Attachment 29

Interim Closure and Reclamation Plan

(459 Pages)

Baffinland Iron Mines Corporation

DRAFT Interim Closure and Reclamation Plan

Phase 2 Proposal Revisions – FOR REVIEW PURPOSES ONLY

This document provides revisions to:
Document # BAF-PH1-830-P16-0012
Rev 5
October 30, 2018

Baffinland Iron Mines Corporation

INTERIM CLOSURE AND RECLAMATION PLAN

BAF-PH1-830-P16-0012

Revised Draft – Rev 5

Prepared By: Christopher Murray
Department: Sustainable Development
Title: Environmental & Regulatory Compliance Manager
Date:
Signature:

Reviewed By: Megan Lord-Hoyle
Department: Sustainable Development
Title: Director, Sustainable Development
Date:
Signature:

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 (BAF-PH1-830-P16-0012) *Note Change in Title from Interim Abandonment and Reclamation Plan*
03/19/2015	3	AG	EM	Approved for Use (BAF-PH1-830-P16-0012)
10/15/2015	4	AG	EM	Approved for Review (BAF-PH1-830-P16-0012)
10/30/2015	4	AG	JM	Approved for Review (BAF-PH1-830-P16-0012)
03/31/2016	4	AG	JM	Approved for Review (BAF-PH1-830-P16-0012)
05/31/2016	5	AG	JM	Approved for Review (BAF-PH1-830-P16-0012)
08/01/2016	5	AG	JM	Approved for Review (BAF-PH1-830-P16-0012)
10/06/2016	5	AG	WM	Approved for Review (BAF-PH1-830-P16-0012)
29/06/2018	5	CM	MLH	Approved for Review (BAF-PH1-830-P16-0012)
19/10/2018	5	RS, CM	MLH	Approved for Review (BAF-PH1-830-P16-0012)

TABLE OF CONTENTS

List of Figures

List of Tables

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 its amendment, and, by the Nunavut Water Board (NWB) with the issuance of Type 'A' Water Licence 2AM-MRY1325 and Amendment No. 1. 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 - Amendment No. 1 which requires the March 2015 ICRP to be updated 60 days after the issuance of the amended Type A Licence, taking into consideration the items listed in Part J, Item 2. The revised plan is to address the relevant comments and recommendations provided by intervening parties during the review period for the Type A Licence amendment application.

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 (21 year mine 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 and its Amendment No 1. The ICRP will be updated as required throughout the life of the Project. This revision (Rev 6) considers the addition of components of the Phase 2 Proposal.

As per Type "A" Water License 2AM-MRY1325 - Amendment No. 1 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 PLAIN LANGUAGE SUMMARY

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 its Amendment No 1) and Type A Water Licence 2AM-MRY1325 - Amendment No. 1. The Project's Interim Mine Closure and Reclamation Plan (ICRP) is considered to be a "living" document, which is refined regularly throughout the life of mine until a Final Closure and Reclamation Plan is achieved. 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 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 approved by Nunavut Impact Review Board (NIRB).

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 "B" Water Licence 8BC-MRY1416,~~ Type "A" Water Licence 2AM-MRY1325 - Amendment No. 1.
- Conditions applying to closure and reclamation set forth in Commercial Lease No. Q13C301.
- The Project Certificate No. 005 (December 28, 2012) and its associated Amendments (May 28, 2014 and Ministerial Approval dated September 30, 2018) terms and conditions.
- The Qikiqtani Inuit Association (QIA) Abandonment and Reclamation Policy for Inuit Owned Lands (Version 3.0, 2013).
- Mackenzie Valley Land and Water Board (MVLWB)/Aboriginal Affairs and Northern Development Canada (AANDC) Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the NWT (2013).

Document Organization

Following development of the PMCRP in 2011, Baffinland agreed to reorganize the ICRP document at QIA's request to follow the recommended template provided in the MVLWB/AANDC Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories. These Guidelines were released in 2013. This ICRP follows the suggested template with some minor exceptions, and 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 Provides a description of 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 the Mine for each of the mine 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 as a whole 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 Provides a tabulated summary of the ICRP's concordance with the primary regulatory instruments

Section 12 Glossary of terms, acronyms, and abbreviations

Section 13 References

Appendix A Provides the closure drawings

Appendix B Provides a tabulated summary of mine closure and reclamation planning guidelines, regulations, and lease requirements

Appendix C Presents recent photos of major work areas

Appendix D Discusses the Reclamation Research Plans developed to address items such as pit water quality, waste rock seepage quality and natural revegetation efforts

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 residual effects predictions from the ~~FEIS, and~~ ERP ~~Addendum, and~~ Phase 2 Proposal

Appendix H Summarizes FEIS Freshwater Quality Predictions (Based on FEIS and its Addendum, Volume 7, Section 3.4, and Phase 2 Proposal TSD 14~~3~~)

Updates to the Closure Plan

This interim closure and reclamation plan will be updated as the project progresses taking into account 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 Annual Security Review (ASR) process to account for any planned constriction 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 License 2AM-MRY1325 - Amendment No. 1 and Section 9.2 of the Commercial Lease, No. Q13C301, agreed to between Baffinland and the QIA and includes consultation with Land-owners 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 policy guiding principles and stated assumptions.

As per Type "A" Water License 2AM-MRY1325 and QIA Commercial Lease No. Q13C301, the Final Mine Closure and Reclamation Plan 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 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.

The Final Mine Closure and Reclamation Plan will be issued to relevant stakeholders including the Land Use Engineer of CIRNAC (Territorial Land Use Regulations, Sections 33 and 35), to the Lands Director at QIA, and to the Nunavut Water Board.

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.

Project and Closure Summary

Project related facilities were designed and constructed to minimize the 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 Mine Closure and Final Mine Closure. In addition to these scenarios, progressive reclamation measures have been proposed to facilitate temporary and final mine closures measures.

Temporary closure, Short-Term Temporary Care and Maintenance or Long-Term Temporary Mine 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 Mine 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 Mine Closure the Project sites will be maintained in a secure condition, all facilities and equipment would 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 Mine Closure and Reclamation will occur when there is no foreseeable intent by Baffinland to return to active mining. Final Mine Closure and Reclamation will include removing all 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 to ship material destined for off-site transport. The airstrips will be closed and reclaimed unless otherwise directed by regulatory agencies or the Land Owner in order 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. At Final Mine 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.

Following the closure activities, there will be several long-term landform changes, including: the creation of waste rock pile, the creation of a mine pit lake where previously there had been a hilltop, and several small quarries will be visible landforms.

The final closure and reclamation activities are expected to last a period of three (3) years based on estimated duration and level of effort required for identified closure activities[2]. 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 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 on the following page.

[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 NWB Type "A" Water Licence No. 2AMMRY1325.

Table 1.1: Outline of Major Reclamation Activities at Each Mine Area

Area	Project Operations	Major Reclamation Activities	Post Closure Landscape
Milne Port	Deep water port operation, with ore dock, ship loading facilities, ore stockpiles and stormwater ponds. A second ore dock will be constructed in Phase 2. Other primary infrastructure includes a freight dock, ~~an~~ accommodations ~~complex~~ with sewage treatment plant, power plant, warehouse/garages, fuel storage, landfarm and hazardous waste storage area, polishing ponds, and quarry/borrow areas. Other major infrastructure planned for Phase 2 includes secondary crusher facilities, rail off-loading facilities and other supporting structures~~.~~	Decommissioning of all infrastructure, removal of building materials and hazardous waste from site. 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.	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 mine 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 North 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.	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.

Table 1.1: Outline of Major Reclamation Activities at Each Mine Area

Area	Project Operations	Major Reclamation Activities	Post Closure Landscape
North Railway	A railway between the Mine Site and Milne Port along the Northern Transportation Corridor is included in the Phase 2 proposal. A temporary ore transfer area at KM 57 will be used during construction. Upon completion of construction, up to 12 Mtpa of ore will be transported via rail.	Removal of all water crossing structures, and equipment associated with quarries and borrow areas. 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. The temporary ore transfer area at KM 57 will be reclaimed following completion of the North Railway.	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.

Table 1.1: Outline of Major Reclamation Activities at Each Mine Area

Area	Project Operations	Major Reclamation Activities	Post Closure Landscape
Mine Site	Mining operations commencing on a hill crest outcrop, progressing to open pit mining following 10-12 years of mining at full production rates. A haul road exists from the orebody to the Ore crushing/loading facilities and Waste Rock Stockpile. 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. The Waste Rock Stockpile will be progressively reclaimed during mining by placement of a ~~25~~ 50 m thick cover of non-PAG rock over PAG rock. 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 potential removal of contaminated soils. Grading of earthen structures and disturbed areas to re-establish natural drainage pathways where acceptable.	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 Waste Rock Pile 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 Waste Rock Stockpile. 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.

Predictions for Post-closure Conditions

Following reclamation, all Project areas are expected to be physically and chemically stable. Excluding the Open Pit and Waste Rock Stockpile areas, water quality is predicted to return to pre-disturbance levels, and the 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 Waste Rock Stockpile have been identified as a research priority of Baffinland. Baseline studies indicated natural fluctuations in concentrations of several metals (reflecting the nature of the regional geology) exceeded water quality (CCME) and safe fish consumption (Health Canada) guidelines. This is unlikely to improve following mining.

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. Communities have indicated a preference to leave select infrastructure in place (e.g. Ore Dock, Tote Road, Airstrip), but the majority of non-native materials will be removed or no longer visible.

Baffinland has committed to a rigorous monitoring program which is laid out in Project permits (i.e. NIRB Project Certificate, NWB Type A Water Licence), and will adaptively manage operations and mitigation strategies to effectively minimize post-closure residual effects where practical. Monitoring results will be reported to government agencies and the QIA for review and comment on an ongoing basis, and working groups have been established specifically to monitor Terrestrial and Marine effects during mining, to avoid unforeseen impacts post-closure. Ongoing mine closure planning will also be informed by community engagement feedback, and focus studies which may address priority areas.

Focus of this Revision

~~The~~ This ~~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, to simplify Table 5.1 to support its discussion and further refinement in collaboration with QIA, and to provide a more accessible document for upcoming QIA engagement efforts for future development of the ICRP~~revision of the ICRP has been completed to include aspects of the Phase 2 Proposal which were submitted in September 2018 to the Nunavut Impact Review Board and Nunavut Water Board.

2 INTRODUCTION

2.1 PURPOSE AND SCOPE OF ICRP

This Interim Mine Closure and Reclamation Plan (ICRP) 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 and its Amendment No.1 issued by the Nunavut Impact Review Board (NIRB) on May 28, 2014, and as outlined in the Phase 2 Proposal.

Mine closure and reclamation for the Project is ~~will be~~ regulated under Baffinland's Commercial Lease No. Q13C301, Type 'A' Water Licence 2AM-MRY1325 - Amendment No. 1 ~~(Type 'A' Water Licence)~~, ~~Type 'B' Water Licence 8BC-MRY1314~~ and Crown Indigenous Relations and Northern Affairs Canada (CIRNAC~~; (formerly INAC~~) Land Lease 47H/16-1-2. In cases, if any, where there was conflict between Type 'B' Water Licence 8BC-MRY1314 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.

The ICRP 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 current planning, temporal boundaries of the projected Project lifecycle are as follows:~~

- ~~Construction (Early Revenue Phase (ERP); 2014 to 2015)~~
- ~~Operation (2016 to 2039)~~
- ~~Closure and Post-Closure (2040 to 2047)~~

The expected schedule for implementation of the Phase 2 Proposal, with consideration of the previously approved Steensby component, is as follows:

- Increase mine production to 12 Mtpa by 2020 with the operation of the North Railway line; and
- Increase mine production by 18 Mtpa by 2024 with the operation of the South Railway and Steensby Port.

Under this implementation schedule, the Project Life for Deposit No. 1 is expected to be 17 years.

Based on the existing development plan and the known mineral resource in Deposit No. 1, the mine will be exhausted by 2035. If additional mineable iron ore is not identified in Deposit No. 1 or in adjacent deposits, the mine will advance through a 3-year active closure phase (2036 to 2039).

As planned final closure is decades away, 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 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.

2.2 ICRP Goal and Principles

Over the life of the Project it is expected that closure and reclamation techniques and methodologies for site reclamation will continue to evolve 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 will be based on the protection of human health and the environment, and remain dynamic to take into account the results of ongoing and future studies and identified best practices.

2.2.1 Policies and Guidelines for Final Closure

The Project is being designed with closure and reclamation considerations in mind in compliance with the Baffinland Sustainable Development Policy (Baffinland, 2015). General closure and reclamation objectives of this ICRP correspond with the QIA A&R Policy (QIA, 2013). The main goals of this Policy and the above guidelines and regulations 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 2002a, 2002b; Northwest Territories 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 the current 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.

2.2.2 Site Abandonment Goal

In accordance with the above Policy, regulations, and guidelines, 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].

2.2.3 Closure Principles to Achieve Site Abandonment Goal

In order 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, waste rock stockpile, quarries, road and railway embankments, stream crossings).
- Ensure chemical stability of the mine open pit, waste rock stockpile, quarries, and, other Project disturbed areas.
- Incorporate considerations for future land use of Project sites in final closure planning (to be informed over time by the Mine Closure Working Group (MCWG)).

[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)

- 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.
- The objectives and criteria proposed for implementing Final Closure and achieving the stated goal and principles are discussed in Section 5.1.1 of this ICRP.

2.3 Closure and Reclamation Planning Team

The Mary River Project ICRP contains and describes the plans related to closure and reclamation of the Project. The ICRP addresses the activities expected to be required to ensure the Project closure goal, principles, objectives, and criteria are met. Participation of local communities and other stakeholders in the consideration of alternative reclamation activities to safeguard community values is encouraged as the Project proceeds. Currently, closure planning related to the Project is the responsibility of the Sustainable Development Department at Baffinland with support consultants. Stantec Consulting ltd. has provided input on this ~~latest~~ revision of the ICRP.

2.3.1 Closure Plan Progression

2.3.1.1 Preliminary Mine Closure and Reclamation Plan

A Preliminary Mine Closure and Reclamation Plan (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 Inuit, Federal and Territorial governments.

2.3.1.2 Interim Mine Closure and Reclamation Plan

The ICRP builds on the PCRP which was reviewed and approved by NIRB under Project Certificate 005 and its amendment, 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, AANDC Land Lease

47H/16-1-2, and Part J, Item 2 of the Type A Water Licence, 2AM-MRY1325 - Amendment No. 1 which required the PCRP to be updated to an ICRP 60 days prior to the commencement of the mining operations.

The Mary River 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 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.

2.3.1.3 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 and the Type "A" Water License 2AM-MRY1325 - Amendment No. 1, and AANDC Land Lease 47H/16-1-2. 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, if successful or positive[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 October 15 of a given year, Baffinland will provide a draft of the upcoming Annual Work Plan to the Landlord for discussion.

[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 the outcomes of the water licence amendment process for the Phase 2 proposal.

- By October 31 of a given year, Baffinland will submit the upcoming Annual Work Plan to all other relevant stakeholders.
- By November 30 of a given year, Baffinland expects review and comments on the upcoming Annual Work Plan from relevant stakeholders including the Landlord.
- By December 31 of a given year, Baffinland will provide an updated ICRP, if required, to the Landlord for review.
- By February 28 of the subsequent year, Baffinland expects discussions with the Landlord to be complete regarding the upcoming Annual Work Plan and ICRP revisions and Landlord approval of the ICRP, if required.
- By March 31 of the subsequent year, Baffinland will distribute the current version of the ICRP to all relevant stakeholders.

2.3.1.4 Final Closure and Reclamation Plan

As per Type "A" Water License 2AM-MRY1325 - Amendment No. 1 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.

2.3.1.5 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 monitoring subsequent to the completion of the Operations and closure activities. 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 Governmental Authorities.

2.3.1.6 Exploration Abandonment and Reclamation Plan

The Exploration Abandonment and Reclamation Plan (BAF-PH1-830-P16-0038) is a distinct 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-MRY142. 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.

2.4 ENGAGEMENT AND POST-CLOSURE LAND USE

Baffinland's approach to stakeholder and Inuit community engagement emphasizes the importance of informing stakeholders, establishing effective communication strategies, and collecting feedback from them on potential issues and concerns.

Since 2014, the engagement program has included considerable consultation related to the Phase 2 Proposal, including the identification and discussion of topics of interest and concern regarding the proposal and potential effects. For detailed consultation information, refer to the Public Consultation Report (TSD 4), prepared in support of the Approved Project for the Phase 2 Proposal.

In support of achieving the engagement objectives defined for the Project, Baffinland implements a variety of engagement mechanisms 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. During engagement with the North Baffin communities, the QIA and other stakeholders related to the ERP, ~~and~~ ongoing operations and the Phase 2 proposal, a few questions were raised about Project closure and reclamation. These were mainly concerned with who would be cleaning 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.

Baffinland has proposed to establish a Mine Closure Working Group (MCWG) to best incorporate considerations for post-closure land use of the Project site. The role of th~~is~~e ~~Mine Closure Working Group~~MCWG will be to 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.

A mandate or terms of reference for the ~~Mine Closure Working Group~~MCWG is currently being developed in consultation with the QIA prior to the initial first meeting of the ~~Mine Closure Working Group~~MCWG. Baffinland is aiming to establish this group ~~following~~ concurrent with the Phase 2 Proposal~~ject~~ regulatory process in order to incorporate community engagement in the planning for the working group. As a prerequisite, Baffinland will review a summary of community feedback received on mine closure to date, as well as available QIA engagement records relevant to closure. This review will help align the terms of reference, group membership, and topic identification with stakeholder priorities. While the ~~Mine Closure Working Group~~MCWG is anticipated to be developed following community engagement during the Phase

2 regulatory process, the approval of the Phase 2 expansion is not a prerequisite for the formation of the working group, and it is anticipated that this working group will be in place by the end of 2019.

Baffinland expects an early priority for the ~~Mine Closure Working Group~~MCWG will be to determine additional or modified reclamation research activities (Appendix D) applicable to the Project to help address identified uncertainties and determine the appropriateness of existing action levels (Section 5.2).

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

- Appropriate closure and reclamation objectives and criteria based on desired future land use (aesthetics and values) of Project areas.
- Additional or modified reclamation research activities (Appendix D).
- 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 North and 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.

Baffinland anticipates relying on the ~~Mine Closure Working Group~~MCWG to best facilitate stakeholder engagement related to the Mary River Project and incorporate considerations for post-closure land use of the Project site. Stakeholder comments and Baffinland responses related to closure and reclamation are found in Appendix E.

2.5 Regulatory Instruments for Closure and Reclamation

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* (the Qikiqtani Inuit Association-Version 3.0).

Relevant policies, guidelines, and associated regulations that Baffinland will adhere to in the development of this and future revisions to the ICRP are outlined in Table 2.1, below.

Table 2.1: Applicable Mine Closure Planning Policies, Guidelines, and Lease Requirements

Title/Year/Agency
Project Certificate No.005 (with associated amendment), 2014, NIRB
Type A Water Licence 2AM-MRY1325 (2013) and Amendment No. 1 (2015), NWB
Commercial Lease No.: Q13C301, 2013, QIA
AANDC Land Lease 47H/16-1-2, 2014, AANDC
Guidelines for the Preparation of an Environmental Impact Statement for Baffinland Iron Mines Corporation's Mary River Project (NIRB File No. 08MN053), 2009, NIRB
Abandonment and Reclamation Policy for Inuit Owned Lands, Qikiqtani Inuit Association, Version 3.0. 2013, 2013, QIA
Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the Northwest Territories, 2013, MVWLB/AANDC
Mine Site Reclamation Policy for Nunavut, 2002, AANDC
Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories, 1990, Northwest Territories Water Board
NWT/Nunavut Mines Health and Safety Act and Regulations, 2005, Government of Nunavut

Appendix F of the Phase 2 Proposal provides a summary of all current and required regulatory approvals, including a brief description of the project activity of concern and scope/expiry date of the applicable permit.

All water crossings identified in the Phase 2 Prosposal do not cross navigable waters that are listed in the Schedule to the *Navigation Protection Act*. Consequently, these proposed in-water works do not require Baffinland to make an application or give notice to Transport Canada.

A Glossary of Terms, Acronyms and Abbreviations used throughout this document and the applicable guidelines and regulations can be found in Section 12. Refer to Section 11 for a concordance review of applicable requirements.

2.5.1 Annual Security Review

On an annual basis, in order 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 License 2AM-MRY1325 and Section 9.2 of the Commercial Lease, No. Q13C301, agreed to between Baffinland and the Landlord and includes consultation with landowners and other key stakeholders.

2.5.2 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 site photographs of current conditions onsite.

3 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), and the ERP (Baffinland, 2013), available through the NIRB website (http://www.nirb.ca/), as follows:

- Volume 4: Human Environment
- Volume 5: Atmospheric Environment
- Volume 6: Terrestrial Environment
- Volume 7: Freshwater Environment
- Volume 8: Marine Environment

Where additional baseline updates are available from Phase 2 Proposal documents, the documents are referenced below.

3.1 ATMOSPHERIC ENVIRONMENT

3.1.1 CLIMATE

The Project is situated in the Northern Arctic Ecozone. The climate is semi-arid and permafrost coverage is continuous to a depth of 500 metres, with an active layer of up to two (2) metres. Extremely cold temperatures, combined with the permafrost, result in a short period of runoff that typically occurs from June to September. All rivers and creeks, except for the very largest systems, freeze during winter. Due to the combination of low temperatures and low infiltration, vegetative cover is minimal and surface water is abundant. The region is dotted with thousands of small lakes and streams.

The region experiences near 24-hour darkness with less than two hours of twilight from November to January. During the winter months the treeless topography and fine powdery snow produce blowing snow conditions, resulting in restricted visibility. Frost-free conditions occur from late June to late August. There is continuous daylight from May to August. The months of July and August usually experience the greatest precipitation. From September to November, temperature and the number of daylight hours decrease, and by mid-October the mean daily temperature is generally well below 0°C. The highest snowfall typically occurs during this period.

A meteorological baseline report is included in the Mary River FEIS, Appendix 5A, Section 1.1 summarizes the collection of baseline meteorological data at each Project site and incorporates long-term meteorological data from regional Environment Canada (EC) stations. Figure 1 in Appendix 5A

Meteorological Report and Meteorological Instrument Report, Volume 5 of the Mary River Project FEIS shows the regional and project specific meteorological station locations used to complete the climatic assessment to support the development of the Mary River Project.

For additional details on the Project climate conditions refer to the Phase 2 Proposal, TSD-06 Climate Change Assessment; and TSD 07 Atmospheric Assessments.

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 provide weather information publicly on Baffinland website.

3.1.1.1 Air Temperature

The baseline meteorological report and meteorological instrument report provided in the Mary River FEIS, Volume 5, Appendix 5A, specifically Section 1.3 provides an overview of the mean monthly, annual, and expected project air temperature conditions. Figure 4 in Appendix 5A - Meteorological Report and Meteorological Instrument Report, Volume 5 of the Mary River Project FEIS shows the monthly mean average temperatures for the years 2005 to 2008 for both Environment Canada (EC) and Baffinland meteorological stations. EC climate stations range from approximately -34°C in February at Pond Port to about 7°C in July at Igloolik. The monthly average temperatures at Nanisivik are 0.7 -7.3°C colder than at other stations during summer and fall. Temperatures at Pond Port are 1-5.6°C colder than other stations during winter months.

Data from Pond Port are most representative of temperatures at all three Baffinland stations compared to the other long-term EC stations, although there is a tendency for warmer temperatures at the Baffinland stations during summer. The Pond Port data, corrected upward by 2.4°C during summer, are assumed to be reasonably representative of baseline conditions at Mary River Project site and to provide the best source of long-term temperature information for the Project sites

3.1.1.2 Precipitation

In the Canadian Arctic, precipitation comes in the form of rain, sleet, snow, and ice crystals. The climatic assessment found in Appendix 5A of the Mary River Project FEIS provides a mean monthly and long-term annual precipitation data for meteorological stations. Data indicates that precipitation has increased slightly over the entire measurement period (about 0.24 mm/year). 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.

Total rainfall was measured at the Project site meteorological stations for months where the mean temperature was typically above 0°C which includes May to October. These months were used to compare the Project-measured precipitation data with measurements from the EC meteorological stations. Mary

River had more rainfall in summer than all other Project stations, whereas rainfall in Milne Port and Steensby was mid-low range except for autumn months, when they were higher than at all other stations. Based on a comparison of the monthly trends, it appears that the data from Hall Beach are most representative of rainfall in Mary River, and data from Pond Port and Igloolik are most representative of rainfall from Milne Port and Steensby, respectively.

Data from the EC Hall Beach meteorological station was assumed to be reasonably representative of baseline rainfall conditions at the Mary River Project site and to provide the best source of long-term precipitation information. Likewise, an average of precipitation data from Pond Port and Igloolik meteorological stations were assumed to be reasonably representative of baseline conditions at both Milne Port and Steensby Port. Additional details are provided in Section 1.4, Appendix 5A, Volume 5 of the Mary River Project FEIS.

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.

In order 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. Section 2, Volume 5 of the Mary River Project FEIS, February 2012, identifies existing air quality conditions in the project area and describes potential effects of the Project on air quality.

Summary tables below were extracted from Tables 5-2.1, 5-2.2 and 5-3.3, Section 2.2, Volume 5 of the Mary River Project FEIS provide the baseline air quality conditions for the Project. Additional details on the air quality monitoring program and baseline conditions refer to the Baseline Air Quality Report Appendix 5C-1 of the Mary River Project FEIS.

Table 3.1: Measured Baseline Concentrations

Parameter	Baseline Concentration (µg/m³)
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 3.2: Baseline Dustfull Deposition Rates

Parameter	Baseline Deposition Rate (mg/100cm²/30-day)
Total Dustfall	0.398

Table 3.3: Baseline Metal Deposition Rates for Select Metals

Parameter	Baseline Deposition Rate (µg/100cm²/30-day)
Al	26.9
Co	0.5
Cr	0.3
Fe	30.6
Mg	23.9
Mn	1.7

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 emissions at the Mine Site and Milne Port, and dust fall monitoring along the Tote Road, at Mine Site and Milne Port. Ambient air quality results to date have indicated that NO_2 and SO_2

continue to meet ambient air quality standards. Dust fall at the Mine Site has generally been within predicted levels; however, at Milne Port dust fall has exceeded predictions near the ore stock piles and near the camp where dust is generated by both traffic and the nearby ore piles. Along the Tote Road, within 30 m and one kilometre on either side of the road, dust fall has shown an increase over predictions. However, outside the one kilometre range the dust fall deposition rates decreased to just at or below laboratory detection limits, which is within predicted levels. With the Phase 2 Proposal, secondary crushing will be moved from the Mine Site to Milne Port, where it will be enclosed, reducing dust emissions at the Mine Site. Although total dust emissions at Milne Port will increase, additional dust control measures are being taken. Baseline ambient air monitoring was reviewed, and information is supplemented by TSD 07 of the Phase 2 Addendum.

