Baffinland Iron Mines Corporation

Mary River Project

Attachment 5: Environmental Monitoring Plan (EMP)

Appendix 10D-12

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1. Introduction

1.1 Background

Baffinland's EH&S Management System includes several Environmental Mitigation and Monitoring Plans (EMMP). These EMMPs define specific procedures, actions, and monitoring needed to accomplish certain tasks required by the Project. Each EMMP enables assessment of the effectiveness of the mitigation measures implemented. These monitoring requirements ensure that:

- The Project is executed as proposed;
- The predicted adverse environmental effects are promptly mitigated in a timely fashion; and
- The conditions set at the time of the Project's authorization and the requirements pertaining to the relevant laws and regulations are met.

Each plan outlines how monitoring results are used to refine or modify the design and implementation of mitigation measures and management activities (operating procedures). These plans also make it possible to ensure the proper operation of works, equipment, and facilities connected to the Project. If necessary, the plans help reorient the work and make improvements at the time of construction and implementation of the various key elements of the Project. Each EMMP consists of the following:

- Specifies criteria or thresholds to trigger corrective action based on its monitoring results;
- Identifies specific personnel responsible for the implementation of the corrective action; and
- Presents the system of accountability and the phase and component of the Project to which the mitigation measure would be applied.

The implementation of mitigation and monitoring measures will continue throughout all phases of the Project. The general organization and content of the EMMPs is presented in Table 1-1.

Table 1-1 Organization and Content of the Environmental Mitigation and Monitoring Plans

Section 1	Introduction	• States the purpose of the plan • Presents the legal and other requirements • Presents Baffinland's commitments • Presents the relationship to other EMMPs
Section 2	Targeted VECs	• List the VECs targeted
Section 3	Mitigation Measures	• Reiterates mitigation measures implemented in each Biophysical Environment Functional Management Plan • Reiterates justification for mitigation measures • Outlines expected residual effects with mitigation in place • Discuss possible effects of mitigation failure
Section 4	Activities / Components	• Description of activities and Project components impacting on VECs from the Construction phase through to the Closure phase
Section 5	Roles & Responsibilities	• Identifies personnel responsible for implementing mitigation measures. • Identifies personnel responsible for conducting the monitoring, collecting, analyzing and interpreting data
Section 6	Performance Indicators & Thresholds	• Lists the selection criteria/threshold for compliance with regulatory requirements and performance target levels. • Identifies thresholds that will trigger corrective action or response • Evaluates the performance of the mitigation measures in place
Section 7	Monitoring and Reporting Requirements	• Lists parameters and indicators to be monitored • Establishes the reporting requirements (internal and external agencies) • Established reporting frequencies, format • Establishes the communication requirements for the monitoring results
Section 8	Audit and Adaptive Strategies	• Defines the review process • Defines procedures for making changes (integrating the results of the monitoring plan) to existing Biophysical Environment Functional Management Plan • Prescribe actions to be taken for observed non-compliance with laws, regulations, permits, performance targets
Section 9	References	• References as required.
Section 10	Attachment	• Supporting documents • Maps/drawings • Useful references

EMMPs vary in detail, reflecting the significance and complexity of the issues and the information available relative to the current stage of Project development. In some cases, proposed mitigation measures may include additional baseline work, further research, and plan development. The purpose of the EEMPs are to provide applicable frameworks and in some instances spell out the specific steps for implementing the impact-mitigating actions. They reflect

the current understanding of the local and regional environmental, social, and economic conditions. Each plan will be updated as the Project progresses and new monitoring information becomes available. Plans are designed to provide timely actions and responses to the issues they address, and task-specific operating procedures will be developed to address Project related environmental aspects..

In addition to the EMMPs, the EHS Management System also includes:

- Biophysical Environmental Effects Monitoring Framework (BEEMF), and,
- Aquatic Effects Monitoring Plan (AEMP) as per the *Metal Mining Effluent Regulations* (MMER) Schedule 5 requirements.

The MMER stipulates a number of conditions under which a mine may release effluent into the environment. These conditions include:

- periodic monitoring of effluent for pH and deleterious substances;
- acute lethality testing in accordance with Environment Canada test methods;
- environmental effects monitoring "EEM" studies.

The aquatic effects monitoring studies are specified in Schedule 5 of the MMER Regulations and in supporting Technical Guidance Documents, and are designed to monitor the potential effects of effluent on the receiving environment, i.e., on fish populations, on fish tissue and on the benthic invertebrates community. Baffinland has developed an "MMER Environmental Effects Monitoring Study Design Framework" to satisfy the requirements of the MMER Schedule 5 . This document has been submitted for comments to Environment Canada and is attached for reference in FEIS Volume 10, Appendix 10D-14 and FEIS Volume 3, Appendix 3B, Attachment 5 which regroups the documents relevant to the Type A Water Licence Application. The AEMP will be finalized once feedback is received from Environment Canada.

This BEEMF is a component of the Baffinland's EHS Management System. Baffinland's approach to environmental management is to seek continuous improvement in performance with documentation comprising a series of Environmental Mitigation and Monitoring Plans (EMMPs) focused on valued ecosystem components (VECs). The goals and objectives of the BEEMF are to address public concerns, regulatory requirements, and scientific issues. The goals, objectives and methodologies of the respective BEEM candidate programs are clearly stated to ensure the results are scientifically defensible and relevant. "Candidate programs" are identified for consideration based on stakeholder and regulatory concern and input into the operation. The process whereby Candidate programs are identified and considered is illustrated in Figure 1.

1.2 Purpose of the Environmental Monitoring Plan

Each of the EMMP contains monitoring requirements. As required, monitoring plans developed under specific Biophysical Environmental Effects Monitoring "Candidate Programs" may trigger the development of additional or updated EMMPs, if and when such additional requirements are confirmed by the BEEM studies.

The purpose of the Environmental Monitoring Plan (EMP) is to regroup all the "**routine**" monitoring requirements of each EMMP into a comprehensive document.

1.3 Adapting and Updating of the EMP

Baffinland is committed to continual improvement in its work activities with the aim of reducing risks to environment, health, and safety, and improving operational effectiveness. The strategy employed by Baffinland is one of adaptive management where the results of monitoring programs, can lead to operational changes including the adoption of new mitigation measures, as warranted.

This "draft" Environmental Monitoring Plan will be updated on the basis of the terms and conditions imposed by Project Certificate and the Type A Water License. Note that the EMP is also "living document". It will be regularly updated on the basis of management reviews, incident investigations, regulatory changes or other Project related changes. Regulatory approvals associated with the project may also impose additional monitoring requirements and conditions.

Baffinland will conduct and document audits and management reviews of its Environmental Monitoring Plan on a regular basis. These reviews provide a formal mechanism to assess the effectiveness of its monitoring programs in achieving the company's objectives and maintaining ongoing compliance with Project permits and authorizations.

The EMP outlines the anticipated monitoring and reporting requirements adopted by Baffinland for the Mary River Project related to aspects of the atmospheric, terrestrial, freshwater and marine environments. As the Project advances to the Operation phase, and specific BEEM "candidate program" studies are completed, additional monitoring and reporting requirements will be incorporated into the EMP.

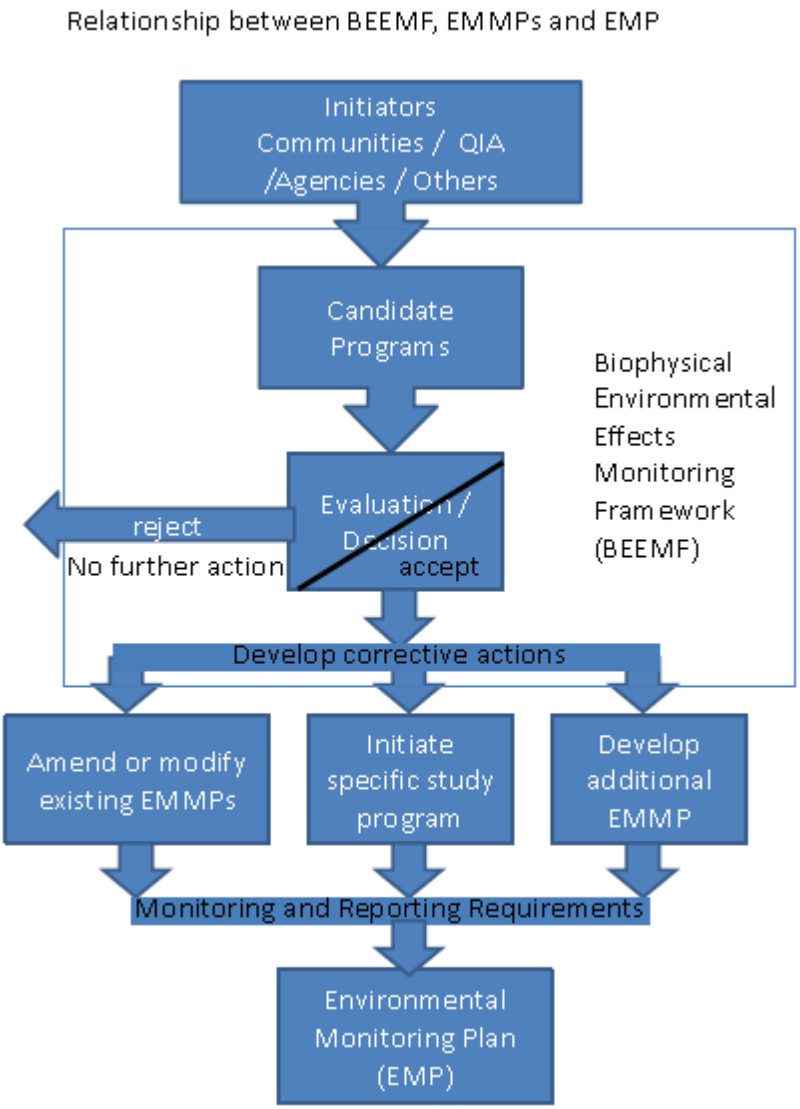


Figure 1 Relationship between BEEMF, EMMPs and EMP

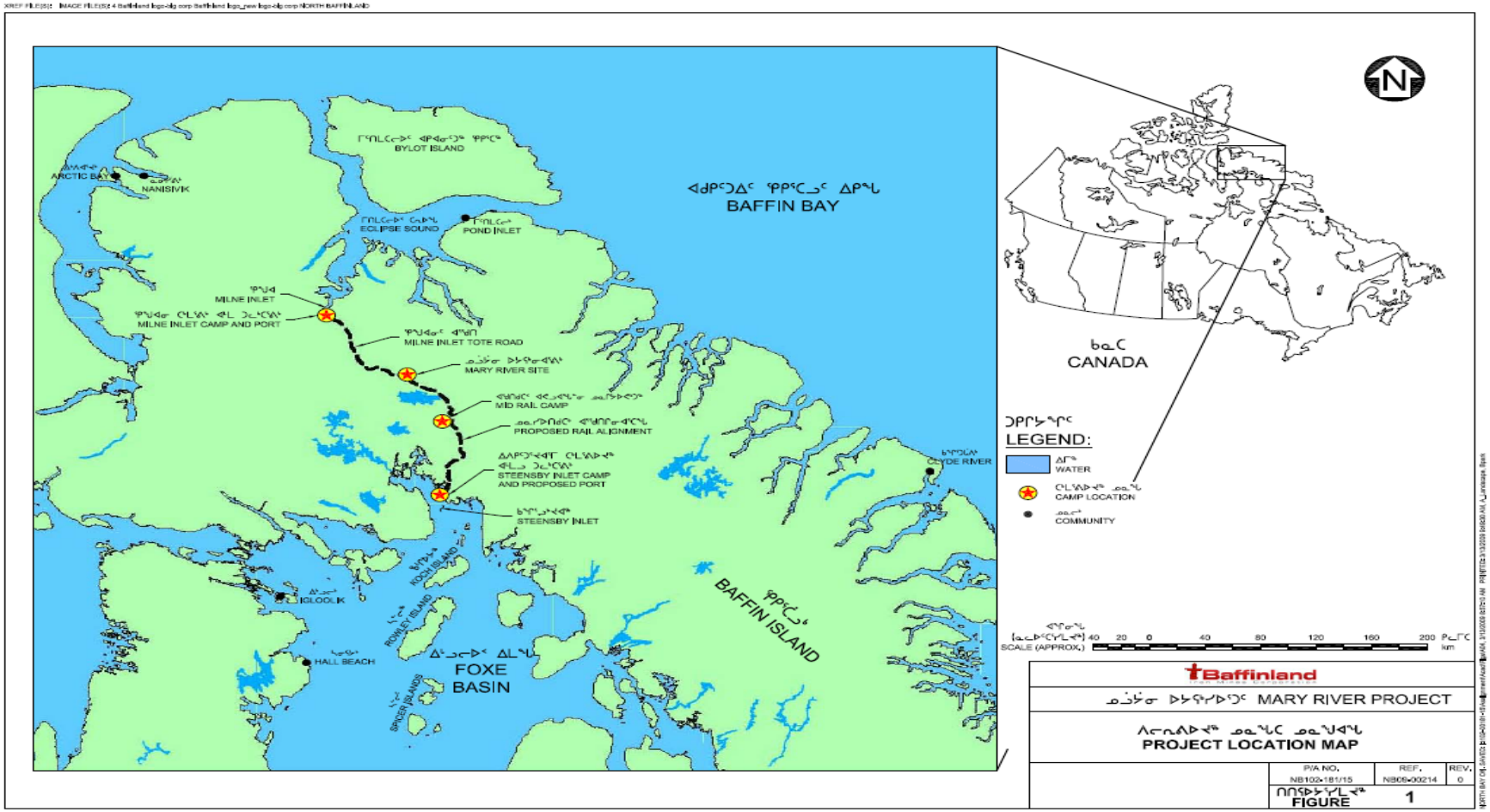


Figure 2 Project Location Map

1.4 Relationship to Other Management Plans

This plan should be viewed in conjunction with the following Environment Mitigation and Management Plans (EMMPs) that have been prepared for the EIS:

- Air Quality and Noise Abatement Management Plan;
- Surface Water & Aquatic Ecosystems Management Plan;
- Wastewater Management Plan;
- Waste Management Plan;
- Waste Rock Management Plan;
- Borrow Pit and Quarry Management Plan;
- Fish Habitat Compensation and Monitoring Plan;
- Roads Management Plan;
- Railway Management Plan;
- Shipping and Marine Wildlife Management Plan;
- Terrestrial Environmental Management and Monitoring Plan; and
- Aquatic Effects Monitoring Plan (to be developed on the basis of the MMER Environmental Effects Monitoring Study Design Framework).

