Arctic Bay Harbour Development

Geotechnical Drilling Survey Regulatory Compliance & Environmental Management Plan

Public Services and Procurement Canada

16 December 2020

317071-00037

Advisian Worley Group

Ikpiaryuk Services Ltd.

advisian.com

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Abbreviations and Acronyms

Acronym/abbreviation	Definition
BMP	Best Management Practices
CCME	Canadian Council of Ministers of the Environment
CD	Chart datum
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
COSEWIC	Committee on the Status of Endangered Wildlife Canada
cSEL	Cumulative sound exposure levels
CWPs	Contractor Work Plans
DAS	Disposal at sea
dB	Decibels
DFO	Fisheries and Oceans Canada
DFO-SCH	Fisheries and Oceans Canada – Small Craft Harbours
DoE	Department of Environment
ECCC	Environment and Climate Change Canada
FAA	Fisheries Act Authorizations
FFHPP	Fish and Fish Habitat Protection Program
GN	Government of Nunavut
GN-LAO	GN Lands Administration Office
HADD	Harmful alteration, disruption, and destruction
HF	High-Frequency
IIBA	Inuit Impact and Benefit Agreement
IUCN	International Union for Conservation of Nature
kPa	Kilopascals
LF	Low-Frequency
LoA(s)	Letter(s) of Advice
LUP	Land Use Permit
mbgs	Metres below ground surface

Acronym/abbreviation	Definition
MF	Mid-Frequency
MMO	Marine Mammal Observer
NBRLUP	North Baffin Regional Land Use Plan
NIRB	Nunavut Impact Review Board
NMCA	National Marine Conservation Area
NOAA	National Oceanic and Atmospheric Administration
NPC	Nunavut Planning Commission
NRI	Nunavut Research Institute
NWB	Nunavut Water Board
OHWM	Ordinary high water mark
OW	Otariid Pinnipeds
PPE	Personal Protection Equipment
PSPC	Public Services and Procurement Canada
PTS	Permanent threshold shifts
PW	Phocid Pinnipeds
QEP	Qualified Environmental Professional
RAs	Regulatory Authorities
RFR	Request for Review
rms	Root mean square
SAR	Species at Risk
SARA	Species at Risk Act
SCH	Small Craft Harbour
SCOPs	Standards and Codes of Practice
SDS	Safety Data Sheets
SDR	Screening Decision Report
SERP	Spill and Emergency Response Plan
SPL	Sound pressure level
SPT	Standard Penetration Testing

Acronym/abbreviation	Definition
the Program	Geotechnical investigations in Arctic Bay
the Project	Arctic Bay SCH
TI	Tallurutiup Imanga
TTS	Temporary threshold shifts
WQG	Water Quality Guidelines

1 Introduction

1.1 Background and Purpose

Fisheries and Oceans Canada – Small Craft Harbours (DFO-SCH) through the Public Services and Procurement Canada (PSPC) are planning the construction of a small craft harbour (SCH) in the Hamlet of Arctic Bay, Nunavut. The Arctic Bay SCH (the Project) is part of the Inuit Impact and Benefit Agreement (IIBA) (IIBA 2019) negotiated for the Tallurutiup Imanga (TI) (Lancaster Sound) National Marine Conservation Area (NMCA).

