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Baffinland Iron Mines Corporation

SURFACE WATER AND AQUATIC ECOSYSTEM MANAGEMENT PLAN

BAF-PH1-830-P16-0026


Rev 4

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Date: March 17, 2016
Signature:

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Date: March 17, 2016
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DOCUMENT REVISION RECORD

Issue Date MM/DD/YY	Revision	Prepared By	Approved By	Issue Purpose
9/25/2007	0	RC	KDE	Issued in Final under Type B Water Licence
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11/31/2012	F	JM	JB	Updated for FEIS
3/31/2012	4 - SWMP	TM/AK	JM	Updated for 2012 Field Season under Type B Water Licence
3/31/2013	00	RK	JM	In support of the 2013 Work Plan
8/29/2013	01	SP	JM	In support of the Type A Water Licence
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3/17/2016	4	AV	JM	In support of the 2016 Work Plan

Item No.	Description of Change	Relevant Section
1	Updated work construction activities according to the 2016 Work Scope	Multiple Sections throughout Plan
2	2016 Work Scope provided	Appendix B
3	Provide reference to Type A Water Licence Amendment No. 1 <i>issued</i> – July 15, 2015	1.0
4	Updated Baffinland Sustainable Development Policy	2.1
5	Updated Baffinland Health, Safety and Environment Policy	2.2

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Item No.	Description of Change	Relevant Section
6	Updated Roles and Responsibilities – Environmental Project Team	8.1.1
7	Updated Mary River Organizational Chart	8.1.2
8	Updated Site Water Balance Block Flow Diagrams	Appendix C
9	Updated Site Drainage Drawings	Appendix D
10	Updated Site Monitoring Locations/Drawings	9.2/Appendix D

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Appendix B - 2016 Work Plan and Site Layout Drawings

Appendix C - Site Water Balances and Catchment Areas

Appendix D - Site Drainage Drawings and Monitoring Locations

Appendix E - Omitted Sections for Deferred Steensby Port and Railway Corridor Construction

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1 INTRODUCTION

As required by Baffinland Iron Mine Corporation's (Baffinland) Type A Water Licence No. 2AM-MRY1325 – Amendment No. 1 *issued* July 21, 2015 (Type A Water Licence) in association with its Type B Water Licence No. 8BC-MRY1416 – Amendment No. *issued* August 6, 2014 (Type B Water Licence) for the Mary River Project (Project), a review of Project Environmental Management and Monitoring Plans (EEMPs) was completed. This Surface Water and Aquatic Ecosystem Management Plan (Plan) was updated to support the 2016 Project Work Plan (refer to Appendix B) and meet the requirements of Baffinlands Type A and B water licences.

Further and continual modifications and revisions to this Plan shall be completed based on future work scope modifications and associated approvals. Once approvals are provided, additional updates to this, and other management plans shall be undertaken. These updates will be completed in accordance to the terms and conditions of Baffinland's Water Licences, QIA Commercial Lease – Q13C301, *issued* September 6, 2013, the Nunavut Impact Review Board (NIRB) amended Project Certificate No. 005 – *issued* May 28, 2014, and any subsequent requirements which may be issued.

Baffinland is committed to collecting and treating, where required, contact water generated from mining activities to ensure that compliance is achieved with prescribed effluent criteria as established in the Water Licences.

1.1 PURPOSE

The purpose of this Plan is to describe the processes and procedures through which Project activities and infrastructure influence the quality and quantity of surrounding waters throughout the lifecycle of the Project. Such processes and procedures include best management practices implemented to limit the potential for adverse impacts to receiving waters, aquatic ecosystems, fish and fish habitat. This Plan details the systems in place to mitigate and manage drainage and runoff at Project facilities, address point and non-point discharges to surface waters, and assess those discharges on water quality and quantity relative to their receiving water systems.

This Plan identifies Project roles and responsibilities, specific requirements, and mitigation and management actions for erosion and sedimentation controls which include methods for controlling erosion pertaining to both temporary and long-term stabilization efforts.


1.2 REGULATORY REQUIREMENTS

Baffinland's water use is regulated by the Nunavut Water Board (NWB) through its water licensing process and is subject to Baffinland's Type A and Type B Licences which provide specific Terms and Conditions for water use required for Project activities.

Water use activities required for the work detailed in the 2016 Work Plan have been assessed for compliance with Baffinland's Type A and Type B Licences. Where it is determined that project activities

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fail to comply with the specific Terms and Conditions, further assessment shall be facilitated to modify such activities such that compliance is achieved.

1.3 RELATIONSHIP TO OTHER MANAGEMENT PLANS

This Plan shall be used in conjunction with Baffinland's Addendum to the Final Environmental Impact Statement (AFEIS) issued June 20, 2013 and relevant EMMPs referred to in Section 14, Part B of the Type A Water Licence, all plans referred to in the NIRB amended Project Certificate No. 005, and all plans relating to the mitigation or prevention of environmental damages, and the remediation of environmental impacts which may be required by the terms of issued licences, permits and authorizations in respect of operations or work pursuant to Baffinland's Commercial Lease – Q13C301.

1.4 UPDATE OF THIS MANAGEMENT PLAN

This Plan is a living, directive document which has been updated to reflect activities outlined in the 2016 Project Work Plan (Appendix B). The responsibilities and procedures presented herein are designed to ensure the effectiveness of the Plan and to provide for ongoing improvement through continuous review processes for 2016 Work Plan as authorized the amended Project Certificate No. 005.

As required, updates shall be completed to include Work Plan development and changes, management reviews, incident investigations, regulatory changes or other Project related modifications. Sections pertaining to the deferred work scope for the construction of the railway corridor, railway camps, Steensby Port and associated infrastructure have been omitted from this update and are provided in Appendix E of this Plan.


1.4.1 CONTINUATION OF CONSTRUCTION - APPROVED EARLY REVENUE PHASE

Due to various business drivers, Baffinland submitted an application to the NIRB for the approval of the ERP which included modifications to the existing schedule and activities in the initial stages of Project development associated with the Mary River Project in 2013. As part of their proposal, Baffinland issued a request to NIRB to amended Project Certificate No. 005 to reflect modifications to the Project associated with the ERP proposal. Upon receipt of the of the approved amendment on May 28, 2014, Baffinland proceeded with development of a nominal 3.5 million tonnes per annum (Mt/a) road haulage operation from the Mary River mine site to a port facility at Milne Port for the shipping of iron ore during the open water season.


1.4.2 2016 WORK PLAN

The 2016 Project Work Plan (refer to Appendix B) was developed to fulfil the requirements of Section 6.1 of Commercial Lease No. Q13C301 and the Type A Water Licence, and provides for:

- Development and operation of the mine, ore crushing and land transportation, stockpiling and marine shipment of ore;

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- The continued development and construction of infrastructure required at Milne Port and the Mary River Mine Site (Mine Site) for the Mary River Project;
- Continued operation of Mine Site and Milne Port Camps to support ongoing operations and construction activities which will include the use of water and deposition of waste as authorized under existing permits;
- On-going operation of permitted quarry and borrow sources; there are also additional planned quarries or borrow areas along the Tote Road that are identified and are to be utilized during 2016;
- At Milne Port, vessels carrying fuel, equipment and supplies for use at the Mine Site and Milne Port will arrive during open water (approximately between mid-July and mid-October 2016). Material, fuel and supplies required for operational and construction activities will be transported to the Mine Site year round via the Tote Road;
- Geotechnical drilling may be required to support engineering, design and construction activities of Project;
- Ongoing environmental effects studies and baseline data collection will continue to support the construction and operation of the Project. These activities will resume, as required, at the Milne Port site, along the Tote Road, at the Mine Site, at numerous quarry sites and at other Project development areas;
- Continued environmental monitoring in accordance with the approved Project Certificate licenses, authorizations, management plans and environmental effects monitoring plans; and
- On-going exploration activities.

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2 BAFFINLAND'S POLICIES

2.1 SUSTAINABLE DEVELOPMENT POLICY

At Baffinland Iron Mines Corporation (Baffinland), we are committed to conducting all aspects of our business in accordance with the principles of sustainable development & corporate responsibility and always with the needs of future generations in mind. Baffinland conducts its business in accordance with the Universal Declaration of Human Rights and ArcelorMittal's Human Rights Policy which applies to all employees and affiliates globally.

Everything we do is underpinned by our responsibility to protect the environment, to operate safely and fiscally responsibly and with utmost respect for the cultural values and legal rights of Inuit. We expect each and every employee, contractor, and visitor to demonstrate courageous leadership in personally committing to this policy through their actions. The Sustainable Development and Human Rights Policy is communicated to the public, all employees and contractors and it will be reviewed and revised as necessary on a regular basis. These four pillars form the foundation of our corporate responsibility strategy:

1. Health and Safety
2. Environment
3. Upholding Human Rights of Stakeholders
4. Transparent Governance

1.0 HEALTH AND SAFETY


- We strive to achieve the safest workplace for our employees and contractors; free from occupational injury and illness, where everyone goes home safe everyday of their working life. Why? Because our people are our greatest asset. Nothing is as important as their health and safety. Our motto is "Safety First, Always".
- We report, manage and learn from injuries, illnesses and high potential incidents to foster a workplace culture focused on safety and the prevention of incidents.
- We foster and maintain a positive culture of shared responsibility based on participation, behaviour, awareness and promoting active courageous leadership. We allow our employees and contractors the right to stop any work if and when they see something that is not safe.

2.0 ENVIRONMENT

- Baffinland employs a balance of the best scientific and traditional Inuit knowledge to safeguard the environment.
- Baffinland applies the principles of pollution prevention, waste reduction and continuous improvement to minimize ecosystem impacts, and facilitate biodiversity conservation.
- We continuously seek to use energy, raw materials and natural resources more efficiently and effectively. We strive to develop more sustainable practices.
- Baffinland ensures that an effective closure strategy is in place at all stages of project development to ensure reclamation objectives are met.

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3.0 UPHOLDING HUMAN RIGHTS OF STAKEHOLDERS

- We respect human rights, the dignity of others and the diversity in our workforce. Baffinland honours and respects the unique cultural values and traditions of Inuit.
- Baffinland does not tolerate discrimination against individuals on the basis of race, colour, gender, religion, political opinion, nationality or social origin, or harassment of individuals freely employed.
- Baffinland contributes to the social, cultural and economic development of sustainable communities in the North Baffin Region.
- We honour our commitments by being sensitive to local needs and priorities through engagement with local communities, governments, employees and the public. We work in active partnership to create a shared understanding of relevant social, economic and environmental issues, and take their views into consideration when making decisions.
- We expect our employees and contractors, as well as community members, to bring human rights concerns to our attention through our external grievance mechanism and internal human resources channels. Baffinland is committed to engaging with our communities of interest on our human rights impacts and to reporting on our performance.

4.0 TRANSPARENT GOVERNANCE

- Baffinland will take steps to understand, evaluate and manage risks on a continuing basis, including those that may impact the environment, employees, contractors, local communities, customers and shareholders.
- Baffinland endeavours to ensure that adequate resources are available and that systems are in place to implement risk-based management systems, including defined standards and objectives for continuous improvement.
- We measure and review performance with respect to our safety, health, environmental, socio-economic commitments and set annual targets and objectives.
- Baffinland conducts all activities in compliance with the highest applicable legal & regulatory requirements and internal standards.
- We strive to employ our shareholder's capital effectively and efficiently and demonstrate honesty and integrity by applying the highest standards of ethical conduct.


4.1 FURTHER INFORMATION

Please refer to the following policies and documents for more information on Baffinland's commitment to operating in an environmentally and socially responsible manner:

Health, Safety and Environment Policy
Workplace Conduct Policy
Inuktitut in the Workplace Policy
Site Access Policy
Hunting and Fishing (Harvesting) Policy
Annual Report to Nunavut Impact Review Board

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ArcelorMittal Canada Sustainability and Corporate Responsibility Report

If you have questions about Baffinland's commitment to upholding human rights, please direct them to contact@baffinland.com.

Brian Penney
Chief Executive Officer
March 2016

2.2 HEALTH, SAFETY AND ENVIRONMENT POLICY

This Baffinland Iron Mines Corporation Policy on Health, Safety and Environment is a statement of our commitment to achieving a safe, healthy and environmentally responsible workplace. We will not compromise this policy for the achievement of any other organizational goals.

