MARY RIVER PROJECT

2012 WORK PLAN

ATTACHMENT 8

SITE SURFACE WATER AND AQUATIC ECOSYSTEM

DATE	REV.	STATUS	PREPARED BY	CHECKED BY	APPROVED BY	APPROVED BY
2011-12-07	A	Approved for Use	R. Kapadia	J. Binns	S. Perry	
HATCH						CLIENT

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0	Issued in Final	October 25, 2007	KDE
1	Updated for 2008 Field Season	March 31, 2008	KDE
2	Issued in Final	March 31, 2009	JM
3	Issued in Final	March 31, 2010	JM
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SECTION 1.0 - INTRODUCTION

1.1 PURPOSE

The "***Surface Water, Aquatic Ecosystem, Fish and Fish Habitat Management Plan"*** outlines the processes and procedures to document the quality and quantity of water that will interact with Project components over the life of the Project. It includes management practices to limit the potential for adverse impacts to receiving waters, aquatic ecosystems, fish and fish habitat. The Plan details the management of runoff collection systems at Project facilities and addresses point and non-point discharges to surface waters from Project components and discharge quality and quantity relative to the receiving water system.

The Plan addresses surface water treatment, including the identification of treatment areas and discharge locations of treated waters. It outlines specific mitigation measures required for stream/river crossings works as well as for general operation and construction activities in proximity of water courses. The Plan identifies the roles and responsibilities, specific requirements, and mitigation and management actions for erosion and sedimentation controls for the Project. The Plan includes methods for controlling erosion for both temporary and long-term stabilization efforts.

The Plan is being updated and submitted to the Nunavut Water Board during the permitting phase to support water licensing, and will be updated throughout the Project life as a condition of the company's water license.

1.2 REGULATORY REQUIREMENTS

Water use is regulated by the Nunavut Water Board (NWB) through the water licensing process. The Project will be subject to a Type 'A' water license.

The on-site work is currently regulated by a Type 'B' water license (2BB-MRY1114). A new Type B water licence application has been submitted for the upcoming 2012 Work Plan this submission provides similar details regarding the water consumption and sewage production as the previous Type B water licence submission. It is expected that the strictures of the new Type B water licence will be very similar to those of the existing Type B water licence given above.

1.3 RELATIONSHIP TO OTHER MANAGEMENT PLANS

This plan should be viewed in concert with all the other Environmental Monitoring and Mitigation Plans as it is an integral part of each EMMP. As well, this Plan should be viewed with the following management plans:

- Health, Safety and Environmental Management Framework (SD-STD-001)
- Environmental Design Guidelines (EIS, Volume 10, Section 3.0)
- Environmental Protection Plan (SD-EPP-001 to 021)

- Emergency and Spill Response and Plan (SD-ERP-001)
- Milne Port and Steensby Port Oil Pollution Emergency Plan (SD-ERP-002 and SD-ERP-003)
- Explosives Management Plan(SD-ERP-004)
- Waste Rock and Ore Management Plan (SD-EMMP-005)
- Borrow Pits and Quarry Management Plan (SD-EMMP-006)
- Roads Management Plan (SD-EMMP-008)

1.4 BAFFINLAND'S COMMITMENT

Baffinland provides adequate resources to implement and maintain the EHS Management System including the necessary human, material and financial resources. Baffinland's Sustainable Development Policy is presented in Section 2.0.

1.5 UPDATE OF THIS MANAGEMENT PLAN

The "***Surface Water, Aquatic Ecosystem, Fish and Fish Habitat Management Plan"*** (*the "Plan"*) was last updated in December 2010. Under the requirements of current water licence 2BB-MRY07, the Plan must be periodically revised to reflect changes to the current field activities undertaken. This update to the Plan was developed to take into consideration the requirements of the NIRB Guideline for the preparation of the EIS for the Mary River Project (November 16, 2009).

This Plan is intended to be a "living document" and its content reflects the level of activity currently taking place on the Project site as well as providing an overview of water management activities that are proposed and presented under the Project Description, EIS Volume 3. Throughout the course of the Project, the Plan will be regularly updated on the basis of management reviews (as outlined in Section 11), incident investigations, regulatory changes or other Project related changes. Commencement of the Construction Phase is a major milestone for the Project.

SECTION 2.0 - SUSTAINABLE DEVELOPMENT POLICY

At Baffinland Iron Mines Corporation, we are committed to conducting all aspects of our business in accordance with the principles of sustainable corporate responsibility and always with the needs of future generations in mind. Everything we do is underpinned by our responsibility to protect the environment, to operate safely and fiscally responsibly and to create authentic relationships. We expect each and every employee, contractor, and visitor to demonstrate a personal commitment to this policy through their actions. We will communicate the Sustainable Corporate Policy to the public, all employees and contractors and it will be reviewed and revised as necessary on an annual basis.
These four pillars form the foundation of our corporate responsibility strategy:

1. Health and Safety
2. Environment
3. Investing in our Communities and People
4. Transparent Governance

1.0 HEALTH AND SAFETY

- We strive to achieve the safest workplace for our employees and contractors; free from occupational injury and illness from the very earliest of planning stages. Why? Because our people are our greatest asset. Nothing is as important as their health and safety.
- We report, manage and learn from injuries, illnesses and high potential incidents to foster a workplace culture focused on safety and the prevention of incidents.
- We foster and maintain a positive culture of shared responsibility based on participation, behaviour and awareness. We allow our workers and contractors the right to stop any work if and when they see something that is not safe.

2.0 ENVIRONMENT

- We employ a balance of the best scientific and traditional Inuit knowledge to safeguard the environment.
- We apply the principles of pollution prevention and continuous improvement to minimize ecosystem impacts, and facilitate biodiversity conservation.
- We continuously seek to use energy, raw materials and natural resources more efficiently and effectively. We strive to develop pioneering new processes and more sustainable practices.
- We understand the importance of closure planning. We ensure that an effective closure strategy is in place at all stages of project development and that progressive reclamation is undertaken as early as possible to reduce potential long-term environmental and community impacts.

3.0 INVESTING IN OUR COMMUNITIES AND PEOPLE

- We respect human rights and the dignity of others. We honour and respect the unique culture, values and traditions of the Inuit people.
- We contribute to the social, cultural and economic development of sustainable communities adjacent to our operations.
- We honour our commitments by being sensitive to local needs and priorities through engagement with local communities, governments, employees and the public. We work in active partnership to create a shared understanding of relevant social, economic and environmental issues, and take their views into consideration when making decisions.

4.0 TRANSPARENT GOVERNANCE

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

Tom Paddon
President and Chief Executive Officer
September 2011

SECTION 3.0 - TARGETED VECS

The targeted VECs for the "***Surface Water, Aquatic Ecosystem, Fish and Fish Habitat Management Plan"*** are:

1. **Water quantity**,
2. **Surface water quality**,
3. **Aquatic ecosystems,**
4. **Fish, and,**
5. **Fish habitat.**

Water is considered a valued ecosystem component and the protection of regional water quality and quantity is important to residents of Baffin Island. There are no reasonably foreseeable long-term downstream users (i.e. local residents), but there is potential for incidental water use by hunters and others using the land. There is also potential to affect fish and fish habitat from either water withdrawals that are too large, or by degrading water quality.

Project activities will interact with surface water through several means, examples of which are:

- Water intakes for potable water in camps and shorter-term construction needs;
- Tote Road stream crossings and road maintenance;
- Sewage treatment and disposal at camps;
- Railway watercourse crossing and diversions;
- Railway construction road (construction and maintenance);
- Operations phase runoff from waste rock and ore stockpiles (subject of the Waste Rock & Ore Stockpile Management Plan);
- Potential surface water runoff from Project developed areas at Milne Port, Mine Site and Steensby Port;
- General site runoff from land disturbances

A complete matrix of Project interaction with these VECs is provides in Volume 7 of the EIS (Freshwater Aquatic Environment Impact Assessment).

SECTION 4.0 - MITIGATION MEASURES

4.1 GENERAL MITIGATION MEASURES FOR SEDIMENT CONTROL AND EROSION

The sediment and erosion control measures described in this section will be applied throughout the duration of the Construction Phase of the Project. Stream, river crossings, and lakes/ponds adjacent to construction activities will receive focussed attention in this respect. Depending on site specific conditions, a variety of civil

design structures may be used to prevent erosion. Such structures are described in the Railway Management Plan and the Road Management Plan.
The construction and ongoing operations of the Mary River Project will result in soil disturbance and water diversions that require sediment and erosion control planning to prevent the discharge of soil contact water. Best management practices, including preventative measures, will be used throughout the duration of the Project. This section details measures that will be used to mitigate potential environmental impacts arising from the storage and discharge of site contact water.

Experience gained from the Bulk Sample Program, for example, during the upgrading of the Milne Inlet Tote Road has resulted in an improved understanding of the unique site conditions that factor into the selection of appropriate sediment and erosion control measures. The climate, topography, and limited vegetation combine to produce short term, high intensity discharge during May, June and July. Frozen conditions between September and May can result in sediment deposition that can be mobilized during freshet. Due to the extremely slow vegetation growth rate, sediment and erosion control techniques that involve vegetative covers (e.g., hydroseeding, bioremediation, erosion control blanket) have been dismissed as potential mitigation options. Also, straw bales are not permitted in the Arctic due to the possibility of introducing foreign species.

The Environmental Superintendent will be responsible for ensuring sedimentation and erosion protection measures are applied as appropriate, and that monitoring is done to ensure control measures are working effectively. Reporting will be completed by means of the Water Licence, NIRB, QIA, and other permit requirements.

4.2 GENERAL MITIGATION MEASURES FOR EROSION CONTROL

A description of the general mitigation measures for erosion control is provided in below.

Armouring	
Description	Armouring is used as a barrier between water flow and materials susceptible to erosion. Quarry rock and/or naturally occurring granular borrow material are used to protect underlying fined grained materials from scour and erosion.
Installation Locations	Armouring may be used in areas of cuts/excavations and for installation of culverts, typically on exposed erodeable slopes.
Substitute	Water diversion, berms, sumps and/or silt fencing may be used where armouring is impracticable or due to low risks of impacts to downstream receptors.
Riprap	
Description	A rock lining that can be installed on the ground surface or structures to prevent erosion of underlying material. Can be placed over non-woven geotextile to provide additional protection.
Installation Locations	- On sides of road embankment. - On upstream and downstream ends of culverts. - At any location where flows exist than might cause erosion of the existing surface materials. - In areas where there is concentrated flow.
Performance Issues	Shortage of available material (that can be used for riprap) at many locations at the Project site

Benefits	- Constructed from local materials - if available. - Effective in protecting embankments and preventing erosion. May be used in combination with non-woven geotextile.

Geotextile (Woven and Non-Woven)	
Description	Low erodible material placed as temporary erosion protection.
Installation Locations	As a liner along water channels / ditches. Use on stream embankments often in combination with riprap.
Performance Issues	Needs to be well anchored or will be ineffective. Difficult to remove from streambeds, etc, when no longer required.
Benefits	Very effective as an erosion barrier on a variety of embankments. Ease of installation.

4.3 STREAM CROSSINGS

A description of the general mitigation measures for stream crossings is provided in below.

Pumping	
Description	Pump used to transfer water from one side of the road or structure to the other.
Installation Locations	At crossings where culverts were not installed, improperly installed or installed with insufficient capacity. Can be used prior to culvert installation to lower the water level. Use pumps as a temporary solution during freshet or prior to culvert installation. Siphons can be used as an alternative, but require a pump to prime the system, and adequate elevation difference between upstream and downstream locations.
Performance Issues	Ineffective if flows are high. Erosion control measures required at discharge point from the pump (e.g., energy dissipater). Risk of fuel spills. Secondary containment required. Temporary solution, labour and resource intensive.
Benefits	Effective temporary solution to lower water level in places where water level is high or prior to culvert installation. Useful at low flow locations where culverts not yet installed.
Culverts	
Description	Pipes install through embankments to allow the passage of water while maintaining access over the site. A hydraulic design study is conducted to assess suitable hydraulic design criteria to avoid flooding or washouts. Culvert capacities are assessed using hydraulic analysis methods assuming an appropriate return period with an allowance for ice accumulation.
Installation Locations	At points where roads intersect streams, rivers, or seasonal drainages. At locations where there is potential for water flow over road. To allow fish passage under road at crossings that are classified as fish habitat.
Performance Issues	Some siltation is caused during installation. Require labour and equipment to properly install using compacted backfill. Water flow is concentrated which can create erosion at downstream discharge point. Clearing of snow/ice prior to spring freshet is required to minimize the potential for blockages.
Benefits	Can handle large amounts of flow - depending upon the size of the culvert. Maintains access while passing flows.
French Drain	
Description	A ditch or channel filled with rock to provide a flow path for water. The rock material can be covered with a non-woven geotextile to prevent the ingress of finer material which could reduce the permeability of the drain.
Installation Locations	At points where roads intersect streams/drainages and where fish passage is not a consideration. As an alternative to a culvert if pipes are not available. Use as a culvert substitute if culverts are not required or available.
Performance Issues	Ice blockage potential in French drains has not been adequately assessed. Long-term performance has not been assessed.
Benefits	Constructed of natural materials.

Bridges	
Description and Installation Locations	Bridges are required for the crossing of larger streams or rivers. For such cases, a hydraulic design study is carried out to assess suitable hydraulic design criteria to avoid flooding or any unexpected damage to the adjacent ground. Bridge locations are assessed using a river hydraulics analysis assuming an appropriate return period with an allowance for ice accumulation. The identification of appropriate engineering options for each river crossing is carried out using a systematic decision making process to evaluate each crossing. This process takes into account engineering and environmental factors at each crossing location. Screening and detailed evaluations are performed to aid in determining the optimum site-specific crossing at each location (i.e. culvert or bridge). Decision-making criteria which were used included: potential impacts to freshwater aquatics, hydraulic conditions, ease of construction and cost.

4.4 GENERAL MITIGATION MEASURES FOR FISH AND FISH HABITAT

Freshet Mitigation
Extreme flows occurring during the freshet can result in significant erosion and damage to creek crossing structures and fish habitat. Several operating procedures have been developed to mitigate the negative impacts caused by freshet events. These measures include: • Establishing/marking locations of susceptible crossings so that they can be identified in the spring, prior to snow / ice melt; • Clearing of snow from roads where culverts / crossings are located; • Excavate downstream and upstream of crossing prior to the onset of freshet; • Monitor culverts for clearance of snow and ice; • Where snow and ice blockage occur, ensure that the blockage is removed to re-establish adequate flow; • Regular monitoring of crossing conditions to ensure acceptable conditions for fish migration. Perform repairs / modification to crossing structures as required, based on results of monitoring and assessment of risk.
Fish Habitat Protection
• For locations where there is a problem with culvert outlet scour and erosion, the construction of rocky ramps downstream of the crossings is considered. Occasionally reinstalling culverts is required, or the installation of additional overflow culverts will be required. • During construction of the docks, for all works requiring the use of explosives (blasting) in or near water bodies, the "Guidelines for Use of Explosives In or Near Canadian Fisheries Water, 1998" will be followed. For any locations where the guidelines cannot be conformed with, the DFO will be consulted prior to commencing blasting. • For dock construction (dredging, piling, backfilling), silt curtain may be used to prevent the dispersion of sediments in marine waters. • Use of bubble curtains to attenuate noise in marine water.

SECTION 5.0 - HYDROLOGY, WATER SUPPLY AND SURFACE WATER RUNOFF

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

5.1 REGIONAL LANDSCAPE

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

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

5.2 CLIMATE

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

5.3 REGIONAL HYDROLOGY

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

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

Knight Piesold has updated the hydrology estimates with the most recent records. They conducted stream flow measurements in the study area and developed flow estimation equations for use. Their report is contained within Volume 7 'Freshwater Environment' of the environmental impact statement.

5.3.1 Surface Water Runoff Estimation – Mine Site

The data presented in this management plan are based on field data collected during the 2006 to 2010 field seasons. A summary of the unit surface water runoff rates for the Mary River area is presented on Table 4.1.

The locations of the stream gauging stations are shown in Figure 7-1.1 in the Appendix. The stations are identified as hydrology stations. The limits of the catchment areas are presented in Figures 5.1, 5.3, 5.4, 5.5 and 5.6 of the appendix. The runoff values indicate that from October to May there should be no runoff and that approximately half of the flows occur in July.

A discussion on water management by area is presented in later sections of this document. The surface water direction and expected quantities (where possible) for each catchment area impacted by the Project are discussed.

Table 4.1 Mary River Monthly Unit Runoff Summary

Station	Drainage Area (km^2)	Unit Runoff (l/s/km2)									
		2006					2007				
		June	July	Aug.	Sep.	Oct.	June	July	Aug.	Sep.	Oct.
H1	250	-	63.3	21.8	17.2	1.2	15.7	27.7	15.1	4.5	0.1
H2	210	-	92.4	25.2	16.2	0.0	21.1	36.8	18.8	4.9	0.0
H3	30.5	-	145.4	27.2	18.0	0.0	26.9	48.2	15.4	3.3	0.0
H4	8.3	-	101.4	34.5	19.1	0.1	13.0	25.5	16.1	4.2	0.0
H5	5.3	-	76.6	29.0	17.8	0.8	19.2	19.3	18.4	5.0	0.0
H6	240	-	105.1	38.2	25.5	0.8	22.2	50.8	23.8	7.4	0.0
H7	14.7	-	118.0	25.2	14.8	0.3	23.7	43.0	16.7	4.2	0.0
H8	208	-	86.9	20.4	13.0	0.0	20.1	45.9	18.4	3.2	0.0
H9	158	-	23.3	11.0	13.0	0.8	11.9	15.8	6.1	4.8	0.7
H11	3.6	-	-	-	-	-	-	-	-	-	-
BR11	52.7	-	-	-	-	-	-	-	-	-	-
BR25	113	-	-	-	-	-	-	-	-	-	-
BR96-2	30.7	-	-	-	-	-	-	-	-	-	-
BR137	314	-	-	-	-	-	-	-	-	-	-
Mary River (06SA001)	690	-	-	-	20.6	1.4	9.3	43.5	15.9	6.8	0.4
Ravn River (06SA002)	8219	-	-	-	31.6	5.7	2.5	44.9	21.8	11.2	1.7
Isortoq River (06SB001)	7172	-	-	-	-	1.2	5.5	99.3	65.0	9.8	0.6
Rowley River (06SB002)	3499	-	-	-	-	1.1	0.9	52.3	15.4	7.7	0.5
Average		-	90.2	25.8	18.8	1.0	14.8	42.5	20.5	5.9	0.3
5th Percentile		-	39.3	14.8	13.0	0.0	1.8	17.9	11.5	3.3	0.0
Minimum		-	23.3	11.0	13.0	0.0	0.9	15.8	6.1	3.2	0.0

Station	Drainage Area (km^2)	Unit Runoff (l/s/km2)									
		2008					2010				
		June	July	Aug.	Sep.	Oct.	June	July	Aug.	Sep.	Oct.
H1	250	44.3	41.2	29.7	11.3	0.3	50.6	37.8	13.6	12.3	1.3
H2	210	57.6	58.3	31.7	12.0	0.0	39.6	68.3	11.1	12.5	0.0
H3	30.5	71.1	72.1	34.3	15.7	0.0	45.0	92.2	11.5	15.1	0.0
H4	8.3	86.2	45.6	30.5	10.4	0.0	84.0	42.6	13.7	13.3	0.1
H5	5.3	61.6	41.5	42.2	12.9	0.0	72.2	35.6	15.1	14.7	0.9