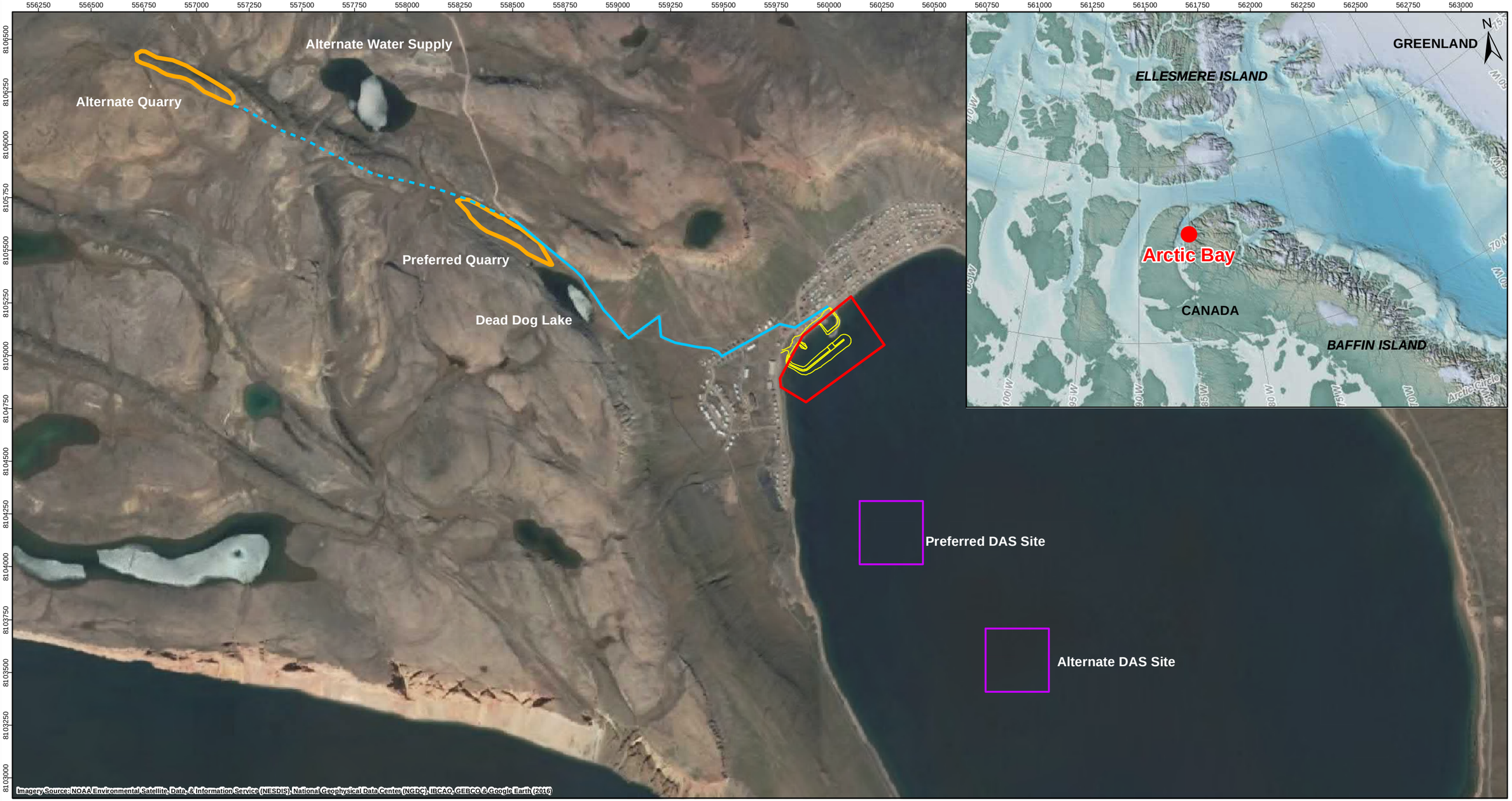
Arctic Bay is a hamlet on the northwest coast of Baffin Island (Borden Peninsula), in Admiralty inlet (73° 1.529'N, 85° 7.203'W) (see Figure 1-1), and is located in the Qikiqtaaluk Region, within the North Baffin Regional Land Use Plan (NBRLUP) area (NPC 2000).

Worley Canada Services Ltd. and Ikpiaryuk Services Ltd. in joint venture, operating as Advisian-Ikpiaryuk JV, have been retained by PSPC to perform detailed design, community consultation and regulatory support services for the development of the SCH. To continue with the detailed design, it's imperative to better understand site conditions, thus the requirement for field investigations.

Advisian was involved in the feasibility phase of the Project where Nunavut Planning Commission (NPC) and Nunavut Impact Review Board (NIRB) permits were obtained in 2019. These permits were then carried forward for Advisian-Ikpiaryuk's 2020 field program. An amendment to the existing NPC determination was submitted and reviewed to include the geotechnical investigations (the Program) planned for early spring of 2021. The NPC has reissued a conformity determination to confirm that review by the NIRB is not required as the scope is encompassed in the initial Screening Decision Report (SDR). Permitting requirements are summarized in Table 1-1.

The focus of this compliance document is alignment of the 2021 Program with pertinent regulatory authority mandates where compliance must be confirmed through the professional opinion of a Qualified Environmental Professional (QEP), appropriate mitigation measures and in some cases permits and approvals. This document has been generated to meet the requirements for compliance with DFO – Fish and Fish Habitat Protection Program (FFHPP), Environment and Climate Change Canada (ECCC), the Nunavut Water Board (NWB) and the Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC).

The purpose of the Program is to gather relevant information for the design of the SCH and the quarry development. Key information includes: confirmation of bedrock depth within the SCH and to identify the presence of obstructions; marine sediment sample collection for analysis should disposal at sea (DAS) be required; core samples within the quarry location (preferred location on Figure 1-1) to investigate rock quality. The variable mandates of the identified Regulatory Authorities (RAs) changes depending on whether drilling is occurring at the quarry or at the SCH. CIRNAC is pertinent to the SCH, DFO-FFHPP to both locations, and the NWB to the quarry. Additional regulatory compliance requirements are summarized in Section 1.2 and Table 1-1.