We implement this Policy through the following commitments:


- Continual improvement of safety, occupational health and environmental performance
- Meeting or exceeding the requirements of regulations and company policies
- Integrating sustainable development principles into our decision-making processes
- Maintaining an effective Health, Safety and Environmental Management System
- Sharing and adopting improved technologies and best practices to prevent injuries, occupational illnesses and environmental impacts
- Engaging stakeholders through open and transparent communication.
- Efficiently using resources, and practicing responsible minimization, reuse, recycling and disposal of waste.
- Reclamation of lands to a condition acceptable to stakeholders.

Our commitment to provide the leadership and action necessary to accomplish this policy is exemplified by the following principles:

- As evidenced by our motto "Safety First, Always" and our actions Health and safety of personnel and protection of the environment are values not priorities.
- All injuries, occupational illnesses and environmental impacts can be prevented.
- Employee involvement and active contribution through courageous leadership is essential for preventing injuries, occupational illnesses and environmental impacts.
- Working in a manner that is healthy, safe and environmentally sound is a condition of employment.
- All operating exposures can be safeguarded.
- Training employees to work in a manner that is healthy, safe and environmentally sound is essential.
- Prevention of personal injuries, occupational illnesses and environmental impacts is good business.
- Respect for the communities in which we operate is the basis for productive relationships.

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We have a responsibility to provide a safe workplace and utilize systems of work to meet this goal. All employees must be clear in understanding the personal responsibilities and accountabilities in relation to the tasks we undertake.

The health and safety of all people working at our operation and responsible management of the environment are core values to Baffinland. In ensuring our overall profitability and business success every Baffinland and business partner employee working at our work sites is required to adhere to this Policy.

Brian Penney
Chief Executive Officer
March 2016

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3 TARGETED VALUED ECOSYSTEM COMPONENTS

Baffinland has identified the following targeted valued ecosystem components (VECs) to serve as indicators subject to this Plan:


- Water quantity;
- Surface water quality;
- Aquatic ecosystems;
- Fish; and
- Fish habitat.

Water is considered a VEC and the protection of regional water quality and quantity is critical to the residents of Baffin Island. Long-term downstream users (i.e., local residents) have not been identified; however, there is potential for incidental water-use by hunters and visitors on adjacent lands. Potential effects to fish and fish habitat from either water withdrawal exceedances or compromised water quality and/or quantity have been identified.

Project activities will influence surface water through the following pathways:

- Water intakes required for potable water in camps and short-term construction;
- Tote Road stream crossings and road maintenance;
- Sewage treatment and disposal at Milne Port and Mary River;
- Operations Phase runoff from waste rock and ore stockpiles (subject to the Phase 1 Waste Rock Management Plan - Doc. No. BAF-PH1-830-P16-0029);
- Potential surface water runoff generated from developed Project areas; and
- General site runoff from land disturbances.

A complete matrix of Project interaction with identified VECs is provided in the AFEIS, Volume 7 – *Freshwater Aquatic Environment*.

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4 MITIGATION MEASURES

4.1 MITIGATION MEASURES FOR SEDIMENTATION AND EROSION

Ongoing Construction and Operations activities at Project areas present the potential for soil disturbance and water diversions requiring sediment and erosion control planning to prevent the discharge of site contact water. Best management practices, including preventative measures shall be implemented throughout the lifecycle of the Project. The following section details measures used to mitigate potential environmental impacts arising from the storage and discharge of site contact water.

As required, assessments of site stream and river crossings, lakes and ponds adjacent to construction areas will be completed to determine criticality. Subject to site-specific conditions, a variety of civil design structures or additional controls may be required to prevent localized erosion.

The deposition of debris or sediment into or onto any water body during the construction of access roads, site laydown pads and areas of other earthworks is prohibited. To prevent sedimentation into adjacent water bodies, stockpiling of debris must take place at a distance greater than 31 m from the ordinary high-water mark to prevent it from entering a water body. In addition, removal of material below the ordinary high-water mark of any water body is prohibited, unless otherwise approved by the NWB.


A greater level of understanding of the unique site conditions that influence the selection of appropriate sediment and erosion control measures was achieved through the ongoing process of upgrading the Milne Port Tote Road. Influences from climate, topography, and limited vegetation combine to produce short-term, high intensity discharges throughout May, June and July. Due to the impeded vegetation growth rate, sediment and erosion control techniques that involve vegetative covers (i.e., hydro seeding and the use of erosion control blankets) have been dismissed as potential mitigation options. Furthermore, straw bales are not permitted in the Arctic due to the possibility of introducing foreign species.

All Project infrastructure and activities that have the potential to influence any watercourse (i.e., modification of culverts, diversion of watercourses, modification of the Milne Port Tote Road, and other areas of the Project site), were designed, and shall be constructed in a manner that is consistent in terms of type, location, and scope with those proposed in the AFEIS and are reflected in existing permits and authorizations. Construction and Operations activities are prohibited from preventing and/or restricting the movement of water in identified fish bearing streams and rivers.

Prior to the development of any new water related infrastructure and/or facilities, geotechnical investigations shall be completed to ensure that sensitive landforms are not negatively impacted (i.e., ice-rich soils or easily erodible soil). Where it is determined that the infrastructure and/or facility developments will not negatively impact sensitive landforms, Baffinland will continue to ensure that all regulatory requirements are met.

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Where practical, Baffinland utilizes chemical Polyacrylamide (PAM) solutions (flocculants) such as Soil Conditioners and Erosion Control Polymers and/or Sediment and Turbidity Control Applicator Logs as site-specific methods for sediment and erosion control at non-fish bearing watercourses impacted by Project construction activities. Soil Conditioners and Erosion Control Polymers are effective, environmentally safe and biodegradable methods for stabilizing soils, even on high grade slopes, preventing them from entering watercourses causing elevated turbidity levels/siltation events. Sediment and Turbidity Control Applicator Logs are a polymer-based flocculent in solid form which can also be used (alone or in combination with Soil Conditioners and Erosion Control Polymers), to mitigate sedimentation from site contact water by effectively binding to suspended sediments causing them to settle out. Carefully selected flocculants may be used in conjunction with other erosion control measures provided in Table 4.1 to further augment mitigation efforts at impacted sites.

4.2 MITIGATION MEASURES FOR EROSION CONTROL


Table 4.1 provides sedimentation and erosion controls used at Project sites. When required, these controls may be used alone or in combination to achieve a more effective control.

Table 4.1: Sediment and Erosion Controls

Armouring	
Description	Used as a barrier between water flow and materials that are susceptible to erosion. Quarry rock and/or naturally occurring granular borrow material are used to protect underlying fine-grained material from scour and erosion.
Installation Locations	In areas of cuts and/or excavations and for installation of culverts, typically on exposed erodible slopes.
Substitute	Water diversion, berms, sumps and/or silt fencing may be used where armouring is not practical or where there is low risk of impacts to downstream receptors.
Riprap	
Description	A rock lining that can be installed along a ground surface or structure to prevent erosion of the underlying material and/or sediments.
Installation Locations	Along road and/or stream embankments and along the upstream and downstream ends of culverts. May also be installed at locations where existing flows may cause erosion of the present surface materials specifically where flows may become concentrated.
Performance Issues	Potential limited material supply available.
Benefits	Materials are local and are effective at protecting embankments from erosion. They may also be installed over non-woven geotextile (see below) to provide additional protection.

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Geotextile – Woven and Non-Woven	
Description	Low erodible lining material installed for temporary erosion control.
Installation Locations	Along stream embankments, water channels and/or ditches.
Performance Issues	Required to be securely anchored to in order to be effective. Installed material is difficult to remove when it is no longer required.
Benefits	Easy to install and an effective erosion barrier that can be installed along a variety of embankments.
Polyacrylamides/Flocculants	
Description	Non-toxic, environmentally safe synthetic chemical polymers Are used as a means of soil Conditioners and Erosion Control Polymers are used to stabilize embankments next to water bodies, as were applied to stream embankments to bind to soil sediments (colloidal clays) to strengthen the surface soil structure making it less susceptible to erosion. Sediment and Turbidity Control Applicator Logs are solid form flocculants that are placed directly in the impacted watercourse to efficiently bind to particulate matter causing it to settle out providing clarification. Can also be used as an additive to settling ponds or sumps (temporary or permanent).
Installation Locations	Along stream embankments or directly in impacted channels and/or ditches. Product can also be used to settle out suspended sediment in dedicated/temporary settling ponds/sumps as required.
Performance Issues	None.
Benefits	Cost effective. Easy to apply and use, specifically on high grade slopes where other controls may be ineffective. Efficient binding to fine particles such as colloidal clays and may be used in combination with other controls to provide additional protection.
Silt Fence	
Description	<p>Geotextile or fabric barrier that impedes the flow of surface water which potentially may cause suspended sediment to be deposited.</p> <p>Typically supported using wooden stakes (attached to the fabric by the manufacturer) and may be placed using methods such as digging a trench and backfilling material to ensure stability. Attempts are made to install silt fence in lines of equal elevation (along contour lines) to prevent channelling or focusing of the runoff.</p> <p>Standards for installation including trench excavation, insertion of fabric, and backfilling and compacting. Found on the Ontario Provincial Standard Drawing (OPSD) 219.110 Light Duty Silt Fence Barrier and 219.130 - Heavy Duty Silt Fence Barrier.</p>

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Installation Locations	Used in areas where surface water could potentially come into contact with disturbed sites causing elevated suspended solids. Typical installation locations are: <ul style="list-style-type: none"> • Downstream of drilling activities • Along roads where surface runoff is expected • Surrounding stockpiles of material or drill cuttings
Performance Issues	Not permeable enough to be placed in streams with greater than low flow. Very difficult to anchor the base against flow. - Difficult to install due to frozen ground conditions, weight and susceptibility to wind.
Benefits	Effective in shoreline construction work where they are used to surround the installation of culvert crossings installed during open-water conditions.
Diversion/Collection Channel or Berm	
Description	Diversion/collection channels or berms are used to locally direct surface water runoff. Constructed using suitable materials to divert the surface water without causing erosion or suspension of additional sediment. Additionally collection channels or berms may be constructed to collect runoff emerging from an area of soil disturbance. Also used to ensure runoff is directed to a constructed mitigation measure such as an in-ground sump.
Installation Locations	Used in locations where diversion and/or collection of surface water is required. Diversion structures are installed to prevent runoff from entering a site where the surface soil has been disturbed and would cause suspension of sediment. May be constructed to collect runoff emerging from an area of soil disturbance.
Substitute	Silt fences can be used as an alternative to constructing a channel or berm.
Benefits	Effective method to direct runoff to a constructed mitigation measure such as an in-ground sump.
Containment Berm	
Description	Constructed to establish a sump, basin or pond to contain or collect water. The sump could be used to contain discharge water to allow settling of sediment before discharge or to temporarily contain the water for re-circulation (i.e., drilling activities). Constructed using native soils or acceptable man-made products which are nominally compacted to provide strength for the structure. Berm heights are minimized (typically <1 m).
Installation Locations	Across small valleys or around natural depressions to augment the capacity of the berms.

