

APPENDIX C.3
DFO TOTE ROAD ANNUAL REPORT



**BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT**

**FISH HABITAT MONITORING
2017 ANNUAL REPORT
EARLY REVENUE PHASE - TOTE ROAD UPGRADES**

2017-12-31	0				Per Dec. 30 Email
		C. Devereaux	W. Bowden	C. Murray	T. Sewell
Date	Rev	Prepared By		Reviewed By	

ACKNOWLEDGEMENTS

This report was prepared by Baffinland Iron Mines Corporation with support from North/South Consultants (NSC) Inc. of Winnipeg, Manitoba. NSC provided fisheries field work, reporting, design services, and technical review.

TABLE OF CONTENTS

	<u>Page</u>
SECTION 1.0 - INTRODUCTION	1
1.1 MARY RIVER PROJECT	1
1.2 AUTHORIZATION FOR WORKS	1
1.3 REPORTING	2
SECTION 2.0 - PROJECT DESCRIPTION	3
2.1 CONSTRUCTION WORK.....	3
2.2 FISH HABITAT ASSESSMENT	3
2.3 FISH HABITAT COMPENSATION	4
2.4 SUMMARY OF DESIGN CHANGES.....	4
SECTION 3.0 - AQUATIC MONITORING	5
3.1 CONSTRUCTION AND TURBIDITY MONITORING	5
3.2 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS.....	5
3.3 FISH USE ASSESSMENTS AT SELECT CROSSINGS	5
3.4 FISH USE ASSESSMENTS AT COMPENSATION SITES	6
SECTION 4.0 - AUTHORIZED HADD CROSSING INSTALLATION SUMMARY	7
SECTION 5.0 - REFERENCES	8

FIGURES

FIGURE 1 MAP OF THE HADD AND COMPENSATION CROSSINGS ALONG THE TOTE ROAD, SHOWING BOTH THE OLD AND NEW ALIGNMENTS

TABLES

TABLE 1 SUMMARY OF CHANGES TO TOTE ROAD CROSSINGS AT FISH-BEARING STREAMS COMPLETED FROM DECEMBER 31, 2016 TO DECEMBER 30, 2017

TABLE 2 TECHNICAL SUMMARY OF EXISTING CROSSINGS STRUCTURES INSTALLED AT FISH-BEARING STREAMS ALONG THE TOTE ROAD

TABLE 3.1 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS, SURFACE WATER WATER QUALITY SUMMARY FOR SAMPLE SITE N1-025 (CV128)

TABLE 3.2 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS, SURFACE WATER WATER QUALITY SUMMARY FOR SAMPLE SITE N1-050 (CV099)

TABLE 3.3 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS, SURFACE WATER WATER QUALITY SUMMARY FOR SAMPLE SITE N1-053 (CV093)

TABLE 3.4 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS, SURFACE WATER WATER QUALITY SUMMARY FOR SAMPLE SITE N1-060 (CV078)

TABLE 3.5 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS, SURFACE WATER WATER QUALITY SUMMARY FOR SAMPLE SITE N1-070 (BG50)

TABLE 3.6 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS, SURFACE WATER WATER QUALITY SUMMARY FOR SAMPLE SITE N1-080 (CV040)

TABLE 3.7 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS, SURFACE WATER WATER QUALITY SUMMARY FOR SAMPLE SITE N1-100 (CV217)

TABLE 3.8 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS, SURFACE WATER WATER QUALITY SUMMARY FOR SAMPLE SITE N1-110 (BG24)

TABLE 4 SUMMARY OF FISH HABITAT STATUS AT EXISTING FISH-BEARING STREAMS ALONG THE TOTE ROAD IN 2017

TABLE 5 INSTALLATION SUMMARY OF HADD AND HABITAT COMPENSATION SITES ALONG THE TOTE ROAD

APPENDICES

APPENDIX A DFO AUTHORIZATIONS AND AMENDMENTS

APPENDIX B PHOTO SUMMARY OF CHANGES OF TOTE ROAD CROSSINGS AT FISH-BEARING STREAMS COMPLETED IN 2017

SECTION 1.0 - INTRODUCTION

1.1 MARY RIVER PROJECT

The Mary River Project (the Project) is an iron ore mining project operated by Baffinland Iron Mines Corporation (Baffinland) located in the North Baffin region of Baffin Island, Nunavut. The Mary River Mine Site coordinates are approximately latitude 71° 19' 35" North and longitude 79° 22' 30" West. Detailed descriptions of the Project and annual activities can be found in reports from Knight Piésold (2007b, 2008) and Baffinland (2009 to 2016, incl.).

The Tote Road was first established in the 1960's and extends approximately 100 km between the Mary River Mine Site (Mine Site) and Milne Port. Currently, the Tote Road is used as a means of transport of iron ore, personnel, equipment, and supplies between the Mine Site and Milne Port. Since 2013, there have been ongoing upgrades to sections of the road as part of the construction and operation of the Early Revenue Phase (ERP) for the Project and in efforts to mitigate infrastructure sedimentation. In order to safely and efficiently transport iron ore from the Mine Site to Milne Port during the early operational period of the mine, the existing Tote Road has been upgraded to accommodate and facilitate and assist in the safe transit of large haul trucks and other vehicles. Work on these upgrades was initiated during the winter of 2013/14 and is still ongoing. Tote Road upgrades have included the following activities:

- Free-span bridges were constructed in 2014 replacing sea container crossings;
- Widening, straightening and realignment of the Tote Road at strategic locations;
- Addition of protective armouring on road embankments and erosion mitigation measures; and
- Continued installation, movement and/or extension of culverts at identified stream crossings to improve transportation safety and minimize erosion/sedimentation, while maintaining fish passage.

As part of the response to the *Fisheries Act* Direction received by Baffinland from Environment and Climate Change Canada (ECCC) on June 7, 2016, Baffinland undertook various works during the summer of 2016 to minimize the potential for sedimentation and erosion. A Tote Road Earthworks Execution Plan (TREETP) was developed in April 2017 (Golder, 2017) to address outstanding concerns (damaged culverts, embankment erosion, etc.) along the Tote Road not addressed in 2016. The TREETP outlined the planned sedimentation mitigation measures to be completed along the Tote Road in 2017 and subsequent years. Work executed by Baffinland in 2017 followed the guidance, recommendations and designs presented in the TREETP as well as the original 2013 designs prepared by Hatch Limited (Hatch).

1.2 AUTHORIZATION FOR WORKS

The Department of Fisheries and Oceans (DFO) (1998) defined Harmful Alteration, Disruption or Destruction (HADD) as: "any meaningful change in one or more habitat components that can

reasonably be expected to cause a real reduction in the capacity of the habitat to support the life requisites of fish." A HADD occurs when the physical, chemical, or biological features of a water body are sufficiently altered, such that habitat becomes less suitable for one or more life history processes of fish. Detailed descriptions of the 2007 HADD authorization and any related amendments and Letters of Advice can be found in previous annual reports (Knight Piésold 2007b, 2008; Baffinland 2009 to 2016, incl.) and the Fish Habitat No Net Loss and Monitoring Plan as described by Knight Piésold (2007a). Habitat compensation is defined by DFO (1998) as "the replacement of natural habitat, increase in the productivity of existing habitat, or maintenance of fish production by artificial means in circumstances dictated by social and economic conditions, where mitigation techniques and other measures are not adequate to maintain habitats for Canada's fisheries resources".

A total of 25 crossings were identified (as HADD) under the August 2007 *Fisheries Act* Authorization, and 14 crossing were identified (as Habitat Compensation) in the August 2007 No Net Loss and Monitoring Plan. The locations of these crossings along the Tote Road are presented in Figure 1.1. Of the 25 HADD crossings, three have since been identified as not fish-bearing and they no longer qualify as HADD sites (Baffinland 2010).

1.3 REPORTING

A written report summarizing the monitoring results is to be submitted to the specified office locations of the Department of Fisheries and Oceans, Fish Habitat Management, Eastern Arctic Area, on or before December 31 of each year. Annual reports have already been submitted for the years 2007 to 2016 (Knight Piésold 2007b, 2008 and Baffinland 2009 to 2016, incl.).

This 2017 Annual Report, herein, covers the period of activity up to and including December 31, 2017. It summarizes the fish habitat monitoring results and provides a record for additional works or undertakings completed in accordance with the approved No Net Loss and Monitoring Plan (Knight Piésold 2007a) and conditions of the authorization, subsequent amendments, and Letters of Advice.

SECTION 2.0 - PROJECT DESCRIPTION

2.1 CONSTRUCTION WORK

Design summaries and descriptions of work along the Tote Road completed up to the end of 2009 are presented, in detail, in Knight Piésold (2007c) and Baffinland (2009). Recent road construction activities and installation of fish access improvement structures at some crossings are described in Baffinland's annual reports to DFO (2010 to 2016, incl.).

In order to safely and efficiently transport iron ore from the Mine Site to Milne Inlet during the early operational period of the mine, the existing Tote Road has been further upgraded (sections were straightened, widened and/or moved) to accommodate large haul trucks and in efforts to mitigate infrastructure sedimentation. The first phase of the upgrades involved replacement of sea container crossings with bridges. Bridge installation was completed during the winter of 2013/14 and seacan container crossings were removed at all locations by early 2017. Culvert movement, replacement and extension work was initiated during 2014 and remains ongoing. Several crossings upgrades were completed between December 2016 and the end of December 2017; however, the majority of these works occurred in non-fish-bearing streams and are not considered further within the scope of this report. A summary of the completed work on fish bearing streams as per original 2013 Hatch designs and the TREEP is provided in Table 1.

2.2 FISH HABITAT ASSESSMENT

Watercourses initially identified as HADD (n = 25) and compensation (n = 14) sites (Knight Piésold 2007a) were each assessed for the quality of available fish habitat at least once between 2006 and 2009 (Baffinland 2009). Detailed assessments for these sites are provided in Knight Piésold (2007b, 2008) and Baffinland (2009 to 2016, incl.).

In 2017, monitoring was conducted at fish-bearing crossings. The emphasis of the 2017 monitoring program was to assess the presence of fish, habitat quality, and fish passage success at all fish-bearing sites and identify any potential impacts from upgrades or general road maintenance.

Habitat surveys involved observations of substrate, flow characteristics, and potential fish use along 50 m reaches upstream and downstream of each applicable crossing. Fish presence was determined through visual surveys and the use of a backpack electrofisher. In previous years, both methods have proven to be highly reliable techniques for determining fish presence/absence in the clear, shallow streams that are typical of the study area. Descriptions of habitat and condition of culverts were noted and photographs were taken. Results of aquatic monitoring are presented in Section 3.0.

Monitoring will continue in 2018 with descriptions of changes and potential impacts to be provided upon completion of upgrades on all crossings for fish bearing streams, both historical and those outlined in the TREEP (Table 2.2). It is expected that there will be some habitat gains (replacement of sea container crossings with bridges) and losses (extension/lengthening of some existing culverts) that will need to be accounted for as work continues.

2.3 FISH HABITAT COMPENSATION

Compensation works completed for the Tote Road prior to 2009 are described in detail in Knight Piésold (2007a) and the results of recent compensation works (e.g., rustic fishway at BG-30) and detailed fish habitat and fish use surveys from 2009 to 2016 are presented in Baffinland (2009 to 2016, incl.). Following successful completion of habitat works at BG-30 (Baffinland 2012), there was a net habitat gain of approximately 1,050 km², which together with other gains met the compensation goals described in Knight Piésold (2007a). Fish presence upstream of the fishway in BG-30 has been confirmed during site visits from 2013-2017, indicating structural integrity and successful fish passage has been maintained.

2.4 SUMMARY OF DESIGN CHANGES

Modifications to accommodate upgrades to the Tote Road and specific water crossings to support the Early Revenue Phase of the Project commenced in 2013 and remain ongoing. Upgrades completed in 2017 to fish bearing crossings are presented in Table 1. A photo summary of upgrades completed in 2017 is presented in Appendix B. These upgrades were presented to the DFO starting in 2013. Baffinland has received approvals from the DFO in the form of Letters of Advice (LOAs) (Appendix A) and email correspondence to proceed with these changes. During November 2016 to December 2017, work was completed on the four bridge crossings and ten fish bearing culvert crossings. Future Tote Road improvements/realignments may be required in support of on-going operations and future expansion projects, but will continue to follow the historical LOA's, original Hatch 2013 drawings and the TREEP. Baffinland Iron Mines will work with the Department of Fisheries and Oceans to ensure planned modifications to fish bearing crossings are in compliance of the federal *Fisheries Act*.

SECTION 3.0 - AQUATIC MONITORING

An aquatic monitoring program was developed to ensure that all measures and works specified in the No Net Loss and Monitoring Plan (Knight Piésold 2007a), as well as the *Fisheries Act* Authorization and amendments, and the TREEP have been implemented and are functioning as intended. Details of aquatic monitoring conducted up to 2016 are provided in Knight Piésold (2007b, 2008) and Baffinland (2009 to 2016, incl.). Aquatic monitoring in 2017 focussed on assessing any changes to fish distribution, habitat, and accessibility at all fish-bearing crossings.

3.1 CONSTRUCTION AND TURBIDITY MONITORING

There was no in-stream construction work in 2017 during periods of flow that required turbidity monitoring.

3.2 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS

Water quality monitoring data from Knight Piesold baseline monitoring work performed during 2005 and 2006, in conjunction with monitoring of the same crossings from 2015, 2016 and 2017 is presented in Table 3.1 to Table 3.8.

3.3 FISH USE ASSESSMENTS AT SELECT CROSSINGS

Fish use assessments in 2017 were conducted at all fish-bearing sites along the Tote Road. Table 4 summarizes assessments conducted in 2017 and identifies any potential fish passage or habitat issues. A summary of follow-up and corrective actions taken subsequent to the field assessments are also provided in Table 4.

Two fish-bearing streams (CV-115 and CV-057) providing marginal habitat were dry or nearly dry in 2017 and did not contain fish at the time of the survey in early July (Table 4). Two additional crossings (CV-176 and BG-50) were wetted, but fish were not captured or observed. CV-176 is used only by anadromous juveniles from Milne Inlet and their presence in the stream is normally sporadic. An absence of fish in BG-50 downstream is unexpected. Juvenile char typically congregated in the downstream scour pool. Causes of their absence in 2017 are unknown but it is suspected to be a result of a perched culvert, though perhaps more fish were using the left branch of the river with the bridge crossing and unobstructed access to upstream habitat. Monitoring in 2018 will focus on confirming these findings and potential basis for observed changes. Fish were captured or observed at all remaining known fish-bearing crossings in 2017. There were no fish passage or habitat issues observed at 23 of the 39 fish-bearing crossings assessed. Fish were captured upstream of the culverts and there were no velocity or physical obstructions at these crossings.

Issues with fish passage and/or habitat were observed at 12 crossings at the time of the survey in early July 2017. Three of these involved some form of physical obstruction to fish passage (e.g., instream silt fence, cobble piles at the upstream and/or downstream end of culverts) that was removed during, or shortly after, completion of the July survey.

Perching of culverts was noted at five crossings and, in some instances (e.g., BG-50), prevented the passage by fish although the crossing at the left branch of the river allows passage (Table 4). Several of these crossings showed greater perching (i.e., increase in vertical drop at downstream and/or upstream end of the culvert) than in previous years. The remaining four crossings with passage issues had damaged culverts that were blocking, or had the potential to block, fish passage. Crossings with damaged or perched culverts were targeted by the TREEP to improve all fish passage and any erosion and sedimentation issues (Table 4). Ten crossings were actively worked on in 2017 (Table 1) and work is planned to continue in 2018.

3.4 FISH USE ASSESSMENTS AT COMPENSATION SITES

All compensation works remain successful (including fish use of the rustic fishway installed at BG-30). For more details on habitat compensation activities, see Baffinland (2009, 2010, 2011, 2012, 2013, 2014, and 2015).

It is expected that there will be a reduction in the original HADD footprint size at crossings where bridges replaced sea containers and some change to the footprint size at crossings where new culverts have been installed and others replaced. Following completion of ERP upgrades and any additional works as recommended by the TREEP, HADD and compensation will be revisited to determine if sufficient compensation remains or if additional works will be required.