H6	240	61.7	70.7	34.2	15.8	0.0	38.7	78.1	15.4	14.7	0.8
H7	14.7	62.5	62.5	18.7	9.3	0.0	42.3	81.1	6.5	9.7	0.3
H8	208	57.0	60.4	24.1	9.4	0.0	35.6	70.3	8.0	8.2	0.0
H9	158	27.2	14.9	29.0	11.1	1.0	-	-	-	-	-
H11	3.6	-	-	-	-	-	-	-	-	-	-
BR11	52.7	84.4	83.8	33.3	13.9	0.0	-	-	-	-	-
BR25	113	74.0	70.8	32.9	11.9	0.0	-	-	-	-	-
BR96-2	30.7	50.0	34.4	42.2	13.4	0.0	-	-	-	-	-
BR137	314	30.7	33.2	44.3	27.6	1.1	31.7	45.8	15.6	12.1	2.5
Mary River (06SA001)	690	35.5	59.7	32.2	17.0	0.8	-	-	-	-	-
Ravn River (06SA002)	8219	20.0	60.9	35.9	18.0	2.9	-	-	-	-	-
Isortoq River (06SB001)	7172	51.9	101.7	60.5	10.6	0.6	-	-	-	-	-
Rowley River (06SB002)	3499	34.3	59.7	28.5	13.0	0.9	-	-	-	-	-
Average		53.5	57.1	34.4	13.7	0.5	48.9	61.3	12.3	12.5	0.6
5th Percentile		25.7	29.5	23.0	9.4	0.0	33.3	36.5	7.1	8.8	0.0
Minimum		20.0	14.9	18.7	9.3	0.0	31.7	35.6	6.5	8.2	0.0

Station	Drainage Area (km^2)	Unit Runoff (l/s/km2)				
		2011				
		June	July	Aug.	Sep.	Oct.
H1	250	33.4	12.4	5.0	2.1	0.0
H2	210	52.9	14.2	6.4	1.9	0.0
H3	30.5	73.4	17.3	5.3	1.4	0.0
H4	8.3	35.1	7.8	4.0	1.0	0.0
H5	5.3	32.1	9.5	4.7	1.3	0.0
H6	240	61.3	22.0	9.7	4.2	0.0
H7	14.7	63.6	14.9	5.2	2.2	0.0
H8	208	55.3	15.4	3.5	0.5	0.0
H9	158	-	-	-	-	-
H11	3.6	-	5.3	4.2	4.8	-
BR11	52.7	-	-	-	-	-
BR25	113	-	-	-	-	-
BR96-2	30.7	-	-	-	-	-
BR137	314	-	31.6	14.1	6.9	1.5
Mary River (06SA001)	690	-	-	-	-	-

Ravn River (06SA002)	8219	-	-	-	-	-
Isortoq River (06SB001)	7172	-	-	-	-	-
Rowley River (06SB002)	3499	-	-	-	-	-
Average		50.9	15.1	6.2	2.6	0.2
5th Percentile		32.6	6.5	3.7	0.7	0.0
Minimum		32.1	5.3	3.5	0.5	0.0

5.3.2 Surface Water Runoff Estimation – Milne Inlet

Streamflow estimates presented in this section are based on site data collected during 2006 to 2008 and 2010 field seasons and regional data collected by Water Survey of Canada (WSC). The locations of the stream gauging stations are shown on Figure 7-1.2 in the appendix. A mean annual unit runoff for the Milne Inlet area of 7.5 L/s/km^2 was selected based on the estimated long-term mean annual runoff at streamflow gauging station H1 (Knight Piésold, 2009). The monthly flow distribution was also based on the long-term average hydrograph shape estimated at streamflow gauging station H1. Given this, surface water runoff rates were estimated for six watersheds in the Milne Inlet area. These estimates are presented on Table 4.2 and the limits of the catchment areas are presented in Figure 5.3 in the appendix. The runoff values indicate that runoff is negligible from October to May and the majority of runoff occurs in June and July.

Discussion regarding water management is presented by Project areas in later sections. These sections discuss surface water flow direction and estimated quantities (where possible) for each catchment area impacted by the Project.

5.3.3 Surface Water Runoff Estimation – Steensby Inlet

Streamflow estimates presented in this section are based on site data collected during 2006 to 2008 and 2010 field seasons and regional data collected by Water Survey of Canada (WSC). A mean annual unit runoff for the Steensby Inlet area of 7.5 L/s/km2 was estimated based on hydrologic conditions (e.g. elevation, lake area, latitude, aspect etc.) at Steensby Inlet compared to hydrologic conditions at the monitored sites. The monthly flow distribution was estimated from flow records measured at streamflow gauging station BR137 during 2008 and 2010. Given this, surface water runoff rates were estimated for three watersheds in the Steensby Inlet area. These estimates are presented on Table 4.3 and the catchment areas are shown on Figure 5.4. The runoff values indicate that runoff is negligible from November to May and runoff volumes are relatively high from June to September due to the high proportion of lakes in the area, which attenuate runoff patterns.

5.3.4 Catchment Areas for the Milne Inlet Tote Road

Figure 5.6 presents the watershed catchment areas along the Milne Inlet Tote Road.

5.3.5 Catchment Areas for the Proposed Railway Corridor

Figure 5.5 presents the watershed catchment areas for the proposed railway corridor.

Table 4.2 Milne Inlet Area - Estimated Catchment Runoff Rates

Catchment No.			MI-01	MI-02	MI-03	MI-04	MI-05	MI-06
Catchment Area (km2)			5.27	3.59	4.11	62.32	5.61	7.96
Mean Annual Unit Runoff (l/s/km2)	7.0							
	Runoff Distribution	Unit Runoff Rate	Runoff Rate					
	(%MAUR)	(l/s/km2)	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)	(m3/s)
January	0%	0.0	0.00	0.00	0.00	0.00	0.00	0.00
February	0%	0.0	0.00	0.00	0.00	0.00	0.00	0.00
March	0%	0.0	0.00	0.00	0.00	0.00	0.00	0.00
April	0%	0.0	0.00	0.00	0.00	0.00	0.00	0.00
May	0%	0.0	0.00	0.00	0.00	0.00	0.00	0.00
June	600%	42.0	0.22	0.15	0.17	2.62	0.24	0.33
July	335%	23.5	0.12	0.08	0.10	1.46	0.13	0.19
August	180%	12.6	0.07	0.05	0.05	0.79	0.07	0.10
September	80%	5.6	0.03	0.02	0.02	0.35	0.03	0.04
October	0%	0.0	0.00	0.00	0.00	0.00	0.00	0.00
November	0%	0.0	0.00	0.00	0.00	0.00	0.00	0.00
December	0%	0.0	0.00	0.00	0.00	0.00	0.00	0.00

Note:

1. The above runoff distribution was derived using data collected at hydrometric monitoring station H4. The distribution applies only to watersheds near Milne Inlet with drainage areas less than 100 km2.

2. The above mean annual unit runoff was derived from data collected at hydrometric monitoring station H1, within the Phillips Creek watershed.

Table 4.3 Steensby Inlet Area - Estimated Catchment Runoff Rates

Catchment No.			SI-01	SI-02	SI-03
Catchment Area (km2)			13.68	21.77	1.99
Mean Annual Unit Runoff (l/s/km2)	7.6				
	Runoff Distribution	Unit Runoff Rate	Runoff Rate		
	(%MAUR)	(l/s/km2)	(m3/s)	(m3/s)	(m3/s)

January	0%	0.0	0.00	0.00	0.00
February	0%	0.0	0.00	0.00	0.00
March	0%	0.0	0.00	0.00	0.00
April	0%	0.0	0.00	0.00	0.00
May	0%	0.0	0.00	0.00	0.00
June	550%	41.8	0.57	0.91	0.08
July	310%	23.6	0.32	0.51	0.05
August	235%	17.9	0.24	0.39	0.04
September	100%	7.6	0.10	0.17	0.02
October	0%	0.0	0.00	0.00	0.00
November	0%	0.0	0.00	0.00	0.00
December	0%	0.0	0.00	0.00	0.00

Note:

1. The above runoff distribution was derived using data collected at hydrometric monitoring station H5. The distribution applies only to watersheds near Steensby Inlet with drainage areas less than 100 km2.

2. The above mean annual unit runoff was derived from data collected at hydrometric monitoring station BR137, located at the outlet of 10km Lake near Steensby.

5.4 GEOCHEMISTRY

Preliminary material testing to date suggests that the majority of waste rock excavated from the open pit will be environmentally benign i.e. it will not be subject to significant metal leaching, and/or acid generation caused by oxidation of sulphide minerals. Due to its northern location, it is likely that the majority of waste rock area material will be permanently frozen, and that only the upper surficial material will be subject to seasonal freezing and thawing. The frozen material is expected to form an effective barrier for acid forming reactions since no liquid water is available and its solid form will limit the potential for exposure to oxidation.

Future testing of waste rock is planned as part of a "Waste Rock Characterization" Plan being developed.

Refer to the Waste Rock &Ore Stockpile Management Plan (SD-EMMP-005) for a detailed discussion on geochemistry and ARD potential.

5.5 WATER SUPPLY

The project fresh water requirements are detailed in the Freshwater Supply, Sewage and Wastewater Management Plan.

SECTION 6.0 - WATER MANAGEMENT - CONSTRUCTION AND OPERATION PHASES

The water management structures will be built at the onset of the construction phase and will remain in operation until the related facility is decommissioned, that is, at the end of useful life of the facility or end of Project life (closure). Drainage drawings for the sites are provided in Attachment 9 of the Type 'A' water license application including stormwater drainage general arrangement plans and stormwater drainage profiles and sections. Site water balance figures are also provided in the appendices for Milne Port, Mine Site and Steensby Port. The water balances show the relative flow inputs and outputs during construction and operation for each site. A summary of the balances provided follows:

Figure 1	Mine Site Water Balance - Construction
Figure 2	Mine Site Water Balance - Operation
Figure 3	Mine Site Water Balance - Closure
Figure 4	Milne Port Water Balance - Construction
Figure 5	Milne Port Water Balance - Operation
Figure 6	Steensby Port Water Balance - Construction
Figure 7	Steensby Port Water Balance - Operation

6.1 MILNE PORT

Milne Port and the Milne Inlet Tote Road will be the main transportation hub for supporting construction at the Mine Site and the north portion of the Railway. Equipment and materials will be delivered to Milne Port by conventional sealift during the open water season and transported overland by trucks to the Mine Site over the Milne Inlet Tote Road. The existing facilities at Milne Port will play a key logistical support role for receiving sealift materials at Milne Port destined for Mary River (Mine Site).

A temporary construction dock will be installed to facilitate the timely offloading of equipment and materials from ships and the existing camp will be expanded to accommodate the peak personnel estimated to be needed during the construction phase.

The Milne Port Site Plan along with the locations of potential quarry sites and borrow pits are shown in the type 'A' water license application, attachment 9 in the drawing titled 'Milne Inlet 2012 Work Site Layout', Doc. No. H337697-7000-10-014-1101. An overview of the major facilities required for the construction and operation phases is presented in Table 6.1. Although additional facilities may be added or decommissioned throughout the life of the Project, relevant mitigation measures will be incorporated as required in the design, construction and operation of such facilities.

Table 6.1: Overview of Facilities at Milne Port
• Temporary floating dock for sealift unloading • Bulk fuel storage facilities (existing 8 ML bladder tank farm and new steel tanks, barrels – installed within lined containment) • Camp facilities (existing) for a peak capacity of approximately 150 people • Waste water treatment systems (sewage & oily water treatment • Communication systems • Domestic water supply from Phillips Creek during the summer months and an unnamed lake along the Milne Inlet Tote Road at km 32 during the winter season • Power generation • Air strip upgrade • Multiple laydown areas • Waste storage areas (hazardous, solid waste and tires) • Contaminated snow treatment pond and contaminated soil/land farm • Truck maintenance facility • Quarries and borrow pits (existing)
List of Facilities for the Milne Inlet Tote Road & Refuge Station
• Communication systems • Two temporary refuge stations, one at km 33 and one at km 68 consisting each of a half size trailer and 4 drum fuel storage area (described below in the section Milne Inlet Tote Road Refuge Stations) • Milne Inlet Tote Road (existing and upgraded), the historic dirt road constructed in the mid 1960's from Mary River to Milne Port was upgraded to support transport of the bulk sample from Deposit No. 1 • Quarries and borrow sources (existing)

Runoff from areas of intense vehicular activities is susceptible to contamination from small spills/leakage of machinery and equipment. As a general rule, the mitigation measures identified in Section 3.0 will divert non contaminated runoff away from these areas. During the design and site preparation of such areas, efforts will be made to channel runoff from these areas to polishing ponds which will enable monitoring of runoff quality (visual inspection) prior to discharge to the receiving environment. The discharge will be equipped with the appropriate erosion prevention measures and adequate silt control structures as outlined in section 4.0. Fuel storage, explosives storage, and hazardous substances storage will be confined within impermeable bermed structures (lined with geomembranes). Runoff from these contained areas will be collected and treated if required (refer to specific sections on bulk fuel storage, explosives and laydown/stockpile areas in this section).

6.1.1 Contaminated Snow Pond and Contaminated Soil Landfarm

Lined ponds will be constructed to receive snow contaminated by accidental fuel and oil spills. Water will be collected from this pond during the summer month and treated, as required, to removal contaminants. A contaminated soil landfarm facility will be constructed to receive and treat hydrocarbon contaminated soils. Treated soils that meet appropriate criteria will be used as landfill cover material or other acceptable purposes.

6.1.2 Surface Water Direction and Quantity

The surface water at the site is ultimately directed to Milne Inlet. Refer to Table 4.2 for the estimated surface water runoff quantities.

6.1.3 Mitigation Measures

Where appropriate, the environmental protection measures implemented during construction will be retained for the useful life of the facilities (until closure). Several sedimentation pond and drainage structures will be installed at the on-set of construction. During the operation period, the Milne Port is not expected to have significant areas of disturbed soils and as such should not have sediment and erosion issues. The site is regularly monitored (Table 10.1). If mitigation measures are required to control sediment and erosion they are selected and installed as previously discussed Section 4.0, Mitigation Measures.

6.2 MILNE INLET TOTE ROAD

The Milne Inlet Tote Road will be upgraded to support traffic volume during construction. Sediment and erosion control measures are installed and monitored. The road is maintained and regularly monitored (Table 10.1). Creek and stream crossings have been designed and constructed to minimize the potential loss of fish habitat.

The upgrade will include some realignment:

- to improve gradients (currently as high as 16%),
- to improve visibility,
- to improve drainage,
- to reduce ongoing maintenance requirements, to facilitate snow clearing, and,
- to reduce road washouts during freshet periods.

6.3 MINE SITE

The Mine Site along with the locations of potential borrow pits and quarry site are shown in the type 'A' water license application, attachment 9 in the drawing titled 'Mine Site Construction Works Water Supply and Wastewater Disposal GA Plan', Doc. No. H337697-7000-10-042-0002. An overview of the facilities required for the construction and operation phases is presented in Table 6.2. Although additional facilities may be added or decommissioned throughout the life of the Project, relevant mitigation measures will be incorporated as required in the design, construction and operation of such facilities.

Table 6.2: Overview of Facilities at Mine Site
• Construction camp and associated support facilities and Contractor offices • Quarry and borrow sites for rock, sand and gravel and related access roads • Temporary and permanent fuel storage (iso-containers and manufactured tanks) • Aggregate crusher and stockpiles • Concrete batching plants • Multiple mobile power generators and temporary fuel storage (double wall iso-containers) • Heavy equipment parking and maintenance facilities • Ore crushing facilities and conveyor systems for the Milne Port trucking operation • Ore stockpiles with associated runoff water polishing ponds • Contaminated snow holding pond • Landfarm for treatment of contaminated soil • Non-hazardous Landfill • Hazardous waste, recyclable waste, used tires and other miscellaneous waste storage area • Waste management building • Ore crushing and screening facilities for railway transportation • Ore stockpiling facilities and runoff water ponds • Railway loading and unloading facilities • Operation worker accommodations • Communication systems • Site roads • Heavy equipment fleet parking and heavy equipment maintenance facilities • Multiple laydown areas • Airstrip existing and upgraded to accommodate Boeing 737s and similar sized aircraft • Helicopter landing pad and hangar • Bulk fuel storage and distribution facilities totalling • Bulk AN storage building and explosive manufacturing and storage • Domestic water supply from adjacent Camp Lake • Power generation for the camps • Main waste water treatment facilities discharging to either storage ponds or Mary River • Waste water treatment facilities for old exploration/bulk sample camp facilities discharging to storage ponds / Sheardown Lake.

Runoff from areas of intense vehicular activities is susceptible to contamination from small spills/leakage from machinery and equipment. As a general rule, the mitigations measures identified in Section 4.0 will divert non contaminated runoff away from these areas. During the design and site preparation, efforts will be made to channel runoff from these areas to polishing ponds which will enable monitoring of runoff quality prior to discharge to the receiving environment. The discharge will be equipped with the appropriate erosion prevention measures and adequate silt containment structures as outlined in Section 4.0. Fuel storage, explosives storage, and hazardous substances storage will be confined within impermeable bermed structures (geomembrane). Runoff from these contained areas will be collected in sump and treated if required (refer to specific sections on bulk fuel storage, explosives and laydown/stockpile areas in this chapter).

6.3.1 Ore Stockpile, Crushing Plan and Maintenance Facilities

These facilities will cover a significant area of a small watershed north of Sheardown Lake. The water management structures constructed to capture runoff from disturbed areas and from the ore stockpile will divert this runoff to the Mary River. As a result, potential impacts (reduction in flows) have been identified for the small streams that are presently draining this sector and flowing to Sheardown Lake. As discussed in Volume 7, some of these streams may have good fish habitat. Additional data will be collected during the construction phase to assess more accurately whether or not this is a potential impact (i.e., follow-up). Once this information is available, the Project will adopt a tiered mitigation strategy as follows:

a) Monitoring/Fish Salvage: Monitor the streams during late summer and fall to determine if Arctic char are becoming stranded and, if so, conduct a salvage fishery to move the fish downstream to Camp / Sheardown lakes;
b) Potential Channel Enhancement: If the potential for stranding is identified in a particular stream, assess the potential for improving connectivity between upstream habitat and Camp / Sheardown Lake and, if feasible improve connectivity;
c) Install Fish Barriers: If stranding is identified as a serious and chronic issue in a particular stream, and restoration of connectivity is not considered possible/feasible, as a last resort, consider the installation of a fish exclusion barrier at the mouth of the stream.

6.3.2 Contaminated Snow Pond and Contaminated Soil Landfarm

Lined ponds will be constructed to receive snow contaminated by accidental fuel and oil spills. Water will be collected from this pond during the summer month and treated, as required, to removal contaminants (refer to Waste Water Management Plan SD-EMMP-003, Oily water treatment).

A contaminated soil landfarm facility will be constructed to receive and treat hydrocarbon contaminated soils. Treated soils that meet appropriate criteria will be used as landfill cover material or other acceptable purposes.

6.3.3 Surface Water Direction and Quantity

Ultimately the surface water at the site is directed towards Camp, Sheardown and Mary River. The estimated surface water runoff quantities for each catchment area are shown on Table 4.1.

6.3.4 Mitigation Measures

Sediment and erosion control measures may be required and will be installed as per Section 3.0, Mitigation Measures. The site will be regularly monitored (Table 10.1). The stockpiles will be located a minimum of 30 m from the normal high water mark of water bodies.