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Performance Issues	Care must be taken when constructing berms to ensure the base is on a solid foundation.
Substitution	In-ground sumps or portable containment sumps or tanks can be used in place of a containment berm.
Armouring	
Description	Used as a barrier between water flow and materials susceptible to erosion. Quarry rock and/or naturally occurring granular borrow material to protect underlying fined grained materials from scour and erosion.
Installation Locations	Used in areas of cuts/excavations and in the installation of culverts.
Substitutes	Water diversion, berms, sumps and/or silt fencing may be used where armouring is impracticable due to the lack of aggregate availability or unnecessary based on the level of risk/significance for significant erosion and associated potential for down gradient impacts.
Benefits	Availability of local quarry rock and/or naturally occurring granular borrow material.
In-Ground Sump	
Description	Constructed to establish a sump, basin or pond to contain or collect water, similar to the containment berm. Constructed by excavating a depression into soil to provide water containment.
Installation Locations	Used in areas where excavation of soil is possible and other control measures are impractical or ineffective.
Substitutes	Containment berms, or portable containment sumps or tanks can be used in place of an in ground sump.
Benefits	Excavated material from the sump can be used to construct a containment berm surrounding the sump to augment the capacity of the sump.
Portable Containment Sump	
Description	Used to establish a sump to contain water from a source such as a drill rig. Where required, can be connected together in a series to provide additional containment or settling capacity if required. Collected sediment or drill cuttings from the portable containment sumps are removed from the sumps as necessary and disposed of in pit locations approved by Baffinland management and located at distances of at least 31 m from water bodies.
Installation Locations	Used in areas where containment berms or in-ground sumps are impractical such as steep topography or in areas where overburden is not readily available.
Substitutes	Containment berms or in-ground sumps are used in place of a portable containment sump.
Benefits	Requires minimal excavation or construction to provide a level

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	base for the sump.
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4.3 STREAM CROSSINGS


Table 4.2 provides mitigation measures implemented to control sedimentation and erosion at Project stream crossings:

Table 4.2: Control Measures at Stream Crossings

Pumping	
Description	Pumps are used to transfer water from one side of the road/structure to another.
Installation Locations	At crossings where culverts are not installed, incorrectly installed, or not allow sufficient flow. Pumping is required prior to culvert installation for dewatering. Pumps may also be used as a temporary solution during freshet or prior to culvert installation. In addition, siphons can be used as an alternative, but require a pump to prime the system and sufficient slop between upstream and downstream locations.
Performance Issues	<ul style="list-style-type: none"> - Ineffective during high flows - Erosion control measures are required as pump discharge points - The associated risk of fuel spills requires secondary Containment - Temporary solution requiring additional resources
Benefits	Effective temporary solution to lower water levels in places where water levels are high or prior to culvert installation. Also useful at low flow locations where culverts have not been installed.
Culvert	
Description	Pipes installed through embankments to allow the passage of water while maintaining access over the site. The size and/or number of culverts required for installation is determined by a hydraulic design study, conducted to assess suitable hydraulic design criteria to avoid flooding or washouts. Culvert flow capacities are assigned using hydraulic analysis methods assuming an appropriate return period with allowance for ice accumulation.

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Installation Locations	<ul style="list-style-type: none"> - At points where roads intersect streams, rivers or seasonal Drainages (freshet) - At locations where there is potential for water to flow over Roads
Performance Issues	<ul style="list-style-type: none"> - Potential for siltation during installation - Requires labour, equipment and materials (compacted backfill) for proper installation - Concentration of flows cause potential for erosion at downstream discharge points - Clearing of snow and/or ice prior to spring freshet is required to minimize the potential for blockages
Benefits	A high flow capacities can be achieved depending on culvert selection. Culverts also permit fish passage under roads where crossings have been identified as fish habitat.
French Drain	
Description	<p>A ditch or channel filled with rock to provide a flow path for water.</p> <p>The rock material can be covered with a non-woven geotextile to prevent the ingress of finer material which could reduce the permeability of the drain.</p>
Installation Locations	At points where roads intersect streams/drainages and where fish passage is not a consideration. May be used as an alternative for a culvert if culverts are not available.
Performance Issues	<p>Ice blockage potential in French drains has not been adequately assessed.</p> <p>Long-term performance has not been assessed</p>
Benefits	Constructed of natural local and/or local materials
Bridge	

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Description and Installation Locations	<p>Bridges are required for the crossing of larger streams or rivers. The installation of bridges require hydraulic design studies undertaken to evaluate suitable hydraulic design criteria to avoid flooding or any unexpected damage to the adjacent ground. Bridge locations are assessed using a river hydraulics analysis assuming an appropriate return period with an allowance for ice accumulation.</p> <p>The identification of appropriate engineering designs for each river crossing is determined using a systematic decision making process which incorporates engineering and environmental factors at each crossing location. Screening and detailed evaluations are performed to assist in determining the most suitable site-specific crossing at each location (i.e., culvert or bridge). Criteria used to assist in the in the decision making process included: potential impacts to freshwater aquatics, hydraulic conditions and ease of construction and cost. Permitting process may be required for watercourses where authorizations are required depending upon watercourse classifications.</p>
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4.4 MITIGATION MEASURES FOR FISH AND FISH HABITAT

The following sections provide mitigation measures implemented to protect fish and fish habitat with specific protection measures required during freshet.

4.4.1 FRESHET MITIGATION

Extreme flows occurring during freshet can result in significant erosion and damage to stream crossing structures. Operating procedures have been developed to mitigate the negative impacts caused by freshet events. Such procedures may include the following:


- Establishing/marketing locations of susceptible crossings so that they can be identified in the spring, prior to snow/ice melt;
- Clearing snow from roads adjacent to culverts and crossings;
- Completing downstream and upstream excavations at crossings prior to the onset of freshet;
- Monitoring of culverts for clearance of snow and ice;
- Re-establishing flows by removing snow and ice blockages;
- Ensuring sufficient fish migration passage through routine monitoring; and
- Based on results of monitoring and risk assessments, complete repairs/modification at crossing structures.

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4.4.2 FISH HABITAT PROTECTION

Extreme flows occurring during freshet can result in significant erosion which have the potential to negatively impact fish habitat. Operating procedures have been developed to mitigate the negative impacts caused by freshet events. Such procedures may include the following:

- Construction of rocky ramps at locations where scour and erosion at culvert outlets are problematic. Alternatively, modifications to existing culverts and/or installation of additional overflow culverts may be required;
- Construction of docks, for work requiring the use of explosives (blasting) in or near water bodies shall be carried-out in accordance with Fisheries and Oceans Canada (DFO) guidance “Guidelines for Use of Explosives In or Near Canadian Fisheries Water, 1998”;
- At locations where compliance with these guidelines cannot be achieved, consultation with DFO shall take place prior to blasting;
- Use of silt curtains to prevent the dispersion of sediments during work activities in marine waters (dredging, piling, backfilling);
- Compliance of Project activities with the *No-Net-Loss* principle to prevent or mitigate direct or indirect fish and fish habitat losses; and
- Consultations with DFO and the QIA may be required to identify Project specific thresholds for blasting that would exceed the requirements of DFO Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters.

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5 HYDROLOGY, WATER SUPPLY AND SURFACE WATER RUNOFF

The Qikiqtani Region, Baffin Island is characterized by long cold winters and short cool summers, with continuous daylight from approximately May to August, and continuous darkness from November through February. The ground is snow-covered from September to June and ice persists in the marine offshore throughout most of the year.

5.1 REGIONAL LANDSCAPE

Surface landforms and glacial deposits are associated with a recent, widespread glaciation on Baffin Island. Surface geology is comprised of locally abundant Holocene Glaciolacustrine sediments, fluvial sediments (alluvial deposits), Marine and Glacio-marine Deltaic sediments, and end moraine till, with occasional outcrops of pre-Quaternary bedrock. The North Baffin region and Mary River area lies within the Committee Belt, a granite-greenstone terrain with intermixed rift basin sediments and volcanic rocks, and bounded by Precambrian mountains to the east and Palaeozoic lowland plateaus to the west. The Project lies within the zone of continuous permafrost, with an active layer thickness of up to two metres and a permafrost depth that may be as much as 700 m deep, based on extrapolation from temperature gradients measured in a 400 m-deep thermistor-instrumented drillhole located on site. The active layer throughout the Project area ranges from approximately 1 to 2 m thickness, but may be greater in areas where there is loose, sandy soil at the edges of lakes or ponds or at bedrock topographic highs.


The presence of permafrost greatly increases ground stability at depth but at surface it can affect the rates of soil erosion through the formation of ice wedges and patterned ground, pingos and palsas, massive ground ice, thermokarst, and mass wasting (i.e., solifluction).

5.2 CLIMATE

Baffin Island is one of the northernmost and coldest parts of Canada and the Mary River Project is situated towards the northern end of the Island. Regional data near the Project site indicate a mean annual temperature of approximately -15°C . Mean daily temperatures are below -20°C from November through April, and are only above freezing (0°C) during June through August, with July mean daily maximum temperatures reaching only $6 - 10^{\circ}\text{C}$. The long length of the sub-zero degree temperatures in this region results in a very short runoff period that typically occurs from June through September, but may extend to late October in systems where large lakes are present. The frigid temperatures also result in very low precipitation values for northern Baffin Island due to the combined effect of the low moisture carrying capacity of cold air and the scarcity of liquid water throughout much of the year. According to Natural Resources Canada, the mean annual total precipitation ranges from 200 to 400 mm in the Project area, classifying it as semi-arid. Mean annual precipitation at the closest regional climate station (Pond Inlet) is closer to the 200 mm end of this range. Pond Inlet experiences 24-hour darkness (with less than 2 hours of twilight) from November 12 to January 29, and continuous daylight from May 5 to August 7.

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5.3 REGIONAL HYDROLOGY

The extreme temperatures of the region, combined with permafrost ground conditions, result in a short period of runoff that typically occurs from June to September, extending into October in watersheds with significant lake surface areas. All rivers and creeks, with perhaps the exception of the very largest systems are frozen solid to the bottom during the winter months. For example, the Sylvia Grinnell River near Iqaluit (watershed area of ~4000 km²), which has been monitored by Water Survey of Canada (WSC) since 1971, freezes solid by April every year. Streams and river systems typically begin to flow in late May with the onset of snow and ice melt with peak flows in June or July with rising temperatures and rapid corresponding snowmelt, before dropping steadily through to September or October when flows essentially cease. The peak runoff period is quite short and the volume of the annual hydrograph is low, relative to the rest of Canada, due to the region's very low average annual precipitation of approximately 200 mm. However, the proportion of annual precipitation that is realized as runoff is very high, due to low temperatures (low evaporation) and the permafrost ground conditions (low infiltration) and minimal vegetative cover (low evapotranspiration). Correspondingly, surface water is abundant, and the region is dotted with thousands of small lakes and streams. Groundwater infiltration and storage in the region is limited due to the permafrost. The groundwater flow is restricted to the upper one to two metres within the summer active layer.

Peak instantaneous flows are significant due to frozen ground conditions and the lack of tall vegetation to provide subsurface root systems. This in turn produces very rapid basin runoff response. In larger watersheds, peak instantaneous flows are typically produced by snowmelt during the freshet, but in smaller watersheds (less than a few hundred square kilometres) rainfall, or rain on snow may produce the largest events and may occur at any time during the non-freeze period. Flood water levels in the smaller watersheds typically rise and fall very quickly with run-off response.

Knight Piésold has updated the hydrology estimates to reflect the most recent records (Knight Piésold, 2009). Stream flow measurements were conducted in the study area and flow estimation equations were developed for use. The Knight Piésold report is provided in AFEIS, Volume 7 – *Freshwater Aquatic Environment*. The Freshwater Regional Study Area map is provided as Figure 7-1.1 in Appendix C to illustrate the Milne Port and Mine Site Catchment Areas in context to their surrounding catchment areas.


The following sections describe surface water flow direction and estimated quantities (where possible) for each catchment area impacted by the Project.

5.3.1 SURFACE WATER RUNOFF ESTIMATION

The data presented in this section were derived from data collected during the 2006 to 2010 field study seasons. A summary of the unit surface water runoff rates for the Mary River area is provided in Table 5.1.

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Stream gauging station locations, identified as hydrology stations at the Mary River Mine Site are identified on Figure 5.1 of Appendix C. The limits of the catchment areas are also provided on this drawing. Calculated runoff values indicate that no runoff is generated from October to May, and that approximately half of all flows occur in July. Surface water direction and expected quantities (where possible) for each catchment area impacted by Project activities are provided in the following sections of this Plan.

