Government of Nunavut

Qikiqtarjuaq Marine Infrastructure Project

Project No. 22205-00762

Construction Documents - 100% Stage Submission

CBCL

Nunavut

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October 23, 2025

Mr. Justin McDonell
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Attention: Mr. McDonell:

RE: Government of Nunavut Qikiqtarjuaq Marine Infrastructure Project, Project No. 22205-00762-02 - CBCL Limited Construction Documentation 100% Report

The following document provides the Construction Documentation 100% Report for the above referenced project.

Yours very truly,

CBCL Limited

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Project No.: 234414.00

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1 Introduction

1.1 General

This 100% Construction Documentation Report has been compiled to provide deliverables outside the project's drawings and specifications. The following are included with this submission:

- Construction schedule
- Risk management register
- Quality assurance plan
- Construction Environmental Management Plan (CEMP)
- Proposed list of warranties applicable to the project.
- Final Geotechnical Report

2 Construction Documentation

The following will provide information on product selections and system descriptions.

2.1 Marine

2.1.1 Codes, Statutes, Regulations, By-Laws

A list of design codes, standards, and guidelines relevant to the marine structure design is provided below:

- Canada Labour Code.
- Canadian Standards Association:
    - CSA A23.3:19, Design of Concrete Structures.
    - CSA S6:19, Canadian Highway Bridge Design Code.
    - CSA S16:24, Design and Construction of Steel Structures.
- Canadian Tide Tables: Volume 4 – Arctic and Hudson Bay.
- Construction of a Deep-Sea Wharf in Canadian Arctic, Rittberg, Kullmann, Dube (2010).
- British Standards:
    - BS 6349-1:2000 Maritime Structures – Part 1: Code of Practice for General Criteria.
    - BS 6349-4:1994 Maritime Structures – Part 4: Code of Practice for Design of Fendering and Mooring Systems.
- Foundation Engineering – Intext series in Civil engineering, Jumikis (1971).
- Harbour Accommodations Guidelines for Small Craft Harbours branch, Fisheries and Oceans Canada by Public Works and Government Services Canada.
- Oil Companies International Marine Forum (OCIMF) – Guidelines and Recommendations for the Safe Mooring of Large Ships at Piers and Sea Islands (1978).
- Oil Companies International Marine Forum (OCIMF) Mooring Equipment Guideline (MEG4), 4th edition, 2018
- The World Association for Waterborne Transport Infrastructure Guidelines:
    - PIANC MarCom WG 34 – Seismic Design Guidelines for Port Structures, 2001.
    - PIANC MarCom WG 135 – Design Principles for Small and Medium Marine Container Terminals: 2014.
    - PIANC MarCom WG 180 - Guidelines for Protecting Berthing Structures from Scour Caused by Ships: 2015.
    - PIANC MarCom WG 185 – Ports on Greenfield Sites – Guidelines for Site Selection and Master Planning: 2019.
    - PIANC MarCom WG 211 – PIANC Fender Guidelines: 2024.
- Recommendations of the Committee for Waterfront Structures Harbours and Waterways EAU 2012.
- The Overseas Coastal Area Development Institute of Japan (OCDI) Technical Standards and Commentaries for Port and Harbour Facilities in Japan.
- Unified Facilities Criteria (UFC) – Design: Piers and Wharves (2017).

2.1.2 Fixed Wharf Design Requirements

The main purpose of the proposed wharf structure is to provide a deep-sea port capable of supporting the northern fishing industry. Where practical, consideration has been given to future growth and flexibility to support other wharf uses, such as accommodating cargo and fuel delivery vessels. A selection of design vessels representing typical vessels expected to make use of the port in the short and long term is summarized in **Table 1-1** below.

Table 1-1 - Design Vessel Particulars

Vessel Particular	Fishing Vessel (MV Arluk II)	Fishing Trawler (MV Atlantic Enterprise)	Cargo Vessel (MV Miena Desgagnés)	Fuel Tanker (MV Kitikmeot W)
Length Overall (LOA), m	29.3	83.2	147.0	150.0
Beam (B), m	8.0	18.0	22.8	23.2
Draft (D), m	4.1	8.1	8.1	9.9**
Dead Weight Tonnage (DWT), tonnes	387	3,314	12,167	19,984
Loaded Displacement	N/A	N/A	17,000*	26,144
Container Capacity, TEU	N/A	N/A	842	N/A
Required Under Keel Clearance (UKC), m	0.4	0.8	0.8	1.0**
Required Water Depth, m	4.5	8.9	8.9	10.0**

*Estimated value

**Confirmed via stakeholder engagement that 10m draft is sufficient for fuel delivery operations.

2.1.3 Water Levels and Deck Elevation

All levels indicated on the Drawings are referred to in Chart Datum. Chart Datum is, by international agreement, a plane by which the tide will seldom fall. The following tide levels are applicable to this project:

- Higher High Water Large Tide (HHWLT): 1.5 m CD
- Higher High Water Mean Tide (HHWMT): 1.2 m CD
- Mean Water Level: 0.8 m CD
- Lower Low Water Mean Tide (LLWMT): 0.3 m CD
- Lower Low Water Large Tide (LLWLT): 0.0 m CD
- Wharf Deck Elevation: 3.7 m CD

The site is projected to experience a drop of 0.07 m relative sea level by the end of the project design life (2080).

2.1.4 Design Service Life

The minimum design service life for the structure will be 50 years. Regular inspection, maintenance, and repair programs will be required to achieve this service life. It is expected that accessory items such as ladders and fenders will require midlife refurbishment and/or replacement.

2.1.5 Live Loads

The maximum uniformly distributed live load / storage load on the wharf is 50 kPa (1000 psf). The design vehicle is a 23-tonne mobile boom truck, which will be used on the wharf to offload cargo.

2.1.1 Ice Loads

An ice study was completed by G. Comfort Ice Engineering to investigate the ice conditions and quantify ice loads for a 100-year return period for permanent design and approximately 5 to 10-year return period for temporary conditions during construction.

2.1.2 Geotechnical Parameters

The following parameters from the geotechnical investigation were developed in conjunction with Adaptive Baseline Geotechnical Ltd (ABG).

Soil Type	Fill	Till	Loose Sand
Unit Weight, γ (kN/m^3)	21	18.5	17
Submerged Unit Weight, γ_{sub} (kN/m^3)	11	8.5	7
Effective Internal Friction Angle, ϕ (^{o})	36	34	32.5

Geotechnical Parameters	
Geotechnical Resistance Factor (Bearing), ϕ_{gu}	0.6
Geotechnical Resistance Factor (Sliding), ϕ_{gu}	0.9
Coefficient of Friction, μ	0.55
Seismic Site Class	C

2.1.3 Design Berthing Procedure

The following outlines the design berthing procedure:

- It is expected that the facility will not have tugboats to assist with berthing and that vessels will need to enter the berth under their power.
- Vessels will approach the berth sideways and will berth alongside and berth on starboard or port side.
- The vessel's longitudinal axis (fore-and-aft line) shall not make an angle greater than 10 degrees with the berthing face (fender line), at the time berthing contact is made.

- The characteristic berthing velocity for a 0.02% probability of exceedance per berthing manoeuvre shall not exceed 0.3 m/s.
- As part of the berthing procedure, vessels may come to a dead stop at a suitable distance in front of the berth, before moving towards the berth.
- The berthing procedure, as outlined, is based on a maximum loaded displacement of 26,144 tonnes.

The above berthing procedures, along with British Standards and World Association for Waterborne Transport Infrastructure (PIANC) design guides, were used to determine the required berthing energy and to select the appropriate fendering system. More information on proposed fenders is provided in **Section 2.1.9.4** below.

2.1.4 Water Depth

The top of wharf elevation along the berthing face is +3.7 m CD. PIANC MarCom WG 135-2014 recommends that the berth pocket be capable of accommodating the fully loaded draft of the vessel for all tides plus 5-10% of the draft for under keel clearance, measured at the mean lower low water (+0.3 m CD) in order to provide clearance for the vessel.

To satisfy this requirement and provide a buffer for future sea level drop, the required under keel clearance has been set at 10% of the vessel draft and the required water depth is measured from the lower low water mark (0.0 m CD). The minimum berth pocket water depth is 10 m, which satisfied the criteria noted above.

2.1.5 Wharf Geometry

The proposed wharf layout consists of a 74.2 m long continuous berth face made up of three 24.8 m long concrete caissons (see **Figure 2-1**). The caissons are founded on a granular mattress at elevation -11.50 m CD and will extend to elevation +1.0 m CD. This will provide an allowance for 1.5 m of scour protection while still providing 10 m of water depth at the wharf face. Two return caissons are provided on the wharf side faces to provide a solid side face and ensure that armourstone material does not extend into the berth area and reduce the available draft depth in the navigation area. The granular mattress will be stepped to allow the side caissons to be placed approximately 2 m above the front caissons. This means that the side caissons will be subjected to less lateral loads and can be made smaller to reduce costs. While this will require more labour to construct the mattress, contractor consultations have confirmed that it is feasible to construct and level the mattress, and build, transport and set the concrete caissons in a single construction season.

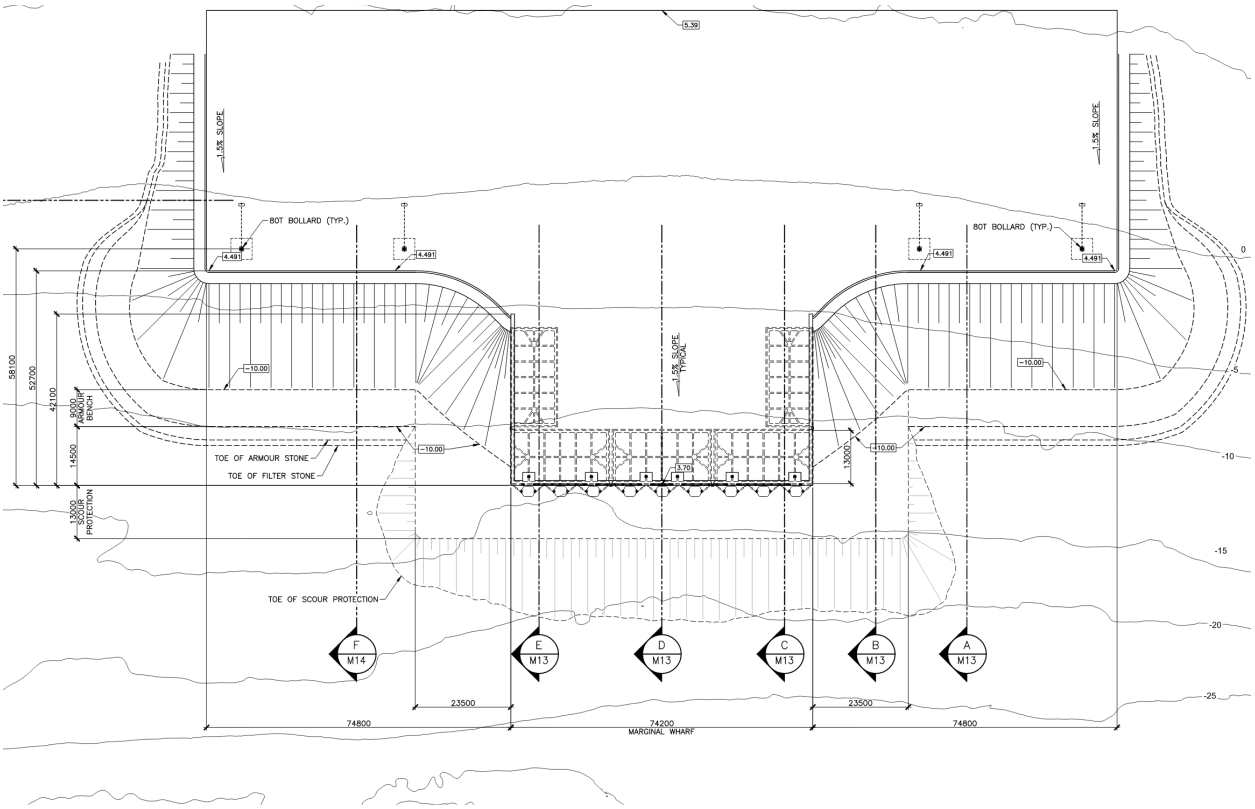


Figure 2-1 - General Wharf Arrangement

The conceptual design of the wharf based on the preliminary 2024 bathymetric survey data was based on a caisson height corresponding to 10 m. As design progressed and all surveys were coordinated and vetted as part of the QA process, it was found that the existing harbour bottom is steeper than originally anticipated, which means that for the location identified in the concept design the water depth is deeper. To provide a similar water depth as shown on previous submissions, the front wharf face was moved 10 m towards the shore. The laydown area has been adjusted to ensure that adequate laydown space is provided.

2.1.6 Laydown Area Geometry

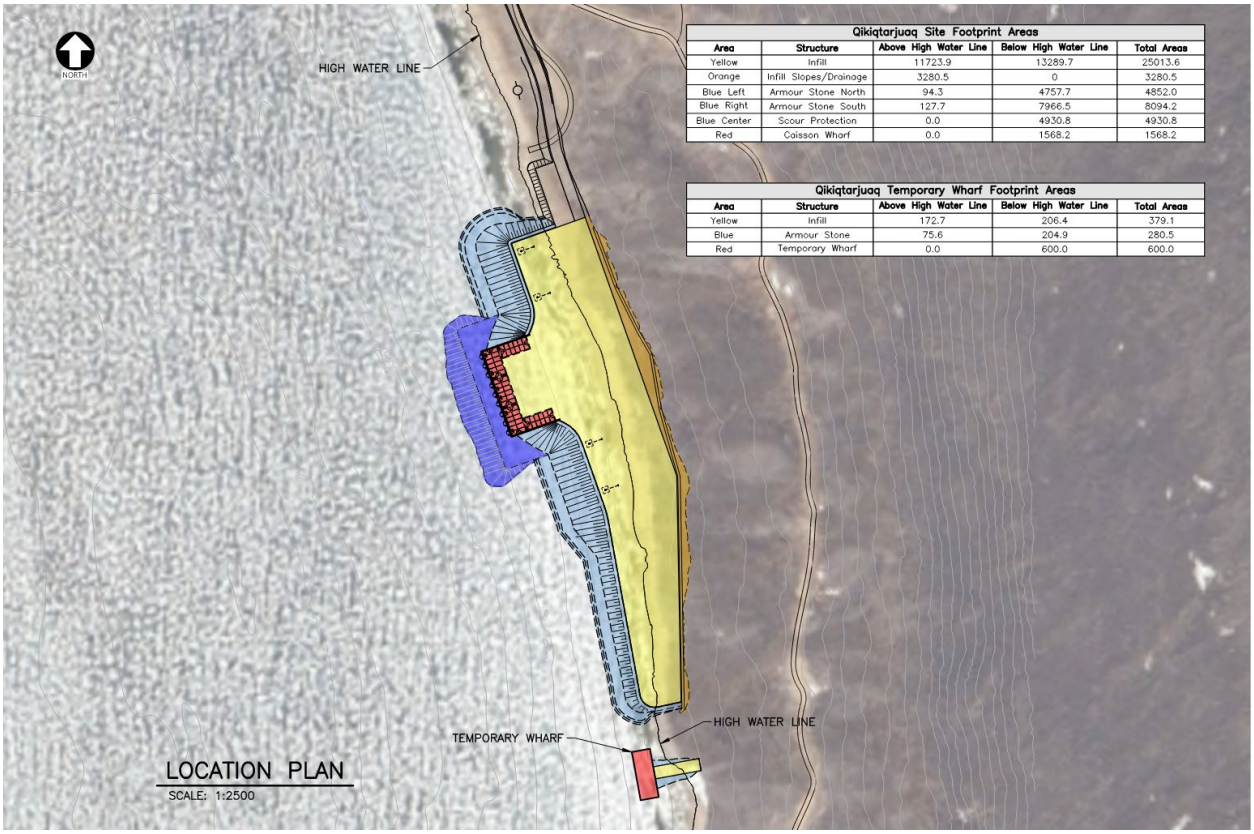
The laydown area will be constructed of granular fill complete with a rock revetment around the perimeter of the site. The side slopes are shown at 1.75H:1V and a 9 m wide toe berm is provided at the bottom of the slope. To prevent this toe berm from extending into the navigation area and reducing available draft, the top of the toe berm will be set at -10 m CD, and the harbour bottom will be dredged as needed.

2.1.7 Dredging Methodology

The contractor will need to dredge approximately 27,500m^3 from the harbour bottom prior to placement of the caisson mattress and rock revetment. The geotechnical investigation

found this material to be a dense sand with cobbles. It is expected that this material will be dredged using a clam bucket and then transported to a containment berm via a temporary wharf. The containment berm will be located on the east and south sides of the project site and will be used to store and dewater the dredge spoils.

Approx 17,000 m^3 can be disposed in the containment berm which will eventually become part of the final infill, which will be below the final grade elevation. The remainder of the material will need to be stockpiled until it is ready to be used for backfilling once the caissons are in place. This will require some double handling of the material. The re-used dredge spoils will be placed above the high-water elevation (+1.5m CD) and below Type 1 and Type 2 materials on the project site. Surplus dredge materials will be stored in the south containment area, resulting in a new land reclamation area. This area will have an overall footprint of approximately 11,500m^2 and approximately 7,000m^2 additional laydown space as shown in **Figure 2-2** below.



Qikiqtarjuaq Site Footprint Areas

Area	Structure	Above High Water Line	Below High Water Line	Total Areas
Yellow	Infill	11723.9	13289.7	25013.6
Orange	Infill Slopes/Drainage	3280.5	0	3280.5
Blue Left	Armour Stone North	94.3	4757.7	4852.0
Blue Right	Armour Stone South	127.7	7966.5	8094.2
Blue Center	Scour Protection	0.0	4930.8	4930.8
Red	Caisson Wharf	0.0	1568.2	1568.2

Qikiqtarjuaq Temporary Wharf Footprint Areas

Area	Structure	Above High Water Line	Below High Water Line	Total Areas
Yellow	Infill	172.7	206.4	379.1
Blue	Armour Stone	75.6	204.9	280.5
Red	Temporary Wharf	0.0	600.0	600.0

Figure 2-2 - Footprint Areas

2.1.8 Mooring Analysis

A Mooring analysis, using DHI MIKE 21 MA software, was completed to determine safe mooring arrangements of design vessels for ballasted conditions. Appropriate recommended environmental conditions were applied to the model to evaluate the mooring forces and vessel displacements. The mooring analysis is run in dynamic mode because of the nature of the software. However, with the absence of waves in the

environmental conditions, the results are similar to a static mooring analysis except for accidental mooring scenarios which consider the sudden break of any mooring line.

The Mooring analysis included the following:

- Assessment of line loads due to uniform wind and current.
- Permissible vessel movements under operational environmental loads for general cargo vessels.
- Accidental mooring scenarios to assure the safety of the berth and mooring equipment.

The simulations included the modelling of four vessels, as follows:

Vessel type	**Tanker**
Length Overall	150 m
Line Material	8 strand Mixed Polyolefin/Polyester 48 mm
minimum break load (MBL)	45 Ton
Vessel type	**General Cargo**
Length Overall	147 m
Line Material	12 strand Mixed Polyolefin/Polyester 46 mm
MBL	42 Ton
Vessel type	**General Cargo**
Length Overall	138 m
Line Material	8 strand Mixed HMPE/Polyester 60 mm
MBL	198 Ton
Vessel type	**Trawler**
Length Overall	80 m
Line Material	8 strand Polyamide 68 mm
MBL	80 Ton

The associated MBL of each line was based on data provided by vessel owners.

Controlling criteria for the mooring analysis included the following:

- The allowable percentage of load to MBL restricted to 50 percent.
- The allowable movement of general cargo vessels are restricted to a peak to peak of ±1 m surge, zero to peak of 0.75 m sway, and peak to peak of ±0.5 m heave and ±2.5 degree for roll (wind heel).
- The allowable movement of trawlers are restricted to a peak to peak of ±0.5 m surge, zero to peak of 1 m sway, and peak to peak of ±0.2 m heave and ±1.5 degree in roll, pitch and yaw.

Various loading conditions have a key effect in shaping the response of a vessel in a Dynamic Mooring Analysis (DMA). However, With the absence of waves as an excitation, the critical scenarios occur in ballasted condition.

Mooring arrangements for the largest design vessel is shown in **Figure 2-3**.

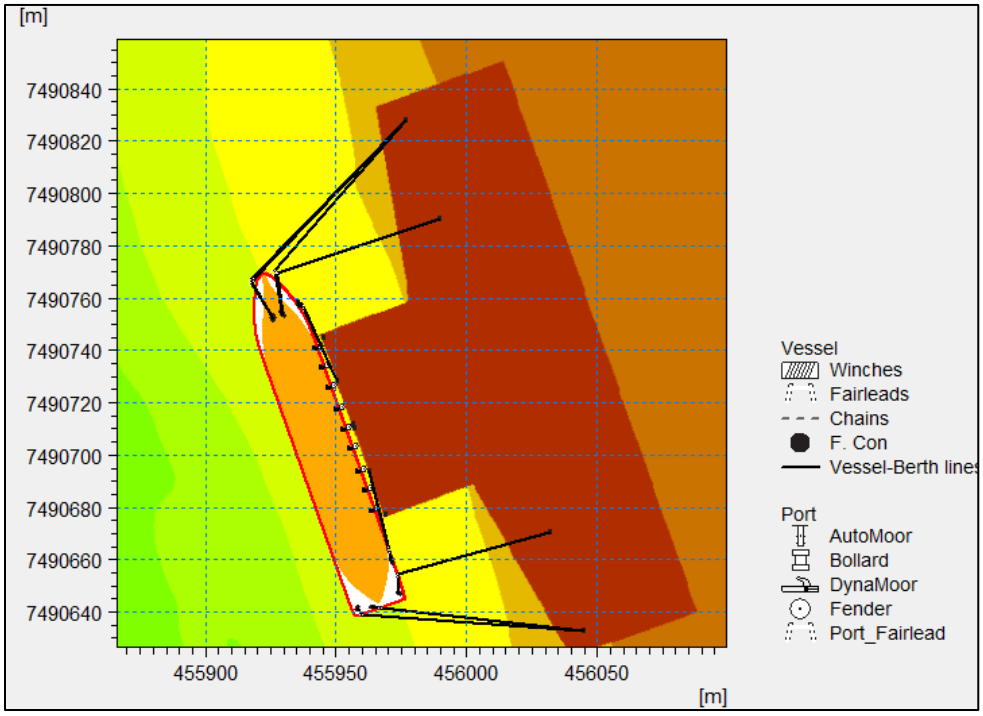


Figure 2-3 - Mooring Arrangement of 138 m Long General Cargo

A small pretension equal to 0.5 Ton was used assuming lines are preloaded by winches to an extent that they are no longer slack.

Operational environmental thresholds applied to the mooring analysis are introduced as follows:

- Current Speed = 2 knot (1 m/s) almost parallel to the vessel longitudinal axis according to OCIMF MEG4 recommendations when specific data is not available.
- Hourly Wind speed = 20 m/s, following typical maritime guidelines for general cargo. In reality, wind gusts and can be modelled as a wind spectrum. However, according to OCIMF MEG 4 it can be introduced as a uniform speed increase to a 1-minute gust. The latter method was approached in these simulations. In this case, the vessel motion gradually reaches its maximum value and then becomes steady. This displacement is controlled by the sudden movement criteria in this study.

The following results were obtained through the analysis:

- In the general cargo vessels, the line loads remain within the threshold limits for the various scenarios. The vessel motions are within the safe limit of sudden movements while loading cargo in HMPE line cases. The vessel motions exceed the safe limits in critical combinations by a small margin when utilizing PP lines. This is due to the use of long lines with higher elastic elongation. In these cases, an additional pretension can decrease the displacement, while the sum of the pretension and mooring forces remain

below 50% MBL. Moreover, it is noted that higher sway limits than 0.75 m have been introduced in many guidelines.

- In the oil tankers which are only modelled with PP lines with lower MBL, the line loads are within the 50% MBL limit. The motion limit criteria are higher than that of a general cargo since the cargo is assumed to be loaded via a floating hose. The motion limit criteria are achieved for operational wind and current.
- Fishing trawler mooring loads and vessel motions are within safe limits.

One final case was also considered where the trawler vessels unload on a refrigerated cargo vessel that is berthed at wharf. In the absence of data on the specific refrigerated cargo that will be used at the site, the following vessel particulars were considered:

Vessel type	**7500 DWT Refrigerated Cargo**
Length Overall	134 m
Beam	20 m
Draught	7.1 m
Line Material	8 strand Mixed HMPE/Polyester 60 mm
MBL	198 Ton

The vessel dimensions are for the average 7500 DWT refrigerated cargo carrier.
The stronger lines were picked due to the necessity of using stronger mooring lines for ship-to-ship transfer operations. The vessel arrangement is shown in **Figure 2-4**.

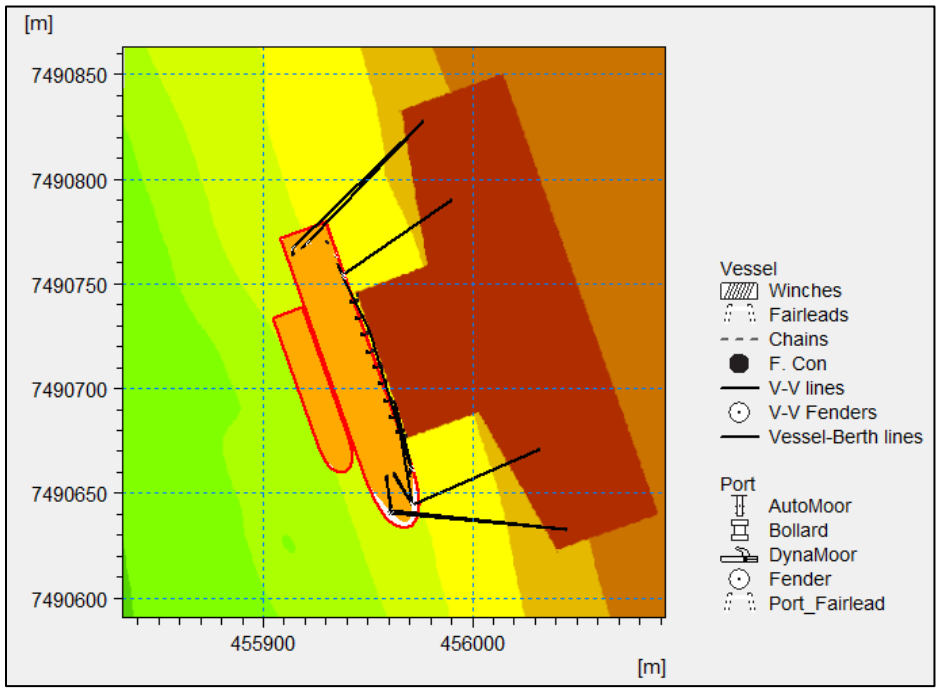


Figure 2-4 - Mooring arrangement of refrigerated cargo carrier

The results indicate that the mooring loads and motions are within limits and the 80-tonne bollard capacities are sufficient.

2.1.9 Seismic Analysis

There is no Canadian standard for the seismic design of marine structures. Other standards were reviewed including:

- PIANC Seismic design guidelines for port structures, 2001
- CSA S6:19 Canadian Highway Bridge Design Code
- British Columbia Supplement to CHBDC S6:19 Volume 1 (Feb 2025 Edition)
- OCDI Technical Standards and Commentaries for Port and Harbour Facilities in Japan (2002 and 2020)
- AASHTO LRFD Bridge Design Specification, 9th Ed, 2020
- American Society of Civil Engineers (ASCE) 61-14 Seismic Design of Piers and Wharves
- National Cooperative Highway Research Program (NCHRP) Report 611 – Seismic Analysis and Design of Retaining Walls, Buried Structures, Slopes and Embankments

In general, the design is based on evaluating structure performance when subjected to different level earthquake events. Different codes use different probability of exceedances for seismic design levels. In general, they are looking at multiple levels of earthquakes (more frequent, smaller event and less frequent, higher event). The damage criteria are based on the structure use and level of acceptable damage. CSA S6 gives general performance requirements but does not provide damage criteria for each performance level. We have compared performance levels in S6 and PIANC to determine an acceptable level of damage for each performance level.

We have completed both a simplified analysis using force-based methods (Monokabe-Okabe) to evaluate lower-level earthquakes and simplified dynamic analysis methods that use deflection-based methods to estimate deflections under higher level earthquakes. The wharf structure currently satisfies the performance design criteria for an 'other bridge' category as defined in CSA S6-19.

2.1.9.1 Geotechnical Subsoil Conditions

The Geotechnical Report by ABG indicated that the proposed wharf site consists of non-liquifiable soil and can be classified as a seismic Site Class C (X_c).

2.1.9.2 Regional Seismic Data

Regional Seismic Data for Qikiqtarjuaq NU was obtained from the 2020 National Building Code of Canada (NBCC) 2020 Seismic Hazard Tool provided by Earthquakes Canada and Natural Resources Canada. This information is provided in **Table 1-2** below. Since the Seismic Hazard Tool does not provide data for a 1-in-75-year return period (50% exceedance in 50-year design life), the level 1 category event will be assumed to be a 1-in-100-year return period (40% exceedance in 50-year design life)

Table 1-2 - NBCC 2020 Regional Seismic Data for Class X_c site in Qikiqtarjuaq NU

Probability of Exceedance Per Annum	0.0404%	0.10%	0.21%	1%
Probability of exceedance in 50 years	2%	5%	10%	40%
S_a (0.05)	0.804	0.416	0.235	0.0536
S_a (0.1)	0.768	0.42	0.252	0.0676
S_a (0.2)	0.573	0.336	0.213	0.065
S_a (0.3)	0.466	0.28	0.18	0.0561
S_a (0.5)	0.34	0.202	0.129	0.0404
S_a (1.0)	0.18	0.105	0.0662	0.0197
S_a (2.0)	0.083	0.0477	0.0296	0.00799
S_a (5.0)	0.0221	0.0122	0.00725	0.00165
S_a (10.0)	0.00736	0.00413	0.00248	0.000558
PGA (g)	0.307	0.179	0.112	0.0318
PGV (m/s)	0.23	0.131	0.0801	0.0217

2.1.10 List of Materials and Details

2.1.10.1 Concrete Caissons and Cope Wall

During the schematic design phase, concrete caissons were selected as the preferred construction material for this facility. It is expected that the caissons will be constructed in the south while the granular mattress and rock infill are prepared on-site. The caissons can then be transported to site via a semi-submersible barge and sunk into place on the granular mattress then filled with granular material. This construction method has been successfully used for a wharf rehabilitation project in the Canadian Arctic (Rittberg, Kullmann, Dube, 2010).

Concrete durability will be an important consideration for the longevity of the structure. Optimizing the concrete mix to provide a high-strength concrete with low permeability and suitable surface for slip-forming will ensure the structure is both constructible and durable to withstand the harsh Arctic climate.

2.1.10.2 Laydown Area

The fill material will be a combination of quarried rock and dredge spoils. While it appears that the dredged material will be suitable for fill material, quarried material / structural fill will be required for the ballast material inside the caissons and the backfill directly behind the caissons. The dredged material will be placed in other areas. A rock revetment consisting of filterstone and armourstone will be provided along the perimeter of the laydown area.

2.1.10.3 Ladders

Ladders will be installed on the concrete caisson keyways. Placing the ladders on the keyways ensures the ladders are spaced at approximately 40 m apart, which satisfies the Canadian Labour Code requirements and ensures the ladders will be recessed from the main wharf face to reduce the likelihood of the ladders interfering with port operations.

The ladders will be suspended chain ladders that can be pulled up before winter freeze-up and will extend from the top of the wharf deck to elevation -1.0 m CD with at least two rungs below the water level at low tide.

2.1.10.4 Fenders

Fenders are required along the front wharf face to absorb the energy of berthing vessels and prevent damage to both the wharf face and vessels. Various alternatives are being considered.

Fixed fenders are vulnerable to ice damage and are not considered practical. Alternative fender types such as cylindrical foam or pneumatic fenders were considered since they can be supported on chains and removed before winter freeze-up.

Pneumatic fenders consist of a vulcanized rubber body that is filled with air and can be protected with a chain and tire net. This fender type is not recommended for remote areas such as the arctic since mechanical damage during port operations could result in the air being released, rendering the fender ineffective until a replacement can be sourced.

Foam fenders are similar but are constructed of a foam core and protected with a reinforced polymer skin. Foam fenders will retain their ability to absorb energy even if damaged. Foam fenders were also identified as the preferred fender type during the stakeholder consultation process. Foam fenders approximately 2.5 m diameter x 4.5 m long will be provided to absorb the energy of the largest design vessels. As the fenders absorb a ship's energy, it will compress up to 60 percent, providing a minimum standoff distance of approximately 1 m. Each foam fender will be supported on two chains. These chains will be connected to the wharf at the wharf deck elevation to make it easier to remove and reinstall in the fall / spring.

2.1.10.5 Bollards

Six 80-tonne mooring bollards will be provided along the wharf face, along with four 80-tonne land mooring bollards in the upland area. This will provide adequate mooring options for the range of proposed vessels. The upland bollards are placed at locations to prevent conflict between mooring lines and the operation area on the wharf's apron. The mooring bollards along the wharf face will be anchored to the reinforced concrete cope wall and / or buttress walls and the land bollard will be anchored to reinforced concrete foundations that are horizontally supported by dead man anchors further back in the upland.

Considering the determined mooring arrangements, the required mooring line lengths for the larger vessels can reach up to 100 m, which can be provided from these vessels as their mooring lines are typically in the range of 180-220 m.

T bollards, **Figure 2-5**, are proposed for this facility. These bollard types are capable of resisting the anticipated mooring loads and can handle a wide range of steep ropes. This bollard style is commonly used at many deep-sea ports.

Figure 2-5 - T-Bollard

2.1.10.6 Scour Protection

Concrete caissons are gravity structures that depend on the integrity of the underlying granular mattress for their stability. Water jets from vessel bow thrusters and propellors as well as storm events can cause the mattress to erode over time. Scour protection is required on the top of the mattress in front of the wharf to protect the integrity of the caisson mattress and the overall wharf structure. A scour analysis was completed in accordance with PIANC guidelines, and it was determined that both concrete scour pads and armourstone were capable of providing adequate scour protection. Armourstone was selected as the preferred option since it the materials can sourced locally and the installation process is simpler.

2.2 Civil

2.2.1 Access Road

To support the marine infrastructure project, a 275-meter long, two-way gravel access road will be built at the end of the existing axis road to the new wharf laydown area. The road will be elevated to minimize ground disturbance and will incorporate a ditch on the upland side to manage stormwater runoff.

2.2.1.1 Road Design

The geometric design will incorporate a 30 km/h design speed, with a minimum horizontal curve radius of 50 m, and a 2% superelevation over the entire length of the road to force

water to drain to the West side. The vertical alignment will include a maximum grade of 6% and a minimum vertical curve length of 30 m. The road design will feature two – 4 m wide lanes with a 1 m shoulder on each side, the structure will consist of a 150 mm thick gravel surface layer over a 450 mm thick compacted aggregate base layer. The subgrade will be 300 mm Minus Shot rock in fill areas and proof rolled existing ground where required. The exterior slope was flattened along the road to 2.5:1 to help flatten slopes for safety purposes. The slope on the uphill side will remain at 2:1 to limit cut into the slope.

2.2.1.2 Stormwater Management

The drainage system will include a minimum 750 mm deep and 1000 mm wide ditch on the upland side with a minimum 1% slope, and culverts will be placed where required to assure proper drainage. The ditch will be lined with 500 mm of R5 rip rap to protect the slope from erosion and permafrost melting. Storm culverts will be utilized for road and site drainage.

Table 2-1 Catchment areas and Culvert Sizing

Culvert	Area (ha)	100 Year Flow (L/s)	Culvert Size (mm)
Culvert #1	4.79	326	750
Culvert #2	5.63	369	750
Culvert #3	2.62	172	600

2.2.1.3 Soil and Erosion Control

During construction appropriate sediment and erosion control measures will be in place on both the uplands and the marine side to prevent sediment from entering the construction site and the marine environment.

2.2.2 Security and Office Building Pad

The Security and Office Building pad will be designed as part of the overall site development. It will be located adjacent to the west side of the access road and the north end of the laydown area, providing optimal visibility of the road and wharf. The pad will accommodate six parking spaces, a guardhouse building, and a radio antenna.

2.2.2.1 Key Consideration

The pad will be sized to ensure adequate clearances and circulation. The pad structure will consist of a 150 mm thick gravel surface layer over a 450 mm thick compacted aggregate base layer to withstand heavy vehicle traffic and local weather conditions. 300 mm Minus Shot rock will be used to bring the pad up to subgrade. The pad will be sloped 2% towards the west to prevent water ponding and erosion. Water and Sanitary services for the guardhouse will be internal and are not part of the civil design.

2.2.3 Wharf Laydown Area

The wharf laydown area will be another key component of the overall site development. It will abut the wharf designed by CBCL's marine engineers and will be designed to support the marine industry in the area. The requested minimum size of the laydown area identified in the terms of reference was 15,000-square-metres.

2.2.3.1 Site Layout and Grading

The laydown area, originally identified in the terms of reference of 15,000 square meters, is currently shown as approximately 18,360 square meters on the site civil plan. The uplands laydown area has been moved in, in coordination with caisson placement. Additional scope items are currently being reviewed as a phase 2 work, and the expected footprint needed to accommodate the additional assets will likely require additional room than 15,000sq.m for that reason, the larger footprint is remaining for now until the phase 2 work is refined.

The area will have a 1.5% slope towards the front with a crown to direct stormwater runoff and snow melt to the sides. A rock-lined channel will be constructed on the upland side to collect and direct stormwater runoff from the uplands area away from the laydown area, either to a culvert at the North end of the laydown area or directly to the South of the site. The pad will also be built up from the adjacent ground to prevent snow melt coming off the adjacent hill from infill the ditch with ice and running across the laydown area.

2.2.3.2 Laydown Structure

The pad's structural layer will consist of a 200 mm thick gravel surface layer atop a 450 mm thick compacted aggregate base layer. Core material will be used to raise the laydown area up from existing conditions to the required subgrade providing necessary support for the gravel structure under heavy vehicle traffic and harsh weather conditions.

2.2.3.3 Security and Access Control

The laydown area will be enclosed by a chain link fence to control access and security. Adequate gate access points will be provided for vehicle and pedestrian traffic. A Security and Office Building, equipped with security personnel will be located outside the laydown area to monitor access and deter unauthorized entry. Onsite lighting will be installed to improve visibility and security during nighttime operations.

2.2.3.4 Vehicle Movement

The primary flow of traffic during offloading will be to the freezer location. For this reason, it is recommended that the freezer space be separated from other areas (warehouse and user storage). Additionally, the fuel tanks will be kept to the southeast of the site to avoid traffic around the tank farm and fuel manifold.

2.2.3.5 Proposed Future Development

The wharf laydown area will accommodate various infrastructure components to support marine operations; these include the following:

- Two 1,000,000-liter fuel tanks with containment berms
- Fuel pump building
- Fuel pump
- Fenced-in user storage area
- Dry warehouse
- Approximate 2,500 square meter freezer storage building. Final size and footprint necessary to be determined
- Chandlery

2.2.3.6 Fuel Supply

The current scope of work does not include construction of fuel tanks as part of the current construction documents; however, design is being carried out to allow for them to be added at a later phase. Due to the size of the tanks, they have been shown on the civil drawings for site layout purposes. The long-term master plan includes the construction of a (2)-1,000,000 Litre tank fuel farm.

During consultation, it was identified that fishing vessels would need to refuel upon arriving in port and would not come to port if fuelling was not available. The larger vessels, (75 m+ vessels) have a fuel capacity of 800,000 L and would typically take on 300,000 L – 500,000 L of fuel per trip, which would typically occur every month. With the size of the fishing fleet that could be serviced by the port, the two (2) proposed fuel tanks would be exhausted within a month and would either require additional trips by Woodwards or require larger fuel capacity. Another option would be to connect the fuel tanks to the Petroleum Products Division (PPD) fuel farm.

The existing tank farm has a 4 million litre (ML) capacity and the community typical utilizes 2 ML per year, leaving 2 ML of reserve capacity. If the existing fuel manifold extended to the new port, the existing tanks could be used in the short term to service the fishing industry and be used in the future to top up the port tanks. This would reduce the amount of added trips required for Woodwards to make per season, and when they do make trips, it would be for larger volumes and therefore more cost effective.

From a site layout perspective, the tanks have been shown on the east side of the laydown space. This would keep the tanks and fuel manifold away from regular traffic and minimize the areas where road crossings would take place. Design layouts have been shown on the civil drawings for the proposed manifold route and suggested extension to the fixed wharf. As part of an additional scope item added to the project, the design team will complete schematic design of the fuel tanks, which will be submitted separate from this report.

2.2.4 Site Cuts and Fills

The design of the road and laydown area has been optimized to minimize the excavation and exposure of existing permafrost, based on previous site experience in the region. The laydown area has been squared off to increase its size and accommodate future

infrastructure needs. Minimal cuts are required, primarily in the southeast corner of the laydown area, the access road's ditch, and the rock lined drainage channel on the east side of the wharf laydown. To protect exposed permafrost, all excavated areas will be promptly covered with a 500 mm layer of R5 riprap. Construction materials for the road and laydown area will be sourced from a local quarry approximately 2km north of the site.

Estimated site cut/fills, and excavation and backfill volumes are presented in the Table below (these quantities do not include excavation for the installation of the wharf, or the protection required on the wharf laydown area slopes):

	Road	Wharf Laydown
Site Cuts (m^3)	900	800
Site Fills (m^3)*	7,000	160,000

**Includes road and surface gravels*

2.3 Architectural

The Operation / Security Building is 106 m^2. The ground level is a barrier-free layout that prioritizes seamless transitions between the entrance, washroom, offices, and security area. Those are all connected by a common area that also has a kitchenette. Overall, the design aims to provide port authority officials with an effective and practical workspace in Qikiqtarjuaq.

The telecommunication tower space has been integrated into the main building. Increasing the area of the main building.

2.3.1 Security and Office Building

Area	Size
Vestibule	6 m^2
Security office	13 m^2
Foyer	4 m^2
Kitchenette/Common area	25 m^2
Office 1	13 m^2
Office 2	10 m^2
Mechanical room	12 m^2
Electrical room	3 m^2
Telecommunication Office	4 m^2
Storage	6 m^2
BF Washroom	7 m^2
Janitor	3 m^2
Total (net area)	**106 m^2**
Total (gross area)	**133 m^2**

2.3.2 Cold Storage Unit (6x)

Six refrigerated shipping containers serve as storage units. Power is supplied from an electrical panel located adjacent to the containers. The units sit directly on the concrete pad.

From prior discussions, these six freezers are insufficient to support the needs of the fishing industry. Further modifications will be required to meet industry demand.

2.3.3 Code Analysis

2.3.3.1 Zoning

The site is to be zoned as *Industrial.*

2.3.3.2 Industrial

If **zoned Industrial**, with permitted uses include the following:

- Building supply or contractors' shop
- Communications facility
- Community freezer
- Outdoor storage
- Heavy equipment and vehicle yard

With conditional uses:

- Barge staging and landing site with associated warehousing
- Fuel storage facility
- Hazardous goods storage

Zone Requirements

The following provisions apply to all development in this Zone:

- Setbacks (minimum):
  - Front = 6 meters
  - Rear = 8 meters
  - Side (Exterior) = 6 meters
  - Side (Interior) = 8 meters, or as required by the Fire Marshal
- Building Height (maximum) 10.7 meters (35 feet)
- Only 1 caretaker unit is permitted on a lot.
- Hazardous goods storage or tank farm uses shall not be permitted within 30.5 meters of any waterbody.
- No food processing facility including food storage, handling, or preparation shall be permitted within 450 meters of a waste handling facility.

2.3.3.3 Transportation

The site is located near the existing Airport that is **zoned Transportation**, which poses restrictions and limits development around the Airport, that includes:

Zone Requirements

- Any development within a 4-kilometre radius of the airport reference point, as shown by the Transportation Influence Zone on the Community Plan Schedule, shall be subject to the approval of NAV Canada and Nunavut Airports.
- No development shall occur within 200 m of the Non-Directional Beacon (NDB) Site.

2.3.3.4 Code Matrix

The building design has been reviewed in accordance with NBC 2015 and the Qikiqtarjuaq Zoning By-law. It is important to note that, due to the extended timeline of this project, construction may commence under a revised building code. As a result, applicable regulations may evolve, and certain requirements could become more stringent, potentially necessitating adjustments to the layout.

Below are the findings and requirements based on NBC 2015. Due to its classification (Group D – offices) and dimension (133 m^2), the building falls into Part 9 Application.

Item	2015 National Building Code of Canada Matrix	NBCC Reference
1	**Project Description:** ■ New Addition Office Building Alteration Change of Use	Part 9
2	**Major Occupancy(s)** Group D, 1 story	9.10.2.1
3	**Building Area (m^2)** Existing: 0 New: 133 m^2	9.10.2.1
4	**Number of Storeys** Above Grade: 1 Below Grade: 0	9.10.2.1
5	**Height of Building (m)** 5.4	
6	**Number of Streets/Access Routes** 1 Street	9.10.2.1
7	**Building Classification** Group D, 1 story	9.10.2.1
8	**Sprinkler System Proposed** NFPA 13 ■ Entire Building Basement Only In Lieu of Roof Rating ■ Not Required	9.10.2.2(2)
9	**Standpipe Required** ☐ Yes ■ No	3.2.5.8 (1)
10	**Fire Alarm Required** ☐ Yes ■ No	9.10.18.2(2)
11	**Water Service/Supply Adequate** ■ Yes ☐ No	3.2.5.7 (1)
12	**High Building** ☐ Yes ■ No	3.2.6.1
13	**Construction** Combustible Allowed ■ Yes ☐ No Proposed: Combustible Non-combustible ■ Both	9.10.2.1
14	**Occupant Load** ☐ m^2/person ■ Based on Design	9.9.1.3
15	**Travel Distance (m)** 25 m	9.9.7.4
16	**Washroom: Number of Fixtures** 1 W.C	3.7.2.2 4)
17	**Barrier Free Design** ■ Yes ☐ No	9.5.2.1
19	**Additional Fire Separations Required** Mechanical Room 1 Hour Janitor Room 1 Hour	 9.10.8.3 9.10.8.1

20	**Required Fire Resistance Rating (FRR)**	Assemblies FRR Floors: - Supporting Members FRR Beams: - Columns: - Other: -	9.10.8.1 - A

	Spatial separation – Construction of exterior wall							9.10.14.4- A	
	Wall	**Area of EBF (m2)**	**L.D. (m)** *Halved*	**L/H**	**Permitted Max % of Unprotected Openings**	**Proposed % of Unprotected Openings**	**FFR (Hours)**	**Non-combustible required (9.10.14.5-A)**	
								Construction	**Cladding**
	North	68.3	N/A		100%	13%	45min	Combustible	Combustible
	South	68.3	4		18%	14%	1h	Combustible	Incomb.
	East	49.7	3		19%	13%	1h	Combustible	Incomb.
	West	37.5	10.9		100%	8%	45min	Combustible	Combustible

2.3.4 Exterior Envelope

The RSI (thermal resistance) requirement for each envelope component has been calculate based on 2017 national energy code as reference as follows.

