Grise Fiord & Resolute Bay Community Harbours

Field Program Environmental Management Plan

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Produced By:

Dynamic Ocean Consulting Ltd.
1490 Union Street
Port Moody, BC V3H 3X5

Produced For:

Government of Nunavut – Community & Government Services
PO Box 1000 Station 200
Iqaluit, Nunavut X0A 0H0

Worley
Suite 200-2930 Virtual Way,
Vancouver BC V5M 4X6

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Laura Borden MSc., RPBio.
Senior Marine Biologist
Dynamic Ocean Consulting Ltd

Reviewed and Approved By:

Victoria Burdett-Coutts, MSc., RPBio.
Senior Marine Biologist
Dynamic Ocean Consulting Ltd

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Acronyms and Abbreviations

Acronyms / Abbreviation	Definition
AHJs	Authorities Having Jurisdiction
AISR	Aquatic Invasive Species Regulations
BMP	Best Management Practices
BSB	Below Seabed
CCME	Canadian Council of Ministers of the Environment
CD	Chart datum
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CWPs	Contractor Work Plans
dB	Decibels
DBGS	Depth Below Ground Surface
DFO	Fisheries and Oceans Canada
Dynamic Ocean	Dynamic Ocean Consulting Ltd
ECCC	Environment and Climate Change Canada
EMP	Environmental Management Plan
FAA	Fisheries Act Authorizations
FFHPP	Fish and Fish Habitat Protection Program
GN	Government of Nunavut
GN-CGS	GN – Community & Government Services
GN -DoE	GN – Department of Environment
GN-LAO	GN – Land Administration Office
HADD	Harmful alteration, disruption, and destruction
HTA	Hunter and Trapper Association
HTO	Hunter and Trapper Organization
HWL	High Water Line
IIBA	Inuit Impact and Benefit Agreement
LoA(s)	Letter(s) of Advice
LUP	Land Use Permit
MMO	Marine Mammal Observer
MMR	Marine Mammal Regulations
NIRB	Nunavut Impact Review Board
NMCA	National Marine Conservation Area
NOAA	National Oceanic and Atmospheric Administration
NPC	Nunavut Planning Commission
NRI	Nunavut Research Institute
NTI	Nunavut Tunngavik Incorporated
NuPPAA	Nunavut Planning and Project Assessment Act
NWB	Nunavut Water Board
OHWM	Ordinary high water mark
Pa	Pascals
PPE	Personal Protection Equipment

Acronyms / Abbreviation	Definition
QEP	Qualified Environmental Professional
RAs	Regulatory Authorities
RFR	Request for Review
rms	Root mean square
SAR	Species at Risk
SCOPs	Standards and Codes of Practice
Screening	Screening under Nunavut Agreement Part 4 by the NIRB
SDR	Screening Decision Report
SDS	Safety Data Sheets
SERP	Spill and Emergency Response Plan
SPT	Standard Penetration Testing
the Existing Conditions Field Program	Grise Fiord and Resolute Bay Field Programs
the Geotechnical Program	A component of the broader Existing Conditions Field Program and is inclusive of a) drilling and b) test pits, both of which will occur in on the foreshores of the respective communities
the Project(s)	Grise Fiord Community Harbour Project and Resolute Bay Harbour Community Harbour Project
TI	Tallurutiup Imanga
Worley	Worley Canada Services Ltd.
WQG	Water Quality Guidelines

1. Introduction

1.1. Background and Purpose

The Government of Nunavut – Community & Government Services (GN-CGS) are planning the construction of Community Harbours in Grise Fiord and Resolute Bay, Nunavut. Worley Canada Services Ltd. (Worley), operating as Worley Consulting, has been retained by the GN-CGS to support the detailed design of the Community Harbours. Dynamic Ocean Consulting Ltd. (Dynamic Ocean) is supporting Worley as the Regulatory Lead for the respective Projects (Grise Fiord Community Harbour Project, Resolute Bay Harbour Community Harbour Project). These Community Harbours are part of the Inuit Impact and Benefit Agreement (IIBA) (IIBA, 2019) negotiated for the Tallurutiup Imanga (TI) (Lancaster Sound) National Marine Conservation Area (NMCA).

The Grise Fiord and Resolute Bay Community Harbour Projects will be permitted separately; however, the field programs to support them will be a single permit through the Nunavut Planning Commission (NPC, No. 150435) and the Nunavut Impact Review Board (NIRB, No. 125979) processes.

Grise Fiord and Resolute Bay are located on Ellesmere and Cornwallis Islands in the Qikiqtaaluk Region (see Table 1-1, Figure 1-1, Figure 1-2).

Table 1-1: Field Program Locations

Location	Location Description	Latitude	Longitude
Grise Fiord	Located on the southern shore of Ellesmere Island in Jones Sound.	76° 25.001'N	82° 54.935'W
Resolute Bay	Located on the south shore of Cornwallis Island in Parry Channel.	74° 41.472'N	94° 51.549'W

1.2. Field Program Intension

Several field programs may be conducted in advance of construction to support permitting and design components of the Project.

Field Program may consist of the following:

- Marine Field Study.
- Wildlife & Vegetation Field Study (potential).
- Geotechnical Field Study (drilling and test pits).
- Geophysics Field Study.
- Water and Sediment Quality Study.
- Topographic and Bathymetric Surveys.

Methodological descriptions for the respective programs is provided in Table 3-1 of the NIRB Application Letter (Dynamic Ocean, 2024).

1.3. Study Areas

Study Areas will be developed prior to mobilization into the field to encompass the following Project components:

- Community Harbour.
- Haul Road and Quarry.