Legend

- Site Location
- **SCH Footprint**
  - Option 1 Layout
  - SCH Study Area
- **DAS SIte**
  - DAS Site
- **Haul Route**
  - Potential Haul Route - Existing Road
  - Potential Haul Route
- Potential Quarry

0 200 400 800
Metres

1:18,000

WGS 1984 UTM Zone 16N

N

Aerial Image: GoogleEarth, July 2016
Locations approximate.

PUBLIC SERVICES AND PROCUREMENT CANADA
ARCTIC BAY HARBOUR DEVELOPMENT

PROJECT LOCATION

Date: 16-DEC-20	Drawn by: KR	Edited by: KR	App'd by: VB
Public Services and Procurement Canada / Advisian / Kpiaryuk Services Ltd.		Project No. 317071-00037	
		FIG No 1-1	REV 0

PLOT DATE & TIME: 2020-12-16 9:43:37 AM USER NAME: Kenneth W.Ritchie
SAVE DATE & TIME: 2020-11-10 11:57:33 AM ISSUING OFFICE: BURNABY GIS

FILE LOCATION: U:\YVR\317071\00037_PWGS_ArcBayCES\10_Eng\16_Geomatics\01_MXD\Baseline\Fig1-1_AB_Site_Location.mxd

1.2 Regulatory Compliance

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

1.2.1 Nunavut Planning Commission and the Nunavut Impact and Review Board

In 2019, the NPC issued Conformity Determination (No. 149159) (NPC 2019) on June 3, 2019. Soon after the Field Program was referred to NIRB which subsequently issued a Screening Decision Report (SDR) (No 19YNO31) (NIRB 2019) on August 15, 2019. On December 10, 2020, NPC issued a Conformity Determination (No. 149425) (NPC 2020) for the amendment of the 2019 field programs to include the upcoming field work. The conformity determination confirms further review by the NIRB is not required, as the initial SDR encompasses the scope of work.

1.2.2 Fisheries and Oceans Canada

Sections 34 and 35 of the *Fisheries Act*, is administered by DFO-FFHPP. The fish and fish habitat protection provisions of the *Fisheries Act* include:

- *a prohibition against causing the death of fish, by means other than fishing (Section 34.4);*
  - *34.4 (1) No person shall carry on any work, undertaking or activity, other than fishing, that results in the death of fish.*
  - *a prohibition against causing the harmful alteration, disruption or destruction of fish habitat (Section 35);*
- *35. (1) No person shall carry on any work, undertaking or activity that results in harmful alteration, disruption or destruction of fish habitat;*
- *a framework of considerations to guide the Minister's decision-making functions (section 34.1); and,*
- *ministerial powers to ensure the free passage of fish or the protection of fish or fish habitat with respect to existing obstructions (Section 34.3).*

Compliance with DFO-FFHPP's mandate can be accomplished through engagement with DFO-FFHPP or through the determination of a QEP. Engagement occurs through a Request for Review (RFR) when there is uncertainty over whether there is the potential for the harmful alteration, disruption or destruction of fish or fish habitat (HADD). 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.

1.2.3 Nunavut Water Board

The NWB's mandate only encompasses freshwater, so they are only considered for the drilling program activity at the quarry. Compliance with the NWB will be accomplished through the submission of an application. Permitting is required for the water withdrawal (Type B) and disposal of drill mud waste (Authorization) (NWB 2014). An application will be submitted to the NWB and this compliance document outlines measures for compliance with the NWB mandate.

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

1.2.5 Government of Nunavut

In order to be in compliance with the Territorial Land Use Regulations, A LUP will be also required from the Government of Nunavut Land Administration Office (GN-LAO) for the drilling works at the quarry. This area is considered Commissioners Land which is defined in the *Nunavut Act* s.49. The quarry is situated on '*untitled land within the municipal boundary excluding Federal Lands*. Similar to the CIRNAC LUP, the differentiation between a Class A and a Class B LUP is determined by the size of the drill (Territorial Land Use Regulations S8).

