NON-TECHNICAL ANNUAL REPORT – NUNAVUT RESEARCH INSTITUTE RESEARCH LICENSE #02 011 21R-M FOR ARCTIC BAY HARBOUR DEVELOPMENT

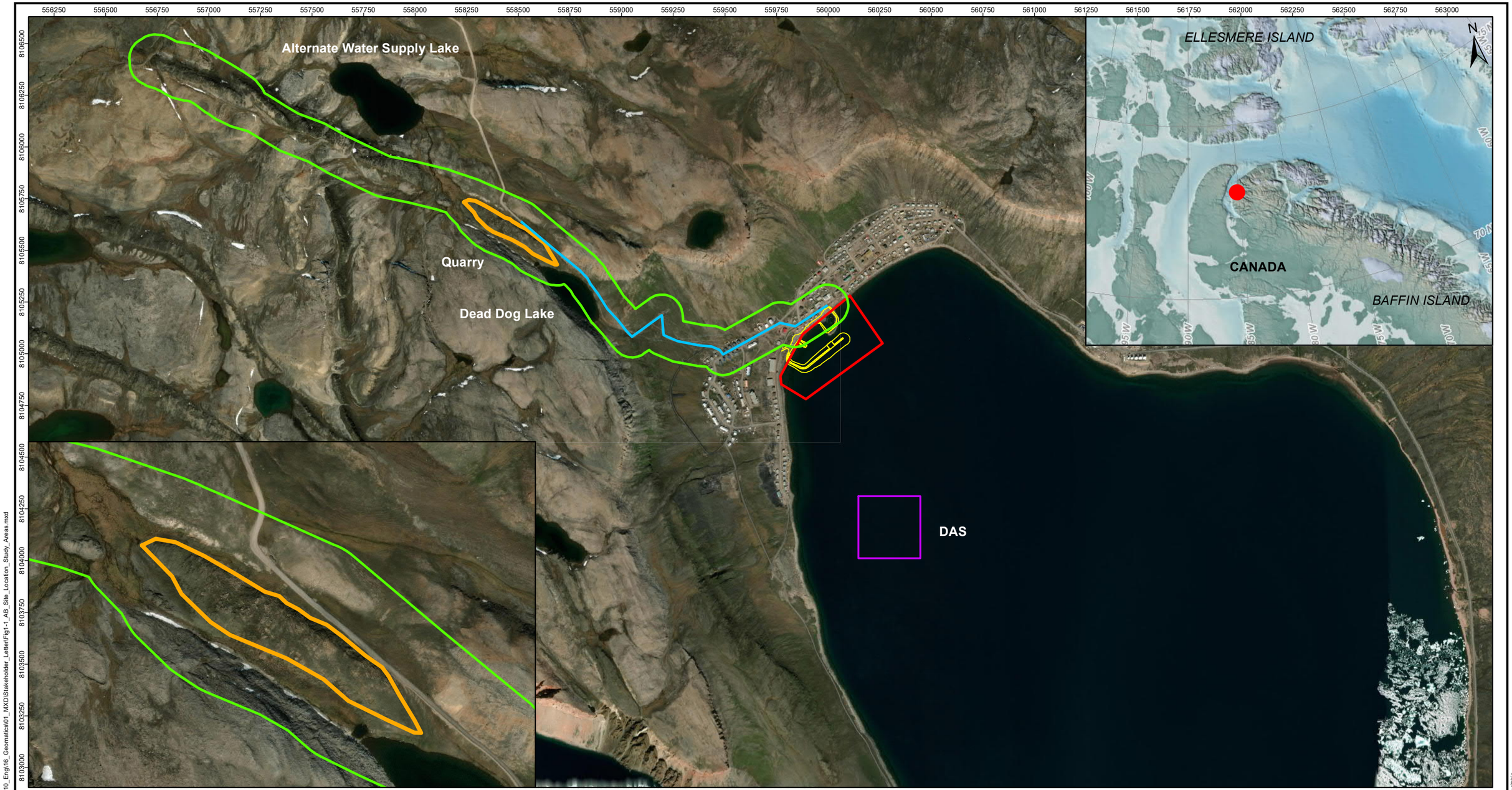
1 Project Overview

Worley Canada Services Ltd. and Ikpiaryuk Services Ltd. in joint venture, operating as Advisian-Ikpiaryuk JV, have been retained by Public Services and Procurement Canada (PSPC) and Fisheries and Oceans Canada – Small Craft Harbours (DFO-SCH) to perform community consultation, regulatory support services, and detailed design for the development of a small craft harbour (SCH) in the Hamlet of Arctic Bay, Nunavut (the Project). This harbour 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), which was announced on August 1, 2019. Arctic Bay is located within the North Baffin Regional Land Use Plan (NBRLUP) Region (NPC 2000) on the northwest coast of Baffin Island (Borden Peninsula) (73° 1.529'N, 85° 7.203'W).