	NEC 2017 requirement for Zone 8 *m2 · K)/W*	**Proposed RSI**
Wall	5.464	7.69
Roof	7.042	9.65
Floor	7.042	7.7

The building's super-insulated envelope is meticulously designed to ensure minimal operational costs, enhancing sustainability and resource efficiency. The wall assembly is insulated externally with two layers of 102 mm XPS insulation, eliminating the impact of thermal bridging. A vapour barrier is installed on the external plywood to optimize thermal performance, while the exterior cladding is supported by 9” ASC thermally broken clips for durability and energy efficiency. The walls meet a 1-hour fire rating as required by Appendix D of the NBC 2015.

The roof assembly follows the same principles, incorporating three layers of XPS boards—two at 102 mm and one at 50 mm. The vapour barrier is positioned on external plywood beneath the insulation, with the roof finished in standing seam steel panels, ensuring resilience against the harsh Arctic climate. The floor is also insulated externally with two layers of 102 mm XPS insulation, with a soffit constructed of 9 mm pressure-treated plywood for added protection and durability.

The exterior materials are specifically chosen to endure the extreme climate. Corrugated steel siding and standing seam metal roofing are both low-maintenance and robust. Replacement materials are easily sourced from Montreal and transported to Qikiqtarjuaq via sealift, simplifying maintenance logistics.

Doors and windows are designed for high thermal performance. The exterior doors, constructed from insulated metal with thermally broken frames, achieve an RSI of 2.00. The fiberglass windows are triple-glazed, argon-filled, and coated with low-e to provide an RSI of 1.11. Bathroom windows include a privacy transparency film, while optional blinds or shades offer varying levels of light control, from 1%-3% dimming to 0% blackout with side channels. These windows also feature low-conductivity spacers, a U-factor of 0.74, a Solar Heat Gain Coefficient (SHGC) of 0.56, and 70% visible light transmission, meeting rigorous energy efficiency standards.

The exterior stair, ramp and landing are to be galvanized steel, which is adequate for this type of climate and usage.

Together, these features ensure the building is not only energy-efficient but also well-suited to the unique challenges of the Arctic environment.

2.3.5 Interior System

The building's interior is thoughtfully designed to enhance comfort, durability, and functionality. All interior walls are insulated with batt insulation, providing acoustical comfort and ensuring privacy. Partitions are constructed with wood studs, and where required, they achieve a 1-hour fire rating.

Interior doors are crafted from hollow wood, stained, and varnished. Doors in offices and the vestibule include glazing inserts to allow natural light to pass through the building. In contrast, doors for storage areas, bathrooms, and mechanical spaces are plain. All doors are fitted with necessary hardware, including hinges, locksets, latch sets, stops, closers, and labels. Door frames are made from 50 mm painted steel, ensuring durability. Exterior doors are insulated metal with thermally broken frames for enhanced energy efficiency.

Floor finishes are designed for practicality and minimal maintenance. Vinyl flooring is used throughout most spaces, providing a durable and easy-to-clean surface. Bathrooms feature 300 mm x 600 mm ceramic tiles, chosen for their superior water resistance. In the vestibule, a scraper mat is installed over a waterproof membrane to reduce dirt entering the building.

Ceilings are finished with 16 mm painted gypsum board, with water-resistant gypsum board in wet areas. Walls are painted gypsum board, also incorporating water-resistant panels in wet areas. In communal spaces and offices, select walls feature plywood panel accents to add warmth and texture. Baseboards are 50 mm vinyl, except in bathrooms, where the wall ceramic extends to the floor for a seamless finish.

Cabinetry and shelving are securely supported with bracing boards installed within the wall framing. The kitchenette features a plastic laminate countertop and melamine cabinets,

with a plywood toe kick to prevent moisture damage. Similarly, the bathroom vanity is equipped with a plastic laminate countertop and melamine cabinetry. All hardware is heavy-duty and selected to meet the demands of commercial use.

High-efficiency, Energy Star-rated appliances are included, such as a refrigerator, dishwasher, stove, and microwave, ensuring energy efficiency and sustainability in daily operations.

2.3.6 Building Civil & Structural Engineering

2.3.6.1 Civil Engineering

Detailed site grading around the building will be completed at the next design stage. Refer to the overall site and civil drawings for site pad elevations and sections.

2.3.6.2 Structural Engineering

The geotechnical reports provided by Adaptive Baseline Geotechnical Ltd. are focused on the Marine Infrastructure of the new deep water port facility in Qikiqtarjuaq, NU.
The project Geotechnical Engineer final recommendation concluded that rock-socketed piles and ad-freeze piles are unsuitable for this location. Instead, it recommended using a superficial foundation system, such as a cribbing foundation or a triodetic space frame. For this building, a timber cribbing foundation system has been selected. This option is relatively low-cost, uses simple materials, and is easier to construct compared to a drilled pile foundation. However, as indicated in the geotechnical report, it requires regular evaluations to monitor movements and ensure the structure is performing as expected. Adjustments may be necessary over time, especially during the first few years after construction, depending on the actual site conditions.

The foundation layout includes timber cribbing arrangements of 1260 x 1260 mm and 840 x 840 mm.

Floor framing will use parallel chord floor trusses or engineered floor joists. Preliminary layouts are shown on the floor and roof framing plans. We have provided preliminary sizes of LVL beams to support the floor system.

The floor and beam system for the main floor will be framed flush. This means the top of the beam and the top of the joists will be at the same elevation.

The roof system employs a similar arrangement of roof joists, columns and beams. The roof joists for the roof framing are designated as 2PLY 38 x 286 mm SPF dimensional lumber at spacing shown on the plans. The roof joists are oriented the same way as the roof slope. To achieve the varying overhang requirements identified on the architectural plans, 4PLY 44 x 286 mm LVL will support cantilever 2PLY 44 x 286 mm LVL. All preliminary sizes are shown on the plans provided. The roof joists will cantilever over the exterior walls to achieve the varying overhang.

The exterior ramp/landings for accessibility are a work in progress. We intend to use timber cribbing to support the layout.

2.3.6.3 Codes and Standards

- Canadian Wood Council (Latest Version)
- National Building Code (2020)
- GN Good Building Practices Guidelines (3rd Edition)
- Good Building Practice for Northern Facilities (4th Ed.)
- Good Engineering Practice for Northern Water and Sewer Systems (2nd Ed.)
- CAN/CSA-A23.3-19, Design of Concrete Structures.
- CAN/CSA-S16-19, Limit States Design of Steel Structures.
- RSIC-2004, Reinforcing Steel Manual of Standard Practice
- Handbook of the Canadian Institute of Steel Construction
- CSA A277-16, Procedures for Certification of Prefabricated Buildings, Modules and Panels

2.3.7 Mechanical Engineering

2.3.7.1 General

The overriding philosophy in design of the mechanical systems will be operating simplicity, consistent with the requirements for providing a healthy and cost-effective environment. Construction will be governed by the National Building Code of Canada (NBCC 2015) and specific standards including the following:

- Plumbing and drainage to Canadian Plumbing Code (NPCC)
- Fuel systems to National Fire Code (NFCC) and CSA-B139, as applicable
- Air systems to ASHRAE 62

2.3.7.2 Heating

The following describe the heating systems:

- Heating will be by hot water (hydronic) using high-temperature corrosion-inhibited antifreeze solution (Dowfrost HD).
- For the purposes of this report, oil is presumed to be the heating fuel of choice.
- One chimney-vented hot water boiler. Weil-McLain Series WGO-3RD.
- A central distribution panel consisting of 4 high-temperature and 2-low-temperature zones. HPS Controls CFI-642. All heating pumps will be contained within this panel. Space heating with high-temperature zones. Heat tracing with low temperature zones.
- Finned tube baseboard in all rooms requiring heat. Engineered Air P10 or similar.
- A preheat coil at the HRV outdoor air inlet is shown in this drawing set. If the building is intended to be used only during the shipping season, a preheat coil will serve no useful purpose. This can be deleted with no other required alterations to the heating design.
- An optional force-flow heater is shown in the front entrance.

- An electric boiler is added and is intended as a back-up heating source. It would run in the event of a primary boiler failure due to fuel starvation or burner failure. It would not work during a power failure.

2.3.8 Plumbing

The following describes the plumbing systems:

- Tanked domestic water and sewage. Upright polyethylene 1477 l for domestic water. Low profile fiberglass 2270 l externally insulated and hydronically heat traced for sewage. Standard of Acceptance: Equinox Industries.
- A single domestic water pressure system for the entire building is proposed. Grundfos Scala2.
- Indirect-fired storage domestic hot water tank. Weil-McLain Aqua Plus 80.

2.3.9 Fire Protection

The following describes the fire protection:

- It is understood that the building will not be sprinklered.
- Class ABC stored pressure multi-purpose fire extinguishers to NFCC requirements will be mounted on wall brackets.

2.3.10 Ventilation

One heat recovery ventilator (HRV) will perform all ventilation functions, including supply air, bathroom exhaust and janitor room exhaust. Standard of Acceptance: Nu-Air NU500-HRV. There is no mechanical cooling.

2.3.11 Fuel Supply

One exterior fuel oil tank, nominal capacity 2200 l, double wall, ULC listed.

2.3.12 Electrical Engineering

2.3.12.1 Preamble

The electrical systems and technologies will be durable, simple to operate and easy to maintain in operating the strategic Qikiqtarjuaq Marine Infrastructure facility in its remote location of the building.

2.3.12.2 Codes & Standards

Canadian Electrical Code 2021 Good Building Practice 4th Edition 2021 and the National Building Code 2015 are the codes to be followed.

2.3.12.3 Acceptable Wiring Methods

EMT, AC90 and NMD90 are acceptable wiring methods. EMT acceptable in exposed areas, and to junction boxes e.g., in the ceiling convenient to each room. NMD90 or AC90 acceptable in concealed wall and ceiling space. AC90 is required for final termination on lighting equipment and mechanical equipment.

2.3.13 Utility Service & Distribution

From the estimated load of the Administration Building, 200A Service at 208/120V 3-Phase 4-Wire is required. The service upgrade is to accommodate the electric boiler that has been introduced. It includes the mechanical loads. The service will be provided from a 200A 3-Pole feeder breaker and cable from the Site Electrical Building. The Service Panel P16 has 42 circuits. From the Admin building service Panel 'P16', a 60A 3-pole feeder breaker and cable will feed the sub-panel P17 in the communication room. The communication subpanel will have 24-circuit capacity.

2.3.14 Communication Service & LAN Network

As the Communication House has now been merged with the Security and Office Building, necessary provision has been made for the Communication Room to accommodate the required equipment, including servers, converters, power supply units, receivers and transmitters, equipment rack, and power sub-distribution panel. The proposed self-supporting communication tower for the radio antennas and microwave dishes would be located about 3 m just outside the wall of the building. The radio room will be linked to the mast with cable tray on support frame, about 2.25 m high, for the microwave guide and communications.

CAT-6 Ethernet Local Area Network voice and data cabling from workstations in the building will home run to patch panel on backboard in the communication room. Through modems and routers necessary hook up to the communication system, as well as public communication service that may be available.

2.3.15 Energy Efficiency – Lighting, Power, Etc.

The use of LED lighting will save energy cost and significantly minimize maintenance by extending re-lamping to about 15 years from the typical 4 years with older technologies. Among other provisions of the 2021 Good Building practice provided in the project, the use of timers, photocell and occupancy sensor lighting control along with mechanical programmable control systems will combine to minimize the energy and life-cycle costs of the building.

2.4 Site Electrical

2.4.1 Codes, Statutes, Regulations, By-Laws

The following is a list of the most relevant codes and standards applicable to the electrical design:

- CASA C22.1-24 Canadian Electrical Code (CEC).
- Office of Chief Electrical Inspector Bulletins and Directives.
- CSA C22.3 No. 7-10 Underground Systems.
- Electrical Guidelines, Design and Construction Manual, Department of Fisheries and Oceans.
- Harbour Accommodations Guidelines for Small Craft Harbours Branch Fisheries and Oceans Canada by Public Works and Government Services Canada.
- Government of Canada's Navigation Protection Act, R.S.C. 1985, c. N-22.
- The Canadian Aids to Navigation System, Canadian Coast Guard.
- IES – Applicable sections of the Illuminating Engineering Society (IES) Recommended Practices (RP).
- Good Building Practice for Northern Facilities, 4th Edition, 2021.

2.4.2 Electrical Utility Services

Three-phase high voltage service will be extended approximately 1.5 km from the existing utility overhead distribution system to a terminal pole(s) adjacent to the boundary of the port. Transformation from the utility distribution voltage to 600 V, 3-phase, 4-wire will occur at this location. Extension of the utility overhead service including the transformers and associated connections will be performed by Qulliq Energy Corporation (QEC). Capital costs associated with the service extension will be shared by QEC and port (GN) based on negotiations between the parties.

Electrical service to the site will be fed from the pole mounted (assumed) transformer(s) and will run underground to the Site Electrical building at the facility. Service conductors will be supplied and installed under the construction contract with final terminations at the transformer by QEC.

The service entrance rating will be calculated to meet CEC requirements for the types of loads within the facility. The size for the initial (priority) phase of the port development is estimated to be below 400 kW. The electric utility QEC has indicated that the local system can accept this load. However, potential future development will significantly increase this load.

Based on current information the anticipated service size required to accommodate the identified initial and future loads is 800 kW.

The electric utility QEC, has indicated that their present system cannot support a load of 800kW without upgrading the capacity of both the generating plant and its associated distribution wiring. The planning and implementation of these upgrades will take three to four years after they receive approval to proceed. Consequently, it is critical that decisions on the port's operations and facilities are reached as soon as possible to finalize the calculated electrical load to accommodate this lead time.

Since the port will not initially be operating at its full potential, there may be a transition period from initial to final electrical loading.

The electrical service will have a single utility revenue meter for the entire facility. Owner's submetering can be provided as necessary to monitor energy usage of loads within the port. However, since details of the required load monitoring are not yet known, Owner's metering is only included for the entire facility.

2.4.3 Site Electrical Distribution

General electrical distribution throughout the site will be 3-phase, 4-wire at 347/600 V and will originate at the main switchboard located in the Site Electrical Building.

Electrical services from the Site Electrical Building to the Security and Office Building will be at 120/208 V, 3-phase, 4-wire. This will avoid having to place a local transformer in the Security and Office Building. Refer to 1.3 Architectural for details of electrical installation at the Administration/Security Building.

Power distribution for initial and anticipated future loads will originate at the Main Switchboard. Circuit breakers will be provided for each identified initial load and space allocated in the switchboard for breakers for anticipated future loads.

The low temperatures experienced at this site are outside the range used in standard testing procedures used to certify most electrical equipment and materials. Consequently, to meet CEC requirements that equipment be installed within conditions for which it is certified, some equipment will have to be installed within environmentally controlled enclosures.

Due to their distance from the Site Electrical Building, the shore supply power shrouds will have to be fed at 600 V requiring a local transformer at the shroud. Transformers will be epoxy-potted in CSA 4 X rated enclosures. Circuits feeding shore power receptacles will be ground fault protected as required by CEC.

Initially there will be six (6) refrigerated (40-ft) containers on site. This type of container requires a 480 V supply. A 600 V circuit from the main switchboard in the Site Electrical Building will feed a 3-phase 600-277/480 V transformer and associated distribution panel to power these loads. Transformer will be epoxy-potted CSA 4 X rated, and the panel will be

installed in an environmentally controlled enclosure both of which will be located adjacent to the containers. The initial quantity of refrigerated containers has already been identified as inadequate to support port operations and it is anticipated that as the design progresses, their numbers will be increased possibly to 80 plus units. Alternatively, the refrigerated containers could be replaced by a cold storage building: however, this option is not part of project scope.

The present electrical layout for refrigerated containers allows for 8 containers. .

Site Receptacles

Industrial grade, general use receptacles will be provided in the electrical enclosures for general servicing and maintenance.

Receptacles for servicing small vessels will be provided at shrouds installed on the fixed wharf. Each shore power shroud will include the following receptacles: 20 A duplex of the non-locking type conforming to Diagram 1 of CEC.

- 20 A and 30 A of the single locking type conforming to Diagram 2 of CEC.
- 100 A single of the special purpose pin and sleeve type (see **Figure 2-6**).

The shore power receptacles are intended to serve the electrical needs of smaller vessels.

Figure 2-6 - 100 A Single Receptacle

All shore power shroud receptacles rated at 125 V, 15 A or 20 A will be protected by ground fault circuit interrupter breakers of the Class A type. The feeders to the transformers will be protected by 30 mA ground fault protection devices.

Wiring Methods

The wiring methods, where exposed to the weather or splashing of water or salt spray, will be:

- Rigid PVC conduit (-40 C) with mechanical protection:
- Armoured TECK 90 (-40 C) cable c/w PVC coated TECK connectors; and

- SOOW flexible cable for final connection to floodlights and similar equipment.

The wiring methods inside the electrical enclosures will be:

- EMT tubing; and
- Rigid PVC conduit stub-ups entering the cabinet from below.

RW90 XLPE and RWU90 XLPE insulated building wires will be used with conduit.
Spare conduits complete with pullcords will be provided between the Site Electrical Building and other buildings and ley locations. This will reduce the requirement for new trenching across the site as development occurs.

2.4.4 Standby Electrical Power

Standby electrical power is not included in the initial scope of the project. However, the desirabilty of having on-site generation was raised during the Schematic Design phase and for the purposes of this report it is assumed that it will be required early in the port's development. Consequently, the Site Electrical design will incorporate provisions for connection of an on-site standby generator system.

Without an on-site generator, a utility outage of greater than 30 minutes is likely to result in a loss of communications. Outages of a few hours, depending on ambient temperature, could result in degrading of frozen product stored in refrigerated containers or cold storage building; this could result in significant financial loss and undermine the port's reputation for reliability among users.

Figure 2-7 - **Typical Generator in Weatherproof Enclosure.**

Considering the potential final electrical load of the port could be in the order of 800 kW, it is likely that the on-site generator will not be sized to service the entire load. It is assumed that the generator will only supply the Security / Office Building, the refrigerated containers (or the Cold Storage building) and the Site Lighting and that this load will be 300 to 500 kW, mostly due to the cold storage. This capacity will be reviewed and revised as the design moves forward assuming the generator is approved. An automatic transfer switch (ATS) rather than a manual one is recommended for this application, and an ATS has been incorporated into the electrical design.

QEC does not allow customer on-site generation to be connected to its system. If the utility cannot supply the required power to the site, and it is desired that some loads be fed from the on-site generator to reduce the loading on the utility then those loads will have to be electrically separated from the utility power. This adds complexity to the electrical system including having the generator rated for prime power instead of standby. This option is not included in the present design intent.

Multiple smaller capacity gensets, such as 250 kW units, will be considered as this will provide redundancy in case of a unit failure and allow for units to be added as the load grows.

Provision for the future installation of generator(s) will be included in the initial design. It is anticipated that the generator(s) will be positioned adjacent to the Site Electrical Building and will be inside a factory built weatherproof enclosure(s) complete with a base mounted fuel tank. The nominal capacity of the fuel tank will permit full load operation of the generator for 24 hours before re-filling. See Figure 2.8.

2.4.5 Grounding

Grounding and bonding conductors shall be installed in accordance with Section 10 of Canadian Electrical Code. However, should permafrost or poor conductivity of the quarry material used to build the site be encountered then specific remedies might be required. Typical remedies include chemically enhanced ground electrodes or stainless-steel plate grounding electrode(s) that is a minimum of 10 mm in thickness and 0.36 m^2 in area installed underwater.

2.4.6 Lighting

Building Interior and Exterior Building Mounted Lighting

The use of LED lighting will reduce energy costs and significantly minimize maintenance due the longevity of LED lamps and fixtures compared to older technologies. Among other provisions of the 2021 Good Building practice provided in the project, the use of controls including timers, photocells, and occupancy sensors along with programmable controls for systems will combine to minimize the energy and life-cycle costs of the buildings. Lighting system performance will meet the applicable IES recommended illumination levels for a particular space and task and applicable building code requirements for exit and egress lighting. Refer to 1.3 Architectural for information on Building Electrical systems.

Exterior Site Lighting

The access road to the site will not be illuminated.
Site Lighting system performance will meet the applicable IES recommended illumination levels for marine outdoor areas and associated tasks. As a minimum, illumination levels will be provided for safety and security. Due to the size of the site and the variability of the

tasks performed across the area, it is not practicable to illuminate the entire site to one common value. Consequently, illumination levels will between 10 lux and 100 lux.

Area lighting for the Security and Office Building parking area, wharf, laydown area, and circulation routes will consist of pole-mounted LED fixtures. Fixture and poles for the Security and Office Building area will be commercial grade. Other site lighting assemblies will be industrial grade. The required lumen output and distribution will be determined based on the final site layout. Fixtures with a high degree of light output control will be selected to reduce light pollution.

The area lighting will be zoned to permit selective control of areas. Controls will include combinations of relays, contactors, and photocells. Hand-Off-Auto selector switches will permit overriding of photocell control or other automatic controls. The controls will be in the Site Electrical Building with remote access in the Administration/Security Building. The lighting controls will permit the lighting to follow the seasonal ambient lighting. Bird spikes will be provided on the fixtures.

Exterior lighting will be supplemented by building mounted exterior lighting especially at building entrances. See **Figure 2-8** and **Figure 2-9**.

Figure 2-8 – Typical Industrial LED Floodlight

Figure 2-9 – Typical Commercial Area Lighting Fixture

Lighting Poles

Lighting poles for area lights will consist of hot dipped galvanised steel poles complete with transformer bases or base mounted pull boxes as required for wiring access and ease of conduit installation. Pole bases may be designed to accommodate pull boxes for systems other than lighting to avoid use of inground pull boxes. Poles will be mounted on reinforced concrete bases, which will extend 750-1500 mm above finished grade to provide mechanical protection. Reinforced concrete bases will be precast off-site where practicable.

Bollards will be provided as deemed necessary to protect poles from vehicular traffic and snow removal. The mounting heights and locations for exterior fixtures and poles will be based on the lighting study and final site layout. However, it is anticipated that approximate pole heights at the Administration/Security Building will be a 6 m and those at the port site will be 18 m. Although higher mounting heights are available, this height allows servicing from standard bucket trucks.

All poles will have features to accommodate CCTV cameras. Pole locations will be selected so they do not interfere with anticipated port operations and traffic movements. Consequently, pole locations and to a lesser extent quantities are subject to change as the design progresses.

2.4.7 CCTV Surveillance and Access Control Systems

These systems are not part of the initial priority list for the project: however, they may be required when operations begin for safety and security reasons for both the port authority and port users.

It is assumed that the head end equipment for these systems will be installed in the Communications room in the Security and Office Building. This equipment, cabling, door/gate controllers, cameras, and monitors, etc. are not included.

Provision for the future installation of these systems such as empty conduits and attachment points for cameras on site lighting poles, conduits for card reader and gate operators will be included to avoid costs and disruption from trenching later.

2.5 Radio Communications

Stakeholder consultations identified that fishing and marine fleets that are expected to utilize the port currently use Star Link Internet when offshore and VHF radio communications when in close proximity and entering a port. To service the fishing and shipping fleets, VHF radio communications is being provided at the port.

3 Costing

CBCL has worked with Hanscomb to provide quantities for an updated Cost Estimate, which will be completed independent of this submission.

4 Schedule

The construction document phase of the project is on schedule. Critical path tasks are identified in red in the following Milestone Schedule. A Gannt chart construction schedule is located in Appendix A of this Report.

WBS	Task Name	Start	Finish
1.15	Tendering Phase	2025-10-06	2026-03-18
1.15.1	Tender Closing	2026-02-18	2026-02-18
1.15.2	Construction Award	2026-03-18	2026-03-18
1.16.3	Sealift Booking	2026-03-27	2026-03-27
1.16.8	Year 1 - 2026 Construction Season	2026-08-03	2026-11-26
1.16.8.1	Approximate Sealift Arrival	2026-09-03	2026-09-03
1.8	Year 1 - 2026 Construction Season	Thu 26-09-03	Mon 28-07-31
1.9	Year 2 - 2027 - Construction Season	Wed 27-06-02	Mon 28-06-05
1.10	Year 3 - 2028 - Construction Season	Mon 28-06-05	Mon 29-06-04
1.11	Year 4 - 2029 - Construction Season	Mon 29-06-04	Mon 30-06-03
1.12	Year 5 - 2030 - Construction Season	Mon 30-06-03	Mon 31-08-25
1.13	Substantial Completion	Mon 31-08-25	Mon 31-08-25
1.14	Warranty Phase	Mon 31-08-25	Mon 32-08-25

Critical path tasks include ensuring tendering is done timely with Construction Contract Award in mid-March 2026. This will allow enough time for the Contractor to book the sealift for 2026. Without this booking confirmed, there would be no guarantee that the sealift would be able to deliver the required startup equipment necessary for the first year of work on site.

5 List of Warranties

The following is a draft of the list of extended warranties that will be required from the Contractor for substantial completion of the project.

Extended warranties are required for the following:

- Genset: 5 years or 1500 hours of operation.
- Exterior light poles: 10 years against corrosion.
- Access control, proxy card readers: lifetime, batteries: 5 years.
- Fire Detection System batteries: 5 years.
- Exit Sign and Emergency Lighting batteries: 10 years.
- Structured Cabling System: 20 years.
- Sheet Metal Roofing: 20 years
- Firestopping: Extend 12-month warranty period to 24 months; Contractor warrants workmanship on materials and installation for a period of 24 months.
- Joint Sealants
  - Manufacturer's warranty: provide manufacturer's standard warranty documentation.
  - Warrant sealant with work in accordance with general conditions, except for five years. Meaning that the contractor is promising that the sealant will not have any of the described issues for a period of five years
- Wood Doors
  - Manufacturer's warranty: submit standard.
  - Special warranty: if the subcontractor is an AWMAC manufacturer member, issue a two-year AWMAC guarantee certificate to the owner. AWMAC Guarantee to cover replacing, reworking, and or refinishing deficient wood doors due to faulty workmanship or defective materials supplied & installed.
- Fenders and fender systems against design errors and manufacture defects: 2 years
- Marine bollard systems against manufacture defects: 2 years

6 Substantial Completion

In construction projects, substantial completion and final completion are two critical milestones that mark different stages of project progress. Empirical definition of the requirements for substantial completion and final completion is as follows:

6.1 Substantial Completion

Substantial completion is the stage where the project is sufficiently complete, allowing the owner to use the building or facility for its intended purpose. While some minor work may still be pending, the primary contractual requirements have been met. For work in Nunavut, any areas that will require speciality equipment that will eventually require demobilization from site needs to be included in substantial completion items. Key conditions will include the following:

- Completion of major building systems (electrical, plumbing, HVAC).
- Installation of essential fixtures and finishes.
- Compliance with building codes and safety regulations.

Once substantial completion is achieved, several important events occur:

- The owner assumes responsibility for the property.
- Warranty periods begin.
- Occupancy permits may be granted.
- Partial payments or retainage releases are initiated.

6.2 Final Completion

Final completion marks the absolute conclusion of the construction project. At this stage, all work—both major and minor—has been completed as per the contract. Any outstanding deficiencies, punch list items, or corrective work have been resolved. A joint inspection involving the owner, contractor, and relevant stakeholders will be conducted to verify that all contractual requirements have been met. Once satisfied, the owner will issue a Certificate of Final Completion, officially closing out the project.

Final completion also triggers important contractual and financial events:

- The remaining retainage is released.
- The final payment is made to the contractor.
- The project transitions to post-construction operations and maintenance.

7 Draft Construction Inspection List

The following is a draft of the construction inspection list for the CBCL Team members.

Site Inspections	Resource	Timelines
Engineer of Record (15)		
Guy Architects (3)	TBC	Year 2, 3 and 4 Year 4 for substantial completion
Guy Arch Struct (3)	TBC	Year 2, 3 and 4 Year 4 for substantial completion
CBCL Civil (3)	David Parsons	Year 2, 3 and 4 Year 4 for substantial completion
CBCL Marine (3)	Jesslyn Fowlie	Year 2, 3 and 4 Year 4 for substantial completion
CBCL Electrical (3)	TBC	Year 2, 3 and 4 Year 4 for substantial completion
Site Inspections		
Civil Engineer (2)	David Parsons	Year 3, 4
Structural Engineer (2)	Jesslyn Fowlie	Year 3, 4
Mechanical Engineer (1)	TBC	Year 3, 4
Electrical Engineer (1)	TBC	Year 3, 4
Additional Trips		
Warranty Trips	David Parsons or Other	2-3 months before warranty expiry

8 Next Steps

CBCL will also provide the following Tendering Services.

- Act in an advisory role to the GN's Project Manager who will tender the project.
- Provide the GN's Project Manager with recommendations and advice on the preparation of the necessary bidding information, bidding forms, conditions of the contract, and the form of contract between the GN and the Contractor.
- Provide the GN's Project Manager with all information required by proponents to fully interpret the Construction Documents. The GN will issue the addenda to all participants.
- Keep full notes of all inquiries during the bidding period and submit to GN's Project Manager.
- Participate in the pre-tender Site Visit for proponents and respond to questions raised by proponents and prepare addenda or clarifications for the GN to issue to proponents.
- Assist the GN's Project Manager with the examining of tenders and advise on acceptance based on the following:
    - The completeness of tender documents in all respects.
    - The technical aspects of the tenders.
    - The effect of alternatives and qualifications which may have been included in the tender.
    - Proponent's capability to undertake the full scope of work.
    - The availability of adequate equipment to carry out the work.

9 Closing

Once you have had a chance to review this 100% Construction Documentation Report and the Issue for Tender Documents, we can meet to discuss and address any comments or questions you may have.

Prepared by:

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Project Manager, Practice Lead, Artic
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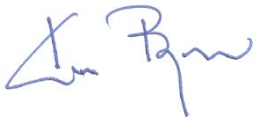
E-Mail: davidp@cbcl.ca

Reviewed by:



Kevin Bezanson, P.Eng.
Director, Ports and Marine

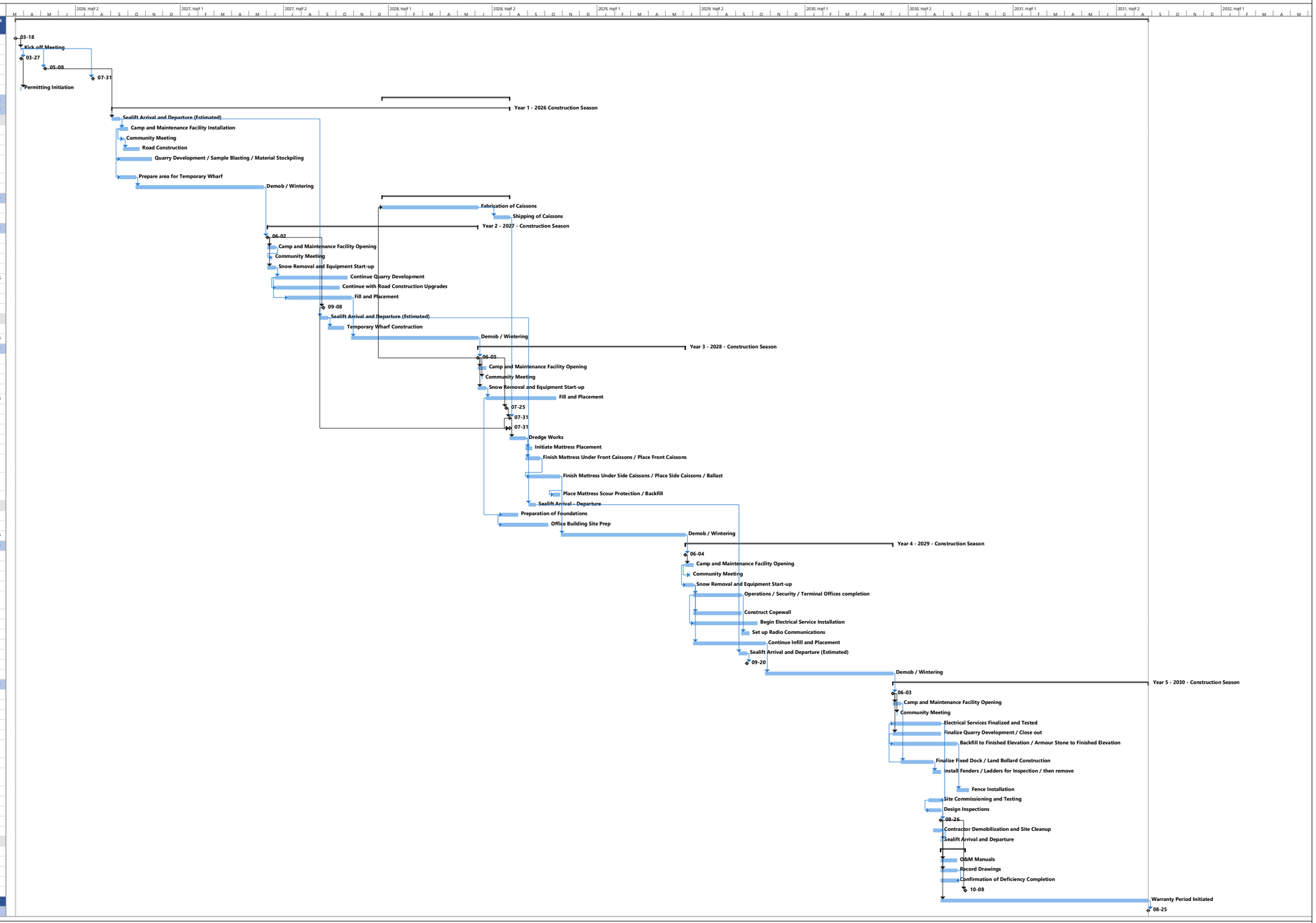
APPENDIX A

Draft Construction Schedule

Qikiqtarjauq Deep Sea Port Project

Draft Construction Schedule

ID	WBS	Task Name	Start	Finish	Duration
1	**1**	**Draft Construction Schedule - Option 4 - Combi-wall**	**Wed 26-03-18**	**Mon 31-08-25**	**1420 days**
2	1.1	Contract Award	Wed 26-03-18	Wed 26-03-18	0 days
3	1.2	Kick off Meeting	Fri 26-03-27	Fri 26-03-27	1 day
4	1.3	Sealift Call to Confirm Booking	Fri 26-03-27	Fri 26-03-27	0 days
5	1.4	Submission of Submittal List	Fri 26-05-08	Fri 26-05-08	0 days
6	1.5	Submission of Construction Plans	Fri 26-07-31	Fri 26-07-31	0 days
7	1.6	Permitting Initiation	Fri 26-03-27	Fri 26-03-27	1 day
8	**1.7**	**Caissons**	**Tue 27-12-21**	**Mon 28-07-31**	**160 days**
11	**1.8**	**Year 1 - 2026 Construction Season**	**Thu 26-09-03**	**Mon 28-07-31**	**498 days**
12	1.8.1	Sealift Arrival and Departure (Estimated)	Thu 26-09-03	Wed 26-09-16	2 wks
13	1.8.2	Camp and Maintenance Facility Installation	Thu 26-09-17	Wed 26-09-30	2 wks
14	1.8.3	Community Meeting	Tue 26-09-22	Tue 26-09-22	1 day
15	1.8.4	Road Construction	Wed 26-09-23	Tue 26-10-20	1 mon
16	1.8.5	Quarry Development / Sample Blasting / Material Stockpiling	Thu 26-09-17	Wed 26-11-11	2 mons
17	1.8.6	Prepare area for Temporary Wharf	Thu 26-09-17	Wed 26-10-14	1 mon
18	1.8.7	Demob / Wintering	Thu 26-10-15	Wed 27-05-26	8 mons
19	**1.8.8**	**Caissons**	**Tue 27-12-21**	**Mon 28-07-31**	**160 days**
20	1.8.8.1	Fabrication of Caissons	Tue 27-12-21	Mon 28-06-05	6 mons
21	1.8.8.2	Shipping of Caissons	Tue 28-07-04	Mon 28-07-31	1 mon
22	**1.9**	**Year 2 - 2027 - Construction Season**	**Wed 27-06-02**	**Mon 28-06-05**	**263 days**
23	1.9.1	Mobilization	Wed 27-06-02	Wed 27-06-02	0 days
24	1.9.2	Camp and Maintenance Facility Opening	Thu 27-06-03	Wed 27-06-16	2 wks
25	1.9.3	Community Meeting	Thu 27-06-10	Thu 27-06-10	1 day
26	1.9.4	Snow Removal and Equipment Start-up	Thu 27-06-03	Wed 27-06-16	2 wks
27	1.9.5	Continue Quarry Development	Thu 27-06-17	Wed 27-10-20	4.5 mons
28	1.9.6	Continue with Road Construction Upgrades	Thu 27-06-17	Wed 27-10-06	4 mons
29	1.9.7	Fill and Placement	Thu 27-07-08	Wed 27-10-27	4 mons
30	1.9.8	Finalize Road to Temporary Wharf Site	Wed 27-09-08	Wed 27-09-08	0 days
31	1.9.9	Sealift Arrival and Departure (Estimated)	Fri 27-09-03	Thu 27-09-16	10 days
32	1.9.10	Temporary Wharf Construction	Fri 27-09-17	Thu 27-10-14	1 mon
33	1.9.11	Demob / Wintering	Thu 27-10-28	Mon 28-06-05	7.9 mons
34	**1.10**	**Year 3 - 2028 - Construction Season**	**Mon 28-06-05**	**Mon 29-06-04**	**261 days**
35	1.10.1	Mobilization	Mon 28-06-05	Mon 28-06-05	0 days
36	1.10.2	Camp and Maintenance Facility Opening	Tue 28-06-06	Mon 28-06-19	2 wks
37	1.10.3	Community Meeting	Tue 28-06-13	Tue 28-06-13	1 day
38	1.10.4	Snow Removal and Equipment Start-up	Tue 28-06-06	Mon 28-06-19	2 wks
39	1.10.5	Fill and Placement	Tue 28-06-20	Fri 28-10-20	4.5 mons
40	1.10.6	Ice Out (Estimate)	Tue 28-07-25	Tue 28-07-25	0 days
41	1.10.7	Caisson Delivery (sinking barge)	Mon 28-07-31	Mon 28-07-31	0 days
42	1.10.8	Delivery of Dredging Equipment	Mon 28-07-31	Mon 28-07-31	0 days
43	1.10.9	Dredge Works	Tue 28-08-01	Mon 28-08-28	1 mon
44	1.10.10	Initiate Mattress Placement	Tue 28-08-29	Fri 28-09-08	2 wks
45	1.10.11	Finish Mattress Under Front Caissons / Place Front Caissons	Tue 28-08-29	Fri 28-09-22	1 mon
46	1.10.12	Finish Mattress Under Side Caissons / Place Side Caissons / Ballast	Mon 28-09-04	Fri 28-10-27	2 mons
47	1.10.13	Place Mattress Scour Protection / Backfill	Mon 28-10-16	Fri 28-10-27	2 wks
48	1.10.14	Sealift Arrival - Departure	Sun 28-09-03	Thu 28-09-14	2 wks
49	1.10.15	Preparation of Foundations	Tue 28-07-18	Mon 28-08-14	20 days
50	1.10.16	Office Building Site Prep	Tue 28-07-18	Fri 28-10-06	3 mons
51	1.10.17	Demob / Wintering	Mon 28-10-30	Mon 29-06-04	7.8 mons
52	**1.11**	**Year 4 - 2029 - Construction Season**	**Mon 29-06-04**	**Mon 30-06-03**	**260 days**
53	1.11.1	Mobilization	Mon 29-06-04	Mon 29-06-04	0 days
54	1.11.2	Camp and Maintenance Facility Opening	Tue 29-06-05	Mon 29-06-18	2 wks
55	1.11.3	Community Meeting	Tue 29-06-12	Tue 29-06-12	1 day
56	1.11.4	Snow Removal and Equipment Start-up	Tue 29-06-05	Mon 29-06-18	2 wks
57	1.11.5	Operations / Security / Terminal Offices completion	Tue 29-06-19	Mon 29-09-10	3 mons
58	1.11.6	Construct Copewall	Tue 29-06-19	Mon 29-09-10	3 mons
59	1.11.7	Begin Electrical Service Installation	Tue 29-06-19	Mon 29-10-08	4 mons
60	1.11.8	Set up Radio Communications	Tue 29-09-11	Mon 29-09-24	10 days
61	1.11.9	Continue Infill and Placement	Tue 29-06-19	Mon 29-10-22	90 days
62	1.11.10	Sealift Arrival and Departure (Estimated)	Fri 29-09-07	Thu 29-09-20	2 wks
63	1.11.11	Delivery of Crane	Thu 29-09-20	Thu 29-09-20	0 days
64	1.11.12	Demob / Wintering	Tue 29-10-23	Mon 30-06-03	8 mons
65	**1.12**	**Year 5 - 2030 - Construction Season**	**Mon 30-06-03**	**Mon 31-08-25**	**320 days**
66	1.12.1	Mobilization	Mon 30-06-03	Mon 30-06-03	0 days
67	1.12.2	Camp and Maintenance Facility Opening	Tue 30-06-04	Mon 30-06-17	2 wks
68	1.12.3	Community Meeting	Tue 30-06-11	Tue 30-06-11	1 day
69	1.12.4	Electrical Services Finalized and Tested	Tue 30-06-04	Mon 30-08-26	3 mons
70	1.12.5	Finalize Quarry Development / Close out	Tue 30-06-04	Mon 30-08-26	3 mons
71	1.12.6	Backfill to Finished Elevation / Armour Stone to Finished Elevation	Tue 30-06-04	Mon 30-09-23	4 mons
72	1.12.7	Finalize Fixed Dock / Land Bollard Construc	Tue 30-06-18	Mon 30-08-12	2 mons
73	1.12.8	Install Fenders / Ladders for Inspection / then remove	Tue 30-08-13	Mon 30-08-26	2 wks
74	1.12.9	Fence Installation	Tue 30-09-24	Mon 30-10-14	3 wks
75	1.12.10	Site Commissioning and Testing	Tue 30-08-06	Mon 30-08-26	3 wks
76	1.12.11	Design Inspections	Tue 30-08-06	Mon 30-08-26	3 wks
77	**1.12.12**	**Substantial Completion Request**	**Mon 30-08-26**	**Mon 30-08-26**	**0 days**
78	1.12.13	Contractor Demobilization and Site Cleanu	Wed 30-08-14	Tue 30-08-27	2 wks
79	**1.12.14**	**Sealift Arrival and Departure**	**Tue 30-08-27**	**Tue 30-08-27**	**1 day**
80	**1.12.15**	**Close out**	**Tue 30-08-27**	**Tue 30-10-08**	**31 days**
81	1.12.15.1	O&M Manuals	Tue 30-08-27	Mon 30-09-23	4 wks
82	1.12.15.2	Record Drawings	Tue 30-08-27	Mon 30-09-23	4 wks
83	1.12.15.3	Confirmation of Deficiency Completion	Tue 30-08-27	Mon 30-09-23	4 wks
84	**1.12.15.4**	**Final Completion**	**Tue 30-10-08**	**Tue 30-10-08**	**0 days**
85	**1.12.16**	**Warranty Period Initiated**	**Tue 30-08-27**	**Mon 31-08-25**	**52 wks**
86	**1.12.17**	**End of Warranty Phase**	**Mon 31-08-25**	**Mon 31-08-25**	**0 days**



Project: 234414.00 - SCH - Draf
Date: Wed 25-10-22

Task · Split · Milestone · Summary · Project Summary · Inactive Task · Inactive Milestone · Inactive Summary · Manual Task · Duration-only · Manual Summary Rollup · Manual Summary · Start-only · Finish-only · External Tasks · External Milestone · Deadline · Progress · Manual Progress