6.4 RAILWAY CONSTRUCTION

Figure 1.1 of the "Quarry Management Plan" presents the alignment of the railway along with locations of potential borrow sites and quarries, and, the location of the railway construction camps. The creek and river crossings subject to an authorization under the Fisheries Act, or, an approval under the Navigable Waters Protection Act have been identified. The associated potential loss of fish habitat is the subject of Baffinland's Not Net Loss Plan (SD-EMMP-007).

6.4.1 Railway Construction Camps

Two main construction camps will be established along the railway alignment, one near the major crossing of Cockburn Lake and the other north of Cockburn Lake mid-way to Ravn River. These camps will have an occupancy ranging in the order of 100 to 150 people. Consideration is being given to locating two smaller construction camps at key bridge locations. A partial list of the facilities required for the construction and operation phases is presented in Table 6.3.

Table 6.3: List of Facilities for Railway

Temporary (Construction Phase)	Permanent (Operation Phase)
• Construction access roads	• Railway embankment
• Quarries and borrow sources	• Train loading and unloading facilities
• Construction camps	• Communication systems
• Refuelling depots at camps and quarries	• Tunnels, bridges
• Explosives magazines	• Rail sidings

6.4.2 Mitigation Measures

The Railway Camp Sites are not expected to have significant areas of disturbed soils and as such should not have sediment and erosion issues. The sites will be regularly monitored (Table 10.1). Where mitigation measures are required to control sediment and erosion they are selected and installed as previously discussed in Section 4.0, Mitigation Measures.

6.4.3 Railway Route and Tunnel

The railway will be constructed from Steensby Port by first building the construction access road, then establishing construction camps to facilitate construction of the railway from multiple faces. The location of proposed quarries, construction camps and the construction access road is shown on Figure 1.1 of the "Quarry Management Plan". A list of the facilities required for the construction and operation phases is presented in Table 6.3.

6.4.4 Water Crossings

A number of crossing structures are required along the route, including large bridges, smaller single-span bridges and culverts.

A hydraulic design study was carried out to assess suitable hydraulic design criteria for culverts and bridges in order to avoid flooding of the railway infrastructure or any unexpected damage to the adjacent ground (Dillon, 2008b). Culvert capacities and bridge locations were assessed using a river hydraulics analysis software package assuming an appropriate return period (as determined in the associated Hydrology Design Brief (Dillon, 2008c)) with an allowance made for ice accumulation.

The identification of appropriate engineering options for each crossing was carried out using a systematic decision making process to evaluate each of the 214 crossings presented in the Mary River Development Proposal (Baffinland, 2008). This process took into account engineering and environmental factors at each crossing location. Screening and detailed evaluations were performed to aid in determining the optimum site-specific crossing at each location (i.e. culvert or bridge). Decision-making criteria which were used included: potential impacts to freshwater aquatics, hydraulic conditions, ease of construction and cost.

A preliminary assignment of crossing structures for each drainage crossing along the railway has been completed. At the majority of locations corrugated steel pipe (CSP) culverts will be used. Alternatively, corrugated structural plate pipe (CSPP) culverts will be used, as required. Corrosion protection will be provided using rip rap.

In addition to major bridges, several shorter bridges will be required over smaller watercourses. These short bridges will likely be simple single-span structures. Standard arctic foundation construction techniques similar to those used in northern Canadian mining and infrastructure projects, such as embedding piles in bedrock or the use of ad-freeze piles, have been assumed. Additional geotechnical investigation is planned to facilitate the final foundation designs to be developed in the detailed design phase. Special consideration, especially for foundations, will also be given to the potential effects of global warming, which could increase the depth of the permafrost active layer.

Culverts have been designed in accordance with AREMA. Corrugated steel pipe is recommended for ease of construction and to avoid any major maintenance needs. In general, a minimum of 1-m cover shall be provided above all culverts.

Conceptual drawings of 24 bridges for the Mine Site, Cockburn Lake, Ravn River and BR-137 (un-named) watercourses are included in the EIS Volume 3, Project Description (Appendix C5). Several shorter bridges will be required over smaller watercourses and the majority of drainages to be crossed using culverts. Typical open deck single span bridges and culvert designs in thaw-stable and thaw-sensitive ground are also included.

6.4.5 Spoil Deposits for Railway

Spoil material excavated during the construction of the railway will be placed in deposits. This spoil material will consist of materials unsuitable for construction (i.e. silty and ice rich soils. The Spoil Deposits will be located and constructed with the following considerations:

- Located in natural depressions or in spent quarries or borrow areas.
- Located a minimum of 30m from all water bodies.
- Constructed sufficiently far from the railway and road alignments to avoid changing the thermal regime of these structures.

6.4.6 Surface Water Direction and Quantity

The catchment areas for the Railway Route are shown on Figure 5.5 of the appendix. The surface water along the corridor is ultimately directed to Cockburn River, Cockburn Lake, Ravn River and Angajurjualuk Lake. Specific surface water runoff quantities were not calculated for the transportation corridor due to the large catchment area and the minimal quantity of water required.

6.4.7 Mitigation Measures

Sediment and erosion control measures may be required and will be installed as per Section 3.0, Mitigation Measures. The site will be regularly monitored (Table 10.1). The stockpiles of spoil material will be located a minimum of 30 m from the normal high water mark of water bodies.

Fuel required will be transported in fuel drums or double walled day tanks. Drip pans are used under the tanks to prevent spills.

All bridges and culverts crossings have been designed for an appropriate hydraulic event return period with allowance made for ice accumulation.

For all construction works requiring the use of explosives in or near water, Baffinland and its EPCM contractor will adhere to the Guidelines for Use of Explosives In or Near Canadian Fisheries Waters.

For each stream/river crossing an assessment is made regarding the potential loss of fish habitat. Some of these crossings will result in the Harmful Alteration, Disruption or Destruction (HADD) of fish habitat under Section 35(2) of the Fisheries Act, and an authorization will be sought from the Department of Fisheries and Oceans. HADDs are expected at a portion of the watercourse crossings, for water intake and sewage outfalls. The compensation plan for the HADD is the subject of the Fish Habitat Compensation and Monitoring Plan.

6.4.8 Borrow Pits and Quarries required for the Railway Construction

Locations of the potential borrow sites and rock quarries are shown in Figure 1.1 of the "Quarry Management Plan" for the railway. As stated in the EPP and the Borrow Pit and Quarry Management Plan (SD-EMMP-006), the following guidelines will be applied for sourcing borrow material and quarries:

- Surficial borrow materials will be obtained by stripping and excavation of the active layer;
- Processing of borrow materials will be limited to screening using a grizzly and segregation of material into temporary stockpiles;
- Excavation will not occur within 30 m of a watercourse, and seasonal drainage ways will be re-established during pit development;
- Rock quarries may be developed for various construction purposes;
- Rock will be obtained through drilling and blasting, and crushing if necessary;
- Quarrying will not occur within 30 m of a watercourse, and drainage will be re-established during quarry development;
- Acid rock drainage (ARD) and metal leaching (ML) tests have been conducted on rock samples, with results indicating that, due to the physical environment and the geochemistry of the rock, ARD and ML are very unlikely to occur from quarry materials;

6.5 STEENSBY PORT

The Steensby Port and the locations of potential borrow pits and quarry sites are shown in the type 'A' water license application, attachment 9 in the drawing titled 'Steensby Inlet Temporary Works Site Layout', Doc. No. H337697-4690-10-014-0001. An overview of the facilities required for the construction and operation phases is presented in Table 6.4. Although additional facilities may be added or decommissioned throughout the life of the Project, relevant mitigation measures will be incorporated as required in the design, construction and operation of such facilities.

Table 6.4: Overview o f Facilities at Steensby Port	
• Construction docks	• Ore stockpiling facilities
• Quarry and borrow sites, and related access roads	• Ore, freight and tug docks
• Concrete batch plant(s)	• Ship loading and unloading facilities
• Bulk fuel storage and distribution facilities	• Cargo (container) handling facilities
• Power plan	• Permanent worker accommodations
• Construction workshops and maintenance shops	• Rail shops and maintenance infrastructure
• Warehouses/stores	• Buildings and offices
• Temporary power generators	• Communication systems
• Laydown areas/freight storage	• Site roads
• Parking areas for construction fleet	• Causeway
• Temporary fuel storage (iso-containers)	• Laydown areas/freight storage
• Explosives plant and magazines	• Water supply facilities
• Airstrip	• Waste management facilities
• Construction worker accommodation and related facilities	• Navigational aids (shipping lane and port)

Runoff from areas of intense vehicular activities is susceptible to contamination from small spills/leakage from machinery and equipment. As a general rule, the mitigations measures identified in section 3.0 will divert non contaminated runoff away from these areas. During the design and site preparation, efforts will be made to channel runoff from these areas to polishing ponds which will enable monitoring of runoff quality prior to discharge to the receiving environment. The discharge will be equipped with the appropriate erosion prevention measures and adequate silt containment structures as outlined in section 4.0. Fuel storage, explosives storage, and hazardous substances storage will be confined within impermeable bermed structures (lined with geomembrane). Runoff from these contained areas will be collected in sump and treated if required prior to release to the receiving environment.

6.5.1 Steensby Port Docks Construction

Construction Docks

To provide rapid and efficient unloading of a large volume of equipment and materials at Steensby Port early in the construction phase, two construction docks will be installed during the open water season in Year 1 of construction. One dock will be situated on the island to facilitate construction of the ore dock and ore handling systems, and the other on the mainland to support all other construction activities at Steensby Port.

The docks will be constructed by placing a concrete caisson out into the water, and backfilling a ramp or causeway to the caisson. Concrete caissons will have been mobilized to Steensby Port during the previous open water season. A level pad will be prepared for the caissons by placing aggregate, the caissons will be moved into place and ballasted (backfilled) with local aggregate. The ramp to the caissons will be constructed by placing and compacting local aggregate (refer to EIS Volume 3, Project Description for construction dock details).

The docks will allow barges and shallow draft ships to go dockside and mobile handling equipment and cranes to operate from the dock. At the end of construction, the ballast will be removed from the caissons and the caissons removed for re-use at another location or disposal. The ramp will be left in place permanently, adding structure to the seabed and improving fish habitat.

Ore Dock

The ore dock will consist of a dock structure on discrete caissons, connected to Steensby Island by a trestle on caissons. The dock will be constructed by blasting and dredging level pads for each of the caissons, placing and backfilling the caissons, and completing the dock superstructure and a trestle to the island. Levelling the seabed at the -25 m contour through blasting and dredging will involve eventual removal of approximately 104,000 m3 of material. Dredged materials are likely to be contained on barges until used as backfill. Concrete caissons will be floated into place and then backfilled with dredged and excavated materials as well as local aggregate. No disposal of dredged material will be required.

In-water blasting will be carried out by an experienced contractor following a blasting plan to be developed and filed with the Department of Fisheries and Oceans, meeting their published overpressure guideline of 100 KPa. In-water blasting will likely be carried out during late winter with ice cover, as marine mammals present will be limited to ringed seals reducing disturbance to marine wildlife. Winter blasting will also ease the construction schedule. The approach to in-water blasting will likely involve the following activities and steps:

- Drilling the blast holes from the ice during late winter
- Divers installing the charges and blast decks under ice
- Using a sonic device to repel the seals, possibly in combination with harvesting of seals in the immediate area by local Inuit hunters
- Divers installing a bubble curtain around the blast area

- Additional use of the sonic device or another deterrent to scare fish from immediate area prior to activating the bubble curtain
- Initiating the blast sequence

Because blasting will be preferentially carried out during ice cover, but removal of the material will only take place during the following open water season, it will be necessary to over-blast up to 1 m deeper than the target elevation to be certain the required elevation is achieved during the blasting.

Freight Dock

A freight dock to support the Project during the operation phase will be constructed. The freight dock will allow for the safe and efficient unloading of the large volumes of fuel, ammonium nitrate to manufacture explosives, and other consumables and replacement equipment to be delivered each year of operations.

The freight dock will be constructed by installing a row of four caissons for the dock face and backfilling behind the caissons to provide a large dock for turnaround of equipment. The dock will be constructed by placing fill to form level pads for each of the caissons, placing and backfilling the caissons with locally quarried aggregate, and completing the dock superstructure and backfilling the land side. Unlike the ore dock, construction of the freight dock will not involve underwater blasting.

The dock will have a minimum draft of -13 m below the low water level. In addition to a large working area for vehicles and cranes for off-loading, a fuel off-loading manifold will be located on the dock to allow for dock to shore fuel transfers.

Mitigation measures for dock construction

Construction of the docks will necessitate piling, installation of casing and backfilling. Detailed construction methods will be established by the EPCM contractor and the contractor undertaking the construction of the docks.

During construction of the docks, for all works requiring the use of explosives (blasting) in or near water bodies, the "Guidelines for Use of Explosives In or Near Canadian Fisheries Water, 1998" will be followed. For any locations where the guidelines cannot be conformed with, the DFO will be consulted prior to commencing blasting.

Bubble curtains may also be used to attenuate the noise generated during blasting and piling.

During dock construction (piling, backfilling), silt curtain may be used to prevent the dispersion of sediments in marine waters.

6.5.2 Crossing to Island

A causeway structure will be constructed to provide the necessary link between the ore dock, stockpiles and ship loading facilities on Steensby Island, and all other infrastructure on the mainland. The crossing structure will support conveyors that will move ore from the railway car dumper to the ore stockpiles on the island. The structure will also allow for the movement of vehicles between the island and the mainland.

The causeway will be built from both directions by placing fill that is appropriately sized to withstand ice loading. Construction of the causeway will take place during the open water season, and no blasting will be required during its construction.

6.5.3 Contaminated Snow Pond and Contaminated Soil Landfarm

Lined ponds will be constructed to receive snow contaminated by accidental fuel and oil spills. Water will be collected from this pond during the summer month and treated, as required, to removal contaminants (refer to Waste Water Management Plan SD-EMMP-003, Oily water treatment).

A contaminated soil landfarm facility will be constructed to receive and treat hydrocarbon contaminated soils. Treated soils that meet appropriate criteria will be used as landfill cover material or other acceptable purposes.

6.5.4 Surface Water Direction and Quantity

The catchment areas for the Steensby Port are shown on Figure 5.4 in the appendix. The surface water at the site ultimately reports to Steensby Port. The estimated surface water runoff quantities are shown on Table 4.3.

6.5.5 Mitigation Measures

Where appropriate, the environmental protection measures implemented during construction will be retained for the useful life of the facilities (until closure). Several sedimentation pond and drainage structures will be installed at the on-set of construction. During the operation period, the Steensby Port is not expected to have significant areas of disturbed soils and as such should not have sediment and erosion issues. The site is regularly monitored (Table 10.1). If mitigation measures are required to control sediment and erosion they are selected and installed as previously discussed Section 4.0, Mitigation Measures.

6.6 BULK FUEL STORAGE AREAS

During construction and operation, the handling and storage of fuel is one of the highest risks of potential impact to the receiving environment. The following section provides a brief overview of the bulk fuel facilities. Detailed requirements for management of the bulk fuel depots are presented in the Emergency Response Plan (SD-ERP-001), the Milne Port OPEP (SD-ERP-002) and the Steensby Port OPEP (SD-ERP-003).

6.6.1 Description

- Milne Port Fuel Delivery during Construction

Tankers of 10 to 20 ML capacity will enter Milne Inlet during the open water shipping season and fill the tank farm by the floating hose method. The ship to shore fuel transfer operation is subject of the Milne Port OPEP (SD-ERP-002).

- Milne Port Fuel Storage and Distribution

The existing 8 ML bladder fuel storage facility will be decommissioned and replaced with a new tank farm.

Local fuel use will be dispensed at the tank farm, and remote work sites along the road such as borrow areas will likely be serviced by positioning 20,000 L double-walled iso-containers in small lined containment facilities. Fuel will be transported to the Mine Site by 30,000 L capacity truck tankers over the Milne Inlet Tote Road.

Additional lined storage capacity will be added to contain additional bulk lubricating oils and antifreeze delivered by sealift.

- Mine Site Fuel Storage and Distribution

The existing bladder farm will be decommissioned. A new tank farm will be constructed. The tank farms will be equipped with an engineered containment system lined with geosynthetic liners. Day-to-day refuelling of vehicles will be carried out at a fuel filling depot. Aircraft and the equipment in the pit will be refuelled using a fuel truck.

A separate diesel storage tank and dispensing facility will be provided for the mining equipment located at the mining area. Fuel trucks will be used to transport diesel fuel from the main tank farm to the mine storage tank.

Various diesel fuel day tanks ranging in size from 1,000 L to 40,000 L will be located across the mine site as required, such as the power plant, boilers, mine dry, water intake pump house, incinerator, and explosives emulsion plant. With the exception of remote locations such as the water pump house and explosives plant, the diesel day tanks will be supplied by the fuel distribution pipeline from the tank farm.

Jet fuel required for turbine engine aircraft and helicopters will be stored in a storage tank, located within a lined containment area.

Bulk antifreeze and heating glycol fluids will be stored in the power plant and maintenance complex. The storage capacities will be based on the anticipated consumption required for a minimum operating period of 12 months. The annual antifreeze quota will be stored in the same area as the lubricant storage tanks, based upon the following estimated requirements:

1. Antifreeze (coolant) tank
2. Power plant glycol initial fill of heat recovery and distribution systems.
3. Building heating circuit.

The premixed glycol solution will be transported to the port by sea and then by rail to the mine where the system will be filled directly.

Lubricating oils for the power plant and maintenance shop will be stored in bulk tanks ranging in size from 12,000 L to 200,000 L. Waste oil will be collected in a common sump linked to a receiving tank from which it will be pumped to the above waste oil storage tanks. Every year, the waste oil will be sent back to the supplier for recycling. Approximately 1 ML of used lubricating oil will be produced annually, with approximately 440,000 L used for fuelling the secondary chamber of the incinerators and the remainder being shipped back south to a refinery for recycling.

A dedicated bulk fuel storage facility will store and dispense Aircraft fuel to fixed wing aircraft and helicopters. De-icing facilities, provided at the airstrip, will consist of a portable discharge pump for the application of de-icing fluid from 200 L drums. De-icing will be carried out to the side of the runway, with propylene glycol, a biodegradable fluid which requires no treatment. Alternately, aircraft may be refuelled directly from a mobile fuelling truck.

- Fuel Transport to Mine Site for Operation Phase

Fuel will be re-supplied to the Mine Site using a fleet of tanker trucks capable of self loading and discharging. The Mine Site tank farm will be re-supplied from the tank farm at Steensby Port; railway fuel cars will transport fuel to the mine on a weekly basis. A fuel unloading facility will be provided to facilitate quick unloading of diesel rail tankers, five at a time. This unloading facility will be mounted on a concrete spill containment pad equipped with a collection sump to contain fuel spills.

Fuel tanker cars will be used to transport fuel, and most freight will be transported in containers to facilitate handling from ship to shore to rail.

- Railway Construction Phase - Fuel Storage and Distribution

The primary fuel storage supporting railway construction will be the large tank farms at the Mine Site and Steensby Port. Smaller temporary tank farms, consisting of multiple 20,000 L capacity double-walled iso-containers within lined containment, will be established at construction camps, quarries and major bridge sites.

These smaller tank farms will be re-supplied using tanker trucks. Equipment at the railway construction camps will be refueled using smaller fuel trucks.

- Steensby Port Fuel Storage and Distribution

A large volume of fuel will be required at Steensby Port early in the construction phase. The development of fuel storage capacity at the port site will occur in stages.

Fuel will be brought in double-walled skid mounted 100,000 L capacity ISO tanks until the permanent tank farm is constructed and operational. Temporary storage for Jet A will consist 2 ML in double-walled 100,000 L capacity ISO tanks. Secondary storage during this period, at quarries and other work areas, will consist of 20,000 L double-walled storage tanks.