Program permits obtained for the field program are provided in Section 5.3, Table 5-1.

This letter provides the summary details for the 2021 field season to fulfil the annual requirements for the Nunavut Research Institute (NRI) post-field program reporting. A renewal for 2022 is expected to be required for potential fish habitat and sediment quality assessments.

Figure 1-1 provides an overview of the Project Site.



Legend

- Site Location
- SCH Footprint
- Haul Road (existing road to preferred quarry)

Study Areas

- SCH Study Area
- DAS Study Area
- Quarry Study Area
- Haul Road and Quarry (HRQ) Study Area

Project Study Area = HRQ + SCH Study Areas

0 200 400 800
Metres

1:18,000

WGS 1984 UTM Zone 16N

N

Locations approximate.

FISHERIES AND OCEANS CANADA
SMALL CRAFT HARBOURS
ARCTIC BAY

PROJECT STUDY AREAS AND LOCATION

Date: 25-JUN-21	Drawn by: KR	Edited by: KR	App'd by: VB
		Project No. 317071-00037	
		FIG No 1-1	REV 0

Advisian Ikpiaryuk Services Ltd.

"This drawing is prepared solely for the use of our customers as specified in the accompanying report. Worley Canada Services Ltd. assumes no liability to any other party for any representations contained in this drawing."

FILE LOCATION: U:\YVR\317071\000037_PWGS_ArcBay\CES\10_Engl\6_Geomatics\01_MXD\Stakeholder_Letter\Fig1-1_AB_Site_Location_Study_Areas.mxd

PLOT DATE & TIME: 6/23/2021 11:27:36 AM USER NAME: kenneth.v.richie
SAVE DATE & TIME: 6/24/2021 1:12:53 PM ISSUING OFFICE: BURNABY GIS

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NOAA Environmental Satellite, Data, & Information Service (NESDIS), National Geophysical Data Center (NGDC), IBCAO, GEBCO

2 Program Name

Arctic Bay Harbour Development

3 Program Location

The Project is located in Arctic Bay, on the northwest coast of Baffin Island (Borden Peninsula) Region (73° 1.529'N, 85° 7.203'W).

The SCH will repurpose the existing breakwater and will be located seaward of the Arctic Bay community. See Figure 1-1.

3.1.1 Planning Region

The North Baffin Regional Land Use Plan (NBRLUP) Region

3.1.2 Administrative Region

Qikiqtaaluk Region

4 Proponent and Representative Details

Contact information for the proponent and representative are provided in Table 4-1.

Table 4-1 Proponent and Contact Information

Contact Category	Contact Details
Name of Proponent Contact / Primary Contact	Eleanor McEwan, Senior Project Engineer
Proponent Mailing Address	Fisheries and Oceans Canada, Small Craft Harbour 501 University Crescent Winnipeg, MB R3T 2N6 Telephone: 204-984-1102 Fax: 204-983-7166 Email: Eleanor.McEwan@dfo-mpa.gc.ca
Name of Consultant	Victoria Burdett-Coutts, Marine Scientist & Regulatory Consultant, M.Sc., R.P.Bio.
Consultant Mailing Address	Suite 200 -2930 Virtual Way Vancouver, British Columbia V5M 0A5 Office: 778-945-5501 Mobile: 778-839-2372 Fax: 604-298-1625 Email: Victoria.Coutts@advisian.com

5 Field Program

5.1 Program Scope

The field program consisted of a geotechnical and environmental drilling program involving drilling of: 10 marine boreholes, 2 boreholes on the shoreline that were finished as groundwater monitoring wells, and 3 boreholes in the Quarry Study Area.

The proposed methodology is available online through the registries of the Nunavut Planning Commission (NPC) and the Nunavut Impact Review Board (NIRB), as well as the NRI application for the 2019 Field Program (Advisian 2020a) and the 2020 NRI annual report (Advisian 2020b). Methodology that was new to the 2021 field studies are provided in this report.

5.2 Study Areas

Study Areas were developed prior to the 2019 field program to encompass the following Project components:

- SCH (SCH Study Area)
- Haul Road and Quarry (collectively referred to as the HRQ Study Area)
- Disposal at Sea sites (DAS Study Area)

All Study Areas were developed to include the maximum footprint required for construction, plus a 100 m buffer (see Figure 1-1). Collectively, they are referred to as the Project Study Areas.

