

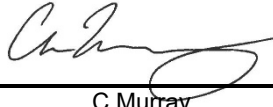




**BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT**

**FISH HABITAT MONITORING
2018 ANNUAL REPORT
EARLY REVENUE PHASE - TOTE ROAD UPGRADES**

2018-12-31	0			
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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.

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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 2017, 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 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 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 (TREEP) 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 TREEP outlined the planned sedimentation mitigation measures to be completed along the Tote Road in 2017 and subsequent years. Work executed by Baffinland in

2018 followed the guidance, recommendations and designs presented in the original 2013 designs prepared by Hatch Limited (Hatch) and the TREEP.

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 2017, 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). Baffinland will continue to update fish bearing status of identified fish bearing crossings in future reports resultant from Baffinland’s annual monitoring program

1.3 REPORTING

A report summarizing the monitoring results is to be submitted to the specified office locations of Fisheries and Oceans Canada, 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 2017 (Knight Piésold 2007b, 2008 and Baffinland 2009 to 2017, incl.).

This 2018 Annual Report, herein, covers the period of activity up to and including December 31, 2018. 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 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 2017, incl.).

In 2018, monitoring was conducted at fish-bearing crossings. The emphasis of the 2018 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.

2.2 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 2017 are presented in Baffinland (2009 to 2017, 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 2013-2018, indicating structural integrity and successful fish passage has been maintained.

2.3 SUMMARY OF CONSTRUCTION

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 2018 to fish bearing crossings are presented in Table 1. A photo summary of upgrades completed in 2018 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. From January 2018 to December 2018, work was completed five 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 will work with Fisheries and Oceans Canada 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 TREP have been implemented and are functioning as intended. Details of aquatic monitoring conducted up to 2017 are provided in Knight Piésold (2007b, 2008) and Baffinland (2009 to 2017, incl.). Aquatic monitoring in 2018 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 2018 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 2015-2018 is presented in Table 3.1 to Table 3.8.

3.3 FISH USE ASSESSMENTS AT SELECT CROSSINGS

Fish use assessments in 2018 were conducted at fish-bearing sites along the Tote Road. Table 4 summarizes assessments conducted in 2018 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.

Fish were captured or observed at all known fish-bearing crossings in 2018, with the exception of crossings CV-115 and BG-50. The fish-bearing stream at crossing CV-115 providing marginal habitat was dry in 2018 and did not contain fish at the time of the survey in early July. Fish have only been captured in CV-115 once since monitoring of the stream began in 2009 and it has frequently been dry.

The fish-bearing stream at crossing BG-50 provided important habitat, but fish were not captured or observed in 2018 in the right channel. BG-50 consists of two separate crossings; a bridge over the left channel and culverts in the right channel. The culverts are perched, impacting upstream fish passage in the right channel. However, upstream habitat is accessible from the bridge crossing in the left channel. This is the second consecutive year in which juvenile char were not captured directly downstream of the culverts, particularly in the scour pool where they had typically

congregated in previous years. Causes of their absence in 2017 and 2018 are unknown but it may be a result of decreased use of the branch in response to the perched culverts.

There were no fish passage or habitat issues observed at 25 of the 36 remaining fish-bearing crossings assessed. Fish were captured upstream of the culverts and there were no high velocity or physical obstructions at these crossings. Issues with fish passage and/or habitat were observed at 11 crossings at the time of the survey in late June, early July 2018. Two of these (CV-111 and BG-29) involved some form of physical obstruction to fish passage (e.g., cobble piles at the upstream and/or downstream end of culverts), which were removed following inspection and full upstream access restored.

Perching of culverts was noted at seven crossings (CV-129, CV-114, CV-106, CV-104, BG-50, BG-24, and CV-255) resulting in limited or no access to upstream habitat. Rocky ramps were installed downstream of CV-114 and CV-106, and will be monitored for effectiveness in future summer monitoring programs. Following further observations in August during low flow conditions, the ramp installed in CV-106 used more material than necessary and resulted in subsurface flows impacting fish passage. This ramp's construction will be assessed and redesigned as required in Spring 2019 to ensure that a reduction in available habitat and fish passage does not occur. Another site (CV-104) had a damaged perched upstream end of a culvert, which was successfully repaired following the early summer survey.

High culvert exit velocities (>1.00 m/s) were recorded at six sites (CV-129, CV-111, CV-99, BG-24, CV-255, and BG-01) during the time of the survey, which appeared to impact upstream access to larger juvenile char based on mean lengths of captured fish. The high flows as compared to previous years may have been influenced by significant precipitation in 2019. Crossings with damaged or perched culverts were targeted by the TREEP and implementation of the original Hatch 2013 designs to improve fish passage and erosion and sedimentation issues.

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).

SECTION 4.0 - AUTHORIZED HADD CROSSING INSTALLATION SUMMARY

No new HADD crossings or habitat compensation sites were installed in 2018. The locations for current authorized HADD crossings and habitat compensation sites are presented in Figure 1. Culverts CV-079A, BG-04 and CV-224 were modified in 2018 using the approved Hatch 2013 design. Completed as-built surveys of these crossings are provided in Appendix C. 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 2017, 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.
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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



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, 2017 TO DECEMBER 31, 2018**

Crossing	Road Chainage (km.m)	Completed Work	Date Completed	Current Crossing Configuration	Design Basis	Fisheries Survey Conducted July 2018 ¹
CV079	A50+109	Existing culvert was extended	June 13, 2018	2 x 1.2m diameter 2 x 0.5m diameter	Hatch (2013)	High velocities at downstream outlet of culvert. Fish smaller than 80 mm are observed downstream but not upstream.
CV102	A35+543	Existing culvert was repaired	May 21, 2018	1 x 1m diameter 3 x 0.5m diameter	Hatch (2013)	Fish were observed upstream of the crossing. No fish passage or habitat issues identified.
BG04	A93+992	Existing culverts were extended Existing culverts were armoured	February 5, 2018 June 17, 2018	3 x 1.2m diameter 1 x 2.0m diameter	Hatch (2013)	Fish were observed upstream of the crossing. No fish passage or habitat issues identified
CV224	A97+576	Existing culvert was extended	January 16, 2018	2 x 1m diameter	Hatch (2013)	Fish were observed upstream of the crossing. No fish passage or habitat issues identified
CV076	A52+536	Old culvert was removed	November 16, 2018	1 x 1m diameter	N/A	Old culvert still in water downstream of new crossing. Road material largely removed, but culvert remains. Culvert subsequently removed in November.

¹ – Fisheries survey conducted in July 2018 prior to additional culvert work completed in fall 2018.

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	Ø = 1.2	Ø = 1.0	Ø = 0.5	Ø = 0.25	Ø = 0.15	Ø = 0.10		
			(m)	(m)	(m)	(m)	(m)	(m)	(m)		
CV170 to CV166	-	A5 to A6	-	-	-	X	-	-	-	MAR ⁵	-
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	-
	B	A30+951	-	X	-	-	-	-	-	IMP	-
	C	A30+953	-	X	-	-	-	-	-	IMP	-
CV111		A31+489	-	-	X	-	-	-	-	IMP	-
CV106		A32+681	-	-	X	-	-	-	-	MAR	-
CV104	A	A33+301	-	X	-	-	-	-	-	MAR	-
	B	A33+307	-	X	-	-	-	-	-	MAR	-
CV102	A	A35+540	-	-	X	-	-	-	-	IMP	-
	B	A35+543	-	-	-	X	-	-	-	IMP	Repaired
	C	A35+544	-	-	-	X	-	-	-	IMP	-
	D	A35+545	-	-	-	X	-	-	-	IMP	-
CV099	A	A37+351	X	-	-	-	-	-	-	IMP	-
	B	A37+343	X	-	-	-	-	-	-	IMP	-
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	Extended
	B	A50+066	-	X	-	-	-	-	-	IMP	-
	C	A50+225	-	-	-	X	-	-	-	IMP	-
	D	A50+226	-	-	-	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	Ø = 1.2	Ø = 1.0	Ø = 0.5	Ø = 0.25	Ø = 0.15	Ø = 0.10		
			(m)	(m)	(m)	(m)	(m)	(m)	(m)		
CV078	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	-
	B	A59+216	-	-	-	X	-	-	-	MAR	-
	C	A59+217	-	-	-	X	-	-	-	MAR	-
	D	A59+218	-	-	-	X	-	-	-	MAR	-
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	-
	B	A78+120	-	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	Ø = 1.2	Ø = 1.0	Ø = 0.5	Ø = 0.25	Ø = 0.15	Ø = 0.10		
			(m)	(m)	(m)	(m)	(m)	(m)	(m)		
CV217	A	79+854	X	-	-	-	-	-	-	IMP	-
	B	80+000	-	-	-	-	-	-	-	IMP	Bridge
CV216	A	A80+951	-	X	-	-	-	-	-	MAR	-
	B	A80+580	-	X	-	-	-	-	-	MAR	-
	C	A80+582	-	X	-	-	-	-	-	MAR	-
BG30		A84+636	-	-	X	-	-	-	-	IMP	-
BG29		A84+706	-	-	X	-	-	-	-	IMP	-
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	Extended
	B	A93+993	-	X	-	-	-	-	-	IMP	Extended
	C	A93+996	X	-	-	-	-	-	-	IMP	Extended
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	Extended
	B	A97+578	-	-	X	-	-	-	-	IMP	Extended
CV225	A	A98+845	-	X	-	-	-	-	-	IMP	-
	B	A98+804	-	X	-	-	-	-	-	IMP	-
BG01	A	A99+483	-	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	Ø = 1.2	Ø = 1.0	Ø = 0.5	Ø = 0.25	Ø = 0.15	Ø = 0.10		
			(m)	(m)	(m)	(m)	(m)	(m)	(m)		
	B	A99+483	-	X	-	-	-	-	-	IMP	-
	C	A99+483	-	X	-	-	-	-	-	IMP	-
CV186	A	A102+812	-	-	X	-	-	-	-	IMP	-
	B	A102+812	-	-	X	-	-	-	-	IMP	-
CV187	A	A102+856	-	-	-	X	-	-	-	MAR	-
	B	A102+856	-	-	X	-	-	-	-	MAR	-

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 to new design in 2018 along the Tote Road, Extended = culvert length extended to meet approved design, Replaced/Repaired = culvert replaced or repaired to existing approved design

5 – Culverts in this area were installed at a natural vertical drop and are not fish bearing at or upstream of the crossing, but they all flow, a short distance downstream, into a marginal quality fish-bearing stream that runs parallel to the Tote Road. As such, the area has been regularly inspected for fish use.