2. Atmospheric Environment

2.1 Meteorology

Three meteorological stations have been established; at the Mine Site, Steensby Port, and Milne Port locations. The stations record air temperature, relative humidity, precipitation, wind direction, and wind speed. Data collected from the meteorological stations will be used to report the monthly and annual climatic conditions observed at each of the stations. Photographs of the meteorological equipment used onsite can be found in Appendix C of this document and the co-ordinates of the met stations onsite are:

- Milne Port, easting =463664.97258076194, northing=7877696.583455513
- Mary River, easting=427338.66731750336, northing=7878596.00134068
- Steensby Port, easting=385526.285250323, northing=7768690.108507192

2.2 Air Quality Monitoring

During both construction and operation, the air quality monitoring program will focus on total suspended particulate (TSP) and dust deposition by means of passive and active air quality monitoring. In addition, daily inspection of mine and port site facilities will also be completed to ensure compliance with the Air Quality and Noise Abatement Management Plan.

Air quality data will be collected via active total suspended particulate (TSP) and passive sampling methods (dustfall), including metal deposition). Snow-core sampling will be used to measure estimate dustfall at selected locations. The sampling locations and frequency will be established before the commencement of construction and will be revised/updated before the operational phase of the Project. For an overview of the indicators and anticipated range of corrective actions to be taken should thresholds be exceeded, see Table 2-1 and Table 2-2.

TSP will be measured using hi-volume samplers over a period of several months at the start of operations, and again in the Year 1 or 2 of operations once operations are well established, to validate assessment predictions on ambient air quality and potential effects to other Valued Ecosystem Components. TSP samples will be tested to confirm metals concentrations.

Table 2-1 Air Quality Performance Indicators and Thresholds

Frequency	Indicator	Threshold				Corrective Action
Number of sampling locations and frequency to be determined	TSP	Indicator	1 hr	24 hr	Annual	Review mitigation measures in place. Review specification on equipment. Review maintenance schedule for combustion equipment.
		TSP ($\mu g/m^3$)		120	60	

Table 2-2 Dustfall Performance Indicators and Thresholds

Location	Frequency	Indicator	Threshold	Corrective Action
Milne Port	Routine inspection.	Dustfall	Deterioration of visibility, safety concerns.	Use dust suppressant.
Tote Road	Routine inspection.	Dustfall	Deterioration of visibility. Safety concerns.	Use dust suppressant.
Mine Site	To be determined.	Dustfall	4.6 $g/m^2/yr$	Use dust suppressant. Review mitigation measures in place. Review specification on equipment. Review maintenance schedule for combustion equipment.
Railway	Routine inspection.	Dust	Deterioration of visibility, safety concerns.	Use dust suppressant.
Steensby Port	To be determined	Dustfall	4.6 $g/m^2/yr$	Use dust suppressant. Review mitigation measures in place. Review specification on equipment. Review maintenance schedule for combustion equipment.

2.3 Waste Incinerator Emission

Camp incinerators that burn non-hazardous waste will require ongoing performance monitoring and stack testing in accordance with applicable GN and EC guidelines. Eight incinerators will be installed.

Table 2-3 Camp Incinerators

Location	Coordinates	Routine Inspection	Stack Testing	
Milne Port	N: 7975450 E: 503590	Daily	Annual	
Mine Site – Exploration Camp	N: 7914780 E: 558000	Daily	Annual	
Mine Site Construction Camp	N: 7913500 E: 561129	Daily	CEMS-stack testing not required	
Ravn River Camp	N: 7894500 E: 595600	Daily	TBD	
Mid-Rail Camp	N: 7876400 E: 595750	Daily	TBD	
Cockburn Tunnel Camp	N: TBD E: TBD	Daily	TBD	
Cockburn South Camp	N: 781950 E: 597800	Daily	TBD	
Steensby Port 2012 Camp	N: 7800650 E: 594550	Daily	Annual	
Steensby Port Construction and Operation Camp	N: 7803200 E: 596600	Daily	CEMS-stack testing not required	

2.4 Noise

The main activities expected to cause atmospheric noise impacts include the mine site camp operations (e.g. vehicles, generators, incinerators, etc.), aircraft activities, construction, mining, crushing, and transportation activities related to ore, overburden, and waste rock.

No noise monitoring is currently planned as a part of the monitoring program.

2.5 Vibration

Residual effects from the Project are considered to be minimal for vibration. The extent of effects is limited to areas directly surrounding the Mine Site, Steensby Port, and Milne Port sites.

No vibration monitoring is currently planned as a part of the monitoring program.

2.6 Green House Gases (GHGs)

There are potentially several point and non point sources for emission of GHGs as part of the project. These will not be actively monitored, and instead determination based on suggested

calculations described by Environment Canada will be made. These following calculators will help estimate GHGs, including SO2 and CO2:

- Fuel calculator and GHGs for vehicles;
- Fuel Calculator and GHGs for heavy equipment;
- GHGs for motors (generators) calculator; and
- Waste disposal and burning calculator.

Other calculations for activities, such as shipping, will also form part of the overall estimate for GHGs.

3. Terrestrial Environment

3.1 Vegetation

Vegetation will be monitored during project construction, operation, and closure. Monitoring will occur every five years and will focus on invasive species and vegetation health in the vicinity of the Project and at control sites within the RSA for comparison.

3.1.1 Invasive Species

The delivery of material, equipment and freight to Steensby and Milne also introduces the potential for introduction of invasive terrestrial species (rodents) into the Arctic environment. Although climatic conditions at both ports are expected to be the major barrier to the survival of introduced species, Baffinland will undertake routine inspection of storage sites (*Wildlife Act, SNu 2003, 91(2)*). If a foreign species is detected, Baffinland will consult with Canada Customs and the Government of Nunavut DoE and take appropriate actions to remove/limit the spread of the species to Northern Baffin Island. The action taken will be species.

Invasive species monitoring will occur within the Project footprint and adjacent habitats to ensure that no invasive species are introduced to the arctic environment by the Project. Surveys for invasive plants will be conducted every five years, and additional surveys may be triggered by observations of plant invasive species. If any invasive species are found, these will be destroyed and, if the pathway of entry can be identified, corrective actions will be taken to eliminate the pathway to reduce the possibility of further introduction of invasive species. See Table 3-1 for more details on invasive species monitoring.

Table 3-1 Vegetation Monitoring — Invasive Species

Indicator	Plant invasive species
Monitoring Category	Surveillance
Design Type	Footprint and adjacent habitat surveys
Measurable Parameter	Occurrence of plant invasive species
Key Project Interactions	Introduction of plant invasive species
Goal	The Project will not introduce invasive plant species to the RSA
Objective	To quantify the occurrence of plant invasive species
Threshold	No introduction of plant invasive species as a result of Project activities
Scope of Monitoring Work	Local monitoring: Surveillance of Project footprint and adjacent habitat, at minimum, surveys to be conducted every 5 years or triggered by observations of plant invasive species
Agency/Partner Participation	None required

3.1.2 Vegetation Health

Vegetation health monitoring will be conducted through permanent monitoring plots in a variety of habitat types (minimum two plots per habitat type) near project infrastructure and in control areas within the RSA. Plots in the vicinity of the Project infrastructure will be situated at varying distances from infrastructure to determine the extent of air quality impacts (the exact locations of plots to be based on results of the air quality monitoring program). Dustfall and emissions potentially affecting vegetation will be monitored as part of the air quality monitoring program. Within each of the plots, species composition will be documented, and the percent cover of each species will be estimated. Lichen samples will be collected adjacent to the plots and sent to accredited laboratories for chemical analysis (Table 3-2).

Table 3-2 Vegetation Monitoring — Vegetation Health

Indicator	Vegetation Health
Monitoring Category	Surveillance and Monitoring
Design Type	Before-After-Control-Impact (BACI)
Measurable Parameter	Vegetation class composition, biomass, and metal levels in lichen
Key Project Interactions	Effluent, dust, and air emissions released into the environment have the potential to impact vegetation health, in particular, contaminants may be absorbed by plants (these metals may then be ingested by wildlife, which may have an effect on the health of individual animals and, consequently, wildlife abundance)
Goal	The Project will not have a significant effect on metal uptake in vegetation
Objective	Quantify by means of periodic monitoring throughout the duration of the Project: vegetation class composition vegetation biomass contaminant levels in lichen (caribou forage)
Threshold	Project activities resulting in >10% change in vegetation composition, biomass, and/or accumulation of metals in lichen beyond acceptable threshold levels for caribou health
Scope of Monitoring Work	Regional monitoring: Assess baseline vegetation class composition and metals levels in lichen and re-assess every 5 years.

	Air quality monitoring program led by Baffinland.
Agency/Partner Participation	None required

3.2 Birds Monitoring

Four monitoring programs for birds will be implemented by Baffinland over the course of the construction, operation, closure, and post-closure phases to increase the available baseline data, to detect possible changes to key indicator (KI) birds in the RSA, to assess the magnitude of these changes, and to determine whether these changes are naturally occurring variations or project-related impacts.

Monitoring of Peregrine Falcon and Gyrfalcon nesting will occur on an annual basis within the RSA to quantify occupancy and productivity and ensure that the Project is not having a significant effect on cliff-nesting raptors. This will involve four aerial/ground surveys – one early in the nesting period, and one just before fledging for each species. Survey results for nests in close proximity to the Project footprint will be compared with results from other portions of the RSA and with baseline findings to determine whether the Project is impacting cliff-nesting species (Table 3-3).

The density of Common Eider, King Eider, and Red Knot nests along the port sites and appropriate control shorelines will be surveyed over three consecutive years to ensure that sensory disturbance from Project activities and wake effects from shipping do not have a significant detrimental effect on shoreline nesting birds (Table 3-4).

Monitoring of seabird migration and overwintering along the Project shipping route will be conducted in collaboration with the Canadian Wildlife Service (Environment Canada) and possibly other partners. The program will contribute to baseline knowledge on the migration and overwintering distributions of murres, eiders and gulls in Hudson Strait and will provide insight regarding seabird interactions with Project shipping. Baffinland's responsibilities within the monitoring program will involve a monetary contribution towards tagging studies (Table 3-5).

Although Baffinland is confident that Project effects will not have a significant impact on migratory songbirds and shorebirds within the RSA, Baffinland will assist the Canadian Wildlife Service in regional baseline research and monitoring for these species. The monitoring program will involve 20 PRISM plots conducted within the RSA every five years (Table 3-6).