3.1.3 Noise and Vibration

A detailed noise baseline assessment was conducted in 2007 and provided as Appendix 5D-1 of the Mary River Project FEIS, February 2012. 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.

Background atmospheric noise levels in remote areas are typically low, ranging from about 25 to 40 dBA, similar to those measured for the Mine Site, Steensby Inlet and Milne Inlet. Table 3.4 below which is a replica of Table 5-3.1 from Volume 5 of the Mary River Project FEIS shows the measured ambient noise values for each site. At these levels, noise would be described as faint.

Table 3.4: Baseline Noise Monitoring Results

Site	L_{eq} (24 h) (dBA)	L_{eq} (Day, 15h) (dBA)	L_{eq} (Night, 9h) (dBA)	Minimum L_{eq} (1 h) (dBA)	Maximum L_{eq} (1 h) (dBA)
Mary River	25	25	26	20	34
Steensby Inlet	29	31	26	23	35
Milne Inlet	30	31	29	21	35

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

3.2 Physical (Terrestrial) Environment

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.

3.2.1 TOPOGRAPHY

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 fairly flat and sandy outwash plain where the exploration camp is currently 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 Section 2.1.1.1. Volume 6 of the Mary River Project FEIS 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 Section 2.1.1.1, Volume 6 of the Mary River FEIS, February 2012.

3.2.2 PERMAFROST

The Project is located in a zone of continuous permafrost which can extend 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 RSA is considered to be deep, typically in the 400–700 m depth range. In 2007, a 400 m 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 typical 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. Details on permafrost are described in Section 2.1.1.4, Volume 6, of the Mary River Project FEIS.

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. Figure 6-2-2 - Surficial Geology in the Regional Study Area (RSA) in Volume 6 of the Mary River FEIS 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 of the proposed and existing project infrastructure locations/sites.

Mine Site - The Project is located 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.

Northern Transportation Corridor - The Northern Transportation Corridor alignment (along the Tote Road and North Railway) generally follows a glacial valley-oriented northwest-southeast to the Mine Site. The surficial deposits along this alignment include till veneer or blankets on the higher elevations with some drumlins and moraines. Glaciofluvial outwash sediments (gravel and sand) forming braided floodplains, terraces and fans or stratified glacial drift (gravel and sand) are typically found in the valley floors. Limited bedrock exposure is present along the Tote Road; however, construction of the North Railway will involve quarrying and cutting though bedrock where necessary. The North Railway will cross a small portion of a large esker located south of David Lake.

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 water-ways. 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 the Steensby Port is generally quite hilly, with the exception of 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. The majority of the overburden is located 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 Section 2.1.1.2 Surficial Geology, Volume 6 of the Mary River Project FEIS.

3.2.3.1 Surficial Soils Composition

A soils evaluation was carried out in 2007 and 2008 by an Arctic soils specialist (Veldhuis, 2010). 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 Section 2.1.2, Volume 6 of the Mary River Project FEIS.

3.2.4 Hydrology and Drainage

Groundwater flow in the Local Study Area (LSA) consists of seepage through unconsolidated materials within the active layer, which typically ranges from 1 to 2 m (up to 3 m) below surface. This groundwater reports to local surface drainages and lakes. The long period of sub-zero temperatures results in a very short runoff season, typically occurring from June through September. Runoff may extend to late October in systems with large lake components. A Baseline Hydrology Report for the Project is found in Appendix 7A, Volume 7 of the Mary River FEIS.

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 are 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 from Volume 7 of the Mary River Project FEIS. Additional details on drainage can be found in Section 2.0 of Volume 7 of the Mary River Project FEIS.

- 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

3.3 CHEMICAL ENVIRONMENT

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 RSA. Soils throughout the RSA were generally poor in nutrients (Table 3.5). 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 Section 2.1.1.3, Volume 6, of the Mary River Project FEIS.

Table 3.5: Total Amounts of Organic Matter And Primary Nutrients In Soils in the Project Area

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(S):
1. FROM VELDHUIS 2010.

3.3.2 SURFACE WATER AND SEDIMENT QUALITY

Freshwater quality measurements in the Mary River area indicate naturally elevated concentrations of dissolved oxygen, turbidity, aluminium, and iron. Some average values for pH, as well as cadmium and mercury in fresh water are greater than levels recommended by the guidelines of Canadian Council of Ministers of the Environment.

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 the Surface Water and Sediment Baseline Report found in Appendix 7B-1, Volume 7 of the Mary River FEIS.

Volume 7 of the Mary River FEIS, February 2012 discusses impacts to the Freshwater Environment, including impacts on water quantity, quality and fish habitat. Sections 1 and 2 of Volume 7 describe the baseline hydrologic conditions, potential impacts and mitigation measures and residual effects of activities on the hydrologic system in the Project area. Sections 3 and 4 of Volume 7 include similar content related to water quality and aquatic biota and habitat, respectively.

Water quality monitoring of the mine has demonstrated general compliance with required discharge limits and have not identified project-related effects on water quality in potentially affected waterbodies. Baffinland has generally been in compliance with the discharge limits specified in its Type A Water Licence, with two exceptions, where immediate corrective action was undertaken. Aquatic Effects Monitoring Program monitoring to date has not identified a significant mine-related effect to the nearby aquatic environment. To date, monitoring under the Environmental Effects Monitoring (EEM) Program under Metal and Mining Effluent Regulations (MDMER, formerly the Metal Mining Effluent Regulations) has demonstrated compliance with MDMER requirements (Baffinland, 2017c).

3.3.3 GEOCHEMISTRY

Deposit No.1 occurs at the nose of a syncline plunging steeply to the north-east (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 a number of 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 also has the fewest impurities, which may indicate it was derived from relatively pure magnetite orthat 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 LOM pit waste rock are provided in the report entitled "Mine Rock ML/ARD Characterization Report Deposit 1, Mary River Project", March 2014 as appended to 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 pile (AMEC 2014 and AMEC 2017).

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 Life of Mine (LOM) characterization determined that 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) with the hanging wall schist (HWS) and footwall schist (FWS) zones 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.

Ten (10) waste rock samples were run in humidity cells for 53 weeks in 2008 and 2009. A further 17 waste rock samples were initiated in humidity cell tests in May 2011 for between 109 and 120 weeks of reported data. Nine (9) of these samples were standard humidity cells and eight (8) were NP depleted humidity cells designed to assess drainage quality in the absence of carbonate NP.

The pH of most cells was in the range of 5.5 to 7 throughout testing. Of the 17 cells in operation since 2011, three cells exhibited slowly declining pH throughout testing reaching a minimum measured weakly acidic pH of between 4.5 and 5 after approximately two (2) years of operation (under laboratory conditions). Selected humidity cell tests are planned to continue. Kinetic testing results and cold climate conditions at site suggest the lag time to acid on-set in PAG rock would be on the order of five (5) years or longer.

Total sulphide content of samples is weakly correlated with sulphate release rates; however, through the current periods of testing metal release rates and trends vary among the cells. Though metal release rates are generally low in most cells, release rates are the highest in the lower pH humidity cells with notable release rates for cadmium, cobalt, copper, nickel, lead and zinc in two (2) cells which also contain near worst case solid concentrations for these metals in Deposit 1 mine rock.

Water quality of the Waste Rock Stockpile runoff and discharge from the Waste Rock Stockpile pond(s) will be used as key environmental performance indicators. Conductivity, pH and sulphate will be used as early-warning indicators to identify potential acid generation in the pile. Ammonia and nitrate will be monitored to inform the effects of remaining explosive residue on the water quality of WRF runoff.

Water quality of effluent discharges from the waste rock surface water management pond(s) will be compared to the water quality criteria outlined in the Type A Water Licence and MDMER and used to inform and implement adaptive management actions as required.

3.4 Biological Environment

3.4.1 Vegetation

Existing knowledge of the North Baffin region with respect to vegetation describes the area as having a harsh climate, high winds and shallow soils result in sparse and dwarfed plant life. Herb- and lichen-dominated communities constitute the main vegetative cover. The latter is closely associated with the rock fields and hilly upland areas. Common herbs are purple saxifrage, mountain avens, and arctic poppy, often mixed with shrubs such as arctic willow. The size of shrubs decreases rapidly as one moves north. Vegetative cover tends to be greater on wetter sites confined to coastal lowlands, sheltered valleys and moist nutrient-rich corridors along streams and rivers. Baseline studies of the Mary River Project area were conducted during each of the summers of 2005 through 2008. A total of 833 plots were surveyed across the terrestrial RSA, focusing mainly on the Potential Development Areas (PDA). A total of 155 vascular plant species were recorded, a vegetation classification system was developed, and a species list

was compiled. In addition to vegetation surveys, there was particular emphasis on establishing baseline levels of different metals and elements of the area prior to project development. Results for of the Vegetation Baseline Report for the project, including selected metals in plant species foliage are summarized and detailed in the Vegetation Baseline Report, Appendix 6C, Volume 6 of the Mary River Project FEIS, February 2012. Figure 2 –Terrestrial Regional Study Area showing Vegetation plot locations found in Appendix 6C of the Mary River FEIS shows the vegetation plot locations in the regional study area.

The vegetation abundance monitoring program to date has indicated no evidence of changes in vegetation abundance in the Project area from 2014 to 2017 as a result of the Project. There is annual variation in the cover of some plant groups in the Project area; however, these differences were found across all plots; therefore, the variation is attributed to natural variation in plant group cover and there is no evidence to support a Project-related effect in the first three (3) years of monitoring. Metals analysis of soil and vegetation was conducted from 2012 to 2016; all results have been within the expected range and below Project-specific thresholds, following the resampling of two stations in 2017 that were confirmed to be outliers.

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 Appendix 7C, Volume 7 of the Mary River FEIS, February 2012 and summarized at a high level in the sections below.

There are two key fish species in the freshwater environment: Arctic char (*Salvelinus alpinus*) and a minnow species named nine-spine stickleback (*Pungitius pungitius*). While both are generally abundant and widespread in distribution, ninespine stickleback are absent from the freshwater lakes and streams that were surveyed near the Milne Inlet coast. As all streams with the possible exception of large rivers freeze solid in winter, lakes provide the only overwintering habitat for both species and 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. Arctic char feed primarily on benthic invertebrates, although cannibalism occurs in a small proportion of at least some populations.

Mercury concentrations in Arctic char muscle exceeded guidelines for human consumption in some fish captured in the Mine Area, although concentrations were similar to those reported for other landlocked Arctic char populations. In general, the lower trophic level communities 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; results of the baseline studies for Mine Area lakes are consistent with this generalization. The benthic invertebrate communities in the Mine Area are generally moderately diverse, although higher diversity is found in some small tributaries, and are dominated by chironomids.

Figures 7-4.2, 7-4.4, and 7-4.8 (FEIS Section 4.5) show the distribution of Arctic char in fresh water at the Project sites.

Monitoring results to 2017 has identified impacts within the FEIS predictions, where FEIS predictions are exceeded, adaptive management is being applied to mitigate observed effects. At the Mine Site, while lake sedimentation rates in Sheardown Lake NW in 2016 and 2017 were greater than baseline, they remained within the range predicted in the FEIS, and monitoring of the biological communities (i.e., phytoplankton, benthic macroinvertebrates, and Arctic Char) conducted during the first three years of operation (2015-2017) indicated that there were no adverse mine-related influences on the biota of the Mine Site waterbodies and watercourses (Minnow Environmental Inc. 2016, 2017). 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 the planning and design of the proposed North Railway watercourse crossings.

3.4.3 Terrestrial Wildlife

Terrestrial wildlife on north Baffin Island (described in the Mary River Project FEIS, Volume 6, Appendix 6F - Terrestrial Wildlife Baseline Report) includes caribou, wolves, foxes, Arctic hares, ermine, and small mammals. Terrestrial wildlife, caribou in particular, are an important part of the Inuit culture and are an important component of a subsistence lifestyle. Occurrence of most wildlife species on north Baffin Island is relatively sparse.

3.4.3.1 Caribou

A key terrestrial wildlife species (to both humans and within the broader ecology) is the North Baffin Island caribou. They currently occur in low densities and their abundance seems to be cyclical – harvest data and Inuit Qaujimajatuqangit (IQ – Inuit Knowledge) suggests a roughly 60- to 70-year cycle of abundance. The cyclical pattern of caribou abundance is similar to patterns described on Greenland and south Baffin Island. The cause of these changes in abundance is currently unknown. The last period of caribou abundance in the regional study area (RSA) was 1980 to 2000. According to IQ, and trail orientation and abundance, movement will predominantly be east-west and will occur within the southern half of the RSA Caribou numbers are expected to gradually increase in the Mary River Region, but might not recover to historical highs until the 2050s. There is evidence that caribou occur, and have historically occurred,

throughout the entire region and, therefore, use most of the RSA as some form of habitat. The most-used habitat is in the southern and central portion of the RSA, as indicated by caribou sign (bones, antlers, tracks, and trails) and IQ. Trails observed along the proposed railway alignment suggest that some areas are better for movement. Analyses of habitat use show a greater probability of caribou occurrence for some habitats during the calving, growing, and winter seasons, but the probability of occurrence of caribou is relatively equal in many locations throughout the Project area. The caribou that currently occupy the RSA are not migratory. The local caribou on average move less than 4 km per day during all seasons with very few focused directional movements and all movements were at the scale of tens of kilometres — most caribou remained within the areas they were collared. Additional details on Caribou populations are summarized in Section 5 and Appendix 6F- Terrestrial Baseline Report of the Mary River FEIS.

The Terrestrial baseline report found in Appendix 6F of the Mary River FEIS 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.

In June 2013, a group of five caribou was observed in the PDA during height of land surveys; however, caribou have not been observed during surveys conducted between 2014 and 2017. Lack of caribou observations on site follows the trends of low numbers recorded in regional observations. Low numbers of incidental observations of caribou between the mine site and Milne Inlet between 2013 and 2017 also coincide with the lack of caribou observations during the height of land surveys.

3.4.3.2 Marine and Terrestial Bird communites

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

Field surveys in the Project Area documented 54 bird species within the marine and terrestrial RSAs, five of them Species at Risk listed by COSEWIC (2010) or SARA (Environment Canada, SARA 2010) as identified during the time of baseline programs, including Peregrine Falcon, Short-eared Owl (documented within the terrestrial RSA but showing no signs of nesting there), and Ivory Gull, Ross's Gull and Harlequin Duck (all detected within the marine RSA, but no nesting sites were located). One additional Species at Risk, the Red Knot, has the potential to be found within the Project Area, but was not detected during baseline surveys.

Staging and breeding areas are found in the Project Area for numerous species of birds including Snow Geese, Common and King Eiders, Brant, and Long-tailed Ducks, and include a known moulting area for Snow Geese prior to fall migration. Twenty-five species were confirmed to breed throughout the marine and terrestrial study area. No large, conspicuous seabird nesting colonies were recorded during Project surveys; however, several are known to exist within and adjacent to the marine RSA, particularly on Bylot

Island, in Foxe Basin, and along Hudson Strait. Marine surveys did locate a large breeding colony of Snow Geese (>5,000 individuals) on the southwestern shores of Steensby Inlet.

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.

Pre-clearing nest surveys in 2017 prior to development in expanded project footprint areas were conducted; no nests were identified within the new disturbance area. The addition of the 2017 results of the cliff-nesting raptor survey has indicated no evidence of a relationship between distance from the road/PDA and the number of birds observed. There has been no effect on cliff-nesting raptor nest occupancy rates since 2011, and distance to disturbance analysis suggests there is no negative effect on monitored raptor nesting productivity. Although annual variation in productivity for peregrine falcons and rough-legged hawks is apparent, it is most likely representative of natural variability associated with variation in prey availability and weather rather than due to any influence of disturbance.

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 Section 2.3, Appendix 6F-Terrestial Wildlife Baseline Report of the Mary River Project FEIS.

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). Refer to Section 2.3, Appendix 6 F of the Mary River Project FEIS, February 2012 Arctic hare are 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 CESCC. In northern Baffin Island Arctic hare are locally abundant. 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.

No caribou, wolf or other large mammal tracks were observed during snow tracking surveys conducted between 2014 and 2017; however, similar numbers of Arctic fox and Arctic hare tracks were observed throughout all survey years.

3.4.4 Marine Wildlife

The Mary River FEIS, Volume 8, Section 5.0 and Appendix 8A presents the marine baseline information for the Project area. In total twenty-two marine mammal species are known or expected to occur in the identified Regional Study Area (RSA) including the proposed shipping routes in Baffin Bay and Davis Strait. Species accounts are provided for all species; however, emphasis is placed on species which regularly occur within the Regional Study A. Only one mysticete or baleen whale species, the bowhead whale (*Balaena mysticetus*), occurs regularly in the RSA. Narwhal (*Monodon monoceros*) and beluga (*Delphinapterus leucas*) are abundant in the RSA; other Odontocetes that occur (albeit in low numbers) in the RSA include killer whales (*Orcinus orca*) and northern bottlenose whales (*Hyperoodon ampullatus*). Pinniped species which occur regularly in the RSA include ringed seal (*Pusa hispida*), bearded seal (*Erignathus barbatus*), harp seal (*Pagophilus groenlandicus*), and walrus (*Odobenus rosmarus*). Polar bears (*Ursus maritimus*) also occur throughout the RSA. 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 Volume 4 of the Mary River Project FEIS.

Marine wildlife in the north Baffin Island (described in the Mary River Project FEIS, Volume 8, Marine Section 5) includes bowhead whale, beluga whale, narwhal, walrus, ringed seals, bearded seals, harp seals, and polar bears. TSD 20 of the Phase 2 Proposal, provides additional detail on local currents, waves, and sediment transport within Milne Inlet.

3.4.4.1 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 are capable of breaking up to 20 cm of ice in order 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 Hall Beach 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. Additional details on Bowhead Whales can be found in Section 5.1.5 Volume 8 of the Mary River FEIS.

3.4.4.2 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 into northern Foxe Basin during spring and remain in the general area of eastern Fury and Hecla Strait throughout the summer. These beluga 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, Hall Beach, 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. The majority of 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 Section 5.1.3. Volume 8 of the Mary River FEIS.

3.4.4.3 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 similar to 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 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, narwhals are 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 1980's and early 1990's 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 Pond Inlet begin migrating down the east coast of Baffin Island in late September. Narwhals 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.

Narwhals were identified in aerial surveys throughout in Eclipse Sound, Milne Inlet, and Koluktoo Bay. Narwhale 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 narwhal between various areas of Eclipse Sound and surrounding fjords.

A much smaller number of narwhal 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 are thought to move through Fury and Hecla Strait into northern Foxe Basin during spring migrations in April and May.

Aerial surveys 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 Section 5.1.4, Volume 8 of the Mary River FEIS. No significant change in overall narwhal abundance and distribution was observed in the area from 2014-2017.

3.4.4.4 WALRUS

Walrus 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. Walrus 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.

Walrus 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 Hall Beach, and among the islands (Rowley, Koch, and the Spicer Islands)

located farther to the east of Hall Beach 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 Section 5.1.2, Volume 8 of the Mary River FEIS.

3.4.4.5 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 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, Hall Beach,

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 Section 5.1.1, Volume 8 of the Mary River FEIS.

3.4.4.6 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 north eastern 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 Section 5.1.7, Volume 8 of the Mary River FEIS.

3.4.4.7 HARP SEALS

Harp seals occur in the northern Atlantic and Arctic oceans below 84ºN. 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. 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 Bowhead Whales can be found in Section 5, Volume 8 of the Mary River FEIS.

3.4.4.8 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 also 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 Section 5.1.6, Volume 8 of Mary River FEIS.

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.

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 Hall Beach 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, Hall Beach, Igloolik, and Pond Inlet. The ties of these individual communities to the Project are described in more detail:

Arctic Bay is located 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 located 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 Raven 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.

Hall Beach is located on the mainland just south of Igloolik, 192 km from the Steensby Port site and 288 km southwest of the Mary River site. Hall Beach harvest patterns are distinct from Igloolik despite their proximity, with a concentration of marine harvesting centred on the Hall Beach 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 shipping route through this area could have both land use and ecosystemic effects on the community.

Igloolik is located on the mainland but 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 Melville Peninsula 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 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. Details on the socioeconomic environment surrounding the Project area are described in detail in Volume 4 of the Mary River Project FEIS, February 2012.

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 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 as a result of federal policy and housing initiatives in the 1950s Contemporary Inuit land use was determined through

consideration of the Nunavut Wildlife Harvest Study interviews and discussions with local communities, and the results of the MRIKS. 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 communities of north Baffin Island (Clyde River, Pond Inlet, Arctic Bay, Igloolik, and Hall Beach). 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 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 Appendix 4C – Land Use Report, Volume 4 of the Mary River Project FEIS.

Contemporary harvesting activities on North Baffin 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 Appendix 4C – Land Use Report, Volume 4 of the Mary River Project FEIS 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) (not sure this is needed)
- 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 LAND FAST ICE

Ice is an important component of land use activities, as much of the travel engaged in by residents is on land fast ice. Land fast 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 – North Baffin Region (Workshop Results); Figure 3.14 Travel Routes – North Baffin Region (interview results); and Figure 3.24 – Sea Ice Conditions – North Baffin from Appendix 4C – Land Use Report, Volume 4 of the Mary River Project FEIS.

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 Appendix 4C – Land Use Report, Volume 4 of the Mary River Project FEIS for location of the parks relative to the Project.

Local outfitting resources are available in local communities for tourism activities such as kayaking, nature viewing and polar bear hunting. Cruise ships visit the North Baffin region each summer, specifically the region around Bylot Island and Sirmilik National Park.

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 would be through Baffin Bay into Eclipse Sound or around Bylot Island through Navy Board Inlet. 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.

The Government of Canada, the Government of Nunavut, and the Qikiqtani Inuit Association (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 consultation conducted with Inuit communities, industry and government, support was expressed. Before the NMCA can be officially established under the Canada *National Marine Conservation Areas Act*, an Inuit Impact and Benefit Agreement (IIBA) must be negotiated and an interim management plan (including a preliminary zoning plan) prepared. Further information is available in TSD 24 (Marine Mammals Effects Assessment).

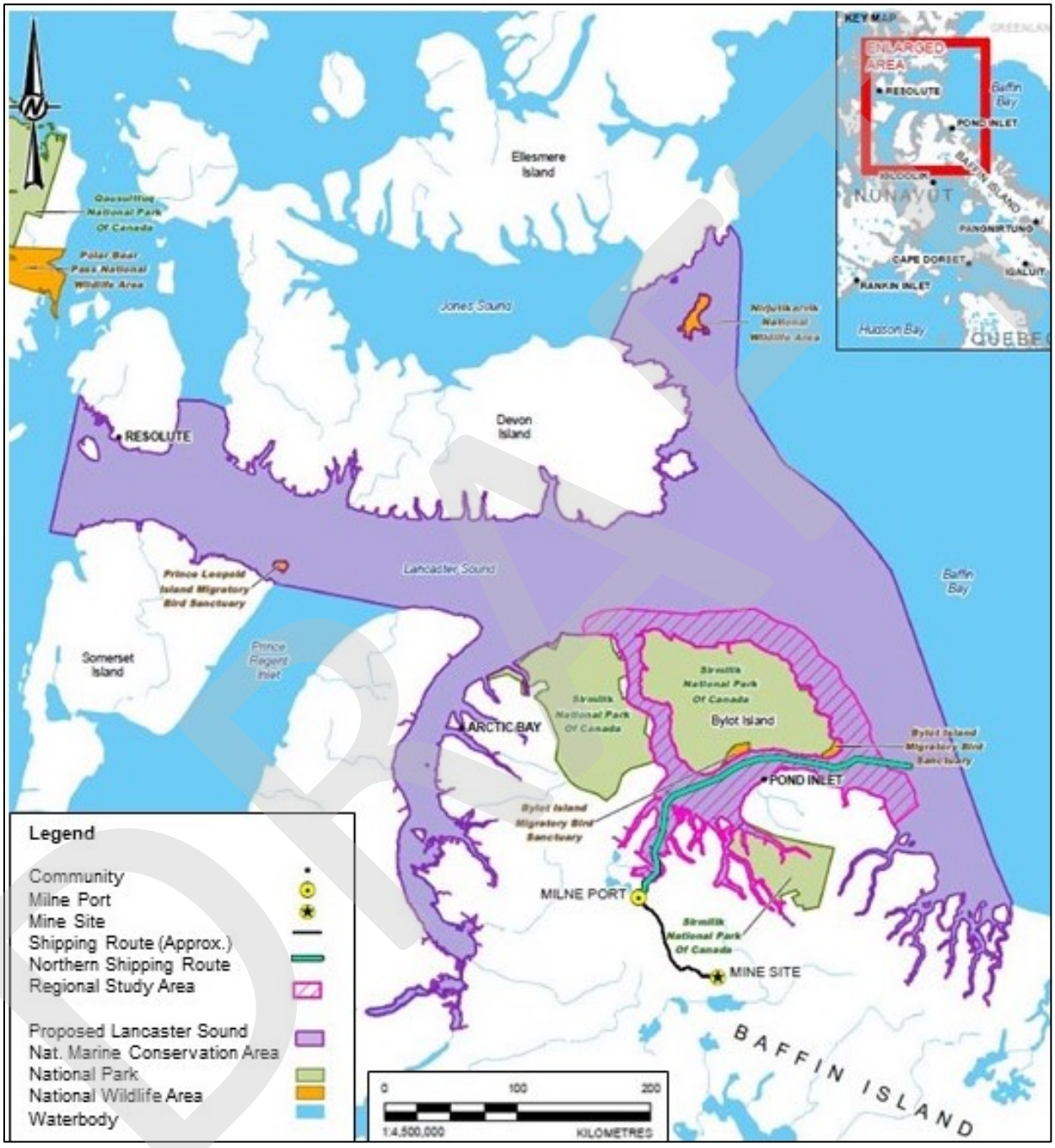

Figure 3.1 Proposed Tallurutiup Imanga (Lancaster Sound) National Marine Conservation Area (Parks Canada, 2018).

