TECHNICAL SUPPORTING DOCUMENT

Mary River Project | Phase 2 Proposal | FEIS Addendum | August 2018

TSD 23

Conceptual-level Marine Offsetting Plan






MARINE OFFSETTING PLAN TECHNICAL SUPPORTING DOCUMENT SUMMARY

The Conceptual Marine Habitat Offsetting Plan Technical Supporting Document identifies conceptual offsetting measures to offset for the loss of marine fish habitat, and demonstrates that the proposed offsetting measures will offset serious harm to fish and loss of productive capacity that could result from the Phase 2 Proposal. The Phase 2 Proposal builds on the extensive baseline studies and assessments carried out since 2011 for the larger Approved Project and is thus closely linked to the FEIS and previous addendums. This document is used as input to the assessment of effects on marine fish and fish habitat.

The development of the Phase 2 proposed ore dock will result in unavoidable loss of marine fish habitat, and has the potential to cause serious harm to fish as defined by the *Fisheries Act*.

Baffinland is committed to offsetting project-related effects to fish and fish habitat that contribute to the sustainability and ongoing productivity of CRA fisheries by proposing to implement an offsetting plan that maintains or increases the quality and type of habitat for the local fisheries in Milne Inlet likely affected by proposed ore dock.

RÉSUMÉ DU DOCUMENT D'ASSISTANCE TECHNIQUE SUR LE PLAN DE COMPENSATION DE L'HABITAT MARIN

Le document d'assistance technique sur le plan de compensation conceptuel des impacts sur l'habitat marin identifie les mesures conceptuelles de compensation de l'habitat marin afin d'annuler la perte nette et démontre que les mesures compensatoires proposées compenseront les dommages sérieux aux poissons et la perte de capacité de production pouvant découler de la proposition de la phase 2. La proposition de la phase 2 est fondée sur les études préliminaires et les évaluations complètes réalisées depuis 2011 pour l'ensemble du projet approuvé et est donc étroitement liée à l'énoncé des incidences environnementales (EIE) et aux addendas précédents. Ce document est utilisé pour l'évaluation des impacts sur les poissons marins et leur habitat.

L'aménagement du quai de minerai proposé dans la phase 2 entraînera la perte inévitable de l'habitat du poisson marin et pourrait causer des dommages sérieux aux poissons, tel que défini par la *Loi sur les pêches*.

Baffinland s'engage à compenser les impacts du projet sur le poisson marin et l'habitat marin qui contribuent à la durabilité et à la productivité continue des pêches commerciales, récréatives et autochtones (CRA) en proposant de mettre en œuvre un plan compensatoire qui maintient ou augmente la qualité et le type d'habitat pour les pêches locales à Milne Inlet. lieu affecté par le quai de minerai proposé.

ᐳᐃᔩᑦ ᐱᔭᓇᐊᑐᔪᑦ ᐃᑲᔪᐃᔾᔪᑎᑦ ᑎᑎᖅᑲᑦ ᐅᓂᒃᑳᓕᐊᑦ

ᐅᓇ ᐳᐃᔩᑦ ᐱᔭᓇᐊᑐᔪᑦ ᐃᑲᔪᐃᔾᔪᑎᑦ ᑎᑎᖅᑲᖓ ᐱᑕᕐᑲᖅᑎᑦᑎᔪᖅ ᕿᒥᕐᕈᐃᓂᒻᒥᒃ ᑖᔅᓱᒥᖓ ᐱᓕᕆᐊᑉ ᒪᕐᕈᕆᓕᖅᑕᖓ ᐅᒃᑑᑎᖓᑕ ᐊᒃᑐᐃᓂᕐᑲᕐᓂᖏᑕ ᐳᐃᔾᖏᓐᓄᑦ ᐊᒻᒪᓗ ᐃᓚᕐᑲᖅᑰᓂᓗ ᓄᑖᓂᒃ ᑐᑭᓯᐅᒪᔾᔪᑎᒃᓴᓂᒃ ᑲᑎᖅᓯᓚᑦ ᑎᑎᕋᐅᓯᐅᔪᓪᓘᓐᓃᑦ ᑕᐃᑲᙵᓂᑦ ᑎᑎᕋᐅᓯᑦ ᓯᕗᓪᓕᖅᐹᑦ ᑐᓐᓂᖅᓴᖅᑕᐅᖅᑎᓪᓗᒋᑦ ᐊᖏᖅᓯᒪᔭᒧᑦ ᐅᓯᕋᖕᓂᐊᕐᓂᕐᒧᑦ. ᐱᓕᕆᐊᑉ ᒪᕐᕈᕆᓕᖅᑕᖓ ᐅᒃᑑᑎᖓ ᐃᓚᒋᐊᕐᓂᕐᑲᖅᑐᖅ ᖃᖓᒍᑦ ᐊᖏᔫᔪᑦ ᑐᙵᕕᑦ ᖃᐅᔨᓴᕖᓐᑦ ᐊᕙᑖᓄᑦ ᑕᒪᓐᓇᓗ ᕿᒥᕐᕈᐃᓂᖅ ᑕᐃᑲᖓᑦ 2011-ᒥ ᑖᔅᓱᒧᖓ ᐃᓗᐃᑦᑑᔪᒧᑦ ᐊᖏᖅᓯᒪᔭᒧᑦ ᐅᓯᕋᖕᓂᐊᕐᓂᕐᒧᑦ ᑕᐃᒫᓪᓗ ᓂᒃᓯᒃᓯᒪᓂᕐᑲᖅᐳᖅ ᑭᖑᓪᓕᖅᐹᑦ ᐅᓂᒃᑳᖏᓄᑦ FEIS ᓯᕗᓂᐊᒍᓪᓗ ᐅᐃᒍᕆᐊᖅᑕᐅᓂᑰᔪᒃᑯᑦ.

ᐅᓯᕋᖕᓂᐊᖅᑐᑦ ᐊᒃᑐᐃᓂᖏᑦ ᑲᔪᓯᑎᑕᐅᕐᑲᓯᐅᔪᖅ ᕿᒥᕐᕈᐃᓂᕐᒧᑦ ᐃᓚᕐᑲᖅᑐᑦ ᐊᓯᐅᔨᓂᖏᑦ ᓇᔪᓲᖏᓐᓂᒃ ᐅᒥᐊᕐᔪᐊᓕᓇᕝᕙᒃ ᐊᖏᓕᕆᐊᕐᓂᖓᓄᑦ, ᐸᕝᕚᔅᑲᕐᓂᐊᓄᑦ, ᑐᔅᓯᐊᕈᓐᓃᖅᑎᑦᑎᓂᕐᒧᑦ, ᐊᒻᒪᓗ ᓈᓚᒐᖅᑭᓂᒃ ᑐᓴᙱᑎᑦᑎᓂᖅ ᐃᒪᖓᓂ ᓂᐱᕐᑲᕐᓂᐊᓄᑦ ᓴᖅᑭᓯᒪᔪᑦ ᐅᒥᐊᕐᔪᐊᑦ ᓂᐱᖏᓄᑦ ᐅᒥᐊᕐᔪᐊᓕᓇᕝᕙᖓᒥᓗ ᓴᓇᔭᐅᓂᐊᓄᑦ (ᓲᓪᓗ, ᐃᖅᑲᖓᓄᑦ ᑐᙵᕕᒃᓴᑦ ᑲᓯᐊᖅᑕᐅᓂᖏᑦ), ᐃᑭᓕᖅᑕᐅᓂᖏᑦ ᑐᕐᑯᑕᐅᓂᖏᓐᓄᑦ ᐳᐃᔩᑦ ᐅᒥᐊᕐᔪᐊᓄᑦ ᑐᑐᖅᑕᐅᑐᑎᒃ ᐃᖏᕐᕋᑎᓪᓗᒋᑦ ᐊᖅᑯᑎᒥᒍᑦ.

ᖃᐅᔨᓴᖅᑐᑦ ᐳᐃᔨᓄᑦ ᐃᓚᕐᑲᖅᑐᖅ ᕿᙳᐊᑕ ᐅᒥᐊᕐᔪᐊᓕᓇᕝᕙᖓ ᐊᒻᒪᓗ ᐅᐊᖕᓈᑕ ᐅᒥᐊᕐᔪᐊᑦ ᐊᖅᑯᑖ ᐃᓚᕐᑲᖅᓱᓂ ᕿᙳᐊᓂᒃ, ᑕᓯᐅᔭᕐᒥᒃ, ᑐᖅᓯᑲᑦᑕᕐᒥᑦ, ᐊᕙᑖᒍᓪᓗ ᑕᓇᐅᖑᔪᑦ. ᕐᑯᓖᑦ ᑕᓇᐅᕐᒥ ᐳᐃᔩᑦ ᐅᕐᑲᐅᓯᐅᓯᒪᕗᑦ ᓇᔪᓲᑦ ᐃᒪᖏᓐᓂᒃ ᖃᐅᔨᓴᖑᔪᒥᒃ ᐃᓚᓕᐅᑎᔭᐅᓯᒪᕗᑦ ᕿᒥᕐᕈᐃᓂᕐᒥᒃ. ᑖᒃᑯᐊ ᐊᕐᕚᑦ, ᖃᐅᓪᓗᖅᑖᑦ ᕿᓚᓗᒐᑦ, ᑑᒑᓕᑦ ᕿᓚᓗᒐᑦ, ᐋᕐᓗᐃᑦ, ᐊᐃᕚᑦ, ᐅᒡᔫᑦ, ᓇᑦᑏᑦ, ᖃᐃᕈᓖᑦ, ᐊᐸᐃᑦ, ᐊᒻᒪᓗ ᓇᓄᐃᑦ. ᑖᒃᑯᓇᙵᑦ, ᓇᓄᐃᑦ ᑎᑎᖅᓯᒪᔪᑐᐊᑦ ᐆᒪᔪᓂᒃ ᓴᐳᒻᒥᔭᐅᔪᖅ ᒐᕙᒪᑐᖅᑲᒃᑯᑦ ᓂᕐᔪᑎᑦ *ᐅᑐᓇᐊᓇᖅᑐᒦᑦᑐᓄᑦ ᐱᕐᑯᔭᖅ (SARA)* ᑕᐃᒍᖅᓯᒪᓪᓗᓂ ᐃᓱᒫᓘᖓᓇᖅᑐᒦᑦᑐᖅ ᓂᕐᔪᑎ (ᐅᐃᒍᖓ 1). ᐊᕙᓂᓖᑦ ᐳᐃᔩᑦ (ᐊᕝᕚᑦ, ᖃᐅᓪᓗᖅᑖᑦ, ᕿᓚᓗᒐᑦ ᐊᒻᒪ ᐋᕐᓗᐃᑦ, ᐊᐃᕚᑦ ᐊᒻᒪᓗ ᓇᓄᐃᑦ) ᑎᑎᖅᑕᐅᓯᒪᔪᑦ ᐃᓱᒫᓘᖓᓇᖅᑐᒦᑦᑐᑦ ᓂᕐᔪᑎᑦ ᑲᑎᒪᔨᕋᓛᑦ ᐃᓕᖅᑯᓯᐊᓄᑦ ᓄᖑᓕᖅᑐᑦ ᓂᕐᔪᑎᑦ ᑲᓇᑕᒥ (COSEWIC).