1.2.6 Environment and Climate Change Canada

ECCC is the RA 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 1-1 List of Compliance Requirements for the Program

Legislation	Regulatory Authority	Construction Activity	Required Authorization/ Permit/Approval	Additional Details	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		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 (SCH drilling)	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	Geotechnical drilling	Research License	Extension request for existing Permit 02 05819N-M	
Nunavut Planning and Project Assessment Act	NPC	Geotechnical drilling	Conformity Determination	Conformity Determination No 149425	https://laws-lois.justice.gc.ca/eng/acts/N-28.75/
Nunavut Planning and Project Assessment Act	NIRB	Geotechnical drilling	Screening Decision Report	Existing 2020 field permit No. 19YN031	https://laws-lois.justice.gc.ca/eng/acts/N-28.75/
Nunavut Waters and Nunavut Surface Rights Tribunal Act	NWB	Water withdrawal for quarry drilling	Type B	Water withdrawal is expected to be <50 m^3, which falls under an Authorization	https://laws-lois.justice.gc.ca/eng/acts/N-28.8/

Legislation	Regulatory Authority	Construction Activity	Required Authorization/ Permit/Approval	Additional Details	Legislation Source
Territorial Lands Act, Territorial Land Use Regulations	GN-LAO	Drilling operations on Commissioners Land (drill rig ≥ 2.5 tons (quarry drilling)	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

2 Program Activity & Schedule

2.1 Activity

The geotechnical drilling survey is anticipated to require approximately ten (10) days in total to complete with 24/7 operations. A 24/7 schedule 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.

A total of eight (8) boreholes will be drilled; three (3) terrestrial and five (5) marine. The borehole locations will be field chosen; however they will all be within the SCH and Quarry 2 footprints. Terrestrial boreholes will be drilled up to 15 metres below ground surface (mbgs) and marine boreholes from 5 to 10 m below seabed, approximately -7 to -20 m Chart Datum (CD). Rock cores will be collected using triple tube diamond drilling techniques, and soil samples gathered via Standard Penetration Testing (SPT) 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 be fresh water pumped from the Alternate Water Supply Lake or Dead Dog Lake (see Figure 1-1 for location). Approximately 2,000 to 3,000 litres of water will be used per borehole for both marine and terrestrial boreholes.

2.2 Schedule

The Program will occur in March or April of 2021 over ten (10) days of work operating on a 24-hour schedule. At this time in Arctic Bay there is expected to be between 10 and 16.5 hours of daylight, with sunrise between 5:30 a.m. and 7:00 a.m. and sunset between 8 p.m. and 10 p.m. Refer to Figure 2-1 for the distribution of daylight between March and April.

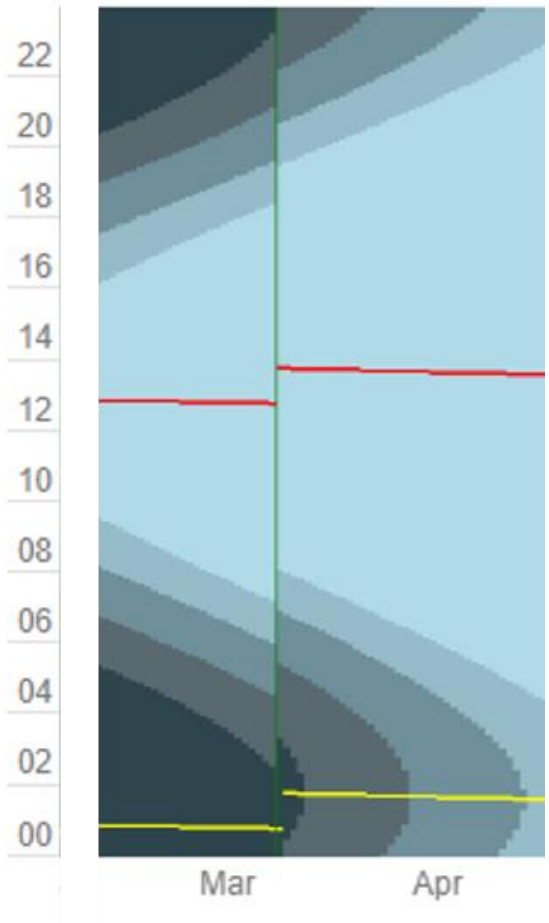


Figure 2-1 March and April Distribution of Daylight for Arctic Bay

Source: Time and Date AS (2020)

2.3 Equipment

The drilling will be executed using a portable five-ton rotary drill mounted onto skids, with a wooden shack surrounding the operation to protect the drill crew from the elements. The drill and its components will be moved using heavy equipment such as front-end loaders. For marine boreholes, the ice will be used as a floating platform to support the drilling equipment.

3 Baseline Conditions

Baseline studies have been performed over two open-water field seasons (August 2019, September 2020) to characterize the intertidal and subtidal habitat of the SCH (Advisian 2020).

The intertidal shoreline habitat was observed to largely be rocky, primarily comprising of cobble and gravel. Marine vegetation was minimal with trace coverage of rockweed (*Fucus sp.)*. No marine invertebrates or fish were observed.