TABLE 3 WATER QUALITY MONITORING OF BASELINE FISHERIES CULVERTS, 2005, 2006, 2015-2018

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	2018		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	03-Jul-18	03-Jul-18	02-Sep-18	02-Sep-18	
Rubidium	mg/L	-	-	-	0.0002	0.0002	0.0002	-	-	-	-	-	-	-	-	-	0.00235	0.00231	0.00121	0.00122	0.00093	0.00093	0.00072	0.00074	0.00094	0.00095
Selenium	mg/L	0.005	0.001	0.0004	0.00005	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	<0.000050	<0.000050	<0.000050	<0.000050	
Silicon	mg/L	-	-	-	0.05	0.05	0.1	-	-	-	-	-	-	-	-	1.98	1.75	0.437	0.451	0.54	0.54	0.32	0.33	0.41	0.4	
Silver	mg/L	0.0001	0.0001	-	0.00005	0.00005	0.00005	0.0001	<0.0001	<0.0001	<0.0001	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<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	0.05	-	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	0.332	0.341	0.75	0.74	
Strontium	mg/L	0.001	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	0.0057	0.0058	0.0125	0.0129	
Sulphur	mg/L	-	-	-	0.5	0.5	0.5	-	-	-	-	-	-	-	-	<0.50	<0.50	<0.50	0.64	<0.50	<0.50	<0.50	<0.50	0.62	<0.50	
Tellurium	mg/L	-	-	-	0.0002	0.0002	0.0002	-	-	-	-	-	-	-	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
Thallium	mg/L	0.0002	-	0.0003	0.00001	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	<0.000010	<0.000010	<0.000010	<0.000010	
Thorium	mg/L	-	-	-	0.0001	0.0001	0.0001	-	-	-	-	-	-	-	-	0.00138	0.00131	<0.00010	<0.00010	0.00012	0.00015	<0.00010	<0.00010	<0.00010	<0.00010	
Tin	mg/L	0.001	0.01	-	0.0001	0.0001	0.0001	-	<0.01	<0.01	<0.01	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Titanium	mg/L	-	-	-	0.0003	0.0003	0.0003	-	-	-	-	-	-	-	-	0.0256	0.0238	<0.00030	0.00042	0.00399	0.0045	0.00145	0.00164	<0.00030	<0.00030	
Tungsten	mg/L	-	-	-	0.0001	0.0001	0.0001	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Uranium	mg/L	-	-	0.001	0.00001	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	0.000346	0.000347	0.00147	0.00154	
Vanadium	mg/L	0.0009	0.001	-	0.0005	0.0005	0.0005	-	<0.001	<0.001	<0.001	-	-	-	-	0.00163	0.00149	<0.00050	<0.00050	<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	0.003	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	<0.0030	<0.0030	<0.0030	<0.0030	
Zirconium	mg/L	-	-	-	0.0003	0.0003	0.0003	-	-	-	-	-	-	-	-	0.00083	0.00076	<0.00030	<0.00030	<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	<0.005	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, 2017 and 2018 dissolved oxygen values in % saturation
 2018 TDS LOR was 10 in June, 20 in September
 * 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	2018		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	03-Jul-18	03-Jul-18
In Situ Parameters																			
Temperature	°C	-	-	-	-	-	-	-	-0.08	9.96	5.77	5.5	5.9	11.3	5.6	3.2	3.8	0.5	2.2
Specific Conductance	mS/cm	-	-	-	-	-	-	-	0.148	0.160	0.182	0.340	0.320	11.570	11.570	0.197	0.182	0.211	0.197
Dissolved Oxygen	mg/L	-	-	-	-	-	-	5.5-9.5	13.70	10.81	12.46	-	-	-	-	-	-	-	-
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	99.4	101.1	99.4	99.0	101.8	102.0	97.4	98.1
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	8.12	8.12
Wetted Width	m	-	-	-	-	-	-	-	20	33	28	2.5	2.5	-	-	1.3	3.8	0.2	1.1
Average Depth	m	-	-	-	-	-	-	-	0.15	0.20	0.20	0.50	0.50	-	-	0.09	0.06	0.04	0.03
Flow Rate	m ³ /s	-	-	-	-	-	-	-	2	4.62	6.85	-	-	-	-	0.02223	0.10944	0.002	0.015
Physical Parameters																			
pH	pH units	-	-	0.01	0.1	0.1	0.1	6.5 - 9.0	7.91	7.84	7.64	8.36	8.26	8.27	8.2	8.13	8.15	8.15	8.17
Conductivity	µS/cm	1	5	-	-	-	-	-	161	165	190	-	-	-	-	-	-	-	-
Turbidity	NTU	0.1	0.1	0.1	0.1	0.1	.1	-	0.5	0.2	-	0.19	1.22	0.92	1.31	0.31	1.74	0.66	0.99
Hardness	mg/L as CaCO ₃	0.5	1	10	10	10	10/20	-	85	86	95	152	158	99	100	81	84	112	108
TSS	mg/L	-	-	2	2	2	2	-	-	-	-	<2.0	2.0	<2.0	4.4	2.1	5.5	<2.0	<2.0
TDS	mg/L	30	5	20	20	20	10	-	105	107	123	147	159	115	105	89	86	128	116
Dissolved Anions																			
Alkalinity	mg/L as CaCO ₃	2	5	10	10	10	10	-	80	85	93	155	163	103	99	77	81	99	98
Br ⁻	mg/L	0.3	0.05	-	-	-	-	-	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-
Cl ⁻	mg/L	0.2	1	0.5	0.5	0.5	0.5	-	<1	<1	<1	0.74	3.07	0.61	0.57	<0.50	0.6	1.10	1.95
Fluoride	mg/L	-	-	-	0.02	0.02	0.02	-	-	-	-	-	-	0.036	0.03	0.028	0.027	0.053	0.035
SO ₄ ⁻	mg/L	0.5	1	0.3	0.3	0.3	0.3	-	3	2	7	2.66	3.9	1.22	1.24	0.62	1	3.02	2.04
Nutrients																			
NH ₃ +NH ₄	mg/L N	0.1	0.02	0.15	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	0.02	0.02	2.9	<0.10	<0.10	<0.10	0.023	0.026	<0.020	0.023	<0.020	<0.020	0.054	0.040
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	0.02	'Variable' ¹	-	-	-	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total Phosphorus	mg/L	0.02	0.01	0.003	0.003	0.003	0.003	-	<0.01	<0.01	<0.01	<0.0030	0.0037	0.0216	0.0657	0.0042	0.0046	<0.0030	<0.0030
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	1	0.5	0.5	-	-	-	-	1.8	2.4	<1.0	<1.0	1.18	1.05	1.17	1.34
TOC	mg/L	-	-	1	1	0.5	0.5	-	-	-	-	1.8	2.1	1.2	<1.0	1.41	2.72	1.49	1.46
TKN	mg/L	-	-	0.15	0.15	0.15	0.15	-	-	-	-	0.23	<0.15	<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	0.005 - 0.100 ²	<0.005	<0.005	0.007	0.018	0.012	0.025	0.139	0.0133	0.048	0.0315	0.0346
Antimony	mg/L	0.0004	-	-	0.0001	0.0001	0.0001	-	-	-	-	-	-	<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	0.0001	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	0.0001	-	<0.01	<0.01	<0.01	-	-	0.00459	0.00434	0.00172	0.00297	0.0019	0.00283