ᓄᖅᑲᖓᔾᔪᐄᑦ ᐱᓕᕆᔾᔪᑎᖏᑦ ᐃᓚᔭᐅᓯᒪᕗᑦ ᐅᒥᐊᕐᔪᐊᓕᓇᕝᕙᐅᑉ ᐃᐱᖅᓯᒪᕝᕙᐊᑕ ᓴᓇᔭᐅᓯᒪᓂᐊᓄᑦ ᒥᑭᑦᒥᒃ ᐊᓯᐅᔨᓂᕐᒥᒃ ᐊᒻᒪ/ᐅᕝᕙᓗ ᐊᓯᔾᔩᓇᓂᖅ ᑕᓇᐅᑉ ᐳᐃᔩᑦ ᓇᔪᓲᖏᓐᓂᒃ, ᐃᓚᖅᑲᖅᓗᓂ ᒥᑭᓕᓇᓇᓱᖕᓂᕐᒥᒃ ᐃᓗᐃᑦᑑᔪᒥᒃ ᐅᓕᑦᑕᖅᑑᑉ ᐊᑐᕐᓂᐊ ᑕᓇᐅᑉ ᐃᖅᑲᖓᓂᒃ ᐅᒥᐊᕐᔪᐊᓕᓇᕝᕙᖓᒍᑦ. ᐸᕝᕚᔅᑲᕐᓂᖏᑦ ᐅᒥᐊᕐᔪᐊᑦ ᓂᐱᖅᑲᕐᓂᐊᓄᑦ ᐊᖅᐸᓯᒐᓱᒡᓗᒋᑦ ᓱᒃᑲᐃᔅᑯᔭᐅᓂᐊᒍᑦ, ᓂᐱᖅᑲᓗᐊᖏᓐᓂᖅᓴᐅᓚᔭᖅᓗᓂ ᐃᖏᕐᕋᓂᖓ. ᓂᐱᖅᑲᓂᖓ ᐊᖅᐸᓯᕆᐊᕋᓱᒃᑭᕙᑦ ᓴᖑᐃᑲᑕᖏᓪᓗᑎᒃ ᓱᒃᑲᔅᑳᓪᓚᑲᑕᖏᓪᓗᑎᒃ ᐃᖏᕐᕋᓂᕐᒥᒍᑦ, ᐊᐅᓚᐅᑎᖏᓪᓗ ᓄᖅᑲᖅᑎᑕᐅᕙᓪᓗᑎᒃ ᐃᐱᖅᓯᒪᓕᕚᖓᒥᒃ ᕿᙳᐊᓂ. ᑖᒃᑯᐊ ᑲᒪᒋᔾᔪᐃᑦ ᑐᑐᖅᓯᙱᑎᑦᑎᓚᔭᓇᕗᑦ ᐅᒥᐊᕐᔪᐊᓂᒃ ᓱᒃᑲᐃᓐᓂᖅᓴᐅᒍᑎᒃ.

ᑐᙵᕕᒋᓪᓗᒍ ᒫᓇ ᕿᒥᕐᕈᔭᐅᓂᖓ ᐸᕐᓈᕐᔪᓯᒪᔪᓪᓗ ᓄᖅᑲᖓᔾᔪᐄᑦ, ᐅᓯᕋᖕᓂᐊᖅᑐᑦ ᐱᓕᕆᐊᖏᑦ ᐊᑐᖅᑕᐅᔪᒪᔪᑦ ᐃᓚᒋᔭᖏᑦ ᐱᓕᕆᐊᑉ ᒪᕐᕈᕆᓕᖅᑕᖓ ᐅᒃᑑᑎᖓᓄᑦ ᓇᓚᐅᑦᑖᕆᔭᐅᖏᑦᑐᑦ ᓴᖅᑮᓗᔭᕐᓂᖓᓂᒃ ᐊᖏᔪᒥᒃ ᐱᐅᖏᑦᑐᒥᒃ ᕿᒪᕈᐃᔪᒥᒃ ᐊᒃᑐᐃᓂᕐᑲᕐᓂᕐᒥᒃ ᐳᐃᔾᖏᓐᓄᑦ.

REPORT

Baffinland Iron Mines Corporation
Mary River Project - PHASE 2 PROPOSAL

Technical Supporting Document No. 23
Conceptual-level Marine Offsetting Plan

Submitted by:

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1663724-066-R-Rev1

13 July 2018

Table of Contents

TABLES

FIGURES

COMMONLY USED ACRONYMS

AIS	Aquatic Invasive Species Program
CCME	Canadian Council of Ministers of the Environment
CRA	Commercial, recreational or Aboriginal (fishery)
DL	Detection limits
DFO	Fisheries and Oceans Canada
EA	Environmental Assessment
ERP	Early revenue phase
INAC	Indigenous and Northern Affairs Canada
km	Kilometres
MEEMP	Marine Environment Effects Monitoring Program
m	Metre
m^2	Square metre
m^3	Cubic metre
µg/L	Micrograms per litre
Mtpa	Million tonnes per annum
NIRB	Nunavut Impact Review Board
NUPPAA	*Nunavut Planning and Project Assessment Act*
Organisms/m^2	Organisms per square metre
Organisms/m^3	Organisms per cubic metre
Organisms/sample	Organisms per sample
PSU	Practical salinity unit
SEM	Sikumiut Environmental Management Ltd.
Taxa/sample	Taxa per sample

1.0 INTRODUCTION

In 2012, the Nunavut Impact Review Board (NIRB) issued Project Certificate No 005 which provided approval for Baffinland to mine 18 million tonnes per annum (Mtpa) of iron ore, construct a railway to transport the ore south to a port at Steensby Inlet which operates year-round, and to ship the ore to market. The Project Certificate was subsequently amended to include the mining of an additional 4.2 Mtpa of ore, trucking this amount of ore by an existing road (the Tote Road) north to an existing port at Milne Inlet, and shipping the ore to market during the open water season. The total approved iron ore production was increased to 22.2 Mtpa (4.2 Mtpa transported by road to Milne Port, and 18 Mtpa transported by rail to Steensby Port). This is now considered the Approved Project. The 18 Mtpa Steensby rail project has not yet been constructed, however 4.2 Mtpa of iron ore is being transported north by road to Milne Port currently (Figure 1-1). Baffinland recently submitted a request for a second amendment to Project Certificate No.005 to allow for a short-term increase in production and transport of ore via road through Milne Port from the current 4.2 Mtpa to 6.0 Mtpa.

The Phase 2 Proposal (the third project certificate amendment request) involves increasing the quantity of ore shipped through Milne Port to 12 Mtpa, via the construction of a new railway running parallel to the existing Tote Road (called the North Railway). The total mine production will increase to 30 Mtpa with 12 Mtpa being transported via the North Railway to Milne Port and 18 Mtpa transported via the South Railway to Steensby Port. Construction on the North Railway is planned to begin in late 2019. Completion of construction of the North Railway is expected by 2020 with transportation of ore to Milne Port by trucks and railway ramping up as mine production increases to 12 Mtpa by 2020. Shipping from Milne Port will also increase to 12 Mtpa by 2020. Construction of the South Railway and Steensby Port will commence in 2021 with commissioning and a gradual increase in mine production to 30 Mtpa by 2024. Shipping of 18 Mtpa from Steensby Port will begin in 2025.

Phase 2 also involves the development of additional infrastructure at Milne Port, including a second ore dock (Figure 1-2). Shipping at Milne Port will continue to occur during the open water season, and may extend into the shoulder periods when the landfast ice is not being used to support travel and harvesting by Inuit. Various upgrades and additional infrastructure will also be required at the Mine Site and along both the north and south transportation corridors to support the increase in production and construction of the two rail lines.

1.1 Background

The development of the Phase 2 proposed ore dock will result in unavoidable loss of marine fish habitat, and has the potential to cause serious harm to fish as defined by the *Fisheries Act*. The scope of this report addresses residual impacts to fish habitat in the marine environment, and identifies conceptual offsetting measures to offset for the habitat loss.

The purpose of this conceptual-level marine offsetting plan (the Offsetting Plan) is to demonstrate that the proposed offsetting measures will offset serious harm to fish and loss of productivity that could result from the proposed ore dock. The Offsetting Plan has the following objectives:

1) Describe the effects of the Project that may result in serious harm to fish, which may occur during the construction, operations, closure, and post-closure phases.
2) Describe the fish species potentially affected by the proposed Project activities and the importance of the affected habitat to the fish population and commercial, recreational, or Aboriginal (CRA) fisheries.
3) Describe the conceptual plans to offset the loss of fish productivity.
4) Outline a monitoring plan to assess the effectiveness of the Offsetting Plan to offset for the habitat loss.

The organization of the report is based on Fisheries and Oceans Canada (DFO) guidance concerning the Fisheries Protection Policy, fish habitat offsetting, and the content of applications for *Fisheries Act* Authorization (DFO 2013a; 2013b; 2013c). The offsetting measures will be incorporated in a future application for a paragraph 35(2)(b) *Fisheries Act* Authorization for serious harm to fish. The application will be developed and submitted to DFO following the environmental assessment of the Project using preliminary engineering design, other analyses, and information as described in this conceptual plan.

LEGEND

- PROJECT SITE
- COMMUNITY
- FUTURE SOUTH RAILWAY
- MILNE INLET TOTE ROAD
- NUNAVUT SETTLEMENT AREA
- SHIPPING ROUTE
- SIRMILIK NATIONAL PARK
- WATER

0 125 250

1:5,000,000 KILOMETRES

REFERENCE(S)

BASE MAP: © ESRI DATA AND MAPS (ONLINE) (2016). REDLANDS, CA: ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

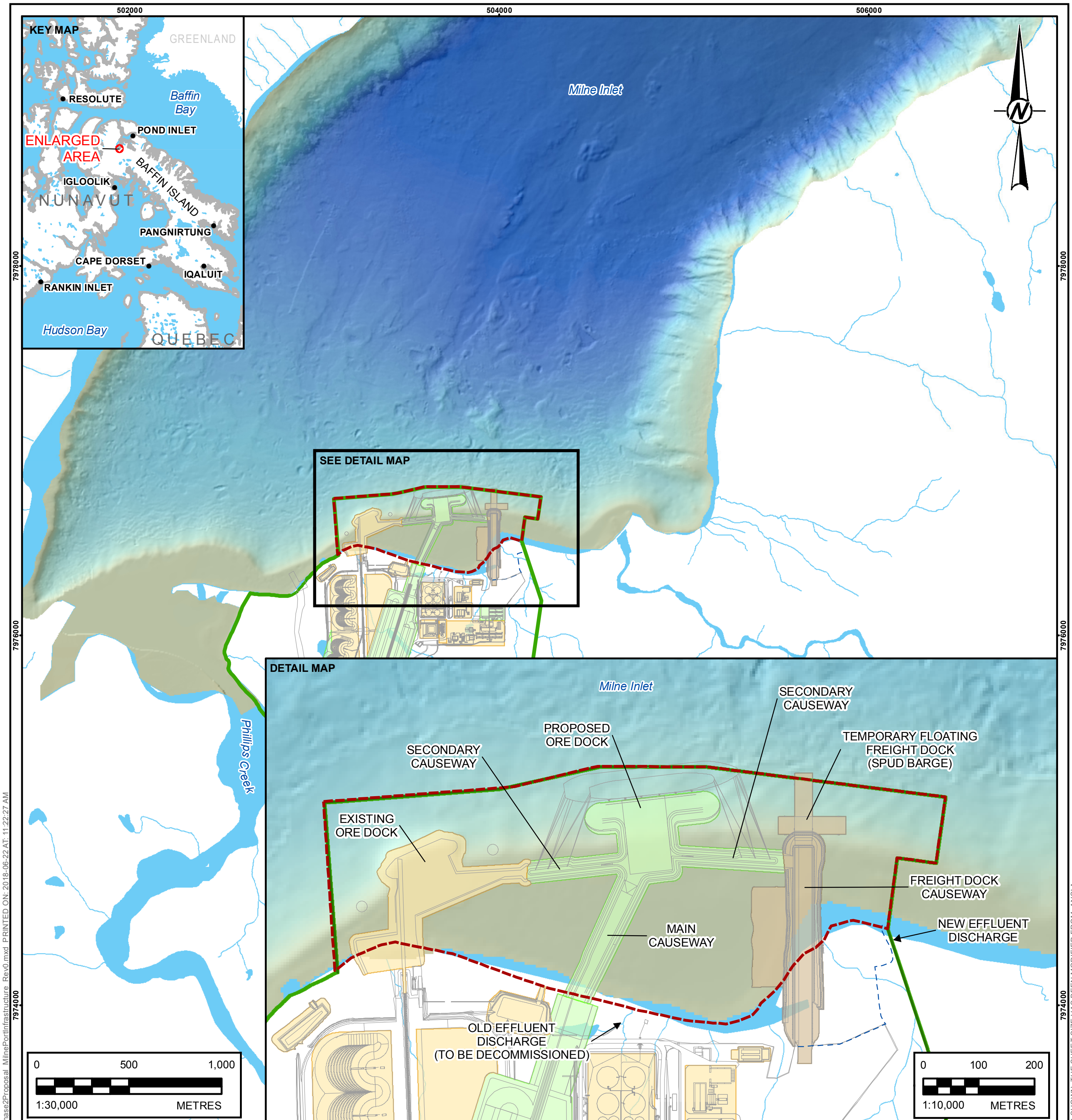
PROJECT
MARY RIVER PROJECT - HABITAT OFFSET MONITORING PROGRAM

TITLE
PROJECT LOCATION

CONSULTANT
GOLDER

YYYY-MM-DD	2018-06-22
DESIGNED	AO
PREPARED	AA
REVIEWED	DN
APPROVED	DN

PROJECT NO.	CONTROL	REV.	FIGURE
1663724	5000-502	0	1.1



LEGEND

- NEW EFFLUENT PIPELINE
- PDA / QIA COMMERCIAL LEASE
- SITE LAYOUT
- WATERCOURSE
- INAC FORESHORE LEASE
- EXISTING ORE DOCK
- NEW ORE DOCK AND CAUSEWAYS
- EXISTING FREIGHT DOCK AND CAUSEWAY
- WATERBODY