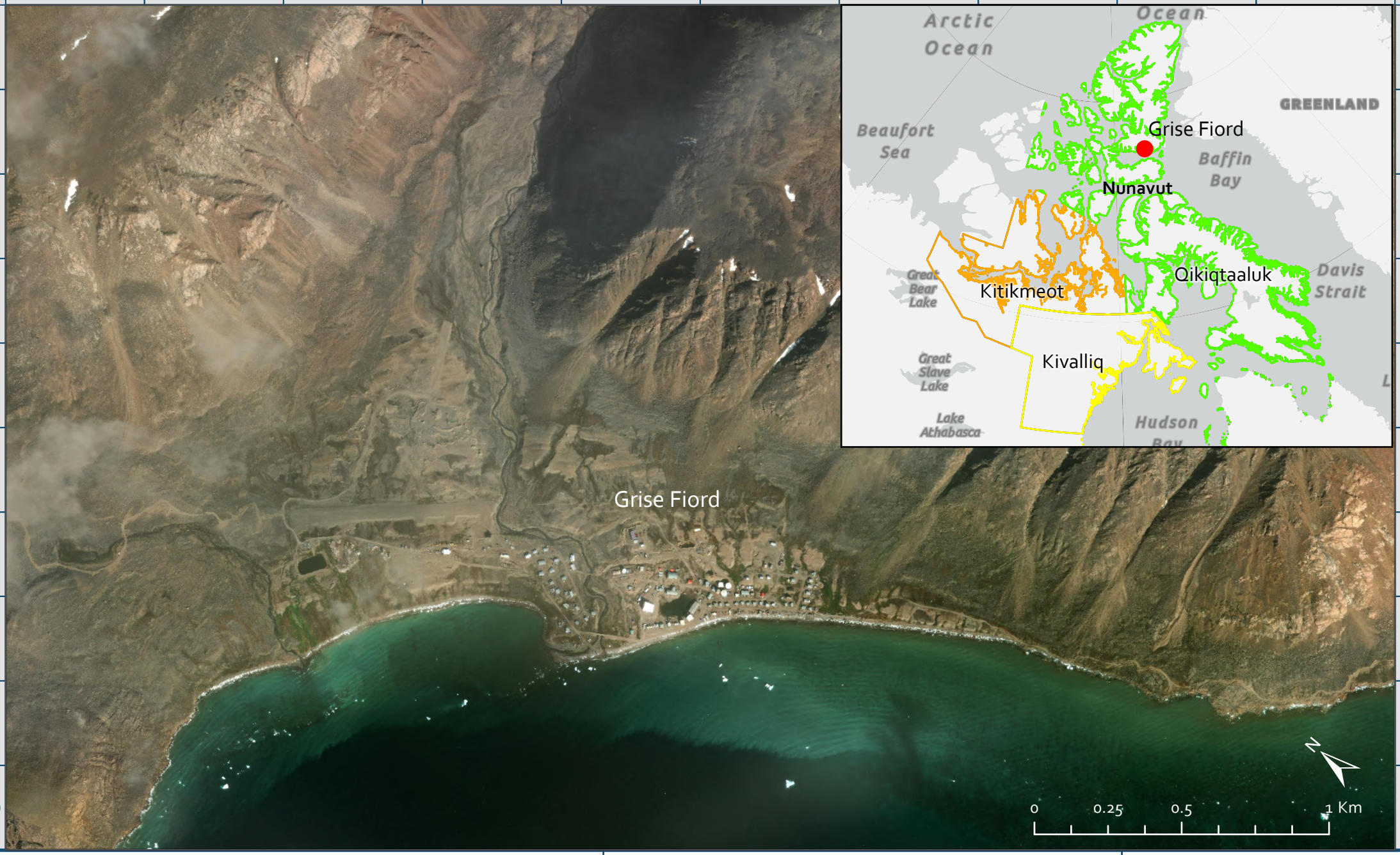
There are two to three locations for each component (Community Harbour, Haul Road, Quarry) currently under consideration, where options may be refined prior to mobilization for the Existing Conditions Field Program. The Study Areas are collectively referred to as the Project Study Areas.
The predicted extent of the Study Areas is described in Table 3-1, Appendix A of the NIRB Application Letter (Dynamic Ocean, 2024).

1.4. Document Intention

This document is the Environmental Management Plan (EMP) that outlines the mitigation and monitoring measures that will be implemented during the Geotechnical Field Study which is largely planned to occur in the Community Harbour Study Area, and potentially in the Quarry Study Area. The Geotechnical Field Study is inclusive of a) drilling and b) test pits. The remaining activities that constitute the Existing Conditions Field Study have minimal environmental effects, and are not discussed in this EMP.

This document has been generated to meet the requirements for compliance with pertinent Authorities Having Jurisdiction (AHJs), inclusive of:

- NIRB.
- Fisheries and Oceans Canada – Fish and Fish Habitat Protection Program (DFO – FFHPP).
- Environment and Climate Change Canada (ECCC).
- Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC).



Spatial Reference
Name: NAD 1983 CSRS UTM Zone 17N
GCS: GCS North American 1983 CSRS
Projection: Transverse Mercator
Map Units: Meter

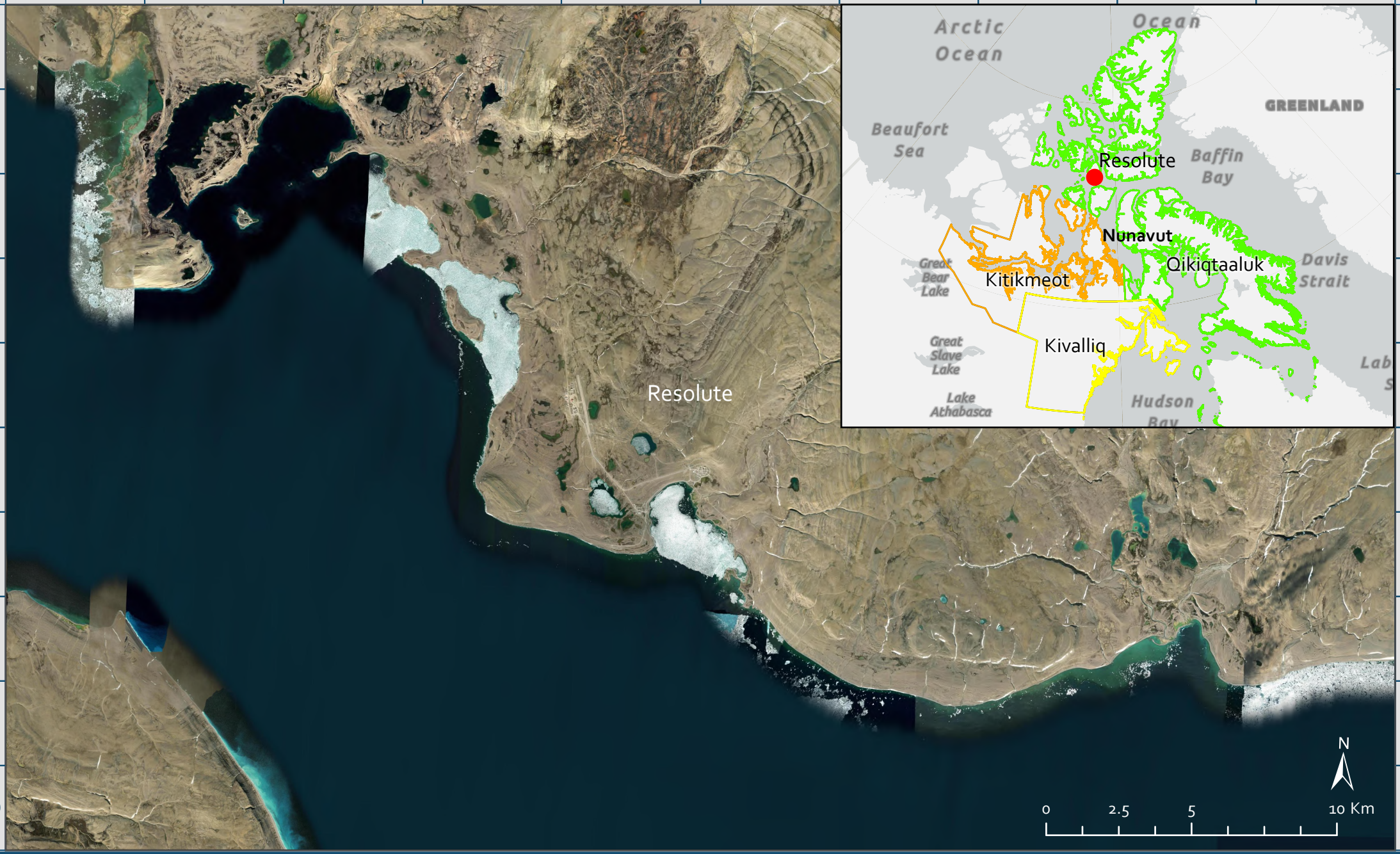
Figure 1-1 Grise Fiord, Nunavut Location