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	2018		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	03-Jul-18	03-Jul-18
Beryllium	mg/L	0.005	-	-	0.0001	0.0001	0.0001	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	0.0003	-	-	0.00005	0.00005	0.00005	-	-	-	-	-	-	<0.000050	<0.000050	<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	<0.01	-	-	<0.010	<0.010	<0.010	<0.010	0.011	<0.010
Cadmium	mg/L	0.0001	0.0001	0.00009	0.00001	0.00001	0.000005	0.000017	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050
Calcium	mg/L	0.05	1	0.5	0.5	0.5	0.05	-	24	25	27	44	43.6	31.2	31.6	26.8	26.9	35.4	34.8
Cesium	mg/L	-	-	-	0.00001	0.00001	0.00001	-	-	-	-	-	-	<0.000010	0.000018	<0.000010	<0.000010	<0.000010	<0.000010
Chromium	mg/L	0.001	0.001	-	0.0005	0.0005	0.0005	-	<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	0.0001	-	<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	0.001	0.002 - 0.004 ³	<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	0.01	0.3	<0.03	<0.03	<0.03	<0.050	<0.050	<0.050	0.179	<0.050	0.057	0.022	0.026
Lead	mg/L	0.0002	0.001	0.0005	0.0001	0.0001	0.00005	0.001 - 0.007 ³	<0.001	<0.001	<0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	0.001	0.001	0.001	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	0.002	0.0014
Magnesium	mg/L	0.005	1	0.5	0.05	0.05	0.005	-	6.0	5.0	6.0	11.8	13.8	5.02	5.19	3.5	4.13	5.74	5.15
Manganese	mg/L	0.0007	0.01	0.001	0.0005	0.0005	0.0005	-	<0.01	<0.01	<0.01	<0.00050	<0.00050	0.00058	0.00362	<0.00050	0.00128	<0.00050	0.00074
Mercury	mg/L	0.0001	0.0001	0.00001	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	<0.000010	<0.000010
Molybdenum	mg/L	0.0003	0.005	0.0005	0.00005	0.00005	0.00005	0.073	<0.005	<0.005	<0.005	<0.00050	<0.00050	0.000093	0.000091	<0.000050	0.000068	0.000118	0.000094
Nickel	mg/L	0.001	0.005	0.001	0.0005	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	<0.00050	<0.00050
Phosphorus	mg/L	-	-	-	0.05	0.05	0.05	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Potassium	mg/L	0.02	0.01	1	0.05	0.05	0.05	-	0.24	0.15	0.23	0.339	0.515	0.618	0.539	0.299	0.475	0.383	0.437
Rubidium	mg/L	-	-	-	0.0002	0.0002	0.0002	-	-	-	-	-	-	0.00122	0.00107	0.00023	0.00064	<0.00020	0.0006
Selenium	mg/L	0.005	0.001	0.0004	0.00005	0.00005	0.00005	0.001	<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	0.0001	0.0001	-	0.05	0.05	0.1	-	<0.0001	<0.0001	<0.0001	-	-	0.643	0.846	0.44	0.59	0.79	0.64
Silver	mg/L	-	-	-	0.00005	0.00005	0.00005	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	0.05	-	0.34	0.23	0.58	0.61	1.75	<0.50	<0.50	<0.50	<0.50	0.234	0.232
Strontium	mg/L	0.001	0.001	-	0.001	0.001	0.001	-	0.019	0.018	0.022	-	-	0.0295	0.0284	0.0216	0.0242	0.0337	0.0336
Sulfur	mg/L	-	-	-	0.5	0.5	0.5	-	-	-	-	-	-	0.74	<0.50	<0.50	0.66	1.2	0.9
Tellurium	mg/L	-	-	-	0.0002	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	0.00001	0.0008	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Thorium	mg/L	-	-	-	0.0001	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	0.0001	-	<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	0.0003	-	-	-	-	-	-	0.00097	0.00745	0.00043	0.00305	<0.0020	0.00136
Tungsten	mg/L	-	-	-	0.0001	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	0.00001	0.015	-	-	-	0.000422	0.00059	0.000159	0.000159	0.000082	0.000125	0.000174	0.000193
Vanadium	mg/L	0.0009	0.001	-	0.0005	0.0005	0.0005	-	<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	0.003	0.03	<0.01	<0.01	<0.01	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Zirconium	mg/L	-	-	-	0.0003	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	<0.005	<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	-	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	0.0003	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	0.05	0.01	-	-	-	-	-	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.0001	0.0001	-	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	-	-	-	-	-	-
Calcium	mg/L	0.05	1	0.0002	-	-	-	-	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	2018		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	03-Jul-18	03-Jul-18
Cesium	mg/L	-	-	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	0.001	0.00005	-	-	-	-	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-
Cobalt	mg/L	0.0003	0.0002	0.05	-	-	-	-	<0.0002	<0.0002	<0.0002	-	-	-	-	-	-	-	-
Copper	mg/L	0.0008	0.001	0.0005	-	-	-	-	<0.001	<0.001	<0.001	0.00024	0.00038	-	-	-	-	-	-
Iron	mg/L	0.02	0.03	0.00001	-	-	-	-	<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	-	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	0.005	1	0.05	-	-	-	-	6	5	6	10.9	13	-	-	-	-	-	-
Manganese	mg/L	0.0007	0.01	0.00005	-	-	-	-	<0.01	<0.01	<0.01	<0.00050	0.00051	-	-	-	-	-	-
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	<0.000010	<0.000010	-	-	-	-	-	-
Molybdenum	mg/L	0.0003	0.005	0.5	-	-	-	-	<0.005	<0.005	<0.005	0.000076	0.000118	-	-	-	-	-	-
Nickel	mg/L	0.001	0.005	-	-	-	-	-	<0.005	<0.005	<0.005	<0.00050	<0.00050	-	-	-	-	-	-
Phosphorus	mg/L	-	-	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	0.02	0.01	-	-	-	-	-	0.24	0.15	0.25	0.344	0.538	-	-	-	-	-	-
Rubidium	mg/L	-	-	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.005	0.001	-	-	-	-	-	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-	-	-
Silicon	mg/L	-	-	0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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, 2017 and 2018 dissolved oxygen values in % saturation

2018 TDS LOR was 10 in June, 20 in September

* 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 3.4 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	2011	2015	2016	2017	2018	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	03-Jul-18	03-Jul-18	02-Sep-18	02-Sep-18	02-Sep-18	
Lead	mg/L	0.0002	0.001	0.00005	0.00001	-	-	-	0.01	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-	-	-	-	-	-	-	-	-
Lithium	mg/L	-	-	0.0005	0.00005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Magnesium	mg/L	0.005	1	0.1	0.0005	-	-	-	0.05	2.09	9.19	11.0	3	9	10	12.8	10.9	-	-	-	-	-	-	-	-	-	-	-	
Manganese	mg/L	0.0007	0.01	0.00005	0.05	-	-	-	0.0005	0.0013	<0.0007	<0.0007	<0.01	<0.01	<0.01	<0.00050	<0.00050	-	-	-	-	-	-	-	-	-	-	-	
Mercury	mg/L	-	-	0.00001	0.00005	-	-	-	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	0.5	-	-	-	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	0.001	0.00001	-	-	-	0.00005	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-	-	-	-	-	-	-	-	
Silicon	mg/L	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Silver	mg/L	0.0001	0.0001	0.000001	0.00001	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	1.61	0.61	-	-	-	-	-	-	-	-	-	-	-	
Sodium	mg/L	0.05	0.05	0.0012	-	-	-	-	0.5	0.30	0.28	0.34	0.30	0.30	0.46	-	-	-	-	-	-	-	-	-	-	-	-	-	
Strontium	mg/L	0.001	0.001	0.0001	0.001	-	-	-	-	0.0099	0.0247	0.0281	0.012	0.028	0.030	-	-	-	-	-	-	-	-	-	-	-	-	-	
Thallium	mg/L	0.0002	-	0.0001	0.00001	-	-	-	0.00001	<0.0002	<0.0002	<0.0002	-	-	-	<0.000010	<0.000010	-	-	-	-	-	-	-	-	-	-	-	
Tin	mg/L	0.001	0.01	0.0001	-	-	-	-	-	<0.001	<0.001	<0.001	<0.01	<0.01	<0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	
Titanium	mg/L	0.003	-	0.01	-	-	-	-	-	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Uranium	mg/L	-	-	0.00001	0.00001	-	-	-	0.00001	-	-	-	-	-	-	0.000549	0.000409	-	-	-	-	-	-	-	-	-	-	-	
Vanadium	mg/L	0.0009	0.001	0.001	-	-	-	-	-	<0.0009	0.0043	0.0042	<0.001	<0.001	0.002	-	-	-	-	-	-	-	-	-	-	-	-	-	
Zinc	mg/L	0.001	0.01	0.003	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, 2017 and 2018 dissolved oxygen values in % saturation
2018 TDS LOR was 10 in June, 20 in September

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

Parameters	Units	Method Detection Limit		LOR				CCME Guideline	Dates																						
		2005	2006	2015	2016	2017	2018		07-Jun-05	06-Aug-05	09-Sep-05	13-Jun-06	02-Aug-06	08-Sep-06	03-Jul-15	03-Jul-15	11-Aug-15	11-Aug-15	30-Jun-16	30-Jun-16	25-Aug-16	25-Aug-16	29-Jun-17	29-Jun-17	03-Jul-18	03-Jul-18	03-Jul-18	02-Sep-18	02-Sep-18		
		US	DS	US	DS	US	DS		US	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS	US	DS	
In Situ Parameters																															
Temperature	°C	-	-	-	-	-	-	-	0.26	9.75	6.05	-0.05	13.74	6.53	-	-	11.4	11.3	10.4	7.2	11.5	11.3	5.9	8.5	6.3	6.3	6.5	7.9	7.9		
Specific Conductance	mS/cm	-	-	-	-	-	-	-	0.067	0.139	0.145	0.112	0.137	0.152	0.130	0.084	0.183	0.180	6.109	6.213	0.175	0.175	0.126	0.171	0.104	0.104	0.1041	0.1394	0.1418		
Dissolved Oxygen	mg/L	-	-	-	-	-	-	5.5-9.5	13.06	10.71	11.89	13.58	10.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	101.5	101.9	98.5	99.4	101.4	100.5	102.4	111.7	96.1	96.1	96.6	100.4	101.2		
pH	pH units	-	-	-	-	-	-	6.5 - 9.0	7.58	8.03	7.70	8.02	8.1	8.16	8.20	8.17	8.42	8.42	6.21	7.47	8.22	8.15	7.78	7.76	8.17	8.17	8.06	8.37	8.40		
Wetted Width	m	-	-	-	-	-	-	-	-	-	52	42	38	-	-	6	6	-	-	-	-	5	10.6	-	-	7.9	-	-	-		
Average Depth	m	-	-	-	-	-	-	-	-	-	-	0.3	0.3	-	-	0.2	0.2	-	-	-	-	2	0.19	-	-	0.09	-	-	-		
Flow Rate	m³/s	-	-	-	-	-	-	-	-	-	-	4.09	-	-	-	-	-	-	-	-	-	-	3.8	1.06742	-	-	0.244	-	-		
Physical Parameters																															
pH	pH units	-	-	0.01	0.1	0.1	0.1	6.5 - 9.0	-	-	-	7.7	7.61	7.64	7.98	7.99	8.20	8.17	7.86	7.94	8.32	8.28	7.94	7.92	7.97	7.95	7.99	8.34	8.39		
Conductivity	µS/cm	1	5	-	-	-	-	-	72	149	143	124	140	171	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Turbidity	NTU	0.1	0.1	0.1	0.1	0.1	0.1	-	0.33	0.25	0.16	0.5	0.3	-	0.29	0.28	0.2	0.2	0.6	0.46	0.28	0.26	0.44	0.72	0.63	0.8	0.6	0.24	0.23		
Hardness	mg/L as CaCO ₃	0.5	1	10	10	10	10/20	-	32.4	79.5	82.0	61	75	80	63	62	80	81	48	48	85	93	55	55	52	52	53	81	85		
TSS	mg/L	-	-	2	2	2	2	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
TDS	mg/L	30	5	20	20	20	10	-	54	74	86	81	91	111	70	73	86*	84*	60	65	83	84	66	66	68	72	55	90	95		
Dissolved Anions																															
Alkalinity	mg/L as CaCO ₃	2	5	10	10	10	10	-	33	74	71	62	74	87	63	63	82	80	47	50	84	89	51	50	43	51	47	83	85		
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	0.5	-	0.9	0.8	0.9	<1	<1	2	1.29	1.30	2.06	2.20	1.26	1.26	1.89	1.88	1.29	1.3	1.12	1.13	1.16	1.55	1.76		
Fluoride	mg/L	-	-	-	0.02	0.02	0.02	-	-	-	-	-	-	-	-	-	-	-	<0.020	<0.020	0.024	0.025	<0.020	<0.020	<0.020	<0.020	<0.020	0.03	0.029		
SO ₄ ²⁻	mg/L	0.5	1	0.3	0.3	0.3	0.3	-	0.7	0.5	0.6	2	<1	3	0.82	1.03	1.55	2.28	0.65	0.62	1.25	1.21	0.64	0.61	0.58	0.58	0.6	0.84	0.91		
Nutrients																															
NH ₃ +NH ₄	mg/L N	0.1	0.02	0.15	0.15	0.15	-	0.021 - 231 ¹	0.2	0.1	<0.10	0.04	0.11	<0.02	<0.15	<0.15	0.28	0.22	<0.15	<0.15	0.2	<0.15	-	-	-	-	-	-	-		
NO ₂ ⁻	mg/L N	0.06	0.005	-	-	-	-	0.06	<0.06	<0.06	<0.06	<0.005	<0.005	0.013	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
NO ₃ ⁻	mg/L N	0.05	0.1	0.02	0.02	0.02	0.02	2.9	0.06	<0.05	<0.05	<0.10	<0.10	<0.10	<0.020	0.035	<0.020	0.052	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
NO ₂ +NO ₃	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	0.02	Variable ¹	-	-	-	-	-	-	-	-	-	-	<0.020	0.054	0.061	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
Total Phosphorus	mg/L	0.02	0.01	0.003	0.003	0.003	0.003	-	<0.02	<0.02	<0.10	<0.01	<0.01	<0.01	0.0043	0.0058	0.0040	0.0038	0.0044	0.0032	0.0231	0.0088	0.0061	0.0066	0.004	0.0037	0.004	<0.0030	<0.0030		
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	1	0.5	0.5	-	-	-	-	-	-	-	2.1	2.1	2.5	2.6	2.1	1.9	2.1	2.3	2.24	2.14	1.9	2.07	1.87	2.48	2.41		
TOC	mg/L	-	-	1	1	0.5	0.5	-	-	-	-	-	-	-	2.1	1.9	2.7	2.6	2.3	2.2	2.5	2.2	2.48	2.79	2.16	2.18	2.08	3.19	3		
TKN	mg/L	-	-	0.15	0.15	0.15	0.15	-	-	-	-	-	-	-	<0.15	<0.15	0.28	0.22	<0.15	<0.15	0.2	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15		
Chlorophyll-a	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Phaeophytin-a	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total Metals and Non-Metals																															
Aluminum	mg/L	0.004	0.005	0.01	0.01	0.005	0.005	0.005 - 0.100 ²	0.008	<0.004	<0.004	<0.005	<0.005	0.006	<0.010	<0.010	<0.010	<0.010	0.018	0.014	<0.010	<0.010	0.0282	0.0269	0.0063	0.0067	0.0085	<0.0050	0.0058		
Antimony	mg/L	0.0004	-	-	0.0001	0.0001	0.0001	-	<0.0004	<0.0004	<0.0004	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<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	0.0001	0.005	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.00010	<0.00010	<0.00010	<0.00010	0.0011	0.0012	<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	0.0001	-	0.001	0.004	0.004	<0.01	<0.01	<0.01	-	-	-	-	0.00347	0.0034	0.00545	0.00569	0.00391	0.00394	0.00328	0.00337	0.00336	0.00532	0.00527		
Beryllium	mg/L	0.005	-	0.0001	0.0001	0.0001	0.0001	-	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Bismuth	mg/L	0.0003	-	-	0.00005	0.00005	0.00005	-	<0.0003	<0.0003	<0.0003	-	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Boron	mg/L	0.05	0.01	-	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	<0.010	<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	0.000005	0.000017	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000090	<0.000090	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium	mg/L	0.05	1	0.5																											

