al. 2004, 2011). From these studies it was concluded that Bylot Island and the surrounding marine environment, including Eclipse Sound, have among the greatest abundance and diversity of birds in the Canadian High Arctic (Lepage et al. 1998, Mallory and Fontaine 2004, Latour et al. 2008). More than 74 species of birds (both marine and terrestrial species) have been documented in the area including the world's largest greater Snow Goose colony (Batt 1998, Lepage et al. 1998). Several well documented seabird colonies are located within and adjacent to the Northern Route MRSA, notably on Bylot Island where large Thick-billed Murre and Black-legged Kittiwake colonies are found at Cape Hay and Cape Graham Moore and along the northeastern coast of Baffin Island where large colonies of Northern Fulmar are found at Buchan Gulf and Scott Inlet (Mallory and Fontaine 2004). Ivory Gull nesting colonies are also found in this region on the Brodeur Peninsula (Gilchrist and Mallory 2005, Latour et al. 2008).

Various bird surveys have been conducted since 2011, including those for cliff nesting raptors, shorebirds and waterbirds, species at risk, and bird encounter transects. Active migratory bird nest surveys are conducted prior to disturbance during the nesting season, and active migratory bird nests are protected. Baffinland supports ECCC's Canadian Wildlife Survey breeding bird surveys and research. In addition, since 2012, Baffinland has provided financial support to CWS-ECCC Program for Regional and International Shorebird Monitoring (PRISM) surveys. The primary objective of PRISM is to monitor the status and trends of Arctic bird populations by estimating the population size at different intervals to determine changes over time. Results are presented to the TEWG. Baffinland has also contributed funding to various research programs seabird ecology led through partnerships with ECCC-CWS and various universities (Baffinland, 2020). The most recent three-year research initiative, "Using cutting-edge biologging and physiological tools to map environmental sensitivities in the Arctic: application to shipping associated with Baffinland Iron Mines", funded through an Natural Science and Engineering Research Council-Collaborative Research and Development Grant became effective in December 2019 (though will be extended into 2023 due to inability of completing field work in 2020 and 2021 because of COVID-19 Pandemic restrictions) aims, in part, to develop innovative techniques to study the potential impacts of marine shipping on seabirds.

In 2019, Baffinland deployed nine passive Autonomous Recording Units (ARUs) to detect red knot vocalizations in collaboration with Canadian Wildlife Services (CWS) and ECCC. No Red Knot were detected during 2019, and CWS-ECCC concluded that further ARU monitoring was not necessary. Upon the recommendation of CWS-ECCC, Red Knot monitoring using ARUs will resume before increasing activities in the southern transportation corridor.

In addition, Baffinland's Ship-based Observer (SBO) Program primarily monitors for potential ship strikes on marine mammals and seabirds in the RSA, and secondarily aims to collect observational data on the presence, relative abundance and distribution of marine mammals and seabirds within the boundaries of the RSA relative to Project vessel operations. The only seabird strike reported over six years of monitoring occurred during the 2019 SBO Program (Baffinland, 2020g). Seabirds are also monitored using the Canadian Wildlife Service (CWS)'s Eastern Canada Seabirds at Sea (ECSAS) protocol (Gjerdrum et al., 2012).

3.4.3.3 WOLVES AND FOXES

Wolves and foxes are the dominant carnivores in the RSA and exist at low densities throughout the RSA. Very little information was collected on these midsize carnivores because they were so rarely observed. Fewer than 100 wolf and fox observations were recorded during extensive baseline surveys from 2006–2010. Information in published journal articles was supplemented with anecdotal and IQ information specific to the Project area for this baseline. Carnivore populations are tied to fluctuating prey densities (e.g., caribou and lemmings). Occurrence of carnivores might increase in the area if caribou populations return in large numbers. Additional details on midsize carnivores in the Project area can be found in FEIS Volume 6, Appendix 6F, Section 2.3.

None of the local carnivores are designated as being of conservation concern. Few wolf and fox dens and a small number of wolves have been observed in the Project area (EDI 2024). Wolf abundance and density is currently low as it is tied to caribou abundance. Interviews with local people suggest that few carnivores are harvested each year. However, occurrence of carnivores might increase in the area if caribou populations return in large numbers. Wolves were identified for follow-up monitoring under Project Certificate No.005, though monitoring is not currently feasible due to low numbers. Wolf monitoring would include monitoring for active wolf dens within a 10 km radius from the mine site, estimating available esker habitat within the RSA/PDA, and tracking abundance and distribution. No wolf tracks have been observed during snow track surveys between 2014 and 2023 (EDI 2024). There have been abundant observations of Arctic fox in the area, with Artic fox tracks recorded during all snow tracking surveys between 2014 and 2023. Arctic Fox interactions have generally increased over the life of the Project as it continues to grow in scale. In 2023, the number of interactions with carnivore and/or Arctic Fox remained generally consistent compared to the number of interactions in previous years; validating the continued success of ongoing waste management practices implemented on site under both the Environmental Protection Plan and the Waste Management Plan (Baffinland 2024b).

3.4.3.4 LEMMING AND ARCTIC HARE

Lemmings are a key prey species in Arctic ecosystems. Their abundance affects the behaviour, habitat use, and population dynamics of carnivores such as Arctic fox, red fox, wolf, Snowy Owls, and falcons. Lemming populations are considered Secure in Nunavut. Populations typically undergo large regular fluctuations in population size every three to four years (FEIS Volume 6, Appendix 6F, Section 2.3). Based on existing studies, brown lemming are known to have 3–4 year population cycles whereas studies of Peary Land collared lemming indicate population cycles are varying. Lemming live trapping completed from 2006–2008 suggested that brown and collared lemming populations were at the peak of their cycle in 2008.

Arctic hare is a lagomorph found in treeless regions across North America and Greenland. They are restricted to mountains, tundra, and coastal barrens due to their apparent inability to use food resources in forested areas). They may occur in groups of 10–60, or up to thousands on Arctic islands. The current population status of Arctic hare in Nunavut is classified as Secure by the Canadian Endangered Species Conservation Council (CESCC). In northern Baffin Island Arctic hare are locally abundant. Arctic hare tracks have been observed during all survey years between 2014 and 2023. Additional details on small prey mammals in Baffin Island can be found in Section 2.3, Appendix 6F-Terrestial Wildlife Baseline Report of the Mary River Project FEIS.

3.4.4 MARINE WILDLIFE

A summary of baseline conditions that existed prior to the Mary River Project for the marine environment is presented in Appendix 8A of Volume 8 of the FEIS (Baffinland 2012) and the FEIS Addendum for the SOP2 (Baffinland 2024). For graphical representation in the RSA of which communities hunt which species of marine animals where, see Figure 3.8 - Land Use Information from DIAND and Figure 3.9 - Wildlife Distribution found in FEIS Volume 4, Appendix 4C.

3.4.4.1 BENTHIC HABITAT AND BIOTA

Benthic habitat in Milne Inlet has been studied using underwater videography since 2008. The recorded footage provided spatial data on substrate and biota, including distribution and abundance of epibenthic fauna and flora. Substrate type was generally related to depth. Overall, the Milne Port area contained primarily fine substrates with a heterogeneous mix of medium sized substrate. In 2008 and 2010 studies, substrate in intertidal and upper subtidal zones (depth <3 m) was predominantly gravelly sand and sandy gravels. In deeper areas (3-15 m and >15 m), substrates were dominated by muddy sand. Baseline surveys in 2013 identified gravel, sand, and shells as predominant substrate classes, mixed with cobble in shallower areas.

Marine algae observed in the Arctic typically consisted of taxa adapted to low light conditions, short growing seasons, and cold temperatures, and included green algae, bladed and filamentous brown algae, and red algae. Areas <3 m in depth were typically barren due to ice scour. Macroflora abundance was typically highest between 3 m and 15 m, with decreasing abundance with depth due to decreasing light penetration. Surveys in 2008 and 2010, performed perpendicular to the shore, found a relatively dense cover of benthic algae in Milne Inlet, with strong vertical zonation. At shallow depths (<3 m), macroalgae were sparse and communities were dominated by filamentous brown algae and rockweed. The mid-subtidal zone (3-15 m) had the highest density of algal cover, with bladed kelps constituting the greatest majority of all benthic flora. The MEEMP surveys in 2014 to 2016 showed relatively high abundance of macroflora in the three transects along the 15 m contour lines (SEM 2017a). The assemblages were dominated by brown algae, sea colander, bladed kelps, and red algae. The highest epifloral density was consistently found in the Coastal Transect, where vegetation cover in 2015 and 2016 was 98.9% and 97.2% of total observed area, respectively.

Benthic epifauna communities in the Arctic are generally dominated by brittle stars, sea urchins, sea cucumbers, sea stars, bivalves, crabs, and other crustaceans. The most common taxa identified during benthic habitat surveys in Milne Inlet in 2008, 2010, and 2013 were unidentified clams, brittle stars, and sea urchins. Abundance, as the number of observations in each of four transects during 2014-2016 MEEMP studies, varied from 444 in the North Transect in 2015 to 6,328 in the Coastal Transect in 2016. Within each of the MEEMP transect, total abundance was highest in 2016, mostly due to the increase in abundance of brittle stars, most of which observed near the port site. Significant among-year differences in the relationship of epifauna abundance as a function of distance from the ore dock were found. However, the changes were not indicative of a Project-related effect, since some slopes indicated a decrease in abundance with an increasing distance from the dock.

In 2010, the highest density of benthic infauna was found at the 15-25 m depth stratum. Infauna was dominated by polychaete worms (Polychaeta); other common taxa in samples included crustacean copepods (Copepoda) and amphipods (Amphipoda) and clams. In the 2013 baseline study, the lowest abundance and richness of benthic infauna was found in the intertidal zone, with a single taxon (oligochaete worm [Oligochaeta]). The highest abundance was found at the 3-15 m stratum, whereas highest average richness was recorded at the 15 25 m depth stratum. Benthic infauna abundance generally decreased with depth between the three strata deeper than 3 m.

During follow-up monitoring undertaken in 2015 and 2016 as part of the Marine Environmental Effects Monitoring Program (MEEMP), benthic infaunal abundance recorded at each depth stratum was considerably lower than during the 2013 baseline surveys. Benthic infaunal samples collected in 2015 were dominated by bivalves, polychaete worms (Polychaeta), and ostracods (SEM 2016). Benthic infaunal abundance results in 2016 were overall similar to those measured in 2015, with some variability observed across the various depth intervals. Similar to 2015, benthic infaunal samples collected in 2016 were dominated by bivalves, polychaete worms, and ostracods (SEM 2017). Taxa accumulation plot and calculated species richness estimator Chao 2 (expected number of species in an infinitive number of samples (Chao 1987) for pooled data from 2013, 2015 and 2016 (SEM 2017) suggest that the three-year sampling effort was sufficient to capture the existing benthic infaunal biodiversity in Milne Inlet. Sampling of benthic infauna to date has not identified any non-native / invasive species.

Zooplankton taxa richness in vertical tows increased with each sampling year. However, taxa accumulation plots of the pooled 2014-2016 data reached an asymptote, suggesting that the three-year sampling effort was sufficient to capture the biodiversity at Milne Inlet. Samples were dominated by copepods, followed by arrow worms and other appendicularians and mollusc larvae. Vertical tows in 2016 differed from previous years as the samples were largely dominated by echinoderm larvae than by copepods.

Fishing effort, the number of fish caught, and relative species composition of catches varied from year to year. Catch per unit effort at the Milne Port area increased with time from 0.3 fish/h in 2013 to 2.9 fish/h in 2016. The total number of fish caught in gill nets also increased from 8 to 163 in 2013 and 2016, respectively. Eleven identified fish species were captured during fish surveys in the Milne Port area from 2010 to 2016. Arctic char was the most common species in gillnet catches in 2013, 2015, and 2016, and sculpins accounted for the majority of the remainder of the catch. Throughout the 2014-2016 MEEMP surveys, none of the marked sculpin were recaptured; therefore, it was not possible to estimate a population size for the species (SEM 2017).

Metals in Arctic char tissue samples from incidental mortalities were mostly below DL, except for arsenic, cadmium, chromium, copper, iron, mercury, and zinc. None of the samples exceeded Health Canada's guideline for mercury in fish tissue for human consumption.

Observations made with underwater video imagery formed the basis of the nearshore seabed habitat mapping at Milne Inlet. Vegetation cover was the dominant biotic feature in nearly all observations, with bladed kelps and filamentous red algae being the dominant flora. Associated fauna at Milne Inlet is depth stratified, generally sparse, and was most often observed in places where algal cover was low. Brittle stars, sea urchins and bivalve siphons are all commonly observed in Milne Inlet.

Surveys revealed that the coastal habitats of Milne Inlet are typical of periglacial coastal environments where most of the shoreline is dominated by either rock or coarse sediment beaches comprised of poorly sorted boulder, cobble, pebble, and sand. Limited open-water seasons and the coarse nature of the shorelines results in complex, poorly organized shoreline morphology. The presence of sea ice limits the development of intertidal biota, although rockweed was commonly observed along the shore.

Abundances in the nearshore algal community were estimated from analysis of the georeferenced underwater video imagery collected at Milne Inlet. The degree of cover varied with water depth and included benthic bladed kelp, foliose red and filamentous red algae.

Cyclopoid copepod *Oithona similis* dominates the Milne Inlet zooplankton community, followed by *Calanus finmarichus/glacialis* and Calanoid copepodites. *C. finmarichus, Pseudocalanus minutus, O. similis, Harpacticoida, Sagitta elegans*, and *Fritillaria borealis* were also present in samples. Zooplankton samples were collected from water depths that ranged to 150 m, and the dominant species were similar to those identified within that depth range in Lancaster Sound in 1979. Calanoida had the highest average density in 2008, followed by the chordate Larvacea, and Thoracica. In 2010, Thoracica had the highest average density followed by Calanoida and Larvacea. Species dominance and richness were similar between the two years. The species *P. minutus* and *Balanus sp.* (nauplius or cypris) were present in 100 % of samples in both years, while *F. borealis, C. finmarichus*, and unidentified polychaete larvae were occasionally absent. In 2010, Harpaticoida and unidentified Calanoid copepodites were also present in 100 % of samples.

A total of 146 benthic infauna species were identified from Milne Inlet. Polychaetes and ostracods were the most abundant taxa in Milne Inlet, although copepods, amphipods and several species of bivalves were also common. As reported in previous studies of the Canadian Arctic, the abundance and community composition of benthic infauna in Milne Inlet varies with depth.

Thirteen marine fish species were encountered during fish surveys from 2010 to 2016. Arctic char was the most common species in gill net catches in 2013, 2015 and 2016 constituting 75%, 75% and 96% of total number of fish, respectively. A particularly high number of Arctic char of 157 was caught in 2016. Sculpins constituted a great majority of non-char fish species caught with shorthorn sculpin (*Myoxocephalus scorpius*) and fourhorn sculpin (*Myoxocephalus quadricorni*) being the most abundant; shorthorn sculpin represented 67% (50) of all fish caught in 2010 and Fourhorn sculpin constituted 58% of all catches in 2014. Other fish species that were caught more than during one survey were four other sculpin species (Arctic sculpin (*Myoxocephalus scorpioides*), Arctic staghorn sculpin (*Gymnocanthus tricupis*), longhorn sculpin (*Myoxocephalus octodecemspinosus*), and Atlantic hookear sculpin (*Artediellus atlanticus*), Greenland cod (Gadus ogac), fishdoctor (*Gymnelis viridis*) and fourline snakeblenny (*Eumesogrammus parecisus*). Species that were caught during only one survey included twohorn sculpin (*Icelus bicornis*), common lumpfish (*Cyclopterus lumpus*) and Arctic cod (*Boreogadus saida*) that was caught only in 2016, although it had previously been identified in fish stomachs.

Metals in incidental Arctic char mortality tissue samples were mostly below detection limits. Exceptions were concentrations of arsenic, chromium, copper, iron, mercury, and zinc. Concentrations of these metals in fish tissue were, in general, consistent from 2010 to 2016. None of the samples exceeded Health Canada's guideline for mercury in fish tissue for human consumption of 0.5 mg/kg.

There has been no evidence to date of a Project-related introduction of a non-native or aquatic invasive species (AIS) in the Milne Inlet ecosystem. Furthermore, monitoring results collected to date for Marine Habitat and Biota, measured as part of the annual MEEMP at Milne Port, do not indicate that construction and operational activities at Milne Port have resulted in adverse effects on the local marine receiving environment, including existing macroalgal, epifaunal and infaunal communities at Milne Port (WSP 2024c).

Monitoring parameters measured in 2023 for the local fish community in Milne Port (i.e., community composition, abundance) were generally comparable to values measured in previous years (standardized sampling for this parameter first began in 2020). Species richness measured in 2023 was the highest recorded since 2020, while fish catch per unit effort (abundance corrected for effort) was highly variable among fishing areas and years but did not show any predictable temporal trend (WSP 2024c). In all sampling years, fish catch per unit effort was generally higher in the Direct Project Footprint area (marine environment adjacent to Ore Dock and Freight Dock) compared to the Indirect Project Footprint area (other marine waters in Milne Port).

Assessments of fish health and body condition in 2023 for the select indicator species (Arctic Char, Fourhorn Sculpin and Hiatella arctica) indicated low magnitude differences in endpoints over time and among sampling areas, suggesting inherent interannual variability in endpoints. All results were within predictions of the FEIS and subsequent addenda, which indicated the potential for low magnitude effects on marine fish health and tissue chemistry. In 2023, there was no evidence for Project-related effects on fish health or tissue chemistry beyond the magnitude of FEIS impact predictions (WSP 2024c).

The NIS/AIS Monitoring Program at Milne Port remains the most comprehensive monitoring program for NIS/AIS for any marine port in Canada. Monitoring results collected to date do not indicate that Project shipping has resulted in any Project-related introductions of NIS/AIS in the RSA as a result of hull fouling or ballast water discharges to the marine environment (WSP 2024c).

3.4.4.2 ANADROMOUS ARCTIC CHAR

Arctic char are a cold-water fish species in the family Salmonidae, native to alpine lakes and arctic and subarctic coastal waters. Arctic char distribution encompasses circumpolar nearshore marine waters and adjacent freshwater habitats and occurs as anadromous (sea-run) and freshwater resident forms. Arctic char represent an important component of inshore Arctic food webs, feeding opportunistically on invertebrate species such as amphipods, mysids, decapods, polychaetes, and small fish or larvae. This species is economically and culturally significant to all northern communities in Canada. In addition to subsistence fisheries, small-scale commercial and recreational fisheries exist in various parts of Nunavut where Arctic Char resources are locally abundant (e.g., Cambridge Bay and Cumberland Sound).

Spawning by Arctic char takes place in freshwater in the fall, between September and November, over gravel beds in lakes or rivers. Incubation occurs over the winter with hatched juveniles emerging the following spring. In the Canadian Arctic, spawning primarily takes place in lakes because most rivers completely freeze over in winter. Arctic char are classified as iteroparous as they are capable of spawning more than once in a lifetime.

Anadromous Arctic char spend a portion of their lives at sea, making annual migrations from freshwater wintering areas to marine waters where they feed intensely during the open-water period. Downstream migration to ocean waters occurs during the ice break-up period in late spring or early summer, although juveniles may rear from three to nine years in freshwater before attempting their first ocean migration and adults may spend a year in freshwater before spawning. The marine phase of the anadromous Arctic char life cycle typically lasts 30 to 60 days, a period during which most of the feeding and growth takes place.

Sea-run Arctic char return to freshwater systems in late summer prior to freeze-up as fish are unable to survive marine conditions in winter. Overwintering habitat for Arctic char occurs in lakes and large rivers that do not freeze to the bottom. Upstream migration typically occurs during late August or September, sometimes starting as early as late July. Most individuals home to their natal system to spawn and, but to a lesser degree, overwinter. Straying and mixing of stocks appears to be more common in anadromous Arctic Char than in other salmonids.

Most Arctic char do not undergo extensive migrations in the marine environment but instead remain within a limited range of their natal river systems where they feed close to shore (Kroeker 1986; Dempson and Kristofferson 1987). Although Arctic char demonstrate high site fidelity to certain shoreline habitats, some mixing of stocks can occur in the marine environment by resting individuals (juveniles or non-spawners) (Johnson 1980; Gyselman 1994; Evans et al. 2002).

Milne Inlet

Anadromous Arctic char occur in several river systems feeding into Milne Inlet and Eclipse Sound on North Baffin Island, including the Tugaat River, Koluktoo (i.e., Robertson) River, Ikaluit River and Satuut River systems (Moshenko 1981; Read 2003; GoN 2018). It is presently unknown if individual rivers in this region support genetically discrete stocks or if there is a high degree of migration (gene flow) between these river systems (DFO 2013). Most river system fisheries on North Baffin Island, especially during the open-water season, have the potential to harvest a mixture of Arctic Char stocks from proximate systems (i.e., these likely represent mixed-stock fisheries). The management of Arctic char fisheries in the Canadian Arctic (co-managed by DFO and NWMB) is based on the assumption that each river system supports a discrete fish stock which has a high-fidelity rate to the population stock (Kristofferson et al. 1984). In the southern portion of Milne Inlet, both Tugaat River and Koluktoo (i.e., Robertson) River support anadromous Arctic char populations which have historically supported small commercial fisheries (Moshenko 1981; Kristofferson and McGowan 1981; Read 2004).

Many streams and tributaries occurring in the Milne Port area provide summer rearing and foraging habitat for Arctic char as well as protection from predators for juvenile char. Most of these systems freeze solid during winter and therefore cannot support Arctic char during this period. Overwintering habitat for Arctic char is limited to lakes and large rivers that do not completely freeze over in winter. Most of the drainage basins that support resident Arctic char either contain barriers preventing anadromous migrations and/or occur at considerable distances from the coast. Phillips Creek does not support an anadromous Arctic char population due to the presence of a fish barrier (waterfall) at approximately km14 on the Milne Inlet Tote Road.

Harvesting of Arctic char is done year-round and is an important cultural activity and represents an important food source for local communities (QIA 2018, 2019, 2021). Community members still fish for Arctic char at the mouths of Robertson River, Phillips Creek and Tugaat River and also fish in the areas of Qurluqtuuq and Tugaat Lake, all of which are accessed from Milne Inlet. In the small lakes and rivers of the Phillips Creek and Mary River watersheds, land locked char are caught (Knight Piésold 2014, QIA 2019).

In support of the Mary River Project, fish sampling has been undertaken annually in Milne Inlet during the open-water season to provide a general characterization of the local fish community and to assess fish health and body condition in the marine receiving environment near Milne Port. Monitoring results to date provide no evidence that Arctic Char habitat, their prey base, or Arctic char health has been compromised by Project activities at Milne Port and along the Northern Shipping Route (WSP 2024c). Concentrations of contaminants in sediments and fish tissues are consistent with baseline and the number of Arctic Char caught in the MEEMP annual surveys has remained consistent through time (WSP 2024c).

Steensby Inlet

Along the south coast of Baffin Island, Arctic char are found along the western and northern coast of Hudson Bay and in coastal areas of Hudson Strait and Foxe Basin (Coad and Reist 2004; GoN 2018b, 2022), with areas of abundance identified at Arviat, Rankin Inlet, the entrance of Chesterfield Inlet, Cape Dorset and Kimmirut (Schneider Vieira et al. 1994; Scott and Crossman 1973). In this region, Arctic char congregate in estuarine habitats before migrating upstream in mid-August to September (Kroeker 1986; 1987). Spawning occurs shortly thereafter, typically along lake shorelines (Sprules 1952; Scott and Crossman 1973; Dempson and Green 1985; Richardson et al. 2001).

Similar to Milne Inlet, the nearshore marine fish community as observed during Project-specific studies at the Steensby Port was characterized by low species diversity and abundance with Arctic char were by far the most common species observed, comprising 90.6% of the total catch between 2007 and 2010 (Appendix 8A of Volume 8 of the FEIS in Baffinland 2012). Similar fish assemblages are noted for other areas of coastal Foxe Basin (GoN 2018b).

An extensive marine fish sampling program was conducted in the Steenby Inlet area in support of the FEIS (see Appendix 8A of Volume 8 in Baffinland 2012). Monitoring results indicated that Arctic char were distributed throughout coastal areas in the vicinity of the Steensby Port site, but were captured in highest abundance in

Ikpikitturjuaq Bay (a large bay just to the north of the Steensby Port site). The Ikpikitturjuaq River enters into Ikpikitturjuaq Bay and has long been known to support a population of anadromous (sea run) Arctic char that was sufficient in size to support a commercial fishery (Kroeker 1986; 1987). IQ and scientific literature contend that most anadromous char populations display strong fidelity to their natal stream, remaining within close proximity when feeding in the marine environment. Thus, it is thought that most of the char captured in the vicinity of the Steensby Port were members of the Ikpikitturjuaq River population. Numerous other rivers within Steensby Inlet support anadromous populations of Arctic char (Kroeker 1986; 1987). Some, such as the Cockburn River or the Rowley River, occur within close proximity (10-15 km) to the Steensby Port. A commercial catch quota (9,100 kg) was established for Ravn River (25 km northwest of Steensby Port), which is fished primarily by the communities of Igloolik and Sanirajak (Carder 1991; GoN 2018b).

3.4.4.3 MARINE MAMMALS

Marine mammals are a key component of Arctic ecosystems (Estes et al. 2016; Albouy et al. 2020) and are a valuable resource for Inuit communities throughout the North Baffin region. At least 11 species of marine mammals have the potential to occur along the Northern Shipping Route, including four species of toothed whales (narwhal, beluga, killer whale and sperm whale), one species of baleen whale (bowhead whale), five species of pinnipeds (ringed seal, bearded seal, harp seal, hooded seal and walrus) and polar bear (Table 3.6). Most of these species is endemic to the Arctic and unique with respect to their seasonal occurrence and habitat use in the RSA, with narwhal and ringed seal being the most common species in the RSA. During aerial surveys conducted by Baffinland in 2023 (WSP 2024a), a total of nine different species of marine mammals were recorded in the marine RSA during the nominal shipping season, including narwhal, beluga, killer whale, bowhead, ringed seal, harp seal, bearded seal, hooded seal and polar bear (WSP 2024a).

With the recent influence of rapidly warming ocean temperatures resulting in changing sea ice conditions and longer open-water seasons due to climate change, pronounced changes in habitat conditions are predicted for marine mammals throughout the Arctic region resulting in profound shifts in species distributions (i.e., natural range) and migratory movements. For example, rapid reductions in sea ice cover in the Arctic due to climate change (Stroeve et al. 2012; IPCC 2013; Overland and Wang 2013; Druckenmiller et al. 2021) has been directly associated with notable shifts in species distributions for both Arctic marine mammals (Laidre et al. 2008, 2015; Frederiksen and Haug 2015; Nøttestad et al. 2015; Víkingsson et al. 2015; Albouy et al. 2020; Chambault et al. 2022) and their prey (Frainer et al. 2017; Steiner et al. 2019, 2021; Møller and Nielsen 2020). Climate change is expected to result in significant indirect effects on marine mammals in the RSA as the food webs on which they depend undergo changes. Restructured food webs, changes in prey populations, the arrival of new marine mammal species from more temperate waters (including new predators and competitors), and potential pathogens from temperate regions are collectively predicted to result in significant pressures on existing marine mammal species in the Arctic (Huntington et al. 2020; Meuter et al. 2021; Moore 2016; Moore and Gulland 2014; Moore and Reeves 2018).

TABLE 3.8 MARINE MAMMAL SPECIES WITH POTENTIAL TO OCCUR IN RSA

Species Common Name	Population of Subspecies (if subdivided)	SARA[1]	COSEWIC[2]
Bowhead Whale	Eastern Canada-West Greenland (EC-WG) population	NS	SC
Beluga Whale	Eastern High Arctic-Baffin Bay (EHA-BB) population	NS	SC
Narwhal	Baffin Bay (BB) population	NS	NAR
Killer Whale	Northwest Atlantic / Eastern Arctic population	NS	SC

Species Common Name	Population of Subspecies (if subdivided)	SARA[1]	COSEWIC[2]
Sperm Whale	N/A – subspecies not delineated	NS	NAR
Atlantic Walrus	Baffin Bay (High Arctic) population	NS	SC
Bearded Seal	N/A – subspecies not delineated	NS	DD
Ringed Seal	N/A – subspecies not delineated	NS	NAR
Harp Seal	Northwest Atlantic population	NS	NS
Hooded Seal	Western North Atlantic stock	NS	NAR
Polar Bear	N/A – subspecies not delineated	Sc1:SC	SC

NOTES:

1. SARA (GoC, 2009): EN=Endangered; T=Threatened; SC=Special concern; UC=Under consideration; NS=No status; Sc1=Schedule 1; Sc2=Schedule 2
2. 2 COSEWIC (COSEWIC, 2024): EN=Endangered; T=Threatened; SC=Special concern; DD=Data deficient; NAR=Not at risk; NS=No status.

For graphical representation in the RSA of which communities hunt which species of marine animals where, see Figure 3.8 - Land Use Information from DIAND (1982b) and Figure 3.9 - Wildlife Distribution found in FEIS Volume 4, Appendix 4C.

To ensure that interactions with marine mammals and Project shipping activities are effectively monitored, Baffinland developed the Ship-based Observer (SBO) Program to primarily monitor for potential ship strikes on marine mammals and seabirds in the RSA, and secondarily to collect observational data on the presence, relative abundance and distribution of marine mammals and seabirds within the boundaries of the RSA relative to Project vessel operations. The SBO program is not structured as a systematic behavioural effects study and is not designed for assessing the behaviour of marine mammals around project vessels before, during and after exposure as there is no control. Baffinland has other monitoring programs designed for this purpose, such as the Narwhal Tagging Program (Golder, 2020b) and the Bruce Head Shore‐based Monitoring Program (WSP, 2023b). The SBO Program was first run in 2013 to 2015 and was subsequently resumed in 2018 and 2019. The 2013 to 2015 SBO Program took place during the construction phase at Milne Port (2013 and 2014) and during Year 1 of shipping operations (2015). The SBO program has not been conducted since 2019. The program could not be completed in 2020 or 2021 due to limitations for ship boarding associated with COVID-19 Pandemic public health restrictions and could not be completed in 2023 due to heavy ice conditions that led to an early termination of the shipping season. As an alternative, Baffinland continues to collaborate with the Marine Mammal Observation Network (MMON) to implement a marine mammal incidental sighting programs through the participation of vessels contracted by Baffinland. MMON is a network of observer members that include shipping operators and is intended to collect data on whale and seal sightings during their regular in-season activities. Participating contracted vessels include the MSV Botnica, Nordic Bulk Carriers and Oldendorff. Baffinland has not designed or constructed purpose-built ore carriers as originally envisioned, therefore Baffinland has relied on placing the observers aboard market vessels and the icebreaker MSV Botnica to conduct the monitoring.

3.4.4.3.1 Bowhead Whale

Bowhead whales occur seasonally in the RSA and are typically found alone or in small groups. Bowheads are adapted to living in areas of heavy unconsolidated ice and can navigate extensive distances under ice although they can break up to 20 cm of ice to breathe. Feeding and calving usually takes place in nearshore, sheltered, shallow waters in summer. During open-water periods bowhead distribution is likely driven by the distribution of the various prey species. Bowheads are baleen whales (filter feeders), eating pelagic crustaceans as well as epibenthic invertebrates. Traditionally, bowheads have been observed feeding along the floe edge and their presence is often dependent on the tides. There are four recognized bowhead stocks, one of which (the Eastern Canada-West Greenland stock) occurs within the RSA. This stock ranges throughout the eastern and central northern Arctic and from northern Baffin Bay to Hudson Strait. Bowhead whales within Davis Strait and Baffin Bay were commercially overexploited in the early 1900's, reduced from an estimated 11,800 whales to perhaps as low as 1,000. The stock has shown a significant recovery in recent decades and may now number greater than 14,000.

Along the proposed northern shipping route, bowhead whales occur during summer and fall. They may summer along the east coast of Baffin Island or move westward through Lancaster Sound during June and July to feed and nurse calves in inlets and sounds within the Canadian Arctic Archipelago. The IQ suggests that the number of bowheads using Eclipse Sound appears to be increasing in recent years. It is thought that fall migrants wintering in Davis Strait follow the east coast of Baffin Island south to wintering areas, whereas whales that winter along the west coast of Greenland may cross north Baffin Bay and then move south.

The number of bowheads within the Foxe Basin-Hudson Bay region is estimated to be over 2,000. Bowheads congregate to feed and nurse calves in spring and summer around Southampton Island, along the western Hudson Bay coast, and in a relatively small area in northern Foxe Basin between Igloolik and Fury and Hecla Strait. The IQ indicates that bowheads observed near Sanirajak in spring migrate from southern Foxe Basin. Migrations are not well documented, though most movement is thought to take place through the western and central portion of Foxe Basin and may be influenced by ice cover. During summer, this species tends to select areas of high ice cover, presumably to reduce the risk of predation by killer whales. Northern Hudson Bay, Foxe Basin, and Admiralty Inlet have been identified as summering areas, with whales moving farther into inlets and bays as the ice breaks up. In summer months, bowhead whales north of Igloolik consist primarily of juveniles and females with calves, suggesting that this location is a nursing area. Aerial surveys of the Foxe Basin area identified small numbers of bowheads in northwest Foxe Basin but not Steensby Inlet.

Hudson Strait has been identified as a primary wintering area for bowhead whales. Bowheads begin winter migrations in October as the sea ice begins to form, heading south towards northeastern Hudson Bay and Hudson Strait. In 1981, over 1,300 bowheads were estimated in Hudson Strait and were observed during aerial surveys. Aerial surveys conducted in 2002–2004 and 2013 for the Eastern Canada-West Greenland (EC-WG) population of bowhead whales indicated population numbers in the thousands and increasing, as a results of commercial whaling restrictions (COSEWIC 2005, DFO 2015). Based on the most recent High Arctic Cetacean Survey completed by DFO in the Project area, the predicted number of bowhead in Eclipse Sound during 2013 was 32 (Doniol-Valcroze et al. 2015a). Additional details on bowhead whales can be found in FEIS Volume 8, Section 5.1.5.

As low number of bowhead sightings have been reported in Milne Inlet, Eclipse Sound and Pond Inlet during the summer season, these areas are not thought to be important summering areas for bowhead (WSP 2022). During 10 years of shore-based monitoring at Bruce Head (2013 to 2017 and 2019 to 2023) a total of 31 bowhead have been recorded near Bruce Head (WSP 2023b, 2024e), while a total of 14 bowhead were recorded along the Northern Shipping Route during three years of open water period aerial surveys as par of the Marine Mammal Aerial Survey Program (MMASP; Section 3.0) (2013 to 2015) (Elliott et al. 2015; Thomas et al. 2015, 2016). During the aerial survey in 2019, when bowhead were migrating through the RSA, the calculated abundance of bowhead in the RSA was 176 (15 July) and 1,291 whales (21–22 July) (Golder 2020a). Bowhead numbers during Leg 2 of surveys conducted between 2019 and 2023 were too low to calculate an abundance (WSP 2024a). No bowhead whales were recorded during five years of the Ship-Based Observer (SBO) program (2013 to 2015 and 2018 and 2023) (SEM 2014, 2016; Golder 2019c; WSP 2024e). However, 23 sightings of 25 individual bowheads were recorded during the 2019 SBO program (Golder 2020c). Observations of bowhead in the RSA have been consistent with IQ, including observations of bowhead aggregating in the RSA in Aujaq (end of July to September; Hay et al. 2000, JPCS 2017).

Underwater sounds from Project shipping activities and non-Project activities have been collected over multiple years (2018–2023) at various locations along the shipping route during Baffinland's Underwater Acoustic Monitoring Program (Austin et al. 2022a, 2022b, 2023, 2024a, 2024c). Data from Baffinland's Underwater Acoustic Monitoring Program have demonstrated that vessel noise in the RSA is lower than that predicted through noise modelling completed in support of the FEIS (Baffinland 2012, 2013). The data further indicate that on average, vessel noise in the RSA rarely exceeded the established acoustic disturbance threshold for marine mammals (broadband SPL of 120 dB re 1 uPa - applicable to all marine mammal species) at any of the recorder locations (i.e., exceedances of less than one hour per day), which is significantly lower than predictions made based on noise modelling.

3.4.4.3.2 Beluga Whale

Beluga whales have a circumpolar distribution and occur seasonally within the RSA. They are opportunistic feeders, consuming a wide array of fish and invertebrates. Mating is thought to peak prior to mid-April with calving likely occurring in offshore areas during late spring migration. A limited amount of calving may also occur near estuaries and bays that is supported by IQ indicating that Koluktoo Bay and the southern portion of Milne and Navy Board inlets may be calving areas.

Four of the seven recognized populations in Canada occur in the RSA, including the Eastern High Arctic- Baffin Bay, Western Hudson Bay, Eastern Hudson Bay population, and Ungava Bay populations. The Eastern High Arctic Baffin Bay population (estimated at >20,000) summers in the Canadian Arctic Archipelago and winters in the loose pack ice of two distinct areas: along the west coast of Greenland and in the North Water Polynya in northern Baffin Bay. Beluga from the smaller population wintering in the North Water begin entering Lancaster Sound in late April or early May with peak movements occurring in late June to July depending on ice conditions. Belugas wintering off the west coast of Greenland generally occupy similar geographic areas between years. Large numbers from the Eastern High Arctic Baffin Bay population migrate past Bylot Island during spring on their way to summering areas concentrated near Somerset Island. Only a small number of animals move into areas inland of Bylot Island, ostensibly for calving and feeding. Eastward fall migrations begin in September and are concentrated almost exclusively along the southern coast of Devon Island. Belugas were observed in Eclipse Sound, Eskimo Inlet, Koluktoo Bay, Milne Inlet, and White Bay during aerial surveys.

All four populations of beluga in the RSA are known or expected to occur along or in the vicinity of the southern shipping route. Beluga from the Eastern High Arctic Baffin Bay population enter northern Foxe Basin during spring and remain in the general area of eastern Fury and Hecla Strait throughout the summer. These belugas typically remain in shallower waters where feeding is thought to occur.

The Western Hudson Bay and Eastern Hudson Bay populations occur in the southern shipping route waters from late October through April when the whales are in their wintering grounds, and during fall migrations from summering areas in late September and October. Beluga whales from both populations occur in the vicinity of Igloolik, Sanirajak, and likely Steensby Inlet during July to early September. The very small (possibly extirpated) Ungava Bay beluga population possibly occur year-round within the RSA. The most recent population estimate for the Western Hudson Bay population is about 57,000. The Eastern Hudson Bay population has been in decline.

The wintering location of the Western Hudson Bay beluga population has not been confirmed but it is thought to be primarily in Hudson Strait. Spring migration to summering areas occurs during late April to May. Most animals likely follow the eastern coast of Hudson Bay south to the Belcher Islands, and then across through the pack ice to the

Manitoba coast in late May and early June. A small number move westwards towards Southampton Island. Belugas generally remain within estuaries along the coast and in September begin a northward migration towards Southampton Island.

Based on aerial survey results, beluga whales were widespread in Steensby Inlet, Foxe Basin, and Hudson Strait but abundance varied with location and month. Additional details on Beluga Whales can be found in FEIS Volume 8, Section 5.1.3.

During five consecutive years of shore-based monitoring at Bruce Head from 2013 to 2017, no beluga were observed (Thomas et al. 2014; Smith et al. 2015, 2016, 2017; Golder 2018), six were recorded in 2019, one each in 2020 and 2021 and none in 2023 (Golder 2020d, 2021a, 2022a; WSP 2024d). Beluga were also not observed during aerial surveys in the RSA from 2013 to 2015 (Elliott et al. 2015; Thomas et al. 2015, 2016). Four were observed in the RSA during the 2019 aerial survey (Golder 2020a), five during the 2020 survey (Golder 2021a), seven during the early shoulder season in 2021 (Golder 2022a) and three during the 2023 survey (WSP 2024a).

Beluga were not observed during three consecutive years of the SBO monitoring program conducted from 2013 to 2015, (SEM 2014, 2016) nor during the 2018 or 2023 (Golder 2019c; WSP 2024e), and only one was recorded in 2019 (Golder 2020c). During the 2022 aerial survey, 152 beluga whales were observed in the RSA, most in Assomption Harbour in July (WSP 2023a). Larger numbers in 2022 may indicate that 2022 was a unique year for beluga numbers in the RSA.

Observations of low numbers of beluga in the RSA are consistent with IQ which reports that, “beluga traditionally do not remain near Pond Inlet… Rather, they migrate through Eclipse Sound and Navy Board Inlet moving westward and northward.” (p. 47, QIA 2018). Beluga and narwhal are also reported to travel in tandem and frequently inhabit that same area at similar times and hunting of both species takes place near the floe edge and during open water periods, e.g., May and September (QIA, 2018). However, beluga have also been reported to give birth in the area (QIA 2018) “…during Upirngasaaq, the whales gather at the floe edge waiting for the breakup of ice. Beluga have been known to birth in southern Navy Board Inlet, southern Milne Inlet, and Koluktoo Bay.” (p. 47).

Data from Baffinland’s Underwater Acoustic Monitoring Program have demonstrated that vessel noise in the RSA is lower than that predicted through noise modelling completed in support of the FEIS (Baffinland 2012, 2013). The data further indicate that on average, vessel noise in the RSA rarely exceeded the established acoustic disturbance threshold for marine mammals (broadband SPL of 120 dB re 1 uPa - applicable to all marine mammal species) at any of the recorder locations (i.e., exceedances of less than one hour per day), which is significantly lower than predictions made based on noise modelling.

3.4.4.3.3 Narwhal

Narwhals generally inhabit deep arctic waters of Baffin Bay, the eastern Canadian Arctic, and the Greenland Sea but are seldom found south of 61°. Their diet is thought to be like that of beluga, consisting primarily of small cod, flatfish such as Greenland halibut, squid, and other small fish and invertebrates.

Narwhals prefer coastal areas that provide deep water and protection from the wind during summer. They appear to favour deep fjords and the continental slope during winter, in areas where water depths are 1,000 to 1,500 m and marine water upwelling increases biological productivity. Narwhals are highly social animals and can be found in small numbers of groups of hundreds or thousands during migration. Based largely on summer distributions, two tentative populations of narwhal occur in Canadian waters: the Hudson Bay population and the Baffin Bay population. However, narwhal is currently assessed as a single population in the eastern Arctic. Narwhals occur throughout the northern shipping route year-round but are found in the RSA primarily during the open-water period.

Those that winter in Baffin Bay typically summer in the eastern Canadian Arctic, moving to summering areas in Melville Bay, Eclipse Sound, Smith Sound, and beyond Lancaster Sound. Important summering areas identified within Baffin Bay include Eclipse Sound, Inglefield Bredning, and Smith Sound-Kane Basin.

Recent estimates indicate that approximately 45,000 narwhal summer around Somerset Island, while over 27,000 inhabit waters in the Prince Regent and Gulf of Boothia area, with approximately 20,000 in the Eclipse Sound area, 10,000 in the East Baffin Island fjord areas, and 5,000 in Admiralty Inlet. Survey results from the late 1980s and early 1990s indicated that summer distribution of narwhal within Eclipse Sound, Milne Inlet, Koluktoo Bay, and Tremblay Sound is influenced by presence and distribution of ice and killer whales.

Narwhals begin to migrate out of their summering areas in groups of a few hundred to several thousand just before freeze-up begins in late September. Those summering near Somerset Island enter Baffin Bay north of Bylot Island in mid to late October. Populations summering in Eclipse Sound begin migrating down the east coast of Baffin Island in late September. Narwhal generally arrive in their wintering areas in November. The Baffin Bay narwhal population winters at two discrete areas in the pack ice in central Baffin Bay, and in polynyas at the north end of Baffin Bay.

Narwhal were identified in aerial surveys throughout Eclipse Sound, Milne Inlet, and Koluktoo Bay. Narwhal observed during a typical survey often numbered in the thousands. Narwhals were also frequently seen in Tremblay Sound and White Bay. Aerial surveys documented fine scale movements of large groups of narwhals between various areas of Eclipse Sound and surrounding fjords.

A much smaller number of narwhals inhabit waters along the southern shipping route. The Hudson Bay population was estimated to be almost 2,000 in the year 2000, though it may be as many as 3,500 during summer months. The timing and routes of migration used by the Hudson Bay narwhal population are less understood than those of the Baffin Bay population. This population is thought to winter in eastern Hudson Strait and move towards summering areas located primarily in the Repulse Bay area north of Southampton Island during late June while some may move north towards Fury and Hecla Strait, in the vicinity of Igloolik.

Fall migrations to Hudson Strait begin in late August or early September, depending on ice conditions. A small number of narwhals that winter in Baffin Bay is thought to move through Fury and Hecla Strait into northern Foxe Basin during spring migrations in April and May.

Aerial surveys conducted during baseline studies confirmed that narwhal occur in relatively low numbers in Foxe Basin; there were no sightings in Steensby Inlet. Narwhal were most abundant in Hudson Strait during April and June surveys when a small number of individuals were recorded. Additional details on narwhal can be found in FEIS Volume 9, Section 5.1.4.

The Marine Mammal Aerial Survey Program (MMASP) is one of several narwhal monitoring programs undertaken by Baffinland in the North Baffin region to address terms and conditions of Project Certificate No. 005 related to evaluating potential disturbance of narwhal from shipping activities that may result in changes in animal distribution, abundance, and migratory movements in the RSA. In support of the MMASP, Baffinland conducted aerial surveys in the North Baffin region between 2019 and 2023 to generate annual abundance estimates for the Eclipse Sound and Admiralty Inlet narwhal summering stocks during the peak open-water season. These aerial surveys were also conducted in 2015 and 2016, as well as prior to Baffinland's operation between 2006-2014. These estimates serve as a basis for comparison to previous abundance estimates derived from Department of Fisheries and Oceans (DFO) surveys during 2004 (Richard et al. 2010), 2013 (Doniol-Valcroze et al. 2015) and 2016 (Marcoux et al. 2019).

DFO has historically considered the Eclipse Sound and Admiralty Inlet narwhal summer aggregations as two separate (i.e., geographically isolated) summer stocks. However, recent telemetry data has shown evidence of mixing between these summering groups (Watt et al. 2012; Golder 2020a; Marcoux and Watt 2021). A review of available IQ (NWMP 2016a, 2016b; QWB 2022) also supports that the Admiralty Inlet and Eclipse Sound narwhal management units are actually one stock that shift between summering areas depending on many factors such as seasonal ice conditions, food availability, local predator/prey dynamics and vessel traffic. For this reason, Baffinland's MMASP also includes a combined abundance estimate for the Eclipse Sound and Admiralty Inlet stocks.

Monitoring results from the 2023 MMASP indicate that narwhal abundance in the RSA (i.e., Eclipse Sound summer stock area) has not changed from baseline conditions (i.e., pre-Project shipping levels) (WSP 2024a). The 2023 Eclipse Sound narwhal summer stock was estimated at 10,492 animals (CV= 0.05; CI = 9,578-11,494) which was not significantly different than the 2013 baseline condition (10,489 animals; CV = 0.24; CI = 6,342 – 17,347; Doniol-Valcroze et al. 2015) or the 2019 narwhal abundance estimate (9,931 animals, CV = 0.05, 95% CI of 9,009– 10,946; WSP 2024a). Furthermore, the 2023 Eclipse Sound abundance estimate was significantly higher than the three preceding years (2020-2022; WSP 2024a). The increase in 2023 was observed despite 2023 having the highest volume of iron ore shipped out of Milne Port since the start of shipping operations and despite the introduction of larger Capesize ore carriers to shipping operations in 2023. Collectively, survey results to date indicate a poor correlation between annual shipping levels and narwhal abundance in the RSA.

The combined narwhal abundance estimate for the Eclipse Sound and Admiralty Inlet summer stocks was similar in 2023 (40,706 animals) to that observed in previous years (2013, 2019, 2020 and 2022) (WSP 2024a). Collectively, aerial survey results indicate that the combined stock size appears to be stable since the start of Baffinland shipping operations and relative to baseline levels. Results further indicate that some level of animal exchange occurs between the two putative stock areas but this does not appear to be related to Project shipping levels in the RSA (WSP 2024a).

Consistent with the above findings, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recently completed an updated Species Status Assessment for narwhal in May 2024 and recommended that narwhal be downlisted from its previous 'Species of Concern' designation to 'Not at Risk' (COSEWIC 2024). The updated assessment confirmed that there is presently no evidence of a decreasing trend in narwhal abundance in the Canadian Arctic region (COSEWIC 2024).

The 2023 monitoring results from the Bruce Head shore-based monitoring program indicated that the relative abundance of narwhal was lower (2.9 narwhal/h) than all previous survey years (WSP 2024d). The highest relative abundance of narwhal recorded at Bruce Head occurred in 2016 (178.0 narwhal/h). Prior to 2023, the lowest relative abundance of narwhal recorded at Bruce Head occurred in 2021 (29.4 narwhal/h). The low narwhal numbers recorded at Bruce Head in 2023 were thought to be linked to the late break-up of landfast ice in the RSA in 2023 and its influence on narwhal distribution during this period. The 2023 aerial survey results indicate that the low narwhal numbers observed at Bruce Head in 2023 do not reflect a true decrease in the abundance of the Eclipse Sound summer stock but rather are reflective of seasonal distribution patterns (WSP 2024a, 2024d).

Data available to date demonstrate that vessel noise in the RSA is lower than that predicted through noise modelling completed in support of the FEIS (Baffinland 2012, 2013), is intermittent in nature, and is below sound levels that would result in acoustic injury to narwhal (e.g., temporary hearing loss or permanent hearing damage). The data further indicate that on average, vessel noise in the RSA rarely exceeded the established acoustic disturbance threshold for marine mammals (broadband SPL of 120 dB re 1 uPa - applicable to all marine mammal species) at any of the recorder locations (i.e., exceedances of less than one hour per day), which is significantly lower than predictions made based on noise modelling.

Capesize class ore carriers transited through the RSA for the first time in 2023. Underwater sounds of Capesize carriers transiting in the RSA were measured in 2023 and compared to sounds levels generated by Panamax and Post-Panamax carriers (i.e., smaller class carriers used for shipping operations to date) (Austin et al. 2024c). Capesize ore carriers were demonstrated to emit underwater noise levels up to 4 dB greater than the smaller ore carriers. However, despite Capesize carriers emitting slightly higher source levels, the overall noise exposure in the RSA was not significantly increased by the addition of Capesize vessels to Baffinland's fleet in 2023.

Narwhal behavioural response monitoring at Bruce Head indicated that narwhal responses to shipping in 2023 were consistent with results from previous monitoring years (2014-2022) and in line with impact predictions made in the FEIS and subsequent addenda, in that shipping effects on narwhal are limited to temporary, localized avoidance behaviour, with animals returning to their pre-response behaviour shortly following initial exposure (WSP 2024d).

Early Warning Indicator (EWI) monitoring aerial data analysis at Bruce Head indicated that the proportion of immature narwhal in the RSA in 2023 was within range of baseline conditions and in line with historical records for the region (WSP 2024a).

3.4.4.3.4 WALRUS

Walruses have a discontinuous circumpolar distribution and are migratory, moving with the ice. They winter in the offshore pack ice of Davis Strait and along the west coast of Greenland, the North Water Polynya off eastern Devon Island and northern Labrador, as well as in Foxe Basin ranging from the floe edge along the north side of Rowley Island and south to the Melville Peninsula. Walruses are primarily benthic feeders on bivalve molluscs and other invertebrates, and are generally confined to shallow coastal waters up to 100 m.

Four extant stocks occur within Canadian waters however these may be further subdivided. Three of the four identified stocks occur within the confines of the RSA: the Baffin Bay (High Arctic) population, the Foxe Basin population, and the North Hudson Bay-Davis Strait population.

The Baffin Bay walrus population is estimated between 1,700 and 3,000 individuals with summering populations in Kane Basin, Buchanan and Princess Marie bays, Jones Sound, eastern Ellesmere Island, and the Lancaster Sound-Barrow Strait area. Walrus along the northern shipping route winter in the North Water and other polynyas among the Canadian Arctic islands, inhabiting northwest Baffin Bay north from Pond Inlet to Kane Basin, Lancaster Sound, Barrow Strait, and Jones Sound. They are also distributed along the west coast of Greenland. Walruses move westward along the southern coast of Devon Island during spring to summering areas in the Canadian Arctic islands. Only a few individuals are now observed among the inlets and fjords south of Bylot Island. Aerial surveys within the vicinity of Eclipse Sound recorded two walrus: one in Eclipse Sound and one in Milne Inlet.

Walruses are considerably more abundant along the southern shipping route. They are year-round residents in northern Foxe Basin, overwintering in small polynyas and shore lead systems near the outlet of Fury and Hecla Strait, to the east of Sanirajak, and among the islands (Rowley, Koch, and the Spicer Islands) located farther to the east of Sanirajak and south of Steensby Inlet. Their distribution appears to be driven by ice and open-water conditions during winter. During the open water period, they move onto beaches and coasts among the islands south of Steensby Inlet and onto drifting pans of ice. Walrus have been observed within Steensby Inlet during late summer, but the degree to which they use other locations within Steensby Inlet is uncertain. The Foxe Basin walrus population is estimated to be approximately 5,500.

Walrus were abundant within northern Foxe Basin portion of the aerial survey route in 2006. They were observed in pack ice or open water with walrus densities in northwest Foxe Basin estimated at about seven times higher than those observed in northeast Foxe Basin or southern Foxe Basin. During the aerial surveys, two terrestrial walrus haulout sites were observed, one at Manning Islands (mid-way between Hall Beach and Spicer Islands) and the other at Bushnan Rock (a small sandy islet west of the gap between Rowley and Koch Islands). Walrus densities in Hudson Strait were lower than any observed in Foxe Basin. Additional details on Walrus can be found in FEIS Volume 8, Section 5.1.2.

Based on extensive aerial survey records, very few walrus occur along the Northern Shipping Route during the shipping season and no walrus haul-out sites are present in this area (Thomas et al. 2016; WSP 2024a). The closest aggregations of walrus occur near Kane Basin in northern Baffin Bay, extending into Lancaster Sound, Barrow Strait, and Jones Sound in the Canadian Arctic Archipelago (Davis et al. 1978; DFO 2002; COSEWIC 2017). This is consistent with local IQ information indicating that small numbers of walrus occur at the northern entrance of Navy Board Inlet and in Lancaster Sound - west of Admiralty Inlet (Baffinland 2013; JPCS 2017). Walrus prefer pack ice habitat so they are unlikely to be present in significant numbers in the RSA during the shoulder seasons.

Data from Baffinland's Underwater Acoustic Monitoring Program have demonstrated that vessel noise in the RSA is lower than that predicted through noise modelling completed in support of the FEIS (Baffinland 2012, 2013), is intermittent in nature, and is below sound levels that would result in acoustic injury to walrus (e.g., temporary hearing loss or permanent hearing damage).

Data from Baffinland's Underwater Acoustic Monitoring Program have demonstrated that vessel noise in the RSA is lower than that predicted through noise modelling completed in support of the FEIS (Baffinland 2012, 2013). The data further indicate that on average, vessel noise in the RSA rarely exceeded the established acoustic disturbance threshold for marine mammals (broadband SPL of 120 dB re 1 uPa - applicable to all marine mammal species) at any of the recorder locations (i.e., exceedances of less than one hour per day), which is significantly lower than predictions made based on noise modelling.

3.4.4.3.5 Ringed Seal

The ringed seal is an important element of the Arctic marine system, both as main prey of polar bears, and as a major consumer of marine fish and invertebrates. Ringed seals occur year-round along both proposed shipping routes and in the vicinity of both proposed port sites and are a major traditional food source for the Inuit.

Ringed seals establish a series of breathing holes and subnivean lairs, with many of these structures created shortly after fall freeze up. Birth lairs are constructed on the landfast ice in mid-March and pups are born in April. Landfast ice is preferred for breeding rather than pack ice. The population of ringed seals in the Canadian Arctic is estimated to be at least a few million.

Ringed seals are common throughout Baffin Bay as well as along the length of West Greenland. During winter and spring, ringed seals concentrate on stable shorefast ice, though in areas where fast ice is limited, as in Baffin Bay, increased numbers may occupy offshore pack ice. As ice breaks up during summer, they disperse as solitary animals or small groups throughout open-water areas or to coastal. Though ringed seals were originally thought to remain in the same general region throughout the year recent evidence suggests that some members of the population, particularly juveniles, may undertake extensive seasonal movements.

Ringed seals are abundant and have been observed throughout along the proposed northern shipping route, occurring throughout Baffin Bay and Davis Strait, Eclipse Sound, Koluktoo Bay, Navy Board and Pond Inlet. Ringed seals are also abundant along the proposed southern shipping route, occurring throughout Foxe Basin, including the landfast ice of Steensby Inlet and Hudson Strait. Southern Steensby Inlet, Igloolik, Sanirajak, Murray Maxwell Bay, and Rowley Island into Fury and Hecla Strait have been described as important hunting and/or pupping areas for ringed seal. Additional details on Ringed Seal can be found in FEIS Volume 8, Section 5.1.1.

Despite being abundant, population structures of ringed seal across the Canadian Arctic are poorly understood in general (Golder 2022b). COSEWIC estimated the ringed seal population in Canada and adjacent waters (West Greenland, Alaska, and Russia) at 2.3 million seals, with low confidence (COSEWIC 2019).

In recent years (2020-2022) Baffinland was provided feedback from Inuit community members and the MHTO indicating that hunters were observing lower number of ringed seal in the RSA (compared to previous years), and that this was potentially associated with shipping in the RSA and/or the presence of acoustic recorders deployed by third parties in the Project area. In response to this feedback and MHTO's request for increased monitoring of ringed seal in the RSA, Baffinland conducted a Ringed Seal Aerial Survey Program in the marine RSA in 2021 for the first time since 2014. The objective of the survey was to update baseline data on ringed seal density and distribution along the Northern Shipping Route. Ringed seal density estimates were calculated using two different methods (strip-transect and line-transect analysis) (Golder 2022b) to allow for comparison with ringed seal aerial surveys undertaken by DFO in the North Baffin region in 2016 and 2017 (Young et al. 2019), prior to the start of Project icebreaking in the RSA in 2018.

Monitoring results of the 2021 RSASP indicated that ringed seal densities in the RSA have remained stable since the onset of iron ore shipping operations in 2015, and since Project icebreaking activities began in the shoulder seasons in 2018. Observed effects of Project shipping on ringed seal are thus in line with impact predictions made in the FEIS and subsequent addenda, with no evidence of large-scale displacement and/or avoidance of existing habitat areas in the RSA that could lead to population-level effects in ringed seal (Golder 2022b). IQ reported in JPCS (2017) indicated that the seal pupping season runs from February to March with seal pupping occurring throughout the RSA. Seal pups occur in the area as late as the middle of April.

3.4.4.3.6 Bearded Seals

The bearded seal has a patchy circumpolar distribution as far north as 85°N. There is no reliable abundance estimate for bearded seals in Canadian waters; however, some have suggested an estimate of >190,000.

Bearded seals typically occur alone or in small groups. Whelping occurs between late April and early May, and pups are typically born on unstable pack ice where they are weaned after 12-18 days. Bearded seals eat a wide variety of foods and are generally considered to be benthic feeders that prey on an array of benthic invertebrates and fish, although pelagic fish are also a food source.

Bearded seal distribution is largely determined by the presence of shallow water, but they usually move into areas of open water <200 m deep when the pack ice retreats, while some individuals associate with ice year-round. They are seldom found in fast ice areas but are widely dispersed in open water areas of pack ice where leads and cracks are frequent, and where ice pans are sufficient for haul out sites.

Bearded seals are considered common in the RSA. Large numbers of bearded seals occur around northeastern Baffin Island and in Lancaster Sound. The many polynyas of northern Foxe Basin support several colonies of bearded seals and is thought to be an area of high density for bearded seals.

During aerial surveys in support of the Project, bearded seals were present in all areas of Foxe Basin and Hudson Strait, and most sightings occurred from April to August 2008 when they are easily observed basking on sea ice. During aerial surveys in June 2008, most bearded seals were sighted near the mouth of Steensby Inlet; densities were lower in northwest Foxe Basin, northeast Foxe Basin, southern Foxe Basin, and Hudson Strait. Bearded seals were observed in small numbers during springtime seal surveys in Eclipse Sound and Milne Inlet in 2007 and 2008. Additional details on Bearded Seal can be found in Volume 8, Section 5.1.7.

As part of Baffinland's MMASP, similar to previous years, bearded seal numbers were low during the 2023 survey, with a total of 17 sightings recorded in the RSA during the 2023, two sightings in each of 2019 and 2020, five in 2021, and three in 2022 (WSP 2024a).

3.4.4.3.7 Harp Seals

Harp seals occur in the northern Atlantic and Arctic oceans below 84°N. Three geographically distinct populations occur in the North Atlantic Basin but only one of which occurs in the RSA, the Northwest Atlantic population. This is the largest population, including a total of ~5.9 million animals. This population spends the summer off west Greenland and in the Canadian Arctic. Harp seal whelping occurs from late February to mid March on first year ice or landfast ice offshore Newfoundland and Labrador and in the Gulf of St. Lawrence. Harp seals enter Lancaster Sound in July and August via migration routes along the fast ice edge off east Baffin or across Baffin Bay from Greenland.

Generally, harp seals enter Pond Inlet and Navy Board Inlet at the end of July. They concentrate at the mouth of Navy Board Inlet and occasionally within Eclipse Sound throughout August and September. Harp seals were sighted in relatively high numbers during aerial surveys in Eclipse Sound and Milne Inlet. Harp seals were seen frequently in large groups of 10-50, and in one case 400. Most sightings were in Eclipse Sound. The September exodus from Lancaster Sound proceeds along the north coasts of Devon and Ellesmere islands, and then either across Smith Sound to Greenland, or along the east coast of Baffin Island. By October, most seals have left the Canadian High Arctic and Greenland.

Smaller numbers of harp seals also move westward into Hudson Bay and Foxe Basin during spring. Some animals move south along the east coast of Hudson Bay, reaching Southampton Island and occasionally as far south as the Belcher Islands near James Bay. Others head west across northern Hudson Bay and disperse along the west coast of the bay and Foxe Basin. There were relatively few sightings of harp seals in Hudson Strait during aerial surveys in 2008. Additional details on harp seals can be found in FEIS Volume 8, Section 5, Volume 8.

3.4.4.3.8 Polar Bear

Polar bears have a circumpolar distribution and occur in relatively low densities throughout most of the ice-covered areas in the RSA. Polar bears tend to be more abundant along shore lead systems and polynyas during winter, where less consolidated ice cover provides habitat for prey species. Non-pregnant females, juveniles, and adult males remain active on the pack ice throughout the year, often moving considerable distances with the ice. The distribution and population size of polar bears is likely regulated by the extent of sea ice and the distribution and numbers of their primary prey, the ringed seal.

Female polar bears give birth to 1-3 cubs every 3 to 4 years. Mating occurs from April to June, and females give birth the following December or January in maternity dens, which are excavated in accumulations of snow on stable parts of landfast ice, offshore pack ice, and most often on land within approximately 50 km of the coast. Dens are created in the fall and bears leave their dens in April.

The global polar bear population is estimated at 22,000 to 25,000, of which at least 15,500 occur in Canada or in subpopulations shared with Canada. Three subpopulations of polar bears occur within the RSA: Foxe Basin, Baffin Bay, and Davis Strait with each subpopulation numbering around 2,000.

Along the northern shipping route, polar bears are distributed throughout Baffin Bay, Lancaster Sound, and along coastal areas. Polar bears from the Baffin Bay subpopulation occupy drifting pack ice and landfast ice between Baffin Island and west Greenland during winter but can concentrate along the Lancaster Sound fast ice edge. Bears are also concentrated along landfast ice edges across Pond and Navy Board inlets during spring. Bylot Island and coastal Baffin Island are used as summer retreats when sea ice melts and provide denning habitat for pregnant females. The Davis Strait subpopulation occurs in the Labrador Sea, eastern Hudson Strait, Davis Strait south of Cape Dyer, and an undetermined portion of southwest Greenland. Polar bears are harvested domestically as well as during commercial spring sport hunt based out of Pond Inlet. Small numbers of polar bears were observed during aerial surveys during the open-water season in Milne Inlet, Eclipse Sound, and Eskimo Inlet and on landfast ice in Milne Inlet, Koluktoo Bay, and Navy Board Inlet.

Polar bears from the Foxe Basin subpopulation range over Foxe Basin, northern Hudson Bay and western Hudson Strait during winter and move ashore during the open-water period, concentrating on Southampton Island and along the Wager Bay and other coasts within Foxe Basin. During aerial surveys polar bears were observed on landfast ice, pack ice, terrestrial areas, and in open-water areas primarily in northern Foxe Basin but also in Hudson Strait. Additional details on Polar Bear baseline studies can be found in FEIS Volume 8, Section 5.1.6.

A total of 14 polar bears were observed during three consecutive years of aerial surveys (2013 and 2015) in the RSA (Elliott et al. 2015; Thomas et al. 2015, 2016). During eight years of shore-based monitoring conducted for Baffinland from 2013 to 2017 and 2019 to 2021, a total of 11 polar bears were recorded near Bruce Head (Thomas et al. 2014; Smith et al. 2015, 2016, 2017; Golder 2018, 2020d, 2022c). In 2019, six polar bears were recorded in the RSA during the shoulder season (July) and 14 polar bears were recorded during the open water season (Golder 2020a). During aerial surveys conducted in 2020, 24 polar bears were recorded in the RSA during the shoulder season and 25 polar bears were recorded over the open water season (Golder 2021a). A total of 38 polar bears were recorded in the RSA during the 2021 MMASP; 16 polar bears during the shoulder season and 22 polar bears during the open water season (Golder 2022a). Over three consecutive years of ship-based monitoring conducted for Baffinland from 2013 to 2015, polar bear were not observed (SEM 2014, 2016). Two polar bears were observed in each of the 2018 and 2019 SBO program (Golder 2019c, 2020c). IQ supports many of these findings (JPCS 2017, QIA 2019) reporting concentrations of polar bear along landfast ice in the area, including Pond Inlet and Navy Board Inlet during the spring.

3.5 SOCIO-ECONOMIC ENVIRONMENT

The Inuit of the North Baffin region have experienced tremendous social and cultural change over the course of a few decades. Recent changes, particularly residential schools, have affected family integrity and by implication, social cohesion. Elders are becoming more engaged in community life and in the education of youth in traditional skills. At the same time, a shift toward Western middle-class expectations appears to be taking place among Inuit youth.

The land-based economy is a major part of the livelihoods of many residents of the North Baffin. Harvesting from the land and sea is estimated to produce food worth between $12 million and $20 million per year in this region. The amount of work to harvest this food is estimated to be similar to 350 full-time jobs.

In addition, residents of the region earn money through sales of arts and crafts, through employment, and from various government social programs such as Income Support. The personal income reported by residents of the five North Baffin communities amounted to $83 million per year.

Residents' demand for wage employment is very high. People want to work, even when this work requires flying to remote locations. However, job opportunities in the North Baffin are limited. Inuit employment in North Baffin is characterized by many individuals earning small levels of income, well under what full-time work would pay, and a small number earning full-time, year-round incomes. Most residents working in full-time jobs in Iqaluit do so year-round. In North Baffin, many more full-time workers are engaged in these jobs for only short periods. Women who work full-time jobs in North Baffin are more likely to work year-round than are men.

Nunavut relies on federal transfer payments for at least 90% of its revenue. Government employment is a mainstay of the wage economy, with many of Nunavut's small businesses and retail outlets established to support government needs or those of public servants. The public sector accounts for a large portion of Nunavut's economic activity. Government jobs in administration, education, and health account for about half of all employment earnings in the territory. Construction has been growing as government infrastructure has been established.

These communities have a subsistence economy and have experienced dramatic population growth over the last 20 years. Over 70% of the population is under 25. Underemployment and lack of opportunities is causing social stress. Community Elders recognize that the communities must position themselves to enter the wage economy. Furthermore, QIA shared that Elders and Inuit expect and require a balancing of wage economic opportunities with protection of the land and waters for future generations.

For many North Baffin households, harvest of country food provides an important contribution to overall well-being. In all five communities, caribou, ringed seal, and Arctic char are of major importance. In addition, walrus is a major species of importance in Sanirajak and Igloolik, while narwhal is a key component of the harvest among households in Arctic Bay, Pond Inlet and, to a lesser degree, Clyde River.

3.5.1 NEARBY COMMUNITIES

There are five communities of north Baffin Island in the immediate vicinity of the Project, which have existing and historical socio-economic and/or ecosystemic ties to the Project area, and for which the Project has a direct effect on the traditional land use of their residents. Listed in alphabetical order, these communities (known as Category 1 communities in literature as they are closest to the Project) include Arctic Bay, Clyde River, Igloolik, Pond Inlet, and Sanirajak. The ties of these individual communities to the Project are described in more detail:

Arctic Bay is on northern Baffin Island, 280 km northwest of the Mary River site. Harvest and land use patterns indicate that the effect of Project activities on these current patterns of Arctic Bay residents is less than what it would have been historically. Arctic Bay residents might use the Milne Inlet, Eclipse Sound, and Mary River areas for hunting on a sporadic or occasional basis, but other geographic areas are more important to this community's land use.

Clyde River is in northeastern Baffin Island, 415 km from the Project area. Historical land use information and discussions with Elders from various communities suggest that the people of the Clyde River area used to travel inland from Cambridge Fiord facing Baffin Bay, into the Ravn River area east of Angajurjualuk Lake and southeast of Mary River. Harvest patterns suggest that contemporary land use activities are now concentrated closer to the community, however, historical ties to the Mary River area resulted in the inclusion of this community in the study area.

Igloolik is located on Igloolik Island and is the closest community to the Steensby Port site (155 km) and second closest geographically to the Mary River Project site (230 km). Historically, Igloolingmiut spent the summer hunting caribou along the western side of North and Central Baffin Island. Current harvest patterns show that while Igloolingmiut use the Baffin coast and marine areas at the mouth of Steensby Inlet, their activities are heavily concentrated around the community on Igloolik Island and the closest Baffin Island shoreline to the north. Igloolingmiut still hunt around Rowley and Koch islands and even in Steensby Inlet; thus, the Project southern shipping route through this area could have both land use and ecosystemic effects on the community.

Pond Inlet is geographically the closest community to the Mary River mine site, located approximately 160 km northeast of Mary River. Pond Inlet relies on hunting in the marine environment of Eclipse Sound and Milne Inlet as well as caribou hunting through the Mary River area. As such, Pond Inlet has the closest land use, historical, and ecosystemic ties to the Mary River area.

Sanirajak is on the mainland just south of Igloolik, 192 km from the Steensby Port site and 288 km southwest of the Mary River site. Sanirajak harvest patterns are distinct from Igloolik despite their proximity, with a concentration of marine harvesting centred on the Sanirajak area. Some hunting occurs on Baffin Island intermixed with Igloolingmiut hunting, including in and around Rowley and Koch islands and Steensby Inlet; thus, the Project southern shipping route through this area could have both land use and ecosystemic effects on the community.

Details on the socioeconomic environment surrounding the Project area are described in detail in FEIS Volume 4.

3.5.2 TRADITIONAL LAND USE

Human habitation of the region extends back at least 4,000 years. The historic period of a region is defined as that point where human activities are documented in written record.

The historic period of the North Baffin region begins in the late 16th century with the first European whaling and exploration in areas adjacent to Baffin Bay. Two ships that over-wintered in the Igloolik area in 1822 and 1823 provide the first record of Euro-Canadian exploration in the Foxe Basin area. The Hudson Bay Company, the Royal Canadian Mounted Police, and the church established themselves at different times in the vicinity of each of the existing communities, as early as 1921). The establishment of these institutions, as with the whalers before, influenced land use and settlement patterns through the mid-twentieth century. The establishment of DEW-line sites in Foxe Basin also influenced land use patterns, with Inuit settling near the DEW-line sites seeking part time employment and for trade. Traditional land use patterns changed substantially with the movement of the Inuit into permanent settlements because of federal policy and housing initiatives in the 1950s. Contemporary Inuit land use was determined through consideration of the Nunavut Wildlife Harvest Study (Priest and Usher, 2004) interviews and discussions with local communities, and the results of the Mary River Inuit Knowledge Study (Knight Piésold, 2014).

Connection with the land continues to be an important aspect of Inuit life and is evident in current land use patterns. Although Inuit now live in permanent settlements, travel and camping continue to be important aspects of Inuit life. Travel routes have been identified linking all the north Baffin communities (Clyde River, Pond Inlet, Arctic Bay, Igloolik, and Sanirajak). Travel is an important land use practice of the Inuit as it enables the development of connections to the land, enables individuals to meet with family and friends from other communities, and enables hunting and gathering. For additional information and a through breakdown of land use areas surrounding the project information refer to Figures 3.13 - Travel Routes - North Baffin Region (workshop results) and Figure 3.14 - Travel Route - North Baffin Region (interview results) from Volume 4, Appendix 4C - Land Use Report.

Contemporary harvesting activities on in the North Baffin region include wildlife hunting, marine mammal hunting, freshwater and marine fishing, berry picking, egg gathering, sea resource harvesting, and land resource harvesting such as soapstone. See the following figures from FEIS Volume 4, Appendix 4C - Land Use Report for geographical representation of identified areas where harvesting activities occur:

- Figure 3.4 - Hall Beach/Igloolik Harvest Locations (Pre-1965)
- Figure 3.5 - Hall Beach/Igloolik Harvest Locations (1965-1974)
- Figure 3.6 - Arctic Bay/Pond Inlet Harvest Patterns (pre-1959)
- Figure 3.7 - Arctic Bay/Pond Inlet Harvest Locations (1959-1964)

- Figure 3.8 - Land Use information from DIAND (1982B) (showing Inuit land use by marine and terrestrial animal activity)
- Figure 3.9 - Wildlife distribution
- Figure 3.10 - Approximate Camp Areas (1930 - 1966)
- Figure 3.19 - Berry Picking Locations - North Baffin Region (workshop results)
- Figure 3.22 - Ocean Resource Collection Areas - North Baffin Region (workshop results)
- Figure 3.31 - Reported Caribou harvest locations in North Baffin (1996 - 2001)
- Figure 3.33 - Reported marine mammal harvest locations on North Baffin (1996 - 2001)
- Figure 3.35 - Reported waterfowl and egg harvest locations in North Baffin (1996 - 2001)
- Figure 3.37 - Reported Fish Harvest Locations in North Baffin (1996 - 2001)
- Figure 4.2 - DFO Arctic Char Commercial Fishing Quotas for North Baffin Rivers

3.5.2.1 TUSAQTAVUT STUDIES

Between February 2019 and April 2021, the QIA interviewed 137 community members from the five Mary River impacted communities: Arctic Bay, Clyde River, Igloolik, Pond Inlet and Sanirajak. These interviews were drawn on to create three reports, referred to as the Tusaqtavut Studies or Reports, for the communities of Pond Inlet (QIA 2019a; NIRB Registry Nos. 325450-325456), Sanirajak (Hall Beach)/Igloolik (QIA 2019b; NIRB Registry Nos. 326993-327004) and Clyde River/Arctic Bay (QIA 2021a; NIRB Registry Nos. 336243-336248). The Tusaqtavut Studies were submitted to the NIRB. Study participants across these three studies identified the following Valued Components:

- Marine Hunting (QIA 2019a, 2019b, 2021a);
- Terrestrial Hunting/Harvesting (QIA 2019a, 2019b, 2021);
- Fishing (QIA 2019a, 2019b, 2021a) and Freshwater (QIA 2019a);
- Travel, Trails and Habitation (QIA 2019a, 2019b, 2021);
- Cultural Continuity (QIA 2019a, 2019b, 2021a);
- Food Sovereignty (QIA 2021).

Key themes identified were consistent across the five impacted communities and included the importance of harvesting on-the-land and water, fishing, freshwater, the ability to travel and stay out on the land, and the importance of Inuit culture and passing on this knowledge to future generations (QIA 2021).

The three Tusaqtavut Studies were conducted by QIA, and fully funded by Baffinland. Baffinland has used information contained within the Tusaqtavut Studies to supplement the results of its own outreach activities and monitoring programs to better understand key issues related to traditional resources and the Inuit way of life, and potential impacts experienced by communities as identified by Inuit since the Mary River Project has commenced operations.

There is clear overlap in the Valued Components identified through the Tusaqtavut Studies and the VECs selected for the FEIS, and subsequent application amendments. For example, Marine Hunting is relevant to the VCs identified for the Marine Environment including Marine Habitat and Biota, and Marine Mammals, as well as Human Environment VECs (Cultural Resources, Resources and Land Use). Similarly, Terrestrial Hunting is also relevant to VECs such as Terrestrial Wildlife and Wildlife Habitat, and Birds and Bird Habitat and associated Human Environment VECs. The importance of archaeological sites and sites of cultural importance (including travel routes), have direct relevance to 'Cultural Continuity' and 'Travel, Trails and Habitation', as they are also integral components of the VEC 'Culture, Resources and Land Use' under Human Environment. Similar parallels can be drawn between Fishing and Freshwater and Freshwater Fish and Human Environment VECs.

Baffinland has committed to additional mitigations for potential Project effects that have been described in the Tusaqtavut Studies associated with the current Project, and many of these have resulted in the Amended Project Certificate in 2022. Baffinland and QIA agreed to carry out a follow up CRLU Assessment, which is ongoing. The Tusaqtavut Studies are an important resource for understanding the pathways Inuit believe exist between the Project, project effects and their experiences in the Project area.

3.5.2.2 CURRENT AND FUTURE LAND USE PLANS

The North Baffin Regional Land Use Plan (NBRLUP; NPC 2000) was established in accordance with Part 5, Article 11 of the Nunavut Agreement. For several years, the Nunavut Planning Commission (NPC) has been undertaking additional land use planning for the development of a Nunavut-wide land use plan. Updated Draft Nunavut Land Use Plans were distributed in 2016 (NPC 2016) and 2021 (NPC 2021). The 2016 updated draft plan provides for protection of caribou calving and post-calving grounds and critical bird habitat; identifies traditional on ice travel routes with special management tools to protect them, areas of mineral potential, as well as areas with potential for tourism activities. The 2016 draft plan also provides Nunavummiut a voice in determining the future of development in the Nunavut Settlement Area (NSA) at the land use planning level. The 2016 draft plan identifies existing and previously approved transportation corridors. In early 2017, Baffinland provided written comments on the draft plan. Public Hearings were held in May 2017. An updated draft plan was issued in July, 2021; public hearings were undertaken in 2022. Once approved, the Nunavut-wide land use plan will replace the NBRLUP.

3.5.2.3 LAND FAST ICE

Ice is an important component of land use activities, as much of the travel engaged in by residents is on landfast ice. Landfast ice is often used to reduce travel time and to access the floe edge for hunting purposes. For more information refer to Figures 3.13 – Travel Routes – Baffin Region (Workshop Results); Figure 3.14 Travel Routes – North Baffin Region (interview results); and Figure 3.24 – Sea Ice Conditions – North Baffin of FEIS Volume 4, Appendix 4C – Land Use Report and TSD03 and TSD05.

3.5.3 PROTECTED AREAS

The Project does not overlap with any terrestrial protected areas and/or known critical habitats such as national or critical wildlife areas. Access to Milne Port is through Baffin Bay into Eclipse Sound and Milne Inlet (an additional route to Milne Port is possible around Bylot Island through Navy Board Inlet, but Baffinland vessels do not utilize this route). Both paths are adjacent to Sirmilik National Park and Bylot Island Bird Sanctuary, and in proximity to key marine bird habitat sites near Cape Graham Moore or Cape Hay on Bylot Island. No interactions are expected along the southern shipping route through Hudson Straight and Foxe Basin.

3.5.4 RECREATIONAL LAND USE

Several parks exist in the vicinity of the Project. Sirmilik National Park of Canada, established in 2001, is one of Canada's newest national parks and covers a considerable landmass with four separate land parcels. The Bylot Island Bird Sanctuary is located within Sirmilik National Park, affording it overlapping legal protection and restrictions on land use. Tamaarvik Territorial Park, located adjacent to the community of Pond Inlet and Little Salmon River, is a relatively small park used mainly for camping. See Figure 7.1 - Parks and Conservation Areas from FEIS Volume 4, Appendix 4C - Land Use Report for location of the parks relative to the Project.

The Government of Canada, the Government of Nunavut, and the QIA signed a memorandum of understanding in December 2009 for consideration of the establishment of a National Marine Conservation Area (NMCA) in Lancaster Sound (Tallurutiup Imanga). The proposed boundary for the NMCA has been announced and encompasses the full Marine Mammal RSA, including Milne Inlet, Eclipse Sound, and Pond Inlet (Figure 3.1). A feasibility assessment on the NMCA was conducted between 2010 and 2016, and included studies of ecological values, traditional knowledge, and tourism. During engagement conducted with Inuit communities, industry and government, support was expressed. Under the Nunavut Agreement, an Inuit Impact and Benefit Agreement (IIBA) must be negotiated prior to establishing any protected area in Nunavut. In August 2019, the Government of Canada and the QIA signed an IIBA required for final establishment of the Tallurutiup Imanga NMCA. An interim management plan (including a preliminary zoning plan) is being prepared. Further information is available in TSD 24 (Marine Mammals Effects Assessment).

FIGURE 3.1 TALLURUTIUP IMANGA (LANCASTER SOUND) NATIONAL MARINE CONSERVATION AREA

4.0 PROJECT INFORMATION

4.1 LOCATION AND ACCESS

The Project is located on the northern part of Baffin Island in the Qikiqtani Region of Nunavut (Figure 4.1). Three project components are operational at present: the Mine Site, the 100-km long Milne Inlet Tote Road, and Milne Port. Project components to be developed in the future include the 149-km Steensby Railway and Steensby Port.

4.1.1 PROPONENT NAME AND ADDRESS

The proponent's name and address is:

Baffinland Iron Mines Corporation
360 Oakville Place Drive, Suite 300
Oakville, Ontario, Canada, L6H 6K8
Tel: (416) 364-8820 Fax: (416) 364-0193

4.2 PROJECT HISTORY

The Mary River iron ore deposits were originally discovered in 1962 by Murray Watts of British Ungava Explorations Limited (Brunex). Brunex staked ten claim groups in the Project area, including the Mary claims which cover the areas now known as Deposit No. 1. The private company Baffinland Iron Mines Ltd. (BIML) was established in 1963 by the financial participants and prospectors of the Brunex group to hold the Mary River claims and leases and to develop the prospects.

BIML undertook an exploration program from 1963 through 1966, with most of the field work carried out in the summers of 1964 and 1965. This work included the establishment of the 100-km Tote Road between Milne Inlet and the Mary River camp, and construction of gravel airstrips near the Mary River camp, at Milne Inlet, and a tundra strip at Katiktok Lake about 40 km northwest of Mary River and near Deposit No. 4. Apart from the required land surveys, some metallurgical test work, and re-examinations of project economics, no additional fieldwork was undertaken between 1965 and 2004.

In 2002, BIML interests were acquired by Baffinland, with the purpose of revitalizing the Project. The current Baffinland Iron Mines Corporation was formed in early 2004, which now holds exclusive rights to the ore deposits at Mary River. Continuous contemporary exploration work began in 2004. In 2007, a 250,000-tonne bulk sample program was approved by the NIRB, and a Memorandum of Understanding was signed with Nunavut Tunngavik Inc. (NTI) to gain mineral rights over 16,695 ha surrounding Deposits No. 1, 2 and 3. In addition an agreement was signed with Fednav to develop and deliver shipping solutions for the Project and letters of intent for the future sale of iron ore were signed with 3 steel companies (Thyssen Krupp, Salzgitter and Voestalpine). A further agreement for future sale of the iron ore was signed with ROGESA Roheisengesellschaft Saar mbH ("ROGESA"), a pig iron producing company, in 2008.

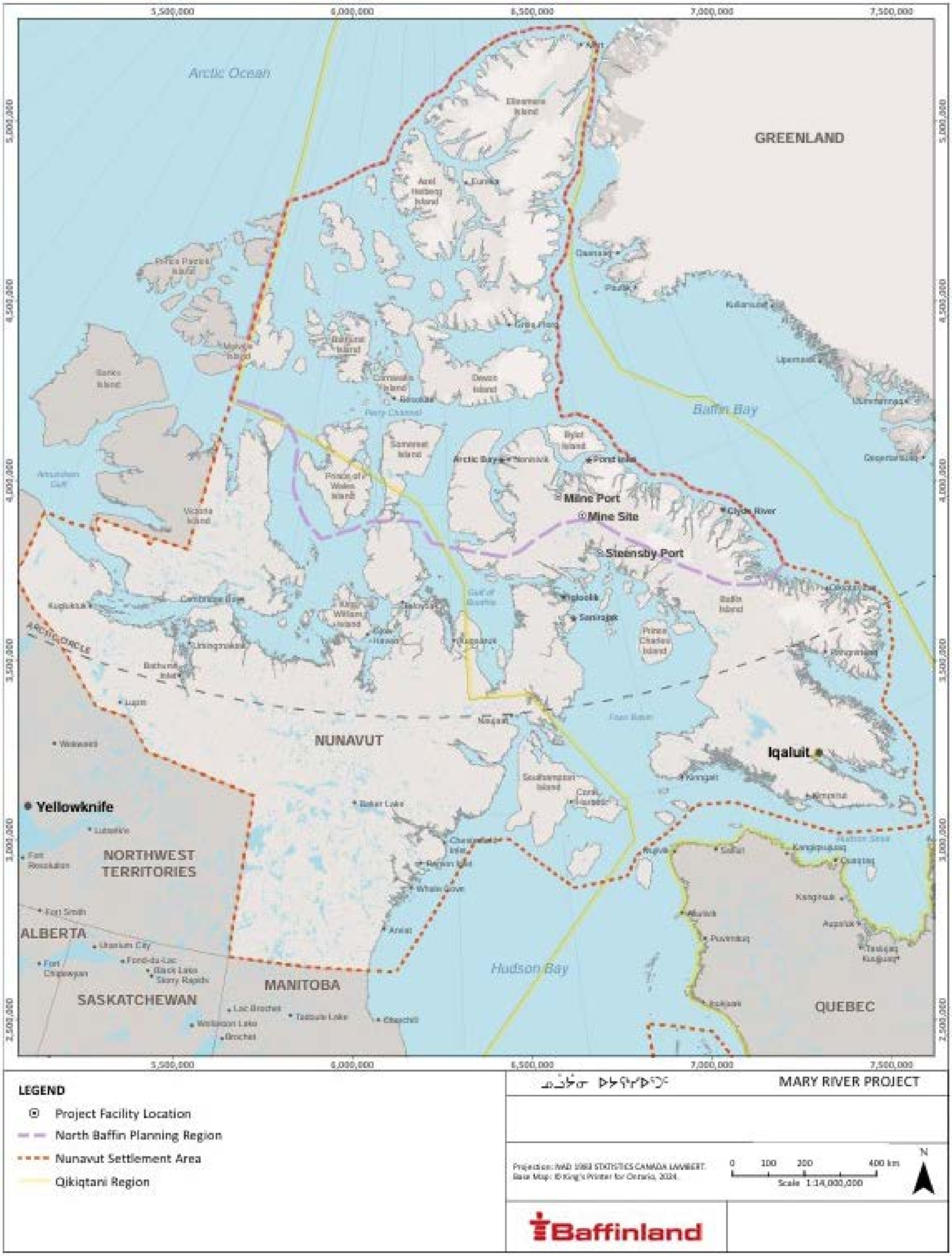


FIGURE 4.1 SITE LOCATION MAP

Exploration drilling was conducted from 2004 to 2008, and geotechnical and geomechnical site investigations of the mine, port areas and Steensby Railway alignment were undertaken in 2006 through 2008. The approved bulk sampling program was carried out in 2007-2008 to extract, transport, and ship ore for testing in Europe. In March 2008, the Company submitted a Development Proposal and associated initial permit applications to initiate the regulatory review of a Project based on currently defined iron ore reserves. Baffinland submitted its Draft Environmental Impact Statement (DEIS) in January 2011 and its Final Environmental Impact Statement (FEIS) in February 2012. A Preliminary Closure and Reclamation Plan (PCRP) was presented in the application for a Type A Water Licence that accompanied the FEIS.

4.2.1 MARY RIVER PROJECT – PROJECT CERTIFICATE NO.005/FEIS

The Mary River Project was approved by Project Certificate No. 005 on December 28, 2012 following the NIRB's review of potential ecosystemic and socio-economic effects and a positive Ministerial decision. The NIRB's review included consideration of a Final Environmental Impact Statement (FEIS) (Baffinland 2012) prepared by Baffinland in support of the Mary River Project. Since the issuance of Project Certificate No. 005 in 2012, Baffinland has proposed modifications to the Mary River Project which has resulted in amendments to the Project Certificate No. 005 (Section 4.2.2 and 4.2.3). The Approved Project is defined as the Mary River Project as approved by Project Certificate No. 005 and most recently amended (Amendment 5) on November 17, 2023.

The approved Southern Transportation Corridor includes the Steensby Railway (a railway of approximately 149 km connecting the Mine Site to Steensby Port) and a Shipping Corridor from Steensby Port through Steensby Inlet, Foxe Basin and Hudson Straight. It is anticipated that the Steensby Port facilities and the Steensby Railway will take approximately three to four years to construct. During construction, supplies will be brought to Milne Port between July and October and year round to Steensby Port. Once the Steensby Railway is operational, iron ore will be transported by the Steensby Railway to Steensby Port for shipment. Shipping of iron ore from Steensby has been approved to occur year round and will require vessels with icebreaking capabilities. When Steensby Port is operational, Milne Port is approved for the delivery of goods and equipment. Similarly, the Tote Road is approved to continue to be used for the delivery of goods, equipment and people between Milne Port and the Mine Site.

For additional details regarding the infrastructure and activities proposed at each Project location during construction and operation, please refer to the documents outlined and referenced in Table 1 for the Mary River Project Final Environmental Impact Statement.

4.2.2 AMENDMENT 1 – EARLY REVENUE PHASE

The Early Revenue Phase (ERP) submission received Ministerial approval April 14, 2014, and the Approved Project was amended and in addition to the approved scope described above, was also approved to proceed with additional mining of iron ore from the reserve at Deposit No. 1 and transporting it by truck to Milne Port for shipment via the Northern Shipping Route between July and October each year.

The ERP involves three main project locations – the Mine Site, Milne Port north of the Mine Site, and the Tote Road, which connects the Mine Site to Milne Port. Following approval of the ERP these three locations were fully constructed and operated. The existing Tote Road was upgraded to enable transportation of ore by truck from the Mine Site to Milne Port. Approved Milne Port infrastructure included what was envisioned under the 2012 FEIS as well as ore stockpile pads, ore unloading and loading facilities, truck maintenance facilities, an ore dock, ship loader and associated infrastructure necessary for the operation of the port facilities to transport ore through the Northern Shipping Corridor.

For additional details regarding the infrastructure and activities proposed at each Project location during construction and operation, please refer to the document outlined and referenced in Table 1 for the Early Revenue Phase Addendum to the FEIS (Baffinland 2013).

4.2.3 SUBSEQUENT AMENDMENTS TO 2024

There have been four additional certificate amendments completed since 2018 to increase ERP northern transportation limits by 1.8 Mtpa which result in the ability to maintain Milne Port trucking and shipping at 6 Mtpa until the end of 2024 which include:

- Amendment 2- Production Increase Proposal (PIP) (approved September 30, 2018)
- Amendment 3- Production Increase Proposal Extension (PIPE) (approved June 18, 2020)
- Amendment 4- Production Increase Proposal Renewal (PIPR) (approved October 4, 2022)
- Amendment 5- Sustaining Operations Proposal (SOP) (approved October 17, 2023)
- Amendment 6- Sustaining Operations Proposal (SOP2) (submitted June 2024)

An overview of the submissions and approvals for the four additional certificate amendments is presented below.

4.2.3.1 AMENDMENT 2 - PIP

In 2018, concurrent with the Phase 2 Proposal application, Baffinland applied for an amendment to the Project Certificate No. 005 to allow an increase of 1.8 Mtpa in ore production and transportation for a total limit of 6 Mtpa along the Northern Transportation Corridor and expand and improve fuel storage and camp capacity and conditions at Milne Port. This Production Increase Proposal (PIP) was originally intended as an interim measure until the Phase 2 Proposal was approved. It was based on the lessons learned since operations commenced at the Mary River Mine in 2014, including the higher levels of operational efficiency achieved and the monitoring data available through the NIRB monitoring programs. Amendment No. 002 of the Project Certificate (NIRB Registry No. 320857) for the PIP was provided on October 30, 2018, with an expiry date of December 21, 2019, based on the then-anticipated timeline of the Phase 2 Proposal regulatory process.

Upon the Ministers Approval Terms and Conditions 179(a) and 179(b) were modified and Terms and Conditions 183 and 184 were added.

4.2.3.2 AMENDMENT 3- PIPE

In December 2019, following delays in the NIRB's consideration of the Phase 2 Proposal, Baffinland applied for an extension to the PIP under the Production Increase Proposal Extension (PIPE) Application. On November 22, 2019, Baffinland received a joint letter of support from the mayors of Pond Inlet, Arctic Bay, Hall Beach (now Sanirajak), Igloolik and Clyde River. In the joint letter, the respective mayors expressed their intent to "encourage and support an extension to the production increase certificate to remain at 6M tons until decision in regard to phase 2". The mayors also noted their support would be conditional on Baffinland not issuing any layoffs to community members and reinstating and accommodating any community members laid off to date. Overall, the mayors recognized that the delay experienced during the Phase 2 review process provided an "opportunity to work with the communities and answer concerns raised by them."[8]

NIRB carried out a reconsideration under both Article 12.8.2 of the Nunavut Agreement and Section 112 of the NuPPAA of the PIPE Application and on March 4, 2020 recommended that Term and Conditions 179(a), 179(b), 179(c) and 183 of the Project Certificate be amended. The Minister required revisions to the NIRB's recommended wording and Amendment No. 3 of the Project Certificate (NIRB Registry No. 330475) was issued on June 18, 2020.

4.2.3.3 AMENDMENT 4 - PIP RENEWAL

On May 20, 2022, Baffinland applied to the NIRB to renew the PIP for the 2022 calendar year (Production Increase Proposal Renewal [PIP Renewal]), to maintain the activity levels at site permitted by the Project Certificate since 2018, which would also provide certainty and stability for the over 2000 workers at the Mary River Project during 2022. The one year duration of the extension request was at the request of the QIA on the basis that an approval for a longer period required more review time than was available.

On June 7, 2022, the NPC issued a positive conformity determination for the PIP Renewal and on June 13, 2022 Baffinland completed its online application to the NIRB for the PIP Renewal. Due to the limited scope and short-term duration of the PIP Renewal, the NIRB determined a public hearing would not be required for this reconsideration (similarly as determined by NIRB in respect of the 2018 or 2020 applications). The NIRB process included written comment periods and a Community Roundtable on August 16, 2022 in Pond Inlet, Nunavut.

In response to a request from an impacted community, Baffinland confirmed that if approval was granted for 6 Mtpa transportation limits for 2022, the company would not terminate any Inuit employees during this production year (excepting employment matters that could give cause for termination on an individual basis, should they arise).

On September 22, 2022, the NIRB released their Reconsideration Report and Recommendations on the PIP Renewal (NIRB 2022b) concluding that *"if the Proposal is carried out in accordance with the limits, mitigation and monitoring requirements included in the additional and revised terms and conditions of Project Certificate No. 005 and recommendation outlined in the Board's Report, the potential for significant adverse ecosystemic and socio-economic effects associated with the Proposal can be effectively managed".* In particular, the NIRB emphasized the 45 new commitments Baffinland made to the QIA and other interested parties (as of the date the NIRB closed the PIP Renewal record on August 19, 2022):

> *"[…] the Board views Baffinland's fulfillment of the commitments they have agreed to meet as central to improving working relationships and rebuilding the trust that is essential to productive working relationships with Nunavut Tunngavik Incorporated, the Qikiqtani Inuit Association, Hamlets, hunters and trappers organizations, other community-based interested parties, members of the North Baffin communities, regulators, and non-governmental organizations."*

8 See Attachment 5, "North Baffin Hamlet Letters of Support for PIP Extension Request" in 2001-608MN053 – BIM Extension Request Info Pack-02-OT4E (NIRB Registry No. 327952).

The NIRB recommended to the Minister of Northern Affairs that the PIP Renewal should be allowed to proceed. The Minister modified the NIRB's recommendation and required additional amendments to the Project Certificate along with the addition of many new commitments made by Baffinland to QIA after the NIRB record closed on August 19, 2021. On October 4, 2022 Baffinland rescinded the termination notices as a result of the positive Ministerial decision of that date. On November 3, 2022 the Project Certificate No. 005 was amended.

The amended Project Certificate included revised Terms and Conditions 49, 77, 179(a), 179(b) and 183 and new Terms and Conditions 185, 186, 187, 188 and 189. A new Appendix B was added to the Project Certificate with 79 separate and distinct commitments recorded by Baffinland and agreed to with various Parties through the NIRB's reconsideration process. The implementation of commitments by both Baffinland and QIA have been subject to a bi-annual reporting process, with reports to NIRB submitted on March 31, 2023, September 30, 2023 and April 5, 2024. The reports cover a range of commitments that include but are not limited to:

- Various commitments related to the required dust audit, including but not limited to:
    - establishing site specific thresholds for conditions that may increase dust dispersion and integration of the same into the Air Quality and Noise Abatement Management Plan;
    - refinement of DUST/BLOKR® application rates in accordance with the manufacturer's instructions and continued communications with the manufacturer;
    - bi-annual reporting on DUST/BLOKR® effectiveness;
    - minimizing drop distances for stockpiling and other relevant ore handling activities;
    - completion of updated dustfall isopleth modelling with considerations for local topography on wind patterns;
    - expansion of satellite imagery analysis beyond 20 km; and
    - implementation of other recommendations for dust monitoring improvements contained with the final Dust Audit Report2[F[2]]
- Significant revisions to the terms of reference for the Marine Environmental Working Group and Terrestrial Environmental Working Group including the appointment of an independent chair, amendments to decision-making processes, and added funding for increased participation by HTOs;
- Baffinland to support and fund the establishment and first year (from September 15, 2022 – March 31, 2023) of the Inuit Stewardship Plan;
- Baffinland to resource QIA in establishing an Inuit-led monitoring program on dustfall; and
- Baffinland to develop and maintain a safe travel route around/across km 13 of the Tote Road to increase travel safety for human and animal traffic.

4.2.3.4 AMENDMENT 5 - SOP

On April 14, 2023, Baffinland submitted the Sustaining Operations Proposal (SOP) to the NIRB seeking an amendment to Project Certificate No. 005 to maintain transportation limits within the Northern Transportation Corridor at the nominal levels previously approved from 2018 to 2022. In particular, Baffinland requested permission to continue to haul iron ore along the Tote Road with the intent to deliver a nominal rate of 6 Mtpa of iron ore to Milne Port each year, and to ship any ore remaining at the stockpile at the conclusion of the previous year's shipping season. Similar to the process undertaken for the PIP, PIPE and PIP Renewal amendments, the NIRB conducted the assessment of the SOP as a reconsideration with a technical review in writing followed by an in-person community roundtable. The SOP review and approval process was longer than any of the previous production increase proposal applications. Following the receipt of oral and written comments, the NIRB issued its Reconsideration Report and Recommendations to the Responsible Ministers on September 13, 2023, indicating that the project should be approved to proceed until December 31, 2024. On October 17, 2023, the Responsible Ministers accepted the NIRB's recommendation and proposed amendments to the Project Certificate and on November 17, 2023 the amended terms and conditions were issued as Amendment No. 005 to the Project Certificate.

The amended Project Certificate included revisions to terms and conditions 28, 35, 76, 82, 83 (a), 85, 99, 101, 150, 179 (a) and (b).

Twenty-eight separate and distinct commitments recorded by Baffinland and agreed to with various Parties through the NIRB's reconsideration process were appended to the Project Certificate. The implementation of commitments by both Baffinland and QIA have been subject to a bi-annual reporting process, with reports to NIRB that include performance against Appendix B submitted on April 5, 2024. The reports cover a range of commitments that include the following related to Appendix B specifically:

- Addition mitigations and monitoring programs related to dust
- Additional and/or alternative methods for monitoring caribou
- Additional adaptive management plan updates
- Additional studies and monitoring programs related to the use of Capesize vessels
- A new regional Inuit training program
- Additional studies and revised management plans related to waste rock

4.2.3.5 AMENDMENT 6 – SOP2

The most recently approved PIP Amendment (SOP) expires on Dec. 31, 2024, which means Baffinland needs to apply for another Project Certificate amendment in order to maintain its operations at the current transportation rates along the Northern Transportation Corridor.

Through the Sustaining Operations Proposal 2 or SOP2 Baffinland is seeking an amendment to Project Certificate No. 005 to maintain the current transportation limits within the Northern Transportation Corridor at the nominal levels previously approved by NIRB under the Project Certificate from 2018 to 2024 (i.e. a total of 6 Mtpa). Approval of SOP2 would allow Baffinland to continue the stability of the operation. The current Project Certificate terms and conditions and binding commitments will all continue to apply (but for required updates to Term and Condition 179(a) and (b)). Baffinland is not requesting any increase or changes to current NIRB approved rates. Baffinland is also not requesting any additional infrastructure or changes to the footprint as part of SOP2.

4.3 SITE GEOLOGY

4.3.1 REGIONAL GEOLOGY

The North Baffin Island region and Mary River area lie within the Committee Belt, a granite-greenstone terrane mixed with rift basin sediments and volcanic rocks. The belt lies within the Churchill Province, extending from Baker Lake to Greenland, and is divided into five main assemblages: the Archean, the Mary River Group, the Piling Group, the Bylot Supergroup, and the Turner Cliffs-Ship Formation (Aker Kvaerner, 2008).

The Mary River iron deposits are located within the Mary River Group, an assemblage of Late-Archean (2.76 to 2.72 Ga) metasedimentary to metavolcanic rocks that have been folded and preserved in greenstone belts (Aker Kvaerner, 2008). The Mary River Group greenstone belts are present as fragmented remnants stretching from Bylot Island south to Eqe Bay, with a maximum thickness of 4,000 m. Primary sequences within the Group consist of a lower series of metavolcanic rocks and an upper series of turbidite pelitic-greywacke; the stratigraphic position of iron formation, quartzite, conglomerate, minor marble, and volcanic breccia units within the belts, which varies across the region. The Mary River Group is part of the regional Committee Belt, an Archean-aged (2.9 to 2.5 Ga) assemblage of granite-greenstone terranes, granitic migmatites gneissic granitic intrusions, and clastic and carbonate sedimentary units reworked during the Paleo-Proterozoic (2.5 to 1.6 Ga).

4.3.2 IRON ORE DEPOSIT GEOLOGY

Iron formations occur in varying thicknesses discontinuously within the Mary River Group metasedimentary units but are typically not present in economically extractable thicknesses or configurations except in the Mine Site area. The high-grade iron ore at Deposits No. 1, 2, 3 and 4 were discovered in 1962, and these initial hematite-magnetite mineralized zones were mapped within extensive belts of banded iron formation in the area over the next three years. Deposit No. 5 was discovered, and surface mapped in 2009. The deposits are characterized by zones of massive layered to brecciated hematite to magnetite, variably intermixed with banded oxide to silicate facies iron formation. As typified at Deposit No. 1, the high-grade iron formations are interlayered with thin bands of chlorite-actinolite schist, staurolite-garnet-mica schist, amphibolite, and banded iron formation across their strike width, with the entire assemblage up to 400m thick.

The Mary River iron deposits are considered to belong to an Algoma-type iron formation (Aker Kvaerner, 2008) formed in a volcanic ark setting in an extensional or rift basin during the Archean. Algoma-type deposits are typically characterized by a lower series of volcanics followed by banded iron formation and/or interlayered to pure iron oxides of variable and potentially substantial thickness, in turn overlain by volcanics and volcaniclastic sediments (Gross, 1996).

4.3.3 GEOTECHNICAL OVERVIEW

4.3.3.1 MILNE PORT

The Milne Port area consists of a series of variably dipping, dissected terraces sloping towards the waters of Milne Inlet. The surficial deposits are marine and glacial marine sediments, ranging from coarse beach sediments (gravel and sand) to finer deltaic sediments (clay, silt, sand, and gravel) to even finer deep-water periglacial silt veneers (silt, clay and fine sand). The soils in the area are often covered by a thin layer of organics at the ground surface. The soils were noted to typically be frozen below 2 m depth and contain ice lenses (FEIS Volume 6, Section 2.1.3.1). Offshore drilling encountered loose to compact silty sand underlain by sand containing varying amount of gravel and cobbles.

4.3.3.2 TOTE ROAD

The Tote Road generally follows a glacial valley, oriented northwest-southeast to the Mine Site. The surficial deposits along this alignment generally include the following materials:

- Till deposits: veneer (up to 2 m thick) or blanket (up to 10 m thick) with drumlins and moraines (in places)
- Glaciofluvial sediments: outwash gravel and sand forming braided floodplains, terraces and fans or stratified glacial drift (gravel and sand)
- Limited bedrock exposure: especially nearer to the Mine Site/Deposit No. 1 area
- Mary River flows across the glacial valley to the southeast of the Mine Site, and several thaw lakes and thermokarst depressions are located along the valley floor

4.3.3.3 MINE SITE

Deposit No. 1 is located along the top and margins of a bedrock hill on the north side of the valley, while the Waste Rock Facility (WRF) is located along the west-facing and east-facing side slopes of the hill. Bedrock is exposed at the apex of the deposit with talus present on the upper slopes. The mid slopes on the east side of the deposit comprise up to 50 m (vertical depth) of glacial till, tapering out to near surface bedrock at the base of the slope. The till on the north and west side of deposit is shallower, in the 10 to 15 m range. The till around Deposit No. 1 is typically dominated by boulders, cobbles, gravel and trace to some organics and a moderately thick, wet organic layer is present over much of this upper area. The overburden materials are very ice-rich based on-site investigations, observations from bulk sample road construction and general understanding of the deposit.

Other Project-related infrastructure in the Mine Site area is located on areas of glaciofluvial terrace along the valley floor directly south and southwest of Deposit No. 1. In addition to the glaciofluvial deposits, there appears to be some direct glacial deposition in and around the south-eastern portion of Sheardown Lake. Overburden depths over much of the valley floor are typically noted to be in the 10 to 20 m thickness ranges. Based on the investigations and surficial features in and around these deposits, evidence of ice-rich areas and localized massive ice bodies are present, particularly in the vicinity of the existing airstrip areas. A thin organic layer is present in some areas, over the till, in depressions and at the base of some slopes.

Underlying the glaciofluvial materials southwest of the deposit in the valley floor is weak, unconsolidated sandstone; gneissic bedrock to the south, west and north of Deposit No. 1; and amphibolite schists to the east. Often, the upper horizon of the bedrock is highly fractured and often contains ice lenses and/or infilling in the joints.

4.3.3.4 RAILWAY

Extensive geotechnical drilling and test pitting along the proposed and former railway alignments were undertaken as part of studies related to the FEIS. The approved railway alignment is shown on FEIS Volume 3 Figure 3-2.4. The design focused on developing the minimum railway infrastructure necessary for operational viability and safety. Management, operations and maintenance have been centralized in one facility. Sidings have been determined by operational requirements, and located to minimize earthworks where possible.

The Railway alignment has been designed to minimize intrusion into water bodies and reduce multiple crossings of the same watercourse. A stringent evaluation procedure was used to select the appropriate structure for each water crossing, considering technical, geotechnical, environmental and cost conditions (Dillon 2008).

The Steensby Railway will consist of 149 km of rail which will run in a generally southeast direction from the

Mine Site to the Steensby Port located on the eastern shore of Steensby Inlet at the top of Foxe Basin. The

Steensby Railway will include:

- Rail line and embankment -including two tunnels, bridges and sidings
- Watercourse crossings (including 42 bridges and a large number of culvert installations)
- Yards and terminals - including loading and unloading (loop) tracks, turning tracks for the locomotives and service and storage track
- Supporting facilities - including maintenance and emergency facilities; train – including locomotives (engines) and cars; and signaling and telecommunications.

4.3.3.5 STEENSBY PORT

Facilities at Steensby Port will be located on the mainland as well as nearby Steensby Island in Steensby Inlet. Facilities at Steensby Port will include:

- Laydown areas, work areas, stockpile, and access roads
- Airstrip, beginning with a starter airstrip
- Ore dock and mooring dolphins
- Rail workshops, maintenance facilities, power plant and Water and sewage treatment plant
- Accommodations complex, and administration buildings
- Ore handling facilities which include rail car dumper, conveyor, stockpiling and ship loading facilities

4.4 PROJECT SUMMARY

A description of the Approved Project activities and components can be found in the FEIS (Baffinland 2012, Volume 3), the ERP FEIS Addendum (Baffinland 2013, Volume 3) and the PIP Applications. A brief summary of Approved Project operations is provided below including the Steensby Component.

The Project locations are shown on Figures 4.2 to Figure 4.6, and the Major Project Components are listed in Table 4.1. The current Mine site layout is shown on Figure 4.3, the Tote Road alignment is shown in Figure 4.4, Milne Port layout is shown in Figure 4.5 and Figure 4.6 shows the South Rail alignment as part of the Approved Project. The approved Steensby Port layout is presented in Appendix A. Unless otherwise noted in Section 6, all project infrastructure is intended to have a similar lifespan as that of the Project.

Figures illustrating site infrastructure that are expected to exist at the end of mining are presented in Appendix A. Aerial photos of recent (2021-2023) site conditions are presented in Appendix C.

4.4.1 OVERVIEW OF THE APPROVED PROJECT OPERATIONS

An overview of Approved Project operations is outlined below.

- **Ore Extraction and Processing at the Mine Site** – Includes ore extraction and processing at the Mine Site from Deposit No. 1.
- **Ground Transportation of Iron Ore from Mine Site to Milne Port (Tote Road)** – Includes ground transportation of iron ore by truck through the Northern Transportation Corridor (Tote Road and Milne Port) currently at a rate of 6 Mtpa and approved to continue through December 31, 2024 (Northern Transportation limits reverting back to the 4.2 Mtpa approved ERP rates after December 31, 2024 unless the Project Certificate is amended).
- **Stockpiling at Mine Port** - Infrastructure at Milne Port currently consists of an ore dock and ore stockpile area that includes a conveyor and ship loader. Delivery of iron ore from the Mine Site takes place year-round, with the material being stockpiled at Milne Port in advance of the shipping period. The material is placed in two stockpiles on-site: the lump stockpile and the fines stockpile. Iron ore is deposited directly on the ground via side-dump trailers and is then transported around the site with front-end loaders.
- **Ground Transportation of Iron Ore from Mine Site to Steensby Port (Steensby Railway)** – Includes construction and operation of an approximately 149 km long railway to transport iron ore from the Mine Site to Steensby Port. Trains drawing ore cars will be used to deliver iron ore from the Mine Site to Steensby Port and transport supplies from Steensby Port to the Mine Site on return trips.

- **Stockpiling and Processing at Steensby Port** - Includes construction and operation of facilities at Steensby Port, both on the mainland as well as nearby Steensby Island. This will include: an initial quarry, access roads and laydown areas, construction worker camps, a concrete batch plant, rail loading and unloading facilities and rail service/maintenance facilities, permanent worker accommodations, ore loading, a construction dock, ore stockpile and ship loading and unloading facilities, and an airstrip.
- **Marine Shipping** –Includes both Northern and Southern Shipping Routes, with ore-carriers ranging in size between Supramax (approximately 55,000 t), post-Panamax (94,000 t) and larger Capesize vessels (200,000 to 215,000 t). Shipping from Milne Port is currently conducted during the annual shipping period from July through end October. The shipping route from Milne Port is well-established; it extends from the head of Milne Port to pass through Milne Inlet, Eclipse Sound, and Pond Inlet into Baffin Bay before proceeding to the North Atlantic Ocean. Baffinland aims to convoy vessels whenever feasible (e.g., two or more vessels available at the staging area, along with sufficient safe anchorages). This includes ore carriers, tankers, tugs and re-supply vessels.

  Year-round marine shipping through the Southern Shipping Route will occur using the nominal Shipping Route through Foxe Basin in and out of Steensby Port along the east side of Koch and Rowley Islands to where it joins with the established shipping lanes in southern Foxe Basin accessing Sanirajak and Igloolik.

4.4.2 STEENSBY COMPONENT CONSTRUCTION ACTIVITIES

Construction activities and infrastructure components related to the Steensby Component of the Approved Project are consistent with those described and assessed in the FEIS (Volume 3, Section 2.6). It is expected that the Steensby Port facilities and the Steensby Railway will take three to four years to construct following the receipt of remaining operational permits, Project financing and a construction decision by the company. Upon completion of the Steensby Railway and Steensby Port construction, iron ore will be transported by rail and transferred to ore carrier vessels from Steensby Port for shipment to international markets. Once the construction of the Steensby Component of the Project is complete and the Steensby Railway has achieved commercial transportation rates, Baffinland will redirect all ore haulage through the Southern Transportation Corridor, with only freight and fuel deliveries to continue through the Northern Transportation Corridor, as anticipated in the original 2012 FEIS (Baffinland 2012).The Northern Transportation Corridor will be progressively reclaimed as described within Section 6.2.2.

