# Baffinland Iron Mines Corporation

## SURFACE WATER AND AQUATIC ECOSYSTEM MANAGEMENT PLAN

## BAF-PH1-830-P16-0026

## Rev 3


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# DOCUMENT REVISION RECORD

| Issue Date MM/DD/YY | Revision | Prepared By | Approved By | Issue Purpose |
|---|---|---|---|---|
| 9/25/2007 | 0 | RC | KDE | Issued in Final under Type B Water Licence |
| 3/31/2008 | 0 - SWMP | RC | KDE | Updated for 2008 Field Season under Type B Water Licence |
| 3/31/2009 | 1 - SWMP | TM/AK | JM | Updated for 2009 Field Season under Type B Water Licence |
| 3/31/2010 | 2 - SWMP | TM/AK | JM | Updated for 2010 Field Season under Type B Water Licence |
| 3/31/2011 | 3 - SWMP | TM/AK | JM | Updated for 2011 Field Season under Type B Water Licence |
| 11/31/2012 | F | JM | JB | Updated for FEIS |
| 3/31/2012 | 4 - SWMP | TM/AK | JM | Updated for 2012 Field Season under Type B Water Licence |
| 3/31/2013 | 00 | RK | JM | In support of the 2013 Work Plan |
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| 3/26/2014 | 02 | LW | JM | In support of the 2014 Work Plan |
| 3/17/2015 | 3 | LW | JM | In support of the 2015 Work Plan |

| Item No. | Description of Change | Relevant Section |
|---|---|---|
| 1 | Updated work construction activities according to the 2015 Work Scope | Multiple Sections throughout Plan |
| 2 | 2015 Work Scope provided | Appendix B |
| 3 | Provide reference to approved Type B Water Licence - 8BC-MRY1416 – *issued* August 6, 2014 | 1.0 |
| 4 | Provide reference to NIRB The amended Project Certificate No. 005 Amendment – *issued* May 28, 2014 | Multiple Sections throughout Plan |
| 5 | Description of new construction works – Milne Port Soil Landfarm and Contaminated Snow Containment Facility | 6.1.1 |

| Item No. | Description of Change | Relevant Section |
|---|---|---|
| 6 | Description of new construction works – Milne Port Stockpile Settling Ponds | 6.1.2 |
| 7 | Provide reference to updated Bulk Sampling Program and Aquatic Effects Monitoring Framework – *issued* June 27, 2014 | 6.2 |
| 8 | Update Waste Rock Pile based on revised Phase 1 Waste Rock Management Plan, Doc. No. BAF-PH1-830-P16-0029 | 7.2 |
| 9 | Updated Roles and Responsibilities – Environmental Project Team | 8.1.1 |
| 10 | Updated Site Water Balances | Appendix C |
| 11 | Updated Site Drainage Drawings | Appendix D |
| 12 | Updated Site Monitoring Locations/Drawings | 9.2/Appendix D |

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# 1 INTRODUCTION

As required by Baffinland Iron Mine Corporation's (Baffinland) Type A Water Licence No. 2AM-MRY1325 *issued* June 10, 2013 (Type A Water Licence) in association with its recently approved Type B Water Licence No. 8BC-MRY1416 – Amendment No. *issued* August 6, 2014 (Type B Water Licence) for the Mary River Project (Project), a review of Project Environmental Management and Monitoring Plans (EEMPs) was completed. This Surface Water and Aquatic Ecosystem Management Plan (Plan) was updated to support the 2015 Project Work Plan (refer to Appendix B) and meet the requirements of Baffinlands Type A and B water licences.

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

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

This Surface Water and Aquatic Ecosystems Management Plan supersedes the preceding revision (Rev. 02), *issued* March 31, 2014.

## 1.1 PURPOSE

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

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

## 1.2 REGULATORY REQUIREMENTS

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

Water use activities required for the work detailed in the 2015 Work Plan have been assessed for compliance with Baffinland's Type A and Type B Licences. Where is it determined that project activities fail to comply with the specific Terms and Conditions, further assessment shall be facilitated to modify such activities such that compliance is achieved.

## 1.3 RELATIONSHIP TO OTHER MANAGEMETN PLANS

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

## 1.4 UPDATE OF THIS MANAGEMENT PLAN

This Plan is a living, directive document which has been updated to reflect activities outlined in the 2015 Project Work Plan (Appendix B). The responsibilities and procedures presented herein are designed to ensure the effectiveness of the Plan and to provide for ongoing improvement through continuous review processes for 2015 Work Plan as authorized the amended Project Certificate No. 005.

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

### 1.4.1 CONTINUATION OF CONSTRUCTION - APPROVED EARLY REVENUE PHASE

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

2014 ERP construction activities consisted of the following activities at Milne Port:

- Construction of a causeway and ore dock that will extend into offshore waters. The causeway and ore dock platform with be built up with aggregate and suitable dredged material;
- Dredging to maintain the required vessel draft depths and for placement of caissons, in the location of the dock and required installation of a silt curtain installed around the extent of the dredging activities;
- Construction of concrete and steel pile foundations onto the rock filled causeway and ore dock to support the ship loader and related ship loader facilities;
- Installation and commissioning of the ship loader onto the ore dock foundations;
- Construction and commissioning of an ore stockpile pad;
- Installation and commissioning of the ore stacker reclaim conveyor system within the ore stockpile pad; and
- Construction of stockpile settling ponds.

### 1.4.2 2015 WORK PLAN

The 2015 Project Work Plan (refer to Appendix B) was developed to fulfil the requirements of Section 6.1 of Commercial Lease No. Q13C301 and the Type A Water Licence, and provides for:

- The continued development and construction of infrastructure required at the Mine Site in addition to the continuation of ERP construction activities provided in the approved ERP;
- Development and operation of the mine, ore crushing and land transportation, stockpiling and marine shipment of ore;
- At Milne Port, vessels carrying fuel, equipment and supplies for both use at the Mine Site and Milne Port will arrive during open water (approximately between mid-July and mid October 2015). Material, fuel and supplies required for construction and operational activities will be transported to the Mine Site year round via the Tote Road year round;
- Ongoing environmental baseline data collection and geotechnical drilling to support the construction and operation of the Project. These activities will resume, as required, at the Milne Port site, along the Tote Road, at the Mine Site, at numerous quarry sites and at other Project development areas;
- Continued environmental monitoring in accordance with the approved Project Certificate, licences, authorizations, management plans and environmental effects monitoring plans;
- Continued archaeological surveys at project component areas as required;

- Operation of the aerodrome at the Mine Site, to support year round passenger and freight service by aircraft. Adjustments to the existing aerodrome flight path to improve aviation safety and will involve the minor levelling out of two knolls within the planned flight path; and
- Continued fuel transfer from the Milne Port tank farm to the Mine Site tank farm along the Tote Road to support ongoing construction and operations activities.

# 2 SUSTAINABLE DEVELOPMENT POLICY

Baffinland
Iron Mines Corporation

## 1.0 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

## 2.0 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.

## 3.0 ENVIRONMENT

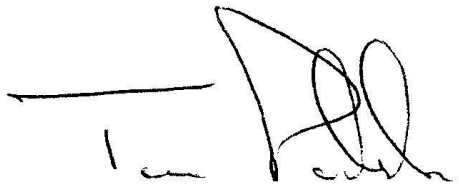
- We employ a balance of the best scientific and traditional Inuit knowledge to safeguard the environment.
- We apply the principles of pollution prevention and continuous improvement to minimize ecosystem impacts, and facilitate biodiversity conservation.
- We continuously seek to use energy, raw materials 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.

## 4.0 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.

## 5.0 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

Baffinland
Iron Mines Corporation

# Mary River Project
# Health, Safety and Environment Policy

The Baffinland Iron Mines Corporation (BIMC) Mary River Project Health, Safety and Environment Policy is a statement of our commitment to achieving a safe, healthy and environmentally responsible workplace. We will not compromise this policy for the achievement of any other organizational goal.

**The Mary River Project implements this Policy through the following commitments:**

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

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

- All injuries, occupational illnesses and environmental impacts can be prevented.
- Employee involvement and active contribution is essential and required.
- Management is responsible for preventing injuries, occupational illnesses and environmental impacts.
- Working in a manner that is healthy, safe and environmentally sound is a condition of employment.
- All operating exposures can be safeguarded.
- Training employees to work in a manner that is healthy, safe and environmentally sound is essential.
- Prevention of personal injuries, occupational illnesses and environmental impacts is good business.
- Respect for the communities in which we operate is the basis for productive relationships.

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

The Mary River Project has no higher priority than the health and safety of all people working on our behalf and the responsible management of the environment. In ensuring our overall profitability and business success every Baffinland and business partner employee working at one of our work sites is required to adhere to this policy.

Tom Peddon
President and Chief Executive Officer
March 2013

# 3 TARGETED VALUED ECOSYSTEM COMPONENTS

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

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

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

Project activities will influence surface water through the following pathways:

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

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

# 4 MITIGATION MEASURES

## 4.1 MITIGATION MEASURES FOR SEDIMENTATION AND EROSION

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

All stream and river crossings, lakes and ponds adjacent to construction zones shall receive detailed assessments to determine criticality. Subject to site-specific conditions, a variety of civil design structures shall be used to prevent erosion.

The deposition of debris or sediment into or onto any water body during the construction of access roads, site laydown pads and areas of other earthworks is prohibited. Debris shall be disposed at least 31 m away from the ordinary high-water mark to prevent it from entering a water body. In addition, material shall not be removed below the ordinary high-water mark of any water body unless otherwise approved by the NWB.

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

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

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

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

## 4.2 MITIGATION MEASURES FOR EROSION CONTROL

Table 4.1 provides sedimentation and erosion controls that may be used at Project construction zones:

**Table 4.1: Sediment and Erosion Controls**

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

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

| | |
|---|---|
| Installation Locations | Used in areas where surface water could potentially come into contact with disturbed sites causing elevated suspended solids. Typical installation locations are:<br>• Downstream of drill rigs<br>• Along roads where surface runoff is expected<br>• Surrounding stockpiles of material or drill cuttings |
| Performance Issues | Not permeable enough to be placed in streams with greater than low flow. Very difficult to anchor the base against flow. - Difficult to install due to weight and susceptibility to wind. |
| Benefits | Effective in shoreline construction work where it is used to surround the installation of the bin walls for box culvert crossings installed during open-water conditions. |
| **Diversion/Collection Channel or Berm** | |
| Description | Diversion/collection channels or berms are used to locally direct surface water runoff. Constructed using suitable materials to divert the surface water without causing erosion or suspension of additional sediment. . Additionally collection channels or berms may be constructed to collect runoff emerging from an area of soil disturbance. Also used to ensure runoff is directed to a constructed mitigation measure such as an in-ground sump. |
| Installation Locations | Used in locations where diversion and/or collection of surface water is required. Diversion structures are installed to prevent runoff from entering a site where the surface soil has been disturbed and would cause suspension of sediment. May be constructed to collect runoff emerging from an area of soil disturbance. |
| Substitute | Silt fences can be used as an alternative to constructing a channel or berm. |
| Benefits | Effective method to direct runoff to a constructed mitigation measure such as an in-ground sump. |
| **Containment Berm** | |
| Description | Constructed to establish a sump, basin or pond to contain or collect water. The sump could be used to contain discharge water to allow settling of sediment before discharge or to temporarily contain the water for re-circulation (i.e., drilling activities).<br>Constructed using native soils or acceptable man-made products which are nominally compacted to provide strength for the structure. Berm heights are minimized (typically <1 m). |
| Installation Locations | Across small valleys or around natural depressions to augment the capacity of the berms. |

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

## 4.3 STREAM CROSSINGS

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

**Table 4.2: Control Measures at Stream Crossings**

| **Pumping** | |
|---|---|
| Description | Pumps are used to transfer water from one side of the road/structure to another. |
| Installation Locations | At crossings where culverts are not installed, incorrectly installed, or not allow sufficient flow. Pumping is required prior to culvert installation for dewatering. Pumps may also be used as a temporary solution during freshet or prior to culvert installation. In addition, siphons can be used as an alternative, but require a pump to prime the system and sufficient slop between upstream and downstream locations. |
| Performance Issues | - Ineffective during high flows<br>- Erosion control measures are required as pump discharge points<br>- The associated risk of fuel spills requires secondary Containment<br>- Temporary solution requiring additional resources |
| Benefits | Effective temporary solution to lower water levels in places where water levels are high or prior to culvert installation. Also useful at low flow locations where culverts have not been installed. |
| **Culvert** | |
| Description | Pipes installed through embankments to allow the passage of water while maintaining access over the site. The size and/or number of culverts required for installation is determined by a hydraulic design study, conducted to assess suitable hydraulic design criteria to avoid flooding or washouts. Culvert flow capacities are assigned using hydraulic analysis methods assuming an appropriate return period with allowance for ice accumulation. |

| | |
|---|---|
| Installation Locations | - At points where roads intersect streams, rivers or seasonal Drainages (freshet)<br>- At locations where there is potential for water to flow over Roads |
| Performance Issues | - Potential for siltation during installation<br>- Requires labour, equipment and materials (compacted backfill) for proper installation<br>- Concentration of flows cause potential for erosion at downstream discharge points<br>- Clearing of snow and/or ice prior to spring freshet is required to minimize the potential for blockages |
| Benefits | A high flow capacities can be achieved depending on culvert selection. Culverts also permit fish passage under roads where crossings have been identified as fish habitat. |
| **French Drain** | |
| Description | 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. Also as an alternative to a culvert if pipes are not available. May be used as an alternative for a culvert if culverts are not required or available. |
| Performance Issues | Ice blockage potential in French drains has not been adequately assessed.<br>Long-term performance has not been assessed |
| Benefits | Constructed of natural local and/or local materials |
| **Bridge** | |
| Description and Installation Locations | Bridges are required for the crossing of larger streams or rivers. The installation of bridges require hydraulic design studies undertaken to evaluate suitable hydraulic design criteria to avoid flooding or any unexpected damage to the adjacent ground. Bridge locations are assessed using a river hydraulics analysis assuming an appropriate return period with an allowance for ice accumulation.<br>The identification of appropriate engineering designs for each river crossing is determined using a systematic decision making process which incorporates engineering and environmental factors at each crossing location. Screening and detailed evaluations are performed to assist in determining the most suitable site-specific crossing at each location (i.e., culvert or bridge). Criteria used to assist in the in the decision making process included: potential impacts to freshwater aquatics, hydraulic conditions and ease of construction and cost. |

## 4.4 MITIGATION MEASURES FOR FISH AND FISH HABITAT

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

### 4.4.1 FRESHET MITIGATION

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

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

### 4.4.2 FISH HABITAT PROTECTION

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

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

- Baffinland shall also engage with DFO and the QIA in exploring possible Project specific thresholds for blasting that would exceed the requirements of DFO Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters.

# 5 HYDROLOGY, WATER SUPPLY AND SURFACE WATER RUNOFF

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

## 5.1 REGIONAL LANDSCAPE

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

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

## 5.2 CLIMATE

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

closer to the 200 mm end of this range Pond Inlet experiences 24-hour darkness (with less than 2 hours of twilight) from November 12 to January 29, and continuous daylight from May 5 to August 7.

## 5.3 REGIONAL HYDROLOGY

The extreme temperatures of the region, combined with permafrost ground conditions, result in a short period of runoff that typically occurs from June to September, extending into October in watersheds with significant lake surface areas. All rivers and creeks, with perhaps the exception of the very largest systems are frozen solid to the bottom during the winter months. For example, the Sylvia Grinnell River near Iqaluit (watershed area of ~4000 $km^2$), which has been monitored by Water Survey of Canada (WSC) since 1971, freezes solid by April every year. Streams and river systems typically begin to flow in late May with the onset of snow and ice melt with peak flows in June or July with rising temperatures and rapid corresponding snowmelt, before dropping steadily through to September or October when flows essentially cease. The peak runoff period is quite short and the volume of the annual hydrograph is low, relative to the rest of Canada, due to the region's very low average annual precipitation of approximately 200 mm. However, the proportion of annual precipitation that is realized as runoff is very high, due to low temperatures (low evaporation) and the permafrost ground conditions (low infiltration) and minimal vegetative cover (low evapotranspiration). Correspondingly, surface water is abundant, and the region is dotted with thousands of small lakes and streams. Groundwater infiltration and storage in the region is limited due to the permafrost. The groundwater flow is restricted to the upper one to two metres within the summer active layer.

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

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

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

### 5.3.1 SURFACE WATER RUNOFF ESTIMATION

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

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

Hydrology data collected in 2014 (2014 Hydrometric Monitoring Program Summary, Knight Piésold, 2014) show changes in the rating curves at station H04 and H11 from the 2013 Hydrologic Data Collection Program Summary (Knight Piésold, 2014). The 2014 stage-discharge measurements at station H04 did not agree well with the previous data, suggesting that there may have been a shift in the channel control. As such, the 2014 rating curve was adjusted to accommodate the low flow measurements in 2013 and 2014. Additional measurements are required across a range of flows to further update the rating curve at station H04. All 2014 stage-discharge measurements at station H11 plotted below the existing rating curve. This suggests there may have been a shift in the downstream control since 2013. Overall, there are few manual measurements at higher stage-discharge conditions and the rating curve has been adjusted to accommodate the 2014 data. Additional measurements are required to strengthen the adjusted rating curve and validate the higher stage-discharge conditions during future monitoring programs.