Table 3-3 Migratory Bird Monitoring: Peregrine Falcon and Gyrfalcon Nesting

Indicator	Peregrine Falcon and Gyrfalcon
Monitoring Category	Baseline Research and Surveillance
Design Type	Before-After-Control-Impact (BACI)
Measurable Parameter	Occupancy and productivity
Key Project Interactions	Sensory disturbances generated from various Project activities
Goal	The Project will not have a significant effect on Peregrine Falcon and Gyrfalcon occupancy and productivity
Objective	To quantify Peregrine Falcon and Gyrfalcon occupancy and productivity within the RSA
Threshold	Less than a 10% difference in near-site and far-site occupancy and productivity averaged over three consecutive years
Scope of Monitoring Work	Local monitoring: Annual territory surveys to determine occupancy and productivity of Peregrine Falcons and Gyrfalcons (total of four surveys – Peregrine Falcon occupancy and productivity, and Gyrfalcon occupancy and productivity).
Agency/Partner Participation	Local monitoring: Government of Nunavut, Department of Environment, ArcticRaptors.net

Table 3-4 Migratory Bird Monitoring: Nesting of Common and King Eider, and Red Knot

Indicator	Common and King Eider, and Red Knot
Monitoring Category	Baseline Research and Monitoring
Design Type	Before-After-Control-Impact (BACI)
Measurable Parameter	Habitat- nesting
Key Project Interactions	Sensory disturbance and wake effects on shoreline nesting birds
Goal	*The Project will not have a significant effect on eider and Red Knot nesting density*
Objective	Quantify number of eider and Red Knot nests at the port sites, and appropriate control shorelines
Threshold	Less than a 20% decrease in nesting within the Steensby Port ZOI relative to control areas over three consecutive years of monitoring (Environment Canada 4.3).
Scope of Monitoring Work	Local: Pre and post-disturbance surveys of eider and Red Knot nesting densities within and adjacent to the port site and control areas.
Agency/Partner Participation	Environment Canada - Canadian Wildlife Service

Table 3-5 Migratory Bird Monitoring: Seabird Migration and Overwintering

Indicator	Seabirds – Murres, Gulls, Eiders
Monitoring Category	Baseline research
Design Type	To be identified in consultation with EC-CWS
Measurable Parameter	Distribution
Key Project Interactions	Potential effects of shipping on migration and overwintering distribution of seabirds in Hudson Strait.
Goal	The Project will not have a significant effect on migration and overwintering distribution of seabirds in Hudson Strait.
Objective	Evaluate migration and overwintering distribution of seabird KIs in Hudson Strait and identify interactions with Project shipping.
Threshold	To be identified by EC-CWS
Scope of Monitoring Work	Regional: Baffinland contribution to tagging studies
Agency/Partner Participation	Environment Canada, Canadian Wildlife Service, (Qikiqtani Inuit Association)
Follow-up Measures	Possible on-board monitoring of seabirds during shipping if interaction is identified through baseline research

Table 3-6 Migratory Bird Monitoring: Songbirds and Shorebirds

Indicator	Shorebirds and Songbirds
Monitoring Category	Baseline research
Design Type	PRISM plots
Measurable Parameter	Abundance and density
Key Project Interactions	Habitat loss and sensory disturbance due to Project activities
Goal	The Project will not have a significant effect on songbird and shorebird abundance and density within the RSA. There is high confidence in this prediction. Follow-up monitoring is not required.
Objective	Contribute to baseline knowledge of songbird and shorebird distribution and abundance in the Eastern Arctic.
Threshold	No thresholds identified – this is a contribution to regional baseline research and monitoring
Scope of Monitoring Work	Regional: 20 PRISM plots every 5 years
Agency/Partner Participation	Canadian Wildlife Service

3.3 Terrestrial Wildlife Monitoring

The impact assessment did not identify any significant impacts on caribou, but there is only moderate confidence in the predictions of effects on habitat and movement. The current low abundance of caribou in the RSA makes it difficult to predict and document effects because negative interactions between mine activities and caribou are unlikely to occur due to the low density of caribou. To ensure that the Project does not have a significant detrimental effect on local caribou, several monitoring programs have been developed. These programs are focused

within the Zone of Influence (ZOI) assessed for caribou; see Volume 6, Section 5 for a description of the ZOI.

3.3.1 *Caribou Habitat Monitoring*

Monitoring of caribou habitat use will involve two monitoring programs: the first assessing indirect habitat loss (resulting from sensory disturbance) and the second looking at caribou calving within the RSA. Monitoring of indirect habitat loss will occur at both the local level by tracking incidental observations of caribou by Project employees, and at the regional level through aerial surveys (when caribou numbers are sufficient enough for robust statistical analysis). Long-term distribution patterns will also be identified by a GN-sponsored caribou satellite collaring program(s). See Table 3-7 for further details on the monitoring of indirect habitat loss. Monitoring of habitat use during the calving season will focus on aerial surveys of known calving sites within the ZOI during construction and initial years of operation to document occurrence. Collar data from the GN-sponsored caribou satellite collaring program will inform regional calving distribution patterns (see Table 3-8). Additionally, periodic consultation will be conducted with local HTOs to provide information on the relative abundance of caribou in and around the RSA.

Table 3-7 Caribou Monitoring: Indirect Habitat Loss

Indicator	Caribou
Monitoring Category	Surveillance
Design Type	Observational (collar data) and opportunistic
Measurable Parameter	Distribution
Key Project Interactions	Indirect habitat loss from Project activities that create sensory disturbances and/or temporarily reduce the effectiveness (usefulness) of habitats adjacent to the Project footprint (e.g., dust deposition reducing palatability of vegetation), resulting in changed distribution
Goal	The Project will not have a significant effect on distribution within the North Baffin Island caribou range
Objective	Evaluate trends in caribou distribution in the ZOI
Threshold	Caribou occurrence within the ZOI equivalent to the prediction made in the Project impact assessment.
Scope of Monitoring Work	Addressing this target requires regional-level surveys. Local monitoring: Continuous log of caribou observations from staff to document occurrence Regional monitoring: When caribou numbers are sufficient to provide robust statistical analysis of distribution within the ZOI, an annual aerial survey program will be implemented to document abundance and distribution of caribou in the RSA. Long-term distribution patterns as identified by a GN-sponsored caribou satellite collaring program.
Agency/Partner Participation	Local monitoring: Baffinland employees, Qikiqtani Inuit Association, Pond Inlet, Igloolik, Arctic Bay HTOs Regional monitoring: Government of Nunavut, Department of Environment

Table 3-8 Caribou Monitoring: Habitat Use during Calving

Indicator	Caribou
Monitoring Category	Baseline research and Surveillance
Design Type	Observational (collar data) and opportunistic
Measurable Parameter	Calving habitat use
Key Project Interactions	Project footprint in known calving habitats and sensory disturbances to caribou during the calving season
Goal	The Project will not have a significant effect on caribou calving habitat use within the ZOI
Objective	Allow caribou to calve undisturbed within the ZOI
Threshold	No quantifiable threshold
Scope of Monitoring Work	Local monitoring: Aerial surveys of known calving sites within the ZOI prior to construction and opportunistic documentation of other calving sites. Monitoring during construction and post-construction to document occurrence. Regional monitoring: Long-term calving distribution patterns as identified by a GN-sponsored caribou satellite collaring program. Collar data will inform regional calving distribution.
Agency/Partner Participation	Local monitoring: Qikiqtani Inuit Association, Pond Inlet, Igloolik, Arctic Bay HTOs, Government of Nunavut, Department of Environment Regional monitoring: Government of Nunavut, Department of Environment

3.3.2 Caribou Movement

Caribou monitoring will include a program looking at Project effects on caribou movement within the Zone of Influence (ZOI). Specifically, the program will monitor the effects of railway infrastructure and operations on caribou movements through seasonal track surveys every three years in key movement areas, and remote motion-sensing cameras set up at select trails that cross or approach the railway. See Table 3-9 for further details. If it is deemed necessary, additional monitoring of caribou movements could involve having wildlife monitors visit the 52 identified trails once annually to document recent use (the focus of this work would be to determine if caribou are crossing the transportation infrastructure), and/or having wildlife monitors ride the trail and drive project roads once a month (when daylight allows sufficient visibility) to count the number of caribou in the area.

Table 3-9 Caribou Monitoring: Movement

Indicator	Caribou
Monitoring Category	Baseline research and Surveillance
Design Type	Observational
Measurable Parameter	Movement in the ZOI
Key Project Interactions	Railway infrastructure and operations may be a filter of or barrier to movement of caribou through the Regional Study Area
Goal	The Project will not have a significant effect on caribou movements across Project infrastructure
Objective	Evaluate movement patterns of caribou as they approach or cross the Railway and other Project infrastructure
Threshold	Less than 10% deflection of approaches to Railway and infrastructure
Scope of Monitoring Work	Local monitoring: Seasonal caribou track surveys in key movement areas where existing trails were detected within the ZOI. These can be ground-based (snowmobile) to observe movement during early winter and spring seasons. These surveys will be conducted every 3 years unless otherwise warranted. Continuous trail monitoring using remote, motion-sensing cameras at select trails that cross or approach the Railway. Regional monitoring: Long-term movement patterns as identified by a GN-sponsored caribou satellite collaring program. This is a longer-term approach that requires analyses at a regional scale. These analyses are expected to be conducted by the Government of Nunavut.
Agency/Partner Participation	Local monitoring: Qikiqtani Inuit Association, Pond Inlet, Igloolik, Arctic Bay HTOs, Baffinland employees Regional monitoring: Government of Nunavut, Department of Environment

3.3.3 Caribou Mortality

Project-related mortality on caribou will be tracked along with other wildlife species as part of the general wildlife monitoring. Additionally, Baffinland will monitor the potential for increased caribou mortality as an indirect result of the Project through increased harvester knowledge. This will be accomplished through tracking the number of hunters passing through and using the camp, and through a multi-year hunter harvest study which will include a summary of annual caribou harvest in the region. This hunter harvest study will be sponsored by Baffinland and done in coordination with local HTOs and the Government of Nunavut Department of Environment (GNDoE).

Table 3-10 Caribou Monitoring: Harvest-related Mortality

Indicator	Caribou
Monitoring Category	Surveillance
Design Type	N/A
Measurable Parameter	Mortality risk
Key Project Interactions	Caribou mortality risk may increase as an indirect result of the Project through increased harvester knowledge
Goal	The Project will not have a significant increase on caribou mortality risk
Objective	Quantify caribou mortality risk in the RSA caused by increased harvesting knowledge
Threshold	Exceeding the herd's Total Allowable Harvest
Scope of Monitoring Work	Local monitoring: Log of hunters passing through and using the camp. Regional monitoring: Baffinland-sponsored multi-year hunter harvest study, which includes a summary of annual caribou harvest.
Agency/Partner Participation	Local monitoring: Qikiqtani Inuit Association, Pond Inlet, Igloolik, Arctic Bay HTOs, Baffinland employees (e.g., train conductor) Regional monitoring: Government of Nunavut, Department of Environment, Nunavut Wildlife Management Board

3.3.4 Caribou Health

Changes in the health of caribou because of project activities are unlikely. However, there is not enough baseline knowledge to predict how caribou health might be affected by consumption of vegetation with heavy dust deposition. Therefore, several programs have been developed to monitor caribou health in response to the Project. The Vegetation Health monitoring will be a key component of this monitoring. Additional monitoring programs will look at contaminants in caribou tissues and body condition measurements as a part of the hunter-harvest study (see Table 3-11), and at caribou productivity within the RSA (see Table 3-12). The GNDoE recently initiated a regional caribou health monitoring program; the Baffinland-sponsored hunter-harvest study should standardize methods so that results are comparable. The data will be used to help monitor potential effects that have a time component (i.e., length of exposure to disturbance). Hunter-harvest data can be collected immediately to acquire pre-development information and the study can be reassessed after five years to determine efficiency and efficacy of the data.

Table 3-11 Caribou Monitoring: Health Contaminants and Body Condition

Indicator	Caribou
Monitoring Category	Monitoring
Design Type	N/A
Measurable Parameter	Health- contaminants in caribou tissues and body condition measurements
Key Project Interactions	Sensory disturbances related to Project construction and operation
Goal	The Project will not have a significant effect on North Baffin Island caribou population-level condition
Objective	Quantify indices of caribou body condition from individuals harvested within the RSA, as an index of population health.
Threshold	No detectable change in caribou health as a result of Project activities
Scope of Monitoring Work	Regional monitoring: Tissue samples and body measurements collected through the Baffinland-sponsored multi-year hunter harvest study
Agency/Partner Participation	Regional monitoring: Qikiqtani Inuit Association, Pond Inlet, Igloolik, Arctic Bay HTOs, Government of Nunavut, Department of Environment, Nunavut Wildlife Management Board

Table 3-12 Caribou Monitoring: Productivity

Indicator	Caribou
Monitoring Category	Baseline Research and Surveillance
Design Type	Control -impact
Measurable Parameter	Productivity
Key Project Interactions	Sensory disturbances related to Project construction and operation
Goal	The Project will not have a significant effect on North Baffin Island caribou activity budgets such that productivity is negatively affected in the RSA
Objective	Quantify productivity of North Baffin caribou within the RSA
Threshold	No detectable change in caribou productivity as a result of Project activities
Scope of Monitoring Work	Regional monitoring: Productivity surveys in the RSA
Agency/Partner Participation	Regional monitoring: Qikiqtani Inuit Association, Pond Inlet, Igloolik, Arctic Bay HTOs, Government of Nunavut, Department of Environment, Nunavut Wildlife Management Board

3.3.5 Monitoring for all Wildlife Species

To ensure that Project effects on all wildlife species are minimized, Baffinland will monitor and annually review the amount of direct habitat loss resulting from the Project footprint (see Table 2-13). They will also track incidental observations of wildlife made by truck drivers and all Project employees within and adjacent to the Project footprint, as well as all Project-related mortalities (see Table 3-14).