APPENDIX B

Risk Register

234414.00 - Risk Register

Gov of Nunavut **Qikiqtarjuaq Marine Infrastructure**

Date: **2025-10-22 13:13**

Need Final Cost Estimate

										Severity			Probability											
Schedule of Risk	Item No.	Risk No. from Workshop	Description	Stakeholder	Issue Type	Sch	Cost	Other	Spec Note Required	High	Med	Low	High	Med2	Low3	Current Value of Risk	Issue Discussion	Mitigation	Action Items	Status	Inerent Risk Amount Estimate	% RRA	Residual Risk Allowance (RRA)	Outcome	Lesson Learned / Notes
2024-06-18		WS 15	Political Pressure	CBCL	Community, Schedule			*		3			3			9	Political pressure impacting scope/lobbying from users/local groups, pressure to expand port to a more full capacity	Ensure scope is fixed at schematic design phase	· Monitor changes in government	Ongoing					
2025-09-13	76		QC Project Takeover	CBCL, Client	Cost, Schedue, Design	*	*	*		3			3			9	Changing the client mid stream of a project could cause several risks including lost project understanding, communications, community trust, construction timelines, etc.	Work with the GN to make the transformation as seamless as possible.	· Monitor changes to the project, i.e., scope, schedule and budget; along with Hamlet concerns	Ongoing					
2023-09-27	16		Weather	Contractor	Construction delays	*	*	*	y		2		3			6	The short construction season can be further reduced by bad weather, which can affect productivity and related costs.	Contractor will require weather buffers in their schedules.	· Mitigation is the Action.	Ongoing					
2025-09-29	74		Re-design or Changes to Design could effect Permitting	Owner	Schedule	x				3				2		6	Management could change scope which could make permitting requirement updates necessary.	Communicate this issue.		Ongoing					
2024-06-18		WS 17	Sealift Schedule	GN/CBCL	Schedule, Cost	*	*			3				2		6	Availability of Sealift impacting schedule.	Can we notify or have early engagement with sealift operators (and not wait for contractors. Avoid risk of not identifying issues early enough.	· Ensure Tender award by Mid March	Ongoing					
2023-09-27	10		Shortage of housing, skilled labour and many materials.	GN/CBCL	Construction	*	*	*	y		2			2		4	We are sensitive to the shortages that exist in many Nunavut communities.	For this project, we will work with our local contacts to secure housing, will plan for materials largely by bringing our own gear and specifying the same for the contractor (and adequate planning of mobilization of materials and equipment via sealift), and training and hiring local community members where possible. The design elements will be kept simple to minimize work crew size and utilize local material and labour when possible.	· Estimate number of housing requirements from preliminary discussions with contacts, cross reference availability. Book early.	Ongoing					
2023-09-27	11		Limited Shipping Window to Site	CBCL	Construction Schedule	*			y		2			2		4	Transporting materials and equipment to site via the sealift is limited missing this window of opportunity could greatly impact the schedule.	Mitigation: The Tender Documents will be very clear to provide information to the Contractor on the schedule and protocol for sealift operations. Cost risks and schedule mitigation and planning is required for this location as it is remote. The team has reviewed the logistics for shipping options to help reduce the effects of costs and schedule increases. Tender award will be critical. Monitor contractor's schedule, do pre-qualification.	· Ensure all aspects of shipping schedule are understood and planning takes into account of these schedules. Ensure time from tender closing is sufficient for contractors to get the sealift booked.	Ongoing					
2023-09-27	18		Placement of materials (armour stone) - in exact placement or lack of oversight	GN/CBCL	Contractor Rework	*	*		y		2			2		4	Construction supervision and inspection is going to be critical here. We have project experience where this has happened before if the contractor wasn't properly monitored.	Monitor placement	· Mitigation is the Action.	Ongoing					
2023-11-15	33		Schedule Timelines - Contract Award / Funding	CBCL	Schedule	*			Y		2			2		4	Late award and several constraints are pushing the current design schedule, including funding schedule.	Plan for a realistic schedule for the client so they can properly line up funding. Client should consider extension to funding agreement. Procurement for tendering will be a constraint.	· Continuously monitor schedule and address any shortfalls as soon as they are predicted.	With GN					
2025-01-07	71		Remote Location Travel	Contractor	Schedule	*			Y		2			2		4	Contractor has to work in a remote location with additional materials would not be available.	Ensure specifications are clear that the contractor is responsbile to provide and ship on schedule all required supplies, materials, etc. Contractor to be responsbile to fly in or somehow ship materials if they are negligent in providing them on schedule to not slow down the work.	· Add to specifications	Ongoing					
2025-06-03	75		Agreement Wording - Weather	GN	Article 20 - Site and Transport Conditions 22.7 could cause high bids or no bids	*	*				2			2		4	Reviewed with Client and Internally	send wording options for GN's consideration	with GN	with GN					
2024-06-18		WS 42	Construction Timeline in Years	CBCL		*					2			2		4	How many years will construction take? Funding timeline contraints are in place and Overwintering costs are expensive. RFP was 30 months over 3 years	Need to guard against building failure into the schedule, stress test schedule before going out to tender, present worst case scenario. Add 1 year to construction schedule	· Test Schedule; present worst case scenarios; ensure we feel the work can be done in the years presented.	Ongoing					
2024-06-18		WS 13	Competent Contractor	GN				*			2			2		4	Lack of Contractor ability to complete the work	Pre-qual/RFQ, Need to decide the process. GN to decide + consult with Procurement. Early advertisement of the contract to potential contractors.	· Pre-qualification choice	Ongoing					
2024-06-18		WS 52	Environmental/Safety	CBCL	Schedule, Environment			*	y		2			2		4	Environmental accident - major fuel spill/other, equipment accident	Work stoppage/cleanup, CEMP - plan for mitigation and response, environmental impact/cleanup, Backup. Ensure emergency plans are in place	· add to specs.	Ongoing					
2024-06-18		WS 41	Equipment loss	CBCL	Schedule	*			y	2				2		4	Major critical equipment loss in transit or during construction	Equipment maintenance plan and space/redundant equipment; Insurance requirements in contract documents, Backup Plan, means and methods for replacing critical equipment	· add to specs	Ongoing					
2024-06-18		WS 53	Labour Force	CBCL	Schedule/Construction, Accommodation, Cost			*	y		2			2		4	Potential lack of skilled labour, remote location,	Group together with other projects to incentivize (not practical), contract to provide proposal to accommodate crew (spec requirement), very expensive to overwinter, ensure contractor has allowed enough food / money to handle unexpected delays w/o change order. Also provide unit rate in tender for overwintering.	· add to specs	Ongoing					
2024-06-18		WS 28	Short Construction Season	CBCL / Contractor	Schedule	*	*		y		2			2		4		Ensure we understand the construction requirements for schedule, identify perhaps 24/7 work days in specs	· Add to Spec	Ongoing					
2024-06-18		WS 51	Survey Weather Conditions	Contractor / CBCL		*			y		2			2		4	Bathymetric survey, seasonal	Build weather buffers, stand by time in schedule, between seasons, damage between seasons, damage to equipment between seasons	· Add to specs	Ongoing					
2023-09-27	1		Remote Location Travel	CBCL	Affects construction schedule	*	*		Y			1	3			3	Our Project Team is familiar with working in Nunavut including the extreme cold climate and other logistical constraints.	We have added extra days and safety measures to conduct field studies in the event of inclement weather or sea conditions during planned work.	· Add to schedule contingency for extra days due to weather.	Ongoing					
2023-09-27	2		Community Approval	GN/CBCL	Approval from community and working relationship	*		*	Y	3					1	3	It will be critical to keep the community accepting of the project works.	Continue regular communications with the community through the GN	· Keep Stakeholder Plan Updated. Monitor correspondence with the community to ensure regular communications.	Ongoing					
2023-09-27	3		Materials (armour stone)	CBCL	Available armourstone		*	*	y	3					1	3	Geotechnical assessment of the available materials (fill) will be critical.	Designing for armour can mitigate this issue	· Ensure geotechnical study determines ability for local rock to provide armour stone required for the project.	Ongoing	$ 7,500,000.00				
2023-11-15	4		Single Contractor Bid	GN/CBCL	Bidding	*	*			3					1	3	One bidder could bid with a high cost.	If not affordable, potential retender will be required with change in scope.	· Action if bid is out of budget, find out why other contractors did not bid, if in budget, discuss in depth the bid to determine the contractor has a full understanding of the project scope and budget.	Ongoing					

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2023-11-15	9		Competing Work loads for Contractors	GN/CBCL	Competing projects for resources	*	*		Y	3					1	3	Contractor may have too much work on	Confirm the contractor agrees they can meet schedule. Could review options for penalty/bonus structure.	· Perform industry evaluation of workload in the area including other tenders that are going to be issued at the same time. If so, try to accelerate tender call to be on the street first.	Ongoing					
2023-09-27	12		Carrying Out Site Work in Cold Weather	CBCL	Construction	*	*		y			1	3			3	Extreme cold and 24-hr darkness in winter causes safety concerns.	Our Team will work with the Team's Health and Safety Specialist to share knowledge and identify or determine that an appropriate and protective Health and Safety Plan is developed.	· Mitigation is the Action.	Ongoing					
2023-11-15	17		Bankruptcies	GN/CBCL	Contractor goes bankrupt	*	*			3					1	3	Contractor goes bankrupt. Remob would delay the project and cause extra costs.	This could cause a long delay in finding a replacement contractor. Confirm that the contractor is financially stable and insured.	· Confirm financial status of contractors, not with Government procurement, open bidding cannot pre-screen financing, but the knowledge of bidders can ask but not demand their information.	Ongoing					
2023-09-27	19		Market Variability	GN	Cost		*			3					1	3	The project will be more subject to changes in requirements and market variations in material and labour costs, due to the long duration of schedule. Sudden changing in market trends, non-competitive bidding situations, significant unforeseen labour and material adjustments, and other similar issues could be of concern.	Phasing of the project to monitor closely work seasons, additional work to validate escalation rates are being used and additional contingency on the cost estimate should be considered. The CBCL team will work to identify these risks wherever possible during the costing phases of the project.	· Mitigation is the Action.	Ongoing					
2024-06-18	22	WS 5	Quarry Yield/Quality	CBCL	Material needed for construction, Poor quarry impacts construction/schedule; cost	*	*			3					1	3	With no previous information on the local existing quarry, there is a high risk that the stone may not be compatible to the requirements needed. Uncertainty around quarry yield, quality, and methods to extract and produce required materials, Finding a good source of rock, making sure you can access it, no blast done before	ABG will do early testing of material yield and quality for a range of materials to be used/produced. They will also determine access to quarry. CBCL to provide high level cost estimate to ship armour stone as backup; Work with Contractor to pre-determine viability of rock location and getting it out reasonably, field investigation,	· the Geotechnical program will mitigate the unknowns for design. Price to ship armourstone as a backup if quarry yields are unavailable. · Ensure geotechnical information is thoroughly reviewed and if necessary engage blasting experts to advise and possible review contractors blasting plan.	Ongoing					
2023-09-27	26		Wharf Design	CBCL	Design			*		3					1	3	Geotechnical findings will define the marine alternatives	Prepare for alternatives with design.	· Ensure schedule allows time for design change due to geotechnical, excess costs, etc.	Ongoing					
2023-11-15; 2024-06-18	35	WS 38	Dredging	CBCL	Design	*	*			1			3			3	Dredging has a high cost and takes longer. Also requires additional permitting	Avoid dredging to keep costs low. Geo physical survey	· Mitigation is the Action.	Ongoing					
2023-11-15	42		Tendering Process	GN/CBCL	Lengthy award will push first year of sealift arrival	*	*			3					1	3	The sealift is dependant in the schedule on Contract Award	Client could mitigate with the pre-qualifications.	· Ensure contracts are fair and equal and share the risk; allow for ample time of tender preparation, issue timely addendums.	Ongoing					
2023-11-15	43		Injury / Death	CBCL	major injury or death on the construction site	*	*	*	Y	3					1	3	Injury to personnel could cause the project to shutdown	Contractor will be required to have a site safety plan.	· Ensure contractor is following their safety plan including frequent tool box meetings to identify hazards.	Ongoing					
2023-11-15	45		No Bids	GN	no bidders	*	*			3					1	3	There have been cases during closing where no bids have been received. Early communication with Contractors can alleviate concerns.	CBCL will confirm bidders are interested, do pre-screening.	· Do check with contractors to determine if they intend to bid; pre-qualification should help with this. Ensure contract documents are fair and equally assigned of risk.	Ongoing					
2023-11-15	54		Change in Government	GN	Significant reduces funding for project	*	*	*				1	3			3	Federal government changes could affect the funding	Client to mitigate	· Work with client to monitor any changes such as new government; set mitigation plan if changes occur.	Ongoing					
2023-11-15	61		Sealift Sinking	All	Accident or sinking of sealift vessel	*	*			3					1	3	Damage or loss of goods from the sealift delivery could cause delays in the project.	Confirm that the Contractor has insurance in place.	· Ensure sealift operation has all necessary safety procedures and is following them. Check on vessel certification and experience of Captain.	Ongoing					
2024-04-02	62		Blasting. PPD to review the blasting plan. Mats will be needed due to proximity of the PPD fuel line. Consideration needs to be given to close infrastructure.	Contractor	Blasting Plan				Y			1	3			3		Ensure any requirements for blasting have a pre-approved blasting plan.	· add to spec	Ongoing					
2023-11-15	62		High risk contract documents	GN/CBCL	Adding too much risk to the contractor will raise pricing	*	*			3					1	3	Poor contract documents could result in high bids, lack of bids and / or unqualified contractor bids.	CBCL to monitor contract documents (drawings and specs) for clear requirements.	· Use standard CCDC contract documents that contractors are familiar with and consider being fair and not requiring additional risk money.	Ongoing					
2024-06-18		WS 40	Contractor Interest	CBCL				*		3					1	3	Possible lack of interest to bid on the project	No bids/high bids, Attend trade shows, Open Houses , GN Tendering website - information about the project, Screen contractors, Evaluation Criteria/Methodology/Relevant Experience on similar projects, Financial information on Prequal?, Legal ramifications?,	· Notify potential contractors and subs; spark interest early. (trade shows, GN Tender website; open houses)	Ongoing					
2024-06-18		WS 39	Procurement	GN	Construction			*		3					1	3	Insufficient info from contractor to adequately assess their ability to do the work	RFP to include contractor schedule/methodology for review : Do not rely on low bid only	· GN to confirm	Ongoing					
2024-06-18		WS 26	Building Code Changes	CBCL				*				1	3			3		Design Now and check before Tender - future specs may change	· check codes throughout design	Ongoing					

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2024-06-18		WS 55	Clear Specifications	CBCL	Cost	*	*		Y	3					1	3	Poor or missing information in specifications could be critical, timely for fixes and costly for change orders.	Use past lessons learned, review risks and past addendums and change orders to ensure all historical data mitigations have been considered for spec sections	· Strong review of Specifications considering all mitigation efforts	Ongoing					
2024-06-18		WS 56	Contractor Staging Area	CBCL	Cost, Schedule	*	*		Y			1	3			3	There will be no current laydown areas for the Contractor	Add to specifications the requirement and information on current staging requirements	· Add to Specs	Ongoing					
2024-06-18		WS 36	Future Maintenance	CBCL				*	y	3					1	3	Using materials that allow for future modifications or renovations	ensure any future maintenance can be completed by locals or other.	· Add training to specs	Ongoing					
2024-06-18		WS 44	Mammals/Environment	CBCL				*	y			1	3			3		Provisional days for seals, whales, sound monitoring, bear monitoring, Have expectations well stated. Contractor to allow for shut downs due to Environment, environmental consultants must be 3rd Party Team, Ask for methodology in the RFP, Put in the contract documents,	· include in specs (standby days/costs)	Ongoing					
2024-06-18		WS 49	Pandemics	GN / CBCL		*	*	*		3					1	3		Update General Conditions - Definition of force majeure	· Review general conditions	Ongoing					
2024-06-12			Spare parts for Hammer/equipment	Contractor / CBCL	Schedule	*			Y	3					1	3	Could shut down the project	add to specifications requirements for extras	· Add to specs	Ongoing					
2023-09-27	5		Sealift	GN/CBCL	Can't maneuver in the planned area	*	*				2				1	2	The sealift location is not part of the scope; however, will be mooring after construction at the wharf.	Notify sealift companies to determine their design requirements.	· Mitigation is the Action.	Ongoing					
2023-09-27	6		Regulatory Delays in Permits and Approvals	CBCL	Communication, confirmation of requirements	*	*				2				1	2	There are more levels of regulation in the North.	Review all requirements and keep permit map updated.	· Define schedule for updating of regulatory map, maintain communication with GN/Regulatory Agencies.	Ongoing					
2023-11-15	7		Ineffective Communications	CBCL	Communications			*			2				1	2	Lack of communication can cause misunderstanding leading to rework or other issues.	Hold regular meetings and action logs/trackers to confirm information is well communicated regularly.	· Address communications failure very early in the project and put in place measures to improve, set action items and monitor them.	Ongoing					
2023-09-27	8		Operation of Harbour	CBCL	Community	*		*	Y			1		2		2	We understand that fish and marine mammal harvesting are essential to the community and that the arrival of the sealift is vital for supplies. This necessitates operation of the harbour to continue through construction.	Project phasing and minimizing construction disruptions during peak harvest times will be incorporated in the construction plan and in the cost estimate to avoid minimal disruption to critical harbour activities.	· Obtain harvest times from community to incorporate into the construction plans and contract documents.	Ongoing					
2023-09-27	13		Long Lead Time on Materials and Equipment	GN/CBCL	Construction	*	*		y		2				1	2	Plan ahead for long lead time items. Material such as certain sizes of steel sheet piling can have long lead times to procure and equipment such as barges and pile drivers can take time to source.	Design for available materials. Pre-screening will lower the risk of lack of equipment / experience	· Ensure materials are going to be available. · Determine long lead times and incorporate into construction plan, ensure Contractor recognizes lead times in their schedule	Ongoing					
2023-09-27	14		Procurement Challenges	GN/CBCL	Construction	*	*				2				1	2	Sourcing Hard to Obtain Materials: Some materials may be difficult to find and purchase such as heavier sections of Steel Sheet Pile Wall.	Any items requiring long lead times such as piles need to be identified as early as possible so that they can be ordered under a separate contract and provided to the Contractor if required. The Project Team has extensive experience with the sealift schedules, understanding the reservation process and associated timing for getting supplies to Valleyfield, Quebec prior to shipping.	· Obtain the information for pre-ordering from the design process as soon as available; check schedule with suppliers to determine if pre-order is necessary. Also pre-screen possible bidders.	Ongoing					
2023-09-27	15		labor disruption, strikes	Team	Construction			*			2				1	2	Labour disruptions could cause loss of time during construction.	Monitor with the contractor labour issues; work with them to ensure they are "fair".	· Communicate with the contractor to ensure their labour forces has appropriate conditions.	Ongoing					
2023-09-27	20		Fiscal Year Spending Constraints	GN	Cost	*	*				2				1	2	As this project will extend over several years it will be important to watch that budgets are efficiently used each year.	Through proper planning, scheduling and providing proper time contingencies, the March 31st budget spending amounts can be met.	· Mitigation is the Action.	Ongoing					
2023-09-27	21		Client Scope Changes	CBCL	Cost	*	*				2				1	2	Late scope changes can cause rework	Communicate that the client is aware of costs and schedule affects to scope changes.	· Mitigation is the Action.	Ongoing					
2023-09-27	23		Environmental Findings and Hydrocarbons	GN/CBCL	Cost	*	*	*	Y		2				1	2	Unknown environmental conditions could cause clean up work	Watch that the Contractor has procedures in place for spills and / or findings.	· Ensure contract documents have robust requirement for environmental protection.	Ongoing					
2023-11-30	24		Power to the new site	CBCL	Design		*		Y		2				1	2	Steve Woodend has concerns over power to wharf for vessels.	Understand what is required for now and future needs; keep in contact with QEC and their power requirements.	· Keep in contact with utility on project power requirements. Identify for future planning.	Ongoing					
2023-09-27	36		Haul Roads	CBCL	Construction			*	Y			1		2		2	Contractor will have to mitigate dust control (water truck speed, etc.)	Place control requirement in the Contract docs.	· Ensure tight specifications on design construction and maintenance of roads Ensure proper communication with the community on road repairs.	Ongoing					
2023-11-15	37		Extreme weather during construction	CBCL	Construction	*	*	*	Y			1		2		2	Extreme weather event could cause damage during construction	Confirm that the contractor is prepared for these events with in the CEMP.	· Mitigation is the Action.	Ongoing					
2023-09-27	38		Construction Budget	GN	fiscal budgeting.	*	*				2				1	2	Costing in NU can be difficult with minimal historical projects to draw information from.	We have a creative and efficient design team who will work within the budget, incorporating feedback from the community. As design progresses and costs develop, changes will be incorporated as required to meet budgets. Costing projects accurately relies on having good cost data and well-estimated quantities. To minimize the risk of inaccurate estimates, CBCL has developed an in-house cost estimating database that will be used on this project. For certain aspects, costing will be determined from the bottom up, by gathering information from marine contractors to determine unit pricing.	· Continue to develop budget as more engineering is completed; keep percent completes updated in schedule for budget balances. Work with third part (Hanscomb) to update costing.	Ongoing					
2023-11-15; 2024-06-18	39	WS 18	Fuel Storage/Availability	CBCL	Construction, Design	*			y		2				1	2	Inadequate fuel for operations/construction; Lack of fuel for contractor works could cause shut downs	It will be the contractor's responsibility to confirm fuel is available or delivered to site. Identify fuel requirements at early stage for construction, Future Planning (master plan)/Determine/prediction future allocations within design; some means of design for getting fuel for initial ships, future fuel requirements and coordination with PPD, Adding it to the Schematic Design Report, Fuel conditions are part of the master plan have to add it to design	· add to spec. Obtain from contractor estimated fuel requirements, discuss with fuel supplier their ability to supply/deliver and store the required amount of fuel.	Ongoing					

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2023-09-27	48		Staying within Scope	CBCL	Responsibility Risk	*	*				2				1	2	Continue to confirm the scope with the client. Don't engage with community wishes	Keep decision log updated.	· When design log is updated, review and immediately take actions of any scope creep or required scope changes.	Ongoing					
2023-09-27	49		Safety Issues with Children	CBCL	Safety			*	Y		2				1	2	Children are curious and may want to be too close to equipment.	Watch that construction specifications outline the extreme requirement for pedestrian safety, especially children, add to kick off meeting as well.	· Discuss traffic control plan and ensure specifications direct contractor to include safety items in the traffic control plan.	Ongoing					
2023-09-27	50		Truck Traffic	CBCL	Safety			*	Y			1		2		2	Trucking could cause concerns to the community	Monitor that the Contractor has a Traffic Control Plan in place	· Discuss traffic control plan and ensure specifications direct contractor to include safety items in the traffic control plan.	Ongoing					
2023-11-15	52		Permitting	CBCL	Schedule risk - delays in approvals	*	*		Y		2				1	2	Delays in permitting approvals could cause delays in baseline studies, geotechnical program and construction award.	Creating a realistic schedule and timeline. Submit applications early with required edits after submissions.	· Mitigation is the Action.	Ongoing					
2023-11-15	53		Geotechnical Findings	CBCL	Significant changes that could cause redesign		*				2				1	2	Geotech findings could change design	Have the geotech program take place early enough to not affect rework on design.	· Work with geotechnical sub-consultant to ensure they understand the design concept and they obtain the information required to go or no go the concepts. Monitor during construction.	Ongoing					
2023-11-15	55		DFO Mammal Requirements	CBCL	Stop work with Mammal sightings	*		*	Y		2				1	2	The location should be far enough away from the local fishing areas	Contractor will be required to have a mammal monitoring plan.	· Review mammal plan, consult with DFO and ensure during construction Contractor follows this plan.	Ongoing					
2023-09-27	57		Unknowns - Archaeology Findings	CBCL / Client	Archaeological	*	*	*			2				1	2	Archaeological Assessment required	The geotechnical program will be taking place prior to this assessment. There is some risk of unknows, talking with the GN PM, they feel any findings can be mitigated.	· Mitigation is the Action.	Ongoing			$ 39,216.10		Paid ERM for services requested by Culture and Heritage
2024-04-02	60		The Qik health centre will be under construction during the same time period as the port	CBCL / Client	Possible constraints for construction through areas; fewer rooms available to rent, etc.				Y		2				1	2	Confirm this is still going to be happening	Plan for health care, Contractors' H&S Plan must reflect this.	Confirm if Centre will be closed and if there is an alternative	Ongoing					
2024-04-02	61		PPD is upgrading the fuel line in Qik in 2026 from 4" to 6". Need to review options to tie in and coordinate the work. Need to determine if extending to the port is an option.	CBCL	Budget		*				2				1	2		have discussions with PPD on a regular basis	· Communicate with PPD; bring new requirements to GN attention.	Ongoing					
2024-08-20	64		AIA Findings	CBCL	Schedule	*			Y			1		2		2	GN heritage have posted restricted areas from the finding of the AIA. Work arounds will have to be coordianted to avoid these areas.	Ensure the CBCL team is aware of these areas and develop work arounds where required.	· Provide info to other Team members that may access the site. Add areas still existing to the specifications.	Ongoing					
2024-10-29	68		Quarry area - Further Archaeology	CBCL/Client	Further Archaeology on Quarry locations		*				2				1	2	Additional archaology could be required with additional quarry locations, must monitor stop work area locations	Complete additional archaeology studies, confirm with heritgagte areas of concern.	Confirm quarry locaiton; engage ERM for summer 2025 if required	Ongoing	$ 80,000.00				
2025-01-07	72		Department of Culture and Heritage - AIA	CBCL/Client	Budget		*				2				1	2	the department may request additional no work zones or study.	Stay in communication and ensure they understand the work scope in affected areas.	· Communicate	Ongoing					
	73		Caisson Movement	Contractor	Possibility of the caissons once they are ballast and left over the winter because they are not backfilled could be moved by ice.	*			Y		2				1	2	CBCL checked it for one and 10 ice but you never know what could happen we could have that one big storm that happens or one big freeze.	Remove some of the ballast refloat them and put them back in place	· Mitigation is the action	Ongoing					
2024-06-18		WS 37	Availability of Concrete	CBCL				*	Y		2				1	2	Depending on Design Method	Concrete plant could be used and materials could be shipped	· Confirm use of Concrete plant if required. * Be clear in specifications the requirements to ensure concrete quality.	Ongoing					
2024-06-18		WS 47	Costing	CBCL			*				2				1	2	Additional Cost Evaluations. Unknow data from limited similar projects in the area	Rough Prices/Estimating ahead of time. CBCL will work with the Cost Consultant to alleviate risks and unknowns	· Provide CCO for Costing Efforts. Work closer with Hanscomb for pricing.	Ongoing					
2024-06-18		WS 11	Out of Scope Items	CBCL	Budget, Community and Scope			*			2				1	2	Out of Scope items that could affect final product. May not meet expectations of Hamlet / community.	Cost more to add to current scope - add water/wastewater requirements; food purchasing; add fuel requirements; accommodations - contractors comp; could train locals for maintenance; ship to ship - not enough freezers; Include a chapter in the schematic design report for project success factors, highlight different areas for additional scope. Ensuring we document the consultation process. Could put in the spec as a provisional item.	· Add items to Schematic Design for Consideration by the GN.	Ongoing					
2024-06-18		WS 20	Caisson Settlement	CBCL	Design			*			2				1	2	Differentiation Settlement in excess of project tolerances	Geotech analysis during schematic design to understand impact & feasibility, Pre-load? , Portable concrete plants can bring in aggregate?,	· Finalize analysis	Ongoing					
2024-06-18		WS 27	Fenders	CBCL	Operations			*			2				1	2	Seasonal Operation; Large/Small Vessels, Community does not have expertise or machinery to support operations as designed.	Operator / crane to install - could be difficult for community fenders	· review options; ensure community can remove and re-install if required. Note, crane should be on site; check that it can be used if required.	Ongoing					
2024-06-18		WS 4	NIRB	CBCL	Schedule; Cost	*		*			2				1	2	Submittal meets criteria for full impact assessment	Collect sufficient information re: consultation & design and environmental mitigation; delay + rework	· Provide as much information as possible to avoid requests from regulatory for additional information which can add additional time	Ongoing					

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2024-06-18		WS 7	Permafrost	CBCL	Settlement, Reliability of Geotech			*				1		2		2	permafrost is present @ site location, we don't want to fill on the upland site. Designing for permafrost issues. Excavations may disturb existing permafrost conditions.	Design -> Location could be in permafrost rich area, location could be selected to mitigate variability in permafrost depth. Geotech program - need to understand geotech risks & design solution that does not excavate into these areas. The Geotechnical program will better understand this requirement early on in the program and will forward that information as soon as possible to not slow down the design process. Care must be exercised to prevent degradation of the materials and the potential for differential settlement. CBCL's environmental and coastal personnel are reviewing requirements to minimize any potential impacts to the environment; the tender documents will require the Contractor to provide an Environmental Protection Plan.	· Avoid disruption to permafrost locations	Ongoing					
2024-06-18		WS 29	Power availability	CBCL	Delay in Construction, Changes to QEC Generation Capacity			*			2				1	2	Early determination of power requirements, communicate with utility, project might require additional utility generation - very long lead time/costs/possible changes to distribution	Keep in contact with QEC and understand what power requirements will be needed now and in the future.	· Monitor and report	Ongoing					
2024-06-18		WS 25	Power Requirements and Annual Energy Use	CBCL				*			2				1	2	Power requirements, even on other projects, etc. Will there be enough power	Contacted QEC, they have a number of projects in the pipeline putting a load in the generating capacity. Have to identify in schematic Design report , Come up with Estimate, Identifying future power requirements , Site offices could be off-site.	· Early determination of power requirements, communicate with utility. Might require additional generation	Ongoing					
2024-06-18		WS 43	Quality Control	CBCL	Schedule, Community Safety			*			2				1	2	Contract does not follow drawings. Items get missed and contractor doesn't want to rehab or complete	Adequate construction supervision (full time, knowledgeable supervision). Could require third party QC for Caissons	· define QC in specifications. Team needs to ensure we have knowledgeable Site Inspector	Ongoing					
2024-06-18		WS 46	Remoteness of Site	CBCL		*	*				2				1	2	Remoteness of Site for Injuries	Cell phone service is at the port site, First Response Plan from Contractor	· Ensure some sort of communication is required that will work from site. Ensure there is a first response plan	Ongoing					
2024-06-18		WS 12	Site Configuration Phasing	CBCL				*			2				1	2	Phased site impacts, Phasing of site impacting building locations	Taking into design considerations for two separate phases.	· further discussion required if funding is not approved.	Ongoing					
2024-06-18		WS 32	Site Contamination	CBCL / contractor		*	*		y		2				1	2	Dew Line Beach	Ensure contractor has their Env plans in place	· Add to Spec	Ongoing					
2024-06-18		WS 34	Sediment Transport	CBCL				*			2				1	2	Require future dredging	Review ABG findings	· Review for potential sedimentation issues	Ongoing					
2024-06-18		WS 14	Stakeholders	CBCL	Community, schedule			*			2				1	2	Consultation impacting scope later in project, unidentified stakeholders impacting project, stakeholders don't identify as stakeholders	Ensure all stakeholders are identified, engaged, and documents & reviewed with stakeholder groups, make sure we're not missing any essential stakeholders, Talk to more fishing groups, Document consultations and read it back to stakeholders, Make it more of a public consultation and specifically invite contractors	· Review required stakeholder lists	Ongoing					
2024-06-18		WS 45	Work Camp	GN / CBCL				*	?			1		2		2	Accommodation for Camp became long term housing for Port	Performance spec for camp, get turned over to GN, Location of camp for consideration for future, put it in schematic design, Contractors can turn over accommodation back to community hamlet? GN to talk to Nunavut Housing Corporation;	· to decide go no go / DP add to schematic Design.	Ongoing					
2024-06-18		WS 2	Community Needs	GN	Community; Scheduling; Cost			*			2				1	2	Consultation fails to capture needs of community	Planning, Robust outreach program, every time someone goes to the community update the Hamlet and locals wherever possible, report communications; add additional consultation.	· Request additional Community Consultation	Ongoing					
2024-06-18		WS 9	Geotech Sonar	CBCL	Construction, Cost		*	*		1				2		2	Geotech boreholes are not as sonar. Boreholes may miss areas with large bedrock elevation change. Nunavut bedrocks have a lot of crevices, the technology of geotech sonar is more advanced	Conduct sonar survey to confirm boreholes resulting - not identify large voids in bedrock will cost construction to stop/delay; large change order; Sonar survey in critical areas so that it doesn't affect schedule.	· GN decided not to proceed with sonar.	Ongoing					
2024-06-18		WS 1	Glacial Rebound	CBCL	Other/Operational Cost			*				1		2		2	Effective Sea level Decline	Increased Cost to add to current scope; look for alternatives for design. Change in draft impact design draft due to sea level change, challenge to have larger vessels enter facility in future, Ice fit lower level on steel sheet pile force or concrete caisson	· Design for possible ice lift on steel or caissons; Design for expected draft requirements	Ongoing					
2024-06-18		WS 3	NIRB, DFO, CIRNAC	CBCL	Schedule; Cost	*		*			2				1	2	Delay in screening decision, Construction tendering or start delayed	Submit proposal ahead of potential deadlines with sufficient information; get permits in early, communicate often	· Push Team for timelines for required submission materials	Ongoing					
2024-06-18		WS 6	Operational Season	CBCL	Delay on supply, ability to do work on water, changes in ice capacity for construction, cost	*	*		y		2				1	2	Ice cover, ability to navigate to site, supply of materials, access to site	Ensure contractor understands the weather conditions and has plans in place to work overtime to make up schedule.	· Add to Spec	Ongoing					
2024-06-18		WS 35	Settlement & Building	CBCL				*			2				1	2	Modular Building, Mass Fill, Settlement Over Years	Floating foundations, ensure compaction requirements and base	· Check requirements; add to specs	Ongoing					
2024-06-18		WS 30	Sub Consultant out of business	CBCL	Schedule, Cost			*	y		2				1	2		Build Time for sub contractors into schedule (emphasize in specs delays will be the responsivity of the Contractor)	· Add to Spec	Ongoing					
2023-09-27	34		Quarry Rock and Susceptibility to Abrasion	CBCL	Design/Construction		*	*				1			1	1	The size of existing armour stone created from quarry rock may reduce over time due to abrasion.	Mitigation: Oversize armour stone or source better armour stone material. Determine abrasive characteristics of the rod testing to determine effect of abrasion on the rock.	· Have geotechnical investigation determine abrasive characteristics of the rock and design accordingly.	Ongoing					
2023-11-15	41		Change in Personnel	GN/CBCL	Key Personnel changes			*				1			1	1	Any Key personnel changes could cause miscommunications	Confirm replacement personnel are well communicated with and brought up to speed with the decision log and meeting minutes.	· Mitigation is the Action.	Ongoing					
2023-09-27	46		Communication (Team) and Stakeholders	CBCL	Provide good communication	*	*	*				1			1	1	Host regular meetings, confirm Stakeholder management plan is followed, update and communicate regularly. Risk review for this Project determined the requirement for good communications with the community and the stakeholders was critical to the project's success.	CBCL will work with the GN to confirm communications are well delivered, clear and concise to minimize the risk of community upset.	· Mitigation is the Action.	Ongoing					
2023-09-27	51		Covid-19	CBCL	safety	*	*	*	Y			1			1	1	Impact of the Covid 19 pandemic on both material supply and labour costs/restrictions could occur.	Currently the team has been successful working around Covid restrictions. The Contract documents will recognize Covid-19 requirements if they are a risk at 100% Construction Document completion.	· Mitigation is the Action.	Ongoing					
2023-09-27	58		Design Cost Limitations	GN/CBCL	Budget		*					1			1	1	There is some risk reducing scope for current savings on the construction budget will cause more required maintenance in the future.	The budget constraint requires the design to be minimalized to "need only" requirements while also measuring maintenance costs.	· Constant monitoring of budget, scope creep and discuss with client any changes.	Ongoing					
2024-10-29	66		Quarry Water Rundown	CBCL	Community Concern				Y			1			1	1	Water could run down from interupting the landscape toward the airport	Confirm quarry location, develop run off planning with the Contractor if required	Add to specifications	Ongoing					
2024-06-18		WS 48	Storage for Building Materials	Contractor / CBCL		*			y			1			1	1	Need sufficient storage to house building materials	Ensure Contractor brings storage as required; perhaps purchase a seacan or two for spare parts if we don't build a building for them.	· Add to spec	Ongoing					

RISK MANAGEMENT PLAN INTERNAL TRACKER

Schedule of Risk	Item No.	Risk No. from Workshop	Description	Stakeholder	Issue Type	Sch	Cost	Other	Spec Note Required	High	Med	Low	High	Med2	Low3	Current Value of Risk	Issue Discussion	Mitigation	Action Items	Status	Inerent Risk Amount Estimate	% RRA	Residual Risk Allowance (RRA)	Outcome	Lesson Learned / Notes
2024-06-18		WS 23	Surveys	CBCL	Schedule, Design			*		1					1	1	Enviro/Archaeology surveys - needing to move site to accommodate protected species at risk, etc.	Relocate project/redesign, complete surveys before detailed design has progressed (Include in Schematic Design report)	· Schematic Design Report	Ongoing					
2024-06-18		WS 54	Workforce	CBCL				*				1			1	1	% of local labour sometimes difficult to achieve	Realistic target to be set for local labour in small communities, percentage of able construction workers is limited, often have other jobs , GN to be aware of this when specifying target of local labour, identify early enough (before start of construction),	· Communicate with Hamlet for any available workers	Ongoing					
	25		The geotechnical program Ice Conditions	CBCL	Schedule, Cost	*	*					0				0	Summer geotechnical program would be extremely costly as it would require a barge.	Geotechnical work in the harbour will be conducted in the winter over the ice.	· Mitigation is the Action. Measuring ice regularly, trying to mitigate plans to spread weight, etc.	Closed			$98,799.95	successful Drillers and ABG had extras approved	Cargo Embargo; low fuel in Qik so couldn't fly all the equipment in at once; drillers held up for a week. NIRB came in just in time. Ice was thin and has to be carefully monitored.
2023-09-27	27		Climate Change	CBCL	Design	*	*									0	Changing conditions associated with climate change can affect future operation of the facilities.	Climate change is impacting the active layer of permafrost in the north as well as changing sea level and ice conditions. Design solutions will incorporate climate change resiliency considerations considering the changing climate over the desired lifespan of the infrastructure.	· Ensure up to date climate data is reflected in design; confirm with Coastal Group.	Closed					
2023-09-27	28		Lack of Data to Calibrate and Validate Coastal Models	CBCL	Design			*								0	The site is a very dynamic environment, which will make calibrating coastal models difficult.	To mitigate the lack of local data, we intend to use the Meteorological Service of Canada (MSC) 50 North Atlantic Wave Hindcast (MSC50) which is a Wind and Wave Reanalysis (1954-2013), providing a long-term record of wave, winds and ice-cover within the vicinity of the project. CBCL has successfully used this data set since 2014 on dozens of SCH design and construction projects.	· Mitigation is the Action.	Closed					
2023-09-27	29		Sea Ice	CBCL	Design			*								0	Ice ridging and pressure on armour stone can cause failure.	Our ice expert to determine the ice ridging and ride-up forces on the armour slope.	· Results of ice study into the design and construction planning.	Closed					
2023-09-27	30		Deck Elevations	CBCL	Design			*								0	Wharf elevation must be operational for different ship loading and tide combinations.	Deck elevations must be set so that ship doors in both the loaded and unloaded conditions considering high and low tides will allow for the transport of cargo and people. This will also have to be reviewed with respect to future sea levels and with wave heights and ice thickness that could impact the underside of the deck superstructure. Limitations may have to be applied to ship usage or movable ramps/stairs considered.	· Design to incorporate information and ensure final design matches this criteria.	Closed					
2023-09-27	32		Additional Services	CBCL	Design	*	*									0	How pertinent are the additional services	The client assumes all additional services will be required. Dredging may be avoided.	· Identify any additional services that would be value added to the project and discuss with Client.	Closed					services were added to original contract
2024-06-18	40	WS 10	Funding	CBCL	Funding; High Contractor Bids		*			3						0	Timeframes associated with when the funding needs to completed by; originally by 2027, not a realistic time frame for construction, High bids could cause additional funding requirements	Client to mitigate; CBCL to reduce risks in contract documents so the contractor will keep their bids reasonable. Getting support from federal funding partners, ask for more funding, what do we need to enable GN to ask for more funding, federal government rarely approves funding to be denied an extension if we demonstrate things are progressing, needs a complete design. something tangible to work towards - going out to tender. Start with Class A estimate. Find out government's mandate - How much is the port worth? If we have the design we can push it out. Schematic Design report can tell us the extent of the issue. Are we doing a pre-ask in November or will it be in Early 2025? Change in Government = The program will not be coming back. Might have to split it up in different tender packages?	· Ensure all costs are included, GN can't go back a second time; · Mitigation is the Action.	With GN					
2023-09-27	47		Taking on responsibility for Design - replacing the feasibility report	CBCL	Responsibility Risk		*									0	The feasibility study did not provide expected data.	Precise review of the new layout by communicating with all disciplines, lessons learned and design experience. Review, review, review. Do not rush for the client, be confident we have looked from all angles	· Mitigation is the Action.	Closed					
	56		The geotechnical program Schedule	CBCL/ABG	Geotech	*	*					0			0	0	Timing for ice to be thick enough	Monitor before mobilization	· Schedule as much as possible to understand local weather patterns and design the construction around this.	Closed					
2024-03-22	63		ERM License was not approved	GN	Archaeological Assessment at risk of missing the 2024 season											0	Daniel Walker was denied a license to do the AIA	ERM are working with the GN and trying to find another Archaeologist to do the work.	• Discuss with the GN and ERM to continue Mitigation; discuss worst case scenario	Closed					Request AIA license in advance of engaging in an Agreement
2024-10-29	67		Drill Rig Access	Contractor	Machinery access				Y							0	Landscape is rough terrain, contractors could have a difficult time reaching quarrys	Confirm armourstone location / quarry location, ensure contractor's understsand the area; pre-bid meeting	Pre bid meeting						
2024-10-29	69		Underwater Lake	CBCL / Client	Community Concern			*				0			0	0	A community member had concerns of an underwater lake being impacted from quarry work.	CBCL prepared a memorandum dismissing the risk as a project issue.	· Issue memo; Update Community	Closed					
2024-11-26	70		Bathymetric Survey for Modelling	CBCL								1			0	0	Bathymetry info wasn't the same as we used for our modeling, which could have wave design parameters different; however, after review, we do not expect to see much difference.	Risk eliminated							
2024-06-18		WS 21	Cobbles	CBCL	Cost, schedule, design, construction			*								0	Ability to drive piles through cobbles	Geotech program (driveability analysis) (pre-Design)	· Going with Caissons instead	Closed					
2024-06-18		WS 33	Combi Wall	CBCL				*								0	May need for drill piles	Decision on pros and cons for combi wall verses caissons	· Using Caissons instead	Closed					
2024-06-18		WS 50	Design Build Items	CBCL				*								0	Design Build Items tend to lead to issues, Limit Design Build.	Avoid Design Build	· Avoid	Closed					
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APPENDIX C

Quality Assurance Plan

Government of Nunavut

Qikiqtarjuaq Marine Infrastructure Project

Project No. 22205-00762

Construction Quality Control Process

CBCL

Nunavut

234414.00 • June 2025

R0	Draft QC Plan	DP	2025-06-19	SEB
Issue or Revision		**Reviewed By:**	**Date**	**Issued By:**

Report: 234414-RE-QC Process

CBCL
Solutions today | Tomorrow IN mind
Maritime Centre, 1505 Barrington Street, Suite 901, Box 606, Halifax, NS,
B3J 2R7 | 902-421-7241 | CBCL.ca | info@CBCL.ca

June 19, 2025

Mr. Justin McDonell
Project Manager, Capital Projects Division
PO Box 1000, Stn. 620
Iqaluit, Nunavut X0A 0H0

Attention: Mr. McDonell:

RE: Government of Nunavut Qikiqtarjuaq Marine Infrastructure Project, Project No. 22205-00762-02 - CBCL Limited Construction Quality Control Plan

Please see CBCL Limited's Construction Quality Control Plan. If after your review you have any questions, please contact us at your convenience.

Yours very truly,

CBCL Limited

Issued by:

Sue Blois
Senior Project Controls Specialist
Direct: 902-539-1330, Ext. 3114
E-Mail: sueb@cbcl.ca

Review by:

David Parsons, P.Eng.
Project Manager

Project No: 234414.00

Contents

Figures

Tables

Appendices

Chapter 1 Introduction

CBCL Limited (CBCL) has been engaged to provide construction support services for the Government of Nunavut Qikiqtarjuaq Marine Infrastructure Project in Nunavut. CBCL will support the Government of Nunavut with the construction phase to assist in confirming the quality, budget and schedule meet the project requirements.

This document presents the Quality Control Process for Construction and Contract Administration.

Chapter 2 Communications

CBCL has drafted a Communication Plan, see Figure 2.1 below, to ensure the GN is aware and communicated with on all aspects of the construction progress. Communication between the Contractor, the construction administration team, the Resident Inspector and GN is impactive to ensure all parties are aware of the current project status and requirements. Also, it is important to have continued communication with the community of Qikiqtarjuaq, regulatory agencies, and other stakeholders invested in the Project.

2.1 Distribution Lists

Developing email distribution lists will ensure all required stakeholders receive pertinent information regarding the project.

2.2 Subject Lines

Standardizing communications with a consistent subject line protocol will allow recipients to quickly recognize the subject of the Email so they can respond in a timely manner and file electronic communications appropriately.