As such, the Mine Site Surface Water Balance, provided in Appendix C reflects the layout as of 2014, with the mean annual unit run-off data as presented in the AFEIS, Volume 7 – *Freshwater Aquatic Environment.*

**Table 5.1: Mary River Monthly Unit Runoff Summary**

| Station | Drainage Area ($km^2$) | Unit Runoff ($l/s/km^2$) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2006 | | | | | 2007 | | | | |
| | | Jun | Jul | Aug | Sep | Oct | Jun | Jul | 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 | - | 154.4 | 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 (6SA001) | 690 | - | - | - | 20.6 | 1.4 | 9.3 | 43.5 | 15.9 | 6.8 | 0.4 |
| Ravn River (6SA002) | 8219 | - | - | - | 31.6 | 5.7 | 2.5 | 44.9 | 21.8 | 11.2 | 1.7 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Isortoq River | 7172 | - | - | - | - | 1.2 | 5.5 | 99.3 | 65.0 | 9.8 | 0.6 |
| Rowley River | 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 | Unit Runoff (l/s/km²) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2008 | | | | | 2010 | | | | |
| | | Jun | Jul | Aug | Sep | Oct | Jun | Jul | 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 | 690 | 35.5 | 59.7 | 32.2 | 17.0 | 0.8 | - | - | - | - | - |
| Ravn River (6SA002) | 8219 | 20.0 | 60.9 | 35.9 | 18.0 | 2.9 | - | - | - | - | - |
| Isortoq River | 7172 | 51.9 | 101.7 | 60.5 | 10.6 | 0.6 | - | - | - | - | - |
| Rowley River | 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 (km²) | Unit Runoff (l/s/km²) | | | | |
|---|---|---|---|---|---|---|
| | | 2011 | | | | |
| | | Jun | Jul | 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 | 690 | - | - | - | - | - |
| Ravn River (6SA002) | 8219 | - | - | - | - | - |
| Isortoq River | 7172 | - | - | - | - | - |
| Rowley River | 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 PORT

Streamflow estimates presented in this section were derived from field data collected during the 2006 to 2008 and 2010 field seasons in addition to regional data collected by Water Survey of Canada (WSC). Stream gauging station locations at Milne Port are illustrated on Figure 5.3 provided in Appendix C. The limits of the catchment areas are also provided on this drawing. A mean annual unit runoff area of 7.5 L/s/km$^2$ at Milne Port was determined by the estimated long-term mean annual runoff at streamflow gauging station H1 (Knight Piésold, 2009). The monthly flow distribution was also determined by long-term average hydrograph shape estimated at streamflow gauging station H1. Surface water runoff rates were estimated for six watersheds in the Milne Port area. These estimates are provided in Table 5.2 and catchment boundary areas are illustrated in Appendix C. Calculated runoff values indicate that runoff is negligible from October to May and the majority of runoff occurs throughout June and July.

Hydrology data collected in 2014 (2014 Hydrometric Monitoring Program Summary, Knight Piésold, 2014) show identical rating curves as in the 2013 Hydrologic Data Collection Program Summary (Knight Piésold, 2014). As such, the Milne Port Surface Water Balance, provided in Appendix C reflects the layout as of 2014, with the mean annual unit run-off data as presented in the AFEIS, Volume 7 – Freshwater Aquatic Environment.

**Table 5.2: Milne Port Estimated Catchment Runoff Rates**

| **Catchment No.** | | **MI-01** | **MI-02** | **MI-03** | **MI-04** | **MI-05** | **MI-06** |
|---|---|---|---|---|---|---|---|
| **Catchment Area (km$^2$)** | | | | | | | |
| **Mean Annual Unit Runoff (l/s/** | 0.7 | | | | | | |
| | **Runoff** | **Unit Runoff** | **Runoff Rates** | | | | |
| | **(%MAUR)** | **(l/s/ km$^2$)** | **(m$^3$/s)** | **(m$^3$/s)** | **(m$^3$/s)** | **(m$^3$/s)** | **(m$^3$/s)** | **(m$^3$/s)** |
| January | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| February | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| March | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| April | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| May | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| June | 600 | 42.0 | 0.22 | 0.15 | 0.17 | 2.62 | 0.13 | 0.33 |
| July | 335 | 23.5 | 0.12 | 0.08 | 0.10 | 1.46 | 0.07 | 0.19 |
| August | 180 | 12.6 | 0.07 | 0.05 | 0.05 | 0.79 | 0.03 | 0.10 |
| September | 80 | 5.6 | 0.03 | 0.02 | 0.02 | 0.35 | 0.0 | 0.04 |
| October | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| November | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| December | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Note:
1. The above runoff distribution was derived using data collected at hydrometric monitoring station H4. The distribution applies only to watersheds near Milne Inlet with drainage areas less than 100 $km^2$.
2. The above mean annual unit runoff was derived from data collected at hydrometric monitoring station H1, within the Phillips Creek watershed.

### 5.3.3 CATCHMENT AREAS FOR THE MILNE PORT TOTE ROAD

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

## 5.4 WATER SUPPLY

The Project fresh water requirements are detailed in Baffinland's *Freshwater Supply, Sewage and Wastewater Management Plan, issued* January 2014.

# 6 WATER MANAGEMENT – CONSTRUCTION AND OPERATION PHASES

The water management structures completed as part of the Construction Phase shall remain in operation until associated infrastructure is decommissioned, or until otherwise approved. The 2015 Work Plan allows for the provisions for construction activities to be complete at Milne Inlet, Tote Road and Mine Site, forecasted under the amended Project Certificate No. 005.

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

Site drainage drawings and water management structures have been developed for Milne Port and the Mine Site to reflect the 2015 Project Work Scope and are provided in Appendix D. The following site water balance figures have been developed and are provided in Appendix C to indicate relative flow inputs and outputs in throughout 2015 at each site:

- Mine Site Water Balance – Construction Phase; and
- Milne Port Water Balance – Construction Phase.

Due to ongoing work required throughout 2015 along the Milne Port Tote Road, water balance figures have not been developed. Upon road construction completion, water balance figures shall be developed and submitted in support of this Plan.

## 6.1 MILNE PORT

In 2015, equipment and materials will be delivered to Milne Port by conventional sealift during the open water season and transported overland by trucks to the Mine Site over the Milne Port Tote Road. The existing facilities at Milne Port will play a key logistical support role for receiving sealift materials at Milne Port destined for the Mary River Mine Site.

During the sealift, most of the activities at Milne Port will focus on unloading the barges and positioning received equipment and material in designated laydown areas. In addition, in 2015 the following construction activities will continue:

- Continue to install and commission communication and IT infrastructure;
- Continue to construct remaining earth/rock fill for laydown areas, the ore dock, ore stockpile pad runoff sedimentation collection ponds, and local site roads at Milne Port;
- Completion of the construction of the ore dock to support the ship loader and related ship loader facilities;
- Finalize assembly and installation of Shiploader 1 and Shiploader 2;
- Milne Ore Stacking, Reclaim and Ship Loader mechanical and electrical completion, commissioning and start-up;
- Install mooring buoys or dolphins as part of the ore dock construction;
- Install and commission trailers (offices, lunchrooms and washcars) including electrical and plumbing;
- Install and commission electrical power systems to the shiploader, trailers, causeway and dock including wharf lighting;
- Complete installation of buildings including maintenance building, workshop office and welding shop;
- Complete installation of power generation systems;
- Install power supply and distribution for buildings including maintenance shops and warehouses;
- If required, additional dredging to maintain the required vessel draft depths. Suitable dredged material will be used as backfill within the ore dock structure;
- Continued development of the Quarry Q1;
- Earthworks including minor pads for maintenance shop, welding shop, truck wash building, as well as additional laydown area required as storage for 2015 Sealift equipment, supplies and materials;

- Construct concrete slabs and foundations for the maintenance shop and welding shop extension;
- Construct exterior concrete foundations and sump for truck wash building;
- Commence construction of the maintenance shop, welding shop extension and truck wash facility;
- Expand the existing accommodation complex with additional 120 beds, including mine dry facilities, recreational and dining facilities;
- Temporary contractor infrastructure determined and required by construction contractors;
- Upgrade the existing sewage treatment plant;
- Modifications to increase capacity of existing potable water treatment plant; and
- Install an additional hazardous waste containment cell.

The Milne Port site layout drawing has been updated to reflect the 2015 Work Plan and has been provided Appendix B.

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

Project laydown areas shall be constructed at least 31 m above the ordinary high-water mark of any water body in order to minimize impacts on surface drainage and Water quality.

All Fuel storage, explosives storage, and hazardous substances storage will be contained within approved impermeable bermed structures (lined with geomembranes). Surface runoff from containment areas will be collected and treated if required (refer to Section 9.2).

### 6.1.1 SOIL LANDFARM AND CONTAMINATED SNOW CONTAINMENT FACILITY

A soil landfarm and contaminated snow containment facility consisting of two geomembrane lined containment cells was constructed in Milne Port in August 2014. The larger (3,383 $m^3$) west cell (landfarm) was constructed for the containment and biotreatment of hydrocarbon contaminated soil. Treated soils that meet appropriate criteria will be used as landfill cover material or other purposes only upon approval.

The smaller (929 $m^3$) east cell was constructed for the containment of hydrocarbon contaminated snow collected during the winter months for treatment during the summer months. Monitoring will be completed to ensure compliance with prescribed water quality guideline criteria (refer to Fresh Water, Sewage and Wastewater Management Plan, Oily water treatment, Attachment 5, Appendix 10D-3).

### 6.1.2 MILNE PORT STOCKPILE SETTLING PONDS

Two stockpile settling ponds were constructed in August 2014 to temporarily retain runoff water from the Milne Port stockpile area and contain the sediment load to meet the water quality standards identified in Part D, Item 16 of the Type A Water Licence. During normal operation, runoff from the stockpile area will drain to the stockpile settling ponds. The ponds are equipped with overflow weirs designed to allow the unloaded surface water to drain through a controlled discharge to Milne Inlet. The ponds were designed with sufficient retention time to ensure the sediment would gravity-settle to the bottom of the pond before the water reaches the overflow weirs.

Settling Pond No. 1 has a design storage capacity of 2,660 $m^3$ with a 0.3 m freeboard (the west pond). Settling Pond No. 2 has a design storage capacity of 2,800 $m^3$ with a 0.3 m freeboard (the east pond).

### 6.1.3 SURFACE WATER DIRECTION AND QUANTITY

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

### 6.1.4 MITIGATION MEASURES

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

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

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

## 6.2 MILNE PORT TOTE ROAD

The Milne Port Tote Road is the primary transportation route for supporting construction at the Mine Site. All equipment, material, fuel, and supplies required for Construction and Operation activities at the Mary River Mine Site will be transported from Milne Port to the Mine Site via the Tote Road. The upgrade of the road will continue throughout 2015.

During 2015 the activities associated with the upgrade to the Tote Road will include:

- Continued Improvements including realignment of the road and offsetting of some culvert crossing locations;
- Reduce maximum slopes;
- Increase turn radii;
- Increase road embankment width;
- Increase culvert capacities by means of new installations and/or culvert extensions where required;
- Crush material as required, haul, place and compact new rock fill as required;
- Installation and maintenance of erosion control measures;
- Construct ditches with rip rap as required;
- Continue development of Borrow P1. Commence development of Km 2 and Km 97 borrows (located near Km 2 and 97 of the Tote Road). Continue the development of other approved quarry and borrow sources to provide access to aggregate for upgrades and sand for winter sanding, minor fill, and maintenance and other approved construction projects. If required, commence the development of Quarries Q7, Q11, and Q19;
- Drill, blast, excavate, and cut and fill activities as required to reduce steep grades and improve curves where necessary and to improve sight distance and visibility along the road;
- Removal of the four (4) sea-can bridges (bin walls will remain in place);
- Install signs and reflective markers as required;
- Bridge maintenance as required;
- Installation of Ice road crossings adjacent to the existing bridges if needed to remove sea can bridges and/or to complete maintenance on new bridges;

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

A minimum 100 m naturally-vegetated buffer shall be maintained between the high-water mark of any fish-bearing water body and all permanent quarries along the Milne Port Tote Road to eliminate the risks of potential for acid rock drainage or metal leaching. All construction areas along the tote road will be designed and prepared such that surface water runoff is effectively channelled/diverted from these areas

to polishing ponds for collection and water quality monitoring subject to Part D, Item 16 of the Type A Water Licence, prior to its discharge to the receiving environment.

Furthermore, Construction laydown shall be constructed at 31 m from the ordinary high-water mark of any water body in order to minimize impacts on surface drainage and Water quality.

## 6.3 MARY RIVER MINE SITE

The Mary River Mine Site layout drawing has been updated to reflect the 2015 Project Work Plan and has been provided Appendix B.

The following list provides the Construction activities to be undertaken in 2015 at the Mar River Mine Site:

- Complete construction of buildings and associated equipment including maintenance shops, site services building, warehouse, waste management buildings, truck wash facilities and truck weigh scale;
- Complete internal and external fit out (electrical and mechanical) of maintenance building welding shop and warehouse;
- Install offices, lunchrooms and washcars including maintenance office/washcar and pit office/washcar;
- Complete installation of the power generating equipment and install additional generators as required;
- Complete installation of power distribution to E-houses and buildings;
- Install E-house at existing Weatherhaven camp;
- Construct hazardous waste and fuel containment berms;
- Construct roads and lay down pads;
- Construct, install and grade waste rock haul road, waste rock pad, drainage ditches and settling pond;
- Construct crusher pad settling pond;
- Complete and improve grade of the airstrip;
- Extend landfill to increase capacity based on the approved design area;
- Install approved two-50,000 L and one-75,000 L Jet-A fuel tanks at the aerodrome apron to service aircraft charters;
- Continue development of QMR2 quarry if required;
- Complete improvements to the aerodrome flight path to increase aviation safety including the leveling of knolls that are within the airstrip approach and the construction of temporary access roads

to those areas for the purpose of completing this work (refer to Appendix F of the 2015 Work Plan for details);

- Earthworks including extensions to existing accommodation pad, power generation pad and crusher pad. The expansion of the crusher pad is required to provide extra area for blending operations as well as to accommodate the second crusher train;
- Earthworks to construct pads for ore haul workshop, truck wash facility, construction office and light vehicle parking lot;
- Construct concrete slabs and foundations for the ore haul workshop and welding shop extension;
- Construct concrete foundations and sump for truck wash building;
- Commence construction of the ore haul workshop, welding shop extension and ore haul truck wash building
- Construct a detour road around the existing facilities connecting the crusher pad to the Tote road
- Expand the existing accommodation complex with additional 172 beds, including mine dry facilities, recreational and dining facilities;
- Install additional sewage treatment capacity;
- Temporary contractor infrastructure determined and required by construction contractors; and
- Complete necessary modifications to increase capacity of existing potable water treatment plant.

Additional facilities at the Mary River Mine Site may be added or decommissioned throughout the life of the Project. Surface water runoff from construction areas of intense vehicular activity is susceptible to contamination from minor spills and/or leakage of machinery and equipment. Mitigation measures identified in Section 4.0 will be implemented at these sites to divert non-contaminated surface runoff away from these areas and minimize the potential for contamination. All construction areas will be designed and prepared such that surface water runoff is effectively channelled/diverted from these areas to polishing ponds for collection and water quality monitoring subject to Part D, Item 16 of the Type A Water Licence, prior to its discharge to the receiving environment. All water discharges volumes shall be controlled by appropriate erosion prevention measures and adequate sedimentation control structures.

Furthermore, Construction laydown shall be constructed at 31 m from the ordinary high-water mark of any water body in order to minimize impacts on surface drainage and Water quality

All Fuel storage, explosives storage, and hazardous substances storage will be contained within approved impermeable bermed structures (lined with geomembranes). Surface runoff from containment areas will be collected and treated if required (refer to Section 9.2).

Stockpiles shall be located at least 31 m from the ordinary high-water mark of water bodies.

### 6.3.1 SURFACE WATER DIRECTION AND QUANTITY

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

### 6.3.2 MITIGATION MEASURES

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

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

# 7 WATER MANAGEMENT – MINING OPERATION

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

### 7.1.1 MITIGATION MEASURES

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

### 7.1.2 OPEN PIT AND ASSOCIATED FACILITIES

During Operations, the open pit and Mine site shall consist of:

- Mine haulage roads;
- Run of mine (ROM) ore stockpile;
- Ore stockpiles (lump and fines) including stacker/reclaimer system;
- Primary crusher;
- Secondary crushing;

- Explosives magazines and emulsion plant; and
- Waste rock dump.

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

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

- Maximum length: 2.0 km;
- Maximum width: 1.2 km; and
- Maximum depth: 465 m (northern side) to 195 m (southern side).

### 7.1.3 GROUNDWATER INFLOWS TO THE PIT

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

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

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

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

### 7.1.4 SURFACE WATER DIRECTION AND QUANTITY

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

## 7.2 WASTE ROCK PILE

During the ERP, it is estimated that about 2.5 Mt will be placed in the stockpile. This is reflected in a smaller waste rock storage area footprint and a new run-off collection pond to be constructed. As additional geological, geotechnical and geochemical data is collected, the waste rock management plan will be updated to identify and implement best management practices. Mining activities involving the production and handling of waste rock will shall be completed in accordance with Baffinland's Phase 1 Waste Rock Management Plan, Doc. No. BAF-PH1-830-P16-0029.

## 7.3 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 to a suitable size for transport. 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 crushers are installed inside buildings. Material handling equipment, including reclaimers, stackers and conveyors are installed outdoors. Conveyors will be enclosed 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 and appropriate sediment control structures will be installed as required. Since approved ERP crushing operations are reduced in scope from what was submitted in the initial FEIS submission, original drainage system design and sediment control structure requirements have been updated to reflect the reduced volume of ore being crushed and therefore have also been reduced in scope.

### 7.3.1 SURFACE WATER DIRECTION AND QUANTITY

The catchment areas for the stockpiles and crusher operations in the vicinity of the Mine Site are provided in the Type 'A' Water License application, Attachment 9 in the drawing titled *Mine Site Permanent Works Water Supply and Wastewater Disposal GA Plan*, Doc. No. H337697-4310-10-042-0001. Surface water

runoff in the area will be directed to a sedimentation pond where monitoring will be completed subject to Part D, Item 16 of Baffinland's Type A Water Licence prior to its release to the environment.