4 PROJECT INFORMATION

4.1 LOCATION AND ACCESS

The basis of the Project (the Project) is production and shipment of high grade iron ore from Deposit No. 1 located on North Baffin Island in the Qikiqtani Region of Nunavut. There are three (3) main project locations consisting of the Mine Site, Milne Port located north of the Mine Site, and, Steensby Port located south of the Mine Site. The Mine Site is located approximately 160 km south of Pond Inlet (Mittimatalik) and approximately 1,000 km northwest of Iqaluit, as shown on Figure 4.1. Milne Port is connected to the Mine Site by a 115 km Tote Road. Phase 2 Proposal includes a 110 km North Railway connecting the Mine Site to Milne Port, generally paralleling Tote Road. A 149 km railway will eventually be constructed to connect Steensby Port to the Mine Site.

4.1.1 PROPONENT NAME AND ADDRESS

The proponent of this ICRP is:

Baffinland Iron Mines Corporation
2275 Upper Middle Road East, Suite 300
Oakville, ON, Canada L6H 0C3
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 a 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.

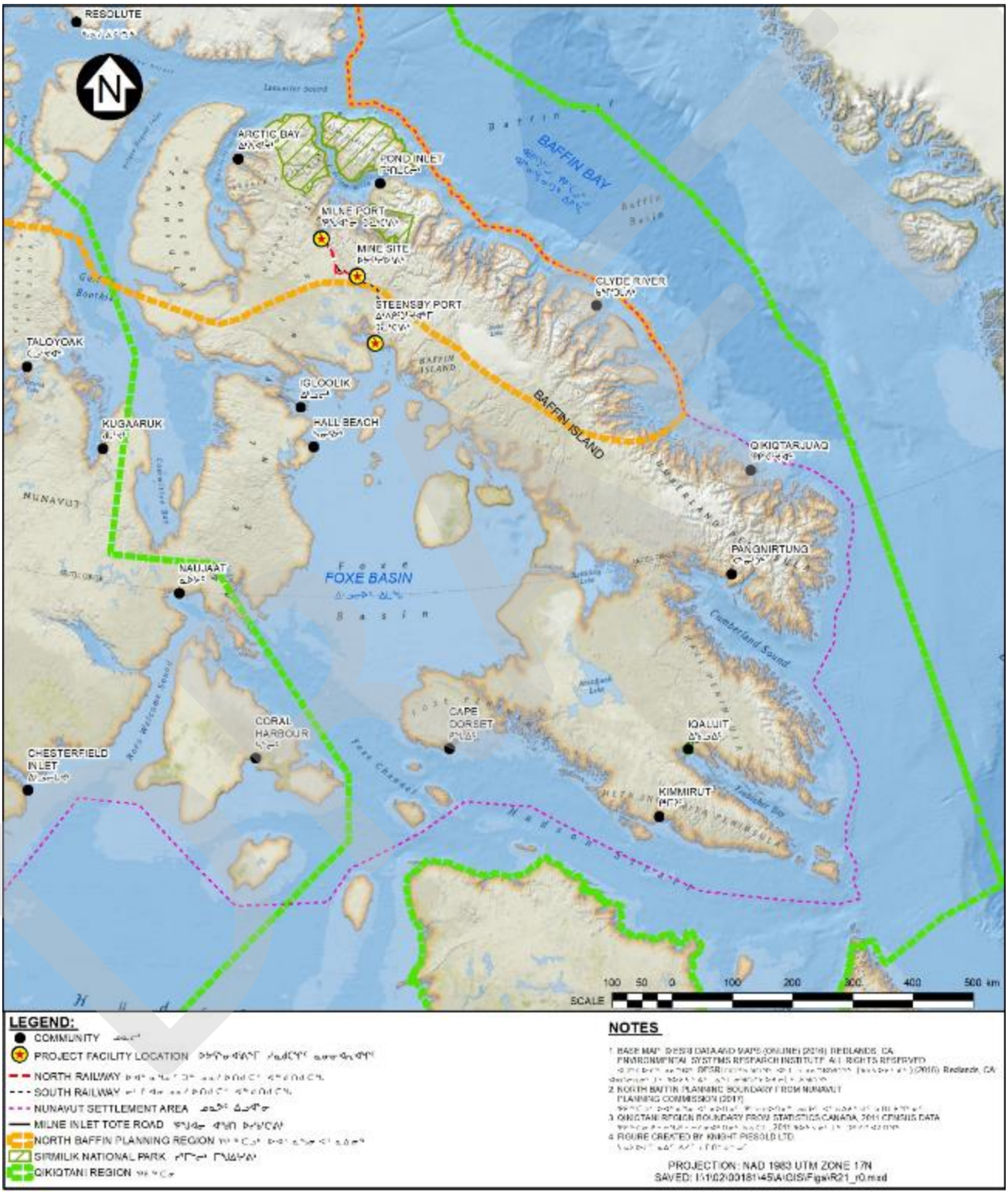

Figure 4.1 Site Location Map

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 ~~Nunavut Impact Review Board~~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.

The year 2008 also saw the completion of a drill program focused on geotechnical, exploration and geomechanical work, as well as further investigations at the Milne Inlet and Steensby Port sites and along the Railway. In addition, a bulk sampling program was undertaken to extract, transport and ship ore for testing in Europe. The results were used to prepare a definitive feasibility study, which found 'excessively robust economics' for a Project based on 18 Mtpa of iron ore production (Baffinland press release, February 23, 2009). In March 2008, the Company submitted a Development Proposal and associated initial permit applications in order to initiate the regulatory review of a Project based on currently defined iron ore reserves. In January 2011, Baffinland submitted a Draft Environmental Impact Statement (DEIS) for stakeholder comment and review including a Preliminary Mine Closure and Monitoring Plan (DEIS, Appendix 10G). In February 2012, Baffinland submitted the FEIS in support of the development of the Project.

The FEIS included the construction, operation, closure and post-closure activities associated with the mine and its related infrastructures, the construction of a 150 km railway to link the Mine Site to a new port facility at Steensby Inlet, and the construction of the Steensby port. On January 13, 2013, Baffinland informed the NIRB that, due to various business drivers, Baffinland was proposing to make changes to the schedule and specific activities in the initial stages of the development associated with the original Mary River Project (File No. 08MN053). Baffinland noted it understood that the request would potentially necessitate a reconsideration of the Terms and Conditions contained within Project Certificate No. 005 as issued by the NIRB on December 28, 2012 for the Mary River Project.

The changes consisted of the re-introduction of shipment of up to 4.2 Mtpa ore via Milne Port, road transport of ore from the Mine Site to Milne Port via the Tote Road, and the deferral of the full-scale development of the original Project (18 Mtpa production, with railway link to Steensby Port and the development of Steensby Port). This phase was termed 'the Early Revenue Phase'. Baffinland received NIRB approval for the ERP amending the Project Certificate in May 2014. The amended Project Certificate allows for the future development of the 18 Mtpa railway operation, for a total combined production rate of 22.2 Mtpa. In 2015, the Type A Water Licence 2AM-MRY 1325 was successfully amended to account for activities approved for in the ERP in 2014. ~~The Project is currently working toward the 4.2 Mtpa~~

~~production rate via Milne Port associated with the ERP.~~ In mid-2018, Baffinland applied to increase its production to 6 Mtpa, and transport this quantity of ore on the Tote Road to Milne Port for shipping to market. Ministerial approval to transport 6 Mtpa on the Tote Road was granted until the end of 2019.

The Phase 2 Proposal builds upon the ERP by the introduction of additional port infrastructure to handle an increase in shipping through Milne Port (including a second ore dock), and the construction of a 110 km railway between the Mine Site and Milne Port, largely following the Tote Road within the Northern Transportation Corridor. The proposal includes the continued shipment of ore along the Tote Road to 6 MTPA in 2020, and transitioning to 12 MTPA via the North Railway. The Phase 2 Proposal is currently under regulatory review.

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 (Mary River Project FEIS 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 and North Railway

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; and
- 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.

The proposed North Railway follows the Tote Road for most of its length, except for an approximately 20 km deviation near David Lake. Starting at Milne Port, the alignment crosses approximately 20 km of Precambrian terrain, glaciofluvial sand and gravel terraces. Further south, the rail alignment spans across relatively flat lying Paleozoic rocks with mainly dolomitic limestone units for approximately 70 km. The final stretch of the rail alignment traverses glaciolacustrine and glaciofluvial plains, terraces, eskers, and bedrock outcrops ranging from granitic gneiss to sedimentary rocks.

Detailed geotechnical and related studies were completed for the Water License amendment application and can be found in the Mary River Project Phase 2 Proposal, TSD 02. Technical design criteria for the Tote Road and Railway can be found in Attachement 5 and 6 to the TSD; figures are included in Attachments 7 and 8 to the TSD, respectively.

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 piles will be 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 the majority of this upper area. The overburden materials are considered to be 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 will be 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 the majority 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.

4.4 Project Summary

A detailed Project Description for the project has been presented in Volume 3 of the Mary River Project Final Environmental Impact Statement and its associated Addendum (Baffinland~~,~~ 2013), and updated in the Phase 2 Proposal (Baffinland 2018).

Pending the approval of the Phase 2 Proposal, the Mary River Project will consist~~s~~ of mining iron ore from the reserve at Deposit No. 1 at a production rate of up to ~~21.5~~30 Million tonnes per year (Mtpa). The Project ~~will~~ would be developed in ~~two~~ several phases:

- **Early Revenue Phase (ERP):** Ore ~~will~~ has been ~~be~~ mined at a rate of ~~3.~~4.2~~5~~ Mtpa and trucked via the Tote Road to Milne Port, from which it ~~will~~ is~~be~~ loaded onto ships during the open water season. Baffinland received Ministerial approval to increase production and shipping to up to 6 Mtpa in 2018 and 2019.
- **Phase 2 (12 Mtps)**: With the construction of the North Railway, transport of ore will increase from 6 Mtpa via Tote Road to 12 Mtpa via the railway, with shipping via two (2) ore docks during the nominal shipping window from July 1 to Novemeber 15.
- **Full-scale (~~21.5~~30 Mtpa) Approved Project:** As global markets improve for the prices of iron ore, the Company intends to proceed with the construction and operation of the larger Approved Project ~~which includes the construction, operation, closure, and reclamation of a large scale mining operation (open pit mine) and associated infrastructure for extraction~~, which includes a railway link for the transportation of ore to Steensby Port, and~~,~~ the construction and operation of ~~a~~ year around port facilities on Steensby Inlet for the shipment of iron ore.

~~It is expected that the Steensby Port facilities and the Railway will take four (4) years to construct. Upon completion of the Railway and Steensby port construction, an additional 18 Mtpa of iron ore will be transported by rail and transferred to ore carrier vessels from Steensby Port for shipment to international markets. Shipping of ore from Steensby Port will occur year-round and will require vessels with icebreaking capabilities.~~

~~The ERP includes a nominal 4.2 million tonnes per annum (Mtpa) road haulage operation from the Mine Site to Milne Port for shipping of iron ore during the open water season. There are 3 main project locations for the ERP – the mine site, Milne Port north of the mine site, and the Tote Road which connects the Mine Site to Milne Port. Only limited development has occurred at the Mine Site, sufficient to support the mining of 4.2 Mtpa of iron ore. The Tote Road has been upgraded to enable safe and efficient transportation of ore by truck from the Mine site to Milne Port. Milne Port has been fully developed and accommodates a 4.2 million tonnes ore stockpile, an ore dock, maintenance facility and associated infrastructure for the operation of the port facilities. Operational activities of the ERP include:~~

- ~~Ore extraction;~~
- ~~Ore processing via crushing;~~
- ~~Transportation of the ore from the Mine site to Milne Port;~~
- ~~Loading and shipping of ore from Milne Port;~~
- ~~Stakeholder and Inuit community engagement; and~~
- ~~Environmental monitoring and reporting.~~

~~Major infrastructure constructed to date at each of the locations consists of the following. Unless noted otherwise in Section 6, this infrastructure will remain in place throughout operation.~~

~~1. Milne Port:~~

- ~~Ore dock;~~
- ~~Ore stockpile;~~
- ~~Ore handling facilities (unloading, transfer and stockpiling, reclaiming, ship loading) and associated surface runoff ponds;~~
- ~~Camp and service buildings (field offices, maintenance shops, vehicle wash stations, ERT, warehouses, concrete batch plant);~~
- ~~Water supply (intake, transport, storage and distribution);~~
- ~~Sewage treatment plant and discharge;~~
- ~~Polishing Waste Stabilization Pond (PWSP);~~
- ~~Waste management facilities including temporary storage areas;~~
- ~~Incinerator;~~
- ~~Fuel tank farm and fuel dispensing facilities;~~
- ~~Hazardous material storage areas and explosives storage;~~
- ~~Landfarm; and~~
- ~~Power generation and distribution.~~

~~2. Mine Site:~~

- ~~Mine Site service roads, ore haul roads, laydown, drainage and diversions;~~
- ~~Camp Lake water supply (intake, transport, storage and distribution);~~
- ~~Quarries and borrow pits;~~
- ~~Power generation and distribution;~~
- ~~Permanent camp, construction camp and 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);~~
- ~~Sewage treatment plants, PWSPs and discharge;~~
- ~~Mining fleet maintenance facilities;~~
- ~~Waste management facilities including temporary storage areas;~~
- ~~Incinerator;~~
- ~~Landfill;~~
- ~~Hazardous material, explosives, and fuel storage areas;~~
- ~~Temporary crushing facility (crusher trains);~~
- ~~Airstrip;~~
- ~~Emulsion plant;~~
- ~~Waste rock storage with associated runoff control structure and water treatment; and~~
- ~~Transitional ore stockpile and runoff control.~~

~~3. Tote Road:~~

- ~~Road embankments and driving surface;~~
- ~~Water crossings including culverts+bridges and abutments;~~
- ~~Water withdrawal for dust control; and~~
- ~~Borrow Pits and Quarries.~~

~~In 2017, Baffinland focused on mine production from Deposit No. 1 with 4.54 million tonnes mined and hauled using the Tote Road. 2017 also marked the third season of open water shipping of iron ore at Milne Port with almost 4.1 million tonnes of iron ore shipped between August 2 and October 17. This represents a record-setting performance for the Company, and the largest shipping program by volume ever executed in the Canadian High Arctic.~~

In 2017 and 2018, Baffinland focused on mine production from Deposit No. 1 and demonstrated efficiencies and the ability to mine more than 4.2 Mtpa. In mid-2018, Baffinland applied to increase its production to 6 Mtpa, and transport this quantity of ore on the Tote Road to Milne Port for shipping to market. Ministerial approval to transport 6 Mtpa on the Tote Road was granted until the end of 2019. The Phase 2 Proposal application includes continuing to truck 6 Mtpa of ore on the Tote Road while the North Railway is under construction, which is anticipated to consist of a three-year construction period, starting as early as 2019 following approval of the Phase 2 proposal. Once the northern half of the North Railway is operational, 12 Mtpa will be transported by truck to the temporary transfer station, where it will be loaded onto trains for transport to Milne Port; the temporary transfer station is expected to be used for 1-2 years until the southern half of the railway is complete and ore transportation will occur completely by train between the mine site and Milne Port.

It is expected that the Steensby Port facilities and the South Railway will take four (4) years to construct. Upon completion of the South Railway and Steensby Port construction, an additional 18 Mtpa of iron ore will be transported by rail and transferred to ore carrier vessels from Steensby Port for shipment to international markets. Shipping of ore from Steensby Port will occur year-round and will require vessels with icebreaking capabilities.

The Project sites are shown on Figure 4.2, and the Major Project Components are listed in Table 4.1. The Mine site layout is shown on Figure 4.3. Unless otherwise noted in Section 6, all ~~Major Project Components~~project infrastructure are intended to have a similar lifespan as that of the Project.