Table 3-13 Wildlife Monitoring: Direct Habitat Loss

Indicator	All species
Monitoring Category	Surveillance
Design Type	Footprint survey
Measurable Parameter	Project footprint
Key Project Interactions	Direct habitat loss within the footprint of the Project (either temporary or permanent)
Objective	Quantify direct habitat loss in the Project footprint
Threshold	Habitat loss limited to the amount identified in the Project description
Scope of Monitoring Work	Local monitoring: Measure area of Project disturbance on an annual basis
Agency/Partner Participation	None required

Table 3-14 Wildlife Monitoring: Incidental Observations and Project Mortality

Indicator	All species
Monitoring Category	Surveillance
Design Type	Opportunistic
Measurable Parameter	Wildlife mortality
Key Project Interactions	Wildlife mortality due to Project activities and indirect habitat loss associated with the Project.
Objective	Track wildlife observations and Project-related mortality within and adjacent to the Project footprint
Threshold	Every Project-related mortality of caribou will be reviewed to determine if further action is needed. Other species dealt with on a species-by-species basis.
Scope of Monitoring Work	Local monitoring: Log of wildlife observations within the RSA. Record of collisions and other observed wildlife mortalities within the RSA.
Agency/Partner Participation	None required

4. Freshwater Environment

4.1 Water Consumption

The monitoring of water consumption ensures that use does not exceed quantity restrictions and is extracted from approved locations without causing adverse effects.

The performance indicator for water quantity is ongoing compliance with the terms and conditions of the applicable water licences as issued by the Nunavut Water Board and compliance with the Fisheries Act. An overall Type A Water Licence will govern the water withdrawal limits for the active phases of the project including construction and operation. Where required, monitoring will be conducted to track actual consumption by measuring the volumes extracted from a water source or discharged into a receiving water body. Water conservation measures will be adopted as necessary, especially during periods of high water

consumption. Other measures that aid in meeting water take thresholds include ensuring operational efficiencies through periodic monitoring and maintenance to limit water losses due to faulty equipment. Water intake locations for the camps as well as anticipated permit limits and thresholds are presented in Table 4-1, below. To stay in compliance with the Fisheries Act drawdown of water bodies must be minimized so that there are no adverse impacts resulting affecting fish or fish habitat.

Table 4-1 Fresh Water Quantity Limits

Camp / Site	Intake	Coordinates	Permit Limit(m3/d)	Threshold (m3/d)
Milne Inlet (Port)	Phillips Creek (summer) Km 32 Lake (winter)	N: 7964579 E: 521714 N: 7951862 E: 514503	67	≤ Permit Limit, minimize water source drawdown
Mary River (Mine Site)	Camp Lake	N:7914695.647 E: 557818.253	655	≤ Permit Limit, minimize water source drawdown
Steensby (Port)	ST 347 Lake (permanent camp) 3 Km lake (dust suppression & other minor uses)	**ST347** N: 7804826.580 E: 596600.563 **3 Km Lake** N: 7800206.654 E: 596698.129	425	≤ Permit Limit, minimize water source drawdown
Ravn River Area	Ravn Camp Lake	N: 7895658.80 E: 594510.99	145	≤ Permit Limit, minimize water source drawdown
Mid-Rail Area	Nivek Lake (summer) Ravn Camp Lake (winter)	N: 7876430.04 E: 595602.59	79	≤ Permit Limit, minimize water source drawdown
Cockburn Lake Tunnels Camp	Cockburn Lake	N: 7833929.50 E: 603882.25	100	≤ Permit Limit, minimize water source drawdown
Cockburn South Camp	Cockburn Lake	N: 7820563.84 E: 597661.01	112	≤ Permit Limit, minimize water source drawdown

4.2 Surface Water Quality

Water quality monitoring includes monitoring of surface (fresh) water sources (e.g. streams and lakes) and end-of-pipe water discharges during construction and operation of the Project.

In terms of surface water quality, both visual inspection and sampling/analytical techniques and results are used as indicators. During routine inspections, any indication of elevated total suspended solids (TSS) level or visible oil sheen will result in immediate corrective action.

Water quality monitoring will include recording the time and location of monitoring, description of testing equipment and methodology, test results and comparison against applicable regulations and guidelines.

Monitoring and reporting requirements under regulatory approvals such as the water licence, QIA land lease, land use permits and fisheries authorization will include:

- Routine inspections and monitoring of various aspects of the operations;
- Surface Water Quality Monitoring;
- Wastewater Treatment Facility Discharge Monitoring;
- Bulk Fuel Storage Facility Discharge Monitoring (Oils and Greases); and
- Vehicle Maintenance Shops Wastewater Monitoring (Oils and Greases).

4.2.1 Surface Water Quality Monitoring

The objectives of the water quality monitoring programs are to:

- Ensure sewage treatment plants, oily water treatment facilities, and discharge from waste rock and ore stockpile collection ponds are meeting effluent quality requirements and that receiving waters are not being negatively impacted.
- Ensure that site drainage and runoff generally are not being adversely affected by site activities.

The water quality monitoring program consists of sampling, analyses, and reporting of water quality, as prescribed in the water licence, and weekly to monthly at sites located downstream of exploration drilling activities during open-water periods. When drilling is conducted on ice, the water column under the ice is monitored for water licence effluent criteria, general parameters, and trace metals. Table 4-2 presents a summary of the planned routine inspection and water licence monitoring.

Signs will be posted in appropriate areas at SNP Monitoring Stations, and will be located and maintained to the satisfaction of the AANDC Inspector.

Table 4-2 Routine Inspection and Monitoring

Site	Routine Inspection
All Project Sites Steensby Port, Mine Site, Milne Port and other camp sites	Water management systems Sediment and erosion control structures Evidence of hydrocarbon staining or leaks from containment areas Drip pans and spill kits. Full-time supervision of fuel transfer operations Water intakes and outfalls Flow meter readings Rutting by vehicles Geotechnical stability.
Tote Road and Railway Construction Road	Monitor during prior to and during freshet for snow and ice blockages Monitor road embankment stability Check for obstructions
Spoil Deposit	Sediment and erosion control structures

locations Tunneling locations	Evidence of hydrocarbon staining or leaks from containment devices Fuel leaks Drip Pans and Equipment condition Spill kits Rutting by vehicles Geotechnical stability.		
Borrow sites and rock quarries	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 Spill kits. Geotechnical stability, permafrost degradation		
Drill Sites	Pre-drilling	Drilling period	Post drilling
	Drillhole coordinates Water source coordinates Site photo Water source photo Distance to nearest water source Archaeological approval Completed wildlife survey	Fuel leaks Sediment and erosion control structures Drip Pans Spill kits. Equipment condition Any rutting by vehicles Water intake Water management Flow meter reading	All materials and debris removed from site Quantity of equipment, rods or casing left in the hole Site photo Water source photo Water use assessment Environmental concerns Wildlife concerns
Waste Rock Stockpile	Sediment and erosion control structures Geotechnical stability. Evidence of hydrocarbon staining or leaks from containment devices Evidence of ARD Drip Pans Equipment condition		
Bulk Fuel Storage and Hazardous Waste Storage Areas (all sites)	Primary containment structure Geotechnical stability Evidence of hydrocarbon staining or leaks from containment devices Equipment condition Spill kits		
Explosives Storage Steensby Port	Primary containment structure Access and security Equipment condition 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 and spill kits Equipment condition Rutting by vehicles		
Polishing Waste Storage Ponds (PWSPs) and Fuel/Hazardous	Daily to weekly inspections for physical stability, liner integrity, and, spills Annual geotechnical inspection and report by a registered geotechnical engineer Spill kits Fuel leaks, drip pans		

waste Storage Facilities	Proper fueling procedures
Road and Railway embankment	Sediment control and erosion control structures Evidence of physical stability
Water Crossings	Impact to water bodies or fish habitat especially during spring freshet after storm events Presence/absence of fish at crossings Suspended solids/turbidity Fish migration structures
Routine inspection and site monitoring will be undertaken by the responsible department with, support, training, and auditing function provided by the Environment lead under the EHS Superintendent	

4.2.1.1 Bulk Fuel Storage Facility Discharge Monitoring

Precipitation will collect within the lined secondary containment of the bulk fuel storage facilities and bermed waste storage areas. Effluent discharged from the bulk fuel storage facilities will be monitored to ensure it meets the effluent quality standards outlined in **Error! Reference source not found.**. Monitoring of the bulk fuel storage facilities are discussed under Facilities Monitoring.

Table 4-3 Bulk Fuel Storage Facility Contact Water

Contact Water Discharge Location and Monitoring Coordinates		
Milne Port Tank Farm	N: 7976209	E: 503641
Mine Services Tank Farm	N: 7913050	E: 562031
Mine Fuel Unloading Station	N: 7912973	E: 561360
Steensby Port Tank Farm	N: 7801713	E: 593376
Steensby Port Freight Dock Tank	N 7799000	E: 595100
Contact Water Quality Criteria for Discharge		
Parameter	**Maximum Average Concentration (µg/L)**	
Benzene	370	
Toluene	2	
Ethyl benzene	90	
Lead	1	
Oil and Grease	15,000 and no visible sheen	

4.2.1.2 Landfarm Monitoring

Monitoring of the Landfarm involves inspection of physical integrity of the berm and has work contact water monitoring. Refer to Table 4-4. 19 for Landfarm contact water discharge coordinates and water quality criteria.

Table 4-4 Landfarm Contact Water

Contact water Discharge Location and Monitoring Coordinates		
Milne Port Landfarm	N: 7975528	E: 503740
Mine Site Landfarm	N: 7912603	E: 560852
Steensby Port Landfarm	N: 7804080	E: 597531
Contact Water Quality Criteria for Discharge		
Parameter	**Maximum Average Concentration (mg/L)**	**Maximum Concentration of any Grab Sample (mg/L)**
pH	6.0-9.0	9.0
Total Suspended Solids	15	30
Oil and Grease	5 and no sheen	15
Total Ammonia-N	2.0	4.0
Total Lead	0.01	0.02
Benzene	0.37	
Toluene	0.002	
Ethylebenzene	0.090	

4.3 Sewage Treatment Facility Discharge Monitoring

The Mary River Project has five sewage treatment facilities. The discharge location of each sewage treatment plant is presented in Table 4-5.

Table 4-5 Mary River project Sewage Treatment Plants

Camp/Site	Discharge/Outfall Location		Discharge Coordinates	Monitoring Frequency	
	Summer	Winter		Water quality	Acute Toxicity
Milne Port	Ocean at Milne Inlet*		N: 7976482.047 E: 503211.450		Annual (summer season)
Mine Site Construction/Operation Camp	Mary River	Storage Pond	N: 7912429.349 E: 562962.542		Annual (summer season)
Mary River Exploration Camp	Sheardown Lake Outfall		N: 7914372 E: 557920		Annual (summer season)
Steensby Port Construction/Operation Camp	Ocean outfall at Steensby Inlet		N: 7801412.600 E: 593378.100		Annual (summer season)

Steensby Port Early Construction Camp (2012 Work Plan)	Ocean outfall at Steensby Inlet	N: 78000048 E: 594650		Annual (summer season)
Ravn River Area	Transported to Mine Site Sewage Treatment Plant	no local discharge	not applicable	not applicable
Mid-Rail Area	Transported to Mine Site Sewage Treatment Plant	no local discharge	not applicable	not applicable
Cockburn Tunnels Area	Transported to Steesnby Port Sewage Treatment Plant	no local discharge	not applicable	not applicable
Cockburn South Camp	Transported to Steesnby Port Sewage Treatment Plant	no local discharge	not applicable	not applicable

Note that a polishing pond will be used to store treated effluent that does not meet discharge criteria for the Mine Site Exploration Camp and the Milne Camp. This treated effluent will be re-circulated to the Sewage Treatment Plant for further treatment or discharge directly depending on water quality.

The effluent from the main Mine Site sewage treatment plant will be stored in a pond for the winter period and discharged to the Mary River during the summer period.

Generally, sampling and monitoring of the wastewater treatment systems will include the following:

1. Regular sampling of sewage discharge in accordance with water licence requirements;
2. More frequent internal process sampling (minimum once per week) and monitoring (daily) to identify potential upset conditions early that could lead to non-compliance;
3. Record of volumes of sewage effluent discharged and sludge generated in accordance with water licence requirements;
4. Completion of daily checklists related to the O&M requirements for the facilities and the reporting of any upset conditions that require action; and
5. Permitted discharge volumes of treated effluent and their discharge locations are presented in Table 2-20.

Samples will be collected at the discharge of the Sewage Treatment Plant every four weeks during discharge and at the Polishing Waste Stabilization Ponds (PWSP) Monitoring Stations once before discharge and every four weeks thereafter. Samples will be analyzed for biochemical oxygen demand (BOD), TSS, pH, fecal coliform, oil, and grease (visual). An acute toxicity test will be conducted once each open water season for each Sewage Treatment Plant discharge. The sewage treatment plant effluent discharge quality criteria are presented in Table 4-6.