Hydrology data collected in 2015 (2015 Hydrometric Monitoring Program, Story Environmental Inc., February 2016) were compared to the existing data collected in the 2014 Hydrometric Monitoring Program Summary (2014 Hydrometric Monitoring Program, Knight Piésold, 2014). The following discussion and interpretation of the current data (2015) to the existing data (2014) was obtained from the Story Environmental 2015 Hydrometric Monitoring Program:

- H01 (Phillip's Creek Tributary) - A stage-discharge measurement was recorded at H01 during the June site visit and is consistent with the existing rating curve. As such, the existing data was used for the development of the 2015 streamflow record.
- H02 (Tom River) - A stage-discharge measurement was recorded at H02 during the June site visit and plots lower than the existing rating curve. The channel at H02 appeared to be stable, however, the data from 2013 to 2015 suggest a possible shift in the rating curve. Additional high flow measurements are recommended at H02 to verify the upper half of the rating curve and determine if the curve should be adjusted. The existing data was used for the development of the 2015 flow record, however, it is considered provisional as the existing curve may be underestimating discharge.
- H04 (Camp Lake Tributary CLT-2) - A stage-discharge measurement was recorded at H04 during the site visit and is consistent with the existing data. Higher flow measurements were not obtained in 2015 to validate the upper half of the rating curve and there is less confidence in the accuracy of flows recorded above 0.4 m³/s. Additional measurements are recommended across a range of flows to further validate existing data at H04. The updated data was used for the development of the 2015 flow record.
- H05 (Camp Lake Tributary CLT-1) - Stage-discharge measurements were recorded at H05 during the June site visit and were consistent with the existing data. The rating curve was used for the development of the 2015 flow record.
- H06 (Mary River) - No stage-discharge measurements were recorded at H06 in 2015 due to ice in the channel, which prevented an accurate measurement of stage. The rating curve at H06 has been consistent over the past several years and the channel appears to be stable. As such, the existing data was used for the development of the 2015 flow record.
- H11 (Sheardown Lake Tributary SDLT-1) - Stage-discharge measurements were recorded at H11 during the June site visit and are generally consistent with the 2014 measurements. There remains

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uncertainty around higher stage-discharge conditions at H11 due to the lack of field measurements for validation.

The 2015 Hydrometric Monitoring Program identifies that a strong diurnal melt pattern is evident through the first half of July and the peak of freshet flows occurred earlier than in previous years, from June 28 to July 4. The peak flows were lower than previous years and of shorter duration. The total annual runoff in 2015 at the H05 station was the lowest recorded from 2006 to 2015. The mean monthly discharge and unit runoff for each station in 2015 are summarized in Tables 5.1 and 5.2.

Table 5.1: 2015 Mary River Monthly Estimated Discharge Summary

Station	Drainage Area (km ²)	Mean Monthly Estimated Discharge (m ³ /s)				Period of Record
		June	July	August	September	
H01	250	15.7*	8.8	3.5	-	June 20 – August 31
H02	210	14.5*	6.0	2.3	0.9*	June 21 – September 2
H04	8.3	0.41*	0.20	0.2	0.03*	June 19 – September 2
H05	5.3	0.13*	0.06	0.08	0.03*	June 19 – September 1
H06	240	18.6*	9.2	3.8	1.1*	June 19 – September 2
H11	3.6	0.026*	0.038	0.063	0.030*	June 18 – September 1

* Months with incomplete data.

Table 5.2: 2015 Mary River Monthly Estimated Unit Runoff Summary

Station	Drainage Area (km ²)	Mean Monthly Estimated Unit Runoff (m ³ /s)				Period of Record
		June	July	August	September	
H01	250	65.3*	36.8	14.9	-	June 20 – August 31
H02	210	69.5*	28.5	11.1	4.2*	June 21 – September 2
H04	8.3	50.1*	24.2	19.8	4.0*	June 19 – September 2
H05	5.3	23.9*	12.2	15.8	5.5*	June 19 – September 1
H06	240	77.4*	38.3	16.0	4.4*	June 19 – September 2
H11	3.6	7.3*	10.6	17.7	8.5*	June 18 – September 1


* Months with incomplete data.

5.3.2 SURFACE WATER RUNOFF ESTIMATION – MILNE PORT

Streamflow estimates presented in this section for Milne Port were derived from field data collected during the 2006 to 2008 and 2010 field seasons in addition to regional data collected by Water Survey of Canada (WSC). Stream gauging station locations at Milne Port are illustrated on Figure 5.3 provided in Appendix C. The limits of the catchment areas are also provided on this drawing. A mean annual unit runoff area of 7.5 L/s/km² at Milne Port was determined by the estimated long-term mean annual runoff at streamflow gauging station H1 (Knight Piésold, 2009). The monthly flow distribution was also determined by long-term average hydrograph shape estimated at streamflow gauging station H1. Surface water runoff rates were estimated for six watersheds in the Milne Port area. These estimates are provided in Table 5.3 and catchment boundary areas are illustrated in Appendix C. Calculated runoff values indicate that runoff is negligible from October to May and the majority of runoff occurs throughout June and July.

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Hydrology data were not collected in Milne Port in 2015. Hydrology data collected in 2014 (2014 Hydrometric Monitoring Program Summary, Knight Piésold, 2014) were used and identify identical rating curves as in the 2013 Hydrologic Data Collection Program Summary (Knight Piésold, 2014). Milne Port Surface Water Balance, provided in Appendix C reflects the layout as of 2015, with the mean annual unit run-off data as presented in the AFEIS, Volume 7 – Freshwater Aquatic Environment.

Table 5.3: Milne Port Estimated Catchment Runoff Rates


Catchment No.			MI-01	MI-02	MI-03	MI-04	MI-05	MI-06
Catchment Area (km ²)								
Mean Annual Unit Runoff (l/s/			0.7					
	Runoff	Unit Runoff	Runoff Rates					
	(%MAUR)	(l/s/ km ²)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)	(m ³ /s)
January	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
February	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
March	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
April	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
May	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
June	600	42.0	0.22	0.15	0.17	2.62	0.13	0.33
July	335	23.5	0.12	0.08	0.10	1.46	0.07	0.19
August	180	12.6	0.07	0.05	0.05	0.79	0.03	0.10
September	80	5.6	0.03	0.02	0.02	0.35	0.0	0.04
October	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
November	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
December	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Note: 1. The above runoff distribution was derived using data collected at hydrometric monitoring station H4. The distribution applies only to watersheds near Milne Inlet with drainage areas less than 100 km ² . 2. The above mean annual unit runoff was derived from data collected at hydrometric monitoring station H1, within the Phillips Creek watershed.								

5.3.3 CATCHMENT AREAS FOR THE MILNE PORT TOTE ROAD

Figure 5.6 of Appendix C provides the watershed catchment areas along the Milne Port Tote Road.

5.4 WATER SUPPLY

The Project fresh water requirements are provided in Baffinland's *Freshwater Supply, Sewage and Wastewater Management Plan* (BAF-PH1-830-P16-0010).

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6 WATER MANAGEMENT – EARLY REVENUE PHASE

The water management structures completed as part of the Early Revenue Phase shall remain in operation until associated infrastructure is decommissioned, or until otherwise approved. The 2016 Work Plan allows for the provisions for construction activities to be complete at Milne Inlet, Tote Road and the Mine Site, forecasted under the amended Project Certificate No. 005.

Issued for Construction engineered designs and drawings for all infrastructure and/or facilities designed to contain, withhold, divert or retain water and/or waste, in addition to specifications and engineering analyses in to support construction designs shall be provided regulatory authorities for review and approval prior to their construction. To fulfill the requirements provided in Part D – Item 2 of the Type A Water Licence, as-built drawings are provided.

Site drainage drawings and water management structures have been developed for Milne Port and the Mine Site to reflect the 2016 Project Work Scope and are provided in Appendix D. The following site water balance figures have been developed and are provided in Appendix C to indicate relative flow inputs and outputs in throughout 2016 at each site:

- Mine Site Water Balance Early Revenue Phase; and
- Milne Port Water Balance Early Revenue Phase.

Due to ongoing work required throughout 2016 along the Milne Port Tote Road, water balance figures have not been developed. Upon road construction completion, water balance figures shall be developed and submitted in support of this Plan.


6.1 MILNE PORT

In 2016, equipment and materials will be delivered to Milne Port by conventional sealift during the open water season and transported overland by trucks to the Mine Site over the Milne Port Tote Road. The existing facilities at Milne Port play a key logistical support role for receiving sealift materials at Milne Port destined for the Mary River Mine Site.

During the sealift, most of the activities at Milne Port will focus on unloading the barges and positioning received equipment and material in designated laydown areas.

Ongoing Construction activities and forecasted Operational plans are provided in the 2016 Project Work Plan provided in Appendix B. Milne Port Site layout drawing has been updated to reflect the 2016 Project Work Plan and has also been provided.

Surface water runoff from areas of intense vehicular activity is susceptible to contamination from minor spills and/or leakage of machinery and equipment. Mitigation measures identified in Section 4.0 will be implemented at these sites to divert non-contaminated surface runoff away from these areas and minimize the potential for contamination. These areas will be designed and prepared such that surface

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water runoff is effectively channelled/diverted from these areas to polishing ponds for collection and water quality monitoring subject to Part D, Item 16 of the Type A Water Licence, prior to its discharge to the receiving environment. Where required, effective erosion prevention measures and adequate sedimentation control structures will be utilized..

To minimize impacts on surface drainage and water quality, Project laydown areas are required to be constructed at least 31 m above the ordinary high-water mark of any water body. .

Storage of hazardous materials (i.e. fuel, explosives, and other hazardous materials) are contained within approved impermeable bermed structures (lined with geomembranes). As required, surface runoff from containment areas is collected, contained and treated (refer to Section 9.2).

6.1.1 SOIL LANDFARM AND CONTAMINATED SNOW CONTAINMENT FACILITY

A soil landfarm and contaminated snow containment facility consisting of two geomembrane lined containment is located at Milne Port. The larger (3,383 m³) west cell (landfarm) provides containment and biotreatment for hydrocarbon contaminated soil. Treated soils that meet appropriate criteria will be used as landfill cover material or other purposes only upon approval.

The smaller (929 m³) east cell provides containment for hydrocarbon contaminated snow collected during the winter months for treatment during the summer months. Monitoring will be completed to ensure compliance with prescribed water quality guideline criteria (refer to Fresh Water, Sewage and Wastewater Management Plan, Oily water treatment, Attachment 5, Appendix 10D-3). As required, erosion and sedimentation controls will be in place prior to discharging water from the treatment process.


6.1.2 MILNE PORT STOCKPILE SETTLING PONDS

Two stockpile settling ponds are located at Milne Port north of the ore stockpile pad to temporarily retain runoff water from the Milne Port stockpile area and contain the sediment load to meet the water quality standards identified in Part D, Item 16 of the Type A Water Licence. During normal operation, runoff from the stockpile area will drain 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 Milne Inlet. 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.

Settling Pond No. 1 has a design storage capacity of 2,660 m³ with a 0.3 m freeboard (the west pond). Settling Pond No. 2 has a design storage capacity of 2,800 m³ with a 0.3 m freeboard (the east pond).

6.1.3 SURFACE WATER DIRECTION AND QUANTITY

Catchment areas for Milne Port are provided in Figure 5.3 of Appendix C. Surface water at the site is directed towards the Milne East and West Settling Ponds (above). The estimated surface water runoff quantities for Milne Port catchment areas is provided in Table 5.2.

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6.1.4 MITIGATION MEASURES

Where appropriate, environmental protection measures implemented during Construction and Operations Phases will be retained for the useful life of the facilities, or until otherwise approved. Drainage structures have been installed to divert site contact water to specific points of discharge for monitoring (refer to Appendix D).

Previous Project construction activities in 2007, 2008, and 2011 identified minor erosion and sediment control issues and it is not anticipated that Milne Port will require significant areas of disturbed soils throughout the Operational life of the Project. Surface water at the Ore Stockpile Facility and surrounding areas is directed toward the settling ponds where it will be collected and contained while suspended solids are permitted to settle out.


Water quality monitoring subject to Part D, Item 16 of the Type A Water Licence, is required prior to water discharge to Milne Inlet. Where required, provisions to allow for monitoring of ongoing construction activities shall be incorporated into this Plan for review and approval. Should it be determined that mitigation measures are required to control sediment and erosion, appropriate methods will be evaluated at that time.

6.2 MILNE PORT TOTE ROAD

The Milne Port Tote Road is the primary transportation route for supporting construction at the Mine Site. All equipment, material, fuel, and supplies required for Construction and Operation activities at the Mary River Mine Site will be transported from Milne Port to the Mine Site via the Tote Road. The upgrade of the road will continue throughout 2016.

The requirement and selection of effective sedimentation and erosion controls to be employed at areas along the Milne Port Tote Road will be assessed subject to Project authorizations and applicable DFO guidance. Stream and river crossings have been designed and constructed to minimize the potential loss of fish habitat. All monitoring shall be conducted in a manner consistent with the methodologies outlined in the Knight Piésold report (Knight Piésold, 2009), Fish Habitat No Net Loss and Monitoring Plan (NB102-00181/10-4) - *issued* August 2003, as well as Baffinland's Bulk Sampling Program and Aquatic Effects Monitoring Framework - *issued* June 27, 2014.