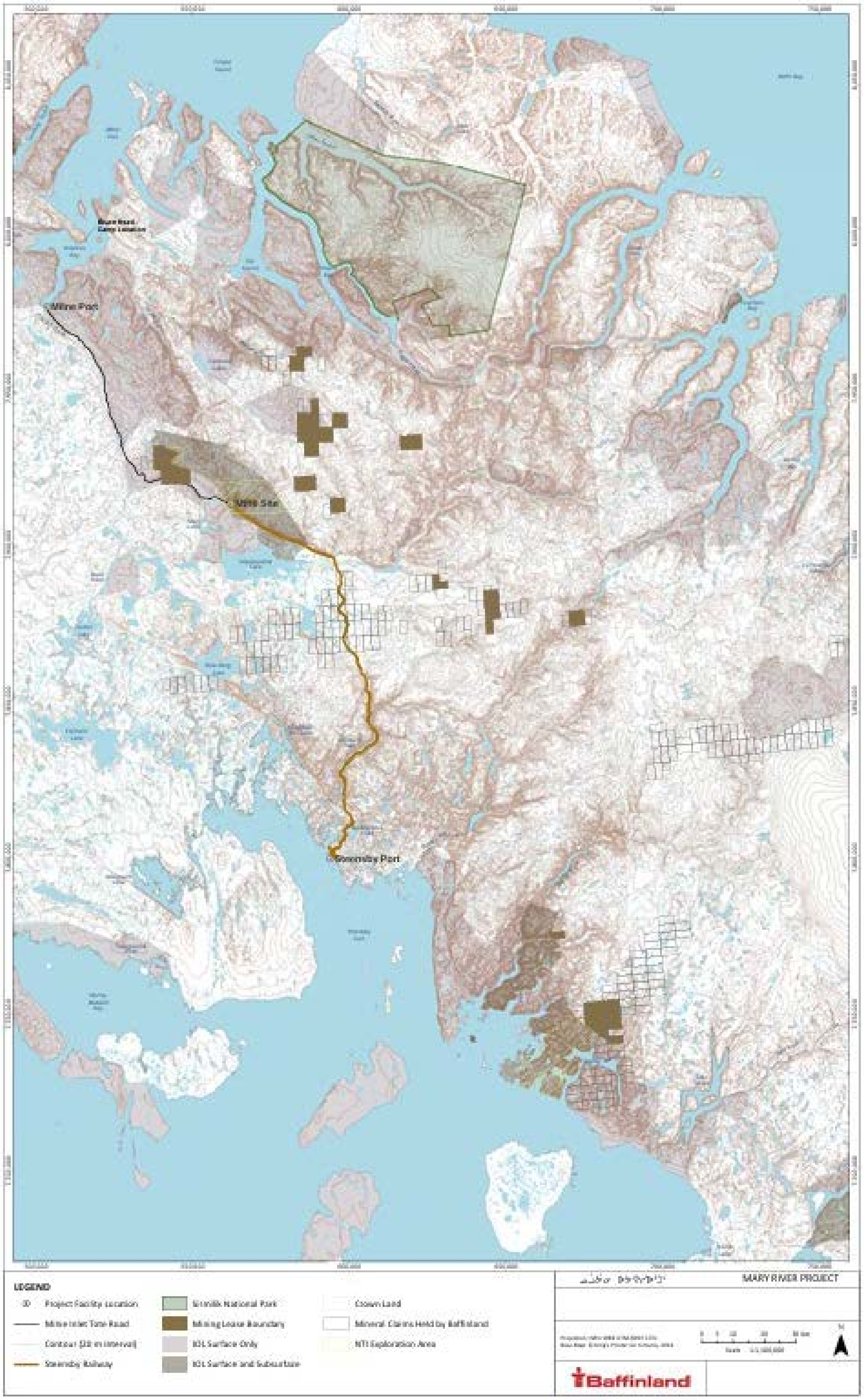


FIGURE 4.2 LOCATION OF PROJECT ACTIVITIES

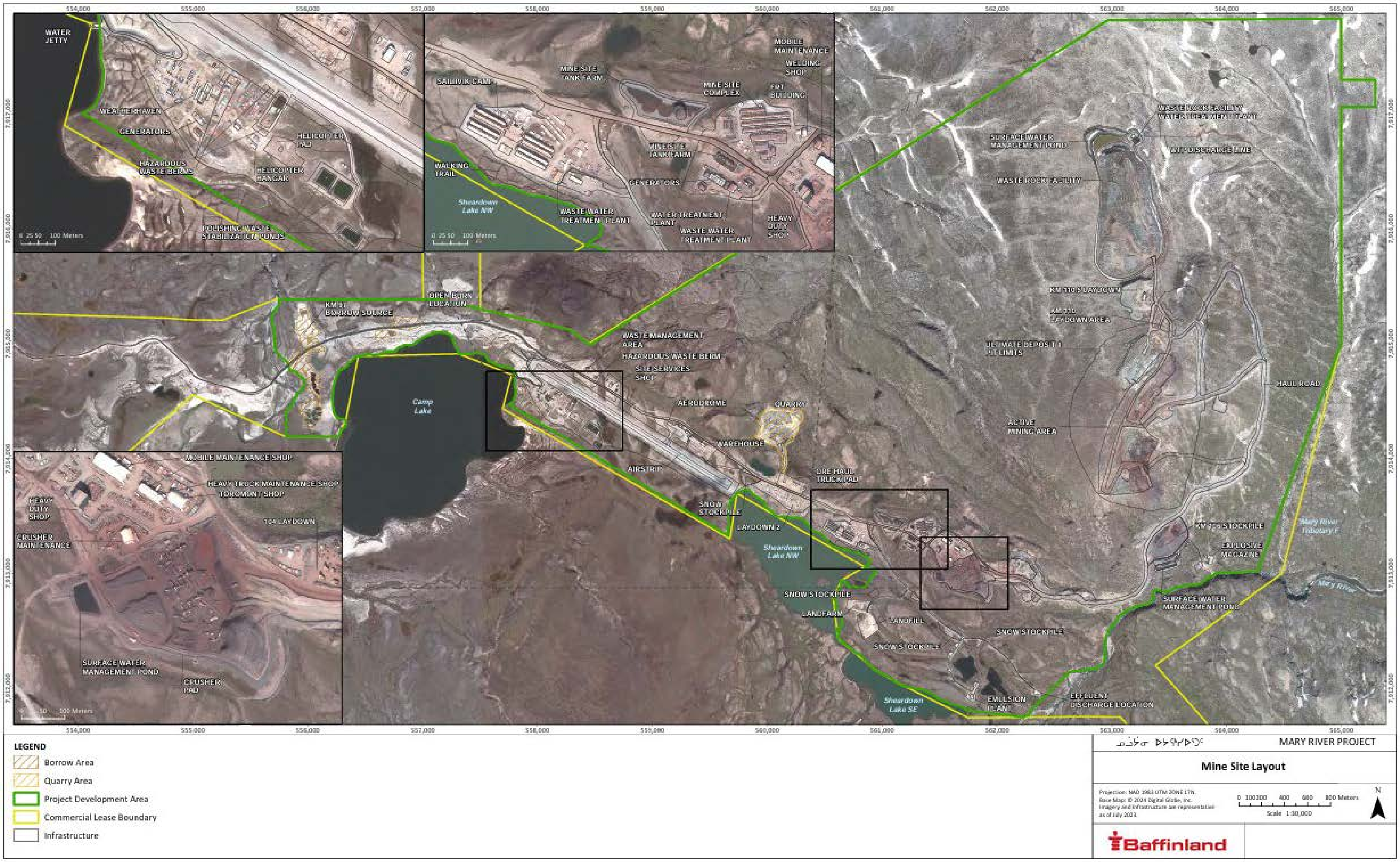


FIGURE 4.3 MINE SITE LAYOUT

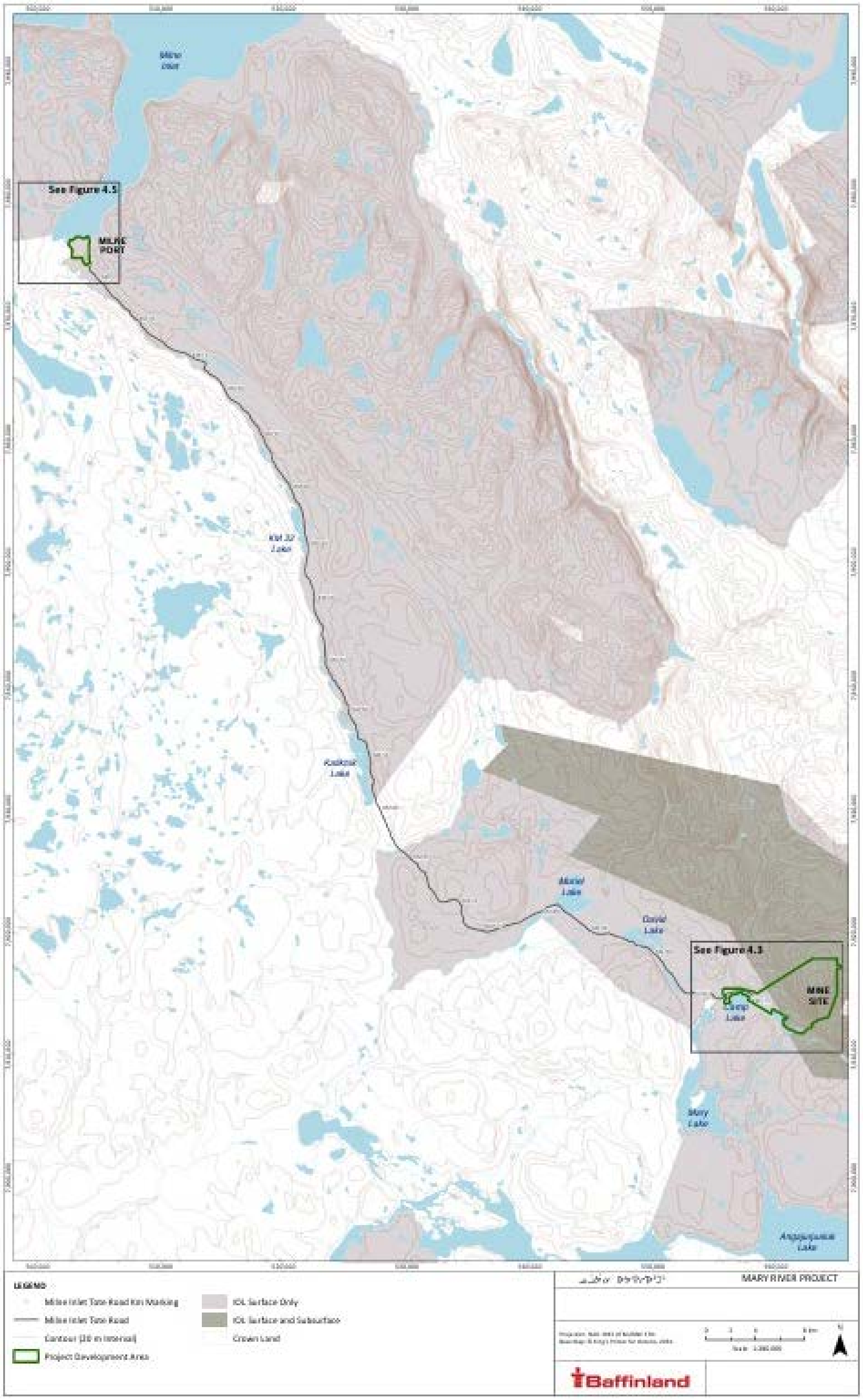


FIGURE 4.4 NORTHERN TRANSPORTATION CORRIDOR

FIGURE 4.5 MILNE PORT LAYOUT

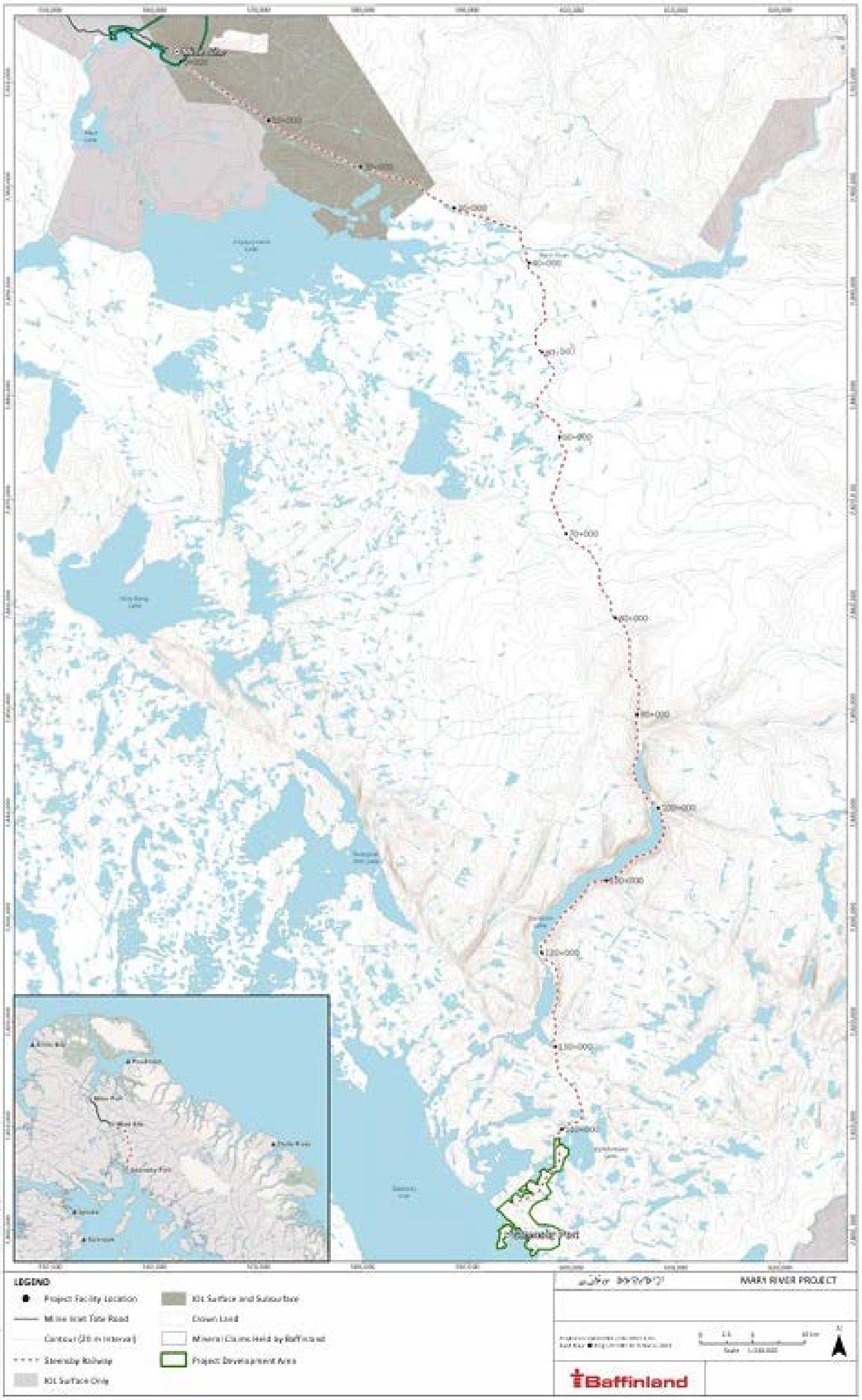


FIGURE 4.6 STEENSBY RAILWAY ALIGNMENT

TABLE 4.1 MAJOR PROJECT COMPONENTS

Major Infrastructure Components	Authorized under Project Certificate No. 005	Development Status as of October 2024	Land Ownership
Milne Port Site			
Ultimate development area	x	Ongoing	IOL
Site development, grading, roads, laydown, drainage	x	Completed	IOL
Water supply (intake, transport, storage and distribution)	x	Completed	IOL
Potable water treatment plant	x	Completed	IOL
Quarries and borrow pits	x	Ongoing	IOL
Port Site Complex (PSC) camp	x	Completed	IOL
Camp expansion (Operations 386-bed camp)	x	Completed	IOL
Sewage treatment plant and discharge	x	Completed	IOL
Polishing Waste Stabilization Pond (PWSP)	x	Completed	IOL
Incinerator	x	Completed	IOL
Service buildings (field offices, maintenance shops, vehicle wash stations, ERT, warehouses, concrete batch plant)	x	Completed	IOL
Waste management facilities including temporary storage areas	x	Completed	IOL
Landfarm	x	Completed	IOL
Power generation and distribution	x	Completed	IOL
Transitional power generation and distribution	x	Completed	IOL
Hazardous material storage areas	x	Completed	IOL
Fuel tank farm and fuel dispensing facilities (Arctic Diesel, Jet-A Fuel)	x	Completed	IOL
Fuel tank farm and fuel dispensing facilities (Marine Diesel)	x	Not Started	IOL
Ore stockpile	x	Completed	IOL
Ore handling facilities (unloading, transfer and stockpiling, reclaiming, ship loading) and associated surface runoff ponds	x	Ongoing	IOL
Ore dock	x	Completed	Crown Land
Freight dock	x	Completed	Crown land
Explosives storage	x	Completed	IOL
Tote Road			
Realignment and grade improvement	x	Ongoing	IOL/Crown
Water crossings improvement/replacement	x	Ongoing	IOL/Crown
Bridge construction	x	Completed	IOL

Major Infrastructure Components	Authorized under Project Certificate No. 005	Development Status as of October 2024	Land Ownership
Borrow Pits and Quarries	x	Ongoing	IOL/Crown
Water withdrawal for dust control	x	Ongoing	IOL
Mine Site			
Mine Site development, grading, service roads, ore haul roads, laydown, drainage and diversions	x	Completed	IOL
Camp Lake water supply (intake, transport, storage and distribution)	x	Completed	IOL
Water crossings and surface water diversions	x	Ongoing	IOL
Quarries and borrow pits	x	Ongoing	IOL
Weatherhaven Camps (early development)	x	Completed	IOL
Sewage treatment plants, PWSPs and discharge	x	Completed	IOL
Incinerator	x	Completed	IOL
Sailivik and Mine Site Complex camps	x	Completed	IOL
Service buildings (field offices, temporary or transitional construction facilities, light vehicles maintenance shops, ore trucks maintenance shops, vehicle wash stations, ERT, warehouses, concrete batch plant)	x	Completed	IOL
Mining fleet maintenance facilities	x	Completed	IOL
Mining activities	x	Ongoing	IOL
Waste rock storage with associated runoff control structure	x	Ongoing	IOL
Waste Rock Facility water treatment plant	x	Completed	IOL
Waste management facilities including temporary storage areas	x	Completed	IOL
Landfill	x	Ongoing	IOL
Landfarm	x	Ongoing	IOL
Transitional power generation and distribution	x	Completed	IOL
Power generation and distribution	x	Ongoing	IOL
Hazardous material storage areas	x	Completed	IOL
Permanent fuel tank farms and fuel dispensing facilities (Jet -A 15 ML)	x	Completed	IOL
Transitional fuel storage facilities (multiple fuel storage tanks for construction phase)	x	Ongoing	IOL
Temporary crushing facility (for ERP)	x	Ongoing	IOL
Permanent crushing facilities (for Steensby Component)	x	Not Started	IOL
Transitional ore stockpile and runoff control	x	Ongoing	IOL

Major Infrastructure Components	Authorized under Project Certificate No. 005	Development Status as of October 2024	Land Ownership
Ore stockpiling (run of mine, crushed ore) and associated runoff control ponds	x	Completed	IOL
Ore handling facilities (unloading, transfer, tertiary crushing and screening, stockpiling, reclaiming, railway loading) and associated surface runoff ponds	x	Not Started	IOL
Airstrip extension	x	Completed	IOL
Explosives storage	x	Completed	IOL
Emulsion plant	x	Completed	IOL
Steensby Railway			
Service road (up to 25 km south of Mine Site)	x	Not Started	IOL
Railway embankment (up to 25 km south of Mine Site)	x	Not Started	IOL
Borrow pits and quarries (up to 25 km south of Mine Site)	x	Not Started	IOL
Water crossings (bridges and culverts)	x	Not Started	IOL
Winter road (up to 25 km south of Mine Site)	x	Not Started	IOL
Service road	x	Not Started	Crown land
Railway embankment	x	Not Started	Crown Land
Winter road	x	Not Started	Crown Land
Railway construction and operation	x	Not Started	Crown Land
Railway construction camps, sewage treatment facilities, emergency ponds and incinerator	x	Not Started	Crown Land
Railway camps associated services facilities	x	Not Started	Crown Land
Water crossings (bridges and culverts)	x	Not Started	Crown Land
Multiple construction fuel storage units	x	Not Started	Crown Land
Mobile explosive units	x	Not Started	Crown Land
Tunnel construction and disposal of waste rock	x	Not Started	Crown Land
Borrow pits and quarries	x	Not Started	Crown Land
Steensby Port Site			
Site development, grading, roads, laydown, drainage	x	Not Started	Crown Land
Water supply (intake, transport, storage and distribution)	x	Not Started	Crown Land
Water crossings and diversions	x	Not Started	Crown Land
Quarries and borrow pits	x	Not Started	Crown Land
Camp	x	Not Started	Crown Land
Sewage treatment plant, PWSPs and discharge	x	Not Started	Crown Land

Major Infrastructure Components	Authorized under Project Certificate No. 005	Development Status as of October 2024	Land Ownership
Incinerator	x	Not Started	Crown Land
Service buildings (field offices, temporary construction facilities, light vehicles maintenance shops, ore trucks maintenance shops, vehicle wash stations, ERT, warehouses, concrete batch plant)	x	Not Started	Crown Land
Waste management facilities including temporary storage areas	x	Not Started	Crown Land
Landfill	x	Not Started	Crown Land
Landfarm	x	Not Started	Crown Land
Power generation and distribution	x	Not Started	Crown Land
Hazardous material storage areas	x	Not Started	Crown Land
Fuel tank farms and fuel dispensing facilities (Arctic Diesel, Jet A-Fuel and Marine Diesel)	x	Not Started	Crown Land
Railway switch yard	x	Not Started	Crown Land
Railway terminal maintenance shop	x	Not Started	Crown Land
Ore stockpile	x	Not Started	Crown Land
Ore handling facilities (unloading, transfer, tertiary crushing and screening, stockpiling, reclaiming, ship loading) and associated surface runoff ponds	x	Not Started	Crown Land
Ore dock	x	Not Started	Crown Land
Construction dock	x	Not Started	Crown Land
Airstrip	x	Not Started	Crown Land
Explosives storage	x	Not Started	Crown Land
Emulsion plant	x	Not Started	Crown Land

NOTES:

1. Includes additional authorizations under Type A Water Licence 2AM-MRY1325.
2. Ongoing items may refer to existing infrastructure which will be modified and/or expanded To support current operations

4.4.3 SITE PLANS

The Mine Site, Milne Port and Steensby Port, final connecting infrastructure and principal camp locations are shown on the series of drawings in Appendix A and described in Table 4.3. These figures represent the intended site layouts upon completion of Project operations including the Steensby Component. Project components that are planned to be progressively rehabilitated following the construction phase are quantified separately, as are components that are located on Inuit Owned Land.

There has been no change to the closure strategy for the approved Steensby Component of the Project (as approved under the Project Certificate No. 005). For drawings to account for interim closure and reclamation adjustments to reflect project development phases until such a time as planned closure commences, see documents/figures associated with the Annual Security Review (ASR) process conducted in accordance with Schedule C of Type A Water Licence 2AM-MRY1325 and Section 9.2 of the Commercial Lease, No. Q13C301, agreed to between Baffinland and the QIA.

Until such time the Steensby Component of the Project commences, Steensby Camp and other explorations camps along the proposed Steensby Railway corridor and exploration areas will be governed by the Exploration Closure and Reclamation Plan (BAF-PH1-830-P16-0038).

TABLE 4.3: DRAWINGS FOR MINE CLOSURE AND RECLAMATION

Drawing Number	Drawing Title
E349000-2000-07-014-00001	Areas of Reclamation – Milne Port Layout
H337697-0000-07-126-0014 (Figure 8.10)	Preliminary Mine Closure and Reclamation Plan – Tote Road
H337697-4210-07-012-0001	Preliminary Mine Closure and Reclamation Plan – Mine Site Construction Phase
H337697-4210-07-012-0002	Preliminary Mine Closure and Reclamation Plan – Mine Site Final Closure Phase
H337697-2000-07-012-0001	Preliminary Mine Closure and Reclamation Plan – Railway Alignment
H337697-7000-07-012-0002	Preliminary Mine Closure and Reclamation Plan – Ravn River Rail Camp
H337697-7000-07-012-0003	Preliminary Mine Closure and Reclamation Plan – North Cockburn Camp – Tunnels
H337697-7000-07-012-0004	Preliminary Mine Closure and Reclamation Plan – South Cockburn Lake Rail Camp
H337697-4510-07-012-0001	Preliminary Mine Closure and Reclamation Plan – Steensby Port Construction Phase
H337697-4510-07-012-0002	Preliminary Mine Closure and Reclamation Plan – Steensby Port Final Closure Phase

4.5 INUIT OWNED LANDS AND LAND ACCESS

The Inuit Owned Lands (IOL) surrounding the Project area are shown on Figure 4.2. The Commercial Lease, No. Q13C301, is held by Baffinland and is leased from the Qikiqtani Inuit Association (QIA). In accordance with this and any future surface leases held with the QIA, this ICRP incorporates the guidelines developed for the Qikiqtani lands entitled the *Abandonment and Reclamation (A&R) Policy for Inuit Owned Lands* (QIA, 2024). The QIA guidelines used for this ICRP are summarized in Appendix B. Milne Port and the Mine Site are located entirely on IOL. The Tote Road is mostly on IOL except for an approximate 5-km section that is on Crown Land. The first 25 km of the Steensby Railway and access roads out of the mine are located on IOL. The remainder of the Steensby Railway and Steensby Port are located on Crown land.

5.0 PERMANENT CLOSURE AND RECLAMATION

The following section outlines interim plans for permanent closure of the Mary River Mine. As presented in SOP2, mining operations at Deposit No.1 are expected to continue until at least 2051.

5.1 DEFINITION OF PERMANENT CLOSURE AND RECLAMATION

Permanent closure is defined in the *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories* (MVLWB/AANDC, 2013) as follows:

> *"Permanent closure is the final closure of a mine site with no foreseeable intent by the existing proponent to return to either active exploration or mining."*

Reclamation is defined in the MVLWB/AANDC Guidelines as follows:

> *"The process of returning a disturbed site to its natural state or which prepares it for other productive uses that prevents or minimizes any adverse effects on the environment or threats to human health and safety."*

Baffinland acknowledges that due to various economic drivers (commodity prices, escalation of construction and production costs, extended maintenance shutdown, others), Baffinland may be forced into a temporary or permanent closure scenario. For planning purposes, Baffinland defines two types of temporary closure as follows:

- **Short-term Closure (described in Sections 7.1 and 7.2):** Cease commercial operation for a period of up to one (1) year while maintaining all equipment and facilities in a state of readiness to resume operation with minimal delay or have project components at the ready for use to support closure activities.
- **Long-term Closure (described in Sections 7.3 and 7.4):** Extension of a short-term closure to over (1) year for an indefinite period while all Project sites are maintained in a secure condition and all facilities and equipment are de-energized and winterized until the operation resumes or the site is reclaimed as part of permanent closure.

Consideration of future land use is an important closure principle in the continuous refinement of this ICRP. To date, ongoing and future land use has been considered in numerous aspects of the mine planning, such as:

- Adopting environmental management best practices during mining to reduce impacts where possible
- Accommodating certain Inuit requests for participating in environmental monitoring efforts (e.g., Ship Observer Program)
- Development of additional management plans to address specific land user concerns (e.g., ballast water management)
- Development of environmental site assessment and landfarm performance research programs;
- Major project considerations such as the avoidance of winter shipping during operations;
- Facilitating travel through the Northern Transportation Corridor, including the Tote Road, during mining operations
- Various planned reclamation activities, such as:
    - Scarification to promote natural revegetation
    - Removal of above-grade buildings
    - Re-establishing pre-existing drainage pathways where practical
- Clean up of pre-existing waste (e.g., non-hazardous debris and hazardous waste storage areas) at Mary River

Moving forward Baffinland will seek further input from communities on potential closure options that promote the desired post-closure land use. Feedback via engagement activities will be compiled and considered within the MCTAG to identify feasible options that can be incorporated into future revisions of the ICRP as detailed within Section 2.4. Baffinland has committed to several closure objectives focusing on land use, which are presented in Table 5.1.

In keeping with the closure principles, the objectives and criteria presented below avoid introducing designs which would require long-term active care. This closure principle was adopted with the inclusion of the MVLWB Guidelines following the preparation of the PCRP and FEIS process, resulting in a modified closure approach at the open pit from long-term passive flooding to include a combination of natural flooding and pumping.

Climate change considerations

Baffinland recognizes that the Company has a role to play in reducing its energy use and emissions and is aware that arctic environments are changing, which is a concern to Inuit. The newest Climate Change Strategy was finalized in March 2023 (Baffinland, 2023a). Baffinland's overarching climate change aspiration, building upon its existing mission statement, is to become 'the lowest-cost, low carbon producer of high-grade iron ore in the world'. Within the new Climate Change Strategy, Baffinland has established two (2) goals with associated actions to support achievement of its Climate Change Strategy:

1. Improve energy efficiency and forge a path to decarbonization; and
2. Monitor changes in climate and associated risks to inform adaptation and closure strategies.

The new Strategy recognizes the role that Inuit want to take to monitor climate change and associated impacts and has integrated these considerations into its supporting actions. Since being finalised in early 2023, Baffinland has been working to implement initiatives that support the two goals of the strategy. This includes the Fuel Reduction Program through Baffinland's Continuous Improvement Department and the implementation of Rapid Improvement Opportunities. A noted strength of the Strategy is its commitment to climate scenario analysis. Baffinland will prioritize climate scenario analysis in its strategy implementation roadmaps and included the specific consideration for adaptation planning to cover the full mine life, including closure.

- As part of ongoing engagement activities, various annual reporting review processes and operational activities, Baffinland will provide status updates on implementation, and will continue to refine its implementation roadmaps as new opportunities and/or priority areas are identified over time. Accordingly, Baffinland's path to decarbonization is expected to evolve over time based on the latest operational realities.

5.2 CLOSURE OBJECTIVES AND CRITERIA

A description of the closure criteria and applicable monitoring program that is proposed to be implemented to confirm that the objectives were met for each Project component is summarized in Table 5.1 for permanent and temporary closure. In addition to the specific criteria listed below to measure reclamation success, QIA's approval is also required to achieve mine closure as a condition of the Commercial Lease (Q13C301).

As the Project is in the initial years of operations, closure planning is expected to be refined over time using findings from the ongoing and planned engagement efforts described in Section 2.4 of this document(e.g., MCTAG, Inuit Committees), site-specific operational knowledge, environmental monitoring programs, progressive reclamation, and reclamation research studies. Traditional knowledge and community expectations for future human and wildlife, and clean water use have been considered and incorporated in closure planning and will continue to be as closure engagement extends and evolves.

An important aspect of ongoing closure planning will be periodic assessment of predicted impacts to the biophysical environment, and the assumed reclamation performance for planned closure activities. This process will reduce uncertainties in post-closure conditions and allow for increasing detail in the closure design leading up to a FCRP. As outlined in the Project Certificate No. 005, one of the primary purposes of the NIRB Monitoring Program for the Project is to assess the accuracy of predictions contained in the environmental impact statements. As a result, the findings of Baffinland's ongoing monitoring and management plans are compared to the predictions made as part of the FEIS and its addendums on a continual basis within the NIRB annual reporting process which allows for comment by Project stakeholders. Project residual effects have also been assessed as part of the ERP FEIS Addendum (Baffinland 2013) and subsequent addenda for the PIP (2018), PIPE (2020), PIP Renewal (2022), SOP (2023) and SOP2 (2024) applications. These assessments have predicted little to no changes in residual effects from the original FEIS assessment. In addition, monitoring of project effects from six years of operating at 6 Mtpa (2018 – 2023) across all VECs have generally confirmed that residual effects are within the predictions contained with the FEIS and addendums for the Approved Project and no significant adverse effects have been identified. A summary of the current predicted residual effects of the Approved Project on all VECs at closure is provided in Appendix G.

Tracking and understanding of project impacts/effects is also a focus of the Marine and Terrestrial Environment Working Groups (MEWG, TEWG). These processes and groups are expected to play important roles in informing ongoing closure planning and ICRP updates.

TABLE 5.1 CLOSURE OBJECTIVES, CRITERIA AND ACTIONS BY MAJOR PROJECT COMPONENTS

Project Component	Closure Objectives	Closure Criteria	Actions/Measurements
Site Wide[2]	Drainage pathways for surface runoff are physically stable to limit risk to humans and receiving environment[1]	Drainage pathways will be designed by a professional engineer for long-term stability to mitigate against erosion. Closure conveyance structures will be designed based on revised return periods established using the latest site hydrology data in time for development of the Final Closure and Reclamation Plan. No significant signs of deformation, degradation and/or erosion and sedimentation which could contribute to physically unstable conditions as visually observed during geotechnical inspections by a qualified professional engineer. Inspection criteria and schedule will be refined based on the final engineering designs for site grading and specific engineered drainage controls.	Geotechnical assessment, analysis and/or monitoring of the drainage pathways will occur as part of the Geotechnical/Engineering Monitoring Program (Section 9.4). Surface water quality monitoring will be completed post-closure at applicable drainage pathways to ensure all relevant closure objectives and criteria have been met. See closure objective relating to Site Wide Surface Water.
	Mine areas are physically stable for use by humans and receiving environment[1]	No significant signs of deformation or degradation at remaining engineered structures and/or other disturbed areas which could contribute to physically unstable conditions. This will be confirmed by visual monitoring as part of site geotechnical inspections. Inspection criteria and will be refined based on the post-closure stability assessment for remaining mine structures and Final Grading Plan.	Geotechnical assessment, analysis and/or monitoring of the mine areas will occur as part of the Geotechnical/Engineering Monitoring Program (Section 9.4). The expected level of effort associated with the different mine areas is included in Section 9. Monitoring scope and duration will be informed by operational performance results where possible and detailed in the final grading and engineering designs for remaining structures.
	Surface water runoff and seepage that is safe for humans and the receiving environment[1]	Closure water quality meets Type A Water Licence effluent criteria, territorial/federal guidelines, MDMER, and/or site-specific risk-based criteria, as relevant to the specific mine areas and components. At present, water quality predictions for the open pit and WRF discharges and receiving waterbodies indicate that risk-based criteria and/or risk management strategies may be required. Criteria will be refined based on water quality monitoring results during operations and research studies.	Monitoring activities as part of the Closure and Post-Closure Aquatic Monitoring and Reporting Program. Specific testing parameters, frequencies, locations and program durations will be refined over time based on findings of operational monitoring programs and research studies.
	Remaining area will be safe for humans and the receiving environment[1]	No buildings or equipment remain above surface grade following final closure (excluding Ore Docks and Tote Road). Completion of an approved Final Grading Plan that has considered input from MCTAG. This criterion is supplemented by several other closure criteria focusing on additional aspects of closure (e.g., chemical and physical stability). Areas with risk to humans, terrestrial wildlife and/or aquatic biota will be managed to reduce hazards to an acceptable level. These criteria will be refined based on the results of planned research studies. Additional, more specific criteria may be added prior to closure to focus on activities such as fish consumption and drinking water quality in particular areas of interest (e.g., Mary's River, Sheardown Lake). These additions will require updated residual effect predictions.	Geotechnical assessment, analysis and/or monitoring of the mine areas will occur as part of the Geotechnical/Engineering Monitoring Program (Section 9.4). The expected level of effort associated with the different mine areas is included in Section 9. Monitoring activities as part of the Closure and Post-Closure Aquatic Monitoring and Reporting Program and Post-Closure Fauna and Flora Monitoring. Final inspection by a qualified professional[3] and representative of Designated Inuit Organization.
Site Wide[2] **(continued)**	Area facilitates the desired wildlife movement	Completion of an approved Final Grading Plan that has considered input from MCTAG. To the extent possible, disturbed areas to be scarified to promote natural revegetation. Use of the site by wildlife (i.e., birds, mammals) will be consistent with FEIS, or updated predictions. Detailed metrics will be developed in concert with MCTAG and included in the FCRP. Current residual effect predictions for individual wildlife and specific site areas are presented in Appendix G.	Geotechnical assessment, analysis and/or monitoring of the mine areas will occur as part of the Geotechnical/Engineering Monitoring Program (Section 9.2). The expected level of effort associated with the different mine areas is included in Section 9.2 Final inspection by a qualified professional[3] and representative of Designated Inuit Organization. Post-closure flora and fauna monitoring (Section 9.5) will address selected metrics to assess wildlife presence and use in comparison with FEIS or updated impact predictions.
	Air quality safe for humans and wildlife	Mean Total Suspended Particulate concentrations and $PM_{2.5}$ closure criteria will be developed based on site-specific risk-based criteria, in consideration of the NU Ambient Air Quality Standard).	Post-closure dustfall and active ambient monitoring at appropriate locations, for a limited duration post-closure as part of the Air Quality Monitoring Program (Section 9.9). These criteria will be developed no later than five years prior to closure.
	Natural revegetation is promoted	Grading and scarification completed as outlined by an approved Final Grading Plan. Baffinland has committed to completing reclamation activities that will promote natural revegetation over long timelines, but specific criteria or goals for vegetation growth post-closure are not planned.	Final inspection by a qualified professional[3] and representative of Designated Inuit Organization.

Project Component	Closure Objectives	Closure Criteria	Actions/Measurements
	Aesthetic conditions of the project areas are similar to surrounding natural conditions	No visible buildings, equipment, or non-local materials. This excludes structures remaining at, and below grade (i.e., concrete foundations) and those which stakeholders have agreed should remain post-closure, such as the Ore Dock, Tote Road, and select water crossing abutments. Final grading reflects surrounding topography where possible (i.e., limit steep slopes) and re-establish pre-existing drainage pathways. Activities to promote natural revegetation to the extent possible as outlined in the Final Grading Plan. Criteria may be refined through discussions in the MCTAG.	Final inspection by a qualified professional[3] and representative of Designated Inuit Organization.
	Inuit-defined Objectives	Objectives, criteria and actions will be defined through implementation of the Closure and Reclamation Engagement Strategy.	To be determined through engagement with the ISP and Inuit Committees
Open Pit and Mine Workings (Including Spillway (to remain post-closure)	Physically stable open pit mine workings and spillway to limit risk of failure that could impact humans and receiving environment[1].	Final open pit, mine workings and spillway are within final long-term stability assessment assumptions/design constraints. No visual indications of significant deformation and degradation is observed during final inspections by a professional engineer. Inspection/monitoring criteria and schedule will be refined based on the final engineering assessments.	Geotechnical assessment, analysis and/or monitoring of the open pit, mine workings and spillway will occur as part of the Geotechnical/ Engineering Monitoring Program (Section 9.4). The expected level of effort associated with the different mine areas is included in Section 9.4 Final inspection completed by Inspector of Mines (WSCC).
	Open pit lake water quality is not a risk to humans and receiving environment[1]	The FEIS predictions for pit water quality indicate that there could be potential exceedances for substances that could cause a risk to humans (such as mercury) and the receiving environment (Appendix H, Table 4). To understand this potential risk and mitigation/management options further, Baffinland plans to refine the Open Pit flooding estimates and water quality predictions in the future using site data. This work is required to develop meaningful criteria.	Monitoring activities as part of the Closure and Post-Closure Aquatic Monitoring and Reporting Program and Post-Closure Fauna and Flora Monitoring (Section 9.5, 9.7). Specific testing parameters, frequencies, locations and program durations will be developed over time based on findings of operational monitoring programs and pit flooding and water quality research studies (Appendix D).
	Surface runoff and seepage water quality is safe for humans and receiving environment[1].	Achieve "Recognized Closed Mine" status per Section 4 of MDMER. Effluent discharge quality is consistent or improved from the initial FEIS predictions. To understand this potential risk and mitigation/management options further, Baffinland plans to refine the Pit flooding estimates and water quality predictions in the future using site data. This work is required to develop meaningful criteria.	Monitoring activities as part of the Closure and Post-Closure Aquatic Monitoring and Reporting Program and Post-Closure Fauna and Flora Monitoring (Section 9.5, 9.7). Specific testing parameters, frequencies, locations and program durations will be developed over time based on findings of operational monitoring programs and pit flooding and water quality research studies (Appendix D).
	Inuit-defined Objectives	Objectives, criteria and actions will be defined through implementation of the Closure and Reclamation Engagement Strategy.	To be determined through engagement with the ISP and Inuit Committees
Waste Rock Facility	Physically stable Waste Rock Facility and to limit risk of failure that would impact humans and receiving environment[1].	Final WRF is within final long-term stability assessment assumptions/design constraints. No visual indications of significant deformation and degradation is observed during final inspections by a professional engineer. Inspection/monitoring criteria and schedule will be refined based on the final engineering assessments.	Geotechnical assessment, analysis and/or monitoring of the WRF will occur as part of the Geotechnical/Engineering Monitoring Program (Section 9.4). The expected level of effort associated with the different mine areas is included in Section 9.4
	Chemically stable Waste Rock Facility to limit risk of failure that would impact humans and receiving environment[1].	Confirmation of PAG placement has occurred as outlined in the approved management plans. Effluent discharge quality is consistent or improved from FEIS predictions. Achieve "Recognized Closed Mine" status per Section 4 of MDMER. To understand this potential risk and mitigation/management options further, Baffinland plans to refine the water quality predictions in the future using site data. This work is required to develop meaningful criteria.	As-built drawing and confirmatory geochemical sampling results (confirming PAG placement) is deemed acceptable by a professional engineer. Monitoring activities as part of the Closure and Post-Closure Aquatic Monitoring Program. Specific testing parameters, frequencies, locations and program durations will be developed over time based on findings of operational monitoring programs and water quality research studies (Appendix D).
	Inuit-defined Objectives	Objectives, criteria and actions will be defined through implementation of the Closure and Reclamation Engagement Strategy.	To be determined through engagement with the ISP and Inuit Committees
Infrastructure and Ancillary Areas **Subcomponents:** **Quarries and Stockpiles**	Physically stable disturbed areas to limit risk of failure that would impact humans and receiving environment[1]	No significant signs of deformation or degradation at remaining engineered structures (e.g., Tote Road sections and select abutments at water crossings, Ore Docks) and/or other disturbed areas (e.g., quarries, laydowns, decommissioned landfills and landfarms) which could contribute to physically unstable conditions. This will be confirmed by visual monitoring as part of site geotechnical inspections. Surface contouring at disturbed areas is completed as outlined in an approved Final Grading Plan.	Geotechnical assessment, analysis and/or monitoring of the infrastructure and ancillary areas will occur as part of the Geotechnical/Engineering Monitoring Program (Section 9.4). The expected level of effort associated with the different mine areas is included in Section 9.4.

Project Component	Closure Objectives	Closure Criteria	Actions/Measurements
Buildings and Equipment **Mine Infrastructure (e.g. pads and laydowns, secondary roads, airstrip, crusher)** **Transportation Routes (Tote Road, North Railway, Steensby Railway, and Docks)** **Waste Management Areas (e.g. landfarms and landfills)** **Water Management Areas (water treatment systems, settling ponds, pit dewatering system)** **Quarries and borrow areas**	Chemically stable disturbed areas to limit risk impact to humans and receiving environment[1]	Chemical contaminant sources are removed from site. Residual soils meet federal/territorial soil quality guidelines or site-specific risk-based criteria as required (CCME agricultural is assumed at this time). If soil exceeds the adopted criteria, it will be removed, or risk managed to the satisfaction of a qualified professional[3] to achieve protection of ecological and human health. For areas such as quarries and landfills that will have runoff, closure runoff water quality meets territorial/federal guidelines and/or site-specific risk-based criteria. Mine areas subject to MDMER (e.g., crusher area). Criteria used to determine whether non-hazardous materials are disposed of on-site or off-site will include: - space required/available in on-site landfills or other approved waste disposal locations - logistical constraints/level of effort required for on-site vs. off-site disposal options - cost of on-site vs. off-site disposal options - input from the MCTAG - input from the Inuit Commitees	Post-Closure Site Assessment will include an ESA component at potentially impacted areas (e.g. equipment and fuel storage areas). If required, HHERA would also be undertaken. Monitoring activities as part of the Closure and Post-Closure Aquatic Monitoring Program. Specific testing parameters, frequencies, locations, and program durations will be refined over time based on findings of operational monitoring programs and research studies.
	Inuit-defined Objectives	Objectives, criteria and actions will be defined through implementation of the Closure and Reclamation Engagement Strategy.	To be determined through engagement with the ISP and Inuit Committees

NOTES:

1. Receiving Environment – includes aquatic (freshwater and marine) biota and terrestrial biota.
2. Site Wide project component – Discussion under this heading includes all project areas.
3. Qualified Professional assumes a minimum of 3 years experience in the relevant field.
4. No closure activities are anticipated for the marine environment, consequently no specific closure objectives have been included. Future updates here may be completed as informed by the MEWG.

5.3 PERMANENT CLOSURE AND RECLAMATION REQUIREMENTS

The closure and reclamation approach for the Project was developed based on:

- *Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the NWT* (MVLWB/AANDC, 2013); and
- *Abandonment and Reclamation Policy for Inuit Owned Lands* (QIA, 2013).

It adheres to generally accepted rehabilitation criteria and focuses on both physical and chemical stabilization of the site. Land disturbances not needed to support active operations will be concurrently reclaimed.

The main work items for final mine closure and reclamation include:

- Filling the open pit with water to stabilize the pit walls and mitigate falling hazards.
- Installation of a boulder fence and signage around the open pit to prevent inadvertent access.
- Removal of all mining and transportation infrastructure other than the open pit, WRF, Milne Inlet Tote Road, and Milne Port docks. The Milne Inlet Tote Road and Milne Port docks will be left in place after the Project life, but not maintained.
- Demolition and removal of all buildings and foundations.
- All mining materials and equipment will either be removed from site or disposed of in on-site landfills/approved waste disposal areas.
- Removal of all hazardous materials and wastes will be removed from site to Licenced disposal facilities.
- Storage of non-hazardous wastes on site.
- Capping of all landfills and other disposal areas.
- Removal of water management systems and infilling of mine water ponds.
- Roads, railways, and development areas will be re-contoured as required to provide long-term stability and reduce the potential for erosion.
- The airstrip will have lighting and mechanical infrastructure removed, and will be stabilized as geotechnical investigations require. The airstrip base will remain.
- Removal of water crossings and regrading of disturbed project areas to restore natural drainage patterns.
- Scarification of disturbed areas of former mine infrastructure to encourage natural revegetation.
- Monitoring during closure and post-closure up until the post-closure site assessment shows that the closure works been successful in meeting the closure criteria.

These following sub-sections describe each of the mine components, a general description of the current closure concepts for each component and what options were considered, the main closure activities identified to date, key uncertainties with respect to the closure and management, monitoring of the project component following closure.

Project components will be considered closed and reclaimed when closure criteria outlined in Section 5.2 are met. As the Project advances through the detailed design phase, changes to the Project may occur that will alter the ICRP. Though changes may occur, at this time it is anticipated that the major components of the Project will remain the same.

5.3.1 OPEN PIT MINE WORKINGS

5.3.1.1 PROJECT COMPONENT DESCRIPTION

There currently is no open pit, although further evolution is expected as per the following section. The current mine workings consist of a hillside cut, with runoff managed in a localized sump (570 Sump), which is pumped to the WRF. Appendix C provides a photolog showing aerial views of the existing site conditions at Deposit 1 and the current mining operations. An open pit is not expected to exist prior to 2034.

5.3.1.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The pre-disturbance, baseline site conditions are summarized in Section 3.0 of this document.

Mining commenced on a hill crest outcrop and will progress until 2034 at the earliest (based on historic and projected production rates) before an open pit is formed. The mine plans call for conventional open-pit mining methods utilizing 7.5 m benches. Ore is delivered to the primary crusher (discussed in Section 5.2.5) located south of the deposit via the east main haul road.

The general configuration of the waste rock dump at final closure are presented in Figure 5.1. Current estimates for the final open pit include a footprint of approximately 1 km by 1.75 km wide with roughly 200 m average depth. The final site condition of the open pit will be a pit lake that will drain to the natural environment through the spillway and natural drainage from the southeast corner of the open pit (KP 2008). It is anticipated that the discharge from the open pit will not require treatment (AMEC 2010), although there is some uncertainty in this prediction (see section 5.3.1.7) and consequently Baffinland has identified this as a focus of their Reclamation Research Program (Appendix D).

The predictions of residual environmental effects presented in the FEIS assumed that upon cessation of operations, the perimeter of the open pit would be barricaded and remain restricted. The need for this restriction is uncertain and will be assessed during ongoing closure planning.

FIGURE 5.1 GENERAL LAYOUT AND DEVELOPMENT OF DEPOSIT 1 PIT

5.3.1.3 CLOSURE OBJECTIVES AND CRITERIA

Based on the closure goals and principles (Section 2.2), three closure objectives were identified for the closure and reclamation of the open pit. Closure objectives are presented in Section 5.2 and closure criteria are presented in Table 5.1.

5.3.1.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

BIM considered two options to address closure objectives for the open pit relating to ensuring the site is physically stable against pit wall slope failure and mitigating the falling risk the void poses to humans and wildlife. These options include:

- Backfilling the open pit with waste rock; and
- Filling the pit with water (flooding).

Backfilling of open pits at closure is rarely conducted at mine sites due to the high cost even when sufficient materials are present on the property. The open pit at final closure will have an estimated volume of 43,400,000 m^3 below the lip of the pit and backfilling this volume of material into the pit is not considered economically viable.

Flooding the pit was found to be more economically viable. The timeline for this process is uncertain, but preliminary estimates suggest that passive pit flooding with water from natural sources such as seepage into the pit, direct precipitation and surface runoff may take between 85 to 150 years (KP 2008). As such an enhanced pit filling alternative (i.e., active pumping) has also been assessed and suggests that pit filling could be completed in as few as 2 years. This is discussed below in greater detail.

The mining plan and the ongoing waste rock characterization plan will inform the prediction modeling of the mine pit water quality at the end of mine life, Appendix D1 provides additional information about the planned and ongoing research. Should the modeling indicate potential exceedance of water quality objectives due to prolonged oxidation of the pit walls, alternative pit filling scenarios will be considered to mitigate this effect, including accelerated pit filling. The discussion below regarding accelerated pit filling is largely theoretical as there will be significant limitations and challenges to undertaking an ongoing, year-round pumping operation on the scale that would be required.

Enhanced Pit Filling Alternative

The filling of the pit can be accelerated via pumping water from a nearby water source – thereby complementing the accumulation of natural precipitation and ground water accumulation.

Assisted pit filling is governed by two parameters – technical limitations that drive pumping costs and water source locations/drawdown limits. Costs are driven by materials and equipment required for the operation (e.g., heat-traced piping, pumps, generators, and fuel requirements) as well as the construction and maintenance of the necessary roads and berms. Pumping water to the pit is uphill and therefore significant elevation head will provide technical challenges to any pumping design. Water source drawdown limits are designed to ensure that the volume of water extracted from a given source does not significantly lower the water table and has minimal impact on the aquatic ecosystem. Key factors to consider when calculating maximum acceptable drawdown of a lake include potential spawning habitat as well as the residency time of the water body. The Department of Fisheries and Ocean (DFO) *Protocol for Winter Water Withdrawal from Ice-covered water bodies in the Northwest Territories and Nunavut* (DFO, 2010) recommends, in the absence of a waterbody-specific assessment, that water withdrawals should not exceed 10% of the under-ice lake water volume. Using this guidance as a proxy, Baffinland evaluated potential lake water sources for pit filling using annual water withdrawal of 10% of the total lake volume. Another consideration is distance to the pit and level terrain, in order to reduce pumping costs.

The Project pit has identified four potential water sources that can theoretically be used for filling the pit – Sheardown Lake, Camp Lake, Mary Lake, and Mary River. This information is summarized in Table 5.2.

TABLE 5.2 POTENTIAL WATER SOURCE PIT FILL DATA (CONCEPTUAL LEVEL)

Water Source	Pumping Distance	Total Volume/ Annual Flow (m^3)	Permissible Annual Water Take (m^3)	Number of Years to Fill Pit
Sheardown Lake (NW Basin)	2 km	8,175,410[1]	820,000	53
Camp Lake	4.7 km	27,511,100[2]	3,000,000	15
Mary Lake	12 km	169,606,250[3]	11,200,000	4
Mary River (at MR-12, east pond discharge location)	< 1 km	78,185,678 (mean)[4] 53,166,261 (10-year dry)[4]	23,000,000 (30% of Mean Annual Discharge)	2

NOTES:

1. Based on Mary River Project FEIS, Appendix 7C, Figure 4.1-3.
2. Based on Mary River Project FEIS, Appendix 7C, Figure 4.1-1.
3. Based on Mary River Project FEIS, Appendix 7C, Figure 4.1-7.
4. Based on Mary River Project FEIS, Volume 7, Table 7-3.18 – Calculated from the Mary River MAD plus annual inputs from the east pond.

Sheardown Lake and Camp Lake are closer to the proposed final pit at 2 km and 4.7 km respectively, as opposed to Mary Lake which is 12 km from the pit. This results in Sheardown and Camp Lakes having shorter pumping distances than Mary Lake. Unfortunately, Sheardown and Camp Lakes have total volumes of 8,175,410 m^3 and 29,690,200 m^3, allowing to draw maximum volumes of only 820,000 m^3 and 3,000,000 m^3 per annum, thus resulting in a total theoretical pit fill times of 53 and 15 years respectively. In addition to this, Sheardown and Camp Lakes have a very long "residence" time for the water in the lake to completely recycle itself. As a result, it may be necessary to draw even less than 10% of the total lake volume to ensure no significant impact to the Sheardown or Camp Lake ecosystem.

The main basin of Mary Lake has a volume of 112,000,000 m^3 providing a total draw volume of 11,200,000 m^3 per annum. Assuming the maximum available volume of water is drawn this will result in a pit fill time of approximately four (4) years. In addition to this Mary Lake has a very high recharge rate completely "recycling" approximately every 1.5 years – resulting in minimal impact to the lakes ecosystem. Unfortunately, Mary Lake is located 12 km from the pit, which would result in substantial pumping costs and technical challenges – which are not expected to be economically feasible.

The Mary River offers the fourth pit filling alternative. DFO (2010) provides guidance on determining ecological flow requirements to establish water withdrawal volumes and rates that are not expected to have an impact. Withdrawals greater than 10% of the instantaneous flow and 30% of the Mean Annual Discharge (MAD) require rigorous assessment. To determine the potential viability of Mary River as a water source, 30% of the MAD has been applied in Table 5.2 to establish a 2-year pit filling period. Pumping may not be possible in low flow years. Between approximately 60 to 70% of the annual flow in the Mary River occurs during a 30-to-35-day freshet period in most years, so much of the annual withdrawal would need to take place during this brief period. Given the shorter length of pipeline, Mary River would likely be the preferred option for pit filling, subject to further study.

Periodic pumping involves pumping from the Mary River during the summer months only, when ice cover is not an issue. This period, June to September provides a maximum four month pumping window. Pumping during this time is essential as Mary River freezes solid during the winter months. Warm weather pumping also reduces the cost of constructing and maintaining a pipeline.

Assuming pumping continues 24 hours a day for the entire summer period, this would require a pumping system that could deliver 8,700 m^3/hour, over approximately a 1 km distance and an approximate elevation head of 200 m. During the winter months the pump and pipeline would be drained and locked out to ensure that the equipment is not damaged by the winter conditions.

Continuous pumping assumes that water will be pumped to the Mine Site pit 24 hours a day all year long. Mary River is not an option for this scenario as it freezes during the winter, leaving Mary Lake the only option for continuous pumping. Technical and economic feasibility is unlikely assuming 24-hour continuous pumping with no delays or malfunctions for the entire year at a pumping rate of 1,300 m^3/hour, over a 12 km distance and 250 m elevation head.

Over winter pumping also presents other challenges including heating of pipelines, snow removal, ice removal from discharge and intake points, extreme weather conditions, increased maintenance costs and risk to personnel. Given these conditions it is expected that continuous pumping would not be a technically and economically feasible option.

5.3.1.5 ENGINEERING WORK ASSOCIATED WITH CLOSURE ACTIVITY

The main work items for closing the open pit are as follows:

- Conducting an engineering stability analysis to confirm the long-term stability of the pit walls
- Barricading the ramps into the pit, construction of a perimeter boulder fence (or equivalent), and installation of hazard signage to mitigate the potential for inadvertent access
- Removal of dewatering infrastructure used during operation (i.e., pumps, surge box and pipelines);
- Cleanup of any soil contamination, i.e., hydrocarbons, etc.
- Filling the open pit with water, either naturally or by enhanced filling
- Construction of a spillway at the southeast corner of the open pit

The proposed closure activities for the open pit suggest that the open pit be allowed to naturally flood to form a "pit lake". At closure, inert wastes (i.e., material having insignificant leachability and pollution content) may be disposed of in the open pit. It is anticipated that the open pit will take an estimated 85 to 150 years to passively fill with water from natural sources such as seepage into the pit, direct precipitation, and surface runoff (KP, 2008). There are several different potential scenarios for accelerating the pit filling which are presented above in Section 5.3.1.4. These will be further assessed prior to final closure as discussed in Appendix D2.

Once the open pit fills to the point of overflow, pit drainage will enter the natural environment through the spillway and natural drainage from the southeast corner of the open pit (KP, 2008), eventually reaching the receiving waters of Mary River. It is currently anticipated that discharge from the open pit will not require treatment, however long-term water quality modelling predictions have not been updated since the submittal of the original 2013 Environmental Impact Study (BIM 2013). As no pit lake currently exists, there are no existing results that can be directly correlated to future pit water quality. Completion of a predictive pit water quality model update is scheduled for 2029. Contingencies are discussed in more detail in Section 5.2.1.9. The overflow location at the southeast area of the pit will provide emergency access to and from the open pit/pit lake.

5.3.1.6 PREDICTED RESIDUAL EFFECTS

The predicted residual effects at planned closure, including those encompassing the open pit mine workings, were assessed as part of the FEIS with respect to VEC/VSECs. These effects, and the methods for their assessment are summarized in Appendix G.

As the project progresses, data will be collected through the environmental monitoring programs which can provide an indication of the accuracy of the predicted effects. These data can also be used to give an indication of the performance of the site mitigative measures and management systems, used as the basis for revising the prediction of residual effects, or implementing adaptive management.

5.3.1.7 UNCERTAINTIES

As noted in Section 5.3.1.6, there is uncertainty as to the pit flooding timeline, long-term water quality in the open pit and pit lake meromixis. Baffinland will conduct monitoring and research as necessary to resolve uncertainties pertaining to residual effect assessments and environmental risks that may have closure implications.

Uncertainties related to the open pit mine workings include whether there is potential for the generation of ML/ARD from the contact of water with the final pit. This uncertainty has been highlighted by stakeholders and Baffinland has committed to addressing the concern within the Reclamation Research Plan and adaptive management during operations (Appendix D). As no pit lake currently exists, there are no existing results that can be directly correlated to future pit water quality. Initial water quality modelling completed as part of the FEIS expected that the quality of pit lake effluent during mine operations to meet MDMER requirements for metals. However, it is possible that, during the latter portion of the mine, pH may decrease below the lower limit of the MDMER (pH 6.0). The estimated water quality derived for the pit drainage includes allowance for acidic drainage from exposed potentially acid generating (PAG) rock toward the end of mine life. It has therefore been assumed that pH adjustment of the pit water will be required in the second half of mine life and into post-Closure.

During Operations, pH adjustment will most likely be carried out inside the pit before the water is pumped to the WRF Pond. Again, humidity cell testing is expected to over-estimate the runoff quality. These modelling results are very conservative and will be reviewed once data are available from recently initiated neutralizing potential-depleted humidity cell testing. This will improve confidence in drainage water quality and pH.

The mining plan and the ongoing geochemical characterization plan will inform the prediction modelling for mine pit water quality at the end of mine life as presented in the Life-of-Mine Waste Rock Management Plan (Appendix 3, BAF-PH1-830-P16-0031) and reclamation research is conducted to confirm the assumptions presented within this plan (detailed within Appendix D1 and D3 of this document).

The quantity of this exposed rock and the data used in deriving this drainage quality is the subject of additional, ongoing study. A Reclamation Research Program related to pit water quality predictions is presented in Appendix D1.

There are two proposed options for options for pit infilling, natural flooding and enhanced pit filling (which uses pumps from nearby lakes and river). For both methods, the total time to flood the pit is uncertain, and for the enhanced pit filling alternative, the source for the water for flooding has only been identified at a conceptual level. These concerns have been highlighted by stakeholders, and Baffinland will proactively address through ongoing and planned research as presented in the Reclamation Research Plan (Appendix D2). Baffinland has committed to ongoing research programs to obtain a better understand the impacts of both passive and enhanced pit flooding options on potential pit water quality, pit filling methodology and timeline, potential water sources for enhanced filling and the potential for meromictic conditions in the future pit lake. The goal of these studies is to validate models on pit flooding, geochemistry and ARD/ML potential presented in the FEIS with observations from active mining of the deposit and subsequent assessments of local hydrology. A description of the planned research is provided in Appendix D. Should modeling indicate potential exceedance of water quality objectives due to prolonged oxidation of the pit walls, alternative pit filling scenarios will be considered to mitigate this effect, including the accelerated pit filling alternative.

As active mining at Deposit 1 remains a hilltop outcrop, and development of an open pit is not anticipated until at least 2034 (based on current development), refinements of the feasibility of potential pit filling scenarios will be provided in future versions of the ICRP based on outcomes of research and studies prior to the development of the open pit.

5.3.1.8 POST-CLOSURE MONITORING, MAINTENANCE AND REPORTING

Conceptual modelling of the pit water quality is presented in the Mary River Project FEIS. Open pit monitoring will be done throughout of the life of the Project as per the Type A Water Licence and in accordance with MDMER requirements. Predictions of pit water quality will be updated throughout the life of the Project as more information comes available on the geochemistry of the waste rock and the pit wall. Although indications to-date demonstrate a low probability of ML/ARD, if monitoring results during Operations suggest a potential ML/ARD it shall be dealt with at that time and any associated impacts that ARD and/or ML would have on closure and reclamation planning, monitoring, long-term maintenance and bonding will be addressed. If there are no indications from test programs or ongoing monitoring of ML/ARD throughout the Operation Phase, at final closure the open pit will be inspected by a qualified engineering professional to assess the physical stability of the pit walls and pit lake and to reconfirm no indicators of ML/ARD.

ARD and ML will be periodically reassessed as a potential issue in the future ICRP revisions and in the Final CRP. The Final CRP will present a time frame for the potential development of ML/ARD conditions, if any, and discuss the impact of ML/ARD release on final closure identifying the need for ongoing monitoring, treatment, and potential mitigations

Post-closure monitoring of open pit mine workings includes geotechnical/engineering monitoring (Section 9.4), aquatic monitoring and reporting (Section 9.5), Environmental Site Assessment (Section 9.6), fauna and flora monitoring (Section 9.7), and safety compliance inspection (Section 9.9). Maintenance required will depend on the outcome of the monitoring programs and would be completed as outlined in Section 9. Baffinland will report on the results of all monitoring programs on an annual basis to the NIRB (as per Project Certificate No. 005), Federal Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301).

5.3.1.9 CONTINGENCIES

Conceptual modelling of the pit water quality is presented in the Life-of-Mine Waste Rock Management Plan (Appendix 5, BAF-PH1830-P16-0031). Open pit monitoring will be done throughout the life of the Project as per Type A Water Licence requirements and in accordance with MDMER requirements. Predictions of pit water quality will be periodically updated throughout the life of the Project as more information becomes available on the geochemistry of the waste rock and the pit wall. Although indications to-date demonstrate a low long-term probability of ML/ARD from the pit, if ongoing water quality modelling or field monitoring shows a trend toward exceedance of discharge requirements operationally or at closure, then water treatment options will be determined and implemented. It should be noted that a “pit” is not scheduled to be developed until 2034 with the current mine plan. Details regarding theoretical treatment options are provided in the Life-of-Mine Waste Rock Management Plan (Section 3.6.4, BAF-PH1830-P16-0031) and were considered for both metal and ammonia/nitrate removal. Theoretical treatment options for metals removal included:

- Resins
- Polymer Addition

- Sodium Hydrosulfite Treatment
- Ozonation
- Biofilters-Sulphide Precipitation
- Activated Carbon
- Lime Precipitation

Theoretical treatment options for ammonia/nitrate removal include:

- Biological De-nitrification (for removal of both ammonia and nitrate)
- Ion Exchange
- Electro-Chemical Ion Exchange
- Breakpoint Chlorination of Ammonia

If there are no indications from test programs or ongoing monitoring of ML/ARD throughout the Operation Phase, at final closure, the open pit will be inspected by a qualified engineering professional to assess the physical stability of the pit walls and pit lake and to reconfirm no indicators of ML/ARD.

ML/ARD will be periodically reassessed as updated research information is available in the future ICRP revisions and in the Final CRP. Reclamation Research to address the uncertainty of what closure and post-closure activities are required to ensure open pit runoff water quality meets closure objectives and criteria, including ML/ARD issues, is expected to commence approximately 4 years prior to when an open pit is expected to exist associated with the Project (which at the earliest would be 2030). Based on the results of this research program, the ICRP will be updated to present a time frame for the potential development of ML/ARD conditions, if any, and discuss the impact of ML/ARD release on final closure and identifying the need for ongoing monitoring, treatment, and potential mitigations.

5.3.2 WASTE ROCK AND OVERBURDEN PILES

5.3.2.1 PROJECT COMPONENT DESCRIPTION

A waste rock disposal area designed for permanent storage of waste rock is located north of Deposit No. 1. Based on the current mine plan, approximately 640 Mt of waste rock will be generated from the mining of Deposit No. 1 (Baffinland, 2012).

The WRF design has sufficient capacity to stockpile the entire volume of waste produced by the mine plan. As described in Section 3.3.6, the majority (approximately 85%) of the LOM waste rock produced by the mine is anticipated to be non-potentially acid generating (non-PAG).

Waste characterization, volume estimation, and monitoring of the Waste Rock ML/ARD is ongoing. The design of the waste rock facility will be updated periodically as necessary throughout the LOM.

The deposition strategy for the WRF is to promote permafrost aggradation. To support this natural process, the following guidelines for placement and development have been adopted:

- The pile will be constructed in lifts from the bottom up with lift and bench characteristics appropriate for the geotechnical conditions and waste handling equipment. These characteristics will be approved by Mine Operations.
- A 4 m thick (minimum) thermal barrier of non-PAG waste rock will be placed during the winter months to the extent practical to protect the permafrost layer during the summer months and allow development of the permafrost into the pile.

- Prior to the placement of any non-PAG rock on natural ground, snow and non-frozen material will be removed from the footprint to the extent practical.
- Non-AG and PAG waste rock placement locations at the WRF shall be documented. Non-AG material that may be intermixed with PAG shall be classified as, and follow the waste rock deposition strategies for PAG material. Waste rock will be placed in lifts while minimizing the overall thickness of the unfrozen material.
- PAG waste rock should be deposited such that permafrost aggradation in the following seasons occurs to the extent practicable.
- The perimeter of the pile will be a minimum of 31 m from any natural water body.

5.3.2.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The pre-disturbance site conditions are summarized in Section 3. Appendix C provides a photolog showing the current mining operations. Figure 5.2 presents the current configuration of the WRF, pond and water management infrastructure.

For the Phase 1 Waste Rock Management Plan, a pond was constructed to the north of the disposal area as well as collection and diversion ditches along the perimeter of the WRF. Water is discharged to the Mary River watershed via a lay flat hose to convey the water to an existing water course draining into a tributary of Mary River.

Collection ditches and diversion ditches have been constructed as the waste rock facility has expanded. In response to monitoring of ongoing water quality from the WRF, a water treatment system is built and is currently operational. Ongoing evaluation of the WRF and associated water management network is completed by Baffinland and its consultants. The most up-to-date details are available in the Waste Rock Management Plan – 2023 to 2026 (WSP 2024b).

As outlined in the FWSSWMP (2019), the Waste Rock Facility Surface Water Management Pond (WRF pond) was constructed to support Deposit No. 1 mining operations and is located northeast of the Deposit No. 1 open pit. Seepage and storm water runoff originating from the Waste Rock Stockpile is intercepted by the Facility's perimeter collection ditches and directed to the WRF pond. The WRF pond was constructed in 2016 and is designed to temporarily retain surface water runoff. Water from the WRF Pond is pumped into the Water Treatment Plant (WTP). The WRF WTP was approved under Water Licence Modification No. 7 and uses a combination of coagulation, pH adjustment, precipitation, flocculation and filtration to ensure effluent discharged from the WRF Pond meets the applicable water quality effluent criteria stipulated by the Type 'A' Water Licence and the MDMER. A full description of the WRF WTP treatment processes is provided in the Project's FWSSWMP (BAF-PH1-830-P16-0010). The effluent is tested to ensure it meets MDMER and applicable Water licence Criteria and then controlled discharged intermittently to the tundra of the approved receiving environment, the Mary River watershed, using a portable pump arrangement. Sludge generated from the operation of the WRF WTP is assessed for suitability of disposal within the WRF or disposed of off-site at an appropriate waste receiving facility. In high rainfall periods (e.g. greater than a 1 in 10-year, 24-hour design storm), the WRF pond is also equipped with an overflow weir on the north side designed to allow the surface water to drain through a controlled discharge diversion channel. The pond was designed with sufficient retention time to ensure the sediment would gravity settle to the bottom of the pond before the water reaches the overflow weir. However, Baffinland endeavors to control discharge water from the pond to meet MDMER monitoring requirements using pumping systems.

Surface water collection systems consisting of collection channels, diversion channels, berms and settlement ponds are implemented as part of the WRF water management system (Figure 5.2). In addition to sediment control, these collection systems will minimize the introduction of water into the WRF, where standing water may adversely affect the thermal regime and, therefore, chemical stability. Further phased surface water management (ditches and ponds) will be designed and implemented as mining progresses. All phases of the runoff management system will be designed such that water discharged from the WRF will comply with applicable water quality discharge criteria outlined in the Type 'A' Water Licence and the MDMER.

At closure, the WRF will remain on site. It will contain approximately 640 Mt of waste rock and overburden, with average side slopes of 2H: 1V. As the surrounding terrain is rugged and rocky with minimal vegetation, no active revegetation or contouring is anticipated to be required to enhance its similarity to the surrounding terrain. Figure 5.3 presents a conceptual schematic of the distribution of PAG, non-PAG and overburden in the WRF at closure, and Figure 5.4 the progressive development over the life of mine.

FIGURE 5.2 CURRENT WASTE ROCK FACILITY

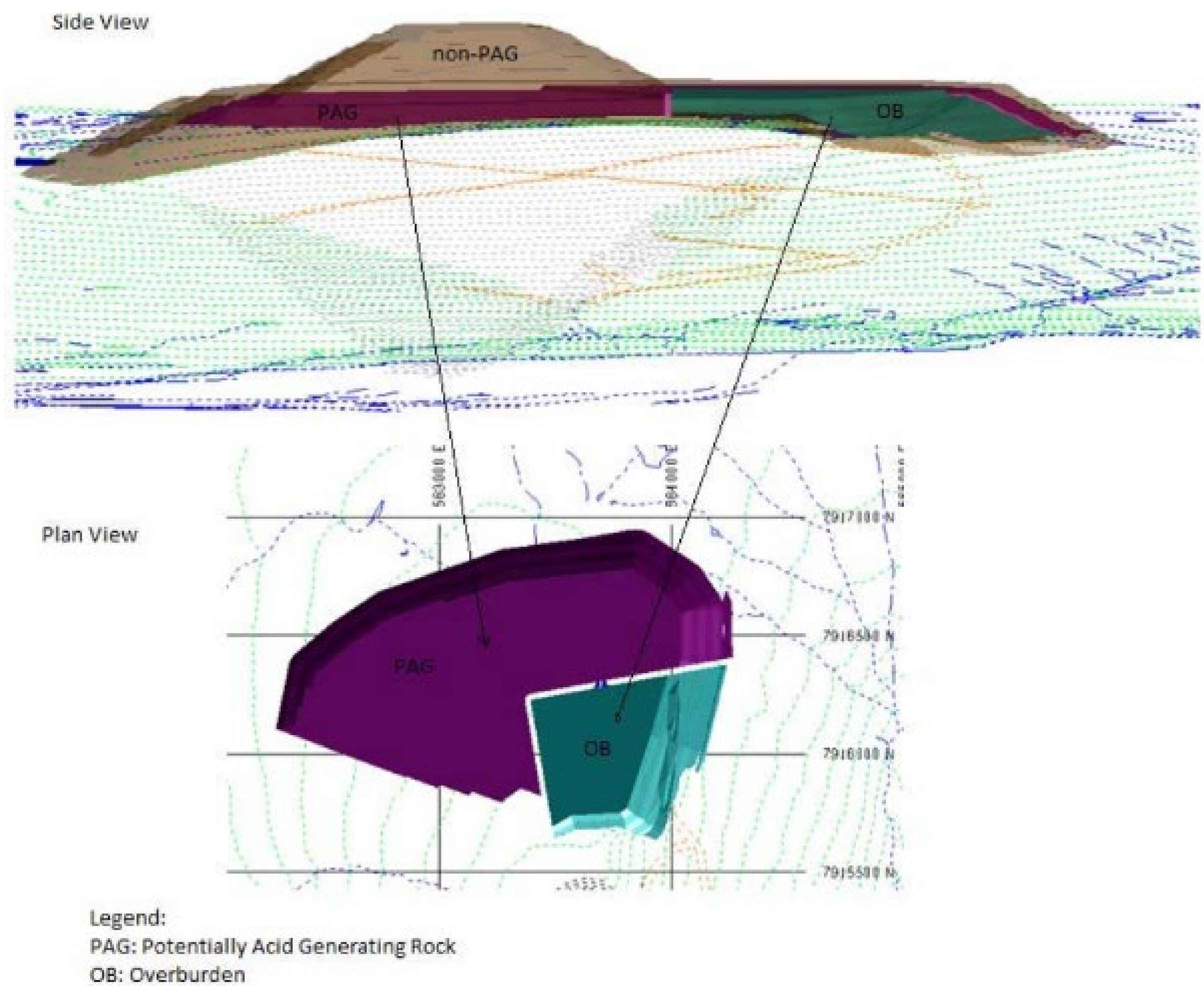


FIGURE 5.3 PLACEMENT OF WASTE ROCK AND OVERBURDEN AT CLOSURE

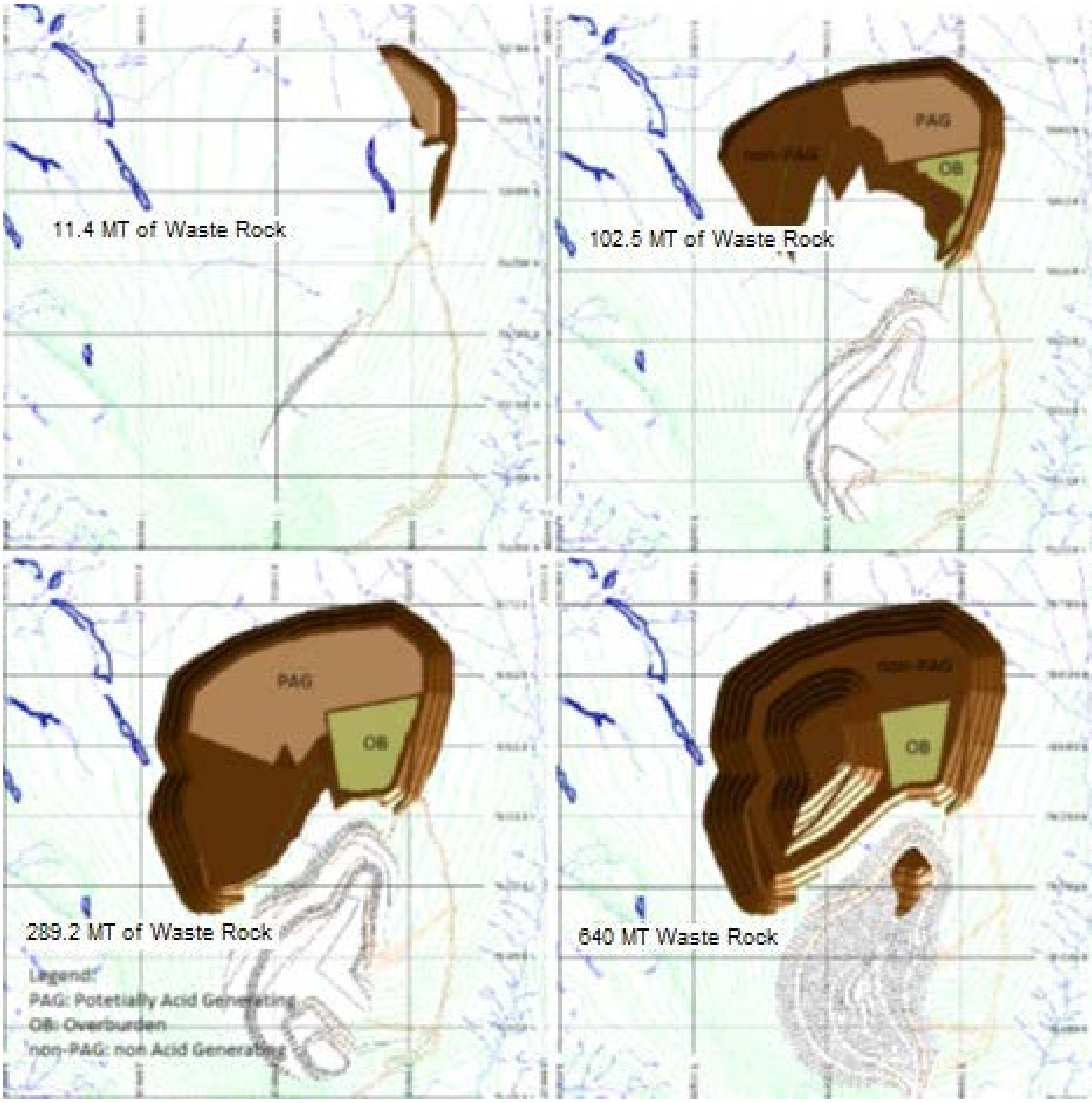


FIGURE 5.4 EVOLUTION OF THE WASTE ROCK FACILITY OVER THE LIFE-OF-MINE

5.3.2.2.1 Waste Rock Storage Facility Materials Geochemical Characterization

Geochemical characterization is ongoing as part of not just the research programs outlined in Appendix D3 of this document and part of the current Phase 1 Waste Rock Management Plan (Baffinland, 2024c), which defines the following operational screning criteria for PAG vs Non-AG material in the excerpted table below:

TABLE 5.3 WASTE CLASSIFICATION CRITERIA

Acid Generation Potential	Criteria*
PAG	Total sulphur ≥ 0.20 wt% as S or paste pH ≤ 6
Non-AG	Total sulphur < 0.20 wt% as S and paste pH > 6

*Total sulphur measured by XRF or LECO method, as supported by WSP, 2024b

The following is excerpted (and modified for inclusion within this report) from WSP, 2024b:

For the BIM Mary River Deposit 1 the current field methodology for geochemical characterization involves testing of drillhole cuttings from each blasthole and measuring the paste pH and total sulphur content. The field classification system was updated in 2019 to consider the possible presence of soluble sulphate minerals (e.g., melanterite) that were observed in portions of the deposit (Golder 2019b) by adding paste pH as an additional criterion.

The 2023 geochemistry update report provides a review of results of geochemical sampling completed from 2020 through 2022. The current evaluation includes review of 8603 blasthole drill cutting samples with measurements of total sulphur and paste pH from on-site as well as review of results from a subset of 395 split samples that underwent both field testing (pH and total sulphur) and analytical laboratory testing which also included acid-base accounting (ABA) analysis. In particular the use of total sulphur, as well as the combination of total sulphur plus sample pH (or paste pH) was evaluated for use in on site classification as compared to the Neutralization Potential Ratio (NPR) developed through full ABA test work. Site water quality measurements were also reviewed for potential metal leaching and acidity trends.

Key conclusions from the completed review and analysis are as follows:

Field vs. Analytical results:

- *A review of sample results from on-site analysis and analytical laboratory testing shows very good agreement for total sulphur analysis and paste pH analysis between field analysis and off-site analytical analysis, indicating that the results of field analysis of total sulphur and paste pH are reasonable for decision making purposes. It is also considered that x-ray fluorescence (XRF) for analysis of total sulphur is a valid method for use in classifying the waste materials in the field.*

Total Sulphur and ABA results/ review of sample representativeness I uncertainty:

- *Considering the dataset of 8603 on-site analysis of paste pH, of the 8603 samples 0.4% of samples (33 samples) had some associated acidity (paste pH values of less than 6) and were distributed near the ore zones. Possible causes of low pH in the absence of elevated total sulphur include stored oxidation products, or soluble sulphate minerals.*

Baffinland currently segregates waste rock material as PAG and Non-AG using a total sulphur cut-off of 0.20 wt% as S and paste pH greater than 6. The uncertainty when using 0.2% S as an analogue for NPR of less than or equal to 2 is approximately 0.5%, with 0.51 % of samples being incorrectly categorized as Non-PAG based on the recent ABA data collected. This recent ABA data continues to support the use of the 0.2 wt% Total Sulphur criteria (and the recently added paste pH criteria of 6) as being a suitable analogue for NPR of less than or equal to 2.

- *When further considering potential soluble sulphate mineral misclassification, when considering that only about 0.38% of materials contain soluble sulphate based on overall paste pH measurements, and a misclassification rate of 0.51 %, only 0.002% of rock placed in the WRF with soluble sulphate minerals has some potential of being incorrectly managed.*
- *A review of the available on site water quality data indicates that misclassification and misplacement of materials with stored acidity in areas where this material should not be placed is not appreciable, as is exemplified by the improvement in WRF water quality observed on site. Leachate Chemistry from lab testing and on-site site runoff and seepage measurements:*
- *There has been an observed improvement in on site water quality with an observed increase in pH and decrease in metals concentrations from 2018 through 2022. All 2022 measurements of on-site runoff and seepage were of neutral pH with no exceedances of the MDMER guideline values with the exception of total suspended solids.*
- *It is considered that the proper use of the waste rock screening criteria coupled with updated rock management practices is resulting in the observed improvement in water quality on-site.*
- *The on site testing shows that a very small proportion (<0.4%) of waste materials have stored acidity or potential for acidification due to oxidation.*
- *Operational procedures currently appear to be effective in reducing and managing ARD/ML on site based on the 2022 observed on-site runoff and seepage chemistry. The geochemical results from SFE testing and on site water quality analysis indicate that the overall waste rock pile design and placement, as presented in the previous WRMPs (including use of thin lifts to promote freezing and placement of Non-AG material around the edges of the pile), are reasonable and appropriate to reduce potential for acid generation and metal leaching. Regular operational monitoring and material segregation is still required to confirm the future geochemical performance of the WR, however based on low potential rock misclassification rates, coupled with on-site observations of seepage and runoff water quality from 2020 through 2022 that show improving water quality over time, the current waste rock segregation criteria is considered reasonable and appropriate.*

Ongoing and further research is described within Appendix D3.

5.3.2.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives are presented in Section 5.2 and closure criteria are presented in Table 5.1.

5.3.2.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

A detailed analysis of other closure options has not been completed by Baffinland due to the early stage of the Project and associated research. As data are collected and analysis is conducted, the ICRP will be updated as required. Please refer to Appendix D for more detail on Reclamation Research Programs relevant to the Project to address uncertainties related to final closure.

Relevant closure options at the WRF will likely be limited to minor changes in PAG/non-PAG material placement occurring as part of the ongoing management of waste materials within the required setbacks as outlined within approved management plans, as well as potential changes to the thermal cover to address results from ongoing thermal and seepage quality modelling as required and identified by the research programs.

5.3.2.5 ENGINEERING WORK ASSOCIATED WITH CLOSURE ACTIVITY

The main work items for closing the WRF and overburden stockpiles are as follows:

- Cleanup of any soil contamination (i.e., hydrocarbons, etc.)
- Monitoring and confirming the freezing (permafrost aggradation) of the pile, except for a shallow "active" zone
- Monitoring the water quality of any seepage from the WRF
- Conducting an engineering stability analysis to confirm the long-term stability of the slopes of the WRF, and recontouring (if necessary) to ensure the slopes are physically stable
- Grading at associated water management structures (e.g., two WRF Ponds, potential temporary dams) to establish final drainage pathways
- Accumulated sediments at the WRF ponds will be assessed for leaching and potential impacts to downgradient water quality. Options for managing potential risk from sediments include but are not limited to covering, excavation, and disposal at an approved facility.

Mine planning will ensure that at closure the exterior of the dump consists of a layer of non-PAG material of at least 4 m thick. 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. Thermal modelling is a component of the ongoing research related to the WRF and associated thermal cover and is further detailed within Appendix D4 of this document.

The physical stability of the WRF will be investigated at the onset of closure. This investigation will consider the final geometry of the stockpile, including the aerial extent, height, cross-sections, and the volume in place. If geotechnical investigations indicate it is necessary, the WRF may undergo re-contouring to ensure physical stability. Following re-contouring and stabilization investigations and activities, as required, the WRF will be considered closed.

Based on the current state of the Mine Site prior to mining activities, the Mine Site is characterized by a rugged rocky terrain with minimal vegetation. Therefore, an uncovered WRF is considered environmentally compatible with the current undisturbed surrounding areas.

Runoff from the WRF will continue to be monitored until runoff meets water quality objectives for closure (described in Section 9.5). Once water quality objectives have been met, the WRF ponds will be decommissioned, and runoff will be allowed to discharge directly to the environment.

5.3.2.6 PREDICTED RESIDUAL EFFECTS

The predicted residual effects at planned closure, including those encompassing the WRF, were assessed as part of the FEIS with respect to VECs/VSECs. A detailed breakdown of these effects, and the methods for their assessment are summarized in Appendix G. Key FEIS residual effects predictions regarding surface water discharges from the WRF post-closure are that any substantive impacts will be localized (see below) and adverse environmental effects on water quality or Arctic Char at the Mine Site LSA are not expected post-closure.

As reported in the Interim WRF Seepage Quality model (Life of Mine Waste Rock Management Plan, Appendix 4, BAF-PH1830-P16-0031), predictions indicate that arsenic, copper, lead, nickel, and zinc concentrations in the WRF seepage will be below MDMER values. However, there is uncertainty in this model as follows:

- The water quality model is based on the mine plan, WRF configuration, water balance and geochemical data. Changes to these assumptions may result in differing water quality. The model is and will continue to be updated as site information is obtained and the mine develops (Appendix D3).
- Several assumptions made to develop the model (permafrost extent, stockpile hydrology, acid drainage source terms, etc.) that will be updated when more appropriate data becomes available
- The current model has considered the surface area based on a review of published and unpublished data from other mine projects which could be different from the actual surface area of the WRF
- Current model estimates are based upon simplified estimates of the seepage pH. These pH values can have a significant impact on the estimated loadings and concentrations of metals predicted in the model.

Details on thresholds and modelled water quality of the specific waters that will receive stormwater from the WRF via the east and west ponds as presented in the FEIS, are provided in Appendix H. The West Waste Rock Stormwater will discharge to Camp Lake via its tributaries, with increasing dilution and mixing along the way. Conservative modelling of the anticipated water quality of the west pond discharge and the predicted water quality in the receiving waters identified potential exceedances of water quality thresholds (CCME PAL) of mercury and selenium in Camp Lake and tributary L1 and L0 under mean flow and dry year conditions (HQ of 1 and 2, respectively in Camp Lake, higher in the tributaries; see Tables 9 and 10 in Appendix H). HQ (Hazard Quotient) is the ratio of the potential exposure to a substance and the level at which no adverse effects are expected. If the Hazard Quotient is calculated to be less than 1, then no adverse effects are expected because of exposure. The same conservative modelling approach completed for the east pond discharge to Mary River (containing fish habitat) identified potential exceedances of water quality thresholds (CCME PAL) of mercury, selenium, and silver under both mean flow and dry flow year conditions (HQ of 4, 1, and 1, respectively).

The reason these results are considered highly conservative is explained in Appendix H. The residual effects are considered partially reversible because reversibility may require ongoing water treatment, and the duration of any required treatment is unknown at this time. The QIA has inquired if there will be changes in water quality that may affect the ability to safely consume fish from waterbodies near the WRF and open pit. The risk associated with consuming arctic char in the Project area is difficult to assess, as baseline sampling results reported in the FEIS found that 29% of arctic char exceeded Health Canada guidelines for mercury (this is not an unusual finding for land-locked char). Nevertheless, as the project progresses, data will be collected through the environmental monitoring programs which can provide an indication of the accuracy of the existing predicted effects. These data can also be used to give an indication of the performance of the site mitigation measures and management systems, and as the basis for revising the prediction of residual effects or implementing adaptive management.

During 2023, in June to August, operation of the WRF WTP was effective at mitigating any water quality concerns for the effluent to be compliant with the applicable criteria. No exceedances of the water licence water quality discharge criteria were observed in samples collected in 2023 under Schedule I of the Type ‘A’ Water Licence. Additional effluent discharge sampling was completed to satisfy the requirements of the MDMER. The results of sampling completed to satisfy MDMER requirements are detailed in Baffinland’s 2023 MDMER annual effluent monitoring report for the Mary River Mine Site (Baffinland, 2024b).

5.3.2.7 UNCERTAINTIES

Baffinland will conduct monitoring and research as necessary to resolve uncertainties (described above) pertaining to residual effect assessments and environmental risks that may have closure implications.

The primary uncertainties related to the waste rock and overburden pile are:

- whether or not there is potential for the generation of ML/ARD from contact water at the end of life; and
- the rate at which permafrost will aggrade into the waste rock stockpile and the thickness of the active layer (layer that will be unfrozen during the warmer months of the year) in the context of climate change.

The mining plan and the ongoing waste rock characterization plan will inform the prediction modeling of the Life--of-Mine Waste Rock Management Plan (Appendix 4, BAF-PH1830-P16-0031).

The uncertainty associated with global climate change creates uncertainty about the performance of the WRF closure in the long-term. A Reclamation Research Program (Appendix D) that utilises long-term monitoring of the cover and thermal conditions of the WRF has been designed to improve understanding of the expected performance of the WRF closure concept with respect to both drainage water quality as well as with respect to permafrost aggradation through operation and closure.

5.3.2.8 POST-CLOSURE MONITORING, MAINTENANCE AND REPORTING

Post-closure monitoring of waste rock and overburden piles includes geotechnical/engineering monitoring (Section 9.4), aquatic monitoring (Section 9.5), Environmental Site Assessment (Section 9.6), fauna and flora monitoring (Section 9.7), safety compliance inspection (Section 9.9), and air quality monitoring (Section 9.11). Maintenance required will depend on the outcome of the monitoring programs and would be completed as outlined in Table 5.1. Baffinland will report on the results of all monitoring programs on an annual basis to the NIRB (as per Project Certificate No. 005), Federal Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301).

5.3.2.9 CONTINGENCIES

5.3.2.9.1 WASTE ROCK FACILITY RUNOFF WATER QUALITY

If field monitoring and/or future water quality modelling show a trend toward exceedance of discharge requirements, then water treatment options will be determined and implemented. Currently on site there is a short-term water treatment facility resulting from this constant trend assessment, but a long-term water treatment facility is not currently predicted to be required at the end of mine life.

Details regarding treatment options are provided in Section 3.6.4 of the Life-of-Mine Waste Rock Management Plan (BAF-PH1830-P16-0031) and were considered for both metal and ammonia/nitrate removal. Theoretical treatment options for metals removal included:

- Resins
- Polymer Addition
- Sodium Hydrosulfite Treatment
- Ozonation
- Biofilters-Sulphide Precipitation
- Activated Carbon
- Lime Precipitation

Theoretical treatment options for ammonia/nitrate removal include:

- Biological De-nitrification (for removal of both ammonia and nitrate)
- Ion Exchange
- Electro-Chemical Ion Exchange
- Breakpoint Chlorination of Ammonia

Updates on waste rock characterization and prediction of runoff water quality will be provided in future updates of the Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031) as they are developed and will be incorporated into future versions of the ICRP as appropriate.

5.3.3 QUARRIES/ROCK CUTS AND ORE/AGGREGATE STOCKPILES

5.3.3.1 PROJECT COMPONENT DESCRIPTION

This project component includes quarries and ore stockpiles located at the Mine Site, Milne Port and future locations associated with the Steensby Rail and Port:

- Mine Site
  - Quarry D1Q1
  - Quarry QMR2
  - KM 97 Borrow Locations
  - Ore Stockpile
  - KM106 Run of Mine (ROM) Stockpile
- Milne Port
  - Borrow Source No. 1
  - Q1 Quarry
  - Ore Stockpiles
- Steensby Port

5.3.3.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The pre-disturbance site conditions are summarized in Section 3. Appendix C provides a photolog showing the current mining operations.

QUARRIES AND BORROW SOURCES

Baffinland currently operates multiple quarries and borrow sources to support Project Road maintenance and infrastructure construction. The quarries and borrow sources at the Mine Site and Milne Port were developed to construct the site. Additional quarries will be developed as part of Steensby Railway and Port construction and operations. Quarries and borrow sources used during 2023 to support Project activities included the Q1 Quarry at Milne Port and the KM 97 Borrow Source near the Mine Site. As per the requirements of the Commercial Lease (Part 6.4, item d) iv; QIA, 2013) and Type ‘A’ Water Licence (Schedule B, Item (g), NWB, 2015), quantities of each specified substance removed are reported on annually.

Quarry materials, including rock, sand and gravel and to a lesser extent cobbles and boulders, will be required for construction of Steensby Port and the Steensby Railway. Lists of aggregate sources, locations and estimated in-situ volume requirements are presented in the Borrow Pit and Quarry Management Plan (FEIS Volume 3, Attachment 6 of Appendix 3B). Proposed Steensby Railway and Steensby Port quarry sites are shown on Figure 3-2.4 and 3-2.9 of

FEIS Volume 3. At Steensby Port, local bedrock knolls will initially be quarried to establish basic roads and laydown areas, starting with QS2 and QS3 (see FEIS Volume 3). The bulk of the aggregate for construction at Steensby Port will come from the cut-and-fill operations needed to produce a level site. A number of rock cuts and two tunnels will be required along the length of the Railway. Further details of design, construction and operation are provided in FEIS Volume 3.

Each borrow pit and quarry has or will have a site-specific quarry management plan that describes how the quarry will be developed, operated, and closed. All borrow areas and quarries will be progressively reclaimed maintaining stable side slopes in accordance with the individual site permit. Closure of active quarry faces will involve removing all materials, equipment, and infrastructure. Active quarry walls will be terraced during operation to closely manage issues related to drainage and will not be altered for closure. The quarry development will reduce the creation of pits and depressions to the degree practicable to reduce the potential for standing water. The quarry pit floors will be left as free draining.

Reclamation of uncovered permafrost and ground/ice will involve removing any ponding water and backfilling the impacted permafrost and/or ground ice with available material.

ORE STOCKPILES

The Mine Site R stockpile is a small stockpile (~400,000 t) which is used to temporarily store mined ore prior to feeding it to the primary crusher. Ore is then crushed to produce lump and fines ore products that are temporarily stockpiled at the crusher pad before being transported to port. Surface water runoff from the Ore Stockpile is directed to the KM 106 Pond by a network of ditches along the Ore Stockpile's perimeter with pumps and hoses.

Crushed ore (fine and lump) is moved to the mine site Ore Stockpile that is used to temporarily store ore that is ready to haul to Milne Port. The Ore Stockpile was constructed of a 1.0 to 1.5 m thick granular pad base with a lined perimeter ditch to direct runoff to a stormwater pond.

Once the ore reaches Milne Port, the crushed ore is stored in a large stockpile until such time that it can be loaded onto a ship. Ore may be stored at the Milne Port ore stockpile for several months over the winter until open water conditions permit shipping.

Expansion of Stockpile #1 at Milne Port was initiated in 2019 following approval of the modification request. Note that construction is divided into two (2) stages, where the second stage was dependant on receipt of a Letter of Advice from Fisheries and Ocean Canada (DFO), which has since been received. Construction of the first stage was completed in 2021. The second stage has been put on hold indefinitely.

An ore stockpile pad, runoff collection ditches and a stormwater management pond(s) will store ore and manage runoff at Steensby Port using a network of ditches with associated ponds and discharge locations. Runoff from stockpiles on the island will be collected and treated if necessary. Further details on design, construction and operation are provided in FEIS Volume 3.

The ore/aggregate stockpiles will be depleted upon closure. Former stockpile areas will be recontoured to blend into the surrounding terrain (where possible) and scarified to promote natural revegetation and allow vegetation to re-establish through natural processes. The crusher and surrounding buildings will be decommissioned and demobilized from site consistent with other buildings and equipment (Section 5.2.4). The potential for soil contamination beneath ore stockpile areas will be assessed as discussed in Section 9.6. The ore/aggregate stockpile bases will be re-contoured as necessary, scarified, and allowed to naturally revegetate. If ore/aggregate stockpiles remain at closure, they will be graded and re-contoured for long-term physical stability. There are currently no plans to place a cover material over residual ore for aesthetic purposes unless aesthetic values identified through community engagement on mine closure determine the need for fill placement. Construction of a clean fill cover, and/or placement of residual ore as backfill will be assessed if water quality concerns are present.

5.3.3.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives are presented in Section 5.2 and closure criteria are presented in Table 5.1

5.3.3.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

A detailed analysis of other closure options has not been completed by Baffinland due to the early stage of the Project and the absence of Project components which represent the largest uncertainty at closure (open pit, Permanent WRF). As data are collected and analysis is conducted, the ICRP will be updated as required. Refer to Appendix D for more detail on Reclamation Research Programs relevant to the Project to address uncertainties related to final closure.

Relevant closure options to consider in the future will likely include grading and drainage options assessed as part of the Final Grading Plan.

5.3.3.5 ENGINEERING WORK ASSOCIATED WITH CLOSURE ACTIVITY

Engineering work required at closure includes inspections of quarries, and rock cuts to:

- Determine what is required to close the borrow area or quarry in accordance with the development plan
- Identify any physical instability, drainage issues, or contamination

At the onset of closure, the borrow areas and quarries will be investigated to assess for potential thermal damage and instability due to thaw impacts. At closure, re-contouring and filling with overburden may be required to ensure slope stability and restore the natural drainage due to thermal disruptions.

Quarrying activities will be closely managed to avoid the accumulation of unnecessary stockpiles of aggregate. Any stockpiles that do remain will be managed as follows:

- Large rock will be spread out on the landscape or used as riprap for erosion control
- Medium sized rock will be used to re-contour affected areas to re-establish a more natural appearance to the area
- Small, crushed rock will be used to assist in drainage restoration, and spread on the landscape to re-establish more natural contours
- Collected soils will be spread to allow for the re-establishment of vegetation. No vegetation planting or seeding operations will be undertaken and natural re-vegetation will be allowed to take place.
- A pre-closure inspection for potentially contaminated soils will be completed across the entire site, including areas underlying ore storage locations. Contaminated soils, snow or ice, or overburden will be flagged. The extent of the contamination will be assessed, and the material removed for treatment at an on- site landfarm or containerized for shipment to a licensed off-site facility. Remedial action plans will be developed to address issue(s) identified in the inspections as outlined in Appendix D6.

5.3.3.6 PREDICTED RESIDUAL EFFECTS

The predicted residual effects at planned closure, including those encompassing quarries and ore/aggregate stockpiles, were assessed as part of the FEIS with respect to VEC/VSEC. These effects, and the methods for their assessment are summarized in Appendix G.

Operational sampling and testing is executed on active quarries to confirm the original predictions that aggregate produced from approved quarries would have a low potential for acid rock drainage and metal leaching. To assess whether a rock is Potentially Acid Generating (PAG) or Non-Acid Generating (Non-AG), representative samples are collected and analyzed for total sulphur content and paste pH. If the sample has a paste pH value greater than 6 and a sulphur concentration less than 0.20%, it is classified as NonAG, while if the sample has either a paste pH value less than 6 or a sulphur concentration greater than 0.20%, it is classified as PAG. In 2022 and 2023, nine (9) and 14 blasthole samples were collected from the active Q1 Quarry respectively. All samples were classified as Non-AG, with sulphur content of 2022 samples ranging from 0.01% to 0.03% and paste pH ranging from 8.8 to 9.6, while 2023 samples had X-Ray Fluorescence (WRF) measured sulfur content ranging from <0.003% to 0.045% and pase pH ranging from 9.5 to 9.8. Supplementary Acid Base Accounting (ABA) parameters, such as Neutralization Potential Ratio (NPR), were also analyzed on the nine (9) samples collected in 2022. As expected, all Q1 Quarry samples collected in 2022 had high NPR values (>2); further validating the classification of the aggregate material as Non-AG.

As the project progresses, additional data will be collected through the environmental monitoring programs which will continue to provide an indication of the accuracy of the predicted effects. These data will also be used to give an indication of the performance of the site mitigative measures and management systems, used as the basis for revising the prediction of residual effects, or implementing adaptive management.

5.3.3.7 UNCERTAINTIES

Uncertainties related to the closure of quarries include whether the remaining exposed aggregate is PAG, which is addressed in the individual quarry management plans. Ore/aggregate stockpiles have the potential to result in contaminated soils and will be assessed at closure (Section 9.6).

5.3.3.8 POST-CLOSURE MONITORING, MAINTENANCE AND REPORTING

Post-closure monitoring of quarries and ore/aggregate stockpiles includes geotechnical/engineering monitoring (Section 9.4), aquatic monitoring and reporting (Section 9.5), Environmental Site Assessment (Section 9.6), fauna and flora monitoring (Section 9.7), safety compliance inspection (Section 9.9), and air quality monitoring (Section 9.11). Maintenance required will depend on the outcome of the monitoring programs and would be completed as outlined in Table 5.1. Baffinland will report on the results of all monitoring programs on an annual basis to the NIRB (as per Project Certificate No. 005), Federal Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301).

5.3.3.9 CONTINGENCIES

Ongoing monitoring at quarries and rock cuts throughout the mine's operation will identify the need to update reclamation plans and assess contingencies.

5.3.4 BUILDINGS (INCLUDING CAMPS) AND EQUIPMENT

5.3.4.1 PROJECT COMPONENT DESCRIPTION

Buildings and infrastructure at the Project are located across the Mine Site and Milne Port areas, and in specific areas along the Tote Road. This component currently includes permanent and temporary buildings and infrastructure, fuel storage facilities, electrical and communications systems and mobile equipment at the Mine Site and Milne Port. To the extent possible, buildings have been consolidated to hold accommodation, administration, maintenance and laboratory complexes to reduce outside travel of in-building workers. Locations of buildings and infrastructure are shown in Figure 4.3 (Mine Site) and 4.5 (Milne Port).

5.3.4.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The pre-disturbance site conditions are summarized in Section 3. Appendix C provides a photolog showing the current buildings onsite at the Mine Site and Milne Port. In general, upon Final Mine Closure, all buildings and equipment will be decommissioned and will no longer be features on site. Associated pads and laydown areas (see Section 5.3.5.2) will be re-graded to restore natural drainage patterns where possible and scarified to allow for natural revegetation at closure.

BUILDINGS

Accommodation buildings at Milne Port consist of two (2) camps including the Port Site Complex (PSC) Camp and the 386-Person Camp. Accommodation buildings at the Mine Site consist of two (2) camps including the Sailiivik Camp Complex, and the Mine Site Complex (MSC) Camp. These buildings consist of prefabricated modular units supported on timber cribbing foundations, and house personnel in single dormitory wings. A central core area comprises kitchen/dining facilities, recreational facilities, and general service space. The fire protection system includes a primary fire pump (with backups) and sprinkler systems for the accommodation, administration, laboratory, and warehouse facilities. See Section 5.3.5 for mining infrastructure, including associated buildings. The assay laboratory houses the metallurgical office and is used for ore sample storage, preparation and analyses. The maintenance area is equipped with oil/water separators in areas associated with the steam-cleaning facility. Elevated corridors/utilidors constructed using prefabricated modular units supported on a structural steel framing system and pipe piles connect all buildings in this area. Additional infrastructure includes potable water and sewage treatment plants discussed in more detail in Section 5.3.8, and the WRF Water Treatment Plant building (see Section 5.3.2.2).

The Mine Site Weatherhaven Camp consists of multi-person tents that were previously used as accommodations for the Project, but are no longer used for this purpose.

Power plant building at the Mine Site includes diesel powered generators which provides power to the accommodations, maintenance area and office complex.

Mine Site aerodrome infrastructure includes a terminal building, runway lighting, navigational aids, radio transmitters and weather observation equipment.

Existing explosives facilities at the Project include:

- Permanent storage magazines at KM7, KM63 and KM97 on the Tote Road
- Permanent emulsion mixing plant and explosives magazines (storage for raw materials) at the Mine Site.

These facilities were designed for modular installation in arctic conditions. The Mine Site emulsion plant is designed based on achieving a zero-effluent process. Contaminated wastewater generated from the manufacturing operations is collected and re-used in the process, including truck wash water. The explosives facility and the operational policies in place meet or exceed the applicable regulations as part of the following acts:

- *Canada Explosives Act*
- *Transport of Dangerous Goods Act*
- Occupational Health & Safety, Nunavut - *Explosives Use Act*
- *Northwest Territories/Nunavut Mine Health and Safety Act* and Regulations

All infrastructure and manufacturing processes are Licenced and approved by Natural Resources Canada (NRCan) Explosives Regulatory Division. Magazine storage sites are Licenced by the Nunavut Workers' Safety and Compensation Commission (WSCC).

A variety of buildings are planned to be constructed at both the Mine Site and Steensby Port as part of the Steensby component of the Approved Project. Steensby Port buildings will include an accommodation complex consisting of a combination of prefabricated modular units supported on pile foundations. The facility will accommodate personnel in two, two-storey dormitory wings. A central core area will include kitchen/dining facilities, recreational facilities and general service space. The building will be located near the power plant, the wastewater treatment plant, and the water supply source. A centralized power plant designed to service the entire port will be located near the accommodation complex. A railway maintenance facility and yard will include maintenance shops, management offices, welding and machine shops, a warehouse and an inspection shed. Railway terminals at both the Mine Site and Steensby Port will be constructed for safe movement of ore, passengers, freight, fuel and backhauled wastes. Further details regarding the buildings and associated infrastructure required for the Steensby component of the Approved Project are provided in FEIS Volume 3.

An airstrip and associated infrastructure are planned for development at Steensby Port. Explosives for Southern Railway construction will be sourced from the bulk emulsion plants at the Mine Site and Steensby Port. Magazines will be located along the Railway, usually within spent quarries. The magazines will be positioned and bermed as required to meet applicable regulatory requirements. No permanent explosives emulsion plant will be required at Steensby Port.

To permit the reclamation of the land area they cover, improve aesthetics, remove the physical hazard they pose to humans and the environment, and address any chemical concerns they may pose, buildings at the Mine Site, Tote Road, Milne Port and Steensby Port will be removed. Explosive facilities will be removed from the site. The associated footprints of all buildings and laydown areas will be re-graded to restore natural drainage patterns where possible and scarified to allow for natural revegetation at closure.

FUELS AND TANK FARM

The Milne Port Tank Farm and dispensing infrastructure includes the marine pipeline (connecting the marine manifold building to the arctic diesel system), the arctic diesel system, the Jet-A1 system, the fuel dispensing systems, the secondary containment earth dyke with synthetic liner, and all interconnecting piping. The systems are designed for marine loading/offloading, tank truck loading/offloading, vehicle fueling, and genset fuel feed at the port facility. The Milne Port tank farm has a total capacity of 64 ML and includes:

- Four (4) 12 ML arctic diesel field-fabricated tanks
- Two (2) 5 ML arctic diesel field-fabricated tanks
- One (1) 3 ML arctic diesel field-fabricated tank
- Two (3) 0.75 ML Jet-A1 fuel prefabricated tanks

These tanks are all vertical single wall steel construction located within an earth dyke with synthetic liner. The tanks are equipped with spiral access stairways and guardrails at the roof of each tank.

The Milne Port tank farm is refuelled annually by ocean going tanker. A floating hose is deployed from the ship and connected to the onshore manifold. An aboveground steel marine pipeline transfers the fuel from the shore manifold to the tank farm. The ship floater manifold connection is equipped with a gate valve and check valve assembly to enable ship-to-shore connection and to prevent backflow. All connections are contained within a spill containment assembly with a hinged and lockable cover.

The fuel dispensing system includes two (2) prefabricated fuel dispensing modules: the Arctic Diesel Fuel Module, and the JetA1 Fuel Module. The existing Arctic Diesel Fuel Module is located to the west side of the tank farm. The new modules are insulated and heated 40 ft ISO shipping containers, complete with piping, fuel transfer equipment, temperature corrected delivery systems, electrical and control components, and code compliant fire suppression systems. Access to the fuelling equipment is through lockable equipment doors and side rollup door.

The Milne Port tank farm was constructed as a rectangular shape to optimize the earthworks materials (granular fills and liner). The tank farm is surrounded by dykes with side slopes not steeper than 2H:1V and the berm top width is 600 mm. The secondary containment area includes ten (10) tank foundation pads, ramp loading areas, dyke access roads and dyke walls, and dyke access stairs on the east side behind the fuelling module. Inside the primary dyke containment area, there is a 1% slope towards the sump.

There are two (2) access ramps into the dyke containment area to allow emergency vehicle and maintenance vehicle access. One ramp is on the south side, into the existing/modified dyke area. The second ramp is on the east side, leading from the fueling area down into the new dyke area. The containment area around the tank farm and dispensing module has been constructed with raised earthworks and synthetic welded liner for the containment of spills. Additionally, the facility is designed for containment of rainwater and snowmelt that can potentially be contaminated by contact with fuel originating from leakage or spills. Contact water is removed and treated if required before it is discharged to the receiving environment. A mobile oil-water separator (OWS) water treatment system is used to treat storm water runoff, overfills, or spills from within the secondary containment area to meet the water licence discharge criteria. The liner is buried 450 mm below the floor of the dyke.

Fuel is delivered to the mine site via bulk fuel truck loaded from the project's Milne Port facility. The Mine Site Tank Farm and dispensing infrastructure includes a tank farm facility within a secondary containment earth dyke with synthetic liner, fuel dispensing system, and all interconnecting piping. The package was designed for tank truck loading/offloading, vehicle fueling, and genset fuel feed at the Mine Site camp facility.

The Mine Site tank farm currently has a total capacity of 17.1 ML and includes.

- One (1) 15 ML arctic diesel field-fabricated tanks with tag numbers
- Four (4) 0.5 ML arctic diesel prefabricated storage tanks

There is additional fuel storage at the mine site in the form of Two (2) 0.05 ML Jet-A1 fuel prefabricated with associated fueling infrastructure to fuel planes at the Mary River Aerodrome.

All tanks are vertical single wall steel construction, designed to API Standard 650. The secondary containment dyke is designed to the requirements of the National Fire Code of Canada. The tanks are equipped with spiral access stairways and guardrails at the roof of each tank.

The fuel dispensing system includes one (1) prefabricated fuel dispensing module: the Arctic Diesel Fuel Module. This module is an insulated and heated 40 ft ISO shipping container, complete with piping, fuel transfer equipment, temperature corrected delivery system, electrical and control components, and code compliant fire suppression system. The diesel dispensing module is located on the plant-south side of the tank farm. Access to the fueling equipment is through lockable equipment doors and side rollup door. The refueling area consists of a ramp up to and down from the fuel modules with a vehicle containment area surrounding the fuel module to ensure appropriate management of potential spills during fueling operations. The lined refueling area drains into the secondary containment dyke.

The Mine Site tank farm is rectangular shaped to optimize the earthworks materials (granular fills and liner). The tank farm is surrounded by dykes with side slopes not steeper than 2H:1V and a berm top width of 600 mm. The secondary containment area includes four (4) tank foundation pads, ramp loading areas, dyke access roads and dyke walls, and dyke access stairs on the south side behind the fueling module. The containment area around the tank farm and dispensing package was constructed with raised earthworks and synthetic welded liner for the containment of spills. Additionally, the facility is designed for containment of rainwater and snowmelt that can potentially be contaminated by contact with fuel originating from leakage or spills. Contact water is removed and treated if required before it is discharged to the receiving environment. The liner is buried 450 mm below the floor of the dyke.

Additional fuel storage facilities are planned to be operated at Steensby Port. Details regarding quantities and locations for the Steensby component of the Approved Project are provided in FEIS Volume 3.

Upon final closure, the fuel storage tank farms, assuming they are not to be maintained, will be decommissioned, and removed from site. Soils will be tested for contamination and contaminated soil and liners will be removed from site. The area will be regraded to restore natural drainage patterns where possible and scarified to allow for natural revegetation.

MOBILE EQUIPMENT

Heavy equipment used at the Project includes diesel powered rubber tire mounted haul trucks equipped with side dump trailers dump and track mounted front-end loaders and bulldozers. Additional mobile equipment includes drill rigs, loaders, shovels and ancillary mobile equipment including excavators, graders and light vehicles. Any decommissioned mobile equipment is currently either backhauled or stored at laydown facilities located at the Mine Site and Milne Inlet.

Mechanical equipment will be considered closed and reclaimed when they no longer pose a risk of contamination to the environment, will not be a safety hazard to humans and wildlife, and no longer need long-term care. At final closure, mobile equipment will be relocated to the mainland for resale, disposed of on-site as refuse or donated to the local community.

5.3.4.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives are presented in Section 5.2 and closure criteria are presented in Table 5.1.

5.3.4.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

A detailed analysis of other closure options has not been completed by Baffinland due to the early stage of the Project and the absence of Project components which represent the largest uncertainty at closure (open pit, Permanent WRF). As data are collected and analysis is conducted, the ICRP will be updated as required. Please refer to Appendix D for more detail on Reclamation Research Programs relevant to the Project to address uncertainties related to final closure.

5.3.4.5 ENGINEERING WORK ASSOCIATED WITH CLOSURE ACTIVITY

Removal of the buildings and equipment will involve the following works:

- Decontaminate buildings and equipment as necessary to permit safe working conditions and mitigate the potential for uncontrolled releases
- Removal of contaminated materials as required from site. Contaminated materials are any materials that are not “inert” and not able to be treated via landfarming (if contaminated by hydrocarbons). Further research will be conducted to categorized and further define what “inert” material is (Appendix D)
- Inert refuse (including concrete and rebar) from demolished buildings at the Mine Site, Milne and Steensby Port will be removed and either:
    - Transported to Milne Port or Steensby Port for shipment to the mainland for either disposal or salvage
    - It is anticipated that environmental site assessment and material classification reclamation research (e.g. the criteria that will be used to determined what material is non-hazardous, hazardous and inert) will inform site disposal activities, including evaluation of available space within landfills. Further discussion regarding this program is within Appendix D.
- Disposed of in the open pit
- Disposed of in the on-site landfills or other approved repository
  Criteria used to determine whether non-hazardous materials are disposed of on-site or off-site will include:
    - space required/available in on-site landfills or other approved waste disposal locations
    - logistical constraints/level of effort required for on-site vs. off-site disposal options
    - cost of on-site vs. off-site disposal options
    - feedback received as part of the Inuit Engagement Strategy
- The foundations of buildings and equipment (and infrastructure) will be demolished:
    - Concrete foundations will be demolished to grade and exposed rebar will be cut to grade to prevent safety hazards
    - Concrete foundation areas will be drilled/broken to allow for water infiltration
    - Any remaining concrete piles will be cut to grade and covered with overburden
- Relocate all equipment to the mainland for resale, dispose of on-site as refuse, or donate to the local community
- Cleanup of any soil contamination (i.e., hydrocarbons, etc.), see Section 9.6
- Re-grade the area to restore the natural drainage patterns
- Scarify the ground surface around the buildings to support natural revegetation

5.3.4.6 PREDICTED RESIDUAL EFFECTS

The predicted residual effects at planned closure, including those encompassing buildings and equipment, were assessed as part of the FEIS with respect to VEC/VSEC. These effects, and the methods for their assessment are summarized in Appendix G.

As the project progresses, data will be collected through the environmental monitoring programs which can provide an indication of the accuracy of the predicted effects. These data can also be used to give an indication of the performance of the site mitigative measures and management systems, used as the basis for revising the prediction of residual effects, or implementing adaptive management.

5.3.4.7 UNCERTAINTIES

There is uncertainty regarding what buildings and equipment will be left in place at final closure. This will be addressed through ongoing engagement as part of the Inuit Engagement Strategy (section 2.4). There is also uncertainty regarding whether any contaminated soils may be present (see section 9.6), and uncertainty related to the level of revegetation success, which is addressed in the Reclamation Research Plan (Appendix D).

5.3.4.8 POST-CLOSURE MONITORING, MAINTENANCE AND REPORTING

Post-closure monitoring of buildings and equipment includes geotechnical/engineering monitoring (Section 9.4), aquatic monitoring (Section 9.5), Environmental Site Assessment (Section 9.6), fauna and flora monitoring (Section 9.7), safety compliance inspection (Section 9.9), and air quality monitoring (Section 9.11). Maintenance required will depend on the outcome of the monitoring programs and would be completed as outlined in Table 5.1. Baffinland will report on the results of all monitoring programs on an annual basis to the NIRB (as per Project Certificate No. 005), Federal Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301).

5.3.4.9 CONTINGENCIES

The need for contingencies for the reclamation of buildings and equipment has not been identified by Baffinland at this time as techniques and approaches to closure and reclamation of infrastructure are relatively standard with demonstrated reliability internationally. As the project progresses, the need for adaptive management and contingency alternatives may arise due to the outcomes of discussions as part of the Inuit Engagement Strategy.

5.3.5 MINING INFRASTRUCTURE

5.3.5.1 PROJECT COMPONENT DESCRIPTION

Mining infrastructure at the Project is located across the Mine Site and Milne Port areas. This component currently includes camp pads, laydowns, site roads, utilidors, conveyors and other infrastructure required for mining. Mining Infrastructure currently comprises the following main elements:

- Mine Site
  - Camp Pads
  - Laydowns
  - Site Roads
  - Air Strip
  - Conduit berms

    - Utilidor/corridor
    - Crushing plant (primary jaw crusher, secondary cone crusher, primary and secondary screens)

- Tote Road
    - Laydown Areas

- Milne Port
    - Camp Pads
    - Laydowns
    - Site Roads
    - Conduit berms
    - Conveyors

Future mining infrastructure is planned as part of the Steensby Component of the Approved Project and comprises the following elements:

- Steensby Railway
    - Laydown Areas
- Steensby Port
    - Camp Pads
    - Laydowns
    - Site Roads
    - Airstrip
    - Utilidor/corridor
    - Rail yard
    - Conduit berms
    - Conveyors

5.3.5.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The pre-disturbance site conditions are summarized in Section 3. Appendix C provides a photolog showing the current mining operations.

PADS AND LAYDOWNS

All pads are constructed with non-PAG construction materials. Pads provide the base for accommodations and other buildings and laydowns provide a base for temporary storage of equipment and other items. A number of laydown areas are located at both Milne Port and the Mine Site.

Laydown areas have been identified at various locations for the Steensby Port as part of the Approved Project (Figure 3-2.9 FEIS Volume 3). A total of approximately 70 ha of laydown area will be constructed on the mainland and 4.5 ha on Steensby island.

At final closure, laydown areas will be re-graded to restore natural drainage patterns where possible and scarified to allow for natural revegetation.

Site Roads

Site roads located at the Mine Site or Milne Port are managed as per Baffinland's Road Management Plan (FEIS Volume 10). At final closure, roads no longer required will be decommissioned. Road berms will be knocked down and they will be re-graded and scarified to promote natural revegetation.

Airstrip

The existing Mine Site airstrip is 2,000 m long with a graded area consistent with the dimensions detailed in Transport Canada's Aerodrome Standards and Recommended Practices. An additional 1,830 m long by 45 m wide airstrip will be located at Steensby Port.

At final closure, the lighting associated with the airstrips will be removed and reclaimed unless otherwise directed by regulatory agencies or the Landowner. The airstrip will be retained to support closure monitoring and provide emergency/rescue landing locations for regional aircraft or helicopters when other options are unavailable.

Ore processing infrastructure

Two mobile, self-contained crushing units are currently used for primary and secondary ore crushing and screening at the Mine Site. Crushing and screening equipment at the Mine Site does not require concrete foundations or structural steel feed bins, except that a sacrificial ore pad was prepared as a base for the ore stockpiling. The mobile crushing/screening units are designed to operate year-round. The crusher trains are equipped with one jaw crusher, one cone crusher, one primary screen and one secondary screen. After crushing and screening, the product is reclaimed and loaded into tractor/trailer units for haulage to Milne Port.

Two products are produced, lump and fines, with fines being material smaller than 6.3 mm. Initial bulk tests indicated that a ratio of 3:1 lump to fines was expected on average. Ore is crushed and screened following delivery to the primary crusher and subsequently transported to customers without further processing.

The crushing and screening assembly is located approximately 2.5 km south of the open pit mine and connected by a 7 km road. The lump product (< 31.5 mm/>6.3 mm) and fines product (<6.3 mm) discharge onto the lump collection conveyor and fines collection conveyor, respectively, for transfer to the local stockpiling area.

Due to the short and variable shipping season (60 – 90 days/season) the Milne Port stockpiles hold nearly the full year's production.

A ship loader with two (2) discharge loaders is provided. These loaders rotate 180° and shuttle in and out giving the full loading coverage of the holds without having to reposition the ship. The loaders are anchored to the ore dock and are tall enough to give 15.2 m of air draft. Stairs and/or ladders and catwalks provide access to all operating and maintenance areas of the loaders. Each tower has a set of stairs from the dock to the main deck of the ship loader. Each loader has an adjustable deflector plate in the head box to deflect iron ore straight down and inward (toward shore) for trimming the shore side of the holds.