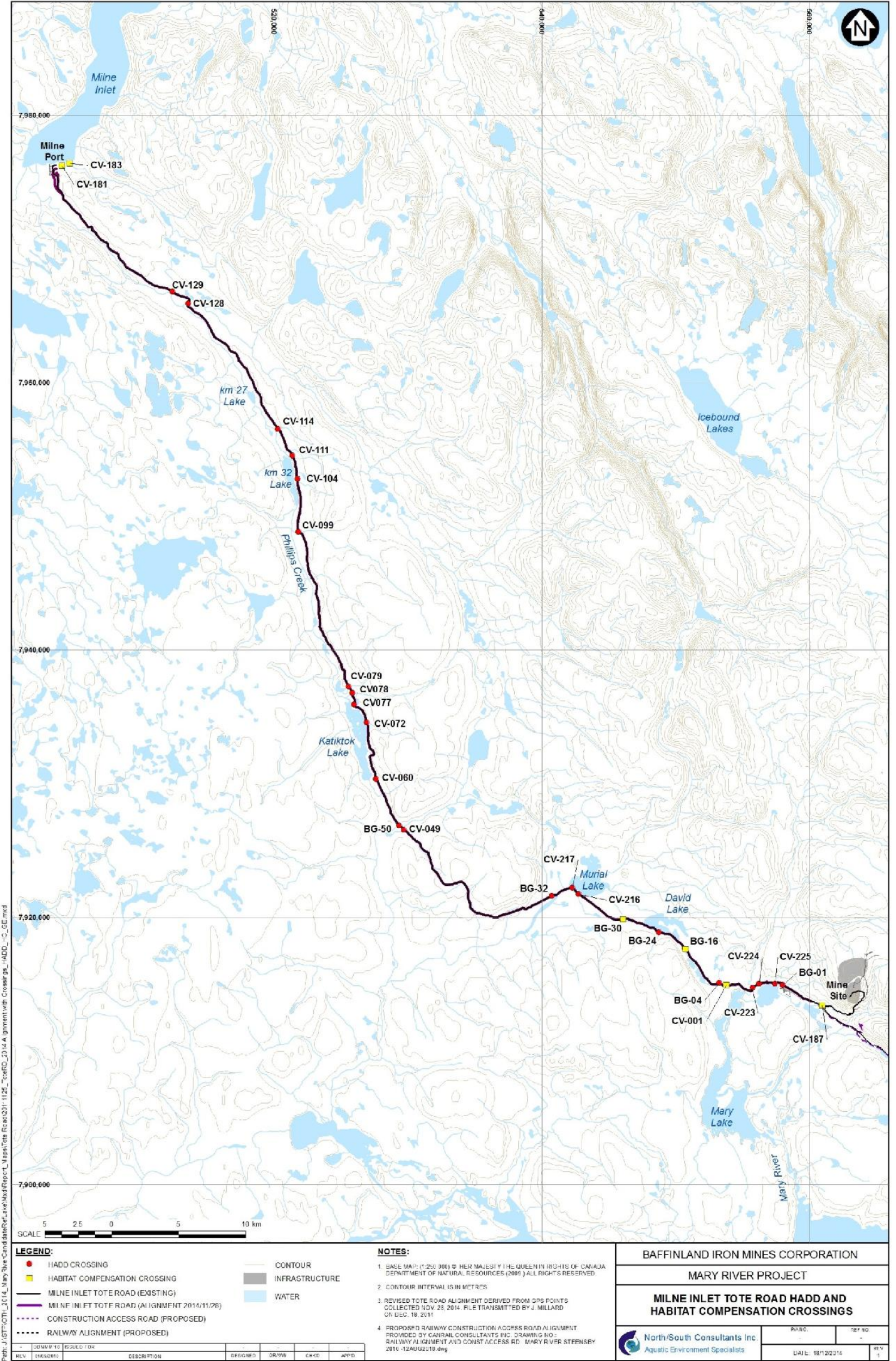
SECTION 4.0 - AUTHORIZED HADD CROSSING INSTALLATION SUMMARY

The locations for current authorized HADD crossings and habitat compensation sites are presented in Figure 1. As of November 30, 2008, all authorized HADD water crossings were installed. Remedial work up to August 2009 at the habitat compensation sites was substantially completed, and by October 2011 additional habitat compensation investigations and access structure installation were complete at select crossings. In 2012, new culverts were installed at two HADD crossings (BG-04 and BG-32) and habitat compensation works were completed at BG-30. No additional work was completed in 2013 due to pending potential upgrades to large portions of the Tote Road as part of the Early Revenue Phase of the Project. In 2013/14, bridges were installed at four crossings and culvert replacement/extension was initiated on another crossing. The now obsolete sea containers were removed from the CV-223 crossing during late fall 2014 and from BG-50 in late 2016, and from the remaining two crossings in early 2017. A complete and updated list of the HADD crossings and habitat compensation sites, including crossing IDs, is provided in Table 5. The data in this table reflect those that were presented in detail in previous reports (Knight Piésold 2007b and 2008, Baffinland 2009), as well as the results from the most recent Tote Road surveys that were completed since 2010 (Baffinland 2010 to 2016, incl.).

SECTION 5.0 - REFERENCES

- Baffinland Iron Mines Corporation. 2009. Mary River Project Bulk Sampling Program - Tote Road Upgrades, Fish Habitat Monitoring 2008 Annual Report to Department of Fisheries and Oceans.
- Baffinland Iron Mines Corporation. 2010. Mary River Project Bulk Sampling Program - Tote Road Upgrades, Fish Habitat Monitoring 2010 Annual Report to Department of Fisheries and Oceans.
- Baffinland Iron Mines Corporation. 2011. Mary River Project Bulk Sampling Program - Tote Road Upgrades, Fish Habitat Monitoring 2011 Annual Report to Department of Fisheries and Oceans.
- Baffinland Iron Mines Corporation. 2012. Mary River Project Bulk Sampling Program - Tote Road Upgrades, Fish Habitat Monitoring 2012 Annual Report to Department of Fisheries and Oceans.
- Baffinland Iron Mines Corporation. 2013. Mary River Project Bulk Sampling Program - Tote Road Upgrades, Fish Habitat Monitoring 2013 Annual Report to Department of Fisheries and Oceans.
- Baffinland Iron Mines Corporation. 2014. Mary River Project Early Revenue Phase - Tote Road Upgrades, Fish Habitat Monitoring 2014 Annual Report to Department of Fisheries and Oceans.
- Baffinland Iron Mines Corporation. 2015. Mary River Project Early Revenue Phase - Tote Road Upgrades, Fish Habitat Monitoring 2015 Annual Report to Department of Fisheries and Oceans.
- Baffinland Iron Mines Corporation. 2016. Mary River Project Early Revenue Phase - Tote Road Upgrades, Fish Habitat Monitoring 2016 Annual Report to Department of Fisheries and Oceans.
- Department of Fisheries and Oceans (DFO). 1998. Decision framework for the determination and authorization of harmful alteration, disruption or destruction of fish habitat. DFO Habitat Management and Environmental Science, Habitat Management Branch, Ottawa Ontario.
- Golder Associates Limited (Golder). 2017. Tote Road Earthworks Execution Plan and Design Report. Report No. 1667708, Rev. 0. Issued April 2017 by Golder Associates Limited.
- Knight Piésold 2007a. Baffinland Iron Mines Corporation, Mary River Project Bulk Sampling Program, Fish Habitat No Net Loss and Monitoring Plan (Ref. No. NB102-00181/10-4). A report prepared by Knight Piésold Ltd.
- Knight Piésold 2007b. Baffinland Iron Mines Corporation, Mary River Project Bulk Sampling Program - Tote Road Upgrades, Fish Habitat Monitoring 2007 Annual Report to Department of Fisheries and Oceans (Ref. No. NB102-00181/10-8). A report prepared by Knight Piésold Ltd.
- Knight Piésold 2007c. Baffinland Iron Mines Corporation, Mary River Project Bulk Sampling Program, Road Upgrade Design Summary (Ref. No. NB102-00181/10-1). A report prepared by Knight Piésold Ltd.
- Knight Piésold 2008. Baffinland Iron Mines Corporation, Mary River Project Bulk Sampling Program, Road Upgrades. Fish Habitat Monitoring 2008 Annual Report to Department of Fisheries and Oceans (Ref. No. NB102-00181/13-1). A report prepared by Knight Piésold Ltd.

FIGURES



TABLES

**TABLE 1 SUMMARY OF CHANGES TO TOTE ROAD CROSSINGS AT FISH-BEARING STREAMS COMPLETED FROM
DECEMBER 31, 2016 TO DECEMBER 30, 2017**

Crossing	Road Chainage (km.m)	Completed Work	Date Completed	Current Crossing Configuration	Fisheries Survey Conducted July 2017 ¹
CV112	A30+947	Existing culverts were extended	17-11-04	3 x 1.2m diameter	Fish were observed both upstream and downstream of the crossing. While movement through the left culvert is fine, the right culvert is badly damaged and may be blocking passage.
CV106	A32+681	Existing culverts were extended	17-12-01	1 x 1m diameter	Fish were observed downstream of the crossing. The culvert is perched too high for fish passage, with the vertical drop increasing since 2016.
CV059	A59+217	Existing culverts were replaced	17-12-18	4 x 0.5m diameter	Fish were observed downstream of the crossing. The culverts were submerged and damaged, with the potential for them to become blocked with substrate.
CV216	A80+951	Existing culverts were extended	17-10-05	3 x 1.2m diameter	Fish were observed downstream of the crossing. The culvert is perched too high for passage of young-of-the-year Arctic Char, which typically use this stream to access upstream habitat.
BG29	A84+706	Existing culverts were extended	17-11-10	1 x 1m diameter	Fish were observed both upstream and downstream of the crossing. Complete blockage of upstream and downstream ends of the culvert by cobble at the time of monitoring. Blockage was removed immediately by BIM staff.
BG01	A99+483	Existing culverts were extended	17-10-10	3 x 1.2m diameter	Fish were observed both upstream and downstream of the crossing. Culvert velocities were relatively high (1-1.5m/s), which may limit passage of smaller juveniles.
CV186	A102+587	Existing culverts were replaced & extended	17-11-27	2 x 1m diameter	Fish were observed both upstream and downstream of the crossing. No fish passage or habitat issues identified.
CV187	A102+856	Existing culverts were extended	17-04-24	1 x 1.0m diameter 1 x 0.5m diameter	Fish were observed upstream of the crossing. No fish passage or habitat issues identified.
BG32	A78+120	Existing culverts were extended	17-09-23	2 x 2.0m diameter	Fish were observed upstream of the crossing. No fish passage or habitat issues identified.
CV099	A37+343	Existing culverts were reinforced	17-12-03	1 x 1.2m diameter 1 x 2.0m diameter	Fish were observed upstream of the crossing. No fish passage or habitat issues identified.

1 – Fisheries survey conducted in July 2017 prior to additional culvert work completed in fall 2017.

TABLE 2 TECHNICAL SUMMARY OF EXISTING CROSSINGS STRUCTURES INSTALLED AT FISH-BEARING STREAMS ALONG THE TOTE ROAD

Water Crossing	Culvert No.	Existing Road Chainage (km + m)	Existing Diameter of CSP Culverts (m) ¹							Fish Habitat Quality Rating ³	Notes ⁴
			Ø = 2.0 (m)	Ø = 1.2 (m)	Ø = 1.0 (m)	Ø = 0.5 (m)	Ø = 0.25 (m)	Ø = 0.15 (m)	Ø = 0.10 (m)		
CV169	-	A5+149	-	-	-	X	-	-	-	MAR	-
CV167		A5+820	-	-	-	X	-	-	-	MAR	-
CV129	B	A16+800	-	X	-	-	-	-	-	IMP	-
	C	A16+803	-	X	-	-	-	-	-	IMP	-
CV128		A16+807	-	-	-	-	-	-	-	IMP	Bridge
CV115	A	A27+193	-	-	-	X	-	-	-	MAR	-
	B	A27+200	-	-	X	-	-	-	-	MAR	-
CV114		A29+151	-	-	X	-	-	-	-	MAR	-
CV112	A	A30+947	-	X	-	-	-	-	-	IMP	New
	B	A30+951	-	X	-	-	-	-	-	IMP	New
	C	A30+953	-	X	-	-	-	-	-	IMP	New
CV111		A31+489	-	-	X	-	-	-	-	IMP	-
CV106		A32+681	-	-	X	-	-	-	-	MAR	New
CV104	A	A33+301	-	X	-	-	-	-	-	MAR	-
	B	A33+307	-	X	-	-	-	-	-	MAR	-
CV102	A	A35+540	-	-	X	-	-	-	-	IMP	-
	B	A35+543	-	-	-	X	-	-	-	IMP	-
	C	A35+544	-	-	-	X	-	-	-	IMP	-
	D	A35+545	-	-	-	X	-	-	-	IMP	-
CV099	A	A37+351	X	-	-	-	-	-	-	IMP	New
	B	A37+343	X	-	-	-	-	-	-	IMP	New
CV087	A	A45+741	-	-	-	X	-	-	-	MAR	-
	B	A45+737	-	-	-	X	-	-	-	MAR	-
	C	A45+752	-	-	-	X	-	-	-	MAR	-
CV080		A50+002	-	-	X		-	-	-	IMP	-
CV079	A	A50+109	-	X	-	-	-	-	-	IMP	-
	B	A50+066	-	X	-	-	-	-	-	IMP	-
	C	A50+225	-	-	-	X	-	-	-	IMP	-

TABLE 2 TECHNICAL SUMMARY OF EXISTING CROSSINGS STRUCTURES INSTALLED AT FISH-BEARING STREAMS ALONG THE TOTE ROAD

Water Crossing	Culvert No.	Existing Road Chainage (km + m)	Existing Diameter of CSP Culverts (m) ¹							Fish Habitat Quality Rating ³	Notes ⁴
			Ø = 2.0 (m)	Ø = 1.2 (m)	Ø = 1.0 (m)	Ø = 0.5 (m)	Ø = 0.25 (m)	Ø = 0.15 (m)	Ø = 0.10 (m)		
CV078	D	A50+226	-	-	-	X	-	-	-	IMP	-
	A	A50+680	-	X	-	-	-	-	-	IMP	-
	B	NA	-	-	X	-	-	-	-	IMP	-
	C	NA	-	-	X	-	-	-	-	IMP	-
	D	NA	-	-	X	-	-	-	-	IMP	-
CV076		A52+536	-	X	-	-	-	-	-	MAR	-
CV072	A	A53+830	-	X	-	-	-	-	-	IMP	-
	B	A53+345	-	X	-	-	-	-	-	IMP	-
	C	A53+379	-	X	-	-	-	-	-	IMP	-
CV071	B	A54+005	-	-	X	-	-	-	-	MAR	-
CV060	A	A58+114	-	-	X	-	-	-	-	IMP	-
	B	A58+114	-	-	X	-	-	-	-	IMP	-
CV059	A	A59+217	-	-	-	X	-	-	-	MAR	New
	B	A59+216	-	-	-	X	-	-	-	MAR	New
	C	A59+217	-	-	-	X	-	-	-	MAR	New
	D	A59+218	-	-	-	X	-	-	-	MAR	New
CV058	A	A59+779	-	-	-	X	-	-	-	MAR	-
	B	A59+773	-	X	-	-	-	-	-	MAR	-
CV057	A	A59+970	-	-	-	X	-	-	-	MAR	-
	B	A59+966	-	-	-	X	-	-	-	MAR	-
	C	A59+967	-	-	-	X	-	-	-	MAR	-
BG50	A	A62+054	-	-	-	-	-	-	-	IMP	Bridge
	B	A62+081	-	X	-	-	-	-	-	IMP	-
	C	A62+081	-	X	-	-	-	-	-	IMP	-
CV049	A	A62+550	-	X	-	-	-	-	-	IMP	-
	B	A62+536	-	X	-	-	-	-	-	IMP	-
CV030	A	A77+495	-	X	-	-	-	-	-	MAR	-
	B	A77+435	-	-	-	X	-	-	-	MAR	-
BG32	A	A78+123	-	X	-	-	-	-	-	IMP	New

TABLE 2 TECHNICAL SUMMARY OF EXISTING CROSSINGS STRUCTURES INSTALLED AT FISH-BEARING STREAMS ALONG THE TOTE ROAD

Water Crossing	Culvert No.	Existing Road Chainage (km + m)	Existing Diameter of CSP Culverts (m) ¹							Fish Habitat Quality Rating ³	Notes ⁴
			Ø = 2.0 (m)	Ø = 1.2 (m)	Ø = 1.0 (m)	Ø = 0.5 (m)	Ø = 0.25 (m)	Ø = 0.15 (m)	Ø = 0.10 (m)		
CV217	B	A78+120	-	X	-	-	-	-	-	IMP	New
	A	79+854	X	-	-	-	-	-	-	IMP	-
	B	80+000	-	-	-	-	-	-	-	IMP	Bridge
CV216	A	A80+951	-	X	-	-	-	-	-	MAR	New
	B	A80+580	-	X	-	-	-	-	-	MAR	New
	C	A80+582	-	X	-	-	-	-	-	MAR	New
BG30		A84+636	-	-	X	-	-	-	-	IMP	-
BG29		A84+706	-	-	X	-	-	-	-	IMP	New
BG27		A86+499	-	-	-	X	-	-	-	MAR	-
BG24	A	A87+588	-	X	-	-	-	-	-	IMP	-
	B	A87+610	-	X	-	-	-	-	-	IMP	-
	C	A87+612	-	X	-	-	-	-	-	IMP	-
BG17	A	A90+016	-	X	-	-	-	-	-	IMP	-
	B	A90+019	-	X	-	-	-	-	-	IMP	-
BG04	A	A93+992	-	X	-	-	-	-	-	IMP	-
	B	A93+993	-	X	-	-	-	-	-	IMP	-
	C	A93+996	X	-	-	-	-	-	-	IMP	-
CV001	A	A94+606	-	-	-	X	-	-	-	IMP	-
	B	A94+351	-	-	X	-	-	-	-	IMP	-
	C	A94+353	-	-	-	X	-	-	-	IMP	-
CV223	A	A97+007	-	-	-	-	-	-	-	IMP	Bridge
	B	A97+050	X	-	-	-	-	-	-	IMP	-
	C	A97+052	-	X	-	-	-	-	-	IMP	-
	D	A97+082	-	X	-	-	-	-	-	IMP	-
	E	A97+084	-	X	-	-	-	-	-	IMP	-
CV224	A	A97+576	-	-	X	-	-	-	-	IMP	-
	B	A97+578	-	-	X	-	-	-	-	IMP	-
CV225	A	A98+845	-	X	-	-	-	-	-	IMP	-
	B	A98+804	-	X	-	-	-	-	-	IMP	-