A minimum 100 m naturally-vegetated buffer shall be maintained between the high-water mark of any fish-bearing water body and all permanent quarries along the Milne Port Tote Road to eliminate the risks of potential for acid rock drainage or metal leaching. All construction areas along the tote road will be designed and prepared such that surface water runoff is effectively channelled/diverted from these areas to polishing ponds for collection and water quality monitoring subject to Part D, Item 16 of the Type A Water Licence, prior to its discharge to the receiving environment.

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Furthermore, laydown areas required for ongoing construction activities shall be constructed not closer than 31 m from the ordinary high-water mark of any water body in order to minimize impacts on surface drainage and water quality.

6.3 MARY RIVER MINE SITE

Ongoing Construction activities and forecasted Operational plans are provided in the 2016 Project Work Plan provided in Appendix B. The Mine Site layout drawing has been updated to reflect the 2016 Project Work Plan and has also been provided.

Surface water runoff from areas of intense vehicular activity is susceptible to contamination from minor spills and/or leakage of machinery and equipment. Mitigation measures identified in Section 4.0 will be implemented at these sites to divert non-contaminated surface runoff away from these areas and minimize the potential for contamination. These areas will be designed and prepared such that surface water runoff is effectively channelled/diverted from these areas to polishing ponds for collection and water quality monitoring subject to Part D, Item 16 of the Type A Water Licence, prior to its discharge to the receiving environment. Where required, effective erosion prevention measures and adequate sedimentation control structures will be utilized.

To minimize impacts on surface drainage and water quality, Project laydown areas are required to be constructed at least 31 m above the ordinary high-water mark of any water body. .

Storage of hazardous materials (i.e. fuel, explosives, and other hazardous materials) are contained within approved impermeable bermed structures (lined with geomembranes). Surface runoff from containment areas is collected, contained and treated if required (refer to Section 9.2).


6.3.1 SURFACE WATER DIRECTION AND QUANTITY

Catchment areas for the Mary River Mine Site are presented in Figure 5.1 of Appendix C. Surface water at the site is directed towards Camp and Mary Lakes. The estimated surface water discharge and runoff quantities for the Mary River Mine Site catchment areas are provided in Tables 5.1 and 5.2.

6.3.2 MITIGATION MEASURES

Where appropriate, environmental protection measures implemented during the Construction Phase will be retained for the useful life of the facilities, or until otherwise approved. Drainage structures have been installed to divert site contact water to specific points of discharge for monitoring (refer to Appendix D).

Where required, provisions to allow for monitoring of ongoing construction activities will be incorporated into this Plan for review and approval. Should it be determined that mitigation measures are required to control sediment and erosion, appropriate methods shall be evaluated at that time.

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7 WATER MANAGEMENT – MINING OPERATION

Runoff management structures required for mining operations are ongoing. Where required, these structures will be maintained throughout the lifecycle of the Project. Open pit mine and waste rock stockpile management activities and accountabilities will progress over time to accommodate work plan development and changes, management reviews, incident investigations, regulatory changes or other Project related modifications. At such time, appropriate water management strategies and associated structures will be augmented to ensure compliance with all applicable regulations.

7.1.1 MITIGATION MEASURES

Sediment and erosion control measures may be required and shall be installed as per Section 4.0 – Mitigation Measures. Berms and other drainage control measures shall be established as required to limit erosion and maintain positive drainage to minimize water ponding. Contouring, berming and silt fences with use of PAMs will be applied as necessary for sediment and erosion control. Routine monitoring shall be completed to ensure compliance with all applicable regulations and prescribed threshold values.

7.1.2 OPEN PIT AND ASSOCIATED FACILITIES


The following facilities have been designed and constructed to facilitate mining operations at Project sites:

- Mine haulroads;
- Run of mine (ROM) ore stockpile;
- Ore stockpiles (lump and fines) including stacker/reclaimer system;
- Primary crusher;
- Secondary crushing;
- Explosives magazines and emulsion plant; and
- Waste rock dump.

The open pit will be excavated using a conventional bench configuration with access via ramps. Movement of vehicles within the pit will be monitored by a central dispatching system in order to ensure worker health and safety and operational efficiency.

Dimensions of the final open pit, determined by the preliminary design presented in the AFEIS are:

- Maximum length: 2.0 km;
- Maximum width: 1.2 km; and

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- Maximum depth: 465 m (northern side) to 195 m (southern side).

7.1.3 GROUNDWATER INFLOWS TO THE PIT

It is anticipated that groundwater inflows will be minimal below the active zone at the open pit. An assessment was completed to compare operations at three mine sites at northern latitudes, including the Polaris, Ekati, and Diavik mines. From this assessment, it was determined that the Ekati mine is most similar to the Mary River Mine Site. The Ekati pits were developed in competent granite that was cut by moderate faults. The base of permafrost at the Ekati mine was encountered at approximately 350 to 400 m. With the exception of the near surface layer, groundwater was not encountered in the pits until mining reached limits below permafrost. From the assessment, it was determined that the Mary River pit will receive negligible groundwater inflow below the active layer because mining activities will take place in competent bedrock characterized by colder mean temperatures, topographically higher elevations, minimal faulting, and a deeper permafrost zone.


Historically, the Polaris underground mine (also located in Nunavut) experienced problems with groundwater entering the mine causing temporary closure of the mine. These water inflows were due to thawing of permafrost in ice-rich rock (shale) due to the ventilation system, rather than natural groundwater inflow. The ventilation system was subsequently renovated and there were no additional problems with underground water accumulations in the mine as it was extended to a total depth of approximately 450 m. The mine was limited to this depth due to the incompetence of the shale, not groundwater inflow problems.

Geotechnical investigations at the Mary River open mine have included drilling of a 400 m deep drillhole instrumented with thermistors along its depth. The thermistors report ground temperatures at various depths within the hole. Extrapolation of temperature gradients with depth suggests that permafrost conditions (i.e., below 0°C for two consecutive years) extend to approximately 700 m, well below planned mine depths. It is anticipated that water inflows into the pit will be minor, consisting of shallow seasonal groundwater flows and direct contribution from precipitation events. Drifting snow is not expected to significantly contribute to in-pit water volumes. A snow fence shall be erected around the perimeter of the pit to minimize drifting snow.

Pit water quality will be transported to a sedimentation pond and monitored prior to discharge to the receiving environment.

7.1.4 SURFACE WATER DIRECTION AND QUANTITY

Catchment areas for the Mary River Mine Site are presented in Figure 5.1 of Appendix C. Surface water at the site is directed towards Camp Lake and Mary Lake. The estimated surface water runoff quantities the Mary River Mine Site catchment area is provided in **Error! Reference source not found.5.1.**

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7.2 WASTE ROCK PILE

In 2016 it is forecasted that approximately 6,093,528 wmt will be mined from the open pit. From this it is estimated that 4,200,000 wmt of ore will be stockpiled at Milne Port, and 1,893,528 wmt of waste rock will be deposited waste rock piles at the Mine Site. As additional geological, geotechnical and geochemical data is collected, the waste rock management plan will be updated to identify and implement best management practices. Mining activities involving the production and handling of waste rock will shall be completed in accordance with Baffinland's Phase 1 Waste Rock Management Plan (BAF-PH1-830-P16-0029).

7.3 MINE SITE CRUSHING OPERATIONS

Ore from the open pit will be processed by crushing to a suitable size for transport. Current crushing location for run-of-mine ore is at the Mine Site, however, analyses of current process flow and quality of the ore has indicated the need to transfer some of the final processing of the ore (crushing and screening) to the ore stockpile pad at Milne Port. The drainage from the crusher/ore stockpiles at the Mine Site and at Milne are controlled by lined and engineered sedimentation collection ponds. .

Runoff from the crusher and surrounding area may be impacted by dust and will be directed to surface drainage and appropriate sediment control structures as required. If dust from surrounding area becomes mobile in water, especially during the freshet period, sediment controls such as silt fences, temporary sumps, flocculation, and silt curtains along the shores of downstream receiving water bodies (e.g., Sheardown Lake) will be installed as soon as practical.

7.3.1 SURFACE WATER DIRECTION AND QUANTITY

The catchment areas for the stockpiles and crusher operations in the vicinity of the Mine Site are provided in the Type 'A' Water License application, Attachment 9 in the drawing titled *Mine Site Permanent Works Water Supply and Wastewater Disposal GA Plan*, Doc. No. H337697-4310-10-042-0001. Surface water runoff in the area will be directed to a sedimentation pond where monitoring will be completed subject to Part D, Item 16 of Baffinland's Type A Water Licence prior to its release to the environment.

7.3.2 MITIGATION MEASURES

Where appropriate, environmental protection measures implemented during the Construction Phase will be retained for the useful life of the facilities, or until otherwise approved. Drainage structures have been installed to divert site contact water to specific points of discharge for monitoring (refer to Appendix D).

Where required, provisions to allow for monitoring of ongoing construction activities shall be incorporated into this Plan for review and approval. Should it be determined that mitigation measures are required to control sediment and erosion, appropriate methods shall be evaluated at that time.

8 ENVIRONMENTAL RESPONSIBILITIES

8.1 ROLES AND RESPONSIBILITIES

The Baffinland Environmental Team is organised into two parts, on-site and off-site. The organisational structure for the Mary River Project in relation to the environment discipline is shown in the Table 8.1 below. Communication channels are described as liaisons in the tables outlining the responsibilities and accountabilities in the following sections.

8.1.1 ENVIRONMENTAL PROJECT TEAM


The Baffinland Environmental Team will oversee all environmental and community works on and off site. The Baffinland Corporate Environmental Team responsibilities are summarized in Table 8.1 and 8.2.

Table 8.1: Baffinland Iron Mines Corporation Senior Management

Baffinland Iron Mines Corporation Senior Management	
Position	Responsibilities and Accountabilities
Project Director	<ul style="list-style-type: none"> - Reports to Baffinland's CEO - Overall accountability for the Project execution - Allocation of resources (human and financial) for the implementation of Baffinland's commitments and objectives related to health, safety and environment during construction of the Project - Accountable for on-site environmental, health and safety performance during construction of the Project
VP Operations	<ul style="list-style-type: none"> - Reports to Baffinland's CEO - Overall accountability for the operation of the Project - Allocation of resources (human and financial) for the implementation of Baffinland's commitments and objectives related to health, safety and environment during operation - Accountable for on-site environmental, health and safety performance during operation
VP Sustainable Development, Health, Safety and Environment	<ul style="list-style-type: none"> - Reports to Baffinland's CEO - Establish corporate environmental policies and objectives - Monitors and reports on Baffinland's performance related to environmental, health and safety policies and objectives - Community liaison - Liaise with regulatory authorities - Obtains necessary permits and authorizations - Monitors compliance with terms and conditions of permits and licences - Routine EHS audit of contractor performance while on site
Manager Purchasing and Contract	<ul style="list-style-type: none"> - Reports to Baffinland's Project Director - Accountable for procurement and purchasing - Ensure that environmental commitments, policies and objectives are included in all contract documents

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Baffinland Iron Mines Corporation Senior Management	
Position	Responsibilities and Accountabilities
VP Corporate Affairs	<ul style="list-style-type: none"> - Reports to Baffinland's CEO - Accountable for external communication (Governments, media, NGO, others) related to Baffinland's press release and overall communication of site incidents/events


The Baffinland Environmental Team will oversee all environmental activities on site. These responsibilities on site are outlined in Table 8.2.