20240411-001	Drawn By : CK	Edited By: CK	Approved By: VBC

Nunavut

Dynamic Ocean Consulting Ltd.

worley
DELIVERING SUSTAINABLE CHANGE



Spatial Reference
Name: NAD 1983 CSRS UTM Zone 15N
GCS: GCS North American 1983 CSRS
Projection: Transverse Mercator
Map Units: Meter

Figure 1-2 Resolute, Nunavut Location

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1.5. Regulatory Compliance

A summary of compliance and permitting requirements is provided in this section and further described in Table 1-2.

1.5.1. Nunavut Planning Commission and the Nunavut Impact Review Board

The territorial and federal permitting processes that govern socio-economic and environmental effects permitting in Nunavut are closely intertwined. As stipulated in the Nunavut Planning and Project Assessment Act (NuPPAA), the NPC is the 'gate keeper' (Responsible Authority) in the determination of referrals to NIRB, which are communicated through a Conformity Determination. The NPC application was submitted on 17 May 2024, initiated formal review on 24 May 2024, with the Conformity Determination (No. 150435) (NPC, 2024) issued on 04 June 2024. The file was subsequently referred to the NIRB (No 125979) where a Screening Decision Report (SDR) is expected to be issued.

The Field Program is expected to require screening under Nunavut Agreement Part 4 by the NIRB (Screening). The Screening will be conducted over 45 to 60 days which will include a 21-day consultation period. Consultation consists of a public comment period via the NIRBs online registry and a NIRB determined distribution list which will include:

- Pertinent AHJs.
- Hamlets of Grise Fiord and Resolute Bay.
- Aviq Hunter Gatherer Association (Hunter and Trapper Organization (HTO), Grise Fiord).
- Resolute Bay Hunter Gatherer Association (Hunter and Trapper Association (HTA)).
- Qikiqtani Inuit Board (QIA).
- Pertinent non-government organizations.

Letters of support for the Field Program has been provided with the NIRB application package from the Aviq HTO and Grise Fiord Hamlet as well as the Resolute Bay HTA and the Resolute Bay Hamlet. Letters of support are provided in Appendix C of the NIRB Application Letter (Dynamic Ocean, 2024).

1.5.2. Fisheries and Oceans Canada – Fish and Fish Habitat Protection Program.

DFO-FFHPP is the AHJ for the *Fisheries Act,* inclusive of several Sections and regulations, as below:

- Section 34.4(1): No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.
- Section 35(1): No person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction (HADD) of fish habitat.
- Section 36: Subject to subsection (4), no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substance that results from the deposit of the deleterious substance may enter any such water.

- Marine Mammal Regulations (MMR)
- Aquatic Invasive Species Regulations (AISR).
- Sections 6 to 10 prohibit any person to import, possess, transport, release, or introduce members of species set out in Part 2 of the schedule into or within areas detailed within the schedule, unless otherwise exempt as outlined within Sections 11 to 17.

Compliance with DFO-FFHPP's mandate can be accomplished through engagement with DFO-FFHPP or through the determination of a Qualified Environmental Professional (QEP). Engagement occurs through a Request for Review (RFR) when there is uncertainty over whether there is the potential for the HADD of fish or fish habitat. When it is clear that HADD will not result, engagement with DFO-FFHPP is not required, although appropriate measures to prevent HADD must be demonstrated in a compliance document.

Based on Dynamic Ocean's experience with similar activities in Nunavut, engagement with DFO-FFHPP will not be required, as it is highly unlikely the geotechnical activities will result in the death of fish or in a HADD. There are measures outlined in the EMP that will minimize negative effects to fish and fish habitat, and there are not expected to be residual environmental impacts.

1.5.3. Nunavut Water Board

The Nunavut Water Board's (NWB) mandate encompasses freshwater. Approval from the NWB will not be required for the geotechnical works at the Community Harbour. However, if geotechnical works at the quarry are planned to occur, a water withdrawal (Type B) license will be obtained prior to the start of the Geotechnical Study.

1.5.4. Crown-Indigenous Relations and Northern Affairs Canada

In order to be in compliance with the Territorial Land Use Regulations, a Class A Land Use Permit (LUP) will be required from CIRNAC. The differentiation between Class A and B LUPs is due to the size of the drill, which in the case of the Project will be in excess of 2.5 tons (S. 8[c]) (CIRNAC, 2010).

On 18 January 2024 the Nunavut Lands and Resources Devolution Agreement was signed by the Government of Nunavut (GN), Nunavut Tunngavik Incorporated (NTI) and the Government of Canada (Government of Canada, 2024). This landmark agreement will transfer decision-making for land management from the Crown to the Commissioner. The transfer is planned to be complete by January 1, 2027; however, at the time of this letter, there is no clear guidance on how the LUP process will change, or if the process be similar to the current GN-CGS LUP process.

An application will be submitted to the CIRNAC and this compliance document outlines measures for compliance with the CIRNAC mandate.

1.5.5. Government of Nunavut

There are no components of the Geotechnical Program that require a LUP from the Government of Nunavut – Government & Community Services (GN-CGS), as all aspects occur on Crown Land.

1.5.6. Environment and Climate Change Canada

ECCC is the AHJ for Section 36 of the *Fisheries Act,* which prohibits the deposit of deleterious substances into waters frequented by fish. Direct engagement with ECCC is not required, and their involvement is generally only from the position of an investigation after an occurrence. Measures are in place to prevent the deleterious substances from entering water bodies.