TABLE 2 TECHNICAL SUMMARY OF EXISTING CROSSINGS STRUCTURES INSTALLED AT FISH-BEARING STREAMS ALONG THE TOTE ROAD

Water Crossing	Culvert No.	Existing Road Chainage (km + m)	Existing Diameter of CSP Culverts (m) ¹							Fish Habitat Quality Rating ³	Notes ⁴
			Ø = 2.0 (m)	Ø = 1.2 (m)	Ø = 1.0 (m)	Ø = 0.5 (m)	Ø = 0.25 (m)	Ø = 0.15 (m)	Ø = 0.10 (m)		
BG01	A	A99+483	-	X	-	-	-	-	-	IMP	New
	B	A99+483	-	X	-	-	-	-	-	IMP	New
	C	A99+483	-	X	-	-	-	-	-	IMP	New
CV186	A	A102+812	-	-	X	-	-	-	-	IMP	New
	B	A102+812	-	-	X	-	-	-	-	IMP	New
CV187	A	A102+856	-	-	-	X	-	-	-	MAR	New
	B	A102+856	-	-	X	-	-	-	-	MAR	New

1 – CSP = Corrugated steel pipe; Ø = culvert diameter

2 – Final length and survey culvert installation data to be provided in issued for construction drawings

3 – MAR = marginal, IMP = important

4 – New = culvert installed or worked on in 2017 along the Tote Road



Table 3.1 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS
SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-025 (CV128)

Parameters	Units	Method Detection Limit		LOR			CCME Guideline	Dates												
		2005	2006	2015	2016	2017		14-Jun-06	03-Aug-06	08-Sep-06	03-Jul-15	03-Jul-15	12-Aug-15	12-Aug-15	30-Jun-16	30-Jun-16	25-Aug-16	25-Aug-16	30-Jun-17	30-Jun-17
Rubidium	mg/L	-	-	-	0.0002	0.0002	-	-	-	-	-	-	-	-	0.00235	0.00231	0.00121	0.00122	0.00093	0.00093
Selenium	mg/L	0.005	0.001	0.0004	0.00005	0.00005	0.001	<0.001	<0.001	<0.001	<0.00040	<0.00040	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon	mg/L	-	-	-	0.05	0.05	-	-	-	-	-	-	-	-	1.98	1.75	0.437	0.451	0.54	0.54
Silver	mg/L	0.0001	0.0001	-	0.00005	0.00005	0.0001	<0.0001	<0.0001	<0.0001	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Sodium	mg/L	0.05	0.05	0.5	0.5	0.5	-	0.61	0.34	1.15	<0.50	<0.50	0.62	0.63	<0.50	<0.50	0.89	0.88	0.53	0.52
Strontium	mg/L	0.001	0.001	-	0.001	0.001	-	0.012	0.01	0.015	-	-	-	-	0.0074	0.0070	0.0114	0.0116	0.0047	0.0056
Sulphur	mg/L	-	-	-	0.5	0.5	-	-	-	-	-	-	-	-	<0.50	<0.50	<0.50	0.64	<0.50	<0.50
Tellurium	mg/L	-	-	-	0.0002	0.0002	-	-	-	-	-	-	-	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	mg/L	0.0002	-	0.0003	0.00001	0.00001	0.0008	-	-	-	<0.00030	<0.00030	<0.000010	<0.000010	0.000016	0.000014	<0.000010	<0.000010	<0.000010	<0.000010
Thorium	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	-	-	0.00138	0.00131	<0.00010	<0.00010	0.00012	0.00015
Tin	mg/L	0.001	0.01	-	0.0001	0.0001	-	<0.01	<0.01	<0.01	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	0.0003	0.0003	-	-	-	-	-	-	-	-	0.0256	0.0238	<0.00030	0.00042	0.00399	0.0045
Tungsten	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	mg/L	-	-	0.001	0.00001	0.00001	0.015	-	-	-	<0.0010	<0.0010	0.00135	0.00135	0.000505	0.000481	0.00212	0.00209	0.000299	0.000353
Vanadium	mg/L	0.0009	0.001	-	0.0005	0.0005	-	<0.001	<0.001	<0.001	-	-	-	-	0.00163	0.00149	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	0.001	0.01	0.003	0.003	0.003	0.03	<0.01	<0.01	<0.01	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zircounim	mg/L	-	-	-	0.0003	0.0003	-	-	-	-	-	-	-	-	0.00083	0.00076	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals and Non-Metals																				
Aluminum	mg/L	0.004	0.005	0.005	-	-	-	<0.005	<0.005	0.005	0.029	0.0108	0.0068	0.0122	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.001	0.0001	-	-	-	<0.001	<0.001	<0.001	<0.00010	<0.00010	<0.00010	<0.00010	-	-	-	-	-	-
Barium	mg/L	0.001	0.01	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	0.05	0.01	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.0001	0.0001	0.00001	-	-	-	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	<0.000010	<0.000010	-	-	-	-	-	-
Calcium	mg/L	0.05	1	0.05	-	-	-	16	16	21	9.65	9.46	14.1	14.2	-	-	-	-	-	-
Chromium	mg/L	0.001	0.001	-	-	-	-	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	0.0003	0.0002	-	-	-	-	<0.0002	<0.0002	<0.0002	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	0.0008	0.001	0.0002	-	-	-	<0.001	<0.001	<0.001	0.00034	0.00033	0.00041	0.00043	-	-	-	-	-	-
Iron	mg/L	0.02	0.03	0.01	-	-	-	<0.03	<0.03	<0.03	0.030	0.015	<0.010	0.014	-	-	-	-	-	-
Lead	mg/L	0.0002	0.001	0.00005	-	-	-	<0.001	<0.001	<0.001	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	-
Magnesium	mg/L	0.005	1	0.05	-	-	-	8	6	8	4.44	4.46	6.62	6.47	-	-	-	-	-	-
Manganese	mg/L	0.0007	0.01	0.0005	-	-	-	<0.01	<0.01	<0.01	0.00102	0.00072	0.00064	0.00084	-	-	-	-	-	-
Mercury	mg/L	-	-	0.00001	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	-	-	-	-	-	-
Molybdenum	mg/L	0.0003	0.005	0.00005	-	-	-	<0.005	<0.005	<0.005	0.000059	0.000063	0.000123	0.000123	-	-	-	-	-	-
Nickel	mg/L	0.001	0.005	0.0005	-	-	-	<0.005	<0.005	<0.005	<0.00050	<0.00050	<0.00050	<0.00050	-	-	-	-	-	-
Potassium	mg/L	0.02	0.01	0.05	-	-	-	0.52	0.26	0.55	0.361	0.348	0.465	0.463	-	-	-	-	-	-
Selenium	mg/L	0.005	0.001	0.00005	-	-	-	<0.001	<0.001	<0.001	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	-
Silver	mg/L	0.0001	0.0001	-	-	-	-	<0.0001	<0.0001	<0.0001	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	0.05	0.05	0.5	-	-	-	0.64	0.28	0.6	<0.50	<0.50	0.62	0.62	-	-	-	-	-	-
Strontium	mg/L	0.001	0.001	-	-	-	-	0.012	0.011	0.015	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0002	-	0.00001	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	-	-	-	-	-	-
Tin	mg/L	0.001	0.01	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	0.00001	-	-	-	-	-	-	0.000315	0.000317	0.00127	0.00127	-	-	-	-	-	-
Vanadium	mg/L	0.0009	0.001	-	-	-	-	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	0.001	0.01	0.001	-	-	-	<0.01	<0.01	<0.01	0.0021	<0.0010	<0.0010	0.0011	-	-	-	-	-	-

Notes:
Site Performance Objective's (SPO) are identified in Baffinland's 2AM-MRY-1325 Water Licence
2006 dissolved oxygen values in mg/L; 2015, 2016 and 2017 dissolved oxygen values in % saturation
* Result qualified by analytical laboratory
SPO and CCME guideline values are pH or Hardness dependent. The lowest to highest applicable guideline value is shown
(1) pH /Temp dependent
(2) pH dependent
(3) Hardness dependent

Analytical values which exceed SPO or calculated CCME guideline value are indicated below:

1	Shaded values exceed CCME guidelines
1	Bold values exceed SPO guidelines

Table 3.3 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS

SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-053 (CV093)

Parameters	Units	Method Detection Limit		LOR			CCME Guideline	Dates								
		2005	2006	2015	2016	2017		14-Jun-06	03-Aug-06	08-Sep-06	12-Aug-15	12-Aug-15	30-Jun-16	30-Jun-16	29-Jun-17	29-Jun-17
In Situ Parameters											US	DS	DS	US	US	DS
Temperature	°C	-	-	-	-	-	-	-0.08	9.96	5.77	5.5	5.9	11.3	5.6	3.2	3.8
Specific Conductance	mS/cm	-	-	-	-	-	-	0.148	0.160	0.182	0.340	0.320	11.570	11.570	0.197	0.182
Dissolved Oxygen %	mg/L	-	-	-	-	-	5.5-9.5	13.70	10.81	12.46	99.4	101.1	99.4	99.0	101.8	102.0
pH	pH units	-	-	-	-	-	6.5 - 9.0	8.32	8.15	8.24	8.42	8.43	8.02	7.99	7.90	7.85
Wetted Width	m	-	-	-	-	-	-	20	33	28	2.5	2.5	-	-	1.3	3.8
Average Depth	m	-	-	-	-	-	-	0.15	0.20	0.20	0.50	0.50	-	-	0.09	0.06
Flow Rate	m ³ /s	-	-	-	-	-	-	2	4.62	6.85	-	-	-	-	0.02223	0.10944
Physical Parameters																
pH	pH units	-	-	0.01	-	0.1	6.5 - 9.0	7.91	7.84	7.64	8.36	8.26	8.27	8.2	8.13	8.15
Conductivity	µS/cm	1	5	-	-	-	-	161	165	190	-	-	-	-	-	-
Turbidity	NTU	0.1	0.1	0.1	-	0.1	-	0.5	0.2	-	0.19	1.22	0.92	1.31	0.31	1.74
Hardness	mg/L as CaCO ₃	0.5	1	10	-	10	-	85	86	95	152	158	99	100	81	84
TSS	mg/L	-	-	-	-	2	-	-	-	-	<2.0	2.0	<2.0	4.4	2.1	5.5
TDS	mg/L	30	5	13	-	20	-	105	107	123	147	159	115	105	89	86
Dissolved Anions																
Alkalinity	mg/L as CaCO ₃	2	5	10	-	10	-	80	85	93	155	163	103	99	77	81
Br ⁻	mg/L	0.3	0.05	-	-	-	-	<0.05	<0.05	<0.05	-	-	-	-	-	-
Cl ⁻	mg/L	0.2	1	0.5	-	0.5	-	<1	<1	<1	0.74	3.07	0.61	0.57	<0.50	0.6
Fluoride	mg/L	-	-	-	-	0.02	-	-	-	-	-	-	0.036	0.03	0.028	0.027
SO ₄ ⁻	mg/L	0.5	1	0.3	-	0.3	-	3	2	7	2.66	3.9	1.22	1.24	0.62	1
Nutrients																
NH ₃ +NH ₄	mg/L N	0.1	0.02	0.15	-	0.15	0.021 - 231 ¹	0.04	<0.02	<0.02	0.23	<0.15	<0.15	<0.15	-	-
NO ₂ ⁻	mg/L N	0.06	0.005	-	-	-	0.06	<0.005	<0.005	0.015	-	-	-	-	-	-
NO ₃ ⁻	mg/L N	0.05	0.1	0.02	-	0.02	2.9	<0.10	<0.10	<0.10	0.023	0.026	<0.020	0.023	<0.020	<0.020
NO ₂ +NO ₃	mg/L N	0.06	0.1	-	-	-	-	<0.10	<0.10	<0.10	-	-	-	-	-	-
Ammonia total as N	mg/L	-	-	0.05	0.02	0.02	"Variable" ¹	-	-	-	-	-	<0.020	<0.020	<0.020	<0.020
Total Phosphorus	mg/L	0.02	0.01	0.003	-	0.003	-	<0.01	<0.01	<0.01	<0.0030	0.0037	0.0216	0.0657	0.0042	0.0046
Dissolved Phosphorus	mg/L	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Organic Compounds																
Phenols	mg/L	0.001	0.001	-	-	-	0.004	<0.001	<0.001	<0.001	-	-	-	-	-	-
DOC	mg/L	-	-	1	-	0.5	-	-	-	-	1.8	2.4	<1.0	<1.0	1.18	1.05
TOC	mg/L	-	-	1	-	0.5	-	-	-	-	1.8	2.1	1.2	<1.0	1.41	2.72
TKN	mg/L	-	-	0.15	-	0.15	-	-	-	-	0.23	<0.15	<0.15	<0.15	<0.15	<0.15
Chlorophyll-a	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pheophytin-a	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals and Non-Metals																
Aluminum	mg/L	0.004	0.005	0.01	0.01	0.005	0.005 - 0.100 ²	<0.005	<0.005	0.007	0.018	0.012	0.025	0.139	0.0133	0.048
Antimony	mg/L	0.0004	-	-	0.0001	0.0001	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.005	0.001	0.001	0.0001	0.0001	0.005	<0.001	<0.001	<0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium	mg/L	0.001	0.01	-	0.0002	0.0002	-	<0.01	<0.01	<0.01	-	-	0.00459	0.00434	0.00172	0.00297



Table 3.3 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS
SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-053 (CV093)

Parameters	Units	Method Detection Limit		LOR			CCME Guideline	Dates								
		2005	2006	2015	2016	2017		14-Jun-06	03-Aug-06	08-Sep-06	12-Aug-15	12-Aug-15	30-Jun-16	30-Jun-16	29-Jun-17	29-Jun-17
Beryllium	mg/L	0.005	-	-	0.0001	0.0001	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	0.0003	-	-	0.00005	0.00005	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	0.05	0.01	-	0.01	0.01	-	<0.01	<0.01	<0.01	-	-	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.0001	0.0001	0.0001	0.00001	0.00001	0.000017	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium	mg/L	0.05	1	0.5	0.5	0.5	-	24	25	27	44	43.6	31.2	31.6	26.8	26.9
Cesium	mg/L	-	-	-	0.00001	0.00001	-	-	-	-	-	-	<0.000010	0.000018	<0.000010	<0.000010
Chromium	mg/L	0.001	0.001	-	0.0005	0.0005	-	<0.001	<0.001	<0.001	-	-	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	0.0003	0.0002	-	0.0001	0.0001	-	<0.0002	<0.0002	<0.0002	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.0008	0.001	0.001	0.001	0.001	0.002 - 0.004 ³	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Iron	mg/L	0.02	0.03	0.05	0.05	0.05	0.3	<0.03	<0.03	<0.03	<0.050	<0.050	<0.050	0.179	<0.050	0.057
Lead	mg/L	0.0002	0.001	0.0005	0.0001	0.0001	0.001 - 0.007 ³	<0.001	<0.001	<0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.000050	<0.000050
Lithium	mg/L	-	-	-	0.001	0.001	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium	mg/L	0.005	1	0.5	0.05	0.05	-	6.0	5.0	6.0	11.8	13.8	5.02	5.19	3.5	4.13
Manganese	mg/L	0.0007	0.01	0.001	0.0005	0.0005	-	<0.01	<0.01	<0.01	<0.00050	<0.00050	0.00058	0.00362	<0.00050	0.00128
Mercury	mg/L	0.0001	0.0001	0.00001	0.00001	0.00001	0.000026	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum	mg/L	0.0003	0.005	0.0005	0.00005	0.00005	0.073	<0.005	<0.005	<0.005	<0.00050	<0.00050	0.000093	0.000091	<0.000050	0.000068
Nickel	mg/L	0.001	0.005	0.001	0.0005	0.0005	0.025 - 0.150 ³	<0.005	<0.005	<0.005	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus	mg/L	-	-	-	0.05	0.05	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050
Potassium	mg/L	0.02	0.01	1	0.05	0.05	-	0.24	0.15	0.23	0.339	0.515	0.618	0.539	0.299	0.475
Rubidium	mg/L	-	-	-	0.0002	0.0002	-	-	-	-	-	-	0.00122	0.00107	0.00023	0.00064
Selenium	mg/L	0.005	0.001	0.0004	0.00005	0.00005	0.001	<0.001	<0.001	<0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon	mg/L	0.0001	0.0001	-	0.05	0.05	-	<0.0001	<0.0001	<0.0001	-	-	0.643	0.846	0.44	0.59
Silver	mg/L	-	-	-	0.00005	0.00005	0.0001	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050
Sodium	mg/L	0.05	0.05	0.5	0.5	0.5	-	0.34	0.23	0.58	0.61	1.75	<0.50	<0.50	<0.50	<0.50
Strontium	mg/L	0.001	0.001	-	0.001	0.001	-	0.019	0.018	0.022	-	-	0.0295	0.0284	0.0216	0.0242
Sulfur	mg/L	-	-	-	0.5	0.5	-	-	-	-	-	-	0.74	<0.50	<0.50	0.66
Tellurium	mg/L	-	-	-	0.0002	0.0002	-	-	-	-	-	-	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	mg/L	0.0002	-	0.0003	0.00001	0.00001	0.0008	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Tin	mg/L	0.001	0.01	-	0.0001	0.0001	-	<0.01	<0.01	<0.01	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	0.003	-	-	0.0003	0.0003	-	-	-	-	-	-	0.00097	0.00745	0.00043	0.00305
Tungsten	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	mg/L	-	-	0.001	0.00001	0.00001	0.015	-	-	-	0.000422	0.00059	0.000159	0.000159	0.000082	0.000125
Vanadium	mg/L	0.0009	0.001	-	0.0005	0.0005	-	<0.001	<0.001	<0.001	-	-	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	0.001	0.01	0.003	0.003	0.003	0.03	<0.01	<0.01	<0.01	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium	mg/L	-	-	-	0.0003	0.0003	-	-	-	-	-	-	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals and Non-Metals																
Aluminum	mg/L	0.004	0.005	0.005	-	-	-	<0.005	<0.005	<0.005	<0.0050	0.0412	-	-	-	-
Antimony	mg/L	0.0004	-	0.0001	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.001	-	-	-	-	<0.001	<0.001	<0.001	<0.00010	<0.00010	-	-	-	-
Barium	mg/L	0.001	0.01	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-
Beryllium	mg/L	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	0.0003	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	0.05	0.01	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-
Cadmium	mg/L	0.0001	0.0001	0.00001	-	-	-	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	-	-	-	-
Calcium	mg/L	0.05	1	0.05	-	-	-	24	26	28	43	41.9	-	-	-	-