The permanent tank farm will consist of four 40 ML capacity steel tanks . A pipeline will be installed from the tank farm to the permanent freight dock to allow for dockside fuel deliveries. Before the freight dock is constructed, the tank farm will be re-supplied from tankers using the floating hose fuel transfer method.

Ore carriers will not be re-fuelled at Steensby Port, and fuel will be delivered to the freight dock as part of normal operations. One 7.5 ML storage tank will nevertheless be located on Steensby Island to supply the tugs and ice management vessels. Fuel will be delivered to this table by truck from the main tank farm.

The main tank farm fuel system will distribute fuel to the following locations:

Power plant
Heavy and light equipment fuel pumps
Incinerator building
Heating boiler building
Railcar fuel loading station.

In addition to the main tank farm and the island tank, a number of day tanks will be required within the port site, ranging in size from 2,000 to 50,000 L in capacity and located in- and outside of the power plant, boiler building, at fuel dispensing stations for light vehicles, and the incinerator.

6.6.2 Mitigation Measures

Temporary and permanent storage facilities will be erected within a bermed and impermeable lined containment area in compliance with applicable regulations and best management practices. These containment areas will have a capacity of 110% of the largest tank. The design of tank farms is consistent with the document entitled "Design Rationale for Fuel storage and distribution facilities" published by the Department of Public Works of the North West Territories. The lining within the bermed area is an impervious HDPE liner membrane.

Refuelling stations are equipped with a lined and bermed area to contain minor spills or leaks during refuelling. The liner (e.g., 40 mm hypolon liner or equivalent) is protected by sand bedding. Vehicles and mobile equipment drive onto this bedding for refuelling. All fuel transfer is done by pumps.

Smaller temporary tank farms and secondary storage consisting of multiple 20,000 L capacity double-walled iso-containers will be established at construction camps, quarries and major bridge sites. These smaller tank farms will be re-supplied using tanker trucks. Equipment at the railway construction fronts will be refuelled using smaller fuel trucks.

For each method of fuel storage and transfer, specific procedures related to fuel storage and transfer will be developed, and proper containment and emergency response equipment will be provided to meet or exceed regulatory requirements (Refer to EPP procedures). The Emergency and Spill Response Plan (SD-ERP-001) will govern land-based operations, and a Transport Canada approved Oil Handling Facility (OHF) Plan (Milne Port OPEP SD-ERP-002 and Steensby Port OPEP SD-ERP-003) will govern ship to shore fuel transfers..

6.7 EXPLOSIVES STORAGE

The Explosives Management Plan SD-ERP-004 outlines the requirements for the management of explosives for the Mary River Project.

6.7.1 Mitigation Measures

All permanent and temporary explosive storage facilities will be designed and constructed in compliance with regulations (refer to Explosive Management Plan SD-ERP-004). As per regulatory requirements, the storage sites will be fenced, and erected within secondary containment structures (berms). The EPP will outline details handling procedures will be established for handling, storage and use of explosives.

6.8 LAYDOWN

6.8.1 Description

For the construction phase, several laydown areas will be constructed at Milne Port, Mine Site, along the railway temporary construction road and Steensby Port, to enable storage of equipment and material required for the construction of the facilities. The EPP provides procedures and guidance for the preparation of laydown areas.

6.8.2 Mitigation Measures

Contouring, berms and silt fences will be applied as necessary for sediment and erosion control. Sediment and erosion control measures will be required and will be installed as per Section 3.0, Mitigation Measures. The site will be regularly monitored (Table 8.3).

6.9 ORE STOCKPILES AT MILNE PORT AND STEENSBY PORT

Ore will be transported to either Milne Port or Steensby Port for shipment. The Mine Site, Milne Port and Steensby Port will have significant ore stockpiles (refer to EIS volume 3, Project Description. and). The locations of these stockpiles along with the water management structures associated with them are presented in the type 'A' water license application, attachment 9 in the drawings numbers H337697-4210-10-014-0009 (Mine Site Proposed Drainage Works), H337697-7000-10-014-1101 (Milne Inlet 2012 Work Site Layout), H337697-4610-07-042-0003 (Steensby Inlet Environmental Monitoring Plan Site Layout).

At each location, the runoff from the ore stockpile will be routed to sedimentation pond prior to discharge to the receiving environment. The discharge will be subject to water quality as established in later sections of this management plan.

SECTION 7.0 - WATER MANAGEMENT – MINING OPERATION

In the type 'A' water license application, attachment 9 in the drawing titled 'Mine Site Permanent Works Water Supply and Wastewater Disposal GA Plan', Doc. No. H337697-4310-10-042-0001 presents the site plan of Mine Site for the operation phase. For the mine infrastructure, the runoff management structures will have been established during the construction phase. Where required, these structures will be maintained for the life of the project. However, the open pit mine, the waste rock stockpile and the ore stockpile will progress over time and the water management strategies and structures will have to be adapted to the terrain as these facilities expand.

7.1.1 Mitigation Measures

Sediment and erosion control measures may be required and will be installed as per Section 4.0, Mitigation Measures. Berms and other drainage control measures will be established as needed to limit erosion and maintain positive drainage to minimize water ponding. Contouring, berming and silt fences will be applied as necessary for sediment and erosion control. The site will be regularly monitored (Table 10.1).

7.2 OPEN PIT AND RELATED FACILITIES

During operations the open pit and mine site will consist of:

- Mine haulage roads

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

The open pit will be excavated using a conventional bench configuration with access via ramps. Movement of vehicles within the pit will be monitored by a central dispatching system in order to ensure worker health and safety and operational efficiency. The general dimensions of the final open pit based on the preliminary design presented in the DFS will be:

- Maximum length: 2.0 km
- Maximum width: 1.2 km
- Depth ranging from 465 m (northern side) to 195 m (southern side)

7.2.1 Groundwater inflows into the pit

The general consensus is that groundwater inflows are likely to be minimal below the active zone. Comparison have been made with operations at three mine sites at northern latitudes including the Polaris, Ekati, and Divak mines, of which the Ekati mine is most similar to the Mary River. The Ekati pits were developed in quality granite that was cut by moderate faults. The base of permafrost at the Ekati mine was encountered at approximately 350 to 400 meters. Other than near the surface, groundwater was not encountered in the pits until mining was below permafrost. Based on this data, the Mary River pit is not likely to have much groundwater inflow below the active layer because it also will be developed in quality bedrock, has generally colder mean temperatures, is topographically higher, has minimal faulting, and has a deeper permafrost zone.

The Polaris mine, also located in Nunavut, had problems with groundwater coming into the mine which caused temporary closure of the mine according. However, the water inflows were due to thawing of permafrost in ice-rich rock (shale) due to the ventilation system, rather than natural groundwater inflow. The ventilation system was subsequently renovated and there were no additional problems with underground water accumulations in the mine as it was extended to a total depth of approximately 450 meters. The mine was not extended deeper due to incompetence of the shale, rather than groundwater inflow problems.

For the Mary River mine pit, geotechnical investigations have included the drilling of a 400 m deep drillhole that was instrumented with thermistors along its length. The thermistors report ground temperatures at various depths within the hole. Extrapolation of temperature gradients with depth suggests that permafrost conditions (i.e., below zero degrees Celsius for two consecutive years) extend to approximately 700 m, well below the planned mine depths. As such, water inflows into the pit are expected to be minor, consisting of shallow seasonal groundwater flows and direct contribution from precipitation events.

Drifting snow is not expected to contribute significantly to in-pit water volume. Snow fence will be erected around the perimeter of the pit to minimize intake of drifting snow.

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

7.2.2 Surface Water Direction and Quantity

The catchment areas for the Mine Site are shown on Figure 5.1 of the appendix. Ultimately the surface water at the site is directed towards Camp, Sheardown and Mary Lakes. The estimated surface water runoff quantities for each catchment area are shown on Table 4.1.

7.3 WASTE ROCK PILES

The waste rock stockpile is located directly north of the mine pit as shown in the mine site layouts provided in the type "A" water license application, attachment 9. The Waste Rock Management Plan (SD-EMMP-005) addresses the specific requirements for management of the waste rock.

Waste rock disposal areas designed for permanent storage of waste rock will be located on the northeast, northwest, west and southwest sides of the open pit. After completion, the northwest to southwest waste rock stockpile will be joined to form a single waste rock stockpile.

The total capacity of the waste rock stockpiles is expected to be on the order of 220 Mm3. Any waste rock classified as potentially acid-generating will be stored in designated areas within the waste rock stockpile to limit its potential for contact with meteoric water and also its exposure to oxidizing conditions.

7.4 MINE SITE CRUSHING OPERATIONS

Crusher locations are provided in the type 'A' water license application, attachment 9 in the drawing titled 'Mine Site Permanent Works Water Supply and Wastewater Disposal GA Plan', Doc. No. H337697-4310-10-042-0001. Ore from the open pit or the ROM stockpile will be processed by crushing and screening, to produce lump product and ore fines to specifications required by the steel mills. The primary objective of the crushing systems is to maximize the production of lump product (-30 mm/+6 mm), while at the same time, keeping ore fines (-6 mm) at a minimum, since lump product has a greater value for sale. The crushing operations consist of:

- Trucks will enter and exit the crushing area using roads from Deposit No. 1 and by the Milne Inlet Tote Road

- Temporary crusher feed stockpile located north-east of Sheardown Lake
- Primary crushing station, a primary screening station
- Secondary crushing station
- Conveyors that transfer the ore to rail-mounted mobile stacker stockpiles where the sized ore can later be reclaimed and loaded on the rail cars
- Temporary stockpiles of lump ore and fines will be located adjacent to the crusher

The crushers and screens are installed inside buildings. Material handling equipment, including reclaimers, stackers and conveyors are installed outdoors. Conveyors will be equipped with wind hoods to reduce wind exposure and potential for ore fines to be blown off the conveyors. Dust collectors will be installed at transfer points and other required areas to limit fugitive dust emissions.

Runoff from the area will be directed to surface drainage ditch and appropriate sediment control structures will be installed as required.

ARD and ML tests have been conducted on the fresh ore, with results indicating that, due to the physical environment and the geochemistry of the ore, ARD and ML are very unlikely to occur. It is noted that no chemicals are added to this process, it is strictly an ore sizing process.

7.4.1 Surface Water Direction and Quantity

The catchment areas for the stockpiles and crusher operations in the vicinity of the Mine Site are shown in the type 'A' water license application, attachment 9 in the drawing titled 'Mine Site Permanent Works Water Supply and Wastewater Disposal GA Plan', Doc. No. H337697-4310-10-042-0001. Surface water in this area is first directed to a sedimentation pond and then release to the receiving environment if it meets discharge water quality guidelines.

7.4.2 Mitigation Measures

Sediment and erosion control measures may be required and will be installed as per Section 4.0, Mitigation Measures. The site will be regularly monitored (able 8.1).

7.5 RAILWAY ROUTE

The railway will be used to transport iron ore from the mine site to the port located at Steensby Port, it will be approximately 143 km long. The basic design is for a heavy haul mineral railway, although the line will also carry some mixed general freight traffic to supply the mining operation. A passenger train (for employees) will also operate three times a week. The proposed railway system will consist of:

- Rail line and embankment - including tunnels, bridges and sidings
- Crossings - across watercourses and drainages

- Yards and terminals - including rail loop, coupling and turn-around
- Supporting facilities - including maintenance and emergency facilities
- Train - including locomotives (engines) and cars
- Cargo
- Signalling and telecommunications

7.5.1 Mitigation Measures

The railway corridor will be inspected weekly. Necessary repair to the railway bed, bridges, stream and creek crossings will be scheduled as required.

SECTION 8.0 - ROLES AND RESPONSIBILITIES

8.1 2012 WORKPLAN

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

Compliance is achieved through on-going monitoring, the development and implementation of operational standards, procedures and employee training. Roles and responsibilities for implementation of this Management Plan and the companion EPP are described in Table 8.1.

Table 8.1: Roles and Responsibilities for Operation

Position	Responsibility
VP Sustainability	- Accountable for the environmental performance on site - Establishes goal and targets for environmental performance - Responsible for implementation of mitigation measures
Environmental Superintendent	- Responsible for the compliance monitoring - Provides direction on environmental issues to the Site Management 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 - Liaise with regulatory agencies on all environmentally related issues
Inuit Environmental Officer	- Environmental inspections - Environmental Monitoring - Wildlife Monitoring
Environmental Consultants	- Provide specialist advice and input on environmental matters, - Conduct environmental studies and monitoring programs - Conducts audits of operations, as requested - Prepare environmental reports
Contractors / Subcontractors	All 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 on-site induction process. The responsibilities of the Contractors / subcontractors include the following: - Comply with the requirements of the EPP and related EMMP - The responsibilities of the Contractors / subcontractors Supervisors include the following: - Conduct regular site check / inspection to ensure that regular maintenance is undertaken in order to minimize environmental impacts - Provide personnel with appropriate environmental toolbox / tailgate meetings and training

8.2 MONITORING AND INSPECTION

The monitoring and inspection requirements are described in Section 10 of this Plan. Responsibilities have been assigned to various personnel on the Project team. Where required, third party resources will be retained to supplement in-house resources and capabilities.

8.3 TRAINING AND AWARENESS

Staff and sub-contractors working on site will receive environmental training as part of the Site Orientation, to achieve a basic level of environmental awareness understanding of their obligations regarding compliance with regulatory requirements, commitments and best practices.

Operations superintendents and contractor supervisors will be provided with this Management Plan, and will receive additional orientation with respect to the requirements outlined in this Plan. In addition, all supervising level staff and sub-contractors will be provided with the Operational Standards (the EPP) as a written guidance for their work.

Targeted environmental awareness training will be provided to both individuals and groups of workers assuming a specific authority or responsibility for environmental management or those undertaking an activity with an elevated high risk of environmental impact. These will be delivered in the form of toolbox/tailgate meetings or other means as appropriate.

The content of the environmental component of the site induction will include at a minimum:

a) Location of environmental sensitivities
b) Location of additional information on environmental matters
c) Due diligence responsibilities
d) Responsibilities related to waste management, minimizing noise as necessary, road traffic rules, etc.
e) Principles and necessary steps to avoid encounters with bears or other wildlife and what to do if one such encounter occurs

8.4 COMMUNICATION

The types of communications for which members of the team will participate include the following:

a) Formal written correspondence and meetings with stakeholders
b) Site visits by community representatives
c) Design, construction and planning meetings
d) Field inspections and monitoring reports disseminated by the EHS Superintendent
e) Electronic communications

f) Tailgate/toolbox meetings
g) Formal written correspondence and meetings with government regulatory bodies
h) Formal environmental awareness training

Communications will be appropriately recorded and filed for future reference. Where appropriate, the copies of communications will be forwarded to the Operations Manager(s), and Vice President Sustainability.

8.5 EXTERNAL COMMUNICATIONS

Effective forms of communication include the proactive notification to external stakeholders of Project activity. Project activity updates will be provided to the communities of North Baffin through various means including regular meetings, public notices and radio announcements as appropriate. Baffinland will endeavour to maintain Community Liaison Offices to assist in this regard.

8.6 CONSTRUCTION

During the construction phase of the Project, the EPCM (Engineering Procurement and Construction Management) contractor will be responsible for implementing this Plan.

This Management Plan will be updated to take into account the numerous construction sites, and types of construction equipment utilized. The organizational structure of the EPCM contractor will reflect the complexity of the construction phase.

The EPCM contractor will appoint a Construction Phase Environmental Superintendent who will oversee the application and adherence to all of Baffinland`s EMMP. He will report to the site construction manager as well as to Baffinland`s Environmental Superintendent. It is expected that the EPCM contractor will hire a number of Environmental Supervisors to assist in site environmental supervision.

8.7 OPERATION & CLOSURE

For the operations and closure phases, Baffinland will revise its organizational structure to reflect the realities of the operation. The EHS Superintendent will be responsible for subsequent updates and implementation of the Plan.

SECTION 9.0 - PERFORMANCE INDICATORS AND THRESHOLDS

In terms of water quantity, the performance indicator is the on-going compliance with the terms and conditions of the water licence.

Table 9.1: Water Quantity Performance Indicator
(to be updated on the basis of Type A Water License, when issued by NWB)

Construction Phase		
Source	Permitted Quantity	Expected Consumption
Milne Inlet - Philips Creek		
Tote Road - Km 26 Lake		
Milne Inlet - Km 32 Lake		
Tote Road - Katiktok Lake		
Tote Road - BG28		
Mary River - Unnamed lake north of camp		
Mary River		
Mary River – Camp Lake		
Railway – Unnamed Lake (summer)		
Railway - Unnamed lake supplying Ravn camp (winter)		
Railway - Cockburn Lake		
Railway - Various lakes and ponds along railway alignment		
Steensby - 3km Lake		
Steensby - Lake ST27		
Steensby - 10km lake		
Steensby - Local ponds		
Steensby – Ocean (hydrotest)		
Operation Phase		
Source	Permitted Quantity	Actual Consumption
Milne Inlet - Philips Creek		
Milne Inlet - Km 32 Lake		
Mary River		
Mary River – Camp Lake		
Steensby - 10km lake		

In terms of surface water quality, both visual inspection and sampling/analytical results are used as indicators. During routine inspections, any indication of elevated TSS level or visible oil sheen will result in immediate corrective action. For the sampling and analytical results, the indicators of water quality are presented in Table 9.2.

Table 9.2: Surface Water Quality Performance Indicators – For All Location			
Parameter	Average Concentration mg/L	Maximum Concentration of any Grab Sample mg/L	Actual mg/L (to be determine)
Total Arsenic	0.5	1.00	
Total Copper	0.30	0.60	
Total Lead	0.20	0.40	
Total Nickel	0.50	1.00	
Total Zinc	0.5	1.00	
Total Suspended Solids	15.0	50.0	
Oil and Grease	No visible sheen	N/A	
pH	6.0 < pH < 9.5		

SECTION 10.0 - MONITORING AND REPORTING REQUIREMENTS

In addition to specific monitoring and reporting requirements under the regulatory approvals such as the water license, QIA land lease, land use permits and fisheries authorization, routine inspections of various aspects of the operations will be undertaken. Routine water management related inspections will be conducted at drill sites, camp sites and related infrastructure, roadways, and landforms generated in association with the Project development.

10.1 ROUTINE INSPECTIONS

Routine inspections and water license monitoring is outlined below in Table 10.1.

Table 10.1: Routine Inspection and Monitoring	
Site	Routine Inspection
Milne Port Mine Site Steensby Port facilities Rail camp locations Milne Inlet Tote Road and Refuge stations	- Water management systems - Sediment and erosion control structures - Evidence of hydrocarbon staining or leaks from containment devices - Full-time supervision of fuel transfer operations - Water intakes - Flow meter readings - Rutting by vehicles
Milne Inlet Tote Road Railway Construction Road Railway	- Sediment and erosion control structures - Fuel leaks - Drip Pans and Equipment condition - Any rutting by vehicles
Spoil Deposit locations Tunnelling locations	- Sediment and erosion control structures - Evidence of hydrocarbon staining or leaks from containment devices - Fuel leaks - Drip Pans and Equipment condition

	- Rutting by vehicles		
Borrow sites 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		
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 - 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

Table 10.1: Routine Inspection and Monitoring (continued)

Site	Routine Inspection
Waste Rock Stockpile	- Sediment and erosion control structures - Evidence of hydrocarbon staining or leaks from containment devices - Evidence of ARD and ML - Drip Pans - Equipment condition
Bulk Fuel Storage Facilities Milne Port Mary River Steensby Port	- Primary containment structure - Evidence of hydrocarbon staining or leaks from containment devices - Equipment condition - Spill kit
Explosives Storage Mary River 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 - Equipment condition - Rutting by vehicles
Routine inspection and site monitoring will be undertaken by the Environmental Superintendent or designate	

10.2 WATER QUALITY MONITORING

The water quality monitoring program consists of several elements as follows:

a) Measurement, recording and reporting of water volumes extracted, as prescribed by the water license
b) Sampling, analysis and reporting of water quality, as prescribed by the water license
c) Weekly to monthly monitoring downstream of exploration drilling activities during periods of open water

Table 10.3 summarizes the results of the current water quality and quantity monitoring program.