Where possible, permanent support infrastructure was built at the onset of construction and used during both the construction and operation phases of the Project. Temporary infrastructure constructed or positioned at Project sites needed only for the construction phase are removed once construction is complete. In line with this strategy, most of the infrastructure developed at the onset of construction activities remains in service for the Life of the Project.

Portable feeders transfer ore to telescopic portable radial stackers, which in turn deposit the ore in the stockpiles at Milne Port. There are sets of portable feeders and portable radial stackers, each with a capacity of 1,500 tph. The feeders and stackers are powered by onboard diesel generators.

Once operational, ore will be transported from the Mine Site to Steensby Port via the Steensby Railway year-round, with possible short breaks during significant weather events and scheduled maintenance shut-downs. The ore will be stored in stockpiles at Steensby Port for loading onto icebreaking ore carriers. Railway ore cars will unload at the dumper pit. The ore from the dumper pit is conveyed to the ore stockpiles on Steensby Island. An ore stockpile pad, runoff collection ditches and a SWM pond will store ore and manage runoff in the same manner as described for the Mine Site ore stockpiles (see section 5.3.3.2).

Relative to pre-development conditions at Milne Port and Steensby Port, the remnants of mining infrastructure will be removed and laydown areas re-graded to restore natural drainage patterns where possible and scarified to allow for natural revegetation at closure. Assessment of laydowns for contamination will be undertaken as per the research plan outlined in Appendix D.

The Mine Site utilidor/corridor will be dismantled and disposed of in either the Mine Site landfill or transported offsite to the mainland via sealift for disposal at an approved facility.

5.3.5.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives are presented in Section 5.2 and closure criteria are presented in Tabel 5.1.

5.3.5.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

Detailed alternative analyses of other closure options have not been completed by Baffinland due to the early stage of the Project and the absence of Project components which represent the largest uncertainty at closure (open pit).

Several mining infrastructure components may be of use to the local communities, including airstrips at the Mine Site and Steensby Port. Baffinland has committed to the establishment of an Inuit Engagement Strategy (section 2.4) to best incorporate considerations for post-closure land use of the Project site and facilitate discussion of alternative uses for decommissioned facilities into the reclamation options for various Project components.

5.3.5.5 ENGINEERING WORK ASSOCIATED WITH CLOSURE ACTIVITY

To permit the reclamation of the land area they cover, improve aesthetics, remove the physical hazard they pose to humans and the environment, and address any chemical concerns they may pose, mine infrastructure at the Mine Site, Tote Road, and Milne and Steensby Port will be removed.

Removal of mine infrastructure will involve the following works:

- Decontaminate buildings and equipment as necessary to permit safe working conditions and mitigate the potential for uncontrolled releases
- Salvage infrastructure that could be sold (crushers, etc.) on or donated to the local community
- Demolish structures (ex: mine site utilidor/corridor) and haul away the refuse
- Demolish foundations of infrastructure:
  - Concrete foundations will be demolished to grade and exposed rebar will be cut to grade to prevent safety hazards
  - Concrete foundation areas will be drilled to allow for water infiltration
  - Any remaining concrete piles will be cut to grade and covered with overburden

- Remove culverts and bridges that form water crossings for Mine Site and Milne Port site roads
- Relocate crushers and screening plants to the mainland for resale, for disposal on-site, or donate to the local community
- Cleanup of any soil contamination (i.e., hydrocarbons, etc.) – see Section 9.6
- Re-grade the area to restore the natural drainage patterns
- Scarify the ground surface around the buildings to support natural revegetation

Refuse from the Mine Site infrastructure will be removed and either:

- Transported to Milne Port or Steensby Port for shipment to the mainland for either disposal or salvage
- Disposed of in the open pit (including concrete and rebar)
- Disposed of in the onsite landfills or other approved repository

5.3.5.6 PREDICTED RESIDUAL EFFECTS

The predicted residual effects at planned closure, including those encompassing mining infrastructure, were assessed as part of the FEIS with respect to VEC/VSEC. These effects, and the methods for their assessment are summarized in Appendix G.

As the project progresses, data will be collected through the environmental monitoring programs which can provide an indication of the accuracy of the predicted effects. These data can also be used to give an indication of the performance of the site mitigative measures and management systems, used as the basis for revising the prediction of residual effects, or implementing adaptive management.

5.3.5.7 UNCERTAINTIES

Uncertainties related to mining infrastructure are limited to whether any such facilities will be left in place, and whether any associated contaminated soils may be present upon closure. There may also be uncertainty in revegetation success. Both uncertainties are addressed in the Reclamation Research Plan (Appendix D).

5.3.5.8 POST-CLOSURE MONITORING, MAINTENANCE AND REPORTING

Post-closure monitoring of mining infrastructure includes geotechnical/engineering monitoring (Section 9.4), aquatic monitoring (Section 9.5), Environmental Site Assessment (Section 9.6), fauna and flora monitoring (Section 9.7), safety compliance inspection (Section 9.9), and air quality monitoring (Section 9.11). Maintenance required will depend on the outcome of the monitoring programs and would be completed as outlined in Table 5.1 Baffinland will report on the results of all monitoring programs on an annual basis to the NIRB (as per Project Certificate No. 005), Federal Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301).

5.3.5.9 CONTINGENCIES

The need for contingencies for the reclamation of mine infrastructure has not been identified by Baffinland at this time. As the project progresses, the need for adaptive management and contingency alternatives may arise due to the outcomes of discussions with the MCTAG.

5.3.6 TRANSPORTATION ROUTES

5.3.6.1 PROJECT COMPONENT DESCRIPTION

Transportation routes on site include the Mine Haul Road, Tote Road, and the ore/freight docks and barge landing area at Milne Port. A southern rail route to Steensby Port has been approved, but a specific timeline to begin construction on this aspect of the project has not been developed. The transportation route component currently includes:

Mine Site

- Mine Haul Road
- Tote Road

Milne Port

- Ore Dock
- Freight Dock
- Barge Landing Area

Future permanent elements planned as part of the Steensby component of the Approved Project comprise the following:

- Steensby Railway
- Steensby Port Ore Dock
- Steensby Port Construction Dock

5.3.6.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The pre-disturbance site conditions are summarized in Section 3. Appendix C provides a photolog showing the current mining operations.

MINE HAUL ROAD AND TOTE ROAD

The total estimated length of the Mine Haul Road is approximately 10 km from the open pit to the primary crusher and the waste dump areas.

The Mine Haul Road was constructed with a minimum granular fill thickness of 1.5 m. The road structure consists of 300 mm surface course overlying a 300 mm layer of base fill, overlying a 900 mm layer of sub-base rock fill.

The Tote Road, a gravel all-season road, is approximately 98.5 km. A fleet of highway trucks is used for ore hauling along the Tote Road and consist of a 600 HP tri-drive tractor and two identical side-tipping trailers with a combined payload of approximately 150 t. The trucks and trailers assembly are custom designed for Arctic conditions.

The four (4) single lane modular bridge crossings constructed as part of the Tote Road upgrade program were constructed to replace the pre-existing side-by-side sea-can style bridge crossings. These bridges are designed to suit the mobile equipment and trucks used on the Tote Road during construction and operations. The bridges are located at chainages KM17, KM62, KM80 and KM97 along the Tote Road between Milne Port and the Mine Site. These bridges are single lane sized to meet the Nunavut *Mine Health and Safety Act* requirements for the design vehicle widths. Bridge spans were designed to meet the hydrologic conditions of the water bodies being crossed. The deck height was designed to meet the requirements of the *Navigable Waters Protection Act* (now *Canadian Navigable Waters Act*) by Transport Canada.

Bridges, culverts, and other water crossings along the Milne Inlet Tote Road will remain in place until all the closure activities requiring Milne Port access at the Mine site are completed. The Tote Road is part of the Inuit-Owned Lands referenced in the Nunavut Agreement. It is designated for public use and communication to communities has indicated the road will be left in good physical condition in accordance with Project requirements, with water crossings removed. The final decision on the removal of the water crossings will remain with the Landowner although the removal cost of the bridge spans and culverts has been included for closure planning. Bridge abutments will be left in place where needed to maintain long-term stability of the section of the road abutting the watercourse; however, this strategy will be reviewed at each location based on the performance of the structure throughout the Project life cycle. Ongoing engagement with communities and discussions with QIA will occur to confirm an approach for the water crossings such that an acceptable level of liability exists for transfer of these remaining structures.

ORE AND FREIGHT DOCKS

There is one ore dock currently operating at Milne Port, capable of berthing Capesize ore carriers. A freight dock and barge landing pushout are also present.

An additional ore dock and construction dock are planned to be constructed at Steensby port as part of the Steensby component of the Approved Project. An island causeway will also be constructed between the mainland at Steensby Port, and Steensby Island.

The Milne Port ore and freight docks will remain in place as the rock armouring on the exterior of these structures provides fish habitat constructed as offsetting measures for their construction, in accordance with requirements under the *Fisheries Act*, and may potentially be used by local communities following closure. Dock infrastructure at Milne Port will be removed and either recycled, shipped offsite to an appropriate facility for disposal, or deposited within an onsite landfill, the open pit, or other approved repositories.

STEENSBY RAILWAY

As part of the Steensby component of the Approved Project, a 149 km railway will transport ore from the Mine Site to Steensby Port. It will also transport annual consumables and equipment arrived at Steensby Port to the Mine Site. The main components of the operating Railway include:

- Railway embankment and railway superstructure (sub-ballast and ballast materials, with wood ties and steel rails);
- Two tunnels;
- Multiple watercourse crossings (bridges/culverts);
- Caribou and snowmobile crossings;
- Locomotives and cars (ore and general freight cars);
- Bungalows - small sheds along the Railway containing power supply and signaling equipment;
- Communication towers - approximately twelve towers positioned in line-of-sight from each other along the railway alignment;
- Ore and freight loading/unloading facilities at the Mine Site and Steensby Port;
- Railway maintenance yard at Steensby Port; and
- Quarry near Steensby Port to obtain rock for ballast replacement for railway maintenance (closure of quarries is described in section 5.3.3.2).

Design and construction of the Railway along with the approved alignment and preliminary engineering drawings are described in FEIS Volume 3 and Appendix 3E.

At final closure, culverts and bridges will be removed. The railway embankment will remain in place. Tunnels will be plugged by rock and sealed with concrete. As with Tote Road water crossings, ongoing engagement with communities and discussions with QIA will occur to confirm an approach for the water crossings such that an acceptable level of liability exists for transfer of these remaining structures. Steel rails and ties will be removed from the railway.

5.3.6.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives are presented in Section 5.2 and closure criteria are presented in Table 5.1.

5.3.6.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

Detailed alternative analyses of other closure options have not been completed by Baffinland due to the early stage of the Project. However, future closure options assessment for the bridge abutments at water crossings will consist of evaluating which structures will remain, and which will be removed/graded, based on long-term stability considerations. Additional discussion on the approach for assessing structures prior to final closure and focus areas for post-closure monitoring are presented in Section 9.

Baffinland has committed to the establishment of a Mine Closure Technical Advisory Group (MCTAG) to best incorporate considerations for post-closure land use of the Project site. Several transportation route components may be of use to the local communities upon closure, including the Tote Road, water crossings and ore docks. Ongoing engagement with communities, the MCTAG and discussions with QIA and CIRNAC will occur to confirm the closure approach for the Tote Road, water crossings and ore docks such that an acceptable level of liability exists for transfer of these remaining structures.

5.3.6.5 ENGINEERING WORK ASSOCIATED WITH CLOSURE ACTIVITY

To permit the reclamation of the land area they cover, improve aesthetics, remove the physical hazard they pose to humans and the environment, and address any chemical concerns they may pose, mine infrastructure at the Mine Site, Tote Road, Milne Port and Steensby Port will be removed.

Closure of transportation infrastructure will involve the following:

- The ore and freight docks at Milne Port will remain in place with all surface infrastructure removed. The ore docks may potentially be used by communities, subject to approval by the landowner (CIRNAC).
- Water crossings, including bridges, along the Tote Road may be left in place at the landowner's request; however, the assumption is that they will need to be removed. A typical water crossing restoration is provided in Figure 5.2. Ongoing engagement with communities and discussions with QIA will occur to confirm an approach for the water crossings such that an acceptable level of liability exists for transfer of these remaining structures.
- Remove road/rail embankment fill from within the high-water limits of the water body.
- Relocate excavated material from the water crossing location and place in areas located more than 30 metres from any water body. This material could be used at nearby grading in borrow areas and quarries.
- Streambed and banks will be restored and stabilized. This will require communication with DFO prior to commencing work.
- Removed culverts will be flattened and disposed of in on-site landfills or demobilized to the mainland.
- Ditching will be subject to grading as necessary to establish post-closure drainage pathways.

- Abandoned sections of the Tote Road are expected to be transferred 'as is.' If any additional closure activities are desired by the parties receiving responsibility for the structures, this will be confirmed via ongoing engagement with the applicable communities, QIA and CIRNAC.
- The bridges, culverts and other water crossings associated with the rail alignment will be decommissioned and the natural drainage and water flows will be restored. Tunnel portals will be backfilled and plugged with rock or equivalent material as available and the openings at each end sealed with concrete.
- Railway rails and ties will be removed and either recycled, shipped offsite to an appropriate facility for disposal, or deposited within an on-site landfill, the open pit, or other approved repositories (subject to discussion as part of the Inuit Engagement Strategy and with the landowners).
- The railroad embankment is to be left in place upon closure. However, the rail ballast will be tested to verify its inert status to determine if it can be left in place at closure. If found unacceptable (from an environmental point of view), the ballast will be cleaned. The resultant fines will be hauled away for more controlled disposal. Locomotives and cars will be sealifted offsite for resale, salvage or disposal at an approved facility.
- Environmental site assessments at road and/or railroad maintenance and fuelling facilities where impacts may have occurred and cleanup of soil contamination (i.e., hydrocarbons, etc.)
- Removal of ore spillage into the ballast from movement of trains and trucks and ballast cleaning and disposal of recovered fines if required.

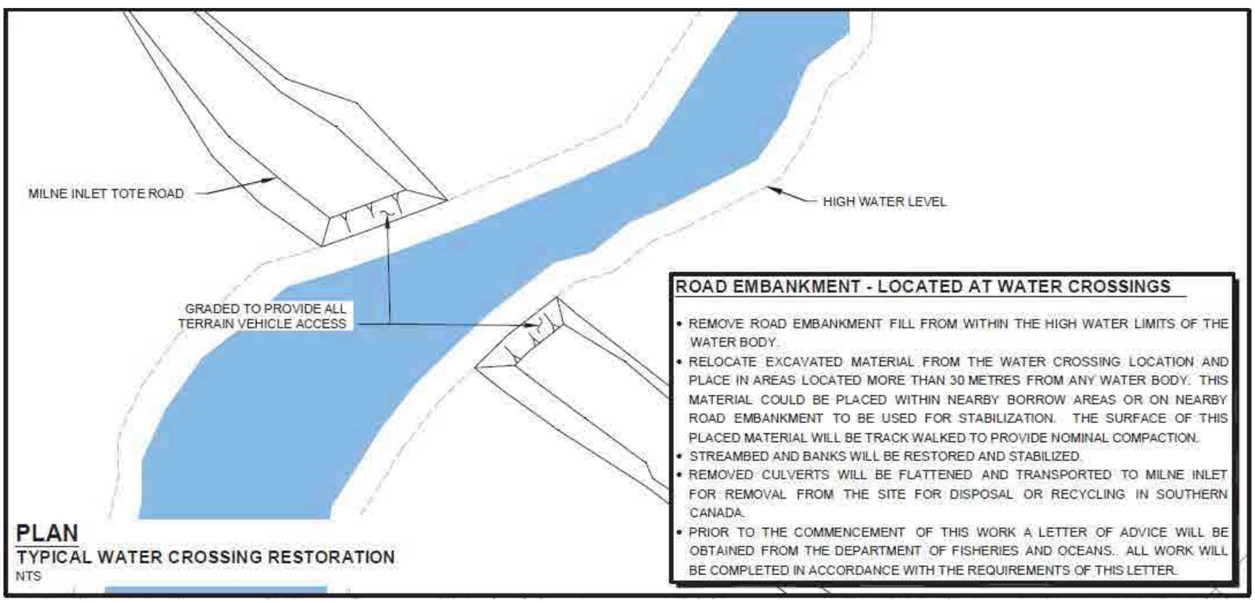


FIGURE 5.2 TYPICAL WATER CROSSING RESTORATION ALONG TOTE ROAD.

5.3.6.6 PREDICTED RESIDUAL EFFECTS

The predicted residual effects at planned closure, including those encompassing transportation routes, were assessed as part of the FEIS with respect to VECs/VSECs. These effects, and the methods for their assessment are summarized in Appendix G.

As the project progresses, data will be collected through the environmental monitoring programs which can provide an indication of the accuracy of the predicted effects. These data can also be used to give an indication of the performance of the site mitigative measures and management systems, used as the basis for revising the prediction of residual effects, or implementing adaptive management.

5.3.6.7 UNCERTAINTIES

Uncertainties related to the transportation routes may include which infrastructure may be left in place and whether any associated contaminated soils may be present upon closure (Section 9.6, Appendix D). There may also be uncertainty in revegetation success. These uncertainties are addressed through the Inuit Engagement Strategy (Section 2.4) and the Reclamation Research Plan (Appendix D).

5.3.6.8 POST-CLOSURE MONITORING, MAINTENANCE AND REPORTING

Post-closure monitoring of transportation routes includes geotechnical/engineering monitoring (Section 9.4), aquatic monitoring (Section 9.5), Environmental Site Assessment (Section 9.6), fauna and flora monitoring (Section 9.7), safety compliance inspection (Section 9.9), and air quality monitoring (Section 9.11). Maintenance required will depend on the outcome of the monitoring programs and would be completed as outlined in Table 5.1. Baffinland will report on the results of all monitoring programs on an annual basis to the NIRB (as per Project Certificate No. 005), Federal Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301).

5.3.6.9 CONTINGENCIES

The need for contingencies for the reclamation of mine infrastructure has not been identified by Baffinland at this time. As the project progresses, the need for adaptive management and contingency alternatives may arise due to the outcomes of discussions with the MCTAG.

5.3.7 WASTE, LANDFILLS AND OTHER DISPOSAL AREAS

5.3.7.1 PROJECT COMPONENT DESCRIPTION

Solids wastes at the Project are managed under the Waste Management Plan (BAF-PH1-830-P16-0028). All hazardous waste is managed under the Hazardous Materials and Hazardous Waste Management Plan (BAF-PH1-830-P16-0011). This mine closure component currently includes:

- Milne Port
  - Landfarm
  - Contaminated snow containment area
  - Future Landfill (planned in for future permitting)
- Mine Site
  - Landfarm
  - Landfill
- Milne Port and Mine Site disposal of fuel and hazardous materials, including:
  - Hazardous Material Storage Areas
  - Waste Management Facilities Including Temporary Storage Areas
  - Hazardous Waste and Hazardous Chemicals

- Fuel
- Explosives Storage

Future permanent elements planned as part of the Steensby component of the Approved Project comprise the following:

- Steensby Port
  - Landfarm
  - Landfill
  - Non-Hazardous Waste Disposal Locations

5.3.7.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The pre-disturbance site conditions are summarized in Section 3. Appendix C provides a photolog showing the current mining operations.

LANDFARMS AND CONTAMINATED SNOW CONTAINMENT AREAS

Landfarms are in place at Milne Port and the Mine Site. The landfarms were constructed for the treatment of PHC-contaminated soils generated during continuing mining operations. This remediation occurs through volatilization and natural biological processes (biodegradation). Each contain multiple geomembrane-lined cells including one cell dedicated to the storage of contaminated ice/snow (instead of soil). In 2021, construction began on a section of the Mine Site Landfarm facility (MS-05), and construction of the first two cells was completed in 2022.

A landfarm will be used for temporary storage and treatment of hydrocarbon-contaminated soil and water at Steensby Port.

Once no longer required, landfarm liners will be removed and landfilled, and the underlying soil will be tested for hydrocarbon contamination. Any contaminated soils will be removed from site and the areas will be contoured. Post-closure water quality run-off objectives in receiving water bodies from landfarms will be met and no long-term active care is expected to be required. Baffinland has identified uncertainties regarding the length of time required to treat contaminated soil at the landfarms.

Baffinland will begin trialing remediation test plots at the Milne Port Landfarm in 2023/2024 and will move forward with developing a remediation plan. The trials scheduled include the application of bioremediation techniques and mechanical tilling on hydrocarbon impacted material during the ice-free season. Baffinland will perform pre and post treatment soil sampling to evaluate if the trial is feasible to scale up to a full size treatment plan. Further details are provided in section 5.3.7.7 and Appendix D.

SOLID WASTE MANAGEMENT

Solid waste management infrastructure includes the incinerators, waste management buildings, and hazardous waste containment areas. Incinerators are used to dispose of applicable non-hazardous waste. Residual ash from the incinerators is landfilled after testing has confirmed it to be non-hazardous waste.

The waste management building provides a heated indoor area for waste to be appropriately sorted to meet the incinerator's burning 'recipe' requirements. The waste management building pads are pre-cast concrete block foundation with poured concrete floors with sumps to contain any effluent.

The hazardous waste containment areas known as Hazardous Waste Berm (HWB) facilities are lined containment cells used to temporarily store hazardous waste/contaminated material until they are shipped offsite to approved disposal or recycling facilities. The hazardous waste containment areas have all been constructed using raised earthworks and with an impermeable geomembrane liner that has been covered with a layer of fill. A groundwater monitoring program using piezometers and standpipes was established for the HWB facilities at the Mine Site in 2021 and 2022 (Tetra Tech, 2022; Knight Piésold, 2023). Monitoring occurs annually in September.

Each of the sea containers housing the incinerator equipment has an access port that penetrates the rear wall of the foldaway building. The waste management buildings are rectangular in shape with truck door access on one side.

Waste management facilities will also be required as part of the Steensby component of the Approved Project (FEIS Volume 3).

At final closure, the incinerators and waste management buildings will be decommissioned and removed from the site (see section 5.3.4) or landfilled as appropriate and the affected footprint regraded to restore natural drainage patterns where possible and scarified to allow for natural revegetation. The hazardous waste containment areas will be evaluated for any remaining hazardous material/soils and addressed as per the Hazardous Materials and Hazardous Waste Management Plan. The area will be re-graded and scarified to allow for natural revegetation at closure.

A list of non-salvageable materials has been developed and will be provided annually as part of the Annual Security Review process conducted in accordance with Schedule C of Type A Water Licence 2AM-MRY1325.

LANDFILLS

The Project's Landfill facility at the Mine site has been designed and operated in accordance with the *Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the Northwest Territories* (Ferguson, Simek Clark Engineers & Architects, 2003). Only non-hazardous, non-organic and inert waste is disposed of in the facility. All liquid industrial waste and hazardous waste is diverted for disposal to a Licensed facility off site.

The area method is used for waste disposal wherein a low height berm is constructed along two sides of the landfill site and then waste is disposed of against the berms and directly onto the ground downstream of the berms. Sand and gravel is used as the cover material. Landfill gas is not expected to be an issue as the deposited waste will be non-hazardous and inert. Therefore, a landfill gas collection system was not installed in the landfill site.

Because of permafrost in the area, no groundwater protection system is included. Monitoring of the solid waste landfill and hazardous waste and materials containment berms at the Mine Site include a groundwater monitoring program (section 5.3.7.2 and section 3.3.4). Expansion of the Mine Site Landfill Facility was initiated in 2018 and involved the construction of and deposition of waste at the Landfill Facility's second waste cell (Cell No. 2). Baffinland has been conducting groundwater monitoring at the Landfill Facility since 2017, using temporary piezometers and standpipes (installed in 2022) to monitor groundwater near the bottom of the active layer in the vicinity of the Landfill Facility. Monitoring is undertaken annually in September, when the active layer is the thickest. In 2023, several new groundwater monitoring well locations were installed at the Landfill Facility and the Mine Site Hazardous Waste Berm (HWB) Facility, located adjacent to the Mine Site Airstrip (Knight Piésold 2023). The monitoring program is a requirement of Condition No. 23 of Baffinland's Project Certification No. 005 (NIRB, 2022). The new monitoring well locations are intended to address some of the historical sampling issues associated with small diameter drive point piezometers, including low sampling volumes.

A landfill for inert, non combustible and non-hazardous wastes will be developed as part of the Steensby component of the Approved Project (FEIS Volume 3).

Project landfills will be progressively covered with overburden, as cells are completed, to allow the contents of the landfill to remain permanently frozen to physically and geotechnically stabilize in the long term, make surface runoff and seepage water quality safe for humans and wildlife, and encourage the desired wildlife movement upon site abandonment, such that post-closure water quality run-off objectives in receiving water bodies are met and no long-term active care is required. To achieve permafrost encapsulation in the landfill site, the final cover will be thicker than the active layer, accounting for climate change. Determination of the required cover thickness will be subject to thermal modelling as described in Appendix D4.

5.3.7.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives are presented in Section 5.2 and closure criteria are presented in Table 5.1.

5.3.7.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

Detailed alternative analyses of other closure options have not been completed by Baffinland due to the early stage of the Project. As data are collected and analysis is conducted, the ICRP will be updated as required. Please refer to Appendix D for more detail on Reclamation Research Programs relevant to the Project to address uncertainties related to final closure.

No major closure options are being considered for this mine component. The closure activities discussed below are expected to be relevant for all existing and any future changes to project infrastructure within this mine component (e.g., additional non-hazardous landfills). Baffinland will develop specific criteria to determine whether non-hazardous materials will be disposed of on-site or off-site. Development of these criteria will include an assessment of:

- space required/available in on-site landfills or other approved waste disposal locations
- logistical constraints/level of effort required for on-site vs. off-site disposal options
- cost of on-site vs. off-site disposal options
- information as received through the Inuit Engagement Strategy

5.3.7.5 ENGINEERING WORK ASSOCIATED WITH CLOSURE ACTIVITY

At final closure, Baffinland will undertake a comprehensive Phase 1/2 Environmental Site Assessment (ESA) to identify areas of soil contamination. Further ESAs and a remedial options assessment will be completed as necessary to determine the extent of contaminated areas and appropriate techniques and methods to deal with such sites as described within Appendix D.

Thermal modelling is proposed in Appendix D4 to determine the required thickness of the final cover over the landfills to keep the waste frozen.

Figure 5.7 demonstrates the major waste streams expected to be generated during closure and reclamation activities and the respective expected transportation and disposal approach.

In response to comments, Baffinland will develop specific criteria to determine which materials in the non-hazardous waste stream will be disposed either on-site or off-site. Criteria used to determine whether non-hazardous materials are disposed of on-site or off-site will include:

- space required/available in on-site landfills or other approved waste disposal locations
- logistical constraints/level of effort required for on-site vs. off-site disposal options
- cost of on-site vs. off-site disposal options
- input from the Mine Closure Technical Advisory Group

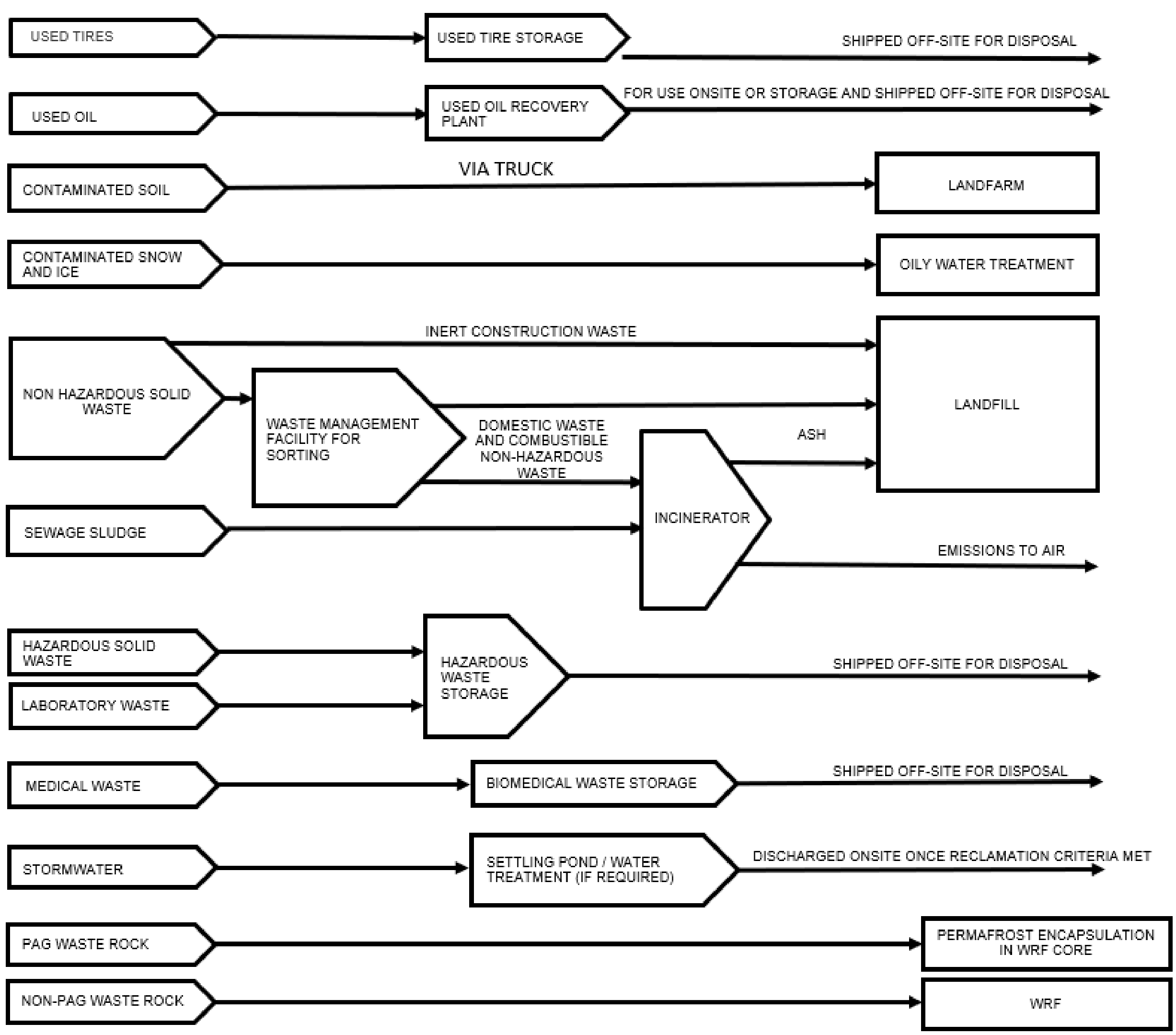


FIGURE 5.3 MAJOR WASTE STREAMS AND METHODS OF TRANSPORTATION AND DISPOSAL

The stock of explosives will be depleted towards the end of the operations phase and any remaining explosives will be securely contained and shipped from the site by a Licenced contractor to an approved facility for disposal or reuse or detonated in a controlled and safe fashion by experienced and Licenced personnel at appropriate locations away from sensitive receptors.

Oil, grease, ammonium nitrate and chemicals will be transported offsite for disposal at an approved facility or where applicable for reuse. All batteries and hazardous waste will be removed and disposed of or recycled at an approved facility offsite.

Combustible non-hazardous wastes will be incinerated at the Project incinerators. Once the incinerators are no longer required, they will be disposed of in one of the non-hazardous landfills or shipped offsite and disposed in a licensed facility.

5.3.7.6 PREDICTED RESIDUAL EFFECTS

The predicted residual effects at planned closure, including those encompassing landfills and other disposal areas, were assessed as part of the FEIS with respect to VEC/VSEC. These effects, and the methods for their assessment are summarized in Appendix G. Following closure, no residual effects related to landfills and other disposal areas are anticipated with the required mitigation (e.g., reclamation/remediation, as required), except for vegetation. Loss of vegetation within the PDA is a residual effect — it is not expected that disturbed areas will become re-vegetated until after closure of the mine. Regeneration of the disturbed area is a slow process and will not occur until beyond the life of the project.

As the project progresses, data will be collected through the environmental monitoring programs which will provide an indication of the accuracy of the predicted effects. These data will also be used to give an indication of the performance of the site mitigative measures and management systems, used as the basis for revising the prediction of residual effects, or implementing adaptive management.

5.3.7.7 UNCERTAINTIES

Uncertainties related to the closure of landfills and other waste disposal areas include; whether the remaining land contains contaminated soils (Section 9.6), revegetation success and depth of overburden cover required to enable permanent freezing, with consideration of climate change. All areas of uncertainty are addressed in the Reclamation Research Plan (Appendix D) and will be discussed with relevant stakeholders as per the engagement strategy described in Section 2.4 of this document.

5.3.7.8 POST-CLOSURE MONITORING, MAINTENANCE AND REPORTING

Post-closure monitoring of landfills and other waste disposal areas includes geotechnical/engineering monitoring (Section 9.4), aquatic monitoring (Section 9.5), Environmental Site Assessment (Section 9.6), fauna and flora monitoring (Section 9.7), safety compliance inspection (Section 9.9), and air quality monitoring (Section 9.11). Maintenance required will depend on the outcome of the monitoring programs and would be completed as outlined in Table 5.1. Baffinland will report on the results of all monitoring programs on an annual basis to the NIRB (as per Project Certificate No. 005), Federal Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301).

5.3.7.9 CONTINGENCIES

The need for contingencies for the reclamation of waste, landfills, and other disposal areas has not been identified by Baffinland at this time. As the project progresses, the need for adaptive management and contingency alternatives may arise due to the outcomes of discussions with the MCTAG and the results of the Inuit Engagement Strategy.

5.3.8 WATER MANAGEMENT SYSTEMS

5.3.8.1 PROJECT COMPONENT DESCRIPTION

Water management systems at the Project consist of infrastructure to support supply of freshwater, management of sewage and wastewater treatment systems and surface water management ponds. The Freshwater Supply, Sewage and Wastewater Management Plan (BAF-PH1-830-P16-00100) describes the plan to manage the fresh water supply and wastewater for the various camp sites for the Mary River Project during the Project's construction and operation phases at Milne Port, the Mine Site, Steensby Port and various temporary camps. The water management systems at the Project include:

- Milne Port and Mine Site
  - Ore stockpile sedimentation ponds
- Milne Port
  - Raw water system
  - Water treatment system
  - Sewage treatment system
  - Polishing and waste stabilization ponds (PWSPs)
- Mine Site
  - Raw water system
  - Contact water ponds
  - Open pit dewatering system
  - WRF Water treatment system
  - Sewage treatment system
  - Polishing and waste stabilization ponds (PWSPs)
  - KM105 Pond

Additional water management systems will be required as part of the Steensby component of the Approved Project and will include;

- Steensby Port
  - Raw water system
  - Water treatment system
  - Sewage treatment system

To manage and monitor stormwater retained by ore and waste rock management facilities, the following eight (8) surface water management ponds have been established at the Mine Site and Milne Port:

Mine Site

- Crusher Facility Pond (CF Pond; MS-06);
- Run-of-Mine (ROM) Ore Stockpile Facility (KM106 ROM Pond; MS-07);
- Waste Rock Facility Pond (WRF Pond; MS-08); and
- KM105 Pond (MS-11).

Milne Port

- Four surface water management ponds: two Ore Stockpile Ponds (East Pond [MP-05] and West Pond [MP-06]) and two surface water management ponds.

- Stormwater retained is directed to surface water management ponds by a network of berms and ditches established around the perimeter of each facility.

5.3.8.2 PRE-DISTURBANCE, EXISTING, AND FINAL SITE CONDITIONS

The pre-disturbance site conditions are summarized in Section 3.0. Appendix C provides a photolog showing the current mining operations.

ORE STOCKPILE SETTLING PONDS

The ore stockpile settling ponds were constructed to temporarily retain the runoff water from ore stockpile areas and contain the sediment load to meet the water quality standards in accordance with applicable effluent quality criteria. During normal operation, runoff from the stockpile area drains to the stockpile settling ponds. The ponds are pumped down manually to permitted final discharge points and are also equipped with emergency spillways designed to pass the inflow design flood (IDF).

The ponds are lined, and the berms have design side slopes not steeper than 3H:1V and berm top widths of 2.0 m to meet the access and liner anchoring requirements. Stockpile settling ponds will be removed during closure, following decommissioning of the ore stockpiles, when management/treatment of site drainage is no longer required.

KM105 DAM AND SEDIMENTATION POND

The KM105 Sedimentation Pond was completed in 2022 as part of the Long-Term Surface Water Management Plan for the Mine Site. This pond temporarily stores runoff from the Mine Haul Road (MHR), and undisturbed areas upslope of the road and KM105 Pond, to settle out a portion of the total suspended solids (TSS) prior to discharge (pumped) to Sheardown Lake Tributary 1 (SDLT-1). It includes embankments along the south and northwest extents of the pond (extending east-west and north-south, respectively). Embankments were constructed using compacted rockfill, and upstream slopes of each embankment are lined. A liner was installed at the toes of the dam to collect bypass water in 2022.

The overall closure objectives for the KM105 Sedimentation Pond are to re-establish the natural drainage of the KM105 Pond area, and to ensure long-term physical stability by limiting future erosion within the drainage path (KP, 2022). The KM105 Sedimentation Pond will be decommissioned once runoff from the catchment area consistently meets applicable discharge limits (Type A Water licence and Schedule 4 of the Metal and Diamond Mining Effluent Regulations [MDMER, 2018]). A minimum of three years of water treatment will be required to ensure alignment with the MDMER.

MILNE PORT – RAW WATER AND WATER TREATMENT SYSTEMS

The Milne Port raw water system requires a raw water truck drawing water from either KM32 Lake (in winter/summer) or Phillips Creek (in summer) and delivering the water to a water storage tank near the camp.

The Milne Port water treatment systems consist of an adsorption clarifier water treatment plant designed to treat raw water for the removal of colour, turbidity and other impurities to provide a high-quality effluent. The high-quality effluent from the adsorption clarifier is then disinfected for potable and domestic use. The process combines flocculation and clarification in the mono-media roughing filter. Flocs are formed and retained in the coarse mono-media. The dual media filter provides polishing of the pre-treated water to provide a high-quality effluent. Disinfection involves UV and chlorination.

The water treatment building at the Port Site Complex (PSC) is a foldaway building located west of the PSC. The system includes the outdoor piping connecting the water treatment plant to the sewage treatment plant, and the piping between the water treatment plant and the accommodations facility. The 386-bed camp water treatment plant is a containerized unit.

At final closure, water treatment systems buildings will be removed and potentially reused. Outdoor piping will also be removed and affected footprints regraded to restore natural drainage patterns where possible and scarified to allow for natural revegetation.

MILNE PORT – SEWAGE TREATMENT SYSTEM

The Milne Port sewage treatment plant (STP) is a membrane bioreactor (MBR) wastewater treatment plant designed for treatment of domestic wastewater. The STP is a packaged plant that comes with containerized inlet screen, equalization tank, post equalization tank screen, aeration tank, membrane tanks, UV disinfection systems and a sludge dewatering unit. The plant is housed inside six (6) 40 ft modified high-cube shipping containers that were interconnected when installed. The system includes the outdoor piping connecting the accommodations facility to the sewage treatment plant, the effluent discharge piping, and the potable water inlet. During normal operation, the treated effluent from the sewage treatment plant (STP) is pumped 750 m to the permitted discharge point at Milne Inlet via the treated effluent discharge above ground pipeline. The sludge generated by the MBR is dewatered using a mechanical dewatering device, a filter press, and then incinerated or backhauled for disposal off site.

The Milne Port sewage treatment plants will be removed at final closure and potentially reused. Outdoor piping including the treated effluent discharge system will also be removed and affected footprints regraded to restore natural drainage patterns where possible and scarified to allow for natural revegetation.

POLISHING/WASTE STABILIZATION PONDS

Polishing Waste Stabilization Ponds (PWSPs) are located at the Milne Port and Mine Sites and are used to store off-spec effluent from the Sewage Treatment Plants (STP). The PWSPs can receive wastewater, sludge, grey water, and non-compliant sanitary effluent from various locations across both sites. These sources include, but are not limited to:

- Non-compliant effluent from wastewater treatment plants
- Excess sludge generated at wastewater treatment plants
- Raw sewage from spills
- Raw sewage from lift stations as a result of malfunction or emergency
- Greywater from lift stations

The pond(s) have been constructed as rectangular shape to optimize the earthworks materials (granular fills and liner). The pond berms have side slope not steeper than 3H:1V and the berm top width is 3.0 m to meet the access and liner anchoring requirements. The pond(s) have been constructed with raised earthworks on top of the laydown pads. It has been sealed with liner material for storing the off-spec effluent without any leakage.

The off-spec effluent pond(s) will be removed concurrently with the decommissioning of the sewage treatment plants. The affected footprints will be regraded to restore natural drainage patterns where possible and scarified to allow for natural revegetation.

MINE SITE – RAW WATER AND WATER TREATMENT SYSTEM

The Mine Site raw water system is a pumping arrangement that draws water from Camp Lake (northwest of the Sailiivik Camp) to the water treatment system for treatment and distribution. The raw water system includes a raw water pumphouse (a heated and insulated sea container) installed on a jetty built out from the east side of Camp Lake. The pump draws water up through the wet well below the pumphouse and pumps the water through a 100 mm (4 inch) HDPE DR11 pipeline over 4 km to the water treatment building.

The Mine Site water treatment system includes an adsorption clarifier water treatment plant designed to treat raw water for the removal of colour, turbidity and other impurities to provide a high-quality effluent. The high-quality effluent from the adsorption clarifier is then disinfected for potable and domestic use. Disinfection involves UV and chlorination. The system is fed by the raw water system drawing from Camp Lake.

The Mine Site water treatment building is a foldaway building located south of the fuel tank farm and southwest of the sewage treatment building. The system includes the outdoor piping connecting the water treatment plant to the sewage treatment plant, and the piping between the water treatment plant and the Sailivik Camp.

At final closure, water treatment systems buildings will be removed and potentially reused. Outdoor piping will also be removed and affected footprints regraded to restore natural drainage patterns where possible and scarified to allow for natural revegetation.

MINE SITE – SEWAGE TREATMENT SYSTEM

The Mine Site has two (2) MBR STP facilities to service the MSC and the Sailiivik Camp Complex. Effluent is discharged via a direct effluent discharge line from the STP servicing the Sailiivik Camp Complex and Mine Site Complex to the approved discharge locations near the Mary River. The STPs are packaged plants that come with containerized inlet screen, equalization tank, post EQ screen, aeration tank, membrane tanks, UV disinfection systems and a sludge dewatering unit. The plant is housed inside six (6) 40 ft modified high-cube shipping containers that were interconnected when installed. The Mine Site sewage treatment plant is located southeast of the fuel tank farm, northeast of the water building, and east of the Sailiivik Camp. The system includes the outdoor piping connecting the Sailiivik Camp to the sewage treatment plant and the connection for the effluent discharge piping.

The Mine Site sewage treatment plants will be removed at final closure and potentially reused. Outdoor piping including the treated effluent discharge system will also be removed and affected footprints regraded to restore natural drainage patterns where possible and scarified to allow for natural revegetation.

MINE SITE – TREATED EFFLUENT DISCHARGE

During normal operation, the treated effluent from the STP is pumped to the permitted discharge points at Mary River via the above ground, 2-km-long treated effluent discharge pipeline. If the treated effluent does not meet discharge requirements, the off-spec effluent would be trucked from the STP to one of the three existing PWSPs for storage and eventual treatment/discharge as required. Once the ‘problem’ in the STP is corrected, the off-spec effluent from the pond(s) will be treated insitu or transported via vacuum truck and re-processed through the STP before directly discharging to Mary River. The treated effluent discharge pipeline is a 50 mm (2 inch) diameter HDPE DR11 pipeline from the STP to the tee connection (valve box/branch) with the remainder of the pipeline (from the valve box/branch to the Mary River discharge) being 75 mm (3 inch) diameter HDPE DR11. The pipeline is approximately 2 km long, above ground, pre-insulated with 50 mm (2 inch) insulation and heat traced for year-round use.

The Long-Term Water Management Plan (LTWMP) for the Mine Site was developed with Knight Piésold in 2021 to address erosion and sedimentation at the Mine Site. In 2021, construction of the MS-11 Surface Water Management Pond began, as part of the first phase of the implementation of the LTWMP at the Mine Site, and the construction was completed in 2022. Construction activities were also completed in the Camp Lake area in 2022 to reduce potential erosion and sedimentation in the area and minimize releases of Total Suspended Solids (TSS) to Camp Lake and its tributaries. The Long-Term Water Management Plan continued to be implemented in 2023 with a geotechnical drilling program conducted to support engineering design work for future planned construction activities.

Disturbances to the surrounding areas of the Project may cause thermal disruptions to the permafrost zone resulting in ponding, settlement and/or subsidence due to changes in the active zone (the upper 1 to 2 m of soil). During closure these areas will be drained of excess water, filled with clean material to insulate, and re-establish the active layer and graded, restoring the natural drainage of the area as necessary. The natural drainage of water courses will be re-established for long-term stability.

5.3.8.3 CLOSURE OBJECTIVES AND CRITERIA

The closure objectives are presented in Section 5.2 and closure criteria are presented in Table 5.1.

5.3.8.4 CONSIDERATION OF CLOSURE OPTIONS AND SELECTION OF CLOSURE ACTIVITIES

A detailed analysis of other closure options has not been completed by Baffinland due to the early stage of the Project and the absence of Project components which represent the largest uncertainty at closure (Open Pit, Permanent WRF). As data are collected and analysis is conducted, the ICRP will be updated as required. Please refer to Appendix D for more detail on existing Reclamation Research Programs relevant to the Project to address uncertainties related to final closure.

Although modifications to the existing water management infrastructure and corresponding sequencing of their closure may change, no significant changes to closure options are expected to be considered for this mine component as no structures are planned to remain following reclamation.

5.3.8.5 ENGINEERING WORK ASSOCIATED WITH CLOSURE ACTIVITY

The water supply systems at the Mine Site and Milne Port will be demolished, removed and either sealifted to the mainland for disposal/salvage or will be disposed of in the onsite landfills or other approved repository.

The sewage treatment plants located at the Mine Site and Milne Port will be decommissioned as per the manufacturer's specifications. The remaining sewage treatment plant components will be either transported for sealift to the mainland for disposal or salvaged or disposed of in the onsite landfill.

The site water management ponds (Polishing Ponds, Ore Stockpile Settling Ponds, KM105 Pond etc.) will be decommissioned when they are no longer required, and water quality is found to consistently meet effluent criteria (Section 5.2). Ponds will be decommissioned as follows:

- Soils and sediment will be tested as part of the Environmental Site Assessment work and impacted soils and sediment will be cleaned up as necessary (Section 9.6)
- Liners, where present, will be removed and disposed of in a non-hazardous waste containment area
- The ponds will be filled with clean material and perimeter berms will be regraded and breached to restore natural drainage patterns

- The ground will be scarified around the pond areas to encourage natural revegetation

Water crossings (bridges and culverts) will be decommissioned, and the drainage channels restored to natural drainage conditions (see section 5.3.6.2).

As pumping equipment is no longer required (cessation of mine dewatering, decommissioning of a pond, decommissioning of a water treatment plant, etc.), the associated pumps and pipes will be decommissioned. Pipes will be disposed of in the non-hazardous waste areas and ownership of pumps will either be transferred (sold) off-site or donated to the local communities.

5.3.8.6 PREDICTED RESIDUAL EFFECTS

The predicted residual effects at planned closure, including those encompassing water management, were assessed as part of the FEIS with respect to VEC/VSEC. These effects, and the methods for their assessment are summarized in Appendix G. With the removal of facilities and rehabilitation of the previously disturbed land, residual effects are expected to be limited to loss of vegetation within the PDA; it is not expected that disturbed areas will become re-vegetated until after closure of the mine. Regeneration of the disturbed area is a slow process and will not occur until beyond the life of the project.

As the project progresses, data will be collected through the environmental monitoring programs which can provide an indication of the accuracy of the predicted effects. These data can also be used to give an indication of the performance of the site mitigative measures and management systems, used as the basis for revising the prediction of residual effects, or implementing adaptive management.

5.3.8.7 UNCERTAINTIES

Uncertainties related to the decommissioning of water management systems include whether there are associated contaminated soils or sediments in the ponds (Section 9.6), and there may be uncertainty in revegetation success, addressed in a reclamation research program (Appendix D).

5.3.8.8 POST-CLOSURE MONITORING, MAINTENANCE AND REPORTING

Post-closure monitoring of decommissioned water management systems includes geotechnical/engineering monitoring (Section 9.4), aquatic monitoring (Section 9.5), Environmental Site Assessment (Section 9.6), fauna and flora monitoring (Section 9.7), safety compliance inspection (Section 9.9), and air quality monitoring (Section 9.11). Maintenance required will depend on the outcome of the monitoring programs and would be completed as outlined Table 5.1. Baffinland will report on the results of all monitoring programs on an annual basis to the NIRB (as per Project Certificate No. 005), Federal Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301).

5.3.8.9 CONTINGENCIES

The need for contingencies for the reclamation of water management systems has not been identified by Baffinland at this time. As the project progresses, the need for adaptive management and contingency alternatives may arise due to the outcomes of discussions with the MCTAG.

5.3.9 MATERIALS SUITABILITY FOR CLOSURE NEEDS

Reclamation activities shall restore the physical and chemical stability of areas where material was removed or altered for Project purposes (i.e., excavation activities). Reclamation activities may include, but are not limited to, replacing those affected areas with suitable cover materials sourced locally, importing/producing fill, restoring drainage to limit unnatural standing water through re-grading, routing of any trapped surface water and scarification. All such reclamation activities shall be performed in a manner that will reduce the risk of erosion and sedimentation to the surrounding environment and limit disturbance to the permafrost.

Criteria for sourcing suitable materials for closure needs requires consideration of several chemical (i.e., pH, sodicity, salinity, saturation, etc.) and physical (i.e., texture, moist consistency, content, etc.) properties. A comprehensive assessment of suitable materials for closure needs will be completed no later than five years prior to planned mine closure as part of the development of the Final Closure and Reclamation Plan, focusing on the following objectives:

- Identifying and mapping suitable locations of material as well as its distribution. Locations will be evaluated for chemical and physical stability, impact to natural environment, etc.
- Geochemical and physical characteristics for suitability for reclamation such as the consistency to prevent erosion, porosity, ability to alter natural snow and water runoff conditions, stability, etc.
- Determining depth and volumes of material types.
- Development of a schedule of availability.

6.0 PROGRESSIVE RECLAMATION

6.1 DEFINITION OF PROGRESSIVE RECLAMATION

Most of the Project areas will be actively used during the Construction and Operation phases of the Project, although where practical, areas which are no longer needed to carry out Project activities will be progressively reclaimed. As per MVLWB/CIRNAC Guidelines, "*Progressive reclamation takes place prior to permanent closure to reclaim components and/or decommission facilities that no longer serve a purpose. These activities can be completed during operations with the available resources to reduce future reclamation costs, minimize the duration of environmental exposure, and enhance environmental protection. Progressive reclamation may shorten the time for achieving closure objectives and may provide valuable experience on the effectiveness of certain measures that might be implemented during permanent closure*." (MVLWB/AANDC, 2013).

6.2 OPPORTUNITIES FOR PROGRESSIVE RECLAMATION

This section describes the proposed progressive rehabilitation measures that will be completed during the construction and/or operation phases of the Project. In accordance with the objectives and guidelines presented in Section 5.2, progressive rehabilitation will be implemented to achieve the Project's site abandonment goal and closure principles. Table 6.1 presents Baffinland's proposed progressive rehabilitation schedule as required under Part J of Type A Water Licence. This schedule will be updated in future versions of the ICRP as additional opportunities are identified.

Most of the Project areas will be actively used during the construction and operation phases and as such there are limited opportunities for progressive reclamation. Where practicable, the inactive areas will be progressively reclaimed during construction and operations.

The process for engagement with Inuit regarding potential opportunities for Inuit to participate in progressive reclamation activities will be confirmed through the Engagement Strategy. Details of progressive reclamation activities and monitoring is currently reported annually as part of the NWB Annual Report for Operations.

Progressive reclamation activities outlined in the Preliminary Closure and Reclamation Plan (Baffinland 2011) for the Milne Port and Steensby Port are provided below. However, it is noted that further discussion is required, and changes may be made based on feedback through the Inuit Engagement Strategy (Section 2.4). Items such as Inuit opportunities for progressive rehabilitation are being considered and will be discussed with relevant stakeholders.

6.2.1 CURRENT OPPORTUNITIES FOR PROGRESSIVE RECLAMATION

6.2.1.1 TOTE ROAD

In 2019, evaluation of the condition of the Tote Road by Tetra Tech led to the implementation of a 2020 action plan to address the historic borrow sources on the Tote Road. While the remaining activities are planned for completion in 2024 and beyond, progressive reclamation activities have been completed according to the action plan between 2020 and 2023.

6.2.1.2 MINE SITE

Ongoing progressive reclamation at the mine site includes demobilization and backhaul of equipment and supplies not required for near term activities, including the current inventory of hazardous waste and other materials by means of sealifts from Milne Port and on-going management of hydrocarbon impacted soils at the Milne Port and Mine Site Landfarm Facilities generated from historical decommissioning efforts and ongoing operations. Further details of onsite reclamation of hydrocarbon contaminated soils are outlined in Appendix D.

6.2.2 FUTURE PROGRESSIVE RECLAMATION OPPORTUNITIES

6.2.2.1 MILNE PORT

Following construction of Steensby Port, the Milne Port will not be permanently decommissioned and reclaimed during operations due to occasional use to receive large loads in open water periods. Specific infrastructure will be decommissioned however as the Port will eventually not be used for ore transportation when the railway is commissioned. This includes:

- Progressive reclamation of the Milne Inlet Ore Stockpile
- Removal and decommissioning of ore conveyors, scales and loading infrastructure.
- Removal of associated equipment related to the use of the Tote Road and Milne Inlet as an ore hauling pathway.

6.2.2.2 STEENSBY PORT

The following additional activities will be undertaken to progressively reclaim Steensby Port:

- The Steensby Port landfill will be progressively reclaimed using a cover to allow the waste materials to remain permanently frozen and isolated;
- Quarries and borrow areas not used for disposal during final reclamation, will be re-contoured to maintain safe side slopes and re-establish natural drainage; and
- The construction camp will be downsized to accommodate the reduced personnel remaining onsite during operations.

6.2.2.3 RAILWAY

Following completion of the railway, the following progressive reclamation activities will be undertaken:

- The railway construction camps will be decommissioned and include the following reclamation activities:
  - Dismantling of the water treatment and sewage treatment systems as per the manufacturer's specifications. All remaining infrastructure will either be sea lifted to an approved facility for disposal or disposed of at the Mine Site landfill, Steensby Port landfill, or other approved repositories;
  - Where practical, buildings, equipment and machinery will be reused. Alternatively, buildings, equipment and machinery will be demolished and sent for sealift to an approved facility for salvage/disposal or disposed of at the Mine Site landfill, Steensby Port landfill, or other approved repositories;
  - All fuel storage containers will be drained and removed from the camp sites for disposal at an approved facility. Secondary containment structures such as liners, will also be removed, tested for hydrocarbon content and sent to an approved facility at the Mine Site or Steensby Port for disposal;

  - Soils suspected of hydrocarbon contamination will be tested. It Is expected contaminated soils will be remediated within landfarms located at either the Mine Site or Steensby Port or alternatively, sent via sealift to an approved facility for disposal;
  - All non recyclable, inert materials (i.e. material having insignificant leachability and pollution content) will be disposed of at the Mine Site landfill, Steensby Port landfill, or other approved repositories. At closure, the onsite landfills located at the Mine Site and Steensby Port will be reclaimed by capping the landfill with overburden or equivalent material. The landfill sites will be allowed to naturally revegetate; and
  - All disturbed areas will be regarded to restore the natural drainage of the area and will be scarified to encourage natural revegetation.
- All quarries and borrow areas will be graded to maintain safe side slopes and natural drainage will be restored unless they are an approved disposal location to be used during reclamation;
- All disturbed areas will be scarified to encourage natural revegetation;
- Areas experiencing thermal disruptions (ponding, settlement and/or subsidence) will be drained of excess water, regarded and/or insulated with a layer of overburden to restore the natural drainage of the area and maintain an active layer above the permafrost of 1 to 2 m (pers. comm. Wiseman). The affected areas will be scarified to encourage natural revegetation;
- Phase I Environmental Site Assessments (ESA) will be carried out on the rail embankment. Further assessment will follow the ESA protocols.
- Progressive reclamation associated with the railroad will be revised at a later stage in the Project and include measures for assessing and remediating, if warranted:
  - Railroad maintenance facilities that have generated wastes and the potential for spillage of solvents and heavy metals;
  - Railroad fuelling facilities: diesel spillage, diesel recovery, water treatment, soil remediation. Storage of gasoline at fuelling facilities;
  - Ballast geochemistry, potential ML/ARD;
  - Other materials to be hauled on the line such as diesel which have the potential to contaminate ballast and soils;
  - Ore spillage into the ballast from movement of trains;
  - Ballast cleaning and disposal of recovered fines; and
  - Tie replacement and disposal of used ties.

TABLE 6.1 SUMMARY OF PROPOSED PROGRESSIVE REHABILITATION SCHEDULE

Phase:	Construction (ERP)				Operation (ERP)				Operation (ERP & Rail Phase)			
Year:	2013	2014	2015	2016	2017	2018	2019	Ongoing	1	2	3	Ongoing
Milne Port												
PWSP (exploration)												
Bladder Farm												
RBC sewage treatment plant												
Nuna workshop												
Tote Road												
KM 97 borrow source												
Sea container bridge at KM 80 (CV-217)												
KM 60 Maintenance Shop												
Historical borrow sources												
Culvert CV-076												
Mary River Mine Site												
Bladder Farm												
Quonset Hut												
Borrow Pits												
Waste Concrete Containment Pond												
Laydown Areas												
Rail Route												
Rail Access Road												

6.2.3 PROPOSED PROGRESSIVE RECLAMATION MEASURES

The overall intent of the proposed progressive reclamation measures is to assist in achieving Baffinland's site abandonment goal to return project sites and affected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities in as minimal duration as reasonably practical. The progressive reclamation measures proposed as part of the ICRP are expected to be technically and economically feasible and reflect Project closure principles. Closure criteria, to determine if the closure objectives outlined in subsections below have been achieved by closure activities, are consistent with the closure criteria described in Table 5.1. It should be noted participation of the local communities, through their QIA representatives, and other applicable government stakeholders, in the consideration of alternative progressive reclamation activities is encouraged via the MCTAG and Inuit Committees as appropriate (refer to Section 2.4 for more information). The experience gained and lessons learned from the closure of the Nanisivik and Polaris mine sites, which are in a similar climate zone, will be used, where applicable, as a benchmark for the progressive rehabilitation of disturbed Project areas.

6.2.3.1 LANDFARM OPERATION

PHC-contaminated soils will be excavated and treated in the Project landfarm(s) throughout the life of the Project to maintain the chemical stability of the site and any discharges. During Operations, soils treated in Project landfarm(s) that meet Nunavut's Contaminated Site Remediation Tier 1 Guidelines for industrial/commercial land uses will be used in select locations (Government of Nunavut, 2009). The use of treated soils meeting these criteria is restricted to areas deemed as a low risk of exposure to transportation pathways and a defined in prescribed operational control procedures. During Operations, soils treated in Project landfarm(s) that meets Nunavut Contaminated Site Remediation Guidelines for agricultural or residential land uses will be spread over land as or used as cover material. Soils treated in Project landfarm(s) that do not meet Nunavut Contaminated Site Remediation Guidelines for industrial/commercial land uses will be kept in containment for further treatment. Another approach that may be utilized is a risk-based methodology for the establishment of hydrocarbon criteria that are protective of human and ecological health. The methods to be followed are outlined in the Canadian Council of Ministers of the Environment Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil (CCME, 2008) and the Environmental Guideline for the Management of Contaminated Sites (GoN, 2014). Once no longer required, landfarms will be closed as described in Section 5.3.7. Research will be conducted to further delineate treatment volumes, efficiency and process as the mine continues to evolve, and is described further in Appendix D.

6.3 COMPLETED AND ONGOING PROGRESSIVE RECLAMATION

To date, progressive reclamation efforts have commenced, or have been completed, at several areas on site. Reductions in reclamation security in response to successfully demonstrating closure criteria have been met. A summary of annual reclamation activities completed at the Mary River Mine and Milne Port and provided to the QIA and NWB as part of the annual reporting is provided in Table 6.2 below. Annual reports summarize progress on progressive reclamation as well as research and monitoring programs the support closure planning. Additional lessons learnt relating to progressive reclamation at other northern mine sites are provided in Appendix F.

TABLE 6.2 ANNUAL RECLAMATION 2014 – 2024

Report	Property Section	Progressive Reclamation Activity	Progress
2014 QIA and NWB Annual Report	Milne Port	Fuel Bladder Farm decommissioned (Appendix E.8)	• Complete
	Mine Site	Quonset Hut decommissioned (Appendix E.8)	• Complete

Report	Property Section	Progressive Reclamation Activity	Progress
2015 QIA and NWB Annual Report	Milne Port	Former Rotary Biological Contactor (RBC) sewage treatment plant	• Decommissioned • Removed from the site
2015 QIA and NWB Annual Report	Milne Port	Nuna workshop decommissioned (Appendix E.8.1)	• Complete • Disassembly of the building structure • Remediation of the underlying soil footprint • Removal of power supply (generators) • Remediation of the soil footprint of the west generator
	Mine Site and Milne Port	Removal of historical inventory of incinerator bottom ash (Appendix E.2)	• Testing of ash • Disposal on-site or off-site at licensed facility
	Mine Site	Mine Site Bladder Farm and Generator Bladder Berm at the Mine Site exploration camp	• Bladders, liners, contaminated soil and piping removed
	Milne Port	Disassembly of contractor (Anmar) tent structure and equipment after a large-scale fire at Milne Port (Appendix E.8.2)	• Complete
	Tote Road	KM 97 Borrow Source	• Commencement of progressive reclamation • Excavation of a ditching and swale structure at the southwest end.
2016 QIA and NWB Annual Report	Mine Site	Mine Site Bladder Farm and Generator Bladder Berm at the Mine Site exploration camp removal	• Remaining bladder at Mine Site Bladder Farm removed.

Report	Property Section	Progressive Reclamation Activity	Progress
2017 QIA and NWB Annual Report	Tote Road	Sea container bridge at KM 80 (CV-217) removal	• Complete
	Tote Road	KM 60 Maintenance Shop decommissioning	• Removal • Soil sampling
	Mine Site	Waste Concrete Containment Pond decommissioning	• Removal • Soil sampling
2018 QIA and NWB Annual Report	Tote Road	KM 97 Borrow Source reclamation	• Ongoing reclamation • Stockpiling material at the historical borrow areas for further reclamation works
	Tote Road	Removal of culvert CV-076	• Removal • Scarification of ground surface
2019 QIA and NWB Annual Report	Tote Road	KM 97 Borrow Source reclamation	• Ongoing reclamation • Dewatering to reduce permafrost degradation.
	Tote Road	Historic borrow sources	• Evaluation study of Tote Road condition by third party (Tetra Tech) • Action plan developed to address historic borrow sources on Tote Road
	Tote Road	KM 7.2 borrow source reclamation	• Placement of material to restore the grade of the borrow pit.
	Tote Road	KM 77 area reclamation	• Removal of the historical road base material to restore natural drainage.
2020 QIA and NWB Annual Report	Tote Road	KM 97 Borrow Source reclamation	• Ongoing reclamation • Dewatering to reduce permafrost degradation
	Tote Road	KM 72.4 area reclamation	• Complete • Bulk fill and grading
	Tote Road	KM 89.8 area reclamation	• Complete • Bulk fill and stabilization
	Tote Road	KM 19.8, 20.7, and 21.9 area reclamation	• Complete • Bulk fill in pits and grading

Report	Property Section	Progressive Reclamation Activity	Progress
2021 QIA and NWB Annual Report	Tote Road	KM 97 Borrow Source reclamation	• Ongoing reclamation • Dewatering to reduce permafrost degradation
	Tote Road	KM 49 area reclamation	• Bulk fill and grading
	Tote Road	KM 29.1	• Slope stabilization
	Tote Road	KM 16.9	• Bulk fill and grading
	Tote Road	KM 15	• Bulk fill and grading
	Tote Road	KM 9.7	• Slope stabilization and shaping of east side embankment
	Tote Road	KM 7.2	• Bulk fill and regrading
2022 QIA and NWB Annual Report	Tote Road	KM 52.2 borrow source	• Ongoing reclamation

7.0 TEMPORARY CLOSURE

7.1 SHORT-TERM TEMPORARY MINE CLOSURE – CARE AND MAINTENANCE

Short-Term Temporary "Care and Maintenance" activities will occur when the Project ceases operations for a period of less than one (1) year with the intent of resuming operational activities or final closure activities. When entering a "Care and Maintenance" phase, the main objective is to maintain all equipment and facilities in a state of readiness to resume operation with minimal delay or have project components at the ready for use to support closure activities.

Care and maintenance of the Project sites will be implemented and executed by operational maintenance staff and other support personnel on site and will be carried out within approximately six (6) months of the initiation of the Temporary Closure Care and Maintenance phase based on the level of effort required. Access to the Project sites, buildings and structures will be restricted to authorized persons only, as during operations. Buildings where potential hazards exist will be locked or otherwise secured.

The Mine Site Reclamation Policy for Nunavut (2002) and the Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (2013) require that contingency measures be established in the ICRP for Temporary Closure of a mine site. Temporary closure is defined as the planned shutdown of a mine site for a period of less than one (1) year. This section of the report presents the plans for suspension of activities of less than one (1) year. Section 7.3 below covers Long-term Temporary Closure beyond one year.

7.1.1 HEALTH AND SAFETY OF WORKERS AND THE PUBLIC DURING TEMPORARY CLOSURE

The health and safety of workers and the Public will be ensured during Temporary Closure Care and Maintenance. Infrastructures will be kept secure by routine maintenance and inspections to eliminate any hazard to the public health and safety or material erosion to the terrestrial or aquatic receiving environment at concentrations that are harmful. Access to buildings and infrastructures will be restricted to authorized personnel only (Section 7.1.2).

Employees on site will be trained in site-specific health and safety requirements. Baffinland commits to abide by all applicable *NWT/Nunavut Mines Health and Safety Act* and Regulations, and the *Explosives Use Act*.

Baffinland will ensure that emergency procedures are updated, if required, and implemented and that all equipment necessary to properly carry out these procedures will be accessible and kept in good working condition.

7.1.2 RESTRICTION OF ACCESS AND SITE SECURITY

During Temporary Closure Care and Maintenance, the Mine Site, Milne Port and Steensby Port will be maintained in a secure condition through the provision of on-site site security. Mine dewatering and water treatment, where required, will be ongoing. As a result, operational maintenance staff, environmental personnel and other support personnel will be onsite at the Mine Site, Milne Port and Steensby Port. Access to buildings, structures, and storage compounds will be restricted to authorized persons, as during operations. Buildings where potential hazards exist will be locked or otherwise secured. Fences and/or barriers with signs will be constructed to restrict access as required.

Security personnel will carry out routine inspections of security, safety and environmental measures and maintain a record of these inspections. Contact information will be provided to pertinent government and Inuit agencies to facilitate their communication and potential access to the Mine Site and/or Milne Port, if necessary.

The explosives contractor will manage explosives in accordance with applicable regulatory requirements as per the NRCan Permit, including the *Mine Health and Safety Act*.

During Temporary Closure Care and Maintenance, reclamation activities such as re-grading may continue as per the progressive reclamation plan (Section 6.0). Erosion and discharge streams will be controlled as part of regular maintenance activities. Additionally, all unused pipelines will be drained and/or care will be taken that lines and pipes do not freeze and rupture.

7.1.3 SECURITY OF MINE OPENINGS

Due to the current configuration of Deposit No 1 as an above grade deposit, an open pit will occur in 2034 at the earliest. The following describes the approach Baffinland intend to take to ensure security of the mine openings under two different scenarios; Prior to creation of an Open Pit at Deposit 1 (pre 2034) and once a pit is established (post 2034).

No open pit (570 Sump, pre-2034)

- The entrance ramp to the active mine openings will be fenced using boulders or other means to prevent inadvertent access. Signage indicating an “Open Hole” will already be in place around the open pit perimeter during operations as per NWT/Nunavut *Mines Safety Act* Regulations. In the absence of a pit, signage will be put up indicating a fall hazard around the perimeter of the current mining face.
- Incidental water and runoff from active mine workings at Deposit 1 is currently collected in the 570 Sump and diverted to the WRF pond, tested and treated if required prior to discharge. In a short-term temporary closure scenario where suspension of mining activities is expected to last less than one year, the 570 Sump will continue to be dewatered and the subsequent treatment and discharge would likely continue in a manner consistent with ongoing operations at the time.

Open pit created (post 2034)

The entrance ramp to the open pit will be fenced using boulders or other means to prevent inadvertent access. Signage indicating an “Open Hole” will already be in place around the open pit perimeter during operations as per NWT/Nunavut Mines Safety Act Regulations.

In a short-term temporary closure scenario where suspension of mining activities is expected to last less than one year, the open pit will continue to be dewatered and the subsequent treatment and discharge would likely continue in a manner consistent with ongoing operations at the time. It is currently anticipated that discharge from the open pit will not require treatment. Uncertainties related to open pit water quality are discussed in section 5.3.1.7 and addressed through the Reclamation Research Plan (Appendix D).

7.1.4 SECURITY OF MECHANICAL, HYDRAULIC SYSTEMS AND ELECTRICAL SYSTEMS

During Temporary Closure Care and Maintenance, equipment required for the security and safety of the infrastructure systems, including environmental aspects, will be maintained in working condition.

Buildings will be locked or otherwise secured to prevent inadvertent access once the Mine Site, Tote Road, North Railway and Milne and Steensby Port are evacuated by most of the personnel, except as required by the onsite staff for site maintenance and security. Non-essential machinery, equipment and systems will be left in a no-load condition or removed from site. Live electrical systems will be fenced, locked, or otherwise secured against inadvertent entry or contact, and appropriate signs will be placed to warn of potential hazards.

7.1.5 HAZARDOUS MATERIALS & WASTE MANAGEMENT SITES

During or prior to Temporary Closure Care and Maintenance, an inventory of all hydrocarbon products, chemicals, explosives and hazardous wastes/materials (e.g., used oils, ammonium nitrate and greases) will be updated and the materials stored in a secure and environmentally sound manner. All storage facilities that contain any such materials will be secured and monitored. Inert waste will be disposed of in the landfill site at the Mine Site or other approved repositories.

During Temporary Closure Care and Maintenance, the non-hazardous waste management facilities at the Project will continue as in normal operations on an as-required basis. If waste management facilities are no longer required, landfills will be covered with 1.5 m of overburden.

If the Temporary Closure Care and Maintenance phase lasts longer than one (1) year, all hazardous materials and wastes will be removed from Project sites via sealift and disposed of at a Licenced hazardous waste disposal facility in Southern Canada (see section 7.3.5).

7.1.6 DOCKS AND AIRSTRIP

During Temporary Closure Care and Maintenance activities, the airstrip, dock infrastructure and equipment will be left in place. All non-essential airstrip and dock machinery, equipment and systems will be left in a no-load condition. Live electrical systems will be fenced, locked, or otherwise secured against inadvertent entry or contact, and appropriate signs will be placed to warn of potential hazards.

7.1.7 CONTROL OF EFFLUENTS

The water management requirements at the Mine Site, Milne and Steensby Port during Temporary Closure Care and Maintenance will include:

- Domestic water and sewage treatment
- Surface/discharge waters, as per applicable regulatory requirements

The drainage system established during operations will be retained and surface water will continue to collect in existing settlement ponds and, where required by the Water Licence, waters will be treated prior to discharge to the receiving environment.

The WRF will be monitored during operations (Section 0). The current water treatment plant will continue to be operated.

The Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031) provides treatment options if waste rock run-off requires treatment. The Fresh Water Supply, Sewage, and Wastewater Management Plan (BAF-PH1-830-P16-0010) provide the design criteria and operations and maintenance requirements for the collection and treatment of the site's wastewater.

7.1.8 STABILIZATION OF STOCKPILES

Ore and waste rock stockpiles will be visually assessed for stability at the start of the Temporary Closure Care and Maintenance period and stabilized if required. The stockpiles will be periodically inspected.

7.1.9 SITE INSPECTION PROGRAM

The general site areas at the Mine Site, Milne and Steensby Port and Tote Road will be periodically inspected by onsite security personnel. Visual inspections of the Mine Site and Milne Port will be carried out to verify the physical stability of quarries/borrow pits, WRF, and pit walls. Section 7.2 and Section 0 identify the environmental management and monitoring plans that will be implemented during any potential Temporary Closure Care and Maintenance period.

7.1.10 NOTIFICATION OF TEMPORARY CLOSURE

Employees, local communities, the public will be notified in advance of any scheduled short-term temporary closure activities in accordance with all relevant legislation.

7.2 SHORT-TERM TEMPORARY CLOSURE MONITORING, MAINTENANCE, AND REPORTING

During the Temporary Closure Care and Maintenance period, all terms and conditions of Type A Water Licence 2AM-MRY1325 will remain in force. "Care and Maintenance" monitoring program will include routine inspection, monitoring, and reporting as required by Type' A' Water Licence Amendment No.1 2AM-MRY1325 and its associated management plans. As the facilities are not operational, key monitoring requirements are established within the following management plans:

- Environmental Protection Plan (BAF-PH1-830-P16-0008)
- Surface Water, Aquatic Ecosystems, Fish and Fish Habitat Management Plan (BAF-PH1-830-P16-0026)
- Terrestrial Environmental Management and Monitoring Plan (BAF-PH1-830-P16-0027)
- Fresh Water, Sewage and Wastewater Management Plan (BAF-PH1-830-P16-0010)
- Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002)
- Emergency Response Plan (BAF-PH1-830-P16-0007)
- Spill Contingency Plan (BAF-PH1-830-P16-0036)
- Explosives Management Plan (BAF-PH1-830-P16-0009)
- Waste Management Plan (BAF-PH1-830-P16-0028)
- Hazardous Materials and Hazardous Waste Management Plan (BAF-PH1-830-P16-0011)
- Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031)
- Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039)
- Roads Management Plan (BAF-PH1-830-P16-0023)
- Railway Operation and Maintenance Management Plan (no document number)

Throughout a Temporary Closure Care and Maintenance period, Baffinland would continue to report on its activities on an annual basis to the NIRB (as per Project Certificate No. 005), the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301). If a Care and Maintenance monitoring schedule is required differing from Operations, it will be established in compliance with the applicable management plans, in consultation with applicable regulators.

During any care and maintenance period, regulatory compliance monitoring will continue to abide by all applicable project authorizations. Environmental Monitoring Programs may be modified and/or suspended, in consultation with applicable regulators and engagement with landowners, until recommencement of Operations. Where applicable, reclamation research programs will continue to support final closure planning.

7.3 LONG-TERM TEMPORARY MINE CLOSURE AND SUSPENSION OF ACTIVITIES

Baffinland may extend the mine closure over a longer timeframe than one (1) year should economic conditions deteriorate while the facility is in Temporary Closure Care & Maintenance. In the event the Project ceases operation for a period of greater than (1) year with the intent of resuming activities in the future, Long-Term Temporary Mine Closure activities will occur. Long-term Temporary Mine Closure activities will ensure the Project sites are maintained in a secure condition, and all facilities and equipment are de-energized and winterized. Hazardous waste and explosives would be removed from the site. Personnel necessary, including environmental personnel, to maintain site security and project monitoring requirements would remain on site.

A detailed "Long-term Care and Maintenance Plan" would be submitted to the NWB and the Landowner at least 60 days prior to entering the Long-term Mine Closure period. Site personnel will conduct general inspections periodically and may decrease that frequency if the site inspections indicate that the site infrastructure is stable. A record of these inspections will be maintained. The names of contact persons will be provided to the pertinent regulators and government agencies such as CIRNAC and the Landlord for their information, and to facilitate their access to the site, if and when necessary. The Project could reopen when the circumstances requiring the Long-term Temporary Closure change (e.g., when economic or other conditions that caused the temporary cessation of operations are no longer of concern).

The following sub-sections describe the detailed activities that would be undertaken to secure the Project components in the event of Long-Term Temporary Mine Closure. Once these measures have been implemented, the labour force on site is reduced to the minimum required to ensure security of the site and ongoing monitoring requirements. It is expected the following activities will be carried out within approximately six (6) months of the initiation of Long-term Temporary Closure based on the level of effort required.

7.3.1 HEALTH AND SAFETY OF WORKERS AND THE PUBLIC DURING LONG-TERM TEMPORARY CLOSURE

Health and safety of workers and the Public will be ensured during Long-term Temporary Closure. Infrastructures will be kept secure by routine maintenance and inspections to eliminate any hazard to the public health and safety or material erosion to the terrestrial or aquatic receiving environment at concentrations that are harmful.

Access to buildings and infrastructures will be restricted to authorized personnel only (Section 7.3.2). Safety will be reinforced by an inspection program (Section 7.3.9).

Employees on site will have been trained for site-specific health and safety. Baffinland commits to abide by the NWT/Nunavut *Mines Safety Act* and Regulations, and the *Explosives Use Act*.

It will be ensured that emergency procedures will be applicable and that all equipment necessary for these procedures will be accessible and kept in good working condition.

7.3.2 RESTRICTION OF ACCESS AND SITE SECURITY

During Long-term Temporary Closure, the Mine Site and Milne Port will be maintained in a secure condition. Access to the buildings, structures and storage compounds will be locked and/or fenced/gated. Potentially unsafe areas will be posted with appropriate signage. Unused machinery and equipment will be removed, where practical.

The explosives contractor will manage explosives in accordance with applicable regulatory requirements by NRCan and the *Mines Health and Safety Act*. On commencement of Long-term Temporary Closure, explosives will be either removed from the Project or/and detonated in a controlled and safe fashion by experienced and Licenced personnel at appropriate locations away from sensitive receptors.

During Long-term Temporary Closure, reclamation activities such as re-grading will continue as per the progressive reclamation plan (Section 6.0). Erosion and discharge streams will be controlled as part of regular maintenance activities. Additionally, care will be taken that lines and pipes do not freeze and break.

7.3.3 SECURITY OF OPEN PIT

Due to the current configuration of Deposit No 1 as an above grade deposit, an open pit will occur in year 2034 at the earliest. The following describes the approach Baffinland intend to take to ensure security of the mine openings under two different scenarios for permanent closure; Prior to creation of an Open Pit at Deposit 1 (pre2034) and once a pit is established (post-2034).

Prior to pit development (pre-2034)

Following notice of Long-term Temporary Closure the pit walls of the open pit will be inspected by a qualified engineer to assess the physical stability, with engineering alternatives and inspection scheduled developed if required. The entrance ramp to the active mine openings will be fenced using boulders or other means to prevent inadvertent access. Signage indicating an “Open Hole” will already be in place around the open pit perimeter during operations as per NWT/Nunavut Mines Safety Act Regulations. Incidental water and runoff from active mine workings at Deposit 1 is currently collected in the 570 Sump and diverted to the WRF pond, tested and treated if required prior to discharge. In the event of a permanent closure prior to the development of an open pit, construction of a 300m long drainage channel would be completed to account for the free drainage of the Deposit 1.

Post pit development (post 2034)

Following notice of Long-term Temporary Closure the pit walls of the open pit will be inspected by a qualified engineer to assess the physical stability. The final site condition of the open pit will be a pit lake that drains to the natural environment. Once a pit is developed, pit water will be monitored during operation for any indication of parameter concentrations at levels that exceed MDMER or that may adversely affect the receiving environment. During Long-term Temporary Closure the decision to continue with dewatering of the open pit will be evaluated based on the planned duration of closure, and forecasts for market conditions at the time.

It is anticipated that the final configuration of the fully developed open pit will take an estimated 85 to 150 years to passively fill with water from natural sources such as direct precipitation and surface runoff (KP, 2008). Therefore, it is anticipated that the open pit will not completely flood during Long-term Temporary Closure and drainage from the open pit is not considered to be an issue.

Other Long-term Temporary Closure activities to close out the open pit include the following as per NWT/Nunavut *Mines Health and Safety Act* Regulations:

- Barricading access ramps into the open pit.
- Placing of fencing and “Danger”/”Open Hole” signage as necessary.
- Baffinland will engage communities and land users to help assess if additional access restrictions are required. This feedback will focus on effective language for signage, and identification of the priority locations for barriers to deter land users and wildlife.

7.3.4 SECURITY OF MECHANICAL, HYDRAULIC, AND ELECTRICAL SYSTEMS

All buildings will be locked and/or otherwise secured to prevent inadvertent access once most of the workforce have left the site, except as required by the remaining onsite staff for site maintenance and security. All non-essential machinery, equipment and systems will be left in a no-load condition. Live electrical systems will be fenced, locked, or otherwise secured against inadvertent entry or contact, and appropriate signs will be placed to warn of potential hazards.

7.3.5 WASTE MANAGEMENT SITES AND HAZARDOUS MATERIALS

Inert waste will be disposed of in the landfill site at the Mine Site or Steensby Port Site, or removed off-site to an approved repository. During operations the landfills will be covered with an interim soil cover layer to reduce infiltration and promote permafrost advancement within the waste. As such, contaminated runoff or seepage from the landfill sites are not anticipated during Long-term Temporary Closure. The required thickness of the soil cover to completely encapsulate waste in permafrost will be informed by reclamation research, as described in Appendix D.

During or prior to the Long-term Temporary Closure an inventory of all hydrocarbon products, chemicals, explosives, and hazardous wastes (e.g., used oils, ammonium nitrate and greases) will be updated and all hazardous materials and hazardous wastes will be shipped off-site south to the appropriate hazardous waste disposal facility via sealift. All storage facilities that contained any such materials will be secured and monitored. Inert waste will be disposed of in the landfill sites at the Project site or off-site to an approved repository.

7.3.6 STABILIZATION OF STOCKPILES

At the onset of Long-term Temporary Closure, the WRF may undergo minor re-contouring and the physical and chemical stability of the WRF will be assessed by qualified professionals. Following this investigation and according to the stockpile geometry at the time of Long-term Temporary Closure, aspects related to erosion, runoff control, slopes, benches, and discharges will be addressed.

Ore stockpiles are expected to be depleted prior to Long-term Temporary Closure. In the event the ore stockpiles remain during Long-term Temporary Closure, they will be monitored.

7.3.7 DOCKS AND AIRSTRIP

During Long-term Temporary Closure activities, the airstrip, freight dock, ore dock, ore dock office, and ship loader will be left in place. All non-essential machinery, equipment and systems will be left in a no-load condition. Live electrical systems will be fenced, locked, or otherwise secured against inadvertent entry or contact, and appropriate signs will be placed to warn of potential hazards. The dock office will be secured to prevent inadvertent access. Infrastructure will be kept secure by routine maintenance and inspections to eliminate any hazard to the public health and safety or material erosion to the terrestrial or aquatic receiving environment at concentrations that are harmful. The names of contact persons will be provided to the pertinent regulators and government agencies such as CIRNAC for their information, and to facilitate their access to the site, when necessary.

7.3.8 CONTROL OF EFFLUENTS

Mine Site and Milne Port water management will be required during Long-term Temporary Closure, including:

- Domestic water and sewage treatment
- Surface/discharge waters, as per applicable regulatory requirements

Surface water will be collected in settlement ponds and those for the ore stockpiles and WRF will be tested for MDMER requirements. The WRF will be monitored during operations. Any required water treatment will continue.

The Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031) provides treatment options if waste rock run-off requires treatment. The Fresh Water Supply, Sewage, and Wastewater Management Plan (BAF-PH1-830-P16-0010) provide the design criteria and operations and maintenance requirements for the collection and treatment of the site's wastewater.

7.3.9 SITE INSPECTION PROGRAM

The Project areas at the Mine Site, Milne Port, North Railway, and Tote Road will be periodically inspected by onsite security personnel. Visual inspections of the Mine Site and Milne Port will be carried out to verify the physical stability of quarries/borrow pits, docks, and port facilities, WRF, and pit walls. The environmental management and monitoring requirements for the Long-term Temporary Closure Care and Management period are identified in Section 7.4.

7.4 LONG-TERM TEMPORARY CLOSURE MONITORING, MAINTENANCE, AND REPORTING

During Long-term Temporary Closure, all terms and conditions of Type A Water Licence 2AM-MRY1325 would remain in force unless an amendment to this Licence is requested by Baffinland as part of the "Long-Term Care and Maintenance Plan". The application for a licence amendment would identify the changes proposed for the facilities required to be shutdown, the location of new discharges (if any), updates to any management plans and/or the AEMP (if required), and an indication of sites to be permanently rehabilitated. A monitoring schedule, if differing from Operations, will be established as part of the "Long-Term Care and Maintenance Plan" in compliance with the AEMP and other applicable Management Plans in consultation with applicable regulators.

Routine inspection, monitoring, and reporting as required by the Type' A' Water Licence 2AM-MRY1325 and its associated management plans remain applicable. As the facilities are not operational, key monitoring requirements are established within the following management plans:

- Environmental Protection Plan (BAF-PH1-830-P16-0008)
- Surface Water, Aquatic Ecosystems, Fish and Fish Habitat Management Plan (BAF-PH1-830-P16-0026)
- Terrestrial Environmental Mitigation and Monitoring Plan (BAF-PH1-830-P16-0027)
- Fresh Water, Sewage and Wastewater Management Plan (BAF-PH1-830-P16-0010)
- Air Quality and Noise Abatement Management Plan (BAF-PH1-830-P16-0002)
- Emergency Response Plan (BAF-PH1-830-P16-0007)
- Spill Contingency Plan (BAF-PH1-830-P16-0036)
- Explosives Management Plan (BAF-PH1-830-P16-0009)
- Waste Management Plan (BAF-PH1-830-P16-0028)
- Hazardous Materials and Hazardous Waste Management Plan (BAF-PH1-830-P16-0011)
- Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031)
- Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039)
- Roads Management Plan (BAF-PH1-830-P16-0023)
- Railway Operation and Maintenance Management Plan (no document number)

Baffinland will continue to report on its activities throughout the Long-term Temporary Closure period on an annual basis to the NIRB (as per Project Certificate No. 005), the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301).

Although regulatory compliance monitoring will continue to abide by all applicable project authorizations. Environmental Monitoring Programs outlined in the Project Certificate will likely be suspended in consultation with applicable regulators and engagement with landowners, until Operations recommence.

8.0 INTEGRATED SCHEDULE OF ACTIVITIES

Based on current estimates of the level of effort required for closure activities, the primary Final Closure phase is expected to be three (3) years, with the flooding of the open pit continuing after the primary closure phase is completed. Following the Final Closure Phase, a minimum of fifteen (15) years of post-closure safety and environmental monitoring and treatment, as and if required, will be conducted. A fifteen (15) year post-closure phase is estimated to be required based on the existing closure design and impacts assessment determinations described in the FEIS and addendums. This estimate is expected to be validated by the operations monitoring program results observed, and their comparison against residual effects predictions and environmental significance determinations. Where concerns in project tracking are identified, specific reclamation research programs may be developed to address uncertainties.

Upon initiation of Final Closure activities, a Short-Term Temporary Care and Maintenance phase would be implemented consistent with Section 7.1, as required, to facilitate final closure planning and logistics. It is expected this phase will last no longer than one (1) year for a planned closure scenario. Consistent with the activities outlined in Section 7.1, the Short-Term Temporary Care and Maintenance period prior to Final Closure activities would focus on maintaining a state of readiness of project components. Although activities would be consistent, the primary difference in a Short-Term Temporary Care and Maintenance period prior to Final Closure is activities would be performed to ensure project components are maintained in a state of readiness to support final closure activities rather maintained in a state of readiness with the intent of resuming operational activities in the future. The sub-section below outlines the planned activities, including this Short-Term Temporary Care and Maintenance period, for Final Closure activities.

It should be noted that Baffinland also recognizes that Short-Term Temporary Care and Maintenance and Long-term Temporary Closure may occur during the construction or commissioning phases of the Project. The Project is being implemented in gradual phases and therefore not all components of the approved Project would be in place, or operational, should various economic drivers force the Company in Temporary Closure, Long-term Closure or Final Closure. Table 4.1 presents the current status of components related to the Project at the time of publishing.

8.1 DURATION OF CLOSURE ACTIVITES

The activities to achieve Baffinland's Site Abandonment Goal (Section 2.2.2) are undertaken with the intent of achieving component-specific closure criteria, as outlined in Table 5.1, in as short duration as practicable. For planned closure, once the decision has been made to permanently close the Project and the NWB and Landowners have approved Baffinland's Final Closure Plan, it is anticipated that the major closure activities, as described in Section 8.2, will be completed between July and October over a period three (3) years. This period is preceded by a one-year final closure planning period (Year 0) and proceeded by a fifteen (15) year post-closure monitoring period (Year 4 to 18), that will extend further depending on the timing of pit filling, which could take 80+ years, or as few as 2 if the pit is actively infilled.

In a planned closure scenario, final closure planning (Year 0) is anticipated to require 1 year. The reclamation program will be predominantly an earthworks exercise with a simple demolition contract and therefore a relatively simple engineering scope. This would indicate long durations for planning, design, procurement, and coordination are not required. In addition, based on the information developed and reviewed to date as part of this document, the level of information developed and discussed during the ongoing ASRs, and the expected content and review process for future ICRP revisions and the Final CRP, it is expected reclamation strategies would be developed in sufficient detail that the final closure planning period would be expedited, and any required approval processes initiated well in advance. It is therefore reasonable to assume that excessive review, planning and revision of the reclamation scope and methodology would not be required and a year duration for a final closure planning period (Year 0) would be sufficient in a planned closure scenario. For the ASR and unplanned closure, a two (2) year final closure planning period is assumed to be required. This assumes a third party would need additional time to go through regulatory approval processes that, in a worst-case scenario, is not reasonably expected to be able to be completed in year or less.

The expectation of an active final closure and reclamation activity period of three (3) years is based on estimated duration and level of effort required for identified active closure activities[9]. Based on the ASR process, all active closure activities have a case-by-case person days associated with them to complete each task or sub-task. The summation of the total person days needed to complete the comprehensive list of active closure tasks expected to be required to meet closure objectives and criterion – including consideration of productivity factors and travel time – demonstrates it can be accommodated in three (3) year period assuming final closure and reclamation work is conducted only during the summer month period (mid-June to mid-September) with a total site-wide available camp space of no more than 100 beds.

The expectation of a fifteen (15) year post-closure monitoring period (Year 4 to 18) is based on findings from the Mary River FEIS that show no significant adverse residual effects are predicted for the VECs (Valued Ecosystem Component) or VSECs (Valued Socio-Economic Component) associated with the Project. The post-closure monitoring period is expected to be 5 (five) years of intensive monitoring, with less frequent monitoring being undertaken over the next ten (10) years as closure conditions reach equilibrium. As shown in the Mary River FEIS, the Project is not expected to compromise the ecosystemic integrity of the Nunavut Settlement Area. In addition, no significant adverse residual effects are predicated to occur to VSECs identified within the socio-economic environment, and the Project is expected to have significant positive effects for most of the VSECs as the Project reflects the priorities and policies of the Government of Nunavut as well as the aspirations of local communities and is expected to enhance the future well-being of the residents and communities of the Nunavut Settlement Area and the rest of Canada. See Appendix G further discussion on Predicted Residual Effects and Appendix H for a summary of the FEIS Freshwater Quality Predictions.

Based on this understanding, Baffinland is currently expecting fifteen (15) years post-closure monitoring and reporting to be required to confirm the prediction that no significant adverse residual effects have been actualized by the Project. This duration in compliance with Section 12.3 of QIA Commercial Lease No.: Q13C301 and was selected as a reasonable timeframe to demonstrate closure activity effectiveness based on the information currently available. As the project progresses into Operations and ongoing monitoring results are developed (such as the rate of pit infilling), if information indicates that fifteen (15) years of post-closure monitoring is not enough time to determine closure activity effectiveness, or vice-versa, is overly conservative, this duration will be re-evaluated in discussions with the Landowner(s) and other stakeholders.

9 Estimated duration and level of effort required for identified closure activities is described in 'Annual Security Review (ASR)' documentation required under Section 9.2 of the Commercial Lease, No. Q13C301, and under Part C and Schedule C of the NWB Type A Water Licence No. 2AM-MRY1325.

8.2 SUMMARY OF ACTIVITIES DURING FINAL CLOSURE BY YEAR

A high-level schedule for planned Final Closure (by year) has been developed assuming productive use of resources performed in a logical manner with consideration given to unique challenges of working in the Arctic, such that reclamation can be accomplished in a timely fashion, in accordance with the ICRP and the regulatory framework established by the Designated Inuit Organization, Federal and Territorial governments. This schedule will be reviewed and revised to include additional and more detailed information as the final closure phase is approached. New information, when available, will be provided in subsequent revisions of the ICRP.

The current high level final closure schedule (by year) for planned closure includes, is presented in Table 8.1.

Baffinland anticipates that all Project sites will be fully decommissioned and rehabilitated by the end of the third year of Final Closure based on level of effort estimates for direct closure activities. The post-closure monitoring and reporting activities to be conducted during this period are discussed in Section 9. Post-closure activities will be extended if closure criteria are not met in this timeframe.

By the end of Year 18, Baffinland expects that the final closure objectives and criteria for all project components will be achieved.

Maintenance to engineered structures during closure activities Years 1 to 3 will depend on results from operational monitoring. It is likely that a small level of effort will be required to maintain water and waste management structures until they are permanently closed. Maintenance is not anticipated beyond Year 4 and would be addressed only as needed.

TABLE 8.1 SCHEDULE OF FINAL CLOSURE ACTIVITIES

Final Closure Activities	Year																			
	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Notification of closure to landowners and NWB	*																			
Final closure preparation activities																				
Prioritization of decommissioning sequence, identification of equipment to remain on site for use during closure activities, and mobilization of contractors																				
Care and maintenance of site																				
Approval of final Closure Plan by NWB and landowners		*																		
Routine inspection and monitoring																				
Demobilization of on-site contractor equipment and material for shipment through Milne Port or Steensby Port																				
Transportation of excess fuel from Mary River Mine Site to Milne Port and/or Steensby Port																				
Decommissioning and demobilization of Baffinland equipment identified for salvage																				
Decontamination and disposal of mobile equipment not suitable for salvage																				
Mobilization sealift of third-party contractor to Milne Port and/or Steensby Port and demobilization sealift of current site contractors and Baffinland equipment and material to the Port of Valleyfield																				
Dismantling of facilities/buildings no longer required for mining or maintenance of trucking and transport equipment fleet																				
Decommissioning of open pit, mineral exploration areas, remote sites, and stockpiles																				
Development of mine open pit overflow discharge channel																				
Pit flooding (if active flooding)																				
Systematic closure of remaining borrow bits and quarry sites (re-grading and contouring)																				
Decommissioning of Mary River Mine Site, Milne Port, and Steensby Port Camps																				

Final Closure Activities	Year																			
	-1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Decommissioning of fuel storage facilities																				
Waste management																				
Systematic removal of water crossings (culverts, bridges, abutments of concern) from the Milne Inlet Tote Road, followed by stabilization of the road for final closure																				
Decommissioning and removal of railway tracks and ties; and systematic removal of culverts and bridges; followed by stabilization of the Railway bed/service road for final closure																				
Treatment of contaminated soil in landfarms																				
Final site clean-up of Mary River Mine Site, including grading and contouring																				
Final site clean-up of Milne Port and Steensby Port, including grading and contouring																				
Application of soil cover to any permanent disposal areas																				
Demobilization sealift from Milne Port and Steensby Port to Valleyfield for third-party equipment and residual reclamation equipment, material and supplies																				
Remaining bulk fuel demobilization sealift																				
Completion of all site contouring and drainage work																				
Construction of the Open Pit spillway																				
Closure and Post-Closure monitoring and reporting activities																				
Open Pit enhanced flooding																				
Completion of Waste Rock Facility cover																				
Site abandonment																				
Achievement of Final Closure objectives and criteria for all Project components																				*

9.0 POST-CLOSURE SITE ASSESSMENT

This ICRP is a living document that will be updated regularly with additional detail incorporated from research and the results of monitoring plans as the Project evolves or approaches Final Closure.

The monitoring programs presented in the subsequent sub-sections are conceptual in nature at this stage of the Project life (initial phased operations). As the project advances a more detailed study design for assessing residual environmental impacts following completion of reclamation activities will be developed. This study will primarily consist of the post-closure inspection/monitoring programs described below, which are designed to assess the conditions at the site against the agreed upon closure objectives and criteria, as well as site visits by the Designated Inuit Organization. Additional activities, such as human health and ecological risk assessments. As part of the Adaptive Management program these plans will be subject to regular reviews for plan effectiveness. Any relevant changes, updates or results related to closure will be integrated into the Interim Reclamation and Closure Plan.

Final Closure activities could result in substantial changes to the Project sites and therefore Baffinland expects the Final Closure and Reclamation Plan to include updated management plans based upon the knowledge gained through studies during the design, construction and operational phases of the Project, and consideration of the anticipated changes.

The following management plans, which include monitoring and reporting requirements, are expected to be updated to support closure and post-closure activities. As these plans are refined and increasing detail is available for closure designs, contingency procedures and/or corrective action levels will be added. The management plans include, but are not limited to:

- Surface Water and Aquatic Ecosystems Management Plan:
  - Updated to reflect re-contoured and natural drainage features re-established to pre-project condition, to the extent reasonably possible.
  - Consideration that sedimentation ponds will be breached and re-profiled.
  - As infrastructure is removed, amended to account for the site final configuration.
- Fresh Water Supply, Sewage, and Wastewater Management Plan:
  - Updated to reflect sewage and wastewater treatment plants will be decommissioned, dismantled and disposed of.
- Waste Management Plan:
  - Modified to account for disposal of equipment, material and waste resulting from demolition and dismantling of facilities considered.
- Terrestrial Environment Mitigation and Monitoring Plan:
  - Modified to account for closure activities.
- Aquatic Effects Monitoring Plan:
  - As some infrastructure is removed, the AEMP will be amended to account for the site final configuration.
- Shipping and Marine Wildlife Management Plan
  - Modified to account for closure activities.

- Air Quality and Noise Abatement Management Plan
  - Modified to account for the decommissioning of facilities.
- Waste Rock Facility Management Plan
  - Modified to account for closure related stabilization and monitoring requirements

After the closure works, the site will not be considered closed out until assessments of the site conditions show that the closure objectives and criteria (Section 5.2) are met. Until those closure objective and criteria are met, monitoring of the site will continue in accordance with the project management plans, as applicable.

The current management plans will be updated regularly throughout the life of the Project and will still be applicable during closure and, as necessary, post-closure monitoring. Appendix B presents concordance to NIRB Project Certificate requirements.

Based on current environmental effect predictions, post-closure monitoring is expected to be required over fifteen (15) years, although this timeframe may be revised, as necessary, as the monitoring programs are further developed to address additional information obtained over the Project lifecycle. Post-closure monitoring would be completed for a period of five (5) years, with a final monitoring assessment completed ten (10) years following.

Table 9.1 represents the anticipated closure and post-closure monitoring program schedule by closure/post-closure year. After closure activities are completed, the results from each monitoring and reporting program will be used to assess if prediction of no significant environmental or social effects are actualized.

TABLE 9.1 ANTICIPATED CLOSURE AND POST-CLOSURE MONITORING & REPORTING PROGRAM SCHEDULE FOR MAJOR MINE AREAS

Monitoring Program	Locations[1]									
Short-Term Temporary Care and Maintenance Program	SW									
Geotechnical/ Engineering Monitoring	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW
Aquatic Monitoring and Reporting Program	SW	SW	SW	SW	MS	MS	MS	MS	MS	MS
Environmental Site Assessment	SW			SW						
Terrestrial Environment Monitoring and Reporting	SW	SW	SW	SW		SW		SW		
Marine Environment Monitoring and Reporting	MP	MP	MP	MP						
Safety Compliance Inspection[2]	SW	SW	SW	SW	SW	SW	SW	TR, MS	TR, MS	TR, MS
Socio-economic Reporting	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW
Air Quality Monitoring Program	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW
	Year 0	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Year 6*	*Year 7*	*Year 8*	*Year 18*
	C&M[3]	**Final Closure (3 yrs)**			**Post-Closure (15 years)[4]**					

NOTES:

1. SW = Site Wide, MP = Milne Port; TR = Tote Road); MS = Mine Site (including open pit and WRF).
2. Frequency will be established at the discretion of the Chief Inspector of Mines in consultation with Baffinland.
3. Care and Maintenance Phase, up to one (1) year.
4. Post Closure activities are expected to last fifteen (15) years but will be extended if closure criteria are not met in that timeframe.

9.1 SHORT-TERM TEMPORARY CARE AND MAINTENANCE PROGRAM

As described in Section 7, the anticipated Short-Term Temporary Care and Maintenance program includes routine inspection, monitoring, and reporting as required by Type A Water Licence 2AM-MRY1325 and its associated management plans. Please refer to Section 7.0 for more information. The Short-Term Temporary Care and Maintenance period is expected to last no longer than one (1) year for a planned closure scenario. The goal of the Short-Term Temporary Care and Maintenance period is to maintain required project facilities as necessary to support the upcoming active closure activities. As further definition of the Short-Term Temporary Care and Maintenance program is developed, it will be provided in future ICRP revisions and/or incorporated into the Closure and Post-Closure Monitoring Plan submitted as part of the Final Closure and Reclamation Plan. If a Care and Maintenance monitoring schedule is required differing from Operations, it will be established in compliance with the AEMP and other appropriate management plans in consultation with applicable regulators and engagement with landowners.

Baffinland will continue to report on its activities in this Temporary Care and Maintenance period on an annual basis to the NIRB (as per Project Certificate No. 005), Federal Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MRY1325), and the Landowners (as per Commercial Lease Q13C301). Through a Care and Maintenance monitoring program, regulatory compliance monitoring will continue to abide by all applicable project authorizations and adaptive management like that of Year 1 of Final Closure.

9.2 LONG-TERM MAINTENANCE

During care and maintenance and closure, facilities that are not yet decommissioned will need to be maintained until closure conditions are stabilized. All facilities are expected to be stabilized prior to demobilization of heavy equipment in Year 3. At this time, the only infrastructure that will require continued maintenance is any pit flooding equipment. If an open pit is present at the time of closure, an open pit spillway will be designed and constructed during closure activities to minimize maintenance requirements post--closure. The geotechnical monitoring (below) will identify the need for maintenance activities on all remaining engineered structures.

Other facilities such as the Milne Port ore dock and sections of the Tote Road may be left in place following negotiations with QIA and would be left as is. Closure activities for these remaining structures will seek to limit residual liability in these areas, as agreed upon with QIA. Any other facility or structure left in place, such as the airstrip and open pit spillway, would only be left if there were no long-term maintenance required, or as agreed upon with QIA.

9.3 REGULATORY REPORTING

Given the uncertain regulatory framework that will exist at the planned end of mining (2051), Baffinland has conservatively assumed that all existing regulatory and permitting reporting requirements from the operations phase will continue until the end of closure activities (Year 3). In post-closure, reporting associated with the monitoring programs discussed below is assumed to capture data collection and interpretation requirements for regulatory and permitting purposes as well as QIA and other public agency interests. In some cases, such as NWB and NIRB annual reports, a small level of additional effort may be required as a preamble to appended post-closure monitoring reports. If additional reporting scope is required by NWB and NIRB post-closure, it will be added to the existing monitoring/reporting to streamline reporting/review efforts when possible.

9.4 GEOTECHNICAL ENGINEERING MONITORING

Up until post-closure (following completion of the closure activities), Baffinland will report on all Geotechnical/Engineering Monitoring results on an annual basis to the NIRB (as per Project Certificate No. 005), Federal Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowners (as per Commercial Lease Q13C301).

The objective of the geotechnical/engineering monitoring will be to confirm the long-term physical stability of the remaining engineered structures and disturbed areas on site, as indicated by closure objectives and criteria in Table 5.1.

Post-closure site assessment/geotechnical engineering monitoring will comprise both engineering analyses and post-construction performance monitoring of both permanent geotechnical structures and disturbed areas (where no permanent structure or significant landform structure will remain). Table 9.2 presents the proposed requirements for post-closure analyses and monitoring. The year prior to Final Closure Activities (Year 0), Baffinland will commission an inspection of the site and review of the design or as-built information (where available) for each of the permanent site features to confirm the scope of post-closure geotechnical assessments (analyses and monitoring). The scope and duration of monitoring and assessments required will be developed and confirmed based on operational performance results and available construction records. If features are no longer needed during mining, this assessment may be completed earlier in the mine's lifespan. Complete studies will be submitted to QIA for review with planned ICRP updates.

TABLE 9.2 PROPOSED POST-CLOSURE GEOTECHNICAL ASSESSMENT AND MONITORING REQUIREMENTS

Mine Feature	Permanent Structure/ Disturbed Area	Engineering Consideration	As-built Assessment Completed	Monitoring	Analyses and Monitoring
Milne Port					
Ore and Freight Docks	Permanent Structure	Stability and Erosion	Operations	X	
Port site drainage	Disturbed Area	Erosion	Post-closure		X
Landfill	Permanent Structure	Erosion	Post-closure		X
Tote Road and South Railway					
Former (removed) water crossings	Disturbed Area	Erosion	Post-closure	X	
Remaining water crossing abutments	Permanent Structure	Erosion	Post-closure		X
Road, rail embankment	Disturbed Area	Erosion	Operations	X	
Cut and fill slopes	Permanent Structure	Stability and Erosion	Operations	X	
Mine Site					
Site drainage	Disturbed Area	Erosion	Post-closure	X	
Open pit	Permanent Structure	Stability and Erosion	Post-closure		X

Mine Feature	Permanent Structure/ Disturbed Area	Engineering Consideration	As-built Assessment Completed	Monitoring	Analyses and Monitoring
WRF	Permanent Structure	Stability and Erosion Permafrost Stability	Post-closure		X
Former stockpiles	Disturbed Area	Erosion	Post-closure	X	
Landfill site	Permanent Structure	Erosion	Post-closure		X
Site Wide					
Site wide – other	Structure	Stability and Erosion	Prior to Mining	X	
			Operations	X	
	Disturbed Area	Erosion	Prior to Mining	X	
			Operations	X	
Abandoned quarry and aggregate borrow sites	Disturbed Area	Stability and Erosion	Operations	X	

Following the completion of closure works for each mine feature/area, a construction record will be prepared. Construction records will include:

- description of the works that were completed
- description of deviations that were made from the design (where appropriate)
- stamped as-built drawings of the completed structure or landform (final grading)
- confirmation of what closure objectives have been met for this structure
- laboratory results (where appropriate)
- a photolog
- confirmation of performance monitoring requirements

9.4.1 GEOTECHNICAL ENGINEERING ANALYSES

Geotechnical engineering analyses will be required for all permanent structures (i.e., pit wall slopes, waste rock slopes, permafrost covers, docks, etc.). The requirements for analyses are as follows:

- Appropriately detailed construction records
- Monitoring records indicating that the structure has been performing well
- Slope stability, erosion protection analyses, or other evaluation of the structure to demonstrate long-term stability
    - based on as-built records, or
    - based on the closure design where as-built conditions have been confirmed to be consistent with the design
- Thermal analyses of the permafrost cover to demonstrate long-term post-closure permafrost stability
- Meets closure criteria (Table 5.1)

These requirements may be found to have already been met for some structures that were constructed during, or prior to operations, provided the records listed above are available.

9.4.1.1 SLOPE STABILITY

Slope stability analyses will be used to confirm the long-term stability of permanent constructed structures on site, except for where analyses are deemed not to be required to confirm long-term stability by a Nunavut-licensed professional engineer. Slope stability analyses may be modelled using industry standard software packages. Slope stability assessments will include both static and pseudo-static (earthquake loading) conditions and will provide an indication of the potential for liquefaction.

Open Pit

Slope stability modelling of the open pit will be completed for both the transient flooding conditions as well as for long-term flooded conditions. Rock mass quality and strength characteristics will be collected during operations once pit development has begun and will be used to inform the assessment.

Under transient conditions, the pit will likely undergo worst case conditions when hydraulic back pressure on the walls from groundwater inflow is at its strongest. Once the pit has flooded, this backpressure will become counterbalanced with the pit lake water/ice, which should improve the pit stability.

Waste Rock Facility

The WRF will be analyzed in consideration of permafrost aggradation. Monitoring of aggradation through operations will inform the stability assessment to confirm the thickness of the active layer that is to be incorporated in the model for the stability assessment.

Permafrost stability will be also modelled using appropriate software to ensure the long-term performance. The geothermal model will be established considering seasonality, climate change and heat generation within the waste rock.

9.4.1.2 EROSION PROTECTION AND DRAINAGE

Drainage features will be assessed for design runoff events. Peak discharges would be modelled using the rational method or by modelling for large catchments over 80 ha.

As no dams will remain on site, there is no anticipated requirement for conducting dam safety or evaluation programs. Decommissioning and breaching of dams will occur in accordance with all applicable regulations.

Revetment designs (shoreline protection) would be evaluated in accordance with the recommendations set out in the US Army Corps of Engineers Shoreline Protection Manual (USACE, 1984).

A Final Grading Plan will be developed to outline reclamation activities and expectations for site conditions post-closure. It will be developed in consultation with local communities and in consideration of planned future land uses and environmental goals (e.g., minimizing wind erosion). The Final Grading Plan will address a variety of topics, and is expected to include information such as:

- Site drainage strategies and construction criteria
- Covering methods for foundations that are left in place
- Quarry reclamation, particularly in areas of permafrost disturbance
- Risk management using soil covers for any areas of impacted soil
- Covering landfills
- Regrading procedures at bermed and/or lined areas (e.g., landfarms)
- Grading of rock cuts and/or infill locations along Railway

- Grading options to promote desired wildlife and human travel
- Priority areas for scarifying to promote natural revegetation

The Final Grading Plan will describe the above information and provide the objectives that these activities will target.

9.4.2 GEOTECHNICAL MONITORING INSPECTIONS

Geotechnical inspections will be carried out at regular intervals following the completion of the closure works. Inspections will review the performance of structures relative to the closure objectives.

Site wide inspections of the condition of all site features are to be carried out the year following completion of closure activities (Year 4), as well as in Years 8 and 18.

The open pit will be inspected regularly during filling, and then 5 years following filling. For the purposes of devising a monitoring program, it is assumed that enhanced pit filling will take ten (10) years to complete. The final inspection would be completed in year 18.

As part of these inspections, site conditions are to be compared to the construction records, where available. During monitoring inspections, it is expected special attention will be given to the following areas:

1. Milne Port
   a) Ore and freight docks – integrity of dock embankment and indication of shore erosion
   b) Port site drainage – indications of excessive erosion
2. Tote Road
   a) Abandoned quarry sites – site condition and advancement of revegetation
   b) Former water crossing – bank stability and indications of excessive stream bank erosion
   c) Road – bed erosion and progress of revegetation cover
3. Steensby Railway (when developed)
   a) Abandoned quarry sites – site condition and advancement of revegetation
   b) Former water crossings – bank stability and indications of excessive stream bank erosion
   c) Railbed – bed erosion and progress of revegetation cover
   d) Landfill site status (indication of bank erosion, depression of cover material)
4. Mine Site
   a) Overall site drainage patterns and indication of erosion channels
   b) Open pit water level and barriers to access
   c) Open pit spillway
   d) Integrity of waste rock stockpile slopes (erosion, slumping of slopes)
   e) Landfill site status (indication of bank erosion, depression of cover material)
   f) Waste Rock temperature readings to ensure stability/permafrost aggradation
   g) Abandoned quarry sites – site condition and advancement of revegetation

Geotechnical/engineering inspections and assessments will be carried out by a Nunavut-licensed professional engineer.

9.4.3 ADDITIONAL SITE OBSERVATIONS

In addition to the detailed geotechnical/engineering monitoring inspections described above carried out by a professional engineer, as part of the closure and post-closure aquatic effects monitoring program (Section 9.5), sampling personnel will be trained to identify and document any suspected cases of physical or geotechnical instability of lands and structures remaining on site (e.g., visible signs of cracking, any indication of seepage, indication erosion that has taken place, natural revegetation progress, slope ratios, etc.). Therefore, in the interim years between full geotechnical/engineering monitoring inspections, suspected cases of physical instability will be identified and documented for annual review by a professional engineer. If the professional engineer deems it necessary to meet established closure criteria, an action plan will be developed and implemented as appropriate to correct the situation for long-term physical stability of the project component or lands in question. The component or lands in question, and similar components or lands, will also then become an area of focus for the subsequent detailed geotechnical/engineering monitoring inspections carried out by the professional engineer to confirm acceptable corrective actions have been taken.

It is anticipated that through discussions with the Inuit Committees that there will be some form of Inuit observation and monitoring integrated into long term post closure site assessment. It is expected the details of this will be developed as Baffinland works through the ISP process and obtains feedback from the QIA and the Inuit Committees (Section 2.4).

9.5 CLOSURE AND POST-CLOSURE AQUATIC MONITORING AND REPORTING

The Closure and Post-Closure Aquatic Monitoring and Reporting Program focuses on detecting the discharge of potential contaminants from various Project components. During Final Closure, the monitoring and reporting will be maintained as outlined by the AEMP (BAF-PH1-830-P16-0039), the SWAEMP (BAF-PH1-830-P16-0026), and in accordance with Type A Water Licence 2AM-MRY1325. If the monitoring schedule is required to be revised from Operations, it will be established in compliance with the AEMP, SWAEMP, and other applicable management plans in consultation with applicable regulators and landowners. It is expected that any additional water quality/quantity monitoring programs developed to focus on specific areas of the Project site (e.g. Tote Road, quarries) will be rolled into a single plan for the post-closure phase. This includes Environmental Effects Monitoring (EEM) required by MDMER (below), the Core Receiving Environment Monitoring Program (CREMP) and the Lake Sedimentation Monitoring Program (see Section 3.0).

An important detail of this post-closure monitoring program will be the clear distinction of what closure criteria will apply to which areas, such that an appropriate monitoring schedule is developed. For example, MDMER requirements will apply at the open pit and WRF, and in addition Water Licence effluent criteria, CCME PAL and/or risk-based criteria informed by baseline and operational water quality data will be considered for these and other areas of the site. Refinement of these criteria to numerical values, will occur in cooperation with QIA. In these other areas, post-closure monitoring schedules will be informed by the large amount of performance monitoring results acquired throughout operations to allow a refined focus on the specific parameters/locations of concern. It is expected that monitoring locations required for operations would act as a starting point, then the level of monitoring would decrease during care and maintenance and closure activities (Years 0-3) to reflect the end of mining and/or construction activities in certain areas and removal of “end of pipe” discharge locations but would not be discontinued until an appropriate duration of post-reclamation monitoring has been at each area. In some areas, geotechnical inspection and monitoring will continue after water quality monitoring to identify unexpected erosion and sedimentation issues. If concerns are observed, water quality monitoring may be required. Monitoring at the Mine Site (i.e., WRF and open pit), which represent the largest environmental risk, will continue until Year 18.

As currently described in Section 5.3.1, the open pit will be filled by natural infilling and active pumping from local water sources (enhanced pit filling). Where possible, Baffinland would like to avoid unnecessary stresses to the nearby aquatic environment that may be associated with water extraction, while also avoiding a closure scenario that requires long-term active care. To achieve this, Baffinland has tentatively assumed a flooding period of 10 years would be achieved. Closure planning for this element will focus on refining estimates for active pumping from the likely water sources in combination with updated estimates for natural infilling based on new information regarding pit geometry, bulk rock hydraulic conductivity and site hydrological processes. In addition to water quality monitoring which will occur periodically throughout flooding, an additional 3-year monitoring period has been assumed to confirm closure criteria are met and the spillway is functioning as per design intent.

It is expected that sampling of the revised, approved locations will take place up to three (3) times per year, during the open water season. During these annual sampling events, sampling personnel will identify and document any suspected cases of physical or geotechnical instability of lands and structures remaining on site as described in Section 9.4.

Baffinland will report on its Closure and Post-Closure Aquatic Monitoring and Reporting Program on an annual basis to the NWB as per Type A Water Licence 2AM-MRY1325.

9.5.1 ENVIRONMENTAL EFFECTS MONITORING PROGRAM (EEM)

As mandated by the MDMER, Schedule 5, the EEM Program focuses on determining if the discharge of mine contact water to the receiving environment will result in adverse environmental effects on the receiving streams and water bodies. This program will be carried out throughout mining, and as the locations of the mine contact water will not change after Final Closure (i.e., open pit water discharge, and WRF runoff discharge), it is expected the EEM component of the AEMP will remain relatively unchanged until Baffinland has achieved the “Recognized Closed Mine” status under Section 4 of the MDMER. Procedures for EEM monitoring are detailed in the existing AEMP including sampling locations, number of samples for each location, frequency of sampling and methods of interpretation.

Baffinland expects to conduct the EEM Program annually during Final Closure activities (Year 0 to 2; three years) as required by the MDMER. This timeline would satisfy MDMER to achieve “Recognized Closed Mine” status, except for the open pit. Years 16-18 have been allocated conservatively to complete remaining EEM requirements for mine effluent at site.

Baffinland will report on any new EEM Program results on an annual basis to the Environment and Climate Change Canada as required under the MDMER.