Table 3.3 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS
SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-053 (CV093)

Parameters	Units	Method Detection Limit		LOR			CCME Guideline	Dates								
		2005	2006	2015	2016	2017		14-Jun-06	03-Aug-06	08-Sep-06	12-Aug-15	12-Aug-15	30-Jun-16	30-Jun-16	29-Jun-17	29-Jun-17
Cesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	0.001	-	-	-	-	<0.001	<0.001	<0.001	-	-	-	-	-	-
Cobalt	mg/L	0.0003	0.0002	-	-	-	-	<0.0002	<0.0002	<0.0002	-	-	-	-	-	-
Copper	mg/L	0.0008	0.001	0.0002	-	-	-	<0.001	<0.001	<0.001	0.00024	0.00038	-	-	-	-
Iron	mg/L	0.02	0.03	0.01	-	-	-	<0.03	<0.03	<0.03	<0.010	0.03	-	-	-	-
Lead	mg/L	0.0002	0.001	0.00005	-	-	-	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	0.005	1	0.05	-	-	-	6	5	6	10.9	13	-	-	-	-
Manganese	mg/L	0.0007	0.01	0.0005	-	-	-	<0.01	<0.01	<0.01	<0.00050	0.00051	-	-	-	-
Mercury	mg/L	-	-	-	-	-	-	-	-	-	<0.000010	<0.000010	-	-	-	-
Molybdenum	mg/L	0.0003	0.005	0.00001	-	-	-	<0.005	<0.005	<0.005	0.000076	0.000118	-	-	-	-
Nickel	mg/L	0.001	0.005	0.00005	-	-	-	<0.005	<0.005	<0.005	<0.00050	<0.00050	-	-	-	-
Phosphorus	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	0.02	0.01	0.0005	-	-	-	0.24	0.15	0.25	0.344	0.538	-	-	-	-
Rubidium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.005	0.001	0.05	-	-	-	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001	0.0001	0.00005	-	-	-	<0.0001	<0.0001	<0.0001	-	-	-	-	-	-
Sodium	mg/L	0.05	0.05	0.5	-	-	-	0.32	0.24	0.4	0.6	1.61	-	-	-	-
Strontium	mg/L	0.001	0.001	-	-	-	-	0.018	0.019	0.022	-	-	-	-	-	-
Thallium	mg/L	0.0002	-	0.00001	-	-	-	-	-	-	<0.000010	<0.000010	-	-	-	-
Tin	mg/L	0.001	0.01	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-
Titanium	mg/L	0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	0.00001	-	-	-	-	-	-	0.000414	0.000573	-	-	-	-
Vanadium	mg/L	0.0009	0.001	-	-	-	-	<0.001	<0.001	<0.001	-	-	-	-	-	-
Zinc	mg/L	0.001	0.01	0.001	-	-	-	<0.01	<0.01	<0.01	<0.0010	0.0025	-	-	-	-

Notes:

Site Performance Objective's (SPO) are identified in Baffinland's 2AM-MRY-1325 Water Licence

2006 dissolved oxygen values in mg/L; 2015, 2016 and 2017 dissolved oxygen values in % saturation

* Result qualified by analytical laboratory

SPO and CCME guideline values are pH or Hardness dependent. The lowest to highest applicable guideline value is shown

(1) pH /Temp dependent

(2) pH dependent

(3) Hardness dependent

Analytical values which exceed SPO or calculated CCME guideline value are indicated below:

1	Shaded values exceed CCME guidelines
1	Bold values exceed SPO guidelines



MARY RIVER PROJECT

Fish Habitat Monitoring 2017 Annual Report
December 2017

Table 3.4 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS
SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-060 (CV078)

Parameters	Units	Method Detection Limit		LOR			CCME Guideline	Date													
		2005	2006	2015	2016	2017		13-Jun-05	06-Aug-05	09-Sep-05	13-Jun-06	02-Aug-06	08-Sep-06	12-Aug-15	12-Aug-15	30-Jun-16	30-Jun-16	25-Aug-16	25-Aug-16	29-Jun-17	29-Jun-17
In Situ Parameters														US	DS	DS	US	DS	US	US	DS
Temperature	°C	-	-	-	-	-	-	0.22	9.28	4.02	-0.06	13.05	3.95	9.6	9.3	8.16	9.36	9.8	10	3.8	4.4
Specific Conductance	mS/cm	-	-	-	-	-	-	0.079	0.222	0.284	0.097	0.237	0.267	0.314	0.315	7.264	7.264	0.299	0.297	0.154	0.123
Dissolved Oxygen	mg/L	-	-	-	-	-	-	13.48	10.95	12.72	14.17	11.43	12.55	-	-	-	-	-	-	-	-
Dissolved Oxygen	%	-	-	-	-	-	5.5-9.5	-	-	-	-	-	-	102.7	102.3	100.4	100.1	102.5	103.8	102.20	102.80
pH	pH units	-	-	-	-	-	6.5 - 9.0	7.36	8.30	7.96	8.22	8.26	8.36	8.53	8.48	7.81	7.93	8.24	8.25	7.65	7.87
Wetted Width	m	-	-	-	-	-	-	-	-	-	ice	9	9	3	3	-	-	-	-	11	10
Average Depth	m	-	-	-	-	-	-	-	-	-	0.15	0.25	0.2	0.1	0.1	-	-	-	-	2	0.19
Flow Rate	m³/s	-	-	-	-	-	-	-	-	-	-	0.74	0.96	-	-	-	-	-	-	2.90	2.78
Physical Parameters																					
pH	pH units	-	-	0.01	0.01	0.1	6.5 - 9.0	-	-	-	7.56	8.10	8.10	8.16	8.32	8.09	8.09	8.42	8.42	7.93	7.91
Conductivity	µS/cm	1	5	-	-	-	-	83	234	269	104	244	277	-	-	-	-	-	-	-	-
Turbidity	NTU	0.1	0.1	0.1	0.1	0.1	-	0.40	<0.10	<0.10	0.5	<0.10	-	1.45	0.24	0.26	0.17	0.13	0.14	0.5	0.37
Hardness	mg/L as CaCO₃	0.5	1	10	10	10	-	41.0	124	160	52	137	141	156	152	60	59	165	163	46	44
TSS	mg/L	30	5	2		2	-	-	-	-	-	-	-	2.4	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
TDS	mg/L	-	-	-	20	20	-	63	123	120	68	159	180	159 *	143 *	65	70	152	148	50	56
Dissolved Anions																					
Alkalinity	mg/L as CaCO₃	2	5	10	10	10	-	40	120	141	51	132	146	158	152	61	64	161	158	41	43
Br⁻	mg/L	0.3	0.05	-	-	-	-	<0.3	<0.3	<0.3	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-
Cl⁻	mg/L	0.2	1	0.5	0.5	0.5	-	0.9	0.2	0.6	<1	<1	<1	3.08	0.79	<0.50	<0.50	1.19	1.19	<0.50	<0.50
Fluoride	mg/L	-	-	-	0.02	0.02	-	-	-	-	-	-	-	-	-	<0.020	<0.020	0.023	0.024	<0.020	<0.020
SO₄ ⁻	mg/L	0.5	1	0.3	0.3	0.3	-	0.6	0.8	1.9	2.0	1.0	5.0	3.84	2.68	<0.30	0.31	3.37	3.35	<0.30	<0.30
Nutrients																					
NH₃+NH₄	mg/L N	0.1	0.02	0.15	0.15	0.15	0.021 - 231¹	0.2	0.6	0.8	<0.02	<0.02	<0.02	0.24	0.25	<0.15	<0.15	<0.15	<0.15	-	-
NO₂ ⁻	mg/L N	0.06	0.005	-	-	-	0.06	<0.06	<0.06	<0.06	<0.005	<0.005	0.018	-	-	-	-	-	-	-	-
NO₃ ⁻	mg/L N	0.05	0.1	0.02	0.02	0.02	2.9	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	0.030	0.026	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
NO₂+NO₃	mg/L N	0.06	0.1	-	-	-	-	<0.06	<0.06	<0.06	<0.10	<0.10	<0.10	-	-	-	-	-	-	-	-
Ammonia total as N	mg/L	-	-	0.05	0.02	0.02	Variable¹	-	-	-	-	-	-	<0.050	<0.050	0.021	<0.020	0.027	0.041	<0.020	<0.020
Total Phosphorus	mg/L	0.02	0.01	0.003	0.003	0.003	-	<0.02	<0.02	<0.10	<0.01	<0.01	<0.01	0.0044	<0.0030	0.0193	0.0282	0.01	0.0139	0.0085	0.0304
Dissolved Phosphorus	mg/L	0.02	-	-	-	-	-	<0.02	<0.02	<0.10	-	-	-	-	-	-	-	-	-	-	-
Organic Compounds																					
Phenols	mg/L	0.001	0.001	-	-	-	0.004	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
DOC	mg/L	-	-	1	0.5	0.5	-	-	-	-	-	-	-	2.4	1.9	1	<1.0	1.5	1.5	1.75	1.78
TOC	mg/L	-	-	1	0.5	0.5	-	-	-	-	-	-	-	2.2	1.8	1.1	1.0	1.6	1.6	2.24	2.13
TKN	mg/L	-	-	0.15	0.1	0.15	-	-	-	-	-	-	-	0.24	0.25	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
Chlorophyll-a	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pheophytin-a	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals and Non-Metals																					
Aluminum	mg/L	0.004	0.005	0.01	0.01	0.005	0.005 - 0.100²	0.006	<0.004	<0.004	0.006	<0.005	<0.005	0.059	0.016	0.011	0.016	<0.010	<0.010	0.0271	0.024
Antimony	mg/L	0.0004	-	-	0.0001	0.0001	-	<0.0004	<0.0004	<0.0004	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic	mg/L	0.005	0.001	0.001	0.0001	0.0001	0.005	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	0.00011	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010
Barium	mg/L	0.001	0.01	-	0.0002	0.0002	-	<0.001	0.002	0.003	<0.01	<0.01	<0.01	-	-	0.00166	0.0019	0.00389	0.00385	0.00131	0.00128
Beryllium	mg/L	0.005	-	-	0.0001	0.0001	-	<0.005	<0.005	<0.005	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	0.0003	-	-	0.00005	0.00005	-	<0.0003	<0.0003	<0.0003	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	0.05	0.01	-	0.01	0.01	-	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium	mg/L	0.0001	0.0001	0.0001	0.00001	0.00001	0.000017	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010



MARY RIVER PROJECT

Fish Habitat Monitoring 2017 Annual Report
December 2017

Table 3.4 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS
SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-060 (CV078)

Parameters	Units	Method Detection Limit		LOR			CCME Guideline	Date												29-Jun-17	29-Jun-17
		2005	2006	2015	2016	2017		13-Jun-05	06-Aug-05	09-Sep-05	13-Jun-06	02-Aug-06	08-Sep-06	12-Aug-15	12-Aug-15	30-Jun-16	30-Jun-16	25-Aug-16	25-Aug-16		
Calcium	mg/L	0.05	1	0.5	0.5	0.5	-	13.2	35.5	44.7	17	41	41	45	43.1	17.4	16.8	45.9	45.6	12.6	12.1
Cesium	mg/L	-	-	-	0.00001	0.00001	-	-	-	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Chromium	mg/L	0.001	0.001	-	0.0005	0.0005	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	0.0003	0.0002	-	0.0001	0.0001	-	<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.0008	0.001	0.001	0.001	0.001	0.002 - 0.004 ³	<0.0008	<0.0008	<0.0008	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Iron	mg/L	0.02	0.03	0.05	0.05	0.05	0.3	<0.05	<0.02	<0.02	<0.03	<0.03	<0.03	0.053	<0.050	<0.050	<0.050	<0.050	<0.050	0.075	<0.050
Lead	mg/L	0.0002	0.001	0.0005	0.0001	0.0001	0.001 - 0.007 ³	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000050	<0.000050
Lithium	mg/L	-	-	-	0.001	0.001	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010	0.0015	0.0016	<0.0010	<0.0010
Magnesium	mg/L	0.005	1	0.001	0.05	0.05	-	1.91	8.74	11.7	3	9	11	14	11.7	3.94	4.03	12.2	11.9	3.44	3.4
Manganese	mg/L	0.0007	0.01	0.00001	0.0005	0.0005	-	0.0016	<0.0007	<0.0007	<0.01	<0.01	<0.01	0.000850	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00113	0.00096
Mercury	mg/L	0.0001	0.0001	0.0005	0.00001	0.00001	0.000026	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum	mg/L	0.0003	0.005	0.001	0.00005	0.00005	0.073	<0.0003	<0.0003	<0.0003	<0.005	<0.005	<0.005	<0.00050	<0.00050	<0.000050	<0.000050	0.000093	0.000091	<0.000050	<0.000050
Nickel	mg/L	0.001	0.005	0.001	0.0005	0.0005	0.025 - 0.150 ³	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus	mg/L	-	-	-	0.05	0.05	-	-	-	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium	mg/L	0.02	0.01	0.05	0.05	0.05	-	0.26	0.26	0.27	0.22	0.28	0.30	0.508	0.355	0.21	0.216	0.344	0.355	0.24	0.245
Rubidium	mg/L	-	-	-	0.0002	0.0002	-	-	-	-	-	-	-	-	-	<0.00020	0.00022	0.00032	0.00034	0.00021	0.00022
Selenium	mg/L	0.005	0.001	0.00005	0.00005	0.00005	0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon	mg/L	-	-	-	0.05	0.05	-	-	-	-	-	-	-	-	-	0.368	0.385	0.789	0.749	0.3	0.29
Silver	mg/L	0.0001	0.0001	-	0.00005	0.00005	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Sodium	mg/L	0.05	0.05	0.5	0.5	0.5	-	0.31	0.27	0.36	0.31	0.31	0.47	1.71	0.61	<0.50	<0.50	0.72	0.7	<0.50	<0.50
Strontium	mg/L	0.001	0.001	-	0.001	0.001	-	0.0098	0.0226	0.0293	0.013	0.029	0.030	-	-	0.0123	0.0121	0.035	0.0337	0.0078	0.0079
Sulfur	mg/L	-	-	-	0.5	0.5	-	-	-	-	-	-	-	-	-	<0.50	<0.50	1.52	1.46	<0.50	<0.50
Tellurium	mg/L	-	-	-	0.0002	0.0002	-	-	-	-	-	-	-	-	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	mg/L	0.0002	-	0.0001	0.00001	0.00001	0.0008	<0.0002	<0.0002	<0.0002	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin	mg/L	0.001	0.01	-	0.0001	0.0001	-	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	0.003	-	-	0.0003	0.0003	-	<0.003	<0.003	<0.003	-	-	-	-	-	0.0006	0.00083	<0.00030	0.00032	0.00091	0.00087
Tungstun	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	mg/L	-	-	0.001	0.00001	0.00001	0.015	-	-	-	-	-	-	0.000577	0.000403	0.000072	0.000073	0.000468	0.000458	0.000047	0.000039
Vanadium	mg/L	0.0009	0.001	-	0.0005	0.0005	-	<0.0009	<0.0009	<0.0009	<0.001	<0.001	<0.001	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	0.001	0.01	0.003	0.003	0.003	0.03	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium	mg/L			-	0.0003	0.0003	-	-	-	-	-	-	-	-	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals and Non-Metals																					
Aluminum	mg/L	0.004	0.005	0.005	-	-	0.005	<0.004	<0.004	<0.004	<0.005	<0.005	<0.005	<0.0050	<0.0050	-	-	-	-	-	-
Antimony	mg/L	0.0004	-	-	-	-	-	<0.0004	<0.0004	<0.0004	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.001	0.0001	-	-	0.0001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.00010	<0.00010	-	-	-	-	-	-
Barium	mg/L	0.001	0.01	-	-	-	-	<0.001	0.002	0.003	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-
Beryllium	mg/L	0.005	-	-	-	-	-	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	0.0003	-	-	-	-	-	<0.0003	<0.0003	<0.0003	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	0.05	0.01	-	-	-	-	<0.05	0.02	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.0001	0.0001	0.00001	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	-	-	-	-	-	-
Calcium	mg/L	0.05	1	0.05	-	-	0.00001	13.1	37.5	42.4	16	40	40	41.3	42.8	-	-	-	-	-	-
Chromium	mg/L	0.001	0.001	-	-	-	0.05	<0.001	0.002	0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
Cobalt	mg/L	0.0003	0.0002	-	-	-	-	<0.0003	0.0004	<0.0003	<0.0002	<0.0002	<0.0002	-	-	-	-	-	-	-	-
Copper	mg/L	0.0008	0.001	0.0002	-	-	-	<0.0008	<0.0008	<0.0008	<0.001	<0.001	<0.001	0.00034	0.00024	-	-	-	-	-	-
Iron	mg/L	0.02	0.03	0.01	-	-	0.0002	<0.05	<0.02	<0.02	<0.03	<0.03	<0.03	<0.010	<0.010	-	-	-	-	-	-