### 7.3.2 MITIGATION MEASURES

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

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

# 8 ENVIRONMENTAL RESPONSIBILITIES

## 8.1 ROLES AND RESPONSIBILITIES

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

### 8.1.1 ENVIRONMENTAL PROJECT TEAM

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

**Table 8.1: Baffinland Iron Mines Corporation Senior Management**

| **Baffinland Iron Mines Corporation Senior Management** | |
|---|---|
| Position | Responsibilities and Accountabilities |
| Project Director | - Reports to Baffinland's CEO<br>- Overall accountability for the Project execution<br>- Allocation of resources (human and financial) for the implementation of Baffinland's commitments and objectives related to health, safety and environment during construction of the Project<br>- Accountable for on-site environmental, health and safety performance during construction of the Project |
| VP Operations | - Reports to Baffinland's CEO<br>- Overall accountability for the operation of the Project<br>- Allocation of resources (human and financial) for the implementation of Baffinland's commitments and objectives related to health, safety and environment during operation<br>- Accountable for on-site environmental, health and safety performance during operation |

| Baffinland Iron Mines Corporation Senior Management | |
|---|---|
| Position | Responsibilities and Accountabilities |
| VP Sustainable Development, Health, Safety and Environment | - Reports to Baffinland's CEO<br>- Establish corporate environmental policies and objectives<br>- Monitors and reports on Baffinland's performance related to environmental, health and safety policies and objectives<br>- Community liaison<br>- Liaise with regulatory authorities<br>- Obtains necessary permits and authorizations<br>- Monitors compliance with terms and conditions of permits and licences<br>- Routine EHS audit of contractor performance while on site |
| Manager Purchasing and Contract | - Reports to Baffinland's Project Director<br>- Accountable for procurement and purchasing<br>- Ensure that environmental commitments, policies and objectives are included in all contract documents |
| VP Corporate Affairs | - Reports to Baffinland's CEO<br>- Accountable for external communication (Governments, media, NGO, others) related to Baffinland's press release and overall communication of site incidents/events |

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

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

| Baffinland Iron Mines Corporation On-Site Environmental Team | |
|---|---|
| Position | Responsibilities and Accountabilities |
| Environmental Manager | - Reports directly to VP Sustainable Development, Health, Safety and Environment and Indirect reporting and coordination with Operations VP and Director Environment<br>- Overall accountability for environmental staff and performance at site<br>- Coordinates implementation and monitors the performance of the Environmental Management System at site<br>- Liaises with the senior management, regulators and stakeholders<br>- Ensures effective monitoring and auditing of environmental performance of departments and contractors on site and identifies opportunities for improvement<br>- Monitors compliance with permits, licenses and authorizations<br>- Ensures all regulatory environmental monitoring and reporting requirements (monthly, annual) are met<br>- Leads and coordinates site permitting requirements.<br>- Initiates and oversees environmental studies |

| Baffinland Iron Mines Corporation On-Site Environmental Team | |
|---|---|
| Position | Responsibilities and Accountabilities |
| | - Oversees investigations and reporting of environmental incidents to regulatory bodies, stakeholders and senior management<br>- Reviews and updates environmental management plans |
| Environmental Superintendent | - Reports to Environmental Manager<br>- Specific accountabilities for environmental monitoring and reporting<br>- Leads investigations and reporting of environmental incidents onsite<br>- Serves as the liaison for regulators during onsite inspections and visits<br>- Provides ongoing environmental education and environmental awareness training to all employees and contract workers<br>- Oversees environmental database management<br>- Prepares updates for management plans |
| Environmental Coordinator | - Reports to the Environmental Superintendent and Manager<br>- Specific accountabilities for environmental monitoring and reporting<br>- Provides day to day direction to Environmental staff onsite<br>- Serves as a liaison for regulators during onsite inspections and visits.<br>- Provides ongoing environmental education and environmental awareness training to all employees and contract workers<br>- Assists with environmental database management |
| Environmental Advisor | - Reports to the Environmental Superintendent and Manager<br>- Specific accountabilities for environmental monitoring and reporting<br>- Assists with environmental database management<br>- Prepare updates for management plans |
| Environmental Monitor and Technician | - Reports to the Environmental Superintendent or designate<br>- Assists with environmental database management<br>- Assists with monitoring and sampling activities as per the Project's management plans |
| QIA Monitor | - Works alongside the Baffinland Environment Department to ensure the proper implementation of all environmental management and monitoring plans<br>- Acts as the QIA liaison for onsite environmental matters |
| Environmental Support Groups (Consultants, etc.) | - Assists with sampling, monitoring and reporting activities as required by permits, licenses and environmental management plans<br>- Provides technical expertise to various environmental studies |

### 8.1.2 MARY RIVER PROJECT ORGANIZATION CHART

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

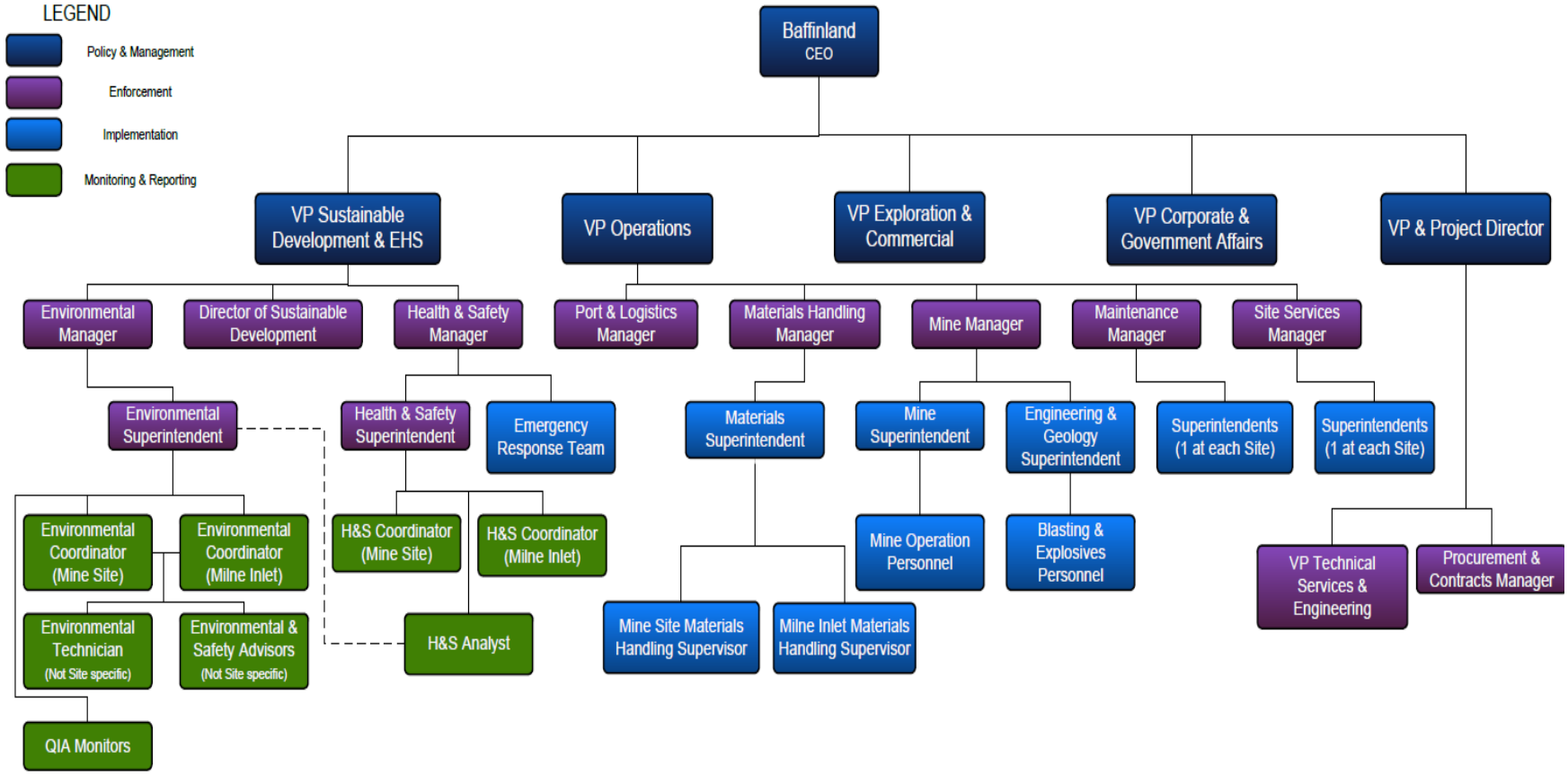



**Figure 8.1: Mary River Organizational Chart**

## 8.2 MONITORING AND INSPECTIONS

Monitoring and reporting requirements are provided in Section 9 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

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

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

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

# 9 MONITORING AND REPORTING REQUIREMENTS

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

## 9.1 ROUTINE INSPECTIONS

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

**Table 9.1: Routine Inspections and Monitoring Requirements**

| Site | Routine Inspections |
|---|---|
| Milne Port<br>Mine Site | - Water management systems<br>- Sediment and erosion control structures |

| Site | Routine Inspections | | |
|---|---|---|---|
| Tote Road and Refuge Stations | - Evidence of hydrocarbon staining or leaks from containment devices<br>- Full-time supervision of fuel transfer operations<br>- Water intakes<br>- Flow meter readings<br>- Rutting by vehicles | | |
| Milne Port | - Sediment and erosion control structures<br>- Fuel leaks<br>- Drip Pans and Equipment condition<br>- Any rutting by vehicles | | |
| Soil Deposit Locations<br>Tunnelling Locations | - Sediment and erosion control structures<br>- Evidence of hydrocarbon staining or leaks from containment devices<br>- Fuel leaks<br>- Drip Pans and Equipment condition<br>- Rutting by vehicles | | |
| Borrow Sites<br>Quarries | - Evidence of hydrocarbon staining or leaks from containment devices<br>- Full-time supervision of fuel transfer operations<br>- Sediment and erosion control structures<br>- Drip Pans and Equipment condition | | |
| Drill Sites | *Pre-Drilling* | *Drilling Period* | *Post-Drilling* |
| | - Drill hole coordinates<br>- Water source coordinates<br>- Site photo<br>- Water source photo<br>- Distance to nearest water source<br>- Archaeological approval<br>- Wildlife survey | - Fuel leaks<br>- Sediment and erosion control structures<br>- Drip Pans<br>- Equipment condition<br>- Any rutting by vehicles<br>- Water intake<br>- Water management<br>- Flow meter reading | - Fuel leaks<br>- Sediment and erosion control structures<br>- Drip Pans<br>- Equipment condition<br>- Any rutting by vehicles<br>- Water intake<br>- Water management<br>- Flow meter reading<br>- Environmental concerns<br>- Wildlife concerns |
| Waste Rock Stockpile | - Sediment and erosion control structures<br>- Evidence of hydrocarbon staining or leaks from containment devices<br>- Evidence of ARD and ML<br>- Drip Pans<br>- Equipment condition | | |
| Bulk Fuel Storage Areas<br>Milne Port<br>Mary River | - Primary containment structure<br>- Evidence of hydrocarbon staining or leaks from containment devices<br>- Equipment condition<br>- Spill kits | | |
| Explosives Storage Areas<br>Mary River | - Primary containment structure<br>- Access and security | | |

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

Permafrost integrity shall be monitored at areas affected by project activities and infrastructure. Preventative measures shall be undertaken to ensure that the integrity of the permafrost is maintained.

## 9.2 WATER QUALITY AND QUANTITY MONITORING

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

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

Where flow may directly or indirectly enter a Water body, Baffinland shall sampled all surface runoff during the Construction Phase of the Project weekly to ensure that concentrations for the parameters provided in Table 9.2 fall below the prescribed effluent quality limits.

**Table 9.2: Effluent Quality Limits for Surface Runoff during Construction**

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

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

### 9.2.1 MONITORING STATIONS

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

**Table 9.3: Milne Port Water Quality Monitoring Locations**

| Station | Description | UTM Coordinates (NAD83) | | Longitude | Latitude |
|---|---|---|---|---|---|
| | | Easting | Northing | | |
| MP-03 | Milne Port Bulk Fuel Storage Facility Stormwater - No Flow | 503,641 | 7,976,288 | 71° 53' 12" N | 80° 53' 42" W |
| MP-04 | Milne Port Landfarm Facility Storm water - Landfarm comissioned in 2014 monitoring to commence in 2015 | 503,748 | 7,975,544 | 71° 52' 48" N | 80° 53' 31" W |
| MP-MRY-12 | Bulk Sample Stockpile Area Seepage - Inactive | 503,357 | 7,976,453 | 71° 53' 17" N | 80° 54' 11" W |
| Surface discharge downstream of construction area at Milne Port | | | | | |
| MP-C-A | Inactive in 2014 | 503,214 | 7,976,483 | 71° 53' 18" N | 80° 54' 27" W |
| MP-C-B | | 503, 191 | 7,975,396 | 71° 52' 43" N | 80° 54' 29" W |
| MP-C-B01 | Added in 2015 | | | | |
| MP-C-C | Inactive in 2014 | 503,436 | 7,975,427 | 71° 52' 44" N | 80° 54' 03.7" W |
| MP-C-D | Inactive in 2014 | 503,651 | 7,976,363 | 71° 53' 14" N | 80° 53' 41" W |
| MP-C-E | Inactive in 2014 | 503,736 | 7,976,346 | 71° 53' 13.7" N | 80° 53' 32.4" W |
| MP-C-F | Inactive in 2014 | 503,922 | 7,976,304 | 71° 53' 12" N | 80° 53' 13" W |
| MP-C-G | Inactive in 2014 | 503,006 | 7,976,484 | 71° 53' 18.2" N | 80° 54' 48.1" W |
| MP-C-H | | 504,113 | 7,976,509 | 71° 53' 18.9" N | 80° 52' 53.2" W |
| Surface Runoff and or Discharge Quarries | | | | | |
| MP-Q1-01 | | 503,828 | 7,975,062 | 71° 52' 32" N | 80° 53' 23" W |
| MP-Q1-02 | | 503,811 | 7,975, 272 | 71° 52' 39" N | 80° 53' 25" W |

**Table 9.4: Mary River Mine Site Water Quality Monitoring Locations**

| Station | Description | UTM Coordinates (NAD83) | | Longitude | Latitude |
|---|---|---|---|---|---|
| | | Easting | Northing | | |
| MS-03 | Mine Site Bulk Fuel Storage Facility Stormwater | 561,182 | 7,913,322 | 71° 18' 52" N | 79° 17' 19" W |
| MS-04 | Mine Site Fuel Unloading Station Stormwater | 561,264 | 7,913,267 | 71° 52' 48" N | 79° 17' 11" W |
| MS-05 | Mine Site Landfarm Facility Stormwater | Facility not yet constructed. Final monitoring location to be determined in cooperation with Inspectors. | | | |
| MS-MRY-6 | Exploration Camp Bulk Fuel Storage Facility (Bladder Farm) Stormwater | 558,186 | 7,914,780 | 71° 19' 41" N | 79° 22' 17" W |
| MS-06 | Ore Stockpile Pond Stormwater | Facility not yet constructed. Final monitoring location to be determined in cooperation with Inspectors. | | | |
| MS-07 | Run of Mine Ore Stockpile Pond Stormwater | Facility not yet constructed. Final monitoring location to be determined in cooperation with Inspectors. | | | |
| MS-08 | Waste Rock Stockpile West pond | Facility not yet constructed. Final monitoring location to be determined in cooperation with Inspectors. | | | |
| MS-09 | Waste Rock Stockpile East pond | Facility not yet constructed. Final monitoring location to be determined in cooperation with Inspectors. | | | |
| MS-MRY-9 | Bulk Sample Open Pit - Surface water drainage (to become inactive in future) | 563,246 | 7,914,632 | 71° 19' 32" N | 79° 13' 48" W |
| MS-MRY-10 | Bulk Sample Weathered Ore Stockpile - Downstream surface water drainage (to become inactive in the future) | 563,488 | 7,915,187 | 71° 19' 50" N | 79° 13' 22" W |
| MRY-11 | Bulk Sample Processing - Downstream surface water discharge (to become inactive in the future) | 560,690 | 7,913,350 | 71° 18' 53" N | 79° 18' 09" W |

| Station | Description | UTM Coordinates (NAD83) | | Longitude | Latitude |
|---|---|---|---|---|---|
| | | Easting | Northing | | |
| MS-MRY-13a & MS-MRY-13b | Non-Hazardous Waste Landfill - Downstream surface water drainage | 13a: 560,754<br>13b: 560,642 | 13a:7,912,484<br>13b:7,912,527 | 13a:71° 18' 25" N<br>13b:79° 18' 26.5" N | 13a:79° 18' 5" W<br>13b: 79° 18' 16.1" W |
| MS-C-A | Surface discharge downstream of construction area at Mine Site | 561,263 | 7,913,571 | 71° 18' 59.6"N | 79° 17' 10.7" W |
| MS-C-B | | 561,454 | 7,913,537 | 71° 18' 58"N | 79° 16' 52" W |
| MS-C-C | | 561,110 | 7,913,199 | 71° 18' 48"N | 79° 17' 27" W |
| MS-C-D | | 561,008 | 7,913,280 | 71° 18' 50"N | 79° 17' 37" W |
| MS-C-E | | 560,980 | 7,913,388 | 71° 18' 54"N | 79° 17' 40" W |
| MS-C-F | | 561,797 | 7,913,278 | 71° 18' 49'' N | 79° 16' 17.8'' W |
| MQ-C-B | Surface Runoff and or Discharge Quarries | 560,083 | 7,913,905 | 71° 19' 11.4'' N | 79° 19' 09'' N |
| MQ-C-D | | 559,447 | 7,914,258 | 71° 19' 23.4'' N | 71° 20' 12'' N |

### 9.2.2 OPPORTUNISTIC MONITORING

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

### 9.2.3 GROUNDWATER MONITORING

Shallow groundwater monitoring stations shall be installed downstream of Project select infrastructure (i.e., landfill, landfarm, etc.) where environmental risks have been identified. Samples shall be collected from locations less than two meters down grade. Initial in-house field parameters shall be conducted prior to sending each sample out for external analyses, depending on location and potential contaminants. Samples shall be collected once per year during the period of greatest active zone thickness (late August). Standard well installation monitoring and sampling methods shall follow. The groundwater monitoring network will be established and monitors installed in late August of 2015. A terms of reference for a shallow groundwater study shall be submitted to the NWB for review and comment prior to implementation.