Subtidal habitat substrate was observed primarily to be soft substrates (sand) with occasional boulder, which were at times in clusters. High densities of marine vegetation were observed when hard substrates were present within the subtidal, with rockweed being most abundantly observed. Other marine vegetation observed included occasional patches of kelp, observed between 2 m to 7 m CD depth, and a brown filamentous algae, possibly thread brown algae (*Chordaria sp*.), was observed throughout the subtidal area as a thing layer on both hard (boulders) and soft (sand) substrates. A silty deep area was observed within the inner harbour of the existing breakwater.

The most commonly observed marine invertebrate within the subtidal of the SCH Study Area was the truncate soft shell clam (*Mya truncata)*, occurring in densities that ranged from 5/m^2 to upwards of 50/m^2. Other marine invertebrates observed included Green sea urchins (*Strongylocentrotus drobachiensis)*, Seastars (sun star, *Solaster* sp., rose star, *Crossater papposus*, blood star), Brittle stars (*Ophiocten* or *Ophiura* sp.), tube dwelling anemones (*Pachycerianthus borealis)*, and anemones (*Hormatia rugosa, Cribrinopsis* sp.). Observations of marine fish were limited to a several sculpin species which were frequently associated with anthropogenic debris.

4 Potential Environmental Effects

Program activities with the potential to have environmental effects on fish and fish habitat include:

- Rotary drilling
- Contact of equipment with the seabed (drill head, drill casing)
- Program vessel traffic and marine equipment
- Fuel storage and refuelling, including spills

Potential environmental effects relating to fish and fish habitat include the following:

- Disturbance or injury to fish or marine mammals due to underwater sound
- Water quality degradation due to sediment disturbance during drilling
- Fish Mortality
- Modification of fish habitat and effects to fish health due to changes in water quality, substrate changes or sedimentation
- Destruction of fish habitat due to drilling
- Risk of harm and disruption to wildlife due to unintended interactions
- Negative effects to species at risk
- Waste production
- Risk of spills and environmental pollution

Potential effects to due to the Program are described in this section, and information on species and habitat in the Study Area is summarized in Section 3. The Program is not expected to result in negative effects to the environment (including HADD to fish or fish habitat).

All effects are considered mitigatable with mitigation and monitoring measures described in Section 5.3.

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

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 (FAAs) 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 metre of 142 – 145 dB re1µPa root mean squared (rms) during drilling and SPT 151–160 dB re 1 µPa^{2}s (Erbe & McPherson 2017). A similar drilling program, where Advisian 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 Program.

4.1.1 Fish

The sensitivity of marine fish to anthropogenic underwater noise is primarily driven by the presence or absence within a particular species of a swim bladder. Species with no swim bladder (e.g. sculpin) are the least sensitive to underwater noise (J. R. Nedwell et al. 2004). Fish with swim bladders will have variable sensitivities to underwater noise, and species who use the swim bladder for hearing, and thus have a close connection between the swim bladder and the ear, are the most sensitive (Halvorsen et al. 2012; J. Nedwell et al. 2006; Popper et al. 2006). Sculpin will be the primary species of interest for an iced ocean coastal environment and are less likely to be vulnerable to sound influencing activities.

DFO recognizes the previous guidance for the underwater sound threshold for marine fish (BC Marine and Pile Driving Contractors Association 2003) at 30 kPa, updated information on acoustic noise thresholds for fish are available. DFO has been recommending two underwater noise thresholds for fish, specified at 206 dB re 1µPa for peak sound pressure levels, and 186 dB re 1µPa^{2}s for an accumulated sound exposure level (cSEL). These thresholds are to be applied at a distance of 10 m from the sound source and are based on NOAA guidance (see Table 4-1).

Table 4-1 Onset of Physical Injury and Behavioural Effects to Fish

Effect	Metric	Fish mass (g)	Threshold
Onset of Injury	Peak Pressure	NA	206 dB re 1µPa
Adverse Behavioural Effects	Accumulated Sound Exposure Level (cSEL)	≥ 2	187 dB re 1µPa^{2}s
		≤ 2	183 dB re 1µPa^{2}s
Adverse Biological Effects	Root Mean Square Pressure (rms)	NA	150 dB re 1µPa

Source: NOAA (2018)

4.1.2 Marine Mammals

The NOAA guidance provides underwater acoustic thresholds to evaluate levels of effect due to underwater sound to marine mammals for temporary threshold shifts (TTS) and permanent threshold shifts (PTS) based on the functional hearing groups of marine mammals. This guidance provides dual metrics for the onset of PTS for sounds that are impulsive or continuous in nature. Under both, the current and pre-August 2019 *Fisheries Act*, DFO's recommended requirement through LoAs and FAAs has been for a single underwater acoustic metric (impulsive sound) for marine mammals at 160 dB re1µPa rms, regardless of the sound characteristics to ensure that marine mammal disturbance (and thereby injury) is avoided (pers. obs. Victoria Burdett-Coutts). NOAA's guidance based on different marine mammal groups is provided in Table 4-2.