Table 1-2: List of Compliance Requirements for the Geotechnical Field Program

Legislation	Regulatory Authority	Construction Activity	Required Authorization/ Permit/Approval	Legislation Source
Federal				
Fisheries Act	DFO-FFHPP	In-water works that have the potential to result in HADD, as defined under the *Fisheries Act*	None, assessed under guidance of a QEP.	http://laws-lois.justice.gc.ca/PDF/F-14.pdf
Territorial Lands Act, Territorial Land Use Regulations	CIRNAC	Drilling operations below the ordinary high water mark (OHWM) (drill rig ≥ 2.5 tons	Class A LUP	https://laws-lois.justice.gc.ca/eng/acts/T-7/ https://laws-lois.justice.gc.ca/PDF/C.R.C.,_c._1524.pdf
Territorial				
Nunavut's Scientist Act	NRI	Not required for the Geotechnical Field Program, but will be obtained for the Fish and Fish Habitat Field Program	Research License	
Nunavut Planning and Project Assessment Act	NPC	All aspects of the Field Program, inclusive of the Geotechnical Drilling and Test Pits (Community Harbour).	Conformity Determination	https://laws-lois.justice.gc.ca/eng/acts/N-28.75/
NuPPAA	NIRB		SDR	https://laws-lois.justice.gc.ca/eng/acts/N-28.75/
Schedule 2 of the Nunavut	NWB	If a Geotechnical Field Program occurs at the Quarry Study	Type B license	Nunavut Waters Regulations (justice.gc.ca)

Legislation	Regulatory Authority	Construction Activity	Required Authorization/ Permit/Approval	Legislation Source
Water Regulations		Area, a water withdrawal (Type B) approval will be required.		

2. Program Activity & Schedule

2.1. Geotechnical Programs (Community Harbour)

2.1.1. Drilling Program

Drilling will be undertaken within the Community Harbour Project footprints for both Grise Fiord and Resolute. The intention of the Geotechnical Drilling is to characterize the soil and materials as it relates to the design of the Community Harbours in each location. A summary of the duration, number of boreholes and the depths below seabed (BSB) and below ground surface (DBGS) is provided in Table 2-1.

A description is provided below:

- A 12/7 schedule is proposed for the summer 2024 drilling.
- A 24/7 schedule is proposed for the April 2025 drilling and is required to prevent the water and fuel lines from freezing. Constant drilling will also minimize the risk of casing and drill rods getting stuck in sea ice and/or below the seabed resulting in loss or damage to equipment and the need to re-drill.
- The borehole locations will be field chosen; however, they will all be within the Community Harbour and laydown footprint (see Figure 2-1 [Grise Fiord], Figure 2-2 [Resolute Bay]).
- Rock cores will be collected using triple tube diamond drilling techniques, and soil samples gathered via Standard Penetration Testing (SPT) or Shelby Tube sampling during the wash/mud rotary drilling procedure.
- For marine boreholes, an ice auger will be used to create a hole through the ice to allow for extraction of seawater for drilling.
- Water for terrestrial boreholes will also be extracted from the ocean during open water conditions.
- Land and marine based boreholes require drill mud. Subsequent to drilling, excess soil and rock cuttings will be placed back down the hole with excess cuttings spread around the ground surface. No cuttings or drill fluids will be removed from site.
- Drill fluids used are environmentally friendly and do not require offsite disposal.

Table 2-1: Schedule and Geotechnical Details

Community	Marine Boreholes						Shore Boreholes				
	Schedule	No of Days	Duration of Work Day (hr)	No. of Boreholes	Depth Below Seabed (m, BSB)	Water Depth (m, Chart Datum [CD])	Schedule	No of Days	Duration of Work Day (hr)	No. of Boreholes	Depth Below Seabed (m, BSB) / Ground Surface (m, DBGS)
Grise Fiord	Apr 2025	14	24	8	3 to 15	3 to 15	Sept 2024	2	12	3	15
Resolute	Apr 2025	10	24	8	5 to 10	5 to 15	Sept 2024	2	12	3	6

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Figure 2-1

LEGEND

SCH FOOTPRINT
- OPTION 1
- OPTION 2

WATERWAY
- FRESH WATER CREEK

STUDY AREA
- COMMUNITY HARBOUR
- BOREHOLE (2024 / 2025)
- BOREHOLE AND TEST PIT (2024)

GOVERNMENT OF NUNAVUT
GRISE FIORD COMMUNITY HARBOUR DEVELOPMENT
ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE SURVEY

FOOTPRINT OF TEST PIT AND BOREHOLE INVESTIGATION

Date:	Drawn by:	Edited by:	App'd by:
18-JUN-24	JLC	JLC	VB

Worley Project Number: 317086-54170
DRG No: 2
REV: A

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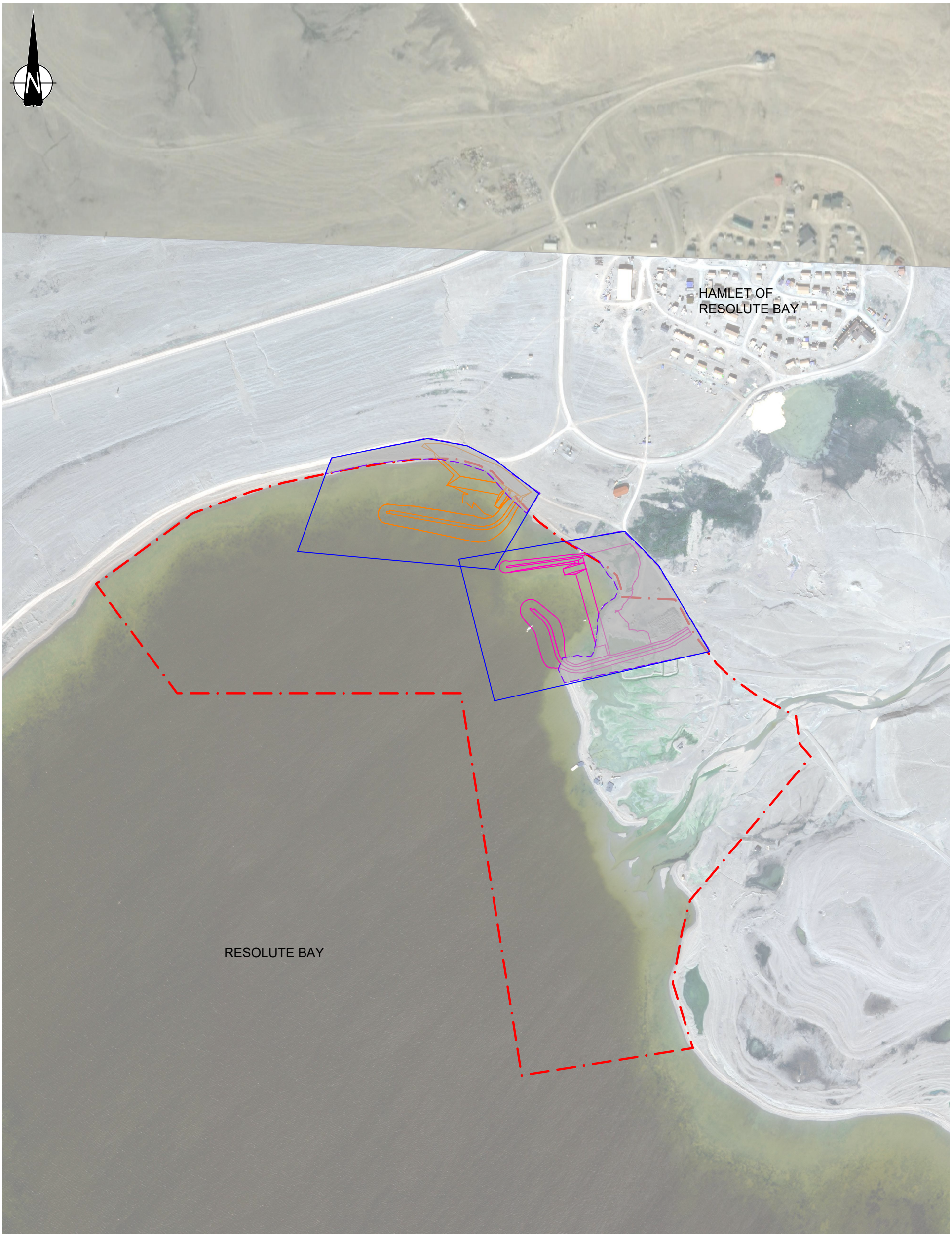