### 9.2.4 MONITORING AT PROJECT QUARRIES AND BORROW PITS

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

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

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

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

**Table 9.5: Effluent Quality Limits for Surface Runoff during Construction**

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

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

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

# 10 DATA MANAGEMENT AND REPORTING

## 10.1 DATA MANAGEMENT

The Environmental Manager is responsible for data management and reporting related to water and waste management. The data management system includes conducting routine inspections and

monitoring, and forwarding results to appropriate parties as prescribed by Baffinland's applicable approvals, permits and authorizations.

## 10.2 WATER LICENCE REPORTING

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

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

## 10.3 STAKEHOLDER REPORTING

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

# Appendix A -
# Table of Concordance
# NIRB Project Certificate
# Type A Water License (2AM-MRY1325)

**Type A water License Terms and Conditions**

Table A-1 provides the Part, number and Type A water License (Water Licence No: 2AM-MRY1325) Condition with the corresponding location where the condition is located within the Surface Water and Aquatic Ecosystems Management Plan (Rev. 03, *issued* March 31, 2015).

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

| Part | Number | Condition | Section |
|---|---|---|---|
| B | 15c | The Licensee shall update and revise, for submission to the Board for review, within sixty (60) days of issuance of this Licence, the following management plans. The updates are to take into account commitments made with respect to submissions received during the preliminary and technical review of the Application documents, as well as final submissions and issues raised during the Public Hearing Process, where applicable. Baffinland Iron Mines Corporation Mary River Project Attachment 5: Surface Water and Aquatic Ecosystems Management Plan dated March 2013. | This Plan supersedes the preceding revision (Rev. 02), *issued* March 31, 2014. |
| B | 18 | The Licensee shall review the Plans or Manuals referred to in this Licence as required by changes in operation and/or technology and modify the Plans or Manuals accordingly. Revisions to the Plans or Manuals are to be submitted in the form of an Addendum to be included with the Annual Report required by Part B, Item 4, complete with a revisions list detailing where significant content changes are made. | This Plan has been updated to reflect the 2015 Work Scope and where necessary, significant changes |
| D | 2 | The Licensee shall submit to the Board for review and acceptance, at least sixty (60) days prior to construction or in a timeframe otherwise approved by the Board in writing, final design and for-construction drawings, stamped and signed by a Professional Engineer, for all infrastructure and/or facilities designed to contain, withhold, divert or retain Water and/or Waste including the following:<br>- Bulk Fuel Storage Facilities<br>- Explosives Facilities<br>- Incineration Systems<br>- Landfarm Facility<br>- Oily Water and/or Wastewater treatment Facilities<br>- Sewage Treatment Facilities<br>- Site Drainage and Surface Water Management Systems<br>- Waste Management Facilities (including temporary and permanent structure for hazardous and non-hazardous waste)<br>- Water Supply Facilities<br>- Water crossings including, pipelines, bridges, and roads<br>- Water course training, flood control, diversions | 6<br>(60 days prior to construction<br>If more immediate timeline required, will issue letter to NWB with early drawings) |

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

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

**Project Certificate Terms and Conditions**

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

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

Hydrology and Hydrogeology

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

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

Groundwater and Surface Waters

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

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

| No. | Term and Condition | Comments |
|---|---|---|
| | | No. H349000-1000-07-126-0013. |
| 45 | The Proponent shall adhere to the No-Net-Loss principle at all phases of the project to prevent or mitigate direct or indirect fish and fish habitat losses. | Refer to Section 4.4 |
| 46 | The Proponent shall ensure that runoff from fuel storage and maintenance facility areas, sewage and wastewater other facilities responsible for generating liquid effluent and runoff meet discharge requirements. | Refer to Section 9.2, the Site Drainage Plans and Monitoring Locations (Appendix D) FEIS - Appendix 10D-12 – Environmental Monitoring Plan (dated January 2012). |
| 47 | The Proponent shall ensure that all Project infrastructure in watercourses are designed and constructed in such a manner that they do not unduly prevent and limit the movement of water in fish bearing streams and rivers. | Refer to section 4.1 and 4.4 |
| 48 | The Proponent shall engage with Fisheries and Oceans Canada and the Qikiqtani Inuit Association in exploring possible Project specific thresholds for blasting that would exceed the requirements of Fisheries and Oceans Canada's Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (D.G. Wright and G.E. Hopky, 1998). | Refer to Section 4.4.2<br>Refer to Borrow Pit and Quarry Management Plan – Doc. No. BAF-PH1-830-P16-0004 and Quarry Management Plan – Milne Inlet Quarry Q1 – Doc. No. H349000-1000-07-126-0013. |

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

Appendix A to NIRB Decision Report

| No. | Subject | Commitment | Action |
|---|---|---|---|
| **6** | Environmental Design (Contact Water) | Baffinland is committed to collecting and treating, if required, contact water generated from mining activities to ensure that relevant effluent criteria are met as established in the water licence. | Refer to section 6 |
| 40 | Monitoring (Abandonment and Restoration) | Baffinland is committed to undertaking environmental effects monitoring during the mine life mine as well as after closure. | Addressed in Abandonment and Reclamation Plan |
| 57 | Management Plans | Baffinland is committed to updating its management plans to reflect new information, new practices and changes to operating conditions. | This Plan has been updated to reflect the 2014 Work Scope and where required, significant project modifications. It has been issued for use on March 31, 2014. |

| | | | |
|---|---|---|---|
| 66 | Monitoring | Baffinland is committed to the development and implementation of a monitoring program during the construction and other phases of the Mary River Project. | This management plan addressed the Surface Water and Aquatic Ecosystems components. Refer to Section 9 and AFEIS - Appendix 10D-12 – Environmental Monitoring Plan (dated January 2012). |

# Appendix B -
# 2015 Work Plan and Site Layout Drawings

H349000-2000-00-015-0021

MILNE INLET

AANDC NUNAVUT LEASE 47H/16-1-2

SHIPLOADER

ORE DOCK

MOORING BUOY

SEALIFT BARGE LANDING AREA

RAMP TO BEACH

LAYDOWN AREA

FUEL TANK FARM

ORE STOCKPILE SETTLING PONDS

EFFLUENT DISCHARGE LOCATION
N 7976341
E 503639

HAZARDOUS WASTE BERMS

LAYDOWN AREA

EXISTING HTO CABIN

FUTURE AIRSTRIP

SERVICES AREA PAD
SITE FACILITIES, INCLUDING:

- MAINTENANCE BUILDING x 2
- EXTEND WELDING SHOP BUILDING
- WORKSHOP OFFICE BUILDING
- TOROMONT MAINTENANCE BUILDING
- TRUCKWASH

POWER GENERATORS

INCINERATOR HAZARDOUS WASTE BERM

POLISHING WASTE STABILIZATION POND

ORE STOCKPILE PAD

EXISTING HAZARDOUS WASTE BERM

CAMP INFRASTRUCTURE PAD
SITE FACILITIES, INCLUDING:

- EXTEND ACCOMMODATION COMPLEX
- EMERGENCY RESPONSE OFFICE
- EMERGENCY RESPONSE GARAGE
- UPGRADE SEWAGE TREATMENT PLANT
- UPGRADE POTABLE WATER TREATMENT PLANT
- WASTE MANAGEMENT FACILITY

MATRIX CAMP

TRAILER CAMP TO BE REMOVED 2015

ADDITIONAL LAYDOWN AREA

LAND FARM

ROCK QUARRY N0.1 BOUNDARY

PHILLIPS CREEK

POTABLE WATER SUPPLY

CONCRETE BATCH PLANT , CRUSHER AND STOCKPILE

FUTURE POLISHING WASTE STABILIZATION POND

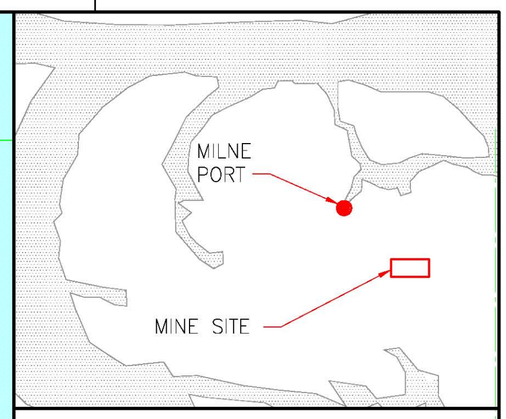
TOTE ROAD

EXTENT OF QUARRY Q1

PERMITTED OPEN BURN PIT AREA

KM2 PLANNED BORROW AREAS

KEYPLAN




FOR INFORMATION

NOTES:

1. TOPOGRAPHY PROVIDED BY TERRAPOINT CANADA INC.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. DRAINAGE WILL BE DIVERTED AROUND NEW LAYDOWN AREAS AND PADS.

0 50 100 150 200 250
SCALE IN METRES

LEGEND:

- WATER
- QUARRY
- COMMERCIAL LEASE
- AANDC LEASE 47H/16-1-2
- RIVER/STREAM/DRAINAGE
- ROAD
- PROJECT DEVELOPMENT AREA
- PLANNED BORROW AREAS

| REV. | ISSUE FOR | AUTH. BY | DATE |
|---|---|---|---|
| C | ISSUE FOR USE | S.M. | T.M. 2014-12-10 |
| B | ISSUE FOR USE | C.L. | T.M. 2014-10-31 |
| A | ISSUE FOR USE | C.L. | A.G. 2014-06-19 |

ISSUE AUTHORIZATION

HATCH™

| | |
|---|---|
| DESIGNED BY C. LEISTNER DATE 2014-10-20 | DRAWN BY J. BAJAGIC DATE 2014-10-20 |
| CHECKED BY S. POTTER DATE 2014-10-20 | DISCIP. ENGR. A. GRZEGORCZYK DATE 2014-10-20 |
| PROJ. DES. COORD. T. THERTELL DATE 2014-10-20 | PROJ. ENGR. J. CLELAND DATE 2014-06-19 |
| PROJ. MGR. J. CLELAND DATE 2014-06-19 | |

Baffinland

MARY RIVER PROJECT

MILNE PORT
INFRASTRUCTURE FOOTPRINT
WORK PLAN 2015

SCALE 1:5000 OR AS NOTED

DWG. NO. H349000-2000-00-015-0021

REV. C

DWG. NO. H349000-4000-00-015-0021

TOM RIVER

KNOLLS TO BE REMOVED FOR AVIATION SAFETY

STORAGE AREA

HAZARDOUS WASTE CONTAINMENT BERM (EXISTING)

BARRELED FUEL LINED CONTAINMENT

WASTE MANAGEMENT BUILDING

HAZARDOUS WASTE CONTAINMENT AREA NEW

LAYDOWN AREA

CONCRETE BATCH PLANT

RAW WATER PUMP HOUSE

WAREHOUSE

QUARRY QMR2

RAW WATER INTAKE PIPELINE

CONSTRUCTION LAYDOWN AREA

CAMP LAKE

Km 97 BORROW SOURCE

EXPLORATION TENT CAMP

EXPLORATION SOFT-WALL CAMP

HELIPAD

EXISTING POLISHING WASTE STABILIZATION PONDS (PWSPs)

RAW WATER INTAKE PIPELINE

WASTE WATER TREATMENT FACILITY

EXPLORATION WORKSHOPS

AERODROME APRON AND FUEL STORAGE

AERODROME RUNWAY

EXPLORATION CAMP SEWAGE PIPELINE

SHEARDOWN NW LAKE

UTILITIES, INCLUDING:

- UPGRADE POWER GENERATION MODULE (B)
- SEWAGE TREATMENT PLANT (B)
- UPGRADE POTABLE WATER TREATMENT PLANT (B)
- BULK FUEL STORAGE FACILITY

LANDFILL AND LANDFARM

EMULSION PLANT

ORE CRUSHING SEDIMENTATION POND

EFFLUENT DISCHARGE POINTS No.1, No.2 & No.3

WASTE ROCK DUMP BOUNDARY AT THE END OF OPERATION

FUTURE WASTE ROCK SEDIMENTATION POND

FUTURE WASTE ROCK DUMP

DEPOSIT NO.1 MINING LEASE 2484

PROPOSED OPEN PIT OUTLINE

OPEN PIT DEVELOPMENT

CAMP INFRASTRUCTURE:

- EXTEND ACCOMMODATION COMPLEX (B)
- EMERGENCY RESPONSE
- MEDICAL CENTRE

PIT OFFICE

QUARRY D1Q1

SITE SERVICE FACILITIES, INCLUDING:

- MAINTENANCE BUILDING
- WELDING SHOP
- TRUCKWASH (B)
- TOROMONT BUILDING
- ORE HAUL WORKSHOP (B)
- ORE HAUL TRUCKWASH (B)

QUARRY D1Q2

TRUCK WEIGH SCALE BUILDING

PIT 1 HAUL ROAD

KM 104 QUARRY

EXPLOSIVE MAGAZINE

EXTEND ORE CRUSHING AND LOADING PADS

MARY RIVER

0 200 400 600 800 1000

SCALE IN METRES

MILNE PORT

MINE SITE

KEYPLAN

FOR INFORMATION

NOTES:

1. TOPOGRAPHY PROVIDED BY TERRAPOINT CANADA INC.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. DRAINAGE WILL BE DIVERTED AROUND NEW LAYDOWN AREAS AND PADS.

LEGEND:

- WATER
- QUARRY
- ROAD
- PLANNED BORROW AREA
- EXISTING ROCK QUARRY
- RIVER/STREAM/DRAINAGE
- RAW WATER INTAKE PIPELINE
- COMMERCIAL LEASE
- PROJECT DEVELOPMENT AREA

| REV. | ISSUE FOR | AUTH. BY | DATE |
|---|---|---|---|
| B | ISSUE FOR USE | S.M. | T.M. 2014-12-10 |
| A | ISSUE FOR USE | C.L. | A.G. 2014-10-31 |

ISSUE AUTHORIZATION

HATCH™

| | |
|---|---|
| DESIGNED BY C. LEISTNER DATE 2014-10-21 | DRAWN BY J. BAJAGIC DATE 2014-10-21 |
| CHECKED BY S. POTTER DATE 2014-10-21 | DISCIP. ENGR. A. GRZEGORCZYK DATE 2014-10-21 |
| PROJ. DES. COORD. T. THERTELL DATE 2014-10-21 | PROJ. ENGR. J. CLELAND DATE 2014-10-21 |
| PROJ. MGR. J. CLELAND DATE 2014-10-21 | |

Baffinland

MARY RIVER PROJECT

MINE SITE
INFRASTRUCTURE FOOTPRINT
WORK PLAN 2015

SCALE 1:15000 OR AS NOTED

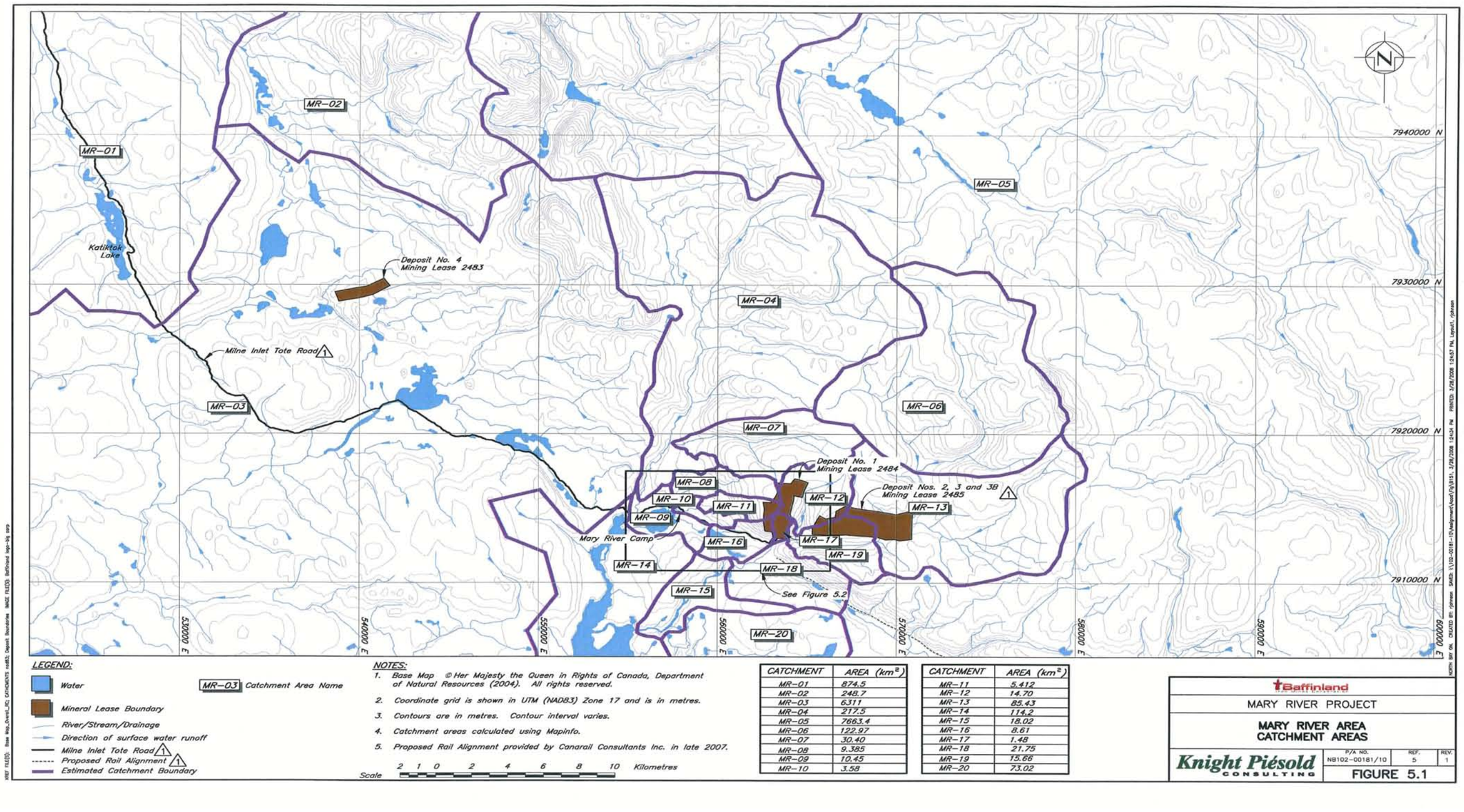
DWG. NO. H349000-4000-00-015-0021

REV. B

ORIGINAL SHEET SIZE: ISO A1 (841 x 594)