An exploration drill water quality monitoring program has been undertaken since 2005 at selected locations upstream (reference), downstream along the Mary River (potentially affected), and along steep seasonal flow channels that drain the rugged topographic terrain that characterizes the land surface in the vicinity of Deposits 1,2 and 3. The main objective of the monitoring program is to identify and measure *Contaminants of Potential Concern* in Mary River, both upstream at locations unaffected by drilling activities, and downstream at locations that may be potentially affected by drilling activities. Each year, the water quality monitoring program is dependent and specific to the planned scope of the drill program. The Environmental Superintendent will, in consultation with Operations personnel the annual exploration drill water quality monitoring program and ensure that it is implemented. The results of the monitoring program will be used to guide adaptive management measures, as appropriate.

10.2.1 Monitoring Stations

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

Table 10.3: Water Monitoring Stations

Monitoring Station Number	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-11	**Surface discharge from the lump ore and fine ore stockpiles at the processing area**
MRY-12	**Surface discharge from the lump ore and fine ore stockpiles at the processing area**

Notes:
1. **The winter water supply for the Milne Port Camp is at km 32 not km 99.**
2. **Monitoring Station MRY-8 is no longer required as there is only one open pit which will be monitored by MRY-9.**

The current monitoring locations are shown in the following figures found in the Type 'A' water license application, attachment 9:

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

Additional monitoring stations will be identified and established with the issuance of the Project Type A Water License to be issued by the NWB.

10.2.2 Bulk Sample Open Pit

All discharge from the bulk sample open pit will be analyzed and discharge at Monitoring Station MRY-9 will not exceed the following limits:

Parameter	**Maximum Average Concentration (mg/L)**	Maximum Concentration of Any Grab Sample (mg/L)
Total Arsenic	0.5	**1.00**
Total Copper	0.30	**0.60**
Total Lead	0.20	**0.40**
Total Nickel	0.50	**1.00**
Total Zinc	0.5	**1.00**
Total Suspended Solids	15.0	**50.0**
Oil and Grease	No visible sheen	**N/A**
Waste discharged will have a pH between 6.0 - 9.5		

10.2.3 Waste Water Treatment Facility (WWTF)

All sewage will be discharged to a Waste Water Treatment Facility at Mary River and Milne Port unless otherwise approved.

All sewage discharged from the Waste Water Treatment Facility at Monitoring Stations MRY-4 and MRY-4a, at Mary River, will not exceed the following quality standards:

Parameter	Maximum Average Concentration
BOD_5	**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**

All sewage discharged from the Waste Water Treatment Facility at Monitoring Stations MRY-5 and MRY-5a, at Milne Port, will not exceed the following quality standards:

Parameter	Maximum Average Concentration
BOD_5	**100 mg/L**
Total Suspended Solids	**120 mg/L**
Fecal Coliform	**10,000 CFU/100 mL**

Oil and Grease	**No visible sheen**
pH	**between 6.0 - 9.5**

10.2.4 Monitoring Station Discharge

Effluent discharged from Monitoring Stations MRY-4 and MRY-4a, and MRY-5 and MRY-5a will be demonstrated to be acutely non-toxic in accordance with test procedures measuring acute lethality to Rainbow trout, Oncorhynchus mykiss (Environment Canada's Environmental Protection Series Biological test Method EPS/1/RM/13) and Daphnia magna (Environment Canada's Environmental Protection Series Biological Test Method EPS/1/RM/14). Testing will occur once annually during open water season.

Samples will be collected at Monitoring Stations MRY-4 and MRY-5 every four weeks during discharge and at Monitoring Stations MRY-4a and MRY-5a once prior to discharge and every 4 weeks thereafter. Samples will be analyzed for: Biochemical Oxygen Demand (BOD), total suspended solids (TSS), pH, fecal coliforms, oil and grease (visual).

10.2.5 Bulk Fuel Storage Facilities

Effluent discharged from the Bulk Fuel Storage Facilities at Monitoring Stations MRY-6 and MRY-7 will meet the following effluent quality standards:

Parameter	Maximum Average Concentration (μg/L)
Benzene	**370**
Toluene	**2**
Ethyl benzene	**90**
Lead	**1**
Oil and Grease	**15,000 and no visible sheen**

10.3 CONSTRUCTION AND OPERATION PHASES

The Nunavut Water Board (NWB) water license is the main regulatory instrument specifying the scope and details of the water quality monitoring program. The water quality monitoring will be conducted in accordance with a QA/QC Plan filed with the NWB. Baffinland's current QA/QC Plan is presented as an attachment to the Wastewater Management Plan (SD-EMMP-003).

This plan will be updated as required to satisfy the requirements required by the NWB during the upcoming licensing process.

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www.baffinland.com

SECTION 11.0 - DATA MANAGEMENT AND REPORTING

11.1 DATA MANAGEMENT

The Environmental Superintendent is responsible for data management and reporting related to waste management. The data management system includes conducting routine inspections and monitoring, and providing these results to appropriate parties as required.

11.2 WATER LICENCE REPORTING

- Monthly water license reporting requirements
- Project annual report that addresses water licence, NIRB and other's annual reporting requirements
- Review results in comparison to predictions
- Opportunity for continuous improvement

Since water is regulated by the Nunavut Water Board (NWB) through the water licensing process, there will be monthly water license reporting requirements. An annual Project report will be prepared that addresses requirements specified by the water licence, the Nunavut Impact Review Board (NIRB), and the landowners.

11.3 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.

SECTION 12.0 - ADAPTIVE STRATEGIES

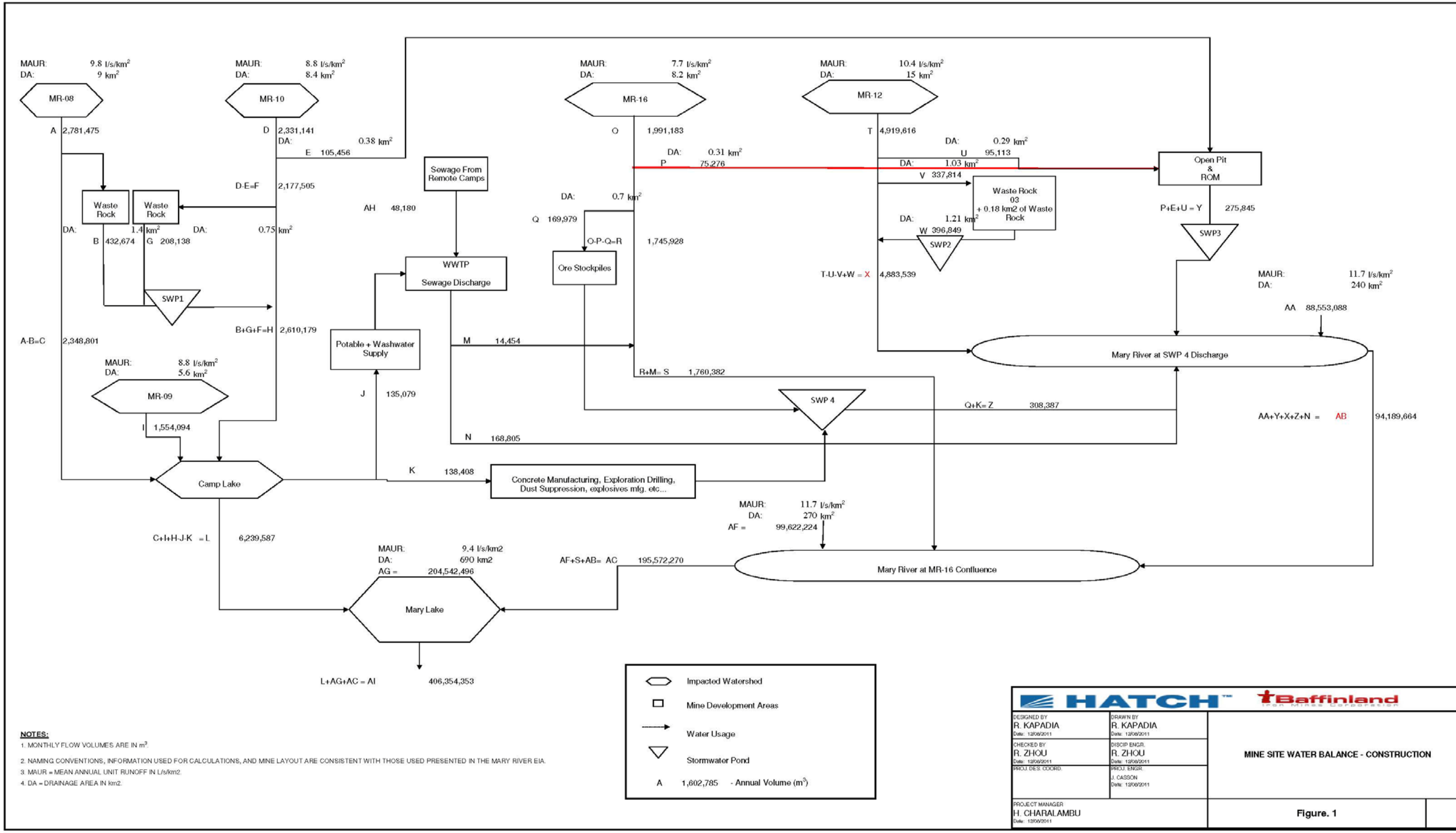
Baffinland is committed to continual improvement in its work activities in the aim of reducing risks to the environment and improving operational effectiveness. The strategy employed at Baffinland is regular monitoring supported by operational change and adoption of other mitigating measures as warranted.

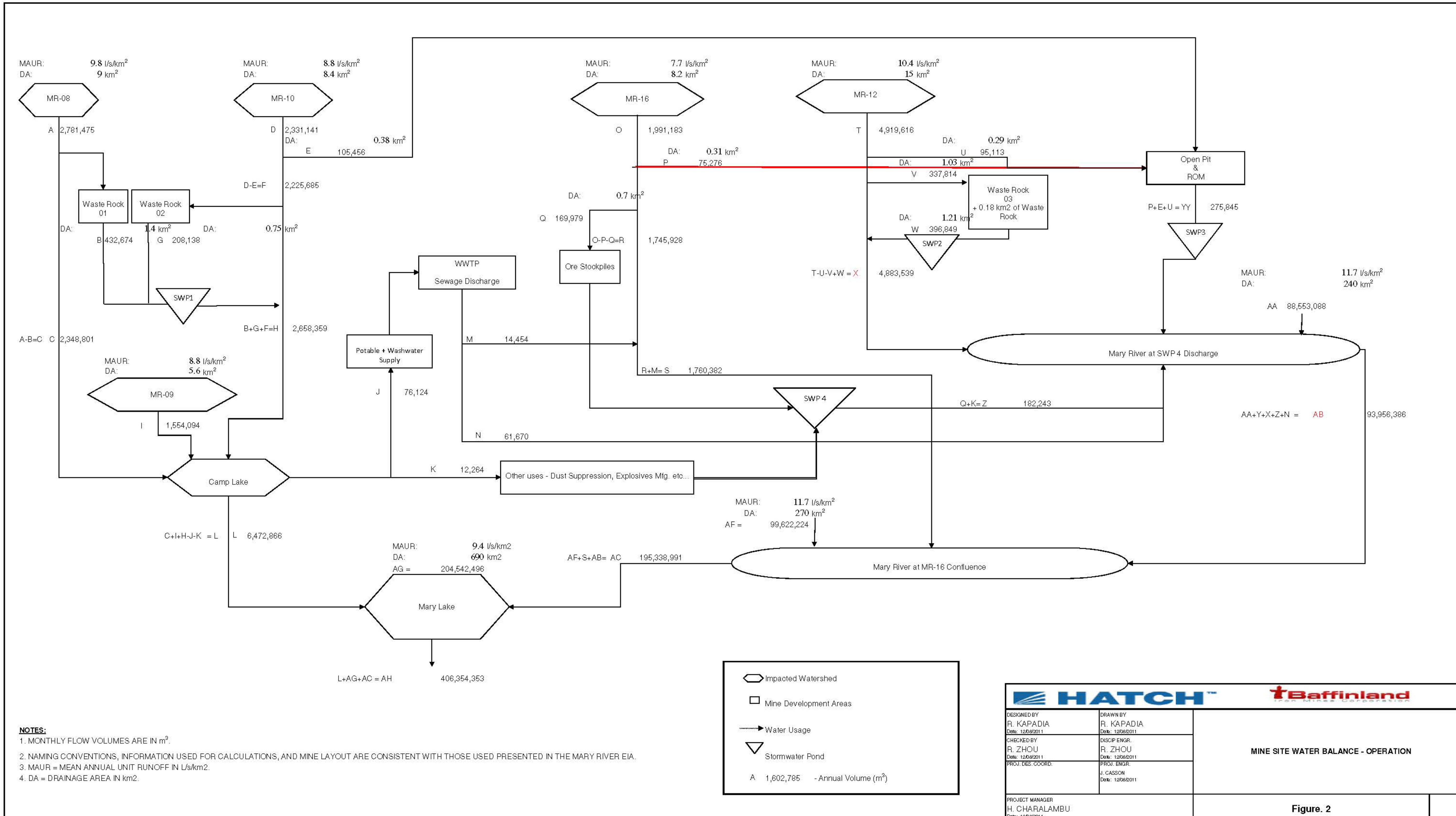
As per the requirements of Baffinland`s HSE Management Framework (SD-STD-001), the company will conduct and document management reviews of its "Surface Water, Aquatic Ecosystem, Fish and Fish Habitat Management Plan" on a regular basis. Such reviews will ensure the integration of monitoring results for the waste management plan are integrated with other aspects of the Project and that necessary adjustments are implemented as required. These reviews also provide a formal mechanism to assess the effectiveness of the management in achieving the company's objectives and maintaining on-going compliance with Project permits and authorizations.

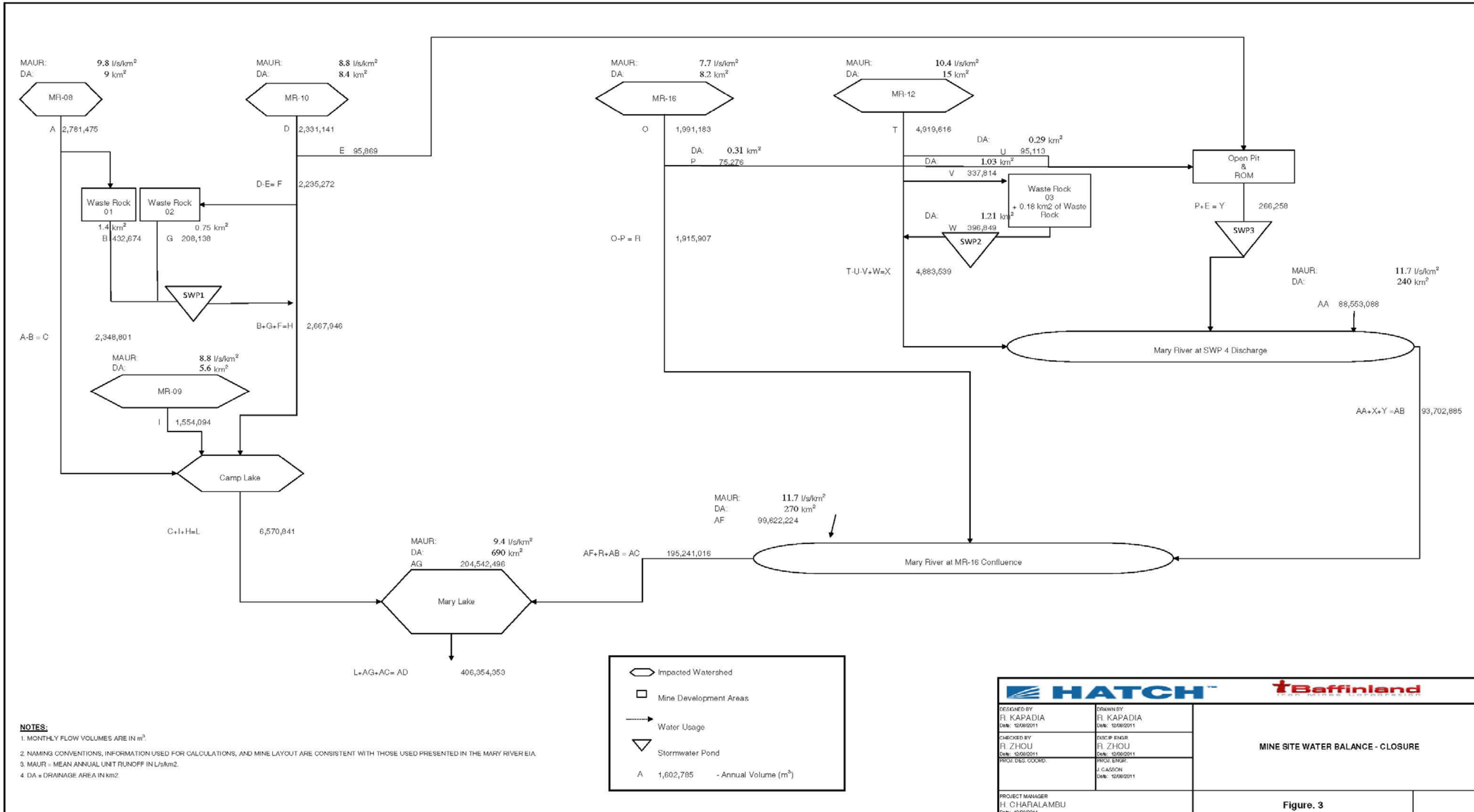
SECTION 13.0 - REFERENCE

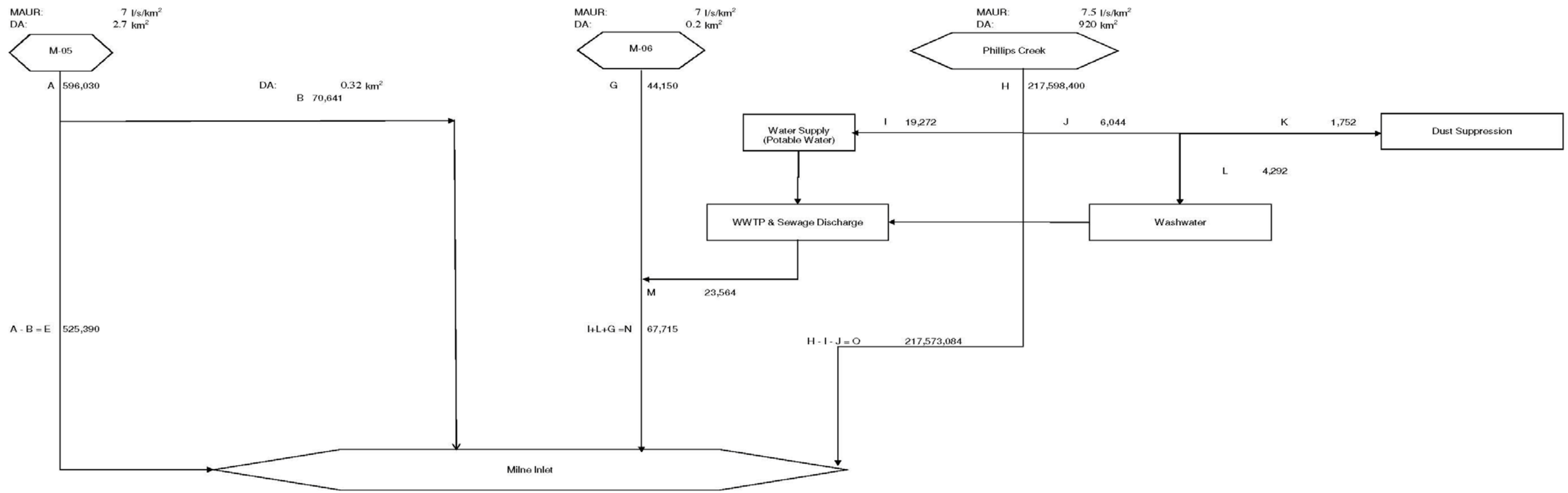
1. Nunavut Water Board, Type 'B' water licence 2BB-MRY1114
2. DFO, Guidelines for Use of Explosives In or Near Canadian Fisheries Water, 1998