ELEVATION (masl)
High : 25
Low : -225

REFERENCE(S)

MILNE PORT INFRASTRUCTURE DATA OBTAINED FROM CLIENT, MAY 28, 2108, AND BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. BATHYMETRY CREATED BY GOLDER FROM MULTIPLE DATA SOURCES.. HYDROGRAPHY DATA BY EAGLE MAPPING (2005), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT - HABITAT OFFSET MONITORING PROGRAM

TITLE
MILNE PORT MARINE INFRASTRUCTURE

CONSULTANT
GOLDER

YYYY-MM-DD	2018-06-22
DESIGNED	AO
PREPARED	AA
REVIEWED	DN
APPROVED	DN

PROJECT NO.	CONTROL	REV.	FIGURE
1663724	5000-502	0	1.2

PATH: I:\2016\1663724\Mapping\MXD\Fish\MarineHabitatOffsetting\1663724_5000_502_Fig1_2_Phase2Proposal_MilnePortInfrastructure_Rev0.mxd PRINTED ON: 2018-06-22 AT: 11:22:27 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
25mm

1.2 Regulatory Context

The authority for the management and conservation of fish and fish habitat in Canada is contained in the federal *Fisheries Act*. DFO is the federal agency responsible for managing Canada's fisheries through the *Fisheries Act*. The fisheries protection provisions of the *Fisheries Act* establish regulatory requirements for the protection of fish and fish habitat through the prohibition of serious harm to fish that are part of, or support, a commercial, recreational, or Aboriginal (CRA) fishery set out in subsection 35(1) of the Act.

Serious harm to fish is defined under Section 2 of the *Fisheries Act* as "the death of fish or any permanent alteration to, or destruction of, fish habitat". This definition is refined in the Fisheries Protection Policy Statement (DFO 2013a) as follows:

- A permanent alteration to fish habitat of a spatial scale, duration, or intensity that limits or diminishes the ability of fish to use such habitats as spawning grounds, or as nursery, rearing or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes; and
- The destruction of fish habitat of a spatial scale, duration, or intensity that fish can no longer rely upon such habitats for use as spawning grounds, or as nursery, rearing or food supply areas, or as a migration corridor, or any other area in order to carry out one or more of their life processes.

The Fisheries Protection Policy requires projects to be planned and designed as much as practical to avoid any serious harm at all project stages. Where serious harm is unavoidable, all efforts should be made to mitigate potential effects and reduce the extent, intensity and duration of any serious harm to fish or fish habitat. If there is any residual serious harm following avoidance and mitigation efforts, counterbalancing offsetting measures must be developed. Offsetting measures should be developed with the goal of maintaining or improving CRA fisheries and with consideration of any regional or local fisheries management objectives and restoration priorities.

1.3 Objectives

Golder Associates Ltd. (Golder) was retained by Baffinland to develop a conceptual-level marine offsetting plan. Based on the Phase 2 Proposal, it was determined that the construction of the proposed ore dock will likely result in serious harm to fish. As such, an Application for a Paragraph 35(2)(b) *Fisheries Act* Authorization including an Offsetting Plan will be required. An Application will be prepared in accordance with the information requirements outlined in Schedule 1 of the Applications for Authorization under Paragraph 35(2)(b) of the *Fisheries Act* Regulations and the Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting (DFO 2013b).

DFO issued a paragraph 35(2)(b) *Fisheries Act* Authorization (14-HCAA-00525) to Baffinland on 30 June 2014 for the Early Revenue Phase (ERP) of the Mary River Project, including the works, undertakings, or activities associated with the Project that were likely to result in serious harm to fish; specifically, for the permanent alteration and destruction of marine fish habitat in Milne Inlet resulting from the construction of the proposed ore dock and mooring structures. Similar methodology used in the application for the ERP *Fisheries Act* Authorization (14-HCAA-00525) to assess project effects, determine serious harm to fish and fish habitat, and develop an offsetting plan will be applied for the new Application.

2.0 CONSULTATION

2.1 Inuit

Baffinland plans to undertake consultation with local community representatives from Pond Inlet, to inform the development of the offsetting plan.

2.2 Regulatory

Local and regional fisheries management objectives and local restoration priorities will be identified through consultation with relevant regulatory bodies.

3.0 PROPOSED ORE DOCK DESCRIPTION

Milne Port is a fully functional port facility capable of loading up to 4.2 Mtpa of ore onto ore carriers calling on the port during the open water season extending from mid-July to late-October. Changes will be undertaken to increase the ore throughput at Milne Port to 12 Mtpa, including construction of a second ore dock mounted with a ship loader capable of berthing cape size vessels. Following receipt of Project approvals, construction of these facilities will be undertaken over a period of three years, concurrent with construction of the North Rail.

The following section identifies the components of the proposed ore dock at Milne Port that will require a paragraph 35(2)(b) *Fisheries Act* Authorization.

3.1 Ore Dock and Causeway Design

The proposed ore dock will be constructed east of the existing ore dock and connected to shore via a causeway (Figure 1-2). The dock face will be oriented parallel to the existing seabed contours, and kept within a range that provides sufficient depth and under keel clearance for fully laden vessels and stays within the physical limitations of steel sheet pile dock construction.

The proposed ore dock will include a sheet pile primary structure consistent with the design of the current dock. Geotechnical investigations have confirmed there is no shallow bedrock that would limit the proposed approach to sheet pile installation. Localized dredging of the upper layers of sediment will occur during construction of the proposed ore dock for the installation of scour protection, and other Project components. It is anticipated that three years will be required for the Phase 2 ore dock expansion. The proposed ore dock will be constructed in succession to limit disturbance to the natural environment, with a focus on in-water activities and producing an effective structure for long term, low maintenance operation.

Construction will be similar to traditional load / haul / place techniques; material will be hauled, dumped and dozed in lifts. Each load will be dumped on top of the existing lift, in front of the working face, and then pushed out with the dozer to limit the amount of material that stacks at the face and causes a steep slope. The proposed ore dock will be constructed in a phased approach:

- Phase 1 - Initial fill above water level with toe of slopes not extending beyond proposed footprint of sheet piles;
- Phase 2 - Cell construction; and
- Phase 3 - Final fill placement to finish grades.

Rock fill sheet pile cells will be installed around the perimeter of the proposed ore dock in order to retain fill and achieve a vertical wall. Cell construction is a staged process, alternating between sheet pile installation and rock backfill.

Equipment used to install sheet piles will operate on the constructed section of the proposed ore dock and therefore will not be entering the water. Machines will be sized with sufficient reach in order to drive sheet piles vertically into designed locations, through native ground only.

3.2 Construction Schedule

The proposed ore dock will be constructed once the Phase 2 Project Certificate Amendment and *Fisheries Act* Authorization are issued. It is anticipated that the earliest construction start date for the ore dock will be September 2019.

4.0 DESCRIPTION OF MARINE ENVIRONMENT

Detailed descriptions of the marine environment, including baseline surveys and effects monitoring of water and sediment quality, benthic habitat, benthic biota and fish communities can be found in the 2017 Milne Ore Dock Fish Offset Monitoring Report (Golder 2017a) and the draft Marine Environment Baseline Report (Golder 2017b). Milne Port is located at the head of Milne Inlet at the north end of Baffin Island. Milne Inlet is a narrow fjord characterized by high surrounding headlands and deep water covered by landfast ice for much of the year.

The water depth near Milne Port is approximately 30 m to 50 m and increases to 100 m to 150 m water depth approximately 200 m north of the port site. The inlet is U-shaped with consistent water depths along the middle of the channel with steeply sloping shorelines. Phillips Creek is located to the west of Milne Port and has created a deltaic feature along the southern fjord-head of Milne Inlet. A deep basin is present in the channel near Koluktoo Bay with water depths reaching 318 m. Robertson River feeds into the west side of Koluktoo Bay. Tugaat River is located to the north of Milne Port, entering Milne Inlet on the eastern shore, opposite Koluktoo Bay. North of Koluktoo Bay are a series of small mid-channel islands and deep basins. North of Ragged Island, Milne Inlet joins Eclipse Sound to the east-northeast and Navy Board Inlet to the north (Figure 4-1).

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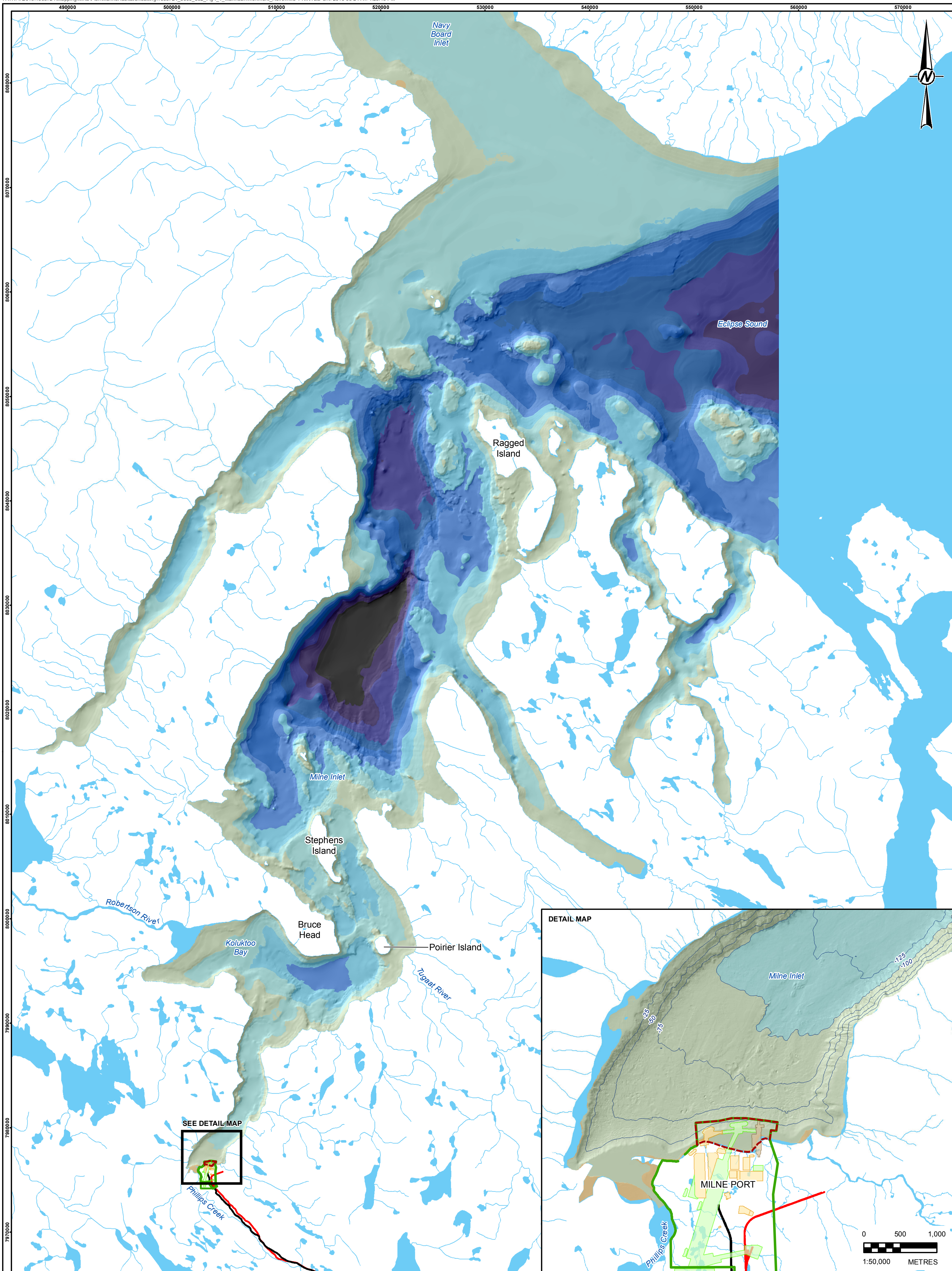