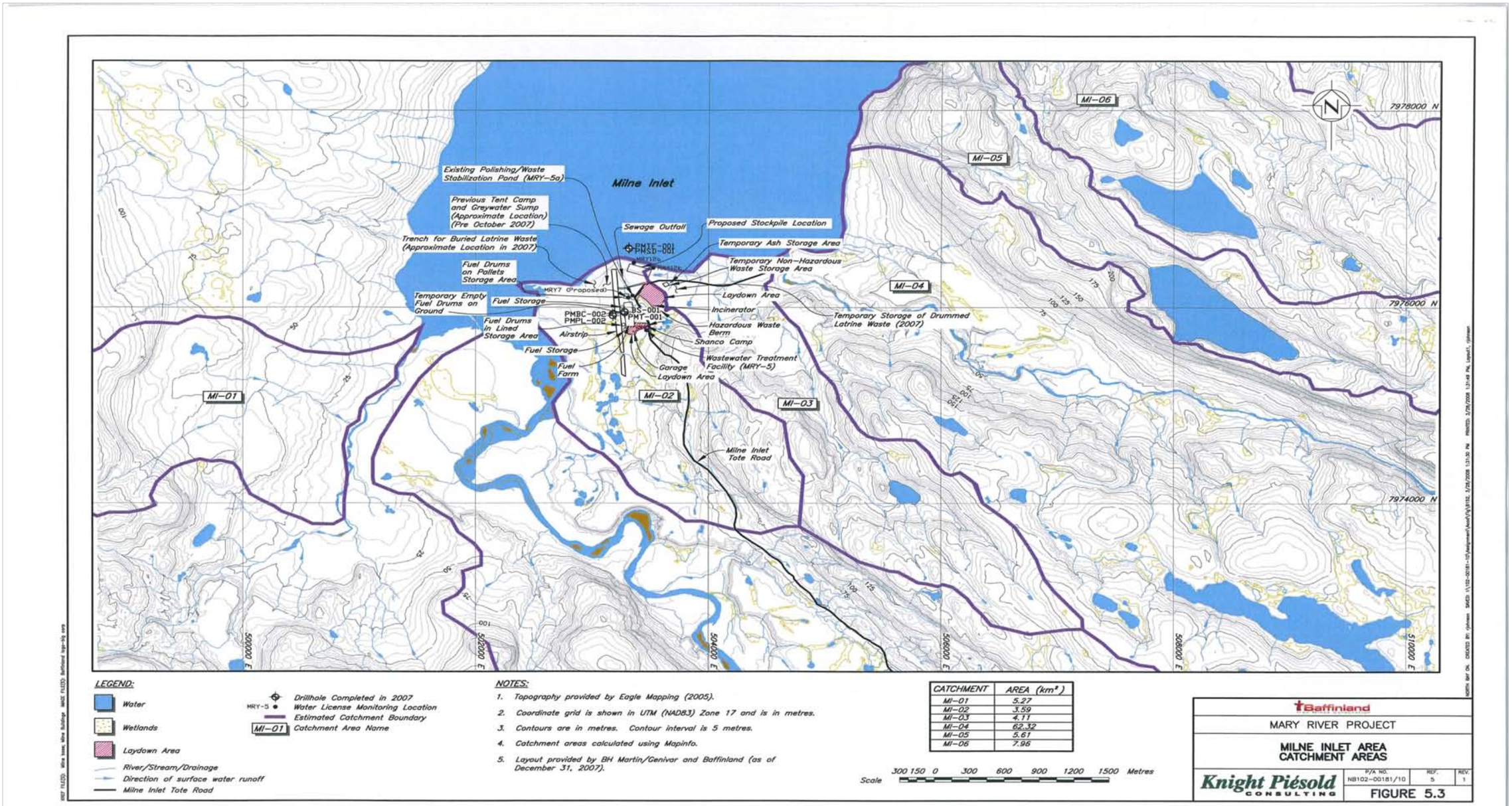
DCUN46272, 2014-10-21 4:35:19 PM, C:\prj\project\wide\dcun46272.dms88860\H349000-4000-00-015-0021.dgn

# Appendix C -
# Site Water Balances and Catchment Areas




| 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
- MRY-5 ● Drillhole Completed in 2007
- 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 (km²) |
|---|---|
| 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

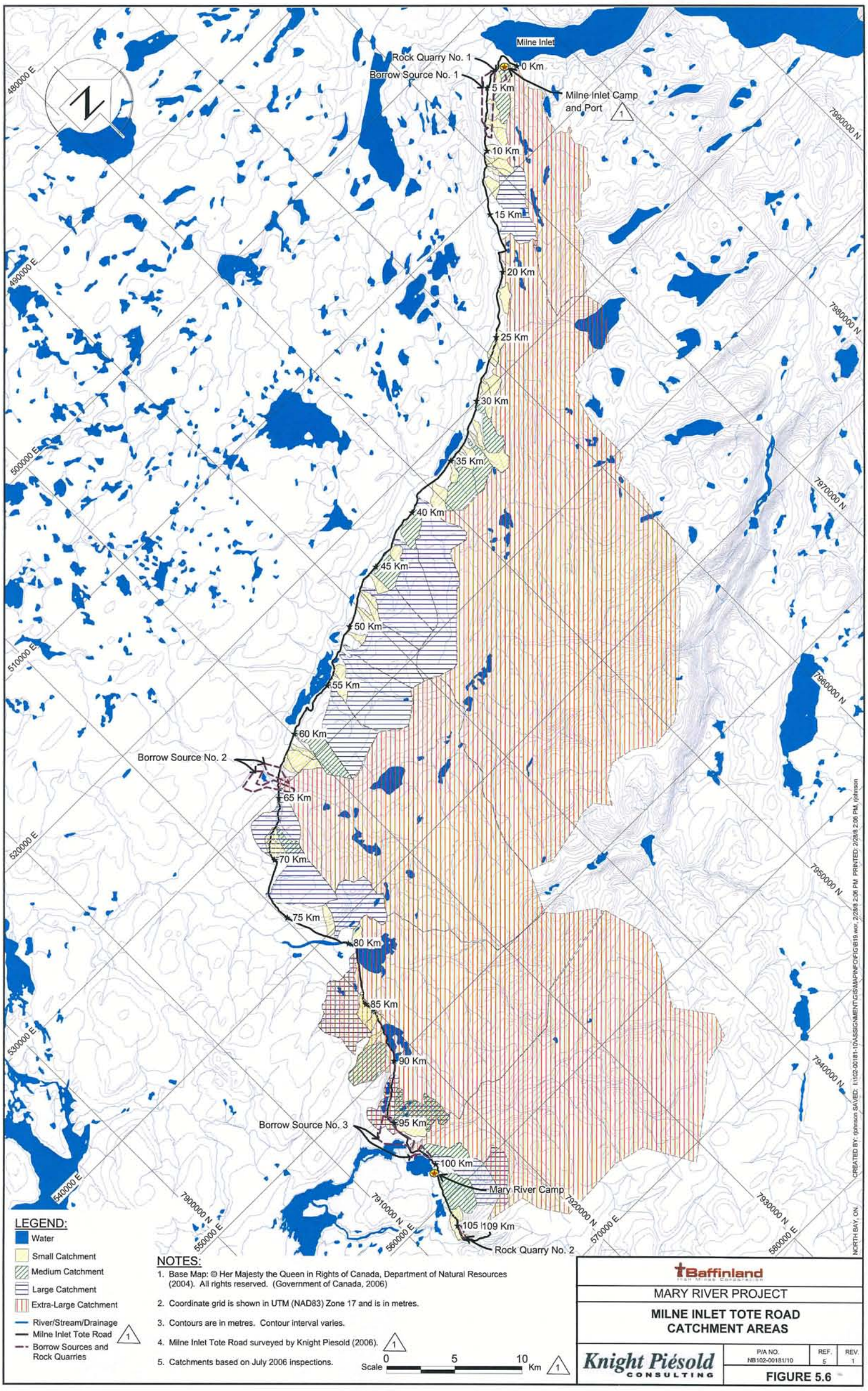
MARY RIVER PROJECT

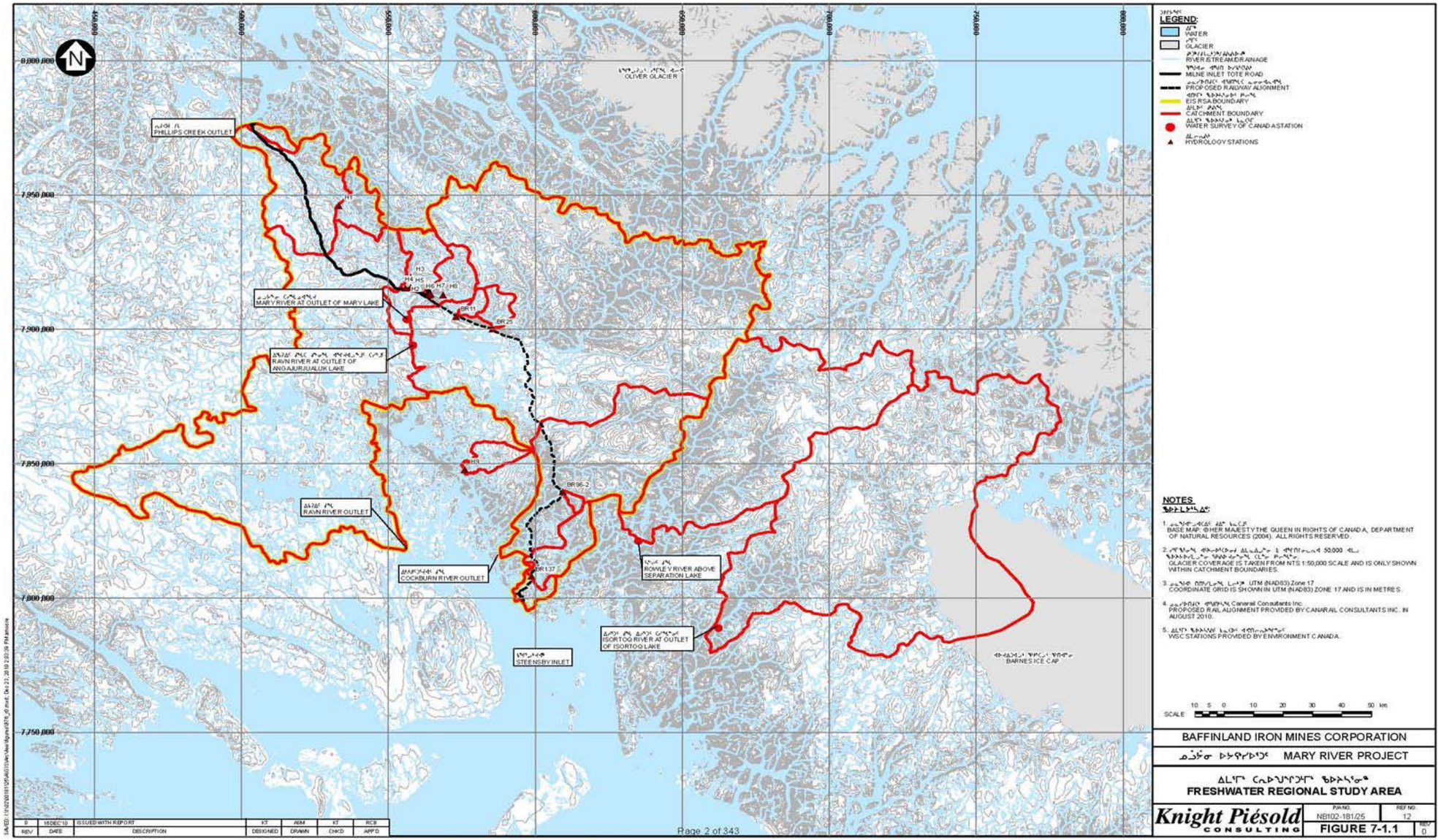
MILNE INLET AREA CATCHMENT AREAS

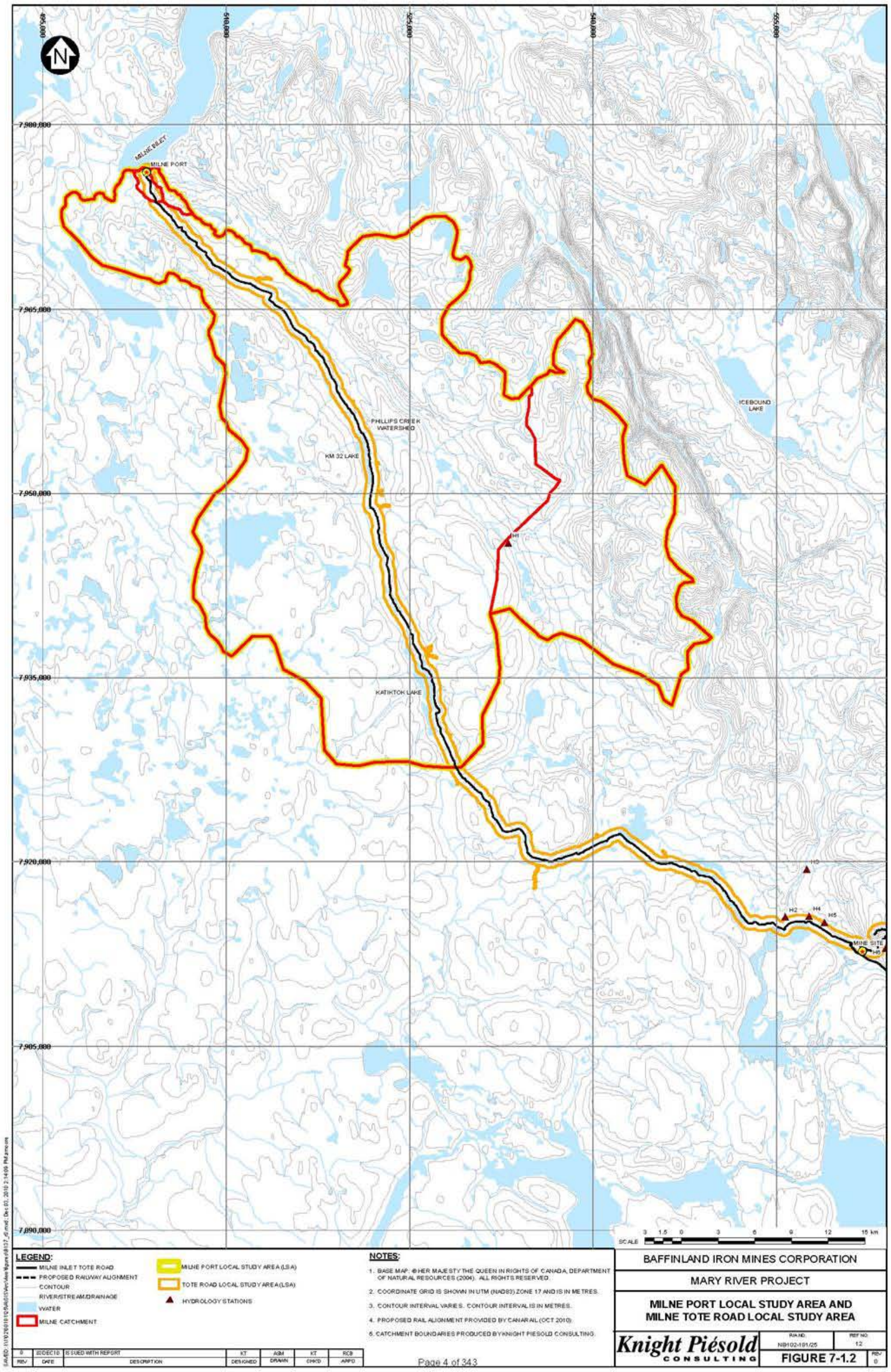
Knight Piésold CONSULTING

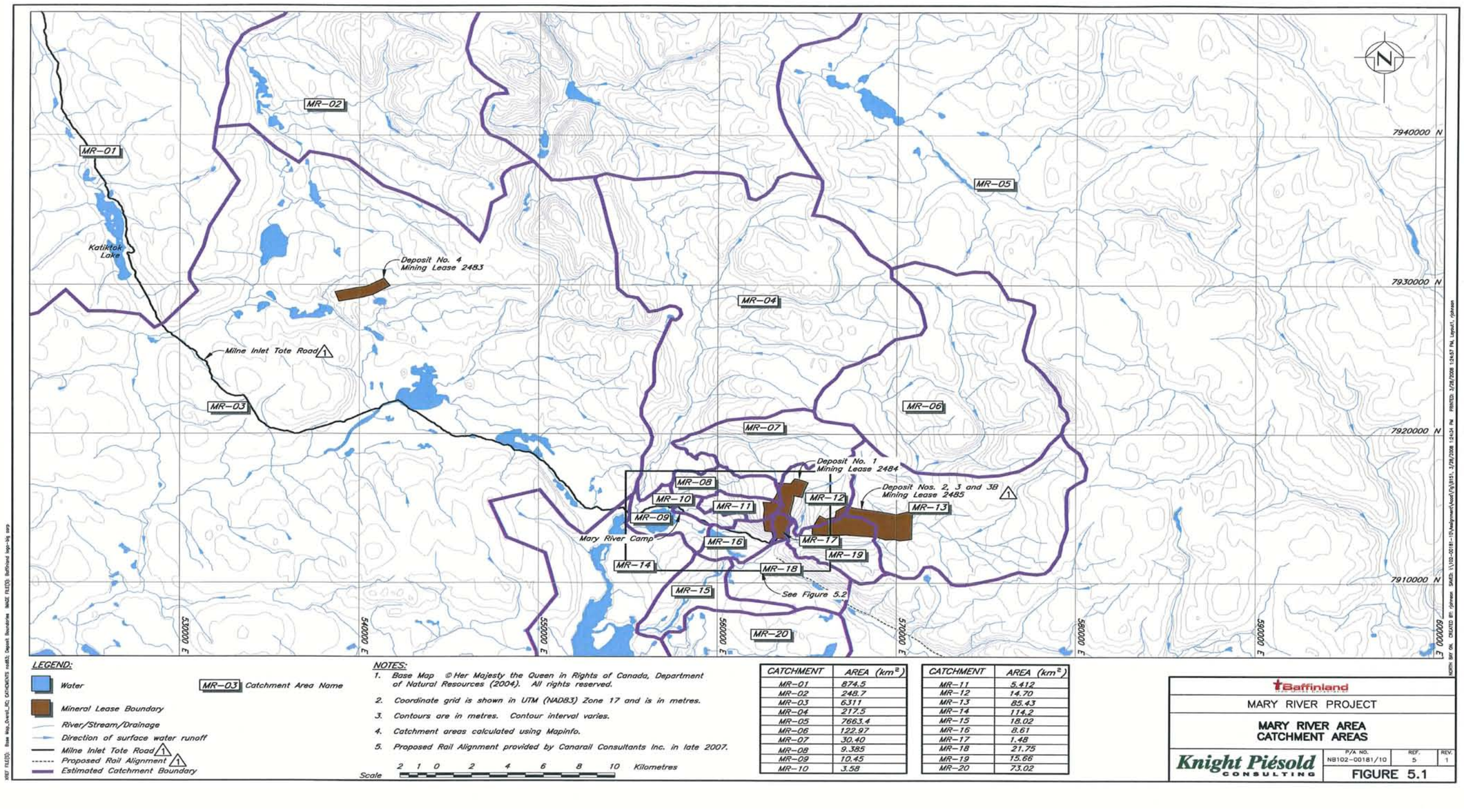
P/A NO. NB102-00181/10 | REF. 5 | REV. 1