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Figure 2-2

LEGEND

SCH FOOTPRINT

- OPTION 1
- OPTION 2

STUDY AREA

- COMMUNITY HARBOUR
- BOREHOLE (2024 / 2025)
- BOREHOLE AND TEST PIT (2024)

GOVERNMENT OF NUNAVUT
RESOLUTE BAY COMMUNITY HARBOUR DEVELOPMENT
ENVIRONMENTAL AND SOCIO-ECONOMIC BASELINE SURVEY

FOOTPRINT OF TEST PIT AND BOREHOLE INVESTIGATION

Date:	Drawn by:	Edited by:	App'd by:
18-JUN-24	JLC	JLC	VB

Worley Project Number: 317086-54175

DRG No: 2

REV: A

WPC_B_FSK

2.1.2. Test Pit Program

Test pits will be required within the foreshore of the Community Harbour footprints in both Grise Fiord and Resolute Bay. These are required to assess subsurface conditions (excavatability and material types) and to collect samples for standard geotechnical laboratory testing. Test pits will be approximately 1 m in width and be excavated to a depth upon which either refusal on hard stratum, sloughing of sidewalls or if the excavator boom reach is maximized. All test pits will be backfilled the same day with cuttings and bucket compacted.

The Test Pit Program will be conducted over one day in August 2024.

2.2. Drilling Program (Quarry)

A Geotechnical Drilling Study within the Quarry Study Area is not expected to be required. However, if it were to occur, terrestrial boreholes could be drilled up to 15 mbgs. Rock cores would be collected using triple tube diamond drilling techniques, and soil samples gathered via Standard Penetration Testing (SPT) during the wash/mud rotary drilling procedure. Water for terrestrial boreholes would be required from a freshwater source, and therefore the respective communities would be engaged to confirm an appropriate (and logistically feasible) source. Land based boreholes require drill mud which will be re-circulated. Subsequent to drilling, excess soil and rock cuttings will be placed back down the hole with excess cuttings spread around the ground surface. No cuttings or drill fluids will be removed from site. Drill fluids used are environmentally friendly and do not require offsite disposal.

2.3. Equipment

Equipment requirements for the Geotechnical Programs is summarized in Table 2-2.

Table 2-2: Estimated Equipment for the Drilling and Test Pit Geotechnical Programs

Component	Drilling Program	Test Pit Program
Community Harbour – Marine Boreholes / Test Pits	The drilling will be executed using a portable five-ton rotary drill mounted on rubber tracks, with a wooden shack surrounding the operation to protect the drill crew from the elements. The drill and its components will be moved using the drill rig. For marine boreholes, the ice will be used as a floating platform to support the drilling equipment. Pick up trucks will be utilized to transport individuals to and from the drill rig.	No relevant, Test Pit Program is intertidal.

Component	Drilling Program	Test Pit Program
Community Harbour – Land / Intertidal based Boreholes / Test Pits	The drilling will be executed using a portable five-ton rotary drill mounted on rubber tracks. The drill and its components will be moved using the drill rig.	The test pits will be executed using an excavator with bucket attachment.

3. Baseline Conditions

3.1. Marine

A marine baseline survey was conducted in each community in August 2019, with intertidal and subtidal marine conditions described below.

Additional surveys are planned for August 2024, as described in this application.

3.1.1. Grise Fiord

Baseline studies were performed in 2019 to characterise the intertidal and subtidal habitat of the community harbour (Advisian, 2020a). The intertidal shoreline habitat was largely hard substrate dominated by gravel areas that consistently had moderate densities of boulders and infrequently density of sand/mud or other soft substrates. Marine vegetation was minimal with trace abundance only. Amphipods were the only invertebrate observed (in infrequent density) and no fish were present.

Subtidal habitat substrate varied between Option 1 and Option 2 locations, where Option 1 was primarily cobble and sand with frequent gravel and occasional boulder clusters, while Option 2 was primarily sand with frequent gravel and cobble. Higher densities of marine vegetation were observed through within Option 1 habitats, where thread brown algae (possibly *Chordaria sp*.) and rockweed (*Fucus sp.*) were both abundant. Two species of kelp were also observed. In Option 2, thread brown algae was the predominant marine vegetation found throughout the Study Area, with some rockweed observed. Truncated soft-shell clams (*Mya truncata*) were the most common invertebrate observed throughout both Option 1 and Option 2 habitats. Green urchins (*Strongylocentrotus drobachiensis*) were also abundant within Option 1 habitats. Fish observations were limited to low densities of sculpin and gunnels.

3.1.2. Resolute Bay

Baseline studies were performed in 2019 to characterise the intertidal and subtidal habitat of the community harbour (Advisian, 2020b). The intertidal shoreline habitat was largely sandy substrate with infrequent to moderate distribution of gravel. There were no observations of marine vegetation, invertebrates or fish.

Subtidal habitat substrate was observed to primarily be soft substrates (silt and sand) with scattered gravel, cobble and boulders. Marine vegetation was generally present in areas with hard substrates and consisted of thread brown algae, sugar kelp (*saccharina latissima*), rockweed and filamentous green algae. The most common invertebrate observed was the truncated soft shell clam. Tube worms were also observed in trace abundance. No fish were observed.

4. Potential Environmental Effects

Potential negative environmental effects due to the Geotechnical Study are summarized in Table 4-1. There are no residual environmental effects, after the implementation of environmental management as outlined in Section 5.

Table 4-1: Potential effects due to the Geotechnical Study

Effect	Drilling	Test Pits	Section
Disturbance, injury, or mortality to fish and marine mammals due to underwater sound	✔	-	4.1
Marine water quality degradation	✔	✔	4.2
Physical damage to marine fauna (Crushing, burial, or mortality)	✔	✔	4.3
Physical damage to marine fauna (Crushing, burial, or mortality)	✔	✔	4.4
Marine Habitat Modifications	✔	✔	4.4
Impacts to Species at Risk (SAR)	✔	✔	4.5
Waste Production	✔	✔	4.6

4.1. Disturbance or Injury to Fish or Marine Mammals due to Underwater Sound

Drilling Study

There are currently no federal sound disturbance criteria in Canada; however, marine mammal sound threshold guidance is provided by the National Oceanic and Atmospheric Administration (NOAA) (NOAA, 2018), and by DFO through Letters of Advice (LoAs) and *Fisheries Act* Authorizations (FAA) which have consistently been providing underwater acoustic metrics and distance radii relevant to fish and marine mammals.