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	2018		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-16	29-Jun-17	29-Jun-17	04-Jul-18	04-Jul-18	03-Sep-18	03-Sep-18	03-Sep-18
In Situ Parameters																														
Temperature	°C	-	-	-	-	-	-	-	0.07	10.80	4.78	-0.1	-0.1	14.96	4.91	-	-	12.8	12.7	15.7	16	-	11.1	3.8	2.4	8.1	8.5	3.4	3.3	3.3
Specific Conductance	mS/cm	-	-	-	-	-	-	-	0.047	0.243	0.318	0.084	0.084	0.264	0.306	0.130	0.125	0.387	0.390	0.151	0.151	-	0.391	0.177	0.101	0.2026	0.1968	0.3137	0.3133	0.31
Dissolved Oxygen	mg/L	-	-	-	-	-	-	5.5-9.5	13.48	10.39	12.74	13.65	13.65	10.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	101.7	102.3	99.8	103.6	-	99.8	109.2	100.8	94.1	94.4	96.3	95.3	95.3
pH	pH units	-	-	-	-	-	-	6.5-9.0	6.99	8.39	8.05	7.97	7.97	8.37	8.50	8.32	8.16	8.61	8.65	8.19	8.23	-	8.36	7.64	7.84	8.24	8.24	8.27	8.24	8.24
Wetted Width	m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average Depth	m	-	-	-	-	-	-	-	-	-	-	-	-	0.25	0.2	-	-	7	7	-	-	-	-	-	-	12.1	30.8	9.2	7.7	9.2
Flow Rate	m³/s	-	-	-	-	-	-	-	-	-	-	-	-	0.28	0.2	-	-	0.2	0.2	-	-	-	-	-	-	0.14	0.12	0.06	0.10	-
Physical Parameters																														
pH	pH units	-	-	0.01	0.1	0.1	0.1	6.5-9.0	-	-	-	7.40	7.47	8.22	8.18	8.18	8.19	8.53	8.50	8.1	8.19	8.47	8.51	7.73	7.75	8.24	8.24	8.43	8.37	5.77
Conductivity	µS/cm	1	5	-	-	-	-	-	54	257	303	92	93	273	321	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Turbidity	NTU	0.1	0.1	0.1	0.1	0.1	0.1	-	0.37	0.13	<0.10	0.6	0.5	0.2	-	0.44	0.54	0.19	0.15	1.48	1.05	0.28	0.33	0.77	0.71	0.62	0.64	0.5	0.27	<0.10
Hardness	mg/L as CaCO ₃	0.5	1	10	10	10	10/20	-	25.1	138	178	48	48	153	159	95	94	168	169	68	69	193	202	35	37	106	102	176	182	<10
TSS	mg/L	-	-	2	2	2	2	-	-	-	-	-	-	-	-	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	5.1	<2.0	<2.0	<2.0	<2.0
TDS	mg/L	30	5	20	20	20	10	-	46	126	200	60	61	177	209	77	90	178*	170*	65	65	208	201	44	46	112	118	195	205	<20
Dissolved Anions																														
Alkalinity	mg/L as CaCO ₃	2	5	10	10	10	10	-	24	130	167	45	45	147	167	112	99	175	177	68	75	187	191	32	27	103	100	171	168	<10
Br ⁻	mg/L	0.3	0.05	-	-	-	-	-	<0.3	<0.3	<0.3	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cl ⁻	mg/L	0.2	1	0.5	0.5	0.5	0.5	-	0.9	0.7	2.4	<1	<1	1	5	2.48	2.28	8.34	8.66	1.81	1.84	13.5	13.8	0.57	0.57	3.16	2.91	13.5	13.8	<0.50
Fluoride	mg/L	-	-	0.02	0.02	0.02	0.02	-	-	-	-	-	-	-	-	-	-	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.031	0.024	0.042	0.041	<0.020
SO ₄ ²⁻	mg/L	0.5	1	0.3	0.3	0.3	0.3	-	0.6	0.8	2.1	2	2	<1	4.00	1.58	1.47	4.81	5.36	0.76	0.84	6.03	6.52	0.3	<0.30	1.3	0.89	3.62	3.52	<0.30
Nutrients																														
NH ₃ +NH ₄	mg/L N	0.1	0.02	0.15	0.15	0.15	-	0.021 - 231 ¹	0.2	0.5	0.6	0.05	0.09	0.04	<0.02	0.17	<0.15	0.37	0.28	<0.15	<0.15	0.24	0.17	-	-	-	-	-	-	-
NO ₂ ⁻	mg/L N	0.06	0.005	-	-	-	-	0.06	<0.06	<0.06	<0.06	<0.005	<0.005	<0.005	0.015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NO ₃ ⁻	mg/L N	0.05	0.1	0.02	0.02	0.02	0.02	2.9	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<0.10	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	
NO ₂ +NO ₃	mg/L N	0.06	0.1	-	-	-	-	-	<0.06	<0.06	<0.06	<0.10	<0.10	<0.10	<0.10	-	-	-	-	-	-	<0.020	0.085	-	-	-	-	-	-	-
Ammonia total as N	mg/L	-	-	0.05	0.02	0.02	0.02	Variable ¹	-	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.020	<0.020	-	-	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Total Phosphorus	mg/L	0.02	0.01	0.003	0.003	0.003	0.003	-	0.030	<0.02	<0.10	<0.01	<0.01	<0.01	<0.01	0.0040	0.0032	<0.0030	<0.0030	0.0067	0.0038	0.0048	0.0034	0.0158	0.0159	<0.0030	0.0031	<0.0030	<0.0030	<0.0030
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	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DOC	mg/L	-	-	1	1	0.5	0.5	-	-	-	-	-	-	-	-	2.2	2.2	3.4	3.5	1.6	1.4	3.2	3	3.93	3.56	3.2	3.05	3.27	3.16	0.51
TOC	mg/L	-	-	1	1	0.5	0.5	-	-	-	-	-	-	-	-	2.4	2.5	3.6	3.5	1.9	2.1	3.6	3.3	4.45	4.17	3.4	3.28	4.01	3.61	0.62
TKN	mg/L	-	-	0.15	0.15	0.15	0.15	-	-	-	-	-	-	-	-	0.17	<0.15	0.37	0.28	<0.15	<0.15	0.24	0.17	0.29	0.26	<0.15	<0.15	0.18	0.27	<0.15
Chlorophyll-a	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phaeophytin-a	mg/m3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals and Non-Metals																														
Aluminum	mg/L	0.004	0.005	0.01	0.01	0.005	0.005	0.005 - 0.100 ²	0.005	<0.004	<0.004	0.006	0.005	<0.005	<0.005	0.019	0.025	0.011	<0.010	0.096	0.042	0.024	0.02	0.0527	0.065	0.0092	0.0121	0.0239	0.011	<0.0050
Antimony	mg/L	0.0004	-	-	0.0001	0.0001	0.0001	-	<0.0004	<0.0004	<0.0004	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<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	0.0001	0.005	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	<0.0010	<0.0010	0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00011	<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	0.0001	-	0.001	0.006	0.007	<0.01	<0.01	<0.01	<0.01	-	-	-	-	0.0055	0.00502	0.0119	0.0118	0.00266	0.00274	0.00574	0.00561	0.0101	0.0104	<0.00010
Beryllium	mg/L	0.005	-	-	0.0001	0.0001	0.0001	-	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	0.0003	-	-	0.00005	0.00005	0.00005	-	<0.0003	<0.0003	<0.0003	-	-	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	0.05	0.01	-	0.01	0.01	0.01	-	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<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	0.000005	0.000017	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<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	0.5	-	6.07	33.9	42.9	11	11	38	40	-	-	42.3	40.5	16.9	16.8	44.7	46.1	8.08	6.64	25.1	24.6	41.2	43.6	<0.050
Cesium	mg/L	-	-	-	0.0001	0.00001	0.00001	-	-	-	-	-	-	-	-	-	-	-	-	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Chromium	mg/L	0.001	0.001	-	0.0005	0.0005	0.0005	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<			