9.5.2 CORE RECEIVING ENVIRONMENT MONITORING PROGRAM (CREMP)

The CREMP focuses on follow-up monitoring to validate predictions to aquatic valued ecosystem components (VECs) and key indicators. Baffinland expects to conduct the CREMP during care and maintenance (Year 0), as well as annually during Final Closure activities (Year 1 to 3) to assess whether component-specific closure criteria are met. Post-closure monitoring would then be conducted the first three years following completion of Final Closure activities (Years 4 to 6) and the Years 7, 8 and 18 at the Mine Site to confirm closure objectives are met. Baffinland will report on any new CREMP results on an annual basis to the NIRB (as per Project Certificate No. 005).

9.5.3 LAKE SEDIMENTATION MONITORING PROGRAM

A Lake Sedimentation Monitoring Program is also performed annually under the AEMP and monitors dust and sediment deposition rates in Sheardown Lake NW to evaluate potential mine-related influences on biota (e.g., fish larvae hatching success). Annual monitoring reports for the Lake Sedimentation Monitoring Program further discuss the methods used and annual monitoring results and are provided as appendices to the QIA and NWB Annual Reports, required under Baffinland's Type A Water Licence and Commercial Lease with the QIA.

Baffinland expects to conduct the Lake Sedimentation Monitoring Program annually during Final Closure activities (Year 1 to 3) to assess whether component-specific closure criteria are met.

9.6 ENVIRONMENTAL SITE ASSESSMENT

A Phase 1 and 2 Environmental Site Assessment (ESA) will be conducted at the onset of closure for areas where there is the potential for contamination with petroleum hydrocarbons or other parameters. Soil materials found to exceed the appropriate cleanup criteria (based on CCME guidelines or site-specific risk-based criteria) will be remediated onsite in the landfarms, removed offsite to a licensed waste management facility, or the risk will be managed using site controls (e.g., covers).

The objective of the Phase 1 and 2 ESAs will be to determine areas of focus for final closure activities and to demonstrate conformance with CCME contaminated sites guidelines or site-specific risk-based criteria at the Mine Site, Milne Port, Tote Road and Steensby Port.

Baffinland will progressively be performing ESAs at selected high priority locations as mine operations continue. Details regarding this program including priority areas and scheduling of research and assessment activities are located within Appendix D.

If not already done so, in the year prior to Final Closure activities (Year 0), Baffinland will commission a confirmatory sampling program at project sites to help determine adequacy of Final Closure activities' ability to meet closure criteria. Based on results, closure activities will be modified accordingly to ensure closure objectives are met. The year following completion of closure activities (Year 4), a second Phase 2 ESA of project sites will be conducted to confirm CCME contaminated sites guidelines or site-specific risk-based criteria have been met. If results indicate CCME contaminated sites guidelines or site-specific risk-based criteria have not been met, additional closure activities/remediation will be performed as necessary to ensure closure objectives are achieved.

If there is reason to suspect an area of soil has been contaminated by chemicals or substances other than hydrocarbons (such as explosives or ore), samples will be collected and analysed. If the applicable regulatory requirements are exceeded, an appropriate method of disposal will be determined in consultation with the appropriate authorities.

Baffinland will report on any new ESA and/or Human Health and Ecological Risk Assessment (HHERA) results on an annual basis to the NIRB (as per Project Certificate No. 005), the NWB (as per Type A Water Licence 2AM-MRY1325) and the Landowner (as per Commercial Lease Q13C301).

9.7 TERRESTRIAL ENVIRONMENT MONITORING AND REPORTING

The Terrestrial Environment Monitoring and Reporting program will occur during temporary care and maintenance (Year 0), and during closure activities (Years 1-3). Terrestrial environment monitoring during closure will include vegetation monitoring (exotic invasive vegetation) and caribou movement monitoring. Other monitoring programs such as vegetation health, migratory bird, snow track, remote camera monitoring and caribou habitat monitoring will continue during active closure as well, but may be discontinued during post-closure, based on monitoring results to date.

The objective of the Terrestrial Environment Monitoring and Reporting program will shift focus slightly from the operational project phase to determine if Project areas achieve the desired re-growth of vegetation and wildlife movement upon completion of Final Closure activities. Given the long operational period, effects monitoring programs will diminish quickly in scope post-closure. As noted in Section 2.7, Baffinland intends to establish a Mine Closure Technical Advisory Group (MCTAG) and Baffinland expects the MCTAG to help drive desired wildlife movement and passive revegetation considerations upon completion of Final Closure activities.

Baffinland expects to resume the Terrestrial Environment Monitoring and Reporting program the second year following completion of closure activities (Year 5) incorporating lessons learned from Operations. This schedule was determined to allow for a one (1) year wildlife/vegetation activity normalization period between active Final Closure activities and post-closure monitoring activities to help ensure an accurate representation of abandonment conditions. A follow up monitoring program is planned in Year 7.

The Terrestrial Environment Monitoring and Reporting program is expected to be a focused program with the main objective of developing evidence of use or occupation of key indicator species in the avian and terrestrial environment for the Project area (visual sighting of species, bones, antlers, tracks, and trails, etc.). It is expected to be conducted by a team of two (2) experts for no more than two (2) weeks accompanied by an associated Wildlife Monitor. Baffinland will evaluate the revegetation of rehabilitated areas and conduct an invasive species assessment. Results of the Terrestrial Environment Monitoring and Reporting period in Year 5 are anticipated to be confirmed using a similar second period, two (2) years after the first, in Year 7.

The Mary River Project FEIS assessed there to be negligible adverse residual effects post-closure to fauna and flora. Post-closure, the loss of vegetation will be reversed with natural revegetation and the residual effects on fauna species will gradually lessen with time as the project areas are naturally revegetated. The risk of invasive plant species colonizing the area is expected to be negligible, however, it will be monitored post-closure.

Baffinland will report on any new Terrestrial Environment Monitoring and Reporting program results on an annual basis to the NIRB (as per Project Certificate No. 005).

9.8 MARINE ENVIRONMENT MONITORING AND REPORTING

Discharges to the marine environment will be captured under the Closure and Post-Closure Aquatic Monitoring and Reporting Program (Section 9.5).

The MEWG will be functioning during the life of the Project to continually evaluate if there are any residual effects from Project activities on the marine environment at the Port. Based on current information that suggest effects on marine mammals are related to ship interaction, it is anticipated that there will be no significant residual effects at closure on the marine environment when ship interaction is removed. If shipping activity is occurring during closure, marine monitoring and reporting in place during operation will continue, as outlined in the Shipping and Marine Wildlife Management Plan and Marine Monitoring Plan at the time of closure. If operational monitoring indicates that the prediction of no significant residual effects at closure on the marine environment may be inaccurate, additional Post-Closure Marine Monitoring will be evaluated in the light of this new information.

9.9 SAFETY COMPLIANCE INSPECTION

The objective of the Safety Compliance Inspection will be to determine if project components are closed and reclaimed in compliance with the Northwest Territories (NT) and Nunavut (NU) *Mine Health and Safety Act* and Regulations, and the *Explosives Use Act* and Regulations. The Safety Compliance Inspection will be conducted by an Engineer/Inspector of Mines under the direction of the Chief Inspector of Mines working on behalf of the Workers' Safety and Compensation Commission (WSCC) of the Northwest Territories and Nunavut. Inspection frequency and scope will be established at the discretion of the Chief Inspector of Mines in consultation with Baffinland.

Baffinland will report on any Safety Compliance Inspection results on an annual basis to the WSCC.

9.10 SOCIO-ECONOMIC REPORTING

As per condition 149 of Project Certificate No. 005, Baffinland published a Closure Scenario Report in September 2014 and submitted it to the NIRB. The report examines the potential socio-economic and cultural impacts closure may have on Inuit employees and analysis of the risk of temporary and permanent mine closure.

Socio-economic monitoring during closure will be governed by the following legislative drivers and agreements:

- The *Nunavut Labour Standards Act*
- Human Resources Skills and Development Canada's (HRSDC) Employment Insurance Regulations
- The Nunavut Agreement on Labour Market Development
- Canada-Nunavut Labour Market Agreement
- Inuit Impact and Benefit Agreement (IIBA) between the Qikiqtani Inuit Association and Baffinland

In the event of permanent layoffs due to closure, under the Canada-Nunavut Agreement on Labour Market Development, Baffinland will engage with the Government of Nunavut to establish a Labour Market Partnership with the aim to develop and implement strategies for dealing with labour force adjustments. Under the Partnership Program a Joint Labour Adjustment Committee would be established to assist affected employees, a primary step being conducting a Needs Assessment to determine what labour adjustment issues have been addressed and determine appropriate programming required (e.g., job-search assistant, resume preparation, vocational counseling). Baffinland will also draw the on the expertise of the Mining Industry Human Resources Council (MiHR) who has developed a Mining Workforce Transition Kit that may address the specific needs of employees and their communities.

Socio-economic reporting, as required by the Project Certificate and in accordance with articles of the IIBA, will be reported on in the Annual Report to the Nunavut Impact Review Board and the Implementation Report for the IIBA for the life of the project.

9.11 AIR QUALITY MONITORING AND REPORTING

During reclamation activities (e.g., construction/regrading), air quality monitoring and reporting will be consistent with operations, occurring across the entire site, as outlined in the Air Quality and Noise Abatement Management Plan. Air quality data will be collected via active TSP, SO_2, NO_2 sampling and passive sampling for dustfall, including metal deposition. As no one area of the mine will close substantially within the 3-year closure construction period, site-wide post-closure ambient air quality monitoring will be executed following closure. As all the major impacts are removed, 2 years of post-closure monitoring is planned to confirm ambient levels of TSP, $PM_{2.5}$, SO_2 and NO_2 are within the closure criteria (NU standards).

Baffinland expects to continue this monitoring during the first year of post-closure activities (Year 4). TSP and $PM_{2.5}$ were selected as particulate matter poses health concerns due to their ability to be inhaled and accumulate in the respiratory system. Small particulate matter (e.g., $PM_{2.5}$) also can behave in the atmosphere like a gas and due to is small particle size, can disperse over greater distances than larger sized particulates before deposition.

Emissions of nitrogen oxides and sulphur oxides (i.e., NO_x and SO_x) are generated by fuel combustion in both stationary and mobile equipment. It should be noted there are negligible residual effects expected during post-closure as the primary sources of dust will no longer be in operation. During post-closure, stationary and mobile equipment will no longer be in use, with few exceptions such as truck traffic during monitoring programs. Accordingly, NO_x and SO_x emissions are expected to be negligible. However, to demonstrate that ambient conditions are below the criteria stated in the Environmental Guideline for Ambient Air Quality, Department of Environment, Government of Nunavut, October 2011 (200 µg/m^3 24 hr average for nitrogen dioxide and 150 µg/m^3 24 hr average for sulphur dioxide), a post-closure monitoring program consisting of up to five (5) sample locations using BAM-1020 or similar with a remote data logger for a period of not more than one (1) month during summer months is expected. Monitoring will be focused on locations identified through operational experience as having particulate emissions higher than other areas.

As indicated respectively by project component in Table 5.1, if Air Quality Monitoring program results demonstrate Mean TSP concentrations less than the risk-based criteria developed in consideration of the NU Ambient Air Quality Standard are met, the project component will be considered to have met the associated closure objectives. Dust deposition has been identified as a potential concern for the health of vegetation and wildlife, however, no residual effects of the Project on caribou health are anticipated due to metal exposure from dustfall. Most dustfall will be associated with the Mine Site and the primary metals are relatively innocuous to caribou (FEIS, Volume 6, Section 5.2.4). The potential effects of metals on plants either from aerial deposition or uptake from soils are highly dependent on site-specific conditions and the plant species themselves. Thresholds have not been developed for dust effects on plants, and the literature acknowledges a lack of data of effects of atmospheric emissions and its effects on Arctic vegetation, leading to uncertainty in effects predictions. To further address this uncertainty, Baffinland is undertaking additional reclamation research on natural revegetation to better understand reclamation options. A dustfall monitoring program is being conducted to confirm project related activities will have a not significant effect on vegetation (see Nunami Stantec 2024).

10.0 FINANCIAL SECURITY

Closure and reclamation costs for the Mary River Project are determined under the Annual Security Review (ASR) process conducted in accordance with Schedule C of the Type A Water Licence 2AM-MRY1325 and Commercial Lease No. Q13C301. Under the ASR process, Baffinland, the respective landowners (QIA & the Crown), the NWB, and other interested parties confer to determine the estimated closure and reclamation costs for an upcoming year on an annual basis. This approach allows for Baffinland to post financial security in incremental adjustments prior to the commencement of work. Publicly available ASR document submissions for a respective year, describing in detail, annual estimated closure and reclamation costs, can be downloaded from the NWB FTP site at: ftp.nwb-oen.ca.

10.1 PRELIMINARY MINE CLOSURE AND RECLAMATION PLAN ESTIMATE AND UPDATES

Prior to commencement of the ASR process, which is the current overriding process to determine Project closure and reclamation costs, Baffinland's estimated closure and reclamation costs were established and outlined in the Preliminary Mine Closure and Reclamation Plan (Rev D, H337697-0000-07-126-0014) which was submitted as part of the Mary River Project FEIS (FEIS Appendix 10G). Estimated costs and assumptions were made based on project design and costs available at the time of development using the Mining RECLAIM spreadsheet provided by Aboriginal Affairs and Northern Development Canada (now CIRNAC).

An addendum to the PCRP Closure and Reclamation Cost Estimate was developed to support the Type A Water Licence 2AM-MRY1325 amendment process for 2015. This addendum was made using current and updated estimated closure and reclamation costs, established through the ASR process, for Milne Port and the Tote Road aggregated with estimated closure and reclamation costs for Mary River Mine Site, the Railway and Steensby Port that were presented in Baffinland's original submission of the PCRP in February 2012. The purpose of this addendum was to incorporate consideration of Baffinland's ERP to support the Type A Water Licence 2AM-MRY1325 amendment process. Details of the results of this process can be found in the following document: *Final Environmental Impact Statement (FEIS) Closure and Reclamation – Financial Security Estimate Addendum, H349001-0000-07-220-0001.*

Baffinland notes that the *Final Environmental Impact Statement (FEIS) Closure and Reclamation – Financial Security Estimate Addendum, H349001-0000-07-220-0001* does not override the ASR process and the ASR is still the governing process to determine reclamation financial security. It is expected that as the Steensby Rail and port design continue to evolve, this total full project reclamation cost will be updated for a future version of the ICRP.

The Ultimate Project closure and reclamation cost estimate completed in 2015 totaled $518,711,208. As noted above, this total cost is a high level estimate, which is subject to change as part of the ASR process. The break down between land and water liability and IOL/Crown Land is presented in Table 10.1.

TABLE 10.1 TOTAL COST AND BREAKDOWN FOR MARY RIVER PROJECT CLOSURE AND RECLAMATION

Land Ownership	Total Cost	Percentage	Land Liability	Water Liability
Inuit Owned Land	$411,234,800	79.2	$405,430,454	$6,106,421
Federal Owned Land	$107,476,408	20.7	$105,391,574	$2,160,637
Total	$518,711,208	100	$510,822,029	$8,267,058

11.0 GLOSSARY OF TERMS, ACRONYMS, OR ABBREVIATIONS

11.1 GLOSSARY OF TERMS

Term	Meaning
Abandonment	The permanent dismantlement of a facility so it is permanently incapable of its intended use. This includes the removal of associated equipment and structures.
Acid-Base Accounting (ABA)	Acid-Base Accounting (ABA) is a screening procedure whereby the acid-neutralizing potential and acid-generating potential of rock samples are determined.
Acid generating (AG)	Production of acidity irrespective of its effect on the adjacent pore water or whether the material is net acid producing or neutralizing.
Acid rock drainage (ARD)	Acidic drainage stemming from open pit, underground mining operations, waste-rock or tailings facilities that contains free sulphuric acid and dissolved metals sulphate salts, resulting from the oxidation of contained sulphide minerals or additives to the process. The acid dissolves minerals in the rocks, further changing the quality of the drainage water.
Acid Potential (AP)	Maximum potential acid generation from a sample. The calculation of AP (or MPA) is an integral part of acid/base accounting.
Acidity	Measure of the capacity of a solution to neutralize a strong base.
Active layer	The layer of ground above the permafrost which thaws and freezes annually.
Alkalinity	Measure of the capacity of a solution to neutralize a strong acid.
Approved Project (or Mary River Project)	The Mary River Project as approved by Project Certificate No. 005 and most recently amended on November 17, 2023 (refer to Section 2.3.1 for details on approved components and activities), inclusive of the ERP and PIP Applications.
Backfill	Material excavated from a site and reused for filling the surface or underground void created by mining. Reinsertion of materials in extracted part(s) of the ore body. Materials used for backfilling can be waste-rock or overburden. In most cases backfill is used to refill mined-out areas in order to: • Assure ground stability. • Prevent or reduce underground and surface subsidence. • Provide roof support so that further parts of the ore body can be extracted and to increase safety. • Provide an alternative to surface disposal, and • Improve ventilation.
Background	An area near the site under evaluation not influenced by chemicals released from the site, or other impacts created by onsite activity.
Baseline	A surveyed condition and reference used for future surveys.
Benign	Having little or no detrimental effect.
Berm	A mound or wall, usually of earth, used to retain substances or to prevent substances from entering an area.
Best Management Practices	Any program, technology, process, operating method, measure, or device that controls, prevents, removes, or reduces pollution and impact on the environment.
Biodiversity	The variety of plants and animals that live in a specific area.

Term	Meaning
Bioremediation	The use of microorganisms or vegetation to reduce contaminant levels in soil or water.
Borrow Pit	A source of fill or embanking material.
Care and Maintenance	A term to describe the status of a mine when it undergoes a temporary closure.
Closure	When a mine ceases operations without the intent to resume mining activities in the future.
Closure Criteria	Detail to set precise measures of when the objective has been satisfied.
Closure Goal	The guiding statement that provides the vision and purpose of reclamation. Attainment of the closure goal happens all closure objectives have been satisfied. By its nature, the closure goal is a broad, high-level statement and not directly measurable.
Closure Principles	A fundamental basis for the selection of closure objectives.
Closure Objectives	Statements that describe what the selected closure activities are aiming to achieve; they are guided by the closure principles.
Contaminant	Any physical, chemical, biological or radiological substance in the air, soil or water that has an adverse effect. Any chemical substance with a concentration that exceeds background levels or which is not naturally occurring in the environment.
Contouring	The process of shaping the land surface to fit the form of the surrounding land.
Cumulative Effects	The combined environmental impacts that accumulate over time and space as a result of a series of similar or related actions or activities.
Crushing	Process that reduces the particle size of run-of-mine ore to such a level that grinding can be carried out. This is accomplished by compression of ore against rigid surfaces, or by impact against surfaces in rigidly constrained motion path.
Cryoconcentration	Concentration of solutes due to exclusion by ice.
Decommissioning	Process by which a mining operation is shut down i.e.: permanently closing a site. Removing equipment, buildings and structures. Rehabilitation and plans for future maintenance of affected land and water are also included.
Dewatering	Process of removing water from an underground mine or open pit, or from the surrounding rock or non-lithified area. The term is also commonly used for the reduction of water content in concentrates, tailings and treatment sludges.
Disposal	The relocation, containment, treatment or processing of unwanted materials or materials that are not reusable. This may involve the removal of contaminants or their conversion to less harmful forms.
Drainage	Manner in which the waters of an area exist and move, including surface streams and groundwater pathways. A collective term for all concentrated and diffuse water flow.
Drainage Chemistry	Concentrations of dissolved components in drainage, including element concentrations, chemical species and other aqueous chemical parameters.
Early Revenue Phase (ERP)	Amendment No. 1 to the Project Certificate which involved the additional extraction and transportation of up to 4.2 Mtpa of iron ore by truck along the existing Tote Road and shipment through Milne Port between July and October of each year
Effluent	Treated or untreated liquid waste material that is discharged into the environment from a structure such as a settling pond or a treatment plant.
End Land Use	The allowable use of disturbed land following reclamation. Municipal zoning and/or approval may be required for specific land uses.

Term	Meaning
Environment	Interrelated physical, chemical, biological, social, spiritual and cultural components that affect the growth and development of living organisms.
Erosion	The wearing away of rock, soil or other surface material by water, rain, waves, wind or ice, the process may be accelerated by human activities.
Evaporation	Physical process by which a liquid is changed into a gas.
Existing Operation	An installation in operation or, in accordance with legislation existing before the date on which this Directive is brought into effect, an installation authorized or in the view of the competent authority the subject of a full request for authorization, provided that that installation is put into operation no later than one year after the date on which this Directive is brought into effect.
Frost Heave	Annual ground displacements and differential ground pressures due to the freezing of water within soils.
Geochemistry	Science of the chemistry of geological materials and the interaction between geological materials with the environment.
Geology	Study of the earth, its history and the changes that have occurred or are occurring, and the rocks and non-lithified materials of which it is composed and their mode of formation and transformation.
Grade	Proportion of any constituent in an ore, expressed often as a percentage, grams per tonne (g/t) or parts per million (ppm).
Ground Thermal Regime	Temperature conditions below the ground surface. A condition of heat losses and gains from geothermal sources and the atmosphere.
Groundwater	All subsurface water that occurs beneath the water table in rocks and geologic formations that are fully saturated. Distinct from surface water.
Humidity Cell Test	Kinetic test procedure used primarily to measure rates of acid generation and neutralization in sulphide-bearing rock.
Hydrogeology	Science of the groundwater circuit (interrelationship of geologic materials and processes with water).
Hydrology	The science that deals with water, its properties, distribution and circulation over the Earth's surface.
Inert Waste	Material having insignificant leachability and pollution content which will not require laboratory analysis.
Infiltration	Entry of water into a porous substance.
In Situ Treatment	A method of managing or treating contaminated soils, sludges and waters "in place" in a manner that does not require the contaminated material to be physically removed or excavated from where it originated.
Inuit Qaujimajatuqangit (IQ)	Guiding principles of Inuit social values including: respecting others, relationships, and caring for people; development of skills through observation, mentoring, practice and effort; working together for a common cause; fostering good spirit by being open, welcoming, and inclusive; serving and providing for family and/or community; decision making through discussion and consensus; being innovative and resourceful; and respect and care for the land, animals and the environment. Inuit Qaujimajatuqangit refers to Inuit "Traditional Knowledge" (NIRB 2024).

Term	Meaning
Inuit Qaujimaningit	Inuit Qaujimaningit refers to Inuit Traditional Knowledge as well as Inuit epistemology without reference to temporality (NIRB 2024). The term Inuit Qaujimaningit is meant to encompass Inuit traditional knowledge (and variations thereof or Inuit Qaujimajatuqangit), local and community-based knowledge, as well as Inuit epistemology as it relates to Inuit Societal Values and Inuit Knowledge (both traditional and contemporary). Inuit Qaujimaningit is rooted in the daily life of Inuit people and represents experience acquired over thousands of years of direct human contact with the environment.
Landfill	An engineered waste management facility at which waste is disposed by placing it on or in land in a manner that minimizes adverse human health and environmental effects.
Leachate	Solution obtained by leaching e.g.,water that has percolated through soil containing soluble substances and that contains certain amounts of these substances in solution.
Leaching	Passage of a solvent through porous or crushed material in order to extract components from the liquid phase. For example, gold can be extracted by heap leaching of a porous ore, or pulverized tailings. Other methods are tank leaching of ore, concentrates or tailings and in-situ leaching.
Lithology	Composition of rocks, including physical and chemical characteristics such as colour, mineralogical composition, hardness and grain size.
Local Assessment Area (LSA)	Areas within which there exists reasonable potential for direct or indirect interaction due to project activities, ongoing normal activities, or possible abnormal operating conditions (i.e., accidents and malfunctions). Individual LSAs may differ amongst various biophysical and socio-economic components.
Migration	The movement of chemicals, bacteria, and gases in flowing water or vapour.
Mineral Resource	Concentration or occurrence of natural, solid, inorganic or fossilized organic material in or on the Earth's crust in such form and quantity and of such a grade or quality that it has reasonable prospects for economic extraction. The location, quantity, grade, geological characteristics and continuity of a Mineral Resource are known, estimated or interpreted from specific geological evidence and knowledge.
Mining	Methods and techniques to extract ore from the ground, including support facilities (e.g.,stockpiles, workshops, transport, ventilation) and supporting activities in the mine itself or in the vicinity.
Mining Operation	Any extraction of ore from which mineral substances are taken, where the corporate intent is to make an operating profit or build continuously toward a profitable enterprise.
Mitigation	The process of rectifying an impact by repairing, rehabilitating or restoring the affected environment, or the process of compensating for the impact by replacing or providing substitute resources or environments.
Monitoring	Observing the change in geophysical, hydrogeological or geochemical measurements over time. Process intended to assess or to determine the actual value and the variations of an emission or another parameter, based on procedures of systematic, periodic or spot surveillance, inspection, sampling and measurement or another assessment methods intended to provide information about emitted quantities and/or trends for emitted pollutants.
Naturally Re-vegetate or Natural Re-vegetation	For the purposes of the Mary River Project natural revegetation will include scarification and covering with overburden as required and allowing the surrounding natural vegetation to encroach and be re-established on the disturbed area.

Term	Meaning
Neutralization	Raising the pH of acidic solutions or lowering the pH of alkaline solutions to near-neutral pH (about pH 7) values through a reaction in which the hydrogen ion of an acid and the hydroxyl ion of a base combine to form water.
Neutralization Potential (NP)	General term for a sample's or a material's capacity to neutralize acidity.
Objectives	Objectives describe what the reclamation activities are aiming to achieve. The goal of mine closure is to achieve the Long-term objectives that are selected for the site.
Open Pit Mining	Mining operation takes place on the surface. Mining operation and environment are in contact over an extended area.
Operator	Any natural or legal person that is responsible for the control, operation, and maintenance of the mine, mineral processing plant, tailings dam and/or related facilities including the after-closure phases.
Ore	Mineral or variety of accumulated minerals of sufficient value as to quality and quantity that it/they may be mined at a profit. Most ores are mixtures of extractable minerals and extraneous rocky material.
Orebody (mineral deposit)	Naturally occurring geological structure consisting of an accumulation of a desired mineral and waste-rock, from which the mineral can be extracted, at a profit, or with a reasonable expectation thereof.
Overburden	Layer of natural grown soil or massive rock on top of an orebody. In case of open pit mining operations it has to be removed prior to extraction of the ore
P	Phosphate
Passive Treatment	Treatment technologies that can function with little or no maintenance over long periods of time.
Permafrost	Ground that remains at or below zero degrees Celsius for a minimum of two consecutive years.
Permafrost Aggradation	A naturally or artificially caused increase in the thickness and/or area extent of permafrost.
Permeability	The ease with which gases, liquids, or plant roots penetrate or pass through soil or a layer of soil. The rate of permeability depends upon the composition of the soil.
Phreatic Surface	The term phreatic is used in Earth sciences to refer to matters relating to ground water below the water table (the word originates from the Greek phrear, phreat- meaning "well" or "spring"). The term 'phreatic surface' indicates the location where the pore water pressure is under atmospheric conditions (i.e., the pressure head is zero). This surface normally coincides with the water table.
Potentially Acid Generating (PAG)	Rock or overburden material that has the potential to produce acidity irrespective of its effect on the adjacent pore water or whether the material is net acid producing or neutralizing.
Potential Development Area (PDA)	The footprints of direct physical disturbance for the Approved Project which include Milne Port, Milne Inlet Tote Road, the Mine Site, Steensby Railway and Steensby Port.
Production Increase Proposal (PIP)	Amendment No. 2 to the Project Certificate which involved the additional extraction and transportation of up to 1.8 Mtpa of iron ore for a total of 6 Mtpa of iron ore by truck along the existing Tote Road and shipment through Milne Port for period of two years (2018 and 2019)
Production Increase Proposal Extension (PIPE)	Amendment No. 3 to the Project Certificate which involved the sustained additional extraction and transportation of up to 1.8 Mtpa of iron ore for a total of 6 Mtpa of iron ore

Term	Meaning
	by truck along the existing Tote Road and shipment through Milne Port for period of two years (2020 and 2021)
Production Increase Proposal Renewal (PIP Renewal)	Amendment No. 4 to the Project Certificate which involved the sustained additional extraction and transportation of up to 1.8 Mtpa of iron ore for a total of 6 Mtpa of iron ore along the existing Tote Road and shipment through Milne Port for period of one year (2020)
Progressive Reclamation	Actions that can be taken during mining operations before permanent closure, to take advantage of cost and operating efficiencies by using the resources available from mine operations to reduce the overall reclamation costs incurred. It enhances environmental protection and shortens the timeframe for achieving the reclamation objectives and goals.
Primary Crushing	Process of reducing ore into smaller fragments to prepare it for further processing and/or so that it can be transported to the processing plant. In underground mines, the primary crusher is often located underground, or at the entrance to the processing plant.
Quarry	Whole area under the control of an operator carrying out any activity involved in the prospecting, extraction, treatment and storage of minerals, including common related infrastructures and waste management activities, being not a mine. It is distinguished from a mine because it is usually open at the top and front, and used for the extraction of building stone, such as slate, limestone, gravel and sand.
Reclamation	The process of returning a disturbed site to its natural state or one for other productive uses that prevents or minimizes any adverse effects on the environment or threats to human health and safety.
Regional Study Area	The area within which there exists the potential for direct, indirect, and/or cumulative biophysical and socio-economic effects. This area includes lands, waters, and potentially affected communities within the Nunavut Settlement Area (NSA). Effects extending beyond the NSA are considered to be transboundary.
Rehabilitation	Activities to ensure that the land will be returned to a form and productivity in conformity with a prior land use plan, including a stable ecological state that does not contribute substantially to environmental deterioration and is consistent with surrounding aesthetic values.
Remediation	The removal, reduction, or neutralization of substances, wastes or hazardous material from a site in order to prevent or minimize any adverse effects on the environment and public safety now or in the future.
Residual Effect	Effect which remains after mitigation has been considered for a potential effect
Restoration	The renewing, repairing, cleaning-up, remediation or other management of soil, groundwater or sediment so that its functions and qualities are comparable to those of its original, unaltered state.
Re-vegetation	Replacing original ground cover following a disturbance to the land.
Risk Assessment	Reviewing risk analysis and options for a given site, component or condition. Risk assessments consider factors such as risk acceptability, public perception of risk, socio-economic impacts, benefits, and technical feasibility. It forms the basis for risk management.
Run-of-mine (ROM)	Run of mine. Unprocessed conveyed material (ore) from the mining operation.
Runoff	Part of precipitation and snowmelt that does not infiltrate but moves as overland flow and drains off the land into bodies of water.
Scarification	Seedbed preparation to make a site more amenable to plant growth.

Term	Meaning
Screening	Separating material into size fractions.
Security Deposit	Funds held by the Crown or designated owner of the land that can be used in the case of abandonment of an undertaking to reclaim the site, or carry out any ongoing measures that may remain to be taken after the abandonment of the undertaking.
Sediment	Solid material, both mineral and organic, that has been moved by air, water, gravity, or ice and has come to rest on the earth's surface either above or below sea level.
Seismic	Relating to an earthquake or to other tremors of the Earth, such as those caused by large explosions.
Solubility	Quantity of solute that dissolves in a given volume and type of solvent, at given temperature and pressure, to form a saturated solution. The degree to which compounds are soluble depends on their ability, and that of the other dissolved species, to form ions and aqueous complexes in particular drainage chemistry.
Southern Shipping Route	Shipping route within the Nunavut Settlement Area from Steensby Port through Foxe Basin and Hudson Strait
Southern Transportation Corridor	Includes Steensby Railway and Southern Shipping Route.
Steensby Component	Collective term for aspects of the Approved Project which relate to the development of ore transportation infrastructure south of the Mine Site and includes the Steensby Railway and Steensby Port (including shipping within the Southern Shipping Route)
Steensby Railway	Railway to be constructed and operated by Baffinland Iron Mines Corporation to transport iron ore from the Mine Site to Steensby Port as approved by Project Certificate No. 005
Sump	An underground catch basin in a mine where water accumulates before being pumped to the surface.
Supernatant	The clear liquid that floats about the sediment or precipitate.
Surface Water	Natural water bodies such as river, streams, brooks, ponds and lakes, as well as artificial watercourses, such as irrigation, industrial and navigational canals, in direct contact with the atmosphere.
Sustainable Development	Industrial development that does not detract from the potential of the natural environment to ensure benefits for future generations.
Sustaining Operations Proposal (SOP)	Amendment No. 5 to the Project Certificate which involved the sustained additional extraction and transportation of up to 1.8 Mtpa of iron ore for a total of 6 Mtpa of iron ore by truck along the existing Tote Road and shipment through Milne Port for period of two years (2023 and 2024). An additional allowance for the shipment of up to 0.9 Mtpa of ore stranded from previous shipping seasons was also approved.
Taliks	Unfrozen zones that can exist within, below, or above permafrost layers. They are usually located below deep water bodies.
Temporary Closure	When a mine ceases operations with the intent to resume mining activities in the future. Temporary closures can last for a period of weeks, or for several years, based on economical, environmental, political, or social factors.
Thermokarst	A landscape characterized by shallow pits and depressions caused by selective thawing of ground ice, or permafrost.

Term	Meaning
Topsoil	Natural huminous layer on top of the orebody, which has to be stripped prior to start-up of ore extraction.
Traditional Knowledge	A cumulative, collective body of knowledge, experience, and values built up by a group of people through generations of living in close contact with nature. It builds upon the historic experiences of a people and adapts to social, economic, environmental, spiritual and political change.
Valued Component	An aspect of the biophysical or socio-economic environment considered to be of vital importance to Inuit or other Indigenous groups, a particular region or community, including: a) resources that are either legally, politically, publicly or professionally recognized as important, such as parks, land selections, and historical sites; b) resources that have ecological importance; c) resources that have social importance or d) components relating to the local economy, health, demographics, traditional way of life, cultural well-being, social life, archaeological resources, existing services and infrastructure, and community and local government organizations
Waste-rock, Discard, or Spoil Material	All rock materials, except ore and tailings that are produced as a result of mining operations.
Watershed	A region or area bordered by ridges of higher ground that drains into a particular watercourse or body of water.
Water Table	The level below where the ground is saturated with water.
Weathering	Processes by which particles, rocks and minerals are altered on exposure to surface temperature and pressure, and atmospheric agents such as air, water and biological activity.

11.2 ACRONYMS AND ABBREVIATIONS

The following are acronyms or abbreviations that may be used in this document:

Abbreviation	Description
General	
A&R	Abandonment and Reclamation
ARD	Acid Rock Drainage
Baffinland	Baffinland Iron Mines Corporation
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of the Environment
CoPC	Chemicals of potential concern
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
ECCC	Department of Environment Climate Change Canada
EHS	Environmental Health and Safety
EIS	Environmental Impact Statement
EMMP	Environmental Mitigation and Monitoring Plans
ERP	Early Revenue Phase

Abbreviation	Description
ESA	Environmental Site Assessment
FEIS	Final Environmental Impact Statement
FOL	Federal Owned Lands
Ga	Giga-annum (billion years)
GN	Government of Nunavut
HADD	Harmful Alteration, Disruption, or Destruction
HoL	Height of Land
HTO	Hunters and Trappers Organization
ICRP	Interim Closure and Reclamation Plan
IIBA	Inuit Impact and Benefits Agreement
IOL	Inuit Owned Lands
IQ	Inuit Qaujimajatuqangit (Inuit knowledge, or traditional knowledge)
KI	Key Indicator
LAC	Land Advisory Committee
LSA	Local Study Area
MASL	Metres above Sea Level
ML	Metal Leaching
MOU	Memorandum of Understanding
Mtpa	Million Tonne-Per-Annum
NAAQS	Nunavut Ambient Air Quality Standards
NLCA	Nunavut Land Claims Agreement
NPRI	National Pollutant Release Inventory
NSA	Nunavut Settlement Area
NWT	Northwest Territories
PAG	Potential Acid Generating
PCRP	Preliminary Closure and Reclamation Plan
PDA	Potential Development Area
PDW	Pre-Development Works
PLA	Production Lease Area
PPR	Personal Property Registry
RA(s)	Responsible Authority(ies)
RMO	Resource Management Officer
RSA	Regional Study Area
TC-NWPP	Transport Canada Navigable Waters Protection Program
TEWG	Terrestrial Environment Working Group
the Project	Mary River Project

Abbreviation	Description
TK	Traditional Knowledge
VC	Valued Component
VEC	Valued Ecosystem Component
VSEC	Valued Socio-Economic Component
Federal and Territorial Acts	
AWPPA	Arctic Waters Pollution Prevention Act
BCANU	Business Corporations Act (Nunavut)
CEAA	Canadian Environmental Assessment Act
CEPA	Canadian Environmental Protection Act, 1999
CLA	Commissioner’s Land Act
CNPA	Canada National Parks Act
CWA	Canada Wildlife Act
EG&GANU	Engineers, Geologists and Geophysicists Act (Nunavut)
EMAANU	Emergency Medical Aid Act (Nunavut)
EPANU	Environmental Protection Act (Nunavut)
EUANU	Explosives Use Act (Nunavut)
EXA	Explosives Act
FA	Fisheries Act
FPANU	Fire Prevention Act (Nunavut)
LSANU	Labour Standards Act (Nunavut)
MBCA	Migratory Birds Convention Act, 1994
MH&SANU	Mine Health and Safety Act (Nunavut)
NW&NSRTA	Nunavut Waters and Nunavut Surface Rights Tribunal Act
PHANU	Public Health Act (Nunavut)
TDGA	Transportation of Dangerous Goods Act, 1992
TDGANU	Transportation of Dangerous Goods Act (Nunavut)
TLA	Territorial Lands Act
TPANU	Territorial Parks Act (Nunavut)
WANU	Wildlife Act (Nunavut)
WCANU	Workers’ Compensation Act (Nunavut)
Federal and Territorial Regulations	
AWPPR	Arctic Waters Pollution Prevention Regulations
CFAEAP&R	Regulations Respecting the Coordination by Federal Authorities of Environmental Assessment Procedures and Requirements
CLR	Commissioner’s Land Regulations
CMR	Canada Mining Regulations
CRFR	AECB Cost Recovery Fees Regulations, 1996

Abbreviation	Description
CSLR	Comprehensive Study List Regulations
CSLRNU	Comprehensive Study List Regulations (Nunavut)
CSRNU	Camp Sanitation Regulations (Nunavut)
ELR	Exclusion List Regulations
EURNU	Explosives Use Regulations (Nunavut)
EXR	Explosives Regulations
FPRNU	Fire Prevention Regulations (Nunavut)
ILR	Inclusion List Regulations
LLR	Law List Regulations
MBSR	Migratory Bird Sanctuary Regulations
MH&SRNU	Mine Health and Safety Regulations (Nunavut)
MDMER	Metal and Diamond Mining Effluent Regulations
NA&PSR	Nunavut Archaeological and Palaeontological Sites Regulations
NBRLUP	North Baffin Regional Land Use Plan
NPWR	National Parks Wildlife Regulations
NWTFR	Northwest Territories Fishery Regulations
NWTWR	Northwest Territories Waters Regulations
PCSRNU	Propane Cylinder Storage Regulations (Nunavut)
SCP&RRNU	Spill Contingency Planning and Reporting Regulations (Nunavut)
TDGR	Transportation of Dangerous Goods Regulations
TDGRNU	Transportation of Dangerous Goods Regulations (Nunavut)
TDR	Territorial Dredging Regulations
TLR	Territorial Lands Regulations
TLUR	Territorial Land Use Regulations
TPRNU	Territorial Parks Regulations (Nunavut)
TQR	Territorial Quarrying Regulations
WAR	Wildlife Area Regulations
WCRNU	Workers' Compensation Regulations (Nunavut)
WSRNU	Wildlife Sanctuaries Regulations (Nunavut)
Federal Government Departments and Agencies	
AANDC	Aboriginal Affairs and Northern Development Canada
CTA	Canadian Transportation Agency
DFO	Fisheries and Oceans Canada
DOJ	Department of Justice Canada
EC	Environment Canada

Abbreviation	Description
CIRNAC	Crown Indigenous Relations and Northern Affairs Canada, formerly Indian and Northern Affairs Canada (INAC) and prior to that Aboriginal Affairs and Northern Development Canada (AANDC)
NRCan	Natural Resources Canada
PCH	Parks Canada Agency (Canadian Heritage)
TC	Transport Canada
Territorial Government Departments and Agencies	
CGSNU	Department of Community and Government Services
CLEYNU	Department of Culture, Language, Elders and Youth
DOJNU	Department of Justice
DOENU	Department of Environment
ED&TNU	Economic Development & Transportation
GN	Government of Nunavut
H&SSNU	Department of Health and Social Services
WSCC	Workers Safety and Compensation Commission of the Northwest Territories and Nunavut
Institutions Of Public Government	
CLARC	Community Land and Resource Committee
CLO	Community Liaison Officer
IPGs	Institutions of Public Government
MVLWB	Mackenzie Valley Land and Water Board
NIRB	Nunavut Impact Review Board
NPC	Nunavut Planning Commission
NSRT	Nunavut Surface Rights Tribunal
NWB	Nunavut Water Board
NWMB	Nunavut Wildlife Management Board
Inuit Organizations	
DIO	Designated Inuit Organizations
MHTO	Mittimatalik Hunters and Trappers Organization
NTI	Nunavut Tunngavik Incorporated
QIA	Qikiqtani Inuit Association
RIA	Regional Inuit Association
RWO	Regional Wildlife Organization

12.0 REFERENCES

AANDC. 2007. Mine Site Reclamation Guidelines for the Northwest Territories, prepared by Indian and Northern Affairs Canada, dated January 2007.

Aker Kvaerner. 2008. Definitive Feasibility Study Report Mary River Iron Ore Project Northern Baffin Island, Nunavut.

Albouy, C., V. Delattre, G. Donati, T. L. Frölicher, S. Albouy-Boyer, M. Rufino, L. Pellissier, D. Mouillot and F. Leprieur. 2020. Global vulnerability of marine mammals to global warming. Sci. Rep. 10: 548.

AMEC. 2010. Interim Report on ML/ARD Characterization Mary River Project, Deposit No. 1, dated December 2010, prepared by AMEC Earth & Environmental.

AMEC. 2014. Technical Memorandum to: Jim Millard, Baffinland (from Steve Walker, AMEC). RE: Mary River Deposit 1, 5-Year Pit ML/ARD Characterization, Rev. 1 – Issued for Phase 1, WRMP. April 28.

AMEC. 2017. Memo TC170202, dated May 15.

Asselin, N.C. and P.R. Richard, 2011. Results of narwhal (Monodon monoceros) aerial surveys in Admiralty Inlet, August 2010. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/065. iv + 26 p.

Austin, M.E., C.C. Wilson, K.A. Kowarski, and J.J.-Y. Delarue. 2022a. Baffinland Iron Mines Corporation – Mary River Project: 2021 Underwater Acoustic Monitoring Program (Open-Water Season). Document 02633, Version 1.0. Technical report by JASCO Applied Sciences for Golder Associates Ltd.

Austin, M.E., C.C. Wilson, K.A. Kowarski, J.J.-Y. Delarue, and E.E. Maxner. 2022b. Baffinland Iron Mines Corporation - Mary River Project: 2020 Underwater Acoustic Monitoring Program. Document - 2514, Version 1.0. Technical report by JASCO Applied Sciences for Golder Associates Ltd.

Austin, M.E., K.A. Kowarski, and C.C. Wilson. 2023. Baffinland Iron Mines Corporation – Mary River Project: 2022 Underwater Acoustic Monitoring Program (Open-Water Season). Document Number 02975, Version 1.0. Technical report by JASCO Applied Sciences for WSP Canada.

Austin, M.E., J. Dolman, and Z. Li. 2024a. Vessel Source Level Summary: Baffinland Iron Mines, Milne Port Shipping Activities 2015-2023. Document 03289, Version 1.0. Technical report by JASCO Applied Sciences for Baffinland Iron Mines.

Austin, M.E., K.A. Kowarski, and C.C. Wilson. 2024c. Baffinland Iron Mines Corporation — Mary River Project: 2023 Underwater Acoustic Monitoring Program (Open-Water Season). Document 03260, Version 1.0. Technical report by JASCO Applied Sciences for WSP Canada.

Baffinland Iron Mines Corporation (Baffinland), 2011. 2011 Abandonment and Reclamation Plan. March, 2011.

Baffinland. 2012. Mary River Project - Final Environmental Impact Statement. February 2012.

Baffinland. 2013. Mary River Project - Addendum to Final Environmental Impact Statement. June 2013.

Baffinland. 2016. Baffinland Iron Mines Corporation, Sustainable Development and Human Rights Policy. March 2016.

Baffinland. 2018. Interim Closure Reclamation Plan. BAF-PH1-830-P16-0012

Baffinland. 2022. 2021 Annual Report to the Nunavut Impact Review Board. March 31, 2022. NIRB Registry No. 220401.

Baffinland. 2023a. Baffinland's Climate Change Strategy 2023-2028. March 8, 2023.

Baffinland. 2023b. 2022 Annual Report to the Nunavut Impact Review Board. April 30, 2023. NIRB Registry No. 230518.

Baffinland. 2023c. Mary River Project – Sustaining Operations Proposal. 2023.

Baffinland. 2024a. Mary River Project - Sustaining Operations Proposal 2. June 2024.

Baffinland. 2024b. 2023 Annual Report to the Nunavut Impact Review Board. NIRB Registry No. 220401

Baffinland. 2024c. Phase 1 Waste Rock Management Plan. BAF-PH1-830-P16-0029.

Batt, B.D.J., editor. 1998. The greater snow goose: report of the Arctic goose habitat working group. U.S. Fish and Wildlife Service, Washington, D.C., and Environment Canada, Canadian Wildlife Service, Ottawa, Ontario. 88 pp.

Bradstreet, M. S. W. 1982. Occurrence, Habitat Use, and Behavior of Seabirds, Marine Mammals, and Arctic Cod at the Pond Inlet Ice Edge. Arctic, 35(1), 28–40. http://www.jstor.org/stable/40509300

Carder, G.W. 1991. Data from the commercial fishery for Arctic Charr, Salvelinus alpinus (L.), in the Cambridge Bay, District of Keewatin and Igloolik Areas, Northwest Territories, 1989-1990. Prepared by G.W. Carder. Department of Fisheries and Oceans – Central and Arctic Region. Canadian Data Report of Fisheries and Aquatic Sciences Report 848: vi + 40p.

Canadian Council of Ministers of the Environment (CCME). 2002. Canadian water quality guidelines for the protection of aquatic life: Total particulate matter. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

Chambault, P., K.M. Kovacs, C. Lydersen, O. Shpak, J. Teilmann, C.M. Albertsen and M.P. Heide-Jorgensen. 2022. Future seasonal changes in habitat for Arctic whales during predicted ocean warming. Science Advances. 8(29).

CIFA (Canadian Food Inspection Agency). 2019. Mercury in Fish. https://www.canada.ca/en/health-canada/services/food-nutrition/food-safety/chemical-contaminants/environmental-contaminants/mercury/mercury-fish.html. Accessed April 1, 2024.

Coad, B. W. and J. D. Reist. 2004. Annotated list of the Arctic marine fishes of Canada. Canadian Manuscript Report of Fisheries and Aquatic Sciences. 2674.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC) 2005. COSEWIC assessment and update status report on the bowhead whale *Balaena mysticetus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. viii + 51 pp.

COSEWIC. 2010. COSEWIC Species Status Reports. Environment Canada, Ottawa, Ontario (cosewic.gc.ca).

COSEWIC. 2016. COSEWIC assessment and status report on the Caribou *Rangifer tarandus*, Barren-ground population, in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 123 pp. (http://publications.gc.ca/collections/collection_2017/eccc/CW69-14-746-2017-eng.pdf)

COSEWIC. 2017. COSEWIC assessment and status report on the Atlantic walrus *Odobenus rosmarus rosmarus*, High Arctic population, Central-Low Arctic population and Nova Scotia-Newfoundland-Gulf of St. Lawrence population in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. xxi + 89 pp

COSEWIC. 2019. COSEWIC assessment and status report on the Ringed Seal *Pusa hispida* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 82 pp.

COSEWIC. 2023. Canadian Wildlife Species at Risk 2023. Committee on the Status of Endangered Wildlife in Canada. Available online at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/publications/canadian-wildlife-species-risk-2023.html

COSEWIC. 2024. COSEWIC Wildlife Species Assessments (detailed version), May 2024. 6 p. Committee on the Status of Endangered Wildlife in Canada. Available online at: https://cosewic.ca/images/cosewic/pdf/2024-Wildlife%20Species%20Assessments-detailed-May-en.pdf

Davis, R.A., W.R. Koski, and K.J. Finley. 1978. Numbers and distribution of walruses in the Central Canadian High Arctic. Prepared by LGL Ltd. Toronto, Ontario for Polar Gas Project, Toronto, Ontario. 50 p.

Dempson, J.B. AND J.M. Green. 1985. Life history of the anadromous Arctic charr (*Salvelinus alpinus*) in the Fraser River, Northern Labrador. Canadian Journal of Zoology. 63: 315-324.

Department of Fisheries and Oceans Canada (DFO), 2002. Atlantic Walrus. DFO Science Stock Status Report E5-17, 18, 19, 20. 19 p.

DFO. 2010. Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut.

DFO. 2013. DFO Review of Pond Inlet Emerging Arctic Char Fishery Application. Submission to the Nunavut Wildlife Management Board (NWMB).

DFO. 2015. Updated abundance estimate and harvest advice for the Eastern Canada – West Greenland bowhead whale population. Canadian Science Advisory Secretariat. Science Advisory Report 2015/052.

DFO. 2020. Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater. Retrieved from: https://www.dfo-mpo.gc.ca/pnw-ppe/codes/screen-ecran-eng.html) (accessed March 2021).

Doniol-Valcroze, T, Gosselin, J.F., Pike, D., Lawson, J., Asselin, N., Hedges, K., and S. Ferguson. 2015. Abundance estimates of narwhal stocks in the Canadian High Arctic in 2013. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/060. v + 36 p.

Druckenmiller, M.L., T. Moon and R. Thoman. 2021. The Arctic. In: Blunden, J. and T. Boyer (eds.) State of the Climate in 2020. Bulletin of the American Meteorological Society. 102: S263–S315.

Environmental Dynamics Inc. (EDI). 2023. 2022 Mary River Project: Terrestrial Environmental Annual Monitoring Report (TEAMR). Report prepared for Baffinland Iron Mines Corporation.

EDI. 2024. 2023 Mary River Project: Terrestrial Environmental Annual Monitoring Report (TEAMR). Report prepared for Baffinland Iron Mines Corporation.

Elliott, R.E., S. Raborn, H.R. Smith, and V.D. Moulton. 2015. Marine mammal aerial surveys in Eclipse Sound, Milne Inlet, Navy Board Inlet, and Pond Inlet, 31 August – 18 October 2013. Final LGL Report No. TA8357-3. Prepared by LGL Limited, King City, ON for Baffinland Iron Mines Corporation, Oakville, ON. 61 p.

Enfotec Technical Services Inc. (Enfotec). 2011. Ice and marine shipping assessment – Mary River Iron Ore Project – North Baffin Island, Nunavut – Revision 2. November 2011.

Enfotec. 2016. Technical Supporting Document (TSD) No. 16: Ice conditions and ship access to the Milne Inlet port site – Update. Mary River Project – Phase 2 Proposal. Report submitted to Baffinland Iron Mines Corporation. Reference No. 2016-BAFFINLAND-01. December 2016.

Environment Canada. 2010. Species at Risk Act (SARA) (www.sararegistry.gc.ca).

Estes J.A., M. Heithaus, D.J. McCauley, D.B. Rasher and B. Worm. 2016. Megafaunal impacts on structure and function of ocean ecosystems. Annual Review of Environment and Resources. 41: 83–116.

Fednav Ice Services (Fednav). 2023. Ice conditions and ship access to the Milne Inlet port. 1 February 2023.

Ferguson Simek Clark, Engineers & Architects, 2003. Guidelines for the Planning, Design, Operations and Maintenance of Modified Solid Waste Sites in the NWT. FSC Project No: 2001-1330. Prepared for The Department Municipal and Community Affairs, Government of the Northwest Territories. April 21, 2003. https://www.enr.gov.nt.ca/sites/enr/files/guidelines/solidwaste_guidelines.pdf

Frainer, A., R, Primicerio, S. Kortscha, M. Auneb, A.V. Dolgovc, M. Fossheimd and M.M. Aschana. 2017. Climate-driven changes in functional biogeography of Arctic marine fish communities. PNAS. 114:46.

Frederiksen, M. and T. Haug. 2015. Editorial: climate change and marine top predators. Front. Ecol. Evol. 3: 136

Gauthier, G., Bêty, J., Giroux, J.-F., and Rochefort, L. 2004. Trophic interactions in a high Arctic snow goose colony. Integrative and Comparative Biology 44(2):119–129. DOI: 10.1093/icb/44.2.119

Gauthier, G., Berteaux, D., Bêty, J., Tarroux, A., Therrien, J., McKinnon, L., Legagneux, P., and Cadieux, M. 2011. The tundra food web of Bylot Island in a changing climate and the role of exchanges between ecosystems. Ecosience 18(3):223–235.

Gérin-Lajoie, J., A. Cuerrier and L. Siegwart Collier. 2016. The caribou taste different now: Inuit Elders observe climate change. Nunavut Arctic College, Iqaluit, Nunanut, Canada.

Gilchrist, H.G. and Mallory, M.L. 2005. Declines in abundance and distribution of the ivory gull (Pagophila eburnea) in Arctic Canada. Biological Conservation 121(2):303–309. DOI: 10.1016/j.biocon.2004.04.021Golder. 2018a. Technical Support Document (TSD) No. 17. Marine Environment Effects Assessment. Mary River Project – Phase 2 Proposal. Report No. 1663724-035-R-Rev2. 10 August 2018.

Golder. 2018. 2017 Bruce Head Shore-based Monitoring Program. Golder Report No.1663724-041-R-Rev0. Prepared by Golder Associates Ltd., Vancouver, BC for Baffinland Iron Mines Corporation, Oakville, Ontario. 89 p. + appendices.

Golder. 2019a. Interim Waste Rock Management Plan. December 2018. Document 032_Rev0. Project Number 1790951.

Golder. 2019b. 2019 Geochemistry Waste Rock Investigation Results – Baffinland Iron Mines Mary River Project. October 25, 2019.

Golder. 2019c. 2018 Ship-based Observer Program. Technical Data Report – Final. Report No. 1663724-088-R-Rev0. 30 May 2019.

Golder. 2020a. 2019 Marine Mammal Aerial Survey. Golder Report No.1663724-191-R-Rev0. Prepared by Golder Associates Ltd., Victoria, BC for Baffinland Iron Mines Corporation, Oakville, Ontario. 98 p.

Golder. 2020b. 2017-2018 Integrated Narwhal Tagging Study – Technical Data Report. Report No. 1663724-188-R-Rev0-12000. 14 August 2020.

Golder. 2020c. 2019 Ship-based Observer Program. Technical Data Report 1663724-185-Rev0-31000. Mary River Project. 24 July 2020.64 p. + appendix.

Golder. 2020d. 2019 Bruce Head shore-based monitoring program. Final Golder Report No. 1663724-199-R Rev0. Prepared by Golder Associates Ltd., Victoria, BC for Baffinland Iron Mines Corporation, Oakville, Ontario. 117 p. + appendices.

Golder. 2021a. 2020 Marine Mammal Aerial Survey. Golder Report No.1663724-270-R-Rev1. Prepared by Golder Associates Ltd., Victoria, BC for Baffinland Iron Mines Corporation, Oakville, Ontario. 79 p.+ appendices.

Golder. 2022a. 2021 Marine Mammal Aerial Survey. Golder Report No.1663724-353-R-Rev0. Prepared by Golder Associates Ltd., Victoria, BC for Baffinland Iron Mines Corporation, Oakville, Ontario. 109 p.+ appendices.

Golder. 2022b. 2021 Ringed Seal Aerial Survey Program. Final Report. Report No. 1663724-351-R-Rev0-41000. 31 August 2022.

Golder. 2022c. 2021 Bruce Head shore-based monitoring program – Golder Report No. 1663724-269-R-Rev0. Prepared by Golder Associates Ltd., Victoria, BC for Baffinland Iron Mines Corporation, Oakville, Ontario. 183 p. + appendices.

Golder. 2024. Waste Rock Management Plan - June 2023 through September 2026. Reference No. 22572750-006-R-Rev1-5000. Prepared by Golder Associates Ltd., for Baffinland Iron Mines, Oakville, Ontario.

Government of Nunavut, Department of Environment (GoN DOE), 2009. Environmental Guideline for Contaminated Site Remediation. Available at: https://www.gov.nu.ca/documents/contaminated-site-remediation-2010.

GoN DOE. 2011. Environmental Guidelines for Ambient Air Quality. Available at: http://env.gov.nu.ca/programareas/environmentprotection

GoN DOE. 2014. Environmental Guideline for the Management of Contaminated Sites. Available at: https://www.gov.nu.ca/in/node/23482.

GoN. 2018a. Nunavut Coastal Resource Inventory – Pond Inlet. Department of Environment, Government of Nunavut. Fisheries and Sealing Division.

GoN. 2018b. Nunavut Coastal Resource Inventory – Hall Beach. Department of Environment, Government of Nunavut. Fisheries and Sealing Division.

GoN. 2019. Government of Nunavut. 2019. Baffin Island Caribou Management Plan. Department of Environment. 22 pp

GoN. 2022. Nunavut Coastal Resource Inventory – Iglulik Pilot Project. Department of Environment, Government of Nunavut.

Hay, K., D. Aglukark, D. Igutsaq, J. Ikkidluak, and M. Meeka. 2000. Final Report of the Inuit bowhead knowledge study, Nunavut, Canada. Nunavut Wildlife Management Board, 101pp. DOI: http://dx.doi.org/10.25607/OBP-1675.

Health Canada 2010

Health Canada, 2022. Guidelines for Canadian Drinking Water Quality—Summary Tables. Water and Air Quality Bureau, Healthy

Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario.

Indian and Northern Affairs Canada (INAC), 1992. *Mine Reclamation in Northwest Territories and Yukon*. Prepared by Steffen Robertson and Kirsten (B.C.) Inc., April 1992.

INAC. 2002a. Mine Site Reclamation Policy for the Northwest Territories.

INAC. 2002b. Mine Site Reclamation Policy for Nunavut.

Intergovernmental Panel on Climate Change (IPCC), 2007. Climate Change 2007: Synthesis Report

IPCC. 2013. Climate change 2013: the physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom.

JPCS. 2017. Results of Community Workshops Conducted for Baffinland Iron Mines Corporation's Phase 2 Proposal. Report prepared for Baffinland Iron Mines Corporation. January 2017.

Knight Piésold Ltd. 2008. Memorandum: *Mary River Project - Estimated Time for Open Pit to Fill with Water (Deposit No. 1)*. Ref. No. NB08-00868, September 8.

Knight Piésold Ltd. 2010. Mary River Public Consultation and IQ Collection Records (2006-2010). NIRB Registry No. 285329.

Knight Piésold Ltd. 2014. Letter to: Oliver Curran, Baffinland Iron Mines Corporation. Re: *Baffinland Iron Mines Corporation - Mary River Project Inuit Knowledge Study Database*. February 5. Ref. No. NB14-00411 (NB102-181/35).

Knight Piésold Ltd. 2021a. Mary River Project – Phase 2 Proposal – Updated Application for Amendment No. 2 of Type A Water Licence 2AM-MRY1325. Ref. No. NB102-181/53-3, Rev. 1, September 17.

Knight Piésold Ltd. 2021b. Mary River Project - Mine Site Water Management Plan. Ref. No. NB102-181/63-1, Rev. 2, June 30.

Knight Piésold Ltd. 2023. 2022 Groundwater Monitoring Program Mary River Project. Prepared for Baffinland Iron Mines Corporation. March 2023.

Kristofferson, A.H. and D.K. McGowan. 1981. Data on Arctic char, Salvelinus alpinus (Linnaeus), collected from test fisheries in the Baffin Region, Northwest Territories, 1975-79. Canadian Data Report on Fisheries and Aquatic Sciences. 255: vi + 43 pp.

Kroeker, K. 1987. Report on the test fishery for Arctic charr, Salvelinus alpinus, in the Steensby Inlet area, Northwest Territories, 1985-1986. A report prepared by North/South Consultants Inc. vi + 118 pp.

Laidre, K. L., I. Stirling, L.F. Lowry, Ø. Wiig, M.P. Heide-Jørgensen and S.H. Ferguson. 2008. Quantifying the sensitivity of Arctic marine mammals to climate-induced habitat change. Ecological Applications. 18: S97–S125.

Laidre, K.L., H. Stern, K.M., Kovacs, L.M., Lowry, L., Moore, S.E., Regehr, E.V., Ferguson, S.H., Wiig, Ø., Boveng, P., Angliss, R.P. and Born, E.W. 2015. Arctic marine mammal population status, sea ice habitat loss, and conservation recommendations for the 21st century. Conservation Biology. 29(3):724-737.

Latour, P.B., Leger, J., Hines, J.E., Mallory, M.L., Mulders, D.L., Gilchrist, H.G., Smith, P.A., and Dickson, D.L. 2008. Key migratory bird terrestrial habitat sites in the Northwest Territories, third edition. Canadian Wildlife Service Occasional Paper 114. Environment and Climate Change Canada, Ottawa, Ontario. 120 pp.

Lepage, D., Nettleship, D.N., and Reed, A. 1998. Birds of Bylot Island and adjacent Baffin Island, Northwest Territories, Canada, 1979 to 1997. Arctic 51(2):125–141. Liebezeit, J.R., Gurney, K.E.B., Budde, M., Zack, S., and Ward, D. 2014. Phenological advancement in arctic bird species: relative importance of snow melt and ecological factors. Polar Biology 37(9):1309–1320. DOI: 10.1007/s00300-014-1522-x

Marcoux, M., B. Young, N. C. Asselin, C. A. Watt, J. B. Dunn, and S. H. Ferguson. 2016. Estimate of Cumberland Sound beluga (Delphinapterus leucas) population size from the 2014 visual and photographic aerial survey. DFO Can. Sci. Advis. Sec. Res. Doc. 2016/037. Iv + 19 p.

Mallory, M.L. and Fontaine, A.J. 2004. Key marine habitat sites for migratory birds in Nunavut and the Northwest Territories. Canadian Wildlife Service Occasional Paper 109. Environment Canada, Ottawa, Ontario. 92 pp. Mansfield, A.W. 1983. The effects of vessel traffic in the Arctic on marine mammals and recommendations for future research. Canadian Technical Report of Fisheries and Aquatic Sciences. 1186: 110 p.

Matthews, C.J.D., Watt, C.A., Asselin, N.C., Dunn, J.B., Young, B.G., Montison, L.M., Westdal, K.H., Hall, P.A., Orr, J.R., Ferguson, S.H., and M. Marcoux. 2017. Estimated abundance of the Western Hudson Bay beluga stock from the 2015 visual and photographic aerial survey. DFO Can. Sci. Advis. Sec. Res. Doc. 2017/061. v + 20 p.

McLaren, P. L. 1982. Spring Migration and Habitat Use by Seabirds in Eastern Lancaster Sound and Western Baffin Bay. Arctic, 35(1), 88–111. http://www.jstor.org/stable/40509305

Minister of Justice, 2022. Territorial Lands Act. R.S.C., 1985, c. T-7. Available at: https://laws-lois.justice.gc.ca/eng/acts/T-7/.

Minnow Environmental Inc (Minnow). 2016. Mary River Project 2015 Core Receiving Environment Monitoring Program Report. Prepared for Baffinland Iron Mines Corp. March 2016.

Minnow. 2017. Mary River Project 2016 Core Receiving Environment Monitoring Program Report. Prepared for Baffinland Iron Mines Corp. March 2017.

Minnow. 2022. Mary River Project Lake Sedimentation Monitoring: 2020 to 2021. Prepared for Baffinland Iron Mines Corporation. March 2022.

Minnow. 2023. Milne Inlet Freshwater Fish Health Program 2022 Report. Prepared for Baffinland Iron Mines Corporation. April 2023.

Minnow. 2024a. Mary River Project Third Environmental Effects Monitoring (2023) Interpretive Report. Prepared for Baffinland Iron Mines Corporation. January 2024

Minnow. 2024b. Mary River Project 2023 Core Receiving Environment Monitoring Program Report. Prepared for Baffinland Iron Mines Corporation. March 2024.

Minnow. 2024c. Mary River Project Lake Sedimentation Monitoring 2022/2023. Prepared for Baffinland Iron Mines Corporation. March 2024.

Metal and Diamond Mining Effluent Regulations (MDMER). 2018. SOR/2002-22.

MOE (Ontario Ministry of the Environment). 2011. Rationale for the Development of Generic Soil and Groundwater Standards for Use at Contaminated Sites in Ontario, revised version April 15, 2011. Standards Development Branch, Ontario Ministry of the Environment.

Møller, E.F. and T. G. Nielsen. 2020. Borealization of Arctic zooplankton—Smaller and less fat zooplankton species in Disko Bay, Western Greenland. Limnology and Oceanography. 65: 1175–1188.

Moshenko, R.W. 1981. A preliminary assessment of the Arctic char sport fishery on the Robertson River (Koluktoo Bay), Northwest Territories, 1979. Can. Data Rep. Fish. Aquat. Sci. No. 306.

National Research Council. 1998. The Canadian System of Soil Classification, prepared by the Soil Classification Working Group, Research Branch of Agriculture and Agri-Food Canada, Third Edition.

MVLWB/AANDC. 2013. Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the NWT, prepared by Mackenzie Valley Land and Water Board & Aboriginal Affairs and Northern Development Canada, dated November 2013.

Nettleship, D. N., and Gaston, A. J. 1976. Patterns of pelagic distribution of seabirds in western Lancaster Sound and Barrow Strait, N.W.T. Canadian Wildlife Service Occasional Paper 39. Environment and Climate Change Canada, Ottawa, Ontario. https://publications.gc.ca/site/eng/9.855691/publication.html

North Water Environmental. 2023. 2022 SNP Hydrometric Monitoring Program. Prepared for Baffinland Iron Mines Corporation. March 2023

North Water Environmental. 2024. 2023 SNP Hydrometric Monitoring Program. Prepared for Baffinland Iron Mines Corporation. March 2024

Nøttestad, L., B. Krafft, V. Anthonypillai, M. Bernasconi, L. Langárd, H.L., Mørk and Fernö. 2015. Recent changes in distribution and relative abundance of cetaceans in the Norwegian Sea and their relationship with potential prey. Front. Ecol.Evol. 2: 150-160.

Nunavut Planning Commission (NPC). 2000. North Baffin Regional Land Use Plan.

https://www.nunavut.ca/sites/default/files/north_baffin_regional_land_use_plan.pdf

NPC. 2016. Nunavut Land Use Plan – 2016 Draft.

Retrieved from: https://lupit.nunavut.ca/portal/registry.php?public=docs&g=10&c=1012&searchtext=

NPC. 2021. Nunavut Land Use Plan – 2021 Draft.

Retrieved from: https://lupit.nunavut.ca/portal/registry.php?public=docs&g=16&c=1043&searchtext=

Nunavut Impact Review Board (NIRB). 2009. Guidelines for the Preparation of an Environmental Impact Statement for Baffinland Iron Mines Corporation's Mary River Project, prepared by Nunavut Impact Review Board, dated November 2009.

Nunami Stantec Limited. 2024. 2023 Annual Air Quality, Dustfall and Meteorology Report. Report prepared for Baffinland Iron Mines Corp. April 30, 2024.

NWMB. 2016a. Public hearing to consider modifications to total allowable harvests for the Eclipse Sound and Admiralty Inlet Narwhal Management Units. 28 November 2016. 237 p.

NWMB. 2016b. Public hearing to consider modifications to total allowable harvests for the Eclipse Sound and Admiralty Inlet Narwhal Management Units. 29 November 2016. 237 p.

Olthof, I., Latifovic, R., and Pouliot, D. 2009. Development of a circa 2000 land cover map of northern Canada at 30 m resolution from Landsat. Canadian Journal of Remote Sensing. Vol. 35, No. 2, pp. 152-165.

Overland, J.E. and M. Wang. 2013. When will the summer Arctic be nearly sea ice free? Geophysical Research Letters 40:2097–2101.

Pace, T.G. 2005. Methodology to Estimate the Transportable Fraction (TF) of Fugitive Dust Emissions for Regional and Urban Scale Air Quality Analyses. US EPA, Research Triangle Park NC, August2005. Available online at: https://www.nrc.gov/docs/ML1321/ML13213A386.pdf.

NWTWB. 1990. Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories, prepared by Northwest Territories Water Board, dated September 1990.

NRCan (Natural Resources Canada). 1994. The Whitehorse Mining Initiative Leadership Council Accord Final Report (October 1994).

Nunavut Water Board (NWB), 2015. *Type A Water Licence 2AM-MRY1325 - Amendment 1*. July 30.

Parks Canada. 2018. Where is the Tallurutiup Imanga?

https://www.pc.gc.ca/en/amnc-nmca/cnamnc-cnnmca/tallurutiup-imanga/emplacement-location

Priest, H., and Usher, P.J., 2004. The Nunavut Wildlife Harvest Study: Final Report, August 2004. Nunavut: Nunavut Wildlife Management Board.

Qikiqtani Inuit Association (QIA). 2013. Commercial Lease No.: Q13C301 – Commercial Lease for Inuit Owned Lands Between Qikiqtani Inuit Association (as Landlord) and Baffinland Iron Mines Corporation (as Tenant). September 6, 2013.

QIA. 2018. Qikiqtaaluk Inuit Qaujimajatuqangit and Inuit Qaujimajangit Iliqqusingitigut for the Baffin Bay and Davis Strait Marine Environment. November 2018. Prepared by Heidi Klein, Sanammanga Solutions Inc. for submission to the Nunavut Impact Review Board for the Baffin Bay and Davis Strait Strategic Environmental Assessment. November 2018.

QIA. 2019. Tusaqtavut Study on the Baffinland Iron Mines Corporation’s Mary River Project Phase 2 Proposal. Report submitted to Nunavut Impact Review Board. June 2019.

QIA. 2021. Tusaqtavut Study Specific to Mary River Project Phase 2 for the Communities of Arctic Bay and Clyde River. 28 May 2021. QIA. 2021b. Tusaqtavut/What We Heard - Mary River Mine Project. QIA-Tusaqtavut-report_2021_web.pdf. 60 p.

QIA. 2024. Abandonment and Reclamation Policy for Inuit Owned Lands (revised), April 2024. Prepared by Qikiqtani Inuit Association.

QWB. 2022. Submission to the Nunavut Wildlife Management Board (NWBM). Regular Meeting No. RM 001-2022. 01 February 2022.

Read, C.J., 2003. Enumeration and biological data on Arctic Char, Salvelinus alpinus, Ikaluit River, Nunavut, 1974-1994. Can. Data Rep. Fish. Aquat. Sci. 1117: v + 33 p.

Renaud, W. E., Johnson, S. R., & Hollingdale, P. D. 1979. Breeding Birds Of Arctic Bay, Baffin Island, N.W.T., With Notes On The Biogeographic Significance Of The Avifauna. Arctic, 32(2), 122-134. https://www.jstor.org/stable/40508954

Renaud, W. E., Johnston, W. G., & Finley, K. J. 1981. The Avifauna Of The Pond Inlet Region, N.W.T.: A Spectacular Mountain Wilderness With A Diverse Arctic Avifauna. American Birds, 35(2), 119-129. https://sora.unm.edu/sites/default/files/journals/nab/v035n02/p00119-p00129.pdf

Richardson E.S., J.D. Reist, AND C.K. Minns. 2001. Life history characteristics of freshwater fishes occurring in the Northwest Territories and Nunavut, with major emphasis on lake habitat requirements. Can. Man. Rep. Fish. Aquat. Sci. 2569: 149 pp.

Schneider-Vieira F., R. Baker and M. Lawrence. 1994. The estuaries of Hudson Bay: a case study of the physical and biological characteristics of selected sites. A report prepared by North/South Consultants Inc. for the Hudson Bay Program (1994). 85 p.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fish. Res. Board Can. 184: 966 pp.

SEM 2014. 2013 Ship-Based Observer Program. Prepared by Sikumiut Environmental Management Ltd., St. John's, NL for Baffinland Iron Mines Corporation, Oakville, Ontario.

SEM. 2016. 2015 Ship-Based Observer Program. Prepared by Sikumiut Environmental Management Ltd., St. John's, NL for Baffinland Iron Mines Corporation, Oakville, Ontario.

Soil Classification Working Group. 1998. The Canadian System of Soil Classification, 3rd ed. Agriculture and Agri-Food Canada Publication 1646, 187p

Smith, H.R., J.R. Brandon, P. Abgrall, M. Fitzgerald, R.E. Elliott and V.D. Moulton. 2015. Shore-based monitoring of narwhal and vessels at Bruce Head, Milne Inlet, 30 July – 8 September 2014. LGL Report No. FA0013. Prepared by LGL Limited, King City, ON for Baffinland Iron Mines Corporation, Oakville, ON. 73 p. + appendices.

Smith, H.R., S. Raborn, M. Fitzgerald and V.D. Moulton. 2016. Shore-based monitoring of narwhal and vessels at Bruce Head, Milne Inlet, 29 July – 5 September 2015. LGL Report No. FA0044. Prepared by LGL Limited, King City, ON for Baffinland Iron Mines Corporation, Oakville, ON. 70 p. + appendices.

Smith, H.R., V.D. Moulton, S. Raborn, P. Abgrall, R.E. Elliott, and M. Fitzgerald. 2017. Shore-based monitoring of narwhal and vessels at Bruce Head, Milne Inlet, 2016. LGL Report No. FA0089-1. Prepared by LGL Limited, King City, Ontario for Baffinland Iron Mines Corporation, Oakville, Ontario. 87 p. + appendices.

Sprules, W.M. 1952. The Arctic char of the west coast of Hudson Bay. Journal of Fisheries Research Board of Canada. 9: 1-15

Steiner, N.S., J. Bowman, K. Campbell, M. Chierici, E. Eronen-Rasimus, M. Falardeau, H. Flores, A. Fransson, H. Herr, S.J. Insley, H.M. Kauko, D. Lannuzel, L. Loseto, A. Lynnes, A. Majewski, K.M. Meiners, L.A. Miller, L. N. Michel, S. Moreau, M. Nacke, D. Nomura, L. Tedesco, J.A. van Franeker, M. A. van Leeuwe and P. Wongpan. 2021. Climate change impacts on sea-ice ecosystems and associated ecosystem services. Elementa: Science of the Anthropocene. 9:1

Stroeve J.C., M.C. Serreze, M.M. Holland, J.E. Kay, J. Malanik and A.P. Barrett. 2012. The Arctic's rapidly shrinking sea ice cover: a research synthesis. Climatic Change. 110: 1005–1027.

Tetra Tech Canada Inc. 2022. 2021 Groundwater Monitoring Program Mary River Mine Project. Prepared for Baffinland Iron Mines Corporation. March 2022.

Thomas, T.A., S. Raborn, R.E. Elliott, and V.D. Moulton. 2015. Marine mammal aerial surveys in Eclipse Sound, Milne Inlet, Navy Board Inlet, and Pond Inlet, 1 August – 22 October 2014. Final LGL Report No. FA0024-2. Prepared by LGL Limited, King City, ON for Baffinland Iron Mines Corporation, Oakville, ON. 70 p.

Thomas, T.A., S. Raborn, R.E. Elliott and V.D. Moulton. 2016. Marine mammal aerial surveys in Eclipse Sound, Milne Inlet and Pond Inlet, 1 August – 17 September 2015. LGL Report No. FA0059-3. Prepared by LGL Limited, King City, ON for Baffinland Iron Mines Corporation, Oakville, ON. 76 p.

US Army Corps of Engineers (USACE), 1984. Shoreline Protection Manual. 2 Volumes. Prepared by the Coastal Engineering Research Center, Department of the Army. Available at: https://usace.contentdm.oclc.org/digital/collection/p16021coll11/id/1934/.

Veldhuis, Hugo. 2010. Mary River Project, Soils Report Part I, Soils, Landscapes and their Properties. Winnipeg Manitoba, 2010.

Vikingsson G.A., D.G. Pike, H. Valdimarsson, A. Schleimer, T. Gunnlaugs son, T. Silva, B. Elvarsson, B. Mikkelsen, N. Øien, G. Desportes, V. Bogason and P.S. Hammond. 2015. Distribution, abundance, and feeding ecology of baleen whales in Icelandic waters: have recent environmental changes had an effect? Frontiers in Ecology and Evolution. 3:6.

Watt, C.A., J. Orr, B. LeBlanc, R. Richard and S.H. Ferguson. 2012. Satellite tracking of narwhal (Monodon monoceros) from Admiralty Inlet (2009) and Eclipse Sound (2010- 2011). DFO Can. Sci. Advis. Sec. Res. Doc. 2012/046. iii + 17 p.50.

Wilson, K., A. Arreak, Sikumiut Committee, T. Bell and G. Ljubicic. 2021. The Mittimatalik Siku Asijjipallianinga (Sea Ice Climate Atlas): How Inuit Knowledge, Earth Observations, and Sea Ice Charts Can Fill IPCC Climate Knowledge Gaps. Frontiers in Climate. Vol. 3. 26 October 2021.

WSP. 2022. 2021 Ship-Based Observer (SBO) Program. Report No. 166372402-497-R-Rev0-74000. 15 March 2024.

WSP. 2023a. 2022 Marine Mammal Aerial Survey Program (MMASP) – Final Report. Report No. 166372401-428 R-Rev0-59000. 27 April 2023

WSP. 2023b. 2022 Bruce Head Shore-based Monitoring Program. Report No. 1663724-438-R-Rev0-63000. 27 April 2023.

WSP. 2024a. 2023 Marine Mammal Aerial Survey Program (MMASP) – Final Report. Report No. 166372401-428 R-Rev0-59000. 27 April 2023

WSP. 2024b. Waste Rock Management Plan – June 2023 through September 2026. Reference No. 22572750-006-R-Rev1-5000, January 2024.

WSP. 2024c. 2023 Marine Environmental Effects Monitoring Program (MEEMP) and Non-indigenous Species / Aquatic Invasive Species (NIS/AIS) Monitoring Program. Report No. 1663724-499-R-Rev0. 1 March 2024.

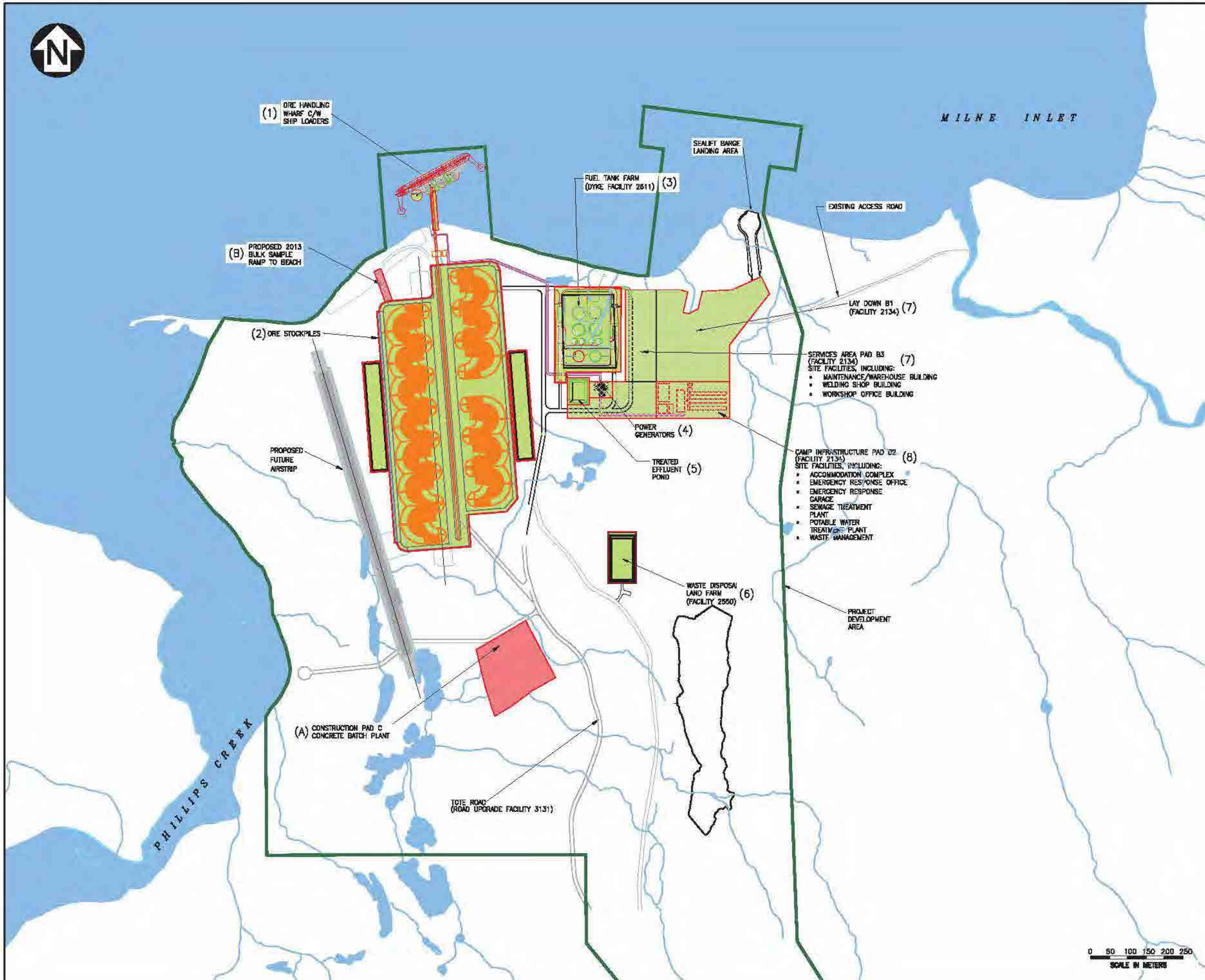
WSB. 2024d. 2023 Bruce Head Shore-based Monitoring Program – Final Report. Report No. 1663724-494-R-Rev0-75000. 15 March 2024.

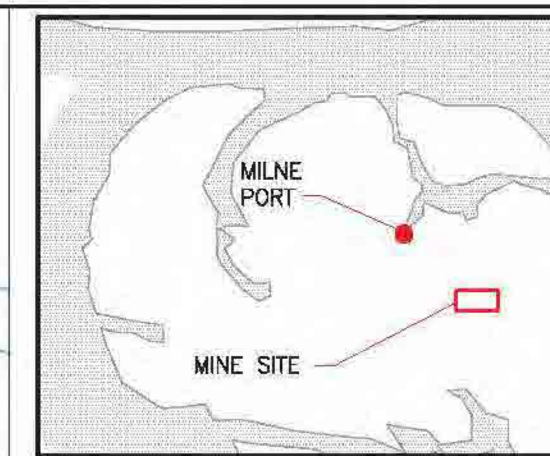
WSB. 2024e. 2023 Ship-Based Observer (SBO) Program. Report No. 166372402-497-R-Rev0-74000. 15 March 2024.

Young, B.G., D.J. Yurkowski, J.B. Dunn, and S.H. Ferguson. 2019. Comparing infrared imagery to traditional methods for estimating ringed seal density. Wildlife Society Bulletin; DOI: 10.1002/wsb.958.

Zoltai, S. C., K. J. Mccormick, And G. W. Scotter. 1983. A Natural Resource Survey Of Bylot Island And Adjacent Baffin Island, North- West Territories. Canadian Wildlife Service Technical Report Series 135. Environment and Climate Change Cananda, Yellowknife, N.W.T. https://publications.gc.ca/site/eng/9.856989/publication.html

Appendix A
Life of Mine Site Layouts





RECLAMATION AREA - AFTER CONSTRUCTION

AREA ID	m²
A	31,597
B	1,835
TOTAL	33,432

RECLAMATION AREA - AFTER OPERATION

AREA ID	m²
1	4600
2	267,770
3	42,630
4	2,780
5	4,450
6	10,500
7	116,730
8	20,000
TOTAL	451,460

LEGEND:

( ) RECLAMATION AREA ID

RECLAMATION AREA - AFTER CONSTRUCTION

RECLAMATION AREA - AFTER OPERATION

BAFFINALND IRON MINES CORPORATION

MARY RIVER PROJECT

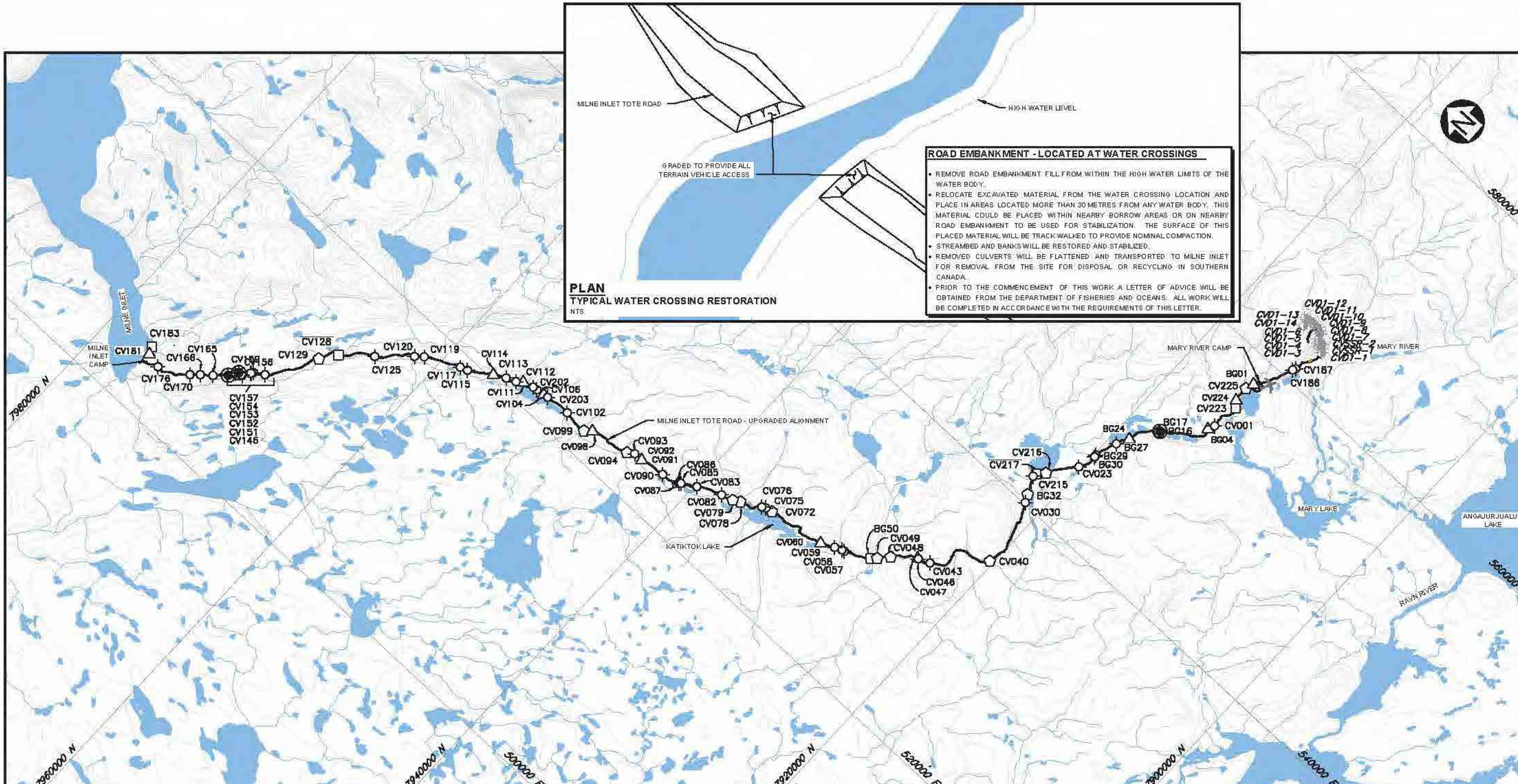
AREAS OF RECLAMATION - MILNE PORT LAYOUT

Baffinland

REF NO. BL_ARP_CAD_001

FIGURE NO. E349000-2000-07-014-0001

REV 0



LEGEND:

- WATER
- MILNE INLET TOTE ROAD - UPDATED ALIGNMENT
- AIRSTRIP
- EXPLORATION CAMP LOCATION
- CULVERT LOCATION
- EXTRA SMALL CROSSING
- SMALL CROSSING
- MEDIUM CROSSING
- LARGE CROSSING
- EXTRA LARGE CROSSING

NOTES:

1. COORDINATE GRID IS UTM (NAD83) ZONE 17.
2. BASE MAP: © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA, DEPARTMENT OF NATURAL RESOURCES, (2004). ALL RIGHTS RESERVED.
3. CONTOURS ARE IN METRES, CONTOUR INTERVAL VARIES.
4. MILNE INLET TOTE ROAD ALIGNMENT SURVEY PROVIDED BY GENIVAR (SURVEY COMPLETED IN JULY 2008).
5. NOT FOR CONSTRUCTION.

SCALE A 3 1.5 0 5 10 15 km

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

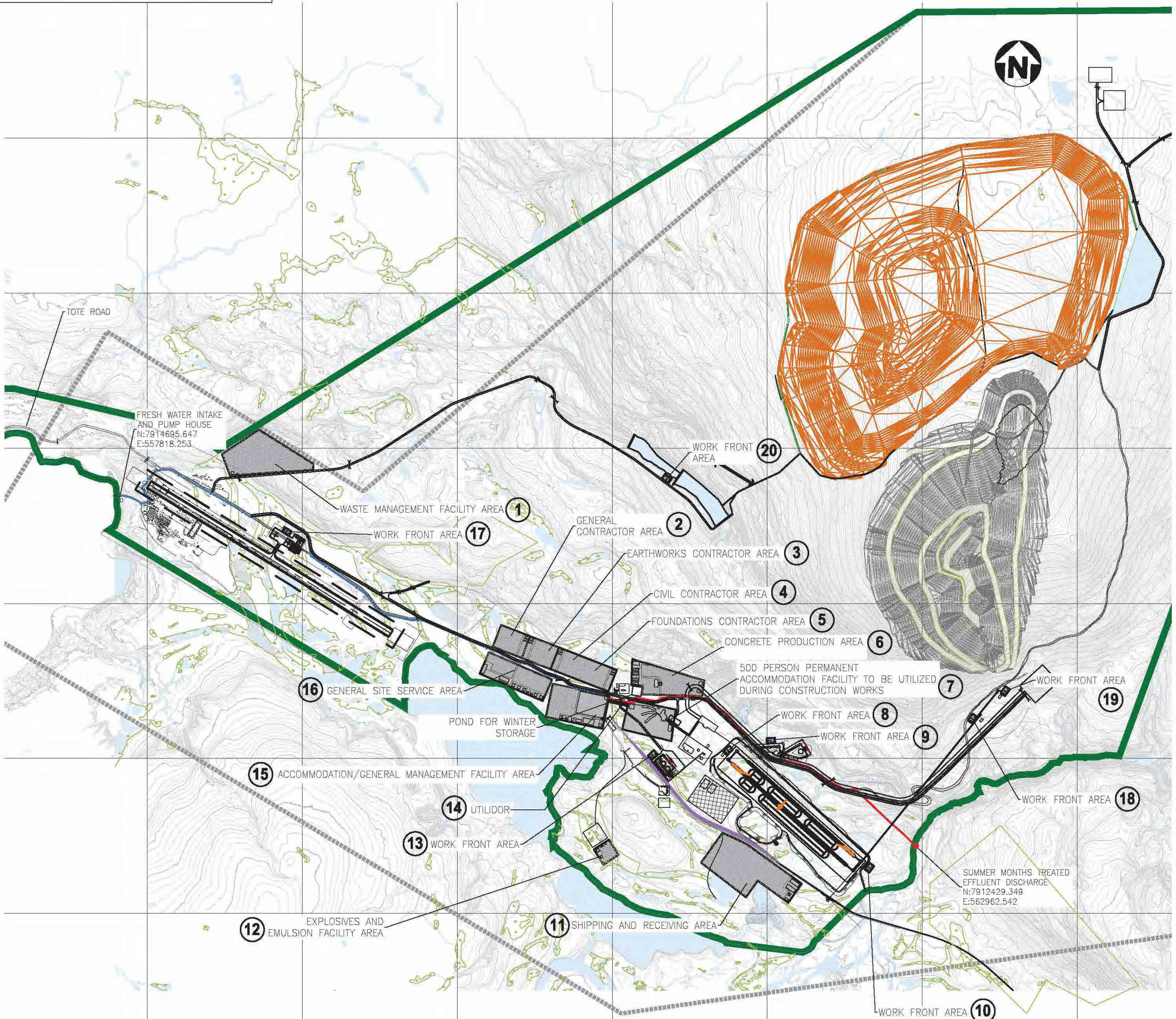
MILNE INLET TOTE ROAD WATER CROSSING RESTORATION

Knight Piésold CONSULTING

P/A NO.	REF NO.
NB102-181/29	1

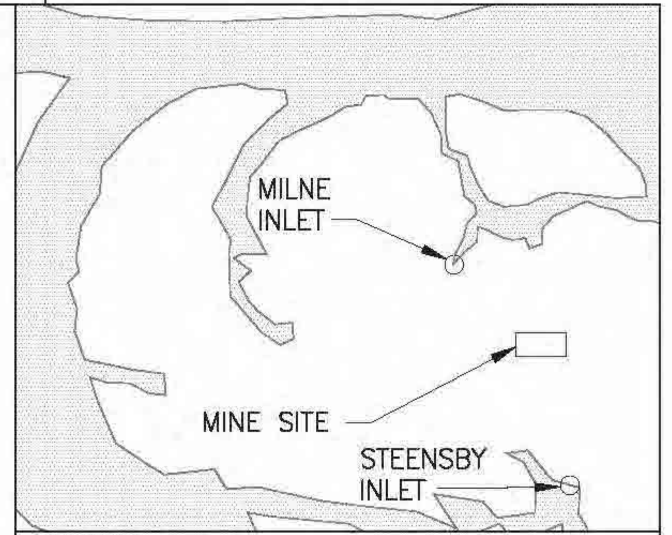
FIGURE 8.10 REV 0

H337697-4210-07-012-0001
DWG. NO.



RECLAMATION AREA - AFTER CONSTRUCTION

AREA	m²
1	102,610
2	30,000
3	30,000
4	30,000
5	30,000
6	71,540
7	63,380
8	1,860
9	1,860
10	1,860
11	133,540
12	132,30
13	1,860
14	2,800
15	81,160
16	66,400
17	1,860
18	1,860
19	1,860
20	1,860
TOTAL	**669,540**



KEYPLAN

LEGENDS:

- RECLAMATION AREA AFTER CONSTRUCTION
- WATER
- WETLAND
- CONSTRUCTION WORKS LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- RAILWAY ALIGNMENT
- TREATED EFFLUENT PIPELINE
- FRESHWATER PIPELINE
- ACCESS ROAD
- POTENTIAL DEVELOPMENT AREA
- BAFFINLAND'S COMMERCIAL LEASE ON INUIT OWNED LAND

NOTES:

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 10 METRES.
4. MINE SITE AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR.
5. PROPOSED PERMANENT WORKS LAYOUT SHOWN FOR REFERENCE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

SCALE 300 150 0 500 1000 1500 mm
SCALE 1:15,000

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INFORMATION				
REVISIONS					

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMITTING		
ISSUE AUTHORIZATION			

HATCH

DESIGNED BY A. GRZEGORCZYK DATE
DRAWN BY M. LU DATE
CHECKED BY T. HO DATE
DISCIP. ENGR. J. BINNS DATE
PROJ. DES. COORD. DATE
PROJ. ENGR. DATE
PROJ. MGR. DATE

Baffinland Iron Mines Corporation

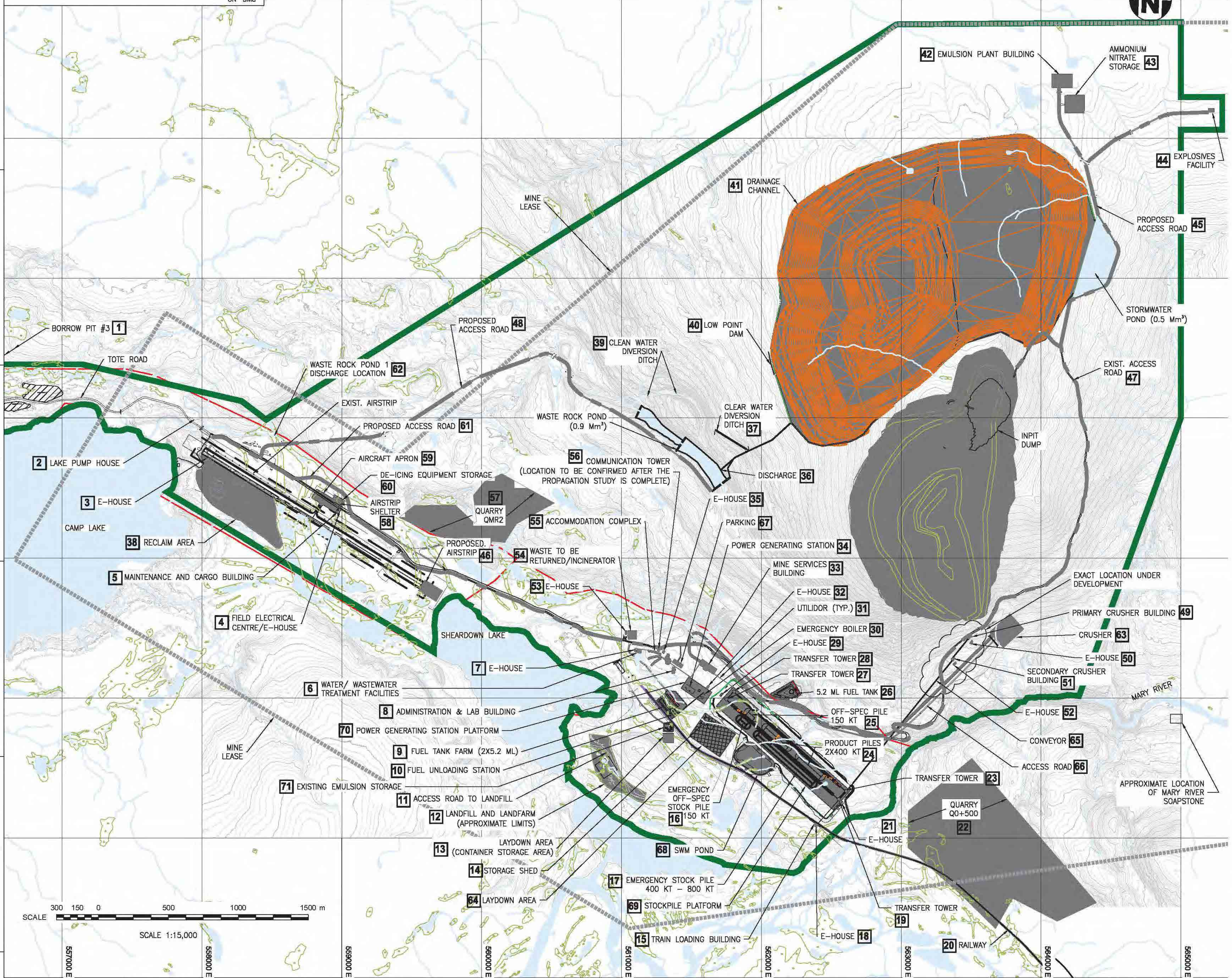
MARY RIVER PROJECT

PRELIMINARY MINE CLOSURE AND RECLAMATION PLAN MINE SITE CONSTRUCTION PHASE

SCALE: OR AS NOTED | DWG. NO. H337697-4210-07-012-0001 | REV. A

Oct 31, 2011 - 4:03pm Login name: fun51283 Layout: MINE SITE
Drawing Name: P:\289980 - Mary River\CAD\Civil\Roads\Reclaim\H337697-4210-07-012-0001 - Standard\H337697-4210-07-012-0001.dwg

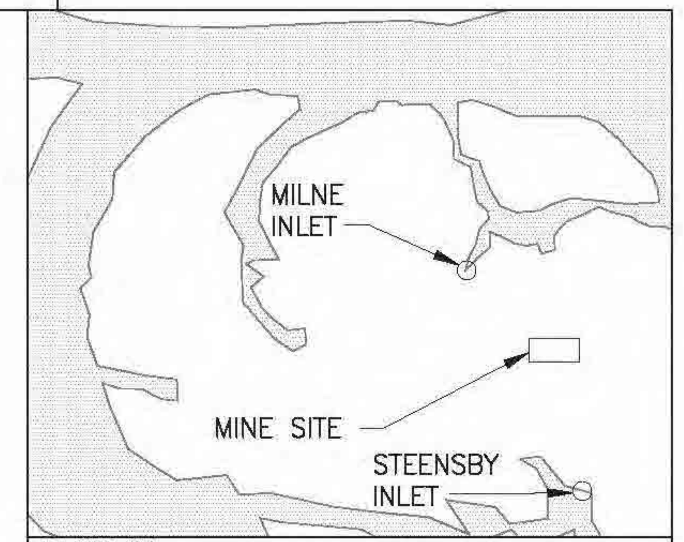
DWG. NO. H337697-4210-07-012-0002



RECLAMATION AREA - AFTER OPERATION

AREA	m²
1	38,850
2	20
3	290
4	40
5	230
6	870
7	290
8	940
9	24,190
10	600
11	4,900
12	76,300
13	4,420
14	4,320
15	370
16	5,760
17	31,450
18	140
19	200
20	26,750
21	140
22	817,690
23	200
24	28,000
25	5,760
26	16,340
27	200
28	200
29	290
30	380
31	2,000
32	290
33	5,750
34	2,550
35	250
36	700
37	800
38	175,780
39	2,400
40	3,300
41	5,080,000
42	14,260
43	17,380
44	1,020
45	27,900
46	13,500
47	56,800
48	34,560
49	500
50	290
51	350
52	290
53	290
54	870
55	5,740
56	220
57	260,310
58	510
59	14,620
60	890
61	41,500
62	500

AREA	m²
63	30,000
64	48,500
65	3,460
66	58,300
67	3,400
68	43,600
69	133,670
70	16,800
71	6,570
TOTAL	7,200,570



KEYPLAN

LEGENDS:

- RECLAMATION AREA AFTER OPERATION
- WATER
- EXISTING BORROW AREA
- TEMPORARY LAYDOWN AREA
- ACCESS ROAD
- RIVER/STREAM/DRAINAGE
- POTENTIAL DEVELOPMENT AREA
- BAFFINLAND'S COMMERCIAL LEASE ON INUIT OWNED LAND
- COMMUNICATION TOWER

NOTES:

1. TOPOGRAPHY PROVIDED BY TERRAPOINT CANADA INC.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2 METRES.
4. MINE SITE INFRASTRUCTURE IS BASED ON EIS AND AMEC DRAWINGS ADDITIONAL DETAILS PROVIDED IN DRAWINGS : A1-164512-6120-121-0100 A1-165926-6000-121-GAD-0100 A1-159952-6020-121-0200
5. MATERIAL HANDLING AND PROCESSING LAYOUT WAS REVISED BASED ON AKER KVAERNER DRAWING DWG-2000-M-0003, REV C.
6. MINE SITE AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR, SURVEYED AS OF JAN. 2009.

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INFORMATION				
REVISIONS					

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMITTING		
ISSUE AUTHORIZATION			

HATCH™

Baffinland Iron Mines Corporation

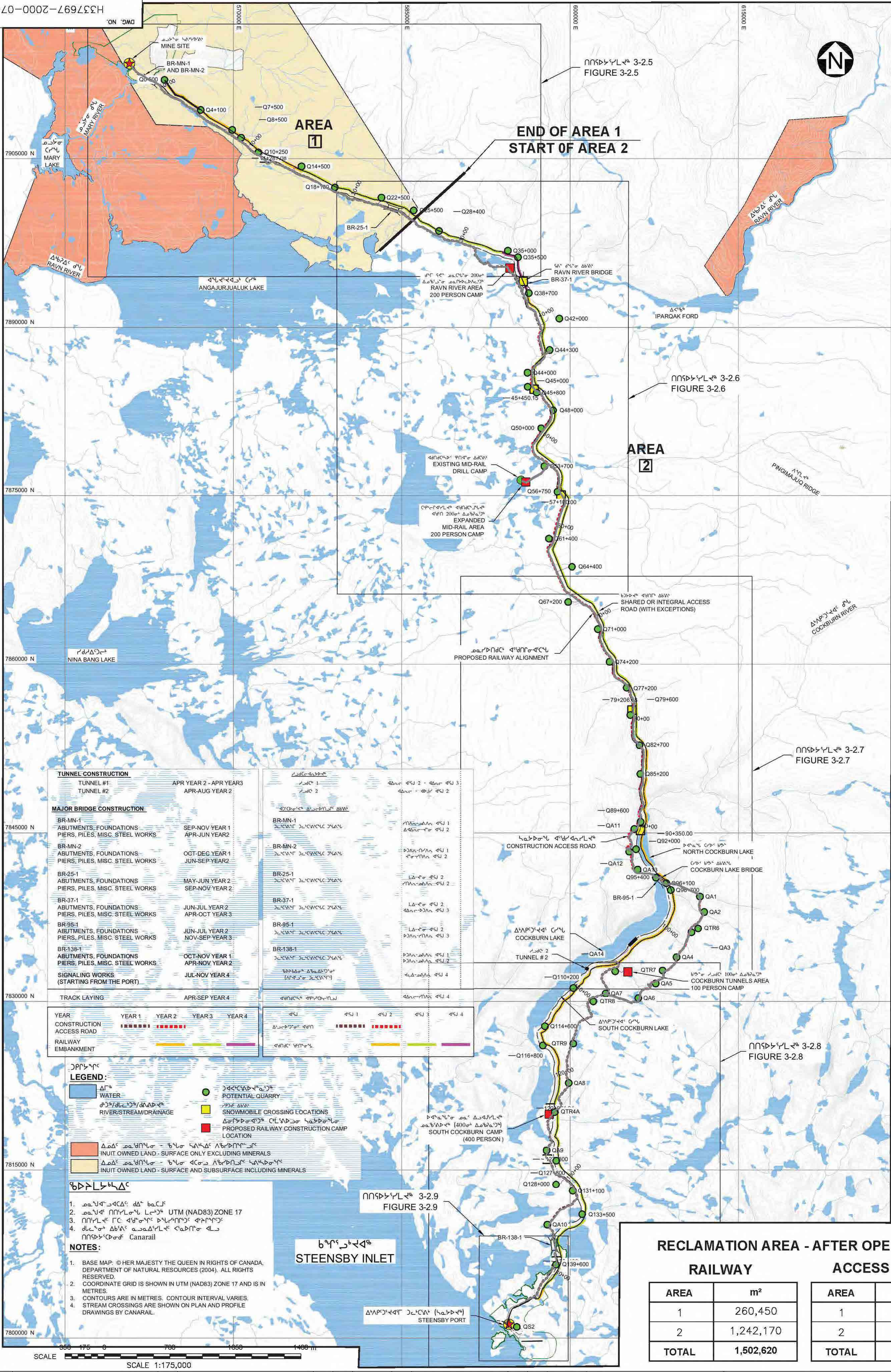
DESIGNED BY A. GREGORCZYK DATE	DRAWN BY M. LU DATE
CHECKED BY T. HO DATE	DISCIP. ENGR. J. BINNS DATE
PROJ. DES. COORD. DATE	PROJ. ENGR. DATE
PROJ. MGR. DATE	

MARY RIVER PROJECT

PRELIMINARY MINE CLOSURE AND RECLAMATION PLAN MINE SITE FINAL CLOSURE PHASE

SCALE OR AS NOTED | DWG. NO. H337697-4210-07-012-0002 | REV. A

Nov 03, 2011 9:03am Login name: fun51283 Layout: Reclaim
Drawing Name: P:\389980 - Mary River\CAD\Civil\Roads\Reclaim\H337697-4210-07-012-0002.dwg



RECLAMATION AREA - AFTER OPERATION

RAILWAY

AREA	m²
1	260,450
2	1,242,170
TOTAL	1,502,620

ACCESS ROAD

AREA	m²
1	269,440
2	1,247,730
TOTAL	1,517,170

HATCH

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

PRELIMINARY MINE CLOSURE AND RECLAMATION PLAN RAILWAY ALIGNMENT

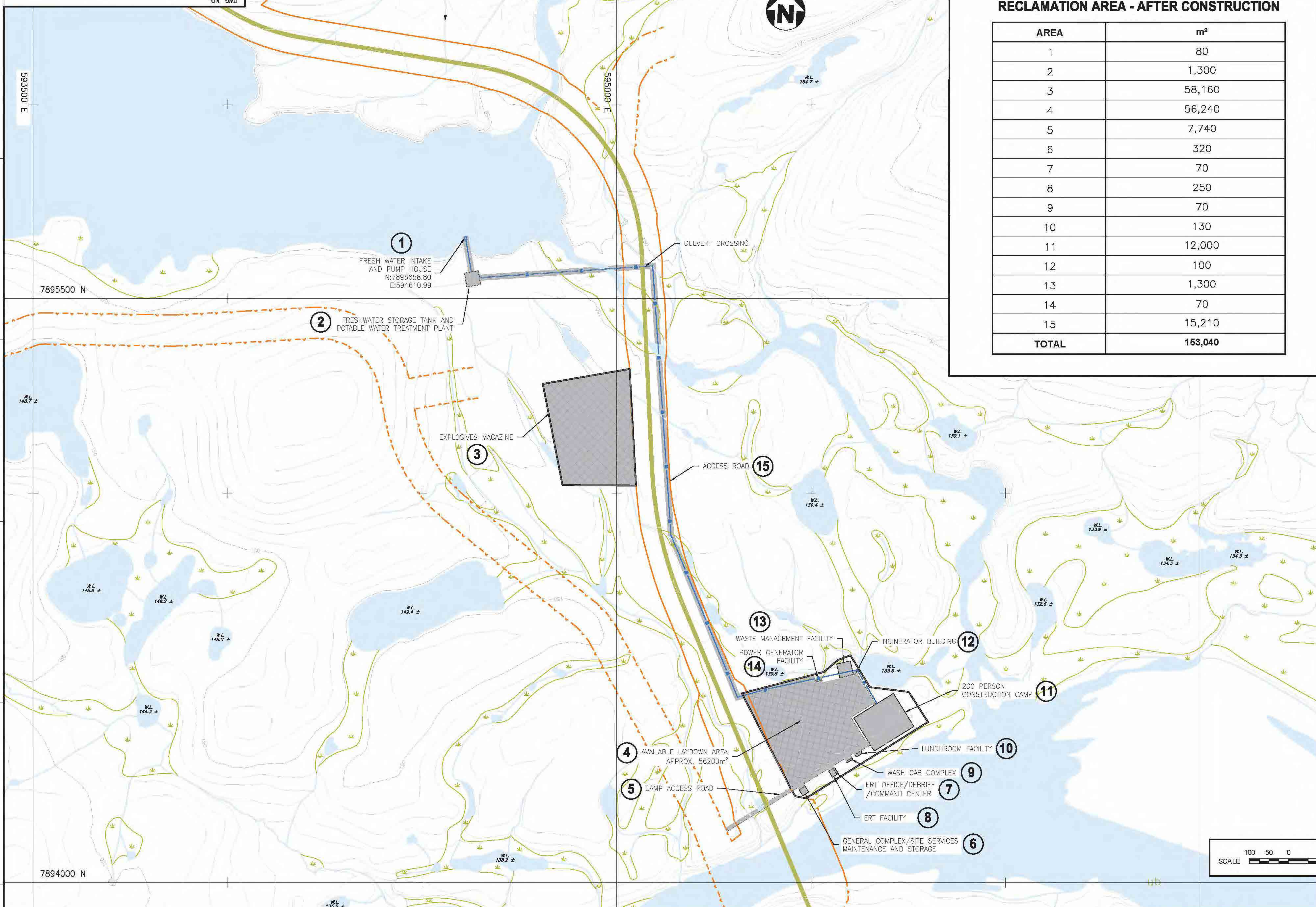
DRAWN BY M.L.

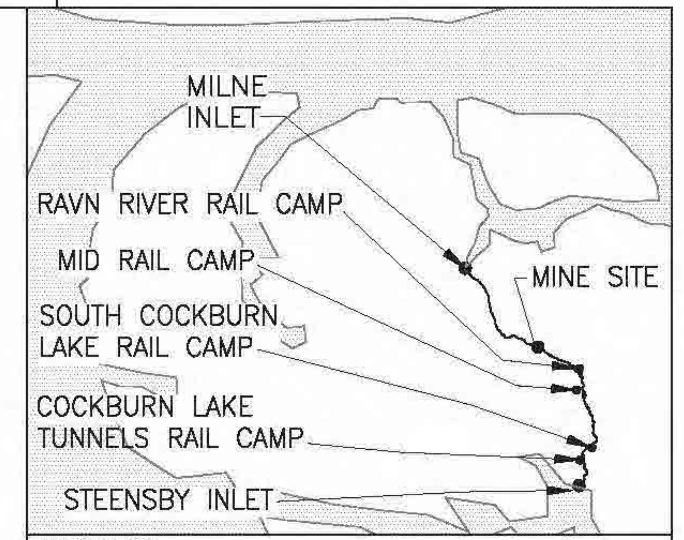
A ISSUED FOR INFORMATION

DWG. NO. H337697-2000-07-012-0001 REV. A

RECLAMATION AREA - AFTER CONSTRUCTION

AREA	m²
1	80
2	1,300
3	58,160
4	56,240
5	7,740
6	320
7	70
8	250
9	70
10	130
11	12,000
12	100
13	1,300
14	70
15	15,210
TOTAL	**153,040**





KEYPLAN

LEGENDS:

- RECLAMATION AREA AFTER CONSTRUCTION
- WATER
- WETLAND
- PRE-DEVELOPMENT LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- FUTURE RAILWAY ALIGNMENT

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 10 METERS.

SCALE 100 50 0 100 200 300 400 500 m

SCALE 1:5,000

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INFORMATION				

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMITTING		

ISSUE AUTHORIZATION

HATCH

DESIGNED BY A. GRZEGORCZYK | DRAWN BY D. FUNG
CHECKED BY T. HO | DISCIP. ENGR. J. BINNS
PROJ. DES. COORD. | PROJ. ENGR.
PROJ. MGR.

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

PRELIMINARY MINE CLOSURE AND RECLAMATION PLAN RAVN RIVER RAIL CAMP

SCALE: AS NOTED | DWG. NO. H337697-7000-07-012-0002 | REV. A

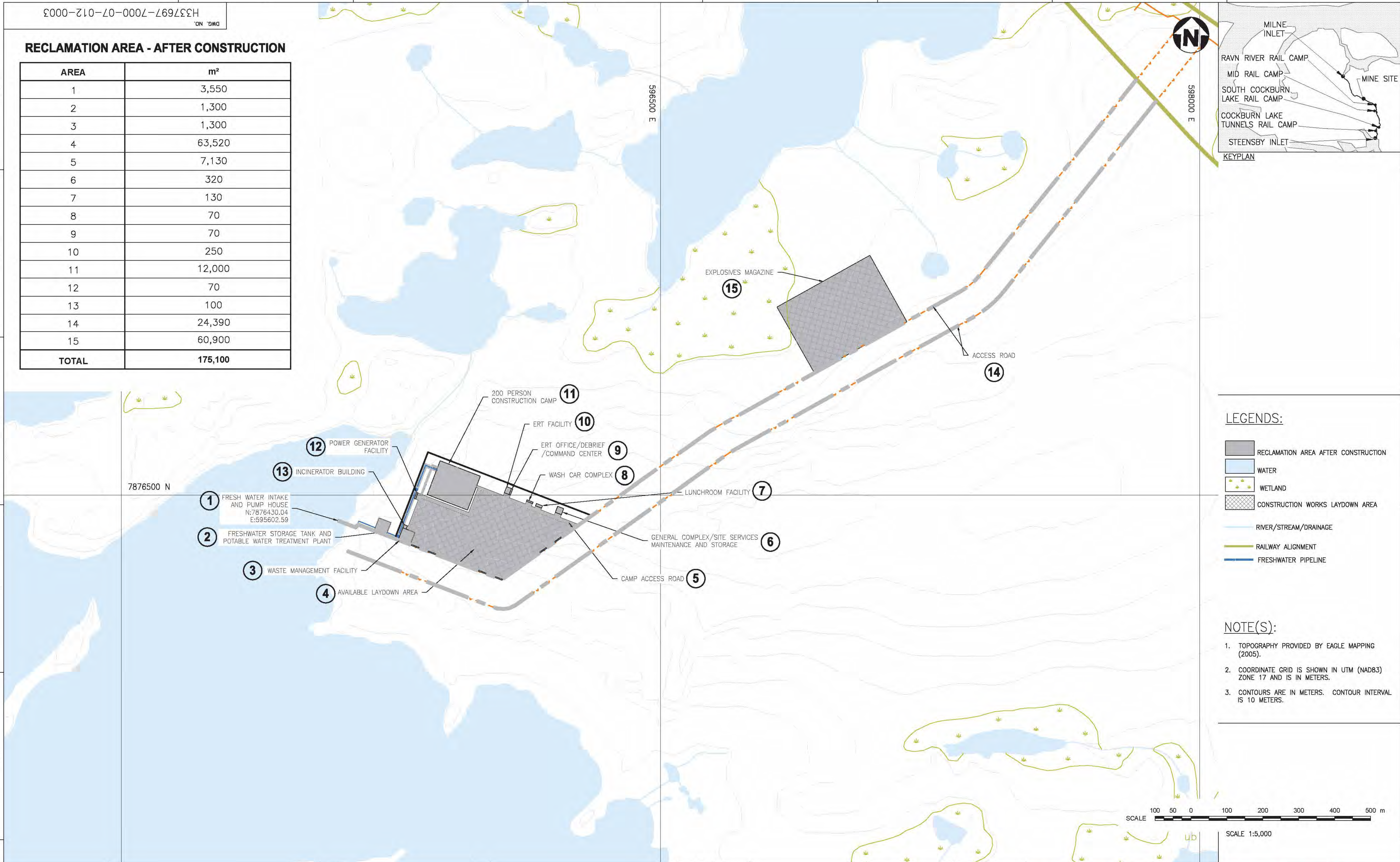
Oct 28, 2011 - 2:44pm Login name: fun51283 Layout: RAVN RIVER CAMP
Drawing Name: P:\285980 - Mary River\CAD\Civil\Roads\Reclam\H337697-7000-07-012-0002 - Standard\H337697-7000-07-012-0002.dwg

H337697-7000-07-012-0003

DWG. NO.