Subject Line recommendation would include Project Title – Subject, an example is as follows:
Qikiqtarjuaq Marine Infrastructure – Shop Drawing Submittal

2.2.1 Contractual and Formal Communication

Communication regarding contractual items should include, at a minimum and unless otherwise defined, the following:

Name	Title	Project Position
Justin McDonell	GN Project Manager	GN Project Representative (GN)
David Parsons	CBCL Senior Civil Engineer; Construction Administrator	Contract Administrator
Contractor	Manager	Contract Manager
Sue Blois	Project Controls	Document Controller

2.2.2 Reporting

Daily Site Reporting should be distributed, at a minimum and unless otherwise defined, as follows:

Name	Title	Project Position

Justin McDonell	GN Project Manager	GN Project Representative
David Parsons	CBCL Senior Civil Engineer	Contract Administrator
Resident Inspector (TBA)	Resident Inspector	Resident Inspector
Contractor	Manager	Contract Manager
Contractor's Site Representative	Site Supervisor	Contractor's General Site Representative
Sue Blois	Project Controls	Document Controller

2.2.3 Submittals, Shop Drawings, RFIs, SIs

For submittals that involve design changes, design questions or site instructions, the design lead appointed to the Construction Phase would be forwarded the requests/comments. The c.c. list would include the following:

Name	Title	Project Position
Justin McDonell	GN Project Manager	GN Project Representative
David Parsons	CBCL Senior Civil Engineer	Contract Administrator
Resident Inspector (TBA)	Resident Inspector	CBCL Resident Inspector
Contractor	Manager	Contract Manager
Contractor's Site Representative	Site Supervisor	Contractor's General Site Representative
Sue Blois	Project Controls	Document Controller

2.3 Stakeholder Communication

Triggers for Stakeholder Communications can vary, one example being Regulatory requirements. Pertaining to stakeholder communication, it is recommended that the following be copied on communications:

Name	Title	Project Position
Justin McDonell	GN Project Manager	GN Project Representative
David Parsons	CBCL Senior Civil Engineer	Contract Administrator
Resident Inspector (TBA)	Resident Inspector	CBCL Resident Inspector
Contractor	Manager	Contract Manager
Contractor's Site Representative	Site Supervisor	Contractor's General Site Representative
Sue Blois	Project Controls	Document Controller

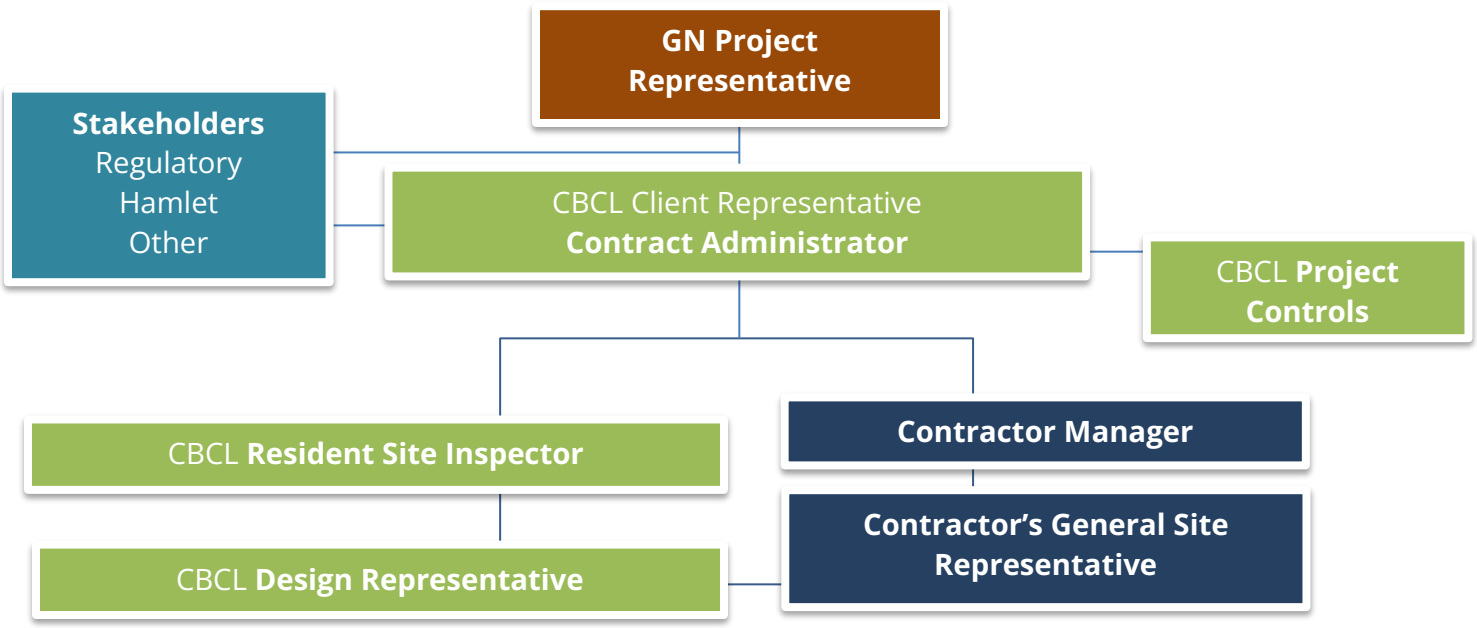
2.4 Heath, Safety and Environemnt (HSE)

For health, safety and environmental communication, include the HSE representative(s) appointed to the Construction phase of the project and include the following in the distribution:

Name	Title	Project Position
Justin McDonell	GN Project Manager	GN Project Representative

David Parsons	CBCL Senior Civil Engineer	Contract Administrator
Resident Inspector (TBA)	Resident Inspector	CBCL Resident Inspector
Contractor	Manager	Contract Manager
Contractor's Site Representative	Site Supervisor	Contractor's General Site Representative
Sue Blois	Project Controls	Document Controller

Figure 2-1 – Communications Plan



Chapter 3 Contractor's Submittals and Queries

The CBCL Contract Administrator will track Contractor's contractual documentation.

3.1 Shop Drawings and Submittals

CBCL will track contractor's submittals, which can include shop drawings, samples, plans, testing results, etc.

All submittals will follow a tracking procedure to ensure they are received, reviewed, commented on, stamped and returned. The tracker will maintain the status until each submittal is marked closed to ensure no submittals are left unanswered or not responded to. Table 3.1 below identifies a sample tracker for submittal tracking purposes.

Note: all material specifications, mixes and test results will be turned over to the Client Representative for future maintenance by the GN and / or others.

3.2 Requests for Information (RFI)

Requests for information will be tracked to ensure responses are timely and complete. A sample RFI tracker is displayed in Table 3.2 below. The Contractor will be responsible to draft the request, the Resident Site Inspector will review and submit to the Contract Administrator and any other relative team members for review and response. If the RFI consists of a scope, schedule or budget change, the Contract Administrator will draft a Contemplated Change Notice (CCN) and move to the CCN process. See Section 4.1.1.

3.3 Site Instructions (SIs)

Site instructions will also be tracked in a similar log as the RFIs. The Resident Site Inspector would be responsible to draft site instructions and have them approved by the Contract Administrator prior to issuance to the Contractor.

Table 3-1: Contractor Submittal Log

Qikiqtarjuaq Marine Infrastructure Project
Contractor Submittal Tracker
INTERNAL CHECKLIST

AEN Apparent Errors Noted Project No.: 234414.00
RRS Revise and Resubmit
REJ Rejected Date Revised: **25-Mar-2**

The following is a list of submittals identified in the Contract Specifications. It is being provided for your information and use and if accepting this list you are to verify that all required submittals have been identified.

Divisi	Spec Sectic	Sub Sectic	Disciplin	Description	Submittal	Due Date	Reviewer													
03	03 10 00	1.2.2	Marine	Concrete Product Data																
03	03 10 00	1.2.2	PM	WHMIS SDS																
03	03 20 00	1.2.2	Marine	Product Literature and Data Sheets																
03	03 20 00	1.2.3	Marine	Reinforced Concrete Drawings																
03	03 20 00	1.2.4	Marine	Quality Assurance Submittals and Mill Tests																

Table 3-2: Request for Information (RFI) Log

Qikiqtarjuaq Marine Infrastructure
RFI (REQUEST FOR INFORMATION) STATUS TABLE

Last Updated: **25-Mar-25**

RFI Number	Description	Date Received	Forwarded to	Date Replied	Cost Impact	Schedule Impact	Status	Notes

Chapter 4 Contract Administration

The CBCL Contract Administrator will be responsible to monitor and report on the scope, schedule and budget for the project.

4.1 Cost Services

CBCL will provide the following cost services to the Client Representative:

- Detail and evaluation of the project's cost performance.
- Assist with cost management advice when requested.
- Evaluate change orders (COs) and claims.
- Provide percent completes, earned value, estimate to complete and cash flows for the construction work.
- Assist in the preparation of CCNs and COs.

4.1.1 CCNs and COs

CBCL will track all CCN and CO requests. A copy of a sample tracker follows as Table 4.1. Requests for CCNs will be reviewed for opinion, costing and schedule for the GN's consideration on authorizing a CO. CBCL will assist in the preparation and distribution as requested by the GN.

Table 4-1: CCNs and CO Status Table

Qikiqtarjuaq Marine Infrastructure Project
CCN/CO Summary

Last Updated: **25-Mar-25**

Rform Ref.	CCN#	CO#	Decription	Date Issued	Status	Credits	Extras	Net Project Cost	Approval date	Corresponding Docs	Comments

4.1.2 Budget Management

CBCL will provide detail and evaluation of the project's cost performance and assist with cost management advice when requested. CBCL will provide percent completes, earned value, estimate to complete and cash flows for the construction work as requested. A cost loaded schedule will be prepared to manage the budget, cost and spend. This cost loaded schedule will provide reporting as required.

4.1.3 Contractor's Progress Claims

The Resident Site Inspector will confirm quantities and measurements for payment so the CBCL Contract Administrator can review Contractor Progress Claims. This review will include a schedule review to ensure the Contractor is meeting the budget, scope and schedule. This review will provide confidence to the GN that the contractor's payment is consistent with the work done to date.

4.2 Scheule

CBCL will monitor schedule and task activity on a regular basis to ensure the Contractor is keeping to their submitted schedule. Deviations from the schedule will be reported to the GN and reviewed with the Contractor as required. A schedule tracker will be maintained to track mitigation methods, float, critical path, and costing as described above.

4.3 Certifications

CBCL will prepare certifications, including the Substantial Completion Certificate(s) and Final Certificate of Completion for sign off by the Client Representative.

Chapter 5 Quality Control on Services

CBCL Contract Administrator will provide quality control by tracking, monitoring and communicating on service delivery.

5.1 Meetings

CBCL will take meeting minutes and track outcomes to ensure all assigned actions have been responded to and communicated effectively.

5.2 Permitting

Permitting assistance to the Contractor will include an updated Roadmap of the permitting progress for submission to the GN. CBCL will assist the Contractor to obtain required permits. The Roadmap will be tracked for scheduled timelines and submissions.

5.3 Site Visits

The designated site visits (10 visits) during construction will provide the key designers the ability to review the construction activities and report on the findings. Site visits will include a Substantial Completion review, a Final Completion review and Warranty site visits.

5.4 Project Reporting

5.4.1 Construction Progress Reporting

The CBCL Contract Administrator will provide Monthly Project Progress Reports to ensure the GN are kept up-to-date on the status of the project. At a minimum, the report will include a summary of work to date, variances to scope, schedule and budget, a cost report, cash flow projections, updated project schedule, risks and updated milestone list. See sample report in Appendix A.

5.4.2 Weekly Reports

Weekly reports will provide the GN Project Representative information on the progress of schedule, major activities commencing or completed, activities in progress, major deliverables of materials/equipment, shortages on labour or materials, and any outstanding information or action required, i.e., work force, weather, accidents, safety incidents, hazards, etc. See sample report in Appendix A.

5.4.3 Daily Reports

The Resident Site Inspector will provide Daily Reports to the GN, including photographs, weather conditions, site activities, material and equipment deliveries, non-conformances,

safety incidents, testing, site visitors, environmental incidents, stop work issuances, and any major activities to note. See sample report in Appendix B, when available.

5.4.4 Monthly Field Reviews

CBCL will provide monthly field review reports to keep the Client Representative informed of the Work progress. Field reports will provide design level reviews, findings from Site Visits and copies of project trackers, including SI, RFI and submittal trackers. See sample report in Appendix A.

5.4.5 Post Construction Report

CBCL will provide a post construction report allowing the GN confidence that the project requirements, documentation and deliverables are complete.

5.5 Site Records

The CBCL Resident Inspector will maintain site records for quick access to the contract and tender documents, approved shop drawings, SIs, RFIs, CCN/COs, memoranda, test reports, deficiencies, schedule, correspondence and meeting minutes, contact information, and communication plans.

5.6 Documentation Reviews

CBCL will provide reviews and comments on various documents submitted by the Contractor such as plans and protocols. The Resident Site Inspector will monitor the Contractor's work for compliance to their Plans.

5.6.1 Contractor's Required Plans

The following list of Contractor required plans will be reviewed by CBCL to ensure compliance to the contract and specifications.

- Health and Safety Plan
- Waste Management Plan
- Road/Marine Traffic Plan
- Blasting Plan
- Wildlife Monitoring Plan
- Schedule and Project Execution Plan
- Environmental Protection Plan
- Communication Plan
- Training / Commissioning Plan

5.7 Acts, Regulations and Guidelines

The Resident Site Inspector will monitor the Contractor's work for adherence to all associated Acts and Regulations.

5.7.1 Contractor's Acts, Regulations and Guidelines

The acts, regulations and guidelines that follow, at a minimum, will be monitored for adherence:

- WSCC Worker's Safety Act and Regulations
- Occupational Health and Safety Regulations, NU
- Mining Health and Safety Regulations
- Territorial Quarry Regulations
- Nunavut Legislation Explosives Guidelines
- Northern Land Use Guidelines, Territorial Lands Act
- Dust Suppression on Unpaved Roads, Department of Environment, NU
- Aviation Turbine Fuel National Standard of Canada
- Municipality of Qikiqtarjuaq By-Laws
- Qikiqtarjuaq Harbour Development Construction Environmental Management Plan (CBCL)

5.8 Tracking Log

CBCL will create and update a project log to track approved major decisions, including any items that impact the project scope, schedule and budget.

5.9 Technical Advice

The CBCL Design Leads and Contract Administrator will be available to offer technical advice as required for the Project to ensure any changes, omissions or errors are reviewed.

5.9.1 Disputes and Claims

The CBCL team will offer technical advice on all disputes and claims between the GN and the Contractor. This will be done to avoid any misconceptions, to clarify the contract requirements and to ensure information is in context with the issue(s) at hand.

5.10 Testing and Inspection of Minor Works

CBCL will authorize testing, inspections and minor work for the contractor as long as the work does not impact the project cost or schedule.

5.11 Resident Inspection Quality Control

The full-time Resident Inspector will assist with coordination of site work, communications, logistics, and monitoring. The Contractor will be required to confirm the Inspector's availability for design confirmation checks prior to proceeding with Work. The Resident Inspector will communicate with the Contractor on any work that will be done in their absence to ensure no work that requires design checks are completed in the Inspector's absence.

The Resident Inspector will inspect the phases of work for compliance against the tender documents and verify quantities and materials received. Attending the job-site meetings will allow the Resident Inspector to ensure the Contractor's site representative is issuing safety and environmental requirements to the Work crew and is communicating with stakeholders, organizing logistics and providing safety to locals on a daily basis.

5.11.1 Stop Work Orders

If the Contractor, or any of the Contractor's crew or sub-contractors, demonstrates an unsafe or unauthorized act, the Resident Site Inspector will implement a Stop Work order on the Project until the act is appropriately documented, and corrected. All Stop Work orders will be immediately communicated to the Construction Administration and the GN Representative.

5.11.2 As-builts

The Resident Inspector will review the accuracy of marked up as-built drawings to ensure the contractor has them up-to-date. The Inspector will report on any discrepancies or deficiencies found immediately after review to ensure any required adjustments are addressed as soon as possible.

5.11.3 Deficiencies

The Resident Inspector will assist in the preparation of deficiencies and monitor for completion of such. A deficiency list will be tracked and budgeted for holdbacks on payments.

Chapter 6 Post Construction

Project close out will include a thorough review of documentation required for completion of the Project.

At a minimum, all project trackers, including SIs, RFIs, Claims Tracker, CNN/CO Tracker, Submittal Trackers, Final Schedule, and final Costing Report will be updated at final completion and provided to the GN Representative.

6.1 Record Drawings

Record drawings will be prepared for submission in both pdf and native file AutoCAD format. As-built reviews will be conducted to ensure there are no discrepancies between the actual work completed and the record drawings.

6.2 Operations and Maintenance Manuals (O&M)

CBCL will confirm that the project adhered to all plans and specifications and ensure that all O&M manuals, warranties, guarantees and other required submittals are turned over to the GN Representative.

6.3 Lessons Learned Workshop

CBCL will participate in a lessons learned workshop with the GN. This will allow the Teams to ensure future projects will benefit in the lessons learned from this Project.

6.4 Warranty Services

CBCL will participate in a warranty inspection with the GN Representative and the Contractor and will complete a warranty deficiency list. Deficiencies will be monitored and checked for correction before the expiry of any warranties.

A final Warranty Review Report will be provided to the GN Representative.

6.5 Environmental System Checks

CBCL will do an environmental system check prior to the expiration of warranties. This will ensure the Community is not left with any ongoing environmental concerns.

Chapter 7 Responsibility for Deliverables

The CBCL Team will be responsible for deliverables as follows:

7.1 CBCL Contract Administrator

The CBCL Contract Administrator will provide the following deliverables. These deliverables will provide assurance that the Contract requirements are being met.

- Progress Claim reviews
- Work Progress Reports
- Contemplated Change Notices and Change Order Recommendations
- Comments to Contractor Schedule
- Certificate of Substantial Performance
- Certificate of Substantial Completion
- Final Certificate of Completion
- Warranty sign-off
- Sign off of SIs and RFIs
- Review of Contractor Plans

7.2 CBCL Resident Site Inspector

The CBCL Resident Site Inspector will provide the following deliverables:

- Meeting Minutes
- Standard Operating Procedure Updates
- Deficiency Lists
- Weekly Reports
- Memorandum to the Contractor
- Daily Reports
- Verification of Surveys
- Warranty List

7.3 CBCL Design Team

The CBCL Design Team will provide the following deliverables:

- Field Review Reports
- Approved Shop Drawings
- Test Report
- Record Drawings

- O&M Manuals
- Final Systems Operation Manual
- Final Warranty Review Report
- Clarifications to SIs and RFIs

APPENDIX A

Sample Progress Reports (TBD); Weekly Reports and Monthly Field Reports

Qikiqtarjuaq Marine Infrastructure Project - Gov of NU – Contract No. 22205-00762-02

Monthly Progress Construction Report

Date Issued:	2024-12-02
Report #:	RE-013
Work Period Starting:	2024-11-01
Work Period Ending:	2024-11-30

1. Narrative Report

Summary of Work Completed in the past month:

2. Contemplated Changes

3. Contractor's Schedule Review

4. Health & Safety and Environmental

5. Risks

APPENDICES

A – Schedule

CBCL LIMITED
Consulting Engineers

Week Site Report

Project Name: _____

Week Of: xx-xx-xxxx to xx-xx-xxxx

Key Items:

1. **Health & Safety**

2. **Environment**

3. **Project Schedule**

4. **Design Impacts**

5. **Site Information**

5.1. Weather:

Sunday	
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	

We are a professional team working together, to provide quality services that satisfy our customers, and contribute to our mutual success.

6. Equipment on Site

7. Activities This Week

Sunday	
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	

8. Work Planned for Next Week

9. Meetings

10. General Comments

Report Prepared By

_____

CBCL Site Inspector

MONTHLY FIELD OBSERVATION REPORT

Project Name: **Report No.:**

Location: **Observer:**

Contract Number:

Contractor: **Date/Time:**

Weather:

Purpose:		
Observations (Progress of the Work):		
Comments/Remarks:		
		Signature:

CBCL File No.

(Picture information)

(Picture Information)

Attachments:

- RFI Tracker
- SI Tracker
- Submittals Tracker

APPENDIX B

Sample Daily Report

CBCL

DAILY INSPECTION REPORT		Page	/
Project Title:		File:	
		Date:	
Client:		Time on Site	From/To
Contractor:			/
Inspector:			/

WEATHER CONDITIONS

CONTRACTOR'S EQUIPMENT ON SITE

CONTRACTOR'S PERSONNEL ON SITE
Foreman/Charge:

MATERIAL ON SITE

WORK PROGRESS THIS DATE		
Item	Unit	Quantity Placed

PHOTOGRAPH LOG

Film No. ________ Frame ____________ to Frame ____________

Film No. ________ Frame ____________ to Frame ____________

Inspector's Signature	

Solutions today | Tomorrow IN mind

www.CBCL.ca

APPENDIX D

Construction Environmental Management Plan (CEMP)

Qikiqtarjuaq Marine Infrastructure Project

Construction Environnemental Management Plan

CBCL

Nunavut

234414.00 • September 2025

001	Draft Report	DP	Sept 11, 2025	LH
Issue or Revision		**Reviewed By:**	**Date**	**Issued By:**

Report: 234414.00

Contents

Appendices

Chapter 1 Introduction

The Government of Nunavut Department of Transportation and Infrastructure is proposing to construct a deep-sea port facility (the Project) in Qikiqtarjuaq in Qikiqtaaluk Region. This coastal infrastructure project will consist of a new closed-face marginal wharf structure complete with modern equipment and tools to accommodate commercial, scientific, and tourist vessels.

The purpose of this Construction Environmental Management Plan (CEMP) is to present and describe proposed environmental protection requirements and mitigation measures that shall be adhered to throughout the Project construction phase. The CEMP will provide a framework for the development and implementation of safe and environmentally responsible practices to reduce environmental and social effects associated with construction activities.

This CEMP will be updated as required by terms and conditions defined by the Nunavut Impact Review Board (NIRB) screening decision report, other permit conditions, and any additional consultation commitments. Revisions will also be made if there are changes to design or construction methods and procedures. Mitigation measures outlined within this CEMP are based on guidelines, regulations, consultation comments, and CBCL's experience with similar project work.

Chapter 2 Project Overview

The Project will be located in the Municipality of Qikiqtarjuaq, Qikiqtaaluk Region, Nunavut, south of the main commercial and residential area of the community. The primary objectives of the Project are to improve marine infrastructure in the community and provide facilities to support marine traffic in the Davis Strait and Baffin Bay.

The Project footprint will overlap with upland, tidal zone, and seabed areas along the western shoreline of Broughton Island, south of the Qikiqtarjuaq Airport. The Project area includes the port, access road, haul roads, quarry, stockpile areas, and temporary work camp.

Construction will involve both land-based (e.g., site preparation, rock quarrying) and marine-based activities (e.g., harbour dredging, construction of wharf and armour stone protection). Rock and fill will be excavated from a new quarry. A temporary camp will be established to accommodate workers during construction. Traffic between construction areas and the camp, quarry, and stockpile areas will make use of existing roads.

2.1 Schedule

Construction will occur over a four-year period from 2026 to 2029, with construction shut down over the winter seasons. Mobilization of equipment and materials, and potentially some site preparation works, will occur in 2026. The majority of construction will occur in 2027, 2028, and 2029. Operation of the port is expected to begin at the start of the open-water season in 2030.

2.2 Project Components

The proposed port layout consists of the following key features:

- Closed-face marginal wharf structure with armour stone protection
- Access road connecting to existing municipal roads
- Crane for offloading cargo
- Wastewater receiving systems
- VHF radio communications station
- Freezer container facilities
- Operations and security office
- Power distribution

2.3 Construction

In addition to the physical components of the Project, the following activities will be carried out during construction:

- Quarrying operations (e.g., blasting, excavation) at a new quarry in Qikiqtarjuaq
- Temporary materials stockpile areas
- Temporary staging/laydown areas
- Temporary camp to accommodate workers
- Dredging and disposal of dredged material (may be used for construction)
- Utility installation (e.g., poles, lighting)

Rock and gravel required to construct the new port and access road will be sourced from a new quarry. The proposed quarry is approximately 2 km via road from the Project site. The road that will be used to haul material from the quarry has been recently constructed by the municipality; a short (approximately 275 m) access road will be constructed as part of the Project to connect the port facilities to the newly constructed road. Infilling and excavation will be carried out to establish the port facilities and expand the upland area for the laydown area. Dredging will be required to construct the new wharf. Dredged materials will be transferred to the laydown area, confined by a berm, for dewatering and storage. A temporary wharf will be constructed below the high-water level south of the footprint of the permanent deep-sea port to facilitate the dredging and transfer of dredged material to the laydown area for de-watering and storage.

Chapter 3 Roles and Responsibilities

For successful completion of the Project, all organizations involved shall be aware of their respective roles and responsibilities as presented below. The responsibility for the application of this CEMP encompasses all Project personnel from management to workers.

3.1 Proponent, Project Authority, and Contract Authority

The Government of Nunavut is the Project proponent and is the main point of contact with the regulatory authorities on permitting and regulatory compliance. As the owner and Project Authority of the Project, the Government of Nunavut has the obligation to ensure that their commitments to protect the environment are met, and that these relevant obligations are known to the Contract Authority, Construction and Contract Administrator, and the Contractor. As the owner, the Government of Nunavut is also responsible for all post-construction activities.

As the Contract Authority of the Project, the Government of Nunavut is ultimately responsible for the management and implementation of the CEMP; however, all Project personnel will share the responsibility of conducting Project activities in accordance with this CEMP and agreed upon standards and protocols.

3.2 Construction and Contract Administrator

The Construction and Contract Administrator will act as the Government of Nunavut representative and is responsible for monitoring the selected Contractor's activities (i.e., compliance with contract, including environmental requirements and the CEMP). The Construction and Contract Administrator will also be responsible for supporting Government of Nunavut in communicating the regulatory requirements to the Contractor and monitoring the Contractor's construction activities for compliance.

The role of a Resident Inspector, who reports to the Construction and Contract Administrator will be assigned to monitor onsite staff and project progress during the Project. The Resident Inspector will have the overall responsibility for the monitoring the Contractor's implementation of activities associated with the CEMP for the Project.

3.3 Contractor and Environmental Monitor

The Contractor is responsible for the day-to-day management of construction activities and compliance with the terms of the contract, compliance with the conditions of all permits and approvals, and compliance with the CEMP. The Contractor's personnel (i.e., anyone

working on behalf of the contractor, including subcontractors) will report to the Contractor directly, and the Contractor will report to the Government of Nunavut. The Contractor will retain an Environmental Monitor whose responsibilities will include the environmental monitoring of construction activities, environmental sampling, reporting monitoring results, incident reporting, and communicating the requirements of the CEMP to the Contractor personnel.

The mitigation or protective measures identified in the CEMP will be primarily the responsibility of the Contractor.

3.3.1 Contractor Construction Work Plans

The selected Contractor will be required to prepare task and site-specific Contractor Construction Work Plans (CWPs) that will include environmental management, mitigation and monitoring measures that comply with the requirements of this CEMP, approval and permit obligations, and legal requirements. At a minimum, the Contractor will be required to prepare the following plans:

- Health and safety—this plan will detail the measures and procedures that will be employed to meet occupational health and safety requirements during construction.
- Quarry operations—this plan will detail the measures and procedures that will be employed to control blasting and manage dust generated during construction.
- Spill prevention, contingency, and emergency response—this plan will detail the measures and procedures that will be employed to prevent, mitigate, and respond to a leak or spill of hazardous material during construction.
- Erosion and sediment control—this plan will detail the measures and procedures that will be employed to control site runoff and prevent and mitigate erosion and sedimentation during construction.
- Waste management—this plan will detail the measures and procedures that will be employed to store, handle, and dispose of waste generated during construction.
- Traffic management—this plan will detail the measures and procedures that will be employed to manage construction traffic and avoid or mitigate traffic conflicts during construction.
- Marine construction management—this plan will detail the measures and procedures that will be employed to manage marine construction activities and avoid or mitigate conflicts with marine fish and wildlife, and community users of the marine environment, during construction.
- Construction staging—this plan will detail the staging of construction activities to avoid conflicts with other activities during construction, as well as public safety measures at the recreational area and trail that currently exists at the proposed quarry location.
- Wildlife mitigation and monitoring—this plan will detail the measures and procedures that will be employed to monitor for the presence of wildlife and avoid conflicts with wildlife during construction.

The plans will be further described with additional context within the Project's specification documents. Additional plans may be required, which will be identified during design development, contracting, and from regulatory permits and approvals.

3.3.2 Training Requirements

Environmental training and orientation, as well as Indigenous cultural awareness training, will be mandatory for staff employed onsite. Topics to be discussed include but are not limited to an overview of environmental risks and mitigation, cultural awareness, accidental spill response, waste management, and contingency plans.

In general, training and orientation will include a review of the CEMP, Contractor CWPs, Project conditions of approval, applicable environmental legislation, and standard practices and procedures.

3.4 Community Complaints

The Government of Nunavut will be responsible for receiving and responding to any comments or complaints received from the community. The Construction and Contract Administrator will prepare a communications protocol for review and approval by the Government of Nunavut. If any complaints or issues with construction activities are raised by the community, the Contractor will be required to prepare an Issue Resolution Plan that will be reviewed by the Construction and Contract Administrator for approval by the Government of Nunavut.

Chapter 4 Summary of Existing Conditions and Construction Impacts

4.1 Existing Conditions

The Project will be located in the Municipality of Qikiqtarjuaq, Qikiqtaaluk Region, Nunavut, south of the main commercial and residential area of the community. Qikiqtarjuaq is located on Broughton Island, which is east of the much larger Baffin Island and separated from it by the 2 to 3 km wide Broughton Channel. The Project is located on Broughton Channel on the western side of Broughton Island. It is not located in or near any designated ecologically or biologically significant areas. Auyuittuq National Park is located on Baffin Island, approximately 30 km southwest.

Air quality is expected to be generally good and similar to other Arctic communities. Emissions come largely from diesel power generation and vehicular exhaust. Located less than 1 km from the Qikiqtarjuaq Airport, it is expected to experience occasional noise. Being north of the Arctic Circle, Qikiqtarjuaq experiences 24 hours of daylight from late May to mid-July and 24-hours of darkness for most of December. Construction will be shut down during winter months.

Permafrost exists approximately 1.6 m below the surface in upland areas within the Project footprint. The location of the proposed port overlaps with rocky and sandy beach shoreline and disturbed communities. The quarry will be constructed on upland bedrock and upland rocky slope.

The terrestrial environment is of limited value to wildlife, used mostly as movement areas with potential habitat for birds that nest on bare ground. Intertidal areas provide foraging opportunities for marine birds and small mammals at low tide. No terrestrial species at risk (SAR) or species of conservation concern (SoCC) were observed in recent surveys. Polar Bears have been reported by community residents and are known to occur on Baffin Island.

Freshwater and marine flora/fauna is relatively scarce near the Project area. It generally contains low value habitat for maritime SAR and does not contain critical habitat. There are no permanent freshwater surface water/watercourse features nearby, and the intertidal zone is relatively steep sloped. Marine flora in the intertidal and subtidal zones is scarce due to seasonal ice scour and a lack of rocky substrate. At least six marine fish species are known to occur in the Broughton Channel, and three were recorded in the Project area during recent field investigations—none of which are considered rare or at risk in Nunavut. Parts of the Davis Strait east of Broughton Island are mapped as moderate to high

sensitivity areas for Bowhead Whale, Beluga, and other toothed whales by Fisheries and Oceans Canada (DFO), but these species are rarely sighted in Broughton Channel. A list of SAR (wildlife, marine and migratory birds, marine fish, and marine mammals) that may occur in the Project area, and their likelihood of occurrence, is provided in the Project Proposal document which can be accessed through the Nunavut Impact Review Board (NIRB) Public Registry (NIRB File No. 25XN030) here: https://www.nirb.ca/application.

The proposed quarry overlaps with a popular local picnic spot and access trail which will be closed during construction to ensure public safety. The construction footprint does not overlap with ecological communities where berries are abundant for traditional picking activities.

4.2 Environmental and Socio-Economic Effects

The potential adverse environmental and socio-economic effects of the Project that may occur during construction are described in Project Proposal document and summarized below.

- Dust is expected to increase during construction due to quarrying and use of existing roads to transport materials between the quarry/stockpile areas and the construction site. Both marine and land construction equipment will generate airborne emissions (e.g., carbon monoxide, sulphur dioxide, fine particulate matter, etc.).
- High levels of ambient noise and vibrations resulting from construction activities, as well as instantaneous pressure changes from blasting, may pose nuisance. Noise and pressure changes can also affect terrestrial and marine wildlife, causing changes in behaviour or avoidance of affected areas.
- Depth to permafrost at the quarry location is uncertain. Construction activities have the potential to induce long-term impacts to permafrost (i.e., permafrost degradation). The ground is in its most vulnerable state during the summer thaw season (open-water season) when surface temperatures are increasing, and the active layer is thawing. Disturbance of the ground when it is in this vulnerable state can potentially cause increased ground temperatures, and future deformation and/or damage to permafrost.
- Soils and terrain will be affected through excavation at a new quarry, infilling at the port construction site, and movement of earth between the quarry and the construction site. The temporary work camp may also cause soil disturbance from the movements of vehicles and workers.
- Disruption of native vegetation within the Project area can occur through the direct destruction/alteration of vegetated areas, mainly in the temporary work camp.
- Permanent removal of some wildlife habitat will occur in a small amount of intertidal areas which are foraging habitat for birds and small mammals, and rocky beach areas which may be suitable nesting habitat for certain birds. Expansion of the existing quarry will result in the loss and alteration of rocky upland areas which may be nesting habitat for certain birds and movement areas for other wildlife.

- Increased traffic along haul roads during construction could potentially increase mortality rates of wildlife. There is also a possibility that birds could nest in work areas or that construction activity could damage nests.
- In-water work during construction could stir up sediment and temporarily affect water quality by increasing turbidity and suspended solids. Dredging, pile-driving, and placement of materials in subtidal waters are the activities most likely to disturb marine sediments.
- Dredging, infill of marine sediments, and installation of armour stone will affect marine fish and fish habitat. Sessile organisms (e.g., clams, mussels, and other animals that live on or in the substrate) may be harmed or killed by pile driving, dredging, and/or disposal of dredged sediment.
- Marine mammals could be affected by noise generated from in-water work activities, which could alter movement patterns, and/or interrupt community hunting.
- Activity at the port and traffic between the port and the community may increase the probability of negative interactions between Polar Bears and humans.
- The temporary work camp will generate waste (e.g., sewage, organic waste, package waste).
- There is increased potential for accidents and hazardous waste spills during construction activities.
- Archaeological sites and/or artifacts could be lost or damaged by excavation or stockpiling, particularly at the proposed quarry area where eight sites have been identified.

Chapter 5 Environmental Management and Mitigation Measures

This section outlines management, mitigation, and monitoring measures to be incorporated into the Construction Work Plan and implemented before and/or during construction.

5.1 Guidelines and Best Management Practices

Applicable guidelines and Best Management Practices (BMPs) for the CEMP include, but are not limited to, the following:

- Northern Land Use Guidelines (Indigenous and Northern Affairs Canada, 2011)
- Contingency Planning and Spill Reporting in Nunavut. A Guide to the Regulations. (Government of Nunavut, n.d.)
- Workplace Hazardous Materials Information System (WHMIS) (Health Canada, 2020)
- A Best Practices Guide to Solid Waste Reduction (Canadian Construction Association, 2001)
- Guidelines for Spill Contingency Planning (Indigenous and Northern Affairs Canada, 2007)
- Environmental Guideline for the General Management of Hazardous Waste (Government of Nunavut, 2010)
- National Oil Spill Preparedness and Response Regime (Transport Canada, 2019)
- Interim code of practice: end-of-pipe fish protection screens for small water intakes in freshwater (DFO, 2020)
- DFO: Fish and Fish Habitat Protection Policy statement (DFO, 2019)
- DFO: Measures to Protect Fish and Fish Habitat (DFO, 2025)
- DFO: Standards and Codes of Practice (DFO, 2024)
- DFO: Nunavut Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (DFO, 2013)
- DFO: Guidelines for the Use of Explosives in or Near Canadian Water (Wright & Hopky, 1998)
- Best Management Practices for Pile Driving and Related Operations (BC Marine and Pile Driving Contractors Association, 2003)
- National Oceanic Atmospheric Administration (NOAA): 2018 Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0) (NOAA, 2018)
- Environmental Protection Service, and Environmental Guideline for Dust Suppression (Government of Nunavut, 2002)

- Government of Canada: General nesting periods of migratory birds (Government of Canada, 2025)
- Government of Canada: Guidelines to reduce risk to migratory birds (Government of Canada, 2023)
- Government of Canada: Guidelines to avoid disturbance to seabird and waterbird colonies in Canada (Government of Canada, 2024).
- Government of Nunavut: Non-native and invasive species in Nunavut (Government of Nunavut, 2011)
- Government of Nunavut: Contingency Planning and Spill Reporting in Nunavut. A Guide to the New Regulations (Government of Nunavut, 2003)
- Indigenous and Northern Affairs Canada (INAC): Guidelines for Spill Contingency Planning (INAC, 2008)
- ECCC: Guidelines for the Preparation of Hazardous Material Spill Contingency Plans (ECCC, 1990)
- Government of Nunavut, Department of Environment (GN DoE):
    - Environmental Guideline for the General Management of Hazardous Waste (GN DoE, 1999)
    - Environmental Guideline for Used Oil and Waste Fuel (GN DoE, 2012)
    - Environmental Guidelines for Industrial Waste Discharges into Municipal Waste and Sewage Treatment Facilities (GN DoE, 2011)
- Government of Northwest Territories (GNWT):
    - Northern Land use Guidelines, Pits and Quarries (GNWT, 2015b)
    - Northern Land Use Guidelines, Access: Roads and Trails (GNWT, 2015a)

5.2 Mitigation and Protection Measures

5.2.1 General

Some of the general measures to protect the environment during construction include:

- **5.2.1.1**The Contractor, sub-contractors, and site managers must review this CEMP and the applicable guidelines prior to each construction phase or new activity.
- **5.2.1.2** To the extent practical, construction equipment should be sourced to meets the Tier 4 emission standards that comply with the Off-Road Compression-Ignition Engine Emission Regulations.
- **5.2.1.3** Stockpile, or have readily available, supplies of materials as appropriate on site to repair or replace damaged or destroyed protection measures.
- **5.2.1.4** Coordinate Project activities around seasonal constraints and weather. If inclement weather affects the safety of field personnel, equipment, or the environment, the Project shall be shut down until conditions on site are deemed safe.
- **5.2.1.5** Clean, drain, and dry equipment prior to being shipped to site from a southern location. Equipment that will enter the aquatic environment (e.g., drill) must be washed down with a phosphate-free cleaning solution before arriving to the Project area to prevent potential spreading of invasive species.

- **5.2.1.6** Stop-work procedures shall be defined for non-compliance with condition of the CEMP or any Permit, Approval, or Authorization.
- **5.2.1.7** Reported destruction or death to wildlife (including birds), fish, marine mammals known to have been caused by construction activities.
- **5.2.1.8** Contractor employees shall be required to sign a Code of Conduct governing behaviour on the Project and during recreational hours to reduce the likelihood of negative social effects on the community. The Contractor shall implement a cultural awareness program for all staff to promote understanding and respect for local residents.
- **5.2.1.9** Review planned construction activities with the community to understand community access needs and important areas for collecting or harvesting.
- **5.2.1.10** The Contractor shall impose a zero-tolerance policy for alcohol and illicit drug possession or use for all Contractor personnel, including sub-contractors.

5.2.2 Community Infrastructure and Access

There is potential that during Project activities, there will be an increased pressure on community infrastructure such as roads, fuel supply, utility services (water, sewage, waste), and fire response. The following mitigation measures are planned:

- **5.2.2.1** Construction contract(s) to include provision of supplies, resources, and services for construction activities and workers to offset the demand on existing community resources.
- **5.2.2.2** Implement a Traffic Management Plan with established speed limits for construction vehicles and procedures to avoid conflict between construction traffic and other traffic in the community.
- **5.2.2.3** The existing wharf in Qikiqtarjuaq will not be affected by construction
- **5.2.2.4** The Project shall obtain approval from the municipal Fire Marshall for construction and establishment of the work camp.

5.2.3 Dust, Erosion and Sediment Control

Dust, sediment, and erosion controls are required for all activities, such as construction of the port, the access road, and upland facilities as well as blasting. The Contractor shall prepare and implement an Erosion and Sediment Control Plan, to ensure that applicable sediment and erosion control methods are implemented (as needed) to meet environmental quality guidelines. The following mitigation measures are planned:

- **5.2.3.1** Suitable dust suppressants (i.e., calcium chloride and/or water) shall be implemented to reduce dust generation to acceptable levels.
- **5.2.3.2** Ongoing visual assessments of the potential for dust generation and combustion emissions shall be conducted (during work and/or when machinery is operating) to determine requirement for the implementation of dust suppression measures.
- **5.2.3.3** The Contractor shall obtain municipal approval for acceptable dust suppressants. Dust suppressants shall be selected in accordance with Government of

Nunavut Sustainable Development, Environmental Protection Services, and Environmental Guideline for Dust Suppressants (Government of Nunavut, 2002).

- **5.2.3.4** Proactive maintenance shall be undertaken to address problem areas of the road which may produce significant dust.
- **5.2.3.6** Materials shall be stockpiled so that soils/sediments do not enter the marine environment. Temporary sediment control measures shall be applied at the base of any soil or rock stockpiles.
- **5.2.3.7** Water quality in the marine environment shall be monitored for sediment run-off.
    - If visual monitoring identifies sediment run-off, total suspended solids (TSS) or turbidity shall be measured and compared to the Canadian Council of Ministers of the Environment (CCME) guidelines for the Protection of Aquatic Life.
    - Corrective actions, including stop work procedures if warranted, shall be implemented if CCME guideline exceedances are detected and attributable to the construction activities.
- **5.2.3.9** Permanent drainage features shall be incorporated into the upland facility area design.
- **5.2.3.10** Equipment and/or vehicles shall not be moved unless the ground surface is in a state capable of fully supporting the load without rutting, gouging, and/or erosion of the ground surface.

5.2.4 Permafrost Management

The Contractor shall prepare and implement Permafrost Management Plan to mitigate impacts from permafrost degradation and associated erosion at the quarry. The following mitigation measures are planned:

- **5.2.4.1** During construction, ground organics shall be left in place and excavations and/or disturbances shall be avoided, where possible. For wet or ice-rich permafrost sections, overland construction shall include no disturbance of the natural ground layer when possible.
- **5.2.4.2** If ice-rich permafrost is encountered during quarrying, measures shall be taken to protect permafrost and ground ice and shall be incorporated into the quarry development and quarry operations plan.
- **5.2.4.3** If snow clearing activities are required, snow cover shall be carefully removed to reduce settlement of the fill during the future thaw periods.
- **5.2.4.4** In areas where snow accumulation and/or drifting are an issue, the Contractor can implement mitigation measures such as flattening snow drifts or spreading plowed snow accumulation.
- **5.2.4.5** If areas with snow drifting become a re-occurring issue, snow fencing can be installed upwind of road embankments to keep snow drifts off the road surface and away from drainage ditches.

5.2.5 Vehicle Operation and Traffic

The primary objective of managing vehicle traffic is to ensure the safety of residents and to maintain road traffic flow. A Traffic Management Plan shall be prepared to supplement the following planned mitigation and monitoring measures:

- **5.2.5.1** Contractor drivers shall be properly trained and licensed.
- **5.2.5.2** All vehicles shall have adequate visibility lighting.
- **5.2.5.3** Road use shall not disrupt the delivery of community services and shall be done in consultation with the municipality. The Traffic Management Plan must be submitted to the municipality for review and approval.
- **5.2.5.4** Public notices—via community presentations, social media posts, and bulletin boards—shall be shared addressing issues and safety concerns around trucks traveling in the community. Construction vehicles shall be restricted to a speed limit set considering community safety concerns, and dust generation. This speed limit must be submitted to the municipality for review and approval. Any road use timing restrictions established by permitting or approvals or requested by the municipality shall be adhered to.
- **5.2.5.5** Construction equipment shall be sized correctly for the task and in compliance with road restrictions.
- **5.2.5.6** Traffic control measures shall be implemented at intersections along the haul road route, as required. This may include the use of a traffic flagger.
- **5.2.5.7** Existing access roads shall be repaired immediately if damaged. Undertaking regular grading and compacting to remove potholes.
- **5.2.5.8** Regular inspection and maintenance of water control features (i.e., culverts) shall be undertaken during construction.
- **5.2.5.9** A regular maintenance program for Project vehicles and equipment shall be implemented to ensure construction equipment is in good working order.
- **5.2.5.10** Gas or diesel engine exhausts shall be fitted with noise mufflers, where available.
- **5.2.5.11** When existing local facilities are not available for refuelling, equipment and vehicles must be serviced and refuelled at least 15 m from sensitive habitats unless secondary containment is used, preferably over an impermeable surface (e.g., drip trays). There shall be designated servicing areas, as well as vehicle laydown areas identified and will be independent of fueling stations. Drip pans and / or other protective devices shall also be used to prevent spills of petroleum products and other potentially hazardous liquids (e.g., antifreeze) during servicing.
- **5.2.5.12** Revving of engines on mobile or stationary machines shall be limited and equipment not in use shall be shut down (restrict idling).
- **5.2.5.13** The use of horns, bells, hooters, or other audible signals on mobile equipment shall be limited, while maintaining safe operation.
- **5.2.5.14** Equipment, material stockpiles, and vehicle parking areas shall be located away from wildlife features (or habitats). If the noise source is directional, equipment shall be orientated to minimize propagation in critical directions.
- **5.2.5.15** Engines shall be shut off and smoking shall be prohibited during fueling.

5.2.6 Marine Vessel Operation and Traffic

A variety of vessels and equipment will be present in the waters around port during construction activities. With an operational wharf located 2 km from the Project, there is a potential for construction vessels to interfere with existing marine use and navigation. The following mitigation and monitoring measures are planned:

- **5.2.6.1** Construction vessels shall keep to pre-defined work areas and routes to minimize the impact on existing traffic and navigation.
- **5.2.6.2** Clear communication protocols or procedures for vessels working in the area shall be established.
- **5.2.6.3** Communication protocols shall be established to notify the community of marine activities, including ongoing consultation with the community, and shipping stakeholders.
- **5.2.6.4** When offshore equipment and marine vessels are refueled through a floating hose, the Contractor shall ensure that all hoses and equipment are in good working order, appropriate spill containment and clean-up equipment is available, and personnel are trained in refueling and spill response procedures.
- **5.2.6.6** Rapid acceleration of vessels shall be avoided.

5.2.7 Marine Construction

Planned marine construction activities (i.e., placement of rock, pile-driving, dredging and re-use of dredged materials) have the potential to impact water, sediments, fish and fish habitat (Section 5.2.8) and mammals in the surrounding marine waters. Thus, the following mitigation and monitoring measures are planned:

- **5.2.7.1** Project-related vessels shall maintain vigilance for marine mammals, document sightings, and employ minimum distances and best practices if within 100 m of any marine mammals. Collisions or any injured or distressed marine mammal must be reported immediately to the Construction and Contract Administrator, the Government of Nunavut, and DFO.
- **5.2.7.2** Vessels must follow the guidance for marine mammals and protected areas as outlined in the most recent Notice to Mariners published by the Canadian Coast Guard.
- **5.2.7.3** A Marine Monitoring Plan for the Project shall be developed that includes protections implemented during dredging and placement of quarry material. This must include allowable levels of turbidity and TSS, as well as marine mammal monitoring requirements.
- **5.2.7.4** Measures to reduce sediment mobilization during in-water activities shall be used by the Contractor when TSS/turbidity exceeds CCME water quality criteria.
- **5.2.7.5** Soft-start procedure shall be implemented for pile-driving that could generate underwater noise above auditory thresholds for marine mammals.
- **5.2.7.6** Mechanical dredging methods shall be used, which result in lower levels of underwater noise compared to hydraulic methods.