Only the SCH and Quarry Study Area were targeted during the 2021 field program.

5.3 Program Permits

The field program was carried out in accordance with the permits outlined in Table 5-1. All permits were held by DFO-SCH.

Table 5-1 Arctic Bay Program Permits

Regulatory Authority	Permit Type	Associated Activity	Location	Permit #	Issued	Expiry
Nunavut Planning Commission (NPC)	Conformity Determination	Development of land and water resources within Nunavut	Quarry, SCH	149425	10/12/2020	N/A
Nunavut Impact Review Board (NIRB)	Screening Decision Report	Any development of land and water resources within Nunavut as determined by NPC's conformity determination	Quarry, SCH	19YN031	15/09/2019	N/A
Nunavut Research Institute (NRI)	Scientific Research License	All activities that require field work toward the design and regulatory compliance	Quarry, SCH	02 011 21R-M	01/03/2021	30/04/2021
Nunavut Water Board (NWB)	Type B Water License	Water withdrawal and drill fluids disposal	Quarry	8BD-ABH2122	17/03/2021	16/03/2022
Government of Nunavut – Community and Government Services (GN-CGS)	Land Use Permit	Construction on Commissioners Land or Untitled Municipal Lands.	Quarry, SCH foreshore	LUP-2021-001	04/02/2021	31/05/2021
Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC)	Land Use Permit (LUP)	Drilling and soil sampling	SCH	N2021S0003	18/03/2021	03/03/2023
Fisheries and Oceans Canada (DFO) – Science	License to Fish for Scientific Purposes	Sampling in Arctic Bay	SCH	S-19/20-1018-NU	28/06/2019	N/A
Fisheries and Oceans Canada (DFO) – Fish and Fish Habitat Protection Program	DFO compliance verification by a Qualified Environmental Professional (QEP)	Drilling and water withdrawal	Quarry, SCH	NA	NA	NA

5.4 Field Activities Summary

The geotechnical and environmental investigation took place from March 23 to April 8, 2021. Ice surveys were required prior to the drilling program to assess ice thickness before mobilizing drilling equipment to site.

5.4.1 Ice Surveys

Ice surveys were undertaken by SmartICE and Associated Engineering on March 1 to 3, 2021 and March 17 to 19, 2021, respectively. Ice surveys were undertaken to ensure that ice thickness met the minimum required to support the drill rig and associated equipment.

5.4.2 Drilling at the Small Craft Harbour

The drill rig chosen to undertake the SCH drilling was an Acker AD-II drill rig, which was shipped to Arctic Bay via sealift. Photographs are provided in Attachment 1.

A total of twelve (12) boreholes were advanced by Logan Drilling under the direct supervision of Advisian (see Figure 5-1). Boreholes were advanced 3.00 m to 8.26 metres below seabed (mbsb). Drilling operations were undertaken 24 hours per day by two crews for the duration of the drilling program. Borehole logs are available upon request.

At completion of each borehole, the rock core was photographed, and representative samples collected and wrapped in bubble wrap, along with the soil samples stored in coolers. Soil and rock samples were flown out with Advisian geotechnical representatives and taken to Advisian's Vancouver office in British Columbia (BC). Soil and rock samples were then shipped to the designated laboratory for subsequent testing.

Drilling at the small craft harbour indicated that overburden varies from approximately 1.3 to 6 m thick overlying bedrock. In the marine area the subsurface conditions typically consisted of loose to dense silty sand overlying at locations soft silty sandy clay, overlying stiff to very stiff sandy silty clay/compact to dense sand (of glacial origin), overlying shale bedrock.

5.4.3 Drilling at the Quarry

A total of three (3) boreholes were advanced at the proposed quarry by Logan Drilling, under the direct supervision of Advisian (see Figure 5-2). Boreholes were advanced 6.17 m to 15.11 metres below existing grade (mbg). Boreholes were advanced using HQ3 diamond coring techniques using water and mud as a drilling fluid. Drilling operations were undertaken 24 hours per day by two crews for the duration of the drilling program. Borehole logs are available upon request.

At completion of each borehole, core boxes were transported to a heated facility where they were logged in further detail, photographed and sub sampled. Rock samples were wrapped in bubble wrap and placed in coolers, which were later flown out with Advisian geotechnical representatives, and taken to Advisian's Vancouver office, BC for rock core sample selection. Rock samples were then shipped to the designated laboratory for subsequent testing.

Subsurface conditions included 1.6 to 2.2 m of colluvium / frost shattered bedrock, overlying diorite bedrock. The diorite bedrock was fresh to medium weathered, medium strong to strong, locally weak. Laboratory testing confirms that the dolerite meets rock durability and ARD requirements for use as rock armour.