Table 4-2 Onset of Physical Injury and Behavioural Effects to Marine Mammals

Hearing Group	PTS		TTS	Behavioural Change
	dB Peak SPL	dB cSEL	dB cSEL	dB rms
Low-Frequency (LF) Cetaceans	219	199	179	120
Mid-Frequency (MF) Cetaceans	230	198	178	120
High-Frequency (HF) Cetaceans	202	173	153	120
Phocid Pinnipeds (PW) (Underwater)	218	201	181	120
Otariid Pinnipeds (OW) (Underwater)	232	219	199	120

Source: NOAA (2018)

4.2 Water and Sediment Quality Degradation

Effects to fish health due to sediment mobilization are not expected. 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. Advisian has performed environmental monitoring for a multitude of drilling programs 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.

4.3 Fish Mortality

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 Program 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.

4.4 Modification and Destruction of Fish Habitat

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

4.5 Species at Risk

The likelihood of Species at Risk (SAR) occurring in the Project Study Area is low due to habitat characteristics of the Project site. No marine mammals are expected to occur as the Program will occur during the iced season. Effects to SAR are not expected, and are covered in the mitigation and monitoring measures proposed for fish and marine mammals (see Section 1).

Potential SAR in the Project Study Area are described in Table 4-3.

Table 4-3 Status of Fauna that have Potential to Occur in the Project Study Area and their Likely of Occurrence

Species	Latin Name	Inukitut		IUCN Status	COSEWIC Status	SARA Status	Nunavut Rank	Study Area	Likelihood of Occurrence (Open Water)	Justification
		Syllabics	Transliteration							
Fish										
Lumpfish	*Cyclopterus lumpus*	ᓂᐱᓴ	Nipisa	Near Threatened	Threatened	No Status	NR	SCH/DAS	Unlikely, due to habitat characteristics	Are distributed throughout the North Atlantic Ocean, with occasional incidental catch up to 65° N in Davis Strait, but more common to the south with highest abundance around Newfoundland (COSEWIC 2017). They are primarily a demersal fish (bottom dwelling). Lumpfish prefer waters that are greater than 300 m, but do migrate to shallow coastal waters in the early summer (April, May) to spawn
Northern wolffish	*Anarhichas denticulatus*	ᓂᐱᓴ	Nipisa; Kerak; Qeraq	Endangered	Threatened	Threatened	NR	SCH/DAS	Unlikely, due to habitat characteristics	Canadian range includes Baffin Bay (south of 66° 36.603' N, 61° 18.638'W on the Baffin Island coast), Labrador, northeast Newfoundland Shelves, Grand Banks, Flemish Cap, the Gulf of Saint Lawrence and the Scotian Shelf. It is most common in deep waters of the continental shelf (500 to 1000 m), and only occasionally observed in Baffin Bay/Davis Strait. A biogeographic range map for the Northern wolfish is available in (Government of Canada 2018b)
Spotted wolffish	*Anarhichas minor*	ᑕᕐᓴᓕᒃ ᑲᓇᔪᖅ	Tarsalik Kanajuq	Near Threatened	Threatened	Threatened	NR	SCH/DAS	Unlikely, due to habitat characteristics	The northwest Atlantic range of this species includes the Davis Strait (south of 68° 17.682'N, 66° 35.026'W on the Baffin Island coast), the Labrador Sea, the Gulf of St Lawrence, the east coast of Newfoundland, on the Grand Banks and on the Scotian Shelf. Preferred depths are between 200 and 750 m. A biogeographic range map for the Northern wolfish is available in (Government of Canada 2018a)
Thorny skate	*Amblyraja radiata*	ᐃᓴᕈᓖᑦ ᐃᖃᕐᒥᐅᑕᖅ	Isaruliit Iqarmiutaq	Vulnerable	Special Concern	No Status	NR	SCH/DAS	Unlikely, due to habitat characteristics	Distributed continuously from Baffin Bay (records are rare north of 68 ° latitude), Davis Strait, Labrador Shelf, Grand Banks, Gulf of St Lawrence, Scotian Shelf and Bay of Fundy to Georges Bank over a wide range of depths (18 m to 1200 m). Nunavut range not north of Baffin Island, depth range > 18 m. A distribution map is available in Figure 5a of (COSEWIC 2012)
Marine Mammals										
Atlantic Walrus (High Arctic population)	*Odobenus rosmarus*	ᐊᑦᓛᑎ ᐊᐃᕖᑦ (ᖁᑦᑎᑐᒥ ᐊᐃᕖᑦ ᐅᓄᕐᑐᑦ ᑲᑎᖓᔪᑦ)	Atlaati Aiviit (Quttitumi Aiviit unurtut katingajut)	Near Threatened	Special Concern	No Status	S3	SCH	Possible	Recorded in this area year-round, especially through the summer.
Bearded seal	*Erignathus barbatus*	ᐅᒡᔪᒃ	Ujjuk	Least Concern	Data Deficient	Not Applicable	NR	SCH	Possible	Year-round presence from hunting record and observations; identified high-density area.