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	2018		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-16	29-Jun-17	29-Jun-17	04-Jul-18	04-Jul-18	03-Sep-18	03-Sep-18	03-Sep-18	
Titanium	mg/L	0.003	-	-	0.0003	0.0003	0.0003	-	<0.003	<0.003	<0.003	-	-	-	-	-	-	-	0.00455	0.00162	0.00166	0.00112	0.00245	0.00325	0.00041	0.00053	0.0013	0.00059	<0.00030		
Tungsten	mg/L	-	-	-	0.0001	0.0001	0.0001	-	-	-	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		
Uranium	mg/L	-	-	0.001	0.00001	0.00001	0.00001	0.015	-	-	-	-	-	-	-	-	-	-	0.000507	0.000533	0.00361	0.00367	0.000129	0.000132	0.00135	0.00123	0.00317	0.00306	<0.00010		
Vanadium	mg/L	0.0009	0.001	-	0.0005	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	<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	0.003	0.03	<0.001	0.0010	<0.001	<0.01	<0.01	<0.01	<0.01	<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	<0.0030	<0.0030	
Zirconium	mg/L	-	-	-	0.0003	0.0003	0.0003	-	-	-	-	-	-	-	-	-	-	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<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	<0.005	<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	<0.001	<0.001	<0.0010	<0.0010	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	-	0.00001	-	-	-	-	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	0.0003	-	0.05	-	-	-	-	<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	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.0001	0.0001	-	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.00010	<0.00010	<0.00010	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	0.05	1	0.0002	-	-	-	-	6.06	35.0	40.5	11	11	38	22.5	22.3	37.9	39.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	0.001	0.01	-	-	-	-	<0.001	0.002	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	0.0003	0.0002	0.00005	-	-	-	-	<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	0.0008	0.001	0.05	-	-	-	-	<0.0008	<0.0008	<0.0008	<0.001	<0.001	<0.001	<0.001	<0.001	0.00057	0.00054	0.00076	0.00077	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.02	0.03	0.0005	-	-	-	-	<0.05	<0.02	<0.02	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.010	<0.010	<0.010	0.014	-	-	-	-	-	-	-	-	-	-
Lead	mg/L	0.0002	0.001	0.00001	-	-	-	-	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.00050	<0.00050	<0.00050	<0.00050	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	0.005	1	0.00005	-	-	-	-	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	<0.01	<0.00050	<0.00050	<0.00050	0.00118	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.0003	0.005	0.00005	-	-	-	-	<0.0003	<0.0003	<0.0003	<0.005	<0.005	<0.005	<0.005	<0.005	0.000067	0.000073	0.000176	0.000174	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	0.001	0.005	-	-	-	-	-	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005	<0.005	<0.00050	<0.00050	<0.00050	<0.00050	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	0.02	0.01	0.5	-	-	-	-	0.39	0.72	0.76	0.61	0.60	0.73	0.80	0.64	0.607	1.24	1.24	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.005	0.001	-	-	-	-	-	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.00050	<0.00050	<0.00050	<0.00050	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001	0.0001	0.00001	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	0.05	0.05	-	-	-	-	-	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	0.00001	-	-	-	-	0.0027	0.0192	0.0224	0.005	0.005	0.023	0.026	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0002	-	-	-	-	-	-	<0.0002	<0.0002	<0.0002	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	0.001	0.01	0.001	-	-	-	-	<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	<0.001	<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, 2017 and 2018 dissolved oxygen values in % saturation
 2018 TDS LOR was 10 in June, 20 in September
 * 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	2018		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	04-Jul-18	04-Jul-18	31-Aug-18	31-Aug-18		
In Situ Parameters																												
Temperature	°C	-	-	-	-	-	-	-	3.76	9.54	7.0	1.99	7.11	4.35	6.8	6.9	5.1	5.0	4.5	5.1	1.8	3.5	2.4	2.5	3.6	3.9		
Specific Conductance	mS/cm	-	-	-	-	-	-	-	0.019	0.079	0.082	0.075	0.076	0.095	0.05	0.05	0.112	0.114	0.371	0.367	0.116	0.105	0.132	0.134	0.2278	0.2352		
Dissolved Oxygen	mg/L	-	-	-	-	-	-	5.5-9.5	10.4	10.91	11.71	12.8	13.55	-	-	-	-	-	-	-	-	-	-	-	-			
Dissolved Oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	104.30	103.00	104.9	105.8	99.3	103.2	101.8	103.6	96.8	96.3	101.5	98.3		
pH	pH units	-	-	-	-	-	-	6.5-9.0	8.07	7.58	7.02	7.55	7.51	7.88	8.58	8.51	7.75	7.84	7.91	7.97	7.41	7.68	8.02	7.83	8.33	7.29		
Wetted Width	m	-	-	-	-	-	-	-	-	-	-	6	17	5	1.5	1.5	4.8	4.8	-	-	5.9	4.4	1.4	2.7	1.45	1.6		
Average Depth	m	-	-	-	-	-	-	-	-	-	-	0.4	0.9	0.3	0.25	0.25	0.2	0.2	-	-	0.17	0.45	0.22	0.1	0.04	0.1		
Flow Rate	m³/s	-	-	-	-	-	-	-	-	-	-	1.1	3.64	0.39	-	-	-	-	-	-	-	-	0.71213	0.5148	0.111	0.097	0.012	0.021
Physical Parameters																												
pH	pH units	-	-	0.01	0.1	0.1	0.1	6.5-9.0	-	-	-	7.40	6.95	6.95	8.34	8.29	7.84	7.91	8.15	8.30	7.90	7.91	7.97	8.03	8.45	8.37		
Conductivity	µS/cm	1	5	-	-	-	-	-	26	88	82	84	78	119	-	-	-	-	-	-	-	-	-	-	-	-		
Turbidity	NTU	0.1	0.1	0.1	0.1	0.1	0.1	-	0.42	3.64	1.93	0.5	2.3	4.9	0.16	0.27	0.41	0.39	0.34	0.22	0.49	0.42	0.73	0.84	0.20	0.43		
Hardness	mg/L as CaCO ₃	0.5	1	10	10	10	10/20	-	7.14	43.6	43.4	47	41	52	133	136	52	52	168	169	43	43	68	69	130	139		
TSS	mg/L	-	-	2	2	2	2	-	-	-	-	-	-	-	<2	<2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0		
TDS	mg/L	30	5	20	20	20	10	-	<30	51	<30	55	51	77	146*	139*	45	45	183	183	42	40	75	65	130	155		
Dissolved Anions																												
Alkalinity	mg/L as CaCO ₃	2	5	10	10	10	10	-	5	43	41	41	40	53	135	141	51	53	152	149	41	42	49	65	126	131		
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	0.5	-	1.3	0.6	0.7	1	<1	4	5.18	5.26	0.8	0.8	16.5	18.0	1.04	1.07	1.26	1.39	6.98	7.41		
Fluoride	mg/L	-	-	0.02	0.02	0.02	0.02	-	-	-	-	-	-	-	-	-	0.0	0.0	0.1	0.1	0.022	0.021	0.037	0.037	0.069	0.064		
SO ₄ ²⁻	mg/L	0.5	1	0.3	0.3	0.3	0.3	-	1.2	<0.5	0.5	2	2	4	5.54	5.38	0.8	0.6	12.2	13.7	0.46	0.58	0.91	0.91	7.38	6.48		
Nutrients																												
NH ₃ +NH ₄	mg/L N	0.1	0.02	0.15	0.15	0.15	-	0.021 - 231 ¹	0.7	0.4	0.6	<0.02	<0.02	<0.02	0.24	0.29	<0.15	<0.15	<0.15	<0.15	-	-	-	-	-	-		
NO ₂ ⁻	mg/L N	0.06	0.005	-	-	-	-	0.06	<0.06	<0.06	<0.06	<0.005	0.017	0.009	-	-	-	-	-	-	-	-	-	-	-	-		
NO ₃ ⁻	mg/L N	0.05	0.1	0.02	0.02	0.02	0.02	2.9	0.12	<0.05	<0.05	<0.10	<0.10	<0.10	0.03	0.03	<0.020	<0.020	0.07	0.08	<0.020	<0.020	0.02	<0.020	<0.020	<0.020		
NO ₂ +NO ₃	mg/L N	0.06	0.1	-	-	-	-	-	0.12	<0.06	<0.06	<0.10	<0.10	<0.10	-	-	-	-	-	-	-	-	-	-	-	-		
Ammonia, total as N	mg/L	-	-	0.05	0.02	0.02	0.02	Variable ¹	-	-	-	-	-	-	<0.050	<0.050	0.07	0.07	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-	-		
Total Phosphorus	mg/L	0.02	0.01	0.003	0.003	0.003	0.003	-	0.02	<0.02	<0.10	<0.01	<0.01	0.01	<0.0030	<0.0030	<0.0030	0.01	0.00	0.00	0.0086	0.0082	0.0060	0.0046	<0.0030	<0.0030		
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	-	-	-	-	-	-	-	-	-	-	-	-	-		
DOC	mg/L	-	-	1	1	0.5	0.5	-	-	-	-	-	-	-	2.3	2.3	<1.0	<1.0	2.0	2.0	1.46	1.57	1.98	1.90	2.29	2.35		
TOC	mg/L	-	-	1	1	0.5	0.5	-	-	-	-	-	-	-	2.3	2.4	<1.0	<1.0	2.2	2.1	1.64	1.76	2.38	2.27	2.70	4.32		
TKN	mg/L	-	-	0.15	0.15	0.15	0.15	-	-	-	-	-	-	-	0.24	0.29	<0.15	<0.15	<0.15	<0.15	<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	0.005 - 0.100 ²	0.017	0.075	0.073	0.010	0.072	0.153	<0.010	0.018	0.022	0.015	0.011	<0.010	0.0214	0.0225	0.0219	0.0195	0.006	0.0137		
Antimony	mg/L	0.0004	-	-	0.0001	0.0001	0.0001	-	<0.0004	<0.0004	<0.0004	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<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	0.0001	0.005	<0.005	<0.005	<0.005	<0.001	<0.001	<0.001	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		
Barium	mg/L	0.001	0.01	-	0.0002	0.0002	0.0001	-	<0.001	0.004	0.004	<0.01	<0.01	<0.01	-	-	0.00197	0.00176	0.00778	0.00702	0.00165	0.0017	0.00228	0.00236	0.00485	0.00602		
Beryllium	mg/L	0.005	-	-	0.0001	0.0001	0.0001	-	<0.005	<0.005	<0.005	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010		
Bismuth	mg/L	0.0003	-	-	0.00005	0.00005	0.00005	-	<0.0003	<0.0003	<0.0003	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050		
Boron	mg/L	0.05	0.01	-	0.01	0.01	0.01	-	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	<0.010	<0.010	0.011	0.011	<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	0.000005	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	<0.000010	<0.000010	<0.000010	<0.000010		
Calcium	mg/L	0.05	1	0.5	0.5	0.5	0.05	-	1.43	9.01	8.72	8	8	12	29.9	32.2	10.9	10.8	35.3	35.8	8.82	8.83	14.7	14.8	28.4	30.1		
Cesium	mg/L	-	-	-	0.00001	0.00001	0.00001	-	-	-	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010		
Chromium	mg/L	0.001	0.001	-	0.0005	0.0005	0.0005	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	0.00248	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050		
Cobalt	mg/L	0.0003	0.0002	-	0.0001	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	<0.00010	<0.00010	<0.00010	<0.00010		
Copper	mg/L	0.0008	0.001	0.001	0.001	0.001	0.001	0.002 - 0.004 ³	<0.0008	0.0009	<0.0008	<0.001	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.0010	<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	0.01	0.3	<0.02	0.05	0.06	0.03	0.05	0.08	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.017	0.016	<0.010	0.023	
Lead	mg/L	0.0002	0.001	0.0005	0.0001	0.0001	0.00005	0.001 - 0.007 ³	<0.0002	0.0004	<0.0002	<0.001	<0.001	<0.001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050		
Lithium	mg/L	-	-	-	0.001	0.001	0.001	-	-	-	-	-	-	-	-	-	<0.0010	0.0013	0.0041	0.0044	<0.0010	<0.0010	0.0015	0.0015	0.0025	0.0024		
Magnesium	mg/L	0.005	1	0.5	0.05	0.05	0.005	-	0																			