Anthropogenic sounds in water are categorized as impulsive or continuous in nature (OSPAR OAP, 2017). Impulsive sounds include impact pile driving, air guns, explosions and sonar pings. Where continuous sounds include activities such as vibratory pile driving, drilling rigs, ship engines and sonar (National Research Council, 2003).

The acoustic effect of drilling on the underwater marine environment is not well understood, as available data are limited. Research conducted in Western Australia during geotechnical site

investigations yielded source levels at 1 m of 142 – 145 decibels (dB) re1µPascals (Pa) root mean squared (rms) during drilling and SPT 151 – 160 dB re 1 μPa^2s (Erbe & McPherson, 2017). A similar drilling study, where Worley conducted compliance monitoring had an acoustic range of 121.32 – 148.89 dB re1µPa rms with sound pressures ranging from 1.16 – 27.82 Pa (previous *Fisheries Act* required 30 kPa @ 10 m from sound source). These results are not directly transferable to the geotechnical drilling survey, due to site specific variables that influence the sound such as substrate type, mechanical equipment specifications, water temperature, and salinity. However, it does provide some indication that exceedances are not expected to occur. Negative effects to fish and marine mammals are not anticipated, and sound thresholds are unlikely to exceed DFO's recommendations. Acoustic monitoring is not considered necessary for the Drilling Study.

Test Pit Study

Not relevant to the Test Pit Study. There will be no impacts to the underwater acoustic soundscape.

4.2. Water and Sediment Quality Degradation

Effects to fish health due to sediment mobilization are not expected.

There is the potential for degradation of marine water quality due to accidental spills, however there will be Best Management Practices (BMPs) in place to minimize the potential for spills to occur. If spills do occur, there will be appropriate spill response equipment on site (see Section 5.3.8). The Geotechnical Study will be in compliance with the Spill Planning and Reporting Regulations in Nunavut. Spill response measures will be designed to be implemented for the prevention and management of spills to a worst-case scenario size that could occur as a result of the Study (further described in Section 5.3.8).

Hazardous products associated with the Geotechnical Study that have a potential to be leaked or spilled are provided in Section 9.3 of the NIRB application letter (Dynamic Ocean, 2024).

Drilling Study

The footprint of the drill head (diameter of 150 mm) is minimal and turbidity beyond a compliance monitoring zone (generally 30 m from source) are not expected to occur. Worley has performed environmental monitoring for a multitude of drilling studies in southern locations with open water conditions and compliance monitoring as per Canadian Council of Ministers of the Environment (CCME) Water Quality Guidelines (WQG) (CCME, 2002) has never been required.

Test Pit Study

The Test Pit Study will occur in out-of-water tidal conditions, and the pits will be infilled prior to the inundation of water. The excavator operator will be instructed to compact the disturbed sediment to minimize its mobilization into the water column.

4.3. Physical Damage to Marine Organisms (Crushing, Burial or Desiccation)

Drilling Study

Direct mortality to fish is not considered to be likely given the small footprint of the drill heads and the underwater sounds are not expected to cause fish mortality. Since the Study will be executed in late winter/early spring when the bay is frozen and ice is approaching maximum thickness, the presence of whales or fish (e.g. Arctic Char or Arctic Cod) is not expected.

Test Pit Study

The Test Pit Study will occur in out-of-water tidal conditions, and the Worley Field Technician will perform an intertidal salvage of macro invertebrates within the test pit footprint and the path that the excavator needs to travel below the High-Water Line (HWL).

4.4. Modification and Destruction of Fish Habitat

Drilling and Test Pit Studies

The permanent loss of fish habitat will not occur as the Geotechnical Study is temporary (see Schedule in Section 2.2) and there are no activities with an effect to fish habitat.

4.5. Species at Risk

Drilling and Test Pit Studies

The likelihood of SAR occurring in the Project Study Area is low due to habitat characteristics at both sites. Effects to SAR are not expected and are covered in the mitigation and monitoring measures proposed for fish and marine mammals (see Section 5).

4.6. Waste Production

Drilling and Test Pit Studies

The Geotechnical Study waste generation is expected to be minimal, and the measures outlined in Section 5.3.7 will be followed.

5. Environmental Management

5.1. Guidelines and Best Management Practices

The following guidelines and BMPs are relevant to the Geotechnical Study.

- DFO: Fish and Fish Habitat Protection Policy statement (DFO, 2019a).
- DFO: Measures to Protect Fish and Fish Habitat (DFO, 2023).
- DFO: Interim code of practice: End-of-pip fish protection screens for small water intakes in freshwater (DFO, 2020).

- Canadian Construction Association: CCA 81 – 2001: A Best Practices Guide to Solid Waste Reduction (Canadian Construction Association, 2001).
- Government of Nunavut - Department of Environment (GN-DoE): Environmental Guideline for the General Management of Hazard Waste (Government of Nunavut, 1999).
- Spill Planning and Reporting Guide (Government of Nunavut, 2003).

5.2. Roles and Responsibilities

The work shall be overseen by the Worley Geotechnical Lead, in addition to a local helper who will function as a wildlife, fish, and marine mammal observer (MMO). The main purpose of this role will be to monitor for the presence and behaviour of seals, and to document their proximity to the drill rig. A communication protocol (e.g. mobile phones, VHF radio) must be established between the local helper, the Worley Team and the drilling Contractor to enable effective regulatory compliance procedures.

5.3. Mitigation Measures

General practices will be put in place to avoid environmental incidents. Mitigation measures in place to reduce the likelihood include those listed in Sections 5.3.1 through 5.3.8. Additional measures that are required through conditions issued by NIRB, the NWB and CIRNAC pertinent to the Geotechnical Study must also be followed.

Contractor Work Plans (CWPs) may be developed to further support regulatory compliance measures (such as spill response and waste management plans); however, the details provided in this section are sufficient for the Geotechnical Study to be carried out in in compliance with permits and approvals.

5.3.1. General

Table 5-1: General Mitigation

ID	Mitigation Measure
G1.	Works shall comply with requirements of applicable laws, legislations, and BMPs.
G2.	Adherence to “Best Management Practices” for working in the marine environment (see Section 5.1).
G3.	If HADD to marine mammals or fish is observed, the event will be immediately reported to DFO at 1-855-852-8320.
G4.	The Contractor shall suspend all activities should any dead fish or wildlife, or any injured wildlife be observed.
G5.	Copies of all permits shall be on site and readily available.
G6.	Personnel shall be adequately trained.
G7.	Routine inspections of the worksite, equipment, as required to ensure regulatory compliance.
G8.	General housekeeping rules will be used to minimize clutter and keep work areas tidy.