Table 8.2: Baffinland Iron Mines Corporation On-Site Management Team

Baffinland Iron Mines Corporation On-Site Environmental Team	
Position	Responsibilities and Accountabilities
Environmental Manager	<ul style="list-style-type: none"> - Reports directly to VP Sustainable Development, Health, Safety and Environment and Indirect reporting and coordination with Operations VP and Director Environment - Overall accountability for environmental staff and performance at site - Coordinates implementation and monitors the performance of the Environmental Management System at site - Liaises with the senior management, regulators and stakeholders - Ensures effective monitoring and auditing of environmental performance of departments and contractors on site and identifies opportunities for improvement - Monitors compliance with permits, licenses and authorizations - Ensures all regulatory environmental monitoring and reporting requirements (monthly, annual) are met - Leads and coordinates site permitting requirements. - Initiates and oversees environmental studies - Oversees investigations and reporting of environmental incidents to regulatory bodies, stakeholders and senior management - Reviews and updates environmental management plans
Environmental Superintendent	<ul style="list-style-type: none"> - Reports to Environmental Manager - Specific accountabilities for environmental monitoring and reporting - Leads investigations and reporting of environmental incidents onsite - Serves as the liaison for regulators during onsite inspections and visits - Provides ongoing environmental education and environmental awareness training to all employees and contract workers - Oversees environmental database management - Prepares updates for management plans
Environmental Coordinator	<ul style="list-style-type: none"> - Reports to the Environmental Superintendent and Manager - Specific accountabilities for environmental monitoring and reporting - Provides day to day direction to Environmental staff onsite

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Baffinland Iron Mines Corporation On-Site Environmental Team	
Position	Responsibilities and Accountabilities
	<ul style="list-style-type: none"> - Serves as a liaison for regulators during onsite inspections and visits. - Provides ongoing environmental education and environmental awareness training to all employees and contract workers - Assists with environmental database management
Environmental Monitor and Technician	<ul style="list-style-type: none"> - Reports to the Environmental Superintendent or designate - Assists with environmental database management - Assists with monitoring and sampling activities as per the Project's management plans
Environmental Support Groups (Consultants, etc.)	<ul style="list-style-type: none"> - Assists with sampling, monitoring and reporting activities as required by permits, licenses and environmental management plans - Provides technical expertise to various environmental studies

8.1.2 MARY RIVER PROJECT ORGANIZATION CHART

For further information regarding the Mary River Projects organizational structure in relation to the environment discipline, please refer to the Figure 8.1 below:

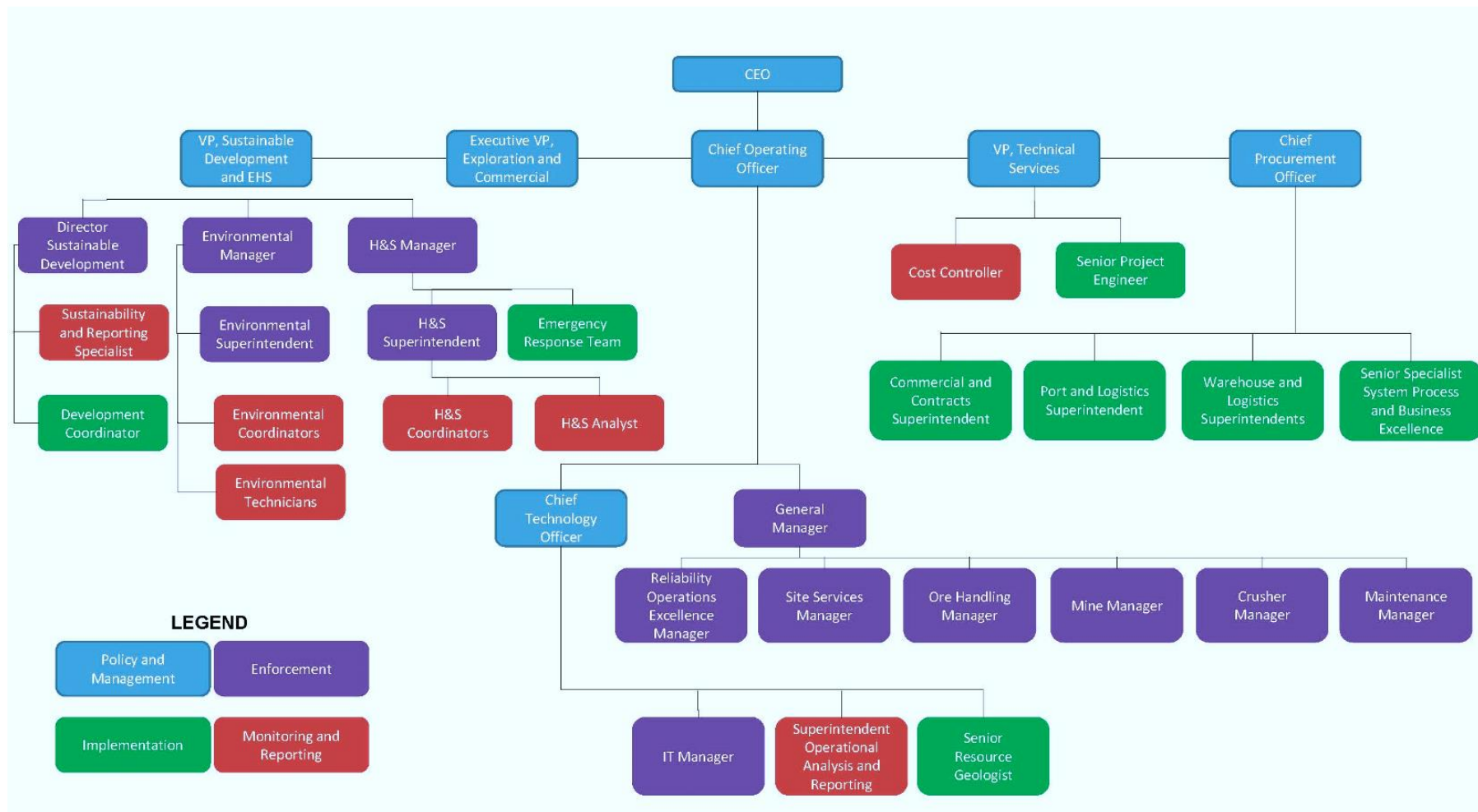



Figure 8.1: Mary River Organizational Chart

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8.2 MONITORING AND INSPECTIONS

Monitoring and reporting requirements are provided in Section 9 of this Plan. Responsibilities have been assigned to various personnel within the Project team. Where required, third party resources will be retained to supplement in-house resources and expertise.

8.3 TRAINING AND AWARENESS

Personnel (Baffinland employees and contractors) working on site are required to receive environmental training as part of Baffinland's Site Orientation to achieve a basic level of environmental awareness and understanding of their obligations regarding compliance with regulatory requirements, commitments and best practices.

Operations Superintendents and contractor Supervisors are provided with this Management Plan, and shall receive additional awareness training with respect to the requirements outlined in this Plan. Additionally, all supervising level staff and contractor employees will be provided with the Environmental Operational Standards provided in Baffinland's Environmental Protection Plan, Doc. No. BAF-PH1-830-P16-008, as a written guidance for their work activities.

Targeted environmental awareness training may be required by individuals and/or groups of workers assuming a specific authority or responsibility for environmental management or those undertaking an activity with an elevated high risk of environmental impact. Awareness training is required for individuals and/or groups at toolbox/tailgate meetings or other means as appropriate.

9 MONITORING AND REPORTING REQUIREMENTS

In addition to the specific monitoring and reporting requirements subject to applicable regulatory approvals, routine inspections at identified locations throughout the Construction and Operations Phases shall be undertaken. Routine water management inspections shall be conducted at drill sites, Project camp sites and related infrastructure, roadways, and landforms generated in association with the Project developments. Where required, inspection locations shall be modified to reflect ongoing Project activities being completed at that time.

9.1 ROUTINE INSPECTIONS


Table 9.1 provides the components of required routine inspections and the sites to which they have been assigned.

Table 9.1: Routine Inspections and Monitoring Requirements

Site	Routine Inspections
Milne Port	- Water management systems
Mine Site	- Sediment and erosion control structures
Tote Road and Refuge	- Evidence of hydrocarbon staining or leaks from containment devices

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Site	Routine Inspections		
Stations	<ul style="list-style-type: none"> - Full-time supervision of fuel transfer operations - Water intakes - Flow meter readings - Rutting by vehicles 		
Milne Port	<ul style="list-style-type: none"> - Sediment and erosion control structures - Fuel leaks - Drip Pans and Equipment condition - Any rutting by vehicles 		
Soil Stockpile Locations	<ul style="list-style-type: none"> - Sediment and erosion control structures - Evidence of hydrocarbon staining or leaks from containment devices - Fuel leaks - Drip Pans and Equipment condition - Rutting by vehicles 		
Borrow Sites Quarries	<ul style="list-style-type: none"> - Evidence of hydrocarbon staining or leaks from containment devices - Full-time supervision of fuel transfer operations - Sediment and erosion control structures - Drip Pans and Equipment condition 		
Drill Sites	<i>Pre-Drilling</i>	<i>Drilling Period</i>	<i>Post-Drilling</i>
	<ul style="list-style-type: none"> - Drill hole coordinates - Water source coordinates - Site photo - Water source photo - Distance to nearest water source - Archaeological approval - Wildlife survey 	<ul style="list-style-type: none"> - Fuel leaks - Sediment and erosion control structures - Drip Pans - Equipment condition - Any rutting by vehicles - Water intake - Water management - Flow meter reading 	<ul style="list-style-type: none"> - Fuel leaks - Sediment and erosion control structures - Drip Pans - Equipment condition - Any rutting by vehicles - Water intake - Water management - Flow meter reading - Environmental concerns - Wildlife concerns
Waste Rock Stockpile	<ul style="list-style-type: none"> - Sediment and erosion control structures - Evidence of hydrocarbon staining or leaks from containment devices - Evidence of ARD and ML - Drip Pans - Equipment condition 		
Bulk Fuel Storage Areas Milne Port Mary River	<ul style="list-style-type: none"> - Primary containment structure - Evidence of hydrocarbon staining or leaks from containment devices - Equipment condition - Spill kits 		
Explosives Storage Areas Mary River	<ul style="list-style-type: none"> - Primary containment structure - Access and security - Equipment condition 		

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Site	Routine Inspections
	- Rutting by vehicles
Laydown and Storage Areas	- Sediment and erosion control structures - Evidence of hydrocarbon staining or leaks from containment devices - Fuel leaks - Drip Pans - Equipment condition - Rutting by vehicles

Ongoing monitoring of permafrost integrity is required for areas impacted by Project activities and infrastructure. Based upon assessments, implementation of preventative measures and mitigation controls may be required to ensure that the integrity of the permafrost is maintained.

9.2 WATER QUALITY AND QUANTITY MONITORING

Baffinland has developed and implemented a Water Quality/Quantity Monitoring Program to fulfil the requirements of PART I: Conditions Applying to General and Aquatic Effects Monitoring of the Type A Water Licence requirements that address the conditions pertaining to General and Aquatics Effects Monitoring and includes the following components:

- Measurement, recording and reporting of water volumes extracted, as prescribed by the water license;
- Locations and GPS coordinates for all Monitoring Stations identified in the licence. These locations shall maintain signs for clear identification;
- Sampling, analysis and reporting of water quality, as prescribed by the water license;
- Biannual geotechnical inspections, of all engineered facilities designed to hold water or waste (i.e., landfills, sediment ponds and polishing waste stabilization ponds); and
- Monitoring Program Quality Assurance/Quality Control as prescribed by the water license.

Where flow may directly or indirectly enter a water body, Baffinland conducts water quality sampling of surface runoff from Project sites to ensure that concentrations for the parameters provided in Table 9.2 fall below the prescribed effluent quality limits.

Table 9.2: Effluent Quality Limits for Surface Runoff during Construction

Parameter	Max. Avg. Concentration (mg/L)	Max. Concentration of Grab Sample (mg/L)
Total Suspended Solids	50	100
Oil and Grease	No Visible Sheen	No Visible Sheen
pH	Between 6.0 and 9.5	Between 6.0 and 9.5
pH	Between 6.0 and 9.5	Between 6.0 and 9.5

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For specific monitoring station locations, parameters and sampling frequencies refer to Schedule I – Conditions Applying to General and Aquatic Effects Monitoring in the Type A Water Licence.

9.2.1 MONITORING STATIONS

Table 9.3 and Table 9.4 provide the monitoring locations for Milne Port and Mary River Mine Site contact water. Appendix D provides updated drainage drawings illustrating monitoring station locations for contact water.