Species	Latin Name	Inukitut		IUCN Status	COSEWIC Status	SARA Status	Nunavut Rank	Study Area	Likelihood of Occurrence (Open Water)	Justification
		Syllabics	Transliteration							
Beluga whale (Eastern High Arctic/Baffin Bay population)	*Delphinapterus leucas*	ᕿᓚᓗᒐ ᖃᑰᑕᖅ (ᑲᓇᖕᓇᖕᒐᓂ ᖁᑎᒃᑐᖅ/ᓴᓐᓂᕈᑎᐅᑉ ᐃᒪᖕᒐᓄᑦ ᑲᑎᖕᒐᔪᑦ)	Qilaluga qakurtaq (Kanangnangani Qutiktuq/Sannirutiup Imanganut katingajut)	Least concern	Special concern	No Status	NR	SCH	not possible in an iced ocean	Recorded summer presence throughout Lancaster Sound
Bowhead whale (Eastern Canada-West Greenland population)	*Balaena mysticetus*	ᐊᕐᕕᖅ	Arviq	Least Concern	Special Concern	No Status	NR	SCH	Not possible in an iced ocean	Within identified critical habitat; recorded summer presence throughout Lancaster Sound
Harp seal	*Pagophilus groenlandicus*	ᖃᐃᕈᓕᒃ	Qairulik	Least Concern	Not Assessed	Not Applicable	NR	SCH	Likely	Recorded in this area throughout open-water season.
Hooded seal	*Cystophora cristata*	ᓇᑦᓯᕙᒃ	Nattivak	Vulnerable	Not at Risk	Not Applicable	NR	SCH	Unlikely	Within range but near the northwestern limit; considered uncommon in this area
Killer whale (Northwest Atlantic/Eastern Arctic population)	*Orcinus orca*	ᐋᕐᓗᒃ	Aarluk	Data Deficient	Special Concern	No Status	NR	SCH	Not possible in an iced ocean	Recorded feeding in the area when the ice breaks up, through the summer until as late as October
Narwhal	*Monodon monoceros*	ᑑᒑᓕᒃ	Tuugaalik	Least Concern	Special Concern	No Status	NR	SCH	Not possible in an iced ocean	Recorded summer presence throughout Lancaster Sound, including calving
Polar bear	*Ursus maritimus*	ᓇᓄᖅ	Nanuq	Vulnerable	Special Concern	Special Concern	S3	Quarry/SCH	Likely	Recorded year-round in the Lancaster Sound area, with cubs; Borden Peninsula is a known denning and summer sanctuary site
Ringed seal	*Pusa hispida*	ᓇᑦᑎᖅ	Nattiq	Least Concern	Special Concern	No Status	NR	SCH	Likely	Year-round presence from hunting record and observations.

4.6 Waste production

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

4.7 Risk of spills and environmental pollution

Measures are in place to manage accidental spills which have been designed to be on 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 Program (further described in Section 5.3.8).

Hazardous products associated with the Program that have a potential to be leaked or spilled are provided in Table 4-4.

Table 4-4 Potential Hazardous Products to be used during the Program

Type	Quantity	Use
Gasoline	100 Litres	Mobile equipment, remote generators, heaters
Diesel	10,000 Litres	Drill Rig
Polypus	400 Litres	Drill Rig
Hydraulic oil	280 Litres	Drill Rig
10/40 oil	120 Litres	Drill Rig
Gun Grease	48 Litres	Drill Rig
Methyl hydrate	20 Litres	Drill Rig
Transmission Fluid	20 Litres	Drill Rig
80/90 Gear oil	80 Litres	Drill Rig
Antifreeze	120 Litres	Drill Rig

5 Environmental Management

5.1 Guidelines and Best Management Practices

The following guidelines and best management practices (BMPs) are relevant to the Program.

- DFO: Fish and Fish Habitat Protection Policy statement (DFO 2019a)
- DFO: Measures to Protect Fish and Fish Habitat (DFO 2019c)
- 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: 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 Advisian-Ikpiaryuk's geotechnical lead at the SCH and the quarry, in addition to a Marine Mammal Observer (MMO) who will be present at the SCH. The MMO will mainly be responsible for monitoring 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 MMO, Advisian-Ikpiaryuk team, and the contractor to enable effective regulatory compliance procedures.