LEGEND

- • POPULATED PLACE
- BATHYMETRIC CONTOUR (25 m INTERVAL)
- MILNE INLET TOTE ROAD
- PROPOSED NORTH RAILWAY
- PDA / QIA COMMERCIAL LEASE
- WATERCOURSE
- EXISTING FREIGHT DOCK AND CAUSEWAY
- EXISTING ORE DOCK
- NEW ORE DOCK AND CAUSEWAYS
- INAC FORESHORE LEASE
- WATERBODY

0 5 10
1:350,000 KILOMETRES

REFERENCE(S)

MILNE PORT INFRASTRUCTURE DATA PROVIDED BY CLIENT MAY 28, 2018 AND BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. BATHYMETRY CREATED BY GOLDER FROM MULTIPLE DATA SOURCES. HYDROGRAPHY AND TOPOGRAPHY DATA BY EAGLE MAPPING (2005), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT – HABITAT OFFSET MONITORING PROGRAM

TITLE
MILNE PORT MARINE ENVIRONMENT

CONSULTANT
GOLDER

YYYY-MM-DD	2018-06-21
DESIGNED	CB
PREPARED	AA
REVIEWED	DN
APPROVED	DN

PROJECT NO.	CONTROL	REV.	FIGURE
1663724	5000-502	0	4.1

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25mm

The oceanography of Milne Inlet is similar to other neighbouring Arctic inlets with full ice cover and no freshwater input during the winter. Open-water and ice-cover seasons typically start in June and early October, respectively. In the winter, the water column is relatively mixed, with relatively consistent temperature and salinity. During the open-water season, large freshwater inputs create a strong stratification in the water column with a typical pycnocline depth of 5 m to 10 m. Currents in Milne Inlet are mostly driven by tides and are generally small.

4.1 Water Quality

As part of baseline characterization for the Project, marine water quality samples were collected in Milne Inlet under ice-cover in June 2008 and during the open-water season of 2008 (September) and 2010 (August). As part of post-construction monitoring, marine water quality samples were also collected in August of 2015 and 2016 as a part of the Marine Environment Effects Monitoring Program (MEEMP).

General water quality parameters and concentrations of major ions in Milne Inlet recorded during the open-water season in 2008 and 2010 were typical for a stratified column, with brackish (mean salinity 18 practical salinity units [PSU]) water layer, 8 m to 10 m in depth from the surface, and a higher saline (30 PSU) water mass below. During the ice-cover season, salinity was higher than during the open-water season and relatively uniform throughout the water column, with average salinity ranging from 31.5 PSU at the surface to 32 PSU near the bottom.

In 2014 and 2015, water samples collected during open-water season were brackish (14 PSU to 20 PSU), with low total suspended solids, low turbidity, and low colour. Most metals were below detection limits (DL), except for aluminum, boron, mercury, strontium, and uranium. Mercury concentrations (0.023 µg/L to 0.025 µg/L) exceeded the Canadian Council of Ministers of the Environment (CCME) guideline (0.016 µg/L) in all samples during the third sampling event in August. Hydrocarbons were not detected in any water samples. In comparison, both mercury and hydrocarbons were below DL in 2016 (SEM 2017a).

4.2 Sediment Quality

Sediment samples for baseline and effects monitoring studies were collected in Milne Inlet during the open-water seasons in 2008 and 2010 (Baffinland 2012 [Appendix 8A-1]), baseline surveys in 2013 (SEM 2014), and the MEEMP surveys from 2014 through 2016 (SEM 2016a and SEM 2017a).

Sediment samples were dominated by either sand or sand and silt and had low nutrient levels. Concentrations of some metals (aluminum, arsenic, calcium, chromium cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, strontium, and vanadium) were correlated with silt content and were higher in samples with greater proportion of silt. None of the detected metals or hydrocarbons exceeded CCME guidelines for sediments, except for arsenic and zinc in seven samples during the 2014-2016 samples. An analysis of the percent fine particles and concentration of iron found no significant differences between the baseline year and consecutive years (SEM 2017a).

4.3 Benthic Habitat

Benthic habitat surveys have been conducted annually in Milne Port since 2008 as part of the baseline data collection program and the MEEMP, Aquatic Invasive Species program (AIS), and fish offset monitoring program. Each of these programs included a different benthic habitat survey design. Seabed characterization was conducted using towed underwater video methods along pre-determined survey transects. Video analysis provided spatial data on substrate and biota, including distribution and abundance of epibenthic fauna and flora communities. Detailed substrate characterization was provided based on the video footage. Benthic infaunal samples were collected using petite or standard Ponar grabs. Species observed during video analysis and sampling were identified to the lowest practical taxonomic level (species, genus, or vegetation class). Identification to species or genus during video analysis was not always possible due to trolling speed, visibility, and distance from the seafloor.

4.3.1 Intertidal

Substrate in the intertidal habitat was primarily composed of sandy gravel and gravely sand with mixed shell (Baffinland 2012 [Appendix 8A-1], Golder 2017b). Typically, shallow water ecosystems at high latitudes have low rates of production and diversity (Gutt 2001). Frequent disturbances due to ice scour reduce the ability of more sessile organisms to colonize (Gutt 2001). This was reflected in the observations of limited macroalgal coverage. Additionally, infaunal densities were low in the intertidal with the 2013 surveys measuring 12.5 organisms per sample (organisms/sample), representing a single taxon (Oligochaetea).

4.3.2 Shallow Sub-tidal

Similar to intertidal areas, the shallow subtidal (< 3 m depth) is subject to exposure and ice scour limiting macroalgal presence to scarce occurrences of filamentous brown algae. Substrate at these depths was found to be primarily composed of fine to medium fine materials, such as sandy gravels, gravely sand and shell (Baffinland 2012 [Appendix 8A-1], Golder 2017b). Oligochaetes dominated the benthic infauna, however, densities and species richness were low in the shallow sub-tidal with an average abundance of 35 organisms/sample and taxonomic richness of 1.4 taxa per sample (taxa/sample), in 2013.

4.3.3 Mid Sub-Tidal

The mid sub-tidal strata (3 m to 15 m deep) was observed to be dominated by muddy sands (Baffinland 2012 [Appendix 8A-1], Golder 2017b). Macroalgae at these depths were primarily bladed kelps, with percent cover (38%) reflecting regional areas of high diversity (Wilce 1997). Benthic infauna densities were found to be much higher at depths greater than 3 m. Surveys in 2013 observed an average of 7,185 organisms per square metre (organisms/m^2) with relatively high taxonomic richness at 29 taxa/sample. Subsequent survey years found similarly high species richness, with lower abundances.

4.3.4 Moderate to Deep Sub-Tidal

Below 15 m depth, lower light penetration through the water column begins to limit macroalgal growth, this was reflected in the lower percent cover (6%) observed in the moderate to deep sub-tidal range. Macroalgae were mostly bladed kelp species, with encrusting and foliose coralline red algae relatively common on boulders (Baffinland 2012 [Appendix 8A-1], Golder 2017b). During benthic infauna surveys, organism densities were high and the greatest taxonomic richness was observed at this range, with an average of 8.421 organisms/m^2 and richness of 35.0 taxa/sample in 2013. Infauna taxa included polychaete worms (Polychaeta), copepods (Copepoda), amphipods (Amphipoda) and clams (Bivalvia).

4.4 Biota

Footage recorded during benthic habitat surveys provided data on abundance of epibenthic fauna. In addition to video recording, benthic epifauna was captured coincidentally with fish in Fukui traps that were set as a part of both MEEMP and AIS monitoring studies. Fish were also captured using gillnets. Phytoplankton biomass was determined by measuring concentrations of chlorophyll *a* and pheophytin *a* in sea water collected during water sampling and zooplankton sampling was conducted using vertical plankton tows.

4.4.1 Benthic Epifauna

Benthic epifaunal communities in the Arctic are generally dominated by mobile invertebrates such as brittle stars, sea urchins, sea cucumbers, sea stars, bivalves, crabs, and other crustaceans (Bluhm and Gradinger 2008). The most common epifauna taxa identified during benthic habitat surveys in Milne Inlet in 2008 and 2010 were unidentified clams (Bivalvia; 30% occurrence), brittle stars (Ophiuroidea; 32% occurrence), and sea urchins (likely green sea urchins, *Strongylocentrotus droebachiensis*; 30% occurrence). Other taxa encountered during surveys included barnacles, scallops, mussels, hydroids, anemones, tube-dwelling anemones, sea cucumbers, sponges and tunicates (Baffinland 2012 [Appendix 8A-1], Golder 2017a). Large numbers of euphasid shrimp were observed in 2017 video transect surveys (Golder 2017a).

Mobile benthic invertebrate species were also captured in Fukui traps during 2014-2016 surveys. These included green sea urchins, red sea urchins, brittle stars, ocean quahog (*Arctica islandia*), common whelk, scallops and a number of clam species, such as razor clam (*Siliqua* sp.), northern propeller clam (*Cyrtodaria siliqua*), *Macoma calcarea*, *Hiatella arctica*, and *Musculus laevigatus* (SEM 2015, 2016a, and 2017a).

4.4.2 Phytoplankton

Life in the Arctic Ocean ultimately depends on the production of marine microalgae. The Arctic bloom consists of two distinct categories of primary producers, ice algae (sympagic algae) growing within and on the underside of the sea ice, dominated by pennate diatoms, and phytoplankton growing in open waters (Søreide et al., 2010). The timing and extent of primary production is strongly affected by the patterns of ice formation. Studies in Arctic suggest two algal bloom seasons, first an increase in the abundances of sympagic algae, followed by an increase of algae in the water column as they are flushed from melting sea ice (Grondin et al., 2016).

Phytoplankton biomass measured during the field surveys was, in general, low, consistent with data reported for Arctic waters previously. Chlorophyll *a* concentrations were slightly higher at depth than at the surface, and slightly higher during the ice-cover season than during the open water season. Higher concentrations during the ice-cover season could be explained by the timing of sampling, which occurred in June when ice began to melt and ice-associated algae were released into the water column (Cross 1982; Baffinland 2012 [Appendix 8.1-A]).

4.4.3 Zooplankton

No scientific literature exists on zooplankton communities within Milne Inlet, but considerable information is available for Lancaster Sound and western Baffin Bay (Buchanan and Sekerak 1982; Sameoto et al. 1986; Welch et al. 1992). The marine planktonic ecosystem of the Arctic is characterized by a brief summer period of intense productivity following the spring phytoplankton bloom, and zooplankton composition is largely dominated by copepods (Darnis et al. 2012; Steiner et al. 2013).