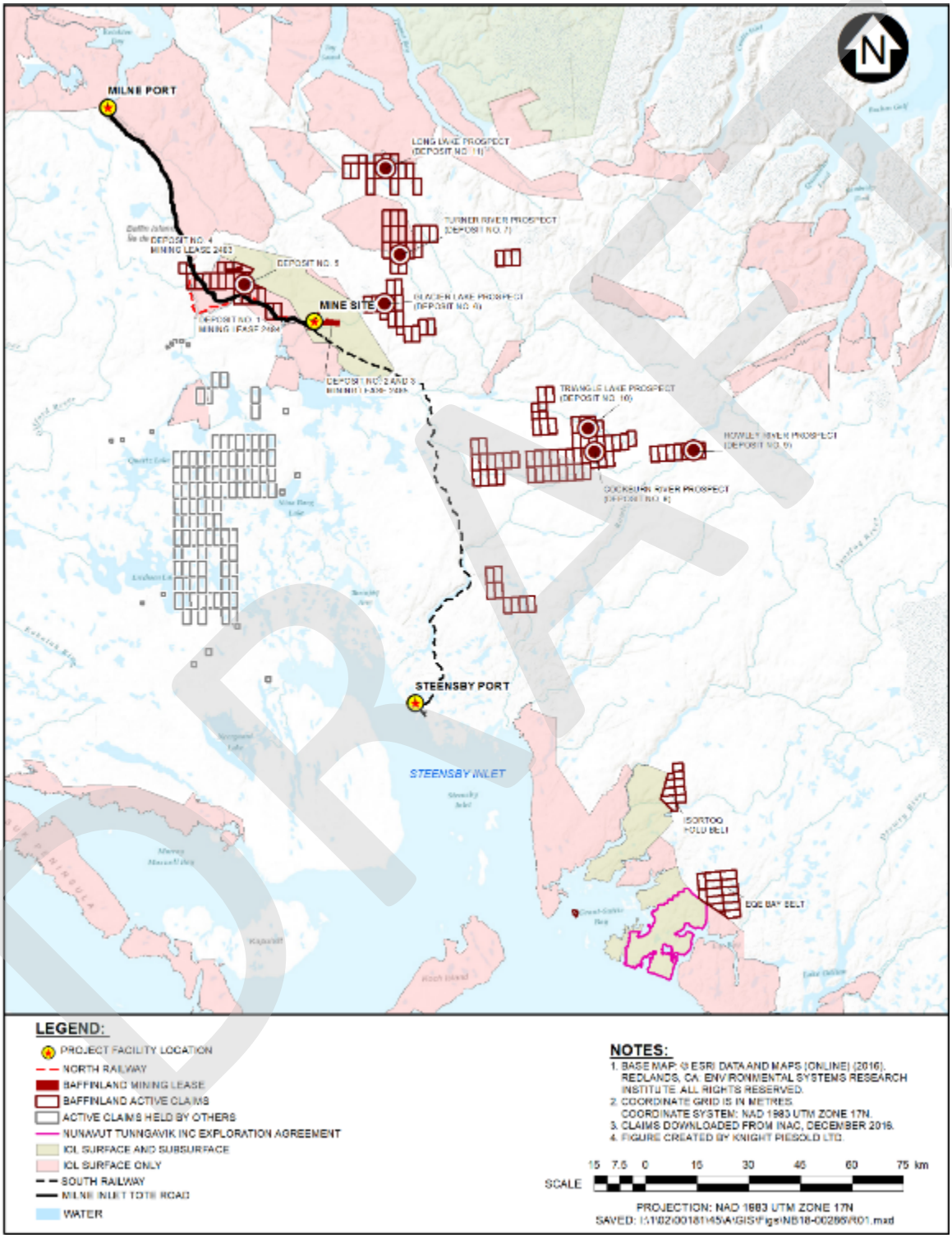

Figure 4.2 Relative Location of Project Areas

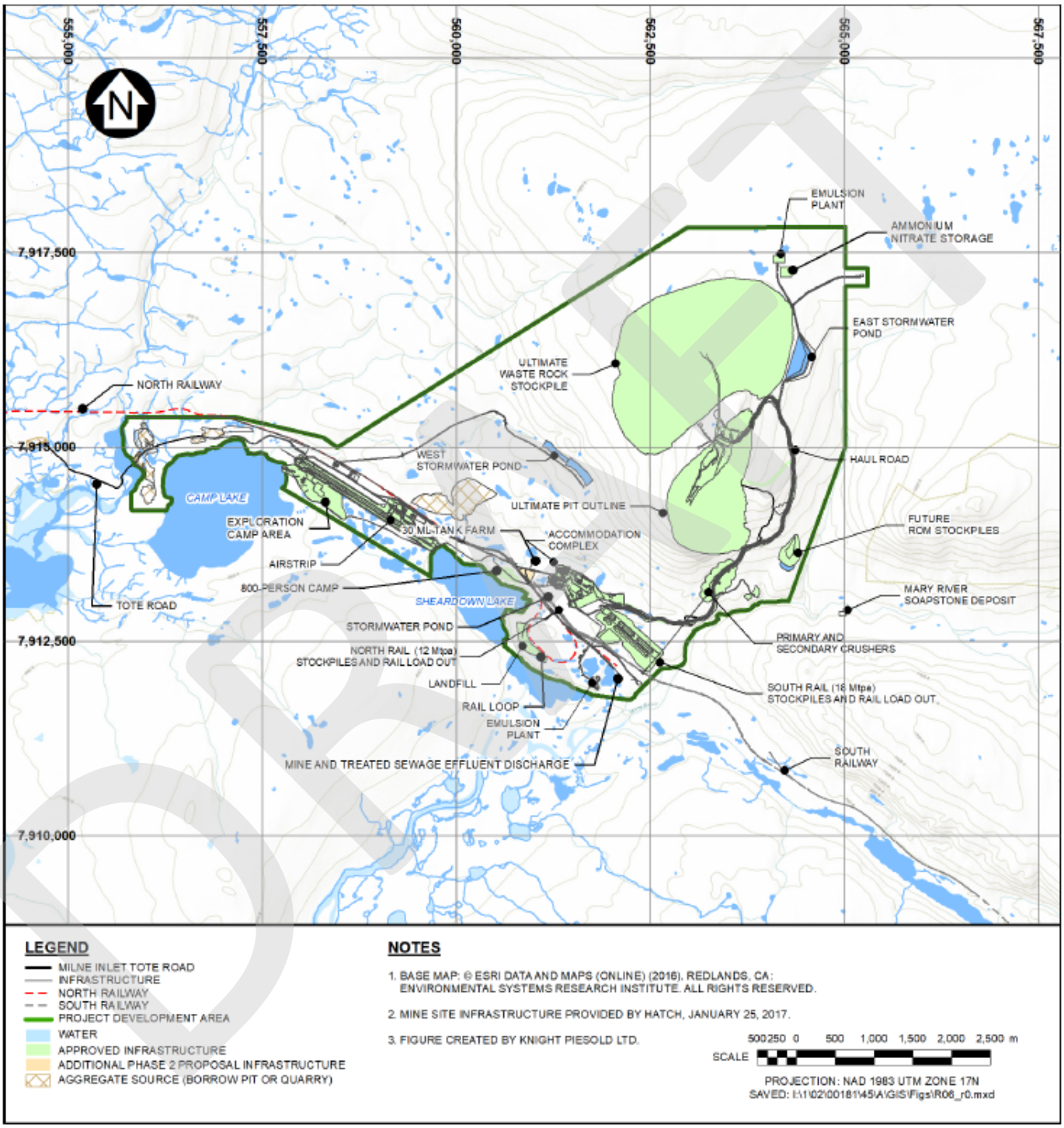

Figure 4.3 Mine Site – Phase 2 Proposal Layout

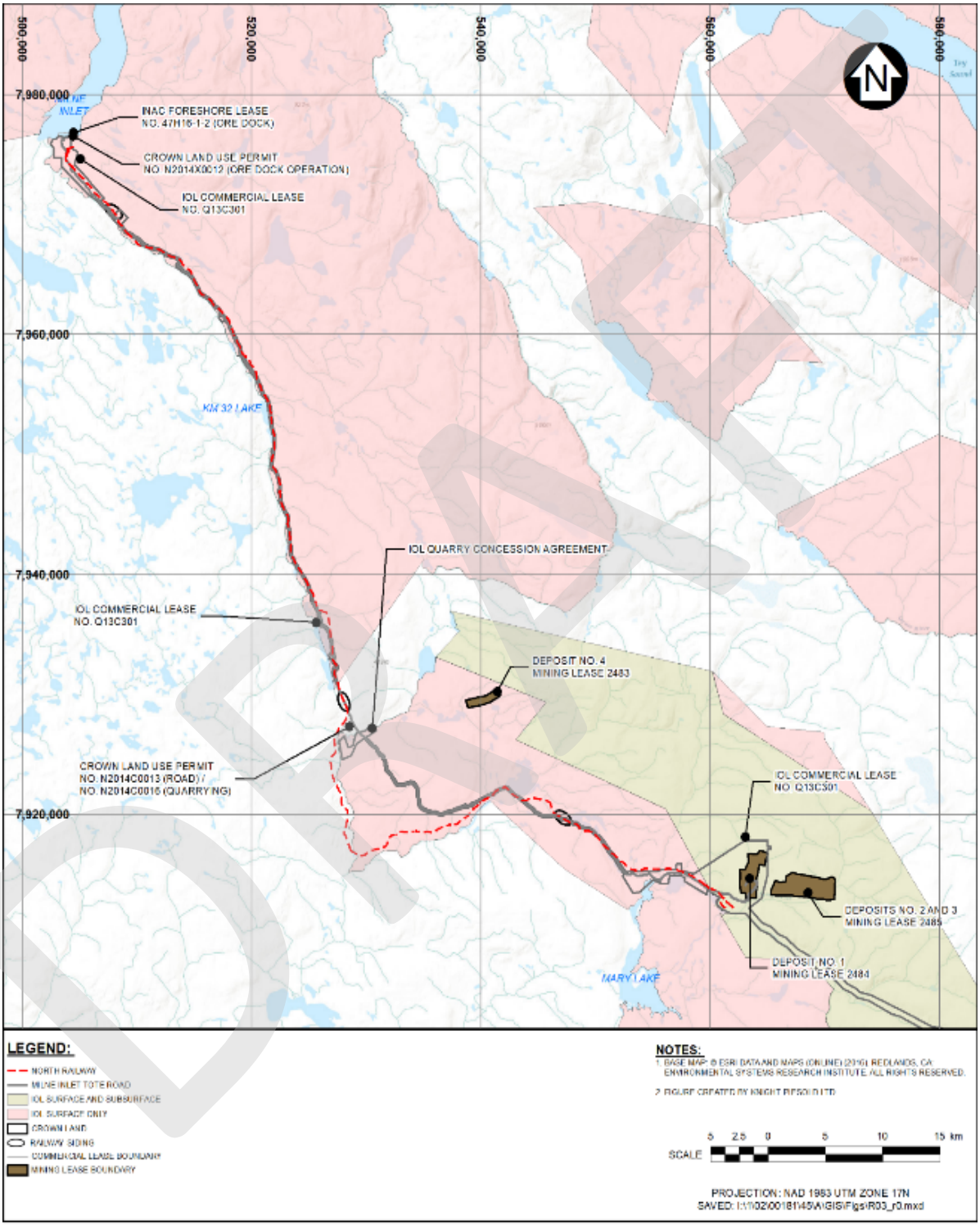

Figure 4.4 Northern Transportation Route

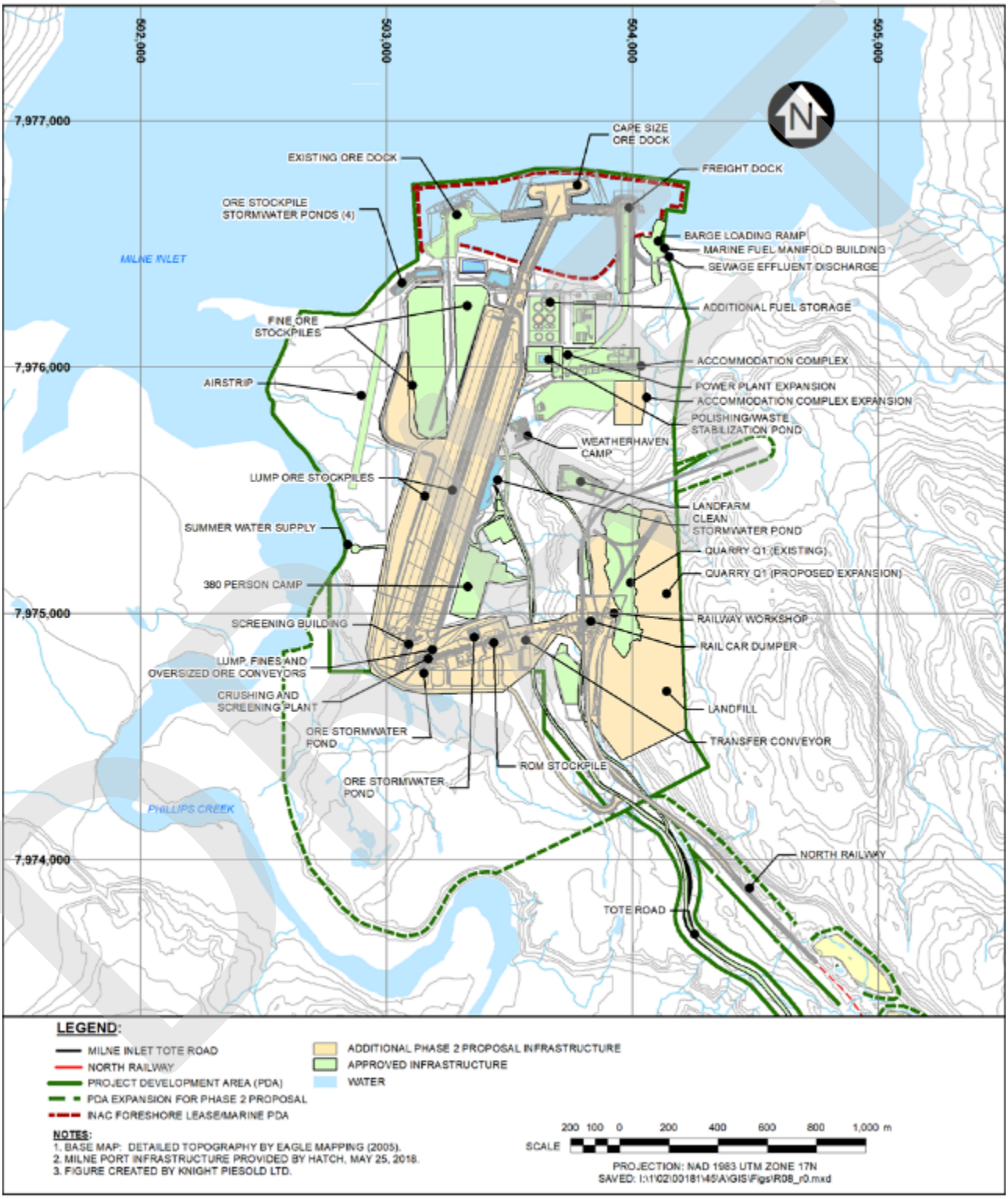

Figure 4.5 Milne Port – Phase 2 Proposal Layout

Table 4.1: Major Project Components

Major Infrastructure Components	Authorized under Project Certificate No 005	Authorized under Project Certificate No 005, ERP Amendment[2]	Status of Development as of March 31, ~~2018~~2019	Land Ownership
Milne Port Site				
Ultimate development area	x	-	On going	IOL
Site development, grading, roads, laydown, drainage	x	x	Completed	IOL
Water supply (intake, transport, storage and distribution)	x	-	Completed	IOL
Potable water treatment plant expansion			On going	IOL
Quarries and borrow pits	x	-	On going	IOL
Camp	x	-	Completed	IOL
Camp expansion (operations 380-bed)			On going	IOL
Sewage treatment plant and discharge	x	-	Completed	IOL
Sewage treatment plant expansion			On going	IOL
Polishing Waste Stabilization Pon~~t~~d (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	-	Deferred	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 stockpile Phase 2 expansion			Proposed	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

Table 4.1: Major Project Components

Major Infrastructure Components	Authorized under Project Certificate No 005	Authorized under Project Certificate No 005, ERP Amendment[2]	Status of Development as of March 31, ~~2018~~2019	Land Ownership
Second ore dock (Capesize capacity)			Proposed	Crown Land
Ore handling for second ore dock			Proposed	IOL
Freight dock	-	x	Not started	Crown land
Explosives storage	x	-	Completed	IOL
12 Mt Secondary ore crushing facility housed in new building			Proposed	IOL
Railway switch yard			Proposed	IOL
Railway unloading station			Proposed	IOL
Railway maintenance building			Proposed	IOL
Airstrip relocation			Deferred	IOL
Tote Road				
Realignment and grade improvement	x	-	~~In progress~~On going	IOL/Crown
Water crossings improvement/replacement	x	-	On going	IOL/Crown
Bridge construction	x	-	Completed	IOL
Borrow Pits and Quarries	x	-	In progress	IOL/Crown
Water withdrawal for dust control	x	x	On going	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	-	On going	IOL
Quarries and borrow pits	x	-	On going	IOL
Transitional Camps (early development)	x	-	Completed	IOL
Sewage treatment plants, PWSPs and discharge	x	-	Completed	IOL
Incinerator	x	-	Completed	IOL
Permanent camp and construction camp	x	-	Completed	IOL
Service buildings (field offices, temporary or transitional construction facilities, light	x	-	Completed	IOL

Table 4.1: Major Project Components

Major Infrastructure Components	Authorized under Project Certificate No 005	Authorized under Project Certificate No 005, ERP Amendment[2]	Status of Development as of March 31, ~~2018~~2019	Land Ownership
vehicles maintenance shops, ore trucks maintenance shops, vehicle wash stations, ERT, warehouses, concrete batch plant)				
Mining fleet maintenance facilities	x	-	Completed	IOL
Mining activities	x	-	On going	IOL
Waste rock storage with associated runoff control structure	x	-	In progress	IOL
Waste R~~r~~ock facility water treatment plant			Completed	IOL
Waste management facilities including temporary storage areas	x	-	Completed	IOL
Landfill	x	-	Completed	IOL
Landfarm	x	-	Deferred	IOL
Transitional power generation and distribution	x	-	Completed	IOL
Power generation and distribution	x	-	On going	IOL
Hazardous material storage areas	x	-	Completed	IOL
Permanent fuel tank farms and fuel dispensing facilities (arctic diesel, jet A fuel – 15.5 ML)	x		Deferred	IOL
Transitional fuel storage facilities (multiple fuel storage tanks for construction phase)	x	-	Completed	IOL
Temporary crushing facility (crusher trains)	x	-	On going	IOL
Permanent crushing facilities	x	-	Deferred	IOL
Transitional ore stockpile and runoff control	-	x	In progress	IOL
Ore stockpiling (run of mine, crushed ore) and associated runoff control ponds	x	-	Deferred	IOL
Ore handling facilities (unloading, transfer, tertiary crushing and screening, stockpiling, reclaiming, railway loading) and associated surface runoff ponds	x	-	Deferred	IOL
Airstrip extension	x	-	Completed	IOL
Explosives storage	x	-	Completed	IOL

Table 4.1: Major Project Components

Major Infrastructure Components	Authorized under Project Certificate No 005	Authorized under Project Certificate No 005, ERP Amendment[2]	Status of Development as of March 31, ~~2018~~2019	Land Ownership
Emulsion plant	x	-	Completed	IOL
North Railway turning loop			Proposed	IOL
North Railway				
Service Road			Proposed	IOL/Crown
Access Roads			Proposed	IOL/Crown
Railway Embankment			Proposed	IOL/Crown
Borrow Pits and Quarries			Proposed	IOL/Crown
Water crossings (bridges and culverts)			Proposed	IOL/Crown
Railway construction and operation			Proposed	IOL/Crown
Temporary transfer station			Proposed	IOL
Laydown Areas and associated shelters and equipment shops			Proposed	IOL/Crown
Mobile temporary construction camps			Proposed	IOL
Explosives storage areas			Proposed	IOL
Ancillary facilities (e.g. Communication towers)			Proposed	IOL/Crown
South Railway				
Service road (up to 25 km south of Mine Site)	x	-	Deferred	IOL
Railway embankment (up to 25 km south of Mine Site)	x	-	Deferred	IOL
Borrow pits and quarries (up to 25 km south of Mine Site)			Deferred	IOL
Water crossings (bridges and culverts)	x	-	Deferred	IOL
Winter road (up to 25 km south of Mine Site)	x	-	Deferred	IOL
Service road	x	-	Deferred	Crown land
Railway embankment	x	-	Deferred	Crown Land
Winter road	x	-	Deferred	Crown Land
Railway construction and operation	x	-	Deferred	Crown Land
Railway construction camps, sewage treatment facilities, emergency ponds and incinerator	x	-	Deferred	Crown Land

Table 4.1: Major Project Components

Major Infrastructure Components	Authorized under Project Certificate No 005	Authorized under Project Certificate No 005, ERP Amendment[2]	Status of Development as of March 31, ~~2018~~2019	Land Ownership
Railway camps associated services facilities	x	-	Deferred	Crown Land
Water crossings (bridges and culverts)	x	-	Deferred	Crown Land
Multiple construction fuel storage units	x	-	Deferred	Crown Land
Mobile explosive units	x	-	Deferred	Crown Land
Tunnel construction and disposal of waste rock	x	-	Deferred	Crown Land
Borrow pits and quarries	x	-	Deferred	Crown Land
Steensby Port Site				
Site development, grading, roads, laydown, drainage	x	-	Deferred	Crown Land
Water supply (intake, transport, storage and distribution)	x	-	Deferred	Crown Land
Water crossings and diversions	x	-	Deferred	Crown Land
Quarries and borrow pits	x	-	Deferred	Crown Land
Camp	x	-	Deferred	Crown Land
Sewage treatment plant, PWSPs and discharge	x	-	Deferred	Crown Land
Incinerator	x	-	Deferred	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	-	Deferred	Crown Land
Waste management facilities including temporary storage areas	x	-	Deferred	Crown Land
Landfill	x	-	Deferred	Crown Land
Landfarm	x	-	Deferred	Crown Land
Power generation and distribution	x	-	Deferred	Crown Land
Hazardous material storage areas	x	-	Deferred	Crown Land
Fuel tank farms and fuel dispensing facilities (Arctic Diesel, Jet A-Fuel and Marine Diesel)	x	-	Deferred	Crown Land
Railway switch yard	x	-	Deferred	Crown Land
Railway terminal maintenance shop	x	-	Deferred	Crown Land

Table 4.1: Major Project Components

Major Infrastructure Components	Authorized under Project Certificate No 005	Authorized under Project Certificate No 005, ERP Amendment[2]	Status of Development as of March 31, ~~2018~~2019	Land Ownership
Ore stockpile	x	-	Deferred	Crown Land
Ore handling facilities (unloading, transfer, tertiary crushing and screening, stockpiling, reclaiming, ship loading) and associated surface runoff ponds	x	-	Deferred	Crown Land
Ore dock	x	-	Deferred	Crown Land
Freight dock	x		Deferred	Crown Land
Airstrip	x	-	Deferred	Crown Land
Explosives storage	x	-	Deferred	Crown Land
Emulsion plant	x	-	Deferred	Crown Land
Overwintering of fuel barge	x	-	Deferred	Crown Land
Dredged sediment disposal area	x	-	Deferred	Crown Land

Note 1: Includes additional authorizations under Type A Water Licence 2AM-MRY1325 – Amendment No. 1

Note 2: Includes additional authorizations under Type A Licence 2AM-MRY1325 – Amendment No. 1

On going items may refer to existing infrastructure which will be modified and/or expanded with the Phase 2 Proposal.

Table 4.2: Key Facts Table

Calendar Year	Measure	2019	2020	2021	2022	2023	2024	2025	2026 - 2035
Project Year		1	2	3	4	5	6	7	17-Aug
PRODUCTION AND EMPLOYMENT									
Pit Production Rates Schedule (Mtpa)	-	Phase 2 Construction							
				South Railway/Steensby Port Construction					
- Full Project	Mtpa	6	6	12	12	12	21	30	30
- North Railway	Mtpa	6	6	12	12	12	12	12	12
- South Railway	Mtpa	-	-	-	-	-	9	18	18
- Total Material Moved	Mtpa	7.9	9.4	21.3	24	25.8	51.1	80.5	75 (Average)
- Strip Ratio	%	0.3	0.6	0.8	1	1.1	1.4	1.7	1.5 (Average)
- Waste Rock	Mtpa	1.9	3.4	9.3	12	13.8	30.1	50.5	45 (Average)
MINE SITE FACILITIES, INFRASTRUCTURE AND ACTIVITIES									
Project Development Area									
- Land	ha	The land-based development area (2740 ha) will not change							
Ore Movement									
- Ore mined	Mt	6	6	12	12	12	21	30	30
- Run of Mine stockpile	Mt	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
- Crushed ore stockpile	Mt	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
- Waste rock stock pile	Mt	4.4	7.8	17.1	29.1	42.8	73	123.5	643 (Total)
Fuel Storage on Site									
- Arctic diesel	ML	45	45	45	45	45	45	45	45
- Other fuels	ML	4	4	4	4	4	4	4	4

Table 4.2: Key Facts Table

Calendar Year	Measure	2019	2020	2021	2022	2023	2024	2025	2026 - 2035
Project Year		1	2	3	4	5	6	7	17-Aug
Fuel Consumption									
- Arctic diesel	-	22	25	53	58	60	88	121	80 - 140
Power Generation Capacity									
- Diesel power plant (installed)	MW	11	14	16	19	22	28	28	28
- Avg annual power demand	MW	6	7	9	9	9	9	9	9
Accommodation Facilities									
- Temporary	# of beds	150	150	400	400	400	400	-	-
- Permanent	# of beds	800	800	800	800	800	800	800	800
Water Supply									
- Camp Lake (Construction)	m^3/day	Licensed for 657m^3/day during construction and 367.5m^3/day during operation for domestic and industrial purposes							
- Demand (domestic & industrial)	m^3/day	285	285	360	360	360	360	240	240
Waste Management and Expected Quantities									
- to landfill	m^3/yr	7,500	7,500	7,500	7,500	7,500	7,500	2,500	2,500
- to incinerator	m^3/yr	1,457	1,457	1,840	1,840	1,840	1,840	1,227	1,227
Quarried Material									
- Number of quarries	#	Material will be sourced from 4 quarries within the Mine Site PDA							
- quantities	m^3	100,000	100,000	100,000	To be sourced as necessary for road repairs				

Table 4.2: Key Facts Table

Calendar Year	Measure	2019	2020	2021	2022	2023	2024	2025	2026 - 2035
Project Year		1	2	3	4	5	6	7	17-Aug
MILNE INLET TOTE ROAD FACILITIES, INFRASTRUCTURE AND ACTIVITIES									
Project Development Area									
- Land	ha	The land-based development area will not change							
- Length of road	km	The Tote Road length remains unchanged							
- Water crossings	#	Up to 13 new culverts and relocation of 5 existing culverts							
Tote Road Operation									
- Service vehicle traffic	-	-	-	-	-	-	-	-	-
- Construction (railway)	trips/week	Use of Tote Road will be mostly localized around construction points between 2019 and 2021							
- Operations	trips/week	250	250	250	250	250	250	250	250
- Ore transportation traffic	-	-	-	-	-	-	-	-	-
- Quantity	Mtpa	6	6	12	-	-	-	-	-
- Total trips per day	trips/day	280	280	560*	-	-	-	-	-
Fuel Consumption									
- Arctic diesel	ML/yr	18	18	36	-	-	-	-	-
NORTH RAILWAY FACILITIES, INFRASTRUCTURE AND ACTIVITIES									
Project Development Area									
- Land	ha	The land-based development area will be 1,306 hectares							
- Length of railway	km	The railway will be approximately 110 km long							
- Length of additional service trail	km	An additional service trail 27.5 km in length will be required							
- Water crossings	#	Up to 425 crossings will be established (421 culverts and 4 bridges)							

Table 4.2: Key Facts Table

Calendar Year	Measure	2019	2020	2021	2022	2023	2024	2025	2026 - 2035
Project Year		1	2	3	4	5	6	7	17-Aug
Quarried Material									
- Quantities	m^3	1,000,000	1,000,000	800,000	-	-	-	-	-
- Number of quarries	number	Material will be sourced from up to 30 quarries, plus one borrow area (Rail Sand Pit) during the operation phase							
Railway Operation									
- Railway ore shipment	Round trips/day	-	-	8	8	8	8	8	8
- Railway track inspection	Round trips/week	-	-	4	4	4	4	4	4
Fuel Consumption									
- Arctic diesel	ML/yr	-	-	8	8	8	8	8	8
Temporary Accommodations									
- Beds	# of beds	255	255	255	-	-	-	-	-
- Fuel storage	litres	30,000	30,000	30,000	-	-	-	-	-
MILNE PORT FACILITIES, INFRASTRUCTURE AND ACTIVITIES									
Project Development Area									
- Foreshore	ha	The foreshore development area will remain at 36.4 hectares							
- Land	ha	The land-based development area will increase to 379 hectares							
- Ore stockpiles	Mt	Ore stockpiles increased to hold 7.8 Mt for operations							
Quarried Material									
- Quantities	m^3	400,000	200,000	100,000	-	-	-	-	-

Table 4.2: Key Facts Table

Calendar Year	Measure	2019	2020	2021	2022	2023	2024	2025	2026 - 2035
Project Year		1	2	3	4	5	6	7	17-Aug
- Number of quarries	#	Material will be sourced from a single quarry (Q1) within the Milne Port PDA							
Fuel Storage Capacity									
- Arctic diesel	ML	64	64	64	64	64	64	64	64
- Jet fuel	ML	3	3	3	3	3	3	3	3
- Marine diesel	ML	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
- Other fuels	ML	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Fuel Consumption									
- Arctic diesel	ML	11	13	29	30	30	30	30	30
Power Generation Capacity									
- Diesel power plant	Installed MW	9.45	22	22	22	22	22	22	22
- Avg annual power demand	MW	6	6	8	8	8	8	8	8
Accommodation									
- Temporary	# of beds	300	300	300	-	-	-	-	-
- Permanent	# of beds	710	710	710	710	710	710	710	710
Waste Management and Estimated Quantities									
- Landfill	m^3/yr	7,500	7,500	7,500	7,500	7,500	7,500	2,500	2,500
- Incinerator	m^3/yr	761	761	761	535	535	535	535	535
- Shipped off site	m^3/yr	510	510	1,020	600	600	1,050	1,500	1,500
- Hazardous waste	m^3/yr	240	240	480	480	480	840	1,200	1,200

Table 4.2: Key Facts Table

Calendar Year	Measure	2019	2020	2021	2022	2023	2024	2025	2026 - 2035
Project Year		1	2	3	4	5	6	7	17-Aug
NORTHERN SHIPPING FACILITIES, INFRASTRUCTURE AND ACTIVITIES									
Ore Docks									
- Ore docks	#	A second ore dock capable of berthing Cape-size vessels will be constructed							
Shipping Season									
- Seasonal shipping		Open Water Shipping		Extended Shipping (July 1 to November 15)					
Ore Shipments									
- Ore carriers	type	Panamax/Supramax		Addition of Cape-size ore carriers					
- Ore shipments	Mtpa	6	6	9	12	12	12	12	12
- Ore shipments	trips/yr	83	83	134	134	134	134	134	134
Freight Shipments									
- Freight deliveries	trips/yr	18	18	18	18	18	18	10	10
- Freight tonnage	m^3/yr	350,000	350,000	350,000	350,000	350,000	350,000	200,000	200,000
Fuel Shipments									
- Fuel deliveries	trips/yr	3	4	8	6	7	8	11	10-Aug
- Arctic diesel	ML/yr	51	56	126	96	98	126	159	120-180
- Marine diesel	ML/yr	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
- Jet A	ML/yr	3	3	3	3	3	3	3	3

The Mine Site, Milne Port and Steensby Port, ~~final~~ connecting infrastructure and principal camp locations site plans are shown on the series of ~~drawings in Appendix A and described in Table 4.2~~figures above. These figures represent the intended site layouts upon completion of Project operations including Phase 2 and the (South) Railway Execution Phase. ~~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.~~ Figures illustrating site infrastructure that are expected to exist at the end of mining are presented in Appendix A. Aerial photos of recent site conditions are presented in Appendix C.

There has been no change to the closure strategy for the approved (South) Railway Execution Phase 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 planned closure commences, see documents/figures associated with the Annual Security Review (ASR) process conducted in accordance with Schedule C of Type "A" Water License 2AM-MRY1325 - Amendment No. 1 and Section 9.2 of the Commercial Lease, No. Q13C301, agreed to between Baffinland and the QIA.

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

Table 4.3~~4.2~~: Drawings for Mine Closure and Reclamation

Drawing Number	Drawing Title
~~H337697-0000-07-126-0014~~ (Figure ~~8.10~~)A.1	Milne Port - Site Infrastructure, End of Mining~~Preliminary Mine Closure and Reclamation Plan – Tote Road~~
H353004-00000-224-272-000(1-3) ~~H337697-4210-07-012~~-0001	Northern Transportation Corridor, Site Plan – Plan and Longitudinal Sections~~Preliminary Mine Closure and Reclamation Plan – Mine Site Construction Phase~~
~~H337697-4210-07-012-0002~~Figure A.1	Mine Site - Site Infrastructure, End of Mining~~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~~Mid Rail 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

4.4.1 Inuit Owned Lands Land Access

The Inuit Owned Lands (IOL) surrounding the Project area are shown on Figure 4.2. The Commercial Lease, No. Q13C301, ~~to the Project~~ 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 (Version 3.0, QIA 2013). The QIA guidelines used for this ICRP are summarized in Appendix B. Milne Port and the Mine Site are entirely located on Inuit Owned Land. The first 25 km of the South Railway and access roads are located on Inuit Owned Land. All remaining Project areas are located on Crown land.

Land leases and permits will be amended or additional approvals obtained for the additional land area required for the Phase 2 Project is shown on the mapbook included in the Phase 2 Proposal, Appendix B of TSD 02 (Figure B.4). The final lease requirements will be determined in consultation with the relevant lease holders, and will include details relating to property identification, start and end dates of the lease, related fees, and other pertinent details.

5 PERMANENT CLOSURE AND RECLAMATION

5.1 DEFINITION OF PERMANENT CLOSURE AND RECLAMATION

Permanent closure is defined in the MVLWB 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 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, on going 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;
- Accomodating 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);

- Major project considerations such as the avoidance of winter shipping during operations, the alignment of the North Railway in relation to outpost camps as well as hunting and travelling routes~~,~~;
- Facilitating travel through the Northern Transportation Corridor, including the Tote Road, during mining operations;~~.~~
- Various planned reclamation activities which are not required to establish physical and chemical stability, such as:
  - Scarification to promote natural revegetation,
  - Removal of above-grade buildings, and
  - 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 MCWG to identify feasible options that can be incorporated into future revisions of the ICRP. 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.

5.1.1 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 engagement efforts (e.g. MCWG), site-specific operational knowledge, environmental monitoring programs, progressive reclamation, and reclamation research studies.

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 the ERP on a continual basis within the NIRB annual reporting process which allows for comment by Project stakeholders. 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. 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 9.2). 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 9.2). 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 Waste Rock Stockpile 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 MCWG. This criteria 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. ~~This criteria~~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 9.2). 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.

Table 5.1: Closure Objectives, Criteria and Actions by Major Project Components

Project Component	Closure Objectives	Closure Criteria	Actions/Measurements
Site Wide[2] (continued)	Area facilitates the desired wildlife movement	Completion of an approved Final Grading Plan that has considered input from MCWG. 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 MCWG 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)
	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.
	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 MCWG.	Final inspection by a qualified professional[3] and representative of Designated Inuit Organization.

Table 5.1: Closure Objectives, Criteria and Actions by Major Project Components

Project Component	Closure Objectives	Closure Criteria	Actions/Measurements
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 9.2). The expected level of effort associated with the different mine areas is included in Section 9.2 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 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 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 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).
Waste Rock Stockpile	Physically stable Waste Rock Stockpile and to limit risk of failure that would impact humans and receiving environment[1].	Final Waste Rock Stockpile 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 Waste Rock Stockpile 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
	Chemically stable Waste Rock Stockpile 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. Golder (2018) outlines the current deposition strategy. 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 pit flooding and water quality research studies (Appendix D).