- **5.2.7.7** Prior to construction, stop-work conditions shall be specified. Such conditions would include exceedance of sound thresholds or sighting of a marine mammal within the exclusion zone. Work must not re-start until the marine mammal has moved out of the exclusion zone.
- **5.2.7.9** Rock material used for in-water construction shall be free of fines that could affect water quality.
- **5.2.7.10** All lubricants and hydraulic fluids used on equipment that will be working below the high-water level shall be biodegradable and non-toxic.
- **5.2.7.11** All Project marine construction vessels and equipment shall be clean and free of marine fouling to avoid the introduction of invasive species.

5.2.8 Fish and Fish Habitat

Some Project activities will take place within an aquatic marine environment. Dredging, infilling, disposal at sea, and rock piling will affect marine habitat. Underwater noise emissions have the potential to adversely affect marine fish, resulting in avoidance of the area, accidental mortality, and injury to fish during marine construction activities. To mitigate negative effects to fish and fish habitat in the marine environment, the following mitigation measures will occur:

- **5.2.8.1** Implement soft-start procedures for pile-driving that could generate underwater noise above auditory thresholds, and using vibratory piling equipment, where possible, to reduce noise effects to community and marine fauna.
- **5.2.8.2** Maintain equipment in good running order to prevent leaking or spilling of potentially hazardous or toxic products.
- **5.2.8.3** Recover waste or miscellaneous unused materials for disposal in a designated facility.
- **5.2.8.4** Avoid depositing deleterious substances in the watercourse.
- **5.2.8.5** Implement a Spill Response Plan (per Section 6.1).
- **5.2.8.6** Plan activities near water such that materials and chemicals do not enter the watercourse.
- **5.2.8.7** Clean, refuel, and service machinery, and store fuel and other materials for the machinery, in such a way as to prevent any deleterious substances from entering the water.

5.2.9 Blasting

For the proposed quarry, the Contractor will be required to prepare a Quarry and Development Plan, which must include a Blasting Management Plan. These Plans will build upon the planned mitigation and monitoring measures provided below:

- **5.2.9.1** Blasting shall be restricted to hours as agreed upon with the municipality. The blasting schedule shall be submitted to the Municipality for review and approval prior to commencing blasting.
- **5.2.9.2** A notification protocol with input from the local community and other stakeholders for advance notification of planned substantial noise-causing activities

shall be implemented. The notification protocol shall be submitted to the Municipality for review and approval.

- **5.2.9.3** Buffers or exclusion zones shall be implemented, in the event a sensitive species or feature (e.g., nest) is identified, to ensure wildlife are not disturbed.
- **5.2.9.4** Prior to blasting occurring, a warning must be issued in affected area using loud signaling devices.
- **5.2.9.5** Quarry development should be initiated prior to the arrival of migratory birds (breeding season mid-May to mid-August) such that the quarry and surrounding area does not become attractive for nesting.

5.2.10 Non-Hazardous Waste and Wastewater

It is expected that there will be a minimal amount of construction waste produced on the site. The majority of waste expected will be from having the additional construction workers in the community generating typical household waste. The Contractor's Waste Management Plan will expand upon the planned mitigation and monitoring measures below:

- **5.2.10.1** Waste containers shall be provided on site.
- **5.2.10.2** Staff shall be trained on sorting and storage requirements of specific wastes or materials that are to be reused; or are prohibited from disposal in the non-hazardous waste system. Containers used for hazardous waste shall not be used for non-hazardous waste types.
- **5.2.10.3** Domestic waste is to be regularly removed from site and disposed of at the municipal landfill or an appropriate disposal facility.
- **5.2.10.4** Domestic waste containers shall be kept closed (e.g., equipped with lids, covers/ tarps over skips) at all times except when bins are being emptied or filled, to prevent scavenging by wildlife and domestic animals, as well as to control odour.
- **5.2.10.5** No burning of refuse or waste materials shall be permitted onsite.
- **5.2.10.6** Food waste shall be stored in a manner that does not attract wildlife, such as Polar Bear.
- **5.2.10.7** All waste shall be stored in plastic bags while conducting marine work to prevent waste being released into the water.
- **5.2.10.8** Used oil filters, grease cartridge containers, and other products associated with equipment maintenance shall be collected, stored in sealed containers, and shipped south for disposal in accordance with applicable regulations.
- **5.2.10.9** All equipment and material shall be removed from the site at the completion of the program.
- **5.2.10.10** Daily site cleaning (housekeeping practices) and routine inspections shall be completed to ensure materials are correctly sorted and placed in the proper bins.

In addition to non-hazardous wastes, wastewater will be generated during Project activities. The Contractor will be responsible to provide temporary washroom facilities at Project sites for construction personnel. The requirements for wastewater management

will be detailed in the Contractor's Waste Management Plan, which will incorporate the following proposed mitigation and monitoring measures:

- **5.2.10.11** Portable washrooms shall be located within the Project area.
- **5.2.10.12** Wastewater shall not be deposited in, or placed on land or ice, under any conditions where the waste may enter arctic waters.
- **5.2.10.13** Sanitary waste generated shall be disposed of at the municipal facility through a contract with the municipal services.

5.2.11 Hazardous Materials

Hazardous materials may be used and/or generated in construction activities such as quarrying, maintenance of mobile equipment, welding and cutting of steel, painting wharf hardware and other miscellaneous components. The requirements for hazardous materials management will be detailed in the Contractor's Waste Management Plan, which will incorporate the following proposed mitigation and monitoring measures:

- **5.2.11.1** Ensure staff are trained and qualified to safely handle the hazardous waste and materials.
- **5.2.11.2** Hazardous waste and materials shall be stored a minimum 30 m distance from a waterbody or identified sensitive environmental area.
- **5.2.11.3** Containers used for hazardous waste and materials shall not be used for non-hazardous waste types.
- **5.2.11.4** All hazardous waste and materials shall be stored within a container which has at least 10% more capacity than the total volume of substances to be stored.
- **5.2.11.5** Containers shall be sound, sealable, and not damaged or leaking.
- **5.2.11.6** All hazardous waste and materials shall be classified and labelled – containers must be clearly labelled to identify their contents according to requirements of the WHMIS and the relevant Transport Authority.
- **5.2.11.7** All hazardous waste and materials containers shall be accompanied by the WHMIS Safety Data Sheet (SDS) or have the SDS on file available.
- **5.2.11.8** Incompatible waste and materials shall be stored in a manner that contact, in the event of a spill or accidental release, is not possible (i.e., corrosive materials must be kept away from flammable materials).
- **5.2.11.9** Containers shall be placed so that each can readily and easily be inspected for signs of leakage, corrosion, or deterioration. Leaking, corroded, or deteriorated containers shall immediately be removed, and their contents transferred to a sound container.
- **5.2.11.10** Inspections of the hazardous waste and materials management shall be performed and recorded at least weekly.
- **5.2.11.11** Records are to be maintained indicating the type and quantity of waste being stored along with the date, type and quantity of hazardous waste brought into or removed from the facility.
- **5.2.11.12** A registered hazardous waste carrier shall be used to transport the waste to a registered receiver or hazardous waste management facility if disposal is required.

- **5.2.11.13** During transfer of petroleum products, a trained person must be in attendance for the entire duration of the operation. Reasonable precautions shall be taken to avoid the discharge of petroleum products onto land or into water (i.e., fuel transfers must be stopped prior to overflowing to leave room for expansion).
- **5.2.11.14** Used petroleum and chemical products shall be stored in appropriate tanks, sealed, and placed into containers, and shipped south for disposal of in compliance with applicable regulations.

5.2.12 Vegetation and Wildlife

The Project will potentially affect wildlife (birds, fish, and mammals) and vegetation during construction. Proposed mitigation and monitoring measures to minimize the potential adverse effects on vegetation and wildlife are presented below:

- **5.2.12.1** Working areas, vehicles, and equipment shall be inspected prior to clearing to ensure they are clean and free of soil, invasive plants and/or their seeds.
- **5.2.12.2** Construction lighting, including at the work camp, must be shielded, downward-directed fixtures; limited to areas required for safety and security; and should be use lighting in the warm colour spectrum.
- **5.2.12.3** All personnel shall be trained through the induction and subsequent toolbox talk session on the risk of damaging or disturbing vegetation and sensitive communities.
- **5.2.12.4** Monitoring of disturbed areas for weed infestations shall occur on a regular basis.
- **5.2.12.5** A zero-tolerance policy regarding the harassment, disturbance, and feeding of wildlife shall be implemented and communicated through the induction process.
- **5.2.12.6** All workers shall be trained in relation to the wildlife (particularly species at risk) expected to occur in the area, including traditional knowledge, through site induction and toolbox sessions.
- **5.2.12.7** Polar bear sightings shall be reported immediately.
- **5.2.12.8** Wildlife sightings shall be reported immediately and tracked in order to respond appropriately to emerging trends.
- **5.2.12.9** Food, food waste, and other attractants shall be handled, stored, and disposed of safely to avoid attracting and habituating animals.
- **5.2.12.10** Speed limits shall be implemented and enforced on all roadways and wildlife will be given the right-of-way so as not to chase, weary, harass, or injure animals on the road.
- **5.2.12.11** Escape routes for wildlife within the quarry shall be provided (where possible).
- **5.2.12.12** Appropriate mitigation measures shall be implemented in the event large congregations of wildlife and birds occur in the Project area.
- **5.2.12.13** A pre-construction wildlife sweep shall be conducted to identify all sensitive wildlife features (e.g., active bird nests, wildlife dens, and wildlife foraging or traveling) by a qualified professional/biologist who is familiar with Arctic biology. Construction activities shall not begin until the area has been surveyed for migratory birds and nests (in a non-intrusive manner).

- **5.2.12.14** When possible, activities and infrastructure shall be sited away from nests and roosts that will be protected by prohibited entry buffers based upon government or biologist recommended setback distances.
- **5.2.12.15** Nest monitoring may be periodically required to determine efficacy of setbacks and buffers.
- **5.2.12.16** Species at risk (SAR), if encountered, should be avoided. If SAR enter active work areas, work in those areas must stop until the SAR has left of its own accord. The SAR encountered must be monitored will within the Project area and the following information recorded: time/date and location of observed species at risk, their behaviour when encountered, and actions taken to avoid disturbance to the species.
- **5.2.12.16** Annual reports of SAR monitoring activities must be submitted to the appropriate regulators and organizations with management responsibility for that species.

5.2.13 Archaeological Resources

There is potential to unearth archaeological resources during Project activities. The footprints of the new port, access road, staging areas, and temporary work camp are all located more than 30 m away from archaeological sites. Eight sites, however, have been documented in the area of the proposed quarry. These features will need to be avoided by excavation and stockpiling and protected from accidental damage during construction. The following proposed mitigation and monitoring measures aim to minimize the potential negative effects on archaeological resources:

- **5.2.13.1** Install safety fencing to delineate a 30 m buffer zone around archaeological sites within 30 m of haul roads and the proposed quarry. Known sites are mapped in the baseline archaeological study report (ERM Consulting Canada Limited 2025).
- **5.2.13.2** If undocumented archaeological features are discovered during construction, work in the area should cease and the find reported to the Nunavut Department of Culture and Heritage for guidance on how to proceed.
- **5.2.13.3** In the event that suspected human remains are discovered during construction, suspend work immediately. Work may not resume until all measures are undertaken.

5.2.14 Metal Leaching/Acid Rock Drainage Testing and Mitigation

The Project will potentially expose sulfide-bearing rock to air and water, that could generate acidic or metal-rich runoff into nearby watercourses. Proposed testing and mitigation measures to minimize the potential adverse effects on the aquatic environment are presented below:

- **5.2.14.1** Inorganic material quarried or excavated during construction will be tested to identify potentially acid-generating (PAG) materials by collecting composite samples from test pits or active excavation areas as it is being excavated. One composite sample is to be collected for every 25,000 m^3 of material quarried or excavated. A minimum of

two well-spaced samples will be collected from the Project area where quarrying or excavation will occur.

- **5.2.14.2** If potentially acid-generating materials (PAG) are encountered, ARD management plans will be developed to detail handling, storage, and disposal of PAG materials to prevent interaction with water and oxygen, and will include the following:
    - Implement measures such as capping or covering rock piles to isolate them from the active layer and prevent metal leaching.
    - Manage surface water to prevent passive runoff or seepage from PAG material entering a watercourse.
    - Develop and implement a monitoring plan.

5.2.15 Restoration and Reclamation

Construction will require quarrying, a temporary wharf, and potential disturbance to areas outside the permanent Project footprint. Restoration and reclamation of such areas will be completed as outlined below:

- **5.2.15.1** - Organic soils and non-PAG overburden materials will be salvaged for restoration of temporarily disturbed areas, including site contouring and natural revegetation.
- **5.2.15.2** - The Contractor will design and implement a progressive reclamation plan for areas temporarily disturbed for construction.
- **5.2.15.3** - After the Project is constructed, all remaining construction materials and debris will be removed from the site.
- **5.2.15.4** - To the extent practical, temporarily disturbed areas will be restored to a stable, useable condition.

Chapter 6 Spill and Emergency Response Plans

6.1 Spill Response Plan

The spill response plan will be prepared and implemented to provide guidance for Project personnel on the required actions responding to a fuel or hazardous material spill. In the unlikely event of a fuel or hazardous material spill, the following actions will be taken:

- Include a pre-work hazard analysis which requires Contractors to identify spill hazards, pathways of exposure to environmental receptors, access for emergency/clean-up vehicles, and storage facilities for spill response gear.
- Immediately stop work activities and assess the hazard to persons and the environment.
- If possible, and safe to do so, stop the source of the spill.
- Shut down sources of ignition.
- Deploy spill kits to contain spills.
- Identify spilled material and consult SDS for appropriate containment and clean-up procedures.
- Determine if additional, external clean-up support is required.
- Spilled hazardous material, such as fuels or lubricants, will be contained and transferred into an appropriate container; remaining residues will be mixed with unconsolidated absorbent materials and transferred into appropriate containers. Containers with spilled material will be sealed and transported south for disposal in accordance with applicable regulations following the Waste Management Plan.
- Reportable spills will be reported to the Nunavut Department of Environment 24-hour spill report line (1-867-920-8130). A NT-NU spill form will be submitted within 24-hours of any significant spill of hazardous materials. An NT-NU spill report form is appended to this EMP (Appendix A). The form will either be faxed (1-867-873-6924) or emailed (spills@gov.nt.ca) to the Nunavut Department of Environment.

6.2 Emergency Response Plan

An Emergency Response Plan will be prepared for the Project by the Contractor and will outline the protection of the environment, personnel, and the public in the event of an emergency. At a minimum, the emergency response plan will:

- Define the roles and responsibilities in the event of an environmental emergency.
- Include emergency classification procedures (as necessary).
- Define communication protocols including a key contact list for emergency response.
- Define incident reporting guidelines and necessary information.

- Include post-incident reporting requirements.
- Be developed in conjunction with hazardous waste management and spill prevention / response plan.

Chapter 7 Monitoring, Reporting and Communications

7.1 Environmental Monitoring

The effectiveness of environmental protection measures will be assessed regularly by the chosen Contractor and reviewed by the Construction and Contract Administrator. Contractor monitoring will occur throughout construction with the frequency and type of monitoring dependent on the construction activities taking place. In addition, the Construction and Contract Administrator will conduct routine inspections of construction activities.

7.2 Reporting

All records, checklists, inspection reports, including any non-compliances or non-conformances and corrective action plans are to be maintained. Records shall be and remain legible, identifiable, and traceable. Daily and/or weekly Environmental Monitoring Reports shall be issued by the Contractor to the Construction and Contract Administrator for review prior to being sent to the Government of Nunavut, and will include the following:

- Description of environmental incidents
- Detail of environmental inspections
- Review of environmental issues raised by employees at meetings or reported to the Contractor's site team and the respective corrective actions
- Overview of past month's environmental activities
- Overview of the upcoming month's environmental activities
- List environmental concerns, environmental milestones, and environmental initiatives implemented

Changes to work processes/procedures or design must be evaluated through a management of change process to ensure risks are being properly managed. The Contractor shall establish a management of change procedure and all workers must receive training on how to identify a change, how to initiate the management of change process to a work procedure, and how to evaluate risks associated with change.

7.3 Communications

The Construction and Contract Administrator will prepare a protocol outlining communications during the Project lifespan. The Contractor will prepare and submit a Communications Plan in accordance with the Communications Protocol. Communications related to the implementation of the CEMP shall include:

- Formal written correspondence among all relevant parties including the Proponent, Project Authority, Contract Authority, Construction and Contract Administrator, Contractor, the municipality, regulators (e.g., DFO, Transport Canada) and other stakeholders (e.g., Hunters and Trappers Association).
- Attendance at design, construction, and planning meetings
- Field inspections and reports
- Electronic communications
- Toolbox Meetings
- Meetings with local communities
- Meetings with representatives of regulatory authorities
- Formal environmental and social awareness training

The Government of Nunavut will work with the community and the Contractor to establish a communications plan to allow for the consultation with community members in order to keep the community informed of ongoing construction activities. As part of this plan, a complaints process will be designed, in which complaints are received and recorded by the Contractor and responded to as required. See Section 3.4 of this CEMP for additional guidance on community complaint handling and issue resolution.

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APPENDIX A

NT-NU Spill Form

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APPENDIX E

Geotechnical Report

GEOTECHNICAL INVESTIGATION
QIKIQTARJUAQ MARINE INFRASTRUCTURE
NEW DEEP-WATER PORT FACILITY
QIKIQTARJUAQ, NU

FINAL REPORT
REVISION 1

PREPARED FOR:
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PROJECT NUMBER:
QIK-G2303

SUBMITTED:
October 20, 2025

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1.0 Introduction

Adaptive Baseline Geotechnical Ltd. (ABG) has carried out the following geotechnical investigation for a new deep-water port facility in Qikiqtarjuaq, NU. The desktop geotechnical investigation presented herein has been carried out in general accordance with the most recent editions of the National Standard of Canada CAN/BNQ 2501-500/2017 *Geotechnical Site Investigations for Building Foundations in Permafrost* and Canada Standards Association (CSA) PLUS 4011:19 *TECHNICAL GUIDE Infrastructure in permafrost: A guide for climate change adaptation*. All third-party information reviewed as part of this investigation has been taken at face value.

2.0 Project Background and Understanding

The current marine infrastructure in Qikiqtarjuaq comprises a rubble breakwater which forms a community small boat harbour. It is understood that a new deep-water port facility will be constructed in the community approximately 2.7 km south of the existing small boat harbour to support the increased needs of northern marine trade, especially the Davis Strait and Baffin Bay marine traffic. The new port will increase northern vessel safety and services by providing refuelling services, spill response services, safe refuge, emergency response services, crew change services, enhanced resupply for dry cargo/fuel and other marine related logistics support.

The new deep-water port facility will consist of a fixed dock with a 10 m depth at low tide, 15,000 m^2 of laydown space, an access road from municipal roads to the facility, a 23 tonne capacity crane to offload cargo, wastewater receiving systems (grey and black water), a radio communications station (5 m^2), services for up to 6 freezer containers, an operations office, security, terminal building (100 m^2) and a site power supply. Space will also be identified for future expansion considerations including re-fuelling facilities (2 x 1,000,000 L tanks and a fuel pump), a marine repair and chandlery service facility (120 m^2), a general warehouse (500 m^2), provisions for a search and rescue operation facility (50 m^2), a crew change dorm and dining area (300 m^2) and a fuel pump station (50 m^2).

The purpose of the geotechnical investigation presented herein is to assess the surface and subsurface conditions at the deep-port facility site to support design and construction. The site location can be seen on Figure 1.

3.0 Scope of Services

ABG's scope of services for this geotechnical investigation includes the following:

- ***Compilation and Review of Available Information:*** ABG compiled all available information related to climate, site topography, surface drainage features, ground temperature and subsurface conditions throughout the community.
- ***Geotechnical Investigation:*** ABG supervised a drilling field program consisting of an uplands investigation with Canadrill Limited's local air-rotary drill, a waterlot investigation with Logan Drilling's mud-rotary drill and quarry investigation with our portable bedrock core drill. The purpose of the investigation was to assess subsurface conditions and bedrock quality/quantity in support of design and construction at the site.

- ***Laboratory Testing Program:*** A geotechnical laboratory testing program was carried out to classify the soils encountered and verify in-situ moisture/ice contents, gradations, and salinity of the soils. Testing was performed on rock samples from the quarry to determine strength and physical properties.
- ***Geotechnical Report:*** This comprehensive geotechnical report has been prepared summarizing the observations and findings of our geotechnical investigations including recommendations pertinent to the design and construction of the proposed harbour development, access roads and associated parking/laydown areas.

4.0 Available Information

ABG has reviewed the following available information as part of this geotechnical investigation:

1. (ABG, 2022). Pile Installation Summary Report, Research Station, Qikiqtarjuaq, NU;
2. (CGD, 2018a). Pile Installation Summary Report, Bell Cellular Tower, Qikiqtarjuaq, NU;
3. (CGD, 2018b). Pile Installation Summary Report, New 5Plex Unit & 2Plex Unit, Qikiqtarjuaq, NU;
4. (CGD, 2018c). Pile Installation Summary Report, Satellite Antenna, Qikiqtarjuaq, NU;
5. Available satellite imagery, Google Earth (2005, 2006, 2021 and 2023);
6. Environment Canada, historical weather data for Qikiqtarjuaq, NU; and
7. Studies and literature related to the distribution of saline permafrost and ground temperature data throughout Nunavut (i.e., Canadian Geotechnical Journals).

5.0 Field Program Methodology

The geotechnical field program was carried out in three phases; air-rotary boreholes on the uplands, CME 45 mud-rotary boreholes on the waterlot (through the icesheet) and bedrock coreholes on the preliminary quarry footprint. Detailed logs of the soil and bedrock conditions encountered (including sampling and testing results) are provided on the attached borehole and corehole logs.

5.1 Uplands Investigation

Air-rotary drilling at the uplands was carried out under ABG supervision on May 5 to 8, 2024 when the area of interest was partially snow covered. The field program consisted of drilling six boreholes (BH01, BH09, BH10, BH11, BH12 and BH13) to approximately 15 metre below grade (mbg). The borehole locations for the uplands field program are shown on Figure 2.

The purpose of the boreholes was to assess subsurface conditions and facilitate the installation of multi-bead thermistors to establish current active layer depth and ground temperature profiles along the shoreline. The field program was supervised on a full-time basis by an ABG field engineer experienced with air-rotary drilling in permafrost soils. Soil samples were collected at regular intervals from drill cuttings returned to the surface during air-rotary drilling. Soil samples were collected at regular intervals from drill cuttings returned to the surface and visually examined and logged in accordance with ASTM D2487 (Standard Practice for Classification of Soils for Engineering Purposes, Unified Soil Classification

System), ASTM D2488 (Standard Practice for Description and Identification of Soils, Visual-Manual Procedure) and ASTM D4083-8 (Standard Practice for Description of Frozen Soils, Visual-Manual Procedure).

Collected soil samples were stored in moisture tight containers and transported to a southern laboratory for further classification and testing. Prior to sample shipment, the initial weights were obtained for all samples to ensure that the moisture contents obtained were representative. Laboratory testing included the determination of natural moisture contents, salinity and grain-size analyses on select samples.

Four multi-bead thermistors (T1 to T4) were installed in select boreholes to depths ranging from 11.5 to 12.2 mbg. Ground temperature readings were obtained by our representative throughout our time in the community. An engineer from ABG returned to the site in mid-October 2024 to obtain additional ground temperature readings from all four thermistor strings.

5.2 Waterlot Investigation

CME 45 mud-rotary drilling at the waterlot was carried out under ABG supervision on April 24 to May 1, 2024 when the ocean was frozen. The field program consisted of drilling eleven boreholes (BH03, BH04, BH05, BH06, BH07, BH08, BH14, BH15, BH16, BH17 and BH18) to depths ranging from approximately 10 to 31 mbg. The borehole locations for the waterlot field program are shown on Figure 2.

The borehole drilling was supervised and logged on a 24 hour basis by ABG field engineers. Each borehole was advanced using HW (114 mm) casing and soil samples were collected using conventional 50 mm split spoon samplers while performing standard penetration testing (SPT). The SPT N-Value (N-value) is used to determine the number of blows required to drive a 50 mm outer diameter split spoon sampler 300 mm into the soil using a standard hammer fall height and weight. N-values are used as an indication of relative density and to estimate other soil parameters. Each split spoon sample was opened immediately upon being received at surface and ABG obtained internal temperatures wherever possible using a temperature probe inserted approximately 50 to 100 mm in each end of the samples, with an average value recorded. The purpose of these temperature readings was to confirm as much as practical, the presence of any nearshore or sub-sea permafrost beneath the area of interest.

A drill shack was constructed around the drill rig and heated with Herman Nelson heaters. The drill and shack were hauled over the icesheet to each borehole location using a local front end loader. A third-party firm was engaged to prepare an ice safety analysis and report to confirm the minimum ice thickness to safely support the weight and forces applied by the drill setup and loader prior to mobilizing to site. ABG measured the ice thickness daily with an ice auger and monitored for cracking, in accordance with the recommendations provided.

Soil samples collected were visually examined and logged in accordance with ASTM D2487 (Standard Practice for Classification of Soils for Engineering Purposes, Unified Soil Classification System), ASTM D 2488 (Standard Practice for Description and Identification of Soils, Visual-Manual Procedure) and ASTM D 4083-8 (Standard Practice for Description of Frozen Soils, Visual-Manual Procedure).

Collected soil samples were stored in moisture tight containers and transported to a southern laboratory for further classification and testing. Prior to sample shipment, the initial weights were obtained for all samples to ensure that the moisture contents obtained were representative. Laboratory testing included

the determination of natural moisture contents, salinity and grain-size analyses on select samples. Core samples retrieved from select boreholes were logged and stored in core boxes for further examination and analysis.

All borehole locations were determined in the field using Global Navigation Satellite System (GNSS) observations via a Topcon Hiper-VR Real Time Kinematic Global Positioning System (RTK GPS) receiver (reported accuracy of ± 0.05 m). ABG carried out a survey of the boreholes referencing Chart Datum.

5.3 Quarry Investigation

ABG carried out the geotechnical field program at the preliminary quarry between August 25 and September 21, 2024. The quarry drilling program consisted of 6 coreholes (CH01 to CH06) throughout the preliminary proposed quarry footprint using our portable core drill. The corehole location plan is shown on Figure 3.

Total core hole lengths were between 2.9 and 7.1 metres (m). The purpose of the core sampling was to determine rock quality, strength and physical properties, with corehole locations and depths roughly representing the rock volumes required as part of the breakwater and wharf construction.

Bedrock was cored using BQ or EQ size core barrel. The rock quality designation (RQD) and recovery of the samples were measured and recorded, and each run of core was photographed and labelled. The RQD is the ratio of the sum of the core recovered greater than 100 mm in length divided by the total core length (expressed as a percentage).

6.0 Historical Climate & Permafrost Conditions

Qikiqtarjuaq is located at approximately 67°33’ N and 64°01’ W on Broughton Island, off the east coast of Baffin Island in Davis Strait, in the Qikiqtaaluk Region of Nunavut. Based on current permafrost mapping, the community is located well within the zone of continuous permafrost; however, it is noted that permafrost will not necessarily extend into the offshore area of interest for this project.

Where the sea level is sufficient to keep the icesheet from freezing to bottom, any permafrost would be relic and in the process of degrading towards non-permafrost conditions (potentially present due to sea level rise). Permafrost remains more likely nearshore where the icesheet freezes to bottom; however, it is expected that permafrost will be present along the uplands area and become warmer to non-existent extending offshore. Based on our temperature probe readings obtained on split spoon samples recovered from depth beneath the proposed wharf area, it does not appear that this area is underlain by permafrost. The temperatures we were able to obtain were all at or above 0°C and the porewater salinity of these samples was also sufficient to depress the freezing point to -1 or -2°C. Unfortunately, it was not practical to install any multi-bead thermistors nearshore, due to the challenges associated with extending the cables to surface through the water and hazards that can represent.

Mean Annual Air Temperature (MAAT) and Indices: A review of Environment Canada climate records for the nearby community of Qikiqtarjuaq revealed a relatively complete set of historical monthly air temperatures spanning the period from 1994 to 2025. The data indicates the MAAT over this time-period was -10.0°C and the average thawing and freezing indices were about 420 and 4069°C-days respectively.

Active Layer Thickness: Based on the above-noted historical air temperature data, simplified empirical methods and active layer thickness measurements throughout the community, it is estimated that the active layer currently varies between approximately 1.1 and 1.7 m, depending on site-specific variables (such as surficial cover, site drainage, sun exposure and in-situ moisture content). The site-specific thermistor readings obtained by ABG in mid-October 2024 confirm the current maximum active layer thickness throughout the uplands area is 1.8 to 2.0 m (slightly more than anticipated).

The above freezing temperatures obtained in late winter from split spoon samples suggests that permafrost does not extend out into the near shore area.

Mean Annual Ground Temperature (MAGT): Based on our ground temperature readings throughout other areas of the community, the current MAGT is typically in the range of approximately -4.5 to -5.5°C, depending on site-specific variables. The site-specific thermistor readings obtained by ABG in early May 2024 and mid-October 2024 showed very good agreement at depth for all four thermistor installations and confirmed the current MAGT throughout the uplands area is -2.3 to -2.8°C (significantly warmer than anticipated).

7.0 Stratigraphy & Subsurface Conditions

The information presented in the following sections depict subsurface conditions only at specific locations and the identified soil boundaries are intended to reflect approximate transition zones for geotechnical design and should not be interpreted as exact planes of geological change for estimation or construction purposes. It is recommended that the subsurface conditions be further evaluated/confirmed at the time of construction by a geotechnical engineer experienced with northern construction and registered with Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists (NAPEG), or their representative.

7.1 Uplands Location

The uplands was partially snow covered during the drilling field program. Boreholes were advanced to a depth of 14.6 to 14.9 mbg and no bedrock was encountered. The principal strata encountered at the uplands are outlined in the following table and subsections. Further details are provided within the attached borehole logs.

TABLE 1 - Uplands Borehole Summary

Location	Total Depth (mbg)	Soil Stratigraphy Thickness (m)			Inferred Depth to Bedrock (mbg)
		ROOTMAT/ TOPSOIL	SAND with silt and gravel to silty SAND	Sandy SILT	
BH01	14.6	-	0.0 - 4.6 / 6.4 - 14.6	4.6 - 6.4	>14.6
BH09	14.9	-	0.0 - 13.4	13.4 - 14.9	>14.9
BH10	14.6	-	0.0 - 14.6	-	>14.6
BH11	14.6	0.0 - 0.05	0.05 - 14.6	-	>14.6
BH12	14.6	0.0 - 0.08	0.08 - 14.6	-	>14.6
BH13	14.6	0.0 - 0.05	0.05 - 14.6	-	>14.6

7.1.1 Native Soils

The native soils throughout the explored areas of the uplands primarily consisted of sand with silt and gravel to a silty sand to a sandy silt. The native soils were frozen and generally observed to be well-bonded with no excess ice to well-bonded with excess ice noted at the time of drilling (N_{bn} to N_{be}). The moisture content for 22 samples obtained throughout this layer ranged from 5.1 to 27.9%, with an average of 14.4%. Gradation and moisture content test results for the samples tested from this layer are summarized in the following table and shown in greater detail on the attached test results.

TABLE 2 - Uplands Soils Gradation and Moisture Content Summary

Location	Sample	Depth (mbg)	Soil Fraction (%)			Moisture Content (%)	Soil Description
			Gravel	Sand	Fines		
BH01	GB1	0.3 - 0.6	4	63	33	8.7	Silty SAND
BH01	GB2	1.5 - 1.8	7	67	26	17.3	Silty SAND
BH01	GB3	3.3 - 3.6	4	73	23	7.6	Silty SAND
BH01	GB4	4.9 - 5.2	1	41	58	23.3	Sandy SILT
BH01	GB6	10.1 - 10.4	6	67	27	11.8	Poorly graded SAND with silt and gravel
BH09	GB1	0.3 - 0.6	15	71	14	14.2	Silty SAND with gravel
BH09	GB2	1.2 - 1.4	3	80	17	10.9	Silty SAND
BH09	GB4	4.3 - 4.6	7	79	14	12.3	Silty SAND
BH10	GB1	0.6 - 0.9	23	64	13	21.4	Silty SAND with gravel
BH10	GB2	2.4 - 2.7	6	71	23	11.7	Silty SAND
BH10	GB3	4.3 - 4.9	2	65	33	18.9	Silty SAND
BH10	GB5	7.6 - 7.9	6	72	22	15.0	Silty SAND
BH10	GB7	10.7 - 11.3	1	87	12	27.9	Silty SAND
BH11	GB1	1.2 - 1.5	8	66	26	9.1	Silty SAND
BH11	GB3	5.2 - 5.5	5	70	25	10.5	Silty SAND
BH12	GB1	1.8 - 2.1	1	94	5	12.1	Poorly graded SAND with silt
BH12	GB3	4.6 - 4.9	3	54	43	20.2	Silty SAND
BH12	GB5	10.7 - 11.9	4	77	19	5.1	Silty SAND
BH13	GB1	0.3 - 0.6	5	68	27	27.2	Silty SAND
BH13	GB2	2.1 - 2.4	4	70	26	12.8	Silty SAND
BH13	GB4	6.4 - 6.7	3	60	37	13.9	Silty SAND
BH13	GB6	10.7 - 11.0	17	68	15	10.9	Silty SAND with gravel

7.1.2 Bedrock

Bedrock was not encountered within the depth explored at the uplands.

7.1.3 Porewater Salinity

Porewater salinity tests carried out on 22 soil samples from the uplands ranged from 0.0 to 14.1 parts per thousand (ppt), with an average value of 4.7 ppt.

7.2 Waterlot Location

The harbour was frozen during the waterlot drilling field program. Boreholes were advanced to depths ranging from approximately 10 to 31 metre below harbour bottom (mbhb) and bedrock was encountered in two boreholes (BH03 and BH05). The principal strata encountered at the waterlot are outlined in the following table and subsections. Further details are provided within the attached borehole logs.

TABLE 3 - Waterlot Borehole Summary

Location	Total Depth (mbg)	Soil Stratigraphy Thickness (m)		Inferred Depth to Bedrock (mbg)
		GRAVEL with sand to silty SAND	Sandy SILT	
BH03	26.2	0.0 - 19.3	-	19.3
BH04	16.1	0.0 - 4.6 / 5.8 - 16.1	4.6 - 5.8	>16.1
BH05	31.2	0.0 - 27.0	-	27.0
BH06	9.9	0.0 - 9.9	-	>9.9
BH07	15.9	0.0 - 9.2 / 10.7 - 15.9	-	>15.9
BH08	10.0	0.0 – 10.0	-	>10.0
BH14	15.5	0.0 - 6.4 / 8.3 - 15.5	6.4 - 8.3	>15.5
BH15	15.6	0.0 - 15.6	-	>15.6
BH16	16.3	0.0 - 16.3	-	>16.3
BH17	15.3	0.0 - 15.3	-	>15.3
BH18	30.4	0.0 - 24.0	-	24.0

7.2.1 Native Soils

The native soils throughout the explored areas of the waterlot primarily consisted of sand with silt and gravel to silty sand to sandy silt. The moisture content for 25 samples obtained throughout this layer ranged from 7.8 to 26.9%, with an average of 15.6%. Gradation and moisture content test results for the samples tested from this layer are summarized in the following table and shown in greater detail on the attached test results.

TABLE 4 - Waterlot Soils Gradation and Moisture Content Summary

Location	Sample	Depth (mbhb)	Soil Fraction (%)			Moisture Content (%)	Soil Description
			Gravel	Sand	Fines		
BH03	SS1	1.3 - 1.9	14	55	31	9.2	Silty SAND
BH03	SS4	1.9 - 2.5	32	56	12	9.1	Poorly graded SAND with silt and gravel
BH03	SS7	4.8 - 5.4	1	87	12	22.7	Silty SAND
BH03	SS13	12.1 - 12.7	22	60	18	10.4	Silty SAND with gravel
BH04	SS4	2.1 - 2.7	32	61	7	8.7	Poorly graded SAND with silt and gravel
BH04	SS6	4.6 - 5.2	0	34	66	25.7	Sandy SILT
BH04	SS9	9.1 - 9.8	9	70	21	12.0	Silty SAND
BH05	SS2	0.6 - 1.2	14	73	13	14.1	Silty SAND
BH05	SS5	3.4 - 4.0	17	66	17	10.0	Silty SAND with gravel
BH05	SS12	13.2 - 13.6	11	58	31	9.8	Silty SAND

TABLE 4 - Waterlot Soils Gradation and Moisture Content Summary

Location	Sample	Depth (mbhb)	Soil Fraction (%)			Moisture Content (%)	Soil Description
			Gravel	Sand	Fines		
BH06	SS1	0.0 - 0.6	5	79	16	26.9	Silty SAND
BH06	SS4	2.1 - 2.7	5	72	23	26.6	Silty SAND
BH06	SS7	5.8 - 6.4	23	63	14	11.8	Silty SAND with gravel
BH07	SS2	1.5 - 2.1	35	58	7	7.8	Well-graded SAND with silt and gravel
BH07	SS7	9.2 - 9.8	55	39	6	16.3	Poorly graded GRAVEL with silt and sand
BH07	SS8	10.7 - 11.3	26	39	35	23.3	Silty SAND with gravel
BH14	SS1	0.0 - 0.6	35	55	10	13.1	Poorly graded SAND with silt and gravel
BH14	SS3	1.2 - 1.9	7	44	49	12.1	Silty SAND
BH14	SS7	6.4 - 7.0	2	46	52	17.4	Sandy SILT
BH15	SS5	3.0 - 3.6	5	65	30	22.6	Silty SAND
BH16	SS5	5.4 - 6.0	15	59	26	11.7	Silty SAND
BH16	SS7	7.2 - 7.8	4	64	32	25.3	Silty SAND
BH16	SS8	8.2 - 8.4	20	54	26	14.3	Silty SAND with gravel
BH17	SS6	4.3 - 4.9	14	77	9	13.4	Well-graded SAND with silt
BH17	SS9	8.8 - 9.5	10	77	13	15.9	Silty SAND

7.2.2 Bedrock

Based on available geological maps for the area, bedrock at the site consists of gneiss and granite, which was confirmed within our boreholes. Grey granitic gneiss was encountered in BH03, BH05 and BH18 at depths ranging from approximately 19 to 24 mbhb at the waterlot. The attached rock quality designation data sheets show photos of the core and the resulting rock quality designation (RQD). It is noted that we inspected the core and indicated any fresh, non-stained break as an obvious mechanical break; however, it is possible that additional breaks were actually due to the drilling process and may not be representative of the actual in-place rock mass.

7.2.3 Porewater Salinity

Porewater salinity tests carried out on 14 soil samples from the waterlot ranged from 15.0 to 27.7 ppt, with an average value of 21.9 ppt.

7.3 Preliminary Quarry Location

The preliminary quarry location is shown on Figure 1. The coreholes were advanced at locations where the bedrock surface was exposed and continued to depths ranging from 2.9 to 7.1 mbg. It is noted that although the quarry location was well elevated and apparently part of a large bedrock hillside, there was a substantial portion of the upper surface that was covered in an unknown thickness of overburden. Test pits were attempted using local heavy equipment; however, the rugged terrain leading into this general area was impassible to the equipment and no test pits could be completed. Some unknown amount of waste would need to be anticipated and determined at the time of quarry development.

Based on available geological maps for the area, it is anticipated that bedrock at the quarry would consist of granitic gneiss, granite and granodiorite. The core samples confirmed the bedrock to be pinkish grey to dark grey granitic gneiss. Unconfined compressive strength (UCS) testing performed on four core samples ranged from 59.1 to 98.7 MPa, with an average of 83.5 MPa. Test results of the intact rock indicated a classification of strong. UCS test results for the samples tested are summarized in the following table and shown in greater detail on the attached laboratory test results. Laboratory testing on select pieces of the bedrock core included; unconfined compressive strength (UCS), LA abrasion, and Micro Deval.

The attached rock quality designation data sheets show photos of the recovered core, with inferred mechanical breaks noted and the resulting RQD included for information. ABG inspected the core at our laboratory and indicated any fresh, non-stained break as a mechanical break; however, it is possible that additional breaks were actually due to the drilling process and may not be representative of the actual in-place rock mass (based on our experience).

TABLE 5 - UCS Testing Summary

Borehole	Section	Unconfined Compressive Strength (MPa)
CH01	Box 1, Row 1	98.7
CH02	Box 1, Row 1	93.2
CH03	Box 1, Row 1	82.8
CH04	Box 1, Row 3	59.1

A combined bulk sample from CH01, CH02, and CH03 was submitted to the laboratory and tested for physical properties, as shown in the following table.

TABLE 6 - Bulk Sample Testing Summary

Test Description	Test Method	Acceptance Criteria	Results
LA Abrasion	ASTM C131	Maximum 20% loss after 500 revolutions	35.0%
Micro Deval	ASTM D6928	n/a	11.8%

8.0 Climate Change in Foundation Design

ABG anticipates that the current maximum active layer thickness throughout uplands area of the site is approximately 2.0 m and the current MAGT is -2.3°C. Changes to the active layer thickness and MAGT throughout the life of the structure will depend on many variables, possibly including but not limited to actual current values, changes to MAAT, snow cover, precipitation, surface/groundwater flow, material gradation and in-situ ice content.

CSA PLUS 4011:19 provides that under a high green house gas scenario the MAAT at Qikiqtarjuaq is estimated to increase by approximately 2.2°C over the next 30 years (by 2055) compared to the historic temperature trends which were available up to 2024. It is noted however, that recent research infers that greenhouse gas emissions over the next 30 years and beyond may be even higher than previously anticipated and new scenarios continue to be produced by global experts. Therefore, accurately estimating what the active layer thickness and MAGT will be 30 years from now is well beyond the scope of this assessment.

To support the current project, we have adjusted the historical temperature data to incorporate the above-noted changes to the MAAT and utilized the same simplified empirical methods from Section 7.0 to generate an estimated maximum active layer thickness 30 years from now. We have also assumed (conservatively) that the MAGT will change in step with the MAAT over this period. The process results in future estimated values for the maximum active layer thickness and MAGT of 2.6 m and -0.1°C respectively.

Given the inherent uncertainties surrounding the effects that climate change and site development will have on active layer thickness and MAGT at the site, we recommend introducing some additional conservatism by the way of engineering judgement. For this reason, we have used a design active layer thickness of 3.0 m and a design MAGT of 0.4°C for foundation design at the site.

Where surficial foundations are utilized it is worth considering the installation of a horizontal string of thermistors within the fill pad and as near as possible to original grade (native soils), such that seasonal thaw penetration can be monitored (to some degree). In this way, the assumptions made to support design can be confirmed based on the real-world conditions and any issues that may occur can be better understood and dealt with accordingly.

It is noted that CSA PLUS 4011:19 states *"The requirement for monitoring, reporting, and reacting to any changes that are noted must be recognized early in the project. The responsibilities need to be defined at the project outset and budgets allocated to collect and summarize the data. An annual review by the geotechnical engineer is recommended with more frequent reviews if undesirable trends appear. Monitoring is pointless unless the data collected are evaluated".* This speaks to the importance of implementing a proper and consistent ground temperature monitoring program that includes review and input from qualified geotechnical personnel as part of responsibly addressing climate change in relation to foundation design and maintenance.

9.0 Discussion and Recommendations

Based on the above, the native soils throughout the area of interest are suitable for the proposed development from a geotechnical perspective. The native soils encountered at our borehole locations were found to comprise predominantly of coarse-grained soils that will not be prone to excessive long-term settlement/creep beneath the anticipated weight of the required infill and capable of providing good bearing for the proposed wharf construction.

It is understood that significant infill will be pushed out from the current shoreline to create an extended laydown area (17,953 m^2), with a large, fixed wharf structure (73.8 m long by 3.7 m high face) created for large vessels. The wharf structure will be created using five caisson sections, three of these sections installed parallel to the shoreline to create the front face and one section installed perpendicular to the shoreline at each end to create the sides of the wharf and extend into the infilled laydown berm. Supporting infrastructure is planned to begin with a small security office, radio tower, series of reefer style freezers and two fixed mooring bollards (one at each corner of the infilled laydown area), with further plans for a large warehouse, chancellery building and large diameter fuel tank farm possible.

It is noted that our investigation throughout the waterlot (nearshore) has not identified any problematic clay or silt dominated layers beneath the site; therefore, staging of construction to allow for consolidation

and strength gain of the underlying soils is not considered necessary. Furthermore, we have not identified any permafrost soils nearshore; therefore, we have no concerns related to permafrost degradation and loss of bearing soil strength beneath the nearshore berm or wharf structure. Concrete cribs founded on a granular mattress over native soils would be a suitable structural system for the wharf.

The geotechnical findings throughout the uplands area did identify some problematic, thaw sensitive permafrost soils, which must be accounted for in design of the associated infrastructure, per below.

9.1 Soil Properties

The properties provided in the following table may be used in the design at the site:

TABLE 7 - Recommended Soil Parameters for Design

Parameter	Undisturbed Native Sand	Granular Fill
Total Unit Weight, γ (kN/m^3)	18.5	21
Submerged Unit Weight, γ' (kN/m^3)	8.5	11
Effective Internal Friction Angle, ϕ' (deg)	34	38
Effective Cohesion, c' (kPa)	0	0
Active Earth Pressure, Ka	0.31	0.24
Passive Earth Pressure, Kp	3.25	4.20
At rest Earth Pressure, Ko	0.47	0.38
Soil/Wall Friction Angle, δ (deg)	17	20

9.2 Site Classification for Seismic Response

Based on the anticipated subsurface conditions, the site can be classified as "X_c" for seismic site response in accordance with the requirements of Section 4.1.8.4 of the National Building Code of Canada (NBCC), 2020. In addition, the overburden soils are also considered to be non-liquefiable.