RECLAMATION AREA - AFTER CONSTRUCTION

AREA	m²
1	3,550
2	1,300
3	1,300
4	63,520
5	7,130
6	320
7	130
8	70
9	70
10	250
11	12,000
12	70
13	100
14	24,390
15	60,900
TOTAL	**175,100**



LEGENDS:

- RECLAMATION AREA AFTER CONSTRUCTION
- WATER
- WETLAND
- CONSTRUCTION WORKS LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- RAILWAY ALIGNMENT
- FRESHWATER PIPELINE

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 10 METERS.

SCALE 1:5,000

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INFORMATION				
REVISIONS					

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMITTING		
ISSUE AUTHORIZATION			

HATCH

DESIGNED BY A. GRZEGORCZYK DATE
DRAWN BY Y. HUANG DATE
CHECKED BY T. HO DATE
DISCIP. ENGR. J. BINNS DATE
PROJ. DES. COORD. DATE
PROJ. ENGR. DATE
PROJ. MGR. DATE

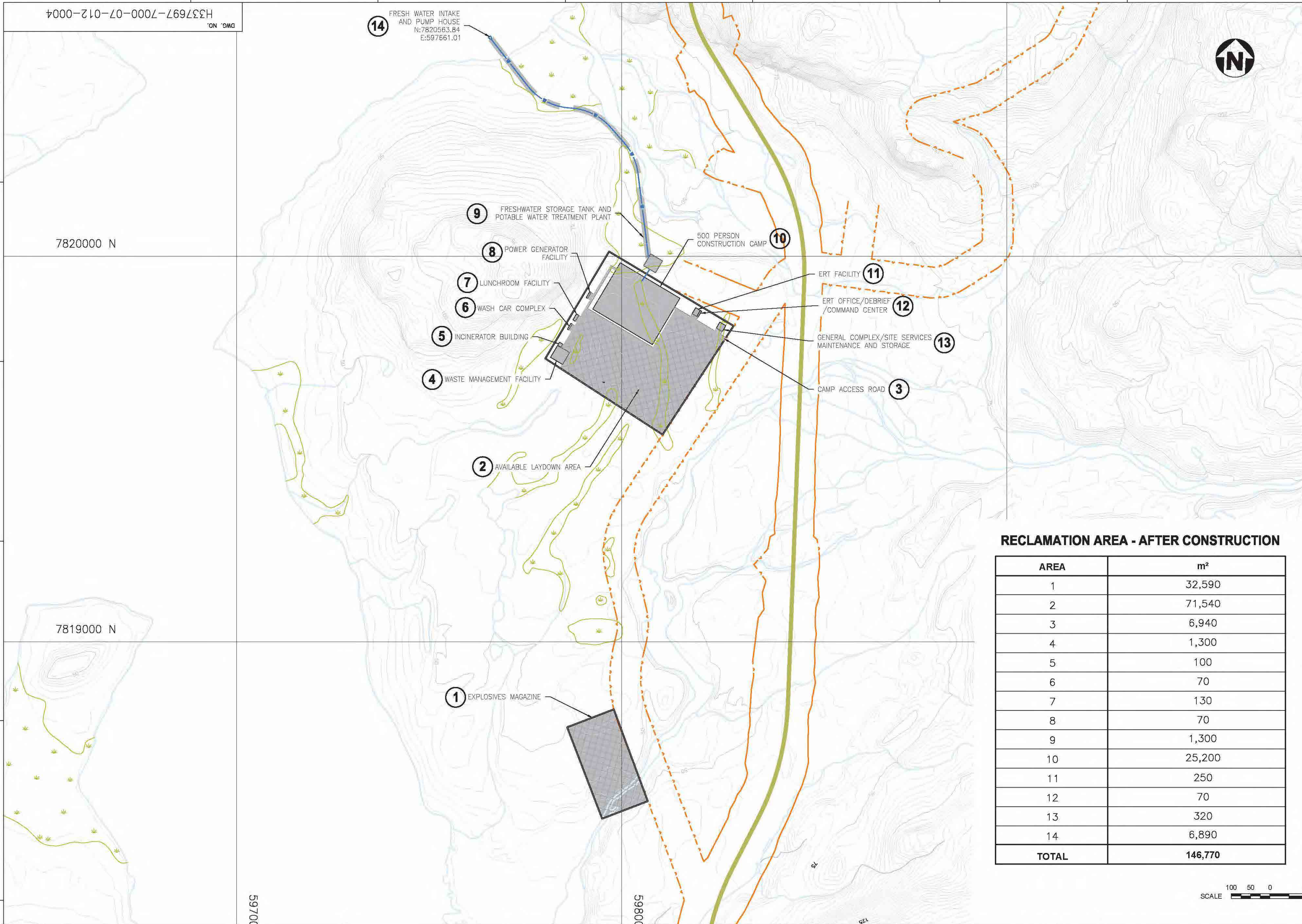
Baffinland Iron Mines Corporation

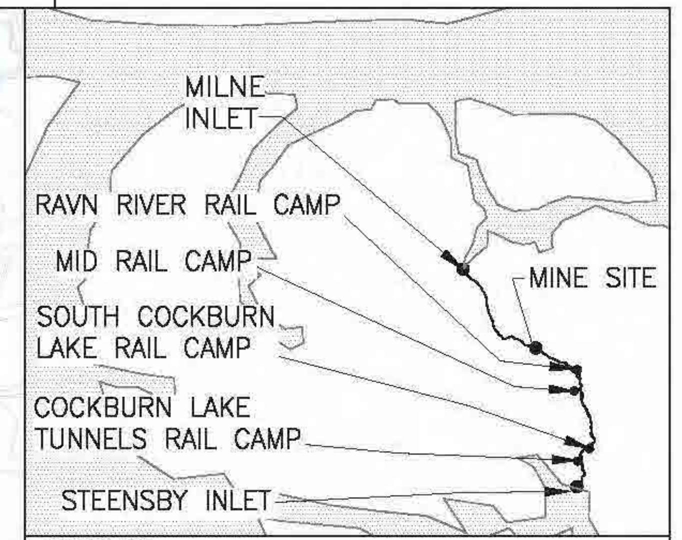
MARY RIVER PROJECT

PRELIMINARY MINE CLOSURE AND RECLAMATION PLAN MID RAIL CAMP

SCALE AS NOTED | DWG. NO. H337697-7000-07-012-0003 | REV. A

Oct 28, 2011 - 3:46pm Login name: fun51283 Layout: Mid Rail Camp
Drawing Name: P:\289980 - Mary River\CAD\Civil\Roads\Reclaim\H337697-7000-07-012-0003 - Standard\H337697-7000-07-012-0003.dwg





KEYPLAN

RECLAMATION AREA - AFTER CONSTRUCTION

AREA	m²
1	32,590
2	71,540
3	6,940
4	1,300
5	100
6	70
7	130
8	70
9	1,300
10	25,200
11	250
12	70
13	320
14	6,890
TOTAL	**146,770**

LEGENDS:

- RECLAMATION AREA AFTER CONSTRUCTION
- WATER
- WETLAND
- CONSTRUCTION WORKS LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- RAILWAY ALIGNMENT
- FRESHWATER PIPELINE

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METERS.
3. CONTOURS ARE IN METERS. CONTOUR INTERVAL IS 10 METERS.

SCALE 100 50 0 100 200 300 400 500 m

SCALE 1:5,000

DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INFORMATION				

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMITTING		

ISSUE AUTHORIZATION

HATCH

DESIGNED BY A. GRZEGORCZYK DATE	DRAWN BY D. FUNG DATE
CHECKED BY T. HO DATE	DISCIP. ENGR. J. BINNS DATE
PROJ. DES. COORD. DATE	PROJ. ENGR. DATE
PROJ. MGR. DATE	

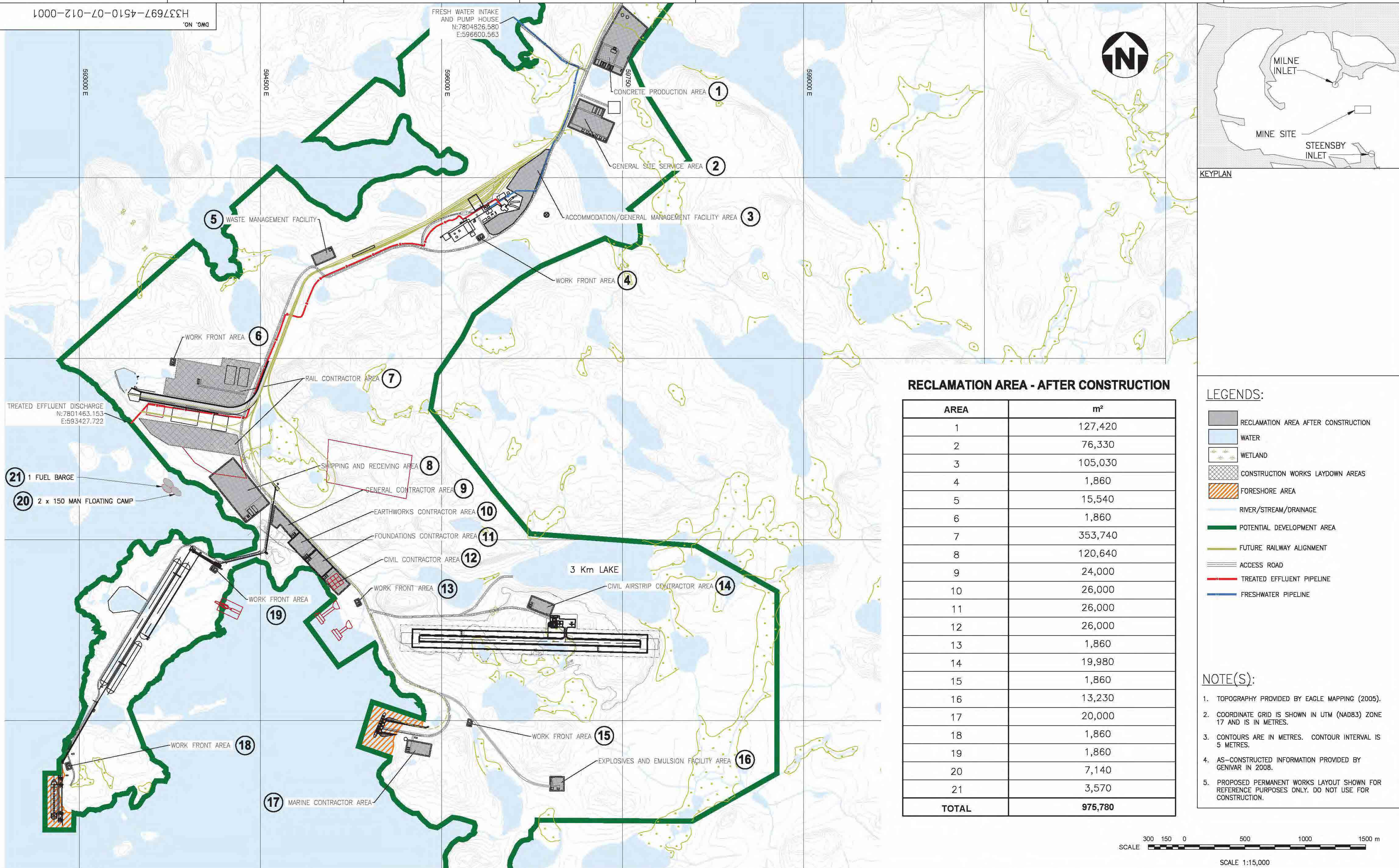
Baffinland Iron Mines Corporation

MARY RIVER PROJECT

PRELIMINARY MINE CLOSURE AND RECLAMATION PLAN SOUTH COCKBURN LAKE RAIL CAMP

SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-7000-07-012-0004	A

Oct 28, 2011, 4:04pm Login name: furh51283 Layout: SOUTH COCKBURN LAKE CAMP
Drawing Name: P:\285980 - Mary River\CAD\Civil\Roads\Reclaim\H337697-7000-07-012-0004 - Standard\H337697-7000-07-012-0004.dwg



RECLAMATION AREA - AFTER CONSTRUCTION

AREA	m²
1	127,420
2	76,330
3	105,030
4	1,860
5	15,540
6	1,860
7	353,740
8	120,640
9	24,000
10	26,000
11	26,000
12	26,000
13	1,860
14	19,980
15	1,860
16	13,230
17	20,000
18	1,860
19	1,860
20	7,140
21	3,570
TOTAL	**975,780**

LEGENDS:

- RECLAMATION AREA AFTER CONSTRUCTION
- WATER
- WETLAND
- CONSTRUCTION WORKS LAYDOWN AREAS
- FORESHORE AREA
- RIVER/STREAM/DRAINAGE
- POTENTIAL DEVELOPMENT AREA
- FUTURE RAILWAY ALIGNMENT
- ACCESS ROAD
- TREATED EFFLUENT PIPELINE
- FRESHWATER PIPELINE

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 5 METRES.
4. AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR IN 2008.
5. PROPOSED PERMANENT WORKS LAYOUT SHOWN FOR REFERENCE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

SCALE 300 150 0 500 1000 1500 m

SCALE 1:15,000

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
A	ISSUED FOR INFORMATION				

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE
A	ENVIRONMENTAL PERMITTING		

ISSUE AUTHORIZATION

HATCH

DESIGNED BY A. GRZEGORCZYK DATE	DRAWN BY D. FUNG DATE
CHECKED BY T. HO DATE	DISCIP. ENGR. J. BINNS DATE
PROJ. DES. COORD. DATE	PROJ. ENGR. DATE
PROJ. MGR. DATE	

Baffinland Iron Mines Corporation

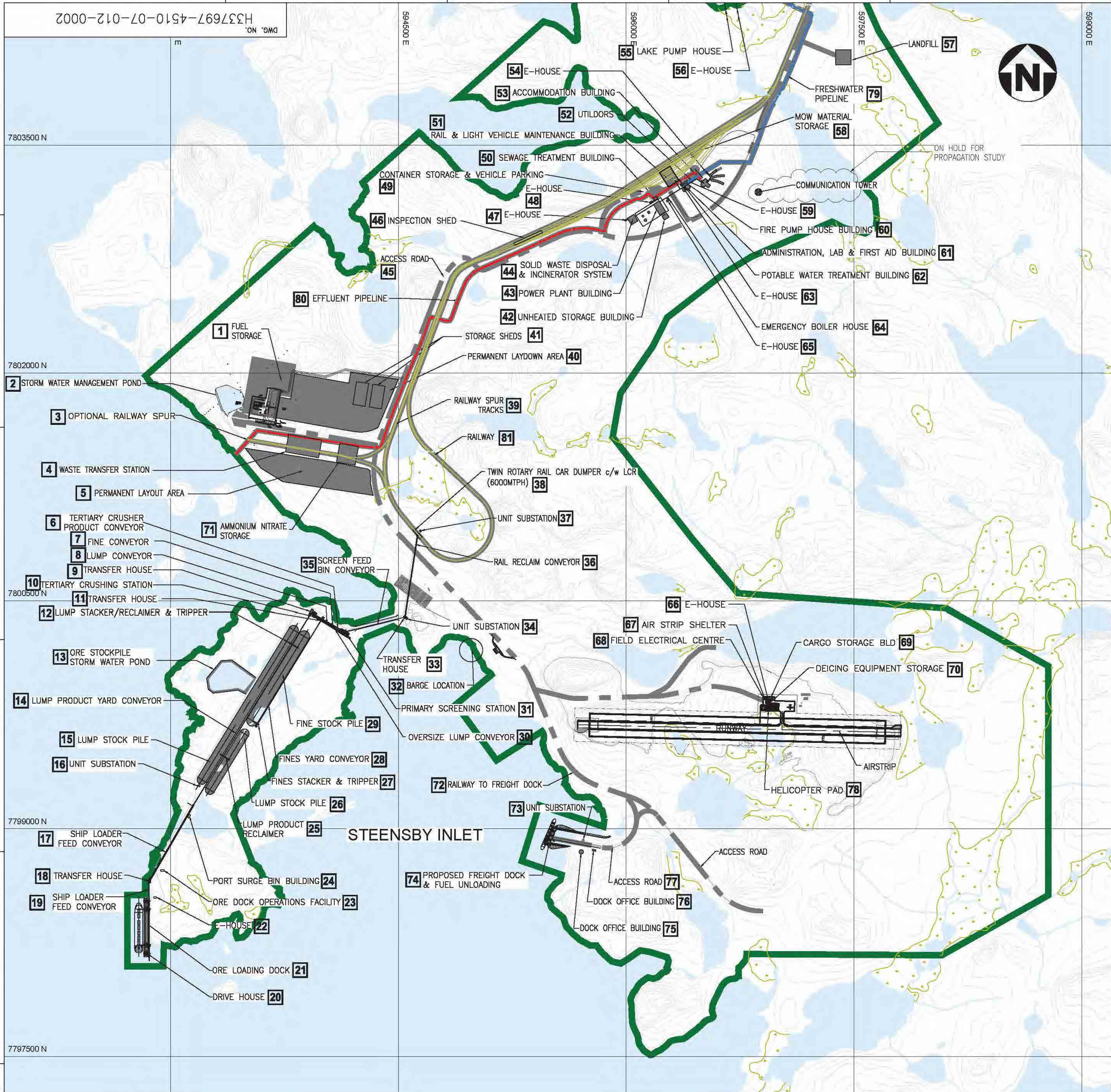
MARY RIVER PROJECT

PRELIMINARY MINE CLOSURE AND RECLAMATION PLAN STEENSBY PORT CONSTRUCTION PHASE

SCALE: OR AS NOTED | DWG. NO. H337697-4510-07-012-0001 | REV. A

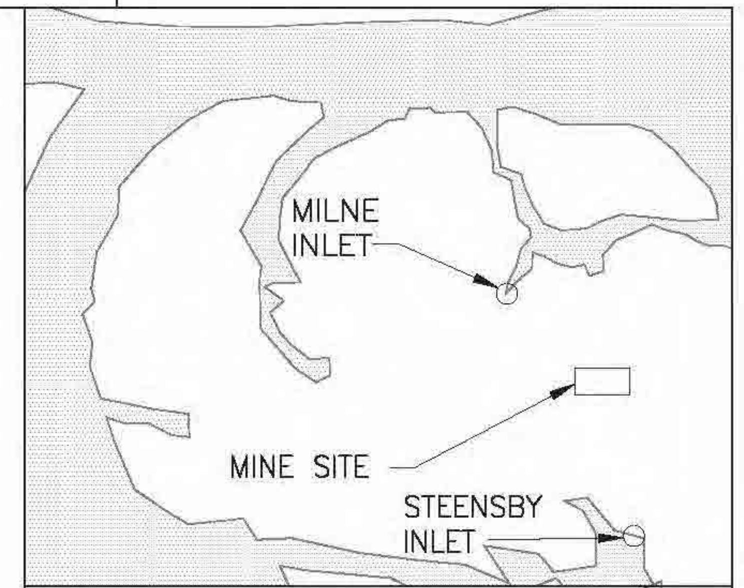
DWG. NO. H337697-4510-07-012-0001

Oct 28, 2011, 4:39pm Login name: fun51283 Layout: STEENSBY INLET
Drawing Name: P:\289850 - Mary River\CAD\Civil\Roads\Prelim\H337697-4510-07-012-0001 - Standard\H337697-4510-07-012-0001.dwg



RECLAMATION AREA - AFTER OPERATION

AREA	m²	AREA	m²
1	100,430	42	1,080
2	25,320	43	3,740
3	8,100	44	2,500
4	26,010	45	89,100
5	130,440	46	3,500
6	430	47	130
7	300	48	60
8	420	49	5,300
9	490	50	480
10	580	51	8,880
11	350	52	2,080
12	360	53	5,260
13	49,330	54	140
14	3,150	55	40
15	74,220	56	40
16	140	57	10,000
17	1,200	58	2,670
18	410	59	140
19	1,110	60	290
20	750	61	900
21	15,440	62	290
22	140	63	140
23	220	64	130
24	220	65	140
25	360	66	40
26	29,670	67	230
27	220	68	360
28	1,250	69	540
29	52,050	70	520
30	460	71	15,630
31	1,800	72	29,030
32	24,000	73	220
33	240	74	2,200
34	100	75	610
35	22,500	76	220
36	830	77	7,650
37	100	78	1,430
38	1,280	79	6,260
39	16,000	80	24,420
40	198,780	81	114,380
41	24,510	TOTAL	1,154,480



KEYPLAN

LEGENDS:

- RECLAIMED AREA AFTER OPERATION
- WATER
- WETLAND
- CONSTRUCTION WORKS LAYDOWN AREAS
- FORESHORE AREA
- RIVER/STREAM/DRAINAGE
- POTENTIAL DEVELOPMENT AREA
- FUTURE RAILWAY ALIGNMENT
- ACCESS ROAD
- TREATED EFFLUENT PIPELINE
- FRESHWATER PIPELINE

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 5 METRES.
4. AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR IN 2008.
5. PROPOSED PERMANENT WORKS LAYOUT SHOWN FOR REFERENCE PURPOSES ONLY. DO NOT USE FOR CONSTRUCTION.

SCALE 300 150 0 500 1000 1500 m

SCALE 1:15,000

ISSUED FOR USE

DRAWING NO.	DRAWING TITLE
REFERENCE DRAWINGS	

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
B	PDA BOUNDARY UPDATED	DF	SP	TH	07/02/12
A	ISSUEDE FOR INFORMATION	DF	AG	TH	11/09/11

REVISIONS

REV.	ISSUE FOR	AUTH. BY		DATE
B	ENVIRONMENTAL PERMITTING	SP	TH	07/02/12
A	ENVIRONMENTAL PERMITTING	SP	TH	11/09/11

ISSUE AUTHORIZATION

HATCH

DESIGNED BY A. GRZEGORCZYK DATE
DRAWN BY D. FUNG DATE
CHECKED BY T. HO DATE
DISCIP. ENGR. J. BINNS DATE
PROJ. DES. COORD. DATE
PROJ. ENGR. DATE
PROJ. MGR. DATE

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

PRELIMINARY MINE CLOSURE AND RECLAMATION PLAN STEENSBY PORT FINAL CLOSURE PHASE

SCALE OR AS NOTED

DWG. NO. H337697-4510-07-012-0002

REV. B

Appendix B
Concordance to Regulatory Instruments, Regulations, and Mine Closure Planning Guidelines

B CONCORDANCE TO REGULATORY INSTRUMENTS, REGULATIONS AND MINE CLOSURE PLANNING GUIDELINES

The ICRP has been developed in accordance with the following guidelines, legislation, and lease requirements:

- Table B.1 Project Certificate No. 005
- Table B.2 Type A Water Licence 2AM-MRY1325
- Table B.3 Territorial Land Use Regulations, pursuant to the Territorial Lands Act
- Table B.4 Abandonment and Reclamation Policy for Inuit Owned Lands (QIA, 2024)
- Table B.5 EIS Guidelines issued to Baffinland by the Nunavut Impact Review Board
- Table B.6 Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories (MVLWB/AANDC, 2013)
- Table B.7 Mine Site Reclamation Guidelines for the Northwest Territories (AANDC, 2007)
- Table B.8 Mine Site Reclamation Policy for Nunavut (AANDC, 2002)
- Table B.9 Mine Reclamation in the Northwest Territories and Yukon (DIAND, 1992)
- Table B.10 Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories (NWT Water Board, 1990)

TABLE B.1 NIRB PROJECT CERTIFICATE TERM AND CONDITIONS RELEVANT TO TEMPORARY CLOSURE/CARE AND MAINTENANCE, CLOSURE AND POST-CLOSURE MONITORING - CONCORDANCE TABLE

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
2	Meteorology and Climate - Climate Change Validation and Studies	To provide feedback on the impacts that climate change might be having on the Project.	The Proponent shall provide the results of any new or revised assessments and studies done to validate and update climate change impact predictions for the Project and the effects of the Project on climate change in the Local Study Area and Regional Study Area as defined in the Proponent's Final Environmental Impact Statement.	1 - Climate Change	None planned at this time however any research conducted during Closure and Post-Closure Phases will be provided during Annual Reporting.	Both	Section 9.11
3	Meteorology and Climate - Green House Gas Emissions	To confirm that the Proponent is exploring and implementing concrete steps to reduce greenhouse gases.	The Proponent shall provide interested parties with evidence of continued initiatives undertaken to reduce greenhouse gas emissions.	1 - Climate Change	Air Quality Monitoring Program. Results of Closure Phase Air Quality Monitoring Program and any other initiatives taken to reduce greenhouse gas emissions during Closure and Post-Closure Phases will be provided during Annual Reporting.	Both	Section 9.11
4	Climate Change - Consultation on Climate	To promote public awareness and engagement of affected groups.	The Proponent shall endeavor to include the participation of Inuit from affected communities and other communities in Nunavut when undertaking climate-change related studies and research.	1 - Climate Change	Air Quality Monitoring Program Mine Closure Technical Advisory Group	Both	Section 2.4 Section 9.11
5	Meteorology and Climate - Weather Monitoring Data	To provide families of employees with up to date information.	The Proponent shall endeavour to explore and implement reasonable measures to ensure that weather-related information for the various Project sites is readily accessible to the public on a continual basis throughout the life of the Project.	2 - Air Quality	Air Quality Monitoring Program. Results of Closure Phase Air Quality Monitoring Program will be provided during Annual Reporting	Both	Section 9.11
6	Meteorology and Climate - Emissions	To provide feedback on the Project's emissions.	The Proponent shall provide the results of any emissions calculations conducted to determine the level of sulphur dioxide (SO_2) emissions, nitrogen oxide (NOX) emissions and greenhouse gases generated by the Project using fuel consumption or other relevant criteria as a basis.	2 - Air Quality	Air Quality Monitoring Program	Both	Section 9.11
11	Air Quality – Incineration Management Plan	To mitigate impacts to air quality from incineration activities.	The Proponent shall develop and implement an Incineration Management Plan that takes into consideration the recommendations provided in Environment Canada's Technical Document for Batch Waste Incineration (2010).	2 - Air Quality	Waste Management Plan (carried over from Operations) will apply when incinerators in operation	Both	Section 5.3.7 Section 9.11
14	Noise and Vibration - Noise and Vibration Monitoring	To mitigate noise and vibration at Project sites, especially living areas.	The Proponent shall conduct noise and vibration monitoring at Project accommodations sites located at the Mary River mine site, Steensby Inlet Port site, and Milne Inlet Port site. Sampling shall be undertaken during the summer and winter months during all phases of Project development.	3 - Noise and Vibration	Considered, however no monitoring proposed during closure and negligible residual effects expected.	Both	N/A
15	Noise and Vibration	To enhance public safety when travelling around the Project area.	Noise and Vibration Monitoring - The Proponent shall collaborate to the extent possible with the Qikiqtani Inuit Association and local Hamlet organizations when undertaking consultation with all affected communities regarding railway, tote road and marine shipping operations. During these consultations, it is recommended that the Proponent provide information including video, audio, and photographic representation as well as any other aids (i.e. models) that may enhance the general public's understanding of railway, tote road and marine shipping operations, as well as all safety considerations for members of the public who may be travelling around the project area.	3 - Noise and Vibration	When undertaking consultation with all affected communities, collaboration with the Qikiqtani Inuit Association and local Hamlet organizations performed via Mine Closure Technical Advisory Group sessions.	Both	Section 2.4
17	Hydrology and Hydrogeology - Effluent Management	To prevent impacts to water bodies from effluent.	The Proponent shall develop and implement effectives measures to ensure that effluent from project-related facilities and/or activities, including sewage treatment plants, ore stockpiles, and mine pit, satisfies all discharge criteria requirement established by the relevant regulatory agencies prior to being discharged into the receiving environment.	8 - Water Quality	Aquatic Monitoring and Reporting Program Environmental Effects Monitoring Program	Both	Section 9.5 Section 9.5.1
18	Hydrology and Hydrogeology - Pit Lake Monitoring	To enhance predictions for mine site closure conditions.	The Proponent shall carry out continued analyses over time to confirm and update, accordingly, the approximate fill time for the mine pit lake identified in the FEIS.	8 - Water Quality 9 - Surface Water and Sediment Quality	None. ICRP will be reviewed annually and updated regularly throughout the life of the Project to confirm and/or update, accordingly the approximate fill time for the mine pit lake identified in the FEIS.	IOL	Section 5.3.1.4 Appendix D2
19	Hydrology and Hydrogeology - Water Infrastructure Monitoring	To mitigate impacts to natural water flow.	The Proponent shall ensure that it develops and implements adequate monitoring and maintenance procedures to ensure that the culverts and other conduits that may be prone to blockage do not significantly hinder or alter the natural flow of water from areas associated with the proposed mine. In addition, the Proponent shall monitor, document and report the withdrawal rates for water removed and utilized for all domestic and industrial purposes.	8 - Water Quality 9 - Surface Water and Sediment Quality	Will be addressed in Annual Report.	Both	N/A
20	Groundwater/Surface Waters - Explosives	To ensure that the effects associated with the manufacturing, storage, transportation and use of explosives do not negatively impact the areas surrounding the Project.	The Proponent shall monitor the effects of explosives residue and related by-products from project-related blasting activities as well as develop and implement effective preventative and/or mitigation measures, including treatment, if necessary, to ensure that the effects associated with the manufacturing, storage, transportation and use of explosives do not negatively impact the Project and surrounding areas.	8 - Water Quality 9 - Surface Water and Sediment Quality	None. Negligible once closure activities have ceased.	N/A	N/A

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
24	Groundwater/Surface Waters - Effluent Management	To mitigate impacts to groundwater and surface waters from effluent.	The Proponent shall monitor as required the relevant parameters of the effluent generated from Project activities and facilities and shall carry out treatment if necessary to ensure that discharge conditions are met at all times.	8 - Water Quality	Aquatic Monitoring and Reporting Program	Both	Section 9.5
27	Landforms, Geology and Geomorphology - Natural Aesthetics	To mitigate impacts to natural aesthetics.	The Proponent shall include within its public consultation report information related to the sentiments expressed by affected communities about the impacts that changes to the topography and landscape have had on the aesthetic value of the Project area.	4 - Landforms, Soil and Permafrost	Geotechnical/Engineering Monitoring	Both	Section 9.4
28	Landforms, Geology and Geomorphology - Permafrost	To ensure that permafrost integrity is maintained.	The Proponent shall monitor the effects of the Project on the permafrost along the railway and all other Project affected areas and must implement effective preventative measures to ensure that the integrity of the permafrost is maintained.	4 - Landforms, Soil and Permafrost	Geotechnical/Engineering Monitoring	Both	Section 9.4
30	Landforms, Geology and Geomorphology - Quarries	To provide oversight on quarry design and management.	The Proponent shall develop site-specific quarry operation and management plans in advance of the development of any potential quarry site or borrow pit.	4 - Landforms, Soil and Permafrost	Geotechnical/Engineering Monitoring	Both	Section 9.4
32	Vegetation - Construction and Operations	To prevent introduction of invasive species.	The Proponent shall ensure that equipment and supplies brought to the Project sites are clean and free of soils that could contain plant seeds not naturally occurring in the area. Vehicle tires and treads in particular must be inspected prior to initial use in Project areas.	5 - Vegetation	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
33	Vegetation - Monitoring	To facilitate monitoring.	The Proponent shall include relevant Monitoring and Management Plans within its Environmental Management System, Terrestrial Environment Management and Monitoring Plan (TEMMP).	5 - Vegetation	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
37	Vegetation - Monitoring	To prevent establishment of invasive species.	The Proponent shall incorporate protocols for monitoring for the potential introduction of invasive vegetation species (e.g., surveys of plant populations in previously disturbed areas) into its Terrestrial Environment and Monitoring Plan. Any introductions of non-indigenous plant species must be promptly reported to the Government of Nunavut Department of Environment.	5 - Vegetation	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
38	Vegetation – Adaptive Management	To mitigate impacts to vegetation abundance, diversity and health.	The Proponent shall review, on an annual basis, all monitoring information and the vegetation mitigation and management plans developed under its Environmental Management System, Terrestrial Environment and Monitoring Plan (TEMMP) and adjust such plans as may be required to effectively prevent or reduce the potential for significant adverse project effects on vegetation abundance, diversity and health.	5 - Vegetation	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
39	Vegetation - Reclamation and Revegetation	To prevent erosion and promote progressive revegetation of disturbed areas.	The Proponent shall develop a progressive revegetation program for disturbed areas that are no longer required for operations, such program to incorporate measures for the use of test plots, reseeding and replanting of native plants as necessary. It is further recommended that this program be directly associated with the management plans for erosion control established for the Project.	5 - Vegetation	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
40	Vegetation - Reclamation and Revegetation	To prevent erosion and promote progressive revegetation of disturbed areas.	The Proponent shall include revegetation strategies in its Site Reclamation Plan that support progressive reclamation and that promote natural revegetation and recovery of disturbed areas compatible with the surrounding natural environment.	5 - Vegetation	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7 Appendix D
41	Freshwater Aquatic Environment - Setbacks	To mitigate impacts of runoff into freshwater aquatic habitat.	Unless otherwise approved by regulatory authorities, the Proponent shall maintain a minimum 100-metre naturally-vegetated buffer between the high-water mark of any fish-bearing water bodies and any permanent quarries with potential for acid rock drainage or metal leaching.	4 - Landforms, Soil and Permafrost 5 - Vegetation	Geotechnical/Engineering Monitoring	Both	Section 9.4
42	Freshwater Aquatic Environment - Setbacks	To mitigate impacts of runoff into freshwater aquatic habitat.	The Proponent shall maintain minimum a 30-metre naturally-vegetated buffer between the mining operation and adjacent water bodies.	4 - Landforms, Soil and Permafrost 5 - Vegetation	Geotechnical/Engineering Monitoring	Both	Section 9.4
44	Freshwater Aquatic Environment - Explosives	To mitigate impacts of explosives on freshwater aquatic habitat.	The Proponent shall meet or exceed the guidelines set by Fisheries and Oceans Canada for blasting thresholds and implement practical and effective measures to ensure that residue and by-products of blasting do not negatively affect fish and fish habitat.	8 - Water Quality	Aquatic Monitoring and Reporting Program Environmental Effects Monitoring Program	Both	Section 9.5 Section 9.5.1
45	Freshwater Aquatic Environment - General	To mitigate impacts to freshwater aquatic habitat.	The Proponent shall adhere to the No-Net-Loss principle at all phases of the project to prevent or mitigate direct or indirect fish and fish habitat losses.	10 - Freshwater Fish, Fish Habitat, and Other Aquatic Organisms	Aquatic Monitoring and Reporting Program Environmental Effects Monitoring Program	Both	Section 9.5 Section 9.5.1
46	Freshwater Aquatic Environment - Drainage	To mitigate impacts to freshwater aquatic habitat.	The Proponent shall ensure that runoff from fuel storage and maintenance facility areas, sewage and wastewater other facilities responsible for generating liquid effluent and runoff meet discharge requirements.	8 - Water Quality	Aquatic Monitoring and Reporting Program Environmental Effects Monitoring Program	Both	Section 9.5 Section 9.5.1

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
49	Terrestrial Wildlife and Wildlife Habitat - Terrestrial Environment Working Group	The TEWG will provide direction and guidance to the Proponent regarding: adding to baseline information during construction and before project operations commence; monitoring and reporting regarding effects occurring during operations; and providing advice regarding changes that may be required to make sure the management of negative impacts is effective and that lasting damage is prevented.	The Proponent shall establish a Terrestrial Environment Working Group ("TEWG") which will act as an advisory group in connection with mitigation measures for the protection of the terrestrial environment and in connection with its Environmental Effects Monitoring Program, as it pertains to the terrestrial environment. Members may consider the draft terms of reference for the TEWG filed in the Final Hearing, but they are not bound by them. The role of the TEWG is not intended to either duplicate or to affect the exercise of regulatory authority by appropriate government agencies and departments.	7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
50	Terrestrial Wildlife and Habitat - General	To ensure appropriate and responsive adaptive management.	The Proponent shall continue to develop and implement Project-specific monitoring for the terrestrial environment, and will demonstrate appropriate refinements to design, incorporation of analytical methods and elaboration of methodologies. The monitoring plan shall contain clear thresholds to allow for the assessment of long-term trends and cumulative effects where project interactions are identified. Coordination and cooperation will be required where data collection, analysis and interpretation, or responsibility for mitigation and management requires the efforts of multiple parties (e.g., government, Qikiqtani Inuit Association, communities).	7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
51	Terrestrial Wildlife and Habitat - General	To promote coordination of monitoring efforts.	The Proponent, either directly or as part of the TEWG, shall consider and, where appropriate, cooperate with relevant regional and/or community-based monitoring initiatives that raise issues or produce information pertinent to mitigating project-induced impacts. The Proponent shall give special consideration for supporting regional studies of population health and harvest programs for North Baffin caribou which help address areas of uncertainty for Project impact predictions.	7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
55	Terrestrial Wildlife and Habitat - Reporting	To mitigate potential impacts to wolves.	The Proponent shall develop an adaptive management plan applicable to wolves and wolf habitat in collaboration with the Government of Nunavut-Department of Environment (GN-DOE) to ensure compliance with the *Nunavut Wildlife Act.* Consideration must be given to the following: a. Monitoring for active wolf dens within a 10 km radius from the mine site, under the direction and prior approval of the GN DOE, and reporting the results through NIRB's Annual Reports on terrestrial wildlife in the Potential Development Area (PDA); b. Estimating the available (glacio-fluvial materials) esker habitat within the Regional Study Area/PDA and identifying such habitat as ecologically sensitive; c. Developing "wolf indices" for presence/abundance of wolves (by conducting studies) to set a baseline pre-construction baseline; and d. Ensuring that wolf monitoring is capable of determining the relative abundance and distribution of wolves in the Project Development.	7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
56	Terrestrial Wildlife and Habitat - Reporting		The Proponent shall develop a strategy for the recovery of terrestrial wildlife habitat in a progressive manner that is consistent with the *Nunavut Wildlife Act.* Overall, this will require the integration of a decision-making process and the identification of mitigation responses to cumulative impacts on caribou survival, breeding propensity, and population dynamics.	7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
57	Terrestrial Wildlife and Habitat - Aircraft Disturbances	To mitigate and monitor for impacts to wildlife.	The Proponent shall report annually regarding its terrestrial environment monitoring efforts, with inclusion of the following information: a. Description of all updates to terrestrial ecosystem baseline data; b. A description of the involvement of Inuit in the monitoring program; c. An explanation of the annual results relative to the scale of the natural variability of Valued Ecosystem Components in the region, as described in the baseline report; d. A detailed presentation and analysis of the distribution relative to mine structures and activities for caribou and other terrestrial mammals observed during the surveys and incidental sightings; e. Results of the annual monitoring program, including field methodologies and statistical approaches used to support conclusions drawn; f. A summary of the chronology and level of mine activities (such as vehicle frequency and type); g. An assessment and presentation of annual environmental conditions including timing of snowmelt, green-up, as well as standard weather summaries; and h. A discussion of any proposed changes to the monitoring survey methodologies, statistical approaches or proposed adaptive management stemming from the results of the monitoring program.	7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Monitoring and Reporting requirements will be addressed in Annual Report.	Both	Section 9.7

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
58	Terrestrial Wildlife and Habitat - Explosives	To mitigate and monitor for impacts to wildlife.	Within its annual report to the NIRB, the Proponent shall incorporate a review section which includes: a. An examination for trends in the measured natural variability of Valued Ecosystem Components in the region relative to the baseline reporting; b. A detailed analysis of wildlife responses to operations with emphasis on calving and post-calving caribou behavior and displacements (if any), and caribou responses to and crossing of the railway, the Milne Inlet Tote Road and associated access roads/trails; c. A description of the extent of dust fall based on measured levels of dust fall (fugitive and finer particles such as TSP) on lichens and blueberries, and ash content of caribou fecal pellets; d. A demonstration and description of how the monitoring results, including the railway, road traffic, air traffic and dust fall contribute to cumulative effects of the project; e. Any proposed changes to the monitoring survey methodologies, statistical approaches or proposed adaptive management stemming from the results of the monitoring program; f. Any updates to information regarding caribou migration trails. Maps of caribou migration trails, primarily obtained through any new collar and snow tracking data, shall be updated (at least annually) in consultation with the Qikiqtani Inuit Association and affected communities, and shall be circulated as new information becomes available.	7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Monitoring and Reporting. Reporting requirements will be addressed in Annual Report.	Both	Section 9.7
59	Terrestrial Wildlife and Habitat - Operations (General)	To mitigate aircraft disturbance to wildlife and Inuit harvesting.	The Proponent shall ensure that aircraft maintain, whenever possible (except for specified operational purposes such as drill moves, take offs and landings), and subject to pilot discretion regarding aircraft and human safety, a cruising altitude of at least 610 metres during point to point travel when in areas likely to have migratory birds, and 1,000 metres vertical and 1,500 metres horizontal distance from observed concentrations of migratory birds (or as otherwise prescribed by the Terrestrial Environment Working Group) and use flight corridors to avoid areas of significant wildlife importance. The Proponent, in collaboration with the Terrestrial Environment Working Group shall develop a program or specific measures to ensure that employees and subcontractors providing aircraft services to the Project are respectful of wildlife and Inuit harvesting that may occur in and around project areas.	6 - Birds	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
61	Terrestrial Wildlife and Habitat - Public Engagement	To mitigate Project impacts to wildlife.	Whenever practical and not causing a human safety issue, a stop work policy shall be implemented when wildlife in the area may be endangered by the work being carried out. An operational definition of 'endangered' shall be provided by the Terrestrial Environment Working Group.	6 - Birds 7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
62	Terrestrial Wildlife and Habitat - Waste Management	To prevent increased harvesting pressure on wildlife.	The Proponent shall prohibit project employees from transporting firearms to site and from operating firearms in project areas for the purpose of wildlife harvesting.	None.	None.	N/A	N/A
63	Birds - Awareness	To keep communities up to date with Project operations.	The Proponent shall liaise with local Hunters and Trappers Organizations in advance of carrying out terrestrial wildlife surveys. At a minimum, The Proponent shall also meet annually in person with Hunters and Trappers Organizations to discuss wildlife monitoring and mitigation plans and address community concerns regarding wildlife interactions. The Proponent may be required to facilitate these meetings through payment of honoraria and meeting costs.	6 - Birds 7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
64	Birds - Species at Risk	To prevent human-carnivore interactions.	The Proponent shall ensure that its Environment Protection Plan incorporates waste management provisions to prevent carnivores from being attracted to the Project site(s). Consideration must be given to the following measures: a. Installation of an incinerator beside the kitchen that will help to keep the food waste management process simple and will minimize the opportunity for human error (i.e. storage of garbage outside, hauling in a truck (odours remain in truck), hauling some distance to a landfill site, incomplete combustion at landfill, fencing of landfill, etc.); and b. Installation of solid carnivore-proof skirting on all kitchen and accommodation buildings (i.e., heavy-duty steel mesh that would drop down from the edge of the buildings/trailers and buried about a half meter into the ground to prevent animals from digging under the skirting).	6 - Birds 7 - Terrestrial Wildlife and Habitat	Geotechnical/Engineering Monitoring	Both	Section 9.7
65	Birds - Species at Risk	To prevent disturbance to birds and bird habitat.	The Proponent shall ensure all employees working at project sites receive awareness training regarding the importance of avoiding known nests and nesting areas and large concentrations of foraging and moulting birds.	6 - Birds	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
66	Birds - Project Infrastructure	To prevent impacts to sensitive bird species.	If Species at Risk or their nests and eggs are encountered during Project activities or monitoring programs, the primary mitigation measure must be avoidance. The Proponent shall establish clear zones of avoidance on the basis of the species-specific nest setback distances outlined in the Terrestrial Environment Management and Monitoring Plan.	6 - Birds	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
67	Birds - Construction/Clearing Activities	To prevent impacts to sensitive bird species.	The Proponent shall ensure that the mitigation and monitoring strategies developed for Species at Risk are updated as necessary to maintain consistency with any applicable status reports, recovery strategies, action plans and management plans that may become available during the duration of the Project.	6 - Birds	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
68	Birds - Construction/Clearing Activities	To prevent potential injuries to birds.	The Proponent shall ensure flashing red, red strobe or white strobe lights and guy-wire deterrents are used on communications towers established for the Project. Consideration should also be given to reducing lighting when possible in areas where it may serve as an attractant to birds or other wildlife.	6 - Birds	Geotechnical/Engineering Monitoring Terrestrial Environment Monitoring and Reporting	Both	Section 9.4 Section 9.7
69	Birds - Flight Altitude Requirements	To prevent nesting by birds in active Project areas.	Prior to bird migrations and commencement of nesting, the Proponent shall identify and install nesting deterrents (e.g., flagging) to discourage birds from nesting in areas likely to be disturbed by construction/clearing activities taking place during the nesting season.	6 - Birds	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
70	Birds - Flight Altitude Requirements	To prevent impacts to birds and nesting areas.	The Proponent shall protect any nests found (or indicated nests) with a buffer zone determined by the setback distances outlined in its Terrestrial Environment Mitigation and Monitoring Plan, until the young have fledged. If it is determined that observance of these setbacks is not feasible, the Proponent will develop nest-specific guidelines and procedures to ensure bird's nests and their young are protected.	6 - Birds	Geotechnical/Engineering Monitoring Terrestrial Environment Monitoring and Reporting	Both	Section 9.4 Section 9.7
71	Birds - Monitoring	To mitigate aircraft disturbance to birds.	Subject to safety requirements, the Proponent shall require all project related aircraft to maintain a cruising altitude of at least: a. 650 m during point to point travel when in areas likely to have migratory birds b. 1100 m vertical and 1500 m horizontal distance from observed concentrations of migratory birds c. 1100 m over the area identified as a key site for moulting snow geese during the moulting period (July-August), and if maintaining this altitude is not possible, maintain a lateral distance of at least at least 1500 m from the boundary of this site.	6 - Birds	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
72	Birds - Monitoring	To mitigate aircraft disturbance to birds.	The Proponent shall ensure that pilots are informed of minimum cruising altitude guidelines and that a daily log or record of flight paths and cruising altitudes of aircraft within all Project Areas is maintained and made available for regulatory authorities such as Transport Canada to monitor adherence and to follow up on complaints.	None	None.	N/A	N/A
73	Birds - Monitoring	To develop appropriate mitigation and monitoring of impacts to birds.	The Proponent shall develop detailed and robust mitigation and monitoring plans for migratory birds, reflecting input from relevant agencies, the Qikiqtani Inuit Organization and communities as part of the Terrestrial Environment Working Group and to the extent applicable the Marine Environment Working Group.	6 - Birds	Terrestrial Environment Monitoring and Reporting Mine Closure Working Group	Both	Section 9.7
74	Birds - Monitoring	To develop appropriate mitigation and monitoring of impacts to birds.	The Proponent shall continue to develop and update relevant monitoring and management plans for migratory birds under the Proponent's Environmental Management System, Terrestrial Environment Mitigation and Monitoring Plan prior to construction. The key indicators for follow up monitoring under this plan will include: peregrine falcon, gyrfalcon, common and king eider, red knot, seabird migration and wintering, and songbird and shorebird diversity.	6 - Birds	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
75	Birds - Monitoring	To assess the extent of terrestrial habitat loss.	The Proponent's monitoring program shall assess and report, on annual basis, the extent of terrestrial habitat loss due to the Project to verify impact predictions and provide updated estimates of the total project footprint.	6 - Birds	Terrestrial Environment Monitoring and Reporting	Both	Section 9.7
76	Marine Environment - Ice Breaking and Shipping	To mitigate potential impacts to the marine environment.	The Proponent shall develop a comprehensive Environmental Effects Monitoring Program to address concerns and identify potential impacts of the Project on the marine environment.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
77	Marine Environment - Ice Breaking and Shipping	The MEWG will consult with, and provide advice and recommendations to the Proponent in connection with mitigation measures for the protection of the marine environment, monitoring of effects on the marine environment and the consideration of adaptive management plans. The role of the MEWG is not intended to either duplicate or to affect the exercise of regulatory authority by appropriate government agencies and departments.	A Marine Environment Working Group ("MEWG") shall be established to serve as an advisory group in connection with mitigation measures for the protection of the marine environment, and in connection with the Project Environmental Effects Monitoring program, as it pertains to the marine environment. Membership on the MEWG will include the Proponent, Environment Canada, Fisheries and Oceans Canada, Parks Canada, the Government of Nunavut, the Qikiqtani Inuit Association, the Mittimatilik Hunters and Trappers Organization, and other agencies or interested parties as determined to be appropriate by these key members. Makivik Corporation shall also be entitled to membership on the MEWG at its election. The MEWG members may consider the draft terms of reference	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
78	Marine Environment -Ice Breaking and Shipping	To obtain accurate and current ice information.	The Proponent shall update the baseline information for landfast ice using a long-term dataset (28 years), and with information on inter-annual variation. The analysis for pack and landfast ice shall be updated annually using annual sea ice data (floe size, cover, concentration) and synthesized and reported in the most appropriate management plan.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
79	Marine Environment -Shoreline Effects and Sediment Redistribution	To assist in the development of nautical charts for Canadian waters.	The Proponent shall provide the Canadian Hydrographic Services with bathymetric data and other relevant information collected in support of Project shipping where possible, to assist in the development of nautical charts for Canadian waters.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
87	Marine Environment -Ballast Water	To prevent invasive species introductions resulting from Project shipping.	The Proponent shall develop a detailed monitoring program at a number of sites over the long term to evaluate changes to marine habitat and organisms and to monitor for non-native introductions resulting from Project-related shipping. This program needs to be able to detect changes that may have biological consequences and should be initiated several years prior to any ballast water discharge into Steensby Inlet and Milne Inlet to collect sufficient baseline data and should continue over the life of the Project.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
89	Marine Environment - Ballast Water	To prevent impacts to marine water quality resulting from ballast water exchange.	The Proponent shall develop and implement an effective ballast water management program that may include the treatment and monitoring of ballast water discharges in a manner consistent with applicable regulations and/or exceed those regulations if they are determined to be ineffective for providing the desired and predicted results. The ballast water management program shall include, without limitation, a provision that requires ship owners to test their ballast water to confirm that it meets the salinity requirements of the applicable regulations prior to discharge at the Milne Port, and a requirement noting that the Proponent, in choosing shipping contractors will, whenever feasible, give preference to contractors that use ballast water treatment in addition to ballast water exchange.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
92	Marine Environment - Spill Prevention	To ensure adequate spill response capacity.	The Proponent shall ensure that it maintains the necessary equipment and trained personnel to respond to all sizes of potential spills associated with the Project in a self sufficient manner.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
103	Marine Environment - Traffic Log and Shipping Information	To monitor effectiveness of mitigation of shipping impacts to marine wildlife.	The Proponent shall report annually to the NIRB regarding project-related ship track and sea ice information, including: a. A record of all ship tracks taken along both shipping routes covering the entire shipping season; b. When employing ice-breaking, an overlay of ship tracks onto ice imagery to determine whether ships are effectively avoiding shore leads and polynyas; c. A comparison of recorded ship tracks to the expected nominal shipping route, and probable (if any) extent of year-round shipping during periods of ice cover and open-water; d. An assessment of the level of adherence to the nominal shipping route and the spatial extent of the shipping zone of influence; and e. When employing ice-breaking, marine bird and mammal species and number of individuals attracted to ship tracks in ice.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
106	Marine Environment - Shipboard Observers	To ensure that interactions with marine mammals and Project shipping activities are effectively monitored.	The Proponent shall ensure that shipboard observers are employed during seasons where shipping occurs and provided with the means to effectively carry out assigned duties. The role of shipboard observers in shipping operations should be taken into consideration during the design of any ore carriers purpose-built for the Project, with climate controlled stations and shipboard lighting incorporated to permit visual sightings by shipboard observers during all seasons and conditions. Any shipboard lighting incorporated should be in accordance with the *Canada Shipping Act, 2001's Collision Regulations*, and should not interfere with safe navigation of the vessel.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
113	Marine Environment - Arctic Char	To prevent impacts to marine fish in Steensby Inlet and Milne Inlet.	The Proponent shall conduct monitoring of marine fish and fish habitat, which includes but is not limited to, monitoring for Arctic Char stock size and health condition in Steensby Inlet and Milne Inlet, as recommended by the Marine Environment Working Group.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
114	Marine Environment - Arctic Char	To prevent impacts to marine fish in Steensby Inlet and Milne Inlet.	In the event of the development of a commercial fishery in the Steensby Inlet area or Milne Inlet-Eclipse Sound areas, the Proponent, in conjunction with the Marine Environment Working Group, shall update its monitoring program for marine fish and fish habitat to ensure that the ability to identify Arctic Char stock(s) potentially affected by Project activities and monitor for changes in stock size and structure of affected stocks and fish health (condition, taste) is maintained to address any additional monitoring issues identified by the MEWG relating to the commercial fishery.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
120	Marine Environment - Marine Mammal Interactions	To prevent impacts to marine mammals associated with Project shipping.	The Proponent shall ensure that, subject to vessel and human safety considerations, all project shipping adhere to the following mitigation procedures while in the vicinity of marine mammals: a. Wildlife will be given right of way; b. Ships will when possible, maintain a straight course and constant speed, avoiding erratic behavior; and c. When marine mammals appear to be trapped or disturbed by vessel movements, the vessel will implement appropriate measures to mitigate disturbance, including stoppage of movement until wildlife have moved away from the immediate area.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
121	Marine Environment - Marine Mammal Interactions	To prevent impacts to marine mammals and seabird colonies associated with Project shipping.	The Proponent shall immediately report any accidental contact by project vessels with marine mammals or seabird colonies to Fisheries and Oceans Canada and Environment Canada respectively, by notifying the appropriate regional office of the: a. Date, time and location of the incident; b. Species of marine mammal or seabird involved; c. Circumstances of the incident; d. Weather and sea conditions at the time; e. Observed state of the marine mammal or sea bird colony after the incident; and, f. Direction of travel of the marine mammal after the incident, to the extent that it can be determined	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
122	Marine Environment - Marine Mammal Interactions	To prevent impacts to marine mammals and seabird colonies associated with Project shipping.	The Proponent shall summarize and report annually to the NIRB regarding accidental contact by project vessels with marine mammals or seabird colonies through the applicable monitoring report.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
123	Marine Environment - Marine Mammal Interactions	To prevent impacts to marine mammals and seabird colonies associated with Project shipping.	The Proponent shall provide sufficient marine mammal observer coverage on project vessels to ensure that collisions with marine mammals and seabird colonies are observed and reported through the life of the Project. The marine wildlife observer protocol shall include, but not be limited to, protocols for marine mammals, seabirds, and environmental conditions and immediate reporting of significant observations to the ship masters of other vessels along the shipping route, as part of the adaptive management program to address any items that require immediate action.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
124	Marine Environment - Marine Mammal Interactions	To prevent impacts to marine mammals and marine fish populations from increased harvesting pressures in Project areas.	The Proponent shall prohibit project employees from recreational boating, fishing, and harvesting of marine wildlife in project areas, including Steensby Inlet and Milne Inlet. The Proponent is not directed to interfere with harvesting by the public in or near project areas, however, enforcement of a general prohibition on harvesting in project areas by project employees during periods of active employment (i.e. while on site and between work shifts) is required.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
125	Marine Environment - Public Engagement	To assess acceptability of acoustic deterrent devices for the general public.	Prior to use of acoustic deterrent devices, the Proponent shall carry out consultations with communities along the shipping routes and nearest to Steensby Inlet and Milne Inlet ports to assess the acceptability of these devices. Feedback received from community consultations shall be incorporated into the appropriate mitigation plan.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
125 a	Marine Environment - Public Engagement	To ensure public acceptability of project vessel anchor sites and reduce potential conflicts between project marine shipping and local harvesting.	The Proponent shall consult with potentially-affected communities and groups, particularly Hunters' and Trappers' Organizations regarding the identification of project vessel anchor sites and potential areas of temporary refuge for project vessels along the shipping routes within the Nunavut Settlement Area. Feedback received from community consultations shall be incorporated into the most appropriate mitigation or management plans.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
126	Marine Environment - Public Engagement	To incorporate local input into monitoring data collection.	The Proponent shall design monitoring programs to ensure that local users of the marine area in communities along the shipping route have opportunity to be engaged throughout the life of the Project in assisting with monitoring and evaluating potential project-induced impacts and changes in marine mammal distributions.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
127	Marine Environment - Public Engagement	To promote public awareness and engagement with Project shipping activities.	The Proponent shall ensure that communities and groups in Nunavik are kept informed of project shipping activities and are provided with opportunity to participate in the continued development and refinement of shipping related monitoring and mitigation plans.	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
128	Marine Environment - Public Engagement	To ensure habitat compensation is acceptable to local communities.	The Proponent shall consult with local communities as fish habitat off-setting options are being considered and demonstrate its incorporation of input received into the design of the Fish Habitat Off-Setting Plan required to offset the Harmful Alteration, Disruption or Destruction of Fish and Fish Habitat (HADD).	N/A - Related to Marine Monitoring	N/A	Crown (Marine)	N/A
129	Population Demographics - Qikiqtaaluk Socio-Economic Monitoring Committee	Description of the general monitoring framework to be developed in consultation with the Qikiqtaaluk Socio-Economic Monitoring Committee.	The Proponent is strongly encouraged to engage in the work of the Qikiqtaaluk Socio-Economic Monitoring Committee along with other agencies and affected communities, and it should endeavor to identify areas of mutual interest and priorities for inclusion into a collaborative monitoring framework that includes socio-economic priorities related to the Project, communities, and the North Baffin region as a whole.	N/A - Related to Population Demographics	Will be addressed by the Socio-Economic Monitoring Committee	Both	Section 9.10
130	Population Demographics - Project-Specific Monitoring	Recognizing that some Project-specific socio-economic monitoring initiatives may be best addressed in smaller more focused working groups, this is encouraged where possible.	The Proponent should consider establishing and coordinating with smaller socio-economic working groups to meet Project specific monitoring requirements throughout the life of the Project.	N/A - Related to Population Demographics	Will be addressed by the Socio-Economic Monitoring Committee	Both	Section 9.10
131	Population Demographics - Monitoring Demographic Changes	To monitor demographic changes affecting the North Baffin communities and the territory as a whole in order to understand changes and to evaluate the Proponent's predictions as related to population demographics.	The Qikiqtaaluk Socio-Economic Monitoring Committee is encouraged to engage in the monitoring of demographic changes including the movement of people into and out of the North Baffin communities and the territory as a whole. This information may be used in conjunction with monitoring data obtained by the Proponent from recent hires and/or out-going employees in order to assess the potential effect the Project has on migration.	N/A - Related to Population Demographics	Will be addressed by the Socio-Economic Monitoring Committee	Both	Section 9.10
132	Population Demographics - Training Programs	To develop training programs in ways which contribute to limiting the potential for migration to occur as North Baffin residents seek training and employment opportunities in the larger centre of Iqaluit.	The Proponent is encouraged to partner with other agencies such as Hamlet organizations in the North Baffin region, the Municipal Training Organization, and the Government of Nunavut in order to adapt pre-existing, or to develop new programs which encourage Inuit to continue living in their home communities while seeking ongoing and progressive training and development. Programs may include driver training programs offered within Hamlets, providing upgraded equipment to communities for use in municipal works, providing incentives for small businesses to remain operating out of their community of origin, or supplementing existing recreational facilities and programming in North Baffin communities.	N/A - Related to Education and Training	Will be addressed by the Socio-Economic Monitoring Committee	Both	Section 9.10
133	Population Demographics - Monitoring Demographic Changes	Training programs may be developed with the goal of limiting the potential for migration to occur as North Baffin residents may choose to seek employment and therefore move from smaller North Baffin communities to the larger centre of Iqaluit.	The Proponent is encouraged to work with the Qikiqtaaluk Socio-Economic Monitoring Committee and in collaboration with the Government of Nunavut's Department of Health and Social Services, the Nunavut Housing Corporation and other relevant stakeholders, design and implement a voluntary survey to be completed by its employees on an annual basis in order to identify changes of address, housing status (i.e. public/social, privately owned/rented, government, etc.), and migration intentions while respecting confidentiality of all persons involved. The survey should be designed in collaboration with the Government of Nunavut's Department of Health and Social Services, the Nunavut Housing Corporation and other relevant stakeholders. Non-confidential results of the survey are to be reported to the Government of Nunavut and the NIRB.	N/A - Related to Population Demographics	Will be addressed by the Socio-Economic Monitoring Committee	Both	Section 9.10
134	Population Demographics - Employee Origin	Project-specific information regarding employee origin is important to comparing predictions of labour availability and employment opportunities with actual levels of employment from various demographic segments over different geographic areas.	The Proponent shall include with its annual reporting to the NIRB a summation of employee origin information as follows: a. The number of Inuit and non-Inuit employees hired from each of the North Baffin communities, specifying the number from each; b. The number of Inuit and non-Inuit employees hired from each of the Kitikmeot and Kivalliq regions, specifying the number from each; c. The number of Inuit and non-Inuit employees hired from a southern location or other province/territory outside of Nunavut, specifying the locations and the number from each; and d. The number of non-Canadian foreign employees hired, specifying the locations and number from each foreign point of hire.	N/A - Related to Population Demographics	Included in Annual Report to NIRB and the Annual IIBA Implementation Report	Both	Section 9.10

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
145	Livelihood and Employment - Barriers to Employment for Women	To monitor and understand the existence of barriers to employment for women specifically relating to childcare availability and costs.	The Proponent is encouraged to work with the Government of Nunavut and the Qikiqtaaluk Socio-Economic Monitoring Committee to monitor the barriers to employment for women, specifically with respect to childcare availability and costs.	N/A - Related to Livelihood and Employment	Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Both	Section 9.10
146	Livelihood and Employment - Availability of Childcare for Project Employees	To lessen the barriers to employment as relating to the availability of childcare.	The Government of Nunavut and the Qikiqtani Inuit Association are strongly encouraged to investigate the possibility for Project revenue streams to support initiatives or programs which offset or subsidize childcare for Project employees.	N/A - Related to Livelihood and Employment	Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Both	Section 9.10
147	Livelihood and Employment - Affordability of Housing	To lessen the barriers to maintaining employment as relating to the availability and costs of housing.	The Proponent is encouraged to work with the Government of Nunavut and the Nunavut Housing Corporation to investigate options and incentives which might enable and provide incentive for employees living in social housing to maintain employment as well as to negotiate for and obtain manageable rental rates.	N/A - Related to Livelihood and Employment	Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Crown	Section 9.10
152	Economic Development and Self-Reliance, and Contracting and Business Opportunities - IIBA contract requirements	To improve ability of small businesses to access Project contract and sub-contract opportunities.	The Qikiqtani Inuit Association is encouraged to provide the Board and the Qikiqtaaluk Socio-Economic Monitoring Committee with information regarding the effectiveness of any provisions within the Inuit Impact and Benefit Agreement which may require that larger contracts be broken down into smaller size in order that they are reasonably managed by smaller businesses in the North Baffin region, while respecting any confidential or privileged information.	N/A - Related to Economic Development and Self-Reliance	Included in Annual IIBA Implementation Report to QIA. Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Both	Section 9.10
153	Human Health and Well-Being - Employee and Family Health and Well-being	To provide adequate medical services on site, including those that contribute to the mental health and well-being of all employees.	The Proponent is encouraged to employ a mental health professional to provide counseling to Inuit and non-Inuit employees in order to positively contribute toward employee health and well-being.	N/A - Related to Human Health and Well-being	Included in Annual IIBA Implementation Report to QIA. Will be addressed by the Mine Closure Technical Advisory Group closer to closure	Crown	Section 9.10
154	Human Health and Well-being - Indirect Impacts to Health and Well-being	To understand the indirect impacts of the Project upon health and well-being.	The Proponent shall work with the Government of Nunavut and the Qikiqtaaluk Socio-Economic Monitoring Committee to monitor potential indirect effects of the Project, including indicators such as the prevalence of substance abuse, gambling issues, family violence, marital problems, rates of sexually transmitted infections and other communicable diseases, rates of teenage pregnancy, high school completion rates, and others as deemed appropriate.	N/A - Related to Human Health and Well-being	Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Both	Section 9.10
156	Human Health and Well-Being - Support Initiatives	To assist with fostering well-being within point-of-hire communities.	The Proponent is encouraged to assist with the provision and/or support of recreation programs and opportunities within the potentially affected communities in order to mitigate potential impacts of employees' absences from home and community life.	N/A - Related to Human Health and Well-being	Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Both	Section 9.10
157	Human Health and Well-Being - Counseling and Treatment Programs	To make available, necessary treatment and counseling services for employee and family well-being.	The Proponent should consider providing counseling and access to treatment programs for substance and gambling addictions as well as which address domestic, parenting, and marital issues that affect employees and/or their families.	N/A - Related to Human Health and Well-being	Included in Annual IIBA Implementation Report to QIA. Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Both	Section 9.10
158	Community Infrastructure and Public Services - Impacts to Health Services	To monitor indirect Project impacts to health and social services provided by the Government of Nunavut.	The Proponent is encouraged to work with the Government of Nunavut and other parties as deemed relevant in order to develop a Human Health Working Group which addresses and establishes monitoring functions relating to pressures upon existing services and costs to the health and social services provided by the Government of Nunavut as such may be impacted by Project-related in-migration of employees, to both the North Baffin region in general, and to the City of Iqaluit in particular.	N/A - Related to Community Infrastructure and Public Service	Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Crown	Section 9.10
159	Community Infrastructure and Public Services - Impacts to Infrastructure	To monitor Project-related impacts to infrastructure within the Local Study Area communities.	The Proponent is encouraged to work with the Government of Nunavut to develop an effects monitoring program that captures increased Project-related pressures to community infrastructure in the Local Study Area communities, and to airport infrastructure in all point-of-hire communities and in Iqaluit.	N/A - Related to Community Infrastructure and Public Service	Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Crown	Section 9.10
160	Community Infrastructure and Public Services - Distribution of Benefits	To ensure the distribution of benefits is done in a way that off-sets Project-related impacts to infrastructure or services.	The Government of Nunavut and the Qikiqtani Inuit Association are encouraged to cooperate to ensure in a broad sense, that Project benefits	N/A - Related to Community Infrastructure and Public Service	Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Both	Section 9.10
161	Community Infrastructure and Public Services - Policing	To ensure the territorial government and its policing service are adequately prepared to handle any Project-related increases to the need for service and associated impacts.	The Government of Nunavut should be prepared for any potential increased need for policing, and ensure that the Royal Canadian Mounted Police is prepared to handle ongoing Project-related demographic changes and subsequent crime prevention that may be needed as a result of the development, operation, and closure of the Project.	N/A - Related to Community Infrastructure and Public Service	Will be addressed by the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Crown	Section 9.10
162	Culture, Resources and Land Use - Public Consultation	To ensure the ongoing and consistent involvement of Elders and community members in developing and revising monitoring and mitigation plans.	The Proponent should make all reasonable efforts to engage Elders and community members of the North Baffin communities in order to have community level input into its monitoring programs and mitigative measures, to ensure that these programs and measures have been	N/A - Related to Cultural Resources and Land Use	Will be addressed by the Community Working Group and the Mine Closure Technical Advisory Group closer to closure	Both	Section 9.10

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
			informed by traditional activities, cultural resources, and land use as such may be implicated or impacted by ongoing Project activities.				
163	Culture, Resources and Land Use - Public Consultation	To involve communities in the development and evolution of management and monitoring plans.	The Proponent shall continue to engage and consult with the communities of the North Baffin region in order to ensure that Nunavummiut are kept informed about the Project activities, and more importantly, in order that the Proponent's management and monitoring plans continue to evolve in an informed manner.	N/A - Related to Cultural Resources and Land Use	Will be addressed by the Community Working Group and the Socio-Economic Monitoring Committee and the Mine Closure Technical Advisory Group closer to closure	Both	Section 9.10
164	Socio-Economic Impacts - Shipping Notification	In order to inform members of North Baffin communities of planned Project shipping transits such that community members' planned travel routing may be adjusted to avoid interaction with Project ships and/or ship tracks.	The Proponent is required to provide notification to communities regarding scheduled ship transits throughout the regional study area including Eclipse Sound and Milne Inlet, real-time data regarding ships in transit and any changes to the proposed shipping schedule to the MEWG and agencies within Pond Inlet on a weekly basis during open water shipping, and to the RSA communities on a monthly basis.	N/A - Related to Cultural Resources and Land Use	Part of already established Marine safety protocols on site and though IIBA Implementation.	Both	Section 9.10
165	Socio-Economic Impacts - Emergency Shelters	In order to provide for human safety precautions in the event of adverse weather or other emergency situations along segments of linear transportation infrastructure.	The Proponent is strongly encouraged to provide buildings along the rail line and Milne Inlet Tote Road for emergency shelter purposes, and shall make these available for all employees and any land users travelling through the Project area. In the event that these buildings cannot, for safety or other reasons be open to the public, the Proponent is encouraged to set up another form of emergency shelters (e.g., seacans outfitted for survival purposes) every 1 kilometre along the rail line and Milne Inlet Tote Road. These shelters must be placed along Tote Road and rail routing prior to operation of either piece of infrastructure, and must be maintained for the duration of project activities, including the closure phase.	N/A	Part of already established Marine safety protocols on site. Will be addressed by the Community Working Group	Both	Section 9.10
166	Socio-Economic Impacts - Public Consultation	To ensure members of the public are able to access shipping information on an as-required basis in order to inform potential users of the scheduled Project activities which could require deviations to land users' schedules or routing.	The Proponent should ensure through its consultation efforts and public awareness campaigns that the public have access to shipping operations personnel for transits into and out of both Steensby Inlet port and Milne Inlet port either via telephone or internet contact, in order that any questions regarding ice conditions or ship movements that could assist ice users in preparing for travel may be answered by Project staff in a timely fashion.	N/A	Part of already established Marine safety protocols on site	Both	Section 9.10
168	Governance and Leadership - Monitoring Program	Outline variables that are relevant to the Project and which should be adopted by the QSEMC's monitoring program.	The specific socioeconomic variables as set out in Section 8 of the Board's Report, including data regarding population movement into and out of the North Baffin Communities and Nunavut as a whole, barriers to employment for women, project harvesting interactions and food security, and indirect Project effects such as substance abuse, gambling, rates of domestic violence, and education rates that are relevant to the Project, be included in the monitoring program adopted by the Qikiqtani Socio-Economic Monitoring Committee.	N/A - Related to Governance and Leadership	Will be addressed by the Socio-Economic Monitoring Committee closer to closure	Both	Section 9.10
169	Governance and Leadership - Monitoring Economic Effects	To maintain transparency inform communities in relation to economic benefits associated with the Project.	The Proponent provide an annual monitoring summary to the NIRB on the monitoring data related to the regional and cumulative economic effects (positive and negative) associated with the Project and any proposed mitigation measures being considered necessary to mitigate the negative effects identified.	N/A - Related to Governance and Leadership	Will be addressed by the Socio-Economic Monitoring Committee closer to closure	Both	Section 9.10
173	Accidents and Malfunctions – Use of best practices	To provide additional spill contingency measures for spills in marine areas.	The Proponent shall employ best practices and meet all regulatory requirements during all ship-to-shore and other marine-based fuel transfer events.	N/A - Related to Marine Monitoring	Part of already established Marine safety protocols on site	Crown (Marine)	N/A
174	Accidents and Malfunctions – Community level spill response	To improve community ability to assist in spill response.	The Proponent and the Canadian Coast Guard are required to provide spill response equipment and annual training to Nunavut communities along the shipping route to potentially improve response times in the event of a spill.	N/A - Related to Marine Monitoring	Part of already established Marine safety protocols on site	Crown (Marine)	N/A
175	Accidents and Malfunctions - Ship Track Markers in Ice Cover	To ensure that measures taken to mark the shipping track(s) during periods of ice cover are effective in advising ice-based travelers, and that, where necessary, revisions to this practice can be made to ensure public safety.	The Proponent shall, in coordination and consultation with the Qikiqtani Inuit Association and the Hunters and Trappers Organizations of the North Baffin communities and Coral Harbour, provide updates to its Shipping and Marine Mammals Management Plan to include adaptive management measures it proposes to take should the placement of reflective markers along the ship track in winter months not prove to be a feasible method of marking the track to ensure the safety of ice-based travelers.	N/A - Related to Marine Monitoring	Part of already established Marine safety protocols on site	Crown (Marine)	N/A
176	Accidents and Malfunctions – Revised spill modeling	To improve community ability to assist in spill response.	The Proponent is required to revise its spill planning to include additional trajectory modeling for areas of Hudson Strait, such as Mill Island, where walrus concentrate, as well as for mid-Hudson Strait during winter conditions as well as for the northern shipping route, including Milne Inlet, Eclipse Sound and Pond Inlet.	N/A - Related to Marine Monitoring	Part of already established Marine safety protocols on site	Crown (Marine)	N/A
177	Accidents and Malfunctions - Foreign Flagged Vessels	To ensure foreign flagged ships operating in Canadian waters are held to the same standard as domestic ships with regard to emergency response planning.	The Proponent shall enroll any foreign flagged vessels commissioned for Project-related shipping within Canadian waters into the relevant foreign program equivalent to Transport Canada's Marine Safety Delegated Statutory Inspection Program.	N/A - Related to Marine Monitoring	Part of already established Marine safety protocols on site	Crown (Marine)	N/A

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
178	Alternatives analysis – Mill Island shipping route consideration	To prevent disturbance to walrus and walrus habitat on the northern shore of Mill Island.	Subject to safety considerations and the potential for conditions, as determined by the crew of transiting vessels, to result in route deviations, the Proponent shall require project vessels to maintain a route to the south of Mill Island to prevent disturbance to walrus and walrus habitat on the northern shore of Mill Island.	N/A - Related to Marine Monitoring	Part of already established Marine safety protocols on site	Crown (Marine)	N/A
180	Transboundary Effects - Makivik Corporation involvement in the Marine Environment Working Group	To enable Makivik Corporation and Nunavik communities near shipping lanes to remain informed and involved in those shipping activities which could affect the marine environment and marine mammals.	The Marine Environment Working Group established for this Project shall invite a representative from Makivik Corporation to be a member of the Group	N/A - Related to Marine Monitoring	Will be addressed in Annual Report and in Marine Environmental Working Group	Crown (Marine)	N/A
181	Transboundary Effects - Marine Environment Working Group Reporting	To enable Makivik Corporation and Nunavik communities near shipping lanes to remain informed and involved in those shipping activities which could affect the marine environment and marine mammals.	Regardless of whether Makivik Corporation participates as a member of the Marine Environment Working Group, the Marine Environment Working Group will provide Makivik Corporation with regular updates regarding the activities of the Marine Environment Working Group throughout the Project life cycle.	N/A - Related to Marine Monitoring	Will be addressed in Annual Report and in Marine Environmental Working Group	Crown (Marine)	N/A
182	Transboundary Effects - Reporting to Marine Environment Working Group (MEWG)	To enable Makivik Corporation and Nunavik communities near shipping lanes to remain informed and involved in those shipping activities which could affect the marine environment and marine mammals.	Baffinland shall make available to Makivik Corporation any ship route deviation reports provided to the NIRB in accordance with the terms and conditions set out in Section 4.12.4 of the Final Hearing Report.	N/A - Related to Marine Monitoring	Will be addressed in Annual Report and in Marine Environmental Working Group	Crown (Marine)	N/A
183	Project monitoring of impacts to marine mammals	To address concerns associated with the potential for impacts to marine mammals, and compliance and enforcement of terms and conditions in Project Certificate No. 005 relating to ship-based observer programs, noise exposure assessments, and the identification of other mitigation measures that have the potential to further reduce potential impacts to marine mammals.	The Proponent shall collaborate with the Marine Environmental Working Group (MEWG) to develop impact avoidance or mitigation strategies for the protection of the marine environment and shall implement these strategies. The Proponent shall implement any direction from the Department of Fisheries and Oceans (DFO), issued in furtherance of their mandate, for any avoidance or mitigation measures, including cessation of any activity, for the protection of the marine environment. The Proponent shall, every six months, provide to DFO and the MEWG a tracking table and a plain language summary of (i) collective recommendation of the other members of the working group, and (ii) any directions from DFO. For each, the table must show the Proponent's means of implementation. Where any direction or recommendations are not fully implemented, the Proponent shall include the rationale.	N/A - Related to Marine Monitoring	Will be addressed in Annual Report and in Marine Environmental Working Group	Crown (Marine)	N/A
184	Project monitoring of impacts to marine mammals	To address concerns associated with the potential for impacts to marine mammals, and compliance and enforcement of terms and conditions in Project Certificate No. 005 relating to ship-based observer programs, noise exposure assessments, and the identification of other mitigation measures that have the potential to further reduce potential impacts to marine mammals.	The proponent shall collaborate with the Marine Environmental Working Group to review the status of compliance with, and implementation of, all of the Terms and Conditions in Project Certificate No. 005 related to marine environmental protection.	N/A - Related to Marine Monitoring	Will be addressed in Annual Report and in Marine Environmental Working Group	Crown (Marine)	N/A
185	General	To provide certainty and predictable timelines for shipping for the project, and to better define criteria for the commencement and closing of the shipping season. Certainty and predictability will increase safety for traditional use of sea ice, and mitigate impacts to marine wildlife.	All project related shipping associated with the Northern Shipping route shall observe the following conditions, subject to the variances and/or exceptions below: a) The Proponent must avoid breaking landfast ice at all times during the shipping season. b) The Proponent shall confirm a continuous path of 3/10th ice concentrations along the Northern Shipping route is available prior to commencement of the shipping season. c)The Proponent is required to plan for and cease all shipping from Milne Port by October 31. The Proponent may proceed with a variance to condition (b) above, or under exceptional circumstances that may occur from time to time seek an exception to condition (c). Variances and exceptional circumstances require the direct engagement of Qikiqtani Inuit Association (QIA), as well as the written confirmations obtained from the Hamlet of Pond Inlet, the Mittimatalik HTO (MHTO) and QIA as described below. Examples of a variance may include: sea ice coverage changing from 3/10th or less to greater than 3/10th due to changes in environmental conditions such as wind, or a generally later forecast for ice break up. Exceptional circumstances include events that are unforeseen and occur outside of Baffinland's control but will not include contingencies that the Proponent should reasonably have planned	N/A - Related to Marine Monitoring	Will be addressed in Annual Report and in Marine Environmental Working Group	Crown (Marine)	N/A

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
			for. Examples of unforeseen events may include: a breakdown in loading equipment, weather disruptions to shipping schedules, or a later than expected ice break up past July 15. In the event a need for variance or an exceptional circumstance arises, the Proponent is required to provide a detailed written description to the NIRB, QIA, Hamlet of Pond Inlet and MHTO clearly demonstrating how it will meet each of the following criteria before continuing with operations: (i) a description of the rationale for variation or exceptional circumstances and anticipated duration of the extended shipping season; (ii) a description as to whether the anticipated ice conditions during the shipping period are consistent with Appendix B commitments and the Shipping and Marine Wildlife Management Plan; (iii) a description confirming that shipping will proceed in full compliance with all Project Certificate terms and conditions and Appendix B commitments (including but not limited to the 6 mtpa limits described in Terms and Conditions 179(a) and (b) and the requirement not to break landfast ice); (iv) a description of any additional mitigation or monitoring efforts being undertaken as a result of the variation or exceptional circumstance; (iv) a description of how the Proponent has made best efforts to meet with the Hamlet, MHTO and the QIA to discuss and consider the variation or exceptional circumstance; (v) copies of all public communications relating to the variation or exceptional circumstance; (vi) written confirmation (or evidence of verbal confirmation) from the Hamlet and the MHTO that sea ice overlapping the shipping route is not being used for travel or harvesting by harvesters or community members, and that the proposed shipping activity will not result in additional safety risks to hunters or the community that cannot be mitigated, for instance, by transiting through a path of less consolidated ice in Eclipse Sound and Milne Inlet or exceptional circumstance. All determinations related to variances and exceptional circumstances will be communicated to NIRB. For greater clarity, this condition applies to all ships supporting the Mary River Project including ore carriers and supply ships.				
186	Terrestrial Environment – Hunters' Access Route(s)	To establish a safe access route for hunters to travel within the project area thereby reducing the shared use of the Milne Inlet Tote Road.	The proponent is required to construct and maintain hunters access route(s) in and around the Milne Inlet Tote Road. The specific location of hunters' access route(s) shall be confirmed based upon input from the Mittimatalik Hunters and Trappers Organization and the Qikiqtani Inuit Association. The responsible parties shall also develop and jointly approve an Access Route Operations and Maintenance Procedure and/or Plan.	N/A - Related to Cultural Resources and Land Use	Will be addressed in Annual Report	Both	N/A
187	Terrestrial Environment – Dust Audit	To consistently assess and monitor impacts of dust from project activities for the purpose of assessing the efficacy of project mitigation measures and to examine alternative mitigation and management options.	The Proponent is required to resource an annual audit of dust impacts and mitigations associated with project activities to be completed by a third party acceptable to the responsible parties. The dust audit shall evaluate effectiveness of current measures and if necessary, contain recommendations and options to reduce the spread and impacts of dust from project activities.	7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Monitoring and Reporting. Reporting requirements will be addressed in Annual Report.	Both	Section 9.7
188	Terrestrial Environment – High Risk Conditions for Dust Dispersion	To establish a program to identify high risk conditions for dust dispersal, and a plan for additional measures to be taken at the times the conditions are present, which may include the use of additional dust suppression and operational staged decreases in dust generating site activities. Baffinland, working with the TEWG will establish site specific thresholds for conditions that may increase dust dispersion (i.e., wind speed), and corresponding mitigations to implement when thresholds are met.	The Proponent is required to resource an annual audit of dust impacts and mitigations associated with project activities to be completed by a third party acceptable to the responsible parties. The dust audit shall evaluate effectiveness of current measures and if necessary, contain recommendations and options to reduce the spread and impacts of dust from project activities.	7 - Terrestrial Wildlife and Habitat	Terrestrial Environment Working Group and Terrestrial Monitoring and Reporting. Reporting requirements will be addressed in Annual Report.	Both	Section 9.7
189	General	There is a need to ensure that Proponent commitments which are made on the public record but not recorded in Project Certificate	The Proponent is to carry out all commitments listed in Appendix B to this Project Certificate 005. Performance of these commitments will be evaluated by an interim Project Monitor appointed on agreement of the Responsible Parties. Where the Proponent has not carried out a	N/A	N/A	Both	N/A

Ref #	Category	Objective	Project Condition/Type A Water Licence Condition	Related VEC	Associated Closure/Post Closure Monitoring Program	IOL or Crown Land	ICRP Ref
		Terms and Conditions are carried out as agreed to. An interim Project Monitor, appointed on agreement of the Responsible Parties, will review and report on a bi-annual (twice yearly) basis regarding the Proponent's performance of Project Certificate Terms and Conditions and the Proponent commitments listed in Appendix B to this Project Certificate 005.	commitment the Proponent is required to provide a detailed written description to the NIRB, clearly explaining why they were unable to carry out the condition and how it will meet the condition going forward.				

TABLE B.2 PART J OF TYPE "A" WATER LICENCE 2AM-MRY1325 (NWB, 2015)

Item	**Requirements of Part J of the Licence** *The Plan under this section will supersede the Plan referred to in Part J, Item 1 once approved and must address all mine related components including the following:*	ICRP Location
2a	Detailed description, including maps and other visual representations, of the preconstruction conditions for each site, accompanied by a detailed description of the proposed final landscape, with emphasis on the reclamation of surface drainage over the restored area	Sections 3, 4 and 5.2
2b	A description of how progressive reclamation will be employed and monitored throughout the life of the mine, plus reclamation scheduling and coordination of activities with the overall sequence of the project; details of reclamation scheduling and procedures for coordinating reclamation activities within the overall mining sequence and materials balance	Section 6
2c	Implications of any updated water balance and water quality model prediction results and any adaptive management measures that may be required	Section 5.3.1 and Appendix D1, D2 and D3
2d	An evaluation of closure and reclamation measures for each mine component, including the goals, objectives, closure criteria and the rationale for selection of the preferred measures	Section 5
2e	A comprehensive assessment of materials suitability, including geochemical and physical characterization and a schedule of availability for reclamation needs. Particular attention shall be given to cover materials, including maps showing sources and stockpile locations of all reclamation construction materials.	Sections 3.3.6, 5.3.2 and 5.3.3
2f	An assessment and description of any required post-closure treatment for pit water that is not acceptable for discharge, taking into consideration further studies completed and updated modeling information	Section 5.3.1.9 and Appendix D1 (under preparation)
2g	Contingency measures for all reclamation components including action thresholds that are linked to the monitoring programs	Section 5.3.1.9
2h	Monitoring programs to assess reclamation performance and environmental conditions including monitoring locations for surface water and Ground Water, parameters	Section 9
2i	Monitoring schedules and overall timeframes	Section 9
2j	QA/QC procedures for managing the demolition landfill and other waste disposal areas	Section 5.3.7
2k	A list of non-salvageable materials and disposal locations	Sections 5.3.4, 5.3.5 and 5.3.7
2l	Rock storage facility closure design plans and sections including the types of material placed and volumes	Section 5.3.2
2m	Protocol for the disposal of any contaminated soil	Section 5.3.7 and 9.6
2n	An assessment of the long-term physical stability of all remaining project components	Section 9.4
2o	A revised closure and reclamation cost estimate	Section 10
2p	A detailed implementation schedule for completion of reclamation work	Section 8, Table 8.1

TABLE B.3 TERRITORIAL LAND USE REGULATIONS, PURSUANT TO THE TERRITORIAL LANDS ACT

Regulation Requirement	TLUR Section	ICRP Location
All closure work shall be carried out in accordance with permit requirements as stated in the *Territorial Land Use Regulations.*	s. 8 through 10, 31	Section 2.5
"Subject to the terms and conditions of his permit or the express written authority of an inspector, every permittee shall replace all materials removed by him in the course of excavating, other than rock trenching, and shall level and compact the area of excavation."	s. 12	Table 5.1
"Restore the channel and bed of the stream to their original alignment and cross section."	s. 13.(1 b)	Table 5.1
"Subject to the terms and conditions of his permit, every permittee shall, after completion of a land use operation, restore the permit area as nearly as possible to the same condition as it was prior to commencement of the land use operation."	s. 18	Table 5.1
Remove all buildings, machinery, equipment, materials and fuel drums or other storage containers used in connection with the land use operation.	s. 19.(1)	Section 5.3
A final plan will be issued to the "engineer" within 60 days following completion of the land use operation or expiration of the permit.	s. 33	Section 1.3
All plan drawings submitted under the Regulations shall: • Be drawn to scale that clearly illustrates all mine features • Shows the scale on the drawing • Provide geographic co-ordinates	s.35	Section 4 and Appendix A
"In order to ensure that a permittee complies with the terms and conditions of his permit with these Regulations, the engineer may include in the permit a condition that the permittee deposit with the Minister a security deposit not exceeding $100,000."	s. 36	Section 10
"(1) Subject to subsection (2), where a permittee wishes to discontinue a land use operation at any time prior to the date of completion set out in the permit, he shall give notice of discontinuance in writing to the engineer indicating the date upon which he proposes to discontinue the land use operation. (2) A notice of discontinuance given pursuant to subsection (1) shall be given to the engineer at least 10 days prior to the proposed date of the discontinuance. (4) The discontinuance of a land use operation pursuant to this section does not relieve the permittee from any obligations arising under the terms and conditions of the permit or under these Regulations up to the time of discontinuance or from complying with any notice, direction or order given by an inspector or by the engineer.	s. 43	Section 2.3.1 and Section 7

TABLE B.4 ABANDONMENT AND RECLAMATION POLICY FOR INUIT OWNED LANDS (QIA, 2024)

Item	Policy Requirement	Baffinland Response
1	Have **all** reports and plans including addendums and responses been submitted?	Yes
2	Are the submitted reports and plans executable standalone documents with adequate rational and detail?	Yes
3	Do all reports and plans contain appropriate referencing (document name, author, section, and page number) to **all** supporting information?	Yes
4	Do the reports and plans demonstrate a firm understanding, of QIA's *Guiding Principles on Reclamation* and provide rationale on how these principles have been satisfied?	Yes
5	Has IQ and consultation with Community Land and Resources Committee(s) been applied? Has the Tenant provided detailed community consultation records?	Closure and reclamation issues discussed at hearings related to the Project Certificate. Commitment to Inuit Engagement Strategy and MCTAG in the future to incorporate community input and IQ.
6	Are **all** the components that are considered in the abandonment and reclamation plan listed?	Yes
7	Does each component of the Project have an abandonment and reclamation objectives and criteria?	Yes
8	Has an A&R plan been provided with a financial security estimate?	Yes. Financial security estimate is conducted in accordance with Section 9.2 of Commercial Lease, No. Q13C301.
9	Have Table 1, 2, 3 and 4 of Appendix B been used in completing the financial security estimate?	Yes. Adapted to suit project specific requirements.
10	Has evidence been provided to support the Policy assumptions for **all** reports and plans?	Yes
11	Has the Tenant contacted QIA if uncertainty existed in how the Tenant was to determine an acceptable estimate?	Yes

TABLE B.5 EIS GUIDELINES (NUNAVUT IMPACT REVIEW BOARD, 2015)

EIS Guidelines Requirement (Section 9.6 of the EIS Guidelines, NIRB, 2015)	ICRP Location
To ensure that issues associated with the effective closure and reclamation of all Project Components is considered at the earliest possible stage in the mine development process, thereby influencing mine design to take into account environmental issues related to mine closure and reclamation	All
To establish major targets for reclamation of lands potentially affected by the Project	Table 5.1
Description of reclamation methods, time frames and schedules, including proposed notice periods to employees and public	Section 5
Description of temporary closure measures and a discussion of at what point a temporary closure should be considered permanent for the purposes of requiring implementation of aspects of the Mine Closure and Reclamation Plan	Section 7
Discussion of research programs to address challenges to reclamation, given the local conditions	Appendix D
Considerations for the protection of public health and safety	Sections 7.1.1 to 7.1.5 and 7.3.1 to 7.3.6
Description of closure and post-closure monitoring of environmental components including, but not limited to, wildlife, vegetation, air quality, landform stability and water quality	Section 9
Discussion of the need for long-term monitoring and maintenance by establishing physical and chemical stability of reclaimed areas	Section 9
Discussion on reduction or elimination of environmental effects once the mine ceases operation	Section 5, Table 5.1 and Section 9
Discussion regarding re-establishment of conditions that permit the land to return to similar pre-mining land use	Table 5.1 & Section 5.3
Consideration for ARD and/or ML potential of rocks, in association with related waste rock management strategies	5.3.1.7, 5.3.1.9 & 5.3.2.7, 5.3.2.9 Appendix D
Any considerations for the restoration of the natural aesthetics of the Project	Table 5.1 Appendix D
The Plan is considered to be a "living" document; the level of detail should undergo further revision to reflect the progress of the Project as well as changes in technology and/or standards or legislation. Future revisions should also consider input from consultations with communities and other stakeholders on methods to be used, and potential uses for project infrastructure, etc.	Section 1.3 and Section 2.4

TABLE B.6 GUIDELINES FOR THE CLOSURE AND RECLAMATION OF ADVANCED MINERAL EXPLORATION AND MINE SITES IN THE NORTHWEST TERRITORIES (MVLWB/AANDC 2013)

Guideline Requirement	ICRP Section
1.0 Plain Language Summary i. Plain language summary of CRP, with key aspects of current plan, major uncertainties and how they will be addressed, and differences from previous plans	Section 1
2.0 Introduction i. Purpose and scope of the closure and reclamation plan as it relates to Boards' requirements, previous versions of CRP, expectation of stakeholders. Approval dates of previous CRPs.	Section 2.1
ii. General project description, description of proponents, spatial and temporal extent of project	Section 2.1
iii. Status of plan (e.g., interim CRP, final CRP, etc.)	Section 2.3.1
iv. Goal of the closure and reclamation plan	Section 2.2
v. Identify closure and reclamation planning team. Describe, list or show important internal/external organizational relationships and specific responsibilities that facilitate/manage closure and reclamation.	Section 2.3
vi. Outline approach to engagement, how they have or will integrate local community values into the CRP, strategies for engaging communities in CRP development and implementation	Section 2.4
vii. Identify relevant regulatory authority and existing/required permits, authorizations, agreements related	Section 2.5
viii. Conformance table showing where CRP satisfies applicable licences/permits. List of additional standards/guidelines to be followed.	Section 2.6 and Appendix B (this appendix)
3.0 Project Environment i. Overview of pre-disturbance atmospheric environment (e.g., climate, temperature, precipitation, air quality), including maps, tables, figures	Section 3.1
ii. Overview of pre-disturbance physical (terrestrial) environment (e.g., physiography, geology, permafrost, geological hazards, hydrogeology), including maps, tables, figures	Section 3.2
iii. Overview of pre-disturbance chemical environment (e.g., soil/sediment chemistry, surface water/groundwater quality, ARD and metal leaching potential), including maps, tables, figures	Section 3.3
iv. Overview of pre-disturbance biological environment (e.g., vegetation, aquatic life, terrestrial wildlife, avifauna, overall ecosystem), including maps, tables, figures	Section 3.4
4.0 Project Information i. Site location, regional and local context of affected areas, access points and methods of access, including maps and photos	Section 4.1
ii. History of ore discovery, exploration, previous development and operations, ownership changes, summary of application, permitting, and licencing process to date	Section 4.2
iii. Description of site geology, mining resource, extraction methods and rational for footprint and specific target areas, including maps, figures, tables	Section 4.3
iv. Project summary, including life of mine plan through closure and reclamation and various options proposed from EA	Section 4.4
v. List of all project components	Table 4.1

Guideline Requirement	ICRP Section
5.0 Permanent Closure and Reclamation i. Definition of permanent closure and reclamation	Section 5.1
ii. Indicate components that may require passive long-term care and expected timelines for relinquishment	Section 5.3
iii. Description of project components, including details (e.g., dimensions, footprint, relative locations on map), lifespan and current status, with supporting maps, figures, photos	Section 4.4, 5.3 and Appendix A
iv. Description of pre-development, existing, and projected final site conditions using maps, photos, figures as appropriate. Illustrate relevant water bodies, topographic modifications, and vegetation changes. Identify important/unique environmental conditions with bearing on closure.	Section 5.3 (Sections 5.3.X.2)
v. List of closure objectives and criteria for each component, with any uncertainties noted with reference to the associated reclamation research plan	Table 5.1
vi. Alternatives analysis of various closure options with clear demonstration of pros and cons, risk scenarios and unique/novel closure situations for the specific component	Section 5.3 (Sections 5.3.X.4)
vii. Selection of preferred closure activity with rationale for selection/rejection of others	Section 5.3 (Sections 5.3.X.4)
viii. Description of engineering work (e.g., demolition, construction) necessary for selected closure activity, with supporting information for proposed work to prove proposed technology or engineering will be successful	Section 5.3 (Sections 5.3.X.5)
ix. Assessment of potential negative residual effects remaining after completion of reclamation. Provide results of risk assessments and discuss how any predicted residual effects compare to stakeholders' preferences and or to company's commitments made during EA.	Section 5.3 (Section 5.3.X.6) Appendix G
x. Identify uncertainties associated with the risks of various closure options and how to select the best closure activity, how to best implement a selected closure activity, how to define closure criteria, how Traditional Knowledge will inform closure planning and more. Include how each uncertainty will be addressed (reclamation research, engineering study plan, etc.).	Section 5.3 (Sections 5.3.X.7) Appendix D
xi. Description of what post-closure monitoring will occur (e.g., fugitive dust, stream flow, wildlife and aquatic life movement etc.) and why, including sampling locations, frequencies, duration, maintenance activities, methods of reporting	Table 3.1, Section 5.3 (Sections 5.3.X.8) Section 9.0
xii. List of possible contingencies should closure activity not be successful in meeting closure criteria and objectives, with identification of preferred contingency with rationale	Section 5.3 (Sections 5.3.X.9)
6.0 Progressive Reclamation i. Definition of progressive reclamation	Section 6.1
ii. Opportunities for progressive reclamation during life of the project, including location, aerial extent of work, description of planned reclamation activities and any planned/required monitoring	Section 6.2
iii. Summary and location of completed progressive reclamation activities, including a list of reports detailing any reclamation that has occurred, and any lessons learned that will inform closure planning	Section 6.3

Guideline Requirement	ICRP Section
7.0 Temporary Closure i. Closure goal and closure objective of temporary closure	Sections 7.1 and 7.3
ii. Selected temporary closure activities for each project component (must include minimum activities identified by MVLWB guidelines)	Sections 7.1 and 7.3
iii. Monitoring activities during temporary closure	Sections 7.2 and 7.4
iv. Contingencies for unforeseen events/conditions during temporary closure if response different from normal operations, including effects on any monitoring activities and plans to address any effects	Section 5.3 (Sections 5.3.X.9)
v. Temporary closure schedule, including anticipated timing/sequence of events, description of temporary closure activities for each component, duration and approximate end date of closure period	Section 7.1 and 7.3
8.0 Integrated Schedule of Activities i. Component-specific schedule depicting operations, closure dates, and expected start and end times for selected closure activities, including progressive reclamation, initiation and completion of research, timeframes for meeting closure criteria and monitoring and reporting phases	Section 8.0
ii. Description of schedule uncertainties	Section 8.0
9.0 Post-Closure Site Assessment i. Description/study design of post-closure impact assessment	Section 9 and Appendix G
10.0 Financial Security i. Estimates of total liability of permanent closure (including post-closure monitoring programs and activities)	Section 10
ii. Cost breakdown for each project component	ASR documentation
iii. Match estimate with timing of closure and reclamation activities	ASR documentation
11.0 References i. List of documents/reports that support characterization of baseline environmental data, geochemical analyses and predicted ML/ARD potential, and relevant engineering work related to support the CRP	Section 12
Appendix A Glossary of Terms and Definitions i. Plain language explanation of discipline specific technical terms and key closure and reclamation planning terms	Section 11.1
Appendix B List of Acronyms, Abbreviations, Units, and Symbols	Section 11.2
Appendix C Record of Engagement i. Table outlining all completed engagement specific to closure, including issues identified by engaged parties and how company has addressed them	Appendix E

Guideline Requirement	ICRP Section
Appendix D Lessons Learned from Other Projects i. Summary table of relevant on-site closure issues/concerns dealt with at other projects, the completed activity, lessons learned and application to managing project closure and reclamation	Appendix F
Appendix E Reclamation Research Plans i. Reclamation research plans required to address uncertainties. Plans should describe the uncertainty, research/study objective, overview of tasks, linkages to other research/studies, project research schedule, costs and references.	Appendix D

TABLE B.7 MINE SITE RECLAMATION GUIDELINES FOR THE NORTHWEST TERRITORIES (AANDC, 2007)

Guideline Requirement	ICRP Location
Develop and implement preventive and control strategies to effectively minimize the potential for ARD and ML to occur	Sections 5.3.1.5, 5.3.2.5, 5.3.3.6
Where ARD and ML are occurring as a result of mine activities, mitigate and minimize impacts to the environment	Sections 5.3.1.9 and 5.3.2.9
Re-establish the pre-mining ground cover, which may involve encouraging self-sustainable indigenous vegetation growth	Table 5.1 and Appendix D
Remediate any sources of contamination that may have been created during the development and operation of the mine site in order to protect humans, wildlife, and environmental health	Table 5.1
Ensure physical stability of residual earth structures for environmental, human, and wildlife safety	Table 5.1
Open Pit: • Minimize access to protect human and wildlife safety • Implement water management strategies to minimize and control migration and discharge of contaminated drainage, and if required, collect and treat contaminated water • Stabilize slopes to minimize erosion and slumping	5.3.1
Waste Rock: • Minimize erosion, thaw settlement, slope failure, collapse or the release of contaminants or sediments	5.3.2
Buildings and infrastructure, equipment: • Return area to its original state or to a condition compatible with the end land-use targets	5.3.4
Restore natural drainage patterns where surface infrastructure has been removed	Table 5.1
Landfills: • Control erosion and effects to the ground thermal regime	5.3.7
Water Management Systems: • Dismantle and remove/dispose of as much of the system as possible and restore natural or established new drainage patterns • Stabilize and protect from erosion and failure for the long term	Tables 5.1 & 5.3.8

TABLE B.8 MINE SITE RECLAMATION POLICY FOR NUNAVUT (AANDC, 2002)

Policy Requirement	ICRP Location
Areas should be returned to viable and self-sustaining areas where practical	5.2
Use best management principles such as progressive reclamation and reduce the environmental risk	Section 2.2
Communication and consultation shall be undertaken with all applicable parties	Section 2.4
Closure impacts for all mine components	Table 5.1 Appendix G
Closure costs estimates should be undertaken by a third party using a recognized methodology such as RECLAIM. Closure cost estimates should include contingency factors.	Section 10
Inclusion of a progressive reclamation plan	Section 6
Removal/stabilization of all structures	Sections 5.3
Reclaim and stabilize waste rock stockpiles remaining on site	Section 5.3.2
Reclaim the disturbed surface areas to acceptable standards	Table 5.1
Water quality at closure shall meet or exceed the accepted standards	Table 5.1
Temporary Closure measures shall be included in the Preliminary Closure Plan and cost estimate	Section 7
Inclusion of a post-closure monitoring program	Section 9
Detailed closure and decommissioning of the following: • Buildings and other structures • Roads • Airstrips • Waste rock stockpiles • Ore stockpiles • Quarries • Open pit • Petroleum and chemical storage areas and facilities • Pipelines • Power corridors • Sewage and waste disposal areas and Mine drainage	Section 5.3
Re-vegetation of the site where practical	Section 5.2 and Table 5.1
Meet or exceed applicable water standards	Table 5.1
Recycle materials where practical	Section 5.3.7
Closure cost estimate to be calculated for the total financial security for final closure	Section 10
Utilization of a recognized methodology for calculating the closure costs (i.e. RECLAIM model)	Section 10
Establish financial security to be provided to the Minister of Aboriginal Affairs and Northern Development Canada (previously Indian Affairs and Northern Development)	Section 10

TABLE B.9 MINE RECLAMATION IN THE NORTHWEST TERRITORIES AND YUKON (DIAND, 1992)

Guideline Requirement	ICRP Location
Preliminary Closure Plan objectives are to: • Protect the public health and safety • Prevent and/or reduce the environmental deterioration • Return all disturbed areas to the original state or an accepted level of reclamation	Table 5.1
Ensure post-closure physical and chemical stability	Section 5.2
Development of a monitoring program to assess the effectiveness of the restoration to be undertaken between the Proponent and Indian and Northern Affairs Canada	Section 9
Reclaimed areas should be returned to previous land use and aesthetics, to the extent possible	Table 5.1
Include temporary closure and indefinite (long-term) Preliminary Closure Plans	Section 5.0 Section 7.0
Mine features should be closed in accordance with the guidelines provided in Tables 5.2 through Table 5.8 (Robertson and Kirsten 1992)	Section 5.0
Inclusion of a fully developed closure cost estimate	Section 10
Re-vegetation where practical. Local arctic species and distributions should be considered	Section 5.2 Appendix D

TABLE B.10 GUIDELINES FOR ABANDONMENT AND RESTORATION PLANNING FOR MINES IN THE NORTHWEST TERRITORIES (NWT WATER BOARD, 1990)

Guideline Requirement	ICRP Location
Evaluation of ML/ARD potential for open pit, waste rock stockpiles and disturbed areas	Sections 3.2, 3.3 and Appendix D
Cover design for waste rock stockpiles, if required. Stockpiles should be designed and contoured to ensure stability.	Section 5.3.2
Re-vegetation of disturbed areas, where practical	Section 5.1 and Table 5.1
Open pit closure preferably backfilling or flooding	Section 5.3.1
Stability of open pit should be investigated	Section 5.3.1
Quarries should be backfilled and contoured to match the surrounding topography	Section 5.3.3
Removal of fuel and chemical storage tanks and associated piping and plumbing if applicable	Section 5.3.4
Fuel contaminated soils should be remediated	Section 5.3.7
Chemical storage facilities should be removed from site	Section 5.3.7
Soils surrounding chemical facilities should be tested for contamination and where present be removed from site	Section 5.3.4
Culverts should be removed from site	Section 5.3.8
Airstrips should be left intact, unless deemed unsafe	Section 5.3.5
Natural drainage should be restored to the site. Roads that do not impede the natural drainage may remain intact	Table 5.1
Solid wastes should be dealt with in responsible manner	Section 5.3.7
Hazardous wastes are to be disposed at an approved facility	Section 5.3.7
Buildings and structures should be removed from the site	Section 5.3.4
Concrete foundations may be left in a safe condition	Section 5.3.4
The Preliminary Closure Plan should include a planned shutdown/temporary closure scenario	Section 7.1
The Preliminary Closure Plan should include a long-term shutdown/Long-term Closure scenario	Section 7.3
The Preliminary Closure Plan should include a final abandonment/final closure scenario	Section 5.0
It is encouraged that site closure include phased plan development (progressive closure)	Section 6.0
A monitoring program should be devised to measure the effectiveness of the site closure	Section 9.0
Financial security is required for the closure phase	Section 10

Appendix C
Site Photos of Current Site Conditions

MINE SITE

Aerial View of Mine Site (September 2021)

Aerial View of Mine Site Bulk Fuel Storage Facility (MS-03) and Power Generation Facility (September 2023)

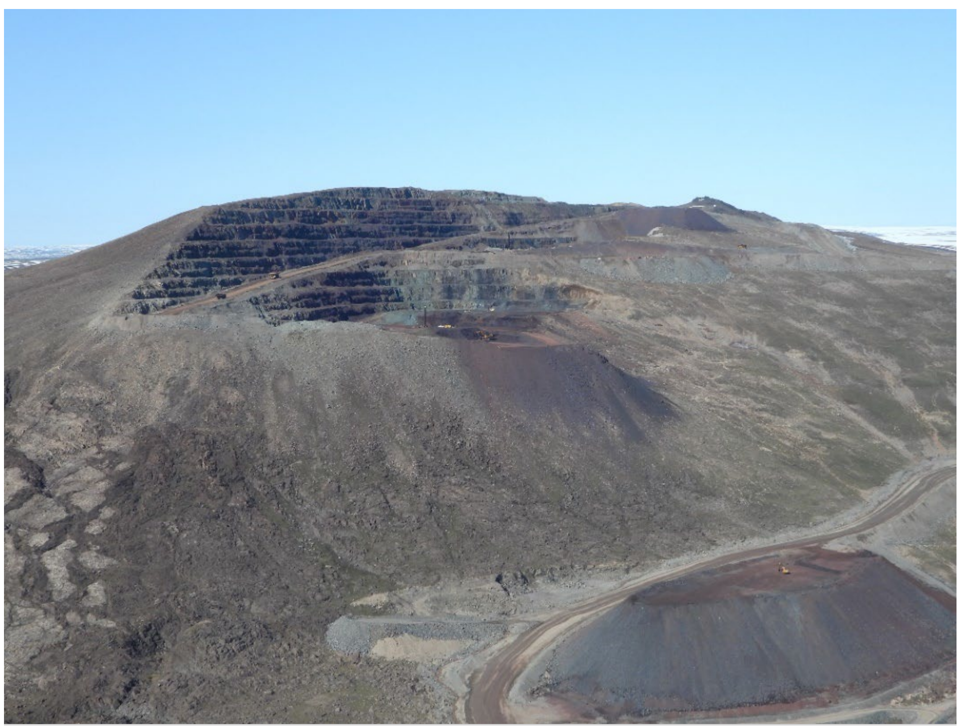
Aerial view of Mine Site Crusher Facility (September 2023)

Aerial view of Mine Site Complex (MSC) (July 2023)

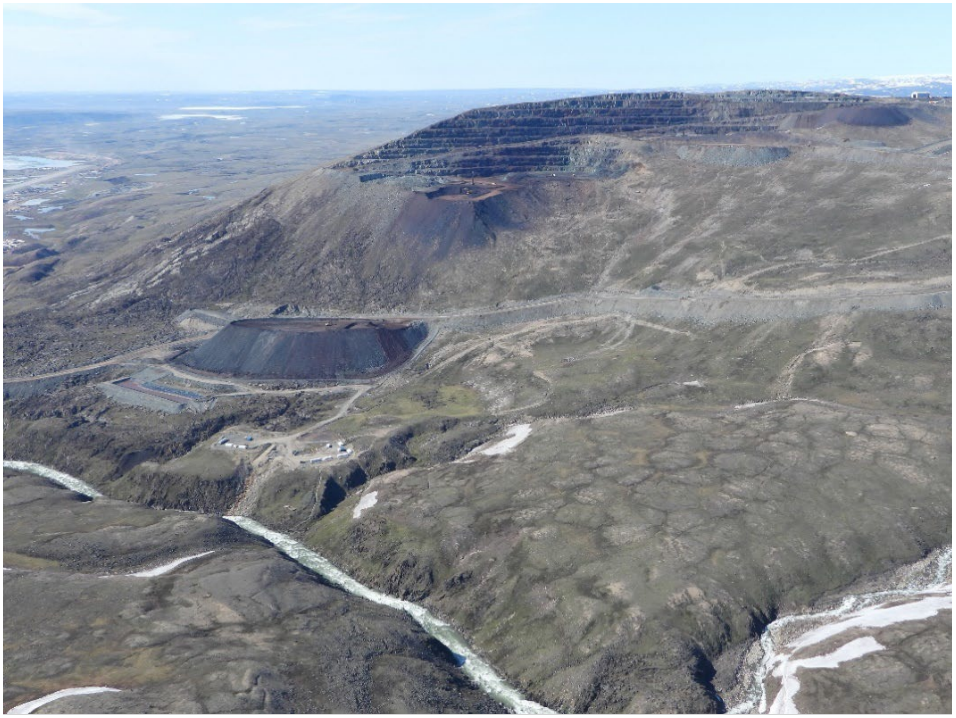
Aerial view of Mine Site Mobile Maintenance Buildings (September 2023)

Aerial view of Emulsion Plant (September 2023)

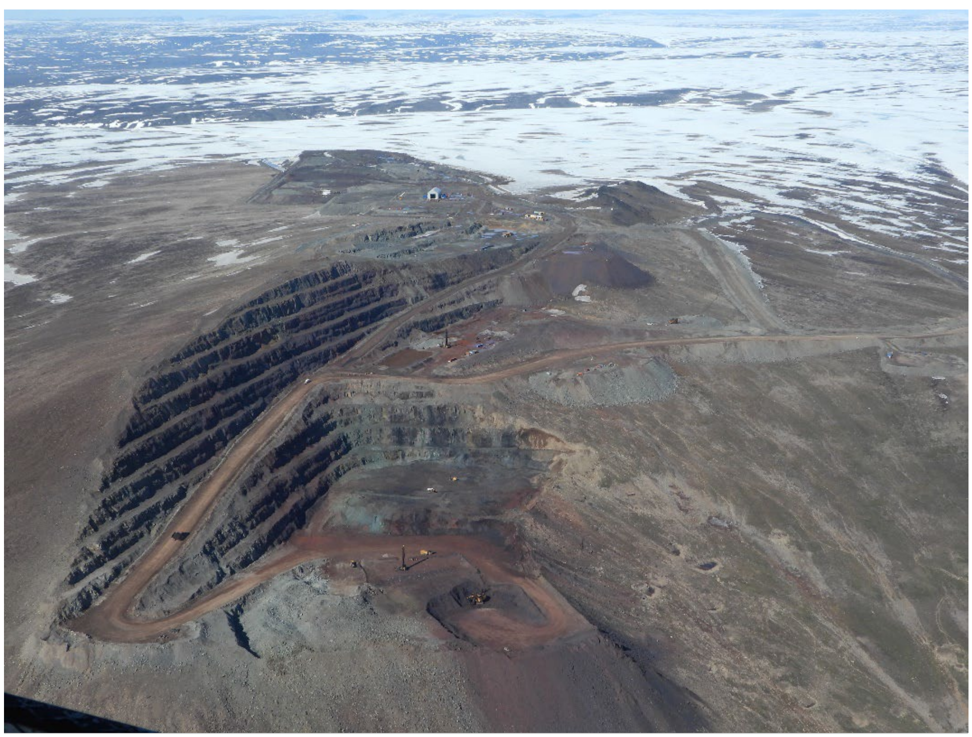
Aerial view of Sailivik Camp Complex (September 2023)



Aerial view of Deposit No. 1 (Nuluujaak Pit) (July 2023)

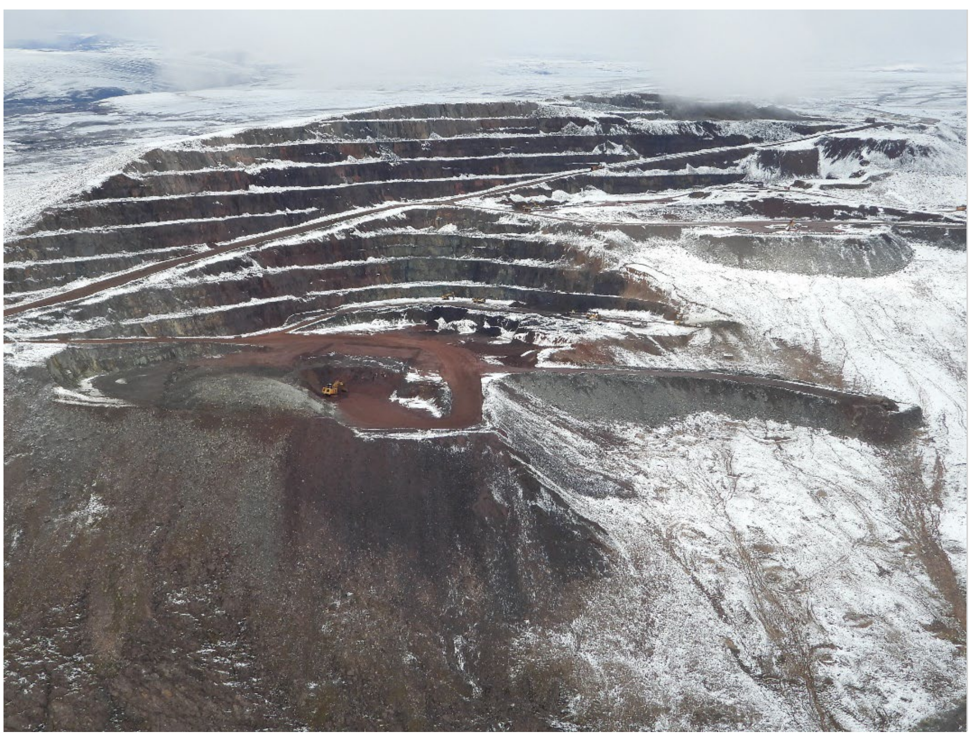


Aerial View of Deposit No. 1 (Nuluujaak Pit) (July 2023)



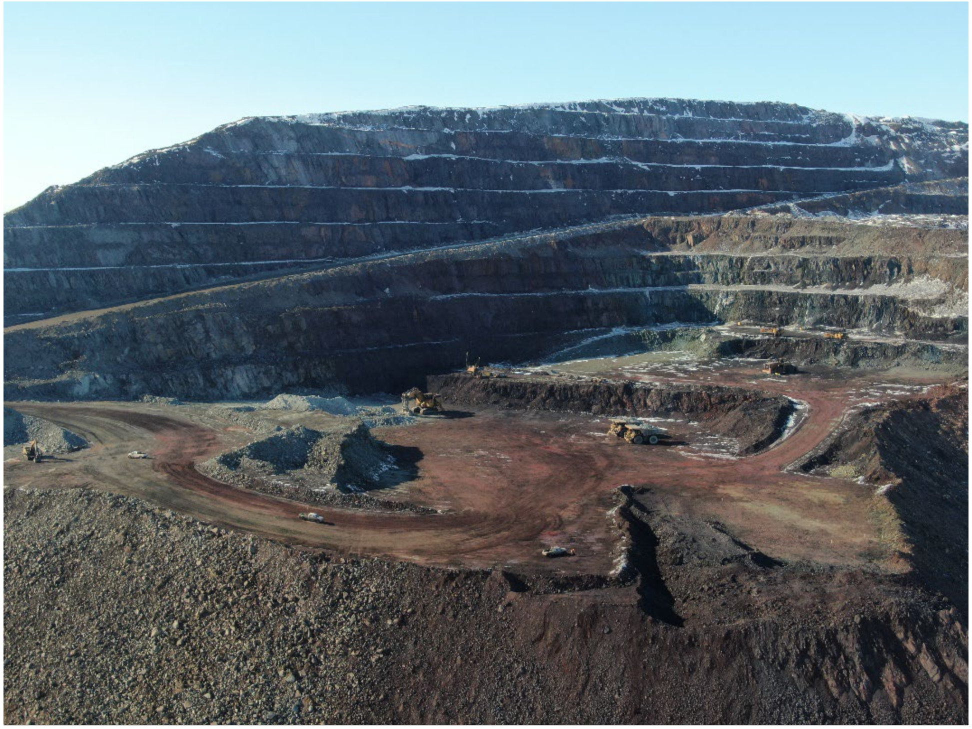
Aerial View of Deposit No. 1 (Nuluujaak Pit) and By-Pass Road (July 2023)

Aerial View of By-Pass Road (September 2023)

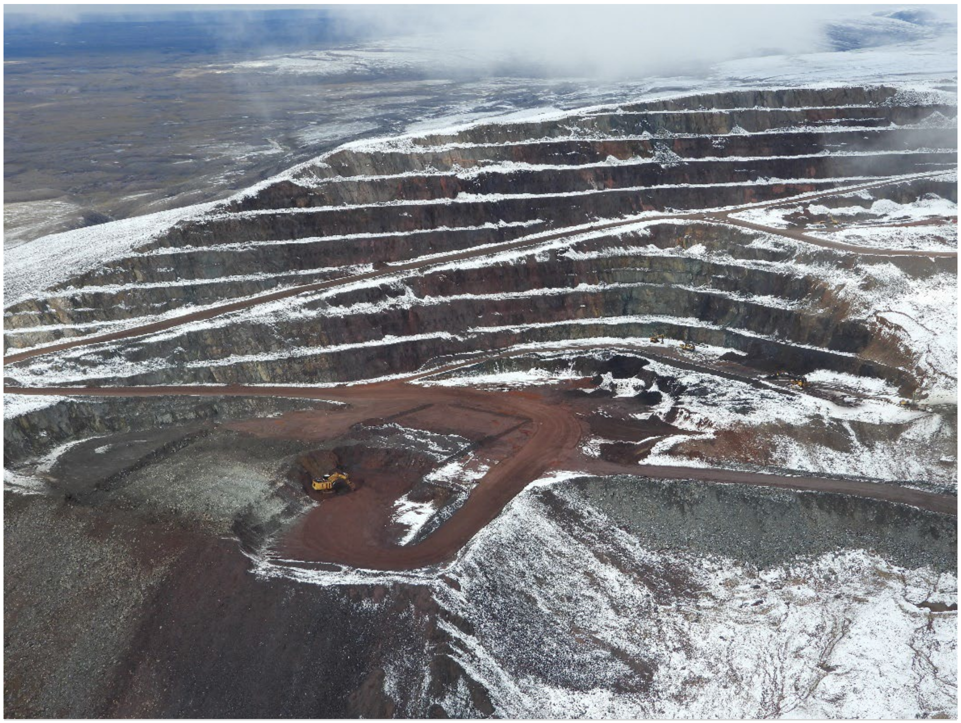


Aerial View of Deposit No. 1 Nuluujaak Pit Wall and Construction of 480 Hill Side Road (September 2023)

Aerial View of Deposit No. 1 Nuluujaak Pit Walls (June 2023)



Aerial view of Deposit No. 1 (Nuluujaak Pit) (May 2023)



Aerial view of Deposit No. 1 (Nuluujaak Pit) Walls (September 2023)

Water management at 570 Bench Laydown) (June 2023)

Aerial View of Cross-cut 570 Hill Side Road (July 2023)

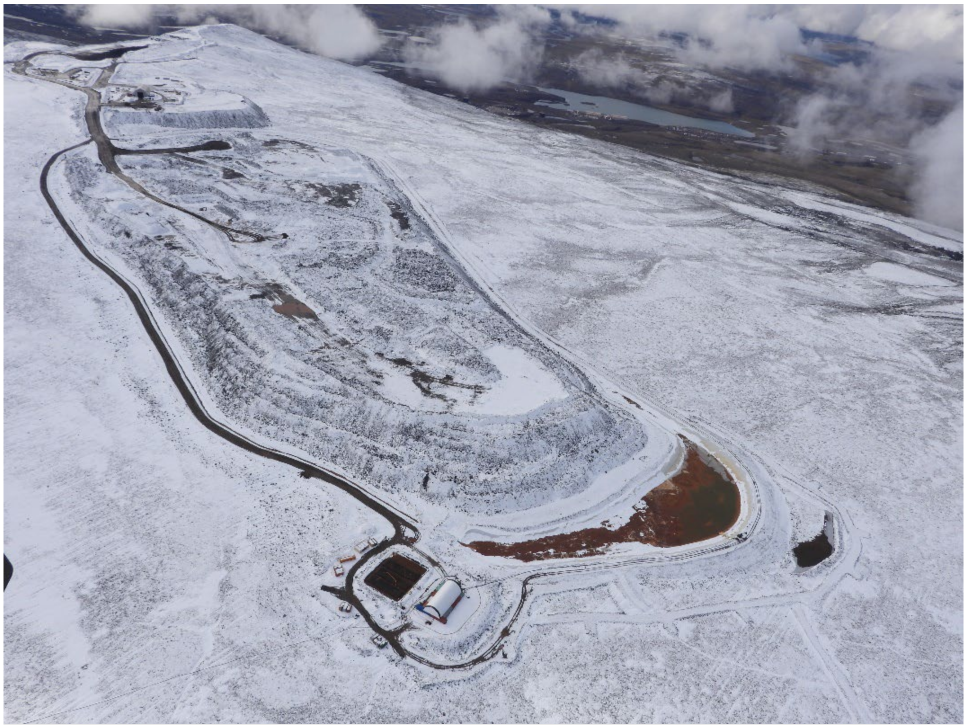
Aerial View of Run of Mine Ore Stockpile Facility (July 2023)

Aerial View of Run of Mine Ore Stockpile Facility (July 2023)

Aerial View of Waste Rock Facility (September 2021)

Aerial View of Waste Rock Facility (July 2023)

Aerial View of Waste Rock Facility Surface Water Management Pond (MS-08) (September 2023)



Aerial View of Waste Rock Facility (September 2023)

Mine Site KM105 Surface Water Management Pond (MS-11) (June 2023)

Aerial View of Mine Site KM105 Surface Water Management Pond (MS-11) (July 2023)

Construction of Geotube Pad at Mine Site KM105 Surface Water Management Pond (MS-11)) (August 2023)

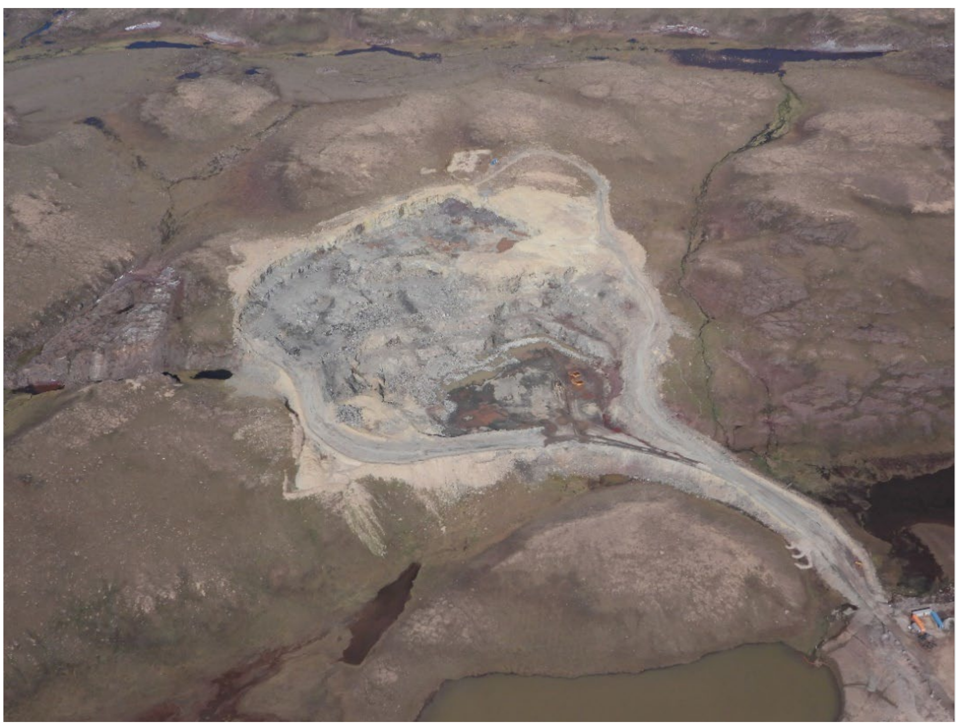
Aerial View of Magazine Access Road and Emulsion Storage (June 2023)

Aerial View of KM 104 Laydown(July 2023)

Aerial View of KM 104 Laydown (June 2023)

Aerial View of Mine Site Crusher Facility (July 2023)

Aerial view of Mine Site Non-Hazardous Waste Landfill and Landfarm Facility(September 2023)



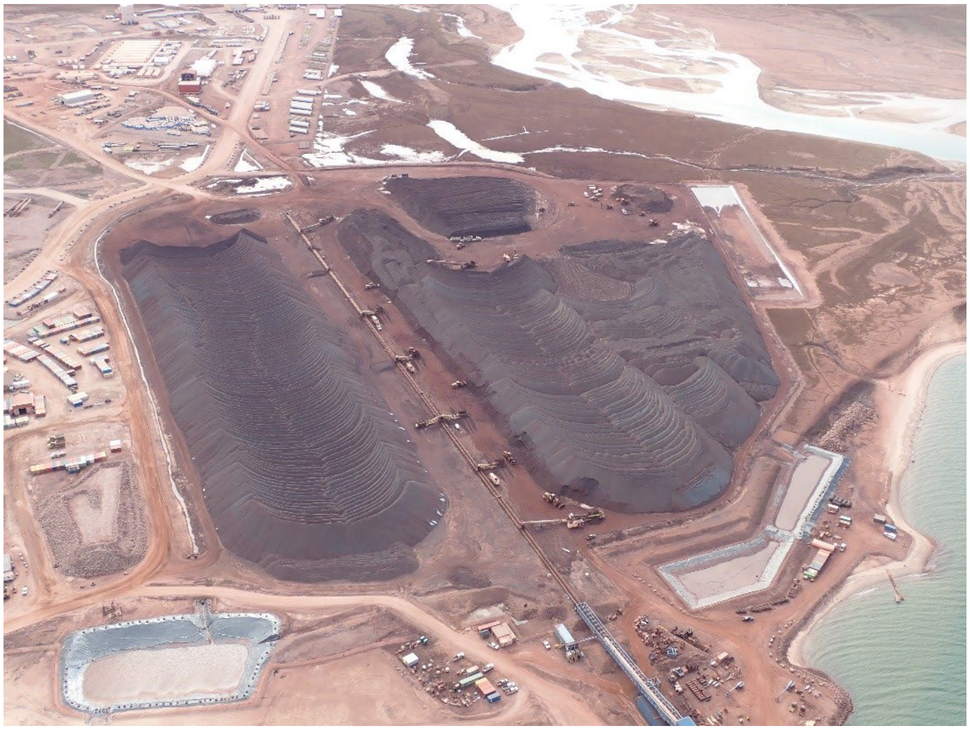
Aerial View of Mine Site Quarry (QRM2) (July 2023)

Aerial View of Mary River Airstrip (September 2023)

MILNE PORT

Aerial view of Milne Port (September 2023)

Aerial View of Ore Pad Facility (August 2023)



Aerial view of Ore Pad Facility (August 2023)

Aerial view of West Ore Pad Surface Water Management Pond (MP-06) (July 2023)

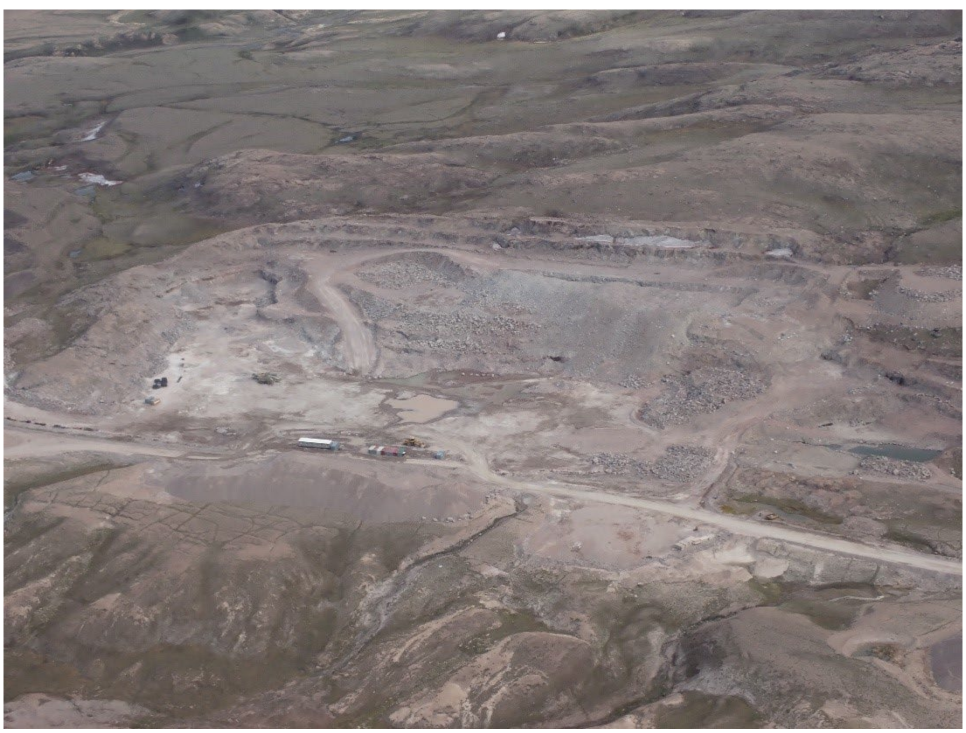
Aerial View of East Ore Pad Surface Water Management Pond (MP-05) (July 2023)

Aerial view of Freight Dock and B1 Pad (September 2023)

Aerial View of Bulk Fuel Storage Facility (MP-03) (August 2023)

Aerial View of Generators, Maintenance Shops, Incinerator Building and Port Site Complex (August 2023)

Aerial View of Polishing Waste Stabilization Pond (MP-01A) and Generators (August 2023)



Aerial View of Quarry (Q1) (July 2023)

Aerial View of the 380 Person Camp (July 2023)

Aerial view of Landfarm (MP-04) and Contaminated Snow Berm (MP-04A) (August 2023)

TOTE ROAD

Aerial view of KM97 Bridge Crossing (August 2023)

Aerial View of KM97 Laydown (September 2023)

Aerial View of KM80 Laydown and Bridge (September 2023)

KM80 Bridge Crossing (July 2023)

Aerial View of KM 63 Bridge (September 2023)

KM63 Bridge Crossing (July 2023)

Aerial View of KM17 Bridge with Flat Deck Truck Crossing (September 2023)

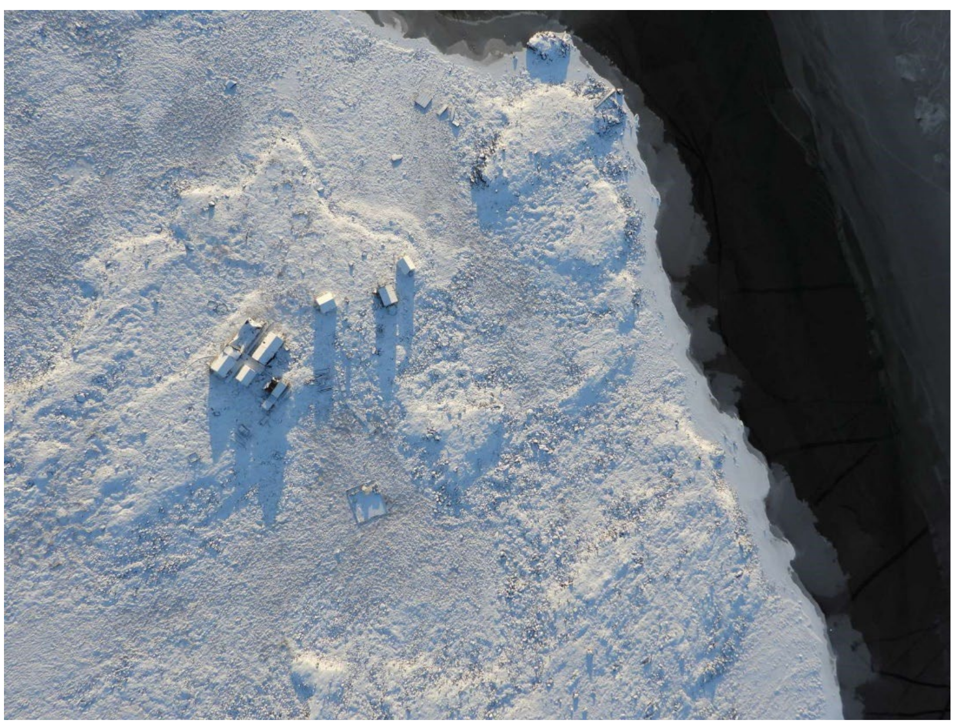
STEENSBY CAMP

Aerial view of Steensby Camp - unoccupied (July 2023)

Aerial view of Steensby Camp – unoccupied (July 2023)

MID-RAIL CAMP

Aerial view of Mid-Rail Camp – unoccupied (September 2021)



Aerial view of Mid-Rail Camp – unoccupied (October 2023)

Appendix D
Reclamation Research Plan

Appendix D1
Reclamation Research Program - Open Pit Runoff Water Quality

D1 RECLAMATION RESEARCH PROGRAM - OPEN PIT RUNOFF WATER QUALITY

D1.1 BACKGROUND

This research plan outlines the schedule and pathway for assessing technical uncertainties and informing the ongoing development of the closure and reclamation plan specific to assumptions and planning regarding pit water runoff quality at closure. Items related to permafrost, hydrology and pit infilled are defined with Appendix D2 of this ICRP.