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	2018		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	04-Jul-18	04-Jul-18	31-Aug-18	31-Aug-18				
Nickel	mg/L	0.001	0.005	0.001	0.0005	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	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	
Phosphorus	mg/L	-	-	-	0.05	0.05	0.05	-	-	-	-	-	-	-	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	
Potassium	mg/L	0.02	0.01	1	0.05	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	0.294	0.31	0.584	0.7				
Rubidium	mg/L	-	-	-	0.0002	0.0002	0.0002	-	-	-	-	-	-	-	-	-	0.00033	0.00024	0.00094	0.00046	0.00031	0.00032	0.00029	0.00034	0.00038	0.00074				
Selenium	mg/L	0.005	0.001	0.0004	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	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	
Silicon	mg/L	-	-	-	0.05	0.05	0.1	-	-	-	-	-	-	-	-	-	0.393	0.381	0.743	0.73	0.4	0.41	0.54	0.54	0.6	0.61				
Silver	mg/L	0.0001	0.0001	-	0.00005	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	<0.000050	<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	0.05	-	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	1.1	1.16	4.81	4.51				
Strontium	mg/L	0.001	0.001	-	0.001	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	0.0083	0.0085	0.0192	0.0205				
Sulphur	mg/L	-	-	-	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	<0.50	<0.50	4.8	5.24	<0.50	<0.50	0.73	0.53	2.83	2.57				
Tellurium	mg/L	-	-	-	0.0002	0.0002	0.0002	-	-	-	-	-	-	-	-	-	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	
Thallium	mg/L	0.0002	-	0.0003	0.00001	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	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	
Thorium	mg/L	-	-	-	0.0001	0.0001	0.0001	-	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Tin	mg/L	0.001	0.01	-	0.0001	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	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Titanium	mg/L	0.003	-	-	0.0003	0.0003	0.0003	-	<0.003	<0.003	<0.003	-	-	-	-	-	0.00087	0.00052	0.00055	<0.00030	0.00075	0.00088	0.00074	0.00071	<0.00030	0.00061				
Tungsten	mg/L	-	-	-	0.0001	0.0001	0.0001	-	-	-	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	
Uranium	mg/L	-	-	0.001	0.00001	0.00001	0.00001	0.015	-	-	-	-	-	-	0.000941	0.000943	0.000116	0.000109	0.0012	0.00131	0.000068	0.000071	0.000217	0.000219	0.000954	0.000937				
Vanadium	mg/L	0.0009	0.001	-	0.0005	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	<0.00050	<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	0.003	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	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	
Zirconium	mg/L	-	-	-	0.0003	0.0003	0.0003	-	-	-	-	-	-	-	-	-	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<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	-	0.0001	-	-	-	-	<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	<0.00010	<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	-	0.00001	-	-	-	-	<0.005	<0.005	<0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	0.0003	-	0.05	-	-	-	-	<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	-	-	-	-	-	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.000010	<0.000010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	0.05	1	0.0002	-	-	-	-	1.54	9.19	8.14	9	8	11	28.0	28.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	0.001	0.001	0.01	-	-	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	0.0003	0.0002	0.00005	-	-	-	-	<0.0003	<0.0003	<0.0003	<0.0002	<0.0002	<0.0002	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	0.0008	0.001	0.05	-	-	-	-	<0.0008	<0.0008	<0.0008	<0.001	<0.001	<0.001	0.00066	0.00063	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.02	0.03	0.0005	-	-	-	-	<0.02	0.02	<0.02	<0.03	<0.03	<0.03	<0.010	<0.010	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lead	mg/L	0.0002	0.001	0.00001	-	-	-	-	<0.0002	<0.0002	<0.0002	<0.001	<0.001	<0.001	<0.000050	<0.000050	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	0.005	1	0.00005	-	-	-	-	0.933	5.30	4.87	6	5	6	15.4	15.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	0.0007	0.01	0.00005	-	-	-	-	0.0092	0.0007	<0.0007	<0.01	<0.01	<0.01	<0.00050	0.00275	-	-	<0.00050	<0.00050	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	-	-	0.05	-	-	-	-	-	-	-	-	-	-	<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	-	-	-	-	-	<0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.00050	<0.00050	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	0.02	0.01	0.5	-	-	-	-	0.83	0.51	0.49	0.52	0.50	0.50	0.577	0.635	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.005</																												

TABLE 4 SUMMARY OF FISH HABITAT STATUS AT EXISTING FISH-BEARING STREAMS ALONG THE TOTE ROAD IN 2018

Water Crossing No.	Fish Habitat Quality Rating ¹	Fish Captured / Observed DS	Fish Captured / Observed US	Potential Fish Passage or Habitat Issues	Potential Fish Passage or Habitat Issues	Follow-up/Corrective Actions
CV-166	NFB	Y	N/A	None	There is no fish habitat at or upstream of the crossing as it sits on a naturally steep gradient; however it and several other fishless streams in the area (CV-170 to CV-166) all flow into a fish-bearing stream a short distance downstream, so the area continues to be regularly monitored.	Continue to monitor in 2019.
CV129	IMP	Y	Y	Yes	Culvert was slightly perched and culvert velocity was high (1.10 DS and 1.05 US). CPUE was much lower (0.23 fish/min) and mean length of captured fish (150 mm) much higher upstream than downstream (1.15 fish/min, 67 mm), which may indicate some passage issues.	Continue to monitor in 2019 and work to mitigate the perch.
CV128	IMP	Y	Y	None		
CV115	MAR	N	N	Stream Dry		
CV114	MAR	Y	Y	Yes	Both culverts were perched and upstream CPUE (0.39 fish/min) was much lower than downstream (3.87), indicating passage issues.	A rocky ramp was installed downstream of the culverts in 2018 to improve access. Effectiveness of the ramp will be examined in 2019.
CV112	IMP	Y	Y	None		
CV111	IMP	Y	Y	Yes	Rocks at the downstream end of the culvert have shifted to create a high (0.99 m/s) entrance velocity, which likely contributed to the very large difference between upstream (0.34 fish/min) and downstream (8.91 fish/min) CPUE	Rocks were rearranged on DS side of culvert to reduce water velocity and provide easier fish passage.
CV106	MAR	Y	N	Yes	Culvert perched. Fish passage completely blocked	A rocky ramp was installed downstream of the culverts in 2018 to improve access. A fall inspection revealed that too much material was used and water now flowed below the rocks, impacting access to the culvert and upstream habitat. Continue to monitor and amend as required in 2019.