9.3 Caisson Design

A minimum mattress thickness of 600 mm is recommended below the caissons at the site. The mattress material should consist of well-graded, hard, durable quarried rock with a maximum size of 300 mm and not more than 10 percent finer than 50 mm. The top levelling course should consist of a clear stone with a maximum size of 50 mm and not more than 5 percent finer than 5 mm. It is recommended to keep the thickness of the mattress uniform beneath the footprint of each caisson in order to keep differential settlement to a minimum. A 10H:1V slope can be used to transition the thickness of the mattress if it is impractical to maintain a uniform thickness. Based on the bathymetric survey and proposed locations of the caissons, it is expected that some dredging will be required to achieve an appropriately uniform mattress thickness.

The mattress should extend laterally at least 13 m beyond the edge of the cribs and should have side slopes no steeper than 2H:1V. The mattress should be protected from scour by armour stone or linked concrete pads.

A factored bearing resistance (uniform pressure over the effective width, i.e. reduced for eccentricity) of 425 kPa may be assumed for the mattress, based on the understood maximum crib width of 11.4 m and maximum mattress thickness of 2.0 m. For calculation of sliding resistance, an ultimate friction factor value of 0.55 may be used between the caisson base and the rock fill mattress.

Backfill behind/against each caisson should consist of rockfill or a well-graded granular material to reduce lateral earth pressure loadings. The backfill zone should extend upwards from the base of the crib at an angle of 45 degrees (minimum). Backfill should have a maximum size of 150 mm.

The caissons will undergo short-term settlement due to compression of both the rock fill mattress and the underlying soils. Some additional long-term settlement should be expected as well. Based on the anticipated caisson loading, mattress thickness and native stratigraphy at our borehole locations, it is estimated that 150 to 200 mm of total settlement may result. In general, up to 90 percent of that settlement is expected to occur within 6 months of caisson filling and/or backfilling, due to the coarse-grained nature of the fill materials and native soils present.

9.4 Slope Stability

The slope stability analyses presented below were carried out using Slope W (GeoStudio 2024) and Morgenstern-Price Method. The highest section of the breakwater located at the north end was analysed using effective stress analysis with static loading and total stress analysis with seismic loading. Total stress analysis for static loading conditions was not undertaken since the factors of safety would be the same as for effective stress analysis.

The following assumptions were made for slope stability analysis:

- The top of deck for the wharf is at elevation 3.7 m.
- The top of the toe of the rock fill slope is at elevation -10.0 m (harbour bottom).
- A 9 m wide by 2.1 m thick armour rock toe is located along the base of the rock fill slope.
- The seaward slopes of the wharf were analysed for slopes of 1.75H:1V on the rock fill slope and 2:1 on the caisson mattress slope.
- A conservative analysis using low tide (0 m elevation, Chart datum).
- The wharf is considered free draining, therefore no rapid drawdown effect at low tide.
- The engineering properties of the various soil strata are provided on the following table based on previous experience in the region and literature research.

TABLE 8 - Engineering Properties of Soils for Slope Stability Analysis

Soil Type	Total Unit Weight (kN/m^3)	Submerged Unit Weight (kN/m^3)	Effective Angle of Internal Friction ϕ (degrees)	Effective Cohesion c' (kPa)
Granular Rock Fill	22	12	40	0
Dredged Material	17	7	28	0
Native: Sandy Silt	17	7	28	0
Native: Sand with Gravel	22	12	34	0
Armour Rock	22	12	44	0

The results of the slope stability analysis are given on the following table.

TABLE 9 - Computed Factors of Safety for Seaward Slopes

Cross Section	Description	Loading Condition	Computed Factor of Safety	Figure
A	Rock Fill Slope	Effective stress analysis	1.52	5
		Total stress analysis + seismic loading	1.45	6
C	South Caisson	Effective stress analysis	1.68	7
		Total stress analysis + seismic loading	1.61	8
D	Centerline Caisson	Effective stress analysis	1.58	9
		Total stress analysis + seismic loading	1.52	10
G	South Side Containment Berm	Effective stress analysis	1.66	11
		Total stress analysis + seismic loading	1.59	12
H	Laydown Area	Effective stress analysis	1.50	13
		Total stress analysis + seismic loading	1.37	14

Based on various standards for large earthworks projects such as this, a minimum factor of safety of 1.5 is required for static loading conditions and a factor of safety of 1.1 is required for pseudo-static seismic loading conditions. A review of the above indicates that the provided slopes would satisfy the required factors of safety; therefore, these slopes may be used in the design of the wharf.

9.5 Dredging

The material to be dredged will consist primarily of compact to very dense silty sand with varying amounts of gravel, cobbles and boulders. Based on the N-values, the proposed dredge material will be moderately difficult to dredge, requiring equipment which can apply considerable force.

The selection of dredging equipment, such as a dipper dredge, should be made by the contractor based on the soil conditions, water depths and other relevant factors which would affect performance. It should be noted that the materials to be dredged may contain contaminants and disposal at sea or on land should follow environmental regulations. Samples of the proposed dredge materials were submitted for environmental testing and are reported under a separate report.

Dredge slopes in the sand should be no steeper than 2H:1V for short term stability or 6H: 1V for long term stability. It is understood that the dredged material is proposed to be placed as fill material on the uplands portion of the site. The amount of fine-grained soil in the dredge material will affect how quickly the material drains on land. It is recommended that the dredged material be stockpiled on the uplands by spreading the fill in lifts to allow the soil to drain/dry during the summer months until the moisture content is about +/- 3 percent of the optimum moisture content prior to placement and compaction. Based on the geotechnical findings it is anticipated that overall drainage should be relatively quick and all the dredge materials are expected to be reusable as fill on the uplands portion.

9.6 Foundation Recommendations

Based on the above, pile foundations are not considered feasible at this site at this time. Local piling equipment is only capable of installing either adfreeze steel pipe piles or rock socket pipe piles, with limitations on achievable depth. Based on the current MAGT at the site, adfreeze piles are not feasible and based on depth to bedrock at the site, rock socket piles are not feasible. Although specialty equipment and supplies could be mobilized to install deeper rock socket piles, it is anticipated that this would be impractical (further discussion and recommendations available upon request). Similarly, specialty equipment could be mobilized to install driven piles at the site; however, several unknowns would exist as to how these piles would accommodate anticipated substantial thaw of the existing permafrost soils and transition into pure friction piles over time (problematic movement would likely result).

From a geotechnical perspective it is recommended that the currently planned radio tower and mooring bollards be designed as gravity base/deadman style installations. The use of surficial foundations (timber cribs/sills, screw jacks or Triodetic multipoint system) would be recommended for the security office building and freezer units. Future infrastructure such as the large warehouse building and large diameter fuel tank farm, will require further evaluation and geothermal modelling. It is anticipated that the use of thermosyphons may be required for each of these foundations, to help preserve the underlying permafrost soils into the future and avoid long-term thaw related settlement. It is anticipated that the chancellery building would be more lightly loaded and used for residence, office space, etc. Such a building is most likely be founded atop surficial foundations as well and slightly elevated per below.

Recommendations to support the design and construction of rock socket steel pipe piles, adfreeze steel pipe piles and surficial foundations, as well as slabs for unheated ancillary equipment are included below.

9.6.1 Surficial Footings

A variety of surficial footings are typically used throughout the north, including timber cribbing, metal screw jacks and the Triodetic multipoint system. The timber cribbing and metal screw jack options are very similar with each foundation unit installed directly beneath the load bearing points along a structural beam. The Triodetic multipoint system receives the structural loads from the building atop a three-dimensional framework of tubes that further distributes the loads down to several additional grade-supported bearing points. The tubular network is intended to be sufficiently rigid to minimize differential movements within the structure even if individual footings move differentially; however, some obvious limitations still exist and limiting movements as much as possible through proper design and construction of an engineered fill pad beneath is still recommended.

All three options require annual (or more frequent) evaluation to determine the extent of any movements and confirm if the structure is performing as anticipated. Adjustments may be required over time, especially within the first few years after construction is completed depending on actual site conditions.

Site Preparation and Fill Pad Construction: It is recommended that the native soils and any existing fill material beneath the foundation elements be evaluated and proofed using compaction equipment under the direct supervision of qualified geotechnical personnel. Over-excavation and replacement of any soft soils identified during the evaluation would be beneficial; however, it is expected that this would represent considerable additional cost and given that the foundation systems are technically adjustable and the modules of rigid construction, we would recommend against this approach and opt instead for

additional effort re-levelling the building if soft subgrades result in additional settlement during the first and second summer.

Where the site is covered in previously placed fill materials, the state of those fill materials should be evaluated by qualified geotechnical personnel and this may require the excavation of test pits at their discretion. Some redistribution of previously placed fill material may be required to ensure the initial lift over native grades can be thoroughly compacted (proofed) and approved, prior to additional fill materials being placed.

The finished fill pad should extend out at least 2.0 m beyond the edge of the bearing pads in all directions and be sloped down to surrounding grades at 2.5H:1V or gentler. It is recommended that the finished fill pad be at least 1.0 m above the native grades; however, it should be appreciated that thicker fill pads will limit the extent of seasonally active native soils beneath the bearing points and as such, thicker fill pads will limit seasonal movement and potential for long-term permafrost degradation beneath the foundation.

Lift thicknesses for any new engineered fill placed to level or raise the new foundation should be appropriate for the material and compaction equipment being used. Typically, for a 1-tonne plate tamper and granular material, compaction can be achieved using 300 mm thick lifts and 6 full passes (back and forth over the area). The material should be compacted to 100% of the Standard Proctor Maximum Dry Density (SPMDD) determined for the material (or equivalent) as determined and approved by qualified geotechnical personnel onsite.

Engineered fill for the project should consist of frost-stable, well-graded sand and gravel, preferably meeting the gradation requirements outlined below. Other gradations may be acceptable for use, subject to review and acceptance by the geotechnical engineer of record. It is recommended that the maximum particle size be limited to 66% of the maximum lift thickness, which will be dictated by the compaction equipment available onsite as noted above. Individual particles larger than approximately 100 mm should be monitored to ensure nesting of those larger particles does not occur, such that unwanted voids are limited.

In general, engineered fill should be within +/- 2% of the optimum moisture content determined for the material to achieve proper compaction more easily. This may require the addition of water onsite. The granular pad will provide improved bearing resistance and provide an opportunity to implement proper site grading and drainage beneath and around the building, as well as limiting the extent of seasonal thaw and freeze back within any frost-susceptible native soils beneath.

TABLE 10 - Recommended Gradation for Type 1, Type 2 and Select Subgrade Materials

Gradation (sieve/% passing)	Type 1 (Base)	Type 2 (Sub-Base)	Select Subgrade
150 mm	–	–	100
75.0 mm	–	100	–
37.5 mm	–	–	–
25.0 mm	100	50 – 100	50 – 100
19.0 mm	75 – 100	–	45 – 100

TABLE 10 - Recommended Gradation for Type 1, Type 2 and Select Subgrade Materials

Gradation (sieve/% passing)	Type 1 (Base)	Type 2 (Sub-Base)	Select Subgrade
9.5 mm	50 – 85	–	–
4.75 mm	35 – 65	20 – 55	20 – 70
2.0 mm	25 – 50	–	–
0.425 mm	15 – 30	5 – 35	5 – 45
0.300 mm	–	–	–
0.150 mm	–	–	–
0.075 mm	5 – 8	0 – 8	0 – 20

Bearing Capacity and Settlement Design: It is anticipated that a spaceframe foundation will be supported by a minimum 250 mm square bearing plates on preserved wood pad footings measuring at least 600 by 600 mm in size. Based on the fill pad being constructed as outlined above, the actual footing sizes may be designed based on a factored ULS bearing resistance of 100 kPa, which includes a geotechnical factor of 0.5. It is understood that future settlements can be accommodated by the design of the framework or manual adjustments; therefore, SLS geotechnical resistances are not expected to govern design.

Uplift and Lateral Foundation Considerations: It is recommended that the structural engineer check the adequacy of the on-grade foundation against both wind and seismic loads, to confirm if there is any requirement to incorporate ground anchors in design. Further recommendations regarding anchor design can be provided upon request, if required.

9.6.2 Thermosyphon Stabilized Foundations

In general, thermosyphon stabilized foundations are more typically utilized when large warehouse style buildings require on-grade access for heavy vehicle loads and/or storage of heavy racking/items, and a concrete slab-on-grade option is desired by the design team. Furthermore, given the ground temperatures determined for the site, it may be necessary to incorporate thermosyphons beneath the planned future large diameter fuel tank farm (depending on detailed thermal modelling as design progresses).

For this project, it is envisioned that the thermosyphon system could potentially be utilized to ensure long-term climate change does not affect surficial or near surface footings that support the structure or slab-on-grade for the warehouse.

It is envisioned that the concept would include concrete spread footings founded atop or within an engineered fill pad, with horizontal insulation and thermosyphons incorporated near the base of the fill pad to ensure the underlying native soils remain frozen throughout the life of the building (avoiding unwanted seasonal or long-term movements). As noted above, the actual feasibility of this option must be evaluated and confirmed by the supplier and structural engineer of record. Some general recommendations for the design and construction of this option are included below.

The native subgrade throughout the zone of influence for the foundation elements should be proof rolled under the direct supervision of qualified geotechnical personnel prior to the placement of any new fill

materials. It is recommended that the proof roll be completed using a minimum 10-tonne vibratory roller. The zone of influence shall be taken as the footprint of the slab plus a 1H:1V splay beneath the footprint to approved native soils. Any soft spots identified during the proof roll should be identified and discussed with the design team to confirm if over-excavation and replacement is warranted.

The actual extent/composition of the engineered fill pad must be determined by the supplier and their design team based on project specific inputs, geothermal modelling and proprietary design elements. It is expected that engineered fill placed beneath the foundation elements should be well-graded, frost-stable sand and gravel preferably conforming to the gradation given for Type 1 or 2 on the following table. The engineered fill should be placed in lifts suitable for the compaction equipment used and each lift compacted to 100% of the SPMDD determined for the material. Typically, this would require 300 mm thick lifts for a minimum 10-tonne vibratory roller. The lift thickness may need to be adjusted by qualified geotechnical personnel at the time of construction.

Positive drainage from any excavation should be provided at the lowest elevation practical to limit the buildup of groundwater within the backfill materials. The placement and compaction of the engineered fill should be carried out under the supervision of a geotechnical personnel working under the direction of a geotechnical engineer. Maintaining positive drainage away from the thermosyphon stabilized fill pad will be critical to ensure long-term performance and site grading/ditching should be well planned and constructed for this reason.

The SLS geotechnical bearing capacity of the granular fill pad constructed as outlined above will be governed by the compressive strength of the Styrofoam insulation used. The reported SLS bearing capacity of HI-40 and HI-60 Styrofoam insulation is 90 and 130 kPa respectively. The corresponding subgrade reaction modulus of the engineered pad may be taken as 35 and 50 MPa/m for HI-40 and HI-60 respectively.

9.7 Roadways, Laydown, Parking, Site Grading and Drainage

The final site grades should be designed to eliminate the potential for ponding water around and ensure positive drainage away from the site. In general, it is recommended that the final grades provide at least 3% grade away from the associated buildings and infrastructure in all directions, with 1.5% minimum grade for drainage elsewhere.

It is anticipated that all traffic areas will be gravel surfaced and the near surface soils onsite will consist predominantly of silty sand. Therefore, the roadways and fill pads for traffic areas and general site grading purposes should perform well and require minimal regrading each year if constructed in accordance with the recommendations included below.

It is recommended that all road and traffic areas receive at least 150 mm of Type 1 material (surface/base course), underlain by at least 450 mm of Type 2 material (sub-base), placed and compacted atop a layer of geotextile fabric (such as TX-90 or approved equivalent), over approved coarse-grained subgrade at a minimum. For heavy duty traffic areas such as the access road and select areas of the site, it is further recommended to include a minimum 300 mm thick lift of 200 mm minus rock fill between the native subgrade and geotextile fabric.

The satisfactory performance of driveway/parking areas will be dependant on the provision of adequate surface/subsurface drainage via professionally designed ditches, swales and culverts at the site.

It is recommended that cuts into the native soils be avoided and design grades be achieved by building atop the native grades of the site. Prior to any material placement, the native subgrade should be inspected by qualified geotechnical personnel to determine if any areas of concern exist (i.e. areas of extensive soft soils) and if so, the extent and nature of the concern should be discussed with the design team to determine the best area-specific treatment.

If it is determined that excavation and replacement is warranted to improve the native subgrade, the excavation should conform to the requirements of the Occupational Health and Safety Act (OSHA) and consider the potential for underlying permafrost soils to thaw/soften during excavation creating an increasingly worse situation. Excavations should be limited to only those areas deemed necessary and carried out in stages such that excavation and replacement back to current grade or higher occurs within hours (dependant on the observed rate of thaw and native soil behaviour).

All driveway/parking area fill material should be placed in maximum 300 mm thick lifts and compacted to 98% of the SPMDD within 300 mm of the subgrade surface and 95% of the SPMDD below this depth. The Type 1/Type 2 granular materials should be compacted to 100% of the SPMDD. Density testing is recommended to confirm each lift receives an adequate level of compaction prior to subsequent lifts. All permanent slopes for driveway/parking areas prepared as outlined herein shall be 2.5H:1V or gentler, unless approved by the geotechnical engineer of record for the project.

10.0 Closure

The use of this report is subject to the attached statement of general conditions. It is the responsibility of CBCL Limited, who is identified as "the Client" within the statement of general conditions and its agents to review the conditions and to notify ABG should any of these not be satisfied. The statement of general conditions addresses; use of the report, basis of the report, standard of care, interpretation of site conditions, varying or unexpected site conditions, planning, design and construction.

We trust the information contained herein is adequate for your present purposes. Should you have any questions about the contents of the report, or if we can be of any further assistance, please do not hesitate to contact the undersigned at your convenience.

Sincerely,

Adaptive Baseline Geotechnical Ltd.

PERMIT TO PRACTICE
ADAPTIVE BASELINE GEOTECHNICAL LTD.
Signature
Date Oct 20, 2025
PERMIT NUMBER: P 1501
NT/NU Association of Professional Engineers and Geoscientist

REGISTERED PROFESSIONAL ENGINEER
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ATTACHMENTS

Photograph 1
Drone photograph of the Site looking south.

Photograph 2
Drone photograph looking east at the Site.

Photograph 3
Clearing snow for air-track drilling on the uplands.

Photograph 4
Drilling an upland borehole.

Photograph 5
Drilling an upland borehole.

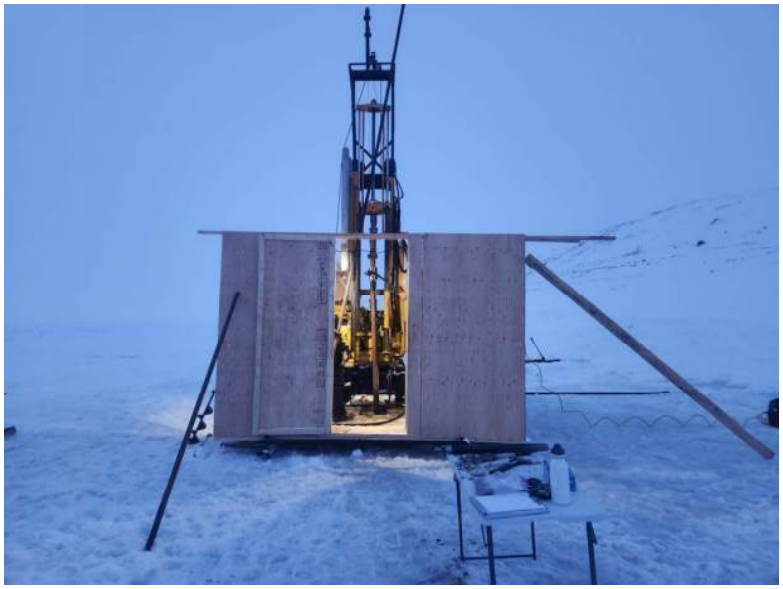
Photograph 6
Drilling an upland borehole.

Photograph 7
Thermistor T1 installed in BH01.

Photograph 8
Thermistor T2 installed in BH10.

Photograph 9
Thermistor T3 installed in BH11.

Photograph 10
Thermistor T4 installed in BH13.



Photograph 11
Drilling a waterlot borehole.

Photograph 12
Drilling a waterlot borehole.

ADAPTIVE BASELINE GEOTECHNICAL LTD.

17 Industrial Way, Elmsdale, NS B2S 2L6
Tel: (867) 222-0184

Scale:	as shown	Client:	**CBCL Limited**
Project No.:	QIK-G2303	Project:	Geotechnical Investigation – Marine Infrastructure – New Deep-water Port Facility
	Figure 1	Title:	Site Location Plan

Notes: (1) Google Earth image used is from 2023; therefore, unknown differences may exist between current site conditions and those shown.
(2) This drawing forms part of the report project number as referenced and should be used only in conjunction with this report.

KEY PLAN

BH11
BH01
BH02 (cancelled)
BH03
BH16
BH14
BH12
BH09
BH05
BH04
BH06
BH18
BH15
BH17
BH13
BH10
BH07
BH08

LEGEND

BOREHOLE LOCATION

100 m

ADAPTIVE BASELINE GEOTECHNICAL LTD.

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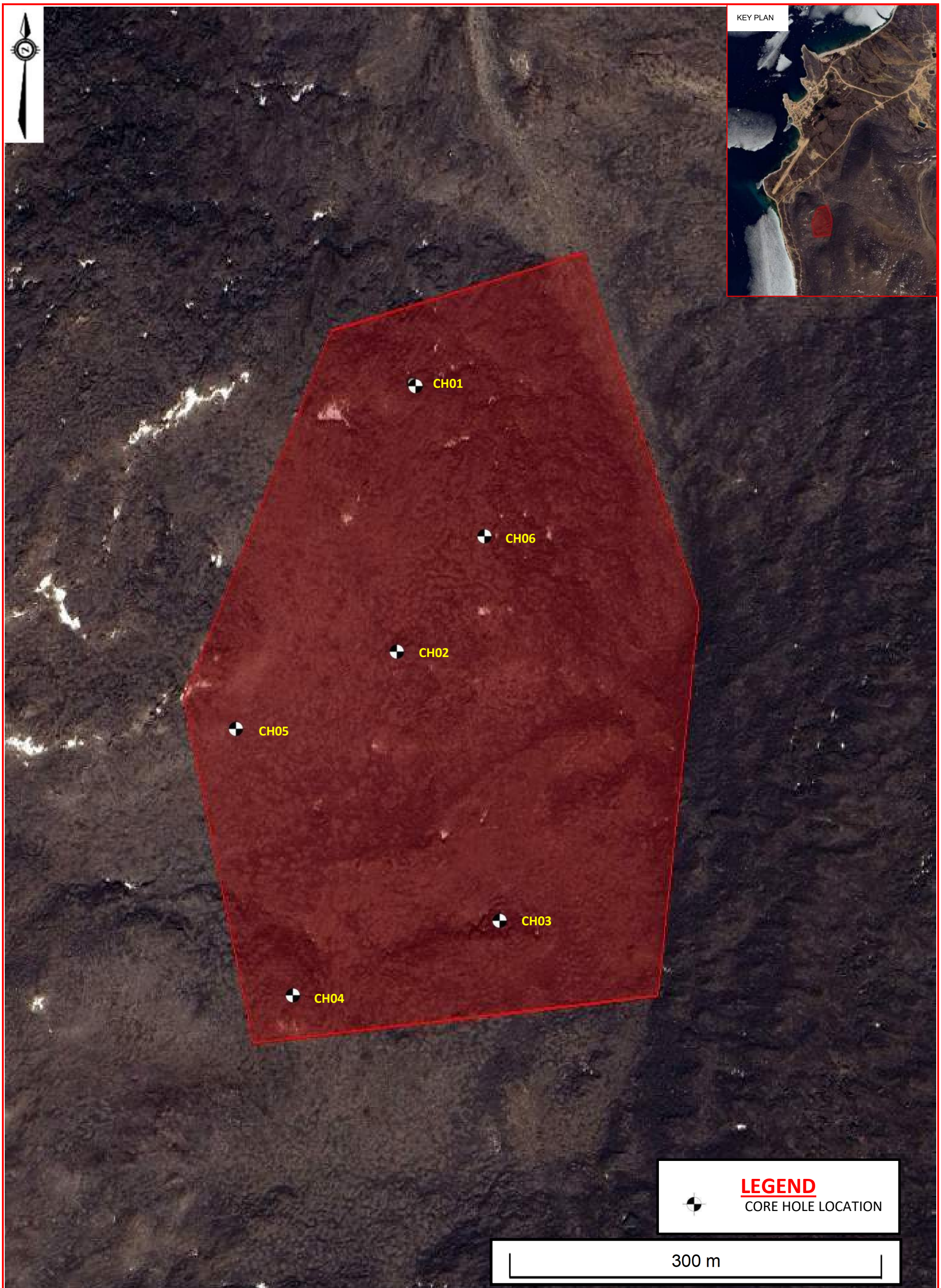
Tel: (867) 222-0184

Scale:	as shown	Client:	**CBCL Limited**
Project No.:	QIK-G2303	Project:	Geotechnical Investigation – Marine Infrastructure – New Deep-water Port Facility
	Figure 2	Title:	Borehole Locations

Notes: (1) Google Earth image used is from 2023; therefore, unknown differences may exist between current site conditions and those shown.
(2) This drawing forms part of the report project number as referenced and should be used only in conjunction with this report.



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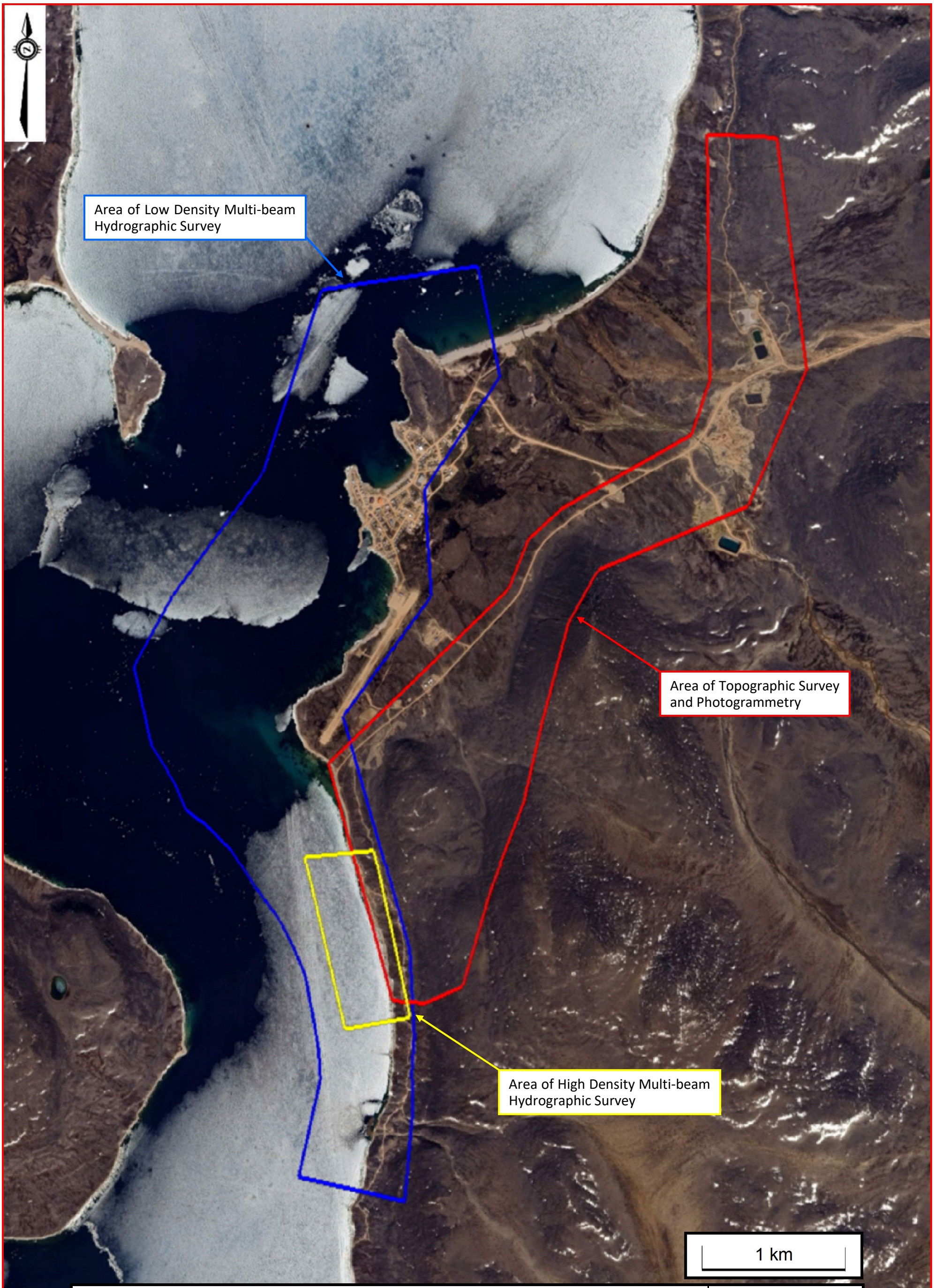
Scale:	as shown	Client:	**CBCL Limited**
Project No.:	QIK-G2303	Project:	Geotechnical Investigation – Marine Infrastructure – New Deep-water Port Facility
	Figure 3	Title:	Core Hole Locations

Notes: (1) Google Earth image used is from 2023; therefore, unknown differences may exist between current site conditions and those shown.
(2) This drawing forms part of the report project number as referenced and should be used only in conjunction with this report.



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Scale:	as shown	Client:	**CBCL Limited**
Project No.:	QIK-G2303	Project:	Survey – Marine Infrastructure – New Deep-water Port Facility
	Figure 4	Title:	Topographic and Hydrographic Location Plan

Notes: (1) Google Earth image used is from 2023; therefore, unknown differences may exist between current site conditions and those shown.
(2) This drawing forms part of the report project number as referenced and should be used only in conjunction with this report.

Figure 5

Slope Stability Analysis

ProjectNo.: QIK-G2303
Project Name: Deep Sea Port
Project location: Qikiqtarjuaq, NU
Section: Cross-Section A - Rock Fill Slope
Analysis: Effective Stress Analysis
Factor of Safety: 1.52

Color	Name	Unit Weight (kN/m³)	Effective Friction Angle (°)
	01 Upper Silty SAND with Gravel	22	34
	02 Sandy SILT	17	28
	03 Lower Silty SAND with Gravel	22	34
	04 Engineered FILL	22	40
	06 Armour Stone	22	44

1.45

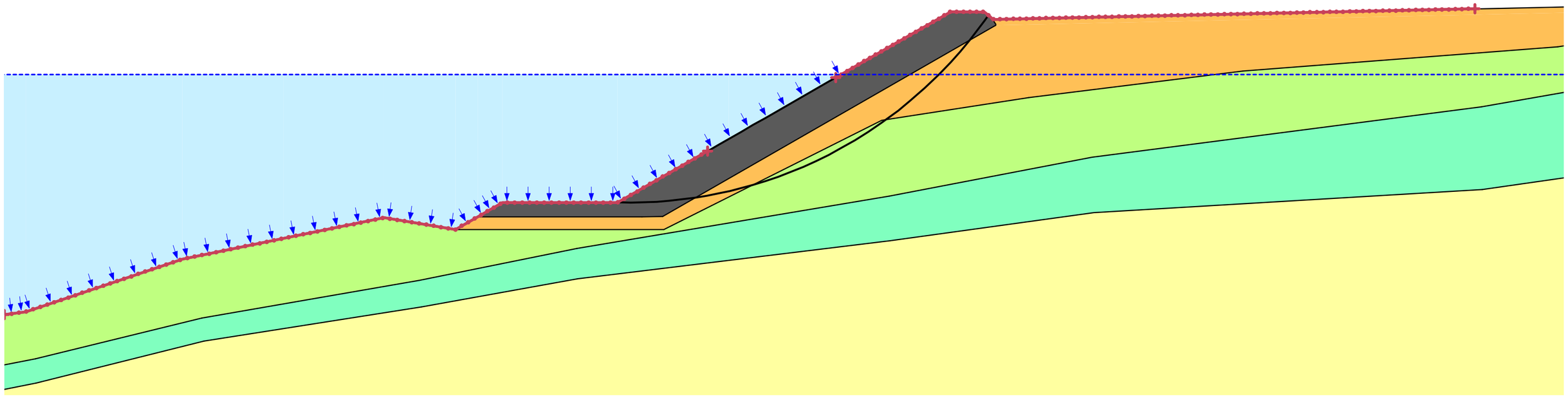


Figure 6

Slope Stability Analysis

ProjectNo.: QIK-G2303
Project Name: Deep Sea Port
Project location: Qikiqtarjuaq, NU
Section: Cross-Section A - Rock Fill Slope
Analysis: Total Stress Analysis + Seismic Loading
Factor of Safety: 1.45

Color	Name	Unit Weight (kN/m³)	Effective Friction Angle (°)
	01 Upper Silty SAND with Gravel	22	34
	02 Sandy SILT	17	28
	03 Lower Silty SAND with Gravel	22	34
	04 Engineered FILL	22	40
	06 Armour Stone	22	44

1.45

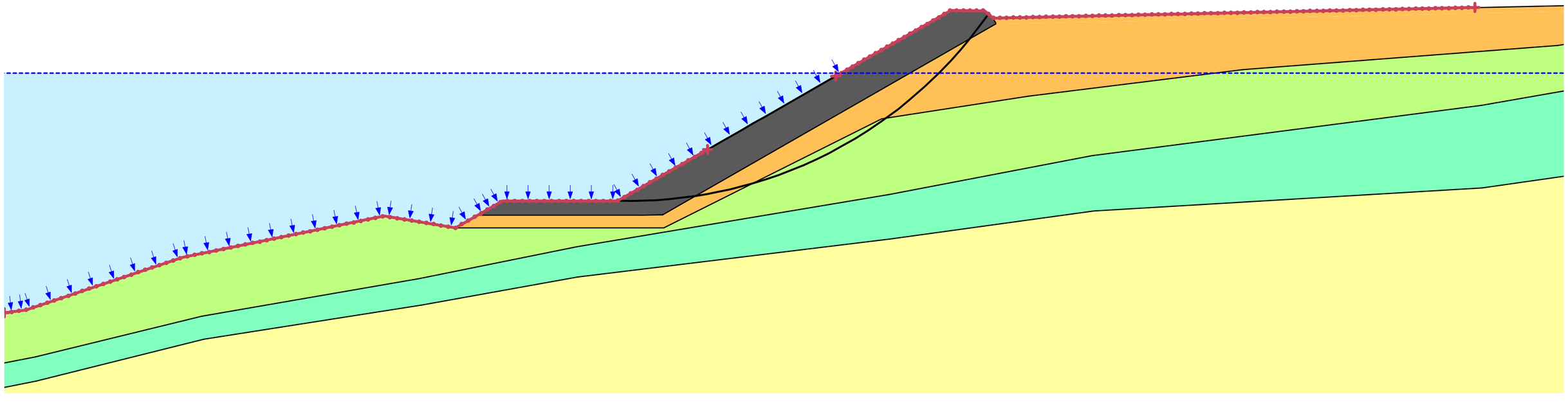


Figure 7

Slope Stability Analysis

ProjectNo.: QIK-G2303
Project Name: Deep Sea Port
Project location: Qikiqtarjuaq, NU
Section: Cross-Section C - South Caisson
Analysis: Effective Stress Analysis
Factor of Safety: 1.68

1.68

Color	Name	Unit Weight (kN/m³)	Effective Friction Angle (°)
	01 Upper Silty SAND with Gravel	22	34
	02 Sandy SILT	17	28
	03 Lower Silty SAND with Gravel	22	34
	04 Engineered FILL	22	40
	06 Armour Stone	22	44

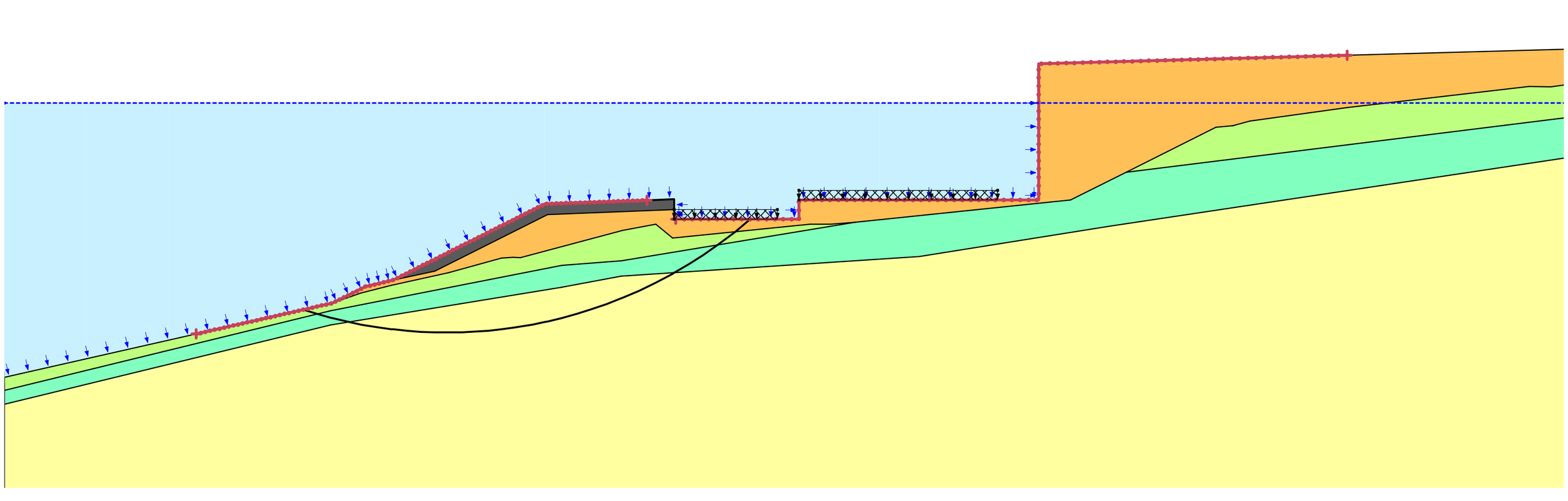


Figure 8

Slope Stability Analysis

ProjectNo.: QIK-G2303
Project Name: Deep Sea Port
Project location: Qikiqtarjuaq, NU
Section: Cross-Section C - South Caisson
Analysis: Total Stress Analysis + Seiemic Loading
Factor of Safety: 1.61

1.61

Color	Name	Unit Weight (kN/m³)	Effective Friction Angle (°)
	01 Upper Silty SAND with Gravel	22	34
	02 Sandy SILT	17	28
	03 Lower Silty SAND with Gravel	22	34
	04 Engineered FILL	22	40
	06 Armour Stone	22	44

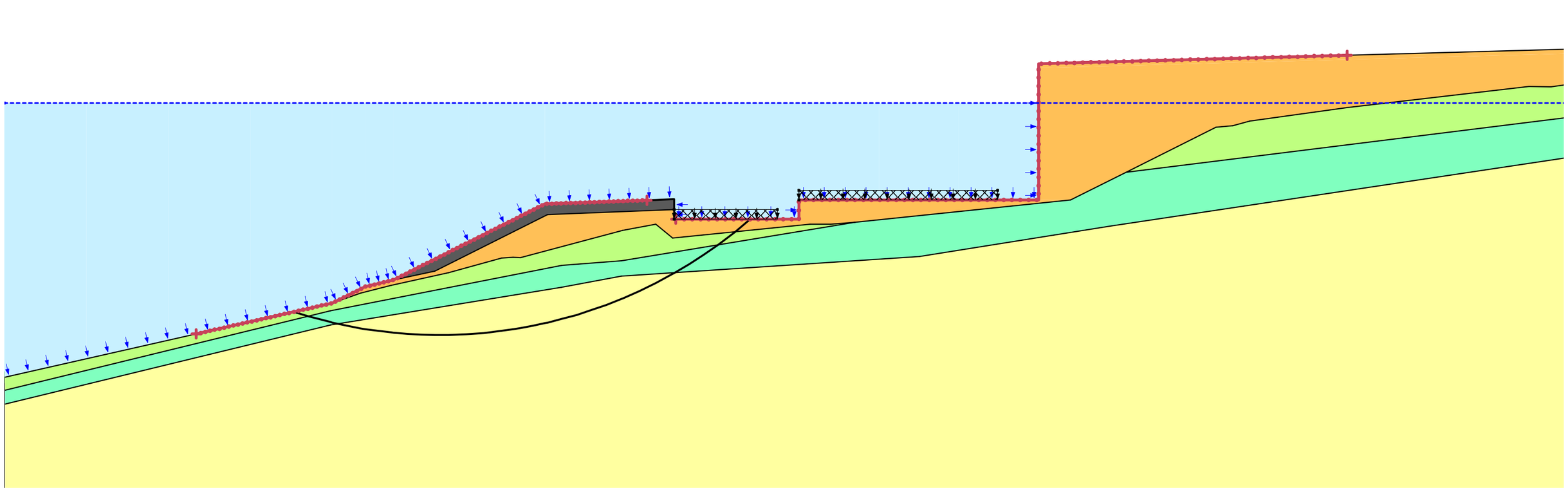


Figure 9

Slope Stability Analysis

ProjectNo.: QIK-G2303
Project Name: Deep Sea Port
Project location: Qikiqtarjuaq, NU
Section: Cross-Section D - Centreline Caisson
Analysis: Effective Stress Analysis
Factor of Safety: 1.58

Color	Name	Unit Weight (kN/m³)	Effective Friction Angle (°)
	01 Upper Silty SAND with Gravel	22	34
	02 Sandy SILT	17	28
	03 Lower Silty SAND with Gravel	22	34
	04 Engineered FILL	22	40
	06 Armour Stone	22	44

1.58

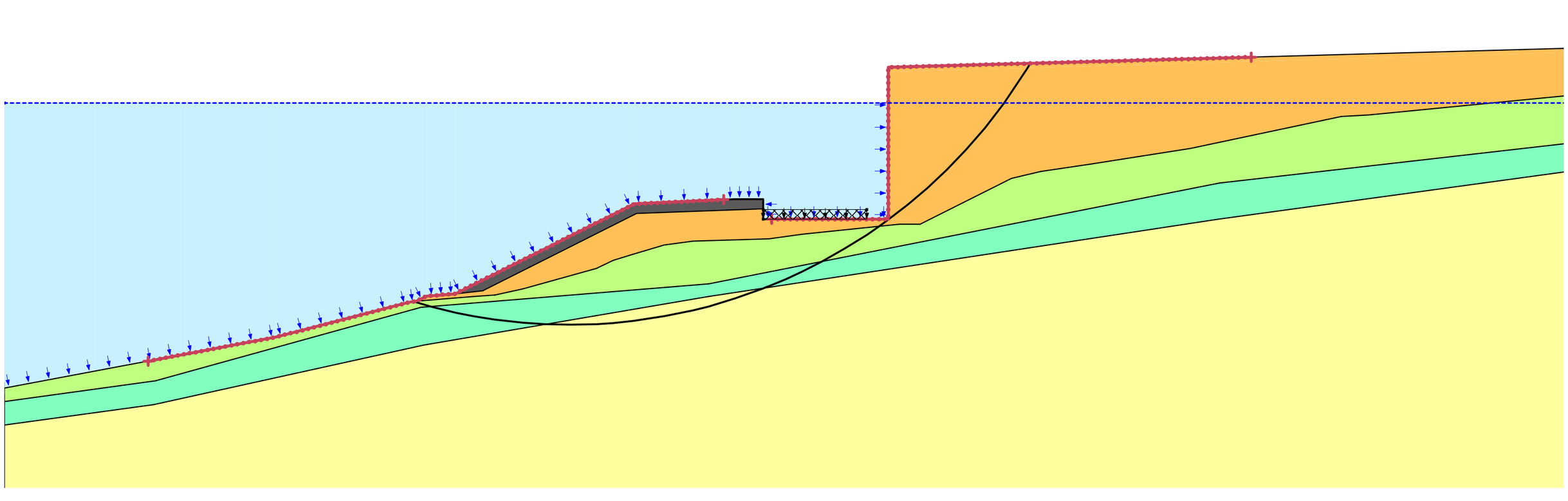


Figure 10

Slope Stability Analysis

ProjectNo.: QIK-G2303
Project Name: Deep Sea Port
Project location: Qikiqtarjuaq, NU
Section: Cross-Section D - Centreline Caisson
Analysis: Total Stress Analysis + Seiemic Loading
Factor of Safety: 1.52

1.52

Color	Name	Unit Weight (kN/m³)	Effective Friction Angle (°)
	01 Upper Silty SAND with Gravel	22	34
	02 Sandy SILT	17	28
	03 Lower Silty SAND with Gravel	22	34
	04 Engineered FILL	22	40
	06 Armour Stone	22	44