Table 5.1: Closure Objectives, Criteria and Actions by Major Project Components

Project Component	Closure Objectives	Closure Criteria	Actions/Measurements
Infrastructure and Ancillary Areas **Subcomponents:** • **Quarries and Stockpiles** • **Buildings and Equipment** • **Mine Infrastructure (e.g. pads and laydowns, secondary roads, airstrip, crusher)** • **Transportation Routes (Tote Road, North Railway, South Railway, and ~~Ore~~ Docks)** • **Waste Management Areas (e.g. landfarms and landfills)** • **Water Management Areas (water treatment systems, settling ponds, pit dewatering system)** • **Quarries and borrow areas**	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 9.2). The expected level of effort associated with the different mine areas is included in Section 9.2
	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).	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.

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.

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.

5.2 Permanent Closure and Reclamation Requirements

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

- MVLWB/AANDC Guidelines for the Closure and Reclamation of Advanced Mineral Exploration and Mine Sites in the NWT (MVLWB/AANDC, 2013); and
- QIA Abandonment and Reclamation Policy for Inuit Owned Lands (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, Waste Rock Pile, Milne Port Tote Road, and Milne Port Docks. The Milne Port Tote Road and 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 licensed 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, airstrips, and development areas will be re-contoured as required to provide long-term stability and reduce the potential for erosion.
- 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, how they are to be rehabilitated and what options were considered, what uncertainties there are 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 5.1.1 are met. As the Project advances through the detailed design phase, changes to the Project may occur that will alter the Interim Mine Closure and Reclamation Plan. Though changes may occur, at this time it is anticipated that the major components of the Project will remain the same.

5.2.1 Open Pit Mine Workings

5.2.1.1 Project Component Description

Mining commenced on a hill crest outcrop, and will progress until Year 10 to 12 of operation at full production volume (based on a nominal 21.5 Mtpa) 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 mine pit, haul road and waste rock dump is presented in Figure 5.1.

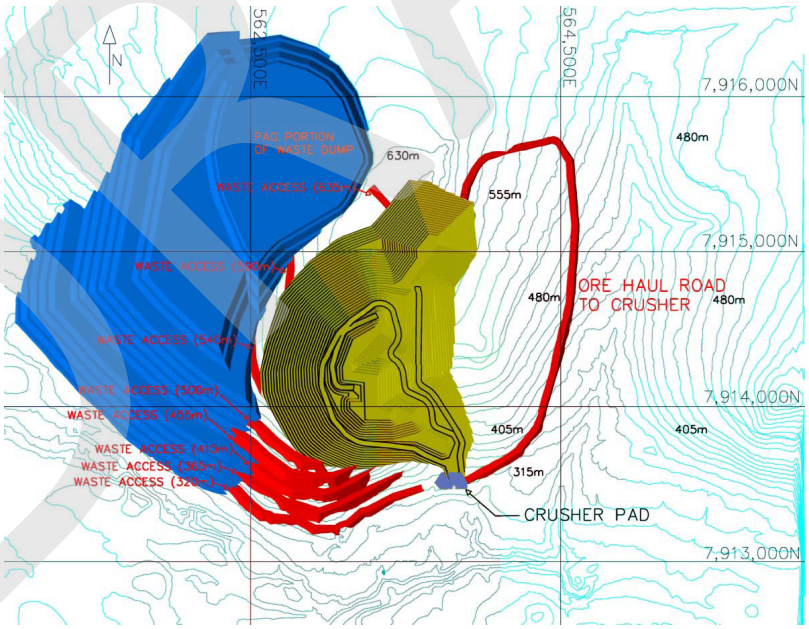

Figure 5.1 General Layout and Development Of Deposit 1 Pit

5.2.1.2 Pre-Disturbance, Existing, and Final Site Conditions

The pre-disturbance site conditions are summarized in Section 3. The current mine workings are free draining and there is no open pit, rather there are the development of benches on the hillside that are largely free draining. Appendix C provides a photolog showing the current mining operations.

The final site condition of the open pit will be a pit lake that drains to the natural environment through the spillway and natural drainage from the southeast corner of the open pit (KP 2008). It ~~is currently~~ is anticipated that the discharge from the open pit will not require treatment (AMEC 2010), although there is some uncertainty in this prediction 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.

5.2.1.3 Closure Objectives and Criteria

The closure objectives are presented in Section 5.1.1 and closure criteria are presented in Table 5.1.

5.2.1.4 Consideration of Closure Options and Selection of Closure Activities

BIML considered two options to address the closure objectives for the Open Pit, including (ensuring the site is physically stable against pit wall slope failure and mitigating the falling risk the void poses to humans and wildlife), including:

- 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). 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. 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 Oceans (DFO) – Protocol for Winter Water Withdrawal from Ice-covered water bodies in the Northwest Territories and Nunavut, 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

Source:

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 a distance of 2 km and 4.7 km respectively, as opposed to Mary Lake which sits at a distance of 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 in order 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 us with 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: the 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.

5.2.1.5 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.) – see Section 9.6;
- Filling the open pit with water, either naturally or by enhanced filling; and
- 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 a number of different potential scenarios for accelerating the pit filling which are presented above in Section 5.2.1.4. These will be further assessed prior to final closure ~~if accelerated filling is deemed required.~~as discussed in Appendix D.

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 the discharge from the open pit will not require treatment (AMEC 2010). However, if treatment is required several effective technologies are currently available to manage metal leaching and/or acid rock drainage (ML/ARD). If ML/ARD were to develop, batch treatments will be carried out to adjust the pH and/or metal concentrations of the water in the pit so that it meets discharge requirements before overflow into the environment. 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.

5.2.1.6 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/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.

5.2.1.7 Uncertainties

As noted in Section 5.2.1.4, there is uncertainty as to the long-term water quality in the open pit. 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 or not there is potential for the generation of ML/ARD from the contact of water with the final pit. 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 5 , BAF-PH1-830-P16-0031) and Section 5.2.1.8, Appendix D of the FEIS.

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 (e.g. Waste Rock Facility effluent monitoring and mitigations). A detailed description of the planned research is presented in Appendix D.

There is uncertainty regarding the infilling rate of the open pit. There are two proposed options for options for pit infilling, natural flooding and enhanced pit filling (which uses pumps from nearby lakes. 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. This concern has been highlighted by stakeholders, and Baffinland will proactively address this issue within the Reclamation Research Plan. A detailed description of the planned research is presented in Appendix D.

5.2.1.8 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 MCRP. The Final MCRP 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 9.2), aquatic monitoring (Section 9.3), Environmental Site Assessment (Section 9.4), fauna and flora monitoring (Section 9.5), and safety compliance inspection (Section 9.7). 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 and its Amendment), AANDC Land Lease 47H/16-1-2, the NWB (as per Type 'A' Water Licence 2AM-MYR-1325 Amendment No. 1) and the Land Owners (as per Commercial Lease Q13C301).

5.2.1.9 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 of the life of the Project as per Type A Water Licence Amendment No. 1 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 probability of ML/ARD, in the event that ongoing water quality modelling or field monitoring shows a trend toward exceedance of discharge requirements, then water treatment options will be determined and implemented. 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 a potential issue 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 at approximately Year 10 of Operations (when an Open Pit is expected to exist associated with the Project). Based results of this research, 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 identifying the need for ongoing monitoring, treatment, and potential mitigations.

5.2.2 Waste Rock and Overburden Piles

5.2.2.1 Project Component Description

A waste rock disposal area designed for permanent storage of waste rock is located north of the open pit. Based on the current mine plan, an estimated 600 Mt of waste rock and 30 Mt of overburden will be generated from the mining of Deposit No. 1.

The Waste Rock Stockpile design has sufficient capacity to stockpile the entire volume of waste produced by the mine plan. As described in Section 3.3.3, 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 PAG, Non-PAG, and Overburden are handled as three separate streams and are placed in zones within the Waste Rock Facility. Figure 5.2 presents the distribution of PAG, non-PAG, and Overburden in the Waste Rock pile. Figure 5.3 presents the progressive development (construction steps) for the Waste Rock Pile.

The deposition strategy for the water rock area 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.
- Waste rock placed within 25 m of the outer edge of the pile should be Non-PAG and be placed during the winter months in lifts of no greater than 2 to 3 m to help advection within the pile.
- A 2 to 3 m 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 within 25 m of the outer edge of the pile, snow and non-frozen material will be removed from the footprint to the extent practical.
- PAG rock should all be placed in the same watershed in the waste rock pile (may be modified in future updates to the Waste Rock Management Plan).
- PAG waste rock placement will be segregated from non-PAG rock placement and the location of PAG material documented.
- 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.
- Haul ramps for the waste stockpile will be similar in design to those within the pit and will be approximately 20 m wide at maximum 10% grades.

The existing disposal area within the LOM WRF footprint is within the western watershed which drains into Camp Lake. For Phase 1, a pond was constructed to the north of the disposal area as well as collection and diversion ditches along the perimeter of the waste rock pile. Water is discharged from the pond 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.

The expanded footprint outlined in the Phase 1 Extension plan is also located in the western watershed up-gradient of the existing WRF and WRF pond. As part of the Phase 1 Extension, the existing WRF pond ~~will~~ has been upgraded to accommodate the additional flows attributed to the footprint expansion. Collection ditches and diversion ditches ~~wil~~are~~l~~ be constructed considering the pile expansion; 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 it's consultants. The most up-to-date details are available in the Interim Waste Rock Manaegment Plan (TSD 28, Appendix I of the Phase 2 Propospal).

Further phased surface water management (ditches and ponds) will be designed as mining progresses. All phases of the run off management system will be designed such that water discharged from the WRF will be in compliance with applicable water quality discharge criteria outlined in the Type A Water Licence and the MDMER.

Surface water collection systems consisting of collection channels, diversion channels and settlement ponds are implemented as part of the waste dump water management system. In addition to sediment control, these collection systems will minimize the introduction of water into the waste dump foundations, where standing water may adversely affect the thermal regime and, therefore, chemical stability. Runoff water quality will be monitored. Discharge from the sedimentation ponds will be channeled to the Camp Lake Tributary (West pond) and to Mary River (East pond). Figure 5.4 presents the drainage features of the Waste Rock Pile.

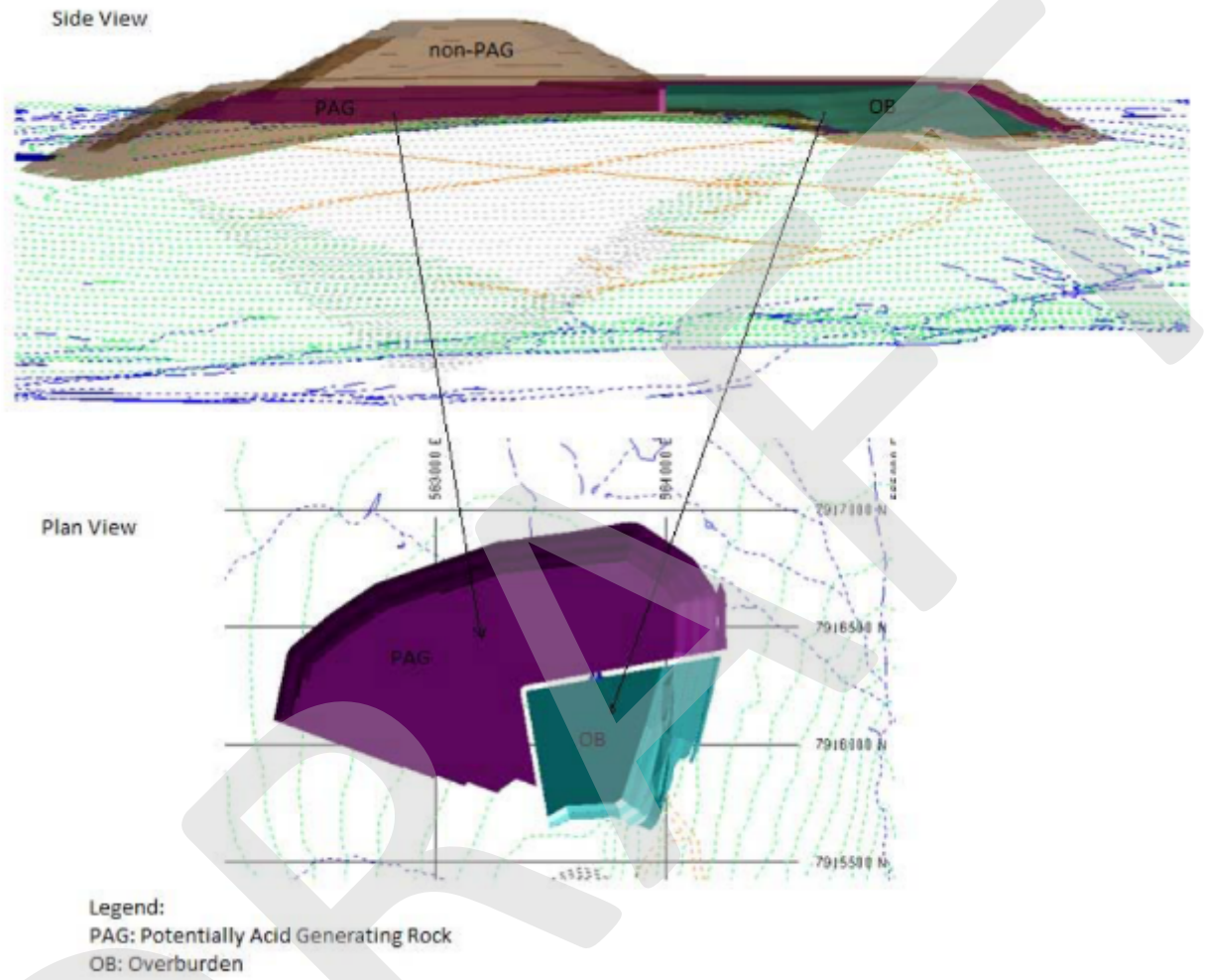

Figure 5.2 Placement of Waste Rock and Overburden

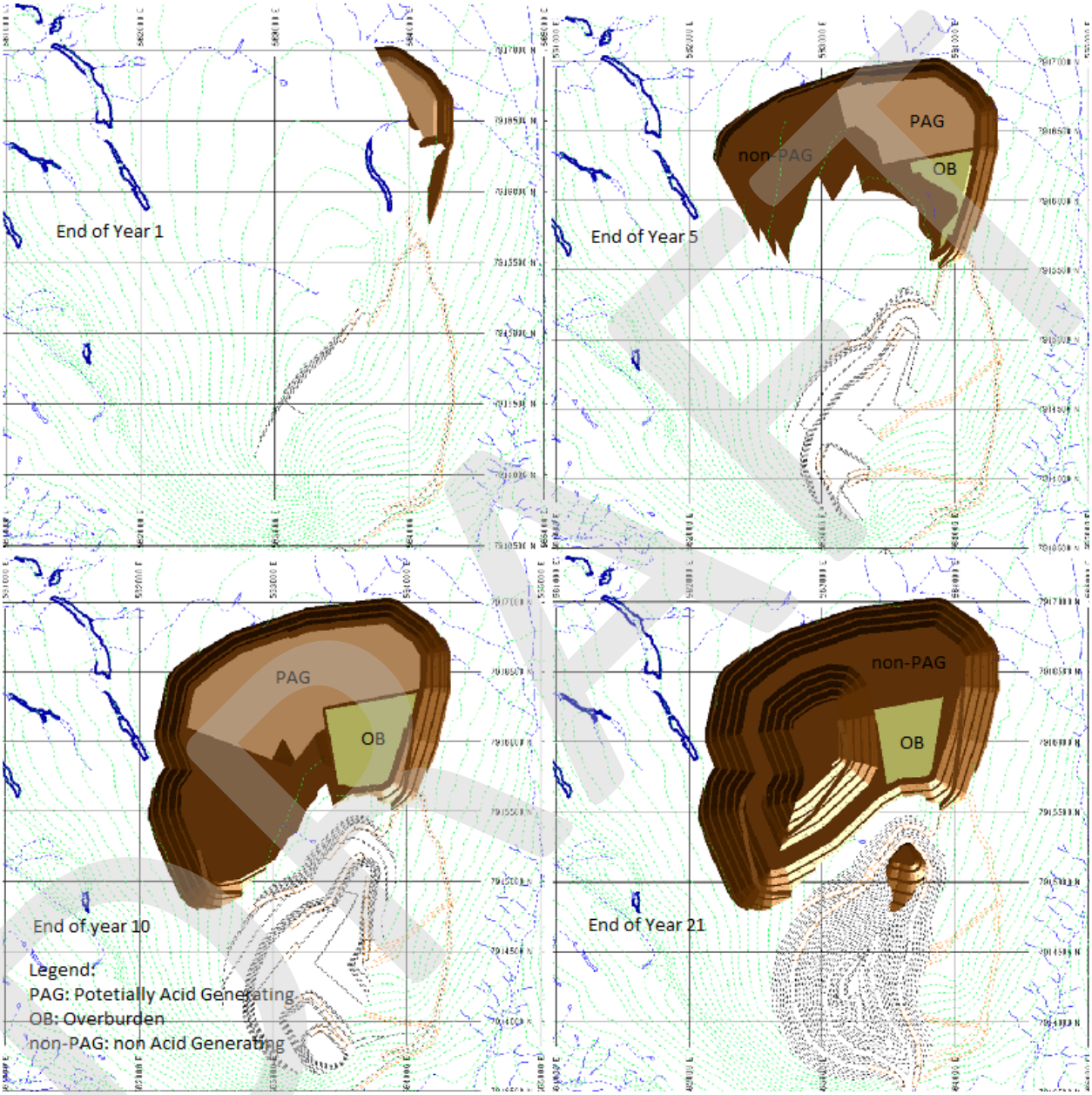

Figure 5.3 Evolution of the Waste Rock Stockpile Over the Life-Of-Mine

Figure 5.4 Water Management Structures for the Waste Rock Storage Area

5.2.2.2 Pre-Disturbance, Existing, and Final Site Conditions

The pre-disturbance site conditions are summarized in Section 3.

Figure 5.5, Figure 5.6 and Figure 5.7 show~~s~~ the ~~summer 2018~~2019 waste rock deposition plan~~, which provides an oblique view of the existing waste rock pile with superimposed deposition locations noted~~ from February through December. In addition, Appendix C provides a photolog showing the current mining operations.

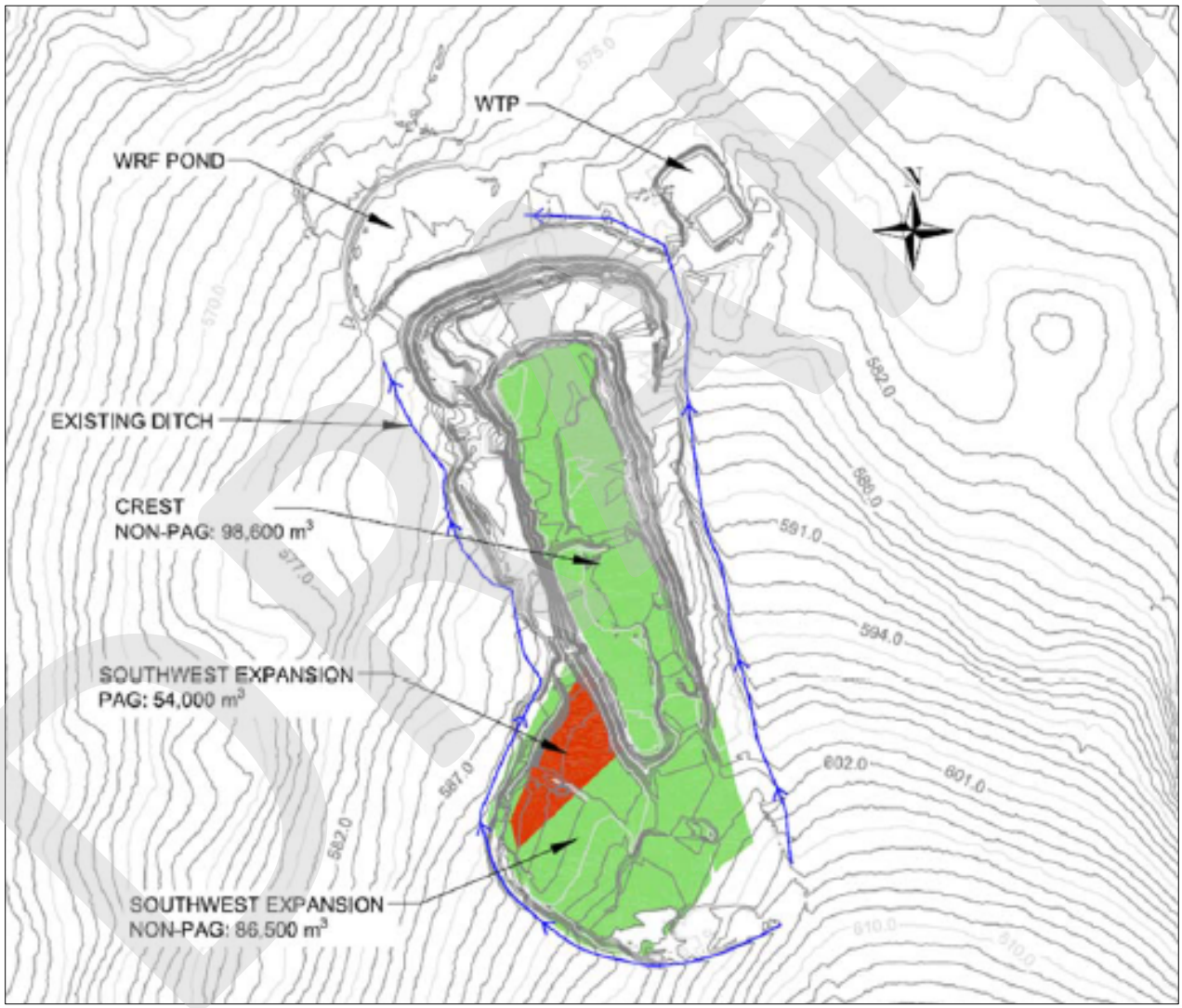

Figure 5.5 Waste Rock ~~Deposition Plan – Summer 2018 – Plan View~~Placement – February 2019 through May 2019

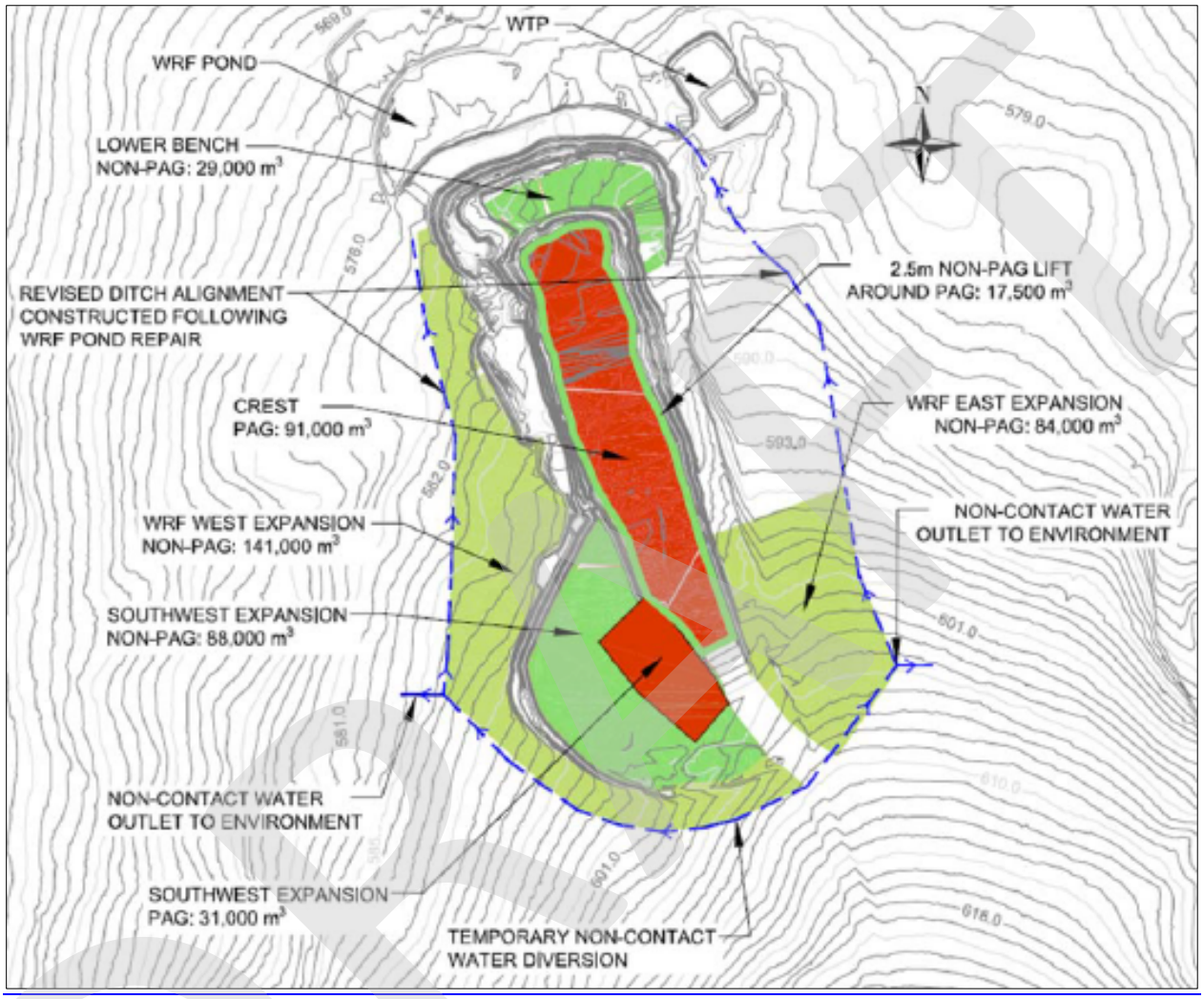

Figure 5.6 Waste Rock Placement – June 2019 through October 2019

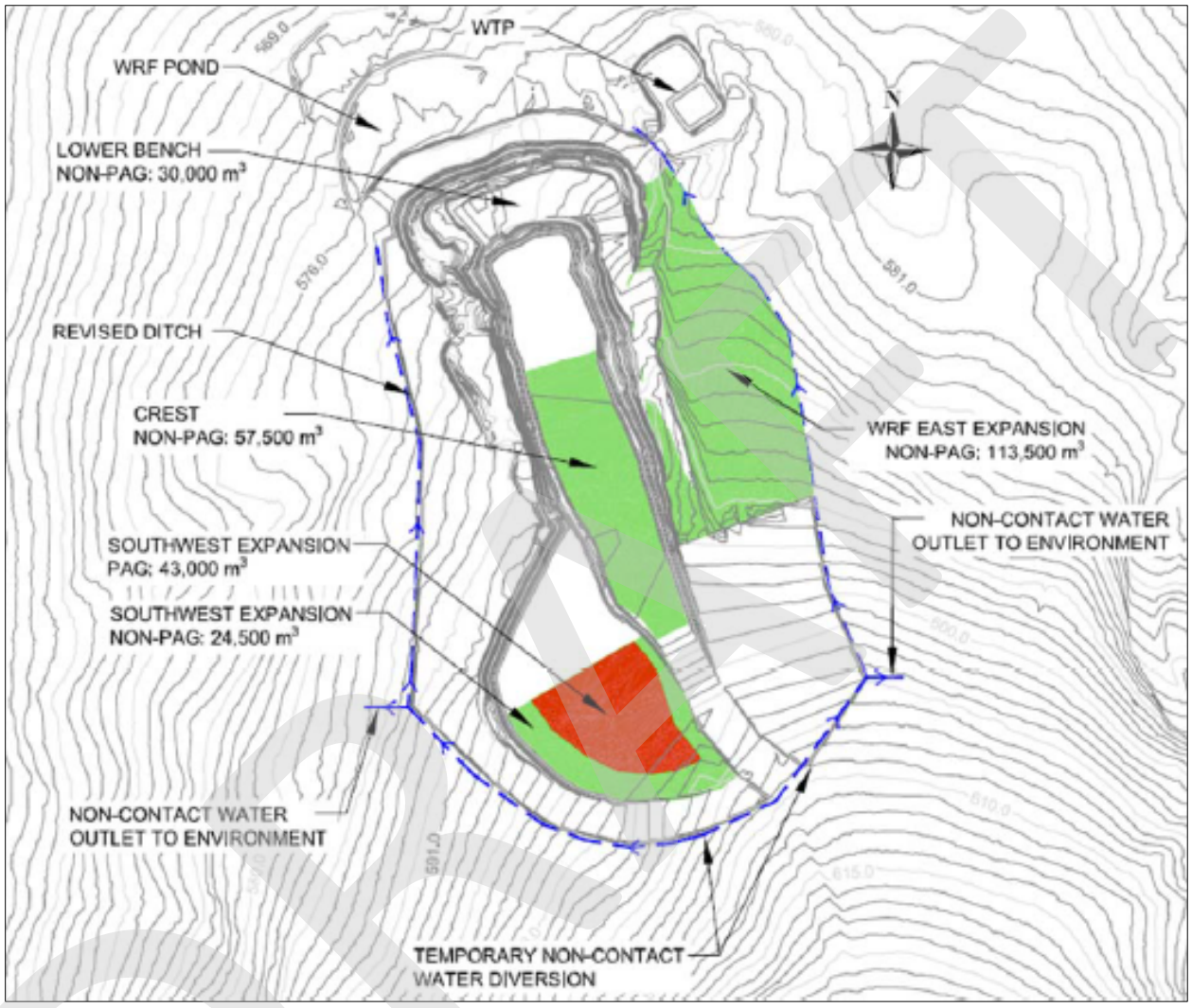

Figure 5.7 Waste Rock Placement – November 2019 through December 2019.