ID	Mitigation Measure
G9.	The Worley Geotechnical Lead will conduct a 'tail-gate' meeting prior to the start of the Study to confirm that all personnel are aware of regulatory compliance requirements and understand their responsibilities (e.g. during spill response).
G10.	The Worley Geotechnical Lead will report all non-compliances and incident reporting as indicated in Sections 5.7.2 and 5.7.3.
G11.	The Worley Geotechnical Lead will complete all AHJ communications as summarized in Section 5.6.
G12.	The Contractor will be provided with a copy of this compliance document and all Study permits in advance of mobilization to the site.

5.3.2. Fish and Fish Habitat (Including Marine Mammals)

Table 5-2: Fish and Fish Habitat

ID	Mitigation Measure
FFH1.	The Contractor shall implement measures designed to minimize disturbance to seabed sediments and benthic communities and marine wildlife when carrying out Study activities within the marine environment.
FFH2.	All aquatic works will cease in the event of fish kill/injury or stress to aquatic wildlife is observed near the Site until a QEP can provide guidance for the continuation of works.
FFH3.	Water intakes for drilling in marine environment will be of an appropriate mesh size to not impinge fish on the screen and will be in compliance with DFO's Standards and codes of practice (SCOPs) for end-of-pipe fish screens (DFO, 2019b).
FFH4.	Drilling activity will be ceased if there is a risk of physical harm to any seals from direct contact. Activity will only resume once there is no longer risk of injury to seals from direct contact.
FFH5.	An MMO will be onsite at all times during drilling to confirm the presence of marine mammals and document any behavioural interferences due to drilling.
FFH6.	The MMO will maintain records of the seal observations and document the species, behaviour and distance from the drilling.

5.3.3. Wildlife Management

Table 5-3: Wildlife Management

ID	Mitigation Measure
WL1.	A wildlife monitor/MMO will be present at all stages of the Geotechnical Study.

ID	Mitigation Measure
WL2.	All project personnel will participate in wildlife safety training, including bear safety training. This will be carried out during the site orientation.
WL3.	Waste material bins to prevent scavenging by wildlife and feral animals, as well as to control odour.
WL4.	All site personnel will be instructed that the feeding of terrestrial or marine wildlife is prohibited.

5.3.4. Water Quality Management

Table 5-4: Water and Sediment Quality

ID	Mitigation Measure
WQM1.	Drill muds, additives, and other products shall be non-toxic and environmentally friendly.

5.3.5. Air Quality

Table 5-5: Air Quality

ID	Mitigation Measure
AQ1.	There will be no unnecessary idling of equipment or vehicles.
AQ2.	Machinery and equipment will be maintained in good working order to minimize emissions.

5.3.6. Fueling and Chemical Storage

Near or over water re-fuelling is required due to the nature of the Drilling Study and because it is standard practice for marine-based studies. Measures are in place to minimize negative effects to the marine environment. These measures have been developed using BMPs and industry standard measures to minimize or prevent spills to the marine environment.

Table 5-6: Fuel and Chemical Storage

ID	Mitigation Measure
FCS1.	Fuelling of equipment that will be over and near water; the plan will outline the use of secondary containment, drip trays, fuel line check valves, and spill kits.
FCS2.	All stationary petroleum products storage facilities shall be marked with flags, posts or similar devices so that they are at all times plainly visible.

ID	Mitigation Measure
FCS3.	All fuel storage containers examined for leaks a minimum of once every day and all leaks repaired immediately. Further they will be covered to keep out rainwater and snow.
FCS4.	Should fuel storage be required, fuel storage containers shall at a minimum be 31 m above the normal high water mark of any natural water body.
FCS5.	All fuel containers will be marked with the Contractor's name.
FCS6.	Procedures and methods will be in place to prevent spillage of deleterious substances or debris falling into the marine environment including measures to minimize the spread to surrounding lands or into water.
FCS7.	The contractor will maintain an inspection record for equipment used in or near the marine environment using hydraulic, fuel, and lubrication systems.
FCS8.	Routine inspection of storage areas, secondary containment, and containers for leaks, and addressing leaks or containers found in poor condition or improperly sealed.
FCS9.	The Contractor will provide a list of all chemicals and expected volumes which are planned to be mobilized to site and stored for use. The plan will also include a description of how chemicals will be stored on site.

5.3.7. Waste Management

Table 5-7: Waste Management

ID	Mitigation Measure
WM1.	Storage and handling procedures designed to prevent harm to personnel and the environment from hazardous materials, as per the Safety Data Sheets (SDS), shall be implemented. SDS will be kept on site.
WM2.	Procedures and methods in place during the Drilling Study that prevents waste material from entering the environment. This will include plans on how food, food waste, and other attractants will be handled, stored, and disposed of safely to avoid attracting and habituating animals.
WM3.	All garbage and debris shall be kept in a covered metal container until disposed of. All wastes shall be kept inaccessible to wildlife at all times.
WM4.	All waste shall be properly sealed and transported to the appropriate disposal facilities if required. Records of disposal shall be maintained and available upon request.
WM5.	Engine oils and lubricants will be stored in separate leak-proof containers.
WM6.	Storage tanks used for mixing muds and storing fluids for the quarry drilling will be within a self -contained closed loop system to allow for reusing and minimization of waste.
WM7.	Routine inspection of worksites, equipment, as required to ensure regulatory compliance and spill prevention.

ID	Mitigation Measure
WM8.	All drill fluids used will be bio-degradable gum xanthum and have minimal impact on the environment.
WM9.	All fluids used for drilling activities will be properly contained and labelled. Secondary containment will be provided.
WM10.	Waste will be stored in labelled containers and appropriately segregated based on material.
WM11.	Disposal of drill wastes shall be undertaken in a way that does not cause harm to the environment.

5.3.8. Spill Prevention and Emergency Response

Steps and measures to be taken in the event of an accidental spill are summarized in Section 5.3.8.1.

Table 5-8: Emergency Spill Response

ID	Mitigation Measure
SERP1.	Emergency response kits and spill kits will be onsite and will be appropriate to the type and amount of hazardous materials associated with the Geotechnical Study. Spill kits will contain materials appropriate for the potential products to be spilled, taking into consideration the surrounding environment and seasonal conditions (e.g. iced ocean). The emergency response kits will include appropriate Personal Protection Equipment (PPE) such as gloves and goggles.
SERP2.	All personnel will be instructed on their role and responsibility in the event of spill response requirements, in addition to the location of spill response equipment.
SERP3.	The Contractor's personnel will understand their roles and responsibilities in the event of a spill in advance of the start of the Geotechnical Study.
SERP4.	The Contractor will have on hand, emergency response kits and spill kits to manage spills of a predictable size for their operations. All contractor personnel will be aware of the location of the spill response materials and they will be in a location that is easily accessible in the event of a spill.
SERP5.	In the event a spill occurs, spill response will be carried out as outlined in Section 5.3.8.1 and notifications to AHJ and the GN-CGS as indicated in Section 5.7.3 will be undertaken.
SERP6.	The Contractor will provide a list of accidental discharges and of corrective actions taken to the Worley Geotechnical Lead.