Table 4-6 Treated Sewage Effluent Discharge to Freshwater Quality Standards

Treated Sewage Effluent Discharge to Freshwater (Mine Site Sewage Treatment Plants)	
Parameter	Maximum Average Concentration
BOD5	30 mg/L
Total Suspended Solids	35 mg/L
Fecal Coliform	1000 CFU/100 mL
Oil and Grease	No visible sheen
pH	between 6.0 - 9.5
Treated Sewage Effluent Discharge to Marine Waters	
Parameter	Maximum Average Concentration
BOD5	100 mg/L
Total Suspended Solids	120 mg/L
Fecal Coliform	10,000 CFU/100 mL
Oil and Grease	No visible sheen
pH	Between 7.0 to 8.7

4.3.1 Water Sampling – Mary River and Sheardown Lake

Under ice and open water testing of receiving water quality will be conducted for the following parameters:

- Biological Oxygen Demand (BOD_5)
- Total Suspended Solids (TSS)
- pH
- Total Kjeldahl Nitrogeen (TKN) plus ammonia-nitrogen
- Total phosphorous
- Dissolved oxygen

4.4 Oily Water Treatment Plants (Maintenance Facilities Wastewater)

The Mine Site and the Steensby Port Site will be equipped with an Oily Water treatment Plant located within the Maintenance Facilities. The oily water pilot treatment facility established at Milne Port will be retained for the Construction period. The locations and water quality discharge criteria for these Oily Water treatment Plants are presented in Table 4-7.

Table 4-7 Vehicle Maintenance Shops Facility Effluent Discharge Quality Standards

Oily Water Treatment Plant	Location and Discharge Coordinates	
Mine Maintenance Building	N: 7913224	E: 561618
Steensby Railway Maintenance Bldg	N: 7803293	E: 596283
Milne Port Oily Water Treatment Facility	N: 7955545	E: 503350
Discharge Water Quality Criteria		
Parameter	**Guidelines : Industrial Waste Discharge in Nunavut (mg/L)**	**Sampling and Monitoring Frequency**
Aluminium	1	Monthly
Ammonia	10	Monthly
Arsenic	1	Monthly
Barium	1	Monthly
Cadmium	0.1	Monthly
Biochemical Oxygen Demand	15	Monthly
Chlorine	1	Monthly
Chromium	0.1	Monthly
Copper	1	Monthly
Cyanide	0.1	Monthly
Fluoride	2	Monthly
Grease, Fat, Oil	15	Monthly
Iron	1	Monthly
Lead	0.05	Monthly
Mercury	0.006	Monthly
Nickel	1	Monthly
pH Range	6 – 10.5	Monthly
Phenolic Compounds	0.02	Monthly
Phosphorous	1	Monthly
Silver	0.1	Monthly
Total Suspended Solids	15	Monthly
Tin	1	Monthly
Zinc	0.5	Monthly

At Steensby Port and Mary River mine site, treated effluent from the oily water treatment plant will be re-circulated for use as wash water for vehicles and other uses within the maintenance facilities. It is anticipated that make-up water will be required.

4.5 Waste Rock and Ore Storage Effluent Monitoring

The monitoring location for runoff from the Waste Rock Stockpile and ore stockpiles are shown on Figure 2 (Annexe 1). Runoff from waste rock piles as well as ore stockpile areas will be sampled once per month and tested for parameters shown in Table 4-8.

Table 4-8 Waste Rock and Ore Stockpiles Runoff Water Quality Criteria

Monitoring Locations	
Facilities	**Coordinates**
Waste Rock Stockpile – West Ponds	N: 7916449; E: 564405
Waste Rock Stockpile – East pond	N: 7915050; E: 561129
Mine Site Ore Stockpile Runoff Water	N: 7912444; E: 562063
Steensby Port Ore Stockpile Runoff Water	N: 7799991; E: 593237
Runoff Water Quality Criteria	
Parameters	**Threshold**
	Maximum Concentration in a Grab Sample
pH	6.0 < pH < 9.0
Ammonia	Non-acutely toxic
Nitrate	Non-acutely toxic
Sulphate	To be established
Deleterious Substances - mg/L	
Arsenic	1.00
Copper	0.60
Lead	0.40
Nickel	1.00
Zinc	1.00
TSS	30.00
Acute toxicity	
Fish species	No mortality

The Effluent Monitoring Study will be initiated upon project start-up, and will involve the periodic sampling of the effluent at the identified final discharge points (Table 4-8).

The MMER requirements for an Effluent Monitoring Study include grab samples of the effluent at each final discharge point:

a. Analysis for pH and the deleterious substances as listed in Schedule 4 of the regulations to be conducted weekly;

b. Acute lethality testing in accordance with procedures specified in Reference Method EPS1/RM/13 to be conducted monthly; and

c. Daphnia magna monitoring in accordance with procedures specified in Reference Method EPS 1/RM/14 to be conducted monthly.

4.5.1 Aquatic Effects Monitoring

Schedule 5 of the MMER provides detailed requirements for the conduct of water monitoring and biological studies to monitor potential effects of effluent on fish populations, fish tissue and on the benthic invertebrate community in the area of the final discharge points. Prior to the

conduct of the biological monitoring studies the MMER requires that a study design be developed and submitted to Environment Canada for approval. The study design should provide a site characterization of potential sampling sites, specific information on how the respective studies will be conducted and how the studies will provide the information necessary to determine whether the effluent has had an effect on the respective sampling targets.

A draft study design is presented in Appendix 10D-14 of the FEIS and Appendix 3B, Attachment 5 (MMER Environmental Effects Monitoring Study Design Framework). This document will be the basis of discussion with Environment Canada. Once this study program is reviewed and approved by Environment Canada, the AEMP will be finalized. Exposure sites and references sites identified in the AEMP will be monitored (Table 4-9).

Table 4-9 Aquatic Effects Monitoring Exposure Sites and Reference Sites

Description	Coordinates (proposed)	Sampling & Monitoring Frequency
Mine Site Exposure Sites		
Exposure Zone 1 – Camp Lake and tributary CLT-1 from the discharge of mine contact water from the west waste rock stormwater pond, as well as reduced flows. Tributary CLT-2 will experience reduced flows only.	TBD	TBD
Exposure Zone 2 – The Mary River ranging from the headwaters (upstream of mine activities) to the inlet to Mary Lake from the discharge of mine contact water from the east waste rock stormwater pond, open pit and ROM stormwater pond	TBD	TBD
Exposure Zone 3 – The outflow of the Ore Stockpile storm water pond which will discharge into Mary River near the proposed railway bridge location	TBD	TBD
Mine Site – Reference Sites (Candidates)		
Mary River, approximately 5 km upstream of the ore stockpile discharge point (Site ID G0-03)	TBD	TBD
Upstream of East SWM pond in Camp Lake Tributary, (Site ID L1-06)	TBD	TBD
Upstream of the West SWM pond in an unnamed tributary to Mary River ("F"), (Site ID F0-05)	TBD	TBD
Steensby Port – Exposure and Reference Sites		
Exposure Zone 4 – Steensby Inlet resulting from the discharge of	TBD	TBD

mine contact water from the ore stockpile stormwater pond.		
Steensby Port marine reference sites	TBD	TBD

4.6 Summary of all Water Monitoring Stations by Project Sites

4.6.1 Current Surveillance Network Program (SNP)

Existing Monitoring Stations under Water Licence will be maintained at the locations shown in Table 2-19.

Table 4-10 SNP Monitoring Stations Under Existing Type B Water Licence 2BB-MRY1114

Current Monitoring Station ID	Description
MRY-1	Water supply for the Mary River Camp at Camp Lake
MRY-2	Summer water supply for the Milne Port Camp at Phillips Creek
MRY-3	Winter water supply for Milne Port Camp at the Km 99 lake (See Note 1)
MRY-4	Mary River Camp sewage discharge at the WWTF
MRY-4a	Mary River Camp sewage discharge from the PWSP
MRY-5	Milne Port Camp sewage discharge at the WWTF
MRY-5a	Milne Port Camp sewage discharge from the PWSP
MRY-6	Water collected within the Bulk Fuel Storage Facility at Mary River prior to release
MRY-7	Water collected within the Bulk Fuel Storage Facility at Milne Port prior to release
MRY-8	Minewater and surface drainage either pumped or released from the Hematite Open Pit
MRY-9	Minewater and surface drainage either pumped or released from the mixed ore (Hematite and Magnetite) Open Pit
MRY-10	Surface discharge from the weathered ore stockpile
MRY-11a	Non-Hazardous waste landfill downstream, location a
MRY- 11b	Non-Hazardous waste landfill downstream, location b
MRY-12	Surface discharge from the bulk sample lump ore and fine ore stockpiles at the processing area
MRY-13	Surface discharge from the lump ore and fine ore stockpiles at Milne Port
Notes: The winter water supply for the Milne Port Camp is at km 32 not km 99. Monitoring Station MRY-8 is no longer required as there is only one open pit which will be monitored by MRY-9.	

During construction, many of the existing site will no longer be relevant for monitoring as new facilities will be constructed on the footprint of these facilities. The proposed new monitoring stations for the Project are presented in Table 4-11. This Table regroups all monitoring points indentified in Table 4-1 to 4-9 by Project sites.

Table 4-11 Monitoring Stations

SMP ID	Description	Coordinates
Milne Port - Reference Drawing H337697-4610-07-042-0001		
	Water supply from Philips Creek	N: 975254 E: 502830
	Summer water supply at Phillips Creek	N: 7964579 E: 514503
	Winter water supply for Milne Port Camp at the Km 32)	N: 7951862 E: 521714
	Surface water surveillance station	
MRY-12b	Bulk fuel tank farm (new)	N: 7976209 E: 503641
	Landfarm	N: 7975528 E: 503740
MRY-7	Bladder tank farm (to be decommissioned)	N: 7976097 E: 503309
MRY-12a	Bulk sampling ore stockpile	N: 7976452 E: 503356
	WWTP Discharges	
MRY-5	Sewage Treatment Plant discharge	N: 7975764 E: 503462
MRY-5a	PWSP discharge	N: 7976118 E: 503344
	WWTP (oily water) Discharge	N: 7955545 E: 503350
Mine Site – Reference Drawing H337697-4610-07-042-0002		
	Water supply from Camp Lake	N: 7914695 E: 557818
	WWTP Discharges	
	Exploration Camp Sewage plant to Sheardown Lake	N: 7914372 E: 557920
	Discharge from the PWSP	N: 7913930 E: 558706
	Construction Camp Sewage plant discharge (Mary River)	N: 7912429 E: 562962
	Oily water treatment plant discharge	N: 7913224 E: 561618
	Surface water surveillance station	
	Mine services tank farm	N: 7913050 E: 562031
	Fuel unloading station	N: 7912973 E: 561360
	Landfarm	N: 7912603 E: 560852
	Surface Runoff	
	Ore stockpile stormwater management pond discharge	N: 7912444

		E: 562063
	Run of Mine stockpile stormwater management pond discharge	N: 7913507 E: 564159
	Bulk sample crusher stockpile	N: 7913364 E: 560987
	Waste Rock Stockpile Runoff	
	West pond	N: 7916449 E: 564405
	East pond (include mine pit water)	N: 7915050 E: 561129
Steensby Port - Reference Drawing H337697-4610-07-042-0003		
	Water supply – ST347	N: 7804826.58 E: 596600.563
	Water supply – 3 km Lake	N: 7800206.654 E: 596698.129
	Surface Runoff	
	Ore stockpile stormwater management pond discharge	N: 7799991 E: 593237
	Surface Runoff	
	Landfarm	N: 7804080 E: 597531
	Bulk fuel farm runoff	N: 7801713 E: 593376
	WWTP Discharges	
	Oily water treatment plant discharge	N: 7803293 E: 590283
	Construction camp sewage treatment plant effluent discharge	N: 7803154 E: 596181

5. Marine Environment

5.1 Construction Period

Adaptive environmental monitoring will be used during construction and operation activities to pro-actively monitor activities such as freight shipping that have the potential to affect sea ice conditions, marine water and sediment quality and aquatic ecosystems. Results will be used to drive changes in practices that result in reducing impacts. In addition to specific monitoring and reporting requirements under regulatory approvals such as the water licence, QIA land lease, land use permits and fisheries authorisation, routine inspections of various aspects of the operations will be undertaken.

With the exception of on-going monitoring of the treated effluent discharge into Steensby Inlet (section 2.3), most routine monitoring activities will not be initiated until the Operation phase or the completion of EEM candidate studies.

5.1.1 Marine Water and Sediment Quality

Water quality monitoring will consist of both visual inspection and sampling/analytical results are used as indicators. During routine inspections (see Freshwater Monitoring for details), any indication of elevated total suspended solids (TSS) level or visible oil sheen will result in immediate corrective action.

Effluent discharge locations are shown on the Environmental Monitoring Plans for Milne Inlet and Steensby Inlet shown in Appendix A.

Water quality monitoring during construction of in-water structures at Milne Port and Steensby Port will be completed. TSS concentrations will be monitored to confirm compliance with water quality guidelines for the protection of aquatic life.

If suspended solids/turbidity exceed the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guidelines for the Protection of Aquatic Life mitigation measures will be reviewed and modified as required to meet the guidelines.

5.1.2 Marine Mammals

Seven marine mammal species known or expected to occur along the proposed shipping routes into Steensby and Milne inlets and along the proposed shipping routes in Baffin Bay and Davis Strait were selected as indicator species in the EIS: ringed seal (*Pusa hispida*), walrus (*Odobenus rosmarus*), beluga whale (*Delphinapterus leucas*), narwhal (*Monodon monoceros*), bowhead whale (*Balaena mysticetus*), bearded seal (*Erignathus barbatus*) and polar bear (*Ursus maritimus*).