In Milne Inlet, zooplankton assessments were conducted during the baseline studies in 2008 and 2010 (Baffinland 2012 [Appendix 8A-1]) and within AIS monitoring program in 2014 through 2016 (SEM 2017a). Average densities were measured as 1,616 organisms per cubic metre (organisms/m³) in 2008 and 548 organisms/m³ in 2010; densities recorded in 2014 to 2016 were considerably lower. The recorded zooplankton taxa were comprised of 12 taxa and 23 taxa in total in 2008 and 2010, respectively (Baffinland 2012 [Appendix 8A-1]). A total of 63 taxa were documented during the 2014-2016 sampling, and 17 taxa were found in all three years (SEM 2017a). Zooplankton sampling to date has not identified any non-native species (Golder 2017b).

Samples were dominated by copepods, followed by arrow worms and other appendicularians and mollusc larvae. The taxonomic composition of zooplankton sampling conducted in all years of sampling was typical of Arctic and Subarctic ecosystems. Vertical tows in 2016 differed from previous years as the samples were largely dominated by echinoderm larvae rather than by copepods.

4.4.4 Fish Community

Limited information is available on marine fish communities in the northern Baffin Island area. Available sources suggest that coastal fish communities in the Arctic have relatively low species diversity and abundance (LGL 1982). The most common species include anadromous Arctic char (*Salvelinus alpinus;* occurring seasonally throughout the region) and Arctic cod (*Boreogadus said;* ubiquitous in the Arctic and frequently occurring in nearshore waters in relative abundance). Arctic cod is an important prey source for other fish, including Arctic char, as well as for many seabirds and marine mammals. Benthic marine fish species such as sculpins, eelpouts, and lumpfish are also relatively common in nearshore waters, although often in low abundance (LGL 1982). Other species known to occur in Milne Inlet include Greenland shark and Greenland cod.

Most of the marine fish studies conducted in this region were focused on commercially important Greenland halibut fisheries (Chambers and Dick 2007; Jorgensen et al. 2005) and were conducted mainly in Baffin Bay and Davis Strait. Considerably more information is available on anadromous Arctic char, including the species' distribution in Milne Inlet, due to its importance to local residents (Kristofferson and McGowan 1981; Moshenko 1981; Read 2004). Tugaat and Robertson rivers, located in the southern portion of Milne Inlet, support anadromous Arctic char populations (Moshenko 1981; Kristofferson and McGowan 1981; Read 2004). Robertson River, which drains into Koluktoo Bay, supported a small commercial fishery that closed in the mid-1970s due to a population decline and to support a sports fishery established by The Pond Inlet Co-op (Moshenko 1981; Read 2004). The Tugaat River commercial fishery for Arctic char, operating between the early 1970s and 1990s, also closed due to population decline (Kristofferson and McGowan 1981; Read 2004). Pond inlet residents continue to harvest Arctic char in Tugaat River for subsistence use (Kristofferson and McGowan 1981; Read 2004).

4.4.4.1 Arctic Char

Arctic char are distributed widely in circumpolar regions and are present in 21 countries (FishBase 2017). Arctic char is an iteroparous species and exhibits both anadromous and land-locked life history strategies (Scott and Crossman 1973; Stewart and Watkinson 2004; FishBase 2017). The anadromous form of this species spends most of its life in the freshwater environment and migrates each spring to marine waters after the first two to six years of life (DFO 2014a; Stewart and Lockhart 2005). It spends 30 to 60 days in the marine environment where most of its feeding and growth occurs (Moore et al. 2014).

Arctic char are carnivorous, but have a remarkably diverse diet (Scott and Crossman 1973). The common Arctic char diet includes crustaceans and fish, including capelin (*Mallotus villosus*), sand lance (*Ammodytes* spp.), Arctic cod, and juvenile Greenland cod (Richardson et al. 2001; Coad and Reist 2004). Arctic cod concentrations are an important prey species in the food supply for Arctic char, as well as for the Arctic marine food web in general (SEM 2014).

Arctic char is harvested by the Inuit for both commercial and subsistence purposes (Moore et al. 2014; Nanuk 1999; Agnico Eagle 2014). Subsistence fisheries are managed by local hunters and trappers organizations, while DFO manages commercial harvests (Moore et al. 2014). Abundance estimates have been attempted in some localities within the Territory, but estimates are deemed unreliable due to the variable migratory behaviour of Arctic char (Moore et al. 2014; Roux et al. 2011). However, stocks are widely distributed in Nunavut and a total available quote for Arctic char harvest is 427,200 kg round mass (i.e., mass of whole, head-on, undressed fish; Roux et al. 2011).

4.4.4.2 Arctic Cod

Arctic cod are also ubiquitous in the Arctic, with a circumpolar distribution. Arctic cod can inhabit a wide variety of marine habitats. They are frequently found in nearshore waters in relative abundance. They have also been noted to be offshore at depths greater than 900 m. They migrate to nearshore waters in late summer and will remain under nearshore ice in winter to spawn before moving offshore in spring (Craig 1984). Nearshore habitats with water depths up to 30 m are considered to be a key marine habitat component for juvenile and adult stages of Arctic cod. Nearshore habitats are used primarily during the open water period extending from July to September (SEM 2014).

Young-of-year Arctic cod feed on phytoplankton and zooplankton, with adults feeding on pelagic zooplankton, substrate and ice-associated crustaceans, and young fish (ADFG 1986). The species is an important prey source throughout the Arctic for other fish, including Arctic char, as well as for many seabirds and marine mammals (bearded seal, ringed seal and narwhal).

4.4.4.3 Fish Studies

Project-specific studies on marine fish populations in Milne Inlet commenced in August 2010 and continued through all subsequent marine environmental study programs. Studies were conducted to obtain information on the taxonomic composition of fish communities, their abundance, age and size distribution, diet, health and accumulation of contaminants in tissue. Fish samples were collected at various locations in the vicinity of the Milne Port area.

Fishing effort, the number of fish caught, and relative species composition of catches varied from year to year. Catch per unit effort at the Milne Port area increased with time from 0.3 fish per hour in 2013 to 2.9 fish per hour in 2016. The total number of fish caught in gill nets also increased from 8 to 163 in 2013 and 2016, respectively.

Eleven identified fish species were captured during fish surveys in the Milne Port area from 2010 to 2016 (Table 4-1). Arctic char was the most common species in gillnet catches in 2013, 2015, and 2016, constituting 75%, 75% and 96% of total number of fish caught by gillnetting, respectively (SEM 2017a). Sculpins constituted a great majority of non-char fish species caught, with Shorthorn sculpin (*Myoxocephalus scorpius*) and fourhorn sculpin (*Myoxocephalus quadricorni*) being the most abundant. Arctic cod was never captured but was observed in large schools around Milne Port in 2016 (SEM 2017b), in video transects in 2017 (Golder 2017a), in addition to being identified in Arctic char stomach contents during Milne Inlet sampling programs (SEM 2017a).

Table 4-1 Total fish catches in the Milne Port area, 2010 to 2016

Common Name	Taxonomic ID	2010	2013	2014	2015	2016
Arctic char	*Salvelinus alpinus*	11	6	3	67	157
Arctic sculpin	*Myoxocephalus scorpioides*	0	0	4	1	-
Shorthorn sculpin	*Myoxocephalus scorpius*	50	4	9	8	18
Fourhorn sculpin	*Myoxocephalus quadricorni*	7	3	39	13	18
Arctic staghorn sculpin	*Gymnocanthus tricuspis*	3	0	0	2	-
Longhorn sculpin	*Myoxocephalus octodecemspinosus*	0	2	4	2	2
Arctic hookear sculpin	*Artediellus atlanticus*	0	0	5	1	-
Unidentified sculpin	Cottidae	-	-	-	12	-
Greenland cod	*Gadus ogac*	4	0	1	0	-
Common lumpfish	*Cyclopterus lumpus*	0	0	1	0	-
Fishdoctor	*Gymnelis viridis*	0	1	0	3	-
Fourline snakeblenny	*Eumesogrammus parecisus*	0	0	1	2	2
Total		75	16	67	111	197

5.0 DESCRIPTION OF EFFECTS ON FISH AND FISH HABITAT

This section describes the potential effects of the construction of the proposed ore dock on fish and fish habitat, the type and extent of fish habitat likely to be affected, the fish species likely to be affected, as well as the probability, magnitude, geographic extent and duration of the effect. Table 5-1 outlines the criteria that were used to determine the degree of the effect on fish and fish habitat. Relative productivity has been used as a measure for the magnitude of the effect.

Table 5-1 Criteria for determining the degree of effect

Category	Degree of Effect		
Probability	**Unlikely**	**Likely**	**Certain**
Magnitude	**Low** – loss of low productivity intertidal and shallow sub-tidal soft substrate habitat	**Moderate** – loss of moderate productivity moderate/deep sub-tidal habitat	**High** – loss of high productivity mid sub-tidal habitat
Geographic Extent	**Site Specific -** Project Footprint	**Local –** Milne Port	**Regional –** Milne Inlet
Duration	**Temporary** - Effect is only during construction.	**Short Term** - Effect is evident for a short time after construction.	**Permanent** – Effect will be permanent after construction

Construction of the proposed ore dock will result in the destruction of fish and fish habitat and the marine footprint that cannot be avoided is presented by Project component in Table 5-2. A summary by habitat type is presented in Table 5-3.

Table 5-2: Proposed ore dock marine footprint

Component	Habitat Type	Area (m^2)	Area (ha)
Proposed Ore Dock			
	Intertidal	1,894	0.19
	Shallow Sub-tidal (< 3 m)	34,060	3.41
	Mid Sub-tidal (3 m to 15 m)	8,926	0.89
	Moderate/Deep Sub-tidal (> 15 m)	5,639	0.56
Sub-total	-	50,519	5.05
Isolated Waterbodies			
Area A	Intertidal	8,089	0.81
Area A	Shallow Sub-tidal (< 3 m)	39,333	3.93
Area B	Intertidal	15,470	1.55
Area B	Shallow Sub-tidal (< 3 m)	57,265	5.73
Sub-total	-	120,157	12.02
Total		**170,676**	**17.07**

* Dredge Area is only the area being dredged not already covered by the footprint of the proposed ore dock

Table 5-3 Area of serious harm to fish by habitat type resulting from the proposed ore dock

Habitat Type	Area (m^2)
Intertidal	25,453
Shallow Sub-tidal (< 3 m)	130,658
Mid Sub-tidal (3 m to 15 m)	8,926
Moderate/Deep Sub-tidal (> 15 m)	5,639
Total Area	**170,676**

Appropriate measures to avoid and reduce the potential for serious harm to fish and fish habitat will be identified using the DFO pathways of effects (DFO 2014b) for marine construction activities, which identifies potential pathways that could lead to serious harm:

- Change in food supply – address increases or decreases in quantity or composition;
- Change in habitat structure and cover – address the removal of vegetation, reduction in substrate stability, cover and protection from predators, and availability of stable and diverse habitat;
- Change in sediment concentrations – address suspension and settling of organic and inorganic material, changes in physical processes, structural attributes and ecological conditions of the habitat;
- Change in nutrient concentrations – address the potential for nutrient enrichment that may cause nuisance algae and oxygen-depleting conditions;
- Change in contaminant concentrations – address the potential for dispersion of sediment contamination and exposure of aquatic biota to harmful contaminant concentrations; and
- Fish mortality – although not included in the pathways of effects for placement of structures in water, there is a potential for entrainment of benthic invertebrates during dredging, isolation of fish in the waterbody, and injury or mortality from acoustic noise during pile driving.

5.1 Food Supply

In-water construction activities have the potential to negatively affect the marine food supply. Potential effects include removal or smothering of food and disturbance to predator-prey interactions with increased acoustic noise and turbidity. Similarly, potential changes and disturbance to the food supply can occur with increased underwater acoustic noise during construction of the proposed ore dock. Underwater acoustic noise can be managed and addressed with implementation of the detailed construction environmental management plan

The aquatic food supply must be plentiful and diverse to sustain the productivity. An increase or decrease in the quantity or composition of the food supply, beginning with phytoplankton and marine plants that grow in the area and plants and organic debris that fall into a waterbody, can alter the structure of the marine community.