The pH measurements in the effluent dropped below the mine effluent MDMER and Type A Water Licence discharge limits in 2017, possibly due to the unexpected onset of weakly acidic conditions in the WRF. Batch treatment in the pond using sodium carbonate was undertaken in August 2017, and an Interim Waste Rock Management Plan was prepared. A treatment program was also initiated in 2017. As a requirement of the Type A Licence MRY 2AA-1325, ongoing plans for addressing acid runoff from the Waste Rock stockpile were submitted and approved by the NWB in 2018.

A further revised Waste Rock Management Plan is under preparation to address waste rock management over the next five years based on recent waste rock geochemistry and WRF pond monitoringresults (Phase

2 Proposal, TSD-13). No changes to waste rock management are required to undertake the Phase 2 Proposal, and existing predictions for waste rock seepage and runoff quality post closure are considered achievable via the planned reclamation measures (i.e. rock cover overlying PAG materials, establishment of permafrost in waste).

At closure, the Waste Rock Stockpile will remain on site. It will contain approximately 630 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.

5.2.2.3 Closure Objectives and Criteria

The closure objectives are presented in Section 5.1.1 and closure criteria are presented in Table 5.1.

5.2.2.4 Consideration of Closure Options and Selection of Closure Activities

Detailed alternative analysis 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, Permanent Waste Rock Stockpile). 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 plans relevant to the Project to address uncertainties related to final closure.

Relevant closure options at the Waste Rock Stockpile 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 set backs as outlined within approved management plans.

5.2.2.5 Engineering Work Associated with Closure Activity

The main work items for closing the Waste Rock and Overburden Stockpiles are as follows:

- Cleanup of any soil contamination (i.e. hydrocarbons, etc.) – see Section 9.6, if applicable;
- Monitoring and confirming the freezing (permafrost aggradation) of the pile, with the exception for a shallow “active” zone;
- Monitoring the water quality of any seepage emanating from the waste rock stockpile;
- Conducting an engineering stability analysis ((Section 9.2) to confirm the long-term stability of the slopes of the waste rock pile, and recontouring (if necessary) to ensure the slopes are physically stable;
- Grading at associated water management structures (e.g. two Waste Rock Stockpile Ponds, potential temporary dams) to establish final drainage pathways;

- Accumulated sediments at the Waste Rock Stockpile management 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, disposal at approved facility.

Mine planning will ensure that at closure the exterior of the dump consists of a layer of non-PAG material up to 50 m thick. To minimize active layer thickness, a stockpile of overburden will be retained to spread a layer of less permeable material over the top of the dump.

Studies of waste rock in permafrost demonstrate that permafrost forms an effective long-term barrier to water and oxygen, thereby preventing significant oxidation of sulphidic waste rock located below the surficial active zone. The surficial "active" zone, which will be subject to seasonal freeze-thaw, will not reach the 50 m thickness of non-PAG material in the long-term (within 200 years) under the influence of climate change (Intergovernmental Panel on Climate Change, 2007). Therefore, over the long term, runoff water quality which is influenced by contact water that flows through the active layer in the waste rock stockpile will not be affected. Following closure, generation of ML/ARD is not anticipated.

The physical stability of the waste rock stockpile will be investigated at the onset of closure. This investigation will take into account the final geometry of the stockpile, including the aerial extent, height, cross-sections and the volume in place. If geotechnical investigations indicate it necessary, the waste rock stockpile may undergo re-contouring to ensure physical stability. Following re-contouring and stabilization investigations and activities, as required, the waste rock stockpiles 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 waste rock stockpile is considered environmentally compatible with the current undisturbed surrounding areas.

Runoff from the Waste Rock Stockpile 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 Waste Rock Stockpile ponds will be decommissioned, and runoff will be allowed to discharge directly to the environment.

5.2.2.6 Predicted Residual Effects

The predicted residual effects at planned closure, including those encompassing the waste rock pile, 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~~in~~ the Mine Site LSA are not expected post-closure.

As reported in the Interim Waste Rock Stockpile Seepage Quality model (Appendix 4, BAF-PH1830-P16-0031), predictions indicate that the concentrations of arsenic, copper, lead, nickel, and zinc concentrations in the waste rock stockpile 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, waste rock stockpile configuration, water balance and geochemical data. Changes to these assumptions may result in differing water quality;
- A number of assumptions made to develop the model (permafrost extent, stockpile hydrology, acid drainage source terms, etc.) that should be updated where 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 Project waste rock; and
- 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 waste rock stockpile via the east and west ponds 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 as a result 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 Waste Rock Stockpile 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, ~~used~~ and as the basis for revising the prediction of residual effects, or implementing adaptive management.

5.2.2.7 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 the waste rock pile will aggrade of permafrost and the thickness of the active layer (layer that will be unfrozen during the warmer months of the year).

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).

Reclamation research programs (Appendix D) have been designed to improve understanding of the expected performance of the waste rock pile closure concept with respect to both drainage water quality as well as with respect to permafrost aggradation through operation and closure.

5.2.2.8 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 and its Amendment), AANDC Land Lease 47H/16-1-2, the NWB (as per Type 'A' Water Licence 2AM-MYR-1325 Amendment No. 1) and the Land Owners (as per Commercial Lease Q13C301).

5.2.2.9 CONTINGENCIES

5.2.2.9.1 WASTE ROCK STOCKPILE RUNOFF WATER QUALITY

In the event that research, ongoing water quality modelling, or field monitoring shows a trend toward exceedance of discharge requirements, then water treatment options will be determined and implemented.

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

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) as they are developed and will be incorporated into future versions of the ICRP as appropriate.

5.2.3 Quarries and Ore/Aggregate Stockpiles

5.2.3.1 Project Component Description

This project component includes:

- Mine Site:
  - Quarry D1Q1
  - Quarry D1Q2
  - Quarry QMR2
  - KM 97 Borrow Locations
  - Ore Stockpile
  - ROM Stockpile
- Tote Road:

- Extended cuts in bedrock along road corridor

- North Railway
  - Extended cuts in bedrock along rail embankment
  - Multiple quarries proposed (up to 30)
  - T~~t~~emporary ore transfer area (including 12,000 t stockpile)
- Milne Port:
  - MP-Q1-01
  - MP-Q1-02
  - Borrow Source No. 1
  - Quarry No. 1
  - Ore Stockpiles

The Run of Mine (ROM) stockpile is a small stockpile which is used to temporarily store mined ore prior to feeding it to the primary crusher. Ore is then either crushed to a fine ore product, or left as lump ore. The ore (fine and lump) is moved to the mine site Ore Stockpile ~~is~~ used to temporarily store ore that is ready to haul to Milne Port. As part of Phase 2, secondary crushing of ore is to move to Milne Port, housed in a building. ~~Once the ore reaches~~At 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.

5.2.3.2 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.

Each existing quarry permit application presents a quarry development plan, drainage information as well as a closure plan. All borrow areas and quarries will be progressively reclaimed maintaining stable side slopes in accordance with the individual site permit. 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. Quarries associated with the Phase 2 Proposal will be managed and reclaimed consistent with existing sites.

The ore/aggregate stockpiles will be depleted upon closure. Soils below the stockpiles will be sent for testing and treatment, if required, as discussed in Section 9.4. The ore/aggregate stockpile bases will be re-contoured as necessary, scarified, and allowed to naturally re-vegetate. 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 ~~excess clean fill is available in a nearby area~~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.

5.2.3.3 Closure Objectives and Criteria

The closure objectives are presented in Section 5.1.1 and closure criteria are presented in Table 5.1

5.2.3.4 Consideration of Closure Options and Selection of Closure Activities

Detailed alternative analysis 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, Permanent Waste Rock Stockpile). 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 plans 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.

5.2.3.5 Engineering Work Associated with Closure Activity

Quarries and borrow pits will no longer be needed at closure. 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 floor will be left as free draining.

All site waste will be collected and placed in appropriate containers for removal. Pre and post waste removal inspections will be made to ensure the thoroughness of the program. Waste will include metallic waste, construction material waste and domestic waste.

At the current time, no washroom facilities for personnel are expected at the quarry site. Any requirement for such facilities will be met by easily removable portable toilets. These will be operated in a manner consistent with regulations, and disposal will be in accordance with Baffinland's Waste Management Plan (BAF-PH1-830-P16-0028).

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

- Large rock will be spread out on the landscape or used as rip-rap 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
- Any collected soils will be spread to allow for the re-establishment of vegetation. No vegetation planting or seeding operations will take be undertaken and natural re-vegetation will be allowed to take place

Quarry access roads will typically be relatively short aggregate structures. The entire road bed will be removed to re-establish desired drainage.

A pre-closure inspection for potentially impacted soils will be completed at the entire site. Any contaminated soils, snow or ice packs, or overburden will be flagged. The extent of the contamination will be assessed, and the material removed for treatment at a site-landfarm or containerized for shipment to a licenced off-site facility.

Other contamination, such as heavy metals or toxins, will require containerization for shipment off site to an appropriate facility (refer to Interim Closure and Reclamation Plan).

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.

At the end of mining, ore and aggregate stockpiles will have all been used up. The former stockpile areas will be recontoured to match the surrounding terrain (where possible), and scarified to promote natural revegetation and allow vegetation to re-establish through natural processes. The secondary crusher and surrounding building at Milne Port will be decommissioned and demobilized from site consistent with other buildings and equipment (Section 5.2.4).

5.2.3.6 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 and Phase 2 Proposal with respect to VEC/VSEC. These effects, and the methods for their assessment are summarized in Appendix G.

Of the thirty-six (36) planned quarries to be used to construct the North Railway and other Phase 2 Proposal infrastructure, twenty-four (24) are located in sedimentary rocks (limestone or sandstone), both of which have a high buffering capacity, and present no Acid Rock Drainage (ARD) risk (Hatch~~)~~, 2018; AMEC, 2010). The remaining nine (9) quarries are located in granitic gneiss or diorite, both of which have a low sulphide content, making them unlikely candidates for producing ARD (AMEC, 2010). However, these rock types also have a low neutralization potential, which means that they could produce ARD if the neutralizing materials within them are insufficiently reactive, or depleted at a faster rate than the sulphides. Overall, the ARD potential of the granitic rocks has been assessed to be low (AMEC, 2010; Hatch, 2017).

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.

5.2.3.7 UNCERTAINTIES

Uncertainties related to the closure of quarries include whether or not 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)~~., and T~~there ~~may be~~is uncertainty in what level of revegetation success at these areas can be expected, and this topic is addressed in a reclamation research program (Appendix D).

5.2.3.8 POST CLOSURE MONITORING, MAINTENANCE AND REPORTING

Post-closure monitoring of quarries and ore/aggregate stockpiles includes geotechnical/engineering monitoring (Section 9.4), aquatic monitoring (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 and its Amendment), AANDC Land Lease 47H/16-1-2, the NWB (as per Type 'A' Water Licence 2AM-MYR-1325 Amendment No. 1) and the Land Owners (as per Commercial Lease Q13C301).

5.2.3.9 CONTINGENCIES

Ongoing monitoring at quarries and rock cuts throughout the mine's operation will identify the need to update reclamation plans and assess contingencies. Geochemical evaluations to date suggest that the potential for ARD/ML is low, and quarrying operations to date have not resulted in significant effects to water quality (Phase 2 Proposal, TSD 13).

Contingencies related to the revegetation efforts 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, Permanent Waste Rock Stockpile). As data are collected and analysis is conducted, the ICRP will be updated as required.

5.2.4 Buildings and Equipment

5.2.4.1 Project Component Description

To the extent possible, buildings have been consolidated to hold accommodation, administration, maintenance and laboratory complexes to reduce outside travel of in-building workers. The accommodation buildings consist of a prefabricated modular unit 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 5.2.5 for mining infrastructure, including associated buildings.

Haul trucks equipped with side dump trailers dump directly on the ground. Front end loaders are used to transport the dumped ore to portable feeders, which transfer the ore to telescopic portable radial stackers, which in turn deposit the ore in the stockpiles. 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 an onboard diesel generator.

5.2.4.2 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 mining operations.

Upon Final Mine Closure, buildings and infrastructure will be decommissioned and no longer be features on site. Associated pads and laydown areas will be re-graded to restore natural drainage patterns where possible, and scarified to allow for natural re-vegetation at closure.

5.2.4.3 Closure Objectives and Criteria

The closure objectives are presented in Section 5.1.1 and closure criteria are presented in Table 5.1.

5.2.4.4 Consideration of Closure Options and Selection of Closure Activities

Detailed alternative analysis 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, Permanent Waste Rock Stockpile). 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 plans relevant to the Project to address uncertainties related to final closure.

5.2.4.5 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, buildings at the Mine Site, Tote Road, and Milne Port will be removed.

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.

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;
- Demolish buildings and haul away the refuse;
- 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 to allow for water infiltration; and
  - 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; and
- Scarify the ground surface around the buildings to support natural revegetation.

Refuse from the demolished buildings and Milne Port will be removed and either:

- Transported to Milne 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

5.2.4.6 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.

5.2.4.7 Uncertainties

Uncertainties related to buildings and equipment are limited to whether or not any such facilities will be left in place, and whether or not any associated contaminated soils may be present upon closure ((Section 9.5). There may be uncertainty in revegetation success, addressed in a reclamation research program (Appendix D).

5.2.4.8 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 and its Amendment), AANDC Land Lease 47H/16-1-2, the NWB (as per Type 'A' Water Licence 2AM-MYR-1325 Amendment No. 1) and the Land Owners (as per Commercial Lease Q13C301).

5.2.4.9 Contingencies

The need for contingencies for the reclamation of buildings and equipment 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 ~~Mine Closure Working Group~~MCWG.

5.2.5 Mining Infrastructure

5.2.5.1 Project Component Description

Mining Infrastructure ~~is~~ comprise~~sd of~~ the following main elements:

- Mine Site
  - Camp Pads
  - Laydowns
  - Air Strip
  - Site Roads
  - Water crossings
  - Conduit berms
  - Utilidor/corridor
  - Crushing plant (primary jaw crusher and secondary cone crusher and primary and secondary screens)
- Milne Port
  - Camp Pads

- Laydowns
- ~~Freight Docks~~
- Site Roads
- Water crossings
- Conduit berms
- Crushing building
- Conveyors

- Tote Road
  - Laydown Areas
- North Railway
  - Temporary Ore Transfer Area
  - Laydown Areas

Two mobile, self-contained crushing units are used for primary and secondary ore crushing and screening at the Mine Site. The Phase 2 Proposal includes transferring secondary ore crushing equipment to Milne Port within an enclosed building. This is expected to reduce dust generation at the Mine Site. This equipment 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.

During the shipping season, ore from the lump ore stockpile will be reclaimed using the travelling (rail-mounted) stacker/reclaimer which will load the ore onto the stacking/reclaim conveyor. Reclaimed ore will then be transferred onto a shiploader feed conveyor for transport to the shiploader. Weigh scales and

product samplers will be installed on the conveyors to facilitate inventory recording and quality control sampling.

Ore from the fines stockpile will be loaded onto the shiploader as is currently undertaken.

The shiploader is the conveyance system used to fill the holds of vessels with the ore, and has a capacity of 6,000 t/h.This shiploader will continue to be used to fill Panamax and Supermax size vessels at the existing ore dock. A second shiploader will be constructed to fill vessels berthing at the new capesize dock with ore from the lump ore stockpile. A bucket wheel reclaimer will be used to reclaim ore from the stockpile and feed the shiploader. The second shiploader will be a dual linear luffing shiploader with a capacity of 16,000 t/h. This type of shiploader has the advantage of full luffing capability, which reduces drop heights and therefore reduces product degradation and dust emissions.

Until railway infrastructure is commissioned, the iron ore haul trucks will continue to dump coarse ore on a stockpile adjacent to the crusher building. This ore will be reclaimed by front end loaders and fed to the crushing plant. Long-haul trucks dump ore (either lump or fines) into small stockpiles, and mobile radial stackers are used to transfer the ore into the appropriate (lump or fines) stockpile.

Ore arriving to Milne Port by truck from the Mine Site has already been crushed and screened into lump ore and fine ore products, as follows:

- Lump ore - 31.5 mm to 6.3 mm in size; and
- Fine ore - less than 6.3 mm in size

The Phase 2 Proposal includes the following changes to how ore is crushed and stockpiled at Milne Port:

- Secondary ore crushing and screening operations will be located at Milne Port (previously located at the Mine Site);
- The crushing and screening plants will be located indoors (the crushing and ~~t~~screening plant at the Mine is currently outdoors);
- Rail will deliver ore;
- Product stockpile sizes will increase in accordance with the increased quantity of ore being loaded onto ships; and
- Fine ore will be loaded into vessels at the existing ore dock only; lump ore will be loaded into vessels berthing at the new capesize ore dock.

The crushing and screening plants will consist of large cone crushers fed from large vibrating screens, which will produce the lump and fine ore products to the same specifications as the crushing and screening operation at the Mine Site.

Placement of the crushers and screens indoors will substantially reduce dust emissions and lower noise levels. Dust collectors will be installed at ore screening and crusher transfer points. A transfer conveyor will deliver lump and fine ore from the crushing and screening plant to a stacker/reclaimer at the lump ore stockpile, and to the mobile radial stackers at the stockpile.

New catchment areas or ponds will be built as required to contain runoff from the expanded stockpile (Section 5.2.8).

~~Due to the short and variable shipping season (60 – 90 days/season) the Milne Port stockpiles hold the full year's production (up to 3.2 Mt). The two lump stockpiles contain up to 1,200,000 tonnes; the fines stockpiles hold up to 400,000 tonnes. The longitudinal piles are located adjacent to each other in two rows with each row separated into two piles. The stockpile is located close to the ore dock.~~

~~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~~A temporary ore transfer area will be constructed at KM 57 and used for 1-2 years following the construction of the northern section of the North Railway to transfer ore transported by truck along the Tote Road to rail cars while the southern section of the North Railway is completed. Once the North Railway is completed, the temporary ore transfer area will be reclaimed.

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.

5.2.5.2 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.

Relative to pre-development conditions at Milne Port, the remnants of infrastructure including buildings will be removed and laydown areas re-graded to restore natural drainage patterns where possible, and

scarified to allow for natural re-vegetation at closure. Milne Port ore dock will remain in place to provide ongoing fish habitat. The water crossings along the Milne Inlet Tote Road will be removed.

The causeway and docks at Milne Port will be left in place. Dock infrastructure at Milne Port will be removed and either recycled, shipped offsite to an appropriate facility for disposal, or deposited within onsite landfill, the open pit or other approved repositories.

The lighting associated with the airstrips will be removed. The airstrips will be re-graded and reclaimed unless otherwise directed by regulatory agencies or the Land Owner to provide emergency/rescue landing spots for regional aircraft, when no other options are available.

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.

The airstrips at the Mine Site and Milne Port will be removed unless otherwise directed by regulatory agencies, Land Owner, or the ~~Mine Closure Working Group~~MCWG to remain in place and left in operating condition. Abandoned airstrips may provide emergency landing locations for regional aircraft or helicopters, when other options are unavailable.

5.2.5.3 Closure Objectives and Criteria

The closure objectives are presented in Section 5.1.1 and closure criteria are presented in Tabel 5.1

5.2.5.4 Consideration of Closure Options and Selection of Closure Activities

Detailed alternative analysis 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, Permanent Waste Rock Stockpile).

Baffinland has committed to the establishment of a “Mine Closure Working Group” (MCWG) in order to best incorporate considerations for post-closure land use of the Project site. The role of th~~is~~e ~~Mine Closure Working Group~~MCWG will be to 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. Several infrastructure components may be of use to the local communities, including the Milne Port ore dock, airstrips at Milne Port, the Mine Site, and at Steensby Port.

5.2.5.5 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 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; and
    - 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; and
- Scarify the ground surface around the buildings to support natural revegetation.

Refuse from the mine infrastructure will be removed and either:

- Transported to Milne 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

5.2.5.6 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.

5.2.5.7 Uncertainties

Uncertainties related to mining infrastructure are limited to whether or not any such facilities will be left in place, and whether or not any associated contaminated soils may be present upon closure ((Section 9.5). There may also be uncertainty in revegetation success, addressed in a reclamation research program (Appendix D).

5.2.5.8 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 and its Amendment), AANDC Land Lease 47H/16-1-2, the NWB (as per Type 'A' Water Licence 2AM-MYR-1325 Amendment No. 1) and the Land Owners (as per Commercial Lease Q13C301).

5.2.5.9 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 ~~Mine Closure Working Group~~MCWG.

5.2.6 Transportation Routes

5.2.6.1 Project Component Description

Transportation routes on site include the Mine Haul Road, Tote Road and the Ore/Freight -Docks 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. Phase 2 includes the construction and operation of the North Railway to Milne Port, and a second ore dock at Milne Port.

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 and was constructed based on the following design criteria:

- Width three times the width of haul trucks (20 m)
- Design speed: 50 km/h

- Maximum gradient: 10 %
- Runaway lanes as required

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 of Granular A, 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. Kilometer marking "0" begins at the ore stockpile located approximately 2.5 km from the Milne Port ore dock. The Tote Road ends at kilometer marking "98.5" at the Mine Site ore crushing and loading pad. 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 km 17, km 62, km 80 and km 97 along the Tote Road between Milne Port and the Mary River Mine Site. These bridges are single lane sized to meet the Nunavut *Mine Health and Safety Act* requirements for the design vehicles' widths. The bridge span was designed to meet the water's design volume and flow rate. The deck height was designed to meet the requirements of the *Navigable Waters Protection Act* (NWPA) by Transport Canada.

Additional dust suppression water sources along the Northern Transportation Corridor are proposed as part of the the Phase 2 Proposal. Baffinland proposes to increase the volumes at three already approved sources, and thirteen new water sources have been identified. An assessment of the new and revised water sources is presented in TSD 13 of the Phase 2 Proposal. All water intakes will be equipped with fish screens in accordance to DFO's fish screen guideline (DFO,1995).

The North Railway will be 110 km in length from the loading station at the Mine Site to the unloading station at Milne Port. For most of the length, the railway embankment will be constructed adjacent to the Tote Road. However, due to various constraints (e.g., topography), an approximately- 20 km section of the railway will deviate from the Tote Road alignment, between KP 57 and KP 84.5, located on IOL land. The railway design is similar to that of the South Railway proposed in the FEIS, and further information is available in Section 4.1.2.2 of the Phase 2 Proposal.

There is one ore dock currently operating at Milne Port, capable of berthing panamax ore carriers. A second ore dock capable of berthing capesize ore carriers is proposed as part of Phase 2. The orientation of the second dock is optimized to allow a clear approach for vessels parallel to the berth face and clearing the existing dock. The dock construction methodology is described in TSD 02 (Section 4.2 and Appendix F)

of the Phase 2 Proposal. The freight dock was authorized under Project Certificate No. 005 Amendment 2, and is planned for construction in 2019.

5.2.6.2 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.