At the end of mining, the open pit will gradually fill with water from precipitation; the timeline for this to occur passively is estimated at 85 to 150 years, depending on annual precipitation, evaporation and other factors (Knight Piésold, 2008). Baffinland has since committed to reducing this time period using alternatives for enhanced flooding of the open pit (addressed under the "Open Pit Flooding Timeline" research program, Appendix D2).

AMEC (2012) developed water quality estimates for pit water for the final year of mining (Year 21), which were utilized as input in the water quality mass loading model under the assumption that, once the pit has filled, in each subsequent (post-closure) year all precipitation into the open pit will accumulate and that excess water will discharge via a spillway during the open water period according to the natural hydrograph.

The mass loading modelling indicated that Level I magnitude effects to water quality will occur under low flow conditions, with a calculated HQ between 1 and 10 for mercury, selenium and silver. It is noted that an HQ >10 was calculated for mercury within the F0 tributary, upstream of fish presence or habitat; however, since the assessment of water and sediment quality is based on fish as the receptor, the effects assessment considers the resultant water quality at fish habitat within the Mary River, where all parameters have an HQ value less than 10.

Based on pit water quality for Year 21 of mining, it is possible the water will have a pH of around 4.2, which is outside of the pH range of the MDMER (6.0 to 9.0) however the mass loading modelling carried out is based on conservative assumptions and Baffinland is continuing to study the geochemistry of waste rock and ore to further refine predictions and management plans, which this research plan outlines.

D1.2 UNCERTAINTY

Due to the early stage of project development and the fact only conceptual geochemical modelling (mass loadings assessment) has been completed to date, there is uncertainty with respect to the open pit water quality predictions.

Inflows to the open pit include: direct precipitation, runoff, groundwater inflow, and any enhanced flooding flows. Outflows include evaporation/sublimation, groundwater seepage discharge, and overflow discharge (once fully flooded). Chemistry of water in the open pit will be influenced by both the chemistry of the inflows, as well as the pit walls, residues from the mining process (blasting, etc.), and seasonal or temporary stratification of the water column into waters of differing chemistry and temperature (such as a chemocline or thermocline) that may be affected by bathymetry, climactic conditions, quality and temperature of inflows, wind, influence of permafrost, ice over (formation) and ice off (melting).

D1.3 RESEARCH/STUDY OBJECTIVE

This research plan aims to:

- improve predictions for water quality within the open pit during flooding operations and to inform decision making with respect to enhanced flooding alternatives, and
- to improve long-term water quality predictions for open pit (pit lake) effluent flows with respect to meeting applicable closure objectives and criteria in Post-Closure, and to assess the effectiveness of water treatment options in modifying open pit runoff water quality, if necessary.

D1.4 OVERVIEW OF TASKS AND PROJECT RESEARCH SCHEDULE

Deep pit lakes are often subject to a stratification of the water column into waters of differing chemistry typically due to strong density gradients within the water due to salinity or temperature. While permenant stratification of the pit lake can result in the long-term storage of salts within the pit, a seasonal turnover of the lake could result in poor water quality conditions at certain times of the year.

Based on the predicted water quality within the lake and data collected from the site weather station, an assessment will be carried out to evaluate if the pit lake will likely be meromictic or if it will become seasonally stratified. In support to this evaluation, a focused review of scientific literature relating to meromictic pit lakes in cold regions was carried out. Further, analyses of the temperature gradients, wind conditions, precipitation, groundwater inflows, and other conditions will be carried out as site conditions allow (i.e. presence of an open pit) to evaluate the likelihood of the pit lake becoming stratified and subsequently becoming mixed.

The following are an overview of the anticipated tasks required to obtain the study objectives; the objectives are general in nature and not explicitly linked to the tasks below. An indication on status of each task is provided and when warranted, anticipated commencement and/or conclusion dates. The anticipated timelines to complete Tasks D1.1 to D1.4 are presented in Table D1.1.

TABLE D1.1 OVERVIEW OF TASKS FOR RECLAMATION RESEARCH - OPEN PIT RUNOFF WATER QUALITY

Task #	Task	Reference Document	Status Anticipated Start and/or End Date
1.1	Establish initial water quality predictions and review relevant baseline conditions	FEIS Volume 7, Section 3.4 (Baffinland, 2012)	Completed
	Conduct literature review and analyze long-term predicted conditions to assess if permanent meromictic conditions are anticipated. - Should long-term meromictic conditions be anticipated, this characteristic should be incorporated into the open pit predictive water quality model. - Should it be possible to create long-term permanent meromictic conditions in the open pit, designs should be developed so that these measures could be incorporated into the ICRP if justified.	Golder, 2021	Completed
	Collect site weather data at the top of Deposit No. 1	Golder, 2021	Ongoing

Task #	Task	Reference Document	Status Anticipated Start and/or End Date
1.2	Monitor water quality within the open pit, runoff to the open pit, groundwater surrounding the open pit, and other inflows to the open pit. Water quality data should be compared against the assumptions made in the initial water quality predictions. Follow up investigation of unknown sources of contaminants may be required. Results and collected data are to be presented in the research program progress reports within the annual report.	N/A	Onset of open pit dewatering activities to end of Project life
1.3	Update the water quality predictive model and compare against the criteria set out in Table 5.1 within the FEIS. - Modelling will include an assessment of the influence of filling time on open pit water chemistry. (see *Appendix D2 - Open Pit Flooding Timeline*). - The development of source terms for the model (including pit wall geochemical parameters and inflow water quality) will be developed as part of this modelling exercise - A risk assessment will be completed assessing the risks to wildlife from incidental contact with the pit water at predicted concentrations Use the updated water quality predictive model to develop the following scenarios: - Operational water quality predictions for the next 5 years - Early closure scenario in the next five years. - Final closure scenario	N/A	Not less than five years prior to the start of pit development for operational and early closure scenarios. Final pit closure scenario developed by 2034.
1.4	If required, suitable contingencies should be identified and assessed for addressing long-term water quality.	N/A	Within 1 year of updating the water quality predictive model (only if required)

D1.5 DETAILED DESCRIPTION OF TASKS AND FINDINGS OF RESEARCH COMPLETED

D1.5.1 COMPLETED RESEARCH

TASK 1.1 - PIT LAKE MEROMIXIS

Golder (2021) completed a literature review of pit lakes in northern climates. The scope of work included:

- Reviewing Baffinland's current ICRP and the planned closure scenario for the open pit
- Literature review for other examples of northern climate pit lakes and proposed pit lakes
- Provide a high-level summary of factors to consider with respect to developing meromictic conditions within the pit lake in post-closure

- Recommend data collect and studies that could be completed during operations to further the understanding of pit lake conditions in post-closure at the Project

The literature review identified a previous study reviewing results from six pit lakes in northern Canada (Pieter and Lawrence, 2014), as well as pit lake predictive water quality modelling conducted by Golder for pits at the Ekati and Diavik mines (Northwest Territories) and the Meadowbank mine (Nunavut).

The Pieter and Lawrence (2014) study included three pit lakes at the Faro mine site (Yukon), two pit lakes at the Equity Silver Mine (Northern BC), and the Zone 2 pit lake at Colomac mine (Northwest Territories). The purpose of their review was to illustrate a variety of observed pit lake behaviour and factors that promote or inhibit meromictic conditions. Of the six pit lakes studied, two showed meromictic conditions of varying degree (Faro and Waterline) while the other four pit lakes were weakly stratified because of varying factors such as groundwater inflow (Zone 2), ongoing sludge and water management at site (Main Zone and Vangorda) and pit slope stability (Grum).

Golder's predictive modelling results for the three NWT/Nunavut pit lakes suggested that the pit lakes would fully mix at least once per year in the spring (some also in the fall) and to show weak meromictic conditions in the summer and winter months. This is a result of hydraulic connection between multiple pits, proximity to surface water bodies and consolidation of waste deposited at the bottom of the pits.

Pit lakes differ from natural lakes due to their small surface area, greater depth and typically brackish water which can result in the formation of permanent stratification known as meromixis (or meromictic conditions). Meromictic conditions form when the deeper water in the pit lake becomes sufficiently dense than surface waters to inhibit mixing of the water column, usually due to higher salinity water at depth. The separation between the upper less saline water (mixolimnion) and deeper more saline water (monimolimnion) is referred to as the chemocline. Even if meromictic conditions form, there is still the possibility of mixing or turnover within pit lakes. Factors that can enhance stability of meromictic conditions include:

- The relative depth of the pit lake (maximum depth divided by diameter of surface area)
- Pit lake salinity and ice cover
- Inflow salinity and volume

For most of the pit lakes presented in Pieters and Lawrence (2014), salinity stratification was predominantly driven by ice-melt and runoff. When surface water freezes, salt dissolved in the water is largely excluded from the ice. This can result in a density contrast between the ice-melt water in the spring and the underlying deep water which can promote and stabilize meromictic conditions within pit lakes.

Salinity of runoff and groundwater inflow can also influence meromictic conditions and either increase or decrease stability of meromictic conditions depending on salinity of these inflows. This is shown in both the Pieters and Lawrence (2014) existing pit lake examples and in the modelled predictions presented in Golder (2018a, 2018b, 2019) where inflows, and even hydraulic connections between multiple pit lakes, can influence the development and strength of meromictic conditions.

Factors that can induce mixing within pit lakes, which weakens meromictic conditions, includes processes such as wind strength and direction, cooling of surface water and ice formation. During ice-free seasons, wind and surface cooling can drive upwelling or deeper mixing zones within pit lakes. Ice formation can weaken meromictic conditions if sufficient salt is excluded from the ice to raise salinity within the upper portion of a pit lake to similar concentrations as deeper parts resulting in mixing/turnover of the pit lake.

In summary, there are many factors to consider when assessing whether, and how strongly, meromictic conditions may develop within a pit lake. Information required to complete an assessment prior to closure can be collected from a site as the open pit is developed. Predictive modelling can then be completed using collected site data to help inform closure options.

The results of the literature review show that development of meromictic conditions can occur at northern Canadian sites depending on the site-specific conditions.

Recommended further studies:

- Further studies of site conditions should be completed to further assess the potential formation of meromictic conditions within the flooded pit post closure. Topography, pit bathymetry/dimensions, temperature, and wind direction/speed play a critical role in understanding potential for pit lake turnover and development of meromictic conditions.
- On-site data should be collected in the vicinity of the open pit and must include site weather, wind conditions, precipitation, and groundwater inflows and water quality to the open pit during operations. Ongoing geochemical characterization of waste rock can be used to understand the potential influence of the exposed pit walls on water quality at closure and during filling of the open pit at closure. This information will also support alternative pit filling strategies.
- Data collected from the on-site monitoring and geochemical characterization can be used to develop hydrodynamic and water quality models to predict pit lake stratification and water quality post-closure. These models would benefit from data and observations once the open pit has been developed and therefore, it is recommended that these tasks be initiated only after mining has progressed to a stage where the open pit has been at least partially developed.

D1.5.2 PROPOSED RESEARCH TASKS 1.2 TO 1.4 - OPEN PIT WATER QUALITY RESEARCH RESULTS

No results have been provided yet as the mine has not advanced into the open pit stage. Ore has, to date, been extracted from the hillslope, rather than the future open pit. The following provides a detailed description of the work scheduled to be completed.

TASK 1.2 - WATER MONITORING AND COMPARISON AGAINST WATER QUALITY PREDICTIONS

The quality and flow of key inflows to the open pit should be monitored (or otherwise estimated) and compared against water quality predictions.

It is, however, not advised that runoff from the pit walls is used as an analogue for future water quality in the open pit. The chemistry of the pit wall runoff will differ from the longer-term pit wall runoff with respect to the proportions of various rock types that comprise the pit walls, the degree of weathering of those faces, and that samples will likely be impacted by other (potentially significantly larger) open pit inflows.

Current mining activities have not yet created a pit at Deposit No. 1, and the active mining area remains a hilltop outcrop. No additional information is available at this time to update the estimated fill time of the mine pit lake. A reclamation research program to evaluate the open pit flooding timeline is outlined in Appendix D2, however Tasks 1.1 and 1.2 under this program cannot be completed until an open pit has formed and active dewatering is occurring.

It is anticipated that the comparison of water quality monitoring results against water quality predictions will occur starting in 2034, when the development of the initial pit water quality model is complete. It is planned that a detailed comparison will occur every 5 years, ideally in conjunction with the development of the ICRP and milestone security estimate. It is possible this timing may be adjusted as the model is developed (as described in the following task) depending on model results and feedback from regulators, landowners and stakeholders.

Should the measured chemistry or flow of any of the key pit inflows deviate significantly from predicted values over a 5-year basis, the water quality prediction model will be updated in light of the results of water quality modelling, and updates to the mine plan or geochemical analyses.

TASK 1.3 - UPDATE WATER QUALITY PREDICTIONS

Updating the water quality prediction requires the mine to be at a stage of development where representative field data can be collected to develop models and closure prediction scenarios. The following work is scheduled to be undertaken in conjunction with key mine development milestones (pit development initiation). The full schedule is available in Appendix D7, and consists of the following steps:

1. Development of pit source terms (completed by 2027)
2. Development of a predictive water quality model by 2029 (5 years prior to pit development). This model will predict operational water quality and "early closure" scenario water quality to support closure plan development. This model will assess the impacts of predicted water quality on wildlife that may interact with the pit lake.
3. Development of a predictive water model for final pit closure (model development initiated by 2030, completed by 2034)

These models will be used to inform security costing, pit development and water treatment (if required).

TASK 1.4 - WATER TREATMENT OPTIONS ANALYSIS

Water treatment alternatives will be considered if it is found that the predicted water quality in the Pit Lake (at initial discharge, or long term) is not anticipated to meet effluent water quality.

D1.6 LINKAGES TO OTHER RESEARCH/STUDIES

This research will be linked to the research being completed regarding pit flooding timelines. Findings of waste rock stockpile runoff water quality reclamation research (Appendix D3) will be considered. Updates on prediction of open pit runoff water quality will be provided in future updates of the ICRP.

The full schedule for undertaking this work is contained with Appendix D7 of the ICRP.

D1.7 COSTS

Cost are to be determined as scoping is still being undertaken.

D1.8 REFERENCES

AMEC, 2012. Interim Mine Rock ML/ARD Report, Mary River Project, January 2012.

Baffinland Iron Mines Corporation, 2012. Mary River Project – Final Environmental Impact Statement. February 2012.

Golder Associates Ltd (Golder), 2018a. *Diavik Mine – Water Quality Modelling of A418, A154 and A21 Mined Out Pits*.

Golder Associates Ltd (Golder), 2018b. *Ekati Mine – Hydrodynamic and Water Quality Modelling of Panda, Koala, and Koala North Pit*.

Golder Associates Ltd (Golder), 2019. *Whale Tail Pit Expansion Project Hydrodynamic Modelling of Whale Tail Pit Lake*.

Golder Associates Ltd. (Golder), 2021. Technical Memorandum: *Baffinland Iron Mines Mary River Project: Pit Lake Literature Review*. Ref. No. 20446413-10000-Rev0, March 15.

Knight Piésold Ltd. (KP), 2008. Memorandum: *Mary River Project - Estimated Time for Open Pit to Fill with Water (Deposit No. 1)*. Ref. No. NB08-00868, September 8.

Pieters, R., and Lawrence, G.A., 2014. Physical processes and meromixis in pit lakes subject to ice cover. *Can. J. Civ. Eng.* **41**: 569–578 (2014). Available at: https://doi.org/10.1139/cjce-2012-0132.

Appendix D2

Reclamation Research Program - Open Pit Flooding Timeline

D2 RECLAMATION RESEARCH PROGRAM - OPEN PIT FLOODING TIMELINE

D2.1 BACKGROUND

Based on passive inflows alone (seepage into the pit, direct precipitation, and surface runoff), it is anticipated that the open pit will take an estimated 85 to 150 years to passively fill (Knight Piésold, 2008). The flooding of the open pit could be accelerated by pumping water from a nearby water source (i.e. accelerated flooding). At a conceptual level, four potential water sources have been identified: Sheardown Lake, Camp Lake, Mary Lake, and Mary River. It was estimated that withdrawal from these sources could reduce the flooding time to as little as 2 years (based on a total withdrawal of 10% of the annual volume, although this would require very specific and ideal conditions to achieve. Section 5.3.1.4 presents some preliminary assumptions and calculations regarding the enhanced pit infilling alternative. As active mining at Deposit 1 remains a hilltop outcrop, and development of an open pit is not anticipated until at least 2034 (based on current development), refinements of the feasibility of potential pit filling scenarios will be provided in future versions of the ICRP based on outcomes of reclamation research and studies prior to the development of the open pit.

D2.2 UNCERTAINTY

With respect to natural, passive flooding, the rate of groundwater inflow is the primary source of uncertainty with respect to open pit flooding time prediction.

With respect to the enhanced flooding schemes, the primary source of uncertainties are:

- the chosen methods of pumping and water withdrawal;
- the maximum permissible rate of water taking from the water sources; and
- the practical limits of pumping water from those sources to the open pit (feasibility and financial viability).

The potential impacts of pit infilling on the permafrost regime in the local area is a source of uncertainty that is relevant to natural pit infilling as well as enhanced flooding scenarios.

D2.3 RESEARCH/STUDY OBJECTIVE

The goal of this program is to better assess the timelines for open pit flooding for both natural flooding and the enhanced pit infilling alternative and develop a flooding program that will meet closure objectives and criteria in post-closure within an appropriate timeline relative to the proposed monitoring.

D2.4 OVERVIEW OF TASKS AND PROJECT RESEARCH SCHEDULE

Pit infilling time is a key parameter that affects proposed closure scenarios and timeline. There have been two pit infilling scenarios, a passive groundwater filling scenario and an active pump based infilled scenario in which nearby water bodies would be used as a water source to accelerate pit infilling. To ascertain which of these methods is better suited to the proposed reclamation plan, a research program will be undertaken to understand the preferred infilling method. The key tasks of the program are as follows:

- Updating the accuracy of the open pit flooding timeline under passive conditions.
- Assessing the potential water sources for enhanced pit infilling in greater detail and increase the accuracy of the enhanced pit infilling timelines.
- Enhancing the understanding of the impacts of the pit flooding time on the overall closure plan and monitoring timeline.
- Understanding the potential impacts of pit flooding on the permafrost regime near the pit.

The following are an overview of the anticipated tasks required to obtain the study objectives; the objectives are general in nature and not explicitly linked to the tasks below. An indication on status of each task is provided and when warranted, anticipated commencement and/or conclusion dates. The anticipated timelines to complete anticipated tasks are presented in Table D2.1.

TABLE D2.1 OVERVIEW OF TASKS FOR RECLAMATION RESEARCH – OPEN PIT FLOODING TIMELINE

Task #	Task	Reference Document	Status Anticipated Start and/or End Date
2.1	Establish initial flooding time estimates.	KP, 2008	Completed
	Monitor mine dewatering flow rates.	N/A	(2034-Life of Project)
	Use mine dewatering flow rates to update mine flooding model to estimate passive (natural) flooding time.	N/A	Initial assessment in 2036, follow-up assessment in 2039 and every 5 years thereafter.
2.2	Assess regional hydrology flows and retention times in each potential water source.	N/A	Completion in 2029
	Evaluate maximum allowable water taking with respect to protection of aquatic life.		
	Feasibility assessment of practicability of pumping from each water source.		
	Estimated flooding times from each water source to be updated using mine flooding model.		
2.3	Review the impacts of natural and enhanced open pit flooding on the mine closure activities and monitoring with MCWG.	N/A	Task to commence following completion of Task 2. Estimated length of 2 years
2.4	Assess the impacts of pit flooding on the permafrost regime surrounding the pit.	N/A	Task to commence following completion of Task 2. Estimated length of 2 years

D2.5 DETAILED DESCRIPTION OF TASKS AND FINDINGS OF RESEARCH COMPLETED

D2.5.1 COMPLETED RESEARCH

Initial predictions for filling times (natural and enhanced) have been previously estimated, as described in Section 5.3.1.4. As the pit will not be formed until 2034 and no significant dewatering has yet occurred, research has yet to be completed for this closure item. Additional research that is to be carried out will be reported in the QIA-NWB Annual Report for Operations and in future updates of the ICRP.

D2.5.2 PROPOSED RESEARCH TASKS 2.1 TO 2.4 – OPEN PIT FLOODING/FILLING RESEARCH RESULTS

The following provides a detailed description of the work scheduled to be completed.

TASK 2.1 - PIT FLOODING TIMELINE PREDICTIONS (PASSIVE CONDITIONS)

To better understand the rate of natural flooding of the open pit, pit dewatering flows (monthly volumes) will be recorded throughout operations to provide an estimate of the overall net inflows to the open pit, including all inflows (groundwater inflow, direct precipitation, and runoff) and outflows (evaporation and seepage).

It was previously estimated that natural flooding would take between 85 and 150 years (Knight Piésold, 2008). Using the open pit dewatering flows as a basis of calibration, this estimate can be refined at a later time.

To complete this task, pumping records and data from the site weather station will be recorded during operations. The pit flooding model will then be updated with acquired site data.

TASK 2.2 - ASSESSMENT OF POTENTIAL WATER SOURCES / ENHANCED FLOODING

Assisted pit filling is governed by two parameters – technical limitations that drive pumping costs, and water source locations/drawdown limits. Costs are driven by materials and equipment required for the operation (e.g., heat traced- piping, pumps, generators, and fuel requirements) as well as the construction and maintenance of the necessary roads and berms. Pumping water to the pit is uphill and therefore significant elevation head will provide technical challenges to any pumping design. Water source drawdown limits are designed to ensure that the volume of water extracted from a given source has minimal impact on the aquatic ecosystem. Key factors to consider when calculating maximum acceptable drawdown of a lake include issues such as the potential disturbance of spawning habitat, as well as the residency time of the water body.

To better understand alternatives for enhanced pit filling, the following steps are planned:

- A desktop review of regional hydrological and potential spawning habitat data will be conducted to support the development of waterbody-specific assessments for the maximum allowable water taking rate
- a feasibility level engineering assessment will be carried out for pumping water from each of the potential water sources to confirm the feasibility of each alternative
- the estimated flooding times will be updated for each enhanced flooding scenario

TASK 2.3 - ENHANCING THE UNDERSTANDING OF THE IMPACTS OF THE PIT FLOODING TIME ON THE OVERALL CLOSURE PLAN AND MONITORING TIMELINE

Following the completion of Tasks 2.1 & 2.2, the integrated schedule of closure activities would be reviewed considering the updated natural and enhanced flooding scenarios and summarized for discussion with the Mine Closure Technical Advisory Group (MCTAG). The flooding timeline would also impact post-closure monitoring durations at the open pit and down gradient areas.

TASK 2.4 - UNDERSTANDING THE POTENTIAL IMPACTS OF PIT FLOODING ON THE PERMAFROST REGIME NEAR THE PIT

The topic of the impacts of flooding on the pit (either passive or active) has been raised during discussions with regulators, landowners and stakeholders. It is possible that flooding could have impacts on permafrost, so to investigate these potential impacts Baffinland is proposing a multi-step research program to determine the factors in play and how each flooding scenario (including after the pit lake is stable) interacts with permafrost at the areas adjacent to the pit site. It is anticipated that this program will consist of the following steps:

- A literature review of applicable papers and site information to inform the assessment of flooding on permafrost within the pit area.
- A qualitative assessment of selected closure scenarios on permafrost regimes.
- If required, design and conduct a quantitative assessment of the potential impacts of permafrost regime. This could include the following:
  - Installation of additional thermistors
  - Development of a thermal model

It is anticipated if a more quantitative assessment is required the research design will be determined utilizing the results from the studies within Appendix D1 related to pit water quality and weather conditions.

D2.6 LINKAGES TO OTHER RESEARCH/STUDIES

This research will be linked to the research being conducted on open pit water quality as described in Appendix D1.

D2.7 COSTS

Costs are to be determined as scoping is still being undertaken.

D2.8 REFERENCES

Knight Piésold Ltd., 2008. Technical Memorandum: *Mary River Project – Estimated Time for Open Pit to Fill with Water (Deposit No. 1)*. Ref. No. NB08-00868, September 8.

Golder Associates Ltd. (Golder), 2021. Technical Memorandum: *Baffinland Iron Mines Mary River Project: Pit Lake Literature Review*. Ref. No. 20446413-10000-Rev0, March 15.

Appendix D3
Reclamation Research Program -
WRF Seepage/Runoff Water Quality

D3 RECLAMATION RESEARCH PROGRAM - WASTE ROCK FACILITY SEEPAGE/RUNOFF WATER QUALITY

D3.1 BACKGROUND

The areas under consideration for the purposes of this research program include:

- Waste rock stockpile (referred to as the Waste Rock Facility, WRF)
- Perimeter ditch system around the WRF
- WRF Pond

Runoff from the WRF is collected by the perimeter ditches and directed towards the WRF Pond for management. An additional inflow from the Deposit 1 sump is pumped to the WRF Pond.

The Water Treatment Plant (WTP) is not included in the current evaluation, however the results of the research program will provide insight as to what if any water treatment may be required, and the duration of this treatment.

Geochemical characterization of the WRF was initially provided in the Final Environmental Impact Statement (FEIS) (AMEC Environment & Infrastructure, 2012) with subsequent evaluation completed as described in WSP, 2024. The results of the geochemical assessment indicate that, in the absence of appropriate mitigation, a small proportion of the rock has potential for generation of acidity through oxidation or release of acidity through dissolution of soluble sulphate minerals. For this reason, PAG waste rock, and non-PAG waste rock are handled as separate streams and are placed in zones within the Waste Rock Facility. PAG material will be effectively encapsulated in non-PAG material and frozen.

In order to mitigate oxidation and subsequent release of acidity and metals, the deposition strategy for the waste rock area is to promote permafrost aggradation. 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 which is subject to seasonal freeze-thaw. Further, based on the geochemical characterization the closure strategy has been refined to focus on thin-lift deposition in the WRF to promote rapid freezing (within two summer seasons). This is expected to limit migration of water and metals from the pile. Following closure, generation of ML/ARD is not anticipated. Some seepage and drainage is still anticipated to discharge from the active layer and from portions of the waste rock pile where permafrost aggradation may not have occurred.

D3.2 UNCERTAINTY

The focus of this reclamation research program is on addressing the physical aspects of the WRF with respect to further understanding and refining water quality from the WRF at closure. Aspects of this program have been underway for several years. Water quality monitoring of seepage from the WRF has been ongoing since 2015. In lieu of developing a field test pad and additional humidity cell testing it was determined that detailed study of the existing WRF would provide substantial additional field-scale information better than what could be determined through field-scale test pads. As such, a detailed waste rock evaluation program is ongoing and includes thermal monitoring, water quality monitoring, geochemical testing and waste placement tracking as is summarized in WSP 2024. A water balance was prepared in 2019 (Golder 2019a) to estimate surface water flows generated over the WRF footprint for the period of January 2020 – September 2021 and provided inputs to the WRF water quality model (Golder 2019b). Baffinland has gained some experience at this point with operation of the facility and resultant water quality. An update to both the water balance and water quality model was completed in 2023 (WSP 2024).

There remains a level of uncertainty as to the final composition of waste rock within the WRF over the life of mine; the composition may vary with respect to the proportion of waste rock by lithology, geochemistry, and the associated seepage/drainage conditions. Climactic conditions as well as thermal conditions within the pile can affect the rate of chemical release and reactions, permafrost development creating low permeability conditions in an otherwise free draining media. The wetting-up time may impact the time for precipitation to report as seepage.

To further refine the closure strategy and better understand implications with respect to water quality the following uncertainties are to be considered as part of this research plan:

- Implications of thin lift deposition on thickness of the active zone and timing of freezing of materials
- Influence of oxidation on upper active zone on downstream water quality under the updated mitigation conditions
- Influence of open pit pumping and runoff on pond water quality
- Influence of climatic conditions and flows on water quality
- Influence of updated geochemical source terms on water quality

There is uncertainty with respect to the results from the modeling, and further uncertainty with respect to downstream and receiver implications should the model results return values that are unexpected or that are above current EIS predictions. Should this be the case then additional downstream data collection and modeling would be required in order to understand the full implications of the project at closure. In addition, as more information becomes available, water quality modelling is expected to be updated periodically.

D3.3 RESEARCH/ STUDY OBJECTIVE

This research plan is designed to improve understanding of the expected performance of the WRF closure concept to confidently characterize predicted waste rock effluent discharge quality and assess if WRF seepage water quality can be expected to meet closure objectives and criteria (MDMER, CCME PAL) in post-closure.

Specific objectives include:

- Determination of quantity of WRF runoff and seepage that can be expected post-closure.
- Determination of quality of WRF runoff and seepage that can be expected post-closure.
- Greater understanding of the thermal evolution of the WRF and permafrost development to determine impact on geochemical reactions and, therefore, seepage water quality.

D3.4 OVERVIEW OF TASKS AND PROJECT RESEARCH SCHEDULE

The following is an overview of the anticipated tasks required to obtain the study objectives; the objectives are general in nature and not explicitly linked to the tasks below. An indication on status of each task is provided and when warranted, anticipated commencement and/or conclusion dates.

D3.4.1 TASK 1 - MONITOR DRAINAGE FROM WRF

Water quality should be monitored at selected locations around the WRF. Where seepage can be reliably associated with a particular area of the WRF, careful records should be kept of the schedule, volumes, and lithology of waste rock that is deposited in that area.

D3.4.2 TASK 2 – MONITORING OF ROCK PLACEMENT UNDER AMBIENT FIELD CONDITIONS (REPLACES FIELD TEST PADS)

A previous iteration of this reclamation research program identified field test pad construction and monitoring, however this is no longer proposed since site-specific data is now available that is more representative of the actual materials mined on site and is not be subject to sampling uncertainties anticipated in developing the correct materials for a field cell test program.

A detailed geochemical review of conditions in the WRF was conducted in 2019 through 2024. The existing WRF was instrumented with thermistors, oxygen sensors, piezometers (vibrating wire plus standpipes). Seepage, runoff oxygen consumption, and thermal conditions were documented (WSP, 2024). Locations were defined where exposure duration was known, logged and sampled in lifts to determine potential depth of oxiditation over time. The program completed was more comprehensive in scope and provided substantial information better than would otherwise have been attainable from field test pads, as such the test pads were determined to be unnecessary, and it is instead proposed to continue with ongoing monitoring of the WRF and re-evaluate the pile based on updated observed conditions and geochemical sources periodically.

D3.4.3 TASK 3 - GEOCHEMICAL \ WATER QUALITY MODELLING

With regards to modelling, the detailed test work completed, combined with supplemental and operational sampling provides suitable data with which to support geochemical and water quality modelling. Results from the current study areas can be extrapolated to the overall WRF. As a first step, the existing WRF pad was studied for basic hydrogeologic function through installation of vibrating wire and standpipe piezometers with an aim to resolve the effects of wetting-up time and advancement of permafrost (see also Research Program: Waste Rock Thermal Modelling Appendix D4). Subsequently, seepage was analysed and continues to be monitored with respect to chemistry, making allowances for composition of the waste rock pile, thermal conditions, and hydrogeologic function. Seepage over time was evaluated in conjunction with implementing thin lift deposition around the pile edges and on-top of the pile. This information now needs to be addressed in an updated geochemical and water quality model which projects to closure conditions which will be the subject of ongoing work.

The model will consider available climactic conditions (based on updated site weather data), mine production data, geochemical assays, and thermal conditions. The model will then be calibrated based on the detailed measurements of size, placement locations/patterns using the leachate from the WRF considering the monitored locations of the WRF. Water quality predictions will then be compared against the relevant criteria.

The model will be constructed with two separate time scales/domains to better inform potential closure scenarios. A near term (or unexpected) closure scenario will be developed first (slated for completion in 2027), which has been added to the search program to address review comments regarding water treatment in an unexpected closure scenario. A life of mine model will be developed (slated for completion in 2028) to address uncertainties and quantify the expected long term water quality from the WRF.

Should additional studies be required, recommendations for these studies would be included within the Reclamation Research Progress Reports. Depending on the results of the comparison this may include extending the water quality modeling

D3.5 OVERVIEW OF TASKS AND SCHEDULE

The anticipated timelines to complete Tasks 1 to 3 above are presented in Table D3.1.

TABLE D3.1 OVERVIEW OF TASKS FOR RECLAMATION RESEARCH - WRF WATER QUALITY

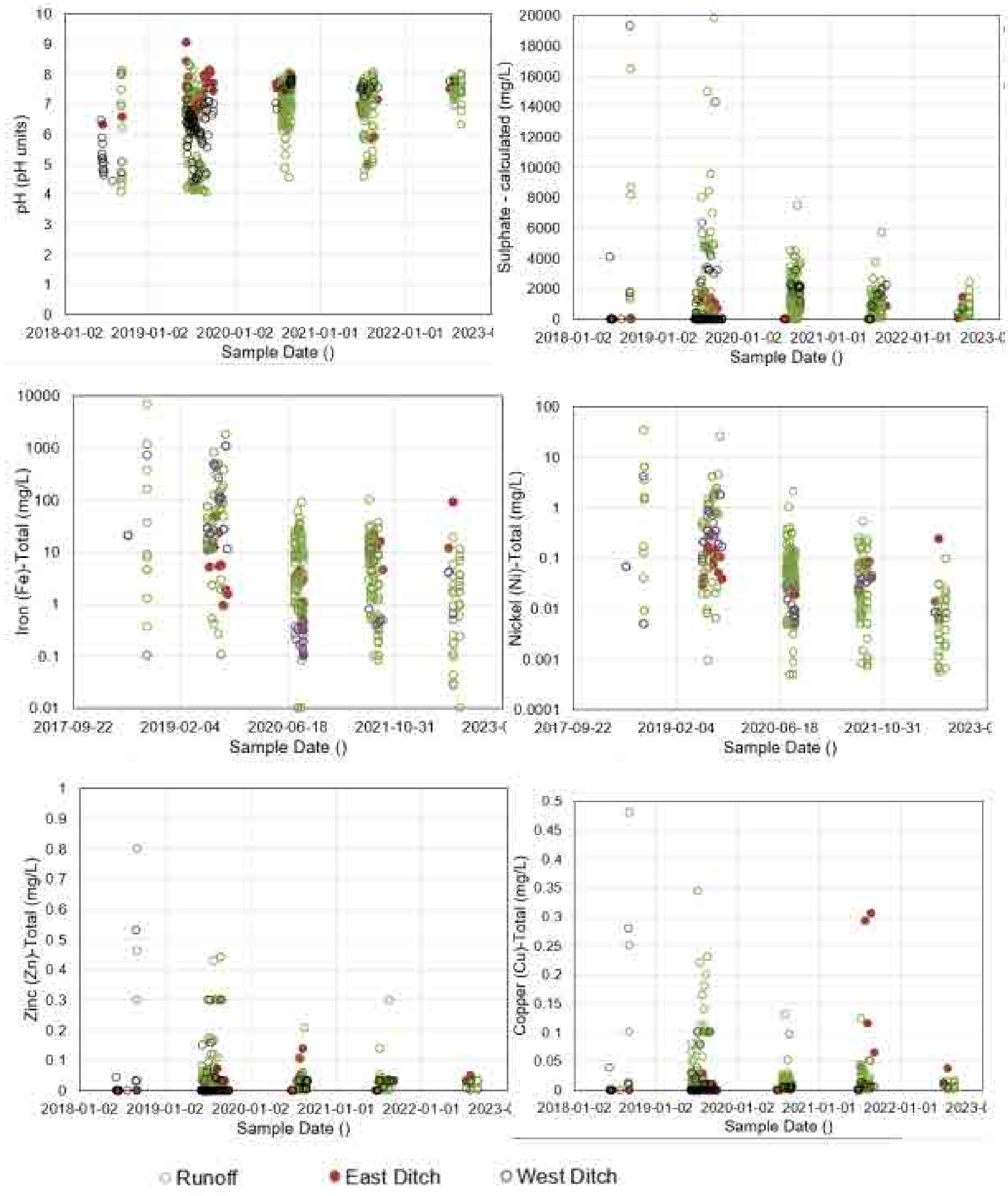
Task #	Task	Reference Document	Status or Anticipated Start and/or End Date
3.1	Monitor drainage water quality from WRF. Conduct periodic focused review of seepage quality monitoring results to predicted leachate values.	N/A	Ongoing for life of Project
3.2	Monitoring of thermal conditions, geochemistry and rock placement under ambient conditions. This is coupled with the tasks for D3.1 and includes review of instrumentation in combination with seepage water quality results. This work will inform the project about projected drainage quality and water quality modelling assumptions under site-specific cold climate conditions. This information will be periodically reviewed for any significant divergence from expected conditions.	Phase 1 Waste Rock Management Plan (BAF-PH1-830-P16-0029)	Designed/constructed in 2019. Updated in 2023, and Monitored from 2019 through the Life of Project
3.3	Geochemical and Water Quality Modelling Modelling, interpretation and documentation of monitoring results updated to include closure and post-closure conditions. Updated periodically to assess confidence if WRF runoff water quality is expected to meet closure objectives and criteria (MDMER, CCME PAL) in post-closure.	N/A	Model constructed for near-term closure scheduled for 2027 Model constructed for Life Of Mine scheduled for 2028, then updated every 10 years

FINDINGS OF RESEARCH COMPLETED

Water quality monitoring

Seepage from the WRF has been monitored as part of regular site operation. In the summer of 2017, seepage conditions from the WRF were found to be more acidic than was anticipated. A water treatment facility was installed to address short-term issues with respect to water quality. Following implementation of changes to operational practices (thin lift deposition and maintaining PAG deposition zones an appropriate distance from the pile edge) water quality improved in the seepage and runoff. When considering the dataset from 2018 onwards a trend of increasing pH values and associated decreasing concentrations of key parameters can be observed (Figure 1). The figure shows that pH values below 4.5 were not observed following 2019. Lower concentrations were observed in the last full year of data (2022) for the seepage and runoff from the WRF: the pH ranged from 6.3 to 8; zinc and nickel concentrations ranged from 0.00056 to 0.24 mg L^{-1} and from 0.003 to 0.048 mg L^{-1}, respectively (both below MDMER limits); and the sulphate concentrations were between 15 to 2413 mg L^{-1}. Details are provided in WSP 2024.

The information provides a valuable understanding of conditions associated with operational decisions as well as influence of input chemistry/rock types on expected discharge chemistry.



Note: Some data from 2018 and 2019 plots above y axis range; Iron and Nickel Y-axis in Logarithmic scale

Figure 1: Concentrations Over Time in WRF Runoff and Seepage for Selected Parameters

Water Quality Modelling

An update to both the water balance and water quality model was completed in 2023 (WSP 2024). An updated water quality model for the period up to 2026 was prepared based on collection and analysis of the instrumentation data (thermistor, oxygen sensor, and geochemical samples) as available through 2022 (WSP, 2024). The water quality model was used to predict runoff concentrations through to 2026 based on the current mine plan and water balance. The model assumed that flow from the WRF only occurs via direct runoff or as shallow interflow within the waste rock active layer as was confirmed through thermal measurements which show aggradation of permafrost in the basal layer of the WRF. Water that infiltrates the WRF becomes frozen due to permafrost aggradation and seepage is limited to shallow interflow near the margins of the WRF which is captured, along with runoff, in collection ditches. The model was calibrated to the observed water quality trends within the WRF runoff with the primary focus on predicting average yearly nickel concentrations as nickel was identified as the primary parameter of concern.

Based on the updated input conditions as observed through 2022, the water quality model predicted neutral pH values (6.6 – 7.4) and concentrations of nickel (median value of 0.1 mg/L) below the MDMER criteria (0.5 mg/L) at the WRF pond. The change in model results and improvement in pH and nickel concentrations between 2019 and 2022 can be attributed to Baffinland's efforts to encapsulate exposed PAG waste rock with non-AG and minimize exposure times for PAG rock. Figure 2 provides the model results for key parameters sulphate and nickel. Building on the existing water quality model, an updated model is required to evaluate potential closure conditions.

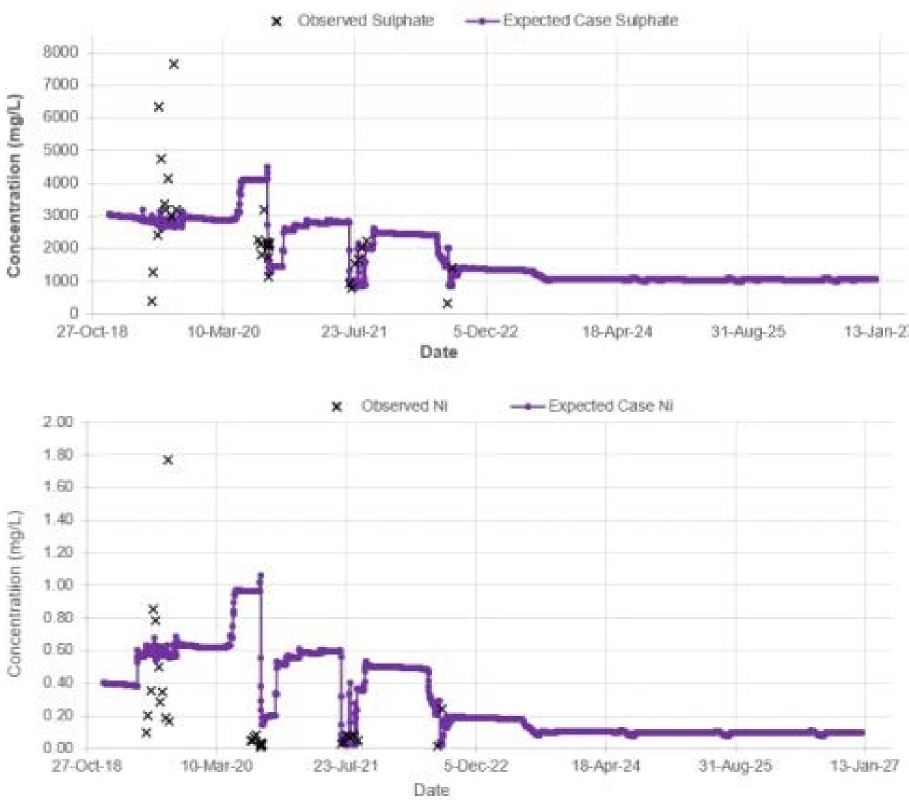


Figure 2: WRF Pond – Time Series Model Results for Sulphate and Nickel

Geochemistry monitoring program

For Deposit No. 1, the current field methodology for geochemical characterization involves testing of drillhole cuttings from each blasthole and measuring the paste pH and total sulphur content. The field classification system was updated in 2019 to consider the possible presence of soluble sulphate minerals (e.g., melanterite) that were observed in portions of the deposit (Golder 2019b) by adding paste pH as an additional criterion. Material where total S is greater than or equal to 0.2 wt. % Total S or if paste pH is less than 6 the material is treated as PAG. Table 1 provides a summary of the current field classification criteria.

Table 2: Acid Generation Potential Criteria Field Classification – Baffinland Mary River Site

Acid Generation Potential	Criteria
Treat as Potentially Acid Generating (PAG)	Total sulphur >= 0.20 wt% as S
Treat as Potentially Acid Generating (PAG)	Total sulphur < 0.20 wt% as S and paste pH <=6
Treat as Non-Potentially Acid Generating (Non-PAG)	Total sulphur < 0.20 wt% as S and paste pH > 6

The 2023 geochemistry update report provides an evaluation of the results of the ongoing geochemistry monitoring program and is based on a review of results of geochemical sampling completed from 2020 through 2022 (WSP, 2024). The evaluation includes a review of 8,603 blasthole drill cutting samples with on-site measurements of total sulphur and paste pH and a review of results from a subset of 395 split samples that underwent both field testing (pH and total sulphur) and analytical laboratory testing which also included acid-base accounting (ABA) analysis. The use of total sulphur, as well as the combination of total sulphur plus sample pH (or paste pH) was evaluated for use in on-site classification as compared to the Neutralization Potential Ratio (NPR) developed through full ABA test work. Site water quality measurements were also reviewed for potential metal leaching and acidity trends.

Key conclusions from the completed review and analysis are as follows:

Field vs. Analytical results:

- A review of sample results from on-site analysis and analytical laboratory testing shows good agreement for total sulphur analysis and paste pH analysis between field analysis and off-site analytical analysis, indicating that the results of field analysis of total sulphur and paste pH are reasonable for decision making purposes. It is also considered that x-ray fluorescence (XRF) for analysis of total sulphur is a valid method for use in classifying the waste materials in the field.
    - Total Sulphur and ABA results / review of sample representativeness / uncertainty:
- Considering the dataset of 8,603 on-site analysis of paste pH, of the 8,603 samples 0.4% of samples (33 samples) had some associated acidity (paste pH values of less than 6) and were distributed near the ore zones. Possible causes of low pH in the absence of elevated total sulphur include stored oxidation products, or soluble sulphate minerals.
- Baffinland currently segregates waste rock material as PAG and Non-AG using a total sulphur cut-off of 0.20 wt% as S and paste pH greater than 6. The uncertainty when using 0.2% S as an analogue for NPR of less than or equal to 2 is approximately 0.5%, with 0.51% of samples being incorrectly categorized as Non-PAG based on the recent ABA data collected. This recent ABA data continues to support the use of the 0.2 wt% Total Sulphur criteria (and the recently added paste pH criteria of 6) as being a suitable analogue for NPR of less than or equal to 2.

- When further considering potential soluble sulphate mineral misclassification, when considering that only about 0.38% of materials contain soluble sulphate based on overall paste pH measurements, and a misclassification rate of 0.51%, only 0.002% of rock placed in the WRF with soluble sulphate minerals has some potential of being incorrectly managed.
- A review of the available on-site water quality data indicates that misclassification and misplacement of materials with stored acidity in areas where this material should not be placed is not appreciable, as is exemplified by the improvement in WRF water quality observed on site.
  - Leachate Chemistry from lab testing and on-site site runoff and seepage measurements:
- There has been an observed improvement in on site water quality with an observed increase in pH and decrease in metals concentrations from 2018 through 2022. All 2022 measurements of on-site runoff and seepage were of neutral pH with no exceedances of the MDMER guideline values with the exception of total suspended solids.
- It is considered that the proper use of the waste rock screening criteria coupled with updated rock management practices is resulting in the observed improvement in water quality on-site.
- The on site testing shows that a very small proportion (<0.4%) of waste materials have stored acidity or potential for acidification due to oxidation.
- Operational procedures currently appear to be effective in reducing and managing ARD/ML on site based on the 2022 observed on-site runoff and seepage chemistry.

The geochemical results from SFE testing and on site water quality analysis indicate that the overall waste rock pile design and placement, as presented in the previous WRMPs (including use of thin lifts to promote freezing and placement of Non-AG material around the edges of the pile), are reasonable and appropriate to reduce potential for acid generation and metal leaching. Regular operational monitoring and material segregation is still required to confirm the future geochemical performance of the WR, however based on low potential rock misclassification rates, coupled with on-site observations of seepage and runoff water quality from 2020 through 2022 that show improving water quality over time, the current waste rock segregation criteria is considered reasonable and appropriate.

D3.6 LINKAGES TO OTHER RESEARCH/STUDIES

Predicted leaching rates for various waste rock lithologies will be shared between this study and the Open Pit Runoff Water Quality research program (Appendix D1).

The thickness of the active layer from the waste rock thermal modelling will be considered in the development of the waste rock runoff water quality predictions.

Regular updates on waste rock characterization and prediction of runoff water quality will be provided in future updates of the Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031) and ICRP.

D3.7 COSTS

Costs are to be determined as scoping is still being undertaken.

D3.8 REFERENCES

AMEC Environment & Infrastructure, 2012. *Interim Waste Rock Stockpile Seepage Quality Model – Mary River Project*. Ref. No. TC111523, Rev. 1. January.

Golder Associates Ltd. (Golder), 2018. Technical Memorandum: *Ongoing Humidity Cell Testing - Review and Recommendations for Path Forward.* Ref. No. 1790951 DOC027,_Rev 0. May 8.

Golder Associates Ltd. (Golder), 2019. Report: *Waste Rock Management Plan for 2020 through 2021.* December 31.

WSP Canada Inc. 2024. Waste Rock Management Plan-June 2023 through September 2026. Baffinland Iron Mines Mary River Project. Report submitted from WSP to Baffinland Iron Mines, January 2024.

Intergovernmental Panel on Climate Change (IPCC), 2007. AR4 Climate Change 2007: Synthesis Report. Available at: https://www.ipcc.ch/report/ar4/syr/.

Appendix D4
Reclamation Research Program - Waste Rock Thermal Modelling

D4 RECLAMATION RESEARCH PROGRAM - WASTE ROCK THERMAL MODELLING

D4.1 BACKGROUND

Thermal analyses of the waste rock facility (WRF) to predict the long-term distribution of permafrost within the dump will be required, as this will have a bearing on post-closure water quality of seepage from the stockpile. The heat transfer processes can be simulated with available computer models; however, none of the models can confirm that permafrost will develop within the stockpile without more reliable input data regarding the method of placing the waste rock and the resulting properties of the waste rock in the stockpile. In addition, it will be important to compare the thermal analyses against existing case histories including the Nanisivik mine.

Currently there is a 2-D thermal model that is used by Baffinland to confirm thermal assumptions and place material within the WRF to best promote fast permafrost aggregation (WSP, 2024a), and a 1-D thermal model that is used to assess long term climate change implications on permafrost within the WRF (WSP, 2024b).

D4.2 UNCERTAINTY

While work has been completed to define how the WRF will experience permafrost aggradation during operations and closure, uncertainties remain regarding what the eventual active layer thickness will be when considering climate change. Preliminary 1-D thermal modelling completed provides a first pass assessment of the required thickness of a thermal cap to be implemented on top of the WRF at closure, but there are still uncertainties related to thermal material properties, the integration of additional thermistor data, and the sensitivity of model inputs (WSP, 2024b).

D4.3 RESEARCH/STUDY OBJECTIVE

Thermal monitoring and evaluation are required as part of the current LOM Waste Rock Management Plan and to support current modelling of permafrost aggradation rates and thickness of the active layer when considering climate change.

The objective of the thermal modelling program is to monitor ground temperatures and confirm the aggradation of permafrost within the WRF and active layer thickness to update long-term ground temperature predictions.

D4.4 OVERVIEW OF TASKS AND PROJECT RESEARCH SCHEDULE

The following is an overview of the anticipated tasks required to obtain the study objectives; the objectives are general in nature and not explicitly linked to the tasks below. An indication on status of each task is provided and when warranted, anticipated commencement and/or conclusion dates. These tasks are summarized in Table D4.1 below.

TABLE D4.1 OVERVIEW OF TASKS FOR RECLAMATION RESEARCH - WRF THERMAL MODELLING

Task #	Task	Reference Document	Status Anticipated Start and/or End Date
4.1	Thermistor Data Collection	Phase 1 Waste Rock Management Plan (BAF-PH1-830-P16-0029)	2018 - Life of Project (as necessary)
4.2	Thermal Model Update - WRF	Phase 1 Waste Rock Management Plan (BAF-PH1-830-P16-0029)	1D thermal model informing the depth of the active layer considering climate change first constructed in 2024. 2D thermal model informing the depth of the active layer considering climate change scheduled to be constructed in 2026 Thermal model to be updated on ~5-year intervals
4.3	Thermal Model - Landfill Cover	N/A	1-D Model - 2027 2-D Model 2028 – Life of Project (as necessary) Update on ~5 year intervals

D4.5 DETAILED DESCRIPTION OF TASKS AND FINDINGS OF RESEARCH COMPLETED

D4.5.1 TASK 4.1 - THERMISTOR DATA COLLECTION

Data from temperature sensors installed to monitor the ground temperatures will be collected on a regular basis and used to ensure that frozen conditions are maintained below the WRF. There are a total of 9 thermistor installation sites at the WRF where data is actively being collected and monitored (Figure D4.1). The requirement for additional instrumentation will be reviewed regularly based on the results of site observations and measurements, future expansions to the WRF footprint and requirements for future modelling.

Thermistor installation to help understand the thermal regime within the landfill is expected to occur in 2025.

D4.5.2 TASK 4.2 - THERMAL MODEL DEVELOPMENT - WRF

Based on the results of geochemical sampling and thermal instrumentation, a thermal model for the waste rock stockpile will be developed. If substantial heat generation from oxidation is expected based on geochemical results, the thermal model may incorporate heat generation from sulphide oxidation in the pile to model the impact of heat generation on the pile freeze-back process. Climate change will be included to account for warming temperatures after closure, based on the latest climate change predictions.

The model will be developed in a staged process, with a 1-D model (WSP, 2024b) being developed using simplified boundary conditions, initial conditions and weather data. This model will be used to provide the basis to develop a more complex 2-D model that assesses the long term implications of climate change which will be completed in 2026. Parameters such as waste rock moisture content, material thermal conductivity and the effects of snow insulation will be defined as part of the 2-D model development.

D4.5.3 TASK 4.3 - THERMAL MODEL DEVELOPMENT - LANDFILL

Thermal modelling of the final landfill cover will be completed using the lessons learned from the modelling of the WRF, including applicable boundary conditions, weather scenarios and other model and site parameters. The initial 1-D model is expected to be complete by 2027, and the 2-D model is scheduled to be completed in 2028.

D4.5.4 FINDINGS OF RESEARCH COMPLETED

WRF Instrumentation & Data Collection

A field program was undertaken in 2018 and 2019 to characterize the waste rock deposited at the WRF and to install instrumentation throughout the WRF to assess its thermal performance. A summary of instrumentation installed in 2018-2019 can be found in the Phase 1 Waste Rock Management Plan (Baffinland 2024). A more recent field program was completed in 2024 with the installation of thermistors at five new sites (BH3R, BH4, BH5R, BH6, T6). Figure D4.1 provides an overview of the thermistor installation sites in the WRF where data is actively being collected and monitored.

WRF Thermal Assessments

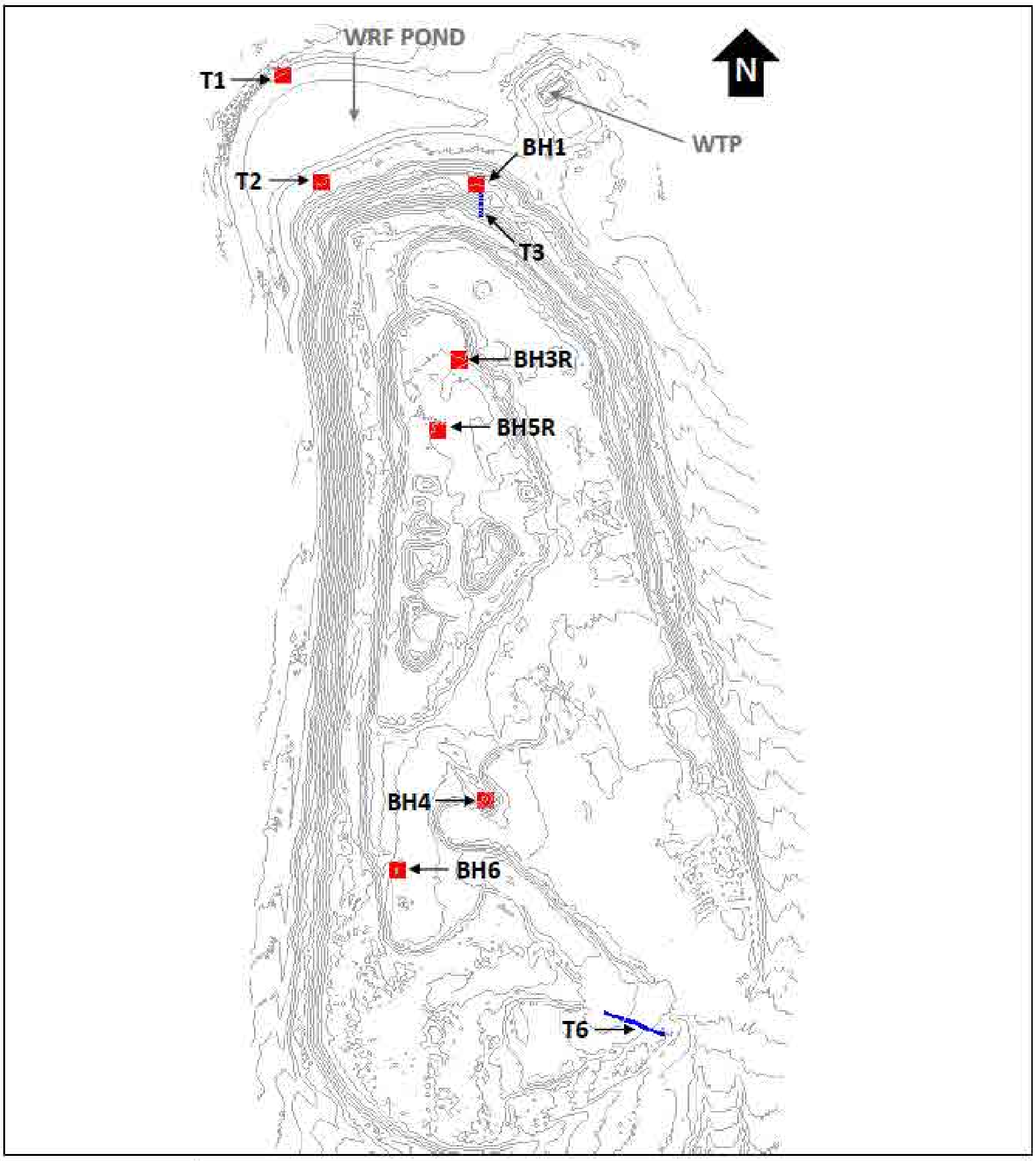
Thermal assessments of the WRF completed in 2019 and 2023 involved interpretation of instrumentation data and preparation of a 2D thermal model to provide guidance to operations on waste rock placement to promote fast permafrost aggradation (WSP 2024a).

Key findings from the WRF thermal assessments include:

- The portions of the pile monitored by temperature probes remained entirely frozen throughout the monitoring period, with exception of a 2 - 3 m thick active zone subject to seasonal freeze and thaw cycles.
- Placement of additional rockfill in the pile prevents previously deposited rock from thawing and allows for progressive cooling over time.
- The thermal regime of the pile is likely effected by a combination of seasonal variations in air temperature preferential air flow through the pile, and localized heat generation associated with sulphide oxidation and/or mineral dissolution, but the fact that the pile remained mostly frozen during all times with a progressive cooling trend continues to indicate that the site cold climatic conditions is the prevailing mechanism governing the thermal regime in the pile, as intended in the design.
- All conceptual deposition schedules modelled eventually achieved sustained sub-zero temperatures at the base of the waste rock lift.

1-D Thermal Model Considering Climate Change

In 2024, Baffinland completed a conceptual 1-D thermal model of the WRF to predict the impact of climate change on the depth of ground subject to seasonal freezing and thawing, in support of preliminary assessment of the required thickness of a thermal cap to be implemented on top of waste rock pile at closure (WSP, 2024b). The 1-D transient thermal model was prepared using available thermistor data and the finite element software TEMP/W. The model, while conceptual, suggests that the thermal cap is required to be at least 3 m thick to maintain an appropriate thermal cover in the WRF when considering climate change projects. The 1-D modelling exercise identified limitations in the model and existing dataset that will be addressed in the next phase of 2-D modelling (schedule is available in Table 4.1 and within Appendix D7). Future updates to the thermal model will establish an appropriate final cover thickness, considering the latest climate change predictions.



PROJECT:	Waste Rock Facility Thermistors
SURVEY DATE:	October 2024
PRINT DATE:	October 2024
LEGEND:	Vertical thermistor site — Horizontal thermistor site
SCALE:	Meters 0 100 200 400 600

FIGURE D4. 1 WRF THERMISTORS

D4.6 LINKAGES TO OTHER RESEARCH/STUDIES

The thickness of the active layer will be considered in the development of the waste rock runoff water quality predictions (Appendix D3).

D4.7 COSTS

Costs are to be determined as scoping is still being undertaken.

D4.8 REFERENCES

WSP 2024a. Waste Rock Management Plan - June 2023 through September 2026. Reference No. 22572750-006-R-Rev1-5000. January 2024.

WSP 2024b. Assessment of Active Zone Depth Considering SSP1-2.6 Climate Change Projections at Mary River Mine. Reference No. CA0020274.4798-005-TM-Rev2. 4 October 2024.

Baffinland. 2024. Phase 1 Waste Rock Management Plan. BAF-PH1-830-P16-0029 Rev 4.1.

Appendix D5
Reclamation Research Program - Natural (unassisted/passive) Revegetation

D5 RECLAMATION RESEARCH PROGRAM – NATURAL (UNASSISTED/PASSIVE) REVEGETATION

D5.1 BACKGROUND

Section 5.0 of the ICRP describes the Project's closure and reclamation principles and site-specific objectives. Consistent with international principles and standards for the recovery of mines sites (Young et al. 2022), the Project's unifying goals are to achieve a safe, stable, and non-polluting landscape that aligns with an agreed-upon end land-use and aesthetic. Specifically, per the ICRP (BIM 2024) *"[…] the [Mary River] site abandonment goal of the final closure activities is to return project sites and affected areas to viable and, wherever practicable, self-sustaining ecosystems that are compatible with a healthy environment and with human activities"*.

To achieve this goal, reclamation and revegetation approaches must be informed by the Project environmental setting (e.g. climate, soil substrate), conditions of the existing project (e.g., historic/legacy factors), and technical feasibility. As described in the FEIS Volume 6, Section 3.0, proposed reclamation activities will provide physical and chemical stability and will be designed to promote natural revegetation of disturbed areas. In practice, for the purposes of the Project, natural revegetation includes recontouring and regrading areas of the Project's disturbance footprint to tie-in to the predominant landscape, minimize instability and erosion potential and allowing the surrounding natural revegetation to encroach and re-establish.

Natural revegetation in the Arctic is characteristically slow and constrained by an inherently challenging environmental setting (Billings 1987, Chapin et al. 1995). The predominant vegetation assembly at the Project refers to Moist to Dry Non-Tussock Graminoid/Dwarf Shrub land cover type (Olthof et al. 2015), adapted to a biogeoclimatically harsh and occasionally sparsely vegetated terrain (depending on location). The growing substrate (if/where mineral soil should occur) refers to Regosolic and Brunisolic Turbic Cryosols characterized by permafrost, rocky/cobbly/sandy textures and aggregation, and low fertility. Given this environmental setting, the expectation and underlying rationale is that revegetation of the reclaimed Project will reflect early succession patterns and species biodiversity for these graminoid, sedge and dwarf shrub dominated plant communities. Therefore, consistent with this objective, this Reclamation Research Program (RRP) focuses on evaluating the suitability of surface and surface substrates (including overburden materials) to support vegetation development, and determining surface preparation techniques that promote (and potentially enhance) natural revegetation processes. Here, emphasis is on re-establishment of native vegetation that is consistent with and on a trajectory toward the adjacent undisturbed landscape.

D5.2 RESEARCH/STUDY OBJECTIVES

This RRP proposes to identify and refine best practices for promoting natural revegetation and early succession at the Project, accounting for the inherent constraints imposed by the Project's history and ecological setting. Key limitations at the Project include a restrictive growing substrate (low fertility, sandy/cobbly textures and aggregation), permafrost and absence of salvaged surface soil (i.e., conserved during construction) that could be used as a reclamation growing substrate. Where appropriate, this reclamation research will inform and occur alongside progressive reclamation programs for disturbed areas, no longer required for operations, with the aim of reducing the Project's active footprint. Primary objectives of this RRP center on evaluating the suitability of surface and surface substrates (including overburden materials) to support vegetation development, and determining post-disturbance surface preparation techniques that promote (and potentially enhance) natural revegetation processes. Here, emphasis is currently on re-establishment of native vegetation that is consistent with and on a trajectory toward the adjacent undisturbed landscape. Given that the Project is in an early operations phase, specific objectives currently focus on (but are not limited to):

- Characterizing the suitability of available surface substrates conducive to natural revegetation
- Determining the timeframe for and composition of natural/unassisted early revegetation
- Identification of appropriate indicators for species establishment and trajectories for revegetation

D5.3 OVERVIEW OF TASKS AND PROJECT RESEARCH SCHEDULE

Table D5.1 summarizes the status of tasks and initiatives under this RRP. Additional tasks and initiatives are expected to be advanced based on research outcomes and as such the schedule is an estimate only.

TABLE D5.1 Overview of Tasks for Reclamation Research - Natural Revegetation

Task #	Task	Reference Document	Status or Anticipated Start/End Date
5.1	Data/information review of Project-specific baseline data applicable to revegetation	EDI 2020 EDI 2022	Completed
5.2	Literature review of available reclamation/revegetation research for Northern/Arctic environments	EDI 2019	Completed
5.3	Reclamation Pilot Study (Phase I). Post-disturbance Natural Revegetation Survey and establishment of Reclamation Pilot Study	EDI 2020 EDI 2022 EDI 2024	Initiated/Ongoing
5.3.1	Characterization of terrain/soil and potential constraints to natural revegetation		
5.3.2	Identification of future research initiatives/opportunities		
5.3.3	Monitoring Reclamation Pilot Study trial sites (as/when necessary)		
5.4	Interim Review/Revision of RRP Objectives	—	Initiated/Ongoing
5.4.1	Updated literature review of available reclamation research for Northern/Arctic environments		
5.4.2	Project Reclamation Feasibility Analysis		
5.5	Inuit Engagement - objectives, indicators, thresholds and responses	—	TBD[1]
5.6	Reclamation Trial (Phase II) - Opportunities for Progressive reclamation	—	Preliminary Scoping 2025-2027
5.6.1	Preliminary Design		
5.6.2	Revegetation Survey and Reclamation Trial Site Scouting		
5.6.3	Establishment of Reclamation Trials/Investigations		

Task #	Task	Reference Document	Status or Anticipated Start/End Date
5.7	Status of Soil Salvage (Feasibility) and Refinement of Scarification Techniques (Surface Configurations)	—	2034

NOTE:

1. Requires discussion with the QIA; this input may be obtained from the QIA-led Culture, Resources and Land Use (CRLU) Monitoring Program and/or the future Mine Closure Technical Advisory Group.

D5.4 DETAILED DESCRIPTION OF TASKS AND FINDINGS OF RESEARCH COMPLETED

Summaries and key findings for completed tasks under this RRP are provided hereafter.

D5.4.1 COMPLETED RESEARCH

TASK 5.1 REVIEW OF BASELINE DATA COLLECTION RESULTS APPLICABLE TO RE-VEGETATION DURING RECLAMATION

A preliminary review of baseline data applicable to re-vegetation was completed as part of FEIS development (Baffinland 2012, FEIS Appendix 6C - Vegetation Baseline Report. Refer to section 4.0 for a description of Project Setting as it related to vegetation; see section 4.4 for Observations Applicable to Reclamation). Approximately 20 plots were established on or adjacent to anthropogenically disturbed portions of the existing Access Road/Corridor (now generally coinciding with the Tote Road). Sites were surveyed to inform volunteer species composition and early succession patterns on disturbed landscapes. Key observations were that natural revegetation of disturbance environments occurs at the Project, although cover vegetation was generally low/scant and species appeared to be slow growing. Vegetation composition differed depending on surface substrate, ranging from predominantly sandy to gravelly/rocky substrates.

Note-1: A more targeted survey of natural revegetation patterns of disturbed environments at the Project is described under Task 5.3 (below).

TASK 5.2 LITERATURE REVIEW OF RE-VEGETATION AT DISTURBED AREAS IN NORTHERN CLIMATES

A literature review (desktop) of recent advances in Northern/Arctic mine reclamation in Canada and the USA was conducted to examine strategies (to the extent possible and practical) that may promote natural revegetation in the Arctic setting (EDI 2019). For example, surface soil preparation, decompaction, and the viability of seeding and planting. The literature review included a summary of the bioregional context and the closure and reclamation programs (e.g., approaches to reclamation and revegetation, and reported outcomes) of nine northern mines across Canada and the USA and lessons learnt. In addition, the review identified potential surface preparation techniques that could be considered at the Mary River Project. The mine projects (both closed and operating) included in the review are presented in Table 5.2.

Table 5.2 Existing mine operations considered in literature review of re-vegetation of disturbed areas in Northern climates

Status	Mine	Location
Closed	Polaris Mine Nanisivik Mine	Little Cornwallis Island, Nunavut Baffin Island Nunavut
Operating	Red Dog Mine Hope Bay Doris North Mine Meadowbank Mine Diavik Diamond Mine Ekati Diamond Mine Gahcho Kué Mine Con Mine	Northwest Alaska, USA Northwest, Nunavut Baker Lake Region, Nunavut North Slave Lake Regional, NWT North Slave Lake Regional, NWT Kennady Lake Regional, NWT Yellowknife, NWT

Lessons from other northern mines during this literature review have been incorporated into Appendix F Lessons Learnt from Other Projects. A key takeaway was that availability of salvaged soil as a reclamation growing substrate is a constraint on the types of reclamation strategies that can be implemented at a given site - not withstanding the implications of biogeoclimatic setting and the range of ecosystems that can be established therein. If/where trials have been initiated, other northern mines have emphasized surface soil preparations conducive to natural revegetation in their reclamation design (EDI 2019).

For these reasons, reclamation research at the Project focuses on evaluating the suitability of surface and surface substrates to support vegetation, and determining surface preparation techniques that promote natural revegetation processes. Given the lack of salvaged soil at the Project, this means facilitating surface conditions conducive to natural (i.e., unassisted or passive) colonization of native species from surrounding undisturbed vegetation. Three recommendations for a path forward to address preliminary uncertainties regarding revegetation were identified:

1. Identify Site Preparation Techniques Best Suited/Tailored for Natural Revegetation:
   a) Characterize control/undisturbed landscape conditions as a template for reclaimed environments.
   b) Examine landscape preparation approaches that will increase the availability of micro-habitats conducive to plant early-establishment.
   c) Determine timelines and measurables for reclamation success.
2. Identify Indicator Species Best Suited for Natural Revegetation:
   a) Characterize control/undisturbed vegetation conditions as a template for reclaimed environments.
   b) Examine landscape preparation approaches that will increase the suitability of micro-habitats for plant early-establishment and development of cover vegetation.
   c) Determine timelines and measurables for reclamation success.
3. Examine the Feasibility (i.e., Viability and Applicability) of Seeding/Planting and Soil Amendments

Note-2: The natural vegetation cover and status of plant growth at the Project varies depending on surface substrate, elevation, proximity to water and availability of soil moisture. Notably, portions of the Project that occur at high elevation and/or are characterized by rocky terrain (typically lacking or having only thin, discontinuous mineral soil) are often naturally devoid of vegetation. Recommendation #3 is not applicable to these portions of the Project. Reclamation and closure activities will focus on grading and surface preparations; revegetation efforts are expected to promote natural (unassisted/passive) vegetation re-establishment commensurate to conditions of the adjacent natural environment.

Note-3: Per Task 5.4 (Table 5.1), BIM is committed to Interim Review/Revision of RRP Objectives, including considerations for recent reclamation research and feasibility analysis of Project-specific reclamation activities. Baffinland recently evaluated outcomes from vegetation propagation studies elsewhere in northern and Arctic climes (cf. Ficko et al. 2015; Hnatowich et al. 2023a, 2023b; Lamarre et al. 2023; Neby et al. 2022). If/where applicable, research outcomes and objectives (hereafter) have been updated in light of these additional literature sources. Upon review, studies on seed-dispersal (Ficko et al. 2015) and direct placement/transplantation of vegetation (Hnatowich et al. 2023a, 2023b; Lamarre et al. 2023) may not be compatible with the Project setting and existing conditions, although understanding of these processes will benefit future reclamation planning. Meanwhile, the study by Neby et al. (2022) highlights the inherent challenges of revegetation in the Arctic and slow revegetation timeline in the tundra biome. Consistent with this ICRP's objectives and approach to facilitate surface conditions conducive to natural (i.e., unassisted or passive) revegetation, it is emphasized that 'natural' revegetation does occur; however, this is contingent on minimizing incidental disturbances to the adjacent and nearby 'natural' (i.e., intact) environment. 'Active' revegetation approaches (relying on reclamation methods more commonly applied in relatively more temperate environments, e.g., seeding/planting, fertilization) have yet to be demonstrated as a viable strategy for the Project.

TASK 5.3 RECLAMATION PILOT STUDY SUMMARY

Building on the desktop review (Task 5.2) and to address the recommendations of the review in phases, Baffinland retained EDI in 2018-2019 to design and implement a field program to address recommendation #1 through design and implementation of a Reclamation Pilot Study (EDI 2020). The Reclamation Pilot Study included the following objectives:

1. Document the status of opportunistic and unassisted revegetation at the Project to understand post-disturbance revegetation and ecological successions patterns
2. Establish preliminary reclamation trials that examine methods and approaches that are considered appropriate and adaptable to the inherent challenges of the Arctic environment
3. Identify pathways and opportunities for future studies

The Reclamation Pilot Study comprised (1) a Post-disturbance Revegetation Survey and (2) and a Reclamation Trial. The Reclamation Trial was intended to be a starting point for research and development to examine revegetation strategies appropriate for and adaptable to the Project. Annual Project Update reports for this RRP including locations of trial sites have been provided to the Nunavut Impact Review Board (NIRB) as part of annual Project reporting. A summary of the two aspects of the Reclamation Pilot Study is provided below.

POST-DISTURBANCE REVEGETATION SURVEY

This survey focused on documenting the terrain, soil conditions, species composition, successional trajectories, and assumed revegetation rates within existing disturbed Project areas. Suitable study sites were selected and established at four (4) locations along the Tote Road; KM52, KM16, KM18 and within an abandoned airstrip near KM58. These sites were chosen as they represented different timeframes since disturbance (relative to the time of the field survey) within the Project footprint, ranging from one-year post-disturbance (KM52) up to >40 years post-disturbance (KM58). Study sites at KM52 and KM16 were established in 2019 and sites at KM18 and KM58 were established in 2021 (Table 5.2). Maps with locations of each are provided in the most recent 2023 Project Update (EDI 2024).

Experimental Design — The first field component of the Post-disturbance Revegetation Survey (summer 2019) focused on surveying natural/unassisted revegetation and establishing a preliminary trial design. The second field component (summer 2021) expanded the number of survey locations and established the Reclamation Trial sites. Each study site layout was comprised of three (3) paired vegetation plots (1x1 m vegetation quadrats) and soil plots (30x30x30 cm soil survey pits) distributed at the start, middle and end of a 100 m or 150 m vegetation cover transect. Applying the same experimental design, control areas (i.e., deemed representative of pre-development [undisturbed] site conditions) were sited on adjacent land approximately 30 m from the Project footprint. The experimental design is a standardized replicated control-comparison study based on accepted industry survey methods for reclamation and closure assessment. Locations were scouted and ground-truthed in collaboration with site environment personnel. Site selection accounted for Tote Road realignment activities (i.e., ground disturbance), access and safety, as well as areas where earthworks for trials could be completed within existing permit conditions. Study objectives were/are to document opportunistic revegetation within the immediate disturbed environment. All sites were paired with nearby/adjacent control (30m from PDA) in these areas, to reflect the same terrain, soil and vegetation conditions within the immediate disturbance footprint. These control sites represent the same soil moisture and nutrient characteristics at the trial sites; control sites are considered the nearest source for seeds and growth propagules for ingress of natural revegetation.

Vegetation survey procedures for characterizing surface cover and composition were based on methods used in Baffinland's existing vegetation monitoring program and described in the Canadian Tundra and Taiga Experiment (CANTTEX) — Field Manual (Bean and Henry 2003; Bean et al. 2003).

Results & Discussion— Predictably, the highest levels of natural revegetation were observed among 'older' sites (KM16, KM58), coinciding with areas demonstrating more vigorous cover vegetation on adjacent undisturbed (control) land. These disturbed areas also occasionally demonstrated remnant intact fragments of the vegetation matte representing source material for revegetation. Consistent with findings by Hnatowich et al. (2023a, 2023b) and Lamarre et al. (2023), who investigated transplantation techniques for surface vegetation, the proximity and viability of intact vegetation should play a key role in 'natural' unassisted/passive site revegetation. Per Neby et al. (2022), this is contingent on minimizing incidental disturbances to the adjacent and nearby 'natural' (i.e., intact) environment.

A key observation of the reclamation pilot study was that all survey sites demonstrated varying levels of natural unassisted revegetation — even KM52, representing ~1-year post-disturbance. Bare ground generally decreased over time due to natural revegetation and surface litter accumulation. Although little-to-no vegetation was observed within 1-year post-disturbance, apparent early colonizers comprising predominately of graminoids, sedges and forbs, were observed at 1 to 3 years post-disturbance and became more prominent over time (5 years post-disturbance). Over a longer timeframe (>40 years post-disturbance) vegetation cover increased substantially (up to 60% to 70% of total cover) and was comprised of graminoids, sedges, forbs, and shrubs/Ericaceae. However, lichen (representing <2% of undisturbed cover vegetation) were not observed at any disturbed sites indicating conditions for their establishment were not satisfied and/or may indicate that lichen require a longer development timeline.

Preliminary findings from this study suggest that natural unassisted revegetation can occur at the Project site. Remarkably, species composition at all survey sites was comprised of only native species, no exotic or non-native vegetation were identified. Understanding revegetation patterns and processes will benefit future reclamation planning and management actions at the Project. As discussed in a companion paper (Audet and Setterington 2024, DRAFT/Under Review), this preliminary chronosequence will benefit from additional data capture and replication to bridge information gaps.

RECLAMATION TRIAL

The second aspect of the Reclamation Pilot Study focused on initiating preliminary reclamation trials at the Project to evaluate different surface configurations (referring to rough and loose and surface track-packing methods, described below) currently used as site preparations for revegetation across a wide range of environments and terrain (EDI 2024). The purpose was to determine logistical considerations and what can feasibly be applied at the Project to optimize natural revegetation outcomes based on landscape features and constraints of the Arctic environment. Site configurations (described below) were selected based on standard best practices identified during the literature review (Task 5.2) and previous reclamation experience.

Experimental Design— The locations of the reclamation trials correspond with the KM52, KM16, and KM18 post-disturbance revegetation survey areas (as outlined above). At each trial location, a 100 m x 10 m (at KM52) or 150 m x 10 m trial strip (at KM16 and KM18) was delineated, all within the 25 m buffer from the centreline of the Right of Way (ROW) and corresponding with the permissible Project area for earthworks and maintenance along the Tote Road.

The two surface configurations evaluated, (1) 'rough and loose' and (2) 'track packing', are described below. Both are considered technically feasible for use at the Project.

- Rough and loose refers to the use of a digging bucket to dig small depressions and generate low-profile mounds within a given landscape (Polster 2013). This method creates surface heterogeneity and microsite conditions favorable to seed establishment and germination (in the absence of direct/drill seeding) and facilitates soil preparation conducive to root proliferation and water infiltration.
- Track-packing (i.e., surface imprinting) refers to using tracked earthwork equipment to create surface roughness (Neville 2003). This method is typically used to reduce the erosion potential of exposed soils by enhancing surface stability and generate micro-site conditions for seed establishment.

The 'rough and loose' surface configuration was applied to the entire reclamation test strip at KM52, KM16 and KM18 (i.e., to the extent possible due to the loose/unconsolidated substrate); 'track-packing' was then applied to half (1/2) of each test strip. More detailed description of earthwork logistical parameters and controls are provided in EDI (2024). Trial sites were established in 2019 and visually evaluated in summer 2020, 2021, 2022 and/or 2023 (depending on location) to document site conditions. A comprehensive survey of the trial sites applying methods used in the 2019 baseline survey (vegetation transect/quadrat, soil plot assessments and visual evaluation) was completed in Summer 2024.

Results & Discussion— Reclamation trials were established with the intention of (1) applying and evaluating the performance of different surface configurations commonly used in reclamation and (2) 'resetting' these environments to examine early colonization patterns. A key observation about the performance of surface preparations was that they were 'washed out' due to weathering (likely due to the sand-sandy loam surficial geology) and were no longer apparent at any of the trial sites within one year of their applications. Surface preparations were intended to create temporary surface heterogeneity and micro-site conditions favourable to seed establishment and germination while reducing erosion potential and enhancing surface stability. Although all sites were stable and demonstrated no major degradation, the surface texturing and micro-topographical earthworks created during the initial trial preparations no longer provided any functional value. Given that the Project setting is prone to prolonged periods of high wind, these surface preparations appear to provide only short-term mitigation. Future investigations could examine alternative options for minimizing erosion potential if/where required based on the surface geography and associated risk of erosion and potential effects on downgradient environments.

In terms of the status of revegetation, all sites predictably lacked a demonstrable/measurable vegetation cover. However, a few volunteer forbs, graminoids and occasionally juvenile shrubs (e.g. bladderpods, campions, sedges and dwarf willow) consistent with the adjacent native vegetation were found to have randomly colonized the trial sites after year 1 (i.e., representing <1% of the total study area). As potential early succession indicators in this environment, these types of volunteer vegetation increased modestly at all sites, representing approximately 1% to 3% of the total study areas from year 1 (2019) to year 5 (2023). Similar outcomes regarding the timelines for revegetation are reported by Neby et al. (2022). Anecdotally, the KM18 and KM16 sites (both characterized as subxeric) demonstrated the highest levels/rates of revegetation within the trial areas and the most vigorous cover vegetation on the adjacent undisturbed (control) area. It is suspected that the status and viability of intact and contiguous vegetation could play a key role in site recovery, as reported by Hnatowich et al. (2023a, 2023b) and Lamarre et al. (2023). However, lichen were not observed at any disturbed/revegetated trial sites. Understanding the environmental conditions and growth requirements of lichen will help to refine expectations for their natural reestablishment at the Project.

Lastly, no non-native/exotic or invasive species were recorded at any of the sites during the follow-up evaluation years. By contrast, disturbed landscapes in relatively more temperate environments (particularly those near settlements and along travel corridors) are often prone to recalcitrant weeds and non-target species. Multi-pronged vegetation management strategies are then needed to prevent the establishment and spread of weeds. As no seeding, planting or vegetation management actions were applied at any trial sites and/or the Project at large, further investigation is required to understand the 'forces at play'. It is suspected that the extreme Arctic setting and vigour/viability of the intact native vegetation may buffer small/discretely disturbed environments (such as these reclamation trial sites) and thereby limit the species capable of recolonizing therein including non-native/exotic or invasive species. The assessment and monitoring timeline for the Reclamation Pilot Study is provided in Table 5.3 below.

Table 5.3 Reclamation Pilot Study – Assessment and Monitoring Timeline

Site	Assessment Time/Year July 2019	July 2020	July 2021	July 2022	July 2023	July 2024
KM52	Baseline Survey					
	Reclamation Trial		Visual/Walkover Monitoring		Comprehensive Survey	
KM16	Baseline Survey					
	Reclamation Trial		Visual/Walkover Monitoring		Comprehensive Survey	
KM18			Baseline Survey			
			Reclamation Trial	Visual/Walkover Monitoring		Comprehensive Survey
KM58			Baseline Survey			
			No Trial			

D5.4.2 PROPOSED RESEARCH

The preliminary reclamation trials described in this RRP are intended as a starting point for research and development to examine revegetation strategies appropriate for and adaptable to the Project. EDI (2024) concluded that the study approach presented in Pilot Study provides an appropriate template and investigative strategy with which to identify other candidate trial sites, potentially initiate reclamation trials and apply consistent survey methods to document revegetation patterns and processes onsite. Building on outcomes of the Research Review (Desktop) and Reclamation Pilot Study (Field-Based) and accounting for the inherent constraints imposed by the Project's history and ecological setting, Baffinland aims to develop a subsequent phase of reclamation trial sites following a comprehensive evaluation of feasibility and scalability of reclamation options (i.e., per the Project setting and constraints) and assessment risks (i.e., associated with potential additional and increased adverse effects to the environment). Several additional tasks (described below) are identified to address the research objectives during this next phase (EDI 2024). Advancement of these investigative threads is active and ongoing. An estimated schedule for these tasks is presented in Table 5.1.

Project Reclamation Feasibility Analysis

Baffinland is committed to ongoing evaluation (where appropriate) of available literature of revegetation in Northern/Arctic Environments to inform what reclamation methods are feasible at the Project given key project limitations related to the environmental setting and historic development. A feasibility analysis will triage and provide supporting rationale for the ICRP's reclamation strategy and the direction for future research initiatives. Key tasks will include and take into consideration:

- Review of the range of different landscape features affected by the Project (i.e., based on topography, surface substrates, nutrient and moisture regimes)
- Determine to what extent/proportions of the project footprint are naturally vegetated (continuous cover) or not (unvegetated areas) — Refer to Note-2, section D5.1.3.2
- Review of existing reclamation trial outcomes
- Review and evaluation of additional literature and case studies of northern mine revegetation programs and reclamation methods for applicability to the Mary River Project
- Determine the technical feasibility of different types of surface configurations to optimize natural revegetation outcomes at landscape features likely to support revegetation
- Completion of a risk assessment of feasible revegetation options
- Refine where 'natural' (unassisted/passive) vegetation establishment is most likely to occur and define appropriate expectations for recovery based on these conditions.

The outcomes of the Project Reclamation Feasibility Analysis will build on the existing technical knowledge and further refine the range of reclamation methods given Project constraints. These outcomes will be communicated as part of the Inuit Engagement Strategy.

Increase trial sites / increase range of reclamation endpoints

The Reclamation Pilot Study establishes a template for future trials. Baffinland will examine opportunities to focus on grading and surface preparations at the Project, emphasising an increase in trial sites and a wider range of reclamation endpoints. Revegetation efforts are expected to promote natural (unassisted/passive) vegetation re-establishment commensurate to conditions of the adjacent natural environment. Per recent findings, these future investigations should examine alternative options for minimizing erosion potential if/where required based on the surface geography and associated risk of erosion and potential effects on downgradient environments. Future studies will continue to inform identification of early indicators of revegetation success.

Reclamation Trial – Phase II

Over the life of the mine, EDI (2024) highlighted the potential benefit of identifying decommissioned and/or progressively reclaimed Project features (e.g. discontinued laydown areas, access roads or other features associated with the Mine Site, the Milne Port and/or Tote Road) that could be potential candidate sites for reclamation studies. Where appropriate, these features could provide opportunities for planning, designing, and reclamation trials to examine the scalability of reclamation approaches and could be used to calibrate the time, effort and cost of reclamation activities onsite. During the next phase of this research program, Baffinland will incorporate outcomes from the Project Reclamation Feasibility Analysis into progressive reclamation occurring at the site.

Status of Soil Salvage (Feasibility) and Refinement of Scarification Techniques (Surface Configurations)

To protect permafrost and existing landforms, all infrastructure is built on top of overburden. As such, overburden and soils are generally not able to be salvaged on site as a result of existing soil and permafrost conditions. An assessment will be completed of new developments within the project footprint to assess locations (area extents), options for, and feasibility of soil salvage. Post construction assessment will then inform refinement of 'scarification' techniques and options (i.e., surface configurations) to promote revegetation and stability. Findings will also inform expectations for early-stage revegetation and indicators of success.

Integration of Inuit Qaujimajatuqangit

Baffinland recognizes the value of integrating IQ in closure planning. Where appropriate, Inuit-defined objectives, criteria and actions as defined through implementation of the Inuit Engagement Strategy (see section 2.4), if provided to Baffinland, will be used in future research plans. The potential role of Inuit in monitoring and management in relation to implementation of the revegetation program will also be considered. Baffinland invites further discussion on these items through the Inuit Engagement Strategy (section 2.4). As this strategy has not been formalised, the schedule for research activities presented in Table 5.1 is presently an estimate only.

D5.5 LINKAGES TO OTHER RESEARCH/STUDIES

Updates and advances to this Reclamation Research Plan will be provided in annual reports to the NIRB under Project Certificate No.005 and to QIA and NWB under Type "A" Water Licence 2AM MRY1325 and will be summarized in future versions of the ICRP.

D5.6 COSTS

TBD

D5.7 REFERENCES

Audet P, Setterington MA. 2024. *Challenges of Reclamation in the Canadian High Arctic: Pilot Study at an Active Mine Site on North Baffin Island, NU*. DRAFT/Under Review by the Proceedings of the BC Technical and Research Committee on Reclamation, Mine Reclamation Symposium 2024. Pp.15.

Baffinland Iron Mines Corporation (BIM). 2012. *Mary River Project – Final Environmental Impact Statement*. February 2012.

Baffinland Iron Mines Corporation (BIM). 2013. *Mary River Project – Addendum to the Final Environmental Impact Statement*. June 2013.

Baffinland Iron Mines Corporation (BIM). 2018. *Interim Closure and Reclamation Plan* Version 5.0.

Bean, D. and Henry, G. 2003. *Canadian Tundra and Taiga Experiment (CANNTEX) Field Manual Part A: Setting up a Basic Monitoring Site*. 31 pp.

Bean, D., Henry, G., and Rolph, S. 2003. *Canadian Tundra and Taiga Experiment (CANNTEX) Field Manual Part B: Additional Methods and Experimental Manipulations*. 59 pp.

Billings, W. D. (1987) Constraints to Plant Growth, Reproduction, and Establishment in Arctic Environments, Arctic and Alpine Research, 19:4, 357-365

Burt, P. 2003. Miramar Hope Bay Ltd., Doris North Gold Project, Vegetation Baseline Studies, Report, Outcrop Ltd. 2003.

Chapin, F.S., Shaver, G.R., Giblin, A.E., Nadelhoffer, K.J., and Laundre, J.A. 1995. Responses of Arctic tundra to experimental and observed changes in climate. Ecology 76(3):694–711. DOI: 10.2307/1939337

Environmental Dynamics Inc. (EDI). 2013. *Baffinland Field Guide to Exotic Plant Species Identification*. Project No. 13-Y-0012. Prepared for Baffinland Iron Mines Corporation. Dated September 20, 2013.

Environmental Dynamics Inc. (EDI). 2014. *Baffinland Mary River Project: DRAFT 2014 Annual Terrestrial Monitoring Report*. Project No. 14-Y-0244. Prepared for Baffinland Iron Mines Corporation. Dated November 16, 2014.

Environmental Dynamics Inc. (EDI). 2019. *Research Review — Advances in Arctic Reclamation: Implications for Reclamation Practices & Trials at the Mary River Mine Project*. Prepared for Baffinland Iron Mines Corporation, Whitehorse, Yukon. 23 pp.

Environmental Dynamics Inc. (EDI). 2020. *Reclamation Pilot Study — Mary River Mine Project: Revegetation Survey & Preliminary Reclamation Trial*. Prepared for Baffinland Iron Mines Corporation, Whitehorse, Yukon. 28 pp.

Environmental Dynamics Inc. (EDI). 2022. *Mary River Project Reclamation Pilot Study — Revegetation Survey & Preliminary Reclamation Trial: 2021 Project Update*. Prepared for Baffinland Iron Mines Corporation, Whitehorse, Yukon. 49 pp.

Environmental Dynamics Inc. (EDI). 2023. Mary River Project Reclamation Pilot Study – Revegetation Survey & Preliminary Reclamation Trial: 2022 Project Update. Prepared for Baffinland Iron Mines Corporation, Whitehorse, Yukon.

Environmental Dynamics Inc. (EDI). 2024. *Mary River Project Reclamation Pilot Study – Revegetation Survey & Preliminary Reclamation Trial: 2023 Project Update*. Prepared for Baffinland Iron Mines Corporation, Whitehorse, Yukon.

Ficko, S., Smith, B., and Zeeb, B. 2015. Assisted Revegetation Following Contaminated Site Remediation in the Arctic: Four-Year Case Study of a Former Radar Site. American Journal of Plan Sciences 6(8):1301–1312. DOI: 10.4236/ajps.2015.68130

Hnatowich, I.G., Lamb, E.G., and Stewart, K.J. 2023a. Vegetative growth and belowground expansion from transplanted low-arctic tundra turfs. Restoration Ecology 31(3):e13716. John Wiley & Sons, Ltd. DOI: 10.1111/rec.13716

Hnatowich, I.G., Lamb, E.G., and Stewart, K.J. 2023b. Reintroducing Vascular and Non-Vascular Plants to Disturbed Arctic Sites: Investigating Turfs and Turf Fragments. Ecological Restoration 41(1):3–15. DOI: 10.3368/er.41.1.3

Lamarre, J.J., Dhar, A., and Naeth, M.A. 2023. Arctic ecosystem restoration with native tundra bryophytes. Arctic, Antarctic, and Alpine Research 55(1):2209394. Taylor & Francis. DOI: 10.1080/15230430.2023.2209394

Neby, M., Semenchuk, P., Neby, E., and Cooper, E.J. 2022. Comparison of methods for revegetation of vehicle tracks in High Arctic tundra on Svalbard. Arctic Science 8(3):1006–1025. NRC Research Press. DOI: 10.1139/as-2021-0016

Neville, M. 2003. Best Management Practices for Pipeline Construction in Native Prairie Environments. Prepared for Alberta Environment and Alberta Sustainable Resource Development (superseded by the Alberta Energy Regulator). 133 pp.

Olthof, I., Latifovic, R., and Pouliot, D. 2015. Northern Land Cover of Canada – Circa 2000. (http://www.nrcan.gc.ca/earth-sciences/land-surface-vegetation/land-cover/north-american-landcover/9150).

Polster, D. 2013. Making Sites Rough and Loose: A Soil Adjustment Technique. Technical Note. Prepared for the Boreal Research Institute, Northern Alberta Institute of Technology. 3 pp.

Young, R.E., Gann, G.D., Walder, B., Liu, J., Cui, W., Newton, V., Nelson, C.R., Tashe, N., Jasper, D., Silveira, F.A.O., Carrick, P.J., Hägglund, T., Carlsén, S. and Dixon, K. 2022. International principles and standards for the ecological restoration and recovery of mine sites. Restoration Ecology, 30: e13771. https://doi.org/10.1111/rec.13771.

Appendix D6
Environmental Site Assessment and Landfarm

D6 RECLAMATION RESEARCH PROGRAM – ENVIRONMENTAL SITE ASSESSMENT AND LANDFARM RESEARCH

D6.1 BACKGROUND

The entire site is considered as part of this research plan. Part of the objectives of the reclamation program is to quantify and remediate areas that may be contaminated because of site operations. While Baffinland has a strong environmental protection plan, walk away closure cannot be achieved until the site has been assessed and areas of potential environmental concern (APEC) have been quantified and reclaimed if required. To complete this objective, there needs to be an understanding of potential areas on site where contamination could have occurred because of mining operations, along with a technical understanding of the extent and type of contamination in relation to applicable regulations, Project Certificate conditions and reclamation guidelines from landowners and regulators.

A key component of the reclamation of APECs will be how the material will be treated. As per Baffinland's existing procedures, soil contaminated with petroleum hydrocarbons will be treated to the extent possible on site, within engineered landfarm facilities. Understanding the efficacy and timeline for treatment is a key component of site reclamation, and as such needs to be quantified for the unique climatic and operating conditions at site.

D6.2 UNCERTAINTY

Understanding and quantifying environmental conditions on site related to soil and water are key component of the overall reclamation plan and objectives. While Baffinland has a robust Environmental Protection Plan and spill prevention and reporting system, unforeseen spills or contaminate migration can occur and as such there is uncertainty regarding areas and extents of potential contamination on site. To further refine the closure strategy and better understand implications with respect to potential site contamination and remediation the following uncertainties are to be considered as part of this research plan:

- Extent of high-risk areas that will require an environmental site assessment
- Identification of what process is appropriate to evaluate these areas
- Extent and type of contamination in assessed areas, and development of a reclamation process (if appropriate)
- Volume of soil/water required to be treated

Reclamation planning requires not just an understanding of extent, type and quantity of contamination, but an understanding of treatment options and timelines. Landfarming is a standard treatment within Nunavut and has been broadly applied successfully at mines and remedial sites across the territory. Weather, landfarm design and operational procedures can all have an impact on treatment time and effectiveness and must be understood to ensure mine reclamation schedules and treatment endpoints are achieved successfully. To refine the understanding of landfarm procedures, effectiveness and timelines the following uncertainties are to be considered as part of the research plan:

- Procedures for landfarm operations (aeration, soil movement and amendments).
- Achievable treatment thresholds for hydrocarbons

- Required timelines for treatment

D6.3 RESEARCH/STUDY OBJECTIVE

This research plan is designed to improve the understanding of areas of potential environmental contamination on site and understand what treatment is required to achieve land use objectives and how this treatment/reclamation will be completed.

Specific objectives include:

- The review of historical literature and reporting to prioritize areas of investigation.
- Assessment and Identification of Areas of Potential Concern (as required).
- Development of remediation and reclamation planning as required to support reclaiming of Areas of Potential Concern (as required).
- Assessment of the efficacy of landfarming at the Mary River site, and the development of procedures and schedules to treat soil.

D6.4 OVERVIEW OF TASKS AND PROJECT RESEARCH SCHEDULE

The following is an overview of the anticipated tasks required to obtain the study objectives; the objectives are general in nature and not explicitly linked to the tasks below. An indication on status of each task is provided and when warranted, anticipated commencement and/or conclusion dates. These tasks are summarized in Table D6.1 below.

TABLE D6.1 OVERVIEW OF TASKS FOR RECLAMATION RESEARCH – ENVIRONMENTAL ASSESSMENT AND LANDFARM RESEARCH

Task #	Task	Reference Document	Status Anticipated Start and/or End Date
6.1	Literature Review	N/A	2025-2026
6.2	Assessment Prioritization	N/A	2027-2028
6.3	Environmental Site Assessment (as required)	N/A	2029 - Closure
6.4	Remediation of Areas of Potential Concern (as required)	N/A	2032 - Closure
6.5	Landfarm Treatment Assessment	N/A	2026-2032

D6.5 DETAILED DESCRIPTION OF TASKS AND FINDINGS OF RESEARCH COMPLETED

D2.5.1 TASK 6.1 – LITERATURE REVIEW

Understanding the site history to date (land use, spill reporting, annual reporting and inspection reports) is needed to identify Areas of Potential Concern and develop a comprehensive understanding of contamination risks on site, to inform the prioritization and identification of areas for formal assessment. The results of this task will be included in future ICRP revisions and annual NIRB/QIA-NWB reporting.

D2.5.2 TASK 6.2 - ASSESSMENT PRIORITIZATION

The results of the literature review will be used to develop a prioritization list for areas on site that will requirement further assessment and potential progressive reclamation. This list, along with a schedule for assessment, will be included in future revisions of the ICRP. Moving forward, this task will be completed annually as a part of routine site operations and the prioritization will be adjusted as required and appropriate.

D2.5.3 TASK 6.3 – ENVIRONMENTAL SITE ASSESSMENT

As identified in Task 2, specific areas and locations will have environmental site assessments performed as required. The goal of these studies is to assess areas deemed to be of priority for the presence, extent and type of contamination, to support the development of reclamation planning. It is anticipated that specific procedures for this research program task will be developed in conjunction with landowners, regulators and the Inuit Committees as deemed appropriate.

D2.5.4 TASK 6.4 – REMEDIATION OF AREAS OF POTENTIAL CONCERN

Where environmental site assessments identify the presence of contaminated materials in Task 3, they will be reclaimed using appropriate procedures and the results of the reclamation efforts will be verified and recorded to support closure planning. Hydrocarbon-impacted soils will be treated in on-site landfarms, as appropriate and informed by the research to be conducted in the following task (Task 6.5). Management methods for other materials such as metal-impacted soil will be determined based on the nature and extent of the impacts, and could include placement within the Waste Rock Facility, non-hazardous landfill facilities, or disposal offsite in a licensed facility.

D2.5.5 TASK 6.5 – LANDFARM TREATMENT RESEARCH

There is currently hydrocarbon impacted soil contained within the Mine Site Landfarm facility. Starting in 2025, a research program will be designed that will assess the effectiveness of treatment within this facility and develop testing and management practices to ensure the landfarm is optimally operated to support closure and reclamation efforts. The results of this research will be communicated within updates to the ICRP.