Table 3.4 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS
SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-060 (CV078)

Parameters	Units	Method Detection Limit		LOR			CCME Guideline	Date													
		2005	2006	2015	2016	2017		13-Jun-05	06-Aug-05	09-Sep-05	13-Jun-06	02-Aug-06	08-Sep-06	12-Aug-15	12-Aug-15	30-Jun-16	30-Jun-16	25-Aug-16	25-Aug-16	29-Jun-17	29-Jun-17
Lead	mg/L	0.0002	0.001	0.00005	-	-	0.01	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	0.005	1	0.05	-	-	0.05	2.09	9.19	11.0	3	9	10	12.8	10.9	-	-	-	-	-	-
Manganese	mg/L	0.0007	0.01	0.0005	-	-	0.0005	0.0013	<0.0007	<0.0007	<0.01	<0.01	<0.01	<0.00050	<0.00050	-	-	-	-	-	-
Mercury	mg/L	-	-	0.00001	-	-	0.00001	-	-	-	-	-	-	<0.000010	<0.000010	-	-	-	-	-	-
Molybdenum	mg/L	0.0003	0.005	0.00005	-	-	0.00005	<0.0003	<0.0003	<0.0003	<0.005	<0.005	<0.005	0.000125	0.000086	-	-	-	-	-	-
Nickel	mg/L	0.001	0.005	0.0005	-	-	0.0005	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.00050	<0.00050	-	-	-	-	-	-
Potassium	mg/L	0.02	0.01	0.05	-	-	0.05	0.26	0.28	0.26	0.20	0.27	0.28	0.488	0.361	-	-	-	-	-	-
Selenium	mg/L	0.005	0.001	0.00005	-	-	0.00005	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001	0.0001	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	1.61	0.61	-	-	-	-	-	-
Sodium	mg/L	0.05	0.05	-	-	-	0.5	0.30	0.28	0.34	0.30	0.30	0.46	-	-	-	-	-	-	-	-
Strontium	mg/L	0.001	0.001	-	-	-	-	0.0099	0.0247	0.0281	0.012	0.028	0.030	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0002	-	0.00001	-	-	0.00001	<0.0002	<0.0002	<0.0002	-	-	-	<0.000010	<0.000010	-	-	-	-	-	-
Tin	mg/L	0.001	0.01	-	-	-	-	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-
Titanium	mg/L	0.003	-	-	-	-	-	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	0.00001	-	-	0.00001	-	-	-	-	-	-	0.000549	0.000409	-	-	-	-	-	-
Vanadium	mg/L	0.0009	0.001	-	-	-	-	<0.0009	0.0043	0.0042	<0.001	<0.001	0.002	-	-	-	-	-	-	-	-
Zinc	mg/L	0.001	0.01	0.001	-	-	0.001	<0.001	0.001	0.002	<0.01	<0.01	<0.01	<0.0010	0.0026	-	-	-	-	-	-

Notes:

Site Performance Objective's (SPO) are identified in Baffinland's 2AM-MRY-1325 Water Licence

2006 dissolved oxygen values in mg/L; 2015, 2016 and 2017 dissolved oxygen values in % saturation

* Result qualified by analytical laboratory

SPO and CCME guideline values are pH or Hardness dependent. The lowest to highest applicable guideline value is shown

(1) pH /Temp dependent

(2) pH dependent

(3) Hardness dependent

Analytical values which exceed SPO or calculated CCME guideline value are indicated below:

1	Shaded values exceed CCME guidelines
1	Bold values exceed SPO guidelines



Table 3.6 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS
SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-080 (CV040)

Parameters	Units	Method Detection Limit		LOR			CCME Guideline	Dates																
		2005	2006	2015	2016	2017		13-Jun-05	06-Aug-05	09-Sep-05	13-Jun-06	13-Jun-06	02-Aug-06	08-Sep-06	03-Jul-15	03-Jul-15	11-Aug-15	11-Aug-15	29-Jun-16	29-Jun-16	25-Aug-16	25-Aug-15	29-Jun-17	29-Jun-17
Titanium	mg/L	0.003	-	-	0.0003	0.0003	-	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	0.00455	0.00162	0.00166	0.00112	0.00245	0.00325
Tungsten	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	mg/L	-	-	0.001	0.00001	0.00001	0.015	-	-	-	-	-	-	-	0.0011	0.0010	0.00326	0.00293	0.000507	0.000533	0.00361	0.00367	0.000129	0.000132
Vanadium	mg/L	0.0009	0.001	-	0.0005	0.0005	-	<0.0009	<0.0009	<0.0009	<0.001	<0.001	0.001	<0.001	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	0.001	0.01	0.003	0.003	0.003	0.03	<0.001	0.0010	<0.001	<0.01	<0.01	<0.01	<0.01	<0.0030	<0.0030	<0.0030	0.0043	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium	mg/L	-	-	-	0.0003	0.0003	-	-	-	-	-	-	-	-	-	-	-	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals and Non-Metals																								
Aluminum	mg/L	0.004	0.005	0.005	-	-	-	<0.004	<0.004	<0.004	<0.005	<0.005	<0.005	<0.005	<0.0050	<0.0050	<0.0050	0.0101	-	-	-	-	-	-
Antimony	mg/L	0.0004	-	0.0001	-	-	-	<0.0004	<0.0004	<0.0004	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.001	-	-	-	-	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	<0.00010	<0.00010	0.00010	<0.00010	-	-	-	-	-	-
Barium	mg/L	0.001	0.01	-	-	-	-	<0.001	0.005	0.007	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	0.005	-	-	-	-	-	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	0.0003	-	-	-	-	-	<0.0003	<0.0003	<0.0003	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	0.05	0.01	-	-	-	-	<0.05	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.0001	0.0001	0.00001	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	<0.000010	<0.000010	-	-	-	-	-	-
Calcium	mg/L	0.05	1	0.05	-	-	-	6.06	35.0	40.5	11	11	38	39	22.5	22.3	37.9	39.6	-	-	-	-	-	-
Chromium	mg/L	0.001	0.001	-	-	-	-	<0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	0.0003	0.0002	-	-	-	-	<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	0.0008	0.001	0.0002	-	-	-	<0.0008	<0.0008	<0.0008	<0.001	<0.001	<0.001	<0.001	0.00057	0.00054	0.00076	0.00077	-	-	-	-	-	-
Iron	mg/L	0.02	0.03	0.01	-	-	-	<0.05	<0.02	<0.02	<0.03	<0.03	<0.03	<0.03	<0.010	<0.010	<0.010	0.014	-	-	-	-	-	-
Lead	mg/L	0.0002	0.001	0.00005	-	-	-	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.001	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	-
Magnesium	mg/L	0.005	1	0.05	-	-	-	2.50	13.3	16.0	5	5	14	15	9.49	9.32	17.8	17	-	-	-	-	-	-
Manganese	mg/L	0.0007	0.01	0.0005	-	-	-	0.0022	<0.0007	<0.0007	<0.01	<0.01	<0.01	<0.01	<0.00050	<0.00050	<0.00050	0.00118	-	-	-	-	-	-
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	-	-	-	-	-	-
Molybdenum	mg/L	0.0003	0.005	0.00001	-	-	-	<0.0003	<0.0003	<0.0003	<0.005	<0.005	<0.005	<0.005	0.000067	0.000073	0.000176	0.000174	-	-	-	-	-	-
Nickel	mg/L	0.001	0.005	0.00005	-	-	-	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.00050	<0.00050	<0.00050	<0.00050	-	-	-	-	-	-
Potassium	mg/L	0.02	0.01	0.0005	-	-	-	0.39	0.72	0.76	0.61	0.60	0.73	0.80	0.644	0.607	1.24	1.24	-	-	-	-	-	-
Selenium	mg/L	0.005	0.001	0.05	-	-	-	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	<0.000050	<0.000050	<0.000050	<0.000050	-	-	-	-	-	-
Silver	mg/L	0.0001	0.0001	0.00005	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	0.05	0.05	0.5	-	-	-	0.29	1.25	1.96	0.42	0.46	1.38	3.12	2.54	2.41	7.10	6.67	-	-	-	-	-	-
Strontium	mg/L	0.001	0.001	-	-	-	-	0.0027	0.0192	0.0224	0.005	0.005	0.023	0.026	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0002	-	0.00001	-	-	-	<0.0002	<0.0002	<0.0002	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	-	-	-	-	-	-
Tin	mg/L	0.001	0.01	-	-	-	-	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	0.003	-	-	-	-	-	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	0.00001	-	-	-	-	-	-	-	-	-	-	0.00101	0.00096	0.00300	0.00288	-	-	-	-	-	-
Vanadium	mg/L	0.0009	0.001	-	-	-	-	<0.0009	0.0047	0.0045	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	0.001	0.01	0.001	-	-	-	0.001	0.002	0.002	<0.01	<0.01	<0.01	<0.01	0.0025	0.0037	<0.0010	0.0029	-	-	-	-	-	-

Notes:
Site Performance Objective's (SPO) are identified in Baffinland's 2AM-MRY-1325 Water Licence
2006 dissolved oxygen values in mg/L; 2015, 2016 and 2017 dissolved oxygen values in % saturation
* Result qualified by analytical laboratory
SPO and CCME guideline values are pH or Hardness dependent. The lowest to highest applicable guideline value is shown
(1) pH /Temp dependent
(2) pH dependent
(3) Hardness dependent

Analytical values which exceed SPO or calculated CCME guideline value are indicated below:

1	Shaded values exceed CCME guidelines
1	Bold values exceed SPO guidelines



Table 3.7 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS
SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-100 (CV217)

Parameters	Units	Method Detection Limit		LOR			CCME Guideline	Dates														29-Jun-17	29-Jun-17
		2005	2006	2015	2016	2017		07-Jun-05	06-Aug-05	09-Sep-05	13-Jun-06	29-Jul-06	10-Sep-06	12-Aug-15	12-Aug-15	29-Jun-16	29-Jun-16	25-Aug-16	25-Aug-16				
In Situ Parameters														US	DS	US	DS	DS	US	US	DS		
Temperature	°C	-	-	-	-	-	-	0.74	9.35	6.59	1.56	7.36	3.02	9.6	9.4	5.6	6.4	8.7	10.7	4.4	3.2		
Specific Conductance	mS/cm	-	-	-	-	-	-	0.019	0.081	0.088	0.031	0.083	0.091	0.100	0.101	0.640	0.800	0.102	0.095	0.166	0.125		
Dissolved Oxygen	mg/L	-	-	-	-	-	5.5-9.5	12.14	11.62	12.82	12.71	13.40	-	102.30	102.8	107.4	109.5	94.1	100.0	107.1	101.9		
pH	pH units	-	-	-	-	-	6.5 - 9.0	7.20	7.60	7.02	7.38	7.59	7.92	8.08	8.07	7.74	8.36	8.19	8.11	7.45	7.71		
Wetted Width	m	-	-	-	-	-	-	-	-	-	-	54	59	-	-	-	-	-	-	-	15.4		
Average Depth	m	-	-	-	-	-	-	-	-	-	-	5	2.5	-	-	-	-	-	-	-	0.7		
Flow Rate	m³/s	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.5276		
Physical Parameters																							
pH	pH units	-	-	0.01	0.01	0.1	6.5 - 9.0	-	-	-	6.97	7.03	6.97	7.80	7.81	7.42	7.41	8.08	7.96	7.65	7.72		
Conductivity	µS/cm	1	5	-	-	-	-	27	90	93	38	86	97	-	-	-	-	-	-	-	-		
Turbidity	NTU	0.1	0.1	0.1	0.1	0.1	-	0.50	0.99	0.55	0.7	1.1	1.4	1.0	1.1	1.1	1.1	2.0	1.0	1.06	1.01		
Hardness	mg/L as CaCO₃	0.5	1	10	10	10	-	8.57	42.0	46.3	16	41	43	37	38	27	29	42	38	28	33		
TSS	mg/L	-	-	-	2	2	-	-	-	-	-	-	-	2	2	<2.0	<2.0	<2.0	<2.0	<2.0	2.0		
TDS	mg/L	30	5	20	-	20	-	31	<30	<30	25	56	63	50 *	46 *	40	25	52	38	34	41		
Dissolved Anions																							
Alkalinity	mg/L as CaCO₃	2	5	10	10	10	-	8	43	45	16	44	47	38	35	30	31	41	35	17	27		
Br⁻	mg/L	0.3	0.05	-	-	-	-	<0.3	<0.3	<0.3	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-		
Cl⁻	mg/L	0.2	1	0.5	0.5	0.5	-	0.8	1.0	1.2	<1	1	2	4.96	5.29	2.44	2.49	3.87	3.79	2.50	3.74		
Fluoride	mg/L	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020		
SO₄²⁻	mg/L	0.5	1	0.3	0.3	0.3	-	0.7	0.6	0.7	2	2	3	1.30	1.35	0.70	0.72	1.15	0.97	0.71	1.06		
Nutrients																							
NH₃+NH₄	mg/L N	0.1	0.02	0.15	0.15	0.15	0.021 - 231¹	0.5	<0.10	0.4	0.04	0.05	0.04	0.27	0.28	<0.15	<0.15	<0.15	<0.15	-	-		
NO₂⁻	mg/L N	0.06	0.005	-	-	-	0.06	<0.06	<0.06	<0.06	<0.005	0.018	0.008	-	-	-	-	-	-	-	-		
NO₃⁻	mg/L N	0.05	0.1	0.02	0.02	0.02	2.9	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.020	<0.020	<0.020	<0.020	0.03	<0.020	<0.020	<0.020		
NO₂+NO₃	mg/L N	0.06	0.1	-	-	-	-	<0.06	<0.06	<0.06	<0.10	<0.10	<0.10	-	-	-	-	-	-	-	-		
Ammonia total as N	mg/L	-	-	0.05	0.02	0.02	'Variable'¹	-	-	-	-	-	-	<0.050	<0.050	<0.020	0.05	<0.020	<0.020	0.029	<0.020		
Total Phosphorus	mg/L	0.02	0.01	0.003	0.003	0.003	-	<0.02	<0.02	<0.10	<0.01	<0.01	0.02	0.0080	0.0058	0.0068	<0.0030	0.0071	0.0095	0.0084	0.0087		
Dissolved Phosphorus	mg/L	0.02	-	-	-	-	-	<0.02	<0.02	<0.10	-	-	-	-	-	-	-	-	-	-	-		
Organic Compounds																							
Phenols	mg/L	0.001	0.001	-	-	-	0.004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-		
DOC	mg/L	-	-	0.5	0.5	0.5	-	-	-	-	-	-	-	2.2	2.2	1.8	1.9	2.3	1.9	2.01	1.88		
TOC	mg/L	-	-	0.5	0.5	0.5	-	-	-	-	-	-	-	2.3	2.3	1.9	1.8	2.3	2.0	2.24	2.17		
TKN	mg/L	-	-	0.1	0.1	0.15	-	-	-	-	-	-	-	0.27	0.28	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15		
Chlorophyll-a	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Pheophytin-a	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Total Metals and Non-Metals																							
Aluminum	mg/L	0.004	0.005	0.01	0.01	0.005	0.005 - 0.100²	0.025	0.039	0.020	0.023	0.043	0.066	0.091	<0.010	0.042	0.150	0.052	0.037	0.033	0.071		
Antimony	mg/L	0.0004	-	-	0.0001	0.0001	-	<0.0004	<0.0004	<0.0004	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		
Arsenic	mg/L	0.005	0.001	0.001	0.0001	0.0001	0.005	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		
Barium	mg/L	0.001	0.01	-	0.0002	0.0002	-	0.002	0.004	0.005	<0.01	<0.01	<0.01	-	-	0.00368	0.00433	0.00576	0.00502	0.00389	0.00457		
Beryllium	mg/L	0.005	-	-	0.0001	0.0001	-	<0.005	<0.005	<0.005	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		
Bismuth	mg/L	0.0003	-	-	0.00005	0.00005	-	<0.0003	<0.0003	<0.0003	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050		
Boron	mg/L	0.05	0.01	-	0.01	0.01	-	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010		
Cadmium	mg/L	0.0001	0.0001	0.00009	0.00001	0.00001	0.000017	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010		
Calcium	mg/L	0.05	1	0.5	0.5	0.5	-	1.51	8.62	9.34	3.0	8.0	9.0	7.76	7.77	5.19	5.58	8.32	7.66	5.61	6.66		
Cesium	mg/L	-	-	-	0.00001	0.00001	-	-	-	-	-	-	-	-	-	<0.000010	0.000016	<0.000010	<0.000010	<0.000010	<0.000010		
Chromium	mg/L	0.001	0.001	-	0.0005	0.0005	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050		
Cobalt	mg/L	0.0003	0.0002	-	0.0001	0.0001	-	<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		
Copper	mg/L	0.0008	0.001	0.001	0.001	0.001	0.002 - 0.004³	0.0009	0.0010	0.0008	<0.001	<0.001	0.001	<0.0010	<0.0010	<0.0010	0.0011	0.0010	<0.0010	<0.0010	<0.0010		
Iron	mg/L	0.02	0.03	0.05	0.05	0.05	0.3	0.05	0.03	0.02	0.07	0.04	0.04	0.121	<0.050	0.052	0.186	0.058	<0.050	0.058	0.10		
Lead	mg/L	0.0002	0.001	0.0001	0.0001	0.0001	0.001 - 0.007³	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000050	0.000		
Lithium	mg/L	-	-	-	0.001	0.001	-	-	-	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010		
Magnesium	mg/L	0.005	1	0.001	0.05	0.05	-	1.16	4.97	5.59	2.0	5.0	5.0	5.07	4.94	3.30	3.59	5.04	4.71	3.48	4.08		
Manganese	mg/L	0.0007	0.01	0.00001	0.00																		