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. This road is part of the Inuit-Owned Lands referenced in the Nunavut Land Claims 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 Land Owner although the removal cost of the bridge spans 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. For example, bridge abutments at the Mary River crossing are within the river and will need to be removed to restore the stream bed and banks as described below. Ongoing engagement with communities and discussions with QIA will occur to confirm an approach for the Tote Road and water crossings such that an acceptable level of liability exists for transfer of these remaining structures. Similarly, the Milne Port ore and freight docks will remain in place to provide ongoing fish habitat and will potentially be utilized for local community use following closure.

5.2.6.3 Closure Objectives and Criteria

The closure objectives are presented in Section 5.1.1 and closure criteria are presented in Table 5.1.

5.2.6.4 Consideration of Closure Options and Selection of Closure Activities

Detailed alternative analysis 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, Permanent Waste Rock Stockpile).

Baffinland has committed to the establishment of a "Mine Closure Working Group" (MCWG) in order to best incorporate considerations for post-closure land use of the Project site. The role of th~~is~~ ~~Mine Closure Working Group~~MCWG will be to 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. Several infrastructure components may be of use to the local communities, including the Tote Road and water crossings, Milne Port ore dock, airstrips at Milne Port, the Mine Site, and at Steensby Port.

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.

5.2.6.5 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, North Railway and Milne Port will be removed.

Closure of transportation infrastructure will involve the following works:

- Water crossings, including bridges, along the Tote Road and North Railway may be left in place at the land owner's request. 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.
- 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 land owner (CIRNAC).
- Remove road/rail embankment fill from within the high water limits of the water body. Water crossing may remain in place based on discussions with the land owner at the time of final closure, however the assumption is that they will need to be removed. A typical water crossing restoration is provided in Figure 5-8.
- 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. 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 and QIA.
- ~~Cleanup of any soil contamination (i.e. hydrocarbons, etc.) – see Section 9.6~~

~~In the even construction the southern rail route to Steensby Port is constructed, the following closure activities have been assumed in mine planning and environmental impact predictions:~~

- Environmental site assessments at road and/or railroad maintenance and fueling facilities where impacts are expected.
- Cleanup of any soil contamination (i.e. hydrocarbons, etc.) – see Section 9.6
- Geochemical sampling of ballast materials to understand potential ML/ARD concerns.
- Removal of ore spillage into the ballast from movement of trains.
- Ballast cleaning and disposal of recovered fines.

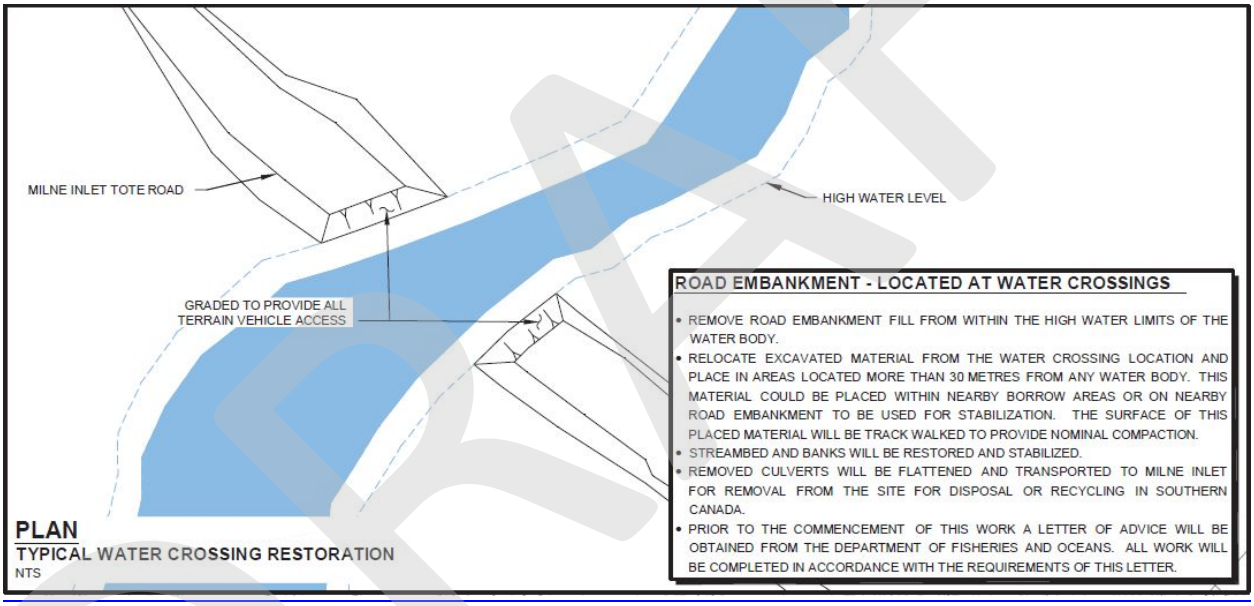

Figure 5.8 Typical Water Crossing Restoration along Tote Road.

5.2.6.6 Tie Replacement and Disposal of Used Ties. 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.

5.2.6.7 Uncertainties

Uncertainties related to the transportation routes may include which infrastructure may be left in place and whether or not any associated contaminated soils may be present upon closure (Section 9.6). There may also be uncertainty in revegetation success, addressed in a reclamation research program (Appendix D).

5.2.6.8 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 and its Amendment), AANDC Land Lease 47H/16-1-2, the NWB (as per Type 'A' Water Licence 2AM-MYR-1325 Amendment No. 1) and the Land Owners (as per Commercial Lease Q13C301).

5.2.6.9 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 ~~Mine Closure Working Group~~MCWG.

5.2.7 Waste, Landfills and other Disposal Areas

5.2.7.1 Project Component Description

This mine closure component includes:

- Milne Port
  - Landfarm
  - Landfill
  - Contaminated snow containment area
  - Non-hazardous waste disposal locations
- Mine Site
  - Landfill
  - Non-Hazardous Waste Disposal Locations
- Milne Port and Mine Site disposal of fuel and hazardous materials, including:
  - Fuel Tank Farm and Fuel Dispensing Facilities (Arctic Diesel, Jet–A Fuel)
  - Hazardous Material Storage Areas

- Waste Management Facilities Including Temporary Storage Areas
- Hazardous Waste and Hazardous Chemicals
- Fuel
- Explosives Storage

Landfarm and Contaminated Snow Containment Area

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 removed from the old bulk fuel bladder farm during decommissioning, and for storage of contaminated soils during continuing mining operations. This remediation occurs through volatilization and natural biological processes. The contaminated snow containment area was constructed as a storage location for contaminated snow removed from the tank farm's berm containment areas and subsequent snow contaminated during mine operations. The landfarm containment area grade slopes towards the sump in the southwest corner to facilitate draining of the soil material.

The design basis for the landfarm containment area water capacity is 3,383 m^3 with 0.3 m of design freeboard. The design basis for the contaminated snow containment area water capacity storage is 929 m^3 with 0.3 m of design freeboard.

The landfarm and contaminated snow containment has been constructed as primarily rectangular in shape to optimize the earthworks materials (granular fills and liner installation). The berms have side slopes not steeper than 2H:1V and a 1.0 m wide horizontal liner length for appropriate liner anchoring in the outer berm. Access to the landfarm package is from the old Tote Road just north of the Q1 quarry site to the south side. The access road contains a 500 mm diameter culvert crossing over a seasonal drainage that is not fish habitat.

The landfarm package was constructed using raised earthworks. All earth fill materials used during construction were compacted during above-freezing summer temperatures to achieve the design compaction required. Both the soil containment and the snow containment compartments were sealed with HDPE liner material for storage of the runoff/seepage, and covered with a layer of fill material. Trucks deposit contaminated soils and snow inside each compartment by driving inside the appropriate area and dumping into the surface gravels as called for in the design.

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 package was designed for marine loading/offloading, tank truck loading/offloading, vehicle fueling, and genset fuel feed at the port facility. The tank farm includes:

- Three (3) 12 ML arctic diesel field-fabricated tanks with tag numbers 2613-TK-004, 2613-TK-005, and 2613-TK-006, and two (2) 5 ML arctic diesel field-fabricated tank with tag number 2613-TK-001 and 2613-TK-002
- Three (3) 0.75 ML Jet-A1 fuel pre-fabricated tanks with tag numbers 2614-TK-007, 2614-TK-008, and 2614-TK-009

These tanks are all vertical single wall steel construction, designed to API 650, located within an earth dyke with synthetic liner. The secondary containment dyke is designed to the requirements of the National Fire Code of Canada. The tank farm includes space for two extra tank pads for future expansion of one additional 0.75ML Jet-A1 tank (2614-TK-010) and one additional ~~12~~ 15 ML arctic diesel tank (2613-TK-003), proposed as part of Phase 2. 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 package 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 in order to meet the water licence discharge criteria. The liner is buried 450 mm below the floor of the dyke.

The facility was designed and constructed to the following codes and standards:

- Tank construction will adopt the API 650 12th Edition, 2013, Welded Steel tanks for Oil Storage
- Tank inspection, repair, alteration and reconstruction will use API 653 4th Edition, 2009; including Addendums 1 and 2
- National Building Code of Canada 2010
- National Fire Code of Canada 2010
- NFPA 30, 2012 Edition, Flammable and Combustible Liquids Code
- CCME Environmental Code of Practice for Aboveground Storage Tank Systems containing Petroleum Products, 2003
- ANSI B31.3-2012, Process Piping
- CSA W47.1-09, Certification of Companies for Fusion Welding of Steel
- CSA W59-03 (R2008) – Welded Steel Construction (Metal Arc Welding)
- *Canadian Environmental Protection Act* 1999 (2008 Update)
- Storage Tank System for Petroleum Products and Allied Petroleum Products Regulations
- CSA W178.2-08, Certification of Welding Inspectors

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 includes four (4) arctic diesel pre-fabricated storage tanks with tag numbers 4613-TK-001, 4613-TK-002, 4613-TK-003, and 4613-TK-004. These tanks are 0.5 ML each, 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 was constructed as 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.

The Approved Project includes an additional 15 ML of Arctic diesel storage at the Mine site, and the Phase 2 Proposal would increase that by an additional 30 ML.

Solid Waste Management Infrastructure

Solid waste management infrastructure includes the incinerators, waste management buildings, and the hazardous waste containment areas. The incinerator is used to dispose of applicable 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 hazardous waste containment areas are lined containment cells used to store hazardous waste/contaminated material in support the Project's site drainage monitoring strategy. The incinerator equipment is modular and operates within three sea containers attached to the rear of the waste management buildings. Residual ash from the incinerators are sent to the project's landfill for disposal.

Each of the three 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.

The hazardous waste containment areas have been constructed rectangular in shape to optimize the earthworks materials (granular fills and liner installation). The berms have side slopes not steeper than

1.5H:1V and a 1.0 m wide horizontal liner length for appropriate liner anchoring in the outer berm. The containment area has a 4% grade access ramp on the west side and a drainage pond on the east side.

The waste management building pad and the hazardous waste containment areas have all been constructed using raised earthworks. The pre-cast concrete block foundation arrangement in the waste management building and poured concrete floor with sumps in each half of the building serves as effluent containment. The hazardous waste containment areas have been sealed with liner material for storage of the runoff/seepage or spills, and been covered with a layer of fill material.

LANDFILLS

The Project's landfill at the Mine site has been designed 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 proper hazardous waste disposal to a licensed facility off site.

The area method is used for waste disposal wherein a low height berm will be constructed along two sides of the landfill site and then waste will be disposed of against the berms and directly onto the ground downstream of the berms. Sand and gravel will be used as the cover material. In order to achieve permafrost encapsulation in the landfill site, the final cover will be thicker than the active layer. No fencing will be required as the inert waste should not attract wildlife, and public access to the area is restricted. Because of permafrost in the area, no groundwater protection system is included. In addition, 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.

The Milne Port landfill will be constructed inside the boundaries of the exhausted Quarry Q1 following construction. The area method will be used for waste disposal wherein a low height berm will be constructed along up to two sides of the landfill site (or using a quarry face) and then waste will be disposed of against the berms and directly onto the ground downstream of the berms. Sand and gravel will be used as the cover material. To achieve permafrost encapsulation in the landfill site, the final cover will be thicker than the active layer. Appropriate surface water, erosion and sediment control measures will be implemented during operations. The landfill is not expected to significantly change the quality of surface waters in the area due to the inert nature of the waste and small landfill footprint.

EXPLOSIVES FACILITY

The explosives facility package includes the explosives plant building (i.e., the emulsion plant) and the explosives shop (storage for raw materials). These facilities were designed for modular installation in arctic conditions. In support of the overall Mary River project development the use of explosives is required to produce construction aggregate and to facilitate mining activities. The facility's purpose is to manufacture

and store the explosives and materials required to facilitate this objective and to minimize potential environmental impacts, specifically for water quality and wildlife during the period where blasting operations are conducted. The design premise for these facilities is based on achieving a zero- effluent process. Contaminated waste water generated from the manufacturing operations are 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 licensed and approved by Natural Resources Canada (NRCan) – Explosives Regulatory Division. Magazine storage sites are licensed by the Nunavut Workers Safety and Compensation Commission (WSCC).

The explosives facility is located south of the Mine Site stockpile. The access road intersects the treated effluent pond access road mid-way between the stockpile and the treated effluent's approved discharge point. The explosives facility is located more than 65 m away from the facility's storage containers, more than 350 m from the explosives magazine, and more than 970 m from the ore crushing and screening pad. The facility pad was constructed of raised earthworks complete with drainage culverts and access ramps.

5.2.7.2 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.

The landfarm and contaminated snow containment area located at Milne Port provides onsite treatment of contaminated soils. Once no longer required, the landfarm and contaminated snow containment area will be closed to physically and geotechnically stabilize for the long term, make surface runoff and seepage water quality safe for humans and wildlife, and to encourage the desired wildlife movement. 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.

The fuels and tank farm at Milne Port and Mine Site, assuming they are not to be maintained, will be decommissioned and removed during closure. Soils will be tested for contamination. The area will be regraded to restore natural drainage patterns where possible, and scarified to allow for natural re-vegetation.

Solid waste management infrastructure includes the incinerators, waste management buildings, and the hazardous waste containment areas. The incinerators and waste management buildings will be decommissioned and removed from the site and affected footprint regraded to restore natural drainage patterns where possible and scarified to allow for natural re-vegetation. 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 re-vegetation at closure.

The Mine Site Landfill Facility is operated to house only non-hazardous material. 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.

The explosives facility will be removed from the site. The associated footprint will be re-graded to restore natural drainage patterns where possible, and scarified to allow for natural re-vegetation 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.

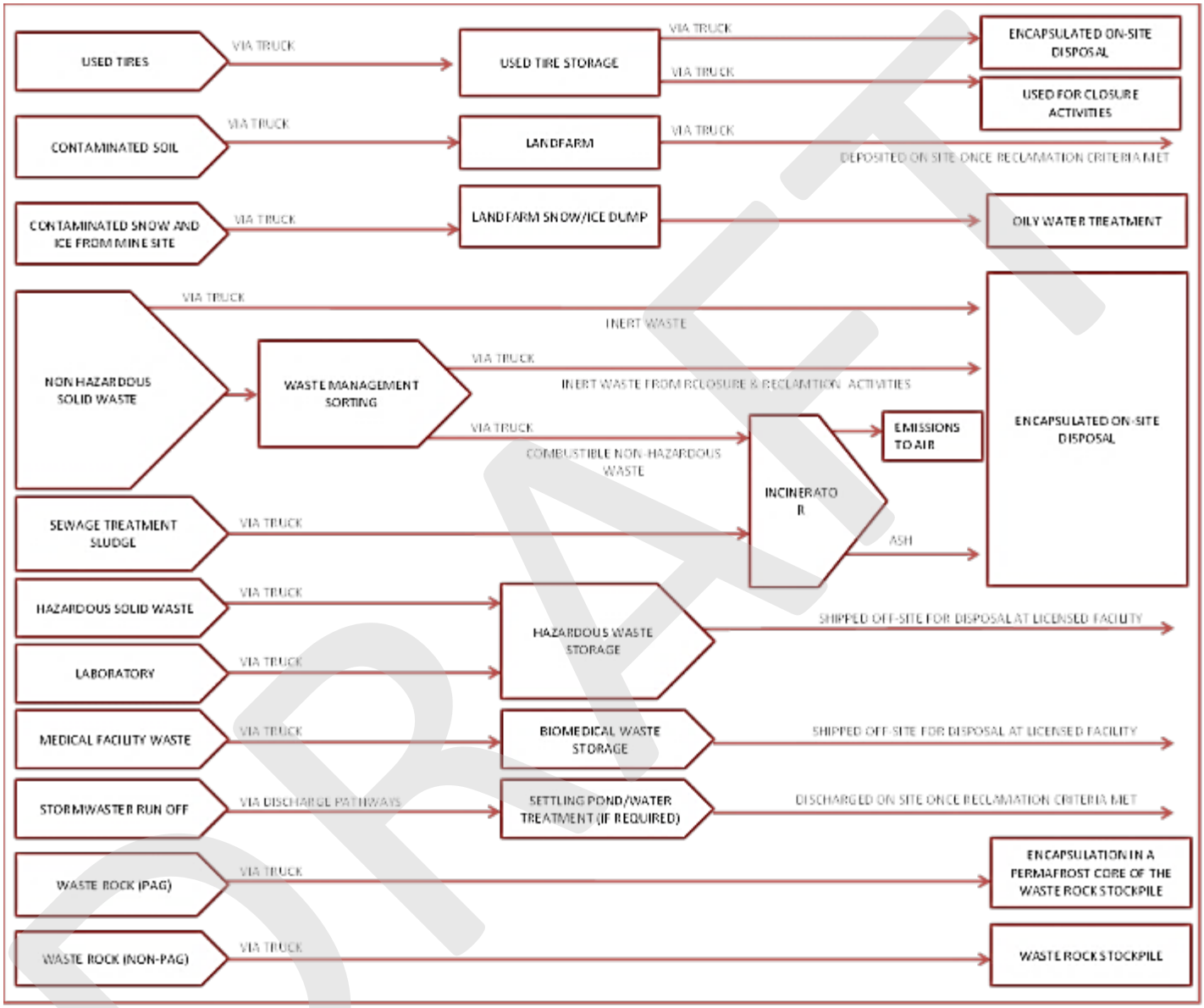

Figure 5.9~~5.6~~ Major Waste Streams and Methods of Transportation

5.2.7.3 Closure Objectives and Criteria

The closure objectives are presented in Section 5.1.1 and closure criteria are presented in Table 5.1.

5.2.7.4 Consideration of Closure Options and Selection of Closure Activities

Detailed alternative analysis 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, Permanent Waste Rock Stockpile). 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 plans 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 is expected to be relevant for all existing and any future changes to project infrastructure within this mine component (e.g. additional non-hazardous landfills).

5.2.7.5 Engineering Work Associated with Closure Activity

At final closure, Baffinland will undertake a comprehensive site Phase 1 Environmental Site Assessment (ESA) to determine extent of contaminated areas and appropriate techniques and methods to deal with such sites.

The onsite landfill located at the Mine Site will be reclaimed by capping the landfill with 1.5 m of overburden or equivalent material to freeze the core of the landfill. The landfill sites will be scarified to encourage natural re-vegetation.

At the end of Project life, Baffinland will consider transferring the facilities to a third party, should a third party express such an interest. The rationale for the approach is to eliminate sources of contamination on-site to the extent reasonably possible. Figure 5.9 demonstrates the major waste streams expected to be generated during closure and reclamation activities and the respective expected transportation and disposal approach.

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 licensed contractor to an approved facility for disposal or reuse or detonated in a controlled and safe fashion by experienced and licensed 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 site non-hazardous landfills, or shipped to the mainland to be disposed of off-site.

Liners will be removed from polishing ponds and Polishing Waste Stabilization Ponds (PWSPs), and berms will be re-graded and levelled.

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.

5.2.7.6 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), with the exception of 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 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.

5.2.7.7 Uncertainties

Uncertainties related to the closure of landfills and other waste disposal areas is whether or not the remaining land contains contaminated soils (Section 9.6), and there may be uncertainty in revegetation success, addressed in a reclamation research program (Appendix D).

5.2.7.8 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 and its Amendment), AANDC Land Lease 47H/16-1-2, the NWB (as per Type 'A' Water Licence 2AM-MYR-1325 Amendment No. 1) and the Land Owners (as per Commercial Lease Q13C301).

5.2.7.9 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 ~~Mine Closure Working Group~~MCWG.

5.2.8 Water Management Systems

5.2.8.1 Project Component Description

The water management systems on site include:

- Milne Port and Mine Site
  - Ore Stockpile settling ponds
- Milne Port
  - Water Treatment System
  - Sewage Treatment System
- Mine Site
  - Raw Water System
  - Contact Water Ponds
    (1) Open Pit Dewatering System
    (2) Stockpile Settling Ponds
  - Water Treatment System
  - Sewage Treatment System

Ore Stockpile Settling Ponds

The stockpile settling ponds were constructed to temporarily retain the runoff water from 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 equipped with overflow weirs designed to allow the unloaded surface water to drain through a controlled discharge to permitted discharge point(s). The ponds were designed with sufficient retention time to ensure the sediment would gravity-settle to the bottom of the pond before the water reaches the overflow weirs. ~~Water in the stockpile settling ponds will be monitored as part of the site drainage monitoring strategy to meet applicable effluent quality criteria.~~

The ponds have been constructed rectangular in shape to optimize the earthworks materials (granular fills and liners) and to fit within the foreshore areas and not encroach near the shoreline. The pond berms have design side slopes not steeper than 3H:1V and the berm top width is 2.0 m to meet the access and liner anchoring requirements. The overflow weir design slopes are 5H:1V exiting the pond. The ponds were excavated to meet the elevation requirements of the design, and the berms constructed with raised

earthworks. It has been sealed with exposed HDPE liner material for storage of the runoff and sediments without any leakage.

Milne Port – Water Treatment System

The Milne Port 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. 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 Milne Port water treatment building is a foldaway building located west of the new accommodation facilities. ~~There is an overhead door on the west side of the building and a man door on the east and west.~~ 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. ~~These pipes are HDPE DR11, pre-insulated with 50 mm (2 inch) insulation and heat traced for year-round use.~~ The system is fed by water truck. The ~~p~~Project is approved to source water from km 32 Lake and from Phillips Creek (summer months only).

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. ~~These pipes are HDPE DR11, pre-insulated with 50 mm (2 inch) insulation and heat traced for year-round use.~~

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 pumps and motors (duty/standby) start and stop as required to empty the containment tanks inside the STP. The treated effluent discharge pipeline is a 50 mm (2 inch) diameter HDPE DR11 pipeline. The pipeline is approximately 750 m long, above ground, pre-insulated with 50 mm (2 inch) insulation and heat traced for year-round use.~~

~~In the event that the treated effluent does not meet discharge requirements, the off-spec effluent is pumped to the effluent pond located south of the fuel tank farm. Once the 'problem' in the STP is~~

~~corrected, the off-spec effluent from the pond will be treated insitu or transported via vacuum truck and re-processed through the STP before directly discharging to Milne Inlet.~~

The Mine Site Water Systems include the facility's raw water system (including the raw water jetty), water treatment system, sewage treatment system, and the treated effluent discharge system.

Off-Spec Effluent Ponds

The off-spec effluent pond(s) have been constructed to store the off-spec effluent from the Project Sewage Treatment Plant (STP). ~~During normal operation, the treated effluent from the STP will be directed to the permitted discharge point(s). In the event that the treated effluent does not meet discharge requirements, the off-spec effluent will be pumped to the pond. Once the problem in the STP is corrected, the off-spec effluent from the pond will be transported via vacuum truck and re-processed through the STP before directly discharging to the permitted discharge point(s).~~

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.

Mine Site – Raw Water System

The Mine Site raw water system is a pumping arrangement that draws water from Camp Lake (west of the main accommodation facilities) 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. ~~This pipeline is pre-insulated and heat traced for year-round use.~~

Mine Site – Water Treatment System

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~~high-quality effluent. The ~~high quality~~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 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 accommodations facility. ~~These pipes are HDPE DR11, pre-insulated with 50 mm (2 inch) insulation and heat traced for year-round use.~~

MINE SITE – SEWAGE TREATMENT SYSTEM

The Mine Site 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 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, north east of the water building, and south of the accommodations facility. The system includes the outdoor piping connecting the accommodations facility to the sewage treatment plant and the connection for the effluent discharge piping. ~~These pipes are HDPE DR11, pre-insulated with 50 mm (2 inch) insulation and heat traced for year-round use.~~

MINE SITE – TREATED EFFLUENT DISCHARGE

During normal operation, the treated effluent from the ~~sewage treatment plant (~~STP~~)~~ is pumped to the permitted discharge points at Mary River via the above ground, 2-km-long treated effluent discharge pipeline. In the event that 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.

5.2.8.2 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.

Water management facilities at the Mine Site will be modified to account for changes to the crusher pad associated with the 12 Mtpa North Rail operation. A new crusher pad will be constructed along with a new stormwater pond. A stream diversion will be required to divert water away from the crusher pad. Fish are not present within the section of stream (referred to as Sheardown Lake Tributary 12 in the FEIS) that will be affected by the diversion. Drawings of the crusher pad and pond are included as Attachment 10.3 of Baffinland's Application to Amend Type A Water Licence 2AM-MRY-1325. The existing crusher pad and stormwater pond will be decommissioned once the new water management features are in place and shown to be functioning effectively.

Similarly, water management at Milne Port will undergo changes to accommodate larger ore stockpiles and new facilities associated with ore crushing and the North Railway. The Milne Port Water Management Plan presented as Attachment 10.2 of Baffinland's Application to Amend Type A Water Licence 2AM-MRY-1325 contains layouts showing water management features including ditches, diversions and ponds.

At the temporary ore staging area (~~km~~KM 57) a pad will be established upon which ore will be unloaded from haul trucks, temporarily stockpiled, and loaded into rail cars. Runoff from this pad will be directed to a stormwater pond. Effluent from the pond meeting mine effluent discharge criteria will be used for dust suppression.

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.

Stockpile settling ponds will be removed during closure, following decommissioning of the ore stockpiles, when management/treatment of site drainage is no longer required.

The Milne Port and Mine Site water treatment systems buildings will be removed and re-used. Outdoor piping will also be removed and affected footprints regraded to restore natural drainage patterns where possible, and scarified to allow for natural re-vegetation.