5.3.8.1. Spill Response Protocol

Accidental releases of deleterious substances, such as hydrocarbons, can affect soils, freshwater fish and aquatic life, terrestrial wildlife, birds, or marine mammals or fish in the area. Whether the spill is on

land, water, or snow/ice, a Spill and Emergency Response Plan (SERP), as outlined below, will be implemented if a spill occurs during the Study:

- In the event of a spill, activities will be immediately suspended, and emergency response procedures will be initiated.
- Stop the spill or leak, where practical and safe to do so.
- Identify, if possible, the substance involved and review applicable SDS prior to attempting further mitigation. Obtain safety equipment as necessary before proceeding.
- Obtain and use spill control equipment to contain the spill.
- Contain any spill to water bodies by installing berms or aquatic containment (e.g., floating oil booms) appropriate for the type and size of spill.
- Contain the spill on land with as required (e.g. sandbags, spill pads).
- Contain any spill on snow or ice and prevent spilled liquids from moving towards waterways using absorbent materials or a snow dike.
- Determine if external support, such as local authorities, should be called to assist.
- Determine if the spill is reportable by consult per the Reportable Threshold Table (http://www.enr.gov.nt.ca/programs/hazardous-materials-spills/reporting-spills).
- Divert potential runoff away from the spill area, if possible.
- Store and/or dispose of contaminated materials resulting from the spill appropriately.
- Determine the extent of the spill, volume, area affected, and equipment required to conduct remediation works.
- Plan and implement remediation works.
- Complete an incident report.

5.3.9. Reclamation

Reclamation is not required given the location that the Geotechnical Study is being undertaken. However, the drill and test pit footprints will be left in the same condition they were in prior to the respective activities.

Table 5-9: Emergency Spill Response

ID	Mitigation Measure
RC1.	After the Geotechnical Study is complete, the area will be cleaned and restored. This includes the removal of all equipment; the plugging and capping of drill holes and waste clean-up.
RC2.	All equipment used to conduct the studies will be removed and transported offsite.
RC3.	Any spills will be cleaned-up and the area remediated and restored prior to completion of the Geotechnical Study.
RC4.	Drill holes will be appropriately filled and capped.
RC5.	Drill cuttings shall be discharged to their marine or terrestrial origin within a small footprint

5.4. Adaptive Management

During the Geotechnical Study, it may be necessary to modify methodology and address site conditions not initially foreseen. Should adaptation to field conditions need to be addressed, the MMO on site, in conjunction with the Contractor and Worley, will develop the update to the methodology and mitigation measures will be updated.

5.5. Communication

5.6. Authority Having Jurisdiction Communication

- CIRNAC will be contacted as required for conditions in the respective permits, which is expected to include the following.
    - The Worley Geotechnical Lead shall communicate via phone call or virtually with a Land Use Inspector at the Iqaluit office of CIRNAC, phone number (867)-975-4517, at least 48 hours prior to the commencement of this land use operation.
    - The Worley Geotechnical Lead shall advise a Land Use Inspector at least ten (10) days prior to the completion of the Drilling Study to confirm plans for completion of reclamation (see Section 5.3.9).
    - The Worley Geotechnical Lead shall provide notification of commencement of the land use operation to the Engineer at the Iqaluit office of CIRNAC either by emailing landsmining@aandc.gc.ca or by telephone at (867)-975-4283.

5.7. Reporting

5.7.1. Regulatory Authority Annual Reporting

Annual reports will be required to be submitted to CIRNAC, and Nunavut Research Institute (NRI), and can be provided to any AHJ upon request.

5.7.2. Non-Compliance

In the event of non-compliance or potential non-compliance with this compliance document and applicable environmental permits, the MMO has the authority to suspend construction activities until the appropriate mitigation measure can be implemented. Non-compliances will be reported to pertinent AHJ as required.

5.7.3. Incident Reporting

Incident reporting is required to pertinent AHJ, including the GN-DoE and DFO. The GN-CGS and Worley must all be notified by the Contractor when a reportable spill has occurred. Incident reporting must be completed within 24 hours of the occurrence.

Incident reporting will be the responsibility of the Contractor and will at a minimum consist of the following, which is taken from the Spill Contingency Planning and Reporting Regulations S.11(1):

- Date and time of call.
- Location, date and time of spill.
- Direction spill is moving.
- Name and contact details for a person close to the location of the spill.
- Type of contaminant and quantity spilled.
- Cause of the spill.
- Whether the spill is continuous or has been contained.
- Evacuation procedure (if required).
- Spill response actions taken prior to reporting.
- Name owner or person in charge, management or control of contaminants spilled.
- Assistance required for successfully containing and cleaning the spill or release.

5.7.3.1. Government of Nunavut

Currently the Spill Contingency Planning and Reporting Regulations outline reporting requirements based on specific volumes. Reporting requirements for spill magnitudes of individual contaminants are provided in Schedule B of the Regulations (R-068-93) (see Appendix 1).

A spill of any kind to any environment (aquatic or terrestrial) is reportable to the GN-DoE 24-hour spill report line (1-867-920-8130) and through their fillable form (Available at: https://www.gov.nu.ca/environment/documents/nt-nu-spill-report-form-pdf).

5.7.3.2. Fisheries and Oceans Canada

Any activities or spills that have the potential to or have caused HADD to fish or fish habitat will be reported to DFO (1-855-852-8320).

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APPENDIX A: Spill Contingency Planning and Reporting Regulations – Schedule B

SCHEDULE B

(Section 9)

Item No.	*TDGA Class*	*Description of Contaminant*	*Amount Spoiled*
1.	1	Explosives	Any amount
2.	2.1	Compressed gas (flammable)	Any amount of gas from containers with a capacity greater than 100 l.
3.	2.2	Compressed gas (non-corrosive, non flammable)	Any amount of gas from containers with a capacity greater than 100 l.
4.	2.3	Compressed gas (toxic)	Any amount
5.	2.4	Compressed gas (corrosive)	Any amount
6.	3.1, 3.2, 3.3	Flammable liquid	100 l
7.	4.1	Flammable solid	25 kg
8.	4.2	Spontaneously combustible solids	25 kg
9.	4.3	Water reactant solids	25 kg
10.	5.1	Oxidizing substances	50 l or 50 kg
11.	5.2	Organic Peroxides	1 l or 1 kg
12.	6.1	Poisonous substances	5 l or 5 kg
13.	6.2	Infectious substances	Any amount
14.	7	Radioactive	Any amount
15.	8	Corrosive substances	5 l or 5 kg
16.	9.1 (in part)	Miscellaneous products or substances, excluding PCB mixtures	50 l or 50 kg
17.	9.2	Environmentally hazardous	1 l or 1 kg
18.	9.3	Dangerous wastes	5 l or 5 kg
19.	9.1 (in part)	PCB mixtures of 5 or more parts per million	0.5 l or 0.5 kg
20.	None	Other contaminants	100 l or 100 kg