TABLE 4 SUMMARY OF FISH HABITAT STATUS AT EXISTING FISH-BEARING STREAMS ALONG THE TOTE ROAD IN 2018

Water Crossing No.	Fish Habitat Quality Rating ¹	Fish Captured / Observed DS	Fish Captured / Observed US	Potential Fish Passage or Habitat Issues	Potential Fish Passage or Habitat Issues	Follow-up/Corrective Actions
CV104	MAR	Y	N	Yes	Right culvert in good condition and fish observed in the culvert (though none captured upstream during site visit). Upstream end of left culvert remained perched and impassable.	Target left hand culvert for 2019 repairs
CV102	IMP	Y	Y	None		Upstream end of left culvert was repaired in summer 2018
CV099	IMP	Y	Y	Yes	High culvert velocities downstream (>1.00 m/s) may be restricting fish passage to only the larger juveniles (150 mm). Mean length of downstream catch was 96 mm.	Continue to monitor in 2019.
CV079	IMP	Y	Y	None		
CV078	IMP	Y	Y	None		
CV076	MAR	Y	Y	None	No issues with fish passage, but the old culvert from prior to road realignment remained in the channel downstream of the new crossing. Needs to be removed.	Old culvert was removed.
CV072	IMP	Y	Y	None	High velocity at the upstream end of the culvert likely due to recent heavy rains. Culvert is otherwise passable.	Continue to monitor in 2019.
CV060	IMP	Y	Y	None		
CV059	MAR	Y	Y	None		
CV058	MAR	Y	Y	None		
CV057	MAR	Y	Y	None		
BG50	IMP	N	N	Yes	Left channel with bridge is in excellent condition. Right channel culverts remain 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 as part of the 2019 culvert work.
CV049	IMP	Y	Y	None		
CV030	MAR	Y	Y	None		
BG32	IMP	Y	Y	None		
CV217	IMP	Y	Y	None		
CV216	MAR	Y	Y	None		

TABLE 4 SUMMARY OF FISH HABITAT STATUS AT EXISTING FISH-BEARING STREAMS ALONG THE TOTE ROAD IN 2018

Water Crossing No.	Fish Habitat Quality Rating ¹	Fish Captured / Observed DS	Fish Captured / Observed US	Potential Fish Passage or Habitat Issues	Potential Fish Passage or Habitat Issues	Follow-up/Corrective Actions
BG30	IMP	Y	Y	None		
BG29	IMP	Y	Y	Yes	Partial blockage of upstream end of culvert by cobble at the time of monitoring.	Blockage was removed by NSC biologist in September, 2018
BG27	MAR	Y	Y	None	Minor damage to both culverts, but currently no passage issues.	Continue to monitor in 2019
BG24	IMP	Y	Y	Yes	Many fish on both sides of the culvert, but a slight perch and high culvert velocities (1.75 m/s) downstream, appear to limit upstream use to large juveniles (152 mm) when compared with downstream (99 mm)	Continue to monitor and mitigate perch in 2019.
BG17	IMP	Y	Y	None		
BG04	IMP	Y	Y	None		
CV001	IMP	Y	Y	None		
CV223	IMP	Y	Y	None		
CV224	IMP	Y	Y	None		
CV225	IMP	Y	Y	Yes	Culverts are slightly perched and velocities very high (2.25 m/s DS), which may limit passage of smaller juveniles. Upstream fish were > 200 mm in 2018 and downstream were < 100 mm.	Continue to monitor and mitigate perch in 2019.
BG01	IMP	Y	Y	Yes	Culvert velocities very high (1.78 m/s), which may limit passage of smaller juveniles. Mean length upstream was 114 mm and downstream was 84 mm	Continue to monitor in 2019.
CV186	IMP	Y	Y	None		
CV187	MAR	Y	Y	None		

1 - Habitat status assessed for current crossings; 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	2008-2018	Culvert damaged, monitor for continued passage success
CV-128	17+486	Extra-large	HADD	23-Sep-07	Winter 2013/14 March 2017	2009-2018	Routine Only
CV-114	29+647	Medium	HADD	29-Sep-07	July 2011	2009-2018	Monitor new rocky ramp for successful passage
CV-111	31+990	Medium	HADD	28-Sep-07	N/A	2009-2018	Routine Only
CV-104	33+794	Medium	HADD	01-Oct-07	November 2016	2009-2018	Repair and monitor left culvert
CV-099	37+840	Large	HADD	04-Oct-07	Winter 2014/15 December 2017	2008-2018	Monitor culvert exit velocities
CV-079	50+600	Large	HADD	08-Jul-08	June 2018	2008-2018	Routine Only
CV-078	51+171	Large	HADD	09-Jul-08	N/A	2008-2018	Routine Only
CV-072	53+878	Large	HADD	05-Mar-08	N/A	2009-2018	Routine Only
CV-060	58+856	Medium	HADD	27-Feb-08	N/A	2009-2018	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	2008-2018	Reinstallation of currently perched culverts and monitoring
CV-049	63+302	Large	HADD	10-Mar-08	N/A	2009-2018	Routine Only
BG-32	78+161	Large	HADD	04-Apr-08	August 2012 September 2017	2009-2018	Routine Only
CV-217	79+915	Extra-large	HADD	17-Apr-08	Winter 2013/14 Winter 2014/15 March 2017	2009-2018	Routine Only
CV-216	80+646	Large	HADD	08-Jun-08	October 2017	2009-2018	Routine Only
BG-30	84 + 636	Small	Compensation - RA	2012	August 2012	2010-2018	Routine monitoring and maintenance of constructed fishway
BG-24	87+710	Medium	HADD	15-May-08	N/A	2008-2018	Monitor culvert perch and exit velocities
BG-17	90+167	Large	HADD	09-May-08	N/A	2009-2018	Routine Only
BG-16	90+218	Extra-small	Compensation - HE	Oct-08	N/A	2009-2010	None
BG-04	94+148	Medium	HADD	05-May-08	August 2012 February 2018	2009-2018	Routine Only
CV-001	94+728	Small	Compensation - RH	08-May-08	Winter 2014/15	2009-2018	Routine Only
CV-223	97+155	Extra-large	HADD	03-May-08	Winter 2013/14	2008-2018	Routine Only
CV-224	97+758	Medium	HADD	04-May-08	January 2018	2008-2018	Routine Only
CV-225	98+989	Large	HADD	21-Sep-07	August 2010 Winter 2014/15	2008-2018	Monitoring for passage in high culvert water velocity
BG-01	99+672	Medium	HADD	20-Sep-07	August 2010 October 2017	2008-2018	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	2008-2018	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

APPENDICES

APPENDIX A

DFO AUTHORIZATIONS AND AMMENDMENTS



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

September 20, 2013

our file *Voire 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 (m ²)	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.

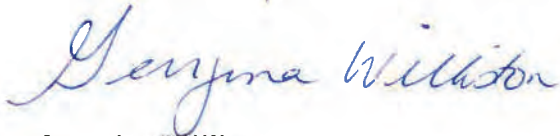
You will not need to obtain a formal approval from DFO in order to proceed with your proposal.

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,

A handwritten signature in blue ink that reads "Georgina Williston". The signature is written in a cursive, flowing style.

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 (m ²)	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 (m ²)	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.



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.

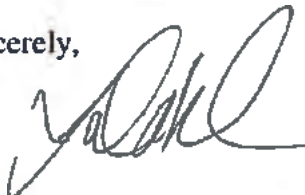
It remains your responsibility to ensure you avoid causing serious harm to fish in compliance with the *Fisheries Act*, and that you meet the requirements under the *Species at Risk Act* as it may apply to your project. If your plans have changed or if the description of your proposal is incomplete, 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/asures/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.

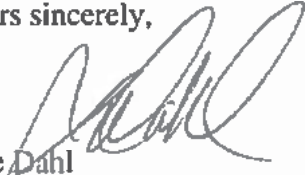
It remains your responsibility to ensure you avoid causing serious harm to fish in compliance with the *Fisheries Act*, and that you meet the requirements under the *Species at Risk Act* as it may apply to your project. If your plans have changed or if the description of your proposal is incomplete, 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 2018**



Figure 1. CV079 pre-construction



Figure 2. CV079 construction activities



Figure 3. CV079 post-construction



Figure 4. CV102 pre-construction



Figure 4. CV102 post-construction



Figure 7. BG04 pre-construction



Figure 8. BG04 construction activities



Figure 8. BG04 post-construction



Figure 7. CV224 pre-construction



Figure 8. CV224 construction activities



Figure 8. CV224 post-construction



Figure 7. CV076 pre-construction



Figure 8. CV076 construction activities

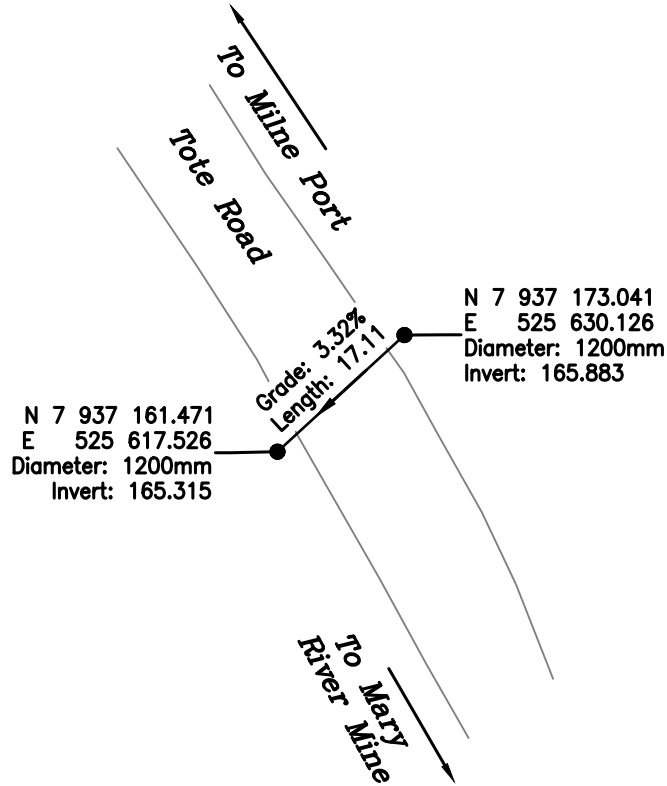
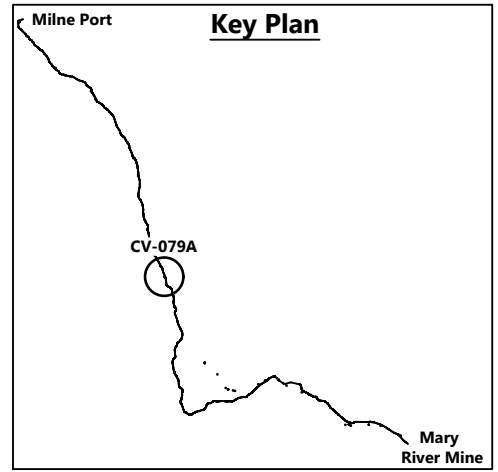