RESULTS TO DATE

TBD

LINKAGES TO OTHER RESEARCH/STUDIES

TBD

COSTS

TBD

REFERENCES

N/A

Appendix D7
Reclamation Research Programs Overall Schedule

TABLE D.7

INTERIM CLOSURE AND RECLAMATION PLAN REV NO. 6
RECLAMATION RESEARCH PROGRAMS OVERALL SCHEDULE

	Hillside Cut																			Open Pit Development																	Closure
Year of Mining	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37
Calendar Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051

Technical Comment ID#	Task	Status
Appendix D1 - OPEN PIT RUNOFF WATER QUALITY		
81.1, 85.1, 85.2, 85.3, 87.1, 91.1, 95.1, 98.1, 99.3	**1.1 - Pit Lake Meromixis**	
	Establish initial water quality predictions and review relevant baseline conditions	Completed (Baffinland, 2012)
	Collect site weather at the top of Deposit No. 1	Ongoing
	Review meromictic lakes in cold regions	Completed (Golder, 2021)
	Evaluate likelihood of pit lake becoming stratified ≥ 5 years prior to planned mining cessation	Scheduled for 2028
82.1, 82.2, 82.3, 87.1, 91.1, 97.1, 97.2, 97.4, 99.3	**1.2 - Water Monitoring and Comparison against WQ Predictions**	
	Comparison of water monitoring results.	Scheduled for 2030
87.1, 91.1, 97.1, 97.2, 97.3, 97.4	**1.3 - Update Water Quality Predictions**	
	Develop Pit Source Terms	Scheduled for 2027
	Complete predictive WQ model update ≥ 5 years prior to open pit development with operational and early closure scenarios.	Scheduled for 2029
	Complete predictive WQ model update with final pit closure scenario	Scheduled for 2029
87.1, 91.1, 97.1, 97.2, 97.3, 97.4	**1.4 - Water Treatment Options Analysis**	
	Complete options assessment if WQ modelling does not meet discharge limits	Contingency; not started
Appendix D2 - OPEN PIT FLOODING TIMELINE: Assess timeline for natural and enhanced open pit flooding		
81.1, 95.1	**2.1 - Pit Flooding Timeline Predictions (Passive Conditions)**	
	Monitor mine dewatering flow rates	Scheduled to start in 2034
	Use mine dewatering flow rates to update passive mine flooding model	Scheduled for 2036
	2.2 - Assessment of Potential Water Sources / Enhanced Flooding	
	Assess flows and retention times of potential water sources	Scheduled for 2027
	Evaluate maximum allowable water take from potential water sources	Scheduled for 2027
	Prefeasibility assessment of pumping	Scheduled for 2027
	Estimate mine flooding from each source using model	Scheduled for 2027
	2.3 - Impacts of Pit Flooding Time on the Closure Plan and Monitoring Timeline	
	Update impacts of passive vs. enhanced pit filling on closure schedule with the MCTAG	Not started
	Update plan based on selected pit filling scenario	Not started
	2.4 - Assessment of Pit Flooding on Permafrost Regime	Scheduled for 2027
Appendix D3 - WASTE ROCK STOCKPILE SEEPAGE/RUNOFF WATER QUALITY: Improve understanding of the expected performance of the waste rock closure concept		
87.1, 99.1	**3.1 - Monitor drainage WQ from waste rock stockpiles and complete humidity cell testing**	
	Monitor drainage water quality from waste rock stockpile	Ongoing
87.1, 91.1	**3.2 - Feasibility of Test Pads or Installing Instruments in a Completed Section of WR Stockpile**	
	Study design for field test pads	Completed in 2019
	Construct, operate and monitor test pile	2019 and ongoing
	3.3 - Water Quality and Quantity Modelling	
	Water quality source terms Development and Refinement	
	Modelling, interpretation and documentation of monitoring results (Near Term Closure)	
	Modelling, interpretation and documentation of monitoring results (Life of Mine)	
Appendix D4 - WASTE ROCK THERMAL MODELLING		
ICRP R-02, 85.1, 85.2, 85.3, 90.1	**4.1 - Thermistor Data Collection**	Ongoing (Golder, 2019)
	Installation and Monitoring of Thermistors in the WRF	
	Installation and Monitoring of Thermistors in the Landfill	
	4.2 - Thermal Model Update - WRF	
	1-D Model Development, interpretation and Documentation	
	2-D Model Development, interpretation and Documentation	
	4.3 - Thermal Model Update - Landfill	
	1-D Model Development, interpretation and Documentation	
	2-D Model Development, interpretation and Documentation	
Appendix D5 - NATURAL REVEGETATION		
84.1	**5.1 - Review Baseline Data (FEIS)**	Completed; Baffinland 2012; EDI (2020,2022)
	5.2 - Literature review of available reclamation/revegetation research for Northern/Arctic environments	Completed; EDI (2019)
	5.3 - Reclamation Pilot Study (Phase I) - Post-disurbance Natural Revegetation Survey and establishment of Reclamation Pilot Study	
	Characterization of terrain/soil and potential constrainst to natural revegetation	Initiated/Ongoing; EDI (2020, 2022, 2024)
	Identification of future research initiatives/opportunities	Initiated/Ongoing; EDI (2020, 2022, 2024)
	Monitoring Pilot Study Reclamation trial sites (as/when necessary)	Initiated/Ongoing; EDI (2020, 2022, 2024)
	5.4 Interim Review/Revision of RRP Objectives	
	Updated literature review of available reclamation research for Northern/Arctic environments	Initiated/Ongoing
	Project Reclamation Feasiblity Analysis	Initiated/Ongoing
	5.5 - Engage Inuit through Inuit Engagement Strategy	
	Engagement activities through Inuit Engagement Strategy	TBD
	5.6 - Reclamation Trial (Phase II)	
	Desktop Review/Planning	Scheduled for 2025
	Revegetation Survey and Reclamation Trial Site Scouting	Scheduled for 2026
	Establishment of Reclamation Trials/Investigations	Scheduled for 2027
	5.7 - Scarification Location Identification	Scheduled for 2034
Appendix D6 - Environmental Site Assessment and Landfarm Research		
N/A	**5.1 Literature review**	Scheduled for 2025
	5.2 Assessment Prioritization	Scheduled for 2026
	5.3 Environmental Site Assessment (as required)	Scheduled for 2028
	5.4 Remediation of Areas of Potential Concern (as required)	Scheduled for 2031
	5.5 Landfarm Treatment Assessment	Scheduled for 2025

Appendix E
Record of Engagement

E RECORD OF ENGAGEMENT

As the Project advances, Baffinland is committed to engagement with stakeholders regarding closure and reclamation issues as outlined in Section 2.4. Baffinland engages with communities that may be impacted by the Project, both directly and through the regulatory processes established by the Nunavut Agreement and through the structures established by its Inuit Impact Benefit Agreement (IIBA) with the Qikiqtani Inuit Association (QIA), signed in 2013 and amended in 2018. This approach has ensured that the communities have had many ongoing opportunities to provide feedback on valued components of importance to the community, the topics addressed in environmental assessment documentation, and proposed mitigations.

Community engagement is at the cornerstone of Baffinland's sustainability initiatives. It permeates every facet of operations, manifesting through several avenues, including our extensive community engagement tours such as the various annual Inuit Education and Training, Recruitment and Procurement tours, as well as workshops and meetings, which are intricately woven into the regulatory process. Baffinland maintains a robust presence within communities, conducting regular information sessions, enabling frequent community visits to the Project Site, and engaging with our Inuit employees. Additionally, Baffinland facilitates ad hoc visits on specialized topics. Through these interactions, Baffinland continually gathers invaluable feedback that informs and enriches operational practices. As Project engagement is an ongoing process for the life of mine, Baffinland will continue to engage with communities in a meaningful way to mitigate risks and gain mutual respect.

Since the Project was approved with the issuance of the Project Certificate No. 005 in 2012, there has been continuing engagement with the communities on the Project generally. These engagements did not restrict topics of discussion. It is important to highlight the breadth of public, community, government, and Inuit engagement that has occurred since mining production began in 2014. The following summarizes the key engagement activities that have been carried out by Baffinland since this time:

- more than 250 formal meetings have been held with Hamlet Councils and HTOs;
- approximately 100 Public Meetings, Towns Halls or Public Radio Shows;
- close to 75 Working Group Meetings (Marine, Terrestrial, and Socio-Economic);
- above 20 formal site visits;
- youth forums and community organization meetings such as sewing groups, foodbanks, schools and Search and Rescue committees;
- innumerable informal engagements through many interactions with local community members at the Mary River Project site; and
- continuous presence of Baffinland Community Liaison Officers in the North Baffin communities since 2007, and Inuit Knowledge Holders and Community Resource Guides since 2022.

These approximately 450 formal engagements related to the project, in addition to the numerous and frequent other informal engagements, shows the deep commitment Baffinland has to working with communities and Inuit. This summary does not reflect:

- engagements with Inuit related to ongoing implementation of the IIBA, including engagements with Inuit contractors, job fairs and workshops and training of potential Inuit employees;
- engagements with Governments (Federal/ Territorial);
- the volume of written materials exchanged with key parties such as the Hamlets and the HTOs via email and via the NIRB review and reconsideration process.

Table E.1 provides a summary of comments received during engagement activities that are specific to closure, together with associated Baffinland responses that were given at the time when the comment was received (where applicable). While mine closure has not been a primary topic of the feedback received during most engagement activities, many indirect discussions on closure have occurred focusing on related issues such as considering land-use in mine design (e.g. Tote Road), proposed environmental mitigation, management and monitoring techniques during mining, and residual effect predictions.

Note that Baffinland also consults with landowners and other key stakeholders as part of the Annual Security Review (ASR) process conducted in accordance with Part C and Schedule C of Type A Water Licence 2AM-MRY1325 and Section 9.2 of the Commercial Lease No. Q13C301 (see Section 1.3). Though not presented here, details of these consultations are available at the NWB public registry.

Table E.1 Record of Engagement – Comments from Localities and Intervenors

Date	Preliminary Interest	Stakeholder Group/Attendees	Location/ Engagement Name	Stakeholder Comment(s)/Summary of Issue(s) raised	Baffinland Response/s (if applicable)
2015-11-20	General	Members of the public – Pond Inlet	Pond Inlet Workshop No. 4	Community participant comment: This is not really concerning Baffinland but refers to caribou. The infrastructure from the Nanisivik Mine was left behind. We tried to get the mine to clean it up, but they didn't. There were fuel and diesel spills left behind. No one has cleaned it up. Seals have bad livers now because of what they were eating. Pond Inlet will need to worry about fuel and fuel clean up. The marine mammals can be affected because of this; we've seen the impacts in Arctic Bay from this. Just beware of all these promises the company makes.	Baffinland is required to post securities for reclamation and closure through the water licensing process. Ongoing monitoring programs, environmental effects assessment, and the development of this Interim Closure and Reclamation Plan will all safeguard against future environmental effects.
2016-05-08	General	Members of the public – Pond Inlet	Pond Inlet In-person meeting	Community participant comment: There's too much dust at the mine site. I'm worried about the stockpile being out in the open. I would like to see it covered with a shed. I'm worried about iron ore dust being left behind on the land.	Comment noted.
2016-11-25	General	Hall Beach	Hall Beach Public Forum/ Meeting	Community participant comment: When they dig down the whole mountain what are we going to call it?	Comment noted.
2017-05-30	General	Members of the public - Pond Inlet	Pond Inlet Community Meeting	Community participant comment: You mention that the mine is going to operate for 100 years, can things start being cleaned up at the mine right now?	While the life of the mine could last 100 years, Baffinland is committed to progressive reclamation measures where appropriate.
2017-05-31	General	Hamlet of Arctic Bay	Hamlet of Arctic Bay In person meeting	Community participant comment: The infrastructure you no longer need, is it possible for those to be made available to the communities.	Project team comment: Yes, QIA and communities have first rights. We will talk to them first before getting rid of anything.
2018-01-08	General	Igloolik	Igloolik In-person meeting	Community participant comment: Good evening, regarding Baffinland Phase 2 proposal, we were involved in Phase 1, in phase 2 there are many things that you are proposing, some of them having been completed, if you increase your trucks to haul, what traffic is going to increase, regarding dust, if you expand your operations how are you going to manage the dust, secondly, our land is our livelihood, this is our land that you are exploiting, people get away with a lot these days, if this is not your land you are visitors, you did not have a personal claim to it like us, how are you going to care for the land, reclaim it, how will you be the steward of the environment. That is very important. There are 5 communities affected, they need to have better information, exactly what changes you are proposing, it is confusing when changes happen and we aren't told, also while you're working on this we who live in our communities we live in this land, you will be working with the world, prices will rise and fall, we know that. Many people are unable to work due to low levels of education, I don't see how you plan to increase your Inuit employment, for instance if you have a train its called the Baffinland via rail, you have I think it would be good if you could say Baffinland which includes Igloolik, Pond Inlet, Arctic Bay, all the communities, not just Baffinland.	In regard to reclamation, the Project team confirmed that Baffinland works with QIA to develop closure and reclamation plans which dictate how the Project area will be reclaimed at closure, including revegetation studies and how infrastructure will be removed.
2018-04-05	General	Hall Beach Hamlet and HTA representatives	Hall Beach In-person meeting	Community participant comment: Drums were used in the early stage of exploration. Later on, they were using containers. The drums of fuel that were used are stockpiled at the dump now, corroding away. When I was a young man, these were used as fuel drums. It that going to be the same practice for you guys? Are you going to leave the drums there when you switch to containers?	Project team comment: No, we will send the empty drums south afterward. Things are different now; we need to put up reclamation funds ahead of time. Also, our practice now is to remove the drums by backhauling empty drums as well as any other waste we can't incinerate.
2018-04-06	General	Hamlet of Igloolik	Igloolik In-person meeting	Community participant comment: Environmental protection, jobs, and restoring the land at closure are all important. What will be done with surplus equipment when exploration is finished? How will drillholes be reclaimed?	Comment noted. This is considered as part of the closure planning.

Date	Preliminary Interest	Stakeholder Group/Attendees	Location/ Engagement Name	Stakeholder Comment(s)/Summary of Issue(s) raised	Baffinland Response/s (if applicable)
2018-04-06	General	Igloolik Municipal Council, Igloolik HTA and QIA	Igloolik In-person meeting	Community participant comment: Three topics. I myself want the environment protected. Although the job opportunities are important, I also want the environment protected. While they are exploring, once they have done their exploration, we know they won't be making any money and they have to clean up the area. They have to close it and try to put it back the way it was before. Will they go back to Baffinland, or will they be surplus and given to QIA? If that were to happen, if they make money they would probably stay there. If they are going to drill deep down, what will they use to close them up (the drillholes)?	Project team comment: Baffinland is required to post securities for reclamation efforts, as a condition of operating the Mary River Project through the water licensing process. Baffinland will decide if camp and equipment will be sold to the community or brought to another project.
2018-06-15	General	Hall Beach	Hall Beach In-person meeting	Community participant comment: We were asking about tents and upgrading accommodations. Maybe you can give the tents to the communities.	Project team comment: There is a policy that the QIA has priority if they want to take decommissioned equipment. We have to consult with them first.
2019-02-12 to 2019-02-14	General	Risk Assessment Workshop Participants, Various Community Members	Trois Riviere Community Risk Assessment Workshop	During the discussion of preliminary closure planning, participants provided the following comments: - It is too early to provide comments on closure. When the time comes, it will be different, and we may get the wrong idea now. Need to obtain community input when the plans are developed. - Consider potential for other mine projects to be developed and use the rail and other infrastructure. - If the rail line is developed from the south to the north port, consider giving it to an Inuit organization to operate. This could be used to transport commercial goods, or potentially used for tourism. This is a decision that should be made by Inuit at that time. - Is there the potential to extend the road to Pond Inlet? - There have been issues in the past with projects leaving equipment behind on the land. All equipment should be removed (do not treat the land as a dumpsite). - Rename the area of Mary River to the Inuktitut name (Old Mary River). A number of questions were raised from participants regarding the planned approach to closure, including: the disposal and burial of equipment, procedures that will be followed before equipment is buried, the locations of equipment burial and landfill sites, and the creation of a pit lake. Specific comments made by participants included the following: - The indigenous plants we had here should all come back. Perhaps once the dust is gone, they will be able to grow back. Vegetation comes back naturally over the years. - We do not have much vegetation in the Inuit diet. - Contaminants need to be assessed. If there are any contaminants in the dust, there may be chemicals that will inhibit growth of vegetation. Lichen takes a long time to grow. - It is difficult to grow vegetation when white rock and gravel is used as a cover. Soil is needed for revegetation. If black rock is used and soil placed on top, vegetation may be able to grow. - Would like Baffinland to try to keep things looking as natural as possible. - Regarding equipment, anything that can be used should be given to Inuit. All contaminants should go down south. The heavy equipment should go to communities. - The five affected communities should cooperate and should be involved in the closing of the mine. What is useful, including the railway, should go to the communities. - You ask what color you would like – we need to see it first. You have a picture of Mary River, but it is not a picture of the natural state. You should use pictures of the natural land before the project to assist with reclamation.	Comments noted.

Date	Preliminary Interest	Stakeholder Group/Attendees	Location/ Engagement Name	Stakeholder Comment(s)/Summary of Issue(s) raised	Baffinland Response/s (if applicable)
2019-01-14/17	General	Risk Assessment Workshop Participants, Various Community Members	Mary River Mine Site Community Risk Assessment Workshop #1	Participants expressed the following point: After the mining is completed, there may be consequences that people find out about after the fact.	Baffinland adheres to an Interim Closure and Reclamation Plan (BAF-PH1-830-P16-0012) which details a Final Closure and Reclamation Plan. Post closure monitoring will continue until closure principles of long-term safety of the site, no long term active care requirements, physical stability and chemical stability have been shown to be met by monitoring results. These activities may be periodic. It is currently estimated post closure monitoring and follow-up inspections will be conducted for a period of fifteen (15) years based on impacts assessment determinations described in the FEIS.
2019-07-03	General	Members of the Public – Arctic bay	Arctic bay In-person meeting	Community participants: Arctic Bay concerned about narwhal and seal populations, dust and project closing date.	Comments noted.
2019-07-03	General	Hall Beach	Hall Beach In-person meeting	Community participant: Hall Beach HTO Chairperson concerned that they have only been shown "certain things" and defines reclamation.	Comment noted.
2019-07-03	General	Members of the Public – Clyde River	Clyde River In-person meeting	Community participant comment: Clyde River EDO would like to see fencing around contaminated areas.	Comment noted.
2021-10-05	General	North Baffin Community Economic Development Officers	Tele-conference	Call with Clyde River, Arctic Bay, and Pond Inlet to discuss updated closure plans for the Mary River Project.	Comment noted.
2021-10-05	General	North Baffin Community Economic Development Officers	Tele-conference	Follow-up call with Arctic Bay and Baffinland on closure plans for the Mary River Project.	Comment noted.
2021-10-13	General	Mary River Socio-Economic Monitoring Working Group Meeting (MRSEMWG)	Tele-conference	Updated Closure Planning.	Comment noted.
2023-12-01	Steensby Community Engagement	Qikiqtani Inuit Association, HTO members	Pond Inlet In-person meeting	Community participant comment: You said you are going to close Milne Inlet and open Steensby. Are you going to put it back to its original form? When are you going to start cleaning up? Are you going to be having meetings about what you are going to do with Milne Inlet?	Project team comment: Baffinland is in the process of determining what, if any, closure requirements there are for the northern infrastructure and will continue to work with QIA on this. Baffinland will share updates with the communities.

Appendix F
Lessons Learned from Other Projects

F LESSONS LEARNED FROM OTHER PROJECTS

Mine and port decommissioning, closure, and rehabilitation have been conducted at sites in the Canadian North for several decades. This time period has allowed the planning, permitting, closure, and post-closure performance to be evaluated. These include: Colomac Mine, Giant Mine, Diavik Mine, Ekati Mine, Faro Mine, Nanisivik Mine/Port. As part of its reclamation research initiatives, Baffinland is committed to establishing the primary lessons learned from these examples and others, to help evaluate options related to, but not limited to: revegetation strategies; post closure property control and land use; stakeholder relationships and commitments; residual waste material management; post-closure maintenance (if required); water management (before, during, and after closure), and managing socio-economic impacts. Understanding the relevant lessons learned at comparable sites will be an ongoing process as part of the closure planning process, future updates will be added as applicable. An initial summary of lessons learned from some of these projects is compiled in Table F.1.

Table F.1 Lessons Learned from other Projects

Development/Location	Activity Leading to Lesson	Lesson Learned	Management Result
Ekati and Diavik Mines - NWT	Placement and covering of mine rock piles and waste	Permafrost develops rapidly within mine rock piles with an active freeze/thaw layer, additional run-off and infiltration of water without proper cover.	The use of mine rock piles will limit the quantity of impacted seepage due to exposure to freezing surface temperatures and permafrost aggradation. Placement of an engineered cover over storage areas will promote surface runoff and further limit infiltration and water contact. Waste rock deposition sequencing in winter (max lift thickness).
Ekati and Diavik Mines - NWT	Revegetation research studies	Revegetation and planting in northern regions has generally been across long time lines, or often with uncertain success. Site re-contouring has improved natural recovery at the Ekati and Diavik Mines.	Identification of appropriate site preparation techniques to promote natural revegetation is a component of the current Reclamation Research Program (Appendix D).
Ekati, Diavik and Snap Lake Mines - NWT Jericho Mine - Nunavut	Caribou concerns and mine site infrastructure	Caribou are known to use artificial habitats created by mine structures (e.g., roads, mine waste piles). Caribou travel through and around the mine site during migration. There is a potential for caribou passage to be impeded or for caribou to be hurt or killed by mining operations. Structures and rock piles may also provide a means of shelter avoiding insects. Fencing can lead to caribou mortality from entanglement. Fences can be used by predators to limit escape options of their prey.	Road and rail crossings designed for the northern transportation corridor at expected caribou travel routes.
Con Mine - NWT	Site surface and infrastructure	Certain infrastructure discussed in ongoing engagement may provide value to the local community, or third parties.	Opportunities for beneficial ongoing use of primary infrastructure including airstrip, road, rail embankments, and docks have been considered in engagement discussions to date.
Ekati Mine - NWT	Operational monitoring programs	Monitoring programs in place at site are effective in detecting changes.	The operational monitoring programs can be used to design effective post-closure monitoring programs.
Ekati Mine - NWT	Progressive reclamation of older infrastructure	The importance of treating closure and reclamation activities as projects is integrated into mining operations.	This learning is incorporated into approach taken for planning, resourcing, and execution of future progressive reclamation, and final reclamation efforts.

Development/Location	Activity Leading to Lesson	Lesson Learned	Management Result
Minto Mine - Yukon	Progressive reclamation measures linked to operational development plans for waste rock storage, overburden dumps and tailings management areas	Reduced financial liability for closure costing and bonding.	Review operational plans and procedures to incorporate rigorous assessment and implementation of progressive closure measures. Baffinland's progressive rehabilitation measures proposed as part of the ICRP are expected to be technically and economically feasible and reflect Project closure principles.
Giant Mine - NWT	Baker Creek Reach 4 Re-alignment	Frozen material exposed during excavation melted and caused settlement of excavated areas.	Characterization of frozen materials is needed for sensitive excavations. This includes road and rail construction areas.
Ekati, Diavik and Snap Lake Mines - NWT	Underestimated groundwater inflows in initial site water quantity and quality predictions	All three mines were developed where zones of enhanced permeability persisted, which led to underestimation of groundwater inflows, and in some cases the volume of high TDS water requiring management at surface.	Assessing the water-balance for the proposed Open Pit and timelines for its enhanced flooding is a priority of closure planning (see Appendix D5).
Faro Mine - Yukon Colomac, Gahcho Kue, Diavik, Ekati Mines - NWT Equity Silver Mine - BC	Flooding of open pits, and establishment of meromictic conditions	Poor water quality (e.g. acidic water, high TDS water) can be isolated at the bottom of the pit when meromictic conditions are present in a flooded pit lake. Information required to complete an assessment prior to closure can be collected from a site as the open pit is developed. Predictive modelling can then be completed using collected site data to help inform closure options. Development of meromictic conditions can occur at northern Canadian sites depending on the site-specific conditions. Topography, pit bathymetry/dimensions, temperature, and wind direction/speed play a critical role in understanding potential for pit lake turnover and development of meromictic conditions.	Considerations for poor quality water, density differences, high TDS mine water at the bottom of the pit and low TDS overlying freshwater cap, as well as the pit geometry may affect homogenization of pit water following closure. This information is guiding development of an ongoing Reclamation Research Program focused on open pit runoff water quality (Appendix D1)
Cartier Mining, ArcelorMittal, Alaskan Railway, Churchill-Manitoba, Scandinavia and Tibet Railway Systems	Railway operations in northern regions that are affected by permafrost conditions	Cold climate conditions and extremities vary across different regions when considering design and implementation of rail systems.	Baffinland will draw from experience of previous railway operators in northern conditions. Baffin Island extreme cold lasts 5 to 6 months. One consideration is strategic management of operation and maintenance crews including rapid rotations at project site during extreme cold conditions.

Development/Location	Activity Leading to Lesson	Lesson Learned	Management Result
Nanisivik Mine, Nunavut	Community in Nanisivik closed with the mine	Closure impacted the socio-economic conditions for Inuit in the area of the mine. This is a result of the precipited closure of the community supporting the mine, which had impacts on Inuit.	Engagement with Inuit is being proactively planned to occur throughout the closure planning process and well in advance of mine closure.
Ekati, Diavik, Gahcho Kue Mines - NWT	Remediation of hydrocarbon -contaminated material during operations and immediately after contamination occurs	Hydrocarbon-contaminated soil material is expected during operations. Establishing a land treatment area for hydrocarbon contaminated soils during operations ensures prompt cleanup, remediation of material, and reduced closure liability.	The Milne Port landfarm package includes the landfarm containment area and the contaminated snow containment area constructed south of the accommodation camp, near the Milne Inlet Quarry (Q1). The landfarm containment area was constructed to store/remediate the petroleum hydrocarbon (PHC) contaminated sand/gravel materials. A landfarm has also been constructed at the Mine Site. Remedial efforts for these impacted materials will be a priority for Baffinland.

Appendix G
Predicted Residual Effects

G PREDICTED RESIDUAL EFFECTS

G1 INTRODUCTION

Residual effects refer to the remaining environmental effects identified for the Project, post-mitigation, at the expected closure period of the Project. Based on the information presented in the Mary River Project FEIS, the Mary River Project as approved will have no significant adverse residual effects for the VECs identified within the biophysical environment. The Project is not expected to compromise the ecosystematic integrity of the Nunavut Settlement Area. In addition, no significant adverse residual effects are predicated to occur to VSECs identified within the socio-economic environment, and the Project is expected to have significant positive effects for most of the VSECs. This position is supported by comprehensive site-specific studies (baseline and modeling studies), IQ, extensive public consultation, and expert opinions.

An overview of the assessment methodology used to develop this residual effect position, as detailed in Volume 2 of the Mary River Project FEIS, is provided in Section G.2. A summary of the residual effects identified for each VEC and VSEC as part of the Mary River Project FEIS is provided in Section G.3. Section G.4 provides current predicted residual effects and Section G.5 provides an overview for Baffinland's approach to ongoing assessment of the predicted residual effects.

Further detail of the Project residual effects is presented in Volume 4 through 8 of the Mary River Project

G2 FEIS RESIDUAL EFFECTS ASSESSMENT METHODOLOGY

G2.1 DETERMINING SIGNIFICANCE OF RESIDUAL EFFECTS

One of the underlying purposes of the EIS is the assessment and determination of significance of the residual effects and their acceptability to Inuit communities and the Project stakeholders. As directed by the NIRB Guidelines (NIRB 2015), determination of significance considers the following criteria.

- Direction or nature of an effect (i.e., positive/beneficial versus negative/adverse);
- Magnitude and complexity of an effect;
- Extent of the effect, including the geographical area that will be affected, the size of the affected human populations, and/ or the size of the affected wildlife populations and habitat;
- Frequency and/or duration of an effect;
- Reversibility or irreversibility of an effect;
- Probability or likelihood of occurrence of the effect; and
- The level of confidence in the effects prediction.

These criteria were adopted for this assessment, as specified in the Guidelines and because the criteria have precedence of use for other environmental assessments in the Canadian Arctic (NIRB 2007, 2009; Lawrence Environmental 2000, 2004; Wolfden Resources Inc. 2006; De Beers Canada Inc. 2004). In addition to the above attributes, NIRB (2009) directed Baffinland to consider additional qualifiers in its significance evaluation. Additional attributes are considered, if and as applicable, in the assessment of the VECs/VSECs. Section 90 of the *Nunavut Planning and Project Assessment Act* (NuPPA) lists factors to be considered in determining the significance of impacts. Certain factors, listed below, are the same for all VECs:

- The ecosystem sensitivity of the area;
- The historical, cultural, and archaeological significance of the area; and
- The size of the human and the animal populations likely to be affected by the effects.

Definitions and assessment criteria for each are identified in Table G.1, which lists the complete set of attributes (criteria and qualifiers), provides a definition and rationale as well as a summary of their relevance or context to the Mary River Project, and describes how the attribute was incorporated into the assessment.

TABLE G.1 ATTRIBUTES USED TO EVALUATE SIGNIFICANCE OR RESIDUAL EFFECTS

Attribute	Definition and Rationale	Role in Significance Determination[2]
Direction and Nature[1]	The ultimate long-term trend of an environmental effect - positive, neutral, or negative.	**Qualifier** Only negative effects are assessed for significance
Magnitude [1]	The amount or degree of change in a measurable parameter or variable relative to existing conditions (the exposed population)[3]. This attribute can also consider complexity - the number of interactions (Project phases and activities) contributing to a specific effect.	**Primary Criterion** High magnitude = high significance **Secondary Criterion** If magnitude and geographic extent are related, the higher the potential significance
Extent[1]	The geographic area over which the interaction will occur.	**Secondary Criterion** The larger the zone of influence, the higher the potential significance
Frequency[1]	The number of times during a project or a project phase that an interaction or environmental effect can be expected to occur.	**Secondary Criterion** Greater the frequency of occurrence, the higher the potential significance
Timing	The Project Phase within which the environmental effect will occur.	**Qualifier** Provides context
Duration[1]	The period over which the environmental effect will occur.	**Secondary Criterion** The longer the duration of an interaction the higher the potential significance
Reversibility[1]	The likelihood that a VEC/VSEC or Indicator will recover from an environmental effect, including consideration of active management techniques. Reversibility is considered for biological VECs at the population level. Therefore, although an effect like mortality is irreversible, the effect at the population level might be reversible.	**Primary Criterion** The greater the potential to reverse an effect, the lower its potential significance
Probability[1]	The likelihood that an interaction and a consequent effect will, in fact occur.	**Qualifier** (considered only for potentially significant effects) The higher the probability of occurrence, the greater the significance
Certainty[1]	The level of confidence in the knowledge or analysis that supports the prediction, in particular with respect to limitations in overall understanding of the ecosystem, and limitations in the ability to foresee future events or conditions.	**Qualifier** (considered only for potentially significant effects) The lower the certainty of occurrence, the more conservative the approach to prediction of significance
Ecological/Socio-economic Context/Value[1]	The general characteristics of the area in which the Project is located, as indicated by existing levels of human activity and associated types of disturbance. Interpreted to mean the basis for assigning "value" to the particular VEC.	**Qualifier** VECs/ VSECs and Indicators have been identified as "valued"

Attribute	Definition and Rationale	Role in Significance Determination[2]
Environmental Sensitivity[1]	Environmental sensitivity of the area likely to be potentially affected. Refers to areas of heightened sensitivity that will be identified where applicable in relation to the Project (i.e., areas sensitive to spills; caribou calving areas).	**Qualifier** The Magnitude of an effect within an area of environmental sensitivity will be greater; therefore environmental sensitivity is considered in the discussion and rating of the Magnitude attribute
Historical, Cultural, Archaeological Significance[1]	To be considered within the geographic area to be potentially affected.	**Qualifier** (Extent - above) Historic, cultural and archaeological significance is evaluated within the archaeology effects assessment (Volume 4)
Human and wildlife populations, and the size of the affected wildlife populations and related habitat[1]	The size of the potentially affected human populations; and the size of the potentially affected wildlife populations and related habitat.	**Qualifier** (Extent - above)
The extent of the effects of the project on other regional human populations and wildlife populations, including the extent of the effects on Inuit harvesting activities[1]	The Project might have the potential to affect other human and wildlife population, if there are residual effects to marine wildlife or socio-economic benefits that extend outside Nunavut.	**Qualifier** Consider within the Transboundary Effects Assessment (FEIS Volume 9, Section 4; Phase 2 Proposal, TSD-27)
The potential for cumulative adverse effects given past, present and future relevant events[1]	The Project might have the potential for cumulative effects where residual effects from the Project are expected to occur.	**Qualifier** Consider in the Cumulative Effects Assessment (FEIS Volume 9, Section 1; Phase 2 Proposal, TSD-27
Ecosystem function and Integrity[1]	Ecosystem function and integrity is important to identified VECs and humans.	**Qualifier** Outcome of the significance determination
The effect on the capacity of resources to meet present and future needs (sustainability)[1]	The sustainability of this Project, and any major industrial project, is an important element to assess.	**Qualifier** Outcome of the significance determination
Value[1]	The value attached to the affected VEC or VSEC by those who identified them. An environmental or socio-economic component was identified as "valued" and was addressed in the EIS if it was found to have a high value to communities.	**Qualifier** Addressed as part of Issues Scoping where the "value" of each component is considered. The value attached to a VEC or VSEC is more or less equivalent to "Sensitivity" described above.

NOTES:

1. Specifically required by NIRB guidelines.
2. Criterion - directly contributes to the determination of significance. Primary criteria are given greater weight than secondary criteria. Qualifier - acts as a modifier to be considered when assigning values/rankings to assessment criteria.
3. In the majority of cases there is either a poor or no estimate available of the total population. However, for the purpose of undertaking an environmental assessment, an effects prediction can be made by making reasonable assumptions. The most common approach is to take an area that is less than the full range of a population and, often on the basis of density estimates (or by using habitat as an indicator), a conservative prediction is possible, i.e. If the effect is calculated for a portion of the population and it results in a magnitude of effect that is beneath a defined threshold, then it is reasonable to predict the effect on the entire population, even in the absence of a total population estimate. This approach is not greatly different from that used by resource managers that have the mandate to manage wildlife populations, who are challenged to develop harvest quotas, even where they do not have an accurate or complete population estimate available to support these decisions.

Volumes 4 through 8 of the Mary River Project FEIS present the effects predictions for individual resource specific component themes presented in each volume. Volume 9 of the Mary River Project FEIS presents the cumulative environmental effects assessment. Additional residual effects predictions for past assessments for the Approved Project include the ERP FEIS Addendum (Baffinland 2013) and subsequent addenda for the PIP (Baffinland 2018), PIPE (Baffinland 2020), PIP Renewal (Baffinland 2022) and SOP (Baffinland 2023) applications. More detail on these assessments is provided in Section G4.

G2.1.1 RATING CRITERIA OF RESIDUAL BIOPHYSICAL IMPACTS

For the categories for criteria and qualifiers applied directly to the determination of significance for residual biophysical effects, with due consideration to the NIRB requirements cited above, see Table G.2.

TABLE G.2 RATINGS FOR EVALUATING RESIDUAL BIOPHYSICAL EFFECTS

Criteria	Classification	
Magnitude (Specific to the VEC and the impact)	Level I	An effect on the exposed indicator/VEC that results in a change that is not distinguishable from natural variation and is within regulated values
	Level II	An effect that results in some exceedance of regulated values and/or results in a change that is measurable but allows recovery within one to two generations
	Level III	An effect predicted to exceed regulated values and/or results in a reduced population size or other long-lasting effect on the subject of assessment
Extent The physical extent of the effect, relative to study area boundaries	Level I	Confined to the LSA
	Level II	Beyond the LSA and within the RSA
	Level III	Beyond the RSA
Frequency How often the effect occurs	Level I	Infrequent
	Level II	Intermittent
	Level III	Frequent or continuous
Duration The length of time over which a Project effect will occur	Level I	Short-term (effect lasts up to four years)
	Level II	Medium-term (up to 25 years, for the life of the Project)
	Level III	Long-term (beyond the life of the Project) or permanent
Reversibility The likelihood of the VEC to recover from the effect	Level I	Fully reversible
	Level II	Reversible with cost/effort
	Level III	Irreversible
Qualifiers		
Certainty Limitations in the overall understanding of the ecosystem and ability to predict future conditions	High	Baseline data are comprehensive; predictions are based on quantitative data; effect relationship is well understood
	Medium	Intermediate degree of confidence between high and low
	Low	Baseline data are limited; predictions are based on qualitative data; effect relationship is not well understood

Probability The likelihood that the predicted impact/residual effect will occur	Unlikely	Less than 20% likelihood of occurrence
	Moderate	Between 20 and 60% likelihood of occurrence
	Likely	Over 60% likelihood of occurrence

Each of the five criteria contributes to the determination of significance. Criteria are categorized in three levels (Levels I, II, and III), where Level I is indicative of a negligible or limited potential to contribute to an overall significant environmental effect, and Level III is indicative of a high potential. Level II represents the intermediate condition.

G2.1.2 RATING CRITERIA FOR RESIDUAL SOCIO-ECONOMICS IMPACTS

Similar criteria were applied to the socio-economic effects assessment with some modification and additional criteria in consideration of the nature, complexity, and multiple perspectives associated with socio-economic issues. For the attributes (criteria and qualifiers) identified as the determinants of significance of socio-economic effects, see Table G.3.

TABLE G.3 RATING CRITERIA FOR EVALUATING RESIDUAL SOCIO-ECONOMIC IMPACTS

Criteria	Classification
Direction	Positive
	Variable
	Negative
Geographic Extent	Description of the area and communities most affected
Social Extent	Demographic groups or social units identified as most affected
Magnitude Intensity of the effect	Low
	Moderate
	High
Frequency How often the effect occurs	Infrequent
	Intermittent
	Continuous
Duration Length of time over which a Project effect will occur	Short-term (less than four years)
	Medium-term (up to 25 years, life of the Project)
	Long-term (beyond the life of the Project)
Reversibility Likelihood of recovery from effect	Reversible
	Partly reversible with cost/effort
	Irreversible

G2.1.3 OVERALL EVALUATION OF SIGNIFICANCE

NIRB (2009) stated that impact significance is based on comparing the predicted state of the environment with and without the Project, and expressing a judgment as to the importance of the changes identified. NIRB directed that the EIS shall present the residual effects assessment of the Project so that the reader can clearly understand the real consequences of the Project, the degree of mitigation of effects, and which effects cannot be mitigated. NIRB also directed Baffinland to consider the dynamic change of ecosystems and their components in determining significance.

The overall significance of an effect is derived from the experience and professional judgment of the environmental practitioners who prepared the assessment, considering the rankings of the contributing attributes of significance:

- While substantially based on professional judgment, the following are general rules of thumb applied in determining significance:
- If the magnitude of the effect is low, then the predicted effect is "not significant," recognizing that magnitude includes consideration of sensitive species, habitats or populations. If effects on measurable components such as air or water quality meet applicable performance criteria, standards or guidelines, then the magnitude of the effect is negligible to moderate, and therefore the prediction will be for an effect that is "not significant."
- If the geographic extent of the effect is confined to the PDA or LSA, then the predicted effect is likely to be "not significant."
- If the extent of a negative socio-economic effect is limited to individuals who also receive a corresponding positive benefit, then the predicted effect is likely to be "not significant."
- If the effect has a moderate to high reversibility, the predicted effect is likely to be "not significant."
- If the duration of the effect is short term (e.g., construction period only) then the effect prediction is also likely to be "not significant."
- NIRB (2009) also directed Baffinland to communicate with potentially affected communities and organizations to solicit input on the values placed on VECs and VSECs as well as significance of impacts:
    - The Proponent shall describe how it will ascertain that significance that different parties assigned to each impact, and how it will proceed if different parties ascribe varying significance to VECs, VSECs or the associated impacts. If it is impossible to attain a consensus on the significance of certain impacts, the Proponent shall present the range of viewpoints expressed and shall present and justify its preference, if any. Finally, the Proponent shall describe the significance it ascribes to each effect, and justify how the significance of the effect was determined, taking into consideration and avoiding duplication of, the information provided above (NIRB 2009)
- Finally, in its Pre-Hearing Conference Report, NIRB (2011) directed Baffinland to reconsider the significance of potential Project impacts where parties raised concerns with the significance determinations presented within the Draft Environmental Impact Statement (DEIS).
- To this end, Baffinland attempted to assemble, synthesize and present feedback from the following sources:
    - Records of public meetings from 2006 through the first part of 2011.
    - Records from Inuit knowledge studies held to date (individual interviews and workshops).
    - Kajjuqtikkut - A five-day workshop held in Arctic Bay March 10-14, 2008, attended by members of the five Inuit Knowledge Study working groups. The key themes of transportation (marine and rail), caribou, marine mammals, and socio-economic issues were discussed and minutes recorded.

- A five-day workshop jointly held by Baffinland and the QIA at Mary River the week of September 1218, 2010, with community representatives selected by the QIA. The workshop focused on community perspectives on the significance of predicted impacts on caribou, marine mammals and land use.
- Feedback of concerns raised with the significance determinations presented in the DEIS.

- Baffinland integrated a summary of the significance determination within each of the individual effects assessments in Mary River Project FEIS Volume 4 through Volume 8 while Volume 9 presents the cumulative environmental effects assessment. The approach in this EIS was to present the evidence clearly and in the manner requested in the Guidelines (NIRB 2009).

Consideration of Inuit Views on Significance

Baffinland recognizes the term “significance” is used differently in different contexts. Inuit have shared different views with Baffinland on what the word “significance” means to them. Some Inuit have told Baffinland that any change to the environment in which they live and carry out harvesting and other cultural practices is significant. Some Inuit have told us that they have observed significant changes to the environment that they do not attribute to the Project. Nonetheless, the assessment must recognize such changes whether the project is causing them or not.

Importantly, significance determinations are made following consideration of important mitigations and management measures applied to each VC. The mitigations applied reflect those that have been developed as a direct result of local Inuit feedback and participation in the Project. For example, many of the shipping mitigations that exist in the current Project have been developed as a direct result of what Baffinland has heard has been of importance to and would help minimize impacts from the Project.

Many Inuit have been clear that they expect Baffinland to make efforts to prevent negative impacts, regardless of how big or small those impacts may be. Baffinland also respects there are some aspects of Inuit views on significance that may be challenging to put into words (written and oral), and that non-Inuit may never fully understand. Based on this more holistic understanding of “significance”, Baffinland has worked with Inuit and regulatory authorities to develop mitigation measures and monitoring programs to address Inuit concerns. Where individuals and/or groups have indicated that they are concerned that an effect has occurred or may occur because of the Project, Baffinland has honored that advice and taken action as demonstrated throughout this assessment– meaning if Inuit have identified a concern, it has been treated as “significant” in terms of developing and implementing robust mitigation measures to minimize that effect. In the context of environmental assessment, the ultimate significance rating may result in a ‘non-significant’ effect as per the methodology applied, but that in no way implies that Baffinland does not treat the concerns and views shared with Baffinland as ‘non-significant’. A determination of non-significance will still result in monitoring programs to be applied and additional mitigation measures to be considered where relevant.

The term “significance” in the context of standard environmental assessment methodology/practice for project regulatory applications has a specific meaning and project proponents are expected to apply specific methodology when determining ‘significance’. The terms “significant” and “not significant” within the environmental assessment context refer specifically to whether a project activity or component, when interacting with a VC, will produce residual effects that by various possible reasons are unacceptable by causing too great an adverse effect (such as exceedance of a defined threshold, if available). The Adaptive Management measures that have been developed for the Project will ensure that this continuous feedback loop will continue throughout the life of the Project, and that mitigations may continue to be developed as a result of feedback on topics of importance to local Inuit.

G3 RESIDUAL EFFECT PREDICTED AT PLANNED CLOSURE

Using the methodology presented in Section G.2, the predicted residual impacts were assessed and the associated consequences were evaluated for each impact to a VEC or VSEC. FIGURE G-1 provides a representation of this process ensure residual effect predictions are meeting expectations. TABLE G-1 provides a summary of the potential residual effects, by VEC and VSEC, identified for the Project during the FEIS and their associated closure and post closure monitoring programs.

Complete details including the environment consequence calculations, residual impact criteria classification, probability of occurrence and level of confidence all VECs and VSECs are presented in Volume 4 through 8 of the Mary River Project FEIS. The EIS was updated to account for the Early Revenue Phase.

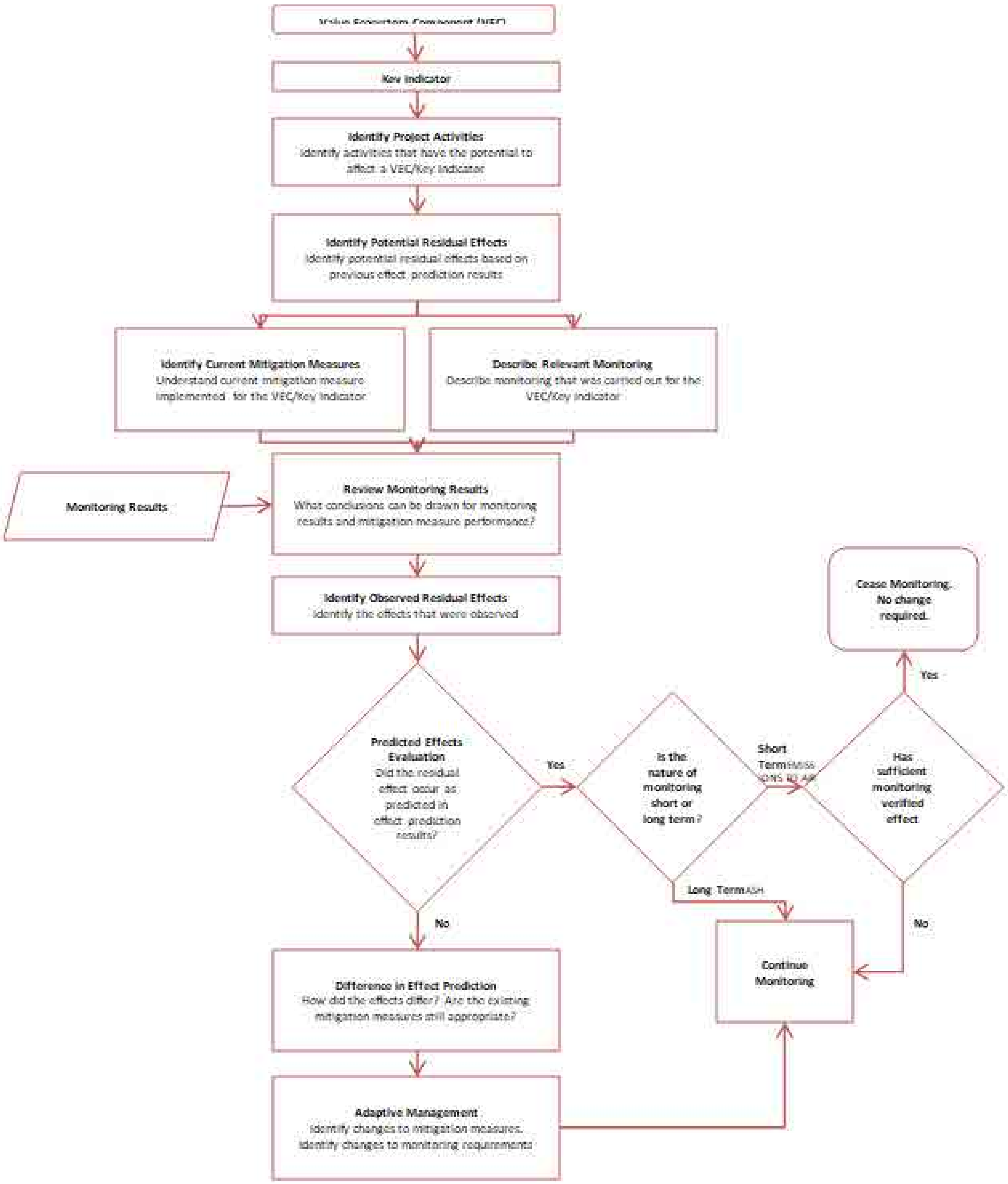


Figure G1: Approach to Evaluating Effect

Table G.1: FEIS Predicted Residual Impacts and Closure/Post-Closure Monitoring

VEC	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect (s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
ATMOSPHERIC ENVIRONMENT								
Climate change	Greenhouse Gases (GHG)	• Increased GHG emissions • Climate change	• Arctic grade diesel fuel • Rail transportation of ore	• Increased GHG emissions	• PC-mandated annual calculation of Project GHG emissions (NIRB Annual Report)	• Minimal GHG emissions generated post-closure (limited to site visits)	• None	• Not applicable; monitoring prescribed by PC and not required to confirm closure objectives met
Air quality	Air quality	• Increased concentrations of total suspended particulate (TSP), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO) • Increased deposition of dust, potential acid input (PAI)	• Apply best management practices for limiting air emissions • Use of low sulphur Arctic grade diesel fuel • Limit speed on roads • Ore crushing facilities are enclosed, vented and equipment with dust collection equipment • Apply dust suppressant as required in high traffic areas and stockpiles • Procurement policy on emissions from equipment (incinerator, generators, vehicles) • Waste segregation (incineration) • Where possible, use of granular material for road construction • Regular maintenance of equipment and vehicles	• Increased concentrations of TSP, SO_2, NO_2, CO • Increased deposition of dust and PAI	• TSP monitoring in Year 2 of active closure	• Negligible residual effects expected post-closure	• None	• Air Quality Monitoring and Reporting described in Section 9.11
Noise and vibration	Noise and vibration levels	• Sensory impact on wildlife	• Procurement policy for noise for equipment and vehicles • Use of mufflers – regular maintenance of engines and equipment	• Sensory impact on wildlife (effect expected to be comparable to the construction phase)	• No monitoring proposed	• Negligible residual effects expected post-closure	• None	• Not applicable
TERRESTRIAL ENVIRONMENT								
Landforms, soil and permafrost	Sensitive landforms	• Soil contamination • Soil structure alteration • Soil destabilization and erosion • Thaw weakening and settlement • Creep settlement	• Sitting of facilities and alignment of roads and railway • Design foundations suitable for site conditions • Design stream crossing structures for extreme flood event • Ensure adequate drainage and prevent pooling of water	• No residual effect (disturbance of sensitive landforms) after mitigation	• Regular visual inspections • Geotechnical Inspection • Environmental site assessment and remediation of hydrocarbon contaminated soils	• Residual effects not expected to occur post-closure; if reclamation objectives have been met	• Post-closure geotechnical inspections at start and end of post-closure monitoring	• Active closure phase monitoring described in Section 9.2 • Post-closure monitoring described in Section 9.2 • Appendix D
Vegetation	Vegetation	• Loss of vegetation abundance and diversity	• Limit physical footprint of facilities • Limit areas of access for vehicles • Progressive reclamation / closure • Promotion of natural revegetation	• Loss of vegetation limited to Project Development Areas (PDA)	• Invasive species monitoring (PC Condition 37) • Annual review of the TEMMP (PC Condition 38)	• Negligible adverse residual effects post-closure.	• None • Post-closure Terrestrial Environment Monitoring and Reporting program in Years 5 and 7 (the second and fourth years of post-closure)	• Terrestrial Environment Monitoring and Reporting described in Section 9.7 • Closure and reclamation research projects, Appendix D

VEC	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect(s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
TERRESTRIAL ENVIRONMENT (CONT`D)								
Birds	Bird key indicators identified in the FEIS, including species at risk	• Destruction of nests • Habitat loss • Mortality • Influences on health • Sensory disturbance	• Mitigation measures identified in the Terrestrial Environment Management and Monitoring Plan (TEMMP), including: • Employee awareness / environmental induction program • Minimize footprint of facilities • Conduct nest search prior to start of activities • No hunting policy • Avoidance of areas of large concentrations of foraging or moulting birds • Avoidance of known nests or nesting areas • To the extent possible, enforce closure of a 500 m radius of the nest until fledging occurs • Nest-specific management plans • To the extent possible, develop appropriate aircraft approach and departure flight paths	• Habitat loss • Mortality • Influences on health	• No monitoring proposed during active closure • Baffinland will seek input from a Closure Working Group on actions that may enhance wildlife use of the area post-closure.	• Residual effects on bird species will gradually lessen with time as the project areas are naturally revegetated.	• Post-closure flora and fauna occupancy and use surveys in Years 5 and 7 (the second and fourth years of post-closure)	• Terrestrial Environment Monitoring and Reporting described in Section 9.7
Terrestrial wildlife and habitat	Caribou	• Habitat loss • Restriction of movement • Mortality	• Use of dust suppressant on Tote Road during growing season • Speed limits for trucks and trains which will provide more time for caribou to get off the road or rail, and will increase the chance of a truck being able to stop before a collision with a caribou. • The train is expected to operate 300 days per year, so seasonal stoppages are possible if large groups of migratory caribou return to the area. • Baffinland has a no hunting policy for all personnel while working on site. • Snow management that will grade snow banks along railway and roadway so that caribou are able to easily cross the transportation corridor without being blocked by steep snow banks. • The railway embankment will be constructed of finer fill material at the five identified trails for easier caribou movement across the railway embankment. The finer fill will replicate natural trail conditions. • Physical barriers from trains will be reduced by limiting train traffic to four passes per day.	• Habitat loss • Restriction of movement • Mortality	• Same as above	• Same as above	• Same as above	• Same as above

	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect(s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
FRESHWATER AQUATIC ENVIRONMENT								
Water quantity	Water quantity	• Reductions in water quantity due to water withdrawals • Increases in water quantity due to effluent discharges • Redistribution of water flows in the natural environment due to diversions	• Permit required for water withdrawal • Measurement of withdrawal quantities as per Water License • Implement measures to reduce water consumption	• Residual effects predicted to occur during the operation phase will either remain or will be reduced through the removal of diversions and watercourse crossings	• Implementation of Closure and Post Closure Aquatic Monitoring • Stream gauging as identified in the Aquatic Effects Monitoring Plan (AEMP) • The Stream Diversion Monitoring Program, a targeted study of the AEMP, will likely have concluded	• Residual effects predicted to occur during the operation and into the active closure phase will remain static or will be reduced	• Implementation of Closure and Post Closure Aquatic Monitoring	• Closure and Post-closure Aquatic Monitoring and Reporting described in Section 9.5
Surface water and sediment quality	Water and sediment quality	• Changes in water quality due to point-source, non point-source and airborne emissions • Changes in sediment quality due to point-source, non point-source and airborne emissions	• Siting of facilities/quarries at least 30 m from stream or water body • Install range of sediment and erosion control structures • Install diversion/collection channel or containment berms where appropriate • Routine inspection and maintenance • Ice and freshet management • Implementation of BMPs for surface water management • Sewage treatment • Wastewater treatment plant (oily water, truck wash, maintenance facilities, explosives equipment wash water) • Management of potentially acid generating rocks from waste rock pile, ore stockpiles, quarries and mine • Minimize footprint of stream crossing • Compensation plan for HADD • Appropriate design of stream/river crossing structures • Limit barrier to movement with site specific design of rocky ramps at culvert crossing (where required) • Channel enhancement where required • Maintain minimum flow in impacted streams where possible • Monitor low flow stream, fish salvage if necessary • Fish barrier for extremely low flow streams • Application of DFO guideline when using explosives near fish-bearing waterbodies • Prevent discharge of contaminants • Storage of fuel and other hazardous materials in secondary containment • Refuelling on impermeable surfaces and runoff contained • Emergency and Spill Response Plan	• Changes in water quality due to point-source, non point-source and airborne emissions • Changes in sediment quality due to point-source, non point-source and airborne emissions	• Implementation of Closure and Post Closure Aquatic Monitoring • Implementation of any remaining monitoring requirements of the closure phase AEMP	• Residual effects predicted to occur during the operation and into the active closure phase will remain static or will be reduced	• Aquatic and AEMP monitoring until mine achieves “recognized closed mine” status from the Nunavut Water Board • Implementation of Closure and Post Closure Aquatic Monitoring • As a component study of the AEMP, a final Environmental Effects Monitoring (EEM) study will be conducted as prescribed in the Metal and Diamond Mining Effluent Regulations (MDMER), to seek “recognized closed mine” status from Environment Canada under the MDMER, anticipate sampling in year 4 and 6 post closure.	• As above

VEC	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect(s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
FRESHWATER AQUATIC ENVIRONMENT (CONT'D)								
Freshwater fish, fish habitat, and other aquatic organisms	Arctic char	• Effects on Arctic char health • Effects on Arctic char movement • Effects on Arctic char habitat quality • Arctic char mortality	• Siting of facilities/quarries at least 30 m from stream or water body • Install range of sediment and erosion control structures • Install diversion/collection channel or containment berms where appropriate • Routine inspection and maintenance • Ice and freshet management • Implementation of BMPs for surface water management • Sewage treatment • Wastewater treatment plant (oily water, truck wash, maintenance facilities, explosives equipment wash water) • Management of potentially acid generating rocks from waste rock pile, ore stockpiles, quarries and mine • Minimize footprint of stream crossing • Compensation plan for HADD • Appropriate design of stream/river crossing structures (culvert, bridges, etc.) • Limit barrier to movement with site specific design of rocky ramps at culvert crossing (where required) • Channel enhancement where required • Maintain minimum flow in impacted streams where possible • Monitor low flow stream, fish salvage if necessary • Fish barrier for extremely low flow streams • Use of explosives in or near streams/water bodies as per DFO Guidelines • Prevent discharge of contaminants • All hazardous materials stored on impermeable surface/secondary containment • Tank farm and large storage tanks placed in secondary containment structures (lined and impermeable) • Smaller tank – double wall ISO-containers • Refuelling on impermeable surfaces and runoff contained • Emergency and Spill Response Plan	• Effects on Arctic char health • Effects on Arctic char movement • Effects on Arctic char habitat quality	• Fisheries monitoring of in-water works during the removal of bridges, culverts and outfalls, as per DFO Fisheries Authorization and Water Licence • Implementation of any remaining monitoring requirements of the closure phase AEMP • Implementation of Closure and Post Closure Aquatic Monitoring	• Residual effects predicted to occur during the operation and into the active closure phase will remain static or will be reduced	• Fish and fish habitat monitoring as outlined in the AEMP until the mine achieves "recognized closed mine" status from the Nunavut Water Board • As a component study of the AEMP, a final Environmental Effects Monitoring (EEM) study will be conducted as prescribed in the Metal and Diamond Mining Effluent Regulations (MDMER), to seek "recognized closed mine" status from Environment Canada under the MDMER.. • Implementation of Closure and Post Closure Aquatic Monitoring	• Closure and Post-closure Aquatic Monitoring and Reporting described in Section 9.5

VEC	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect(s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
MARINE ENVIRONMENT								
Marine water and sediment quality	Marine water and sediment quality	• Changes in water and sediment quality in Steensby and Milne Inlets • Accident and malfunction (e.g. oil spill)	• Site runoff water management as per management plan • Hazardous substances contained within impermeable areas as per Waste Management Plan • Sewage treatment and wastewater treatment plant (oily water, truck wash, maintenance facilities, explosives equipment wash water) • Emergency and Spill Response Plan, Milne Port OPEP and Steensby Port OPEP; SOPEP for all ships • Ship on-board waste management - no discharge at sea	• Changes in water and sediment quality in Steensby and Milne Inlets • Accident and Malfunction	• Implementation of Closure and Post Closure Aquatic Monitoring	• Residual effects predicted to occur during the operation and into the active closure phase will remain static or will be reduced	• Implementation of Closure and Post Closure Aquatic Monitoring	• Closure and Post-closure Marine Environment Monitoring and Reporting described in Section 9.8
Marine mammals	Ringed Saels Bearded Seals Walruses Beluga whales Narwahls Bowhead whales	• Disturbance caused by airborne and/or underwater noise from construction, shipping, and aircraft • Hearing impairment and/or damage caused by noise from construction activities • Masking of environmental sounds caused by vessel and construction noise	• Dock structures were designed to minimize the footprints in the marine environment • Schedule dock construction activity during period of low mammal occurrence – April to June (blasting, pile driving, dredging) • Use proven mitigation measures to reduce noise and noise propagation during construction (DFO's guideline overpressure limit, bubble curtain system for blasting) • Discourage marine mammals from the blast area with potential use of acoustic deterrent device • Vessels will maintain a constant course and speed whenever possible - reduce vessel speed in Milne Inlet • Vessels will minimize idling of engines when docked at Milne and Steensby ports • Aircraft will be operated at a minimum altitude of 450 m over marine areas, when weather conditions allow • Aircraft will be prohibited from flying low over marine mammals for sightseeing or photography	• Disturbance caused by noise from construction, shipping, and aircraft overflights • Masking caused by shipping noise	• Implementation of Closure and Post Closure Aquatic Monitoring	• Residual effects predicted to occur during the operation and into the active closure phase will remain static or will be reduced	• Implementation of Closure and Post Closure Aquatic Monitoring	• As above
	Polar bears	• Habitat change resulting from icebreaking and/or ice management • Disturbance caused by noise from construction, shipping, and aircraft • Mortality from human-bear interactions	• Primary use of Mary River airstrip during the Operation Phase • Educate workers about bear safety • Work areas kept clean of food scraps, garbage, and toxic materials • Use of bear monitor at camp sites • Use of bear deterrent devices	• Habitat change from icebreaking and/or ice management • Disturbance caused by noise from construction, shipping, and aircraft overflights • Mortality if a bear is killed in defense of human life	• Implementation of Closure and Post Closure Aquatic Monitoring • Baffinland will seek input from a Closure Working Group on actions that may enhance wildlife use of the area post-closure.	• None	• Implementation of Closure and Post Closure Aquatic Monitoring • Post-closure flora and fauna occupancy and use surveys in Years 5 and 7 (the second and fourth years of post-closure)	• As above • Terrestrial Environment Monitoring and Reporting described in Section 9.7.

VEC	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect(s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
HUMAN ENVIRONMENT								
Population demographics	Demographic stability	• In-migration of a small number of workers from south will have effect on the demographic make-up of communities • Migration of non-Inuit Project employees into the North Baffin LSA • Migration of non-Inuit into North Baffin for indirect jobs • Inter-community Inuit migration • Out-migration from the North Baffin	• Designation of North Baffin communities as "Point of Hire" (Arctic Bay, Clyde River, Hall Beach, Igloolik, and Pond Inlet) • Iqaluit and a southern hub are also designated "Point of Hire" • Free transportation from "Point of Hire" to Mine Site	• In-migration of a small number of workers from south or other Nunavut communities will have effect on the demographic make-up of communities • Inter-community Inuit migration seeking alternate employment	• Baffinland will seek input from the Socio-Economic Working Group on actions that may support monitoring movement • Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments	• Inter-community Inuit migration seeking alternate employment	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
	Education and Skills	• Incentives related to school attendance and success • Opportunities to gain skills	• Minimum age of 18 yrs for Project employment • Career planning • Priority hiring for Inuit • Upgrading opportunities • Summer experience • Career counselling • Training	• Transferable skills for LSA employees • Incentives related to school attendance and success	• Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments	• Transfer of skills to alternate employment	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
Livelihood and Employment	Wage Employment	• Creation of jobs in the LSA • Employment of LSA residents	• LSA points of hire • Recruitment strategy • Inuit hiring policy • Management commitment	• Ongoing employment of LSA residents for closure roles • Development of banking and money management skills	• Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments	• Development of money management skills	• None	• Socio-economic Monitoring and Reporting described in Section 9.10

VEC	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect(s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
	Job Progression and Career Advancement	• New career paths	• Individual career support • Inuit hiring / promotions policy • Management commitment •	• Expanded employment options based on acquired skills and experience • Resume and other employment documents to support future employment	• Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments	• Expanded employment options based on acquired skills and experience	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
Economic Development and Self-reliance	Land	• Increased pressure on the land • Changes to human engagement in land-based economy	• Lease agreement • VEC-related measures • Resources and Land Use measures (VSEC)	• Increased employment capacity and general well-being	• Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments	• Transferable employment and life skills • Improved education and training • Increased wealth • Increased capacity to engage in procurement processes/provide services on alternate projects, industries and government contracts	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
	People	• Increased opportunities for youth • Improved education and training • Increased wealth and well-being	• Inuit recruitment strategy • Education and training program • Community support fund • Employee and family assistance program	• Improved ability to achieve strategic community development objectives	• Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments	• Increased local businesses • Increased capacity to engage in procurement processes/provide services on alternate projects and industries and government contracts	• None	• Socio-economic Monitoring and Reporting described in Section 9.10

VEC	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect(s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
	Community Economy	• Increased wealth in community • Rotational absence of residents • Increased local business opportunities	• Money management orientation • Community Fund • Monitoring to support decision-making	• Growth in the economy and related job creation and business expansion	• Baffinland will seek input from the Socio-Economic Working Group on actions that may support monitoring movement • Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments •	• Increased local businesses • Increased capacity to engage in procurement processes/provide services on alternate projects and industries and government contracts	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
	Territorial Economy	• Expanded economic activity (GDP) • Increased diversity of territorial economy	• Direct and indirect investment in the economy • Payment of taxes • Payment of resource royalties	• Positive – increase awareness for LSA employees, focus on health and safety, employee assistance and counselling • Negative - increased ability to afford substances will have effects on substance abuse	• "No drug and alcohol" policy remains in place consistent during active closure in addition to medical checks in relation to new employees on site	• Positive – increase awareness for LSA employees, focus on health and safety • Negative - increased ability to afford substances will have effects on substance abuse	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
Human health and well-being	Substance abuse	• Transport of substances through Project sites • Affordability of substances • Attitudes towards substances and addictions	• "No drug – no alcohol" policy • Measures to prevent transportation through sites • Employee and Family Assistance Program	• Improved well-being of children • Access to Employee and Family Assistance Program	• Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments •	• Increased life skills for parents and young adults of LSA employees	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
	Well-being of children	• Changes in parenting • Increased household income and food security • Overall effects on children	• Orientation and training related to fly-in/fly-out adaptation, health, well-being • Employee and Family Assistance Program • Money management training • Community support fund	• Absence of residents while they are working at Project • Moving off of rotation, families will have to readjust to potential full time living/working arrangements	• Ongoing monitoring of exit interviews and grievance procedure to understand impact of rotation on employees • Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments	• Moving off of rotation, families will have to readjust to potential full time living/working arrangements	• None	• Socio-economic Monitoring and Reporting described in Section 9.10

VEC	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect(s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
	Community social stability	• Absence from community during work rotation	• Orientation and training related to fly-in/fly-out adaptation • Short rotation (two week in / two week out)	• Competition for skilled workers may lead to temporary effects on municipal services. • Long term improvement in labour force capacity	• Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments •	• Competition for skilled workers	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
Community infrastructure and public service	Recruitment and Retention of Hamlet	• Competition for skilled workers • Labour force capacity	• Early start for skills training • Ongoing training • Employment experience	• Expanded market —business services to Project • Expanded market —consumer goods and services • Increased entrepreneurial capacity	• Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments	• Increased entrepreneurial capacity • Increased ability to participate in procurement processes	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
Contracting and business opportunities	Opportunities For Business	• Expanded market - business services to Project • Expanded market - consumer goods and services • Increased entrepreneurial capacity	• Inuit contracting strategy • Cooperation with QIA to build Inuit capacity • Establish a fund to support and build capacity • Management assistance to Inuit designated firms • Opportunities for local entrepreneurs to work with Project	• Chance of unmitigated archaeological sites subject to accidental or deliberate partial or complete destruction is minimal • Potential for chance finds • Increased traffic at Steensby Inlet could affect archaeological resources	• Ongoing procedures for archeological finds on site	• Potential for chance finds	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
Cultural resources	Archaeological Sites	• Disturbance or removal of archaeological sites • Unauthorized removal of artefacts • Potential loss of regionally significant sites through approved mitigation	• Pre-development archaeological surveys to support avoidance and protections of sites, mitigation by SDR prior to construction, implementation of a chance finds procedure • Training, flagging and exclusion zones, implementation of government-approved mitigation plans, involvement of local people, management plans, implementation of chance finds procedure	• Changes in caribou harvesting • Changes in marine mammal harvesting • Changes in fish harvesting	• Ongoing implementation of Article 13.4 NLCA Inuit Rights of Travel and Access • Ongoing implementation of Hunting and Weapons Policy on site	•	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
Resources and land use	Inuit harvesting of wildlife	• Changes in caribou harvesting • Changes in marine mammal harvesting • Changes in fish harvesting	• Prohibition of harvesting by employees • Measures to mitigate VEC effects (VEC assessments)	• Safe travel around Eclipse Sound and Pond Inlet • Safe travel through Milne Port • Emissions and noise disruption • Sensory disturbance and safety along Milne Inlet Tote Road • Detour around Mine Site • HTO cabin closure • Difficulty and safety relating to railway crossings • Detour around Steensby Port • Restrictions on camping locations around Steensby Port	• Ongoing implementation of Article 13.4 NLCA Inuit Rights of Travel and Access • Ongoing implementation of Hunting and Weapons Policy on site during active closure	• Safety protocols developed as necessary for post closure including detours as necessary	• None	• Socio-economic Monitoring and Reporting described in Section 9.10

VEC	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect(s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
Resources and land use	Travel and camps	• Safe travel around Eclipse Sound and Pond Inlet • Safe travel through Milne Port • Emissions and noise disruption • Sensory disturbance and safety along Milne Inlet Tote Road • Detour around Mine Site • HTO cabin closure • Difficulty and safety relating to railway crossings • Detour around Steensby Port • Restrictions on camping locations around Steensby Port	• Road Management Plan • Mine Closure Plan • Safety Plan • IIBA Agreement with QIA • Designated railway crossing locations	• Ongoing cultural awareness training for all staff and visitors on site • Increased awareness from cross-cultural training	• Ongoing monitoring of exit interviews and grievance procedure	• Increased awareness from cross-cultural training	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
Cultural Well-Being	Cultural Well-Being	• Pijitsirnjiq – serving and providing for… • Pilnimmaksarniq – passing on of knowledge and skills • Avatittinnik Kamattiarniq – environmental stewardship	• Measures to support Inuit culture on site, including Inuktitut language plan • Inuit priority for employment • Inuit involvement in environmental monitoring	• Payments of payroll and corporate taxes to territorial government	• None	• None	• None	• Socio-economic Monitoring and Reporting described in Section 9.10
Benefits, taxes and royalties	Territorial own-source revenues	• Increased taxes and revenues from indirect and induced growth • Payments of payroll and corporate taxes to territorial government	• None	• IIBA agreement with QIA • Development of leadership skills	• Ongoing documentation of any supervisory skills training in place	• Increased leadership and team working skills	• None	• Socio-economic Monitoring and Reporting described in Section 9.10

VEC	Key Indicator	Potential Effect(s)	Mitigation Measures	Residual Effect(s) Predicted to Occur During Active Closure	Monitoring During Active Closure	Residual Effect(s) Remaining Post-Closure	Post-Closure Monitoring	ICRP Section Reference
Governance and leadership	Governance and leadership	• IIBA Agreement with QIA • Development of leadership skills	• Participation in initiatives to identify indicators of relevance to regional monitoring programs, share data generated by activities related to the Project, and discuss the interpretation of this data with others involved in these initiatives • Fit well with the strategic priorities identified for both the RSA	• In-migration of a small number of workers from south or other Nunavut communities will have effect on the demographic make-up of communities • Inter-community Inuit migration seeking alternate employment	• Baffinland will seek input from the Socio-Economic Working Group on actions that may support monitoring movement • Baffinland will engage with the GN to establish a Labour Market Partnership to develop and implement strategies for dealing with labour force adjustments	• Inter-community Inuit migration seeking alternate employment	• None	• Socio-economic Monitoring and Reporting described in Section 9.10

G4 CURRENT PREDICTED RESIDUAL EFFECTS

At this time, the residual effect and impact assessment results from the Mary River EIS remain relevant as the Project is in the relatively early stages of operation and development has proceeded largely as proposed. Collection of information and data occurs on an annual basis under Baffinland's environmental and socio-economic monitoring programs and is used to assess current site conditions for comparison to initial predictions and assumptions from the Mary River EIS. Results are reported annually to the NIRB and other relevant stakeholders (Section 2.7). Overall, based on environmental monitoring program results to date, Baffinland suggests the Project has provided net positive effects to the region. No significant adverse effects have been identified. It is noted however, monitoring programs will provide more information during the life of the project.

Project residual effects have also been assessed as part of the ERP FEIS Addendum (Baffinland 2013) and subsequent addenda for the PIP (2018), PIPE (2020), PIP Renewal (2022), SOP (2023), and SOP2 (2024) applications. These assessments have predicted little to no changes in residual effects from the original FEIS assessment. In addition, monitoring results have generally confirmed that project effects from six years of operating at 6 Mtpa (2018 – 2023) across all VECs are within the predictions contained with the FEIS and addendums for the Approved Project. A summary of the current predicted residual effects of the Approved Project on all VECs is provided in TABLE G-8. However, it is acknowledged that community members have communicated concerns related to adverse effects and community experiences and observations may not always align with monitoring results (Baffinland 2024).

Revisions to existing predictions of residual impact assessments will be completed where significant variances are identified. Identification of significant variances includes the QA/QC; comparisons to the respective benchmark and to reference and/or baseline; and review of the data using various tools such as Exploratory Data Analysis (EDA) and Statistical Data Analysis (SDA), to determine if change is occurring. A change may be detected statistically or qualitatively, relative to benchmarks, baseline values and/or spatial or temporal trends. A change may be statistically significant, but professional judgement will also be applied using the various evaluation tools to detect a change qualitatively. If this analysis does not detect change, then no action is required. If a change is observed, then further evaluation of the data for that/those indicator(s) will be carried out to determine whether the observed change is Project-related. If the evaluation has indicated with some certainty that the measured change is Project-related, a determination of the action level associated with the observed monitoring results through comparisons to indicators or benchmarks will be conducted. As appropriate to the VEC in question, a determination of the action level associated with the observed monitoring results, and the appropriate response will align with:

- Section 5 of the Aquatic Effects Monitoring Plan (BAF-PH1-830-P16-0039)
- Section 5 of the Shipping and Marine Wildlife Management Plan (BAF-PH1-830-P16-0024)
- Appendix B of Terrestrial Environment Mitigation and Monitoring (BAF-PH1-830-P16-0027)

G5 ONGOING RESIDUAL EFFECT EVALUATION

To evaluate whether or not residual effect predictions are meeting expectations, Closure and Post Closure monitoring and reporting will occur. Similar to Operations monitoring, Closure and Post Closure monitoring will focus on the Project's potential effects on VECs and key indicators, and to apply the monitoring results to assess the Project`s environmental performance relative to the effects predictions.

The evaluation process involves several key steps, as follows:

- Identify the project activities that have the potential to affect a VEC/Key Indicator
- Identify the potential effects as identified in the FEIS or in subsequent environmental effects assessment processes
- Review monitoring results and conclusions to determine which predicted residual effects occurred (and other effects not predicted, if this occurred)
- Determine if the measured residual effect exceeded or differed from the predicted effect
- If the measured residual effect is different than predicted, identify adaptive management measures that can be implemented to eliminate or reduce the severity of the residual effect
- Determining whether or not ongoing monitoring is required, depending on:
    - The intended nature of the monitoring program - short- or long-term
    - Whether or not monitoring objectives have been required
    - Or if unexpected effects have required adaptive management - modifications to mitigation measures and/or monitoring programs

A review and re-evaluation of residual effect predictions, which help drive closure approach and criteria is conducted on an annual basis based on the most recent monitoring results and research available. The results of this process are communicated to key stakeholders in the NIRB Annual Report and QIA/NWB Annual Report for Operations and applicable results are incorporated into future revisions of the ICRP. Post Closure Monitoring Programs expected to be executed in Post Closure are detailed in Section 9.

- Geotechnical/Engineering Monitoring (Section 9.4)
- Closure and Post Closure Aquatic Monitoring and Reporting (Section 9.5)
- Environmental Effects Monitoring (Section 9.5.1)
- Environmental Site Assessment (Section 9.6)
- Post Closure Terrestrial Environment Monitoring and Reporting (Section 9.7)
- Marine Environmental Monitoring (Section 9.8)
- Safety Compliance Inspections (Section 9.9)
- Socio-economic Reporting (Section 9.10)
- Air Quality Monitoring (Section 9.11)

The Post Closure Monitoring Programs referenced above are expected to be required based on current residual effect predictions. It is noted that additional detail regarding the study design for evaluating the residual impacts (e.g., scope and duration of performance monitoring programs, inspections, assessments, etc.) will be required in the future to support final approval of closure criteria.

Table G.8: Summary of Residual Effects of the Approved Project

VEC[1]	FEIS Residual Effects (Baffinland 2012)	ERP FEIS Addendum Residual Effects (Baffinland 2013)	SOP (Baffinland 2023)
ATMOSPHERIC ENVIRONMENT			
Climate Change	• Increased GHG emissions	• Negligible increase in GHG emissions	• Negligible changes in residual effects from the ERP
Air Quality	Increased concentrations of: • Total Suspended Particulate (TSP), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), and carbon monoxide (CO). • Increased deposition of: • Dust, potential acid input (PAI).	• Minor increased effects on air quality at Milne Port, along the Tote Road and at the Mine Site	• Negligible changes in residual effects from the ERP particularly with implementation of dust control measures
Noise and Vibration	• Sensory impact on wildlife	• Minor increased effects on noise and vibration at Milne Port, along the Tote Road and at the Mine Site	• Negligible changes in residual effects from the ERP
TERRESTRIAL ENVIRONMENT			
Ground/Permafrost Stability	• No change from the ERP FEIS Addendum (no residual effect)	• No change from the ERP FEIS Addendum (no residual effect)	• No change from the ERP FEIS Addendum (no residual effect)
Vegetation	• Loss of vegetation limited to PDAs	• Loss of vegetation limited to the PDA	• Loss of vegetation abundance and diversity • Reduced vegetation health • Effects on culturally valued vegetation
Birds and Bird Habitat	• Habitat loss • Mortality risk • Influences on health	• Habitat loss, increased mortality risk, and decreased health due to the increase in PDA associated with the Tote Road	• Influences on health • Sensory disturbance
Terrestrial Wildlife and Wildlife Habitat	• Habitat loss • Restriction of movement • Mortality risk	• Habitat loss, negative effects on movement, increased mortality risk, and decreased health and energetics associated with increased traffic along the Tote Road and activity at Milne Port	• Habitat loss • Restriction of movement • Mortality risk
Caribou	• Habitat loss • Restriction of movement • Mortality risk	• Habitat loss, negative effects on movement, increased mortality risk, and decreased health and energetics associated with increased traffic along the Tote Road and activity at Milne Port	• Habitat loss • Restriction of movement • Mortality risk
FRESHWATER ENVIRONMENT			
Freshwater Quantity and Quality	• Surface water quantity reductions from withdrawals and diversions • Changes in water quality due to point-source, non point-source, and airborne emissions	• Surface water quantity reductions from withdrawals and diversions • Changes in water quality due to point-source, non point-source, and airborne emissions	• Changes in water quality due to point source, non-point source, and airborne emissions.
Freshwater Biota and Habitat[2]	• Effects on freshwater biota health and condition • Alteration and/or destruction of freshwater habitat • Effects on productive capacity of freshwater habitat	• Effects on freshwater biota health and condition • Alteration and/or destruction of freshwater habitat • Effects on productive capacity of freshwater habitat	• Effects on freshwater habitat quality (i.e., changes in sediment quality due to point source, non-point source airborne emissions) • Effects on freshwater biota health and condition (i.e., Arctic char as Key Indicator)
MARINE ENVIRONMENT			
Sea Ice	• Disruption of landfast ice along shipping route in Steensby Inlet	• No change	• No change
Marine Water and Sediment Quality	Steensby Inlet: • Change in water and sediment quality due to port construction activities including piling/blasting/dredging, propeller wash from barge/ship traffic, and discharges of wastewater / site run-off. • Change in water and sediment quality due to port operational activities, including propeller wash from ship traffic, ore dust dispersion/deposition, discharge of wastewater / site run-off, and discharges of ship ballast water.	Milne Inlet: • Change in water and sediment quality due to port construction activities including piling/blasting/dredging, propeller wash from barge/ship traffic, and discharges of wastewater/site run-off. • Change in water and sediment quality due to port operational activities, including ore dust dispersion/deposition.	Milne Inlet: Increase in severity of the following residual effects: • Changes in marine water and sediment quality due to propeller wash, discharge of wastewater and site run-off, and ore dust dispersion/deposition.

VEC[1]	FEIS Residual Effects (Baffinland 2012)	ERP FEIS Addendum Residual Effects (Baffinland 2013)	SOP (Baffinland 2023)
	Milne Inlet: • Change in water and sediment quality due to port construction activities including propeller wash from barge/ship traffic, and discharges of wastewater / site run-off. • Change in water and sediment quality due to port operational activities, including propeller wash from ship traffic, discharge of wastewater / site run-off, and discharges of ship ballast water.		
Marine Habitat and Biota	Steensby Inlet: • Alteration of marine fish habitat via changes in marine water and sediment quality due to port construction activities including dredging/blasting/infilling, and wastewater/site run-off. • Alteration of marine fish habitat via changes in marine water and sediment quality due to port operational activities including propeller wash from vessel traffic, ore dust dispersion/deposition and discharge of ship ballast water. • Acoustic disturbance of fish caused by construction and operational (i.e., ship) noise Milne Inlet: • Acoustic disturbance of fish caused by construction and operational (i.e., ship) noise.	Milne Inlet: • Alteration of marine fish habitat via changes in marine water and sediment quality due to port operational activities including propeller wash from vessel traffic and wastewater/site run-off. • Acoustic disturbance of fish caused by construction and operational (i.e., ship) noise.	Milne Inlet: Increase in severity of the following residual effects: • Effects on marine fish habitat and fish health via changes in marine water and sediment quality due to increased in port operational activities at Milne Port including propeller wash from ship traffic, ore dust dispersion/deposition, effluent discharge (stockpiles). • Change in benthic community structure due to NIS/AIS introductions from ballast water discharge or ship hull biofouling
Anadromous Arctic Char	Steensby Inlet: • Alteration of Arctic char marine habitat via changes in marine water and sediment quality due to port construction activities including dredging/blasting/infilling, and wastewater/site run-off. • Alteration of Arctic char marine habitat via changes in marine water and sediment quality due to port operational activities including propeller wash from vessel traffic, ore dust dispersion/deposition and discharge of ship ballast water. • Acoustic disturbance of fish caused by construction and operational (i.e., ship) noise Milne Inlet: • Acoustic disturbance of fish caused by construction and operational (i.e., ship) noise.	Milne Inlet: • Alteration of Arctic char marine habitat via changes in marine water and sediment quality due to port operational activities including propeller wash from vessel traffic and wastewater/site run-off. • Acoustic disturbance of fish caused by construction and operational (i.e., ship) noise.	Milne Inlet: Increase in severity of the following residual effects: • Effects on Arctic char marine habitat and Arctic char health via changes in marine water and sediment quality due to increased in port operational activities at Milne Port including propeller wash from ship traffic, ore dust dispersion/deposition, effluent discharge (stockpiles).
Marine Mammals	Milne Inlet and Steensby Inlet: • Alteration of habitat due to icebreaking (Steensby only). • Behavioural disturbance caused by noise from construction, shipping, and aircraft overflights. • Acoustic masking caused by construction and ship noise.	• Alteration of habitat due to installation of port infrastructure. • Disturbance caused by noise from construction, shipping, and aircraft overflights. • Acoustic masking caused by construction and ship noise. • Hearing impairment and/or damage caused by construction or ship noise.	Milne Inlet: Increase in severity of the following residual effects: • Alteration of habitat due to icebreaking. • Behavioural disturbance from ship noise. • Acoustic masking from ship noise. • Mortality if individual is killed in defense of human life (polar bear only).

VEC[1]	FEIS Residual Effects (Baffinland 2012)	ERP FEIS Addendum Residual Effects (Baffinland 2013)	SOP (Baffinland 2023)
	• Hearing impairment and/or damage caused by construction and ship noise. • Mortality from collisions with vessels during construction and operational phase.	• Mortality from collisions with vessels during construction and operational phase. • Mortality if individual is killed in defense of human life (polar bear only).	
Narwhal	Milne Inlet and Steensby Inlet: • Alteration of habitat due to icebreaking (Steensby only). • Behavioural disturbance caused by noise from construction, shipping, and aircraft overflights. • Acoustic masking caused by construction and ship noise. • Hearing impairment and/or damage caused by construction and ship noise. • Mortality from collisions with vessels during construction and operational phase.	Milne Inlet: • Alteration of habitat due to installation of port infrastructure. • Disturbance caused by noise from construction, shipping, and aircraft overflights. • Acoustic masking caused by construction and ship noise. • Hearing impairment and/or damage caused by construction and ship noise. • Mortality from collisions with vessels during construction and operational phase.	Milne Inlet: Increase in severity of the following residual effects: • Alteration of habitat due to icebreaking. • Behavioural disturbance from ship noise. • Acoustic masking from ship noise. • Mortality from entrapment events during icebreaking.
Ringed Seal	Milne Inlet and Steensby Inlet: • Alteration of habitat due to icebreaking (Steensby only). • Behavioural disturbance caused by noise from construction, shipping, and aircraft overflights. • Acoustic masking caused by construction and ship noise. • Hearing impairment and/or damage caused by construction and ship noise. • Mortality from collisions with vessels or icebreakers (during construction and operational phase) or from exposure to blasting (during construction).	Milne Inlet: • Alteration of habitat due to installation of port infrastructure. • Disturbance caused by noise from construction, shipping, and aircraft overflights. • Acoustic masking caused by construction and ship noise. • Hearing impairment and/or damage caused by construction or ship noise. • Mortality from collisions with vessels during construction and operational phase.	Milne Inlet: Increase in severity of the following residual effects: • Alteration of habitat due to icebreaking. • Behavioural disturbance from ship noise. • Acoustic masking from ship noise. • Mortality from icebreaking.
Walrus	Milne Inlet and Steensby Inlet: • Alteration of habitat due to icebreaking (Steensby only). • Behavioural disturbance caused by noise from construction, shipping, and aircraft overflights. • Acoustic masking caused by construction and ship noise. • Hearing impairment and/or damage caused by construction and ship noise. • Mortality from collisions with vessels and/or stampedeing at haul-out sites during construction and operational phase.	Milne Inlet: • Alteration of habitat due to installation of port infrastructure. • Disturbance caused by noise from construction, shipping, and aircraft overflights. • Acoustic masking caused by construction and ship noise. • Hearing impairment and/or damage caused by construction or ship noise. • Mortality from collisions with vessels during construction and operational phase.	Milne Inlet: Increase in severity of the following residual effects: • Alteration of habitat due to icebreaking. • Behavioural disturbance from ship noise. • Acoustic masking from ship noise.
HUMAN ENVIRONMENT			
Population Demographics	• In-migration of a small number of workers from south or other Nunavut communities will have effect on the demographic make-up of communities	• In-migration effects may be modestly increased with increased scale of operations employment. • Out-migration from the LSA is not expected to change since the level of local employment is unchanged.	• No change in residual effects beyond what was assessed for the ERP
Education and Training	• Improved life skills amongst many LSA residents. • Incentives related to school attendance and success.	• Negligible change to effects since the level of local employment (the source of interactions with life skills) is unchanged. • Effects on education will be the same. Training program will be	• No change in residual effects beyond what was assessed for the ERP

VEC[1]	FEIS Residual Effects (Baffinland 2012)	ERP FEIS Addendum Residual Effects (Baffinland 2013)	SOP (Baffinland 2023)
	• Opportunities to gain skills	similar, with likely addition of haul truck training.	
Livelihood and Employment	• Creation of jobs in the LSA. • Employment of LSA residents. • Expanded employment and career development options.	• More jobs will be created and the level of job creation will still be of high magnitude relative to the LSA labour market baseline. • No change to local employment since available jobs are expected to exceed local supply capacity. • A slight increase in the diversity of career paths will occur with addition of road haul jobs. However, this is only a minor increase in what was already a major expansion in career paths introduced to the local labour market.	• Employment of LSA residents. • Continued positive effect
Contracting and Business Opportunities	• Expanded market — business services to Project. • Expanded market — consumer goods and services. • Increased entrepreneurial capacity.	• There will be a modest increase in the diversity of business opportunities, however the magnitude of opportunities was already high in the Approved Project FEIS. • Negligible change to effects to entrepreneurial capacity.	• No change in residual effects beyond what was assessed for the ERP
Economic Development and Self-reliance	• Increased industrial utilization of land. • VC-related residual effects. • Harvesting and travel residual effects. • Increased human capacity and well-being. • Growth in the economy and related job creation and business expansion.	• Negligible change to effects since local employment (and associated income) is unchanged, and the level of business opportunities offered in the Approved Project were already diverse and substantial relative to local entrepreneurial capacity. • Job creation and taxes paid will be increased and remain high magnitude.	• Increased opportunities for youth • Increased education and training • Increased wealth • Economic activity • Continued positive effect
Benefits, Royalty, and Taxation	• Increased taxes and revenues. • Payments of payroll and corporate taxes to territorial government.	• Increase in taxes and royalties due to additional 3.0 Mt/a production. • No change in the components of taxes / royalties to be paid. Likely change in the timing of royalty and tax payments.	• No change in residual effects beyond what was assessed for the ERP
Community Infrastructure and Public Services	• Competition for skilled workers may lead to temporary effects on municipal services. • Long term improvement in labour force capacity.	• Negligible change to effects since level of LSA employment is not changed.	• No change in residual effects beyond what was assessed for the ERP
Human Health and Well-being	• Negative - increased ability to afford substances will have effects on substance abuse • Positive – focus on health and safety, employee assistance and counselling will increase awareness of employees • Improved well-being of children • Absence of residents while they are working at Project will have effect on community social stability	• Negligible change to effects since level of LSA employment is not changed	• Increased household food security due to increased income
Inuit Culture, Resources, and Land Use	• Unmitigated archaeological sites subject to accidental or deliberate partial or complete destruction. • Potential for chance finds. • Increased traffic at Steensby Inlet could affect archaeological resources. • Changes in caribou harvesting. • Changes in marine mammal harvesting. • Changes in fish harvesting. • Emissions and noise disruption. • HTO cabin closure.	• No change to archaeological sites due to the same mitigation measures being implemented as in the Approved Project. • Potential for increased caribou – truck collisions but these will still be infrequent. • Potential for increased interactions with narwhal harvesting by Pond Inlet. • Increased frequency and duration of emissions and noise.	• No change to archaeological sites given that activities will occur in areas previously surveyed and mitigated • Adverse residual effects on caribou harvesting, marine mammal harvesting, fish harvesting, and land and water use due to dust on snow • No other change in residual effects beyond what was assessed for the ERP

VEC[1]	FEIS Residual Effects (Baffinland 2012)	ERP FEIS Addendum Residual Effects (Baffinland 2013)	SOP (Baffinland 2023)
	• Detour around Steensby Port. • Restrictions on camping locations around Steensby Port		
Inuit Travel Route Safety	• Safe travel around Eclipse Sound and Pond Inlet. • Safe travel through Milne Port. • Sensory disturbance and safety along Milne Inlet Tote Road. • Detour around Mine Site. • Difficulty and safety relating to railway crossings.	• Increased duration and probability but continued low magnitude of effects on safe travel around Eclipse Sound and Pond Inlet. • Increase in the frequency, duration and probability of travel interactions through Milne Port, but interactions readily managed to ensure safety. • Increased sensory disturbance and increased interactions with travellers along Milne Inlet Tote Road.	• No change in residual effects beyond what was assessed for the ERP
Cultural Well-being	• Support for values that are central to Inuit culture and cultural development.	• No change	• Potential change to: o Pijitsirnjiq – serving and providing for family and/or community… o Pilnimmaksarniq – passing on of knowledge and skills… • Avatittinnik Kamattiarniq – environmental stewardship
Governance and Leadership			

Notes:

1 VC names have evolved since the FEIS.

2 In effects assessments of the Approved Project, Arctic char has been used as the key indicator for effects to freshwater biota and habitat. As such, previously described residual effects on Arctic char and Arctic char habitat have been applied here as residual effects on both the freshwater biota and habitat and Arctic char VCs.

G6 REFERENCES

Baffinland Iron Mines Corporation (Baffinland). 2012. Mary River Project - Final Environmental Impact Statement. February 2012.

Baffinland. 2013. Mary River Project - Addendum to Final Environmental Impact Statement. June 2013.

Baffinland. 2018. Production Increase Proposal. NIRB File No. 08MN053. Project certificate No. 005. June 19, 2018.

Baffinland. 2020. Production Increase Proposal Extension Application.

Baffinland. 2022. Production Increase Proposal Renewal. May 20, 2022.

Baffinland. 2023. Sustaining Operations Proposal (SOP). NIRB File No. 08MN053. April 2023.

Baffinland. 2024. Sustaining Operations Proposal 2 (SOP2) NIRB File No. 08MN053. August 2024.

Nunavut Impact Review Board (NIRB). 2009. Guidelines for the Preparation of an Environmental Impact Statement for the Baffinland Iron Mines Corporation’s Mary River Project. NIRB File No. 08MN053. November 16, 2009. Public Registry Identification: 283183.

NIRB. 2015. Guidelines for the Preparation of an Environmental Impact Statement for Baffinland Iron Mines Corporation’s Mary River Project – Amended Version for the Phase 2 Development Proposal. NIRB File No. 08MN053. October 6, 2015. Public Registry Identification: 317361

Appendix H
FEIS Freshwater Quality Predictions

H DETAILED WATER AND SEDIMENT QUALITY ASSESSMENT

H1 METHODOLOGY AND INPUTS

Effects to freshwater and sediment quality have been identified as an area of interest by QIA during review of Baffinland's ICRP since 2015. This appendix presents a summary of findings specifically for this VEC. Effects on the surface water and sediment quality VEC were assessed in accordance with the methodology outlined in FEIS Volume 2, Section 3.0. VEC-specific modifications were made to the general methodology, which are highlighted below. As part of the effects assessment completed for the Phase 2 Proposal in 2018, a review of existing effluent quality predictions was completed. The conclusion of this review was that the previous modelling was substantially representative of the effluent quality monitoring conducted at site to date (TSD 13, Phase 2 Proposal). It is worth noting that modelling efforts to assess seepage and runoff quality at the Waste Rock Facility are ongoing as part of the Phase 1 Waste Rock Management Plan.

H1.1 ASSESSMENT METHODS AND CRITERIA

The following basic EA steps were undertaken during the assessment:

- Regional and local study areas were determined.
- VECs, Key Indicators and Thresholds were identified.
- Project activities that could affect surface water and sediment quality were identified.
- Project interactions with, and effects on, the surface water and sediment quality VEC were identified.
- Linkage evaluations were performed outlining potential effects related to various phases of the Project (Construction, Operation, and Closure) and Project LSAs (Milne Port, Milne Inlet Tote Road, Mine Site, Railway Alignment, and Steensby Port).
- Mitigation measures were identified to avoid or reduce the potential effects during the various phases of the Project.
- Residual effects and their relative significance were identified for the surface water and sediment quality VECs.
- Long-term monitoring programs were identified to distinguish Project-related impacts from natural variability, in order to verify impact assessment predictions and to meet compliance/conformance criteria.

H1.1.1 KEY INDICATORS AND THRESHOLDS

For the assessment of potential effects on the surface water and sediment quality VEC a list of key indicators that were the most relevant and important elements of the VEC was assembled. The key indicators fall into four categories:

1. General Parameters
2. Metals
3. Nutrients
4. Petroleum Hydrocarbons

Thresholds were identified representing a level of change where adverse effects may be expected to occur. In the case of water and sediment quality, it is important to note that the thresholds do not relate to water or sediment quality, but rather to known effects on aquatic receptors that rely on water and sediment to exist.

The thresholds used in this assessment were derived from the following sources, which are relevant in the context of this environmental effects assessment:

- Schedule 4 of the Metal and Diamond Mining Effluent Regulations under the Federal *Fisheries Act*.
- CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life (PAL) (2003).
- Interim Sediment Quality Guidelines (ISQG) and Probable Effects Level (PEL) identified in the CCME Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (2003).

The CCME PAL thresholds are typically the most stringent; hence these values were generally selected for application.

Local waters around the Project sites have not historically been used for drinking, although the Project uses and will use local waters for potable water supply, and it is conceivable that Inuit travelling over the land could also drink any of the local water. Therefore, Health Canada's Canadian Drinking Water Guidelines (2004) have been used for comparison purposes.

To fill gaps for those key indicators that have no thresholds identified in the sources listed above, two secondary sources were adopted:

- BC Ministry of Environment (MOE) Approved and Working Water Quality Guidelines and Alert Levels.
- Criteria Continuous Concentration (Chronic) National Recommended Water Quality Criteria, USEPA (2006).

The relationships between potential surface water and sediment quality effects, key indicators and thresholds are summarized in Table H.1.

TABLE H.1 KEY INDICATORS AND THRESHOLDS FOR WATER AND SEDIMENT QUALITY

Potential Effect	Key Indicator	Thresholds (Magnitude and Extent)			
		MDMER[1]	CWQG (PAL)[2]	CDWQG[3]	NWB[4]
Water Quality from Mine Contact Water and Site Runoff	TSS (mg/L)	15	+5		35
	pH (pH unit)	6.0 - 9.5	6.5 - 9.0	6.5 - 8.5[11]	6.0 - 9.5
	Hardness $CaCO_3$ (mg/L)				
	Alkalinity $CaCO_3$ (mg/L)				
	Chloride (mg/L)		640 (Short-term) 120 (Long-term)	250[12]	
	Sulphate SO_4 (mg/L)			500[12]	
	Ammonia N (total) (mg/L)		Varies[5]		
	Ammonia N (un-ionized) (mg/L)		0.019		
	Nitrate N (mg/L)		13	10	
	Nitrite N (mg/L)		0.06	3.2	
	Total P (mg/L)		see Table 7-3.4 (FEIS Volume 7)		
	Total Aluminum (mg/L)		0.005 - 0.1[6] (0.94)[7]	0.1	
	Total Antimony (mg/L)			0.006	
	Total Arsenic (mg/L)	0.3	0.005	0.01	
	Total Barium (mg/L)			1	
	Total Beryllium (mg/L)		0.0053[8]		
	Total Boron (mg/L)		29 (Short-term) 1.50 (Long-term)		
	Total Cadmium (mg/L)		0.000029[8]	0.005	
	Total Chromium (mg/L)		0.0047[7]	0.05	
	Trivalent Chromium (mg/L)		0.001		
	Hexavalent Chromium (mg/L)		0.0089		
	Total Cobalt (mg/L)				
	Total Copper (mg/L)	0.3	0.00467[7]	1.0[12]	
	Total Cyanide (mg/L)	0.5	0.005 (as free CN)	0.2	
	Total Iron (mg/L)		1.2[7]	0.3[12]	
	Total Lead (mg/L)	0.1	0.001[9]	0.01	
	Total Manganese (mg/L)			0.05[12]	
	Total Mercury (mg/L)		0.000026	0.001	
	Total Molybdenum (mg/L)		0.073		

Potential Effect	Key Indicator	Thresholds (Magnitude and Extent)			
		MDMER[1]	CWQG (PAL)[2]	CDWQG[3]	NWB[4]
	Total Nickel (mg/L)	0.5	0.083[10]		
	Total Selenium (mg/L)		0.001	0.01	
	Total Silver (mg/L)		0.0001		
	Total Thallium (mg/L)		0.0008		
	Total Uranium (mg/L)		0.015	0.02	
	Total Vanadium (mg/L)		0.006[11]		
	Total Zinc (mg/L)	0.5	0.03	5.0	
	1-2 Propylene Glycol		500 (interim)		
Water Quality from Fuel Contact	Benzene (µg/L)		370		
	Toluene (µg/L)		2		
	Ethyl benzene (µg/L)		90		
	Lead (µg/L)		1		
	Oil and Grease (µg/L)		15,000		
Water Quality from Discharge of Sewage	BOD_5 (mg/L)				30
	Fecal Coliform (CFU/100mL)				1,000

Potential Effect	Key Indicator	Thresholds (Magnitude and Extent)			
		ISQG[14]	PEL[14]		
Sediment Quality	Arsenic (mg/kg)	5.9	17		
	Cadmium (mg/kg)	0.6	3.5		
	Chromium (mg/kg)	37.3	90		
	Copper (mg/kg)	35.7	197		
	Lead (mg/kg)	35.0	91.3		
	Mercury (mg/kg)	1.7	4.86		
	Zinc (mg/kg)	123	315		

NOTES:

1. Mean monthly maximum averages in Table 2 of Schedule 4 of the Metal and Diamond Mining Effluent Regulations under the federal F*isheries Act*.
2. Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (pal) (2011).
3. Health Canada Guidelines for Canadian Drinking Water Quality Summary Table (2010).
4. Nunavut Water Board Effluent Quality Discharge Limits for Sewage Treatment Facilities to Freshwater Receiving Environment from in Table 4 of Type A Water Licence 2AM-MRY1325
5. Varies with temperature and pH.
6. Varies with pH; at pH <6.5 criterion is 0.005 mg/l; at pH >6.5 criterion is 0.1 mg/l.
7. Site specific criterion developed for the Mary River mine site area (Knight Piésold, 2011).

8. Varies with hardness [CD] = $10^{0.86[LOG10(HARDNESS)]-3.2}$ *mg/L*. based on mean hardness in Mary River of 84 mg/L, the cadmium criterion would be 0.000029 mg/L.
9. Varies with hardness. [PB] = $E^{1.273[LN(HARDNESS)]-4.705}$ *µG/L*. based on mean hardness in Mary River of 84 mg/L, the lead criterion would be 0.00255 mg/L.
10. Varies with hardness. [NI] = $E^{1.273[LN(HARDNESS)]-4.705}$ *µG/L*. based on mean hardness in Mary River of 84 MG/L, the nickel criterion would be 0.083 mg/L.
11. BC MOE approved and working Water Quality Guidelines.
12. Aesthetic Objective.
13. Proposed Guideline.
14. Interim Sediment Quality Guidelines (ISQG) and Probable Effects Level (PEL) identified in the CCME Canadian Sediment Quality Guidelines for the Protection of Aquatic Life (2003).

The thresholds identified in Table H.1 were applied in the effects assessment in the following manner:

- MDMER Schedule 4 thresholds were applied as 'end of pipe' criteria for mine contact water discharge.
- CCME PAL (or site-specific water quality objectives) were applied as receiving environment criteria for all sources.
- NWB were applied as 'end of pipe' criteria for wastewater (sewage effluent) discharge.

Several key parameters are naturally elevated in surface waters around the Mine Site, and as such, site specific water quality objectives (SSWQOs) were developed for the following parameters using CCME (1993) background concentration procedure (Knight Piésold, 2011):

- Aluminum
- Chromium
- Copper
- Iron

The developed SSWQOs are summarized in Table H.1. It was not appropriate to develop site specific criteria for Uranium or Selenium as explained in FEIS Appendix 7B-2.

H1.1.2 KEY ISSUES AND PATHWAYS

Key issues which were assessed for the surface water and sediment quality VEC included:

- Pit water quality from the Mine Site LSA
- Surface runoff from Project roads in the five freshwater LSAs
- Discharges from Project WWTFs from the five freshwater LSAs
- Acid Rock Drainage (ARD) and Metal Leaching (ML) resulting from waste rock piles, ore stockpiles, open pit dewatering, construction fills, embankment of roads and railway, and open quarries in the five freshwater LSAs
- Nutrient input from blasting activities and chemical leaching from rail sleeper coatings in the five freshwater LSAs
- Suspended sediment due to construction of mine facilities, Milne Inlet Tote Road, the railway and associated water crossings
- Runoff at fuel storage facilities, including fuel spills and malfunctions from the five freshwater LSAs
- Effects from waste management activities including storage, handling and landfilling of waste, landfarming of contaminated ice/snow/soil, the management of historically contaminated material, and sewage effluent discharges in the five freshwater LSAs
- Effects from construction and operation of camps in the five freshwater LSAs

- Effects from erosion and sediment transport due to vegetation removal, cuts/fills and other disturbances in the five freshwater LSAs
- Effects from dust deposition in the five freshwater LSAs
- Effects from drilling water withdrawals and returns in the Mine Site LSA

An account of key issues, indicators, and Project locations and phases that were incorporated in the effects assessment is provided in Table H.2.

TABLE H.2 KEY ISSUES FOR WATER AND SEDIMENT QUALITY

Key Issue	Indicators	Project Location (LSA)	Project Phase
Ground Preparation, Earthworks, Road and Railway Construction	pH, TSS, Metals and Nutrients	All	Construction and Closure
Site Water Management	pH, TSS, Metals, Nutrients and Petroleum Hydrocarbons	Milne Inlet LSA Northern Transportation Corridor LSA Mine Site LSA Rail Alignment LSA	Construction, Operation and Closure
Laydown Areas	pH, TSS, and Metals	All	Construction and Closure
Airstrips and Airstrip Use	TSS and Petroleum Hydrocarbons	All	Construction, Operation, Closure
Mine Contact Water - Waste Rock Stockpile	pH, TSS, Metals and Nutrients	Mine Site LSA	Operation, Closure and Post Closure
Mine Contact Water - Open Pit and Run of Mine Stockpile	pH, TSS, Metals and Nutrients	Mine Site LSA	Operation, Closure and Post Closure

H1.1.3 RESIDUAL EFFECTS RATING CRITERIA

Residual effects are those effects that persist after mitigation has been applied to potential effects. Each Project -related residual effect was rated using the standard criteria described in FEIS Volume 2.0 and the VEC specific criteria identified- in Table H.3.

TABLE H.3 SIGNIFICANCE RATING FOR EVALUATING RESIDUAL WATER AND SEDIMENT QUALITY EFFECT

Criteria	Classification	
Magnitude	Negligible	Concentrations of indicator(s) predicted to be less than threshold value(s)
	Level I	Concentrations of indicator(s) predicted to be above but within an order of magnitude of threshold value(s) (1 to 10x the threshold)
	Level II	Concentrations of Indicators predicted to exceed threshold value(s) by an order of magnitude or greater (10 to 100x the threshold)
	Level III	Concentrations of Indicators predicted to exceed threshold value(s) by more than two orders of magnitude (greater than 100x the threshold)
Extent The physical extent of the effect, relative to study area boundaries	Level I	Confined to the LSA
	Level II	Beyond the LSA and within the RSA
	Level III	Beyond the RSA
Duration The length of time over which a Project effect will occur	Level I	Short-term (effect lasts for up to 4 years)
	Level II	Medium-term (up to 25 years, for the life of the Project)
	Level III	Long-term (beyond the life of the Project) or permanent
Frequency How often the effect occurs	Level I	Infrequent - rarely occurring
	Level II	Intermittent – occasionally occurring
	Level III	Continuous
Reversibility The likelihood of the VEC to recover from the effect	Level I	Fully reversible after activity is complete
	Level II	Partially reversible after activity is complete
	Level III	Non-reversible after activity is complete

Of the five rating criteria used in rating residual effects, magnitude is heavily weighted when determining the significance of the residual effect and is also the criterion that requires the most interpretation. Since the main receptor affected by changes in water quality is aquatic life, magnitude ratings were established based on aquatics -related thresholds, as summarized in Table H.1.

Receiving water quality objectives (WQOs) have been established for the Protection of Freshwater Aquatic Life (CCME PAL). If receiving waters meet the selected Water Quality Objectives (CCME PAL or SSWQOs) with a discharge, this is deemed a Negligible effect to freshwater biota and hence to water and sediment quality. Level I, II and III magnitude effects are related to the relative level of exceedance of any WQOs.

The potential effects associated with discharge of mine contact water into the natural environment are well understood and have led to the enactment of the MDMER under the *Fisheries Act*. The following parameters, identified in Schedule 4 of the MDMER, are regulated by point-of-discharge concentrations:

- Arsenic
- Copper
- Cyanide
- Lead

- Nickel
- Zinc
- TSS
- Radium

These parameters have been regulated due to potential deleterious effects on fish and other biota in the receiving environment. Mine contact waters may be authorized for discharge under the MDMER of the *Fisheries Act*, provided the effluents at the point of discharge meet the MDMER Schedule 4 criteria and pass regular testing for acute lethality and chronic toxicity.

H1.1.4 BASELINE CHARACTERIZATION

Using the baseline data as a frame of reference, the following methods were applied to aqueous non-point source emissions, aqueous point source emissions and airborne emissions.

H1.1.5 AQUEOUS NON-POINT SOURCE EMISSIONS

Infrastructure and activities that were widespread or had non-point source emissions, were assessed in a qualitative manner on a Project-wide basis rather than assessing residual effects for each individual water body. To identify potential sensitivity to the particular indicators and to add context to the rating, general water quality parameters determined for the Sample Group and/or the LSA were considered. The description of the general water quality characteristics for Sample Groups (rivers/streams and lakes) is provided in FEIS, Volume 7, Tables 7-3.5 and 7-3.7.

Given the uncertainty regarding the potential contaminant source, distribution, and location that would be required to complete a quantitative assessment, a qualitative assessment was undertaken applying conservative assumptions. Examples of residual effects associated with aqueous non-point source emissions included increased TSS due to erosion and sediment transport, ML/ARD from various earth materials, nutrient additions from blasting, and petroleum hydrocarbon constituents from accidental spills.

The majority of meltwater and precipitation in the Project area occurs between June and September, the open -water period for streams and rivers. Consequently, erosion and sediment transport, nutrient and metals transport, and petroleum hydrocarbon mobilization are likely to occur in this period, when receiving waterbodies are at their maximum flows and have increased capacity to buffer these inputs.

Where residual effects were considered likely and there was a lack of reliable data available to quantify the contaminant source, a conservative approach was employed by assuming that the concentration of the key indicator(s) for that particular effect would exceed the respective threshold(s) (Table 7-3.8, FEIS, Volume 7), resulting in a Level II magnitude effect. For these cases, it was further assumed that the magnitude could be maintained below a Level III effect (i.e., less than an order of magnitude greater than the threshold) by identifying the occurrence of the effect through environmental monitoring and responding appropriately under an adaptive management framework.

A conservative approach was also applied to assumptions regarding the effectiveness of mitigation measures, in recognition that there may be limitations associated with implementation and effectiveness, given the extreme climatic conditions in the Project area. Following that logic, where qualitative assessment was employed, a magnitude of Level I was only attributed to a residual effect when there was a high Level of Certainty that mitigation would be fully implemented and effective. All instances where the effectiveness of the mitigation was in question resulted in a magnitude rating of Level II.

H1.1.6 AQUEOUS POINT SOURCE EMISSIONS

For Project infrastructure and activities that generate point-source emissions with the potential to affect a specific receiving waterbody, the residual effects assessment focused on those particular locations, where adequate baseline data were available.

For point source mine contact water discharges, source terms of runoff water quality were obtained from geochemical testing (AMEC, 2012b) to compare effluent water quality to MDMER criteria, and to evaluate the resultant water quality in receiving waters compared to CCME PAL Guidelines. As a mitigation measure to maximize mixing, and to minimize changes in the natural flow regimes, discharges of mine contact waters will be carried out following the natural hydrograph. The Camp Lake tributary at MR-12 and the Mary River are gauged during the open water season, which will allow for real-time monitoring of flows and regulation of releases.

A mass balance approach was used, mixing annualized discharge flows with the annualized receiving flow at the nearest downstream location inhabited by fish. The mass balance model is shown below:

$$C_{Res} = \frac{(C_D \times Q_D) + (C_R \times Q_R)}{Q_{Res}}$$

Where:
C_D = indicator concentration in discharge (mg/L)
Q_D = volume of effluent discharged annually (m^3/year)
C_R = indicator concentration in receiving waterbody (mg/L)
Q_R = volume of water in the receiving waterbody annually (m^3/year)
C_{Res} = resulting (mixed) indicator concentration (mg/L)
Q_{Res} = volume of resulting (mixed) waterbody annually (m^3/year)

The model assumes near-instantaneous mixing in riverine environments due to the discharge to receiving flow ratio, and no modification of indicators due to precipitation, speciation, attenuation or degradation.

Modelling was carried out using both mean and 90th percentile baseline concentrations, and under both mean and low flow (7Q10) conditions.

H1.2 MIXING ASSUMPTIONS

While the water quality model used above assumes instantaneous mixing, in reality Initial Dilution Zones (IDZs) will exist at each discharge. The specifics for each discharge location are discussed below.

- West Waste Rock Stormwater Pond - Stormwater will be discharged to a natural drainage (L1) that is fishless until about 100 m before the drainage discharges into a main tributary of Camp Lake (tributary L0). The receiving water is the lower reach of L0 below the falls that provide the fish barrier. Stormwater will be mixed with the natural waters in the drainage L1, and although discharge flows are greater than natural flows, it is expected that this mixing will effectively occur over the approximate 1.5 km length to where the water flows over the falls and subsequently into tributary L0, receiving further dilution.

- East Waste Rock Stormwater Pond - Stormwater will be discharged to a natural drainage (F0) that is fishless until the F0 drainage discharges into the Mary River. Stormwater will be mixed with the natural waters in the drainage F0, and although discharge flows are similar to the natural flows, it is expected that this mixing will effectively occur over the approximate 2,500 m section to where the water flows over the falls. F0 then discharges into the Mary River at a point where the flows are highly turbulent, and therefore further mixing is expected to be nearly instantaneous.
- ROM Stockpile Stormwater Pond and Ore Stockpile Stormwater Pond - These discharges will be directly to the Mary River, but at distinct locations separated by approximately 1,500 m of river. IDZs will exist downstream of each discharge. Because of the volume and turbulent nature of flows in the Mary River, the IDZs will be confined to 20 to 30 m in length.

H1.3 SOURCE TERMS - WASTE ROCK

Mine contact water from the Waste Rock Stockpiles at the Mine Site will be collected in stormwater ponds prior to discharge. Stormwater runoff water quality (source terms) from Waste Rock Stockpiles were derived by preparing a mass loading model using laboratory derived reaction data and the anticipated site conditions. The ponds will be designed with holding capacities that act to moderate water quality. During mining, when the waste rock pile is under development, stormwater will require retention to settle out solids. The water quality modelling by AMEC (2012a) suggests that if suspended solids are properly managed, the quality of discharge will meet MDMER requirements. While water treatment is not expected to be required, treatment options will be available as a contingency measure. As a conservative measure, maximum waste rock runoff quality estimates were used in the assessment.

For a number of parameters sampled in the humidity cell tests, metals were measured at or below the analytical method detection limit (MDL) for a large proportion of samples. Generally, the MDLs are high relative to the selected water quality objectives (CCME PAL or SSWQOs). For these parameters, the values assigned were set at one-half the MDL (AMEC, 2012a). The 90th percentile calculated source term was influenced by predicted water quality results based largely on the non-detect results in the humidity cells for the following metals: mercury (Hg), selenium (Se), copper (Cu), arsenic (As), cadmium (Cd), chromium (Cr), silver (Ag) and thallium (Tl). Consequently, the modelled water quality for these parameters is highly conservative.

A similar issue with detection limits was identified in the baseline water quality dataset. The majority of sample results for several metals were reported as non-detect (measured below the MDL). In the baseline dataset, non-detect samples were conservatively set at the MDL. This contributed to overly conservative modelling results, i.e., when the majority of results were reported at the detection limit, the calculated values were close to or even exceeded the Water Quality Objective (WQO).

Two notable parameters, mercury and selenium, were calculated to exceed the respective WQO because of the high proportion of non-detects in both the baseline receiving waters and in the humidity cell testing.

	Mercury	Selenium
WQO (CCME PAL) (mg/L)	0.000026	0.001
90th Percentile Baseline Concentration (mg/L)	0.0001	0.0001
% of Detects in Baseline (Measured above MDL)	2 %	2 %
Calculated Source Term (mg/L) (west discharge / east discharge)	0.004 / 0.003	0.047 / 0.038
Humidity cell testing MDL (mgl/L)	0.001	0.001

As a consequence, mercury and selenium are predicted to reach Level II magnitude in the assessments.

During the technical review of the DEIS, the Qikiqtani Inuit Association expressed concern over the potential for nitrates to be elevated in the waste rock stormwater runoff, due to the quantities of ammonium nitrate fuel oil (ANFO) explosives that will be used in mining.

Ammonia releases have been associated with the use of certain explosives at mining and quarrying operations. The use of ammonium nitrate and fuel oil (ANFO) explosive could cause elevated nitrates in waste rock and mine run-off. Ammonia can occur as un-ionized (NH_3) or ionized (NH^{4+}) ammonium ion species. Total ammonia is a measure of both un-ionized and ammonium ion species. The un-ionized is more toxic to aquatic life than the ionized species. Consequently, mining companies have taken a number of initiatives to address this issue. For example, Diavik Diamond Mines Inc has investigated the use, loss and mitigation measures to address nitrate losses, and as a result, has developed and implemented at its site several iterations of an Ammonia Management Plan (Diavik Diamond Mines: Ammonia Management Plan).

Annual explosive use for blasting waste rock and ore is estimated to range from 15,700 tonnes to 18,200 tonnes per annum depending on the year. FEIS Volume 3, Appendix 3B, Attachment 8, Section 2.6 states that the emulsion: AN ratio used for the Project is 70:30. The use of emulsion improves the bulk strength of the explosive and allows efficient rock breakage. The emulsion product also reduces ANFO solubility. Modeling by other companies concludes that ammonia releases can be reduced if proper controls are not implemented. The Explosives Management Plan (FEIS Volume 3, Appendix 3B, attachment 8) and FEIS Volume 10 Section 4.3.3 outline the mitigation measures that will be taken to control the nitrate concentrations entering the receiving environment.

Commercial ammonia reduction technologies, if required, include biological treatment, air stripping, ion exchange, reverse osmosis and breakpoint chlorination. Non-commercial technologies that may have future applications include aerated lagoons, constructed wetlands, land treatment and natural treatment in ponds. (Table 5, Annex C of the Diavik Diamond Mines Ammonia Management Plans), describes for each technology an ammonia reduction estimate, the environmental effect, an evaluation of technology feasibility, capital cost and operating time frames.