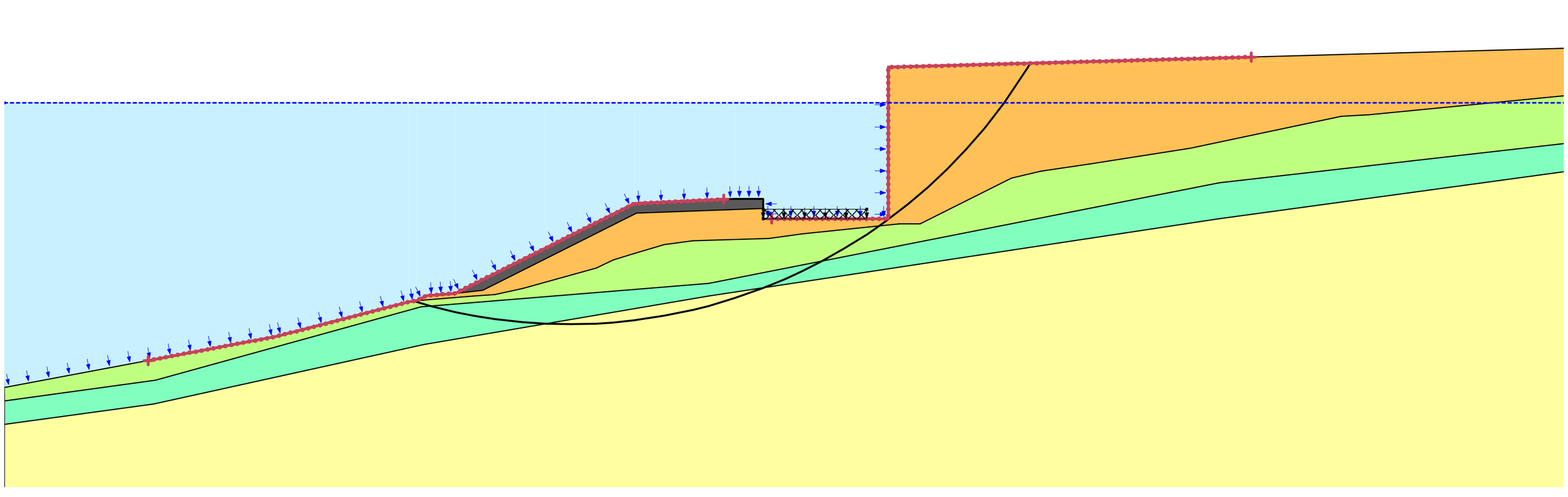


Figure 11

Slope Stability Analysis

ProjectNo.: QIK-G2303
Project Name: Deep Sea Port
Project location: Qikiqtarjuaq, NU
Section: Cross-Section G - South Side Containment Berm
Analysis: Effective Stress Analysis
Factor of Safety: 1.66

Color	Name	Unit Weight (kN/m³)	Effective Friction Angle (°)
	01 Upper Silty SAND with Gravel	22	34
	04 Engineered FILL	22	40
	05 Filter Stone	22	44
	06 Armour Stone	22	44
	10 Dredge reuse	17	28

1.66

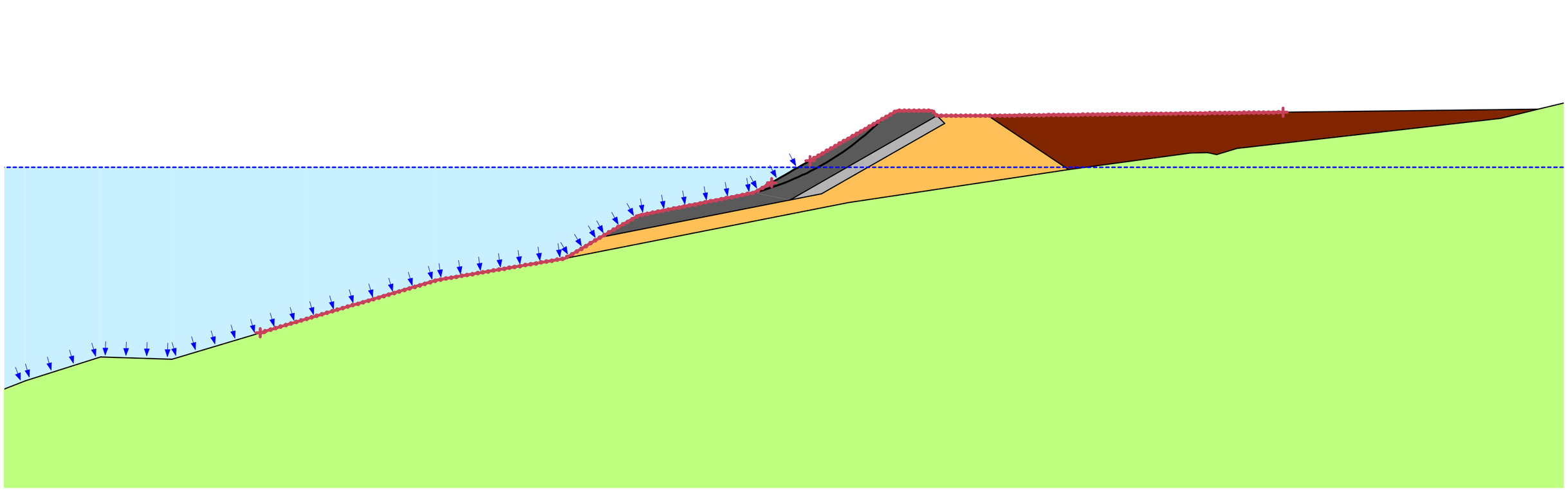


Figure 12

Slope Stability Analysis

ProjectNo.: QIK-G2303
Project Name: Deep Sea Port
Project location: Qikiqtarjuaq, NU
Section: Cross-Section G - South Side Containment Berm
Analysis: Total Stress Analysis + Seismic Loading
Factor of Safety: 1.59

Color	Name	Unit Weight (kN/m³)	Effective Friction Angle (°)
	01 Upper Silty SAND with Gravel	22	34
	04 Engineered FILL	22	40
	05 Filter Stone	22	44
	06 Armour Stone	22	44
	10 Dredge reuse	17	28

1.59

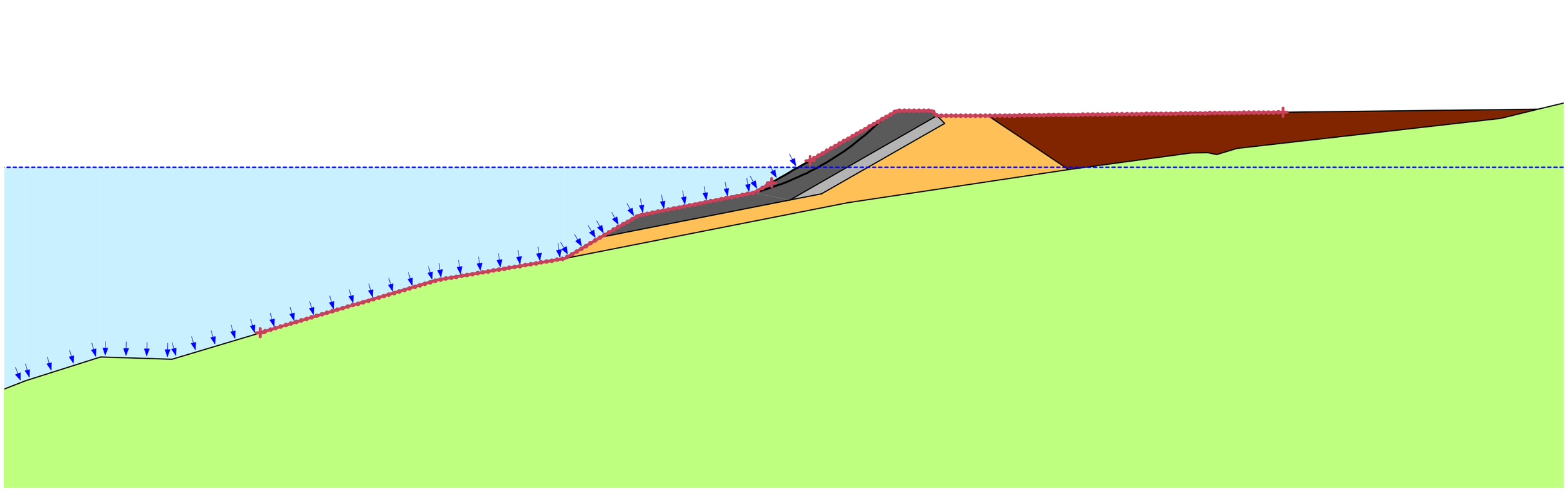


Figure 13

Slope Stability Analysis

ProjectNo.: QIK-G2303
Project Name: Deep Sea Port
Project location: Qikiqtarjuaq, NU
Section: Cross-Section H - Laydown Area
Analysis: Effective Stress Analysis
Factor of Safety: 1.50

Color	Name	Unit Weight (kN/m³)	Effective Friction Angle (°)
	01 Upper Silty SAND with Gravel	22	34
	02 Sandy SILT	17	28
	03 Lower Silty SAND with Gravel	22	34
	04 Engineered FILL	22	40
	10 Dredge reuse	17	28

1.50

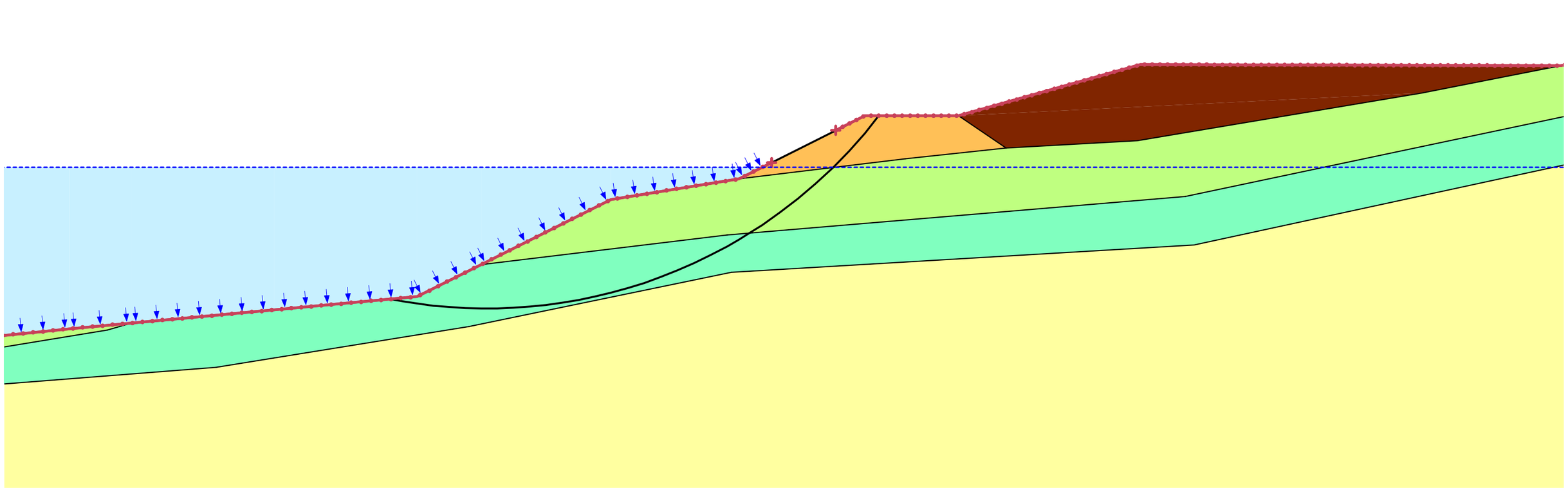


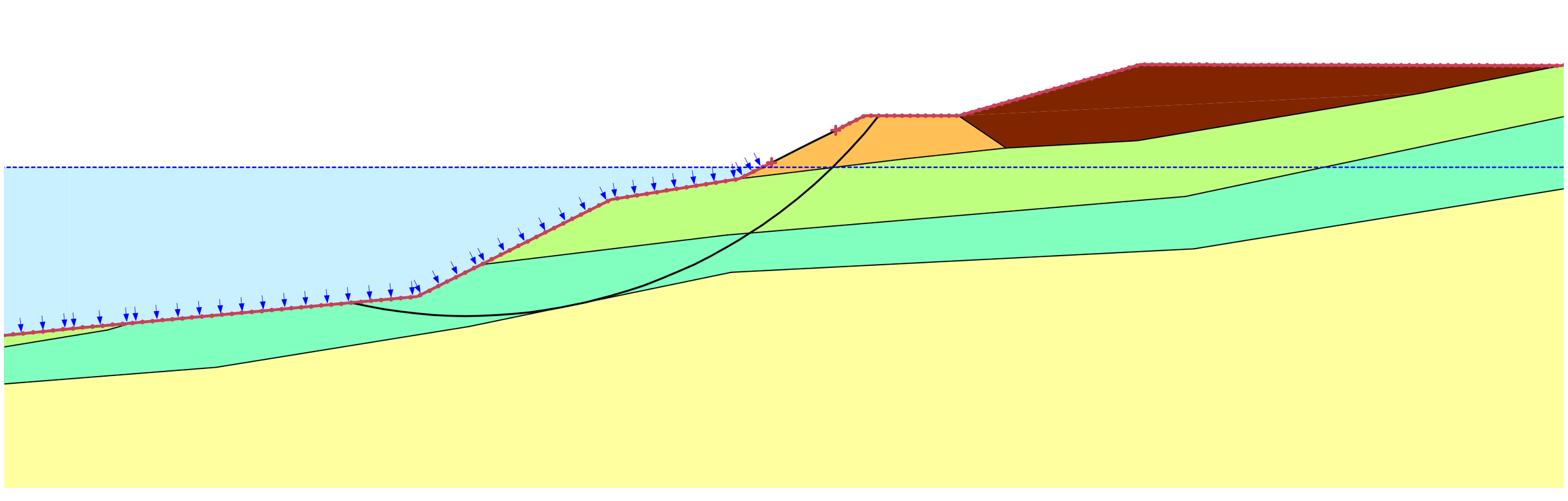
Figure 14

Slope Stability Analysis

ProjectNo.: QIK-G2303
Project Name: Deep Sea Port
Project location: Qikiqtarjuaq, NU
Section: Cross-Section H - Laydown Area
Analysis: Total Stress Analysis + Seismic Loading
Factor of Safety: 1.37

1.37

Color	Name	Unit Weight (kN/m³)	Effective Friction Angle (°)
	01 Upper Silty SAND with Gravel	22	34
	02 Sandy SILT	17	28
	03 Lower Silty SAND with Gravel	22	34
	04 Engineered FILL	22	40
	10 Dredge reuse	17	28



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BOREHOLE LOG

BH03

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.29 **COMPLETED** 2024.04.30
GROUND ELEVATION -13.08 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490819.04 E:455923.18
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY MS **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
0	Compact to very dense grey poorly-graded SAND with silt and gravel to silty SAND	SP-SM	SS	1	0	50/30mm	
			SS	2	230	64	S
-15.52			SS	3	300	26	S
	Compact grey poorly-graded SAND with silt and gravel	SP-SM	SS	4	330	18	
			SS	5	400	29	
-17.60							
	Very loose SAND with silt	SP	SS	6	200	2	
-18.26							S
	Compact grey silty SAND - trace gravel	SM	SS	7	600	15	
			SS	8	360	39	
			SS	9	360	37	
			SS	10	0	10	
-22.17							
	Very dense grey SAND with gravel to silty SAND with gravel - trace silt - frequent cobbles	SWG	SS	11	280	54	
			SS	12	300	59	
			SS	13	330	87	S
			SS	14	250	50/110mm	
			SS	15	0	50/100mm	
-32.38			RC	16	28%	0%	

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

(Continued Next Page)

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BOREHOLE LOG

BH03

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU

DEPTH (m)	MATERIAL DESCRIPTION	GRAPHIC LOG	WATER LEVEL	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
21	Very poor to good quality grey granite: BEDROCK - some silt infilling between fractures *(continued)*				RC	17	100%	81%	
22					RC	18	55%	27%	
23					RC	19	79%	44%	
24					RC	20	100%	53%	
25					RC	21	88%	68%	
26	-39.32								
27	Borehole Terminated at 26.24 m - Target depth								
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

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BOREHOLE LOG

BH04

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.26 **COMPLETED** 2024.04.27
GROUND ELEVATION -13.96 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490713.07 E:455961.34
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY MS **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
0	Compact to dense grey poorly-graded SAND with silt and gravel	SP-SM	SS	1	300	32	
			SS	2	460	28	
			SS	3	410	28	
			SS	4	610	46	S
			SS	5	230	37	
-18.53							
5	Very loose grey sandy SILT - with shell fragments	ML	SS	6	480	2	S
-19.76							
6	Very dense grey SAND with gravel to silty SAND - occasional cobbles and boulders	SM	SS	7	480	54	
			SS	8	280	57	
			SS	9	610	63	S
			SS	10	380	76	
	- 300 mm cobble - 760 mm boulder - 225 mm cobble		SS	11	380	62/80mm	
			SS	12	300	88/110mm	
	- 2 x 80 mm cobbles						
-30.09			SS	13	0	60/130mm	
	Borehole Terminated at 16.13 m - Target depth						

SPT N VALUE: 20 40 60 80
PL MC LL: 20 40 60 80

CANADRILL SOUTHERN BH LOG QIK2303 CURRENT DRAFT.GPJ GINT STD CANADA.GDT 2024.06.19

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BOREHOLE LOG

BH05

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.27 **COMPLETED** 2024.04.28
GROUND ELEVATION -4.11 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490729.75 E:456008.72
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY CFH **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
0	Compact to very dense grey silty SAND	SM	SS	1	200	15	
1	- some gravel		SS	2	250	35	S
2			SS	3	150	23	
3			SS	4	330	50/80mm	
4			SS	5	460	83	S
5							
6			SS	6	280	52	
7			SS	7	100	19	
8			SS	8	100	18	
-12.57							
9	Compact to very dense brown silty SAND	SM					
10	-some gravel		SS	9	0	37	
11			SS	10	0	102	
12							
13			SS	11	0	85	
14			SS	12	0	50/60mm	S
15			SS	13	0	50/80mm	
16							
17							
-21.64							
18	Compact to very dense grey silty SAND	SM	SS	14	410	50/60mm	
19	- occasional cobbles - 250 mm cobble						
20							

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

(Continued Next Page)

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BOREHOLE LOG

BH05

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU

DEPTH (m)	MATERIAL DESCRIPTION	GRAPHIC LOG	WATER LEVEL	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
21	Compact to very dense grey silty SAND - occasional cobbles *(continued)*				SS	15	0	50/80mm	
22									
23	- 2 x 75 mm cobbles			SM					
24					SS	16	0	72/80mm	
25									
26									
27	-31.13				SS	17	0	60/100mm	
28	Very poor to good quality, slightly weathered grey granite: BEDROCK - some silt infilling between fractures				RC	18	66%	0%	
29					RC	19	82%	77%	
30					RC	20	83%	0%	
31	-35.30				RC	21	117%	74%	
32	Borehole Terminated at 31.19 m - Target depth				RC	22	95%	43%	
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

>>
>>
>>

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BOREHOLE LOG

BH06

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.28 **COMPLETED** 2024.04.28
GROUND ELEVATION -20.99 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490701.95 E:455932.22
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY MS **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
0	Loose to very dense medium brown silty SAND - some gravel	SM	SS	1	130	7	S
1			SS	2	150	11	
2			SS	3	0	14	
3	- 175 mm cobble		SS	4	250	37	S
			SS	5	200	50/30mm	
4	- 250 mm cobble - 2 x 85 mm cobbles						
	-25.31						
5	Compact to very dense medium brown silty SAND with gravel	SW	SS	6	200	39	
6	- 2 x 85 mm cobbles		SS	7	300	26	S
7							
8			SS	8	280	16	
9			SS	9	150	56	
10			SS	10		35	
	-30.87						
	Borehole Terminated at 9.88 m - Target depth						
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

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BOREHOLE LOG

BH07

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.24 **COMPLETED** 2024.04.25
GROUND ELEVATION -2.04 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490623.44 E:456045.88
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY MS **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
0	Very dense grey well-graded SAND with silt and gravel	SW	SS	1	360	142	
2			SS	2	380	76	S
3			SS	3	510	43	
5			SS	4	330	80	
6	- 500 mm boundler						
-8.16							
7	Dense grey-brown SAND with gravel	SW	SS	5	360	38	
-9.69							
8	Compact brown SAND with gravel	SW	SS	6	180	21	
-11.21							
10	Loose brown poorly-graded GRAVEL with silt and sand	GP-GM	SS	7	180	6	S
-12.73							
11	Loose grey silty SAND with gravel	SM	SS	8	280	4	S
-14.26							
13	Compact to very dense grey SAND with gravel - 500 mm boundler	SW	SS	9	130	50/80mm	
-17.91			SS	10	610	16	
	Borehole Terminated at 15.87 m - Target depth						

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

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BOREHOLE LOG

BH08

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.25 **COMPLETED** 2024.04.25
GROUND ELEVATION -12.67 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490606.76 E:455998.33
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY CFH **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)
0	Dense to very dense dark grey silty SAND with gravel	SM	SS	1	280	34
1	- some shell fragments		SS	2	410	77
-14.19	- 90 mm cobble					
2	Loose to dense medium brown silty SAND	SM	SS	3	360	42
3	- some gravel		SS	4	430	33
4	- 115 mm cobble		SS	5	380	13
5			SS	6	360	23
6	- 2 X 80 mm cobbles					
7	- 200 mm cobble		SS	7	300	8
8			SS	8	360	10
9						
-21.86	- 350 mm boulder					
10	Very dense dark grey GRAVEL with sand	GW	SS	9	410	96
-22.68	Borehole Terminated at 10.01 m - Target depth					
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

OTHER TESTS

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

CANADRILL SOUTHERN BH LOG QIK2303 CURRENT DRAFT.GPJ GINT STD CANADA.GDT 2024.06.19

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BOREHOLE LOG

BH14

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.28 **COMPLETED** 2024.04.29
GROUND ELEVATION -13.45 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490747.33 E:455949.11
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY MS **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
0	Dense to very dense grey poorly-graded SAND with silt and gravel	SP-SM	SS	1	280	34	S
			SS	2	250	61	
-14.69	Loose to compact grey silty SAND	SM	SS	3	360	27	S
			SS	4	280	27	
			SS	5	530	28	
			SS	6	300	9	
	- 610 mm boulder						
-19.80	Compact grey sandy SILT - some cobbles	ML	SS	7	200	17	S
-21.73	Very dense grey SAND with gravel - some cobbles	SW	SS	8	180	50/30mm	
			SS	9	180	73/130mm	
			SS	10	0	50/80mm	
			SS	11	180	50/110mm	
			SS	12	300	60/130mm	
-28.92	Borehole Terminated at 15.47 m - Target depth						

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

CANADRILL SOUTHERN BH LOG QIK2303 CURRENT DRAFT.GPJ GINT STD CANADA.GDT 2024.06.19

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BOREHOLE LOG

BH15

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.26 **COMPLETED** 2024.04.26
GROUND ELEVATION -13.12 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490677.19 E:455973.1
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY MS **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
0	Compact to dense dark grey silty SAND with gravel	SM	SS	1	130	43	S
	- some shells		SS	2	560	49	
	- 75 mm cobble						
	- 75 mm cobble		SS	3	360	43	
-15.86			SS	4	0	23	
	Loose dark grey silty SAND	SM	SS	5	560	4	
-17.64	- 100 mm cobble		SS	6	250	41	
	Compact to very dense medium brown SAND with gravel to silty SAND	SW	SS	7	0	45	
	-		SS	8	150	50/80mm	
	- 250 mm cobble		SS	9	560	46	
			SS	10	200	21	
-25.13			SS	11	150	50/60mm	
	Very dense grey SAND with gravel to silty SAND	SP	SS	12	0	50/30mm	
	- some gravel						
	- 75 mm cobble						
	- 250 mm cobble						
	- 75 mm cobble						
-28.74	- 75 mm cobble		SS	13	0	68	
	- 75 mm cobble						
	Borehole Terminated at 15.62 m - Target depth						

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

CANADRILL SOUTHERN BH LOG QIK2303 CURRENT DRAFT.GPJ GINT STD CANADA.GDT 2024.06.19

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BOREHOLE LOG

BH16

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.29 **COMPLETED** 2024.04.29
GROUND ELEVATION -4.33 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490760.84 E:455999.35
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY CFH **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
0	-4.48 Compact dark grey silty SAND	SM	SS	1	410	18	
1	Compact to very dense medium brown SAND with silt and gravel		SS	3	0	50/130mm	
2			SS	2	530	52	
3	- 0.450 mm boulder - 3 x 75 mm cobbles	SW-SM					
4	- 0.350 mm boulder - frequent cobbles						
5	-9.13						
6	Loose to compact medium brown silty SAND - some gravel	SM	SS	4	280	18	
			SS	5	200	7	S
7	-10.88 Compact medium brown silty SAND	SM	SS	6	0	16	
8	-12.10		SS	7	460	11	S
9	Loose medium brown silty SAND with gravel	SM	SS	8	360	7	S
10	-14.16						
11	Loose to very dense medium brown silty SAND with gravel	SM	SS	9	0	43	
12			SS	10	50	6	
13	- some small cobbles		SS	11	200	14	
14	- 400 mm boulder						
15	- 150 mm cobble - 300 mm cobble		SS	12	230	50/80mm	
16	-20.64		SS	13	0	50/60mm	
17	Borehole Terminated at 16.3 m - Target depth						
18							
19							
20							

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

CANADRILL SOUTHERN BH LOG QIK2303 CURRENT DRAFT.GPJ GINT STD CANADA.GDT 2024.06.19

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BOREHOLE LOG

BH17

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.25 **COMPLETED** 2024.04.26
GROUND ELEVATION -3.69 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490682.81 E:456024.68
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY MS **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	GRAPHIC LOG	WATER LEVEL	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS
0	Compact to very dense grey SAND with gravel			SW	SS	1	430	23	
					SS	2	360	54	
					SS	3	610	57	
					SS	4	280	50	
3					SS	5	610	102	
-6.74	Loose to compact grey well-graded SAND with silt			SW					
					SS	6	410	29	S
					SS	7	200	14	
-11.00	Loose grey silty SAND			SM	SS	8	200	9	
	- Occasional cobbles								
					SS	9	230	5	S
-13.44	Very dense grey SAND with gravel			SW					
	- 380 mm boulder				SS	10	510	71	
	- 560 mm boulder								
					SS	11	530	62/60mm	
	- Occasional cobbles								
-19.01					SS	12	230	50/80mm	
	Borehole Terminated at 15.32 m - Target depth								

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

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BOREHOLE LOG

BH18

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.04.30 **COMPLETED** 2024.05.01
GROUND ELEVATION -13.57 m CHART **HOLE SIZE** HW mm
DRILLING CONTRACTOR Logan Drilling
NOTES UTM Zone 20W N:7490696.73 E:455966.78
DRILLING METHOD CME 45 Rotary Drill
LOGGED BY CFH **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)
0	medium brown silty GRAVEL with sand to silty SAND with gravel	GP-GM	SS	1	200	45
1			SS	2	460	89
2			SS	3	250	57
3			SS	4	410	75
-16.64	Compact dark grey silty SAND	SP-SM	SS	5	430	11
4			SS	6	410	13
5						
6			SS	7	360	30
-20.17	Very dense medium brown to grey silty SAND with gravel - frequent cobbles - ocassional boulders - 150 mm cobble - 125 mm cobble	SM	SS	8	300	39
7						
8			SS	9	30	50/100mm
9	- 575 mm boulder					
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

OTHER TESTS

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80

(Continued Next Page)

Adaptive Baseline Geotechnical
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BOREHOLE LOG

BH18

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU

DEPTH (m)	MATERIAL DESCRIPTION	GRAPHIC LOG	WATER LEVEL	USCS	TYPE	SAMPLE NUMBER	REC. SOIL (mm) REC. ROCK (%)	N-VALUE RQD (%)	OTHER TESTS	SPT N VALUE / PL MC LL
21	Very dense medium brown to grey silty SAND with gravel - frequent cobbles - ocassional boulders *(continued)* - 75 mm cobble - 175 mm cobble - clayey sand with gravel sampled - 150 mm cobble			SM						
22										
23										
24	-37.57									
25	Very poor to good quality grey granite: BEDROCK - some silt infilling between fractures				RC	10	100%	85%		
26					RC	11	54%	19%		
27					RC	12	77%	41%		
28					RC	13	64%	0%		
29					RC	14	79%	27%		
30	-43.95									
31	Borehole Terminated at 30.38 m - Target depth									
32										
33										
34										
35										
36										
37										
38										
39										
40										
41										
42										

Adaptive Baseline Geotechnical
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BOREHOLE LOG

BH01

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.05.06 **COMPLETED** 2024.05.06
GROUND ELEVATION 2.68 m CHART **HOLE SIZE** 190 mm
DRILLING CONTRACTOR Canadrill Ltd.
NOTES UTM Zone 20W N:7490852.28 E:456026.07
DRILLING METHOD Air Rotary
LOGGED BY CFH **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	GRAPHIC LOG	USCS	GROUND ICE DESCRIPTION	SAMPLE NUMBER	SALINITY (ppt)	SOIL FRACTION (%) GRAVEL	SAND	FINES	MOISTURE CONTENT (%)	RQD (%)
0	FILL: Light brown silty SAND										
0.90				Nbn	1	5	4	63	33	9	
1	Medium brown silty SAND										
2				Nbe	2	6	7	67	26	17	
3			SM								
3.40											
4	Light brown silty SAND			Nbn	3	7	4	73	23	8	
4.60			SM								
5	Dark brown sandy SILT			Nbe	4	10	1	41	58	23	
6			ML								
6.40											
7	Medium grey poorly-graded SAND with silt and gravel										
8					5						
9			SP-SM								
10	- 450 mm boulder										
11	- 600 mm boulder			Nbn	6	14	17	72	11	6	
11.30											
12	Medium brown silty SAND				7						
13			SM								
14					8						
14.63											
15	Borehole Terminated at 14.63 m - Target depth										
16											
17											
18											
19											
20											

▲SPT N VALUE▲ 20 40 60 80
PL MC LL 20 40 60 80
☐FINES (%)☐ 20 40 60 80

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BOREHOLE LOG

BH09

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.05.05 **COMPLETED** 2024.05.05
GROUND ELEVATION 2.18 m CHART **HOLE SIZE** 190 mm
DRILLING CONTRACTOR Canadrill Ltd.
NOTES UTM Zone 20W N:7490746.72 E:456059.52
DRILLING METHOD Air Rotary
LOGGED BY CFH **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	GRAPHIC LOG	USCS	GROUND ICE DESCRIPTION	SAMPLE NUMBER	SALINITY (ppt)	SOIL FRACTION (%) GRAVEL	SAND	FINES	MOISTURE CONTENT (%)	RQD (%)	▲ SPT N VALUE ▲ / PL MC LL / □ FINES (%) □
0	Medium brown silty SAND with gravel to silty SAND		SM	Nbe	1	3	15	71	14	14		
1				Nbe	2	5	3	80	17	11		
2	2.10											
2	Light brown to light grey silty SAND				3							
3												
4				Nbe	4	4	7	79	14	12		
5												
6					5							
7			SM									
8					6							
9												
10												
11	- 300 mm boulder				7							
12												
13												
13	13.40											
14	Sandy SILT		ML		8							
15	14.94				9							
15	Borehole Terminated at 14.94 m - Target depth											
16												
17												
18												
19												
20												

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BOREHOLE LOG

BH10

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.05.06 **COMPLETED** 2024.05.06
GROUND ELEVATION 2.76 m CHART **HOLE SIZE** 190 mm
DRILLING CONTRACTOR Canadrill Ltd.
NOTES UTM Zone 20W N:7490641.92 E:456095.6
DRILLING METHOD Air Rotary
LOGGED BY CFH **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	GRAPHIC LOG	USCS	GROUND ICE DESCRIPTION	SAMPLE NUMBER	SALINITY (ppt)	SOIL FRACTION (%) GRAVEL	SAND	FINES	MOISTURE CONTENT (%)	RQD (%)
1	Medium brown silty SAND with gravel - 75 mm ice layer - 450 mm boulder		SM	Nbe	1	0	23	64	13	21	
2	2.10										
3	Dark grey silty SAND with gravel to silty SAND		SM	Nbe	2	4	6	71	23	12	
4	4.00										
5	Medium brown silty SAND		SM	Nbe	3	5	2	65	33	19	
6					4						
7											
8	8.20			Nbe	5	6	6	72	22	15	
9	Light grey silty SAND		SM		6						
10											
11				Nbe	7	5	1	87	12	28	
12	12.20										
13	Light brown silty SAND		SM		8						
14											
	14.63				9						
15	Borehole Terminated at 14.63 m - Target depth										
16											
17											
18											
19											
20											

▲SPT N VALUE▲ 20 40 60 80
PL MC LL 20 40 60 80
☐FINES (%)☐ 20 40 60 80

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BOREHOLE LOG

BH11

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.05.07 **COMPLETED** 2024.05.07
GROUND ELEVATION 17 m CHART **HOLE SIZE** 190 mm
DRILLING CONTRACTOR Canadrill Ltd.
NOTES UTM Zone 20W N:7490918.05 E:456075.48
DRILLING METHOD Air Rotary
LOGGED BY CFH **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	GRAPHIC LOG	USCS	GROUND ICE DESCRIPTION	SAMPLE NUMBER	SALINITY (ppt)	SOIL FRACTION (%) GRAVEL	SAND	FINES	MOISTURE CONTENT (%)	RQD (%)
0.05	Dark brown ROOTMAT/Topsoil										
1	Light brown silty SAND										
2	- frequent cobbles		SM	Nbn	1	5	8	66	26	9	
3					2						
3.40	Medium brown silty SAND										
4											
5											
6			SM	Nbe	3	5	5	70	25	11	
7	- 450 mm boulder										
7.60	Light brown silty SAND										
8											
9					4						
10	- 150 mm cobble										
11	- 450 mm boulder		SM		5						
12					6						
13	- 300 mm boulder - 450 mm boulder										
14											
14.63					7						
15	Borehole Terminated at 14.63 m - Target depth										
16											
17											
18											
19											
20											

▲SPT N VALUE▲
20 40 60 80
PL MC LL
20 40 60 80
☐FINES (%)☐
20 40 60 80

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BOREHOLE LOG

BH12

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.05.08 **COMPLETED** 2024.05.08
GROUND ELEVATION 18.39 m CHART **HOLE SIZE** 190 mm
DRILLING CONTRACTOR Canadrill Ltd.
NOTES UTM Zone 20W N:7490766.64 E:456138.77
DRILLING METHOD Air Rotary
LOGGED BY CFH **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	GRAPHIC LOG	USCS	GROUND ICE DESCRIPTION	SAMPLE NUMBER	SALINITY (ppt)	SOIL FRACTION (%) GRAVEL	SAND	FINES	MOISTURE CONTENT (%)	RQD (%)	▲SPT N VALUE▲ 20 40 60 80 / PL MC LL 20 40 60 80 / □FINES (%)□ 20 40 60 80
0.08	Dark brown ROOTMAT/Topsoil											
1	Light brown silty SAND with gravel			Nbn	1	0	26	52	22	7		● □
2	- frequent cobbles		SP									
3					2							
4												
4.30												
5	Light brown silty SAND			Nbe	3	6	3	54	43	20		● □
6			SM									
7					4							
7.60												
8	Light brown silty SAND											
9	- 300 mm boulder											
10	- 450 mm boulder											
11	- 300 mm boulder											
12	- 150 mm cobble		SM	Nbn	5	0	4	77	19	5		● □
13	- 750 mm boulder											
14					6							
14.63	- 150 mm cobble											
15	Borehole Terminated at 14.63 m - Target depth											
16												
17												
18												
19												
20												

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BOREHOLE LOG

BH13

CLIENT CBCL Limited
PROJECT NAME Qikiqtarjuaq Marine Infrastructure
PROJECT NUMBER QIK-G2303
PROJECT LOCATION Qikiqtarjuaq, NU
DATE STARTED 2024.05.07 **COMPLETED** 2024.05.07
GROUND ELEVATION 19.62 m CHART **HOLE SIZE** 190 mm
DRILLING CONTRACTOR Canadrill Ltd.
NOTES UTM Zone 20W N:7490648.06 E:456179.99
DRILLING METHOD Air Rotary
LOGGED BY CFH **CHECKED BY** LF

DEPTH (m)	MATERIAL DESCRIPTION	USCS	GROUND ICE DESCRIPTION	SAMPLE NUMBER	SALINITY (ppt)	SOIL FRACTION (%) GRAVEL	SAND	FINES	MOISTURE CONTENT (%)	RQD (%)
0.05	Dark brown ROOTMAT/Topsoil									
1	Light brown silty SAND		Nbe	1	0	5	68	27	27	
2	- frequent cobbles - 300 mm boulder	SM								
3			Nbe	2	0	4	70	26	13	
4										
4.60										
5	Grey to light brown silty SAND			3						
6		SM								
7			Nbe	4	4	3	60	37	14	
8										
8.20										
9	Light brown GRAVEL with sand	GP		5						
9.50										
10	Dark grey silty SAND with gravel									
11			Nbe	6	12	17	68	15	11	
12	- 750 mm boulder	SP-SM								
13										
14				7						
14.63										
15	Borehole Terminated at 14.63 m - Target depth									
16										
17										
18										
19										
20										

▲SPT N VALUE▲ 20 40 60 80
PL MC LL 20 40 60 80
☐FINES (%)☐ 20 40 60 80

CANADRILL BH/TP LOG QIK2303 CURRENT DRAFT.GPJ GINT STD CANADA.GDT 2024.06.19

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	1 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	April 29, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	BH03
CORE DIAMETER:	64 mm	**LENGTH OF CORE RUN:**	7.21 m

18.01 - 20.25	20.25 - 22.20	22.20 - 23.62
		
L = 300 mm L = 120 mm	L = 230 mm L = 260 mm L = 340 mm	L = 550 mm L = 360 mm

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	2 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	April 29, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	BH03
CORE DIAMETER:	64 mm	**LENGTH OF CORE RUN:**	7.21 m

23.62 - 25.22		
 L = 240 mm L = 300 mm L = 520 mm		**RQD = 3.22/7.21 = 45%**

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	1 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	April 27, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	BH05
CORE DIAMETER:	64 mm	**LENGTH OF CORE RUN:**	3.97 m

27.22 - 27.80	**27.80 - 28.42**	**28.42 - 30.46**
	 L = 180 mm	 L = 110 mm L = 310 mm

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	2 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	April 27, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	BH05
CORE DIAMETER:	64 mm	**LENGTH OF CORE RUN:**	3.97 m

30.46 - 31.19

L = 200 mm

L = 200 mm

RQD = 1.00/3.97 = 25%

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	1 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	April 30, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	BH18
CORE DIAMETER:	64 mm	**LENGTH OF CORE RUN:**	6.38 m

24.00 - 25.83 m	**25.83 - 27.48**	**27.83 - 28.88**
 L = 300 mm L = 100 mm L = 120 mm	 L = 240 mm L = 500 mm	

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	2 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	April 30, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	BH18
CORE DIAMETER:	64 mm	**LENGTH OF CORE RUN:**	6.38 m

28.88 - 30.38

L = 140 mm

L = 180 mm

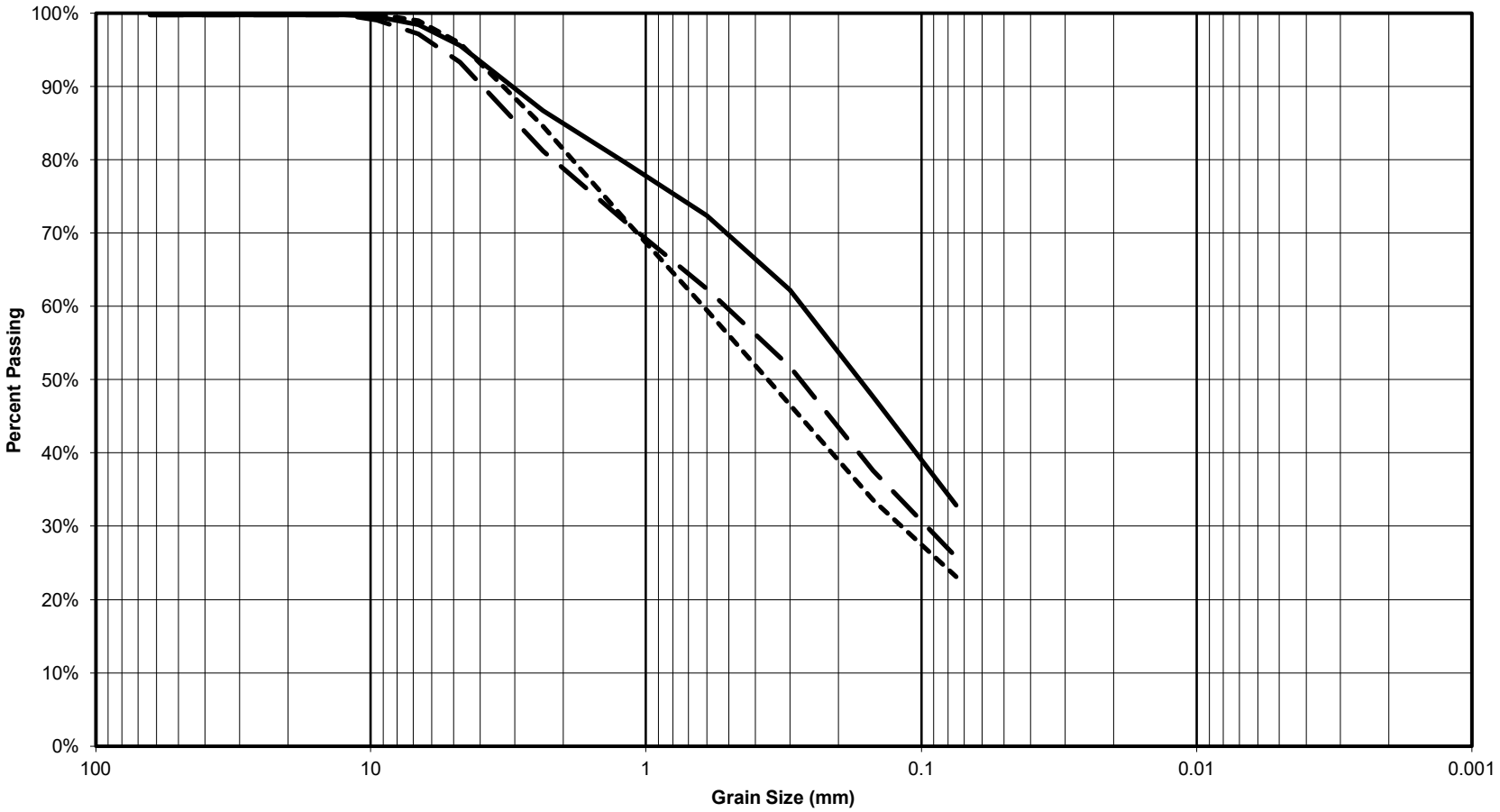
L = 220 mm

L = 250 mm

RQD = 2.05/6.38 = 32%

Grain Size Analysis

Project: QIK-G2303



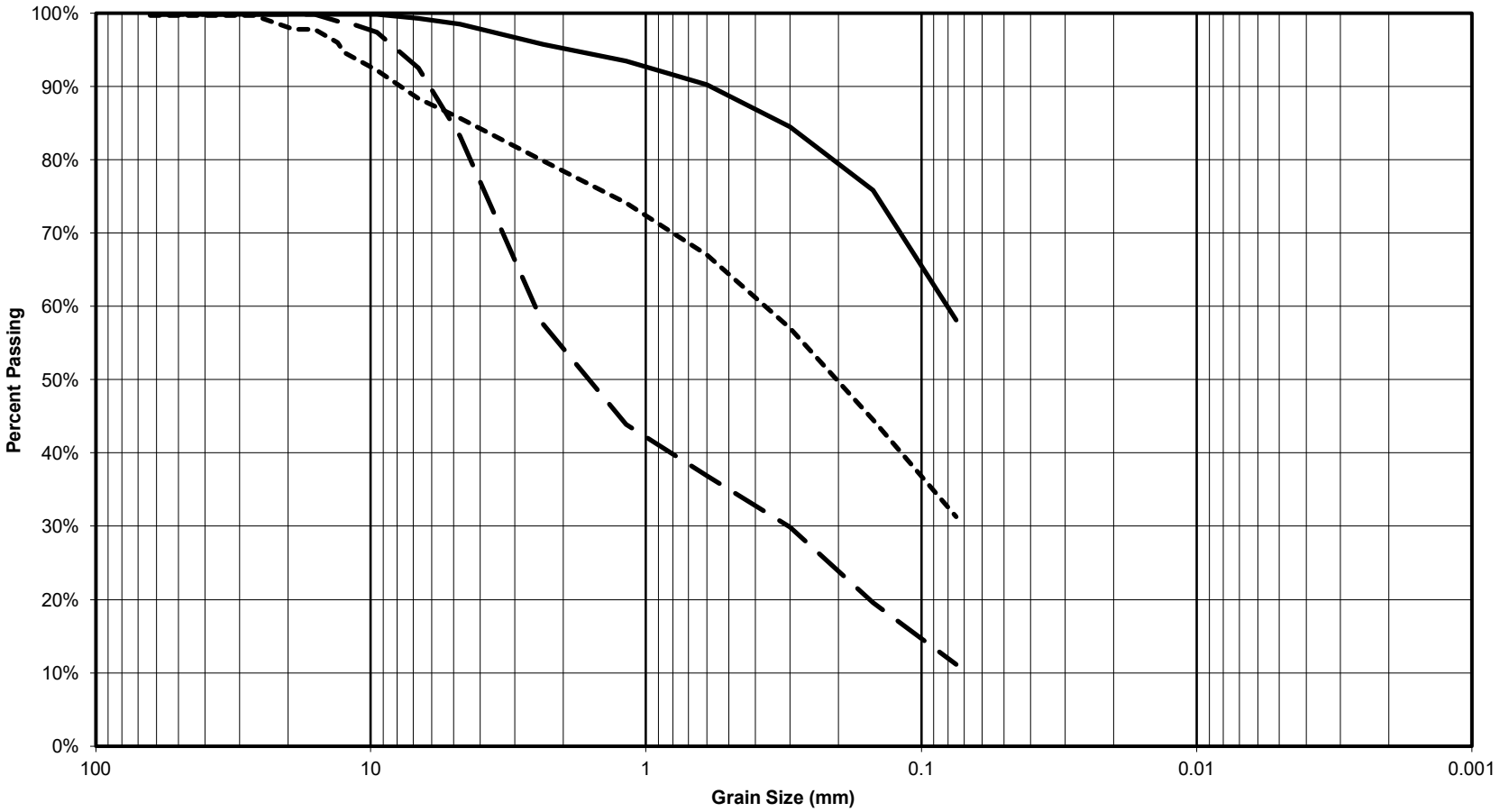
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH01	GB1	0.3 - 0.6	4%	63%	33%	8.7%	Silty SAND
— —	BH01	GB2	1.5 - 1.8	7%	67%	26%	17.3%	Silty SAND
- - - -	BH01	GB3	3.3 - 3.6	4%	73%	23%	7.6%	Silty SAND