FIGURE 5.3



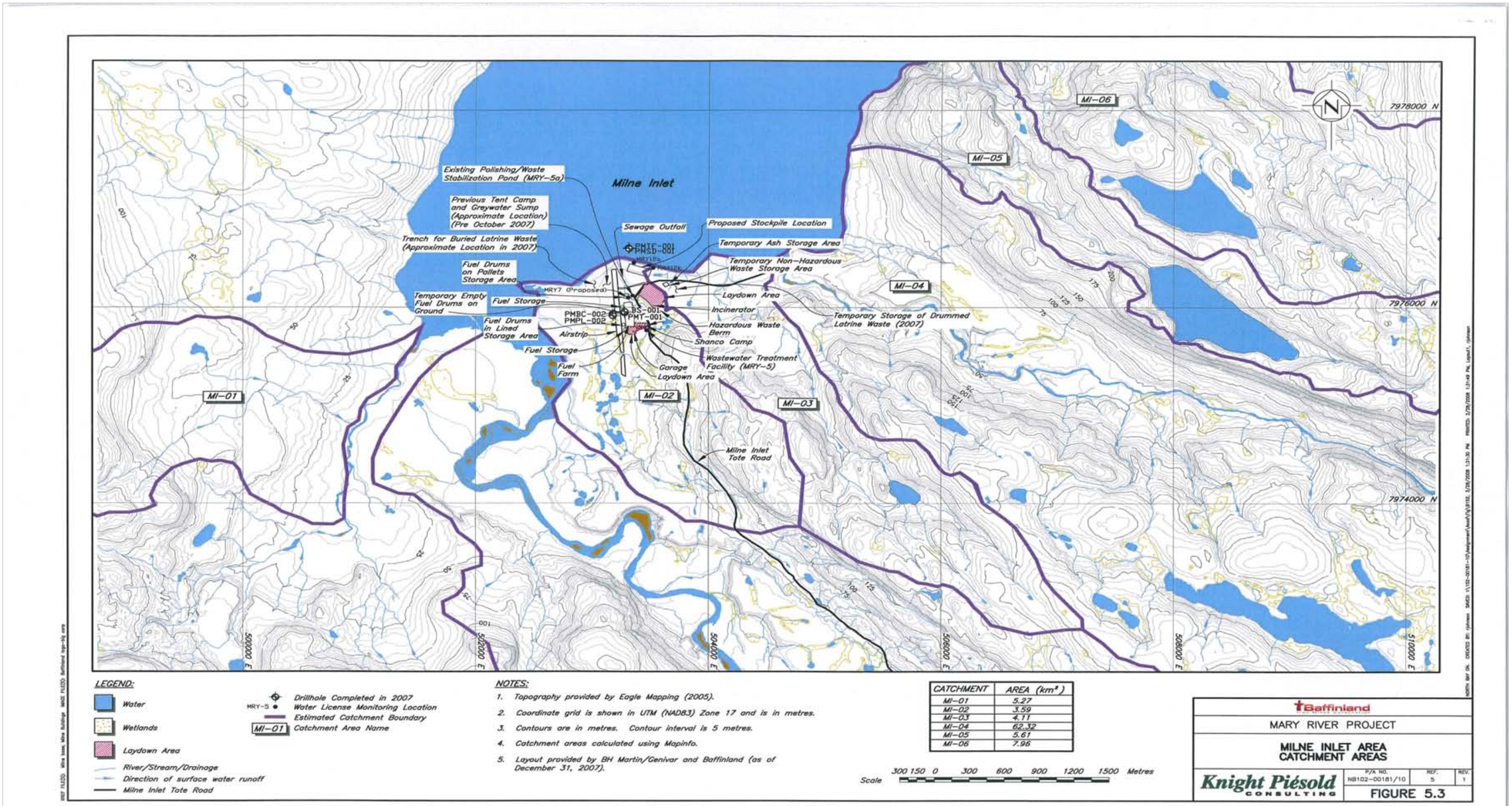







| CATCHMENT | AREA (km²) |
|---|---|
| MR-01 | 874.5 |
| MR-02 | 248.7 |
| MR-03 | 6311 |
| MR-04 | 217.5 |
| MR-05 | 7663.4 |
| MR-06 | 122.97 |
| MR-07 | 30.40 |
| MR-08 | 9.385 |
| MR-09 | 10.45 |
| MR-10 | 3.58 |

| 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
- MRY-5 ● Drillhole Completed in 2007
- 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 (km²) |
|---|---|
| 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