Monitoring will include noise monitoring from pile driving and blasting, ore carrier and freight vessels and marine mammal observations.

5.1.2.1 Noise

There is also some uncertainty associated with acoustic modelling results, primarily because details on pile driving and blasting were limited during preparation of this assessment. As such, acoustic measurements will be acquired at the beginning of the Construction Phase to refine the safety zone for pile driving and blasting to ensure that the 100 kPa overpressure guideline for blasting is met. Noise levels produced by aircraft will be monitored at the port site and at select walrus haulout sites during the Construction Phase.

5.2 Marine Environment – Operation Period

The following monitoring activities have been identified and will begin at the onset of the Operation Period (2017).

5.2.1 Sea Ice Monitoring

The Marine Transportation Management Team will monitor ice conditions and disseminate ice and navigation information within the Baffinland operations and to the local communities.

Monitoring to establish the effect of late season shipping on the timing and nature of land fast formation and break up of ice in Steensby Inlet will be completed.

The ore carriers will maintain a digital record of their travel routes within the RSA. Baffinland will compile this information for each vessel and submit a report to Environment Canada annually.

5.2.2 *Noise*

Measurements of underwater sound levels from the Cape-size ore carrier that will transit the southern shipping route and a typical ore carrier that will transit the northern shipping route will be made. These data will provide information that can be used in conjunction with marine mammal monitoring data to confirm predictions made in the EIS, assess the effectiveness of mitigation measures, and to quantify marine mammal response to ore carrier traffic relative to received sound levels. Along the southern shipping route, acoustic measurements will be made once during or prior to Year 1 of the Operation Phase. Along the northern shipping route, it is possible that the acoustic signature of an ore carrier will be established during the Construction Phase if that ore carrier represents the vessels which will be used during the Operation Phase. If not, this will be determined for an ore carrier transiting the northern shipping route during Year 1 of the Operation Phase.

5.2.3 *Marine Mammal Observations*

A marine mammal observation program will be established to document the response of marine mammals from shipping. The monitoring program will include Marine Mammal Observers (MMOs) positioned onboard a representative number of ore carriers, aerial surveys with a fixed-wing aircraft and potentially using an unmanned airborne system, and an ice imagery study. Inuit Advisors/Monitors will act as the Marine Mammal along both the northern and southern shipping routes.

Wake wave monitoring from ore and freight vessels moving into and out of the area during open water season will be discussed. The use of conventional wave measuring devices has not proven successful in arctic conditions, as the sensor along the ice face tends to “melt in” and produce false readings. If wake monitoring is required, it will be included as part of the Marine Mammal Observations, using a combination of visual, aerial, stationary camera observations and buoy mounted sensors during open water season.

5.2.4 *Ore Carrier Anti-fouling Sampling and Monitoring*

Refer to section 4.2.1.1 of the Shipping and Marine Wildlife Management Plan (Appendix 10D-10).

Sampling of the anti-fouling system will follow the Guidelines for Brief Sampling of Anti-fouling Systems on Ships (MEPC.104(49)) . The number of samples taken will be representative of the ship’s hull and occur at areas where the anti-fouling system is intact. A minimum of four (4) sample points, equally spaced down the length of the hull will be taken.

The number of samples taken at each sample site will allow for a retention quantity for back-up and storage. For dry samples, triplicate specimens of paint at each sampling point should be taken approximately 10 cm from each other. Should more than one type of anti-fouling system

be present on the vessels, sampling will be taken from all anti-fouling systems when access is possible.

Samples will be sent to accredited and recognized laboratories meeting the ISO 17025 standard.

5.2.5 Ballast Water Sampling and Monitoring

Refer to Section 4.2.2 of the Shipping and Marine Wildlife Management Plan.

Monitoring and sampling protocols will be designed in consultation with appropriate provincial and federal agencies. In addition to the onboard sampling, control sites within Steensby Inlet and impact sites that are anticipated to interact with discharged treated ballast water within Steensby Port will be sampled. This program will be implemented as part of AEMP for the Project.

6. Other Monitoring

The Environmental Lead will coordinate routine inspections of various aspects of the operations in addition to specific monitoring and reporting requirements under the regulatory approvals such as the water licence, QIA land lease, land use permits, and fisheries authorization as well as monitoring of Project effects. Routine inspections are conducted to confirm overall conformance with the requirements of the Waste Management Plan, companion EPP, and operating procedures/work instructions, and will include inspections of site-based waste management activities.

Compliance Monitoring Forms are used to document the findings and required actions. These reports are generated as an internal operational management tool to promote continuous improvement in environmental performance and stewardship. Checklists are used as internal operational monitoring and compliance tools. These checklists are integrated into the EPP and other operating procedures/work instructions.

6.1 Waste Monitoring

An annual Project report will be prepared that addresses requirements specified by the water licence, the Nunavut Impact Review Board (NIRB), and the landowners. Information to be included in reporting regarding waste disposal includes:

- GPS coordinates and photographic records of waste disposal facilities
- Inspection recommendations from a geotechnical engineer from annual summer inspection
- Any other details on waste disposal requested by the NWB

Records of waste disposal activities will be available upon request to NWB inspectors.

6.2 Airport Facilities

Record of flights arrival and departure at each airstrip will be kept. This information will be passed on to Parks Canada for information.

6.3 Site Inspection

Baffinland will make monitoring information available to the NWB and DFO inspectors. The Company will respond to direction provided by the NWB and DFO inspectors as they arise.

7. Reporting

Reporting of environmental monitoring information includes documentation and data control and the preparation of regulatory reports and other reports as may be required for Project Stakeholders.

Baffinland's Environment Department will prepare an annual summary report on the status of the terrestrial and marine environment as dictated in the terms and conditions of the Project Certificate. A detailed report illustrating trends of measurable parameters will be prepared every 5 years or as deemed necessary between all agencies and partners.

7.1 Documentation and Quality Control (QA/QC)

Baffinland's EHS Superintendent or designate will coordinate preparation, review, and distribution, as appropriate, of the data and reports required for regulatory purposes.

Execution of some of the monitoring programs will be conducted by, or supported by consultants and contractors to Baffinland. Data and reports will be prepared and delivered to Baffinland by its consultants for internal and external distribution and use, as appropriate.

All formalized documents and reports will follow data-control procedures, with revision numbers and revision tracking. Documents and data that are to be issued and liable to change will be controlled to ensure they are approved before issue and that the current issue or revision is known to and available to those requiring them.

In terms of the physical sampling and analytical services, Baffinland's procurement procedures for these services will ensure that contractors retained to execute the work have the necessary accreditation and QA/QC procedures in place. All monitoring will be done in accordance with generally accepted standards of good scientific practice at the time of the sampling using documented and validated methods. Standard environmental monitoring quality controls measures will meet the measures outlined in Appendix B – Environmental Monitoring Standard Quality Control Measures.

QA/QC procedures will identify, implement, manage and continuously improve the effectiveness of the sampling programs that are being undertaken. The protocols developed for the monitoring programs will be managed in order to achieve the objectives which allow for management action and relevant support decisions, as part of the monitoring and measurement/sample collection and delivery programs.

All sample collection and monitoring observations will undergo planned verification (checking) activities to verify that the data meet the QA/QC requirements for the different disciplines such as water quality testing, emissions measurement, wildlife observations and others. Validation

processes to confirm that data are properly managed will include duplicate samples, chain of custody signoffs and written verification of collection. Document control measures that include proper notarization and retrieval systems for the activities and results will also be implemented.

Quality assurance processes will include internal quality audits, management of quality incidents (non conformance to QA/QC protocols), reporting and data management. Quality incidents that are identified as part of the audits and reviews will be documented, managed and tracked to completion in accordance with non-conformance management procedure protocols.

7.2 Regulatory Reporting

Reporting of all environmental monitoring data will be conducted in accordance with all licences and approvals. It is anticipated that regulatory requirements will entail formal monthly and annual reports, including disclosure of issues of non-conformance.

Annually a monitoring report will be produced that will summarize all of the monitoring data that took place within the last reporting period. The monitoring report will include a summary of the new data collected during the reporting period, and a discussion on previous data. Baffinland will use the NWB's standardised format for annual reporting.

Records of environment inspections and observations will be kept on file and made available upon request.

7.3 Stakeholder Reporting

Future arrangements regarding reporting could be made through the Inuit Impact Benefits Agreement (IIBA) or other mechanisms; this will be incorporated in future Plan updates.

8. Roles and Responsibilities

Baffinland's Environmental Department is responsible for monitoring compliance with applicable regulations and permit requirements. The responsibility for implementation of mitigation measures rests with the VP Sustainability

Compliance is achieved through ongoing monitoring, and development and implementation of operational standards, procedures, and employee training. Table outlines the roles and responsibilities for implementation of the Environmental Monitoring Plan.

Table 8-1 Roles and Responsibilities

Position	Responsibility
HSE Lead	Accountable for onsite environmental performance.
	Establishes goal and targets for environmental performance.
	Responsible for implementation of mitigation measures.
Environmental Lead	Responsible for compliance monitoring.
	Provides direction on environmental issues to the Environmental Site Monitors Team.
	Staffing of Environmental Department.
	Supervise/conduct site inspection and audits.
	Initiate and manage environmental studies as required.
	Manage external environmental consultants/specialists.
	Environmental reporting as required by permits and authorizations.
	Liaison with regulatory agencies on all environmentally related issues.
Environmental Site Monitors	Provide specialist advice and input on environmental matters.
	Conduct environmental studies and monitoring programs.
	Conduct audits of operations, as requested.
	Prepare environmental reports.
Bear Monitors	Provide polar bear safety training.
	Accompany workers if working on the land, at a distance from camp facilities.
	Report any incidents or other events to the Environmental Lead.
	Record of all observed wildlife mortality reports by personnel.
Safety Lead	Ensure that all personnel engaged in operations are aware of hazards related to work.
	Ensure that all personnel are provided with and shall wear the appropriate personal protection equipment (PPE) which shall be suitable for the task at hand under the existing weather conditions.
	Be the source of expertise and technical review in the development of the contingency and emergency response plans.
	Be informed of any incident on site.
	Report any incidents or other events to the Environmental Lead.

Position	Responsibility
Contractors/ Subcontractors	Contractors/subcontractors are considered equivalent to Baffinland staff in all aspects of environmental management and control and their responsibilities in this respect mirror those of Baffinland personnel. Contractor personnel will be included in the onsite induction process.
	Responsibilities of contractors/subcontractors include the following:
	• Comply with requirements of the EPP and related EMMP.
	Responsibilities of the contractor/subcontractor supervisors include the following:
	• Conduct regular site inspections to ensure regular maintenance is undertaken to minimise environmental impacts.
	• Provide personnel with appropriate environmental toolbox/tailgate meetings and training.

9. Environmental Monitoring Locations

Environmental Monitoring Plan Site Layouts for the three main Project areas (Milne Inlet, Mary River Mine Site and Steensby Port) are included in Appendix A. The Plans show locations of the planned discharges resulting from the Project.

10. References

- 10D-1 Air Quality and Noise Abatement Management Plan (SD-EMMP-001);
- 10D-2 Surface Water, Aquatic Ecosystems, Fish and Fish Habitat Management Plan (SD-EMMP-002);
- 10D-3 Freshwater Supply, Sewage and Wastewater Management Plan (SD-EMMP-003);
- 10D-4 Waste Management Plan (SD-EMMP-004);
- 10D-5 Waste Rock Management Plan (SD-EMMP-005);
- 10D-6 Borrow Pit and Quarry Management Plan (SD-EMMP-006);
- 10D-7 Fish Habitat Compensation;
- 10D-8 Roads Management Plan (SD-EMMP-008);
- 10D-9 Railway Management Plan;
- 10D-10 Shipping and Marine Wildlife Management Plan;
- 10D-11 Terrestrial Environmental Management and Monitoring Plan (SD-EMMP-011);
- 10D-14 Aquatic Effects Monitoring Plan;