Appendix A - Figures


MAUR: 9.8 l/s/km²
DA: 9 km²
MR-08
A 2,781,475
MAUR: 8.8 l/s/km²
DA: 8.4 km²
MR-10
D 2,331,141
DA: 0.38 km²
E 105,456
MAUR: 7.7 l/s/km²
DA: 8.2 km²
MR-16
O 1,991,183
DA: 0.31 km²
P 75,276
MAUR: 10.4 l/s/km²
DA: 15 km²
MR-12
T 4,919,616
DA: 0.29 km²
U 95,113
DA: 1.03 km²
V 337,814
Open Pit & ROM
Sewage From Remote Camps
D-E=F 2,177,505
Waste Rock
Waste Rock
DA: 1.4 km²
B 432,674
G 208,138
DA: 0.75 km²
AH 48,180
DA: 0.7 km²
Q 169,979
O-P-Q=R 1,745,928
Waste Rock 03 + 0.18 km2 of Waste Rock
DA: 1.21 km²
W 396,849
SWP2
P+E+U = Y 275,845
SWP3
WWTP
Sewage Discharge
Ore Stockpiles
T-U-V+W = X 4,883,539
MAUR: 11.7 l/s/km²
DA: 240 km²
AA 88,553,088
SWP1
B+G+F=H 2,610,179
Potable + Washwater Supply
M 14,454
Mary River at SWP 4 Discharge
A-B=C 2,348,801
MAUR: 8.8 l/s/km²
DA: 5.6 km²
MR-09
R+M= S 1,760,382
J 135,079
SWP 4
Q+K= Z 308,387
AA+Y+X+Z+N = AB 94,189,664
I 1,554,094
N 168,805
K 138,408
Camp Lake
Concrete Manufacturing, Exploration Drilling, Dust Suppression, explosives mfg. etc...
MAUR: 11.7 l/s/km²
DA: 270 km²
AF = 99,622,224
C+I+H-J-K = L 6,239,587
MAUR: 9.4 l/s/km2
DA: 690 km2
AG = 204,542,496
AF+S+AB= AC 195,572,270
Mary River at MR-16 Confluence
Mary Lake
L+AG+AC = AI 406,354,353
Impacted Watershed
Mine Development Areas
Water Usage
Stormwater Pond
A 1,602,785 - Annual Volume (m³)
NOTES:
1. MONTHLY FLOW VOLUMES ARE IN m³
2. NAMING CONVENTIONS, INFORMATION USED FOR CALCULATIONS, AND MINE LAYOUT ARE CONSISTENT WITH THOSE USED PRESENTED IN THE MARY RIVER EIA.
3. MAUR = MEAN ANNUAL UNIT RUNOFF IN L/s/km2.
4. DA = DRAINAGE AREA IN km2.
HATCH
Baffinland Iron Mines Corporation
DESIGNED BY R. KAPADIA Date: 12/06/2011
DRAWN BY R. KAPADIA Date: 12/06/2011
CHECKED BY R. ZHOU Date: 12/06/2011
DISCIP ENGR. R. ZHOU Date: 12/06/2011
PROJ. DES. COORD.
PROJ. ENGR. J. CASSON Date: 12/06/2011
PROJECT MANAGER H. CHARALAMBU Date: 12/06/2011
MINE SITE WATER BALANCE - CONSTRUCTION
Figure. 1


MAUR: 9.8 l/s/km2
DA: 9 km2
MR-08
A 2,781,475
MAUR: 8.8 l/s/km2
DA: 8.4 km2
MR-10
D 2,331,141
DA: 0.38 km2
E 105,456
D-E=F 2,225,685
Waste Rock 01
Waste Rock 02
DA: 1.4 km2
DA: 0.75 km2
B 432,674
G 208,138
SWP1
B+G+F=H 2,658,359
A-B=C C 2,348,801
MAUR: 8.8 l/s/km2
DA: 5.6 km2
MR-09
I 1,554,094
Camp Lake
C+I+H-J-K = L
L 6,472,866
MAUR: 7.7 l/s/km2
DA: 8.2 km2
MR-16
O 1,991,183
DA: 0.31 km2
P 75,276
DA: 0.7 km2
Q 169,979
O-P-Q=R 1,745,928
Ore Stockpiles
WWTP
Sewage Discharge
Potable + Washwater Supply
J 76,124
M 14,454
R+M= S 1,760,382
N 61,670
K 12,264
Other uses - Dust Suppression, Explosives Mfg. etc...
SWP 4
MAUR: 10.4 l/s/km2
DA: 15 km2
MR-12
T 4,919,616
DA: 0.29 km2
U 95,113
DA: 1.03 km2
V 337,814
Waste Rock 03 + 0.18 km2 of Waste Rock
DA: 1.21 km2
W 396,849
SWP2
T-U-V+W = X 4,883,539
Open Pit & ROM
P+E+U = YY 275,845
SWP3
MAUR: 11.7 l/s/km2
DA: 240 km2
AA 88,553,088
Mary River at SWP 4 Discharge
Q+K= Z 182,243
AA+Y+X+Z+N = AB 93,956,386
MAUR: 11.7 l/s/km2
DA: 270 km2
AF = 99,622,224
MAUR: 9.4 l/s/km2
DA: 690 km2
AG = 204,542,496
AF+S+AB= AC 195,338,991
Mary River at MR-16 Confluence
Mary Lake
L+AG+AC = AH 406,354,353
Impacted Watershed
Mine Development Areas
Water Usage
Stormwater Pond
A 1,602,785 - Annual Volume (m3)
NOTES:
1. MONTHLY FLOW VOLUMES ARE IN m3.
2. NAMING CONVENTIONS, INFORMATION USED FOR CALCULATIONS, AND MINE LAYOUT ARE CONSISTENT WITH THOSE USED PRESENTED IN THE MARY RIVER EIA.
3. MAUR = MEAN ANNUAL UNIT RUNOFF IN L/s/km2.
4. DA = DRAINAGE AREA IN km2.
HATCH
Baffinland Iron Mines Corporation
DESIGNED BY R. KAPADIA
DRAWN BY R. KAPADIA
CHECKED BY R. ZHOU
DISCIP ENGR. R. ZHOU
PROJ. DES. COORD.
PROJ. ENGR. J. CASSON
PROJECT MANAGER H. CHARALAMBU
MINE SITE WATER BALANCE - OPERATION
Figure. 2


MAUR: 9.8 l/s/km²
DA: 9 km²
MR-08
A 2,781,475
MAUR: 8.8 l/s/km²
DA: 8.4 km²
MR-10
D 2,331,141
E 95,869
D-E= F 2,235,272
Waste Rock 01
Waste Rock 02
1.4 km²
B 432,674
0.75 km²
G 208,138
SWP1
B+G+F=H 2,667,946
A-B = C 2,348,801
MAUR: 8.8 l/s/km²
DA: 5.6 km²
MR-09
I 1,554,094
Camp Lake
C+I+H=L 6,570,841
MAUR: 7.7 l/s/km²
DA: 8.2 km²
MR-16
O 1,991,183
DA: 0.31 km²
P 75,276
O-P = R 1,915,907
MAUR: 10.4 l/s/km²
DA: 15 km²
MR-12
T 4,919,616
DA: 0.29 km²
U 95,113
DA: 1.03 km²
V 337,814
Waste Rock 03 + 0.18 km2 of Waste Rock
DA: 1.21 km²
W 396,849
SWP2
T-U-V+W=X 4,883,539
Open Pit & ROM
P+E = Y 266,258
SWP3
MAUR: 11.7 l/s/km²
DA: 240 km²
AA 88,553,088
Mary River at SWP 4 Discharge
AA+X+Y =AB 93,702,885
MAUR: 11.7 l/s/km²
DA: 270 km²
AF 99,622,224
Mary River at MR-16 Confluence
AF+R+AB = AC 195,241,016
MAUR: 9.4 l/s/km²
DA: 690 km²
AG 204,542,496
Mary Lake
L+AG+AC= AD 406,354,353
Impacted Watershed
Mine Development Areas
Water Usage
Stormwater Pond
A 1,602,785 - Annual Volume (m³)
NOTES:
1. MONTHLY FLOW VOLUMES ARE IN m³.
2. NAMING CONVENTIONS, INFORMATION USED FOR CALCULATIONS, AND MINE LAYOUT ARE CONSISTENT WITH THOSE USED PRESENTED IN THE MARY RIVER EIA.
3. MAUR = MEAN ANNUAL UNIT RUNOFF IN L/s/km2.
4. DA = DRAINAGE AREA IN km2.
HATCH
Baffinland
DESIGNED BY R. KAPADIA Date: 12/08/2011
DRAWN BY R. KAPADIA Date: 12/08/2011
CHECKED BY R. ZHOU Date: 12/08/2011
DISCIP ENGR. R. ZHOU Date: 12/08/2011
PROJ. DES. COORD.
PROJ. ENGR. J. CASSON Date: 12/08/2011
PROJECT MANAGER H. CHARALAMBU Date: 12/08/2011
MINE SITE WATER BALANCE - CLOSURE
Figure. 3



N+O+E+B = P 218,236,829

Notes:

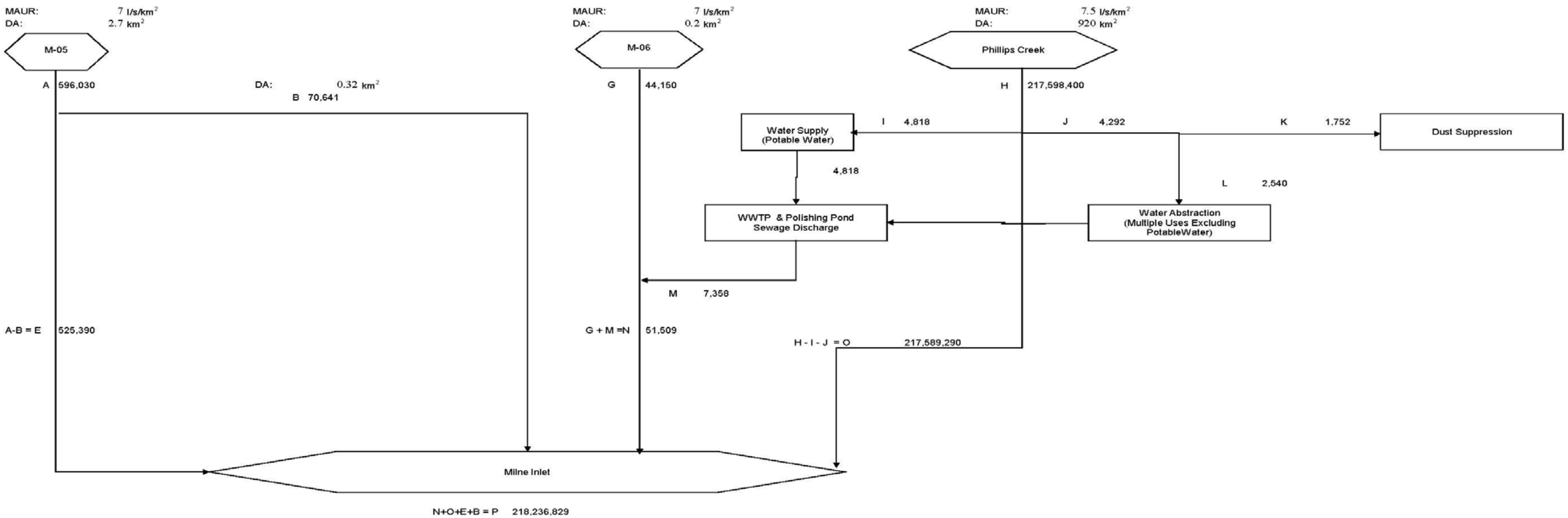
1. MONTHLY FLOW VOLUMES ARE IN m^3.
2. NAMING CONVENTIONS, INFORMATION USED FOR CALCULATIONS, AND MINE LAYOUT ARE CONSISTENT WITH THOSE USI
3. MAUR IN WATERSHEDS M5 AND M6 LIKELY RANGE BETWEEN 5 AND 7 l/s/km2. 5 l/s/km2 WAS SELECTED TO BE CONSISTENT WITH THE MARY RIVER EIA.
4. POTABLE WATER REQUIREMENTS INCLUDE THOSE OF THE MILNE INLET TOTE ROAD CONSTRUCTION CAMP.
5. MAUR = MEAN ANNUAL UNIT RUNOFF IN L/s/km2
6. DA = DRAINAGE AREA IN km2

Legend:

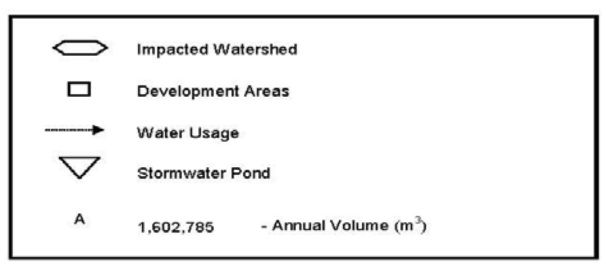
- Impacted Watershed
- Development Areas
- Water Usage
- Stormwater Pond
- A 1,602,785 - Annual Volume (m^3)

HATCH | Baffinland Iron Mines Corporation

DESIGNED BY R. KAPADIA Date: 12/06/2011	DRAWN BY R. KAPADIA Date: 12/06/2011	MILNE SITE WATER BALANCE - CONSTRUCTION
CHECKED BY R. ZHOU Date: 12/06/2011	DISCIP ENGR. R. ZHOU Date: 12/06/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 12/06/2011	
PROJECT MANAGER H. CHARALAMBU Date: 12/06/2011		Figure. 4

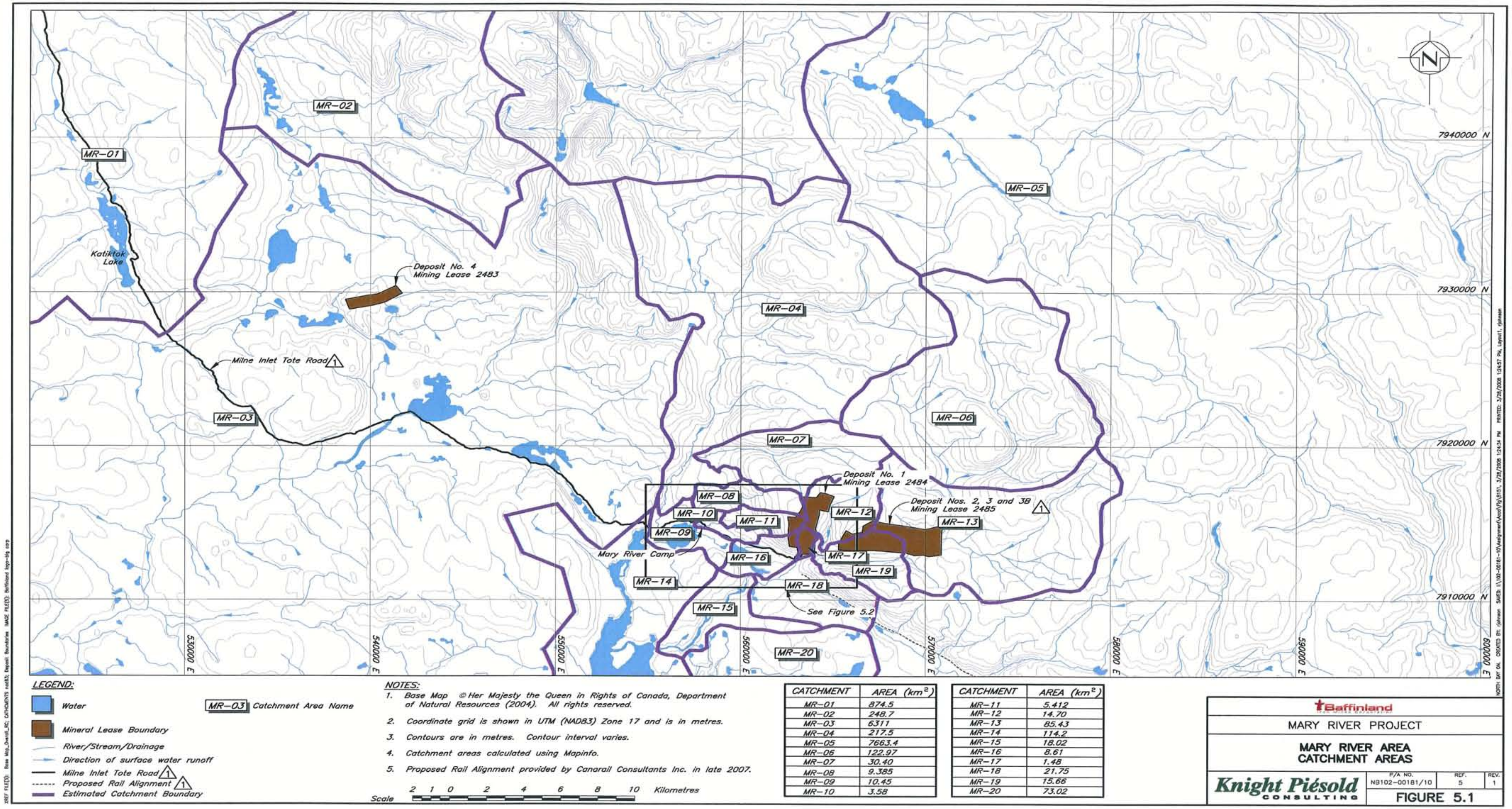


Notes:
1. MONTHLY FLOW VOLUMES ARE IN m^3.
2. NAMING CONVENTIONS, INFORMATION USED FOR CALCULATIONS, AND MINE LAYOUT ARE CONSISTENT WITH THOSE USED PRESENTED IN THE MARY RIVER EIA.
3. MAUR IN WATERSHEDS M5 AND M6 LIKELY RANGE BETWEEN 5 AND 7 l/s/km2. 5 l/s/km2 WAS SELECTED TO BE CONSISTENT WITH THE MARY RIVER EIA.
4. MAUR = MEAN ANNUAL UNIT RUNOFF in L/s/km2
5. DA = DRAINAGE AREA IN km2