The Contractor will be required to prepare a Spill Response Plan and Advisian-Ikpiaryuk's geotechnical lead will maintain compliance with all regulatory conditions and confirm all measures are followed by site personnel.

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 Program 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 Program to be carried out in in compliance with permits and approvals.

5.3.1 General

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 1-867-979-8000.

G4. The Contractor shall suspend all Program activities should any dead fish or wildlife, or any injured wildlife be observed during any works or activities in and around the marine waters.

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.

G9. The Advisian-Ikpiaryuk's geotechnical lead will conduct a 'tail-gate' meeting prior to the start of the Program to confirm that all Program personnel are aware of regulatory compliance requirements and understand their responsibilities (e.g. during spill response).

G10. The contractor or the Advisian-Ikpiaryuk's geotechnical lead will report all non-compliances and incident reporting as indicated in Sections 5.7.2 and 5.7.3.

G11. The Advisian-Ikpiaryuk's geotechnical lead will complete all RA communications as summarized in Section 5.6.

G12. The contractor will be provided with a copy of this compliance document and all program permits in advance of mobilization to the site.

5.3.2 Fish and Fish Habitat (Including Marine Mammals)

FFH1. The Contractor shall implement measures designed to minimize disturbance to seabed sediments and benthic communities and marine wildlife when carrying out Program 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 and fresh-water environments will be of an appropriate mesh size to not impinge fish on the screen and for the quarry (freshwater) 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 at the SCH 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

WL1. A wildlife monitor will be present at all stages of drilling for both the SCH and quarry location.

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 and Management

WQM1. Drill muds, additives, and other products shall not be used in connection with holes drilled through marine ice unless they are re-circulated or contained such that they do not enter the water, or are demonstrated to be non-toxic.

WQM2. If drilling additives are used for on-ice drilling, they must be re-circulated in a way that they do not enter the marine environment or be demonstrated as non-toxic.

5.3.5 Air Quality

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 Program and because it is standard practice for marine based programs. 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.

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.

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. All fuel containers will be marked with the contractor's name.

FCS5. 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.

FCS6. The contractor will maintain an inspection record for equipment used in or near the marine environment using hydraulic, fuel, and lubrication systems.

FCS7. Routine inspection of storage areas, secondary containment, and containers for leaks, and addressing leaks or containers found in poor condition or improperly sealed.

FCS8. 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 onsite.

5.3.7 Waste Management

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 Program 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. All drill cuttings will be removed from ice surfaces daily.

WM7. Routine inspection of worksites, equipment, as required to ensure regulatory compliance and spill prevention.

WM8. All fluids used for drilling activities will be properly contained and labelled. Secondary containment will be provided.

WM9. Waste will be stored in labelled containers and appropriately segregated based on material.

WM10. 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.

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 Program. 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 Program.

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 RAs and DFO-SCH 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 Advisian-Ikpiaryuk's 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, the following measures will be implemented if a spill occurs during the Program.

- 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 Program is being undertaken. However the SCH and quarry locations will be left in the same condition they were in prior to drilling.

R1. After the Program 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.

R2. All equipment used to conduct the studies will be removed and transported offsite.

R3. Any spills will be cleaned-up and the area remediated and restored prior to completion of the Program.

R4. Drill holes will be appropriately filled and capped.

R5. Drill cuttings shall be discharged to their marine or terrestrial origin within a small footprint.

5.4 Adaptive Management

During the Program, 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 Advisian-Ikpiaryuk, will develop the update to the methodology and mitigation measures will be updated.

5.5 Communication

5.6 Regulatory Authority Communication

CIRNAC and NWB will be contacted as required for conditions in the respective permits, which is expected to include the following.

5.6.1 CIRNAC

- The Advisian-Ikpiaryuk's geotechnical lead shall contact or meet 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 Advisian-Ikpiaryuk's geotechnical lead shall advise a Land Use Inspector at least ten (10) days prior to the completion of the Program to confirm plans for completion of reclamation (see Section 5.3.9).
- The Advisian-Ikpiaryuk's 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.

5.6.2 NWB

- NWB will be notified if there are any changes in operating plans or associated conditions, a minimum of 30 days prior to the Program.

5.7 Reporting

5.7.1 Regulatory Authority Annual Reporting

Annual reports will be required to be submitted to NWB, CIRNAC, and Nunavut Research Institute (NRI), and can be provided to DFO-FFHPP 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 RAs as required.

5.7.3 Incident Reporting

Incident reporting is required to pertinent RAs, including the Government of Nunavut (GN) – Department of Environment (DoE) and DFO. PSPC, DFO-SCH and Advisian 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 1 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