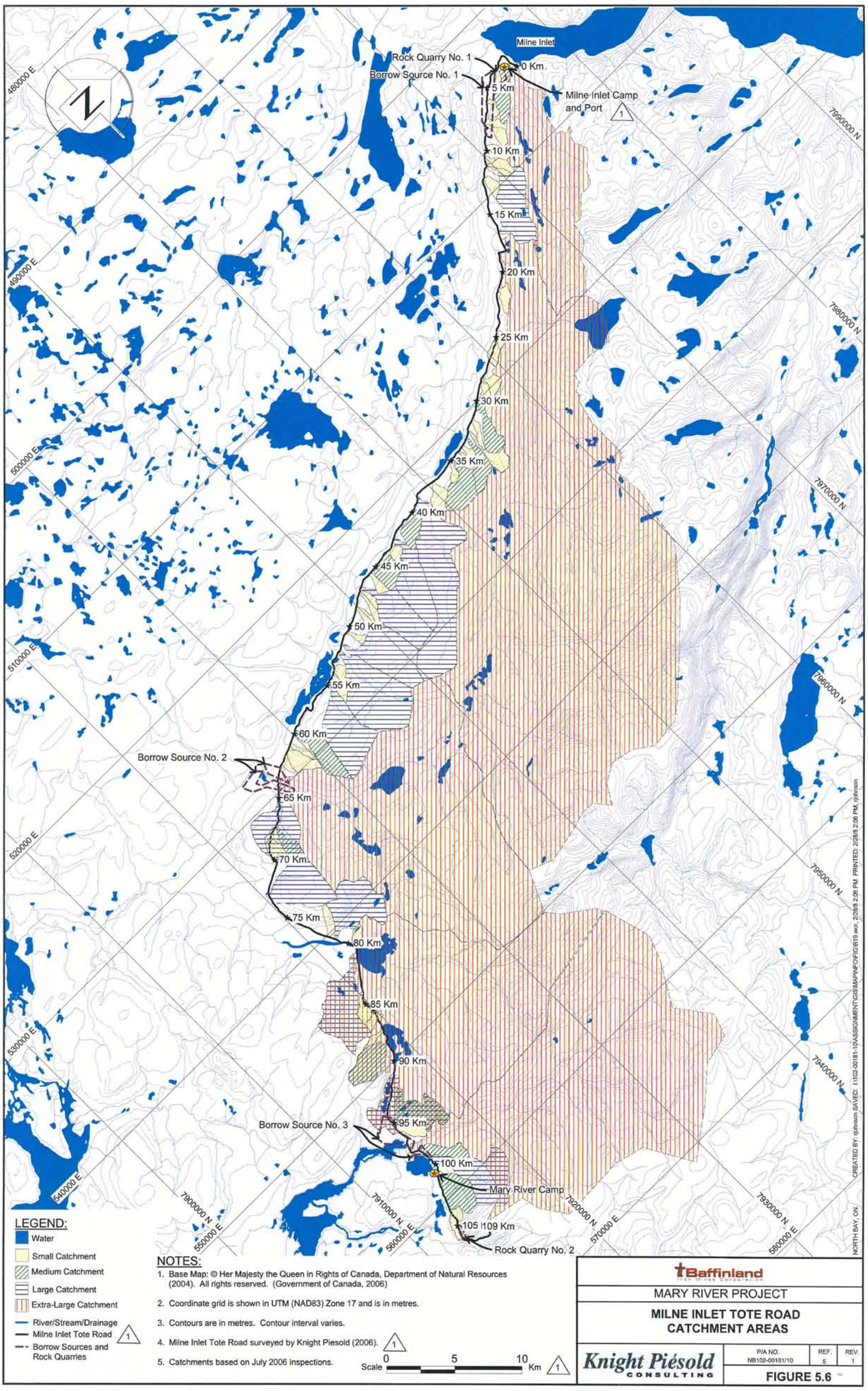
MARY RIVER PROJECT

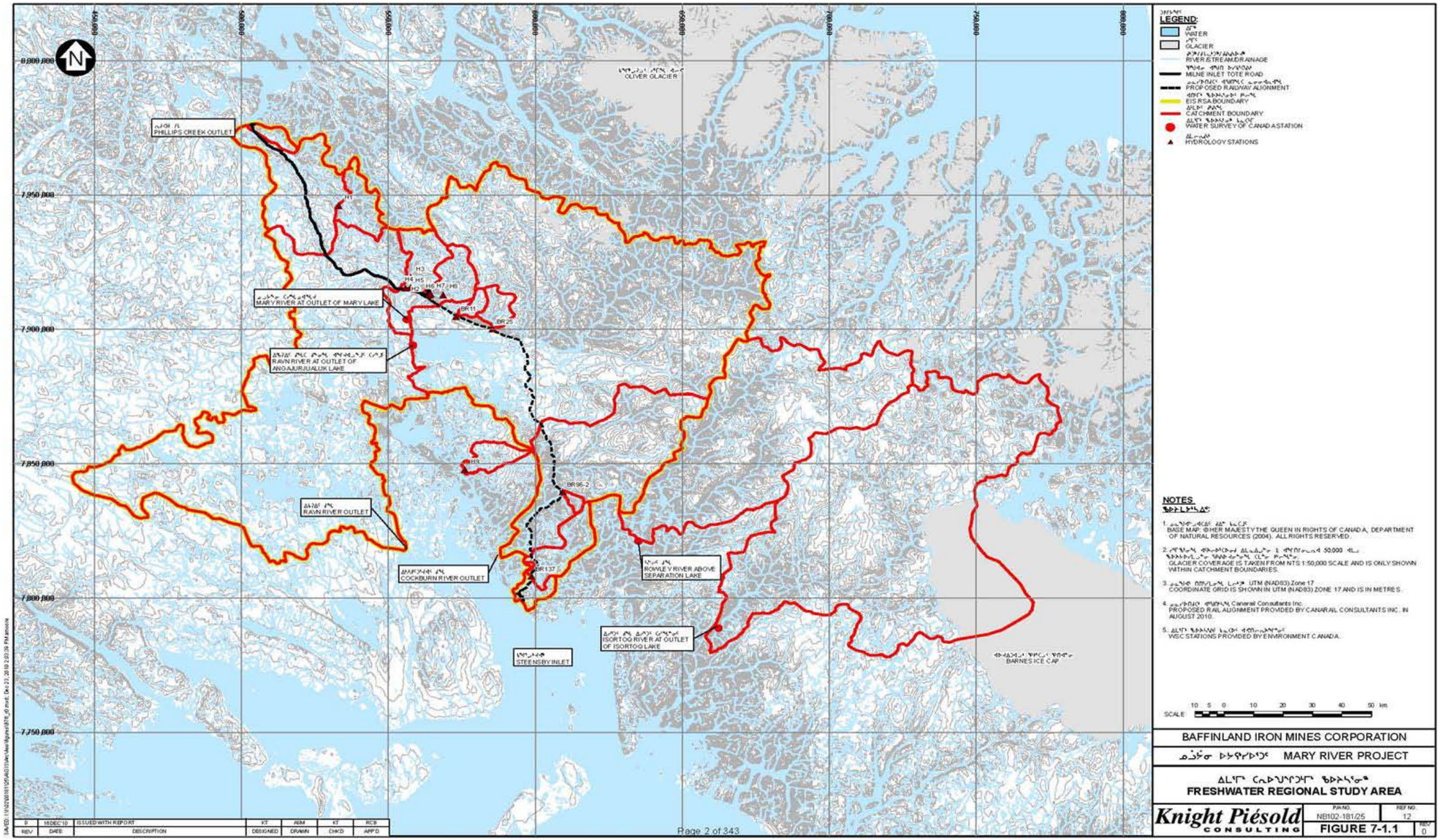
MILNE INLET AREA CATCHMENT AREAS

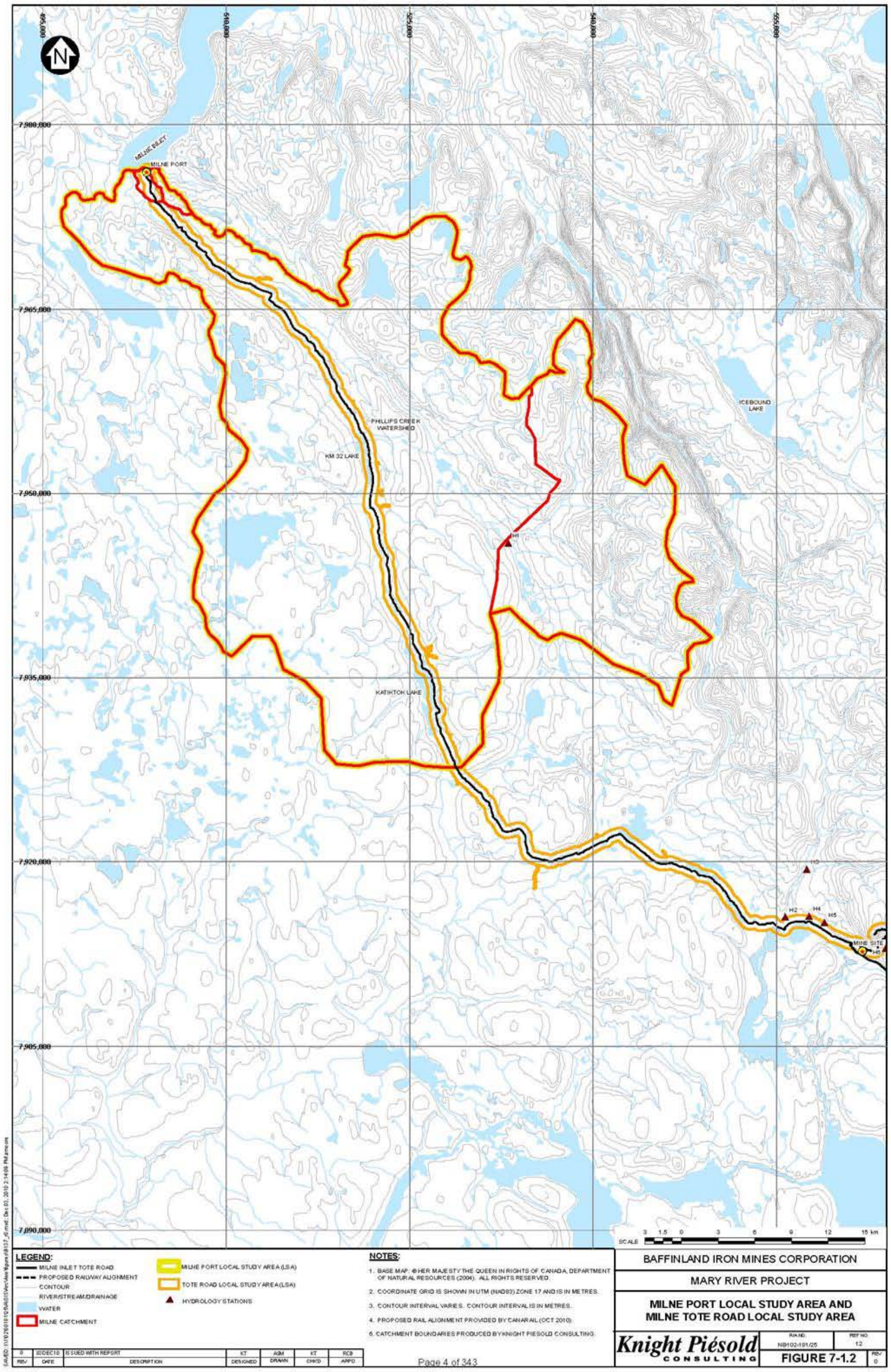
Knight Piésold CONSULTING

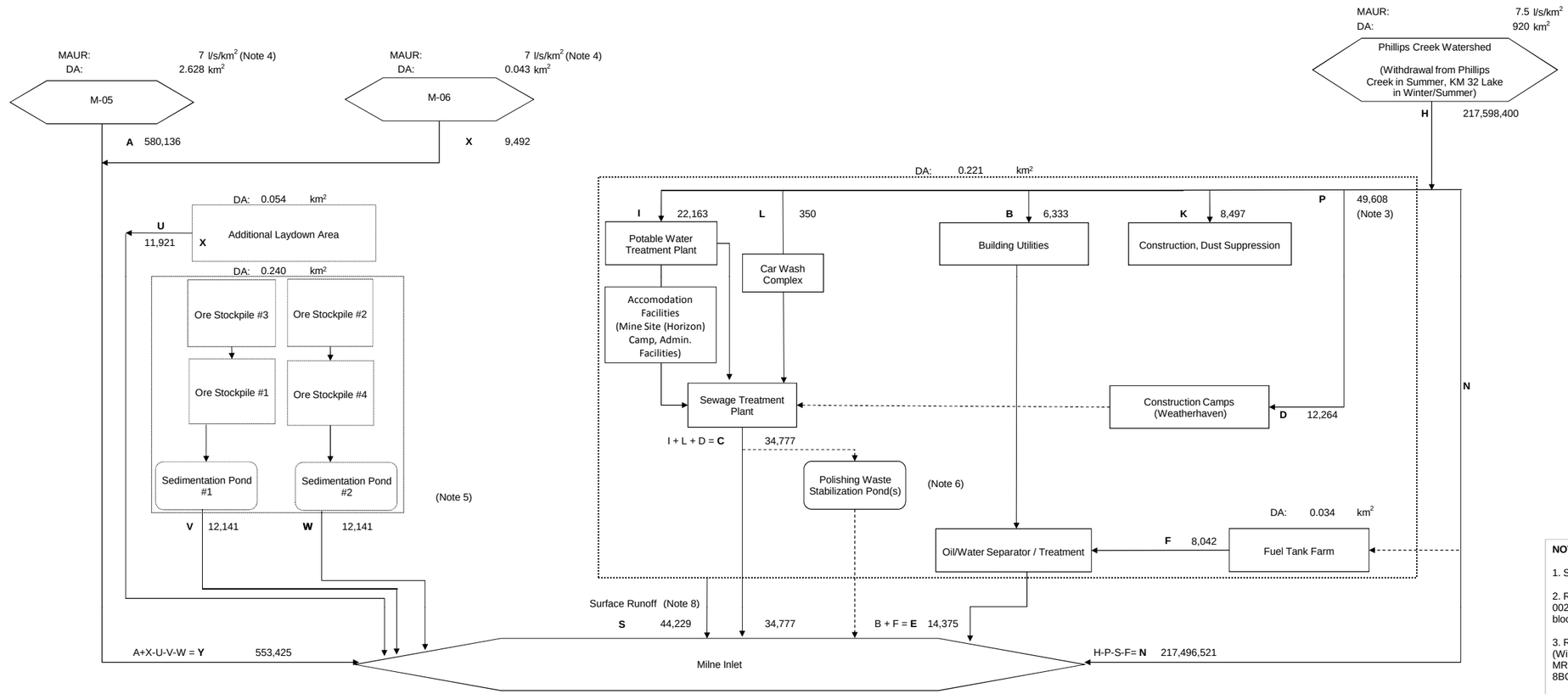
P/A NO. NB102-00181/10 | REF. 5 | REV. 1

FIGURE 5.3










**LEGEND**

- Impacted Watershed
- Development Areas
- Development Areas subject to ERP Approval
- Stormwater Ponds
- Continuous or Watershed Flow
- Intermittent Flow
- **A / AA** 100,000 — Annual Volume ($m^3$/year)
- MAUR — Mean Annual Unit Runoff (L/s/$km^2$)
- DA — Drainage Area ($km^2$)

**NOTES:**

1. Site layout per Figure H349001-2100-07-015-0001, Rev. B.
2. Refer to Figure H349000-2000-10-002-0001-001, Rev B, and H349000-2000-10-002-0001-002, Rev C, for more detailed water supply and waste water treatment block flow diagrams.
3. Raw water supply flow rate from Philips Creek (Summer) & KM 32 Lake (Winter/Summer) are currently equal to or less than Type A Water Licence 2AM-MRY1325 flow rate limit of 68.5 $m^3$/day (25,000 $m^3$/year) plus Type B Water Licence 8BC-MRY-1416 flow rate limit of 299 $m^3$/day (109,135 $m^3$/year) total.
4. MAUR in watersheds M5 and M6 likely range between 5 and 7 l/s/$km^2$. Part of the M6 natural catchment will be used for proposed infrastructure construction.
5. Ore stockpile and sedimentation pond construction subject to ERP Approval. Ore stockpiles receive only precipitation and no surface water runoff from surrounding areas.
6. Use of Polishing Waste Stabilization Pond(s) will occur on a contingency basis only, should off-spec treated sewage effluent be produced.
7. Per Project Memo H349000-2133-10-220-0001, the runoff coefficient from ore stockpiles is zero and only road runoff reports to sedimentation ponds.
8. Plant site receives only precipitation-runoff and no surface water runoff from surrounding areas.
9. This drawing originated from Figure 4 in Appendix C of document H349000-2000-10-002-0002.

| REV | ISSUE FOR | AUTH. BY | | DATE |
|---|---|---|---|---|
| B | FOR INFORMATION | TV | JY | 3/6/2015 |
| A | FOR INFORMATION | TV | WB | 2/5/2015 |

ISSUE AUTHORIZATION

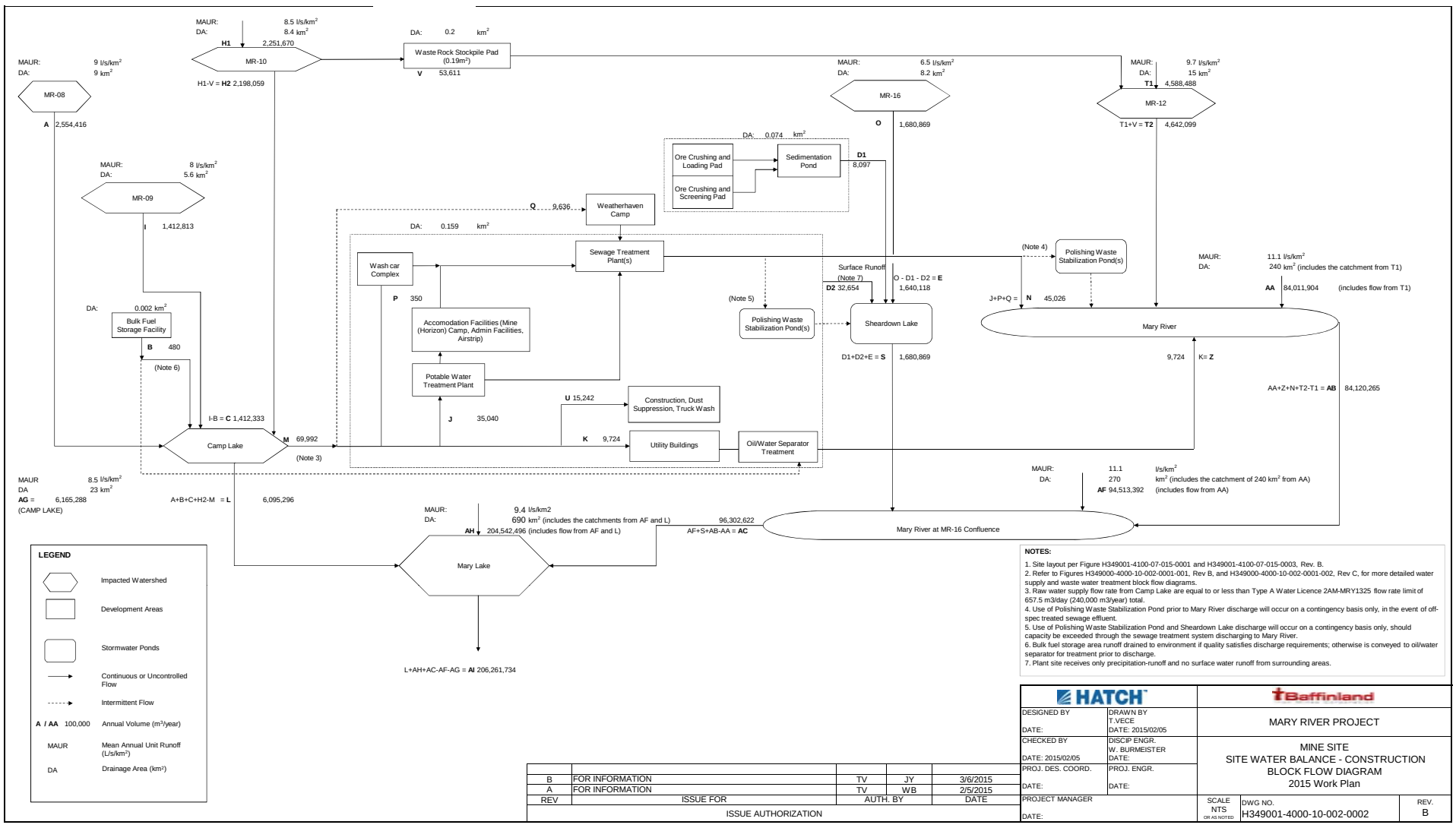
HATCH™ | Baffinland Iron Mines Corporation

| | |
|---|---|
| DESIGNED BY<br>DATE: | DRAWN BY<br>T. VECE<br>DATE: 2015/02/05 |
| CHECKED BY<br>DATE: 2015/02/05 | DISCIP ENGR.<br>W. BURMEISTER<br>DATE: |
| PROJ. DES. COORD.<br>DATE: | PROJ. ENGR.<br>DATE: |
| PROJECT MANAGER<br>DATE: | |

MARY RIVER PROJECT

MILNE INLET
SITE WATER BALANCE - CONSTRUCTION
BLOCK FLOW DIAGRAM
2015 Work Plan

| SCALE | DWG NO. | REV. |
|---|---|---|
| NTS OR AS NOTED | H349001-2000-10-002-0002 | B |




**LEGEND**

- Impacted Watershed
- Development Areas
- Stormwater Ponds
- Continuous or Uncontrolled Flow
- Intermittent Flow
- **A / AA** 100,000 — Annual Volume (m³/year)
- MAUR — Mean Annual Unit Runoff (L/s/km²)
- DA — Drainage Area (km²)

**NOTES:**

1. Site layout per Figure H349001-4100-07-015-0001 and H349001-4100-07-015-0003, Rev. B.
2. Refer to Figures H349000-4000-10-002-0001-001, Rev B, and H349000-4000-10-002-0001-002, Rev C, for more detailed water supply and waste water treatment block flow diagrams.
3. Raw water supply flow rate from Camp Lake are equal to or less than Type A Water Licence 2AM-MRY1325 flow rate limit of 657.5 m3/day (240,000 m3/year) total.
4. Use of Polishing Waste Stabilization Pond prior to Mary River discharge will occur on a contingency basis only, in the event of off-spec treated sewage effluent.
5. Use of Polishing Waste Stabilization Pond and Sheardown Lake discharge will occur on a contingency basis only, should capacity be exceeded through the sewage treatment system discharging to Mary River.
6. Bulk fuel storage area runoff drained to environment if quality satisfies discharge requirements; otherwise is conveyed to oil/water separator for treatment prior to discharge.
7. Plant site receives only precipitation-runoff and no surface water runoff from surrounding areas.

| REV | ISSUE FOR | AUTH. BY | | DATE |
|---|---|---|---|---|
| B | FOR INFORMATION | TV | JY | 3/6/2015 |
| A | FOR INFORMATION | TV | WB | 2/5/2015 |

ISSUE AUTHORIZATION

HATCH

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|---|---|
| DESIGNED BY<br>DATE: | DRAWN BY<br>T.VECE<br>DATE: 2015/02/05 |
| CHECKED BY<br>DATE: 2015/02/05 | DISCIP ENGR.<br>W. BURMEISTER<br>DATE: |
| PROJ. DES. COORD.<br>DATE: | PROJ. ENGR.<br>DATE: |
| PROJECT MANAGER<br>DATE: | |

Baffinland

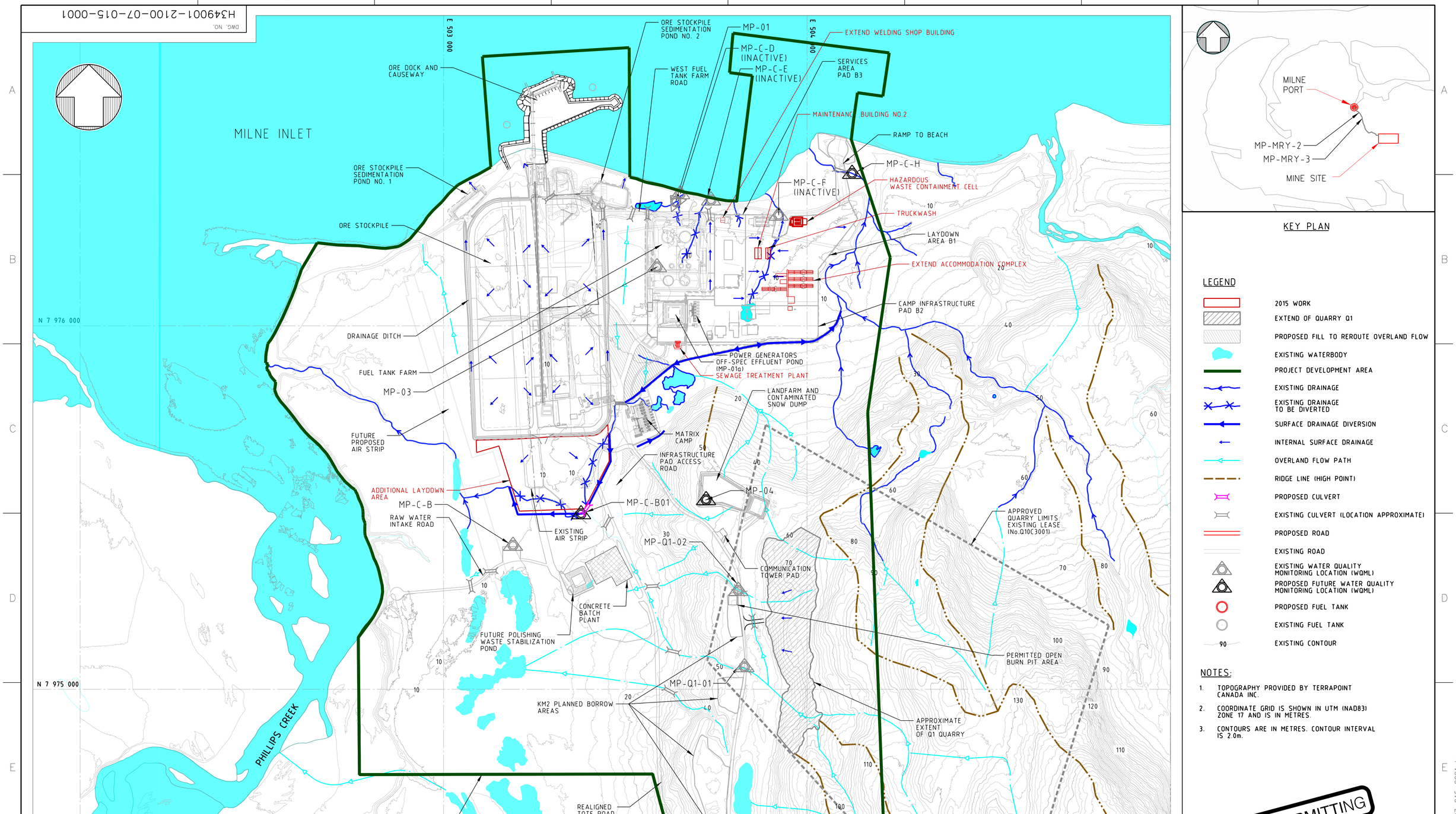
MARY RIVER PROJECT

MINE SITE
SITE WATER BALANCE - CONSTRUCTION
BLOCK FLOW DIAGRAM
2015 Work Plan

| SCALE | DWG NO. | REV. |
|---|---|---|
| NTS OR AS NOTED | H349001-4000-10-002-0002 | B |

# Appendix D -
# Site Drainage Drawings and Monitoring Locations

DWG. NO. H349001-2100-07-015-0001







## KEY PLAN

## LEGEND

- 2015 WORK
- EXTEND OF QUARRY Q1
- PROPOSED FILL TO REROUTE OVERLAND FLOW
- EXISTING WATERBODY
- PROJECT DEVELOPMENT AREA
- EXISTING DRAINAGE
- EXISTING DRAINAGE TO BE DIVERTED
- SURFACE DRAINAGE DIVERSION
- INTERNAL SURFACE DRAINAGE
- OVERLAND FLOW PATH
- RIDGE LINE (HIGH POINT)
- PROPOSED CULVERT
- EXISTING CULVERT (LOCATION APPROXIMATE)
- PROPOSED ROAD
- EXISTING ROAD
- EXISTING WATER QUALITY MONITORING LOCATION (WQML)
- PROPOSED FUTURE WATER QUALITY MONITORING LOCATION (WQML)
- PROPOSED FUEL TANK
- EXISTING FUEL TANK
- 90 EXISTING CONTOUR

## NOTES:

1. TOPOGRAPHY PROVIDED BY TERRAPOINT CANADA INC.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2.0m.

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| DRAWING NO. | DRAWING TITLE |
|---|---|
| REFERENCE DRAWINGS | |

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|---|---|---|---|---|
| B | FOR PERMITTING | LJ | SH | 2015-02-20 |
| A | INTERNAL/CLIENT REVIEW | LJ | SH | 2015-02-03 |
| ISSUE AUTHORIZATION | | | | |

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| DESIGNED BY L. JIANG DATE 2015-01-21 | DRAWN BY L. JIANG DATE 2015-01-21 |
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| PROJ. DES. COORD. T. THERTEL DATE 2015-02-20 | PROJ. ENGR. M. BUYKX DATE 2015-02-20 |
| PROJ. MGR. J. CLELAND DATE 2015-02-20 | |

Baffinland

# MARY RIVER PROJECT 2015 WORK PLAN

## MILNE PORT DRAINAGE PLAN

| SCALE | DWG. NO. | REV. |
|---|---|---|
| 1:5000 OR AS NOTED | H349001-2100-07-015-0001 | B |

ORIGINAL SHEET SIZE: ISO A1 (841 x 594)