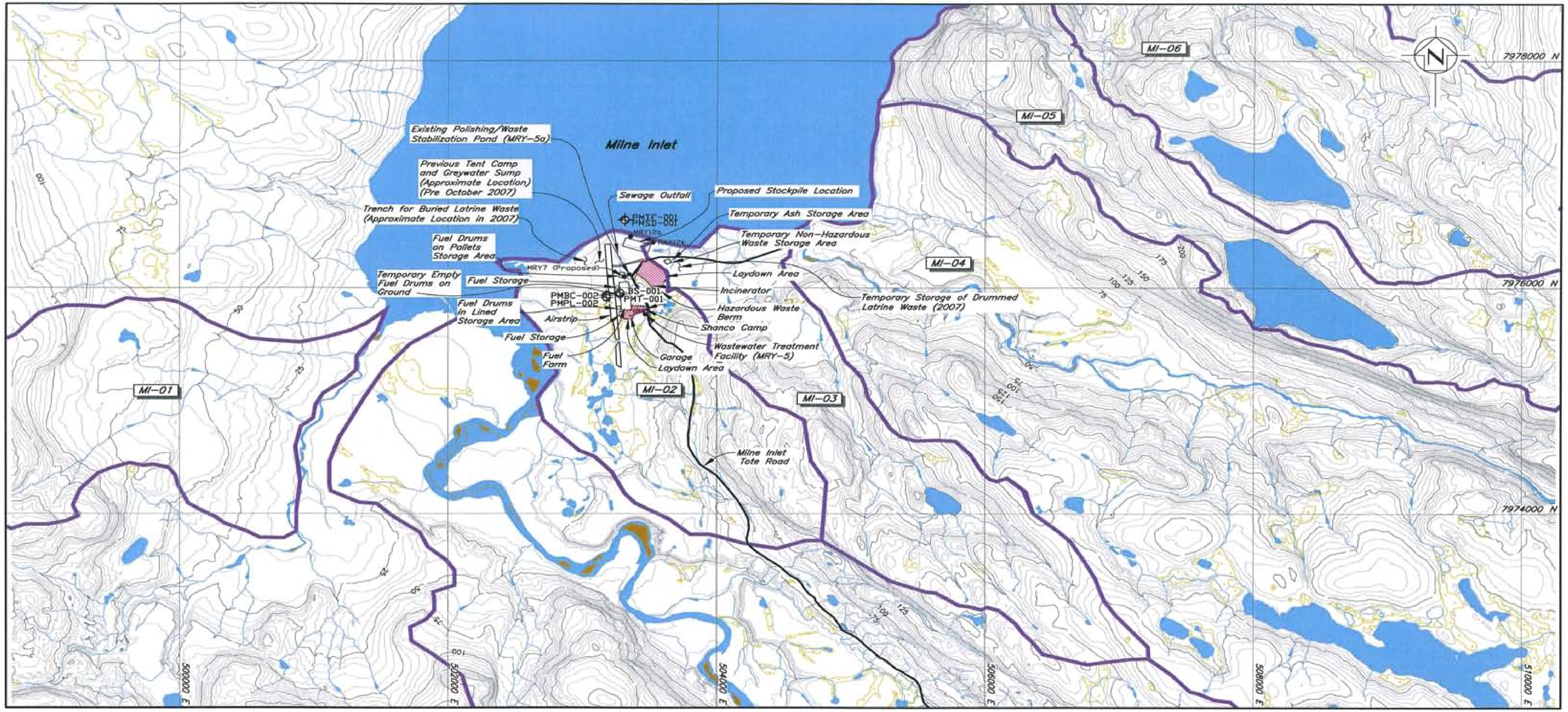
HATCH | Baffinland Iron Mines Corporation

DESIGNED BY R. KAPADIA Date: 12/08/2011	DRAWN BY R. KAPADIA Date: 12/08/2011	MILNE SITE WATER BALANCE - OPERATION
CHECKED BY R. ZHOU Date: 12/08/2011	DISCIP ENGR. R. ZHOU Date: 12/08/2011	
PROJ. DES. COORD.	PROJ. ENGR. J. CASSON Date: 12/08/2011	
PROJECT MANAGER H. CHARALAMBU Date: 12/08/2011		Figure. 5



CATCHMENT	AREA (km²)
MR-01	874.5
MR-02	248.7
MR-03	6311
MR-04	217.5
MR-05	7663.4
MR-06	122.97
MR-07	30.40
MR-08	9.385
MR-09	10.45
MR-10	3.58

CATCHMENT	AREA (km²)
MR-11	5.412
MR-12	14.70
MR-13	85.43
MR-14	114.2
MR-15	18.02
MR-16	8.61
MR-17	1.48
MR-18	21.75
MR-19	15.66
MR-20	73.02



LEGEND:

- Water
- Wetlands
- Laydown Area
- River/Stream/Drainage
- Direction of surface water runoff
- Milne Inlet Tote Road
- Drillhole Completed in 2007
- MRY-5 ● Water License Monitoring Location
- Estimated Catchment Boundary
- MI-01 Catchment Area Name

NOTES:

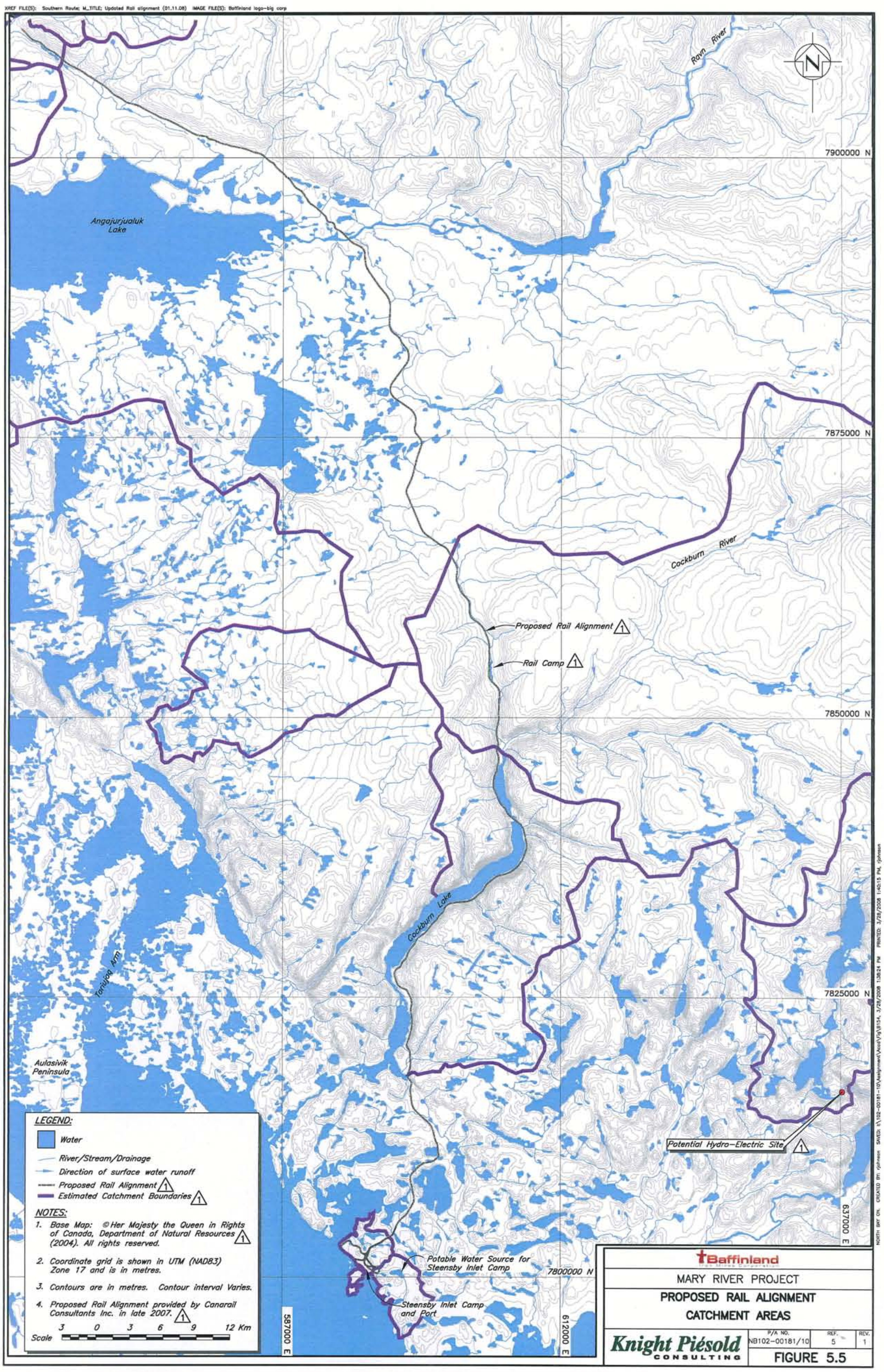
1. Topography provided by Eagle Mapping (2005).
2. Coordinate grid is shown in UTM (NAD83) Zone 17 and is in metres.
3. Contours are in metres. Contour interval is 5 metres.
4. Catchment areas calculated using Mapinfo.
5. Layout provided by BH Martin/Genivar and Baffinland (as of December 31, 2007).

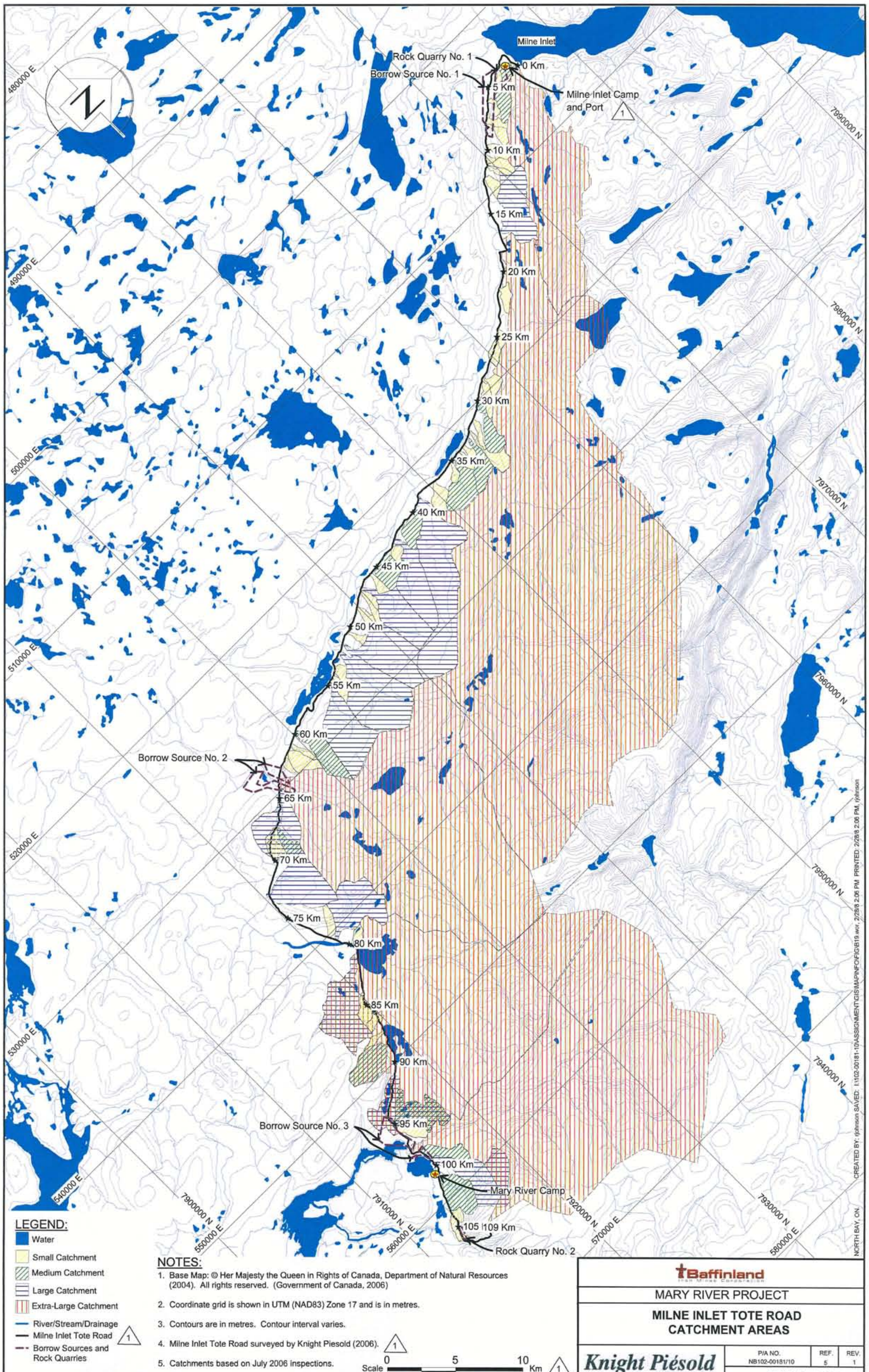
CATCHMENT	AREA (km^2)
MI-01	5.27
MI-02	3.59
MI-03	4.11
MI-04	62.32
MI-05	5.61
MI-06	7.96

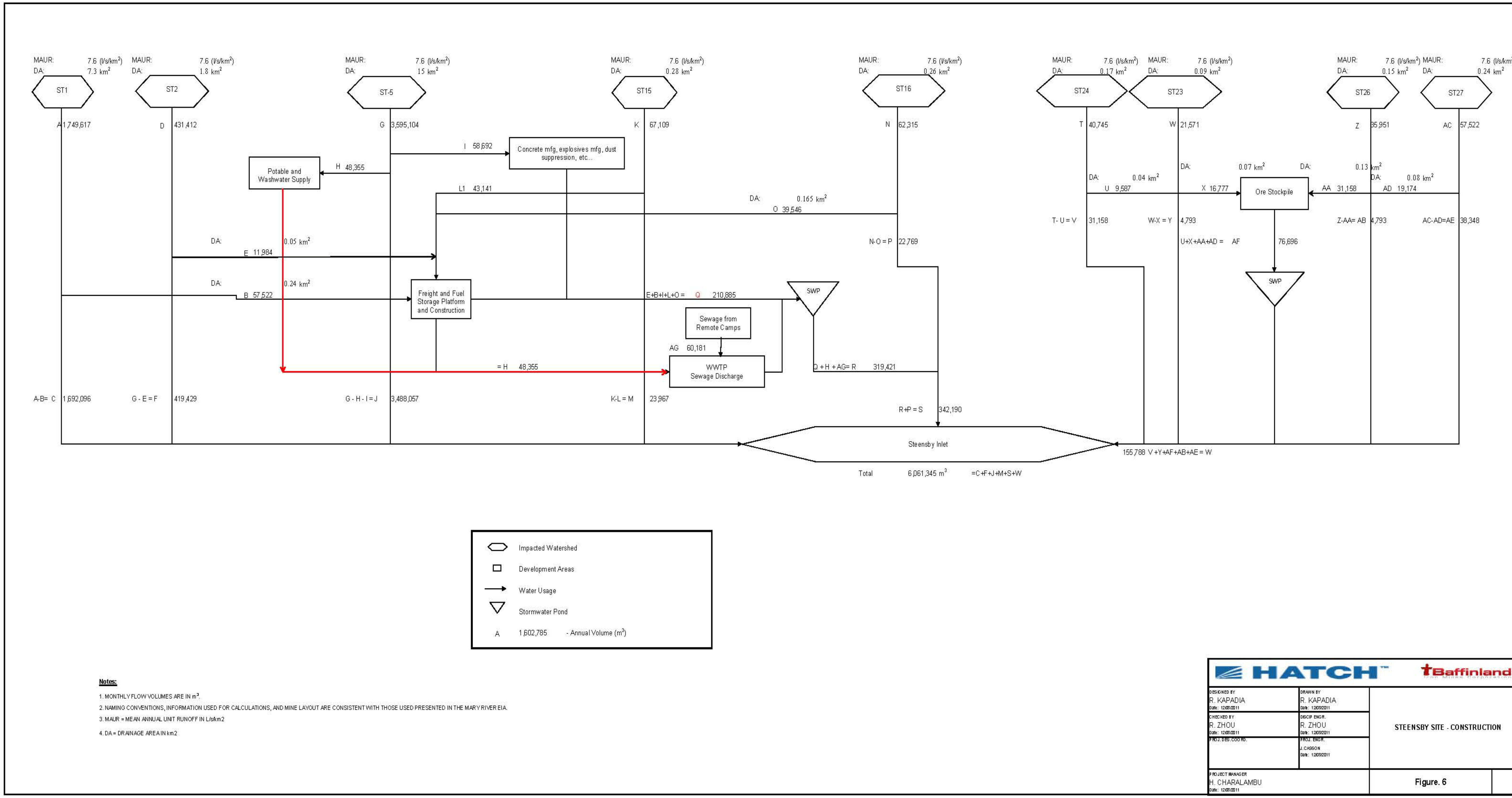
Scale 300 150 0 300 600 900 1200 1500 Metres

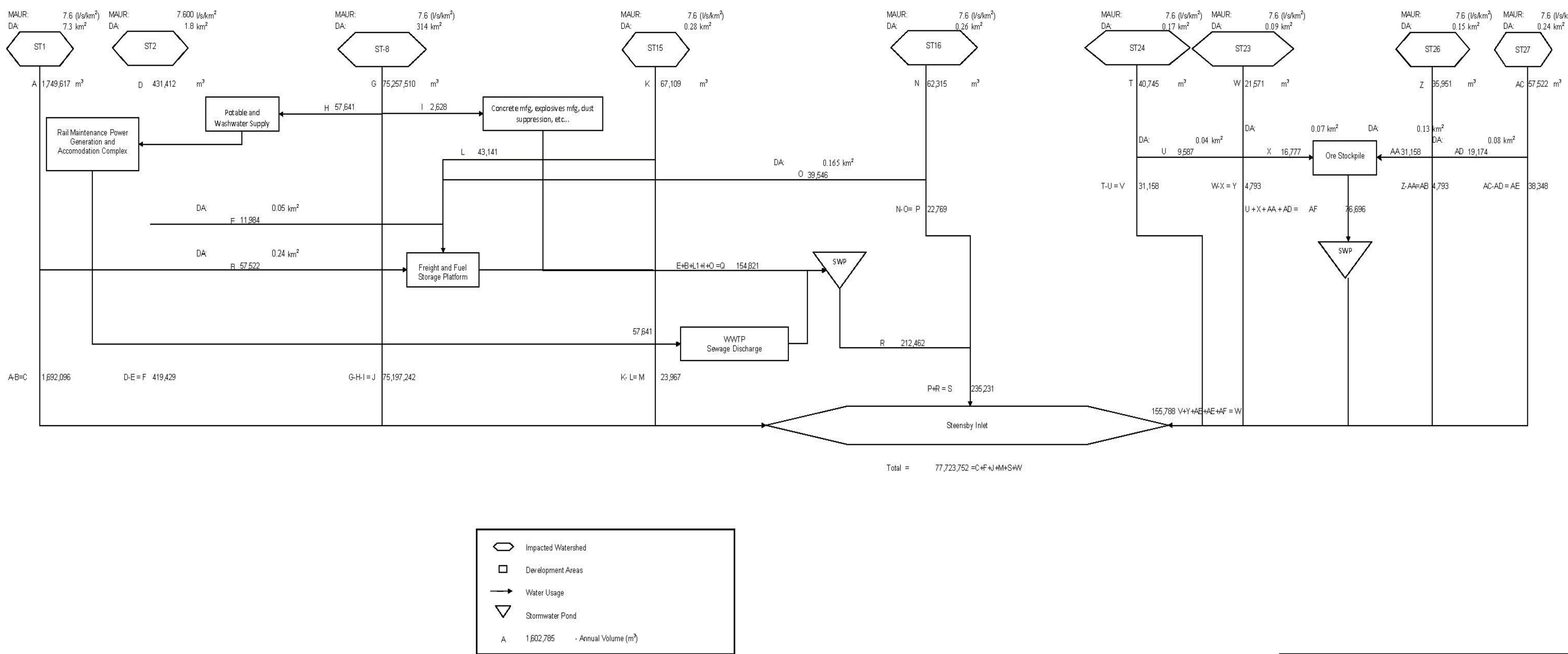
Baffinland
MARY RIVER PROJECT
MILNE INLET AREA CATCHMENT AREAS
Knight Piésold CONSULTING
P/A NO. NB102-00181/10 REF. 5 REV. 1
FIGURE 5.3