Table 9.3: Milne Port Water Quality Monitoring Locations


Station	Description	UTM Coordinates (NAD83)		Longitude	Latitude
		Easting	Northing		
MP-03	Milne Port Bulk Fuel Storage Facility Stormwater - No Flow	503,641	7,976,288	71° 53' 12" N	80° 53' 42" W
MP-04	Milne Port Landfarm Facility Storm water - Landfarm commissioned in 2014 monitoring commenced in 2015	503,748	7,975,544	71° 52' 48" N	80° 53' 31" W
MP-MRY-12	Bulk Sample Stockpile Area Seepage - Inactive	503,357	7,976,453	71° 53' 17" N	80° 54' 11" W
Surface discharge downstream of construction area at Milne Port					
MP-C-A	Inactive in 2014	503,214	7,976,483	71° 53' 18" N	80° 54' 27" W
MP-C-B		503,191	7,975,396	71° 52' 43" N	80° 54' 29" W
MP-C-B01	Added in 2015	503,242	7,975,559	71° 52' 48" N	80° 54' 23.6" W
MP-C-C	Inactive in 2014	503,436	7,975,427	71° 52' 44" N	80° 54' 03.7" W
MP-C-D	Inactive in 2014	503,651	7,976,363	71° 53' 14" N	80° 53' 41" W
MP-C-E	Inactive in 2014	503,736	7,976,346	71° 53' 14" N	80° 53' 32.4" W
MP-C-F	Inactive in 2014	503,922	7,976,304	71° 53' 12" N	80° 53' 13" W
MP-C-G	Inactive in 2014	503,006	7,976,484	71° 53' 18" N	80° 54' 48.1" W
MP-C-H		504,113	7,976,509	71° 53' 19" N	80° 52' 53.2" W
MP-06-TEMP	Added in 2015	502,731	7,975,819	71° 52' 57" N	80° 53' 33.0" W
Surface Runoff and or Discharge Quarries					
MP-Q1-01		503,828	7,975,062	71° 52' 32" N	80° 53' 23" W
MP-Q1-02		503,811	7,975, 272	71° 52' 39" N	80° 53' 25" W

Table 9.4: Mary River Mine Site Water Quality Monitoring Locations

Station	Description	UTM Coordinates (NAD83)		Longitude	Latitude
		Easting	Northing		

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Station	Description	UTM Coordinates (NAD83)		Longitude	Latitude
MS-03	Mine Site Bulk Fuel Storage Facility Stormwater	561,182	7,913,322	71° 18' 52" N	79° 17' 19" W
MS-04	Mine Site Fuel Unloading Station Stormwater	561,264	7,913,267	71° 52' 48" N	79° 17' 11" W
MS-05	Mine Site Landfarm Facility Stormwater	Facility not yet constructed. Final monitoring location to be determined in cooperation with Inspectors.			
MS-MRY-6	Exploration Camp Bulk Fuel Storage Facility (Bladder Farm) Stormwater	558,186	7,914,780	71° 19' 41" N	79° 22' 17" W
MS-06	Ore Stockpile Pond Stormwater	561,502	7,912,968	71° 18' 40" N	79° 16' 48.4" W
MS-07	Run of Mine Ore Stockpile Pond Stormwater	Facility not yet constructed. Final monitoring location to be determined in cooperation with Inspectors.			
MS-08	Waste Rock Stockpile West pond	563,492	7,916,272	71° 20' 24" N	79° 13' 18.4" W
MS-09	Waste Rock Stockpile East pond	Facility not yet constructed. Final monitoring location to be determined in cooperation with Inspectors.			
MS-MRY-9	Bulk Sample Open Pit – Surface water drainage (to become inactive in future)	563,246	7,914,632	71° 19' 32" N	79° 13' 48" W
MS-MRY-10	Bulk Sample Weathered Ore Stockpile – Downstream surface water drainage (to become inactive in the future)	563,488	7,915,187	71° 19' 50" N	79° 13' 22" W
MRY-11	Bulk Sample Processing – Downstream surface water discharge (to become inactive in the future)	560,690	7,913,350	71° 18' 53" N	79° 18' 09" W
MS-MRY-13a & MS-MRY-13b	Non-Hazardous Waste Landfill – Downstream surface water drainage	13a: 560,754 13b: 560,642	13a: 7,912,484 13b: 7,912,527	13a: 71° 18' 25" N 13b: 79° 18' 26.5" N	13a: 79° 18' 5" W 13b: 79° 18' 16.1" W
MS-C-A	Surface discharge downstream of construction area at Mine Site	561,263	7,913,571	71° 18' 59.6" N	79° 17' 10.7" W
MS-C-B		561,454	7,913,537	71° 18' 58" N	79° 16' 52" W
MS-C-C		561,110	7,913,199	71° 18' 48" N	79° 17' 27" W
MS-C-D		561,008	7,913,280	71° 18' 50" N	79° 17' 37" W
MS-C-E		560,980	7,913,388	71° 18' 54" N	79° 17' 40" W
MS-C-F		561,797	7,913,278	71° 18' 49" N	79° 16' 17.8" W

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Station	Description	UTM Coordinates (NAD83)		Longitude	Latitude
MS-C-G	Surface Runoff and or Discharge Quarries	561,813	7,911,830	71° 18' 03'' N	79° 16' 20.3'' W
MS-C-H		561,162	7,912,067	71° 18' 12'' N	79° 17' 25.1'' W
MQ-C-A		559,489	7,914,408	71° 19' 28'' N	79° 20' 06.9'' W
MQ-C-B		560,083	7,913,905	71° 19' 11.4'' N	79° 19' 09'' N
MQ-C-D		559,447	7,914,258	71° 19' 23.4'' N	71° 20' 12'' N
MQ-C-E		563,351	7,912,902	71° 18' 36'' N	79° 13' 42.5'' W

9.2.2 OPPORTUNISTIC MONITORING

Conditional to Construction and/or Operations activities, it may be determined that Baffinland will require the installation of additional monitoring stations to effectively assess, and adequately monitor site-specific surface runoff. At which time, Baffinland will provide notification to the NWB and update the Water Quality/Quantity Monitoring Program Plan accordingly.

9.2.3 GROUNDWATER MONITORING

Upon resource availability, and where conditions permit, shallow groundwater monitoring stations shall be installed downstream of Project select infrastructure (i.e., landfill, landfarm, etc.) where environmental risks have been identified. Samples shall be collected from locations less than two meters down grade. Initial in-house field parameters shall be conducted prior to sending each sample out for external analyses, depending on location and potential contaminants. When possible, samples shall be collected once per year during the period of greatest active zone thickness (late August). Standard well installation monitoring and sampling methods shall follow. A terms of reference for a shallow groundwater study shall be submitted to the NWB for review and comment prior to implementation.

9.2.4 MONITORING AT PROJECT QUARRIES AND BORROW PITS

As required in the Type A Water Licence, during periods of elevated flows and following major precipitation events, Baffinland shall conduct monitoring on a monthly basis on any observed flows related to effluent quality under Part D, Item 16 and the monitoring requirements as established under Part I, Item 23 for any borrow pits or rock quarries.

Monthly monitoring of existing and future borrow pit and rock quarry developments during high flow is completed for the following parameters:

- Total suspended solids (TSS);
- Oil and grease;
- Ammonia;
- Nitrate (total NO₃-N);
- pH;
- Conductivity; and

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- Acute toxicity.

Weekly sampling is completed where it is determined that surface runoff from quarry activities flow directly or indirectly into a water body, to ensure that concentrations for the parameters provided in Table 9.5 fall below the prescribed effluent quality limits.

Table 9.5: Effluent Quality Limits for Surface Runoff during Construction

Parameter	Max. Avg. Concentration (mg/L)	Max. Concentration of Grab Sample (mg/L)
Total Suspended Solids	50	100
Oil and Grease	No Visible Sheen	No Visible Sheen
pH	Between 6.0 and 9.5	Between 6.0 and 9.5

As required, Baffinland will incorporate best management practices including sediment and erosion control measures installed as per Section 4.0 – Mitigation Measures. Berms and other drainage control measures shall be established where necessary to minimize or prevent surface runoff from entering nearby water bodies from Quarry and borrow pit sites.

Efforts are maintained to ensure that a minimum 100 m naturally-vegetated buffer between the high-water mark of any fish-bearing water bodies and any permanent quarries with potential for acid rock drainage or metal leaching.

10 DATA MANAGEMENT AND REPORTING


10.1 DATA MANAGEMENT

The Environmental Manager or designate is responsible for data management and reporting related to water and waste management. The data management system includes conducting routine inspections and monitoring, and forwarding results to appropriate parties as prescribed by Baffinland's applicable approvals, permits and authorizations.

10.2 WATER LICENCE REPORTING


Baffinland's Type A Water Licence details the specific reporting requirements in Schedule B – General Conditions. Baffinland shall submit an Annual Report to the NWB, no later than March 31st of the following year. The Annual Report shall include:

- Monthly and annual water consumption volumes (in cubic meters) for Project domestic and industrial purposes, from approved locations specified in PART E , Items 3 and 4 of the Type A Water Licence; and
- The monthly and annual volumes of reclaimed or recycled water used and the purpose for which it is used.

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10.3 STAKEHOLDER REPORTING


Future arrangements regarding reporting could be made through the Inuit Impact Benefits Agreement (IIBA) or other mechanisms; this shall be incorporated in future Plan updates for stakeholder review and comment where necessary.

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Appendix A - **Table of Concordance** **NIRB Project Certificate** **Type A Water License (2AM-MRY1325)** **Amendment No. 1**

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Type A water License Terms and Conditions


Table A-1 provides the Part, number and Type A water License (Water Licence No: 2AM-MRY1325 Amendment No. 1) Conditions with the corresponding location where the condition is located within the Surface Water and Aquatic Ecosystems Management Plan.

Table A-1: List of Commitments Identified and Location of the Corresponding Responses

Part	Number	Condition	Section
B	15c	The Licensee shall update and revise, for submission to the Board for review, within sixty (60) days of issuance of this Licence, the following management plans. The updates are to take into account commitments made with respect to submissions received during the preliminary and technical review of the Application documents, as well as final submissions and issues raised during the Public Hearing Process, where applicable. Baffinland Iron Mines Corporation Mary River Project Attachment 5: Surface Water and Aquatic Ecosystems Management Plan dated March 2013.	This Plan supersedes the preceding revision (Rev. 03), <i>issued</i> March 17, 2014.
B	18	The Licensee shall review the Plans or Manuals referred to in this Licence as required by changes in operation and/or technology and modify the Plans or Manuals accordingly. Revisions to the Plans or Manuals are to be submitted in the form of an Addendum to be included with the Annual Report required by Part B, Item 4, complete with a revisions list detailing where significant content changes are made.	This Plan has been updated to reflect the 2015 Work Scope and where necessary, significant changes
D	2	The Licensee shall submit to the Board for review and acceptance, at least sixty (60) days prior to construction or in a timeframe otherwise approved by the Board in writing, final design and for-construction drawings, stamped and signed by a Professional Engineer, for all infrastructure and/or facilities designed to contain, withhold, divert or retain Water and/or Waste including the following: <ul style="list-style-type: none"> - Bulk Fuel Storage Facilities - Explosives Facilities - Incineration Systems - Landfarm Facility - Oily Water and/or Wastewater treatment Facilities - Sewage Treatment Facilities - Site Drainage and Surface Water Management Systems - Waste Management Facilities (including temporary and permanent structure for hazardous and non-hazardous waste) - Water Supply Facilities - Water crossings including, pipelines, bridges, and roads - Water course training, flood control, diversions 	6 (60 days prior to construction If more immediate timeline required, will issue letter to NWB with early drawings)