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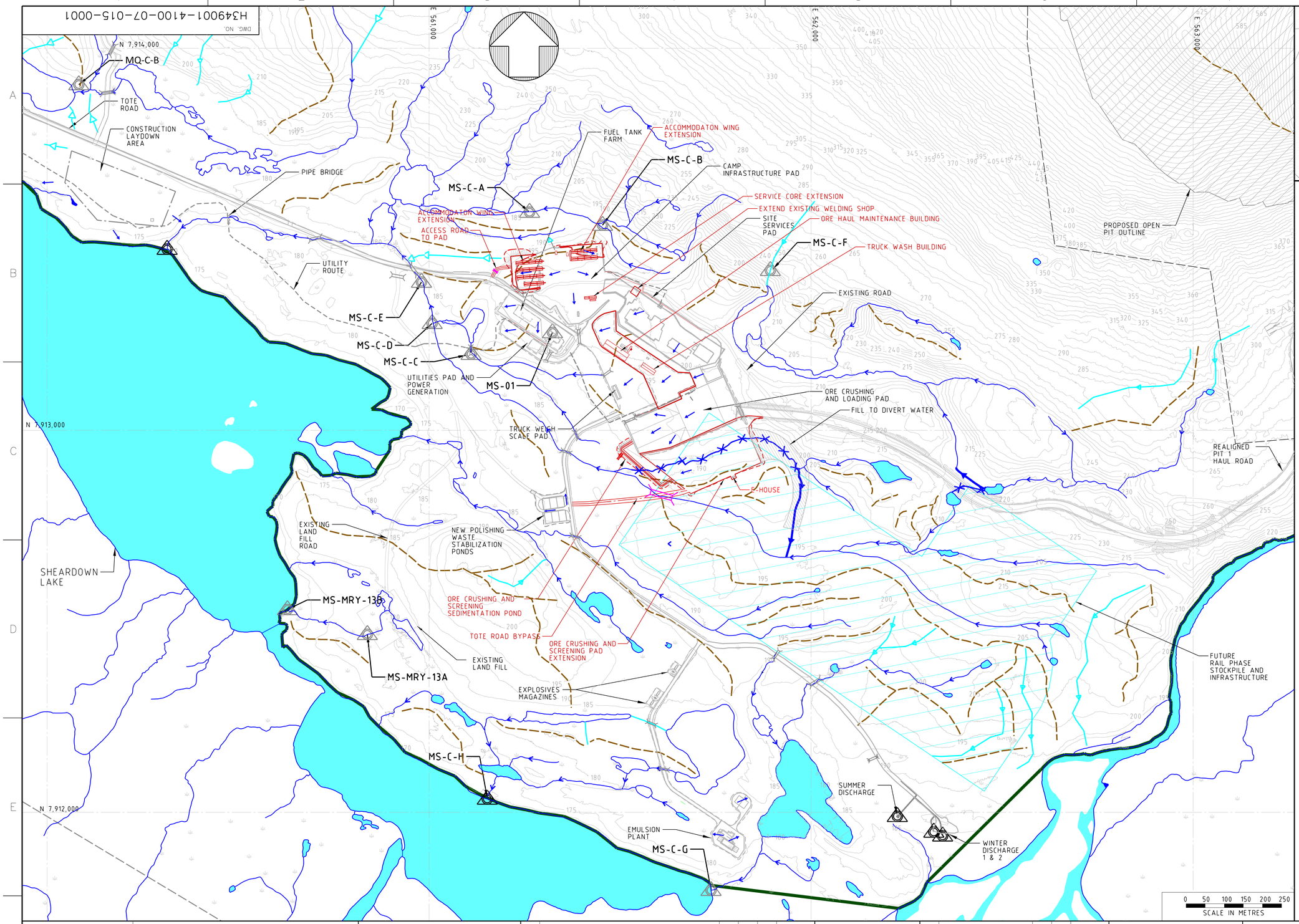


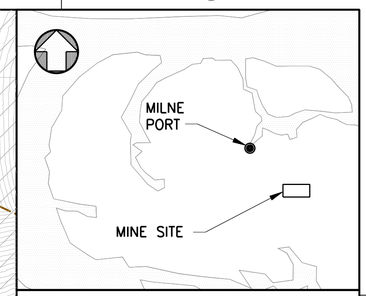


## KEY PLAN

### LEGEND

- 2015 WORK
- PROPOSED FILL TO REROUTE OVERLAND FLOW
- EXISTING WATERBODY
- PROJECT DEVELOPMENT AREA
- DEPOSIT No.1 MINING LEASE 2484
- EXISTING DRAINAGE
- EXISTING DRAINAGE (TO BE DIVERTED)
- SURFACE DRAINAGE DIVERSION
- INTERNAL SURFACE DRAINAGE
- OVERLAND FLOW PATH
- RIDGE LINE (HIGH POINT)
- PROPOSED CULVERT
- EXISTING CULVERT (LOCATION APPROXIMATE)
- PROPOSED ROAD
- EXISTING ROAD
- EXISTING WATER QUALITY MONITORING LOCATION (WQML)
- PROPOSED FUTURE WATER QUALITY MONITORING LOCATION (WQML)
- EXISTING CONTOUR

### NOTES:

1. TOPOGRAPHY PROVIDED BY TERRAPOINT CANADA INC.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 5.0m.

FOR PERMITTING

| REFERENCE DRAWINGS | |
|---|---|
| DRAWING NO. | DRAWING TITLE |
| H349001-4100-07-015-0003 | MINE SITE – WEST SHEET – DRAINAGE PLAN |

**PERMIT TO PRACTICE**
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Signature
Date
**PERMIT NUMBER: P 512**
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| NO. | DESCRIPTION | BY | CHK'D | APP'D | DATE |

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|---|---|---|---|
| REV. | ISSUE FOR | AUTH. BY | DATE |
| B | FOR PERMITTING | LJ SH | 2015-02-20 |
| A | INTERNAL/CLIENT REVIEW | LJ SH | 2015-02-03 |

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|---|---|
| DESIGNED BY L. JIANG DATE 2015-01-21 | DRAWN BY L. JIANG DATE 2015-01-21 |
| CHECKED BY S. HASSAN DATE 2015-02-20 | DISCIP. ENGR. S. HASSAN DATE 2015-02-20 |
| PROJ. DES. COORD. T. THERTELL DATE 2015-02-20 | PROJ. ENGR. M. BUYKX DATE 2015-02-20 |
| PROJ. MGR. J. CLELAND DATE 2015-02-20 | |

Baffinland

MARY RIVER PROJECT
2015 WORK PLAN

MINE SITE
EAST SHEET
DRAINAGE PLAN

SCALE 1:5000 OR AS NOTED | DWG. NO. H349001-4100-07-015-0001 | REV. B

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E 559,000 E 560,000 E 561,000

N 7,915,000 N 7,914,000 N 7,913,000

CAMP LAKE

SHEARDOWN LAKE NW

HAZARDOUS WASTE CONTAINMENT BERM (EXISTING)
BARRELED FUEL LINED CONTAINMENT
WASTE MANAGEMENT BUILDING
HAZARDOUS WASTE CONTAINMENT AREA NEW
LAYDOWN AREA
E-HOUSE
CONCRETE BATCH PLANT BUILDING
TOTE ROAD
LAYDOWN AREA
NEW AERODROME APRON
MS-MRY-1
RAW WATER PUMP HOUSE
MS-MRY-6
MS-MRY-4
MS-MRY-4a
HELIPAD
UTILITY ROUTE
EXPLORATION TENT CAMP
EXPLORATION SOFT-WALL CAMP
WASTE WATER TREATMENT FACILITY
EXPLORATION WORKSHOPS
EXISTING POLISHING WASTE STABILIZATION PONDS (PWSPs)
E-HOUSE
WAREHOUSE BUILDING
EX. TOTE ROAD
AERODROME RUNWAY
EXPLORATION CAMP SEWAGE PIPELINE
MQ-C-A
MQ-C-D
MQ-C-B
BH-QMR2
APPROXIMATE EXTENT OF QMR2 QUARRY
CONSTRUCTION LAYDOWN AREA
PIPE BRIDGE
CAMP INFRASTRUCTURE PAD
MS-C-A
MS-C-B
SITE SERVICES PAD
UTILITY ROUTE
MS-C-E
MS-G-D
MS-C-C
UTILITIES PAD AND POWER GENERATION
MS-01
TRUCK WEIGH SCALE PAD
NEW POLISHING WASTE STABILIZATION PONDS
EXISTING LAND FILL ROAD
FUTURE RAIL PHASE STOCKPILE AND INFRASTRUCTURE

0 75 150 225 300 375
SCALE IN METRES

MILNE PORT
MINE SITE

## KEY PLAN

### LEGEND

- 2015 WORK
- PROPOSED FILL TO REROUTE OVERLAND FLOW
- EXTEND OF QUARRY QMR2
- EXISTING WATERBODY
- BAFFINLAND'S COMMERCIAL LEASE ON INUIT OWNED LAND
- PROJECT DEVELOPMENT AREA
- EXISTING STREAM
- EXISTING DRAINAGE (TO BE DIVERTED)
- INTERNAL SURFACE DRAINAGE
- SURFACE DRAINAGE DIVERSION
- OVERLAND FLOW PATH
- RIDGE LINE (HIGH POINT)
- PROPOSED CULVERT
- EXISTING CULVERT (LOCATION APPROXIMATE)
- PROPOSED ROAD
- EXISTING ROAD
- EXISTING WATER QUALITY MONITORING LOCATION (WQML)
- PROPOSED FUTURE WATER QUALITY MONITORING LOCATION. (WQML)
- EXISTING BOREHOLE
- EXISTING CONTOUR

### NOTES:

1. TOPOGRAPHY PROVIDED BY TERRAPOINT CANADA INC.
2. COORDINATE GRID IS SHOWN IN UTM (NAD83) ZONE 17 AND IS IN METRES.
3. CONTOURS ARE IN METRES. CONTOUR INTERVAL IS 2.0m.

FOR PERMITTING

| DRAWING NO. | DRAWING TITLE |
|---|---|
| H349001-4100-07-015-0001 | MINE SITE – EAST SHEET – DRAINAGE PLAN |

REFERENCE DRAWINGS

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The Association of Professional Engineers, Geologists and Geophysicists of NWT/NU



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| B | FOR PERMITTING | LJ | SH | 2015-02-20 |
| A | INTERNAL/CLIENT REVIEW | LJ | SH | 2015-02-03 |

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HATCH™

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|---|---|
| L. JIANG DATE 2015-01-21 | L. JIANG DATE 2015-01-21 |
| CHECKED BY | DISCIP. ENGR. |
| S. HASSAN DATE 2015-02-20 | S. HASSAN DATE 2015-02-20 |
| PROJ. DES. COORD. | PROJ. ENGR. |
| T. THERTELL DATE 2015-02-20 | M. BUYKX DATE 2015-02-20 |
| PROJ. MGR. | |
| J. CLELAND DATE 2015-02-20 | |

Baffinland

MARY RIVER PROJECT
2015 WORK PLAN

MINE SITE
WEST SHEET
DRAINAGE PLAN

| SCALE | DWG. NO. | REV. |
|---|---|---|
| 1:7500 OR AS NOTED | H349001-4100-07-015-0003 | B |

ORIGINAL SHEET SIZE: ISO A1 (841 x 594)

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

The following Sections pertaining to Construction and Operation Activities at Steensby Port and along the Railway Corridor have been omitted from the Surface Water and Aquatic Ecosystems Management Plan, *issued* March 31, 2014 and have been provided in this Appendix, as listed in the preceding revision (Rev. 01), *issued* September 6, 2013. Figures referenced in the following Sections have also been omitted from the updated Plan.

### 5.3.3 Surface Water Runoff Estimation – Steensby Port

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 Port area of 7.5 L/s/km2 was estimated based on hydrologic conditions (e.g. elevation, lake area, latitude, aspect etc.) at Steensby Port 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 Port area. These estimates are presented on Table 5-3 and the catchment areas are shown on Figure 5.4 in Appendix C. 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.

**Table 5-3: Steensby Port 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.

#### 5.3.4 Catchment Areas for the Milne Port Tote Road

Figure 5.6 in Appendix C presents the watershed catchment areas along the Milne Port Tote Road.

#### 5.3.5 Catchment Areas for the Proposed Railway Corridor

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

#### 5.3.6 Water Supply

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

### 6.4 Railway Construction

Figure 1.1 of the Borrow Pit and 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 Fish Habitat Compensation Plan (Appendix 10D-7). No construction is planned along the rail alignment during 2013.

#### 6.4.1 Railway Construction Camps

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 200 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.

A minimum 100-metre naturally-vegetated buffer shall be maintained between the high-water mark of any fish-bearing water bodies and any permanent quarries with potential for acid rock drainage or metal leaching except where authorized by the authority having jurisdiction.

#### 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 Borrow Pit and Quarry

Management Plan (Appendix 10D-6). 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 climate change, 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 31m 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 4.0, 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 Plan.

A minimum 100-metre naturally-vegetated buffer shall be maintained between the high-water mark of any fish-bearing water bodies and any permanent quarries with potential for acid rock drainage or metal leaching except where authorized by the authority having jurisdiction.

### 6.4.8 Borrow Pits and Quarries Required for the Railway Construction

Locations of the potential borrow sites and rock quarries are shown in the "Quarry Management Plan" for the railway (Appendix 3B, Attachment 6). As stated in the EPP and the Borrow Pit and Quarry Management Plan, 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 31 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 31 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. If samples from any quarry indicate a potential to generate ARD then that quarry will not be developed.

### 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 (FEIS, Appendix 3B) 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. No construction work is planned during 2013.

**Table 6-4: Overview of Facilities at Steensby Port**

| | |
|---|---|
| • Construction docks<br>• Quarry and borrow sites, and related access roads<br>• Concrete batch plant(s)<br>• Bulk fuel storage and distribution facilities<br>• Power plan<br>• Construction workshops and maintenance shops<br>• Warehouses/stores<br>• Temporary power generators<br>• Laydown areas/freight storage<br>• Parking areas for construction fleet<br>• Temporary fuel storage (iso-containers)<br>• Explosives plant and magazines<br>• Airstrip<br>• Construction worker accommodation and related facilities | • Ore stockpiling facilities<br>• Ore, freight and tug docks<br>• Ship loading and unloading facilities<br>• Cargo (container) handling facilities<br>• Permanent worker accommodations<br>• Rail shops and maintenance infrastructure<br>• Buildings and offices<br>• Communication systems<br>• Site roads<br>• Causeway<br>• Laydown areas/freight storage<br>• Water supply facilities<br>• Waste management facilities<br>• 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 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 (lined with geomembrane). Runoff from these contained areas will be collected in a 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 FEIS 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. 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. The levelling of the seabed at the -25 m contour will be carried out through blasting and dredging. 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.

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.

*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 blasted rock 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 Appendix 10D-3, Fresh Water Supply, Sewage and Wastewater Management Plan, 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 of Appendix C. 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.

Shallow groundwater monitoring stations will be established downstream of major infrastructure (i.e., landfill, landfarm, etc.) to draw samples from the subsurface ~ 2 meter deep active zone to ensure that groundwater has not been impacted. Samples will be taken from the monitoring stations once a year during the period of greatest active zone thickness (late August). Standard well installation monitoring and sampling methods will be followed.

### 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, the Milne Port OPEP and the Steensby Port OPEP.

### 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 (Appendix 10C-2).

*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 with contained dispensing areas. 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, if required, 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:

- Antifreeze (coolant) tank
- Power plant glycol initial fill of heat recovery and distribution systems.
- 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, 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 fuel 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
- Heating boiler building
- Railcar fuel loading station.

In addition to the main tank farm, 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, Appendix 10B). The Emergency and Spill Response Plan will govern land-based operations, and a Transport Canada approved Oil Handling Facility (OHF) Plan (Milne Port OPEP and Steensby Port OPEP) will govern ship to shore fuel transfers.

## 6.9 Ore Stockpile at Steensby Port

Ore will be transported to Steensby Port for shipment. The Mine Site and Steensby Port will have significant ore stockpiles (refer to EIS volume 3, Project Description). 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), and H337697-4610-07-042-0003 (Steensby Inlet Environmental Monitoring Plan Site Layout – Appendix 3B, FEIS).

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.

## 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 150 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. 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, streams and creek crossings will be scheduled as required.

### 10.1 Routine Inspections

Routine inspections and water license monitoring is outlined in the table below.

**TABLE 10-1: ROUTINE INSPECTION AND MONITORING**

| Site | Routine Inspection |
|---|---|
| Steensby Port facilities<br>Rail camp locations | - Water management systems<br>- Sediment and erosion control structures<br>- Evidence of hydrocarbon staining or leaks from containment devices<br>- Full-time supervision of fuel transfer operations<br>- Water intakes<br>- Flow meter readings<br>- Rutting by vehicles |
| Railway Construction Road<br>Railway | - Sediment and erosion control structures<br>- Fuel leaks<br>- Drip Pans and Equipment condition<br>- Any rutting by vehicles |
| Spoil Deposit locations<br>Tunnelling locations | - Sediment and erosion control structures<br>- Evidence of hydrocarbon staining or leaks from containment devices<br>- Fuel leaks<br>- Drip Pans and Equipment condition<br>- Rutting by vehicles |
| Borrow sites and rock quarries | - Evidence of hydrocarbon staining or leaks from containment devices<br>- Full-time supervision of fuel transfer operations<br>- Sediment and erosion control structures<br>- Drip Pans and Equipment condition |
| Steensby Port | - Primary containment structure<br>- Evidence of hydrocarbon staining or leaks from containment devices<br>- Equipment condition<br>- Spill kit |
| Steensby Port | - Primary containment structure<br>- Access and security<br>- Equipment condition<br>- Rutting by vehicles |

| Site | Routine Inspection |
|---|---|
| The effects of the project on the permafrost along the railway and other project affected areas shall be monitored the integrity of the permafrost. Preventative measures will be undertaken to ensure that the integrity of the permafrost is maintained. | |

The following Figures have been omitted from Surface Water and Aquatic Ecosystems Management Plan, *issued* March 31, 2014.

Figure 6 - Steensby Port Water Balance - Construction

Figure 7 - Steensby Port Water Balance – Operation