The Milne Port and Mine Site sewage treatment plants will be removed 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 re-vegetation.

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 re-vegetation.

5.2.8.3 Closure Objectives and Criteria

The closure objectives are presented in Section 5.1.1 and closure criteria are presented in Table 5.1.

5.2.8.4 Consideration of Closure Options and Selection of Closure Activities

Detailed alternative analysis 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, Permanent Waste Rock Stockpile). 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 plans 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 closure options are expected to be considered for this mine component as no structures are planned to remain following reclamation.

5.2.8.5 Engineering Work Associated with Closure Activity

The water supply system 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 (Off-spec, Stockpile Settling Ponds, etc.) will be decommissioned when they are no longer required and water quality is found to consistently meet effluent criteria ((Section 5.1.1). Ponds will be decommissioned as follows:

- Soils and sediment will be tested as part of the Site Environmental 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 non-hazardous waste containment area;
- The ponds will be filled with clean material and perimeter berms will be regraded 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.

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 transferred (sold) off-site or donated to the local communities.

5.2.8.5.1 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 prior to the use of any material for cover purposes 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.

5.2.8.6 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.

5.2.8.7 Uncertainties

Uncertainties related to the decommissioning of water management systems include whether or not there are associated contaminated soils (Section 9.6), and there may be uncertainty in revegetation success, addressed in a reclamation research program (Appendix D).

5.2.8.8 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 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 and its Amendment), AANDC Land Lease 47H/16-1-2, the NWB (as per Type 'A' Water Licence 2AM-MYR-1325 Amendment No. 1) and the Land Owners (as per Commercial Lease Q13C301).

5.2.8.9 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 ~~Mine Closure Working Group~~MCWG.

6 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 CIRNAC Guidelines[6], "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."

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 5.1.1, progressive rehabilitation will be implemented to achieve the Projects site abandonment goal and closure principles. Table 6.1 presents Baffinland's proposed progressive rehabilitation schedule. This schedule will be updated in future ICRPs as additional opportunities are identified.

Table 6.1: Summary of Conceptual Current and Proposed Progressive Rehabilitation Schedule

Phase:	Construction (ERP)				Operation (ERP)				Construction (Phase 2)				Operation (~~ERP & Rail Phase~~Phase 2)			
Year:	1	2	3	4	1*	2*	3*	4*	1	2	3	4	1	2	3	4
Milne Port																
PWSP (exploration)																
Bladder Farm																
Quarry (Q1)																
Mary River Mine Site																
Bladder Farm																

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

Table 6.1: Summary of Conceptual Current and Proposed Progressive Rehabilitation Schedule

Phase:	Construction (ERP)				Operation (ERP)				Construction (Phase 2)				Operation (~~ERP & Rail Phase~~Phase 2)			
Quarry (QMR2)																
Laydown Areas																
Borrow Pits																
Crusher Pad																
Stormwater Pond																
Km 57 Ore Transfer Station																
Rail Route																
Rail Access Road																

~~***Rail phase construction begins**~~

6.2.1 Proposed Progressive Rehabilitation Measures

The overall intent of the proposed progressive rehabilitation 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 rehabilitation 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 MCWG (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 located in a similar climate zone, will be used, where applicable, as a benchmark for the progressive rehabilitation of disturbed Project areas.

6.2.1.1 Landfarm Operation

Hydrocarbon-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 Contaminated Site Remediation Tier-1 Guidelines[7] for

[7] Environmental Guideline for Contaminated Site Remediation, Department of the Environment, Government of Nunavut, March 2009

industrial/commercial land uses will be used in select locations. 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[8] for agricultural or residential land uses will be spread over land as or used of as cover material. Soils treated in Project landfarm(s) that do not meet Nunavut Contaminated Site Remediation Guidelines[8] 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 Canadian Council of Ministers of the Environment (CCME) Canada-Wide Standards for Petroleum Hydrocarbons (PHC) In Soil (2008).

Once no longer required, landfarms will be closed as described in Section 5.2.7.

6.3 Completed Progressive Reclamation

To date, progressive reclamation efforts have commenced, or been completed, at several areas on site. Reductions in reclamation security in response to successfully demonstrating closure criteria have been met. The following lists progressive reclamation works have occurred to date, as well as the publicly available reports summarizing completed activities:

- Fuel Bladder Farm at Milne Port. See Appendix E.8 of the 2014 QIA and NWB Annual Report for Decommissioning Reports related to this activity.
- Quonset Hut at the Mine Site. See Appendix E.8 of the 2014 QIA and NWB Annual Report for Decommissioning Reports related to this activity.
- Calcium chloride salt storage. Ongoing long-term management of calcium chloride salt storage and use at the Project Site includes waste segregation of salt bags and proper disposal of collected materials in accordance with Baffinland's Waste Management Plan (BAF-PH1-830-P16-0028) as well as identifying and containing compromised salt packages to prevent materials being distributed around the site. Currently salt is stored at both the Mary River Mine Site and Milne Port Site for use in future exploration drilling as well as for dust suppression on Project roads and camp pads.
- Km 97 Borrow Source. Borrowing in this area has led to thawing of the underlying permafrost soils, which has caused considerable increase in ponded water; and, there is settlement resulting from thaw of both the ground ice in the soil matrix and thaw of ice wedges. Although approved, due to resource limitations, only minor work was completed thus far. See the Borrow Source Reclamation Plan, Milne Inlet Tote Road, Km 97, submitted to AANDC on June 19th, 2015.
- Disposal and off-site transport of historical inventory of remaining incinerator bottom ash at the Mine Site and Milne Port. Ash that was tested and determined to be non-hazardous was disposed of at the

Landfill Facility while ash that was identified as hazardous was transported off-site for disposal in a licenced facility in Southern Canada. See Appendix E.2 of the 2015 QIA and NWB Annual Report for more information related to this activity.

- Demobilization of equipment and supplies not required for near term activities, as well as the current inventory of hazardous waste and other materials by means of sealift from Milne Port Site was undertaken in 2015. See Appendix E.4 of the 2015 QIA and NWB Annual Report for more information related to this activity.
- Decommissioning activities completed for former contractor (Nuna) work shop no longer required at Milne Port to provide for the completion of the southeast extent of Ore Stockpile Pad. Decommissioning activities included disassembly of the building structure, remediation of the underlying soil footprint, removal of structure power supply (generators) and remediation of the underlying soil footprint of the west generator. Refer to Appendix E.8.1 of the 2015 QIA and NWB Annual Report for the Nuna Shop Decommissioning Report.
- Former Rotary Biological Contactor (RBC) sewage treatment plant was removed from the site by the contractors.
- Commencement of decommissioning of the Mine Site Bladder Farm and Generator Berm Bladder at the Mine Site exploration camp. The bladders and piping was removed from these facilities. A single bladder containing oily water remains in the Mine Site Bladder Farm. The lined berms will be converted to other uses such as the storage of drummed fuel.
- Ongoing management of hydrocarbon impacted soils from historical decommissioning efforts, as well as from period spills resulting from day-to-day fuel handling and management activities at both the Mine site and Milne Port. These soils have been placed in the Milne Port Landfarm Facility for biotreatment to meet the objectives as outlined in the Government of Nunavut's Environmental Guideline for Site Remediation, 2010. For approximate quantities of hydrocarbon impacted soils deposited in the Landfill Facility during 2015, refer to Table 2.5.2 of the 2015 QIA and NWB Annual Report.
- Disassembly of contractor (Anmar) tent structure and equipment was completed after a large-scale fire at Milne Port. The fire debris, residual waste material, and soils were characterized under the direction of a qualified consultant provided by Qikiqtaaluk Environmental Inc. (QE). The hazardous and potentially hazardous waste material was sorted and packaged for off-site transport to waste receiving facilities in Quebec. Refer to Appendix E.8.2 of the 2015 QIA and NWB Annual Report for QE's final summary report for the remediation conducted. The report includes the manifests and Certificates of Disposal/Recycling provided by the receiving facilities.

7 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 0 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 and Milne 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, a number of operational maintenance staff, environmental personnel and other support personnel will be onsite at the Mine Site and Milne 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 and when necessary.

The explosives contractor will manage explosives in accordance with applicable regulatory requirements as per the NRCan Permit ~~and~~ , 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). 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 is not expected to occur until years 10 to 12 of operation at full production volume (21.5 Mtpa nominal). If a pit exists, 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, pit dewatering and the subsequent treatment and discharge would likely continue in a manner consistent with ongoing operations at the time.

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 Port are evacuated by the majority 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 licensed hazardous waste disposal facility in Southern Canada (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 and Milne Port during Temporary Closure Care and Maintenance will include:

- Domestic 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 waste rock stockpile will be monitored during operations (Section 9). Current investigations identify that most of the waste rock will not be prone to metal leaching or acid drainage; however, if ongoing work characterization studies show that the minor portion waste rock that is potentially acid generating (PAG) could cause unacceptable impact to runoff and seepage, the waste rock stockpile construction strategy

will be modified accordingly. If treatment is required, water will be batch treated with lime dosing for Acid Rock Drainage (ARD) affected water or a treatment plant such as a High Density Sludge (HDS) treatment plant may be provided.

The Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031) provides treatment options in the event that 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 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, waste rock stockpiles, and pit walls. Section 9 identifies 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, and the public will be notified in advance of any scheduled short-term temporary closure activities.

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-MYR-1325 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-MYR-1325 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)
- DRAFT 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-MYR-1325 Amendment No. 1) and the Land Owners (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 land owners, until recommencement of Operations.

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 Land Owner 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 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 is 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. ~~Table 5.1 provides an overview of the actions taken for each component of the Project for a Long-term Temporary Closure scenario.~~ 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 licensed 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). 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

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. Pit water will be monitored during the course of the operation for any indication of contamination at levels that exceed MDMER or 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 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 a discharge 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 the Project is evacuated by the majority of the personnel, except as required by the 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 Hazardous Materials and Waste Management Sites

Inert waste will first be disposed of in the landfill site at the Mine Site or other approved repositories. 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 thermistor measurements at the site.

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 wastes will be shipped 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 site at the Mine Site or other approved repositories.

7.3.6 Stabilization of Stockpiles

At the onset of Long-term Temporary Closure the waste rock stockpile may undergo minor re-contouring and the physical and chemical stability of the waste rock stockpile will be assessed. 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, ~~the~~ ore dock, ore dock office, and ~~the~~ 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 ~~AANDC~~ CIRNAC for their information, and to facilitate their access to the site, if and 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 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 waste rock stockpile will be tested for MDMER requirements. The waste rock stockpile will be monitored during operations. Based on current investigations it is anticipated that most of the waste rock will not be prone to metal leaching or acid drainage. However, if ongoing work characterization studies show that the minor portion waste rock that is potentially acid generating (PAG) could cause unacceptable impact to runoff and seepage, the waste rock stockpile construction strategy will be modified accordingly. If treatment is

required, water will be batch treated with lime dosing for Acid Rock Drainage (ARD) affected water or in a treatment plant such as a High-Density Sludge (HDS) treatment.

The Life-of-Mine Waste Rock Management Plan (BAF-PH1-830-P16-0031) provides treatment options in the event that 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, waste rock stockpiles, 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 Amendment No. 1 2AM-MYR-1325 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-MYR-1325 Amendment No. 1 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 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)
- DRAFT 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, Amendment No. 1), the NWB (as per Type A Water Licence 2AM-MYR-1325 Amendment No. 1) and the Land Owners (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 landowners, until Operations recommence.

8 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 to last no longer than one (1) year for a planned closure scenario. As 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. ~~Table 5.1 presents an overview of the actions to be taken for each major Project component (by Project site) for Short Term Temporary Care and Maintenance as well as Long Term Temporary Closure and Final Closure.~~ 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 could 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.

The Phase 2 Proposal will involve an increase in the intensity of approved activities and an expansion of existing infrastructure. There are no new types of activities or infrastructure associated with the Phase 2 Proposal. Similarly, final reclamation activities will include more resources to implement the closure design, an no changes to the existing final closure schedule have been made at this time. As the project approaches the end of operations and the scope of work has refined to a level that more detailed logistical

planning can be carried out, this schedule and work plan will be re-evaluated and updated. The current schedule is intended to show a rational sequencing and timeframe for closure activities, and actual dates are subject to change based on various factors such as market conditions, exploration results, updated reclamation methods and changes to existing mine plan.

Select closure activities such as the removal of water crossings along the Tote Road and North Railway have been included in this schedule, but the closure approach may be modified based on input from communities regarding post-closure land use (e.g. some crossings left in place).

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 Land Owners 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 purpose of the ASR and unplanned closure, a two (2) year final closure planning period is assumed to be required. This is based on the assumption a 3rd Party would need additional time to go through a 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[8]. 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 H for further discussion on Predicted Residual Effects.

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 time-frame 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 a sufficient amount of time to determine closure activity effectiveness, or vice-versa, is overly conservative, this duration will be re-evaluated in consultation with the Land-Owner(s) and other stakeholders.

[8] 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. 2AMMRY1325.

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 Inuit, 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 Figure 8.1.

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 land owners 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 land owners		*																		
Routine inspection and monitoring			■	■	■															
Demobilization of on-site contractor equipment and material for shipment through Milne Port or Steensby Port			■																	
Transportation of excess fuel return 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 either Milne Port 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 and 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				■	■															
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 stablization of the road for final closure				■	■															
Decommissioning removal of railway tracks, tracks, and ties; and systematic removal of culverts and bridges; followed by stablization 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 of 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 Cover	■	■	■			■				■										
Site abandonment																				■
Achivement of Final Closure objectives and criteria for all Project components																				*

Figure 8.1~~8.1~~ Schedule of Final Closure Activities

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.

9 POST-CLOSURE SITE ASSESSMENT

This ICRP is considered to be 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, and.

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

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 5.1.1) 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.

Monitoring the NIRB requirements, as required during planned closure, are dealt with in the implementation of current management plans that will be updated regularly throughout the life of the Project and through the monitoring and reporting programs shown below. These management plans will still be applicable during closure and, as necessary, post-closure monitoring. See Table 11.3 for concordance to NIRB Project Certificate requirements.

Based on current environmental effect predictions, post-closure monitoring is expected to be required over a fifteen (15) year period, although this time period 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.

Figure 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.

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 18
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[1]	SW	SW	SW	SW	SW	SW	SW	NTR, MS	NTR, MS	NTR, MS
Socio-economic Reporting	SW	SW	SW	SW	SW	SW	SW	SW	SW	SW
Air Quality Monitoring Program	SW	SW	SW	SW	SW					
	C&M[2]	**Final Closure (3 yrs)**			**Post Closure (15 years)**					

NOTES:

SW = Site Wide, MP =Milne Port; NTR~~TR~~ = Northern Transportation Routes (Tote Road~~,~~; North Railway);~~-~~ MS =Mine Site (including Open Pit and Waste Rock Stockpile)

1. Frequency will be established at the discretion of the Chief Inspector of Mines in consultation with Baffinland
2. Care and Maintenance Phase, up to one (1) year
3. Post Closure activities are expected to last fifteen (15) years but will be extended if closure criteria are not met in that timeframe

Figure 9.1 Anticipated Closure and Post Closure Monitoring & Reporting Program Schedule for Major Mine Areas

The following subsections provide outlines of monitoring programs proposed for closure and/or post-closure.

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 Amendment No. 1 2AM-MYR-1325 and its associated management plans. Please refer to Section 7 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 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 and its Amendment), AANDC Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MYR-1325), and the Land Owners (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 similar to 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 the pit flooding equipment, which is anticipated to be completed between year 8 and year 15. The Open Pit spillway, which will be constructed during closure activities, will be designed and constructed 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 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 (2040), 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 and its Amendment), AANDC Land Lease 47H/16-1-2, the NWB (as per Type A Water Licence 2AM-MYR-1325) and the Land Owners (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 9.1 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 9.1: 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
~~Abandoned quarry sites~~	~~Disturbed area~~	~~Stability and erosion~~	~~Operations~~	~~X~~	
Tote Road and North 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
Waste rock pile (s)	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 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; and
- 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, port embankments, etc.). The requirements for analyses are as follows:

- Appropriately detailed construction records;
- Monitoring records indicate 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 NU engineer. Slope stability analyses may be modelled using industry standard software packages such as Geostudio, RocScience, or Plaxis. 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, which should improve the pit stability.

Waste Rock

The waste rock pile 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 Geostudio package or other appropriate software to ensure the long-term performance. The geothermal model will be established taking into account 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 HEC-HMS and/or HEC-RAS 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 (USACE) Shoreline Protection Manual.

Bridge abutments that are to remain within the Mary River will be assessed for erosion potential. Amongst the methods that could be employed to assess the stability of the riprap erosion protection include the Tractive Force Method.

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 Tote Road
- 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 should 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.
   ~~b)~~c) Landfill site status (indication of bank erosion, depression of cover material)
2. Tote Road
   a) Abandoned quarry sites – site condition and advancement of re-vegetation.
   b) Former water crossing – bank stability and indications of excessive stream bank erosion.
   c) Road – bed erosion and progress of re-vegetation cover.
3. North Railway
   a) Abandoned quarry sites – site condition and advancement of re-vegetation.

b) Former water crossings – bank stability and indications of excessive stream bank erosion.
c) Railbed – bed erosion and progress of re-vegetation cover.

~~3.~~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 re-vegetation.

All geotechnical/engineering inspections and assessments will be carried out by licensed NU engineer.

9.4.3 Additional Site Observations

In addition to the detailed geotechnical/engineering monitoring inspections described above carried out by licensed NU engineer, as part of the Closure and Post-Closure Aquatic Monitoring and Reporting 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 re-vegetation 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 licensed NU engineer. If the licensed NU engineer deems it necessary in order to meet established closure criteria, an action plan will be developed and implemented as appropriate to correct the situation and ensure 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 licensed NU engineer to confirm acceptable corrective action.

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 Aquatic Monitoring and Reporting Program 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 required by MDMER (below), as well as the Core Receiving Environment Monitoring Program (CREMP). 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 Waste Rock Stockpile, 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. ~~Existing water quality monitoring locations are presented on Figure 9-1 and Figure 9-2 below~~. It is expected that monitoring locations required for operations would act as a starting point, then ~~this~~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 in order to identify unexpected erosion and sedimentation issues. If concerns are observed, water quality monitoring may be required. Monitoring at the Mine Site (i.e. Waste Rock Stockpile and Open Pit), which represent the largest environmental risk, will continue until Year 18. Current water quality monitoring location~~no~~s are presented on Figures 9.1 and Figure 9.2 below. These locations will be updated to account for the Phase 2 Proposal as part of the upcoming NWB process.

As currently described in Section 5.2.1, 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.

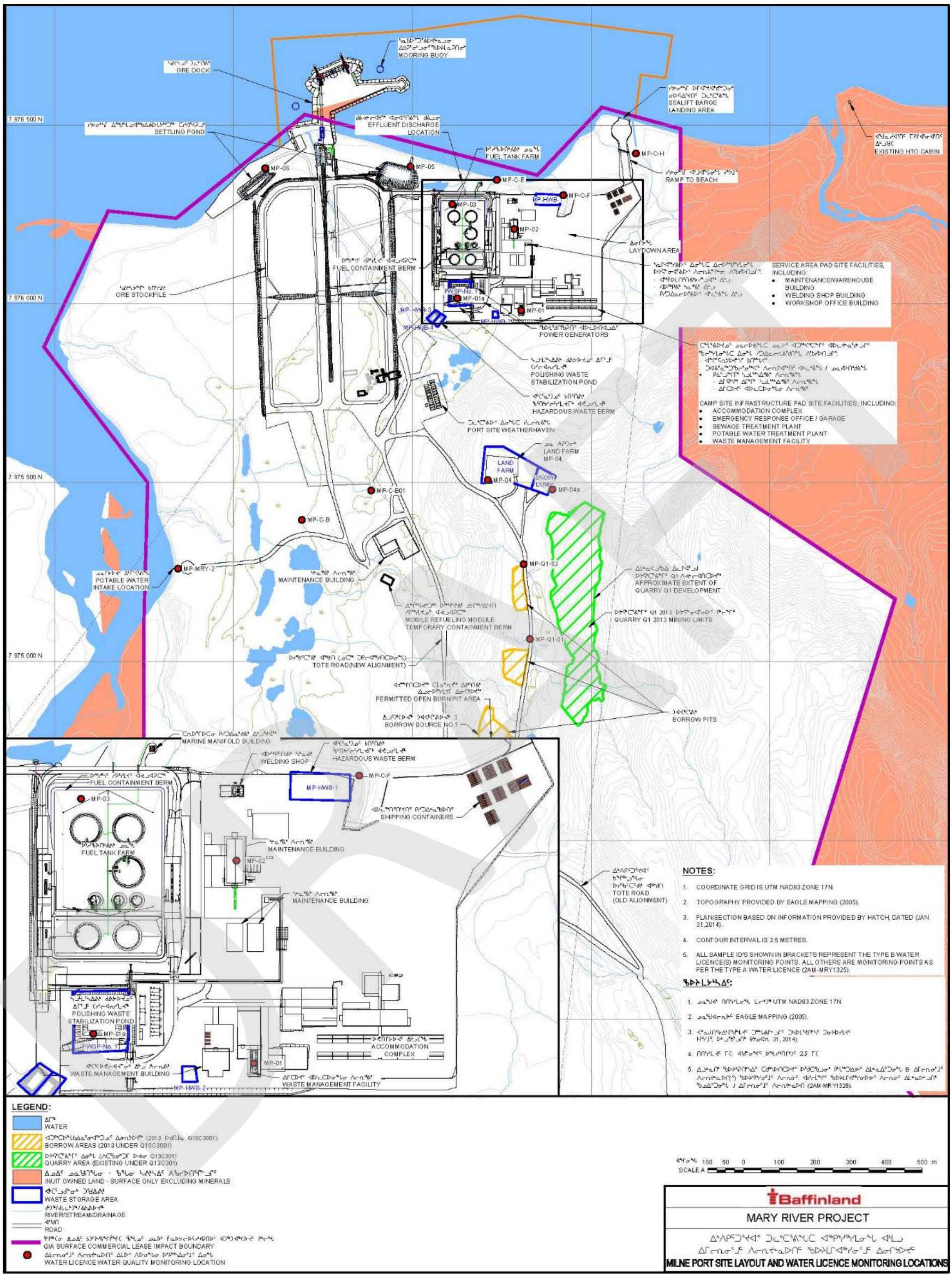

Figure 9.2~~9.2~~ Milne Port Site Plan

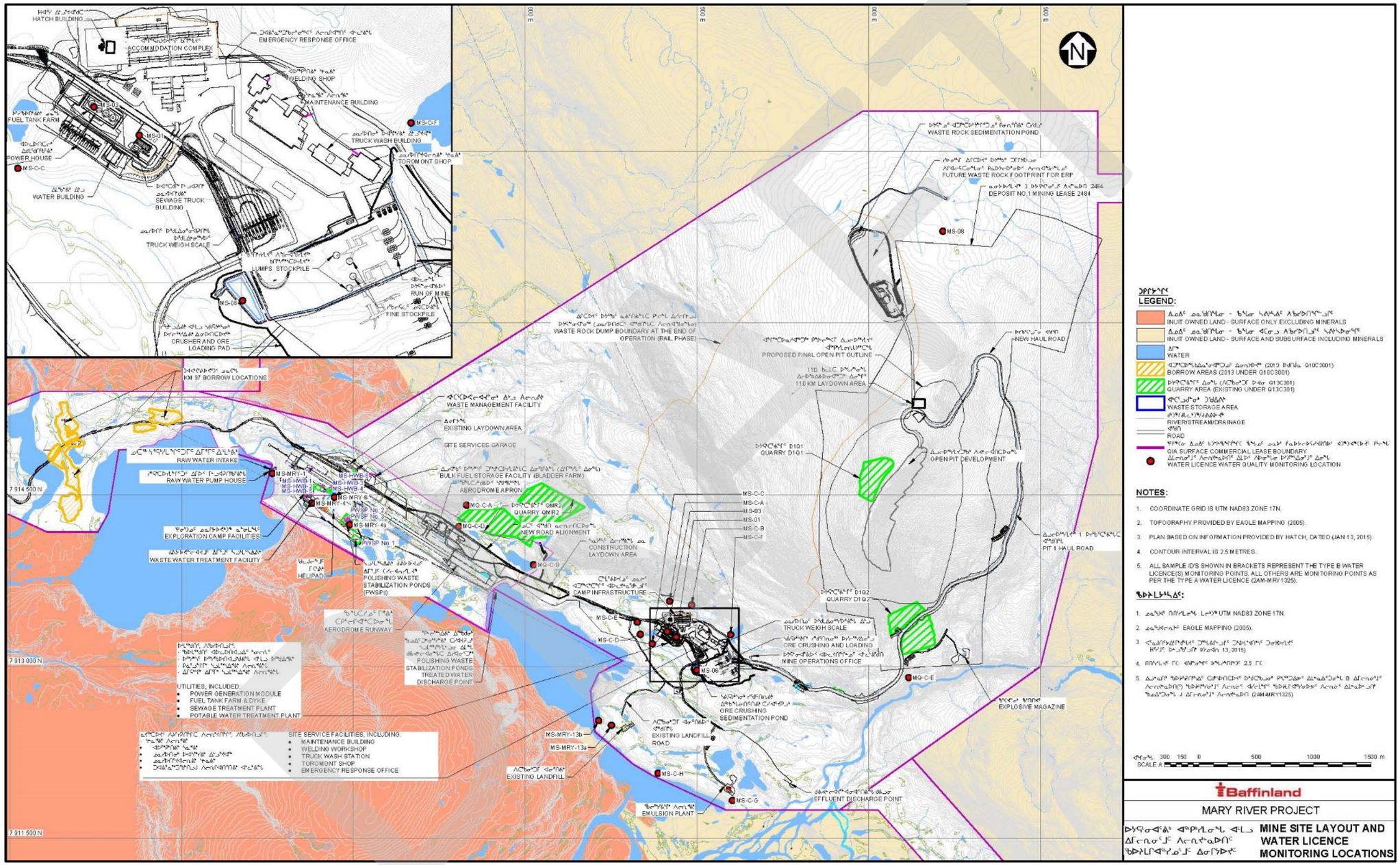

Figure 9.3 **Mary River Mine Site Plan**