Figure 8. CV076 post-construction

APPENDIX C

AS-BUILT SURVEYS FOR HADD CROSSINGS MODIFIED IN 2018

UTM 17N
 GRID NORTH
 NAD83 CSRS (2002)
 Geoid: HTv2.0



SURVEY CONTROL			
DESCRIPTION	NORTHING	EASTING	ELEVATION
ACL 004	7 959 448.309	518 793.322	114.502
ACL 005	7 950 970.755	522 018.527	114.633
ACL 006	7 940 533.749	524 159.924	175.632

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CLIENT:



TITLE:

**Topographic Survey
 for Culvert CV-079A
 at 51km**

PROJECT:

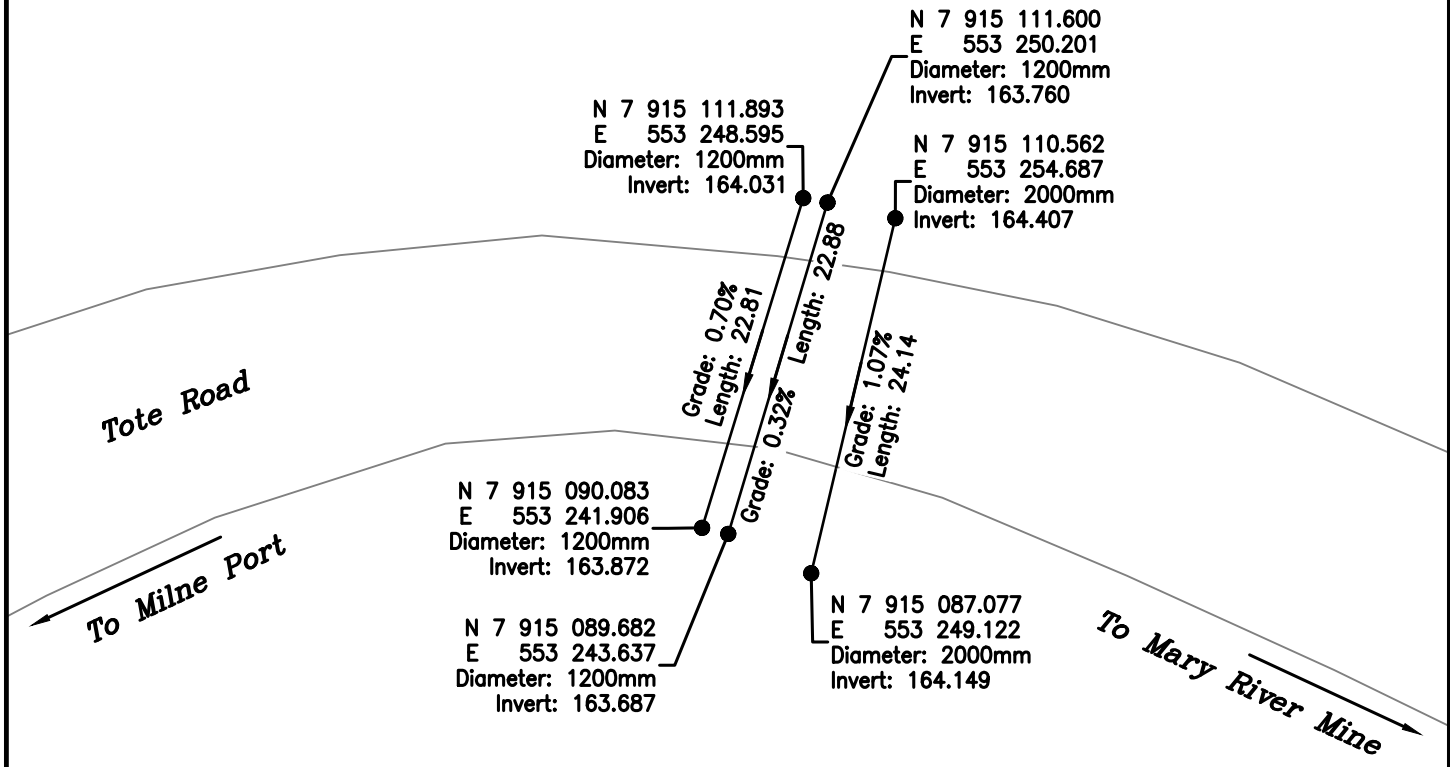
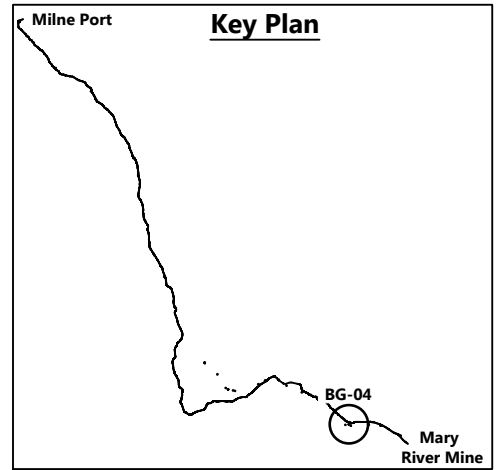
**18SJ0057
 Baffin Island, NU**

REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
-	-	-	-	-

CLIENT NO:	-	FIELD:	AS	DATE:	18/11/04
PROJECT NO:	18SJ0057	DRWN:	NKP	DATE:	18/12/05
DRAWING SIZE:	ANSI "A"	CHKD:	TD	DATE:	-
SCALE:	1:750	APVD:	TD	DATE:	-

DWG NO:	18SJ0057-000-2126-013	REV:	0
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UTM 17N
GRID NORTH
NAD83 CSRS (2002)
Geoid: HTv2.0



SURVEY CONTROL			
DESCRIPTION	NORTHING	EASTING	ELEVATION
ACL 010	7 915 188.464	554 091.614	169.670
P0001(3043)	7 914 647.313	557 930.082	170.983

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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

CLIENT:

TITLE:

**Topographic Survey
for Culvert BG-04
at 94km**

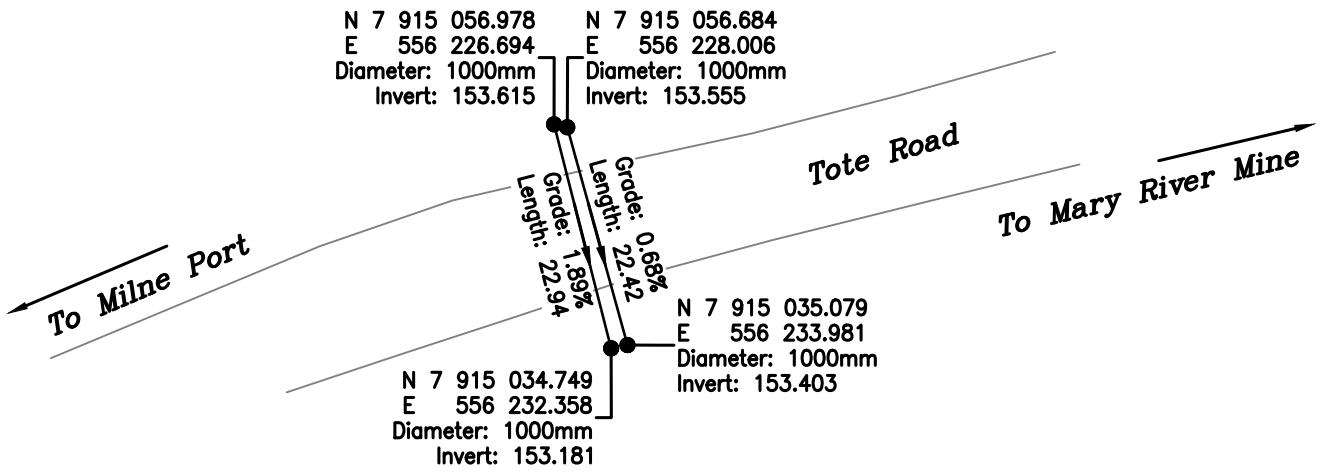
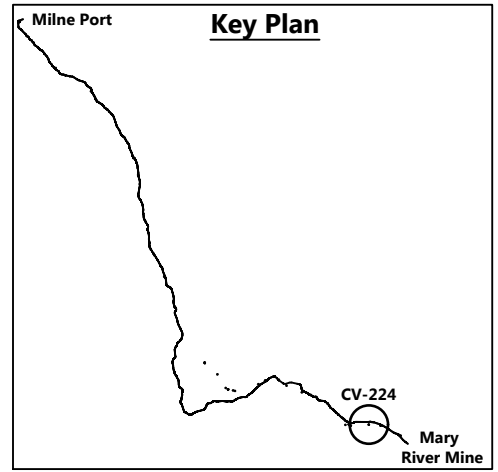
CLIENT NO:	-	FIELD:	AS	DATE:	18/10/28
PROJECT NO:	18S\0057	DRWN:	NKP	DATE:	18/12/05
DRAWING SIZE:	ANSI "A"	CHKD:	TD	DATE:	-
SCALE:	1:500	APVD:	TD	DATE:	-

PROJECT:

**18S\0057
Baffin Island, NU**

DWG NO:	18S\0057-000-2126-032	REV:	0
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UTM 17N
GRID NORTH
NAD83 CSRS (2002)
Geoid: HTv2.0



SURVEY CONTROL			
DESCRIPTION	NORTHING	EASTING	ELEVATION
P0001(3043)	7 914 647.313	557 930.082	170.983
MR1	7 913 406.463	561 204.758	198.911

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REV	YY/MM/DD	DESCRIPTION	DRWN	APVD
-	-	-	-	-

CLIENT:

TITLE:

**Topographic Survey
for Culvert CV-224
at 97.5km**

CLIENT NO:	-	FIELD:	AS	DATE:	18/10/27
PROJECT NO:	18SJ0057	DRWN:	NKP	DATE:	18/12/05
DRAWING SIZE:	ANSI "A"	CHKD:	TD	DATE:	-
SCALE:	1:750	APVD:	TD	DATE:	-

PROJECT:

**18SJ0057
Baffin Island, NU**

DWG NO:	18SJ0057-000-2126-034	REV:	0
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