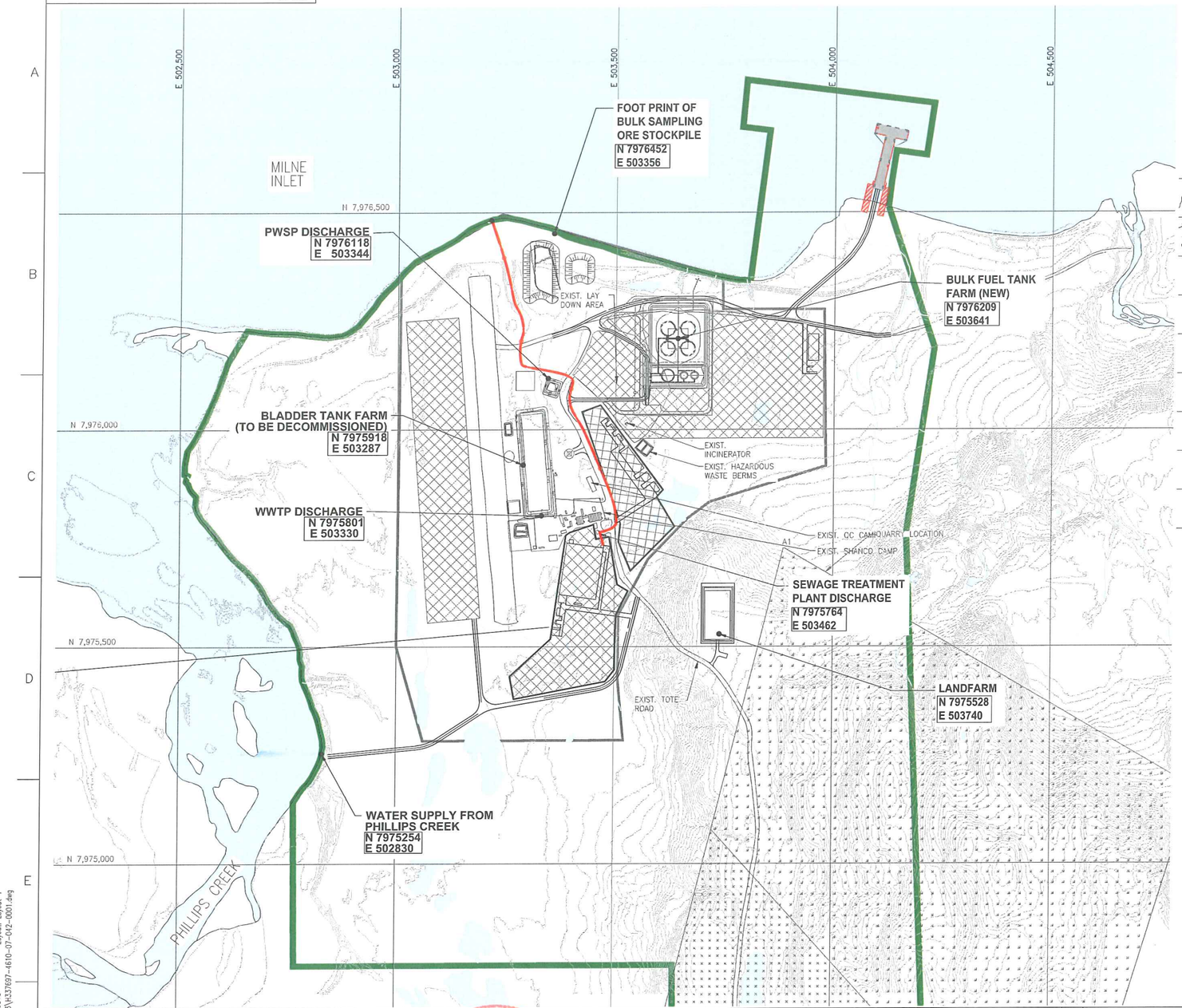
- Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (CEQG);
- Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products. Source: http://www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=61B26EE8-1&offset=2&toc=show; and
- MMER. 2002. Metal Mine Effluent Regulations SOR/2002-222.

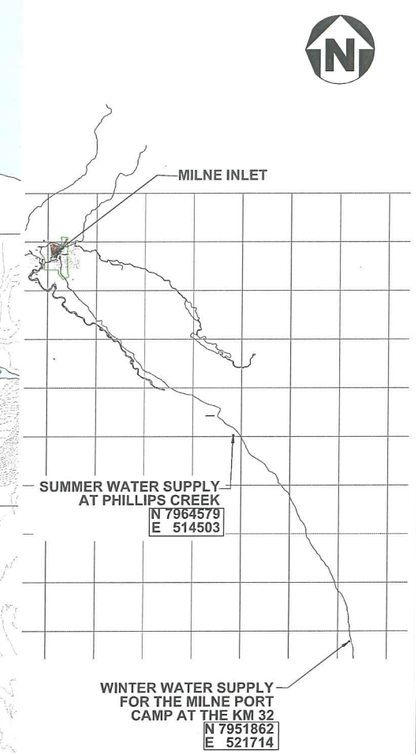
Appendix A

Figures

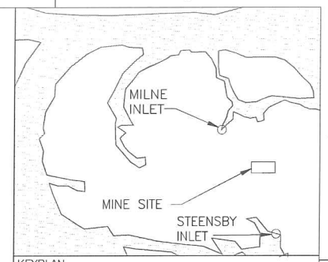
H337697-4610-07-042-0001 Milne Inlet Environmental Monitoring Plan Site Layout
H337697-4610-07-042-0002 Mine Site Environmental Monitoring Plan Site Layout
H337697-4610-07-042-0003 Steensby Inlet Environmental Monitoring Plan Site Layout

DWG. NO. H337697-4610-07-042-0001





PLAN
N.T.S.



KEYPLAN

LEGEND:

- WATER
- PROPOSED QUARRY
- LAYDOWN AREA (CONSTRUCTION PHASE)
- CONSTRUCTION PHASE INFRASTRUCTURE
- RIVER/STREAM/DRAINAGE
- POTENTIAL DEVELOPMENT AREA
- BAFFINLAND'S COMMERCIAL LEASE ON INUIT OWNED LAND
- TREATED EFFLUENT PIPELINE
- FRESH WATER PIPELINE

NOTE(S):

1. TOPOGRAPHY PROVIDED BY EAGLE MAPPING (2005).
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 1.5 METRES.
4. AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR IN 2008.
5. SMP – SURVEILLANCE MONITORING POINT

SCALE 100 50 0 100 200 300 400 500 m

SCALE 1:5,000

Jan 20 , 2012 , 11:38am Login name: HUA63318 Layout: Layout 1
Drawing Name: C:\pr\projectwise\yhuang\dms14683\h337697-4610-07-042-0001.dwg

REFERENCE DRAWINGS

DRAWING NO.	DRAWING TITLE

REGISTERED PROFESSIONAL ENGINEER
JM GASSON
LICENSEE
20[illegible]/12
NT/NU

REVISIONS

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
D	ISSUED FOR INFORMATION	RK	JK	JB	2012/01/20
C	ISSUED FOR INFORMATION	RK	JK	JB	2012/01/17
B	ISSUED FOR INFORMATION	RK	JK	JB	2011/11/18
A	ISSUED FOR INFORMATION	RK	JK	JB	2011/11/03

ISSUE AUTHORIZATION

REV.	ISSUE FOR	AUTH. BY	DATE
D	ENVIRONMENTAL PERMIT	JC	2012/01/20
C	ENVIRONMENTAL PERMIT	JC	2012/01/17
B	ENVIRONMENTAL PERMIT	JC	2011/11/18
A	ENVIRONMENTAL PERMIT	JC	2011/11/03

HATCH

DESIGNED BY R. KAPADIA	DRAWN BY Y. HUANG
DATE	DATE
CHECKED BY J. KEECH	DISCIP. ENGR. J. BINNS
DATE	DATE
PROJ. DES. COORD.	PROJ. ENGR.
DATE	DATE
PROJ. MGR.	
DATE	

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

MILNE INLET
ENVIRONMENTAL MONITORING PLAN
SITE LAYOUT

SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-4610-07-042-0001	D

DWG. NO. H337697-4610-07-042-0002

WEST POND (INCLUDE MINE PIT WATER)
N 7915050
E 561129

EAST POND
N 7916449
E 564405

WATER SUPPLY FROM CAMP LAKE
N 7914696
E 557818

CAMP LAKE

FUEL UNLOADING STATION
N 7912973
E 561360

DISCHARGE FOR THE CONSTRUCTION CAMP
N 7913347
E 561141

WWTP DISCHARGE
N 7913224
E 561616

MINE SERVICES TANK FARM
N 7913050
E 562031

ROM STOCKPILE DISCHARGE POINT
N 7913507
E 564159

DISCHARGE FROM THE PWSP
N 7913930
E 558706

EFFLUENT DISCHARGE POINT
N 7913627
E 559718

BULK SAMPLE CRUSHER STOCKPILE
N 7913364
E 560987

LANDFARM
N 7912603
E 560852

ORE STOCKPILE DISCHARGE POINT
N 7912444
E 562063

MARY RIVER

MILNE INLET
MINE SITE
STEENSBY INLET

KEYPLAN

LEGEND:

- WATER
- EXISTING BORROW AREA
- TEMPORARY LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- POTENTIAL DEVELOPMENT AREA
- ACCESS ROAD
- COMMUNICATION TOWER
- TREATED EFFLUENT PIPELINE
- FRESH WATER PIPELINE

NOTES:

1. TOPOGRAPHY PROVIDED BY TERRAPOINT CANADA INC.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2 METRES.
4. MINE SITE INFRASTRUCTURE IS BASED ON EIS AND AMEC DRAWINGS ADDITIONAL DETAILS PROVIDED IN DRAWINGS : A1-164512-6120-121-0100 A1-165926-6000-121-CAD-0100 A1-159952-6020-121-0200
5. MATERIAL HANDLING AND PROCESSING LAYOUT WAS REVISED BASED ON AKER KVAERNER DRAWING DWG-2000-M-0003, REV C.
6. MINE SITE AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR, SURVEYED AS OF JAN. 2009.
7. SMP - SURVEILLANCE MONITORING POINT.

SCALE 300 150 0 500 1000 1500 m

SCALE 1:15,000

DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

REGISTERED PROFESSIONAL ENGINEER J.V. CASSON LICENSEE 2012/1/12 NT/NU

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
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D	ISSUED FOR INFORMATION	RK	JK	JB	2012/01/17
C	ISSUED FOR INFORMATION	RK	JC	JB	2012/01/10
B	ISSUED FOR INFORMATION	RK	JC	JB	2011/11/18
A	ISSUED FOR INFORMATION	RK	JC	JB	2011/11/03

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE
E	ENVIRONMENTAL PERMIT	JC	2012/01/19
D	ENVIRONMENTAL PERMIT	JC	2012/01/17
C	ENVIRONMENTAL PERMIT	JC	2012/01/10
B	ENVIRONMENTAL PERMIT	JC	2011/11/18
A	ENVIRONMENTAL PERMIT	JC	2011/11/03

ISSUE AUTHORIZATION

HATCH

DESIGNED BY R. KAPADIA DATE	DRAWN BY Y. HUANG DATE
CHECKED BY J. KEECH DATE	DISCIP. ENGR. J. BINNS DATE
PROJ. DES. COORD. DATE	PROJ. ENGR. DATE
PROJ. MGR. DATE	

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

MINE SITE
ENVIRONMENTAL MONITORING PLAN
SITE LAYOUT

SCALE	DWG. NO.	REV.
OR AS NOTED	H337697-4610-07-042-0002	E

Jan 20, 2012 - 11:50am Login name: HUA59318 Layout: Layout1
Drawing Name: C:\pr\projectwise\yhuang\dms14683\H337697-4610-07-042-0002.dwg

DWG. NO. H337697-4610-07-042-0003

WWTP DISCHARGE
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E 596283

SEWAGE PLANT DISCHARGE
N 7803154
E 596181

WATER SUPPLY ST347
N 7804826
E 596600

LANDFARM
N 7804080
E 597531

BULK FUEL FARM RUNOFF
N 7801713
E 593376

ORE STOCKPILE
N 7799991
E 593237

WATER SUPPLY - 3KM LAKE
N 7800206
N 596698

ACCOMMODATION BUILDING BLD-4520.101
UTILIDORS BLD-4750.100
LANDFILL
MOW MATERIAL STORAGE
FAIL & LIGHT VEHICLE MAINTENANCE BUILDING BLD-4560.101
CONTAINER STORAGE & VEHICLE PARKING
E-HOUSE BLD-4740.107
E-HOUSE BLD-4740.111
INSPECTION SHED BLD-2300.101
ACCESS ROAD
SOLID WASTE DISPOSAL & INCINERATOR SYSTEM BLD-4660.100
POWER PLANT BUILDING BLD-4730.101
UNHEATED STORAGE BUILDING BLD-4560.102
UNHEATED STORAGE SHEDS BLD-4560.102
PERMANENT LAYDOWN AREA
FUEL STORAGE
STORM WATER MANAGEMENT POND
COMMUNICATION TOWER BLD-4730.100
ON HOLD FOR PROPAGATION STUDY
E-HOUSE BLD-4740.106
FIRE PUMP HOUSE BUILDING BLD-4520.100
ADMINISTRATION, LAB & FIRST AID BUILDING BLD-4540.101
E-HOUSE BLD-4740.108
EMERGENCY BOILER HOUSE BLD-4650.100
E-HOUSE BLD-4740.110
E-HOUSE BLD-4740.109
FUEL DISTRIBUTION PUMP HOUSE BUILDING LD-4640.100
WASTE TRANSFER STATION
PERMANENT LAYDOWN AREA
AMMONIUM NITRATE STORAGE
TERTIARY CRUSHER PRODUCT CONVEYOR 1260-CV-068
FINE CONVEYOR 5350-CV-014
LUMP CONVEYOR 5350-CV-001
E-HOUSE BLD-4740.112
RAIL CAR UNLOADING BUILDING BLD-5210.100
RAIL RECLAIM CONVEYOR 5340-CV-001
STEENSBY INLET
E-HOUSE BLD-4740.102
TRANSFER HOUSE BLD-5350.102
TERTIARY CRUSHING BUILDING BLD-1270.100
TRANSFER HOUSE BLD-5350.101
LUMP STACKER/RECLAIMER &TRIPPER
ORE STOCKPILE STORM WATER POND
E-HOUSE BLD-4740.113
E-HOUSE BLD-4740.104
AIR STRIP SHELTER BLD-4590.101
FIELD ELECTRICAL CENTER BLD-4590.104
CARGO STORAGE BUILDING BLD-4590.103
DEICING EQUIPMENT STORAGE BLD-4590.102
ISLAND TRANSFER HOUSE BLD-5210.101
SCREEN FEED BIN CONVEYOR 1260-CV-001
E-HOUSE BLD-4740.101
SECONDARY SCREENING BUILDING BLD-1260.100
OVERSIZE LUMP CONVEYOR 1270-CV-001
FINE STOCK PILE
LUMP PRODUCT YARD CONVEYOR 5350-CV-011
E-HOUSE BLD-4740.114
FINES YARD CONVEYOR 5350-CV-024
FINES STACKER & TRIPPER
LUMP STOCK PILE
LUMP PRODUCT RECLAIMER
HELICOPTER PAD
AIRSTRIP
SHIP LOADER FEED CONVEYOR 5370-CV-011
STEENSBY INLET
TRANSFER HOUSE BLD-5370.101
SHIP LOADER FEED CONVEYOR
PORT SURGE BIN BUILDING BLD-5370.100
ORE DOCK OPERATIONS FACILITY BLD-3280.101
E-HOUSE BLD-4740.115
SHIP LOADER FEED CONVEYOR 5370-CV-018
ORE LOADING DOCK
DRIVE HOUSE BLD-5370.103
PROPOSED FREIGHT DOCK & FUEL UNLOADING
ACCESS ROAD
FREIGHT DOCK OPERATIONS FACILITY BLD-3280.102
FUEL TANK