8105000 559800 8105200 560000

BH/MW21-10
BH/MW21-11
BH21-08
BH21-05
BH21-04
BH21-06
BH21-03
BH21-01
BH21-07
BH21-09
BH21-02B
BH21-02

8104800
559800

Name	Northing	Easting
BH21-01	8105041.90	559993.40
BH21-02	8105052.90	560083.30
BH21-02B	8105049.40	560079.80
BH21-03	8105058.70	560022.30
BH21-04	8105076.30	559968.40
BH21-05	8105038.90	559901.20
BH21-06	8104959.00	559858.80
BH21-07	8104949.10	559939.50
BH21-08	8105092.80	559938.80
BH21-09	8105003.20	560012.80
BH/MW21-10	8105096.90	559862.30
BH/MW21-11	8105175.40	559966.90

Legend

- Small Craft Harbour Footprint
- High Water Line
- Low Water Line

Sampling Locations

- Borehole
- Monitoring Well

0 15 30 60

Metres

1:1,500

WGS 1984 UTM Zone 16N

Locations approximate.
SCH configuration is the April 2021 configuration (concurrent with Phase III ESA investigation).

FISHERIES AND OCEANS CANADA
SMALL CRAFT HARBOURS
ARCTIC BAY

SMALL CRAFT HARBOUR 2021 INVESTIGATION LOCATIONS

Date:	Drawn by:	Edited by:	App'd by:
13-DEC-21	KR		

Project No. 317071-00037

FIG No 5-1

REV A

Advisian Ikpiaryuk Services Ltd.

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ISSUING OFFICE: BURNABY GIS

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Name	Northing	Easting
BHQ21-01	8105680.90	558335.80
BHQ21-01B	8105680.50	558336.20
BHQ21-02	8105655.40	558382.90

Legend

Quarry Boundary

Sampling Locations

Borehole

0 30 60 120

Metres

1:2,500

WGS 1984 UTM Zone 16N

N

Locations approximate.
SCH configuration is the April 2021 configuration (concurrent with Phase III ESA investigation).

FISHERIES AND OCEANS CANADA
SMALL CRAFT HARBOURS
ARCTIC BAY

QUARRY 2021 INVESTIGATION LOCATIONS

Date: 13-DEC-21	Drawn by: KR	Edited by:	App'd by:
		Project No. 317071-00037	
		FIG No 5-2	REV A

Advision Ikpiaryuk Services Ltd.

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5.4.4 Soil and Sediment Sampling

Soil and sediment logging was completed on samples recovered from Standard Penetration (SPT) tests. All recovered soil intervals were described, classified, photographed and packaged.

Samples for analysis of volatiles concentrations (VOCs, BTEX, and PHC F1-F4), organic and inorganic were collected. Samples were given a unique field identification number and were flown to Vancouver, BC. The coolers were collected by an Advisian employee and delivered to the designated laboratory, along with standard chain-of-custody documentation.

Soil and sediment samples were submitted for laboratory analysis of concentrations of one or more of the following parameters: BTEX, styrene, MTBE, PHC F1-F4, VPH, TEH, EPH, LEPH/HEPH, polycyclic aromatic hydrocarbons (PAHs), metals, polychlorinated biphenyls (PCBs), total inorganic carbon (TIC), total organic carbon (TOC), PCBs, particle size, PAHs toxicity characteristic leaching procedure (TCLP) and metals TCLP.

Additional details on geotechnical drilling and sediment quality results from the 2021 field program can found in Section 6.2.2 and 5.2.4, respectively, of the Environmental and Socio-Economic Baseline Report (ESEB) (Advisian-Ikpiaryuk JV 2021), which is available on the NIRB registry for the Project.

5.4.5 Local Support

The day shift and nightshift crews included a wildlife monitor and helper sourced locally by Ikpiaryuk Services.

5.5 Inuit Quajimajatuqanjit and Community Consultation

IQ, as we understand it, is not merely a collection of information about the land and wildlife, but also an approach and set of principles to conduct research and project development that is based on respect and collaboration. The local knowledge holders we work jointly with are also actively guiding decisions on the design and construction planning of the SCH for Arctic Bay.

In addition to the above field program, as per the terms and conditions of the NIRB SDR (NIRB File No.: 19YN031), the community was engaged regarding planning and field program activities. Early engagement with the community allowed for a collaborative approach between the field team and community members during the field surveys including the coordination of local resources for personnel and equipment.