5.2 Habitat Structure and Cover

Infilling and placement of substrate on the sub-tidal slope can result in instability and deposition of sediment can affect the capacity of the area to maintain a dispersed and diverse community of marine organisms by decreasing opportunities for organisms to use, colonize, and move between existing habitats. The removal of marine vegetation can reduce cover and protection from predators and physical disturbances, and the availability of diverse and stable habitats.

The area to be filled is characterized as:

- Predominantly fine substrates with a heterogeneous mix of medium sized substrate;
- Salinity regime varies seasonally with a deeper freshwater lens during freshet;

- Experiences lower irradiance than the mid intertidal in particular during the winter;
- Relatively high mean-immersion time i.e., the area is functionally similar to the shallow sub-tidal except during a limited number of low tide events during the summer; and
- Subject to wave activity.

Based on the prior assessments by Sikumiut Environmental Management Ltd. (SEM), discrete tidal habitat classes and related footprints were delineated primarily from horizontal habitat zones. Substrate throughout the horizontal habitat zones was dominated by gravel/sand sediments with mud occurring primarily at deeper depths (SEM 2014). Throughout the zones, various algae and kelps were observed. Fauna was limited throughout, particularly limited in shallower areas (composed almost exclusively of invertebrates). Associations with habitat (combined dominant substrates and biotic assemblages) were not apparent (SEM 2014).

Infilling will remove useable habitat and decreases opportunities for fish to use, colonize, feed and move between existing aquatic environments (Table 5-3, Figure 5-1):

- Effects to Intertidal Habitat: a permanent loss of 25,453 m^2 habitat due to the infilled area of the proposed ore dock on the seabed and isolation of the water bodies between the existing and proposed ore docks. Of this intertidal habitat that will be permanently lost, approximately 300 m^2 is offset habitat from the existing ore dock required under a *Fisheries Act* authorization (14-HCAA-00525);
- Effects to Shallow Sub-tidal Habitat (< 3 m): a permanent loss of 130,658 m^2 habitat due to the infilled area of the proposed ore dock on the seabed and isolation of the water bodies between the existing and proposed ore docks. Of this shallow sub-tidal habitat that will be permanently lost, approximately 600 m^2 from the existing ore dock required under *Fisheries Act* authorizations (14-HCAA-00525 and TBD);
- Effects to Mid Sub-tidal Habitat (3 m to 15 m): a permanent loss of 8,926 m^2 habitat due to infilling from the proposed ore dock; and
- Effects to Moderate/Deep Sub-tidal Habitat (> 15 m): a permanent loss of 5,639 m^2 habitat due to infilling from the proposed ore dock.

LEGEND

- NEW ORE DOCK AND CAUSEWAY
- EXISTING FREIGHT DOCK AND CAUSEWAY

HABITAT TYPE

- LAND
- INTER-TIDAL
- UPPER SUB-TIDAL (< 3 m)
- SHALLOW SUB-TIDAL (3-15 m)
- MODERATE/DEEP SUB-TIDAL (> 15 m)

0 100 200

1:7,500 METRES

REFERENCE(S)

SATELLITE IMAGERY BY DIGITALGLOBE (AUGUST, 2016), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017. NEW MILNE PORT FOOTPRINT PROVIDED BY CLIENT, MAY 28, 2018. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT – HABITAT OFFSET MONITORING PROGRAM

TITLE
PHASE 2 PROPOSAL MARINE FOOTPRINT

CONSULTANT

GOLDER

YYYY-MM-DD	2018-06-21
DESIGNED	DV
PREPARED	AA
REVIEWED	DN
APPROVED	DN

PROJECT NO.	CONTROL	REV.	FIGURE
1663724	5000-502	0	5.1

PATH: I:\2016\1663724\Mapping\MXD\Fish\MarineHabitatOffsetting\1663724_5000_502_Fig5_1_Phase2_Proposal_Marine_Footprint_Rev0.mxd PRINTED ON: 2018-06-21 AT: 4:23:04 PM

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25mm

5.3 Sediment Re-suspension

A qualitative desk-based modelling assessment of incremental and relative project effects on near-shore sediment transport potential was conducted for the construction of the proposed ore dock (Golder 2018). The integrated hydrodynamic and sediment transport potential numerical model was driven by site specific wind, tide, and temperature/salinity forcing.

Similar to existing conditions, most of the sediment transport occurs on the southern shore of Milne Inlet. The model suggests that the addition of the proposed ore dock would not affect the sediment transport patterns in the delta area at the mouth of Phillips Creek.

5.4 Sediment Quality (Contaminants and Nutrients)

Increased erosion of sub-tidal slope can result in an excess of fragmented organic and inorganic material which is transported by water and gravity. These sediments, which contain nutrifying elements can capture or absorb contaminants, are suspended or deposited in adjacent habitat affecting physical processes, structural attributes, and ecological conditions such as water clarity (by reducing visibility and sunlight and damaging fish gills) and reducing the availability and quality of spawning / rearing habitat (through infilling).

5.5 Fish Mortality

Fish mortality has the potential to occur during construction from dredging and acoustic noise and from isolation in the waterbodies that will be created between the proposed ore dock and the existing and the freight dock. During in water construction, a silt curtain will be installed in order to isolate the footprint of the proposed ore dock. The curtain will be designed and procured in sections which relate to the water depth in order to remain buoyant and extend to the ocean floor with sufficient slack. Prior to construction work within the silt curtain area, efforts will be made to salvage fish and release them alive outside of the work area. The silt curtain will also serve as a deterrent to fish re-entering the isolated work area. Despite salvage efforts, direct fish mortality, specifically benthic invertebrates, is still expected due to potential isolation.

6.0 AVOIDANCE AND MITIGATION MEASURES

Construction of the ore dock will be managed to avoid serious harm to areas adjacent to the Project footprint. The construction design includes a number of mitigation features that will minimize disturbance and includes installation of sheet piles using vibratory methods in lieu of impact driving, placement of the dock face in parallel to existing seafloor contours, and minimizing the use of in-water machinery during construction. No blasting is proposed as part of the Phase 2 proposed ore dock. Construction activities will be managed through development of the Environmental Protection and Monitoring Plan, outlining specific procedures to avoid or reduce effects on the marine environment. Proposed mitigation measures during construction will include the installation of silt curtains around in-water works to minimize disturbance to the surrounding marine environment, turbidity monitoring and underwater noise monitoring during pile installation and dredging, and environmental monitoring with regular inspection audits to verify effectiveness of mitigation measures and compliance of Project activities with existing permits and authorizations.

7.0 RESIDUAL SERIOUS HARM TO FISH AFTER IMPLEMENTATION OF AVOIDANCE AND MITIGATION MEASURES AND STANDARDS

The measures and standards that will be implemented were used to provide a quantitative description of the anticipated serious harm to fish that is likely to result from the proposed ore dock. Despite avoidance and mitigation measures, the proposed ore dock will result in the destruction of fish habitat.

7.1 Summary of Habitat Offsetting Required

From the extent of the infilling and isolation of water bodies due to construction of the proposed ore dock, it was determined that 170,676 m^2 of fish habitat will require offsetting (Table 5-3). Species important to regional CRA fisheries that may be directly or indirectly impacted by serious harm to fish habitat are Arctic cod and Arctic char. Juvenile and adult anadromous char utilize the marine environment for feeding and migration, primarily pelagic habitats with minimal interactions with bottom substrates and marine flora, from mid-June to mid-September (SEM 2014). The preferred marine habitat of Arctic char juveniles and adults can be characterized as the area along the coastline ranging from the high water mark out to the 10 m contour within 25 km of freshwater spawning areas (SEM 2014).

Nearshore habitats with water depths up to 30 m are considered to be a key marine habitat component for juvenile and adult stages of Arctic cod, as well as Arctic char, and seasonally significant to Arctic char in terms of food supply and the importance of Arctic cod concentrations to the Arctic marine food web in general (SEM 2014).

Baseline surveys of the Milne Port area indicate that intertidal and shallow sub-tidal habitats (< 3 m depth display low levels of productivity for both macroalgae and benthic infauna. Project construction activities will result in the loss or isolation of 156,111 m^2 of low productivity intertidal and shallow sub-tidal habitat (Table 5-3). Higher levels of productivity were observed at depths greater than 3 m. At these depths, macroalgal percent cover was higher and benthic infauna abundances and species richness were greatest. Construction of the proposed ore dock will result in the direct loss of 14,565 m^2 of mid sub-tidal habitat and moderate to deep subtidal habitat.

8.0 CONCEPTUAL OFFSETTING PLAN

Baffinland is committed to offsetting project-related effects to fish and fish habitat that contribute to the sustainability and ongoing productivity of CRA fisheries by proposing to implement an offsetting plan that maintains or increases the quality and type of habitat for the local fisheries in Milne Inlet likely affected by proposed ore dock. Baffinland’s approach to offsetting, conceptual offsetting plan, rationale for selection, and effectiveness monitoring are described in the sections below.

8.1 Approach

The Fisheries Productivity Investment Policy (“Offsetting Policy”)(DFO 2013b) states that “the objective of offsetting is to counterbalance unavoidable serious harm to fish and the loss of fisheries productivity resulting from a project. Offsetting measures support and enhance the sustainability and ongoing productivity of fish that are part of or support a commercial, recreational or Aboriginal fishery.”

The offsetting plan should include the objective, the offsetting measures, and an analysis, using scientifically defensible and clearly described methods, on how the measures will meet the offsetting objective (DFO 2017). The offsetting plan must also outline a monitoring plan that assesses the effectiveness of the offset. The Offsetting Policy offers flexibility in choosing offset methods provided that increases in fisheries productivity are achieved and four key principles are met. The second principle states that “benefits from offsetting measures must balance project impacts.” This principle is meant to capture the idea of equivalency between impact and offset, in relation to fisheries productivity (DFO 2017).

When identifying offsetting measures consideration should be given to options that:

- Provide flexibility in the selection provided they are focused on improving fisheries productivity;
- Benefit the specific fish populations and areas that are affected by the project are most likely to balance losses;
- Occur within the vicinity of the project or within the same watershed and should not be applied outside of provincial or territorial boundaries; and
- Could be undertaken in water bodies or for fish species other than those affected by the project, provided the measures are supported by clear fisheries management objectives or regional restoration priorities (DFO 2013a).

All of the above will be considered in the identification of offsetting options.

8.2 Guiding Principles

In applying offsetting measures for fisheries protection, Baffinland has selected measures that consider the following Offsetting Policy principles (DFO 2013b):

- Principle 1: *Offsetting measures must support fisheries management objectives or local restoration priorities.* Offsets will be designed so they contribute to the objectives identified in fisheries management plans, if they exist. The EA process will also be used to engage and consult with fisheries managers, Inuit, local organizations and stakeholders to help identify habitat that may require restoration or improvement;
- Principle 2: *Benefits from offsetting measures must balance project impacts.* Offsets are more likely to successfully balance losses when they benefit the specific fish populations;
- Principle 3: *Offsetting measures must provide additional benefits to the fishery.* Benefits to the fishery are caused by offset actions and not by other factors such as other programs or activities; and
- Principle 4: *Offsetting measures must generate self-sustaining benefits over the long term.* The offset should generate self-sustaining benefits to fisheries productivity and the benefits should last at least as long as the impacts from the development project.

8.3 Selection and Description of Offsetting Measures

8.3.1 OFFSETTING MEASURES OPTIONS

A preliminary overview of potential offsetting needs for the Project and options that may be considered for offsetting will be conducted. The feasibility of retained options will be assessed against selection criteria which may include, but will not be limited to the following:

- Land ownership: Preference given to options on land owned by Baffinland;
- Proximity to existing areas of construction: to make efficient use of construction equipment that will already be on site. Those distant from existing areas of construction will be less preferable;
- DFO objectives: options that align with feedback from DFO regarding fisheries management objectives will be given a high ranking;
- Constructability: the resources (construction material, equipment) that may be needed to implement an offsetting option will considered qualitatively, with a high ranking assigned for options that are relatively common and the outcome is relatively well known; and
- Long-term viability: the potential success of the offsetting option will be evaluated qualitatively. Options with greater potential to succeed will be given a high ranking.