H1.4 SOURCE TERMS - PIT WATER QUALITY

Preliminary estimates of pit water quality were made using a similar mass loading approach to that for the waste rock drainage quality (AMEC 2012b). Equilibrated estimates of pit water quality are presented in Table H.4. It is expected that the effluent quality during mine operations will meet MDMER requirements for metals. It is possible that, during the latter portion of the mine, pH may decrease below the lower limit of the MDMER (pH 6.0). The estimated water quality derived for the pit drainage includes allowance for acidic drainage from exposed potentially acid generating (PAG) rock toward the end of mine life. The quantity of this exposed rock and the data used in deriving this drainage quality is the subject of additional study.

It has therefore been assumed that pH adjustment of the pit water will be required in the second half of mine life and into post-Closure. During Operations, pH adjustment will most likely be carried out inside the pit before the water is pumped to the East Waste Rock Pond. Again, humidity cell testing is expected to over-estimate the runoff quality. These modelling results are very conservative and will be reviewed once data are available from recently initiated neutralizing potential-depleted humidity cell testing. This will improve confidence in drainage water quality and pH.

Although the pit water quality source term for the latter part of mine life is beyond the MDMER range for pH and may require minor pH adjustment, the source terms (assuming no treatment) have been applied in the water quality modelling as a conservative measure.

The EEM program under MDMER is specifically designed for this type of situation and is a well-designed monitoring tool. It is a tiered program, meaning that the results of monitoring are used in the design of subsequent monitoring, and results also serve to identify the need for corrective action (Dumaresq *et al*. 2002).

H1.5 SOURCE TERMS - ORE RUNOFF

Mine contact water from the ROM stockpile and the main ore stockpile at the Mine Site will be collected in stormwater ponds prior to discharge to the Mary River. Source terms were derived by calculating the 90th percentile concentrations from sampling carried out by Baffinland in 2010 from lysimeters installed in an ore stockpile generated at the site during the bulk sampling program in 2008. No runoff has been collected since then due to especially dry conditions during the 2011 field season. The runoff data, while limited, are considered conservative in that they represent runoff collected after the stockpile had been sitting dormant for two years; in reality the turnover in the ore stockpiles will be rapid and therefore the contact time between water and the ore will be limited. It has also been identified that non-representative manganese-rich ore may be a component of the lysimeter samples, since this ore was used in construction of the crusher pads where the lysimeters were located. Therefore, lysimeter results may be influenced by drainage from atypical ore.

Runoff from the ore stockpiles is not expected to require treatment beyond settlement of suspended solids in the stormwater pond. Nevertheless, treatment has been identified as a potential contingency measure that can be implemented if monitoring program results indicate that the water quality does not meet discharge criteria. More detail on contingency treatment options for mine contact water is provided in Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031).

TABLE H.4 PREDICTED PIT WATER QUALITY

Parameters	MDMER Limits	Year 6	Year 10	Year 15	Year 21
pH	6 - 9.5	6.5	6.5	5.1	4.2
Sulphate (mg/L)		77	80	88	158
Arsenic (mg/L)	0.3	0.006	0.006	0.006	0.007
Copper (mg/L)	0.3	0.007	0.008	0.016	0.074
Lead (mg/L)	0.1	0.0005	0.0005	0.0007	0.0022
Nickel (mg/L)	0.5	0.004	0.005	0.018	0.11
Zinc (mg/L)	0.5	0.030	0.031	0.035	0.062
Aluminum (mg/L)		0.24	0.24	0.77	4.2
Antimony (mg/L)		0.007	0.007	0.007	0.008
Boron (mg/L)		0.060	0.062	0.067	0.11
Cadmium (mg/L)		0.00005	0.00005	0.00006	0.00016
Chromium (mg/L)		0.007	0.007	0.008	0.019
Cobalt (mg/L)		0.002	0.002	0.008	0.053
Iron (mg/L)		<0.002	<0.002	0.031	0.22
Manganese (mg/L)		0.0001	0.0001	0.10	0.57
Mercury (mg/L)		0.0013	0.0014	0.0014	0.0016
Molybdenum (mg/L)		0.023	0.024	0.024	0.027
Selenium (mg/L)		0.015	0.016	0.016	0.022
Silver (mg/L)		0.0002	0.0002	0.0002	0.0008
Thallium (mg/L)		0.0007	0.0007	0.0007	0.0009
Vanadium (mg/L)		0.0024	0.0025	0.0025	0.0029
Barium (mg/L)		0.022	0.023	0.024	0.034
Sodium (mg/L)		1.0	1.0	1.1	1.8
Potassium (mg/L)		29.2	30.1	30.2	34.9
Calcium (mg/L)		36.0	37.2	37.4	43.4
Magnesium (mg/L)		20.2	20.8	22.9	40.0

NOTES:

1. Equilibrated concentrations, which assume equilibrium with amorphous $Al(OH)_3$, ferrihydrite and manganite where estimated concentrations exceed saturation indices for those phases.

H1.5.1 SIGNIFICANCE DETERMINATION

The potential to result in significant adverse environmental effects was determined for each residual effect, based on professional judgment of the combination of residual effect ratings for each potential effect and taking into account the environmental context and the Level of Confidence associated with each rating.

H2 RESIDUAL EFFECTS ASSESSMENT

This Section presents potential effects, mitigation measures and the residual effects assessment for two categories:

- Aqueous Non-Point Source Emissions
- Aqueous Point Source Emissions

H2.1 AQUEOUS NON-POINT SOURCE EMISSIONS

Potential effects on surface water and sediment quality associated with aqueous non-point source emissions (key issues) and the significance of residual effects are identified in Table H.5. These emissions are common where activities take place near water bodies and may affect watercourses throughout the Project area. Locations of infrastructure and activities are described for each LSA.

H2.1.1 PREDICTION CONFIDENCE

The significance rating and confidence level assigned to the predictions of significance for aqueous non-point source discharge effects to water and sediment quality are summarized in Table H.6.

H2.1.2 GROUND PREPARATION AND EARTHWORKS - IMPACT STATEMENT SWSQ-1

Impact Statement SWSQ-1: Project-related ground preparation and earthworks may result in changes to surface water and sediment quality in the five freshwater aquatic LSAs.

Ground preparation and earthworks are essential prerequisites during the Construction and Closure phase in all five freshwater LSAs. The areas requiring earthworks notably include the following:

- Developing each of the key areas (Milne Port, Mine Site and Steensby Port) including the construction and reclamation of buildings, laydown areas, access roads and other site infrastructure;
- Minor improvements to the roadbed of the Milne Inlet Tote Road; and
- Railway construction, including the construction access road.

Typical ground preparation activities include vegetation removal and stripping, resulting in ground surface conditions that are prone to potential erosion and liberation of potential contaminants of concern; this may have an effect on surface water quality through changes in pH or the introduction of TSS, petroleum hydrocarbons and/or nutrients. Left unmitigated, direct effects may be observed in surface water quality. By implementing standard best management practices (BMPs) during ground preparation activities, water quality effects can be avoided or reduced to the point where only incidental, minor to moderate adverse short-term effects are anticipated. As required, the following mitigation measures will be applied:

- Minimize the footprint of disturbance;
- Schedule ground preparation to maintain adequate ground cover during periods of expected rainfall;
- Install and maintain water management features, designed to segregate and prevent co-mingling of offsite water and onsite water;
- Install and maintain adequately designed erosion control features;
- Install and maintain adequately designed sediment transport control features;
- Capture and treat potentially contaminated site run-off to applicable water quality standards prior to discharging to the receiving environment; and
- Erosion control measures.

Following the ground preparation activities, earthworks (earth moving, excavation, grading, cut/fill and backfilling) are required for development of components during Construction and reclamation of components during Closure.

The disturbance, exposure, transportation and relocation of earth materials can potentially affect surface water quality in receiving bodies adjacent to these work areas. Left unmitigated, direct effects may be observed in surface water quality including changes in pH, introduction of TSS, petroleum hydrocarbons, and/or nutrients. By implementing standard BMPs described above, water quality impacts can be avoided or reduced to the point where only minor to moderate short-term adverse effects are anticipated.

In the event that existing contamination is suspected or encountered during earthwork activities, the Hazardous Materials and Hazardous Waste Management Plan (BAF-PH1-830-P16-0011) will be used as a guideline for containment, testing, removal, treatment and disposal of contaminated media.

Soil spoils will be re-used nearby as general fill (if suitable), stored for reclamation purposes and/or disposed of in roadside borrows. Borrows will be contoured to provide stable side slopes and restore natural drainage.

Temporary roads will be decommissioned and restored through scarification as soon as practical to reduce the risk of potential effects of erosion and sediment transport. Culverts and bridges will be removed to restore pre-disturbance drainage patterns.

The Southern railway alignment and train-related infrastructure are described and illustrated in FEIS Volume3. Completion of the rail line will incorporate ground preparation and earthworks, a temporary access road, rail bed construction and rail sleeper installation. The entire rail line consists of new construction through previously unaltered landscape; therefore, potential effects on water and sediment quality are anticipated.

Rail line construction activities with the potential to affect surface water and sediment quality include culvert installation, bridge construction, infilling of right-of-way through watercourses (encroachment), rail bed construction, grading, and water management.

Standard BMPs will be employed to address potential effects during Construction and Closure. The rail bed, rail line and associated features will be designed and installed so as to avoid contamination of surface waters. Specifically, all structures will be designed, constructed and operated in compliance with *Fisheries Act* authorizations designed to protect water quality as an integral component of fish habitat. Adherence to the conditions of the *Fisheries Act* Authorizations and standard BMPs are anticipated to result in minor adverse residual effects.

TABLE H.5 EFFECTS ASSESSMENT SUMMARY - AQUEOUS NON-POINT SOURCE EMISSIONS

Effect		**Residual Effect Evaluation Criteria**					**Significance**
Effect	**Direction & Nature of Effect**	**Magnitude / Complexity**	**Geographical Extent**	**Frequency**	**Duration**	**Reversibility**	**Rated Significance of Residual Effect**
SWSQ-1 **Ground preparation & earthworks**	**Negative** Water quality (pH, TSS, metals, nutrients and hydrocarbons)	**Level II:** Effect is expected to result in a change greater than threshold value(s)	**Level I:** confined to the LSA	**Level I:** infrequent	**Level II:** will occur for the operation phase (life of the Project)	**Level I:** effect is reversible after activity is complete	Not Significant
SWSQ-2 **Site Water Management**	**Negative** Water quality (pH, TSS, metals, nutrients and hydrocarbons)	**Level II:** Effect is expected to result in a change greater than threshold value(s)	**Level I:** confined to the LSA	**Level I:** infrequent	**Level I:** will occur mainly during the construction phase	**Level II:** effect is partially reversible with cost/effort	Not Significant
SWSQ-3 **Laydown Areas**	**Negative** Water quality (pH, TSS, metals, nutrients and hydrocarbons)	**Level II:** Effect is expected to result in a change greater than threshold value(s)	**Level I:** confined to the LSA	**Level I:** infrequent	**Level I:** will occur mainly during the construction phase	**Level I:** effect is reversible after activity is complete	Not Significant
SWSQ-4 **Explosives**	**Negative** Water quality (pH, TSS, metals, nutrients and hydrocarbons)	**Level II:** Effect is expected to result in a change greater than threshold value(s)	**Level I:** confined to the LSA	**Level I:** infrequent	**Level II:** will occur for the operation phase (life of the Project)	**Level I:** effect is reversible after activity is complete	Not Significant
SWSQ-5 **Quarries and Borrow Areas**	Negative Water quality (pH, TSS, metals, nutrients and hydrocarbons)	**Level II:** Effect is expected to result in a change greater than threshold value(s)	**Level I:** confined to the LSA	**Level I:** infrequent	**Level I:** will occur mainly during the construction phase	**Level I:** effect is reversible after activity is complete	Not Significant

Effect		Residual Effect Evaluation Criteria					Significance
Effect	**Direction & Nature of Effect**	**Magnitude / Complexity**	**Geographical Extent**	**Frequency**	**Duration**	**Reversibility**	**Rated Significance of Residual Effect**
SWSQ-7 **Camps and Fuel Management**	**Negative** Water quality (pH, TSS, metals, nutrients and hydrocarbons)	**Level I:** Effect is expected to be less than threshold values	**Level I:** confined to the LSA	**Level II:** will occur intermittently	**Level II:** will occur for the operation phase (life of the Project)	**Level II:** effect is partially reversible with cost/effort	Not Significant
SWSQ-8 **Water Use and Management**	**Negative** Water quality (pH, TSS, metals, nutrients and hydrocarbons)	**Level I:** Effect is expected to be less than threshold values	**Level I:** confined to the LSA	**Level III:** continuous	**Level II:** will occur for the operation phase (life of the Project)	**Level I:** effect is reversible after activity is complete	Not Significant
SWSQ-9 **Airstrips and Airstrip Use**	**Negative** TSS and Petroleum Hydrocarbons	**Level II:** Effect is expected to result in a change greater than threshold value(s)	**Level I:** confined to the LSA	**Level I:** infrequent	**Level III:** will occur beyond the life of the Project	**Level I:** effect is reversible after activity is complete	Not Significant

TABLE H.6 SIGNIFICANCE OF RESIDUAL EFFECTS FROM NON-POINT SOURCE DISCHARGES

Key Issue	Significance of Predicted Residual Environmental Effect		Likelihood (1)	
	Significance Rating	Level of Confidence	Probability	Certainty
SWSQ-1: Project-related ground preparation and earthworks, including road and railway construction/closure	N	2	N/A	N/A
SWSQ-2: Project-related site water management	N	2	N/A	N/A
SWSQ-3: Project-related laydown areas	N	1	N/A	N/A
SWSQ-4: Project-related explosives manufacture, storage, and use	N	2	N/A	N/A
SWSQ-5: Quarries and borrow sources	N	2	N/A	N/A
SWSQ-7: Camps, fuel storage and waste management	N	2	N/A	N/A
SWSQ-8: Water use and management	N	2	N/A	N/A
SWSQ-9: Airstrips and airstrip use	N	2	N/A	N/A

KEY:

2. Significance Rating: S= Significant, N = Not Significant, P = Positive
   Level of Confidence: 1= Low; 2= Medium; 3=High
   a. Likelihood - only applicable to significant effects
   b. Probability: 1= Unlikely; 2= Moderate; 3=Likely
   c. Certainty: 1= Low; 2= Medium; 3=High

Materials from borrow sources have undergone representative geochemical testing, which has indicated that non-reactive material is available throughout the alignment for rail bed construction. The use of non-reactive rock avoids the potential for acid generation and metals leaching that could affect surface water and sediment quality. Imported materials used in rail bed construction will be screened for other obvious contaminants that could affect nearby watercourses. In the event that existing contamination is suspected or encountered during earthwork activities, the Project's Hazardous Materials and Hazardous Waste Management Plan (BAF-PH1-830-P16-0011) will be used as a guideline for containment, testing, removal, treatment and disposal of contaminated media.

The rail sleepers will be hewn from raw wood and will not have any preservatives such as creosote or zinc chloride. One of the factors in the selection of raw wood for rail sleepers was to remove the potential for adverse water quality effects. No negative adverse effects are expected from materials leaching from the raw wood rail sleepers.

H2.1.3 RESIDUAL EFFECTS RATING

H2.1.3.1 MAGNITUDE

Based on a qualitative assessment, there is a potential for minor to moderate water quality effects associated with ground preparation and earthworks activities, including road and railway construction and reclamation. Generally, the mitigation measures described above are expected to prevent contact of sediment-laden water with natural surface waterbodies in the LSA. Mitigation measures may, however, have limitations, especially considering the extreme climatic conditions: the effectiveness of the installation and performance of sediment transport mitigation (e.g. silt fences) in frozen ground conditions, challenges in providing adequate ground cover, and challenges in completing earthworks in areas of permafrost.

Given the potential limitations of mitigation measures, it is anticipated that TSS loading could occasionally exceed the CCME threshold of +5 mg/L relative to baseline conditions. These effects are most likely to coincide with freshet conditions, which in themselves result in elevated TSS and have the potential to mitigate the magnitude of the potential effect through added capacity to buffer these inputs. Environmental construction monitoring is expected to be successful in identifying potential effects as they arise, and adaptive management will improve the performance of mitigation measures and thereby avoid exceedance of the CCME PAL guidelines.

In the event that existing (pre-Project) contaminated media are identified on any of the Project sites, appropriate measures will be taken to collect, treat and dispose of the material without increasing the footprint of the contamination and/or creating new pathways for contaminant transport. Currently, there are no known instances of existing contamination located in the Project area. Negligible to minor effects may be anticipated with any existing contaminated media identified during ground preparation and earthworks activities.

Based on the potential for water quality to occasionally exceed the identified thresholds, the effect was rated at Level II.

Environmental monitoring, ongoing water quality monitoring and adaptive management are expected to limit the magnitude of potential TSS related effects.

H2.1.3.2 EXTENT

The extent of residual water and sediment quality effects associated with ground preparation and earthworks will be limited to the LSA where the infrastructure is located. Environmental construction monitoring will identify effects and where necessary, mitigation will limit the extent of the effect. The extent is rated as Level I.

H2.1.3.3 FREQUENCY

Considering the temporal relation between freshet and/or extreme weather conditions and residual water and sediment quality effects, it is anticipated that these effects will be limited to summer months when construction activities are scheduled and when freshet and the majority of rain events occur. Frequency is rated as Level I.

H2.1.3.4 DURATION

While ground disturbance and road and railway construction will be concentrated in the Construction phase, these facilities will require ongoing maintenance throughout the duration of the Project. The duration has been rated as Level II.

H2.1.3.5 REVERSIBILITY

The potential effects are anticipated to be fully reversible, once the roads have been decommissioned and rehabilitated and natural drainage has been restored. The effect is rated as Level I.

H2.1.3.6 SIGNIFICANCE - SWSQ-1 - PROJECT-RELATED GROUND PREPARATION AND EARTHWORKS, INCLUDING ROAD AND RAILWAY CONSTRUCTION/RECLAMATION

Based on the ratings described above, ground disturbance and earthworks activities are not expected to result in significant adverse environmental effects on the water and sediment quality VEC. The residual effect is ranked as *Not Significant* (Table H.5). The Level of Confidence associated with the significance ranking is Medium due to the combined qualitative and semi-quantitative nature of the assessment (Table H.6).

H2.2 SITE WATER MANAGEMENT - IMPACT STATEMENT SWSQ-2

Impact Statement SWSQ-2: Project-related site water management may result in changes to surface water and sediment quality in the five freshwater aquatic LSAs.

Management of storm water, process water and site runoff from engineered surfaces will be required throughout the five freshwater LSAs during all Project phases. The areas requiring site water management are identified in FEIS Table 3.2.1, Major Project Components, Volume 3. The approach to site water management is provided in the Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026).

All stormwater sources have the potential to affect surface water quality through the alteration of Ph and/or introduction of TSS, petroleum hydrocarbons, metals and nutrients. By implementing standard BMPs such as the Land Development Guidelines for the Protection of Aquatic Habitat (DFO, 1993), adverse effects can be avoided or reduced. The following mitigation measures will be used to manage the effects of water management on surface water quality:

- Minimize the footprint of disturbance;
- Install and maintain water management features, designed to segregate and prevent co-mingling of offsite water and onsite water;
- Install and maintain adequately designed erosion control features;
- Install and maintain adequately designed sediment transport control features;
- Where required, locate infrastructure on competent bedrock or provide ground conditions that limit permeability and transport into the active layer; and
- Capture and treat contaminated site run-off prior to discharging to the receiving environment.

H2.2.1 RESIDUAL EFFECTS RATING

H2.2.1.1 MAGNITUDE

Preliminary site observations coupled with experience gained from existing operations in the Project area indicate that untreated site water can typically be managed in a way that prevents contact with natural surface waterbodies and water contained in the active layer. The underlying bedrock and permafrost conditions will act as a relatively impermeable barrier to migration of potential contaminants into groundwater.

All potentially affected stormwater sources will be collected, contained and treated to applicable water quality criteria prior to discharge. Environmental construction monitoring will focus on receiving waterbodies that have relatively soft water, i.e., sensitive to increased metal toxicity (upstream of the deposits, Mary Lake and tributaries, Camp Lake, Sheardown Lake, Ravn River and Cockburn Lake) and watercourses that are sensitive to nutrient inputs.

Based on the anticipated success of controlling stormwater and treating it to applicable discharge standards, only minor to moderate water effects are anticipated. The magnitude is rated as Level II.

H2.2.1.2 EXTENT

Based on the scale of the surface areas where site water is being collected, the extent of residual water and sediment quality effects associated with Project-related site water management may extend beyond the LSA where the source is located, but is not anticipated to extend to the RSA scale. Environmental construction monitoring will identify residual water and sediment quality effects and where necessary, mitigation efforts will limit the extent of the effect. A Level I extent rating was assigned.

H2.2.1.3 FREQUENCY

Considering the temporal relation between freshet and/or extreme weather conditions and residual water and sediment quality effects, it is anticipated that these effects occur during summer months when construction activities are scheduled. A Level I frequency rating was assigned.

H2.2.1.4 DURATION

Residual water and sediment quality effects associated with site water management are expected during the Construction and Operation phases of the Project and are anticipated to coincide with the timing of freshet, when any potential effect would be expected to be diluted by high flow conditions resulting in key indicator concentrations indistinguishable from baseline. A Level I duration rating was assigned.

H2.2.1.5 REVERSIBILITY

Residual surface water and sediment quality effects associated with site water management are anticipated to be partially reversible. The majority of Project areas where site water management is required will be returned to the pre-disturbed state during Closure phase. Following rehabilitation, key indicators are generally expected to return to baseline conditions through removal of the contaminant source. A Level II reversibility rating was assigned.

H2.2.1.6 SIGNIFICANCE - SWSQ-2 - PROJECT-RELATED SITE WATER MANAGEMENT

Based on these ratings, site water management infrastructure and site water discharge are not expected to result in significant adverse environmental effects on the water and sediment quality VEC in the five freshwater LSAs. The residual effect is ranked as *Not Significant* (Table H.5). The Level of Confidence associated with the significance ranking is Medium (Table H.6). While the assessment is qualitative, there is a high Level of Confidence in the effectiveness of mitigation measures.

H2.3 LAYDOWN AREAS - IMPACT STATEMENT SWSQ-3

Impact Statement SWSQ-3: Project-related laydown areas may result in changes to surface water and sediment quality in the five freshwater aquatic LSAs.

Laydown areas are temporary sites used for the storage of equipment and construction materials during the Construction and Closure phase. Requirements are dictated by equipment needs, the sequence of construction/closure activities, and the timing of material shipments. These factors will be optimized to reduce the number of anticipated laydown areas, and to minimize their anticipated footprints. The two main considerations are sediment and erosion control, and introduction of hazardous substances, leading to discharge of sediment-laden or contaminated water into the receiving environment.

Left unmitigated, direct effects may be observed through the introduction of TSS and metals. By implementing standard BMPs during development and use, water quality effects can be avoided or minimized to the point where only minor to moderate adverse effects are anticipated. In addition to the mitigation measures described in the ground preparation section, the following mitigation measures will be employed in laydown areas, as required:

- Siting of laydown areas over competent bedrock or impermeable ground layers;
- Placement and grading of clean, free draining material to promote a workable lay down area environment;
- Installation of adequate storm water management infrastructure to restrict runoff from overland flow or seepage through the active layer into receiving waterbodies; and
- Appropriate handling and storage of hazardous materials.

H2.3.1 RESIDUAL EFFECTS RATING

H2.3.1.1 MAGNITUDE

Based on a qualitative assessment, that minor to moderate water quality effects may be associated with Project-related laydown areas and activities. The mitigation measures described above, while they are expected to prevent contact of sediment-laden or contaminated water with natural surface waterbodies may have limitations associated with their implementation and effectiveness.

Given these limitations, TSS loading could occasionally exceed the CCME threshold of +5 mg/L relative to baseline conditions. These effects are most likely to coincide with freshet conditions, which have the potential to mitigate the magnitude of the potential effect through added capacity to buffer these inputs. Environmental construction monitoring will identify potential effects as they arise and adaptive management will reduce the risk of exceeding the CCME PAL guidelines.

Potentially hazardous materials will be stored in appropriate containment in designated locations away from water bodies, to reduce the potential for loss of hazardous materials to the aquatic environment.

Based on the potential for changes in water quality occasionally to exceed the identified thresholds, a Level II magnitude rating was assigned.

H2.3.1.2 EXTENT

The extent of residual water and sediment quality effects associated with Project-related laydown areas will be limited to the LSA in which they are located. Environmental construction monitoring will identify effects and, where necessary, mitigation efforts preclude or limit the extent of the effect. A Level I extent rating was assigned.

H2.3.1.3 FREQUENCY

Considering the temporal relation between freshet and/or extreme weather conditions and residual water and sediment quality effects that these effects would be limited to summer months when construction activities are scheduled and when freshet and the majority of rain events in the Project area occur. A Level I frequency rating was assigned.

H2.3.1.4 DURATION

Residual water and sediment quality effects associated with laydown areas are only expected to occur during Construction and Closure. Potential effects are anticipated to coincide with the timing of freshet, when any potential effect would be expected to be diluted by high flow conditions resulting in key indicator concentrations indistinguishable from baseline. A Level I duration rating was assigned.

H2.3.1.5 REVERSIBILITY

Residual surface water and sediment quality effects associated with Project-related laydown areas are anticipated to be fully reversible. Following the closure and rehabilitation, key indicators are generally expected to return to baseline conditions through removal of the contaminant source. A Level I reversibility rating was assigned.

H2.3.1.6 SIGNIFICANCE - SWSQ-3 - PROJECT-RELATED LAYDOWN AREAS

Based on these ratings, laydown areas are not expected to result in significant adverse environmental effects on the water and sediment quality VEC in the five freshwater LSAs. The residual effect is ranked as *Not Significant* (Table H.5). The Level of Confidence is Low due to the qualitative nature of the assessment and potential limitations related to mitigation measures (Table H.6).

H2.4 EXPLOSIVES MANUFACTURE, EXPLOSIVES MAGAZINE, AND EXPLOSIVES USE - IMPACT STATEMENT SWSQ-4

Impact Statement SWSQ-4: Project-related explosives manufacture, magazine, and use may result in changes to surface water and sediment quality in the five freshwater aquatic LSAs. Explosives transportation, storage and handling have the potential to affect surface water quality in receiving environments during the Construction, Operation and Closure phases.

Explosives will be used throughout the Project footprint area during Closure to operate quarries, make rock cuts and access aggregate. During early construction and late closure, packaged explosives and ANFO will be delivered to specific areas of use. Packaged explosives will be stored in magazine areas, which will comply with the set-back requirements of NRCan.

Permanent bulk explosives factories will be established at the Mine Site and Steensby Port as early as possible to manufacture explosives from ammonium nitrate. These will be used if possible during early closure.

Explosives (primarily ANFO) manufacture, transportation, storage and handling may result in the introduction of nitrogenous and petroleum hydrocarbon based components into surface water. Certain nitrogenous compounds can be toxic to aquatic life, depending on the form (e.g. nitrate, nitrite, or ammonia) and relative concentration. Elevated nitrogen concentrations can also result in the eutrophication of receiving waters where phosphorus is not limiting.

The following mitigation will be used to manage potential effects on surface water and sediment quality:

- Explosives will be stored in explosives magazines positioned in accordance with the Nunavut Mine Health and Safety Act and Regulations. Detonators and explosives will be stored in separate magazines, and inventory will be strictly controlled by designated supervisors.

- Prefabricated magazines will be positioned and appropriately bermed to store explosives between unloading and distribution.
- If bulk mixing plants are available, ammonia nitrate (AN) will be delivered in bulk and transported by truck to the permanent storage facilities.

By implementing standard BMPs identified for explosives transportation, storage, and handling, water quality effects can be avoided or reduced to the point where only minor adverse effects are anticipated.

The mining pit will be mostly dry throughout the year; consequently ammonia or residual nitrogen is not expected to escape to the aquatic environment. During the freshet and summer months, any residual explosives washed away by precipitation will report to the waste rock pile; runoff will be channelled to a sedimentation pond, and discharge will be monitored for compliance with MDMER water quality limits.

The interaction between explosives use and water quality can be a challenge. The primary forms of mitigation to avoid contamination by nitrogen and petroleum hydrocarbons include use of appropriate weights of explosives to achieve desired blasting results, use of blast guards to prevent 'fly-away', and adequate water management features that will prevent co-mingling of contact and noncontact water. The primary area of use of explosives during Construction and Closure are quarries and borrow sources for aggregate production and are generally sited in competent ground conditions, away from sensitive receiving waterbodies, to minimize the potential for adverse effects. As an additional measure, collection sumps can be constructed to capture and treat potentially contaminated contact water prior to discharge.

H2.4.1 RESIDUAL EFFECTS RATING

H2.4.1.1 MAGNITUDE

Based on a qualitative assessment, minor to moderate water quality effects may be associated with explosives manufacture, transportation, magazine and use. Due to the potentially serious nature of health and safety effects, mitigation will be tightly controlled and intently managed. The permanent bulk explosives factories, ANFO mixing plants, ammonium nitrate storage facilities, and truck wash facilities will be constructed to contain any solid explosives and contact water for appropriate treatment. It is not anticipated that nitrogenous and petroleum hydrocarbon residues originating from these sources will exceed applicable CCME thresholds. Residual effects on water quality and sediment quality are expected to be negligible to minor.

The majority of blasting during the Operation phase will be confined to the open pit where water containing elevated levels of nitrogenous and petroleum hydrocarbon residues can be collected and treated prior to discharge (described in Section 3.4.1.6).

During Construction and Closure, nitrogenous and petroleum hydrocarbon residues are likely to be released due to blasting and wastage (minimal with pre-packaged ANFO) at quarry locations and other required sites. For these other scenarios, restricting blasting during freshet, volatilization by sunlight and attenuation by vegetation and soil and containment of contact water (where possible) are expected to limit potential effects. Even with the implementation of mitigation measures, it is possible that ammonia, nitrates, nitrites and petroleum hydrocarbon residues originating from blasting activities in less confined locations may occasionally exceed their respective CCME thresholds. These effects would likely coincide with the snow melt when accumulated nitrogen and petroleum hydrocarbon residues are released during the thaw and freshet conditions. High flow conditions will moderate the magnitude of the potential effect.

Nutrient characteristics of the receiving streams and lakes are summarized in FEIS Tables 7-3.5 and 7-3.7. The findings indicate that all of the freshwater receiving environments are relatively sensitive to nutrient inputs; therefore, environmental monitoring coupled with adaptive management will limit the magnitude of residual effects.

A Level II magnitude rating was assigned.

H2.4.1.2 EXTENT

The extent of residual water and sediment quality effects associated with Project-related explosives manufacture, transportation, magazine and use will be limited to the LSA in which it is located. Environmental monitoring will identify residual water and sediment quality effects and where necessary, mitigation efforts will limit the extent of the effect. A Level I extent rating was assigned.

H2.4.1.3 FREQUENCY

Considering the temporal relation between freshet and/or extreme weather conditions and residual water and sediment quality effects, it is anticipated that these effects would occur during summer months when construction activities are scheduled and when freshet and the majority of rain events occur. A Level I frequency rating was assigned.

H2.4.1.4 DURATION

Explosives manufacture, transportation, storage and use will be required during the Construction, Operation and Closure phases. Considering that the most likely uncontrolled contribution of nitrogen to the aquatic environment would come from blasting in unconfined areas along the Milne Inlet Tote Road or Railway Alignment, it is likely the source would not persist beyond the Construction phase. Nitrogen introduced in the form of ammonium would likely be assimilated into biomass rapidly, resulting in a relatively short duration of effect. Since the nitrogen source will be removed after Construction, and given the anticipated rapid assimilation of ammonium, a Level II duration rating was assigned.

H2.4.1.5 REVERSIBILITY

The potential effects are anticipated to be fully reversible once blasting activities have ceased. This assumes that residual nutrient levels will be attenuated through nitrification/denitrification and that the conclusion of blasting activities will terminate the nitrogen source. A Level I reversibility rating was assigned.

H2.4.1.6 SIGNIFICANCE - SWSQ-4 - EXPLOSIVES MANUFACTURE, STORAGE AND USE

Based on the ratings described above, explosives manufacture, storage and use are not expected to result in significant adverse environmental effects on the water and sediment quality VEC. The residual effect is ranked as *Not Significant* (Table H.5). The Level of Confidence is Medium (Table H.6). Despite the qualitative nature of the assessment, there is a High Level of Confidence in the effectiveness of the identified mitigation measures.

H2.5 QUARRIES AND BORROW SOURCES - IMPACT STATEMENT SWSQ-5

Impact Statement SWSQ-5: Project-related quarries and borrow sources may result in changes to surface water and sediment quality in the five freshwater aquatic LSAs.

Quarries and borrow sources required for rock, fill and aggregate during construction and closure are identified on FEIS Figures 3.2.1 through 3.2.9 in Volume 3. The primary concern is the potential for ML/ARD and sediment generated at these locations to affect water quality when released into the natural environment.

As a mitigation measure, materials from identified quarries and borrow sources have undergone representative geochemical testing, which has indicated that the material is non-reactive (FEIS Volume 6). Additional testing will be completed to ensure that sources used during Construction and Closure consist of non-reactive material.

Quarries and borrow sources are generally sited in competent ground conditions away from sensitive receiving waterbodies to avoid the potential for adverse effects. As an additional measure, collection sumps will capture and treat affected contact water to applicable water quality standards prior to discharge. As stated in the Borrow Pit and Quarry Management Plan (BAF-PH1-830-P16-0004) Baffinland will strive to avoid quarry site that have the potential for ML/ARD. A detailed ML/ARD testing protocol for potential quarry sites is presented in the Borrow Pit and Quarry Management Plan. Based on the results of the representative geochemical testing, it is not anticipated that treatment will be required to address ML/ARD issues.

H2.5.1 RESIDUAL EFFECTS RATING

H2.5.1.1 MAGNITUDE

A semi-quantitative assessment of magnitude was based on representative geochemical testing of materials from quarries and borrows sources, which indicated that the sampled materials are non-reactive (FEIS, Volume 6). The use of non-reactive materials makes it likely that run-off from quarries and borrow sources will meet the CCME thresholds for pH and metals (ML/ARD). FEIS Tables 7-3.5 and 7-3.7, which summarize acid sensitivity of the receiving streams and lakes, indicate that none of the streams or lakes is particularly sensitive to acidic inputs.

Nitrogenous and petroleum hydrocarbon residues originating from blasting activities, as well as sediment-laden water, will be confined to the water management infrastructure within each quarry and borrow site. While mitigation measures will prevent contact of storm water with natural surface waterbodies, they may have limitations associated with their implementation and effectiveness. Given these limitations, it is anticipated that uncontrolled discharges of water from quarries and borrow sources may occasionally exceed applicable CCME thresholds. These exceedances would likely coincide with freshet conditions during snow melt; this will mitigate the potential effect through dilution.

Environmental construction monitoring will be comprehensive, with an emphasis on those receiving bodies that have relatively soft water quality, a condition that can result in increased susceptibility to metals uptake.

A Level II magnitude rating was assigned.

H2.5.1.2 EXTENT

The extent of residual water and sediment quality effects associated with quarry or borrow sources will be limited to the LSA in which they are located. The relative insensitivity of watercourses to acidic inputs suggests a relatively high potential to buffer through elevated levels of calcium carbonates that are present. Environmental monitoring will identify effects and, where necessary, mitigation efforts will limit their extent. A Level I extent rating was assigned.

H2.5.1.3 FREQUENCY

Considering the temporal relation between freshet and/or extreme weather conditions and residual water and sediment quality effects, these effects will be limited to summer months when construction/closure activities are scheduled and when freshet and the majority of rain events occur. A Level I frequency rating was assigned.

H2.5.1.4 DURATION

Quarries and borrow sources will be required during the Construction and Closure phase. Potential effects are anticipated to coincide with the timing of freshet, when any potential effect will be diluted by high flow conditions, resulting in key indicator concentrations indistinguishable from baseline. A Level I duration rating was assigned.

H2.5.1.5 REVERSIBILITY

The potential effects associated with quarry or borrow sources are anticipated to be fully reversible once blasting is completed and these locations have been closed and rehabilitated. A Level I reversibility rating was assigned.

H2.5.1.6 SIGNIFICANCE - SWSQ-5 - QUARRIES AND BORROW SOURCES

Based on the ratings described above, the residual effect is ranked as *Not Significant* (Table H.5). The Level of Confidence associated with the significance ranking is Medium due to the semi-quantitative nature of the assessment (Table H.6).

H2.6 CAMPS, FUEL STORAGE AND WASTE MANAGEMENT - IMPACT STATEMENT SWSQ-7

Impact Statement SWSQ-7: Project-related camps, fuel storage and waste management may result in changes to surface water and sediment quality in the five freshwater aquatic LSAs.

Temporary and permanent camps will be located throughout the Project area as described and illustrated in FEIS Volume 3. The potential effects include changes in water and sediment quality due to withdrawal, waste management, fuel storage, and discharge of sewage.

In order to protect water quality, the following management actions have been adopted at waste management facilities:

- Incineration of non-hazardous combustible wastes;
- Landfilling of inert non-combustible wastes;
- Temporary storage and off-site shipping of hazardous and recyclable waste materials; and
- On-site treatment for hydrocarbon-impacted materials (soil, water, ice, and snow).

Diesel, gasoline and aviation fuel will be delivered to temporary camp locations via tanker trucks and will be stored in double-walled fuel tanks located on foundations equipped with impermeable bermed liners and bedding materials. The storage site will be far enough removed from receiving watercourses to reduce the potential for water quality effects.

Fuel will be delivered to the camps at Milne Port, the Mine Site and Steensby Port via marine vessels and tanker trucks and will be stored in large volume double-walled tanks located on foundations equipped with impermeable bermed liners and bedding materials. Within the bermed fuel storage areas, any fuel-contact water will be collected in engineered drainage and sumps, treated to applicable water quality standards, and then discharged if it does not exceed the CCME thresholds for TSS, oil and grease, or petroleum hydrocarbons.

H2.6.1 RESIDUAL EFFECTS RATING

H2.6.1.1 MAGNITUDE

Effects associated with fuel storage and use and waste management were all assessed qualitatively. Mitigation measures described above will prevent the discharge of fuel contact water that exceeds CCME thresholds for TSS, oil and grease, or petroleum hydrocarbons.

Waste management mitigation as described above will limit any potentially adverse effects to a negligible to minor magnitude.

A Level I magnitude rating was assigned.

H2.6.1.2 EXTENT

The extent of the potential effect is likely to be limited to watercourses located in the LSA in which a camp is situated. A Level I extent rating was assigned.

H2.6.1.3 FREQUENCY

The frequency of potential effects will be periodic and limited to summer months when the majority of precipitation falls in the Project Area. A Level II frequency rating was assigned.

H2.6.1.4 DURATION

Camps, fuel storage and waste management will be required during Construction and Operation; therefore, a Level II duration rating was assigned.

H2.6.1.5 REVERSIBILITY

The potential effects are anticipated to be partially reversible once this infrastructure is decommissioned and rehabilitated. A Level II reversibility rating was assigned.

H2.6.1.6 SIGNIFICANCE - SWSQ-7 - CAMPS, FUEL STORAGE AND WASTE MANAGEMENT

Based on these ratings, construction and operation of camps, fuel storage and waste management are not expected to result in significant adverse environmental effects on the water and sediment quality VEC. The residual effect is ranked as *Not Significant* (Table H.5). The Level of Confidence is Medium (Table H.6). While the assessment is qualitative in nature, there is a High Level of Confidence in the effectiveness of mitigation measures.

H2.7 WATER USE AND MANAGEMENT - IMPACT STATEMENT SWSQ-8

Impact Statement SWSQ-8: Project-related water use and management may result in changes to surface water and sediment quality in the five freshwater aquatic LSAs.

Water withdrawal will support a number of Project-related activities (FEIS Tables 7-2.5, 7-2.6, 7-2.9 and 7-2.10). Withdrawal from these sources has the potential for indirect effects on surface water quality by reducing the total volume of water in the system at that location.

Various Project-related water uses have the potential to affect water and sediment quality when process water is released back into the freshwater environment, including:

- Aggregate washing;
- Concrete manufacture;
- Concrete curing;
- Truck wash; and
- Equipment/floor wash-down.

Water for aggregate washing will be pumped from the potable water source and stored in a designated washing area. The main consideration with aggregate wash water is the potential for it to contain a high TSS concentration. Wash water will be reused and recycled to the extent possible, and solids will be settled out prior to discharge.

Water used for concrete manufacture and curing will be pumped from the potable water source and stored at the batch plant. Volumetric trucks will be used for remote concrete pours, and standard BMPs will be put in place to ensure that untreated contact water is not discharged. The main consideration with concrete contact water is the potential to contain elevated TSS and pH, which may affect water quality in the environment. Concrete contact water will be treated through settlement and with pH adjustment (e.g. carbon dioxide sparging) prior to discharge.

Truck wash facilities will be constructed with water management features designed to segregate and prevent co-mingling of offsite and onsite water. A drain system and sump will capture and treat potentially contaminated water to applicable quality standards prior to discharge.

Snow, ice, soil or water that has been contaminated by petroleum hydrocarbons has the potential to impair water quality. Any such materials will be transported to lined, bermed treatment landfarm facilities, and materials that have been in contact with oil will be transported to the same locations for treatment in oil/water treatment facilities in the maintenance shops. Contaminated snow will be placed into cells in the landfarms; after thawing it will be treated and discharged. Discharges will not be directed into the freshwater environment; therefore, only minor adverse effects are anticipated from incidental occurrences.

H2.7.1 RESIDUAL EFFECTS RATING

H2.7.1.1 MAGNITUDE

Negligible to minor magnitude residual water quality effects may be associated with water abstraction (FEIS Tables 7-2.5, 7-2.6, 7-2.9 and 7-2.10). Water used for other activities (e.g., aggregate washing, concrete manufacture, concrete curing, and dust suppression for the quarry crusher) will be managed to ensure the discharges meet applicable CCME water quality guidelines. Negligible to minor water and sediment quality effects are anticipated.

Potential effects of contaminated by petroleum hydrocarbons were assessed qualitatively. Based on the mitigation described above, it is anticipated that treated contact water discharges will meet applicable CCME water quality guidelines and only negligible to minor adverse effects are expected.

A Level I magnitude rating was assigned.

H2.7.1.2 EXTENT

The extent of the potential effect is likely to be limited to watercourses from which the abstraction or water use is occurring. A Level I extent rating was assigned.

H2.7.1.3 FREQUENCY

The frequency of the potential effect will be year round, while seasonal discharge of treated contact water will occur during freshet. A Level III frequency rating was assigned.

H2.7.1.4 DURATION

Effects are anticipated to last through the Construction, Operation and Closure phases; therefore, a Level II duration rating was assigned.

H2.7.1.5 REVERSIBILITY

The potential effects are anticipated to be fully reversible, once water withdrawal and treated contact water discharge are discontinued. A Level I reversibility rating was assigned.

H2.7.1.6 SIGNIFICANCE - SWSQ-8 - WATER USE AND MANAGEMENT

Based on these ratings, water use and management are not expected to result in significant adverse environmental effects on the water and sediment quality VEC. The residual effect is ranked as *Not Significant* (Table H.5). The Level of Confidence is Medium (Table H.6). While aspects of the assessment are qualitative, there is a High Level of Confidence in the effectiveness of mitigation measures.

H2.8 AIRSTRIPS AND AIRSTRIP USE - IMPACT STATEMENT SWSQ-9

Impact Statement SWSQ-9: Project-related airstrips and airstrip use may result in changes to surface water and sediment quality in the five freshwater aquatic LSAs.

The airstrip and related infrastructure are described in FEIS Volume 3. Its construction, operation and closure have the potential to affect surface water quality in adjacent water bodies. The primary concern during Closure stems from erosion and sediment transport during ground preparation and earthworks. Mitigation measures are summarized in the sections above.

The primary concern stems from the possibility of contaminating nearby water bodies with runoff from the surface of the airstrip, including de-icing agents such as propylene glycol. De-icing by a portable discharge unit will be carried out in a defined area to the side of the runway using propylene glycol. A synthetic organic polymer (EK 35) will be used as a dust suppressant on the airstrips as needed.

Water management features will be installed and maintained to prevent co-mingling of offsite water with potentially affected onsite water. Any potentially contaminated water will be treated to applicable quality standards prior their discharge.

H2.8.1 RESIDUAL EFFECTS RATING

H2.8.1.1 MAGNITUDE

As a result of the crowned configuration of the airstrip, surface run-off will be directed to drainage collection structures around the perimeter. Mitigation measures will prevent contact of sediment-laden water with natural surface waterbodies; however, mitigation measures may have limitations associated with their implementation and effectiveness. Given these limitations, it is anticipated that TSS loading could occasionally exceed the CCME threshold of +5 mg/L relative to baseline conditions. These exceedances would likely coincide with freshet conditions during snow melt, which is likely to dilute and mitigate any potential effects.

Use of propylene glycol is anticipated to result in negligible to minor water quality effects as collection and treatment will to ensure that the CCME interim guideline is not exceeded.

The synthetic organic polymer EK 35 is not an identified substance under CCME PAL; therefore, it is recommended that potential effects be assessed through routine water quality monitoring.

Based on the potential for infrequent exceedances of applicable CCME thresholds, a Level II magnitude rating was assigned.

H2.8.1.2 EXTENT

The extent of the potential effect is likely to be limited to waterbodies adjacent to the airstrips. A Level I extent rating was assigned.

H2.8.1.3 FREQUENCY

The frequency of potential effects will be limited to summer months, when the majority of precipitation falls in the Project Area. A Level I frequency rating was assigned.

H2.8.1.4 DURATION

Airstrips and airstrip use will be required during Construction, Operations and Closure. Potential effects are anticipated to coincide with the timing of freshet, when high flows will act to reduce concentrations and render them indistinguishable from baseline. A Level III duration rating was assigned.

H2.8.1.5 REVERSIBILITY

The potential effects are anticipated to be fully reversible once the infrastructure is decommissioned and rehabilitated and de-icing and dust suppression ceases. A Level I reversibility rating was assigned.

H2.8.1.6 SIGNIFICANCE - SWSQ-9 - AIRSTRIPS AND AIRSTRIP USE

Based on these ratings, airstrips and airstrip use are not expected to result in significant adverse environmental effects on the water and sediment quality VEC. The residual effect is ranked as *Not Significant* (Table H.5). The Level of Confidence is Medium (Table H.6). While the assessment is qualitative, there is a high Level of Confidence in the effectiveness of the identified mitigation measures.

H2.9 AQUEOUS POINT SOURCE EMISSIONS

Potential effects on surface water and sediment quality associated with aqueous point source emissions (key issues) identified in Table H.2 are described below. These emissions are from a single, identifiable, localized source and affect a specific receiving waterbody. Locations of infrastructure and activities involving each aqueous point source emission are presented by LSA.

Table H.7 summarizes the ratings assigned to the significance criteria of residual effects associated with each effect discussed below.

H2.9.1 PREDICTION CONFIDENCE

The confidence level assigned to the predictions of significance for aqueous non-point source discharge effects to water and sediment quality are summarized in Table H.8.

H2.9.1.1 MILNE PORT LSA

All aqueous point source emissions from the Milne Port LSA are directed into Milne Inlet (marine environment) via surface release through a combination of constructed/natural drainage to areas that have no identified sensitive receptors (i.e., fish and/or fish habitat). Due to the absence of sensitive secondary receptors, an assessment of freshwater effects was not completed. The assessment of residual effects associated with emissions into the marine environment, where secondary receptors are located, is addressed in FEIS Volume 8.

H2.10 MILNE INLET TOTE ROAD LSA

No aqueous point source emissions into the freshwater receiving environment are located in the Milne Inlet Tote Road LSA.

TABLE H.7 EFFECT ASSESSMENT SUMMARY - AQUEOUS POINT SOURCE DISCHARGES

Effect		Residual Effect Evaluation Criteria					Significance
Effect	**Direction & Nature of Effect**	**Magnitude / Complexity**	**Geographical Extent**	**Frequency**	**Duration**	**Reversibility**	**Rated Significance of Residual Effect**
SWSQ-10 West Waste Rock Stormwater Discharge to Camp Lake and Tributaries	**Negative** Water quality (pH, TSS, metals, ammonia, nitrite)	**Level II:** concentrations of indicator(s) predicted to exceed threshold value(s) by an order of magnitude or greater	**Level I:** confined to the LSA	**Level II:** will occur frequently	**Level III:** long-term/permanent	**Level II:** effect is partially reversible (water treatment, if required)	Not Significant
SWSQ-11 Waste Rock and Ore Stormwater Discharge to Mary River	**Negative** Water quality (pH, TSS, metals, ammonia, nitrite)	**Level I:** concentrations of indicator(s) predicted to be above but within an order of magnitude of threshold value(s)	**Level I:** confined to the LSA	**Level II:** will occur frequently	**Level II:** will occur for the Operation phase (life of the Project)	**Level II:** effect is partially reversible (water treatment, if required)	Not Significant
SWSQ-12 Exploration Drilling Runoff to Mary River	**Negative** Water quality (pH, TSS, chlorides)	**Level I:** concentrations of indicator(s) predicted to be above but within an order of magnitude of threshold value(s)	**Level I:** confined to the LSA	**Level II:** will occur frequently	**Level II:** will occur for the Operation phase (life of the Project)	**Level I:** effect is reversible after activity is complete	Not Significant
SWSQ-13 Pit Lake and Waste Rock Discharges to Mary River in Post-closure	**Negative** Water quality (pH, TSS, metals)	**Level I:** concentrations of indicator(s) predicted to be above but within an order of magnitude of threshold value(s)	**Level I:** confined to the LSA	**Level II:** will occur frequently	**Level III:** long-term/permanent	**Level II:** effect is partially reversible (water treatment, if required)	Not Significant
SWSQ-14 Exploration Camp WWTF Effluent	**Negative** Water quality (pH, TSS, BOD,	**Level I:** Effect is expected to be less than threshold values	**Level I:** confined to the LSA	**Level II:** will occur frequently	**Level II:** will occur for the Operation phase (life of the Project)	**Level I:** effect is reversible after activity is complete	Not Significant

Effect		Residual Effect Evaluation Criteria					Significance
Effect	**Direction & Nature of Effect**	**Magnitude / Complexity**	**Geographical Extent**	**Frequency**	**Duration**	**Reversibility**	**Rated Significance of Residual Effect**
Discharge to Sheardown Lake	nutrients, ammonia)						
SWSQ-15 Mine Site WWTF Effluent Discharge to Mary River	**Negative** Water quality (pH, TSS, BOD, nutrients, ammonia)	**Level I:** Effect is expected to be less than threshold values	**Level I:** confined to the LSA	**Level II:** will occur frequently	**Level II:** will occur for the Operation phase (life of the Project)	**Level I:** effect is reversible after activity is complete	Not Significant

TABLE H.8 SIGNIFICANCE OF RESIDUAL EFFECTS FROM POINT SOURCE DISCHARGES

Key Issue	Significance of Predicted Residual Environmental Effect		Likelihood (1)	
	Significance Rating	Level of Confidence	Probability	Certainty
SWSQ-10 West Waste Rock Stormwater Discharge to Camp Lake and Tributaries	N	3	N/A	N/A
SWSQ-11 Waste Rock and Ore Stormwater Discharge to Mary River	N	3	N/A	N/A
SWSQ-12 Exploration Drilling Runoff to Mary River	N	2	N/A	N/A
SWSQ-13 Pit Lake and Waste Rock Discharges to Mary River in Post-closure	N	2	N/A	N/A
SWSQ-14 Exploration Camp WWTF Effluent Discharge to Sheardown Lake	N	2	N/A	N/A
SWSQ-15 Mine Site Camp WWTF Effluent Discharge to Mary River	N	2	N/A	N/A

KEY:

3. Significance Rating: S= Significant, N = Not Significant, P = Positive
4. Level of Confidence : 1= Low; 2= Medium; 3=High
   a. Likelihood - only applicable to significant effects
   b. Probability: 1= Unlikely; 2= Moderate; 3=Likely
   c. Certainty: : 1= Low; 2= Medium; 3=High

H2.11 MINE SITE LSA

Impact Statements SWSQ-10 to SWSQ-13: Project-related discharges of mine contact water may result in impaired surface water and sediment quality in the Mine Site LSA.

Management of storm water and process water that has been in contact with the iron ore (mine contact water) is required at the Mine Site. Plans and drawings illustrating proposed site water management infrastructure for mine contact water are provided in the Surface Water and Aquatic Ecosystem Management Plan (BAF-PH1-830-P16-0026). The following sources have been identified for inclusion in the aqueous point source emissions assessment because they involve mine contact water that will be discharged into the freshwater environment:

- Waste Rock Stockpile runoff to Camp Lake and Tributaries (SWSQ-10);
- Waste rock and ore stockpile runoff to Mary River (SWSQ-11);
- Exploration drilling runoff (SWSQ-12); and
- Pit lake water and waste rock discharges to Mary River in post-closure (SWSQ-13).

The development of source terms (runoff water quality estimates) for waste rock, ore and pit water is described above.

Given the variability in runoff flows, the ponds were sized to accommodate the two-year extreme event. Discharge is anticipated to be distributed evenly with the natural flows from approximately mid-June until September.

Details regarding theoretical treatment options are provided in the Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031). The main findings suggest that, with sufficient storage and upstream control, any water quality issues that arise can be managed. If the only challenge with the water quality is TSS concentration, this will often be solved using retention time alone. With a buffer pond that has a sufficiently large retention time it is possible to allow particles to settle while discharging - either by gravity or pumping - in a continuous system.

All mine contact water (including that from the ore stockpiles) in the Milne Port and Steensby Port LSAs is discharged to the ocean; their potential effects are assessed in FEIS Volume 8.

Residual effects ratings for the various mine contact water discharges are provided below.

H2.12 WASTE ROCK STORMWATER DISCHARGE TO CAMP LAKE AND TRIBUTARIES - IMPACT STATEMENT SWSQ-10

Runoff discharged from the West Waste Rock Stockpile Pond (Pond 1) has the potential to adversely affect water quality in the tributary of Camp Lake to which stormwater will be discharged, and downstream into Camp Lake.

Contact water (runoff) from the Waste Rock Stockpile will be settled in the west pond (Pond 1) prior to discharge to tributary L1, which in turn reports to tributary L0 and subsequently to Camp Lake. The arrangement of the stockpile, the sedimentation pond and the receiving environment are illustrated in Life-of-Mine Waste Rock Management Plan. It is predicted, based on waste rock seepage modelling, that runoff from the stockpile will meet MDMER requirements (Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031)).

Background water quality was measured in the open-water seasons (June to September) of 2006, 2007, 2008 and 2011. Open-water season means were calculated for key water quality parameters at sampling locations L0-01, L-02 and L1-08. Water quality sampling included analysis of routine water quality parameters identified in the Baseline Water and Sediment Quality Report in FEIS Appendix 7B-1. Background mean and 90th percentile baseline concentrations were applied to the modelling.

Mean and low flow rates (or annual volumes) were obtained from hydrological surveys conducted over five years (2006, 2007, 2008, 2010 and 2011).

A mass balance approach was applied using the methodology described above to estimate water quality in the receiving waters under mean flow conditions and by discharging runoff following the natural hydrograph. Resultant water quality in Camp Lake tributary L1 (at the location of falls which prevent the upstream passage of fish), downstream where L1 reports to tributary L0 and then at Camp Lake is presented in Table H.9. The same analysis during the 10-year dry year is presented in Table H.10.

H2.12.1 RESIDUAL EFFECTS RATING

H2.12.1.1 MAGNITUDE

The mass balance modelling indicates that several parameters will have Level II magnitude effects to water quality under both mean and low flow conditions at the nearest downstream location inhabited by fish at L0, and in Camp Lake (Hazard Quotient - HQ of >1 and <10). An HQ >10 and <100 was applied for mercury using 90th percentile baseline concentrations. All other parameters are at Level I or lower.

As mentioned above, each of the metals showing an HQ >1 (a Level I effect) or HQ >10 (a Level II effect) is identified in the humidity cell testing as having >50 % non-detects, and half the detection limits were assumed for non-detect results. Consequently, the derived source terms for these metals are substantially based on the MDLs. Most of these same parameters (including arsenic, cadmium, chromium, mercury, selenium and silver, as well as other metals that do not trigger a Level I effect) have measured baseline concentrations that are mostly non-detect, and therefore the calculated mean or 90th percentile concentrations are substantially based on MDLs. On this basis, the assignment of a Level II magnitude rating for water and sediment quality effects arising from discharge of stormwater from the west waste rock pond to the Camp Lake tributaries and Camp Lake is considered to be highly conservative. Baffinland is exploring options for re-testing or additional testing to obtain a dataset of more precise measurements for these parameters.

Aquatic Effects Monitoring, Environmental Effects Monitoring and routine water quality monitoring are expected to identify potential effects as they arise, and adaptive management will reduce the risk of exceeding the predicted effects level.

H2.12.1.2 DURATION

Discharge of mine contact water from the West Waste Rock Pond into the lower reach of Camp Lake tributary L1 will be required during the Operation, Closure and post-closure phases of the Project; a Level III duration rating was assigned.

H2.12.1.3 FREQUENCY

The frequency of the potential effect will be annual, limited to the period between June and September. A Level II frequency rating was assigned.

H2.12.1.4 EXTENT

The extent of the potential effect is expected to be limited to the Mine Site freshwater LSA and to reach negligible levels where Camp Lake discharges into Mary Lake. A Level I extent rating was assigned.

H2.12.1.5 REVERSIBILITY

The potential effects are anticipated to be partially reversible. A Level II reversibility rating was assigned.

H2.12.1.6 SIGNIFICANCE - SWSQ-10 - WEST WASTE ROCK STORMWATER DISCHARGE TO CAMP LAKE AND TRIBUTARIES

Based on these ratings, discharge of mine contact water from the West Waste Rock Sedimentation Pond into the tributary of Camp Lake is not expected to result in an adverse environmental effect on water and sediment quality in the Mine Site LSA. The residual effect is ranked as *Not Significant* (Table H.7). The Level of Confidence (Table H.8) is High due to the quantitative nature and conservative assumptions of the assessment. Additionally the EEM requirements of MDMER provide assurance that effects will be detected and necessary corrective actions implemented.

H2.13 WASTE ROCK AND ORE STORMWATER DISCHARGE TO THE MARY RIVER - IMPACT STATEMENT SWSQ-11

Runoff discharged from the East Pond (Pond 2), containing both Waste Rock Stockpile runoff and pit water, has the potential to adversely affect water quality in the Mary River.

A mass balance approach similar to that used for the West Waste Rock Pond (SWSQ-10) was applied using the methodology described above to estimate water quality in the receiving waters under mean flow conditions and by discharging effluent following the natural hydrograph. Resultant water quality in the Mary River following discharge of the East Pond is presented in Table H.11, and the same analysis during the 10-year dry year is presented in Table H.12.

H2.13.1 RESIDUAL EFFECTS RATING

H2.13.1.1 MAGNITUDE

The mass balance modelling indicates that Level I magnitude effects to water quality will occur under both mean and low flow conditions (all indicator parameters <10x the applicable WQO) in the Mary River at each of the locations modelled:

- In the Mary River at MR-12 where tributary F0 containing the east pond discharge reports to the Mary River, under mean flow conditions (Table H.11) and the 10-year dry condition (Table H.12); and
- At the point of mixing of the discharge of stormwater from the main ore stockpiles, including the ROM stormwater discharge, under mean flow conditions (Table H.13) and the 10-year dry condition (Table H.14).

TABLE H.9 PREDICTED WATER QUALITY IN CAMP LAKE TRIBUTARIES AND CAMP LAKE UNDER MEAN FLOW CONDITIONS

									WATER QUALITY IN THE RECEIVING WATERS									
Parameter	Units	Baseline Water Quality (L0-01, L1-02, L1-08)			Baseline Water Quality Camp Lake	Receiving Water Quality Objectives (Note 5)	Discharge Scenario		CAMP LAKE TRIB L1 BEFORE DISCHARGE TO TRIB L0				MOUTH OF TRIB L0 AT OUTLET TO CAMP LAKE				CAMP LAKE	
							Flows Used		Discharge Equalized to Mean Summer Flow Discharge Volume = 843,000 m³/yr Mean Baseline Flows in L1 = 790,807 m³/yr				Discharge Equalized to Summer Flow - Additional Dilution in L0 Discharge Flows = 1,633,807 m³/yr Mean Baseline Flows in L0 (MR-10) at outlet to lake = 976,453 m³/yr				Assume Instantaneous Mixing within Lake = 27,511,100 m³ Discharge Flows into Camp Lake (MR-10 Outlet Flows + Discharge Volume) = 2,610,260 m³/yr	
		Mean Concentration	90th Percentile Concentration	% Detects	Mean Concentration		Baseline Concentrations		Mean	HQ	90th Percentile	HQ	Mean	HQ	90th Percentile	HQ	Mean (Lake) 90th Percentile (Streams)	HQ
							MDMER	West Waste Rock Pile Source Terms										
pH		7.84	8.38		7.61	6.5 - 9.0	-	6.9	7.35	-	7.62	-	7.54	-	7.90	-	7.64	-
Hardness	mg/L CaCO₃	74.11	121.00		57.69	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminum	mg/L	0.0190	0.0390	82%	0.0095	0.94	-	0.12	0.071	0.1	0.081	0.1	0.052	0.05	0.065	0.07	0.0143	0.02
Antimony	mg/L	-	0.0004	0%	0.00010	-	-	0.0031	-	-	0.0018	-	-	-	0.0013	-	0.00020	-
Arsenic	mg/L	-	0.0050	6%	0.00018	0.005	0.30	0.0025	-	-	0.0037	0.7	-	-	0.0042	0.8	0.00053	0.1
Barium	mg/L	0.0093	0.0119	59%	0.00565	-	-	0.064	0.038	-	0.039	-	0.027	-	0.029	-	0.0076	-
Beryllium	mg/L	-	0.0050	0%	0.00050	0.0053	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	-	0.0320	10%	0.01000	1.5	-	0.025	-	-	0.028	0.02	-	-	0.030	0.02	0.012	0.01
Cadmium	mg/L	-	0.00010	10%	0.000023	0.000029	-	0.000020	-	-	0.00006	2.0	-	-	0.00007	2.6	0.00003	0.9
Chromium	mg/L	-	0.0010	10%	0.00055	0.0047	-	0.0029	-	-	0.0020	0.4	-	-	0.0016	0.3	0.00064	0.1
Cobalt	mg/L	-	0.0003	4%	0.00011	-	-	0.00079	-	-	0.00055	-	-	-	0.00046	-	0.00014	-
Copper	mg/L	0.0015	0.0020	94%	0.00207	0.0047	0.30	0.0031	0.0023	0.5	0.0026	0.5	0.0020	0.4	0.0024	0.5	0.0021	0.4
Iron	mg/L	0.0471	0.0610	67%	0.03152	1.2	-	<0.002	0.023	0.02	0.030	0.03	0.032	0.03	0.042	0.03	0.032	0.03
Lead	mg/L	0.0002	0.0007	18%	0.000171	0.001	0.10	0.00020	0.0002	0.2	0.00044	0.4	0.0002	0.2	0.001	0.5	0.0002	0.2
Manganese	mg/L	0.0063	0.0100	51%	0.002289	-	-	0.00004	0.0031	-	0.0049	-	0.004	-	0.0068	-	0.002678	-
Mercury	mg/L	-	0.00010	2%	0.000040	0.000026	-	0.00057	-	-	0.00034	13	-	-	0.00025	9.7	0.000058	2.2
Molybdenum	mg/L	0.0027	0.0050	46%	0.000620	0.073	-	0.010	0.0065	0.1	0.0076	0.1	0.0051	0.07	0.0066	0.09	0.0011	0.02
Nickel	mg/L	0.0030	0.0050	32%	0.00109	0.083	0.50	0.0019	0.0024	0.03	0.0034	0.04	0.0026	0.03	0.0040	0.05	0.0013	0.02
Selenium	mg/L	-	0.0050	2%	0.00100	0.001	-	0.0077	-	-	0.0064	6	-	-	0.0059	5.87	0.0014	1.4
Silver	mg/L	-	0.0001	4%	0.000017	0.0001	-	0.000064	-	-	0.00008	0.8	-	-	0.00009	0.9	0.000023	0.2
Thallium	mg/L	-	0.0002	0%	0.00010	0.0008	-	0.00029	-	-	0.00025	0.3	-	-	0.00023	0.3	0.00011	0.1
Uranium	mg/L	0.0016	0.0027	100%	0.000402	0.015	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	0.0010	2%	0.00100	0.006	-	0.0010	-	-	0.0010	0.2	-	-	0.0010	0.2	0.0010	0.2
Zinc	mg/L	0.0020	0.0030	25%	0.00247	0.03	0.50	0.013	0.008	0.3	0.008	0.3	0.006	0.2	0.006	0.2	0.00280	0.1

NOTES:

1. Model assumes complete near instantaneous mixing of effluent and receiving water.
2. No mean concentration calculated where the majority of sampling results were below the method detection limit.
3. Effluent source terms provided by Amec (January, 2012).
4. Effluent source term of 0.001 used in calculations for iron.
5. Receiving water quality objectives obtained from Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (pal) (2003), continuous concentration (chronic) national recommended water quality criteria (United States Environmental Protection Agency (2006)), British Columbia Ministry of Environment approved and working water quality guidelines or other thresholds, as applicable.
6. In order to estimate effluent source terms, half the method detection limit of a parameter was adopted where more than half of the results for that parameter were non-detect (i.e. Less than the MDL). These effluent source terms are highlighted in blue.
7. Results with an HQ greater than 1 are highlighted in orange, to focus discussion in the effects assessment.

TABLE H.10 PREDICTED WATER QUALITY IN CAMP LAKE TRIBUTARIES AND CAMP LAKE IN A DRY YEAR

Parameter	Units	Baseline Water Quality (L0-01, L1-02, L1-08)			Baseline Water Quality Camp Lake	Receiving Water Quality Objectives (Note 5)	Discharge Scenario		WATER QUALITY IN THE RECEIVING WATERS									
									CAMP LAKE TRIB L1 BEFORE DISCHARGE TO TRIB L0				MOUTH OF TRIB L0 AT OUTLET TO CAMP LAKE				CAMP LAKE	
							Flows Used		Discharge Equalized to 10-Year Low Flow Discharge Volume = 354,060 m³/yr 10-Year Low Baseline Flows in L1 = 332,139 m³/yr				Discharge Equalized to 10-Year Low Flow - Additional Dilution in L0 Discharge Flows = 686,199 m³/yr 10-Year Low Baseline Flows in L0 (MR-10) at outlet to lake = 410,110 m³/yr				Assume Instantaneous Mixing within Lake = 27,511,100 m³ Discharge Flows into Camp Lake (MR-10 Outlet Flows + Discharge Volume) = 1,096,309 m³/yr	
		Mean Concentration	90th Percentile Concentration	% Detects	Mean Concentration		Baseline Concentrations		Mean	HQ	90th Percentile	HQ	Mean	HQ	90th Percentile	HQ	Mean (Lake) 90th Percentile (Streams)	HQ
							MDMER	West Waste Rock Pile Source Terms										
pH		7.84	8.38		7.61	6.5 - 9.0	-	6.9	7.35	-	7.62	-	7.54	-	7.90	-	7.62	-
Hardness	mg/L $CaCO_3$	74.11	121.00		57.69	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminum	mg/L	0.0190	0.0390	82%	0.0095	0.94	-	0.286	0.157	0.2	0.166	0.2	0.105	0.11	0.119	0.13	0.0137	0.01
Antimony	mg/L	-	0.0004	0%	0.00010	-	-	0.007	-	-	0.004	-	-	-	0.003	-	0.0002	-
Arsenic	mg/L	-	0.0050	6%	0.00018	0.005	0.30	0.006	-	-	0.0055	1.1	-	-	0.0053	1.06	0.00038	0.08
Barium	mg/L	0.0093	0.0119	59%	0.00565	-	-	0.152	0.083	-	0.084	-	0.056	-	0.057	-	0.0076	-
Beryllium	mg/L	-	0.0050	0%	0.00050	0.0053	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	-	0.0320	10%	0.01000	1.5	-	0.060	-	-	0.046	0.03	-	-	0.041	0.03	0.0112	0.01
Cadmium	mg/L	-	0.00010	10%	0.000023	0.000029	-	0.00005	-	-	0.00007	2.5	-	-	0.00008	2.9	0.00003	0.87
Chromium	mg/L	-	0.0010	10%	0.00055	0.0047	-	0.007	-	-	0.0040	0.9	-	-	0.0029	0.62	0.00064	0.14
Cobalt	mg/L	-	0.0003	4%	0.00011	-	-	0.0019	-	-	0.0011	-	-	-	0.0008	-	0.00014	-
Copper	mg/L	0.0015	0.0020	94%	0.00207	0.0047	0.30	0.007	0.0045	1.0	0.0048	1.0	0.0034	0.7	0.0037	0.8	0.00213	0.5
Iron	mg/L	0.0471	0.0610	67%	0.03152	1.2	-	0.002	0.024	0.02	0.031	0.03	0.033	0.03	0.042	0.0351	0.032	0.03
Lead	mg/L	0.0002	0.0007	18%	0.000171	0.001	0.10	0.0005	0.0003	0.3	0.0006	0.6	0.0003	0.3	0.0006	0.6	0.00019	0.2
Manganese	mg/L	0.0063	0.0100	51%	0.002289	-	-	0.00010	0.0031	-	0.0049	-	0.0043	-	0.0068	-	0.0025	-
Mercury	mg/L	-	0.00010	2%	0.000040	0.000026	-	0.001	-	-	0.00075	29	-	-	0.00051	19.46	0.000058	2.23
Molybdenum	mg/L	0.0027	0.0050	46%	0.000620	0.073	-	0.024	0.014	0.2	0.015	0.2	0.010	0.13	0.011	0.15	0.0010	0.01
Nickel	mg/L	0.0030	0.0050	32%	0.00109	0.083	0.50	0.005	0.004	0.05	0.005	0.06	0.003	0.04	0.005	0.06	0.00123	0.01
Selenium	mg/L	-	0.0050	2%	0.00100	0.001	-	0.018	-	-	0.0119	12	-	-	0.0093	9.31	0.0013	1.32
Silver	mg/L	-	0.0001	4%	0.000017	0.0001	-	0.0002	-	-	0.00013	1.3	-	-	0.00012	1.2	0.00002	0.21
Thallium	mg/L	-	0.0002	0%	0.00010	0.0008	-	0.001	-	-	0.00045	0.6	-	-	0.00036	0.448	0.00011	0.14
Uranium	mg/L	0.0016	0.0027	100%	0.000402	0.015	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	0.0010	2%	0.00100	0.006	-	0.002	-	-	0.0017	0.3	-	-	0.0014	0.24	0.0010	0.17
Zinc	mg/L	0.0020	0.0030	25%	0.00247	0.03	0.50	0.031	0.017	0.6	0.017	0.6	0.011	0.4	0.012	0.4	0.0028	0.1

NOTES:

1. Model assumes complete near instantaneous mixing of effluent and receiving water.
2. No mean concentration calculated where the majority of sampling results were below the method detection limit.
3. Effluent source terms provided by Amec (January, 2012).
4. Effluent source term of 0.001 used in calculations for iron.
5. Receiving water quality objectives obtained from Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (pal) (2003), continuous concentration (chronic) national recommended water quality criteria (United States Environmental Protection Agency (2006)), British Columbia Ministry of Environment approved and working water quality guidelines or other thresholds, as applicable.
6. In order to estimate effluent source terms, half the method detection limit of a parameter was adopted where more than half of the results for that parameter were non-detect (i.e. Less than the MDL). These effluent source terms are highlighted in blue.
7. Results with an HQ greater than 1 are highlighted in orange, to focus discussion in the effects assessment.

Fish habitat is present at the outlet of MR-12 (tributary F0), for which the resultant water quality in Mary River is shown on the far right of Tables H.11 and H.12. At this location, Level I water quality effects may be experienced based on an HQ >1 for mercury, selenium and silver (under mean flow conditions). Copper and chromium are added under the dry year condition. As discussed in the assessment of discharges from East Waste Rock Pond, the calculated baseline concentrations and source terms used in the modelling are from datasets where these parameters were predominantly non-detect. As such, a Level I magnitude rating is highly conservative.

Farther downstream, the ROM and main ore stockpiles will discharge into the Mary River. The resultant water quality in the Mary River considering these discharges as well as the east waste rock pond discharge discussed above is presented in Tables H.13 and H.14. Mercury, selenium and silver (under mean flow and low flow conditions), have a calculated HQ >1, suggesting a Level I magnitude effect with the same qualifiers as described above.

The resultant water quality downstream in Mary Lake was approximated considering discharges from the west stormwater pond via Camp Lake and the multiple discharges to Mary River, which also report to Mary Lake. Based on the average lake volume of 169,000,000 ^{m3}, HQs of 4, 1 and 1 were calculated for mercury, selenium and silver, respectively. Given that the modelling inputs (both baseline and source terms) for each of these parameters are based on MDLs, it is anticipated that the HQ values will be below 1, achieving a negligible effect on water quality in Mary Lake.

H2.13.1.2 DURATION

While the temporary ore stockpiles will discharge stormwater during the Operations phase only, a Level II duration rating is assigned to this effect. The east waste rock pond and pit will continue to discharge runoff in the long term; however the post-closure effects of this is assessed separately in SWSQ-13.

H2.13.1.3 FREQUENCY

The frequency of the potential effect will be annual, limited to the period between June and September when discharge is proposed. A Level II frequency rating was assigned.

H2.13.1.4 EXTENT

The extent of the potential effect is expected to reach negligible levels where the Mary River discharges into Mary Lake, so, given that the effect is expected to be limited to the Mine Site freshwater LSA, a Level I extent rating was assigned.

H2.13.1.5 REVERSIBILITY

The potential effects associated with the discharge of mine contact water from the Waste Rock Stockpile into the Mary River system are anticipated to be partially reversible. A Level II reversibility rating was assigned.

H2.13.1.6 SIGNIFICANCE - SWSQ - WASTE ROCK AND ORE STORMWATER DISCHARGE TO THE MARY RIVER

Based on these ratings, discharge of mine contact water from the Waste Rock Stockpile, ROM stockpile and Main Ore Stockpile into the Mary River is not expected to result in an adverse environmental effect on water and sediment quality in the Mine Site LSA. The residual effect is ranked as *Not Significant* (Table H.7). The Level of Confidence is High due to the quantitative and conservative nature of the assessment.

H2.14 PIT LAKE WATER AND WASTE ROCK DISCHARGES TO MARY RIVER IN POST-CLOSURE - IMPACT STATEMENT SWSQ-13

At the end of mining, the open pit will gradually fill with water from precipitation; time is estimated at 85 to 147 years, depending on annual precipitation, evaporation and other factors (Knight Piésold, 2008).

During the years that the pit is filling, runoff will continue to discharge to tributary F0 and the Mary River from the East Waste Rock Pond.

AMEC (2012b) developed water quality estimates for pit water for the final year of mining (Year 21), which were applied in a water quality model under the assumption that, once the pit has filled, in each subsequent (post-Closure) year all precipitation into the open pit will accumulate and spill over the southern edge facing the Mary River, behaving like a spillway, and that water will be released during the open water period according to the natural hydrograph.

Based on pit water quality for Year 21 of mining, it is possible the water will have A pH of around 4.2, which is outside of the pH range of the MDMER (6.0 to 9.0). Adjustment of pH will be carried out periodically through post-closure using either batch lime treatment or in-line treatment, drawing down the pit lake periodically. As mentioned in above, the mass loading modelling carried out is based on conservative assumptions and Baffinland is continuing to study the geochemistry of waste rock and ore to further refine predictions, management plans, and post-closure strategies.

H2.14.1 RESIDUAL EFFECTS RATINGS

H2.14.2 MAGNITUDE

The estimated water quality in the Mary River from pit water and waste rock stormwater discharges, assuming no treatment to adjust pH of pit water, is presented in Table H.15. The mass balance modelling indicates that Level I magnitude effects to water quality will occur under low flow conditions, with a calculated HQ between 1 and 10 for mercury, selenium and silver. It is noted that an HQ >10 was calculated for mercury within the F0 tributary, upstream of fish; however, since the assessment of water and sediment quality is based on fish as the receptor, the effects assessment considers the resultant water quality at fish habitat within the Mary River, where all parameters have an HQ value less than 10.

H2.14.3 DURATION

The effects associated with the discharge of pit water and waste rock runoff into the Mary River are permanent; Level III duration. The waste rock seepage will run off into the Mary River starting in the first year post-closure, whereas the pit water is not expected to discharge to the Mary River until the pit fills, after 80 years or more.

H2.14.4 FREQUENCY

The frequency of the potential effect will be annual, limited to the period between June and September when discharge is proposed. A Level II frequency rating was assigned.

H2.14.5 EXTENT

The extent of the potential effect is likely to be limited to the Mine Site freshwater LSA; a Level I extent rating was assigned.

H2.14.6 REVERSIBILITY

The effects associated with the discharge of pit water and waste rock runoff into the Mary River is partially reversible. A Level II reversibility rating was assigned.

H2.14.7 SIGNIFICANCE - SWSQ-13 - PIT LAKE WATER AND WASTE ROCK DISCHARGES TO MARY RIVER IN POST-CLOSURE

Based on these ratings, discharge of pit water and stormwater from the East Waste Rock Sedimentation Pond into the Mary River is not expected to result in an adverse environmental effect on water and sediment quality in the Mine Site LSA. The residual effect is ranked as Not Significant (Table H.7). The Level of Confidence (Table H.8) is Medium, due to the assumptions made in the mass loading models and the consequently highly conservative nature of the effect prediction.

TABLE H.11 PREDICTED WATER QUALITY IN THE MARY RIVER UNDER MEAN FLOW CONDITIONS (EAST DISCHARGE)

Parameter	Units	Baseline Water Quality in Trib F0 (F0-01, F0-05)			Baseline Water Quality in Mary River (E0-01, E0-03, E0-10)			Receiving Water Quality Objectives (Note 5)	Discharge Scenario			COMBINED EFFLUENT DISCHARGE FROM THE EAST WASTE ROCK POND	WATER QUALITY IN THE RECEIVING WATERS							
													WATER QUALITY IN TRIB F0 - CATCHMENT MR-12 (U/S OF FISH HABITAT)				WATER QUALITY IN MARY RIVER AT MR-12 OUTLET (FISH HABITAT)			
									Flows Used			Mean Volume of Effluent from East Pond = 370,138 m^3/yr Mean Volume of Effluent from Open Pit = 224,978 m^3/yr	Mean Volume of Effluent Discharged from East Pond and Open Pit = 595,116 m^3/yr Mean Volume to mix at MR-12 = 4,152,146 m^3/yr				Mean Volume of Effluent Discharged from Tributary, East Pond and Open Pit = 4,747,262 m^3/yr Mean Volume to mix in Mary River = 78,185,678 m^3/yr			
		Mean Concentration	90th Percentile Concentration	% Detects	Mean Concentration	90th Percentile Concentration	% Detects		Baseline Concentrations			Mean	Mean	HQ	90th Percentile	HQ	Mean	HQ	90th Percentile	HQ
									MDMER	Pit Water Source Terms (Year 21)	East Waste Rock Source Terms									
pH		8.01	8.31		7.83	8.20		6.5 - 9.0	-	4.20	6.9	5.88	7.74	-	8.01	-	7.83	-	8.19	-
Hardness	mg/L $CaCO_3$	84	133		58	105		-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminum	mg/L	0.020	0.042	81%	0.191	0.394	100%	0.94	-	4.2	0.095	1.65	0.22	0.2	0.24	0.3	0.19	0.2	0.39	0.4
Antimony	mg/L	-	0.0004	0%	-	0.0001	2%	-	-	0.008	0.0025	0.0046	-	-	0.001	-	-	-	0.00015	-
Arsenic	mg/L	-	0.0010	4%	-	0.0010	8%	0.005	0.30	0.007	0.0020	0.0039	-	-	0.001	0.3	-	-	0.00102	0.2
Barium	mg/L	0.00945	0.01068	47%	0.01011	0.01319	57%	-	-	0.0340	0.051	0.045	0.014	-	0.015	-	0.010	-	0.013	-
Beryllium	mg/L	-	0.0050	0%	-	0.0005	0%	0.0053	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	-	0.010	2%	-	0.010	6%	1.5	-	0.11	0.020	0.054	-	-	0.016	0.01	-	-	0.010	0.01
Cadmium	mg/L	-	0.0000200	0%	-	0.00002	8%	0.000029	-	0.00016	0.000016	0.00007	-	-	0.000026	0.9	-	-	0.000020	0.7
Chromium	mg/L	0.0010	0.0010	8%	0.0018	0.0020	27%	0.0047	-	0.019	0.0023	0.0086	0.0020	0.4	0.0020	0.4	0.0018	0.4	0.0020	0.4
Cobalt	mg/L	0.0002	0.0003	4%	0.0002	0.0002	20%	-	-	0.053	0.00063	0.020	0.0027	-	0.0028	-	0.00035	-	0.00035	-
Copper	mg/L	-	0.0009	38%	0.0012	0.0018	64%	0.0047	0.30	0.074	0.0025	0.030	-	-	0.0045	1.0	-	-	0.0020	0.4
Iron	mg/L	0.04	0.05	19%	0.18	0.36	86%	1.2	-	0.22	<0.002	0.084	0.045	0.04	0.054	0.05	0.17	0.1	0.34	0.3
Lead	mg/L	0.00016	0.00020	13%	0.00029	0.00087	35%	0.001	0.10	0.0022	0.00016	0.0009	0.00026	0.3	0.00029	0.3	0.00029	0.3	0.00084	0.8
Manganese	mg/L	0.00260	0.01000	32%	0.00386	0.01000	48%	-	-	0.57	0.00004	0.22	0.029	-	0.036	-	0.0053	-	0.011	-
Mercury	mg/L	-	0.00010	0%	-	0.00010	2%	0.000026	-	0.0016	0.00045	0.0009	-	-	0.00020	8	-	-	0.00011	4.1
Molybdenum	mg/L	0.00306	0.00500	38%	0.00288	0.00500	46%	0.073	-	0.027	0.0078	0.015	0.0046	0.06	0.0063	0.09	0.0030	0.04	0.0051	0.07
Nickel	mg/L	0.0032	0.0050	10%	0.0031	0.0050	92%	0.083	0.50	0.11	0.0015	0.043	0.0081	0.1	0.010	0.1	0.0034	0.04	0.0053	0.06
Selenium	mg/L	-	0.001	0%	-	0.001	0%	0.001	-	0.022	0.0051	0.011	-	-	0.0023	2.3	-	-	0.0011	1.1
Silver	mg/L	-	0.00010	4%	-	0.00010	10%	0.0001	-	0.0008	0.000051	0.00033	-	-	0.00013	1.3	-	-	0.00010	1.0
Thallium	mg/L	-	0.0001	0%	-	0.0001	0%	0.0008	-	0.0009	0.00023	0.00048	-	-	0.00015	0.185	-	-	0.00010	0.1
Uranium	mg/L	0.00213	0.00299	100%	0.00252	0.00468	98%	0.015	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	0.001	0%	0.001	0.001	11%	0.006	-	0.0029	0.00083	0.0016	-	-	0.0011	0.179	-	-	0.0010	0.2
Zinc	mg/L	-	0.009	8%	0.003	0.006	25%	0.03	0.50	0.062	0.010	0.030	-	-	0.012	0.386	-	-	0.0063	0.2

NOTES:

1. Model assumes complete near instantaneous mixing of effluent and receiving water.
2. No mean concentration calculated where the majority of sampling results were below the method detection limit.
3. Effluent source terms provided by Amec (January, 2012).
4. Effluent source term of 0.001 used in calculations for iron.
5. Receiving water quality objectives obtained from Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (pal) (2003), continuous concentration (chronic) national recommended water quality criteria (United States Environmental Protection Agency (2006)), British Columbia Ministry of Environment approved and working water quality guidelines or other thresholds, as applicable.
6. In order to estimate effluent source terms, half the method detection limit of a parameter was adopted where more than half of the results for that parameter were non-detect (i.e. Less than the MDL). These effluent source terms are highlighted in blue.
7. Results with an HQ greater than 1 are highlighted in orange, to focus discussion in the effects assessment.

TABLE H.12 PREDICTED WATER QUALITY IN THE MARY RIVER UNDER 10-YEAR DRY CONDITIONS (EAST DISCHARGE)

Parameter	Units	Baseline Quality in Trib F0 (F0-01, F0-05)			Baseline Quality in Mary River (E0-01, E0-03, E0-10)			Receiving Water Quality Objectives (Note 5)	MDMER (Mean Monthly)	Discharge Scenario		COMBINED EFFLUENT DISCHARGE FROM THE EAST WASTE ROCK POND	WATER QUALITY IN RECEIVING WATERS							
													WATER QUALITY IN TRIB F0 - CATCHMENT MR-12 (U/S OF FISH HABITAT)				WATER QUALITY IN MARY RIVER AT MR-12 OUTLET (FISH HABITAT)			
										Flows Used		10-Year Low Flow Volume of Effluent from East Pond = 244,291 m³/yr -10-Year Low Flow Volume of Effluent from Open Pit = 148,485 m³/yr	10-Year Low Flow Volume of Effluent Discharged from East Pond and Open Pit = 392,777 m³/yr 10-Year Low Flow Volume to mix at MR-12 = 2,740,417 m³/yr				10-Year Low Flow Volume of Effluent Discharged from Tributary, East Pond and Open Pit = 3,133,194 m³/yr 10-Year Low Flow Volume to mix in Mary River = 53,166,261 m³/yr			
		Mean Concentration	90th Percentile Concentration	% Detects	Mean Concentration	90th Percentile Concentration	% Detects			Baseline Concentrations			Mean	HQ	90th Percentile	HQ	Mean	HQ	90th Percentile	HQ
										Pit Water Source Terms (Year 21)	East Waste Rock Source Terms									
pH	0	8.01	8.31		7.83	8.20		6.5 - 9.0	-	4.20	6.9	5.88	7.74	-	8.01	-	7.83	-	8.19	-
Hardness	mg/L $CaCO_3$	84	133		58	105		-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminum	mg/L	0.020	0.042	81%	0.191	0.394	100%	0.94	-	6.4	0.144	2.50	0.33	0.4	0.35	0.4	0.20	0.2	0.39	0.4
Antimony	mg/L	-	0.0004	0%	-	0.0001	2%	-	-	0.012	0.004	0.01	-	-	0.0012	-	-	-	0.00016	-
Arsenic	mg/L	-	0.0010	4%	-	0.0010	8%	0.005	0.30	0.011	0.003	0.006	-	-	0.002	0.3	-	-	0.001	0.2
Barium	mg/L	0.00945	0.01068	47%	0.01011	0.01319	57%	-	-	0.0515	0.077	0.07	0.01673	-	0.018	-	0.010	-	0.013	-
Beryllium	mg/L	-	0.0050	0%	-	0.0005	0%	0.0053	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	-	0.010	2%	-	0.010	6%	1.5	-	0.17	0.030	0.082	-	-	0.019	0.01	-	-	0.011	0.01
Cadmium	mg/L	-	0.0000200	0%	-	0.00002	8%	0.000029	-	0.00024	0.00002	0.0001	-	-	0.00003	1.1	-	-	0.00002	0.7
Chromium	mg/L	0.0010	0.0010	8%	0.0018	0.0020	27%	0.0047	-	0.029	0.003	0.013	0.003	0.5	0.003	0.5	0.0018	0.4	0.0020	0.4
Cobalt	mg/L	0.0002	0.0003	4%	0.0002	0.0002	20%	-	-	0.080	0.0010	0.031	0.004	-	0.004	-	0.0004	-	0.0004	-
Copper	mg/L	-	0.0009	38%	0.0012	0.0018	64%	0.0047	0.30	0.112	0.004	0.045	-	-	0.006	1.4	-	-	0.0021	0.4
Iron	mg/L	0.04	0.05	19%	0.18	0.36	86%	1.2	-	0.33	0.002	0.13	0.051	0.04	0.060	0.05	0.17	0.1	0.34	0.3
Lead	mg/L	0.00016	0.00020	13%	0.00029	0.00087	35%	0.001	0.10	0.0033	0.0002	0.001	0.0003	0.3	0.0004	0.4	0.00029	0.3	0.00084	0.8
Manganese	mg/L	0.00260	0.01000	32%	0.00386	0.01000	48%	-	-	0.86	0.00006	0.33	0.043	-	0.050	-	0.006	-	0.01221	-
Mercury	mg/L	-	0.00010	0%	-	0.00010	2%	0.000026	-	0.0024	0.001	0.001	-	-	0.0003	9.8	-	-	0.00011	4.2
Molybdenum	mg/L	0.00306	0.00500	38%	0.00288	0.00500	46%	0.073	-	0.041	0.012	0.023	0.006	0.08	0.007	0.1	0.0030	0.04	0.0051	0.07
Nickel	mg/L	0.0032	0.0050	10%	0.0031	0.0050	92%	0.083	0.50	0.17	0.002	0.064	0.011	0.1	0.012	0.1	0.004	0.04	0.0054	0.07
Selenium	mg/L	-	0.001	0%	-	0.001	0%	0.001	-	0.033	0.008	0.02	-	-	0.003	3.1	-	-	0.0011	1.1
Silver	mg/L	-	0.00010	4%	-	0.00010	10%	0.0001	-	0.0012	0.0001	0.001	-	-	0.0002	1.5	-	-	0.00010	1.0
Thallium	mg/L	-	0.0001	0%	-	0.0001	0%	0.0008	-	0.0014	0.0003	0.001	-	-	0.0002	0.2	-	-	0.00010	0.1
Uranium	mg/L	0.00213	0.00299	100%	0.00252	0.00468	98%	0.015	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	0.001	0%	0.001	0.001	11%	0.006	-	0.0044	0.001	0.002	-	-	0.001	0.2	-	-	0.0010	0.2
Zinc	mg/L	-	0.009	8%	0.003	0.006	25%	0.03	0.50	0.094	0.015	0.045	-	-	0.014	0.5	-	-	0.0064	0.2

NOTES:

1. Model assumes complete near instantaneous mixing of effluent and receiving water.
2. No mean concentration calculated where the majority of sampling results were below the method detection limit.
3. Effluent source terms provided by Amec (January, 2012).
4. Effluent source term of 0.001 used in calculations for iron.
5. Receiving water quality objectives obtained from Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (pal) (2003), continuous concentration (chronic) national recommended water quality criteria (United States Environmental Protection Agency (2006)), British Columbia Ministry of Environment approved and working water quality guidelines or other thresholds, as applicable.
6. In order to estimate effluent source terms, half the method detection limit of a parameter was adopted where more than half of the results for that parameter were non-detect (i.e. Less than the MDL). These effluent source terms are highlighted in blue.
7. Results with an HQ greater than 1 are highlighted in orange, to focus discussion in the effects assessment.

TABLE H.13 PREDICTED WATER QUALITY IN THE MARY RIVER UNDER MEAN FLOW CONDITIONS (ALL CHARGES)

Parameter	Units	Baseline Quality in Mary River (E0-01, E0-03, E0-10)			Receiving Water Quality Objectives (Note 5)	MDMER	Discharge Scenario						WATER QUALITY IN MARY RIVER AFTER EAST POND DISCHARGE (FROM TABLE 7-3.18)		WATER QUALITY IN MARY RIVER AFTER ROM AND MAIN STOCKPILE DISCHARGE			
							Flows Used						Mean Volume of Effluent Discharged from Tributary, East Pond and Open Pit = 4,747,262 m^3/yr Mean Volume to mix in Mary River = 78,185,678 m3/yr		Mean Volume after Discharge of Tributary, East Pond, Open Pit and Mary River Upstream of MR-12 = 82,932,940 m^3/yr Mean Volume of ROM Pond = 18,203 m^3/yr Mean Volume of Effluent from Main Ore Stockpiles = 143,489 m^3/yr Total Ore Effluent = 161,692 m^3/yr Additional Dilution in Mary River = 5,333,330 m^3/yr			
		Mean Concentration	90th Percentile Concentration	% Detects			Ore Runoff (Based on Lysimeter Monitoring Results of Bulk Sample Ore Stockpile)						Mean Baseline	90th Percentile Baseline	Mean Baseline	HQ	90th Percentile Baseline	HQ
							Lump Ore Total Metals (2010-09-07)	Lump Ore Total Metals (2010-09-19)	Fine Ore Total Metals (2010-09-07)	Fine Ore Total Metals (2010-09-19)	Mean Ore Stockpile Source Terms	95th Percentile Ore Stockpile Source Terms						
pH	0	7.83	8.20		6.– - 9.0	-	5.76	5.93	6.68	6.48	6.21	6.65	7.8	8.2	7.8	-	8.2	-
Hardness	mg/L $CaCO_3$	58	105		-	-												
Aluminum	mg/L	0.191	0.394	81%	0.94	-	0.127	<0.015	<0.02	<0.06	0.044	0.112	0.19	0.39	0.19	0.2	0.39	0.4
Antimony	mg/L	-	0.0001	0%	-	-	<0.0005	<0.0005	<0.002	<0.002	0.001	0.001	-	0.00015	-	-	0.00015	-
Arsenic	mg/L	-	0.0010	4%	0.005	0.50	<0.0005	<0.0005	<0.002	<0.002	0.001	0.001	-	0.0010	-	-	0.0010	0.2
Barium	mg/L	0.01011	0.01319	47%	-	-	0.0236	0.0251	0.0213	0.0115	0.020	0.025	0.010	0.013	0.010	-	0.013	-
Beryllium	mg/L	-	0.0005	0%	0.0053	-	<0.0025	<0.0025	<0.01	<0.01	0.003	0.005	-	-	-	-	-	-
Boron	mg/L	-	0.010	2%	1.5	-	0.16	0.16	0.21	0.31	0.210	0.295	-	0.010	-	-	0.011	0.007
Cadmium	mg/L	0.00003	0.00010	0%	0.000029	-	0.000203	0.000198	<0.0002	0.00057	0.00027	0.00051	-	0.00002	-	-	0.00003	0.9
Chromium	mg/L	0.0018	0.0020	8%	0.0047	-	<0.0025	<0.0025	<0.01	<0.01	0.003	0.0050	0.0018	0.0020	0.0018	0.4	0.0020	0.4
Cobalt	mg/L	0.0002	0.0002	4%	-	-	0.09740	0.1080	0.0462	0.1400	0.098	0.1352	0.0003	0.0004	0.00058	-	0.00059	-
Copper	mg/L	0.0012	0.0018	38%	0.0047	0.30	0.00183	<0.0025	<0.002	<0.01	0.002	0.0045	-	0.0020	-	-	0.0019	0.4
Iron	mg/L	0.18	0.36	19%	1.2	-	0.825	0.031	0.041	0.082	0.24	0.714	0.17	0.34	0.17	0.1	0.34	0.3
Lead	mg/L	0.00029	0.00087	13%	0.001	0.20	<0.0003	0.001	<0.001	<0.001	0.0005	0.0009	0.00029	0.00084	0.00029	0.3	0.00084	0.8
Manganese	mg/L	0.00386	0.01000	32%	-	-	18.4	21.5	65.5	112	54.4	105.0	0.005	0.01147	0.197	-	0.203	-
Mercury	mg/L	-	0.00010	0%	0.000026	-	<0.00001	0.00004	<0.00001	<0.00001	0.00001	0.00003	-	0.00011	-	-	0.00011	4.0
Molybdenum	mg/L	0.00288	0.00500	38%	0.073	-	<0.00025	<0.00025	<0.001	0.0012	0.0005	0.001	0.0030	0.0051	0.0030	0.04	0.0051	0.1
Nickel	mg/L	0.0031	0.0050	10%	0.083	0.50	0.0977	0.107	0.035	0.113	0.088	0.112	0.0034	0.0053	0.0036	0.04	0.005	0.1
Selenium	mg/L	**-**	**0.001**	0%	0.001	-	<0.005	0.0051	<0.02	<0.02	0.007	0.010	**-**	0.0011	-	**-**	0.0011	1.1
Silver	mg/L	-	0.00010	4%	0.0001	-	<0.00005	<0.00005	<0.0002	<0.0002	0.00006	0.00010	-	0.00010	-	-	0.00010	1.0
Thallium	mg/L	-	0.0001	0%	0.0008	-	<0.0005	<0.0005	<0.002	<0.002	0.001	0.001	-	0.00010	-	-	0.00010	0.1
Uranium	mg/L	0.00252	0.00468	100%	0.015	-	0.00010	<0.00005	<0.0002	<0.0002	0.00008	0.00010	-	-	-	-	-	-

Parameter	Units	Baseline Quality in Mary River (E0-01, E0-03, E0-10)			Receiving Water Quality Objectives (Note 5)	MDMER	Discharge Scenario						WATER QUALITY IN MARY RIVER AFTER EAST POND DISCHARGE (FROM TABLE 7-3.18)		WATER QUALITY IN MARY RIVER AFTER ROM AND MAIN STOCKPILE DISCHARGE			
							Flows Used						Mean Volume of Effluent Discharged from Tributary, East Pond and Open Pit = 4,747,262 m^3/yr Mean Volume to mix in Mary River = 78,185,678 m3/yr		Mean Volume after Discharge of Tributary, East Pond, Open Pit and Mary River Upstream of MR-12 = 82,932,940 m^3/yr Mean Volume of ROM Pond = 18,203 m^3/yr Mean Volume of Effluent from Main Ore Stockpiles = 143,489 m^3/yr Total Ore Effluent = 161,692 m^3/yr Additional Dilution in Mary River = 5,333,330 m^3/yr			
		Mean Concentration	90^{th} Percentile Concentration	% Detects			Ore Runoff (Based on Lysimeter Monitoring Results of Bulk Sample Ore Stockpile)						Mean Baseline	^{90}th Percentile Baseline	Mean Baseline	HQ	^{90}th Percentile Baseline	HQ
							Lump Ore Total Metals (2010-09-07)	Lump Ore Total Metals (2010-09-19)	Fine Ore Total Metals (2010-09-07)	Fine Ore Total Metals (2010-09-19)	Mean Ore Stockpile Source Terms	^{95}th Percentile Ore Stockpile Source Terms						
Vanadium	mg/L	0.001	0.001	0%	0.006	-	<0.005	<0.005	<0.02	<0.02	0.006	0.010	-	0.0010	-	-	0.0010	0.2
Zinc	mg/L	0.003	0.006	8%	0.03	0.50	<0.005	<0.015	<0.02	<0.06	0.013	0.027	-	0.0063	-	-	0.0063	0.2

NOTES:

1. Model assumes complete near instantaneous mixing of effluent and receiving water.
2. No mean concentration calculated where the majority of sampling results were below the method detection limit.
3. Effluent source terms provided by Amec (January, 2012).
4. Effluent source term of 0.001 used in calculations for iron.
5. Receiving water quality objectives obtained from Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (pal) (2003), continuous concentration (chronic) national recommended water quality criteria (United States Environmental Protection Agency (2006)), British Columbia Ministry of Environment approved and working water quality guidelines or other thresholds, as applicable.
6. In order to estimate effluent source terms, half the method detection limit of a parameter was adopted where more than half of the results for that parameter were non-detect (i.e. Less than the MDL). These effluent source terms are highlighted in blue.
7. Results with an HQ greater than 1 are highlighted in orange, to focus discussion in the effects assessment.

TABLE H.14 PREDICTED WATER QUALITY IN THE MARY RIVER UNDER 10-YEAR DRY CONDITIONS (ALL DISCHARGES)

Parameter	Units	Baseline Quality in Mary River (E0-01, E0-03, E0-10)			Receiving Water Quality Objectives (Note 5)	MDMER	Discharge Scenario						WATER QUALITY IN MARY RIVER AFTER EAST POND DISCHARGE (TABLE 7-3.19)		WATER QUALITY IN MARY RIVER AFTER ROM AND MAIN STOCKPILE DISCHARGE			
							Flows Used						10-Year Low Flow Volume of Effluent Discharged from Tributary, East Pond and Open Pit = 3,133,194 m3/yr 10-Year Low Flow Volume to mix in Mary River = 53,166,261 m3/yr		10-Year Low Flow Volume after Discharge of Tributary, East Pond, Open Pit and Mary River Upstream of MR-12 = 56,299,454 m^3/yr 10-Year Low Flow Volume of ROM Pond = 12,378 m^3/yr 10-Year Low Flow Volume of Effluent from Main Ore Stockpiles = 97,573 m^3/yr Total Ore Effluent = 109,951 m^3/yr Additional Dilution in Mary River = 3,626,664 m^3/yr			
		Mean Concentration	90^{th} Percentile Concentration	% Detects			Ore Runoff (Based on Lysimeter Monitoring Results of Bulk Sample Ore Stockpile)						Mean Baseline	90^{th} Percentile Baseline	Mean Baseline	HQ	90^{th} Percentile Baseline	HQ
							Lump Ore Total Metals (2010-09-07)	Lump Ore Total Metals (2010-09-19)	Fine Ore Total Metals (2010-09-07)	Fine Ore Total Metals (2010-09-19)	95^{th} Percentile Ore Stockpile For Mean Flows Source Terms	Ore Stockpile Source Terms (Dry Year)						
pH	0	7.83	8.20		6.– - 9.0	-	5.76	5.93	6.68	6.48	6.65	6.65	7.83	8.01	7.82	-	8.0	-
Hardness	mg/L $CaCO_3$	58	105		-	-												
Aluminum	mg/L	0.191	0.394	81%	0.94	-	0.127	<0.015	<0.02	<0.06	0.112	0.170	0.20	0.39	0.20	0.2	0.39	0.4
Antimony	mg/L	-	0.0001	0%	-	-	<0.0005	<0.0005	<0.002	<0.002	0.001	0.002	-	0.000162	-	-	0.00016	-
Arsenic	mg/L	-	0.0010	4%	0.005	0.50	<0.0005	<0.0005	<0.002	<0.002	0.001	0.002	-	0.00103	-	-	0.00103	0.2
Barium	mg/L	0.01011	0.01319	47%	-	-	0.0236	0.0251	0.0213	0.0115	0.025	0.038	0.010	0.013	0.011	-	0.013	-
Beryllium	mg/L	-	0.0005	0%	0.0053	-	<0.0025	<0.0025	<0.01	<0.01	0.005	0.008	-	-	-	-	-	-
Boron	mg/L	-	0.010	2%	1.5	-	0.16	0.16	0.21	0.31	0.295	0.447	-	0.011	-	-	0.011	0.008
Cadmium	mg/L	0.00003	0.00010	0%	0.000029	-	0.000203	0.000198	<0.0002	0.00057	0.00051	0.00078	-	0.000021	-	-	0.000027	0.9
Chromium	mg/L	0.0018	0.0020	8%	0.0047	-	<0.0025	<0.0025	<0.01	<0.01	0.0050	0.008	0.0018	0.0020	0.0018	0.4	0.0020	0.4
Cobalt	mg/L	0.0002	0.0002	4%	-	-	0.09740	0.1080	0.0462	0.1400	0.1352	0.205	0.0004	0.0004	0.0008	-	0.0008	-
Copper	mg/L	0.0012	0.0018	38%	0.0047	0.30	0.00183	<0.0025	<0.002	<0.01	0.0045	0.007	-	0.0021	-	-	0.0020	0.4
Iron	mg/L	0.18	0.36	19%	1.2	-	0.825	0.031	0.041	0.082	0.714	1.08	0.17	0.34	0.17	0.1	0.35	0.3
Lead	mg/L	0.00029	0.00087	13%	0.001	0.20	<0.0003	0.001	<0.001	<0.001	0.0009	0.001	0.00029	0.00084	0.0003	0.3	0.00084	0.8
Manganese	mg/L	0.00386	0.01000	32%	-	-	18.4	21.5	65.5	112	105.0	159.1	0.006	0.012	0.30	-	0.30	-
Mercury	mg/L	-	0.00010	0%	0.000026	-	<0.00001	0.00004	<0.00001	<0.00001	0.00003	0.00005	-	0.00011	-	-	0.00011	4.2
Molybdenum	mg/L	0.00288	0.00500	38%	0.073	-	<0.00025	<0.00025	<0.001	0.0012	0.001	0.0017	0.0030	0.0051	0.0030	0.04	0.0051	0.1
Nickel	mg/L	0.0031	0.0050	10%	0.083	0.50	0.0977	0.107	0.035	0.113	0.112	0.170	0.004	0.0054	0.0038	0.05	0.0057	0.1
Selenium	mg/L	**-**	**0.001**	0%	0.001	-	<0.005	0.0051	<0.02	<0.02	0.010	0.015	-	0.0011	-	-	0.0011	1.1
Silver	mg/L	-	0.00010	4%	0.0001	-	<0.00005	<0.00005	<0.0002	<0.0002	0.0001	0.0002	-	0.00010	-	-	0.00010	1.0
Thallium	mg/L	-	0.0001	0%	0.0008	-	<0.0005	<0.0005	<0.002	<0.002	0.001	0.002	-	0.00010	-	-	0.00011	0.1
Uranium	mg/L	0.00252	0.00468	100%	0.015	-	0.00010	<0.00005	<0.0002	<0.0002	0.0001	0.0002	-	-	-	-	-	-

Parameter	Units	Baseline Quality in Mary River (E0-01, E0-03, E0-10)			Receiving Water Quality Objectives (Note 5)	MDMER	Discharge Scenario						WATER QUALITY IN MARY RIVER AFTER EAST POND DISCHARGE (TABLE 7-3.19)		WATER QUALITY IN MARY RIVER AFTER ROM AND MAIN STOCKPILE DISCHARGE			
							Flows Used						10-Year Low Flow Volume of Effluent Discharged from Tributary, East Pond and Open Pit = 3,133,194 m3/yr 10-Year Low Flow Volume to mix in Mary River = 53,166,261 m3/yr		10-Year Low Flow Volume after Discharge of Tributary, East Pond, Open Pit and Mary River Upstream of MR-12 = 56,299,454 m^3/yr 10-Year Low Flow Volume of ROM Pond = 12,378 m^3/yr 10-Year Low Flow Volume of Effluent from Main Ore Stockpiles = 97,573 m^3/yr Total Ore Effluent = 109,951 m^3/yr Additional Dilution in Mary River = 3,626,664 m^3/yr			
		Mean Concentration	90th Percentile Concentration	% Detects			Ore Runoff (Based on Lysimeter Monitoring Results of Bulk Sample Ore Stockpile)						Mean Baseline	90th Percentile Baseline	Mean Baseline	HQ	90th Percentile Baseline	HQ
							Lump Ore Total Metals (2010-09-07)	Lump Ore Total Metals (2010-09-19)	Fine Ore Total Metals (2010-09-07)	Fine Ore Total Metals (2010-09-19)	95th Percentile Ore Stockpile For Mean Flows Source Terms	Ore Stockpile Source Terms (Dry Year)						
Vanadium	mg/L	0.001	0.001	0%	0.006	-	<0.005	<0.005	<0.02	<0.02	0.010	0.015	-	0.0010	-	-	0.0010	0.2
Zinc	mg/L	0.003	0.006	8%	0.03	0.50	<0.005	<0.015	<0.02	<0.06	0.027	0.041	-	0.0064	-	-	0.0065	0.2

NOTES:

1. Model assumes complete near instantaneous mixing of effluent and receiving water.
2. No mean concentration calculated where the majority of sampling results were below the method detection limit.
3. Effluent source terms provided by Amec (January, 2012).
4. Effluent source term of 0.001 used in calculations for iron.
5. Receiving water quality objectives obtained from Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (pal) (2003), continuous concentration (chronic) national recommended water quality criteria (United States Environmental Protection Agency (2006)), British Columbia Ministry of Environment approved and working water quality guidelines or other thresholds, as applicable.
6. In order to estimate effluent source terms, half the method detection limit of a parameter was adopted where more than half of the results for that parameter were non-detect (i.e. Less than the MDL). These effluent source terms are highlighted in blue.
7. Results with an HQ greater than 1 are highlighted in orange, to focus discussion in the effects assessment.

TABLE H.15 PREDICTED WATER QUALITY IN THE MARY RIVER DURING POST-CLOSURE DUE TO DISCHARGES OF PIT WATER AND WASTE ROCK STNDER 10-YEAR LOW FLOW CONDITIONS

Parameter	Units	Baseline Quality in Trib F0 (F0-01, F0-05)			Baseline Quality in Mary River (E0-01, E0-03, E0-10)			Receiving Water Quality Objectives (Note 5)	MDMER (Mean Monthly)	Discharge Scenario			COMBINED EFFLUENT DISCHARGE FROM THE EAST WASTE ROCK POND	WATER QUALITY IN RECEIVING WATERS							
														WATER QUALITY IN TRIB MR-12 (U/S OF FISH HABITAT)				WATER QUALITY IN MARY RIVER AT MR-12 (FISH HABITAT)			
										Flows Used			10-Year Low Flow Volume of Effluent from East Pond = 244,291 m³/yr 10-Year Low Flow Volume of Effluent from Open Pit = 296,971 m³/yr	10-Year Low Flow Volume of Effluent Discharged from East Pond and Open Pit = 541,262 m³/yr 10-Year Low Flow Volume to mix at MR-12 = 2,740,417 m³/yr				10-Year Low Flow Volume of Effluent Discharged from Tributary, East Pond & Open Pit = 3,281,679 m³/yr 10-Year Low Flow Volume to mix in Mary River = 53,166,261 m³/yr			
		Mean Concentration	90th Percentile Concentration	% Detects	Mean Concentration	90th Percentile Concentration	% Detects			Baseline Concentrations			Mean	Mean	HQ	90th Percentile	HQ	Mean	HQ	90th Percentile	HQ
										Pit Water Source Terms (Year 21)	East Waste Rock Source Term (Mean Flows)	East Waste Rock Source Terms (Dry Year)									
pH	0	8.01	8.31		7.83	8.20		6.5 - 9.0	-	4.20	6.9	6.9	5.42	7.58	-	7.83	-	7.82	-	8.18	-
Hardness	mg/L CaCO₃	84	133		58	105		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	5.7	18.6		8.3	17.0		120	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	-	2		3	6		15	15.00	-	-	-	-	-	-	-	-	-	-	-	-
Total Alkalinity	mg/L CaCO₃	74	108		47	81		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ammonia	mg/L	0.06	0.11		0.05	0.07		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate	mg/L	0.1	0.1		-	0.1		13	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite	mg/L	0.011	0.017		0.010	0.014		0.06	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	2	4		3	5		-	-	239	26	39	149	26	-	28	-	4	-	6	-
Total Phosphorous	mg/L	0.013	0.030		0.013	0.026		-	-	-	-	-	-	-	-	-	-	-	-	-	-
Aluminum	mg/L	0.020	0.042	81%	0.191	0.394	100%	0.94	-	6.4	0.095	0.144	3.56	0.60	0.6	0.62	0.7	0.21	0.229	0.41	0.4
Antimony	mg/L	-	0.0004	0%	-	0.0001	2%	-	-	0.012	0.003	0.004	0.01	-	-	0.0017	-	-	-	0.00019	-
Arsenic	mg/L	-	0.0010	4%	-	0.0010	8%	0.005	0.30	0.011	0.002	0.003	0.007	-	-	0.0020	0.4	-	-	0.00106	0.2
Barium	mg/L	0.00945	0.01068	47%	0.01011	0.01319	57%	-	-	0.0515	0.051	0.077	0.06	0.01831	-	0.019	-	0.011	-	0.014	-
Beryllium	mg/L	-	0.0050	0%	-	0.0005	0%	0.0053	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	-	0.010	2%	-	0.010	6%	1.5	-	0.17	0.020	0.030	0.105	-	-	0.026	0.02	-	-	0.011	0.01
Cadmium	mg/L	-	0.0000200	0%	-	0.00002	8%	0.000029	-	0.00024	0.00002	0.00002	0.0001	-	-	0.000040	1.4	-	-	0.000021	0.7
Chromium	mg/L	0.0010	0.0010	8%	0.0018	0.0020	27%	0.0047	-	0.029	0.002	0.003	0.017	0.004	0.8	0.0037	0.8	0.0019	0.406	0.0021	0.4

Parameter	Units	Baseline Quality in Trib F0 (F0-01, F0-05)			Baseline Quality in Mary River (E0-01, E0-03, E0-10)			Receiving Water Quality Objectives (Note 5)	MDMER (Mean Monthly)	Discharge Scenario			COMBINED EFFLUENT DISCHARGE FROM THE EAST WASTE ROCK POND	WATER QUALITY IN RECEIVING WATERS: WATER QUALITY IN TRIB MR-12 (U/S OF FISH HABITAT)				WATER QUALITY IN RECEIVING WATERS: WATER QUALITY IN MARY RIVER AT MR-12 (FISH HABITAT)			
										Flows Used			10-Year Low Flow Volume of Effluent from East Pond = 244,291 m³/yr 10-Year Low Flow Volume of Effluent from Open Pit = 296,971 m³/yr	10-Year Low Flow Volume of Effluent Discharged from East Pond and Open Pit = 541,262 m³/yr 10-Year Low Flow Volume to mix at MR-12 = 2,740,417 m³/yr				10-Year Low Flow Volume of Effluent Discharged from Tributary, East Pond & Open Pit = 3,281,679 m³/yr 10-Year Low Flow Volume to mix in Mary River = 53,166,261 m³/yr			
		Mean Concentration	90th Percentile Concentration	% Detects	Mean Concentration	90th Percentile Concentration	% Detects			Baseline Concentrations			Mean	Mean	HQ	90th Percentile	HQ	Mean	HQ	90th Percentile	HQ
										Pit Water Source Terms (Year 21)	East Waste Rock Source Term (Mean Flows)	East Waste Rock Source Terms (Dry Year)									
Cobalt	mg/L	0.0002	0.0003	4%	0.0002	0.0002	20%	-	-	0.080	0.0006	0.0010	0.044	0.008	-	0.0076	-	0.0006	-	0.00063	-
Copper	mg/L	-	0.0009	38%	0.0012	0.0018	64%	0.0047	0.30	0.112	0.003	0.004	0.063	-	-	0.011	2.4	-	-	0.0023	0.5
Iron	mg/L	0.04	0.05	19%	0.18	0.36	86%	1.2	-	0.33	0.001	0.002	0.18	0.064	0.1	0.072	0.06	0.17	0.144	0.34	0.3
Lead	mg/L	0.00016	0.00020	13%	0.00029	0.00087	35%	0.001	0.10	0.0033	0.0002	0.0002	0.002	0.0005	0.5	0.00049	0.5	0.00030	0.299	0.00085	0.8
Manganese	mg/L	0.00260	0.01000	32%	0.00386	0.01000	48%	-	-	0.86	0.00004	0.00006	0.47	0.080	-	0.087	-	0.008	-	0.01445	-
Mercury	mg/L	-	0.00010	0%	-	0.00010	2%	0.000026	-	0.0024	0.00045	0.00068	0.002	-	-	0.00035	13.6	-	-	0.00011	4.4
Molybdenum	mg/L	0.00306	0.00500	38%	0.00288	0.00500	46%	0.073	-	0.041	0.008	0.012	0.028	0.007	0.1	0.0088	0.12	0.0031	0.043	0.0052	0.07
Nickel	mg/L	0.0032	0.0050	10%	0.0031	0.0050	92%	0.083	0.50	0.17	0.002	0.002	0.092	0.018	0.2	0.019	0.2	0.004	0.048	0.0058	0.07
Selenium	mg/L	-	0.001	0%	-	0.001	0%	0.001	-	0.033	0.005	0.008	0.02	-	-	0.0044	4.4	-	-	0.0012	1.2
Silver	mg/L	-	0.00010	4%	-	0.00010	10%	0.0001	-	0.0012	0.0001	0.0001	0.001	-	-	0.00020	2.0	-	-	0.00011	1.1
Thallium	mg/L	-	0.0001	0%	-	0.0001	0%	0.0008	-	0.0014	0.0002	0.0003	0.001	-	-	0.00023	0.3	-	-	0.00011	0.1
Uranium	mg/L	0.00213	0.00299	100%	0.00252	0.00468	98%	0.015	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	0.001	0%	0.001	0.001	11%	0.006	-	0.0044	0.001	0.001	0.003	-	-	0.0013	0.2	-	-	0.0010	0.2
Zinc	mg/L	-	0.009	8%	0.003	0.006	25%	0.03	0.50	0.094	0.010	0.015	0.058	-	-	0.017	0.6	-	-	0.0066	0.2

NOTES:

1. Model assumes complete near instantaneous mixing of effluent and receiving water.
2. No mean concentration calculated where the majority of sampling results were below the method detection limit.
3. Effluent source terms provided by Amec (January, 2012).
4. Effluent source term of 0.001 used in calculations for iron.
5. Receiving water quality objectives obtained from Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life (pal) (2003), continuous concentration (chronic) national recommended water quality criteria (United States Environmental Protection Agency (2006)), British Columbia Ministry of Environment approved and working water quality guidelines or other thresholds, as applicable.
6. In order to estimate effluent source terms, half the method detection limit of a parameter was adopted where more than half of the results for that parameter were non-detect (i.e. Less than the MDL). These effluent source terms are highlighted in blue.
7. Results with an HQ greater than 1 are highlighted in orange, to focus discussion in the effects assessment.

H3 REFERENCES

AMEC, 2012c. Interim Mine Rock ML/ARD Report, Mary River Project. January 2012.

AMEC, 2012a. Interim Waste Rock Stockpile Seepage Quality Model Report, Mary River Project. January 2012.

AMEC, 2012b. Interim Open Pit Water Quality Model Technical Memorandum, Mary River Project. January 2012.