Community consultation in March 2021 included a joint meeting with key community members, including the Ikajutit HTA, the Hamlet, local Qikiqtani Inuit Association (QIA) community representatives, and the Tallurutiup Imanga Nauttiqsuqtiit (Arctic Bay Guardians). The intent of this meeting was to inform the community of project progress and collaborate with community members on refining the design and construction planning for the SCH. The upcoming drilling program was a main topic of discussion during the meeting. Proposed drilling locations and methodology were presented to the community for their feedback. A brief land use interview with knowledge holder and outfitter, Tom Nagitarvik, was also conducted to better understand ice access and skidoo trails along the shoreline and haul route to the quarry. The locations of sled dog teams were also determined with Mr. Nagitavik to ensure that the proposed drilling program did not impact the dogs.

6 2022 Field Program

Fieldwork in 2022 will include archaeological studies and may also include sediment quality analysis and a fish and fish habitat assessment. For archaeological studies, an archaeological research permit will be required through the Government of Nunavut Culture and Heritage (GN-CH). If additional studies are undertaken for marine investigations, relevant permits will be secured prior to the start of field programs.

7 Conclusion

The Field Program described in this document provides information to support regulatory compliance and detailed design for the Arctic Bay SCH. Data that were field collected have been summarized and those that required laboratory processing can be provided upon request to DFO-SCH.

8 Closure

We trust that this report satisfies your current requirements and provides suitable documentation for your records. If you have any questions or require further details, please contact the undersigned, Victoria Burdett-Coutts, at any time by email at Victoria.coutts@advisian.com or by phone either at 778-945-5501 (office) or, during the COVID-19 working from home requirements, at 778-839-2372 (mobile).

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Advisian-Ikpiaryuk JV
December 2021

9 References

Advisian-Ikpiaryuk JV. (2021). Arctic Bay Harbour Development - Environmental & Socio-Economic Baseline Report. Prepared for Public Services and Procurement Canada. *(Document No. 317071-00037-00-EN-REP-0001, Revision 0)* August 11, 2021.

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Attachment 1 Photograph Log

Attachment 1 – Arctic Bay Site Photographs

Photo 1 Augering hole through sea ice, March 24, 2021

Photo 2 Logan Drilling assembling drill rig, March 24, 2021

Photo 3 Floor of drill shack constructed. March 26, 2021

Photo 4 Dozer clearing snow to the ice, March 27, 2021

Photo 5 Loader clearing snow at BH21-01, March 28, 2021

Photo 6 Set-up at BH21-02, March 28, 2021

Photo 7 *Core in split spoon sampler at depth of 0.81 – 1.42m in BH21-01-02, March 28, 2021*

Photo 8 *Field vane test at BH21-07, March 31, 2021*

Photo 9 Loader placing snow back on ice after completion of BH21-0, March 29, 2021

Photo 10 Water intake at Dead Dog Lake, April 5, 2021

Photo 11 Filling the water tank, April 5, 2021

Photo 12 Permit information displayed on drill rig, April 5, 2021

Photo 13 Loader taking sand to the quarry road, April 5, 2021

Photo 14 Drill rig set up at BHQ21-01, April 5, 2021

Photo 15 Drill rig set up at BHQ21-01, April 6, 2021

Photo 16 Monitoring well installation complete at BH/MW21-10, April 8, 2021

Attachment 2 Drilling Coordinates

Attachment 2 –Drilling Coordinates

Table 1 Arctic Bay Drilling Coordinates

Borehole	Location	Completion Depth (m)	Ground Elevation (m)	Bedrock Start (m)	Northing (m)	Easting (m)
BH21-01	SCH	6.99	-4.91	4.7	8105042	559993.4
BH21-02	SCH	8.26	-11.12	6.04	8105053	560083.3
BH21-02B	SCH	4.54	-11.4	N/A	8105049	560079.8
BH21-03	SCH	6.77	-6.05	4.6	8105059	560022.3
BH21-04	SCH	6.6	-2.06	5.26	8105076	559968.4
BH21-05	SCH	3.87	-0.83	2.3	8105039	559901.2
BH21-06	SCH	3.02	-1.43	1.28	8104959	559858.8
BH21-07	SCH	4.03	-6.81	2.6	8104949	559939.5
BH21-08	SCH	4.03	-0.46	3.93	8105093	559938.8
BH21-09	SCH	4.88	-9.83	4.5	8105003	560012.8
BH21-10	SCH	3.00	4.1	N/A	8105097	559862.3
BH21-11	SCH	3.00	3.1	N/A	8105175	559966.9
BHQ21-01	Quarry	6.17	109.5	N/A	8105681	558335.8
BHQ21-01B	Quarry	12.80	109.5	N/A	8105681	558336.2
BHQ21-02	Quarry	15.11	113.1	N/A	8105655	558382.9