8.3.2 COASTAL AND GEOTECHNICAL ANALYSIS

The coastal geomorphology is integral to the conceptual habitat design to provide an area that is suitable for species to establish in the appropriate tidal elevation while taking into account the underlying bathymetry, tidal and current regime, salinity and freshwater presence, and wave exposure to build a structure to withstand the conditions at the site.

Coastal habitat projects need to be designed to strike the right balance between: (i) allowing for dynamic adjustment to seasonal conditions, (ii) resilience to extreme or storm conditions, particularly during the first years of establishment, and (iii) maintenance.

Adopting a performance-based design approach, the offsetting habitat will be designed to withstand waves, tidal changes, and ice with return periods of up to 10 years (i.e., with a 40% chance of occurrence over the initial five-year monitoring period). For permanent structural elements designed to support the habitat (e.g. hard structures) it is assumed a 25-year working life.

8.4 Amount of Offsetting Required

8.4.1 Quantification of Losses and Gains

The footprint of the proposed ore dock will likely result in the permanent destruction of 170,676 m^2 of fish habitat (Table 5-3).

8.4.2 UNCERTAINTY AND TIME LAGS OF THE PREDICTED EFFECTS AND PROPOSED OFFSETTING

Prediction of potential Project effects from coastal infilling and dredging projects are well understood and appropriate plans have been developed and will be implemented to avoid and mitigate Project effects. Environmental monitoring during construction of the Project will also be conducted.

Successful offsetting due to destruction of fish habitat has inherent uncertainties. These uncertainties come from three main sources:

- Difficulty understanding the relationships between fish production and physical habitat;
- Time lags between when the offset habitat is complete and when the habitat becomes fully functional; and
- Assumption that we fully understand and can replicate the physical habitat features fish actively select for their different life stages (e.g., refuge, rearing).

In order to address this uncertainty and time lag, an offset plan will be create using the following approach:

- Providing offsets adjacent to the Project site, and for the local fish populations, most directly affected by the Project;
- Building offset projects as soon after construction of the Project as possible;
- Providing offsets that improve the temporal availability of habitat to fish;
- Providing offsets that maintain or provide higher quality habitat functions than will potentially be affected;
- Providing equivalent areas of habitat as to what will be lost or altered by the Project; and
- Using the *Fisheries Act* Authorization effectiveness monitoring results for the existing ore dock to inform this plan.

Developing a conceptual offsetting plan, combined with Baffinland's commitment to build offset habitat during or shortly after serious harm to fish occurs from Project construction, increases the certainty that the offsetting plan will meet its goal of maintaining or increasing fisheries productivity in Milne Inlet.

8.5 Analysis of How Measures will Offset for Serious Harm

The design philosophy for the conceptual offsetting plan is to:

- Provide tangible benefit to fisheries resources, specifically Arctic char and Arctic cod;
- Integrate with and enhance the adjacent habitats that occur at the location such as the nearby creeks used by Arctic char; and
- Reflect the coastal geomorphological processes that characterize the location.

8.5.1 Support for Local Fisheries Management Objectives

Subsistence fisheries by Inuit for adult Arctic char have taken place in inner Milne Inlet, however, there is no evidence such fisheries took place at the exact site of the ERP or proposed ore dock (SEM 2014). Until recently, the Arctic char fishery in Milne Inlet was a recreational or subsistence fisheries. There are no Fisheries Management Objectives in place and applicable to the area of concern. In 2013, DFO approved exploratory Arctic char fisheries at four sites within Milne Inlet, namely Robertson River at Koluktoo Bay, Tuapak, Saviit Nuvua, and Ipiutalik. These exploratory fisheries have been approved for five years and, following assessment of catch/effort data and biological samples, a decision may be made on potentially establishing an Arctic char commercial fishery (SEM 2014). Fisheries Management Objectives may be developed by DFO at that time and it is assumed that consultations related to the objectives would include aspects on any potential impacts related to the Project.

In April 2010, Baffinland convened public meetings with potentially affected communities to help determine key marine aquatic habitat and biota. Arctic char was selected as a key indicator of the proposed ore dock component and the rationale for selection included the importance of Arctic char to Inuit.

8.5.2 Benefits Balance the Project Impacts

The conceptual offset plan will be developed to increase the diversity of habitat in Milne Inlet. The proposed ore dock will result in the loss of intertidal and sub-tidal soft bottom habitat, of which much of Milne Inlet is comprised. Baseline surveys performed around Milne Port indicate that much of the existing habitat that will require offsetting is of relatively low productivity. Offsetting habitat will be designed to enhance productivity, e.g. increase food resources for both Arctic char and Arctic cod, and provide a higher productivity than the majority of the habitat affected by the Project. Creating higher value offset habitat may reduce the total area required to offset serious harm to fish and fish habitat.

8.5.3 Self-sustaining Benefits over the Long term

The design will consider underlying substrate, bathymetry, tidal and fluvial regimes, salinity regime, waves and currents to create productive habitat that considers existing conditions present at the site.

Intervention to address the physical stability of constructed features during the design life of the offset habitat is not anticipated.

8.5.4 MEASURES FOR SUCCESS

The offsetting proposed for the proposed ore dock will be similar to the previously successfully permitted, constructed and monitored offsetting consisting of coarse rock substrate placed around the perimeter of the existing ore dock. Currently, in Year 3 of the offset effectiveness monitoring program, the rocky reef structure has been found to be stable and functioning as predicted.

8.5.5 ANALYSIS SUMMARY

Based on the effectiveness monitoring program for the ERP *Fisheries Act* Authorization, it is proposed that offsetting for the current proposed ore dock expand on the presence of coarse rock habitat within the Port facilities.

8.6 Offsetting Options

The objective of the conceptual offsetting plan is to increase habitat diversity in Milne Inlet and consider opportunities that can improve the understanding of Arctic fish and fish habitat a diversity of marine habitat conditions.

A desktop review of the Milne Port area and surrounding region resulted in the selection of six sites that suggest reasonable potential for habitat offsetting through habitat enhancement. Benthic surveys of the local marine environment indicate that higher productivity habitat ranges in depth from 3 m to 25 m depth. Additionally, species of local CRA concern are known to prefer habitat along the coastline ranging from the high water mark out to 30 m within 25 km of freshwater spawning areas (SEM 2014). The creation of highly productive and complex habitat within these areas will likely benefit CRA fishery species by improving food and shelter availability.

8.6.1 Habitat Restoration and Enhancement

Habitat restoration and enhancement includes physical manipulation of existing habitat to improve habitat function and productivity (DFO 2013b). Along the coastal zone, examples of habitat restoration and enhancement offsetting measures include increasing structure through the placement of coarse substrate or large woody debris to improve habitat structures, such as reefs to enhance feeding, refuge, and spawning habitat, and increasing shoreline complexity.

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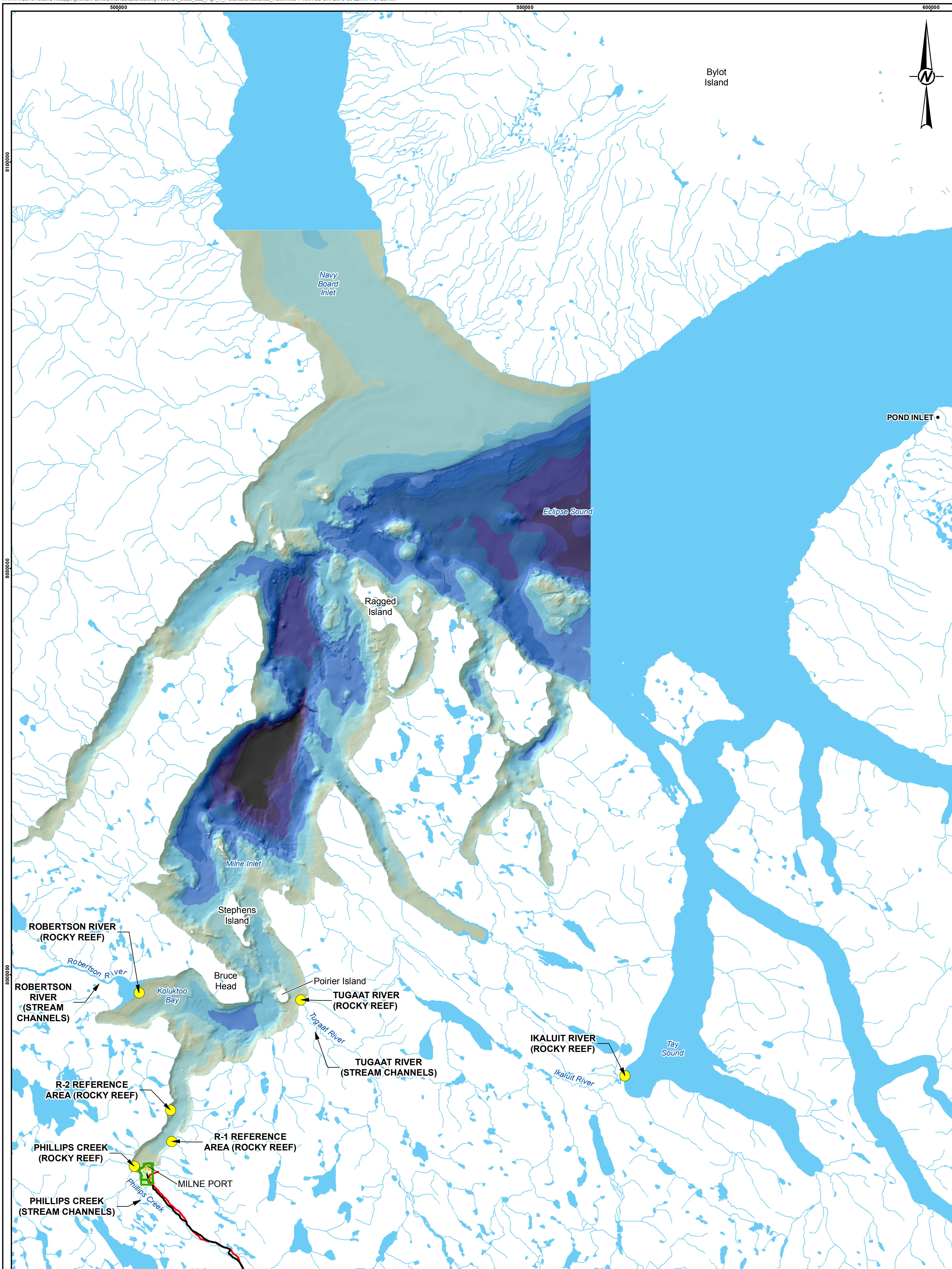

LEGEND

- POPULATED PLACE
- POTENTIAL HABITAT OFFSET SITE
- BATHYMETRIC CONTOUR (25 m INTERVAL)
- MILNE INLET TOTE ROAD
- PROPOSED NORTH RAILWAY
- PDA / QIA COMMERCIAL LEASE
- WATERCOURSE
- EXISTING FREIGHT DOCK AND CAUSEWAY
- EXISTING ORE DOCK
- NEW ORE DOCK AND CAUSEWAYS
- WATERBODY

0 10 20

1:450,000 KILOMETRES

REFERENCE(S)

MILNE PORT INFRASTRUCTURE DATA PROVIDED BY CLIENT MAY 28, 2018 AND BY HATCH, JANUARY 25, 2017, RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE MAY 19, 2017. BATHYMETRY CREATED BY GOLDER FROM MULTIPLE DATA SOURCES. HYDROGRAPHY AND TOPOGRAPHY DATA BY EAGLE MAPPING (2005), RETRIEVED FROM KNIGHT PIESOLD LTD. FULCRUM DATA MANAGEMENT SITE, MAY 2017. HYDROGRAPHY, POPULATED PLACE, AND PROVINCIAL BOUNDARY DATA OBTAINED FROM GEOGRATIS, © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
PROJECTION: UTM ZONE 17 DATUM: NAD 83

CLIENT
BAFFINLAND IRON MINES CORPORATION

PROJECT
MARY RIVER PROJECT – HABITAT OFFSET MONITORING PROGRAM

TITLE
POTENTIAL HABITAT OFFSET SITES

CONSULTANT

GOLDER

YYYY-MM-DD	2018-06-22
DESIGNED	CB
PREPARED	AA
REVIEWED	DN
APPROVED	DN

PROJECT NO.	CONTROL	REV.	FIGURE
1663724	5000-502	0	7.1

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Rocky Reef

Increasing water structure by constructing a rocky reef outside of the Milne Port operations area near Philips Creek (Figure 8.1), a known Arctic char spawning stream, would create hard three dimensional structure within the marine environment in an area that is predominantly dominated in the depth range from 3 to 15 m by fine substrates (muddy sand) with a heterogeneous mix of medium sized substrate (Baffinland 2012). A rocky reef habitat would benefit Arctic char and Arctic cod, species identified as important to local fisheries. This type of structure would increase habitat availability for adults and juveniles as well as potentially increase the availability food through the colonisation of a more complex habitat by other organisms.