Table 3.7 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS
SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-100 (CV217)

Parameters	Units	Method Detection Limit		LOR			CCME Guideline	Dates												29-Jun-17	29-Jun-17
		2005	2006	2015	2016	2017		07-Jun-05	06-Aug-05	09-Sep-05	13-Jun-06	29-Jul-06	10-Sep-06	12-Aug-15	12-Aug-15	29-Jun-16	29-Jun-16	25-Aug-16	25-Aug-16		
Nickel	mg/L	0.001	0.005	1	0.0005	0.0005	0.025 - 0.150 ³	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.0010	<0.0010	0.00077	0.00054	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus	mg/L	-	-	-	0.05	0.05	-	-	-	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium	mg/L	0.02	0.01	0.0004	0.05	0.05	-	0.81	0.58	0.60	0.49	0.58	0.57	0.631	0.627	0.516	0.580	0.717	0.645	0.613	0.688
Rubidium	mg/L	-	-	-	0.0002	0.0002	-	-	-	-	-	-	-	-	-	0.00073	0.00109	0.00138	0.00110	0.00082	0.00101
Selenium	mg/L	0.005	0.001	-	0.00005	0.00005	0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon	mg/L	-	-	-	0.05	0.05	-	-	-	-	-	-	-	-	-	0.390	0.603	0.636	0.525	0.470	0.520
Silver	mg/L	0.0001	0.0001	0.5	0.00005	0.00005	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Sodium	mg/L	0.05	0.05	-	0.5	0.5	-	0.34	0.68	0.70	0.31	0.72	0.93	2.81	2.91	1.40	1.49	2.25	2.39	1.55	2.09
Strontium	mg/L	0.001	0.001	0.0003	0.001	0.001	-	0.0012	0.0049	0.0054	0.002	0.006	0.007	-	-	0.0046	0.0048	0.0079	0.0074	0.0049	0.0060
Sulfur	mg/L	-	-	-	0.5	0.5	-	-	-	-	-	-	-	-	-	<0.50	<0.50	<0.50	0.53	0.51	<0.50
Tellurium	mg/L	-	-	-	0.0002	0.0002	-	-	-	-	-	-	-	-	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	mg/L	0.0002	-	-	0.00001	0.00001	0.0008	<0.0002	<0.0002	<0.0002	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	-	-	-	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010
Tin	mg/L	0.001	0.01	-	0.0001	0.0001	-	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	0.003	-	-	0.0003	0.0003	-	<0.003	<0.003	<0.003	-	-	-	-	-	<0.0020 *	0.00821	0.00203	0.00165	<0.0015	0.00388
Tungsten	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	mg/L	-	-	0.0010	0.00001	0.00001	0.015	-	-	-	-	-	-	0.000319	0.000324	0.000210	0.000238	0.000368	0.000319	0.000193	0.000261
Vanadium	mg/L	0.0009	0.001	-	0.0005	0.0005	-	<0.0009	<0.0009	<0.0009	<0.001	<0.001	<0.001	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	0.001	0.01	0.003	0.003	0.003	0.03	0.0020	0.0020	<0.001	<0.01	<0.01	<0.01	<0.0030	<0.0030	<0.0030	<0.0030	0.0053	<0.0030	<0.0030	<0.0030
Zirconium	mg/L	-	-	-	0.0003	0.0003	-	-	-	-	-	-	-	-	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals and Non-Metals																					
Aluminum	mg/L	0.004	0.005	0.005	-	-	-	0.013	0.006	0.004	0.009	<0.005	0.007	<0.0050	0.090	-	-	-	-	-	-
Antimony	mg/L	0.0004	-	-	-	-	-	<0.0004	<0.0004	<0.0004	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.001	0.0001	-	-	-	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.00010	<0.00010	-	-	-	-	-	-
Barium	mg/L	0.001	0.01	-	-	-	-	0.002	0.004	0.005	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-
Beryllium	mg/L	0.005	-	-	-	-	-	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	0.0003	-	-	-	-	-	<0.0003	<0.0003	<0.0003	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	0.05	0.01	-	-	-	-	<0.05	0.02	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.0001	0.0001	0.00001	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	-	-	-	-	-	-
Calcium	mg/L	0.05	1	0.05	-	-	-	1.60	9.05	8.60	3	8	9	7.39	7.78	-	-	-	-	-	-
Chromium	mg/L	0.001	0.001	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
Cobalt	mg/L	0.0003	0.0002	-	-	-	-	<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	-	-	-	-	-	-	-	-
Copper	mg/L	0.0008	0.001	0.0002	-	-	-	<0.0008	0.0009	0.0010	<0.001	<0.001	<0.001	0.00066	0.00080	-	-	-	-	-	-
Iron	mg/L	0.02	0.03	0.01	-	-	-	0.04	<0.02	<0.02	0.06	<0.03	<0.03	<0.010	0.107	-	-	-	-	-	-
Lead	mg/L	0.0002	0.001	0.00005	-	-	-	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-	-	-
Magnesium	mg/L	0.005	1	0.0005	-	-	-	1.24	5.23	5.12	2	5	5	4.40	4.56	-	-	-	-	-	-
Manganese	mg/L	0.0007	0.01	-	-	-	-	0.0175	<0.0007	<0.0007	<0.01	<0.01	<0.01	0.00058	0.00181	-	-	-	-	-	-
Mercury	mg/L	-	-	0.00001	-	-	-	-	-	-	-	-	-	<0.000010	<0.000010	-	-	-	-	-	-
Molybdenum	mg/L	0.0003	0.005	0.00005	-	-	-	<0.0003	<0.0003	<0.0003	<0.005	<0.005	<0.005	0.000065	0.000080	-	-	-	-	-	-
Nickel	mg/L	0.001	0.005	0.0005	-	-	-	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.00050	<0.00050	-	-	-	-	-	-
Potassium	mg/L	0.02	0.01	0.05	-	-	-	0.85	0.61	0.58	0.48	0.54	0.57	0.599	0.680	-	-	-	-	-	-
Selenium	mg/L	0.005	0.001	0.00005	-	-	-	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-	-	-
Silver	mg/L	0.0001	0.0001	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-	-	-	-	-	-
Sodium	mg/L	0.05	0.05	-	-	-	-	0.37	0.72	0.68	0.31	0.72	1.02	2.68	2.82	-	-	-	-	-	-
Strontium	mg/L	0.001	0.001	-	-	-	-	0.0013	0.0052	0.0049	0.002	0.006	0.007	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0002	-	0.00010	-	-	-	<0.0002	<0.0002	<0.0002	-	-	-	<0.000010	<0.000010	-	-	-	-	-	-
Tin	mg/L	0.001	0.01	-	-	-	-	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-
Titanium	mg/L	0.003	-	-	-	-	-	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	-	-	0.000010	-	-	-	-	-	-	-	-	-	0.000296	0.000329	-	-	-	-	-	-
Vanadium	mg/L	0.0009	0.001	-	-	-	-	<0.0009	0.0015	<0.0009	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
Zinc	mg/L	0.001	0.01	0.001	-	-	-	0.002	0.002	0.001	<0.01	<0.01	<0.01	<0.0010	0.0029	-	-	-	-	-	-

Notes:
Site Performance Objective's (SPO) are identified in Baffinland's 2AM-MRY-1325 Water Licence
2006 dissolved oxygen values in mg/L; 2015, 2016 and 2017 dissolved oxygen values in % saturation
* Result qualified by analytical laboratory
SPO and CCME guideline values are pH or Hardness dependent. The lowest to highest applicable guideline value is shown
(1) pH /Temp dependent
(2) pH dependent
(3) Hardness dependent

Analytical values which exceed SPO or calculated CCME guideline value are indicated below:

1	Shaded values exceed CCME guidelines
1	Bold values exceed SPO guidelines



Table 3.8 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS
SURFACE WATER QUALITY SUMMARY FOR SAMPLE SITE N1-110 (BG24)

Parameter	Units	Method Detection Limit		LOR			CCME Guideline	Dates													
		2005	2006	2015	2016	2017		07-Jun-05	06-Aug-05	09-Sep-05	13-Jun-06	29-Jul-06	10-Sep-06	12-Aug-15	12-Aug-15	29-Jun-16	29-Jun-16	25-Aug-16	25-Aug-16	29-Jun-17	29-Jun-17
Nickel	mg/L	0.001	0.005	1	0.0005	0.0005	0.025 - 0.150 ³	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus	mg/L	-	-	-	0.05	0.05	-	-	-	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium	mg/L	0.02	0.01	0.0004	0.05	0.05	-	0.77	0.48	0.51	0.50	0.51	0.50	0.565	0.649	0.297	0.269	0.818	0.731	0.308	0.317
Rubidium	mg/L	-	-	-	0.0002	0.0002	-	-	-	-	-	-	-	-	-	0.00033	0.00024	0.00094	0.00046	0.00031	0.00032
Selenium	mg/L	0.005	0.001	-	0.00005	0.00005	0.001	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Silicon	mg/L	-	-	-	0.05	0.05	-	-	-	-	-	-	-	-	-	0.393	0.381	0.743	0.73	0.4	0.41
Silver	mg/L	0.0001	0.0001	0.5	0.00005	0.00005	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Sodium	mg/L	0.05	0.05	-	0.5	0.5	-	0.43	0.51	0.48	0.57	0.48	1.61	5.22	5.33	0.77	0.75	8.94	9.62	0.83	0.81
Strontium	mg/L	0.001	0.001	0.0003	0.001	0.001	-	0.0011	0.0049	0.0048	0.005	0.005	0.008	-	-	0.0056	0.0056	0.025	0.0262	0.0044	0.0045
Sulphur	mg/L	-	-	-	0.5	0.5	-	-	-	-	-	-	-	-	-	<0.50	<0.50	4.8	5.24	<0.50	<0.50
Tellurium	mg/L	-	-	-	0.0002	0.0002	-	-	-	-	-	-	-	-	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Thallium	mg/L	0.0002	-	0.0001	0.00001	0.00001	0.0008	<0.0002	<0.0002	<0.0002	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin	mg/L	0.001	0.01	-	0.0001	0.0001	-	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	0.003	-	-	0.0003	0.0003	-	<0.003	<0.003	<0.003	-	-	-	-	-	0.00087	0.00052	0.00055	<0.00030	0.00075	0.00088
Tungsten	mg/L	-	-	-	0.0001	0.0001	-	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Uranium	mg/L	-	-	0.0010	0.00001	0.00001	0.015	-	-	-	-	-	-	0.000941	0.000943	0.000116	0.000109	0.0012	0.00131	0.000068	0.000071
Vanadium	mg/L	0.0009	0.001	-	0.0005	0.0005	-	<0.0009	<0.0009	<0.0009	<0.001	<0.001	<0.001	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Zinc	mg/L	0.001	0.01	0.003	0.003	0.003	0.03	0.0040	0.0010	0.0020	<0.01	<0.01	<0.01	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium	mg/L	-	-	-	0.0003	0.0003	-	-	-	-	-	-	-	-	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dissolved Metals and Non-Metals																					
Aluminum	mg/L	0.004	0.005	0.005	-	-	-	0.010	0.009	0.007	<0.005	<0.005	<0.005	<0.0050	<0.0050	-	-	-	-	-	-
Antimony	mg/L	0.0004	-	-	-	-	-	<0.0004	<0.0004	<0.0004	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.001	0.0001	-	-	-	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.00010	<0.00010	-	-	-	-	-	-
Barium	mg/L	0.001	0.01	-	-	-	-	<0.001	0.003	0.004	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-
Beryllium	mg/L	0.005	-	-	-	-	-	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	0.0003	-	-	-	-	-	<0.0003	<0.0003	<0.0003	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	0.05	0.01	-	-	-	-	<0.05	0.02	<0.01	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.0001	0.0001	0.00001	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	-	-	-	-	-	-
Calcium	mg/L	0.05	1	0.05	-	-	-	1.54	9.19	8.14	9	8	11	28.0	28.9	-	-	-	-	-	-
Chromium	mg/L	0.001	0.001	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
Cobalt	mg/L	0.0003	0.0002	-	-	-	-	<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	-	-	-	-	-	-	-	-
Copper	mg/L	0.0008	0.001	0.0002	-	-	-	<0.0008	<0.0008	<0.0008	<0.001	<0.001	<0.001	0.00066	0.00063	-	-	-	-	-	-
Iron	mg/L	0.02	0.03	0.01	-	-	-	<0.02	0.02	<0.02	<0.03	<0.03	<0.03	<0.010	<0.010	-	-	-	-	-	-
Lead	mg/L	0.0002	0.001	0.00005	-	-	-	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-	-	-
Magnesium	mg/L	0.005	1	0.0005	-	-	-	0.933	5.30	4.87	6	5	6	15.4	15.6	-	-	-	-	-	-
Manganese	mg/L	0.0007	0.01	-	-	-	-	0.0092	0.0007	<0.0007	<0.01	<0.01	<0.01	<0.00050	0.00275	-	-	-	-	-	-
Mercury	mg/L	-	-	0.00001	-	-	-	-	-	-	-	-	-	<0.000010	<0.000010	-	-	-	-	-	-
Molybdenum	mg/L	0.0003	0.005	0.00005	-	-	-	<0.0003	<0.0003	<0.0003	<0.005	<0.005	<0.005	0.000093	0.0001	-	-	-	-	-	-
Nickel	mg/L	0.001	0.005	0.0005	-	-	-	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.00050	<0.00050	-	-	-	-	-	-
Potassium	mg/L	0.02	0.01	0.05	-	-	-	0.83	0.51	0.49	0.52	0.50	0.50	0.577	0.635	-	-	-	-	-	-
Selenium	mg/L	0.005	0.001	0.00005	-	-	-	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-	-	-
Silver	mg/L	0.0001	0.0001	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-	-	-	-	-	-
Sodium	mg/L	0.05	0.05	-	-	-	-	0.47	0.53	0.47	0.58	0.50	1.64	5.04	4.95	-	-	-	-	-	-
Strontium	mg/L	0.001	0.001	-	-	-	-	0.0011	0.0045	0.0044	0.005	0.005	0.008	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0002	-	0.0001	-	-	-	<0.0002	<0.0002	<0.0002	-	-	-	<0.000010	<0.000010	-	-	-	-	-	-
Tin	mg/L	0.001	0.01	-	-	-	-	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-
Titanium	mg/L	0.003	-	-	-	-	-	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	0.00001	-	0.00001	-	-	-	-	-	-	-	-	-	0.000883	0.00088	-	-	-	-	-	-
Vanadium	mg/L	0.0009	0.001	-	-	-	-	<0.0009	0.0013	<0.0009	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
Zinc	mg/L	0.001	0.01	0.001	-	-	-	0.003	0.003	0.002	<0.01	<0.01	<0.01	<0.0010	0.0019	-	-	-	-	-	-

Notes:
Site Performance Objective's (SPO) are identified in Baffinland's 2AM-MRY-1325 Water Licence
2006 dissolved oxygen values in mg/L; 2015, 2016 and 2017 dissolved oxygen values in % saturation
* Result qualified by analytical laboratory
SPO and CCME guideline values are pH or Hardness dependent. The lowest to highest applicable guideline value is shown
(1) pH /Temp dependent
(2) pH dependent
(3) Hardness dependent
Analytical values which exceed SPO or calculated CCME guideline value are indicated below:

1	Shaded values exceed CCME guidelines
1	Bold values exceed SPO guidelines

TABLE 4 SUMMARY OF FISH HABITAT STATUS AT EXISTING FISH-BEARING STREAMS ALONG THE TOTE ROAD IN 2017

Water Crossing No.	Fish Habitat Quality Rating ¹	Fish Captured DS - July 2017	Fish Captured US - July 2017	Potential Fish Passage or Habitat Issues	Potential Fish Passage or Habitat Issues	Follow-up/Corrective Actions
CV-176	MAR	N	N/A	None		Note that there is no natural fish habitat upstream of these crossings, regardless of water level, so passage is unnecessary, but must make sure there are no downstream effects. Continue to monitor in 2018.
CV-166	MAR	Y	N/A	None		
CV129	IMP	Y	Y	Yes	Culvert is damaged, but still provides fish passage. Appears that road work on the embankment may lead to sedimentation as water levels rise	
CV128	IMP	Y	Y	None		Continue to monitor in 2018.
CV115	MAR	N	N	Stream Dry		
CV114	MAR	Y	N	Yes	Both culverts now perched (only left culvert was perched in 2016). Upstream fish passage is blocked	These culverts are to be targeted as part of the 2018 culvert work.
CV112	IMP	Y	Y	Yes	Left culvert providing fish passage. Right culvert is badly damaged and may be blocking fish passage in that channel	This culvert will need to be repaired or replaced if it is to continue allowing unobstructed passage. This culvert is to be targeted as part of the 2018 culvert work.
CV111	IMP	Y	Y	None	Fish observed upstream and downstream. No passage issues.	
CV106	MAR	Y	N	Yes	Vertical drop at upstream end of culvert has increased since 2016. Fish passage blocked	Culverts were extended in December 2017 after habitat assessment. Continue to monitor in 2018.
CV104	MAR	Y	Y	Yes	Right culvert in good condition and providing fish passage. Upstream end of left culvert is perched (culvert was damaged, but not perched in 2016) and passage in left channel is fully impeded	Repair culvert to prevent culvert becoming problem for fish passage. This culvert was replaced during the Fall 2016.