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Part	Number	Condition	Section												
D	5	The Licensee shall implement sediment and erosion control measures, as required, prior to and during the Construction and Operation Phases of the Mary River Project to prevent and/or minimize sediment loading Water.	4, 4.1, 4.2, 4.3, 4.4 and 6												
D	10	The licensee shall locate equipment storage areas on gravel, sand or other durable land at a distance of at least thirty-one (31) meters above the ordinary High Water Mark of any Water body in order to minimize impacts on surface drainage and Water quality.	4.1, 6.1, 6.2 and 6.3												
D	16	<div>All surface runoff during the Construction Phase of the Project, where flow may directly or indirectly enter a Water body, shall be sampled Weekly and not exceed the following effluent quality limits:</div> <div>Table 1: Effluent quality limits for surface runoff during construction</div> <table><tr><th>Parameter</th><th>Maximum Average Concentration (mg/L)</th><th>Maximum Concentration of Any Grab Sample (mg/L)</th></tr><tr><td>Total Suspended Solids</td><td>50</td><td>100</td></tr><tr><td>Oil and Grease</td><td>No Visible Sheen</td><td>No Visible Sheen</td></tr><tr><td>pH</td><td>Between 6.0 and 9.5</td><td>Between 6.0 and 9.5</td></tr></table>	Parameter	Maximum Average Concentration (mg/L)	Maximum Concentration of Any Grab Sample (mg/L)	Total Suspended Solids	50	100	Oil and Grease	No Visible Sheen	No Visible Sheen	pH	Between 6.0 and 9.5	Between 6.0 and 9.5	6.1, 6.2, 6.3
Parameter	Maximum Average Concentration (mg/L)	Maximum Concentration of Any Grab Sample (mg/L)													
Total Suspended Solids	50	100													
Oil and Grease	No Visible Sheen	No Visible Sheen													
pH	Between 6.0 and 9.5	Between 6.0 and 9.5													
D	21	The Licensee shall not erect camps or store material on the surface of frozen streams or lakes including the immediate banks except what is for immediate use. Camps shall be located such that impacts on surface drainage are minimized.	4.1												
D	22	The Licensee shall undertake necessary corrective measures to mitigate impacts on surface drainage resulting from the Licensee’s activities.	4.1, 6.1.3												
D	26	The Licensee shall prevent the deposition of debris or sediment from entering into or onto any water body, with respect to the construction of access roads, site laydown pads and areas or other earthworks. These materials shall be disposed of at a distance of at least thirty-one (31) metres from the ordinary High Water Mark in such a manner that they do not enter the water.	4.1												
E	12	The Licensee shall not remove any material from below the ordinary High Water Mark of any water body unless authorized.	4.1												
E	13	The Licensee shall not cause erosion to the banks of any body of Water and shall provide necessary controls to prevent such erosion.	4, 4.1, 4.2, 4.3, 4.4												

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Part	Number	Condition	Section
E	19	The Licensee shall undertake appropriate corrective measures to mitigate impacts on surface drainage resulting from the Licensee's operations.	4.1, 7.1.1 and 7.3.2
E	20	The Licensee shall limit any in-stream activity, as much as possible, to low water periods. In-stream activity is prohibited during fish migration.	4.1
E	21	The Licensee shall locate stream crossings to minimize approach grades. Approaches shall be stabilized during construction and upon completion of the project, to control runoff, erosion and subsequent siltation to any water body.	4.3 and Table 4.2
F	13	The Licensee shall, unless otherwise approved by the Board in writing, discharge effluent at a distance of least thirty-one (31) metres above the Ordinary High Water Mark of any Water body, where direct flow into the Water body is not possible, such that surface erosion is minimized and no additional impacts are created.	4.1
J	8	The Licensee shall, unless otherwise identified within the approved Plan under Part J, item 1, remove all Culverts and open the natural drainage channel. In carrying out this activity, measures shall be implemented to minimize erosion and sedimentation.	4 for Sedimentation and Erosion control measures

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Project Certificate Terms and Conditions

Table A-2 to A-4 provides the number and the term and condition as it is presented in the Nunavut Impact Review Board's (NIRB) amended Project Certificate No. 005 – *issued* May 28, 2014. Comments as they pertain to each term and condition are also provided as they are presented in this Plan.

Table A-2: Hydrology and Hydrogeology Terms and Conditions provided in the Project Certificate

Hydrology and Hydrogeology

No.	Term and Condition	Comments
16	The Proponent shall ensure that the water related infrastructure or facilities that are designed and constructed, including the modification of culverts, diversion of watercourses, and diversion of runoff into watercourses along the railway, access roads, the Milne Tote Road, and other areas of the Project site, are consistent, with those proposed in the FEIS and FEIS Addendum in terms of type, location, and scope and that the requirements of all relevant regulatory authorities are satisfied advance of constructing those facilities.	Refer to Section 4.1
17	The Proponent shall develop and implement effective measures to ensure that effluent from project-related facilities and/or activities, including sewage treatment plants, ore stockpiles, and mine pit, satisfies all discharge criteria requirement established by the relevant regulatory agencies prior to being discharged into the receiving environment.	Refer to Section 9.2.1 and Site Drainage Drawings and Monitoring Plans (Appendix D) for monitoring and sampling locations.
18	The Proponent shall carry out continued analyses over time to confirm and update, accordingly, the approximate fill time for the mine pit lake identified in the FEIS.	A requirement of the Abandonment and Reclamation Plan update.
19	The Proponent shall ensure that it develops and implement adequate monitoring and maintenance procedures to ensure that the culverts and other conduits that may be prone to blockage do not significantly hinder or alter the natural flow of water from areas associated with the proposed mine. In addition, the Proponent shall monitor, document and report the withdrawal rates for water removed and utilized for all domestic and industrial purposes.	Refer to Section 4.1 and Section 9.1 for Water Quality and Quantity Monitoring and Table 9.1.

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Table A-3: Groundwater and Surface Waters Terms and Conditions provided in the Project Certificate

Groundwater and Surface Waters

No.	Term and Condition	Comments
20	The Proponent shall monitor the effects of explosives residue and related by-products from project-related blasting activities as well as develop and implement effective preventative and mitigation measures, including treatment, if necessary, to ensure that the effects associated with the manufacturing, storage, transportation and use of explosives do not negatively impact the Project and surrounding areas.	Refer to Borrow Pit and Quarry Management Plan (dated March 2014) and Quarry Management Plan – Milne Inlet Quarry Q1 (dated March 2013) Refer to the Explosives Management submitted as part of the FEIS.
21	The Proponent shall ensure that the scope of the Aquatic Effects Monitoring Plan (AEMP) includes, at a minimum: a) monitoring of non-point sources of discharge, selection of appropriate reference sites, measures to ensure the collection of adequate baseline data and the mechanisms proposed to monitor and treat runoff, and sample sediments; and b. measures for dustfall monitoring designed as follows: i. To establish a pre-trucking baseline and collect data during Project operation for comparison; ii.) To facilitate comparison with existing guidelines and potentially with thresholds to be established using studies of Arctic char egg survival and/or other studies recommended by the Terrestrial Environment Working Group (TEWG); and, iii.) To assess the seasonal deposition (rates, quantities) and chemical composition of dust entering aquatic systems along representative distance transects at right angles to the Tote Road and radiating outward from Milne Port and the Mine Site.	Refer to the AMEP Framework (dated February 2013) and FEIS - Appendix 10D-12 – Environmental Monitoring Plan (dated January 2012).
22	The Proponent shall develop a detailed Sediment and Erosion Management Plan to prevent and/or mitigate sediment loading into surface water within the Project area.	Refer to Section 4 and Site Drainage Drawings and Monitoring Locations (Appendix D)
23	The Proponent shall develop and implement a Groundwater Monitoring and Management Plan to monitor, prevent and mitigate the potential effects of the Project on groundwater within the Project area.	Refer to Section 9.2.3
24	The Proponent shall monitor as required the relevant parameters of the effluent generated from Project activities and facilities and shall carryout treatment if necessary to ensure that discharge conditions are met at all times.	Refer to Section 9
25	The Proponent shall undertake the additional geotechnical investigations to identify sensitive landforms, modify engineering design for Project	Refer to section 4.1

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No.	Term and Condition	Comments
	infrastructure, develop and implement preventative and/or mitigation and monitoring measures to minimize the impacts of the Project's activities and infrastructure on sensitive landforms.	
26	The Proponent shall develop and implement a comprehensive erosion management plan to prevent or minimize the effects of destabilization and erosion that may occur due to the Project's construction and operation.	Refer Section 4.1, 6.3.4, 7.1.1 and 9.2.2
28	The Proponent shall monitor the effects of the Project on the permafrost along the railway and all other Project affected areas and must implement effective preventative measures to ensure that the integrity of the permafrost is maintained.	Refer to Section 9.1
29	The Proponent shall provide to the respective regulatory authorities, for review and acceptance, for-construction engineering design and drawings, specifications and engineering analysis to support design in advance for constructing those facilities. Once project facilities are constructed, the Proponent shall provide copies of the as-built drawings and design to the appropriate regulatory authorities.	Refer to Section 6
30	The Proponent shall develop site-specific quarry operation and management plans in advance of the development of any potential quarry site or borrow pit.	Refer to Borrow Pit and Quarry Management Plan – Doc. No. BAF-PH1-830-P16-0004 and Quarry Management Plan – Milne Inlet Quarry Q1 – Doc. No. H349000-1000-07-126-0013
41	Unless otherwise approved by regulatory authorities, the Proponent shall maintain a minimum 100-metre naturally-vegetated buffer between the high-water mark of any fish-bearing water bodies and any permanent quarries with potential for acid rock drainage or metal leaching.	Refer to Section 9.2.4
42	The Proponent shall maintain minimum a 30-metre naturally-vegetated buffer between the mining operation and adjacent water bodies.	Refer to Section 4.1
43	Prior to the start of construction, the Proponent must submit a Site Drainage and Silt Control Plan to the appropriate regulatory authorities for approval.	Refer to site drainage plans in Appendix D, Table 4.1 and section 6.
44	The Proponent shall meet or exceed the guidelines set by Fisheries and Oceans Canada for blasting thresholds and implement practical and effective measures to ensure that residue and by-products of blasting do not negatively affect fish and fish habitat.	Refer to Borrow Pit and Quarry Management Plan – Doc. No. BAF-PH1-830-P16-0004 and Quarry Management Plan – Milne Inlet Quarry Q1 – Doc. No. H349000-1000-07-126-0013.
45	The Proponent shall adhere to the No-Net-Loss principle at all phases of	Refer to Section 4.4

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No.	Term and Condition	Comments
	the project to prevent or mitigate direct or indirect fish and fish habitat losses.	
46	The Proponent shall ensure that runoff from fuel storage and maintenance facility areas, sewage and wastewater other facilities responsible for generating liquid effluent and runoff meet discharge requirements.	Refer to Section 9.2, the Site Drainage Plans and Monitoring Locations (Appendix D) FEIS - Appendix 10D-12 – Environmental Monitoring Plan (dated January 2012).
47	The Proponent shall ensure that all Project infrastructure in watercourses are designed and constructed in such a manner that they do not unduly prevent and limit the movement of water in fish bearing streams and rivers.	Refer to section 4.1 and 4.4
48	The Proponent shall engage with Fisheries and Oceans Canada and the Qikiqtani Inuit Association in exploring possible Project specific thresholds for blasting that would exceed the requirements of Fisheries and Oceans Canada's Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (D.G. Wright and G.E. Hopky, 1998).	Refer to Section 4.4.2 Refer to Borrow Pit and Quarry Management Plan – Doc. No. BAF-PH1-830-P16-0004 and Quarry Management Plan – Milne Inlet Quarry Q1 – Doc. No. H349000-1000-07-126-0013.


Table A-4: Appendix A to NIRB Decision Report Commitments

Appendix A to NIRB Decision Report

No.	Subject	Commitment	Action
6	Environmental Design (Contact Water)	Baffinland is committed to collecting and treating, if required, contact water generated from mining activities to ensure that relevant effluent criteria are met as established in the water licence.	Refer to section 6
40	Monitoring (Abandonment and Restoration)	Baffinland is committed to undertaking environmental effects monitoring during the mine life mine as well as after closure.	Addressed in Abandonment and Reclamation Plan
57	Management Plans	Baffinland is committed to updating its management plans to reflect new information, new practices and changes to operating conditions.	This Plan has been updated to reflect the 2014 Work Scope and where required, significant project modifications. It has been issued for use on March 31, 2014.
66	Monitoring	Baffinland is committed to the development and implementation of a monitoring program during the construction and other phases of the Mary River Project.	This management plan addressed the Surface Water and Aquatic Ecosystems components. Refer to Section 9 and AFEIS - Appendix 10D-12 –

The information contained herein is proprietary to Baffinland Iron Mines Corporation and is used solely for the purpose for which it is supplied. It shall not be disclosed in whole or in part, to any other party, without the express permission in writing by Baffinland Iron Mines Corporation.

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	Surface Water and Aquatic Ecosystems Management Plan	Issue Date: March 17, 2016 Rev.: 4	
	Environmental Health and Safety	Document #: BAF-PH1-830-P16-0026	

			Environmental Monitoring Plan (dated January 2012).
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