7803500 N
7802000 N
7800500 N
7799000 N
596000 E
596600 E
597200 E
598000 E

MILNE INLET
MINE SITE
STEENSBY INLET
KEYPLAN

LEGEND:

- WATER
- EXISTING BORROW AREA
- TEMPORARY LAYDOWN AREA
- RIVER/STREAM/DRAINAGE
- POTENTIAL DEVELOPMENT AREA
- ACCESS ROAD
- COMMUNICATION TOWER
- TREATED EFFLUENT PIPELINE
- FRESH WATER PIPELINE

NOTES:

1. TOPOGRAPHY PROVIDED BY TERRAPOINT CANADA INC.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2 METRES.
4. MINE SITE INFRASTRUCTURE IS BASED ON EIS AND AMEC DRAWINGS ADDITIONAL DETAILS PROVIDED IN DRAWINGS : A1-164512-6120-121-0100 A1-165926-6000-121-GAD-0100 A1-159952-6020-121-0200
5. MATERIAL HANDLING AND PROCESSING LAYOUT WAS REVISED BASED ON AKER KVAERNER DRAWING DWG-2000-M-0003, REV C.
6. MINE SITE AS-CONSTRUCTED INFORMATION PROVIDED BY GENIVAR, SURVEYED AS OF JAN. 2009.
7. SMP - SURVEILLANCE MONITORING POINT.

SCALE 300 150 0 500 1000 1500 m

SCALE 1:15,000

DRAWING NO.	DRAWING TITLE

REFERENCE DRAWINGS

REGISTERED PROFESSIONAL ENGINEER J.V. CASSON LICENSEE 20/1/12 NT/NU

NO.	DESCRIPTION	BY	CHK'D	APP'D	DATE
D	ISSUED FOR INFORMATION	RK	JC	JB	2012/01/20
C	ISSUED FOR INFORMATION	RK	JC	JB	2012/01/16
B	ISSUED FOR INFORMATION	RK	JC	JB	2011/11/18
A	ISSUED FOR INFORMATION	RK	JC	JB	2011/11/03

REVISIONS

REV.	ISSUE FOR	AUTH. BY	DATE
D	ENVIRONMENTAL PERMIT	JC	2012/01/20
C	ENVIRONMENTAL PERMIT	JC	2012/01/16
B	ENVIRONMENTAL PERMIT	JC	2011/11/18
A	ENVIRONMENTAL PERMIT	JC	2011/11/03

ISSUE AUTHORIZATION

HATCH

DESIGNED BY R. KAPADIA DATE
DRAWN BY D. FUNG DATE
CHECKED BY J. KEECH DATE
DISCIP. ENGR. J. BINNS DATE
PROJ. DES. COORD. DATE
PROJ. ENGR. DATE
PROJ. MGR. DATE

Baffinland Iron Mines Corporation

MARY RIVER PROJECT

STEENSBY INLET
ENVIRONMENTAL MONITORING PLAN
SITE LAYOUT

SCALE OR AS NOTED
DWG. NO. H337697-4610-07-042-0003
REV. D

Appendix B

Environmental Monitoring Standard Quality Control Measures

Environmental Monitoring Standard Quality Control Measures

Quality control for environmental monitoring includes the preparation of Standard Operating Protocols for sampling, recording and analysis prior to the start of monitoring activities. Standard Operating Protocols provide a method to ensure that all personnel follow the same procedures to avoid variance of data quality between personnel in charge, and that they conduct their works with good understanding of QA/QC.

Individual Standard Operating Protocols will be developed for the various atmospheric, terrestrial, freshwater and marine monitoring programs. The Standard Operating Protocols will contain the following information:

1. Measurement quality objectives;
2. Location map and UTM coordinate of regular sampling/monitoring sites;
3. Description of parameter being monitored (e.g. Total Suspended Solids);
4. Frequency of sampling/monitoring;
5. Method used to collect sample/monitoring data;
6. Methods used for handling and transportation of samples;
7. Method used for analyzing samples (e.g. standard procedure, equipment type, etc.);
8. Equipment calibration procedures;
9. Data control measures (e.g. method for reviewing data results); and
10. Data reporting requirement.

Although not intended to be ISO 9000 compliant, the principles as outlined for QA/QC within the ISO 9000 guidelines will be followed as suggested.

Definition of QA/QC

Quality Control (QC) is a system of routine technical activities, to measure and control the quality of the inventory as it is being developed. The QC system is designed to:

1. Provide routine and consistent checks to ensure data integrity, correctness, and completeness;
2. Identify and address errors and omissions; and
3. Document and archive inventory material and record all QC activities.

QC activities include general methods such as accuracy checks on data acquisition and calculations and the use of approved standardised procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting. Higher tier QC

activities include technical reviews of source categories, activity and emission factor data, and methods.

Quality Assurance (QA) activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process. Reviews, preferably by independent third parties, should be performed upon a finalised inventory following the implementation of QC procedures. Reviews verify that data quality objectives were met, ensure that the inventory represents the best possible estimates of emissions and sinks given the current state of scientific knowledge and data available, and support the effectiveness of the QC program.

Appendix C

Photographs

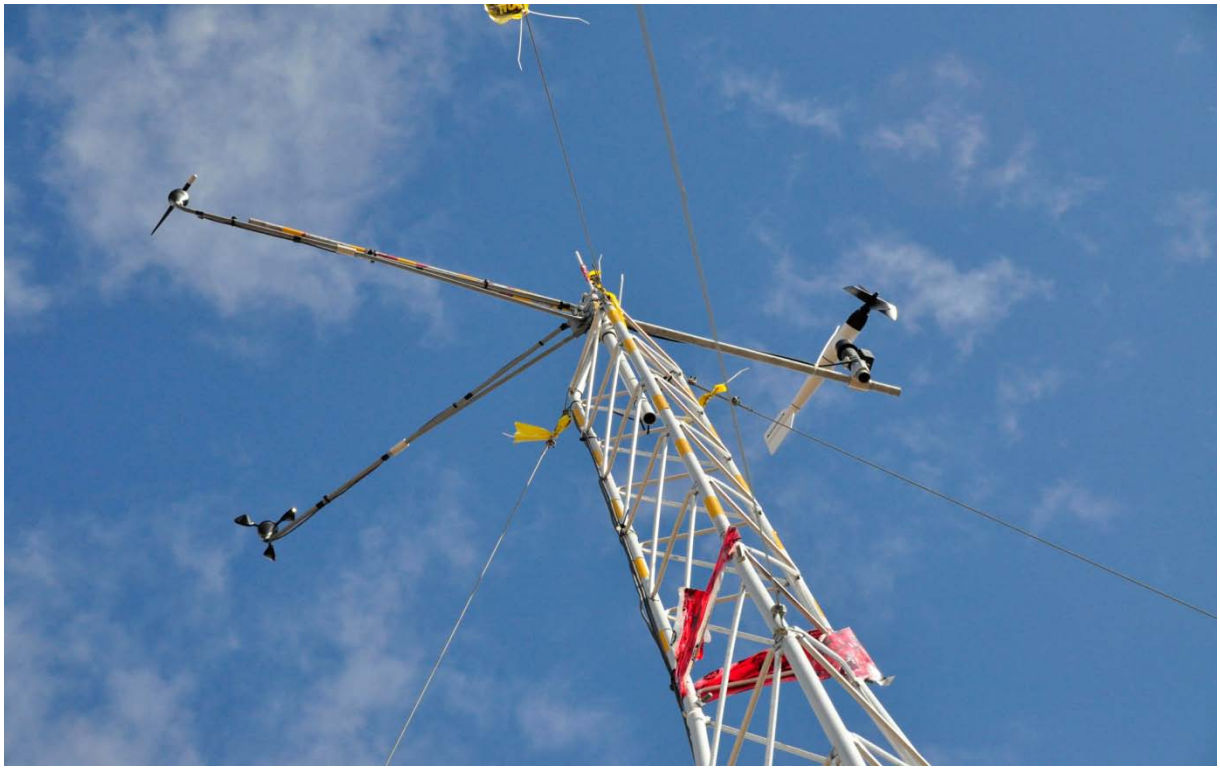

Photo 1 Campbell Scientific Weather Station – Top of 10-m Tower

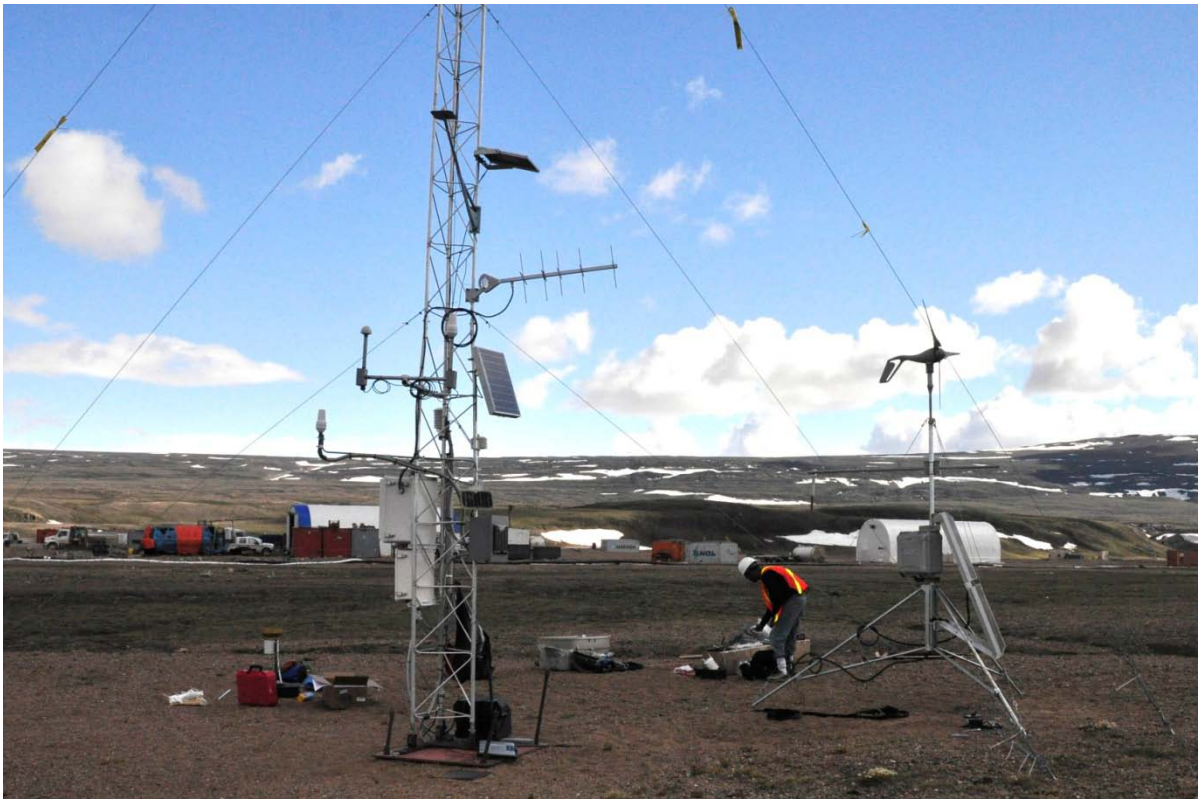

Photo 2 Campbell Scientific Weather Station (Left, bottom of 10-m tower) and Vaisala 520 (Right, 3-m Tripod)

Photo 3 Campbell Scientific Weather Station – Middle of 10-m Tower