TABLE 4 SUMMARY OF FISH HABITAT STATUS AT EXISTING FISH-BEARING STREAMS ALONG THE TOTE ROAD IN 2017

Water Crossing No.	Fish Habitat Quality Rating ¹	Fish Captured DS - July 2017	Fish Captured US - July 2017	Potential Fish Passage or Habitat Issues	Potential Fish Passage or Habitat Issues	Follow-up/Corrective Actions
CV102	IMP	Y	Y	None	No current issues with culvert or habitat; however, culvert has filled with cobble, creating more natural stream habitat and velocity refugia for fish which may enhance fish passage, but may also result in blockage – crossing should be closely monitored in the future	Monitoring will occur in 2018 to ensure no blockage.
CV099	IMP	Y	Y	None	Fish observed upstream and downstream. No issues with stranding.	
CV079	IMP	Y	Y	None	Fish observed upstream and downstream. No issues with stranding.	
CV078	IMP	Y	Y	None	Fish observed upstream and downstream. No issues with passage or habitat.	
CV076	MAR	Y	Y	None	Fish observed upstream and downstream. No issues with passage or habitat.	
CV072	IMP	Y	Y	None	Fish observed upstream and downstream. No issues with passage or habitat.	
CV060	IMP	Y	Y	None	Fish observed upstream and downstream. No issues with passage or habitat.	
CV059	MAR	Y	N	Yes	Submerged damaged culvert could become blocked with substrate.	Culverts were replaced in December 2017 after habitat assessment. Continue to monitor in 2018.
CV058	MAR	Y	Y	None		
CV057	MAR	N	N	Nearly dry	Nearly dry at the time of monitoring	
BG50	IMP	N	N	Yes	Left channel with bridge is in excellent condition. Right channel culverts remain badly perched and fish passage is fully impeded. No fish observed downstream of the right channel culverts, suggesting limited or no use of the right channel	Culverts in the right-hand channel will need to be re-installed and properly embedded. This culvert is to be targeted as part of the 2018 culvert work.
CV049	IMP	Y	Y	None	Fish observed upstream and downstream. No issues with passage or habitat.	

TABLE 4 SUMMARY OF FISH HABITAT STATUS AT EXISTING FISH-BEARING STREAMS ALONG THE TOTE ROAD IN 2017

Water Crossing No.	Fish Habitat Quality Rating ¹	Fish Captured DS - July 2017	Fish Captured US - July 2017	Potential Fish Passage or Habitat Issues	Potential Fish Passage or Habitat Issues	Follow-up/Corrective Actions
V030	MAR	Y	N	None	Low water has resulted in natural blockage downstream of the culvert; isolated ponds still support some stickleback.	
BG32	IMP	Y	Y	None	Fish observed upstream and downstream.No issues with passage or habitat.	
CV217	IMP	Y	Y	None	Fish observed upstream and downstream.No issues with passage or habitat.	
CV216	MAR	Y	N	Yes	Vertical drop at the upstream end of the culvert too large for passage of young-of-the-year Arctic Char, which typically use this stream to access upstream habitat	Culverts were extended in October 2017 after habitat assessment. Continue to monitor in 2018.
BG30	IMP	Y	N	None		Continue to monitor fish ladder functionality in 2018.
BG29	IMP	Y	Y	Yes	Complete blockage of upstream and downstream ends of culvert by cobble at the time of monitoring	Blockage was removed by Baffinland in July, 2017
BG27	MAR	Y	Y	Yes	Silt fence was partially blocking channel, fewer fish observed upstream of fence during survey	Silt fence was removed by NSC biologist during survey in July, 2017
BG24	IMP	Y	Y	None	Fish observed upstream and downstream.No issues with passage or habitat.	
BG17	IMP	Y	Y	None	Fish observed upstream and downstream.No issues with passage or habitat.	
BG04	IMP	Y	Y	None	Fish observed upstream and downstream.No issues with passage or habitat.	
CV001	IMP	Y	N	Yes	Upstream end of culvert completely obstructed by cobble at the time of monitoring	Blockage was removed by Baffinland in July, 2017
CV223	IMP	Y	Y	None	Fish observed upstream and downstream.No issues with passage or habitat.	
CV224	IMP	Y	Y	Yes	Upstream ends of both culverts (particularly the left culvert) were partially obstructed, which may limit fish passage	This culvert is to be targeted as part of the 2018 culvert work.
CV225	IMP	Y	Y	Possible	Culvert velocities very high (2.0 m/s), which may limit passage of smaller juveniles	This condition is to be monitored during 2018.

TABLE 4 SUMMARY OF FISH HABITAT STATUS AT EXISTING FISH-BEARING STREAMS ALONG THE TOTE ROAD IN 2017

Water Crossing No.	Fish Habitat Quality Rating ¹	Fish Captured DS - July 2017	Fish Captured US - July 2017	Potential Fish Passage or Habitat Issues	Potential Fish Passage or Habitat Issues	Follow-up/Corrective Actions
BG01	IMP	Y	Y	Possible	Culvert velocities relatively high (1.0-1.5 m/s), which may limit passage of smaller juveniles	Culverts were extended in October 2017 after habitat assessment. Continue to monitor in 2018.
CV186	IMP	Y	Y	None		
CV187	MAR	N	Y	None		

1 - Habitat status assessed for current crossings prior to pending upgrades; MAR = marginal, IMP = important

TABLE 5 INSTALLATION SUMMARY OF HADD AND HABITAT COMPENSATION SITES ALONG THE TOTE ROAD

Crossing ID	Road Chainage (km + m)	Crossing Size Classification	Authorization (HADD or Compensation)¹	Initial Work Completion Date²	Additional Work Completion Date³	Years Monitored	Additional Corrective Actions and Monitoring Required
CV-183	0+145	Extra-large	Compensation - RH	Oct-08	N/A	2009-2010	None
CV-181	0+583	Medium	Compensation - RH	24-Jul-09	N/A	2008-2010	None
CV-129	15+650	Large	HADD	17-Sep-07	July 2011 Winter 2014/15	2008-2012, 2015-2017	Culvert damaged, monitor for continued passage success
CV-128	17+486	Extra-large	HADD	23-Sep-07	Winter 2013/14 March 2017	2009-2010, 2014-2017	Routine Only
CV-114	29+647	Medium	HADD	29-Sep-07	July 2011	2009-2012, 2015-2017	Culverts perched, repair and monitor
CV-111	31+990	Medium	HADD	28-Sep-07	N/A	2009-2010, 2015-2017	Routine Only
CV-104	33+794	Medium	HADD	01-Oct-07	November 2016	2009-2010, 2015-2017	Culverts were replaced in 2016, survey in 2017 shows only righthand culvert provides passage; repair and monitor left culvert
CV-099	37+840	Large	HADD	04-Oct-07	Winter 2014/15 December 2017	2008-2010, 2015-2017	Routine Only
CV-079	50+600	Large	HADD	08-Jul-08	N/A	2008-2010, 2015-2017	Routine Only
CV-078	51+171	Large	HADD	09-Jul-08	N/A	2008-2012, 2015-2017	Routine Only
CV-072	53+878	Large	HADD	05-Mar-08	N/A	2009-2010, 2015-2017	Routine Only
CV-060	58+856	Medium	HADD	27-Feb-08	N/A	2009-2010, 2015-2017	Routine Only

TABLE 5 INSTALLATION SUMMARY OF HADD AND HABITAT COMPENSATION SITES ALONG THE TOTE ROAD

Crossing ID	Road Chainage (km + m)	Crossing Size Classification	Authorization (HADD or Compensation)¹	Initial Work Completion Date²	Additional Work Completion Date³	Years Monitored	Additional Corrective Actions and Monitoring Required
BG-50	62+804	Extra-large	HADD	30-Oct-07	Winter 2013/14 Winter 2014/15 November 2016	2008-2010, 2014-2017	Reinstallation of currently perched culverts and monitoring
CV-049	63+302	Large	HADD	10-Mar-08	N/A	2009-2010, 2015-2017	Routine Only
BG-32	78+161	Large	HADD	04-Apr-08	August 2012 September 2017	2009-2010, 2015-2017	Routine Only
CV-217	79+915	Extra-large	HADD	17-Apr-08	Winter 2013/14 Winter 2014/15 March 2017	2009-2010, 2014-2017	Routine Only
CV-216	80+646	Large	HADD	08-Jun-08	October 2017	2009-2010, 2015-2017	Routine Only
BG-30	84 + 636	Small	Compensation - RA	2012	August 2012	2010-2013, 2015-2017	Routine monitoring and maintenance of constructed fishway
BG-24	87+710	Medium	HADD	15-May-08	N/A	2008-2010, 2015-2017	Routine Only
BG-17	90+167	Large	HADD	09-May-08	N/A	2009-2010, 2015-2017	Routine Only
BG-16	90+218	Extra-small	Compensation - HE	Oct-08	N/A	2009	Routine Only
BG-04	94+148	Medium	HADD	05-May-08	August 2012	2009-2010, 2015-2017	Routine Only
CV-001	94+728	Small	Compensation - RH	08-May-08	Winter 2014/15	2009-2010, 2015-2017	Routine Only
CV-223	97+155	Extra-large	HADD	03-May-08	Winter 2013/14	2008-2010, 2014-2017	Routine Only
CV-224	97+758	Medium	HADD	04-May-08	N/A	2008-2010, 2015-2017	Culvert damaged, monitor for continued passage success
CV-225	98+989	Large	HADD	21-Sep-07	August 2010 Winter 2014/15	2008-2011, 2015-2017	Monitoring for passage in high culvert water velocity
BG-01	99+672	Medium	HADD	20-Sep-07	August 2010 October 2017	2008-2011, 2015-2017	Monitoring for passage in high culvert water velocity

TABLE 5 INSTALLATION SUMMARY OF HADD AND HABITAT COMPENSATION SITES ALONG THE TOTE ROAD

Crossing ID	Road Chainage (km + m)	Crossing Size Classification	Authorization (HADD or Compensation)¹	Initial Work Completion Date²	Additional Work Completion Date³	Years Monitored	Additional Corrective Actions and Monitoring Required
CV-187	103+078	Small	Compensation - RH	14-Jun-08	April 2017	2008-2010, 2015-2017	Routine Only

1 - Includes only current HADD and compensation sites and not those eliminated from calculations following 2010 surveys

2 - Includes work outlined during the initial planning and construction phase

3 - Includes repair work, installation of fish access improvement structures, and ERP upgrades

APPENDICIES

APPENDIX A

DFO AUTHORIZATIONS AND AMMENDMENTS



Fisheries and Oceans Pêches et Océans
Canada Canada

301-5204 50th Avenue
Yellowknife, NT
X1A 1E2

September 20, 2013

our file Votre référence

Our file Notre référence
07-HCAA-CA7-00050

Oliver Curran
Baffinland Iron Mines Corporation
2275 Upper Middle Road East, Suite 300
Oakville, ON
L6H 0C3

Dear Mr. Curran:

Subject: Proposal not likely to result in impacts to fish and fish habitat.

Fisheries and Oceans Canada – Fisheries Protection Program (DFO) received your proposal on August 29, 2013. Please refer to the file number and title below:

DFO File No.: **07-HCAA-CA7-00050**

Title: **Mary River Iron Ore Project, Baffin Island (Baffinland), Nunavut**

You may be aware of changes to the *Fisheries Act*, however these have not affected the review of your project at this time. For more information on current changes to the *Fisheries Act* please refer to the DFO website at www.dfo-mpo.gc.ca/media/infocus-alaune/2012/habitat-eng.htm.

Your proposal has been reviewed to determine whether it is likely to result in impacts to fish and fish habitat which are prohibited by the habitat protection provisions of the *Fisheries Act* or those prohibitions of the *Species at Risk Act* that apply to aquatic species.*

Our review consisted of:

Changes to Culverts along the Tote Road, Submission dated August 29, 2013 from Oliver Curran - Baffinland Iron Mines Corporation

Freshwater Aquatic Baseline Synthesis Report 2005-2011 (January 2012), Baffinland Iron Mines Corporation, Mary River Project, Prepared by North/South Consultants Inc.

*Those sections most relevant to the review of development proposals include 20, 22, 32 and 35 of the *Fisheries Act* and sections 32, 33 and 58 of the *Species at Risk Act*. For more information please visit www.dfo-mpo.gc.ca.

We understand that you propose to carry out the following culvert upgrades along the Tote Road:

Culvert ID	Proposed Culvert Diameter (m)	Proposed Culvert Length (m)	Area of Rip Rap (m2)	Proposed Culvert Upgrade
BG31A	1.2	19.5	24.96	Extend 1m left & 2.5m right
BG30	1	22	17.33	Extend 7m right
BG29	1	31	0	Extend 7.5m left & 8.5m right
BG27B	0.5	31	4.33	Extend 5m left & 8m right
BG27C	0.5	31	0	Extend 5m left & 8m right
BG27A	0.5	31	0	Extend 4.5m left & 8.5m right
BG17A	1.2	36.5	24.96	Extend 8m left & 13.5m right
BG17B	1.2	37.5	24.96	Extend 15.5m left & 7m right
BG04A	1.2	24	0	Extend 5.5m left & 3.5m right
BG04B	1.2	24	0	Extend 5m left & 4m right
CV224A	1	26	0	Extend 6m left & 5m right
CV224B	1	26.5	0	Extend 6.5m left & 5m right
CV225B	1.2	18	0	Replace with new length of 18m
CV225A	1	18.5	17.33	Replace with new length of 18.5m
BG01C	1.2	37	24.96	Extend 11m left & 8m right
BG01A	1.2	36.5	24.96	Extend 11.5m left & 7m right
BG01B	1.2	37	24.96	Extend 12m left & 7m right
BG01D	0.5	10	0	New Culvert
BG01F	0.5	18	0	New Culvert
BG01E	1.0	10	0	New Culvert
BG01G	0.5	23	0	New Culvert
CV186	1	27	0	Extend 6m left
CV187A	0.5	20.5	0	Extend 6m left & 4.5m right
CV187B	0.5	16	0	New Culvert
CV166A	1	23.5	17.33	Extend 8.5m right
CV166B	0.5	22.5	0	Extent 7.5m right
CV115A	0.5	17.5	0	Extend 2.5m left
CV115B	1	17	0	Extend 2m left

Provided that your plans are implemented as described DFO has concluded that your proposal is not likely to result in impacts to fish and fish habitat.

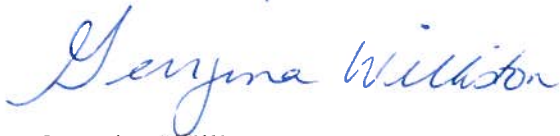
You will not need to obtain a formal approval from DFO in order to proceed with your proposal.

If the plans have changed or if the description of your proposal is incomplete you should contact this office to determine if the advice in this letter still applies.

Please be advised that any unauthorized impacts to fish and fish habitat which result from a failure to implement this proposal as described could lead to corrective action such as enforcement.

If you have any questions please contact the undersigned at (867) 669-4927 or by email at Georgina.Williston@dfo-mpo.gc.ca.

Yours sincerely,



Georgina Williston
Fisheries Protection Biologist

cc. Stuart Niven- Fisheries and Oceans Canada
Jim Millard- Baffinland Iron Mines Corporation
Bevin LeDrew- Sikumiut Environmental Management Ltd.



301-5204 50th Ave
Yellowknife, NT
X1A 1E2

Our file Notre référence
NU-07-0050

December 16, 2013

Baffinland Iron Mines Corp.
275 Upper Middle Road East Suite 300
Oakville, ON L6H 0C3

Dear Mr. Curran:

Subject: Implementation of mitigation measures to avoid and mitigate serious harm to fish.

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada received your proposal on August 28, 2013.

Your proposal has been reviewed to determine whether it is likely to result in serious harm to fish which is prohibited under subsection 35(1) of the *Fisheries Act*.

Our review consisted of:

Baffinland Submission: Tote Road Upgrade-Four Seacan Bridge Replacements, Tote Road Upgrade- Fish Bearing Culvert submission, Attachments 1 &2, August 2013.

We understand that you propose to: Upgrade the following crossings along the Tote Road.