Rocky reef structures would be constructed at depth between -4 to -10 m CD, which is within the photic zone while avoiding potential impacts to navigation and to MEEMP transects.

Rocky reef habitats near the existing Milne Port may experience potential interactions with port activities which may limit offset productivity. The construction of additional rocky reef structures at other offsite locations would reduce the risk of disturbances by port operations

Within Milne Inlet, freshwater sources with known spawning grounds for Arctic char are Robertson River and Tugaat River (Figure 8.1). The creation of rocky reef structures in the marine environment near these rivers would be beneficial to adult and juvenile char, and incidentally, other species impacted by construction activities.

Additionally, benthic surveys for baseline analysis in 2013 were performed using two reference sites (R-1 and R-2) in Milne Inlet (Figure 8.1). These sites were similar to the Project site in species abundances and richness, and located close to the Project site. The creation of rocky reefs at these sites may benefit similar species as those impacted by the construction of the proposed ore dock.

Additional habitat offsetting may be considered around the mouth of Ikaluit River, where it flows into Tay Sound. This region is considered by the residents of Pond Inlet to be an important area for commercial and sustenance Arctic char fishery. Complex structures such as rocky reefs may enhance these fisheries. However, this is located at a significant distance from Milne Port.

8.6.2 Habitat Creation

Habitat creation involves physical manipulation of terrestrial environments to develop or expand existing marine environment (DFO 2013b). As this involves the removal or replacement of existing habitat, it is considered only when the productivity of the new habitat is considerably greater.

Spawning Channels

The creation or expansion of stream channels along Robertson River, Phillips Creek and Tugaat River (Figure 8.1), have the potential to increase available spawning habitat for Arctic char in these systems. However, there is limited information of Arctic char stocks in these systems and it is unknown if the availability of spawning habitat currently limits populations.

8.6.3 Complementary Measures

In areas where there are limited opportunities for measures to offset fisheries productivity losses and where there is limited understanding or data on fisheries populations, such as Milne Inlet, complementary measures may be considered in addition to other offsetting measures. A proposed complementary measure is determined on a case-by-case basis in consultation with DFO.

Complementary measures (DFO 2013b):

- Are investments in data collection and scientific research related to maintaining or enhancing the productivity of CRA fisheries;
- May comprise up to 10% of the required amount of offsetting; the remaining 90% of the offset amount must consist of habitat enhancement, restoration or creation of offsetting measures; and
- Should only be considered in exceptional circumstances such as in remote, pristine areas where there is a lack of information about fisheries productivity and where offsetting opportunities are limited (i.e. Milne Inlet).

Complementary measures will require a rationale describing why other offsetting methods are not appropriate for fulfilling the entire offset requirement and a detailed plan outlining how the proposed complementary measure will be carried out, evaluated, and communicated.

Potential research studies, where there are currently gaps in information for Arctic fisheries in Milne Inlet, are listed below. Each one would require engagement with stakeholders and regulatory agencies, consultation with Inuit, and further developed into a research program:

1) Spawning surveys in Phillips Creek – identifying the current potential in available spawning habitat and juvenile rearing locations and comparing to actual returns. This could inform potential opportunities for future instream habitat creation.
2) Ikaluit River Arctic char stock assessment – an important area for commercial and sustenance fisheries for the Pond Inlet community. This stock is not very well understood, despite its importance and it may present a good opportunity for research benefiting the local community.
3) Outmigration of Arctic char juveniles – determining population potential, identifying sources of mortality at vulnerable life stages.
4) Current limitations on productivity – determining the extent of food availability, suitable spawning habitat, and fishing pressure to identify areas of concern for local species. This could identify locations for habitat restoration or enhancement for future offsetting purposes (see Habitat Banking, below).
5) Benthic mapping – Improving the understanding of benthic habitat profiles to gain a better idea of current habitat availability and limitations
6) Recruitment surveys – determining rates of recruitment and settlement in different habitats and depths. This can inform current constraints on population growth and species richness.
7) Mark recapture programs – informing populations of Arctic char and cod and other local species, understanding population and habitat connectivity.
8) Marine mammal surveys – narwhal and seals, identification of important feeding and breeding areas. Determination of important food stocks for these species.

8.7 Habitat Banking

Establishing a proponent-led habitat bank is another option that may be considered as an offsetting measure and, once established, can be used to offset serious harm to fish that may result from a number of small projects in the future.

A proponent-led habitat bank is a formalized approach for creating offsets where various offsetting methods, such as habitat creation, enhancement or restoration, are used to achieve offsetting in advance of a project's impact (DFO 2013b). Much like a financial bank, proponents may “withdraw” credits from the habitat bank to offset the serious harm to fish resulting from their project. When the balance of habitat credit in the habitat bank reaches zero, the bank is closed and no more “withdrawals” can be made (DFO 2013b).

Information describing the state of the habitat, taking into account the following considerations would be provided to DFO:

- A suitable proponent-led habitat bank must meet the offsetting principles and be demonstrated to be functional prior to use as a habitat bank;
- Issues of land ownership and access should be clear. Proponents are responsible for ensuring that all required permits are in place. The proposed habitat banking site should not be part of a previous authorization or court-ordered restoration;
- The existence of a habitat bank does not guarantee the authorization of future projects. All projects will be reviewed on their own merit and a decision to authorize a project will be made independently of the existence of a habitat bank; and
- A habitat bank must be evaluated prior to each use as an offset to ensure that the habitat is functioning to provide benefits to fisheries as expected and to determine its value. This will require comparison of the current habitat with the data collected to describe the "before" conditions.

After drawing on the bank, the proponent must document the portion of the bank that has been used. If only a portion of the bank is used for any given offset, it is important to document which part of the bank remains available for future use as offset credits. If the productivity of any part of the bank increases after it has been used as an offset, this increase will not be considered additional banked habitat.

The proponent must maintain detailed records to track the creation and use of habitat banks to avoid double-crediting.

The benefits of establishing a proponent-led habitat bank are that they can:

- Reduce mobilization and construction costs – by constructing one large habitat area once rather than mobilizing and constructing several smaller offset projects each time a *Fisheries Act* Authorization is required;
- Reduce the effectiveness monitoring period – the habitat bank is monitored for a given period and provides regulatory certainty;
- Reduce the review time for obtaining a *Fisheries Act* Authorization – an established offsetting habitat reduces the regulatory review time by DFO as the offsetting habitat is already established; and
- Reduce uncertainty and time lag - offsetting is already established and functioning as fish habitat.

8.8 Offset Habitat Monitoring

A monitoring plan will be created to address both the compliance monitoring of the offset construction activities as well as the effectiveness monitoring of the Offsetting Plan.

Compliance monitoring will be required to assess the immediate effects of construction of the offsetting habitat on the marine environment, assess the effectiveness of the mitigation measures, identify increased sediment levels, and identify additional mitigation or advise construction activities. Compliance monitoring will also confirm the final Project footprint that resulted in serious harm to fish and that the proposed fisheries offsets are installed or implemented as designed.

The objective of the effectiveness monitoring program will be to evaluate and document the stability and functioning of the constructed offset habitat. Specifically:

- Delineate the offsetting habitat to assess stability over a specified monitoring period;
- Document using repeatable videos and photos of the offsetting habitat to show extent of community establishment compared to a reference site;
- Assess fish presence and usage; and
- Assess the functionality of the offset habitat and identify any failures or problems and actions implemented to remediate problems.

8.8.1 Methods

Possible monitoring methods will be similar to those proposed in the application for the existing ore dock *Fisheries Act* Authorization (SEM 2014) and may include:

- Under water video – used to document structural integrity and biological utilization of created offsetting habitat;
- Encrusting epifauna settlement surveys – conducted to document species presence and colonization;
- Larval fish surveys – determining use and settlement rates of target species compared to reference sites; and
- Marine fish and mobile epifauna sampling - determining use and colonization of offset habitat by mobile species.

8.8.2 Monitoring Report

Upon completion of offsetting habitat construction, a monitoring report will be prepared to document that it was created as per the conditions of the Authorization. The report will include documentation of the monitoring of the measures and standards to avoid and mitigate serious harm to fish that were conducted. Dated photographs and inspection reports will be included to demonstrate effective implementation and functioning of mitigation measures and standards described in the Authorization. In the event that mitigation measures did not function as described, details of any contingency measures that were followed to avoid unauthorized serious harm will be included.

8.9 Contingency Measures for the Offsetting Plan

In the event that offset habitat is unsuccessful in offsetting serious harm to fish, or if previously unseen effects to fish and fish habitat are identified, contingency measures may be required to fully counterbalance the losses associated with the Project. Contingency measures and associated monitoring measures will be implemented if the offsetting habitat:

- Is not implemented as intended;
- Fails to remain physically stable, even after remediation, or to provide the habitat conditions intended for the species and life stages of fish for which the offset was intended to benefit, (i.e., rearing and refuge habitat); and
- Does not meet any of the effectiveness criteria at the end of the post-construction 6-year monitoring.

Contingency measures that may be implemented for the Project, if required, will be determined and finalized based on consultation with DFO.

9.0 PERMITTING

9.1 Application for *Fisheries Act* Authorization

The Mary River Project is undergoing a Nunavut Environmental Assessment (EA) under the *Nunavut Planning and Project Assessment Act* (NUPPAA). For Project planning purposes, it is assumed that this process will result in a positive EA recommendation by the NIRB Board and a positive decision from the Indigenous and Northern Affairs Canada (INAC) Minister. The territorial and federal permits directly related to the construction of the Mary River Project cannot be issued until an EA decision allowing the Phase 2 Proposal to proceed is made and the Project Certificate amendment is issued.

Subsection 35(1) of the *Fisheries Act* prohibits the carrying on of a work, undertaking, or activity that results in serious harm to fish that are part of a CRA fishery or to fish that support such a fishery. The Minister of Fisheries and Oceans may issue an authorization with terms and conditions in relation to a proposed work, undertaking, or activity that may result in serious harm to fish under Paragraph 35(2)(b) of the *Fisheries Act*. The *Fisheries Act* Applications Regulations set out the information requirements and documentation that must be submitted by an applicant requesting such an authorization. The DFO Minister cannot issue an Authorization until a federal EA decision is made that allows a project to proceed.

DFO (2013c) provides additional guidance concerning the information requirements and review process for applications for authorization.

9.2 Nunavut and Other Permits

The following is a list of additional permits and authorizations that may be required to construct offsetting measures:

- Financial security for use of Inuit owned land;
- Modification to the Type A water licence for work in and around water; and
- Permit for sampling and handling of fish species.

The list is preliminary and pending further discussions with regulators.

10.0 CLOSURE

We trust this report provides Baffinland with the information required at this time. Should Baffinland have questions regarding the contents of this report, or require any further information, please do not hesitate to contact the undersigned.

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