STEENSBY INLET
ST–01
ST–02
ST–03
Existing Steensby Inlet Camp Limits (Approx.)
7804300 N
7802300 N
7800300 N
7798300 N
7797053 N
591000 E
593000 E
595000 E
597000 E
LEGEND:
Water
Wetland
River/Stream/Drainage
Direction of surface water runoff
Estimated Catchment Boundary
Proposed Rail Alignment
Catchment Area Name
NOTES:
1. Topography provided by Eagle Mapping (2005).
2. Coordinate grid is shown in UTM (NAD83) Zone 17 and is in metres.
3. Contours are in metres. Contour interval is 5 metres.
4. Catchment areas calculated in Mapinfo.
5. Proposed Rail Alignment provided by Canarail Consultants Inc. in late 2007.
Scale 300 150 0 300 600 900 1200 1500 Metres
CATCHMENT | AREA (km²)
ST–01 | 13.68
ST–02 | 21.77
ST–03 | 1.99
Baffinland
MARY RIVER PROJECT
STEENSBY INLET AREA CATCHMENT AREAS
Knight Piésold CONSULTING
P/A NO. NB102–00181/10
REF. 5
REV. 1
FIGURE 5.4


Ravn River
7900000 N
Angajurjualuk Lake
7875000 N
Cockburn River
Proposed Rail Alignment
Rail Camp
7850000 N
Cockburn Lake
Tariujaq Arm
7825000 N
Aulasivik Peninsula
Potential Hydro-Electric Site
637000 E
Potable Water Source for Steensby Inlet Camp
Steensby Inlet Camp and Port
7800000 N
587000 E
612000 E
LEGEND:
Water
River/Stream/Drainage
Direction of surface water runoff
Proposed Rail Alignment
Estimated Catchment Boundaries
NOTES:
1. Base Map: © Her Majesty the Queen in Rights of Canada, Department of Natural Resources (2004). All rights reserved.
2. Coordinate grid is shown in UTM (NAD83) Zone 17 and is in metres.
3. Contours are in metres. Contour interval Varies.
4. Proposed Rail Alignment provided by Canarail Consultants Inc. in late 2007.
Scale 3 0 3 6 9 12 Km
Baffinland
MARY RIVER PROJECT
PROPOSED RAIL ALIGNMENT
CATCHMENT AREAS
Knight Piésold CONSULTING
P/A NO. NB102-00181/10
REF. 5
REV. 1
FIGURE 5.5


Milne Inlet
Rock Quarry No. 1
Borrow Source No. 1
0 Km
5 Km
Milne Inlet Camp and Port
10 Km
15 Km
20 Km
25 Km
30 Km
35 Km
40 Km
45 Km
50 Km
55 Km
60 Km
Borrow Source No. 2
65 Km
70 Km
75 Km
80 Km
85 Km
90 Km
95 Km
Borrow Source No. 3
100 Km
Mary River Camp
105
109 Km
Rock Quarry No. 2
480000 E
490000 E
500000 E
510000 E
520000 E
530000 E
540000 E
550000 E
560000 E
570000 E
580000 E
7900000 N
7910000 N
7920000 N
7930000 N
7940000 N
7950000 N
7960000 N
7970000 N
7980000 N
7990000 N
LEGEND:
Water
Small Catchment
Medium Catchment
Large Catchment
Extra-Large Catchment
River/Stream/Drainage
Milne Inlet Tote Road
Borrow Sources and Rock Quarries
NOTES:
1. Base Map: © Her Majesty the Queen in Rights of Canada, Department of Natural Resources (2004). All rights reserved. (Government of Canada, 2006)
2. Coordinate grid is shown in UTM (NAD83) Zone 17 and is in metres.
3. Contours are in metres. Contour interval varies.
4. Milne Inlet Tote Road surveyed by Knight Piesold (2006).
5. Catchments based on July 2006 inspections.
Scale 0 5 10 Km
Baffinland
MARY RIVER PROJECT
MILNE INLET TOTE ROAD CATCHMENT AREAS
Knight Piésold CONSULTING
P/A NO. NB102-00181/10
REF. 5
REV. 1
FIGURE 5.6


ST1
MAUR: 7.6 (l/s/km2)
DA: 7.3 km2
A 1,749,617
ST2
MAUR: 7.6 (l/s/km2)
DA: 1.8 km2
D 431,412
ST-5
MAUR: 7.6 (l/s/km2)
DA: 15 km2
G 3,595,104
ST15
MAUR: 7.6 (l/s/km2)
DA: 0.28 km2
K 67,109
ST16
MAUR: 7.6 (l/s/km2)
DA: 0.26 km2
N 62,315
ST24
MAUR: 7.6 (l/s/km2)
DA: 0.17 km2
T 40,745
ST23
MAUR: 7.6 (l/s/km2)
DA: 0.09 km2
W 21,571
ST26
MAUR: 7.6 (l/s/km2)
DA: 0.15 km2
Z 35,951
ST27
MAUR: 7.6 (l/s/km2)
DA: 0.24 km2
AC 57,522
I 58,692
Concrete mfg, explosives mfg, dust suppression, etc...
H 48,355
Potable and Washwater Supply
L1 43,141
DA: 0.165 km2
O 39,546
DA: 0.05 km2
E 11,984
DA: 0.24 km2
B 57,522
Freight and Fuel Storage Platform and Construction
E+B+I+L+O = Q 210,885
SWP
Sewage from Remote Camps
AG 60,181
WWTP Sewage Discharge
= H 48,355
Q + H + AG= R 319,421
N-O = P 22,769
DA: 0.04 km2
U 9,587
T- U = V 31,158
DA: 0.07 km2
X 16,777
Ore Stockpile
W-X = Y 4,793
U+X+AA+AD = AF
76,696
SWP
DA: 0.13 km2
AA 31,158
DA: 0.08 km2
AD 19,174
Z-AA= AB 4,793
AC-AD=AE 38,348
A-B= C 1,692,096
G - E = F 419,429
G - H - I = J 3,488,057
K-L = M 23,967
R+P = S 342,190
Steensby Inlet
155,788 V +Y+AF+AB+AE = W
Total 6,061,345 m3 =C+F+J+M+S+W
Impacted Watershed
Development Areas
Water Usage
Stormwater Pond
A 1,602,785 - Annual Volume (m3)
Notes:
1. MONTHLY FLOW VOLUMES ARE IN m3.
2. NAMING CONVENTIONS, INFORMATION USED FOR CALCULATIONS, AND MINE LAYOUT ARE CONSISTENT WITH THOSE USED PRESENTED IN THE MARY RIVER EIA.
3. MAUR = MEAN ANNUAL UNIT RUNOFF IN L/s/km2
4. DA = DRAINAGE AREA IN km2
HATCH
Baffinland
DESIGNED BY R. KAPADIA
DRAWN BY R. KAPADIA
CHECKED BY R. ZHOU
DISCIP ENGR. R. ZHOU
J. CASSON
PROJECT MANAGER H. CHARALAMBU
STEENSBY SITE - CONSTRUCTION
Figure. 6

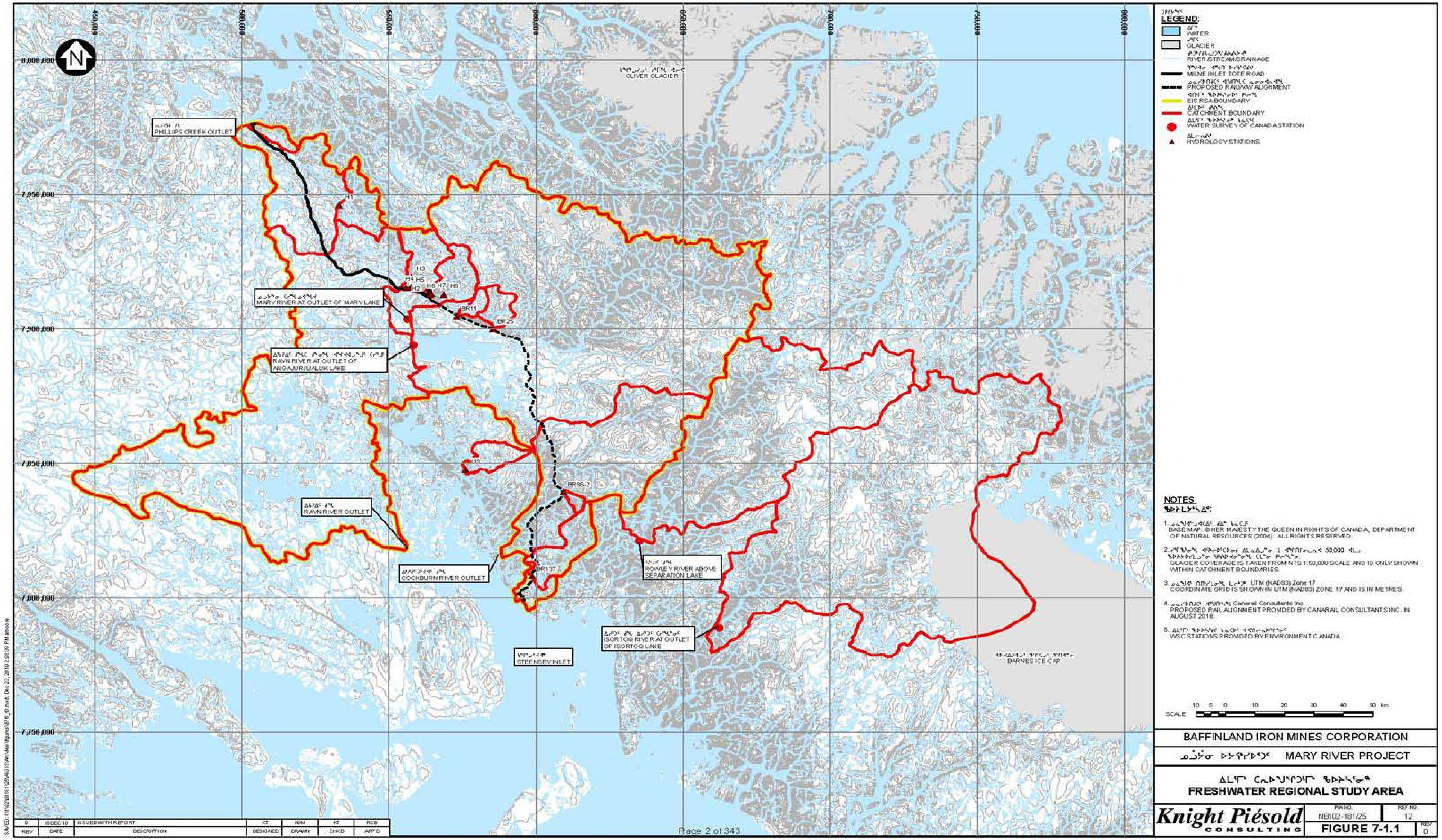


Notes:

1.MONTHLY FLOW VOLUMES ARE IN m³.
2. NAMING CONVENTIONS, INFORMATION USED FOR CALCULATIONS, AND MINE LAYOUT ARE CONSISTENT WITH THOSE USED PRESENTED IN THE MARY RIVER EIA.
3. MAUR = MEAN ANNUAL UNIT RUNOFF IN L/s/km2
4. DA = DRAINAGE AREA IN km2

HATCH™ Baffinland

DESIGNED BY R. KAPADIA Date : 12/08/2011	DRAWN BY R. KAPADIA Date: 12/08/2011	STEENSBY SITE - OPERATION
CHECKED BY R. ZHOU Date : 12/08/2011	DISCIP ENGR. R. ZHOU Date: 12/08/2011	
PROJ. DES.COORD.	PROJ. ENGR. J.CASSON Date: 12/08/2011	
PROJECT MANAGER H. CHARALAMBU Date : 12/08/2011		Figure. 7


LEGEND:
WATER
GLACIER
RIVER/STREAM/DRAINAGE
MILNE INLET TOTE ROAD
PROPOSED RAILWAY ALIGNMENT
EIS RSA BOUNDARY
CATCHMENT BOUNDARY
WATER SURVEY OF CANADA STATION
HYDROLOGY STATIONS
OLIVER GLACIER
PHILLIPS CREEK OUTLET
MARY RIVER AT OUTLET OF MARY LAKE
RAVN RIVER AT OUTLET OF ANGAJURJUALUK LAKE
RAVN RIVER OUTLET
COCKBURN RIVER OUTLET
ROWLEY RIVER ABOVE SEPARATION LAKE
ISORTOQ RIVER AT OUTLET OF ISORTOQ LAKE
STEENSBY INLET
BARNES ICE CAP
NOTES
1. BASE MAP: © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA, DEPARTMENT OF NATURAL RESOURCES (2004). ALL RIGHTS RESERVED.
2. GLACIER COVERAGE IS TAKEN FROM NTS 1:50,000 SCALE AND IS ONLY SHOWN WITHIN CATCHMENT BOUNDARIES.
3. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
4. PROPOSED RAIL ALIGNMENT PROVIDED BY CANARAIL CONSULTANTS INC. IN AUGUST 2010.
5. WSC STATIONS PROVIDED BY ENVIRONMENT CANADA.
SCALE 10 5 0 10 20 30 40 50 km
BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT
FRESHWATER REGIONAL STUDY AREA
Knight Piésold CONSULTING
P/A NO. NB102-181/25
REF NO. 12
FIGURE 7-1.1
REV 0
ISSUED WITH REPORT
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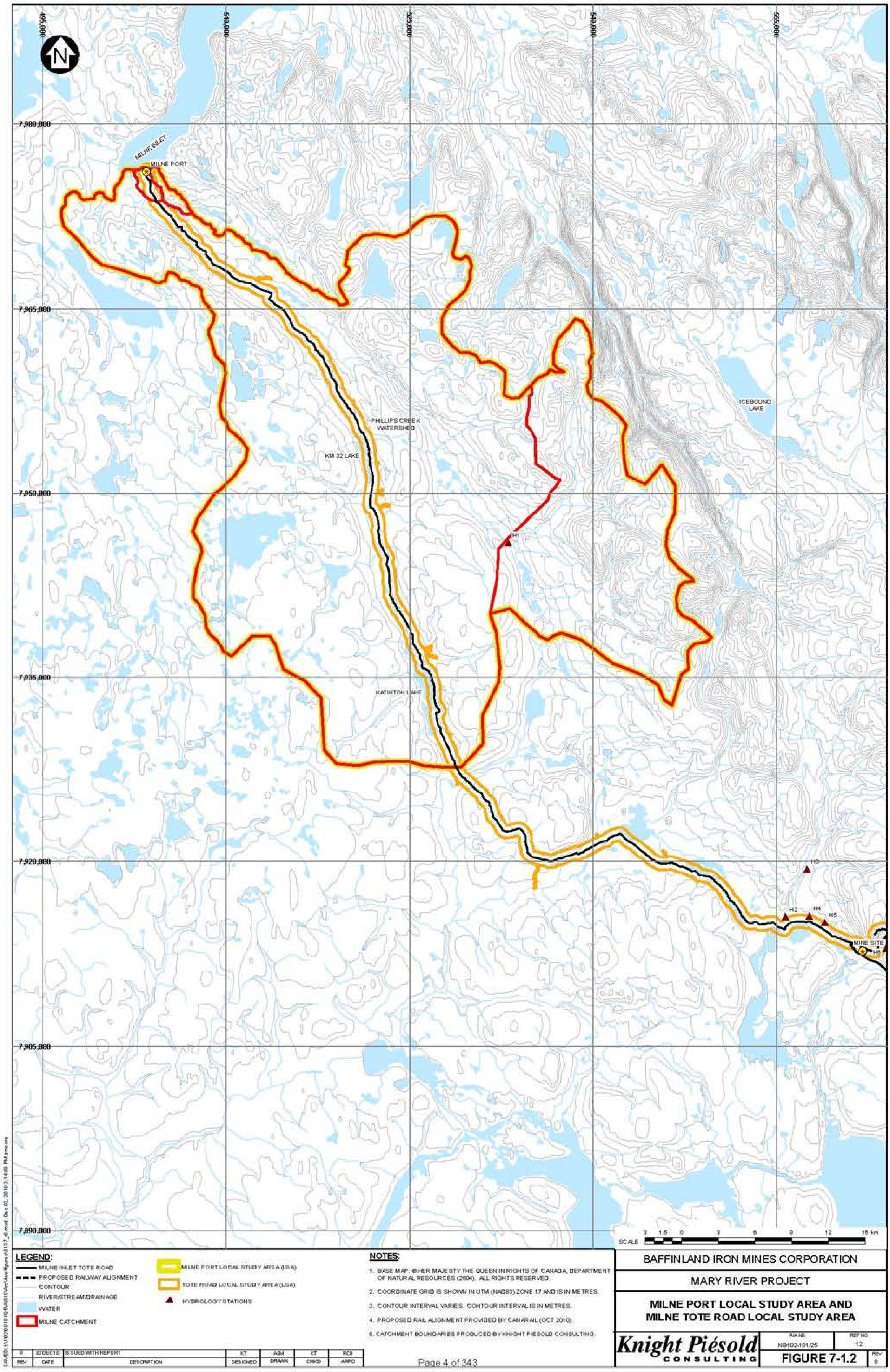
MILNE INLET
MILNE PORT
PHILLIPS CREEK WATERSHED
KM 32 LAKE
KATIKTOK LAKE
ICEBOUND LAKE
MINE SITE
H1
H2
H3
H4
H5
H6
7,980,000
7,965,000
7,950,000
7,935,000
7,920,000
7,905,000
7,890,000
495,000
510,000
525,000
540,000
555,000
SCALE 3 1.5 0 3 6 9 12 15 km
LEGEND:
MILNE INLET TOTE ROAD
PROPOSED RAILWAY ALIGNMENT
CONTOUR
RIVER/STREAM/DRAINAGE
WATER
MILNE CATCHMENT
MILNE PORT LOCAL STUDY AREA (LSA)
TOTE ROAD LOCAL STUDY AREA (LSA)
HYDROLOGY STATIONS
NOTES:
1. BASE MAP: © HER MAJESTY THE QUEEN IN RIGHTS OF CANADA, DEPARTMENT OF NATURAL RESOURCES (2004). ALL RIGHTS RESERVED.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOUR INTERVAL VARIES. CONTOUR INTERVAL IS IN METRES.
4. PROPOSED RAIL ALIGNMENT PROVIDED BY CANARAIL (OCT 2010).
5. CATCHMENT BOUNDARIES PRODUCED BY KNIGHT PIESOLD CONSULTING.
0 20DEC10 ISSUED WITH REPORT KT ASM KT RCB
REV DATE DESCRIPTION DESIGNED DRAWN CHK'D APP'D
Page 4 of 343
BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT
MILNE PORT LOCAL STUDY AREA AND
MILNE TOTE ROAD LOCAL STUDY AREA
Knight Piésold
CONSULTING
P/A NO. NB102-181/25
REF NO. 12
FIGURE 7-1.2
REV 0