The following seacan crossings will be removed and replaced with clear span bridges

- STA 17 (CV 128)
- STA 62 (BG50)
- STA 80 (CV 217)
- STA 97 (CV223)

The following culvert crossings will be upgraded as follows:

Culvert ID	Proposed Culvert Diameter (m)	Proposed Culvert Length (m)	Area of Rip Rap (m2)	Proposed works to be completed
CV217B	1.2	16	24.96	Extend 1m right
CV217C	1.2	16	24.96	Extend 1m right
CV217A	1.2	16	24.96	Extend 1m right
CV217D	0.15		0	Abandon
CV216B	1.2	17.5	0	Extend 1.5m left & 1m right
CV216C	1.2	16.5	0	Extend 1.5m left
CV216A	1.2	18.5	0	Extend 1.5m left & 2m right
CV216D	0.5	14.5	0	Replace with new length of 14.5m
CV216E	0.5	14	0	Abandon and replace with new length of 14m
CV216F	0.5	12	0	Replace with new length of 12m
CV223B	1.2	28	24.96	Extend 13m left
CV223C	1.2	28	24.96	Extend 13m left
CV223D	1.2	29	24.96	Extend 14m left
CV223A	2	24	69.33	Extend 14m left
CV223E	1.2	19.5	0	Extend 4.5m left
CV223F	1.2	19	0	Extend 4m left
CV115C	0.5	15.5	0	Extend 3.5m right
CV115D	0.5	17	4.33	Extend 8m left
CV114A	1	15.5	17.33	Extend 0.5m right
CV114B	0.5	14	0	Extend 5m left
CV114C	0.5	11	4.33	Replace with new length of 11m
CV114D	0.5	11.5	4.33	Extend 2m left & 0.5m right
CV112A	1.2	17.5	24.96	Extend 2.5m right
CV112B	0.5	24	0	Extend 9m right
CV112C	0.5	21	4.33	Extend 9m left
CV111	1	24	17.33	Extend 4.5m left & 1.5m right
CV106	1	19	17.33	Extend 4m left
CV104A	1.2	19	24.96	Extend 4m left
CV104B	1.2	19	24.96	Extend 4m left
CV102A	1	22.5	17.33	Extend 7.5m left
CV102B	0.5	21.5	0	Extend 6.5m left
CV102C	0.5	21.5	0	Extend 6.5m left
CV102D	0.5	20.5	0	Extend 5.5m left
CV099B	1.2	17	24.96	Replace with new length of 17m

Culvert ID	Proposed Culvert Diameter (m)	Proposed Culvert Length (m)	Area of rip rap (m2)	Proposed works to be completed
CV099A	1.2		0	Remove culvert
CV099C	2	18.5	69.33	Replace with new length of 18.5m
CV099D	0.5		0	Remove culvert
CV099E	0.5		0	Remove culvert
CV099F	0.5	14	0	Extend 2m right
CV087B	1.2	19	24.96	Extend 6.5m left & 0.5m right
CV087A	1.2	18.5	24.96	Extend 6m left & 0.5m right
CV087C	0.5	18	0	Extend 6m right
CV079B	1.2	16.5	0	Extend 1.5m left
CV079A	1.2	16.5	0	Extend 1.5m left
CV079C	0.15		0	Remove culvert
CV079D	0.15		0	Remove culvert
CV078A	1.2	16.5	0	Extend 1.5m left
CV078B	1	19.5	0	Extend 1.5m left
CV078C	1	19.5	0	Extend 1.5m left
CV078D	2	22	0	Extend 2m right
CV076	1	11.5	0	Replace with new length of 11.5m
CV072B	1.2	17.5	0	Replace with new length of 17.5m
CV072C	1.2	17.5	0	Replace with new length of 17.5m
CV072A	1.2	17.5	0	Replace with new length of 17.5m
CV060A	1	16.5	0	Extend 1.5m left
CV060B	1	16.5	0	Extend 1.5m left
CV059B	0.5	16.5	0	Extend 3.5m left & 1m right
CV059A	0.5	16	0	Extend 3m left & 1m right
CV059C	0.5	16.5	0	Extend 4m left & 0.5m right
CV059D	0.5	16.5	0	Extend 4m left & 0.5m right
CV057B	0.5	16.5	0	Extend 1.5m left
CV057C	0.5	16.5	0	Extend 1.5m left
CV057A	0.5	16.5	0	Extend 1.5m left
BG50A	1.2	33.5	24.96	Extend 15.5m left
BG50B	1.2	32	24.96	Extend 14m left
CV049A	1.2	24.5	24.96	Extend 5.5m left & 4m right
CV049B	1.2	24.5	24.96	Extend 4.5m left & 5m right
CV030A	1	16	0	Extend 1m left
CV030B	0.5	16	0	Extend 1m left

To avoid the potential of serious harm to fish and their habitat, we are recommending that the following mitigation measures be included into your plans.

- If in-stream work is required during the open water season it should be completed in the dry by de-watering the work area and diverting and/or pumping flows around cofferdams placed at the limits of the work area.
- Existing stream flows should be maintained downstream of the de-watered work area without interruption, during all stages of the work.
- A fish stranding program should be implemented if necessary by a qualified fisheries person, who is experienced in this area, immediately following isolation and prior to de-watering to ensure that fish are removed from any dewatered area and released alive immediately downstream of the work area.
- Flow dissipaters and/or filter bags, or equivalent, should be placed at water discharge points to prevent erosion and sediment release.
- Silt or debris that has accumulated around the temporary cofferdams should be removed prior to their withdrawal.

Provided that these mitigation measures are incorporated into your plans, the Program is of the view that your proposal will not result in serious harm to fish. No formal approval is required from the Program under the *Fisheries Act* in order to proceed with your proposal.

If your plans have changed or if the description of your proposal is incomplete, or changes in the future, you should consult our website (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>) or consult with a qualified environmental consultant to determine if further review is required by the Program.

Please notify this office at least 10 days before starting your project. A copy of this letter should be kept on site while the work is in progress.

If you have any questions, please contact Georgina Williston at our Yellowknife office at 867-669-4927, by fax at 867-669-4940 or by email at geogina.williston@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,



Stu Niven
Senior Fisheries Protection Biologist
Fisheries and Oceans Canada

Georgina Williston- Fisheries and Oceans Canada
Bevin LeDrew- Sikumiut Environmental Management Ltd.
Tessa Mackay- Hatch



Suite 301 – 5204 59th Ave.
Yellowknife NT, X1A 1E2

Our file Notre référence
NU-07-0050

February 20, 2015

James Millard
Environmental Manager
Baffinland Iron Mines Corp.
275 Upper Middle Road East Suite 300
Oakville, ON L6H 0C3

Dear Mr. Millard:

Subject: Implementation of mitigation measures to avoid and mitigate serious harm to fish – Mary River Project, Tote Road Realignment.

The Fisheries Protection Program of Fisheries and Oceans Canada received your proposal on February 15, 2015.

Your proposal has been reviewed to determine whether it is likely to result in serious harm to fish which is prohibited under subsection 35(1) of the *Fisheries Act*.

Your proposal has also been reviewed to determine whether it will adversely impact listed aquatic species at risk and contravene sections 32, 33 or 58 of the *Species at Risk Act (SARA)*.

Our review considered the following:

- Letter from Baffinland Iron Mines Re: Mary River Project – Request for Advice on Realignment of Tote Road at Culvert CV076, Km 53 Tote Road, DFO File dated February 15, 2015 and submitted by James Millard with 1 attachment.
- Attachment 1 - Mark-up of proposed field change, Drawing H349000-3000-10-012-0073

We understand that you propose to:

- Realign the existing Tote Road at Culvert CV076, 160 meters upstream from the existing crossing and install one culvert which is 1.2m in diameter and 18 m in length.
- Install culverts during the winter months when the stream is frozen to bottom.
- Remove existing culvert from the old Tote Road alignment.

Since there are no *SARA* species or their habitats identified in the project area, no additional approvals under *SARA* will be required for your proposed activities. To avoid the potential for serious harm to fish that is prohibited under the *Fisheries Act*, the mitigation measures set out in your project plans are to be followed.

Provided that you implement the required mitigation measures for your project, and follow the guidance available on the DFO website at <http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/index-eng.html>, the Program is of the view that your proposal should not result in serious harm to fish or contravene sections 32, 33 or 58 of the *Species at Risk Act*. No formal approval is required from the Program under the *Fisheries Act* or the *Species at Risk Act* in order to proceed with your proposal.

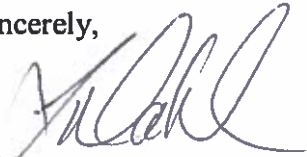
It remains your responsibility to ensure you avoid causing serious harm to fish in compliance with the *Fisheries Act*, and that you meet the requirements under the *Species at Risk Act* as it may apply to your project. If your plans have changed or if the description of your proposal is incomplete, or changes in the future, you should consult our website (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>) or consult with a qualified environmental consultant to determine if further review is required by the Program.

Please be advised that it is also your *Duty to Notify* DFO if you have caused, or are about to cause, serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery. Such notifications should be directed to <http://www.dfo-mpo.gc.ca/pnw-ppe/violation-infraction/index-eng.html>.

A copy of this letter should be kept on site while the work is in progress. It remains your responsibility to meet all other federal or territorial requirements that apply to your project.

If you have any questions, please contact Georgina Williston at our Yellowknife office at (867) 669-4927, by fax at (867) 669-4940, or by email at georgina.williston@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,



Julie Dahl
Regional Manager, Regulatory Reviews
Fisheries Protection Program

cc.
Georgina Williston- Fisheries and Oceans Canada
Oliver Curran-Baffinland Iron Mines Corp.
Erik Madsen-Baffinland Iron Mines Corp.



Fisheries and Oceans Canada Pêches et Océans Canada

5204-50th Avenue
Yellowknife, NT
X1A 1E2

December 9, 2014

Your file *Votre référence*

Our file *Notre référence*
NU-07-0050

Baffinland Iron Mines Corp.
Attention: Jim Millard, Environmental Manager
2275 Upper Middle Road, Suite 300
Oakville, ON
L6H 0C3

Dear Mr. Millard:

Subject: Implementation of mitigation measures to avoid and mitigate impacts to fish and fish habitat and listed aquatic species at risk – Mary River Project

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada received your proposal on November 27, 2014.

Your proposal has been reviewed to determine whether it is likely to result in serious harm to fish which is prohibited under subsection 35(1) of the *Fisheries Act*.

Your proposal has also been reviewed to determine whether it will adversely impact listed aquatic species at risk and contravene sections 32, 33 or 58 of the *Species at Risk Act (SARA)*.

Our review considered the following:

- Letter from Baffinland Iron Mines RE: Realignment of Tote Road at Culvert CV099. Dated November 27, 2014 and submitted by James Millard, with 1 attachment.
- Attachment 1- Mark up of proposed field change, Drawing H349000-3000-10-012-0052

We understand that you propose to:

- Realign the existing Tote Road and install one 2 metre diameter culvert in the stream bed and two 1.2 metre overflow culverts. Culverts will be approximately 27 metres in length.

- Install culverts during the winter months when the stream is frozen to bottom.
- Remove existing culverts along the old Tote Road alignment.

Since there are no *SARA* species or their habitats identified in the project area, no additional approvals under *SARA* will be required for your proposed activities.

To avoid the potential for serious harm to fish that is prohibited under the *Fisheries Act*, the mitigation measures set out in your project plans are to be followed.

Provided that you implement the required mitigation measures for your project, and follow the guidance available on the DFO website at <http://www.dfo-mpo.gc.ca/pnw-ppe/measures/index-eng.html>, the Program is of the view that your proposal should not result in serious harm to fish or contravene sections 32, 33 or 58 of the *Species at Risk Act*. No formal approval is required from the Program under the *Fisheries Act* or the *Species at Risk Act* in order to proceed with your proposal.

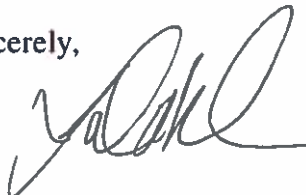
It remains your responsibility to ensure you avoid causing serious harm to fish in compliance with the *Fisheries Act*, and that you meet the requirements under the *Species at Risk Act* as it may apply to your project. If your plans have changed or if the description of your proposal is incomplete, or changes in the future, you should consult our website (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>) or consult with a qualified environmental consultant to determine if further review is required by the Program.

Please be advised that it is also your *Duty to Notify* DFO if you have caused, or are about to cause, serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery. Such notifications should be directed to <http://www.dfo-mpo.gc.ca/pnw-ppe/violation-infraction/index-eng.html>.

A copy of this letter should be kept on site while the work is in progress. It remains your responsibility to meet all other federal or territorial requirements that apply to your project.

If you have any questions, please contact Georgina Williston at our Yellowknife office at 867-669-4927 or by email at Georgina.Williston@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,



Julie Dahl
Regional Manager, Regulatory Reviews
Fisheries Protection Program

cc. Oliver Curran- Baffinland Iron Mines
Erik Madsen – Baffinland Iron Mines



Fisheries and Oceans
Canada

Pêches et Océans
Canada

5204-50th Avenue
Yellowknife, NT
X1A 1E2

October 27, 2014

Your file Votre référence

Our file Notre référence
NU-07-0050

Baffinland Iron Mines Corp.
Attention : Jim Millard, Environmental Manager
2275 Upper Middle Road, Suite 300
Oakville, ON
L6H 0C3

Dear Mr. Millard:

Subject: Implementation of mitigation measures to avoid and mitigate impacts to fish and fish habitat and listed aquatic species at risk – Mary River Project

The Fisheries Protection Program (the Program) of Fisheries and Oceans Canada received your proposal on October 17, 2014.

Your proposal has been reviewed to determine whether it is likely to result in serious harm to fish which is prohibited under subsection 35(1) of the *Fisheries Act*.

Your proposal has also been reviewed to determine whether it will adversely impact listed aquatic species at risk and contravene sections 32, 33 or 58 of the *Species at Risk Act* (SARA).

Our review considered the following:

- Letter from Baffinland Iron Mines RE: Realignment of Tote Road at Culvert CV225B. Dated October 16, 2014 and submitted by James Millard, with 2 attachments.
- Attachment 1- Mark of proposed field change, Drawing H349000-3000-10-012-0139
- Attachment 2- Project Wide, Civil Standard Drawing, Typical Culvert Detail, H349000-1000-10-041-0003

We understand that you propose to:

- Realign the existing Tote Road and install two new 1.2 metre culverts in the stream bed and one 1.0 metre culvert 45 m away as an overflow. Culverts will be approximately 27metres in length.

- Install culverts during the winter months when the stream is frozen to bottom.
- Remove the two existing 1.2m culverts along the old Tote Road alignment.

Since there are no *SARA* species or their habitats identified in the project area, no additional approvals under *SARA* will be required for your proposed activities.

To avoid the potential for serious harm to fish that is prohibited under the *Fisheries Act*, the mitigation measures set out in your project plans are to be followed.

Provided that you implement the required mitigation measures for your project, and follow the guidance available on the DFO website at <http://www.dfo-mpo.gc.ca/pnw-ppe/measures/index-eng.html>, the Program is of the view that your proposal should not result in serious harm to fish or contravene sections 32, 33 or 58 of the *Species at Risk Act*. No formal approval is required from the Program under the *Fisheries Act* or the *Species at Risk Act* in order to proceed with your proposal.

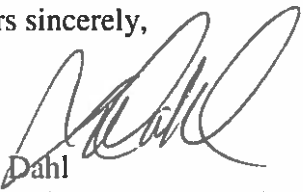
It remains your responsibility to ensure you avoid causing serious harm to fish in compliance with the *Fisheries Act*, and that you meet the requirements under the *Species at Risk Act* as it may apply to your project. If your plans have changed or if the description of your proposal is incomplete, or changes in the future, you should consult our website (<http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>) or consult with a qualified environmental consultant to determine if further review is required by the Program.

Please be advised that it is also your *Duty to Notify* DFO if you have caused, or are about to cause, serious harm to fish that are part of or support a commercial, recreational or Aboriginal fishery. Such notifications should be directed to <http://www.dfo-mpo.gc.ca/pnw-ppe/violation-infraction/index-eng.html>.

A copy of this letter should be kept on site while the work is in progress. It remains your responsibility to meet all other federal or territorial requirements that apply to your project.

If you have any questions, please contact Georgina Williston at our Yellowknife office at 867-669-4927 or by email at Georgina.Williston@dfo-mpo.gc.ca. Please refer to the file number referenced above when corresponding with the Program.

Yours sincerely,



Julie Dahl
Regional Manager, Regulatory Reviews
Fisheries Protection Program

cc. Oliver Curran- Baffinland Iron Mines
Erik Madsen – Baffinland Iron Mines
Stu Niven – Fisheries and Oceans Canada

APPENDIX B

PHOTO SUMMARY OF CHANGES OF TOTE ROAD CROSSINGS AT FISH-BEARING STREAMS COMPLETED IN 2017



Figure 1. BG01 DS pre-construction 17-09-02



Figure 2. BG01 US mid-installation 17-10-05



Figure 3. BG01 US installed 17-10-09



Figure 4. BG29 DS pre-culvert extension
16-08-12



Figure 5. BG29 DS culvert extension
installation 17-11-07



Figure 6. BG29 DS culvert extension installed
17-11-09



Figure 7. BG32 DS pre-culvert extension
17-07-24



Figure 8. BG32 DS mid-culvert extension
installation 17-09-22



Figure 9. BG 32 DS culvert extension
completed 17-09-23



Figure 10. CV059 DS after historical culvert removal 17-12-09



Figure 11. CV059 DS during culvert replacement 17-12-18



Figure 12. CV099 DS pre slope embankment reinforcement 17-09-11



Figure 13. CV099 DS post slope embankment reinforcement 17-12-03



Figure 14. CV106 DS pre-culvert extension
17-09-11



Figure 15. CV106 DS post-culvert extension
17-12-03



Figure 16. CV112 DS pre-culvert extension
17-09-11



Figure 17. CV112 DS culvert extension
installation 17-11-04



Figure 18. CV112 DS post-culvert extension
17-11-04



Figure 19. CV186 DS pre-culvert extension
17-09-02



Figure 20. CV186 DS culvert extension
17-11-28



Figure 21. CV186 DS culvert installation
17-11-27



Figure 22. CV186 DS culvert extension
completed 17-12-01



Figure 23. CV187 US culvert extension
17-04-23



Figure 24. CV187 DS culvert extension
17-04-20



Figure 25. CV187 US culvert extension
completed 17-04-24



Figure 26. CV187 DS culvert extension
completed 17-04-24



Figure 27. CV216 DS pre-culvert extension
17-07-24



Figure 28. CV216 DS post-culvert extension
17-10-05