Grain Size Analysis

Project: QIK-G2303



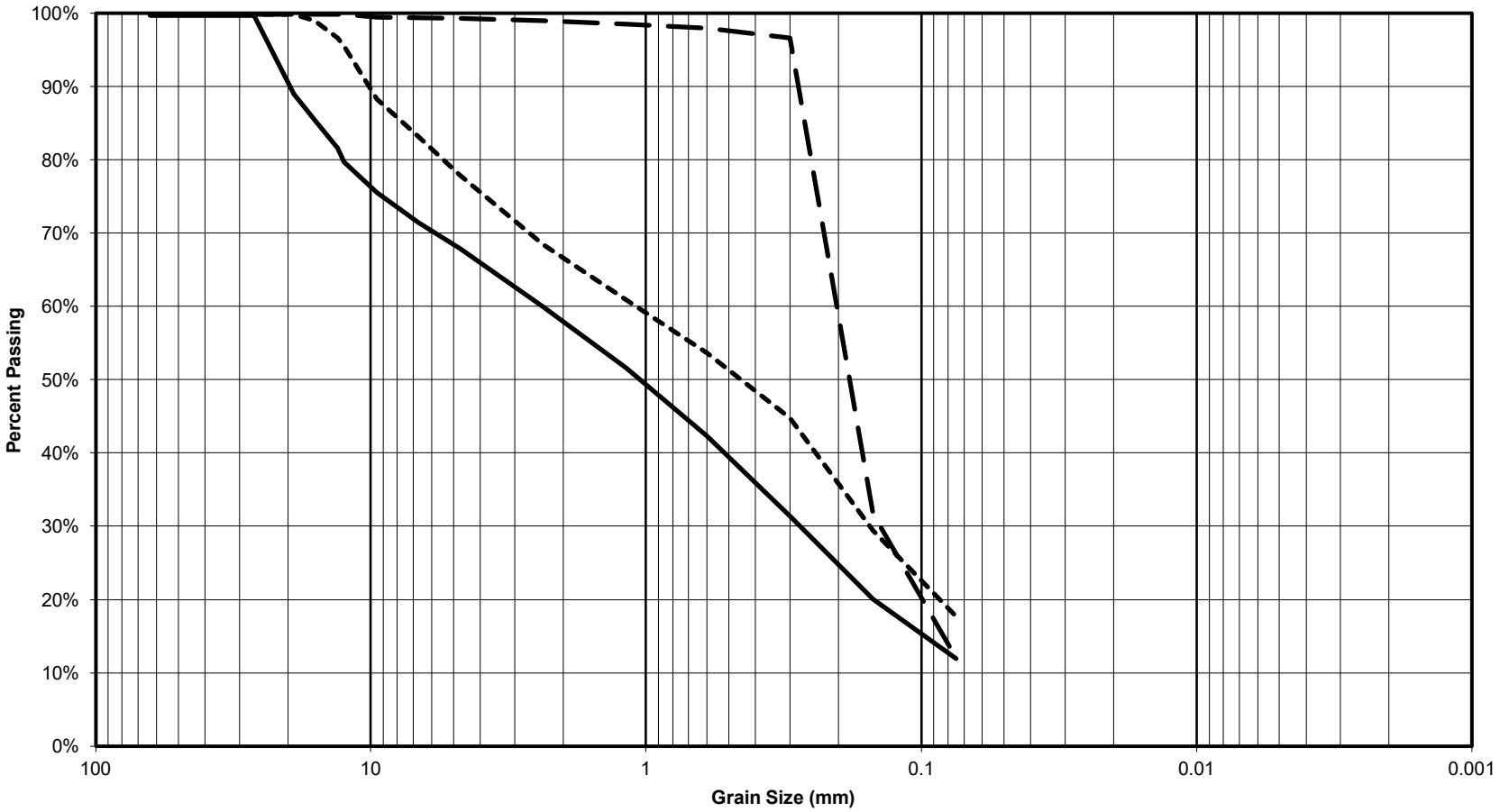
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH01	GB4	4.9 - 5.2	1%	41%	58%	23.3%	Sandy SILT
— —	BH01	GB6	10.1 - 10.4	17%	72%	11%	5.6%	Poorly-graded SAND with silt and gravel
- - - -	BH03	SS2	1.3 - 1.9	14%	55%	31%	9.2%	Silty SAND

Grain Size Analysis

Project: QIK-G2303



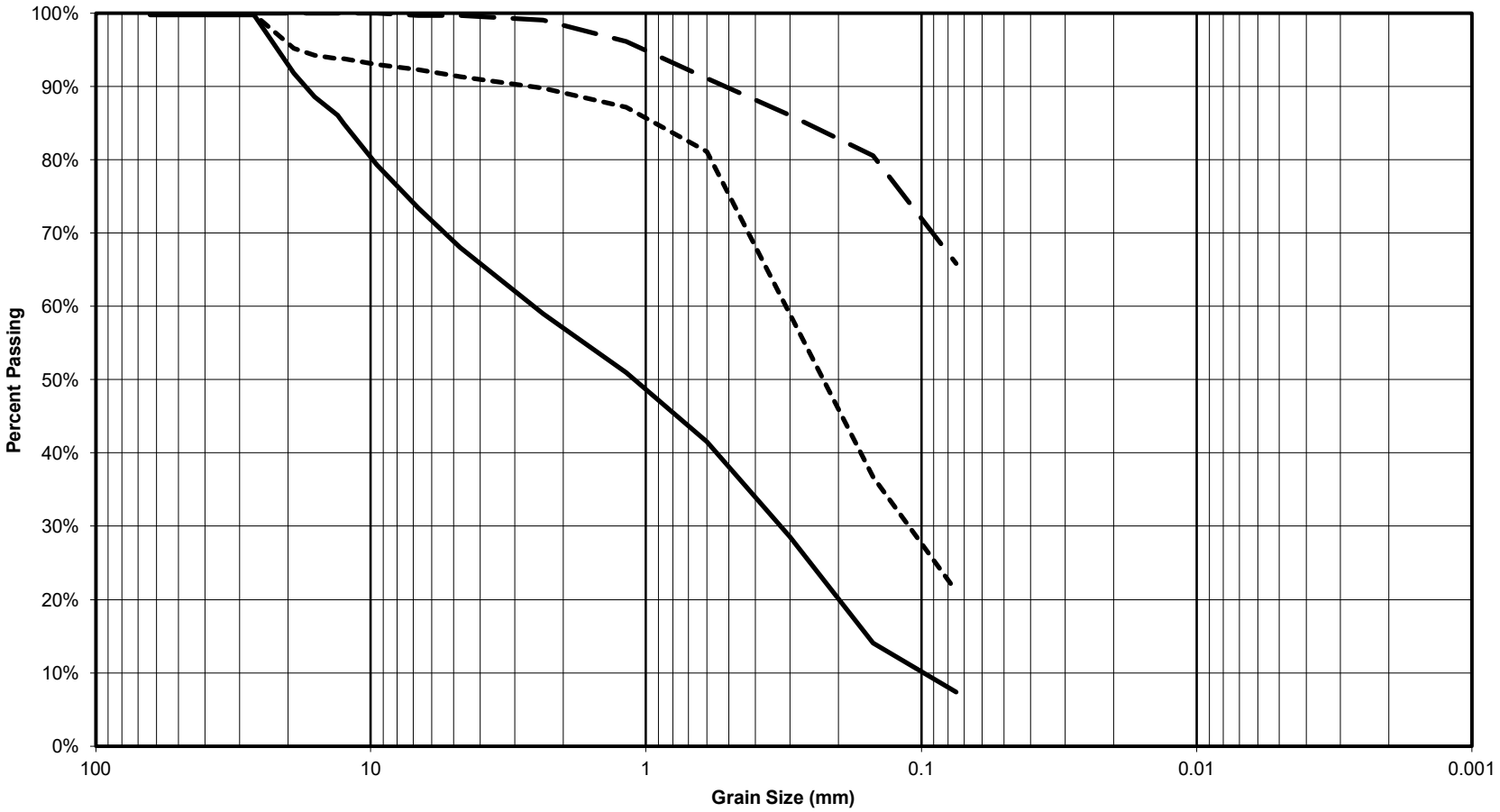
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH03	SS4	1.9 - 2.5	32%	56%	12%	9.1%	Poorly-graded SAND with silt and gravel
— —	BH03	SS7	4.8 - 5.4	1%	87%	12%	22.7%	Silty SAND
- - - -	BH03	SS13	12.1 - 12.7	22%	60%	18%	10.4%	Silty SAND with gravel

Grain Size Analysis

Project: QIK-G2303



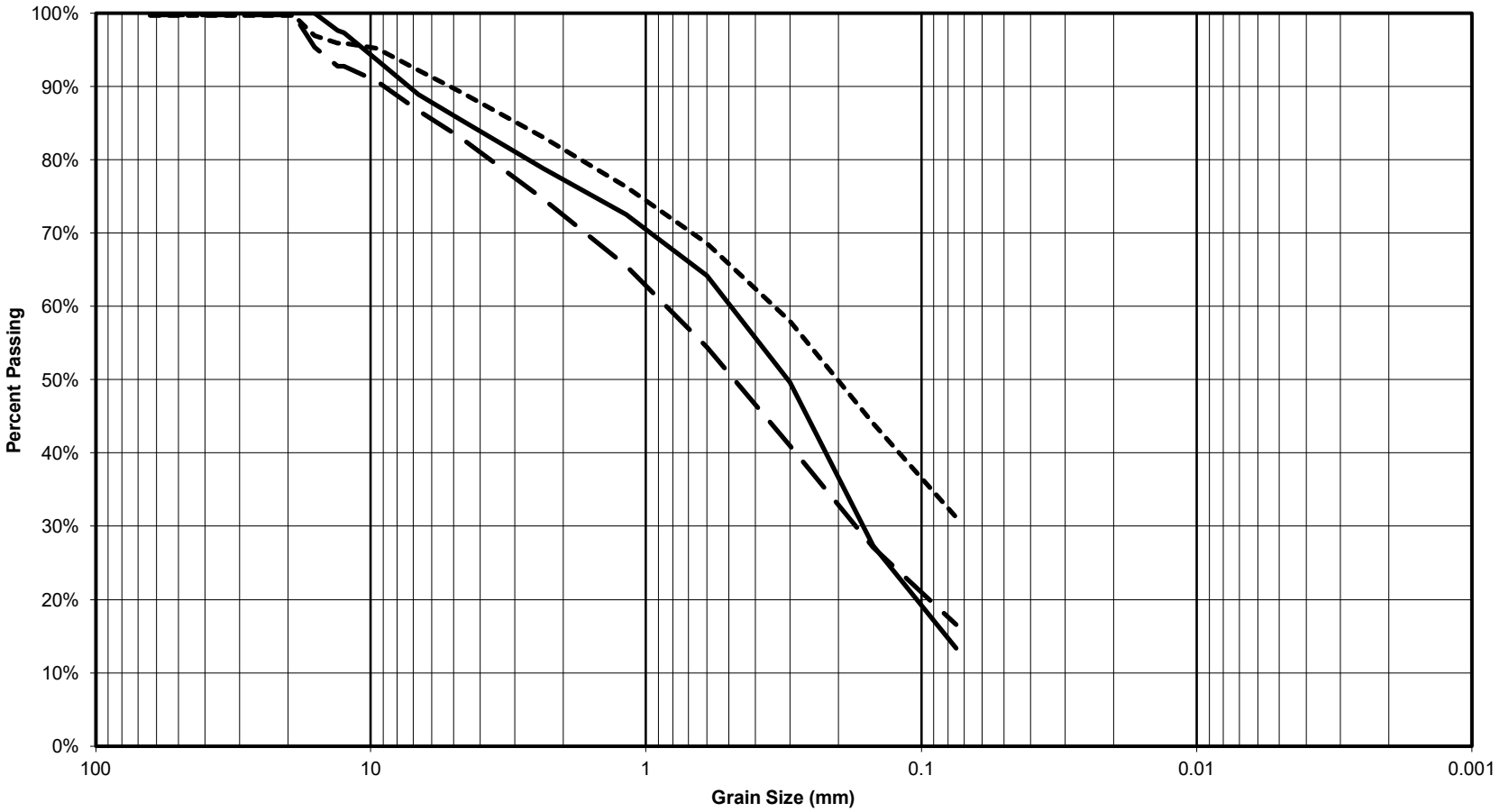
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH04	SS4	2.1 - 2.7	32%	61%	7%	8.7%	Poorly-graded SAND with silt and gravel
— —	BH04	SS6	4.6 - 5.2	0%	34%	66%	25.7%	Sandy SILT
- - - -	BH04	SS9	9.1 - 9.8	9%	70%	21%	12.0%	Silty SAND

Grain Size Analysis

Project: QIK-G2303



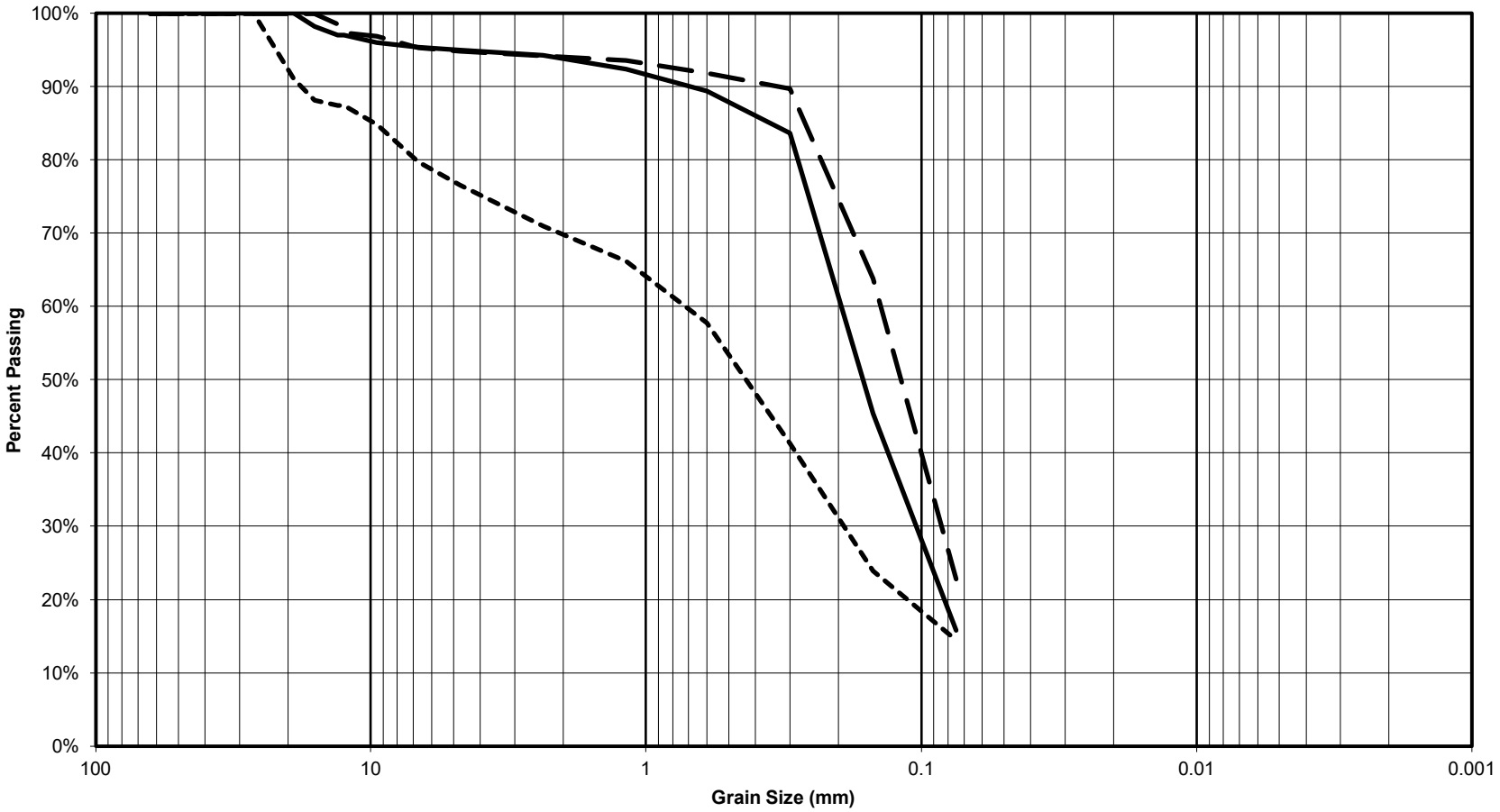
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH05	SS2	0.6 - 1.2	14%	73%	13%	14.1%	Silty SAND
— —	BH05	SS5	3.4 - 4	17%	66%	17%	10.0%	Silty SAND with gravel
- - - -	BH05	SS12	13.2 - 13.6	11%	58%	31%	9.8%	Silty SAND

Grain Size Analysis

Project: QIK-G2303



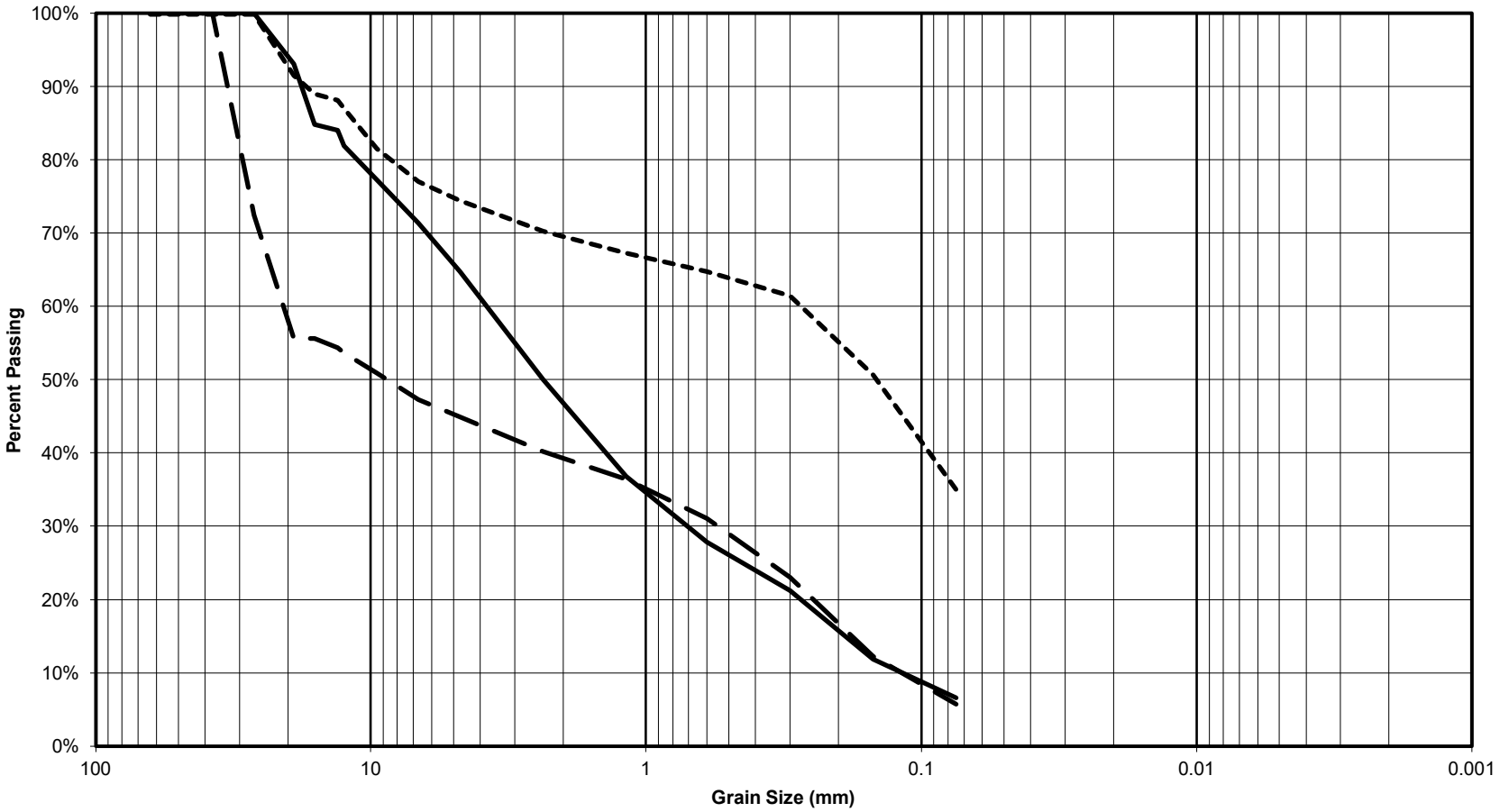
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH06	SS1	0 - 0.6	5%	79%	16%	26.9%	Silty SAND
— —	BH06	SS4	2.1 - 2.7	5%	72%	23%	26.6%	Silty SAND
- - - -	BH06	SS7	5.8 - 6.4	23%	63%	14%	11.8%	Silty SAND with gravel

Grain Size Analysis

Project: QIK-G2303



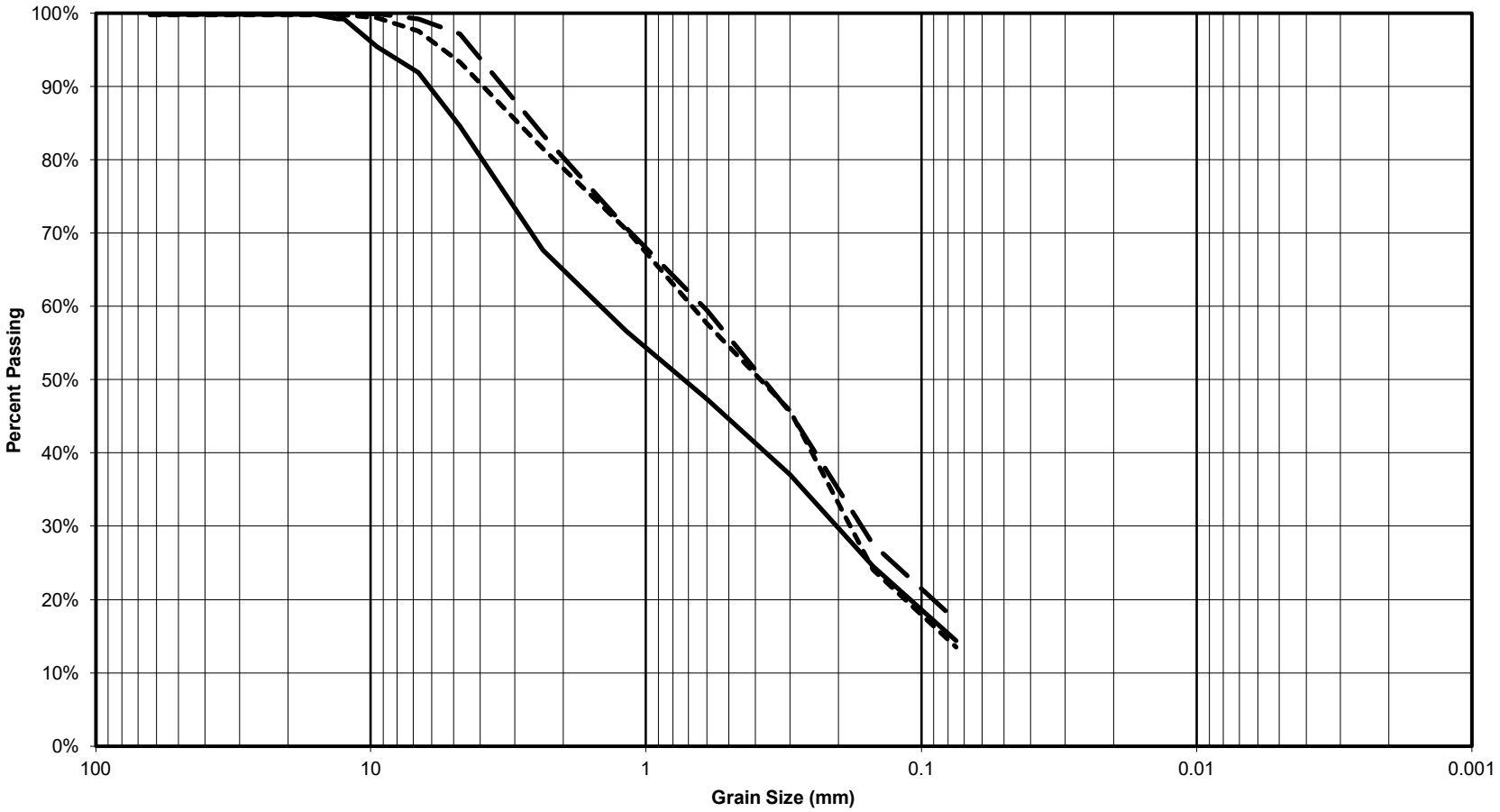
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH07	SS2	1.5 - 2.1	35%	58%	7%	7.8%	Well-graded SAND with silt and gravel
— —	BH07	SS7	9.2 - 9.8	55%	39%	6%	16.3%	Poorly-graded GRAVEL with silt and sand
- - - -	BH07	SS8	10.7 - 11.3	26%	39%	35%	23.3%	Silty SAND with gravel

Grain Size Analysis

Project: QIK-G2303



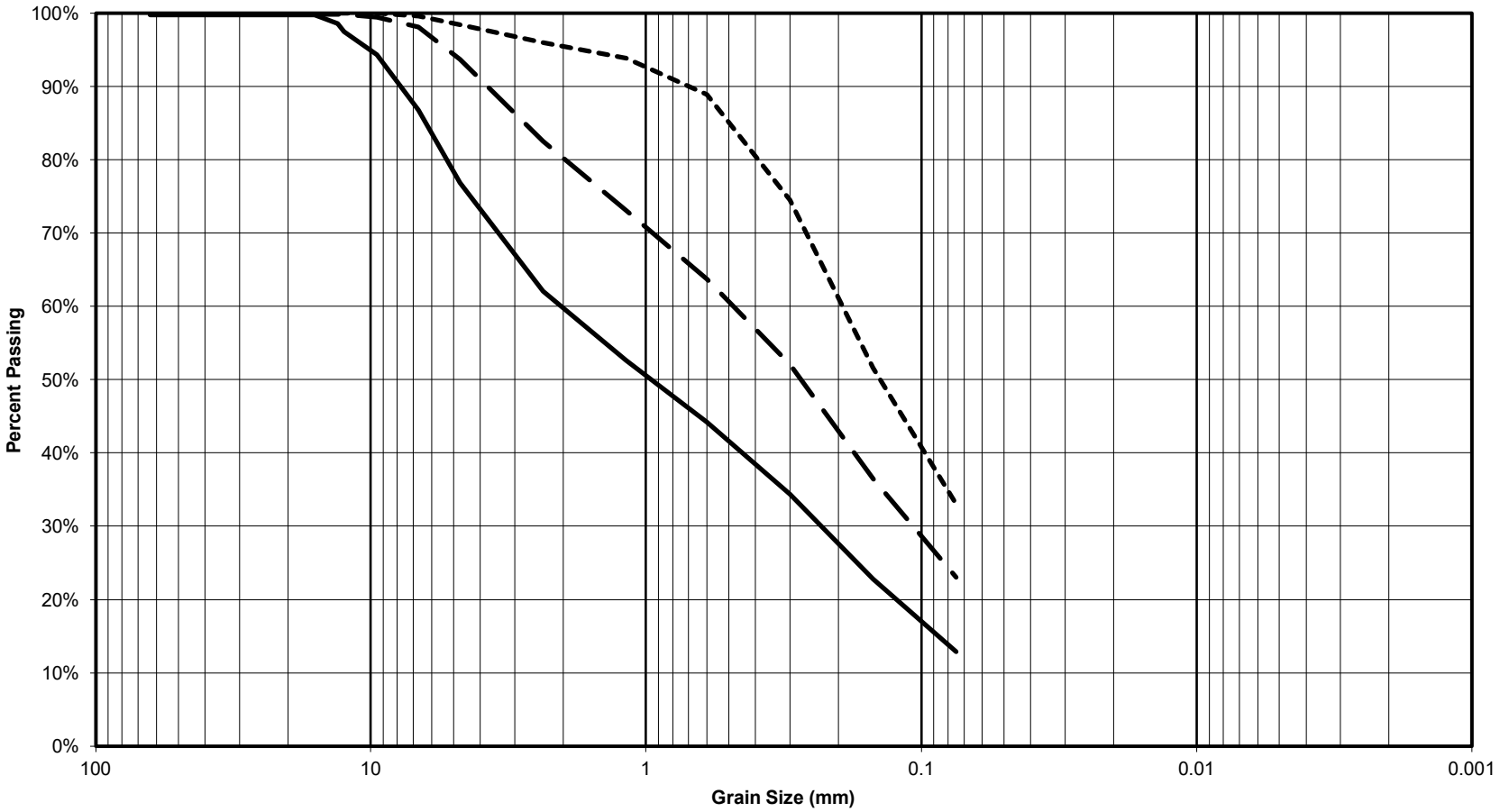
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH09	GB1	0.3 - 0.6	15%	71%	14%	19.7%	Silty SAND with gravel
— —	BH09	GB2	1.2 - 1.4	3%	80%	17%	10.9%	Silty SAND
- - - -	BH09	GB4	4.3 - 4.6	7%	79%	14%	12.3%	Silty SAND

Grain Size Analysis

Project: QIK-G2303



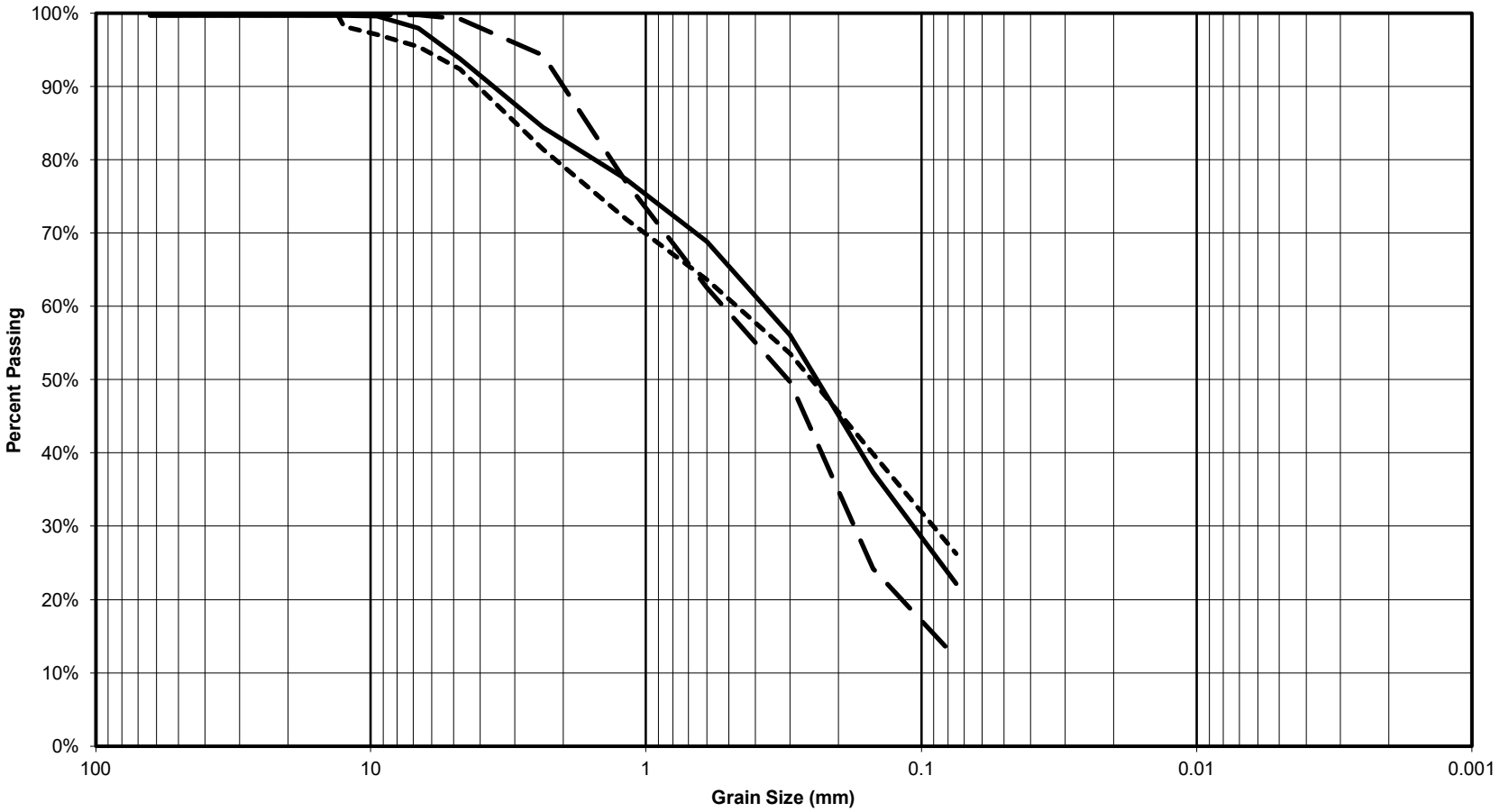
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH10	GB1	0.6 - 0.9	23%	64%	13%	21.4%	Silty SAND with gravel
— —	BH10	GB2	2.4 - 2.7	6%	71%	23%	11.7%	Silty SAND
- - - -	BH10	GB3	4.3 - 4.9	2%	65%	33%	18.9%	Silty SAND

Grain Size Analysis

Project: QIK-G2303



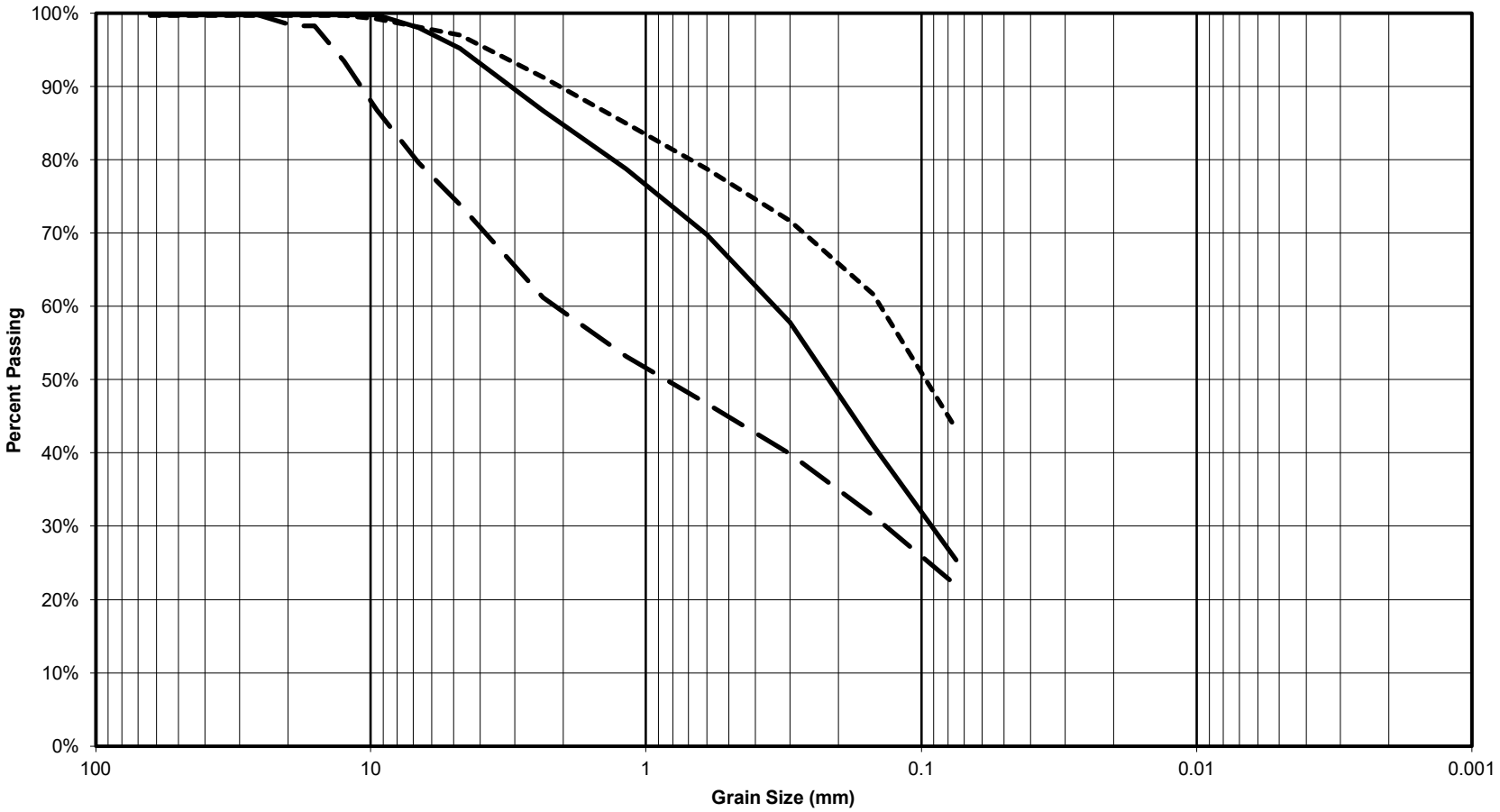
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH10	GB5	7.6 - 7.9	6%	72%	22%	15.0%	Silty SAND
— —	BH10	GB7	10.7 - 11.3	1%	87%	12%	27.9%	Silty SAND
- - - -	BH11	GB1	1.2 - 1.5	8%	66%	26%	9.1%	Silty SAND

Grain Size Analysis

Project: QIK-G2303



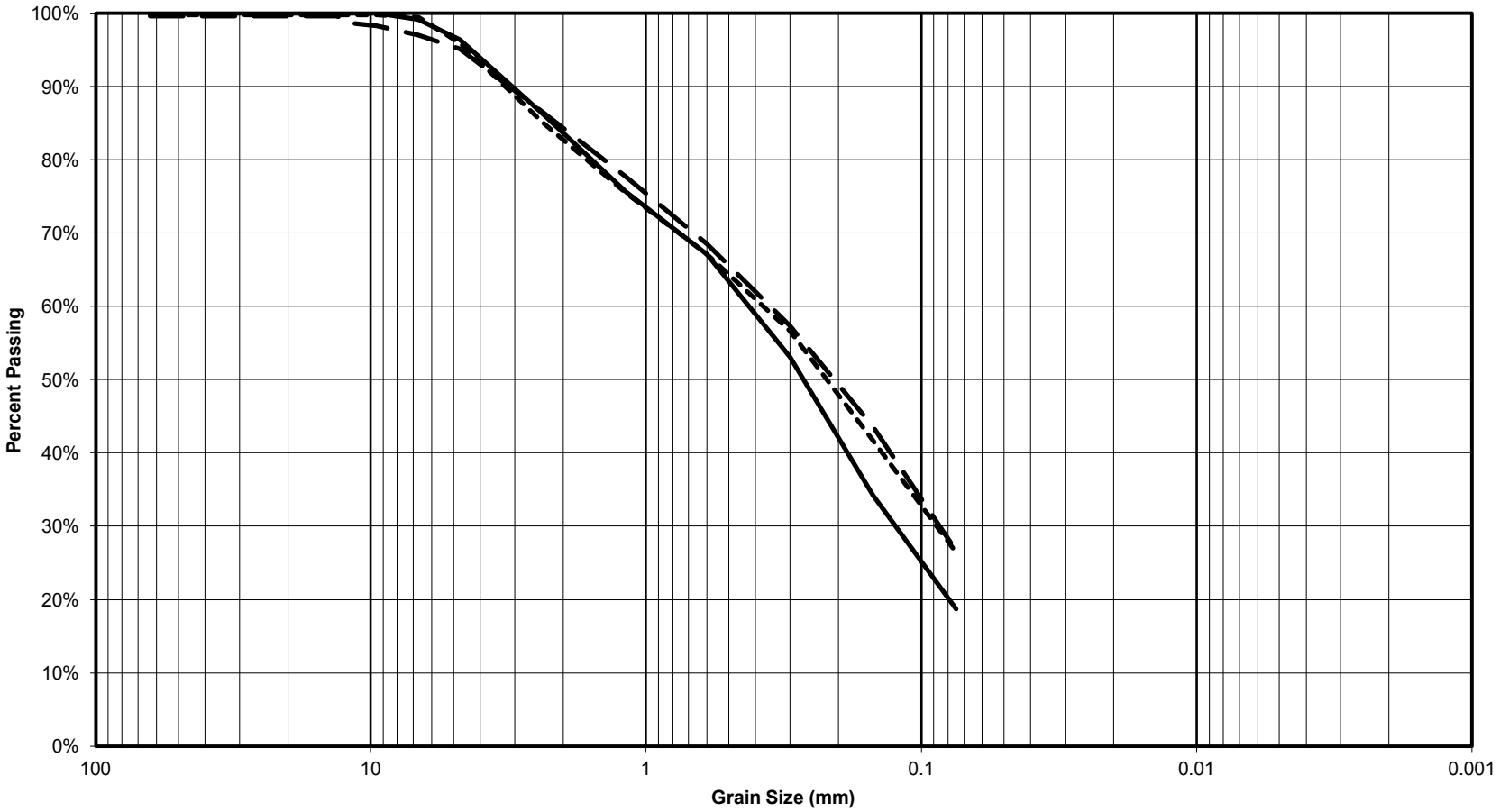
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH11	GB3	5.2 - 5.5	5%	70%	25%	10.5%	Silty SAND
— —	BH12	GB1	0.3 - 0.6	26%	52%	22%	6.7%	Silty SAND with gravel
- - - -	BH12	GB3	4.6 - 4.9	3%	54%	43%	20.2%	Silty SAND

Grain Size Analysis

Project: QIK-G2303



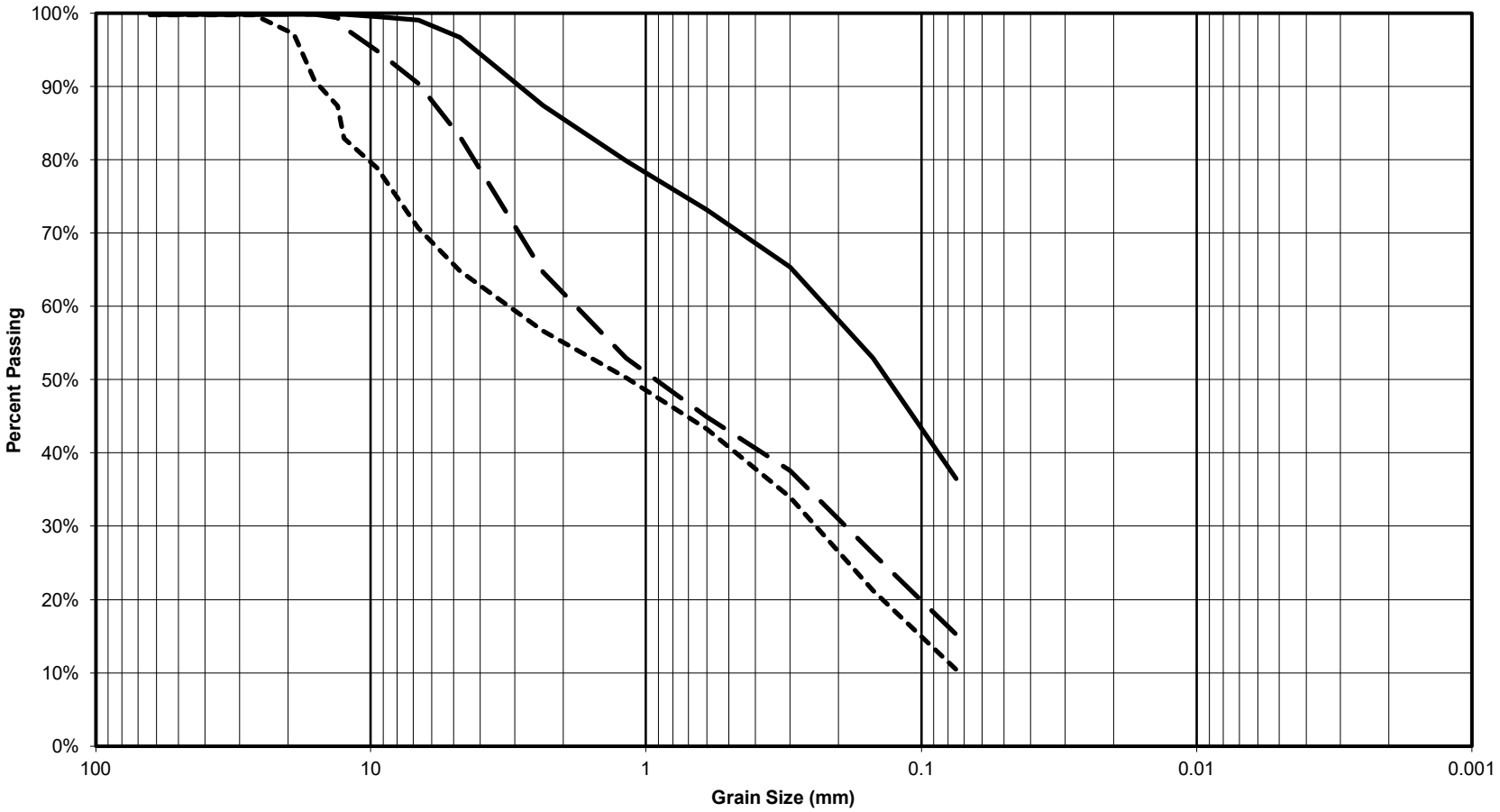
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH12	GB5	10.7 - 11.9	4%	77%	19%	5.1%	Silty SAND
— —	BH13	GB1	0.3 - 0.6	5%	68%	27%	27.2%	Silty SAND
- - - -	BH13	GB2	2.1 - 2.4	4%	70%	26%	12.8%	Silty SAND

Grain Size Analysis

Project: QIK-G2303



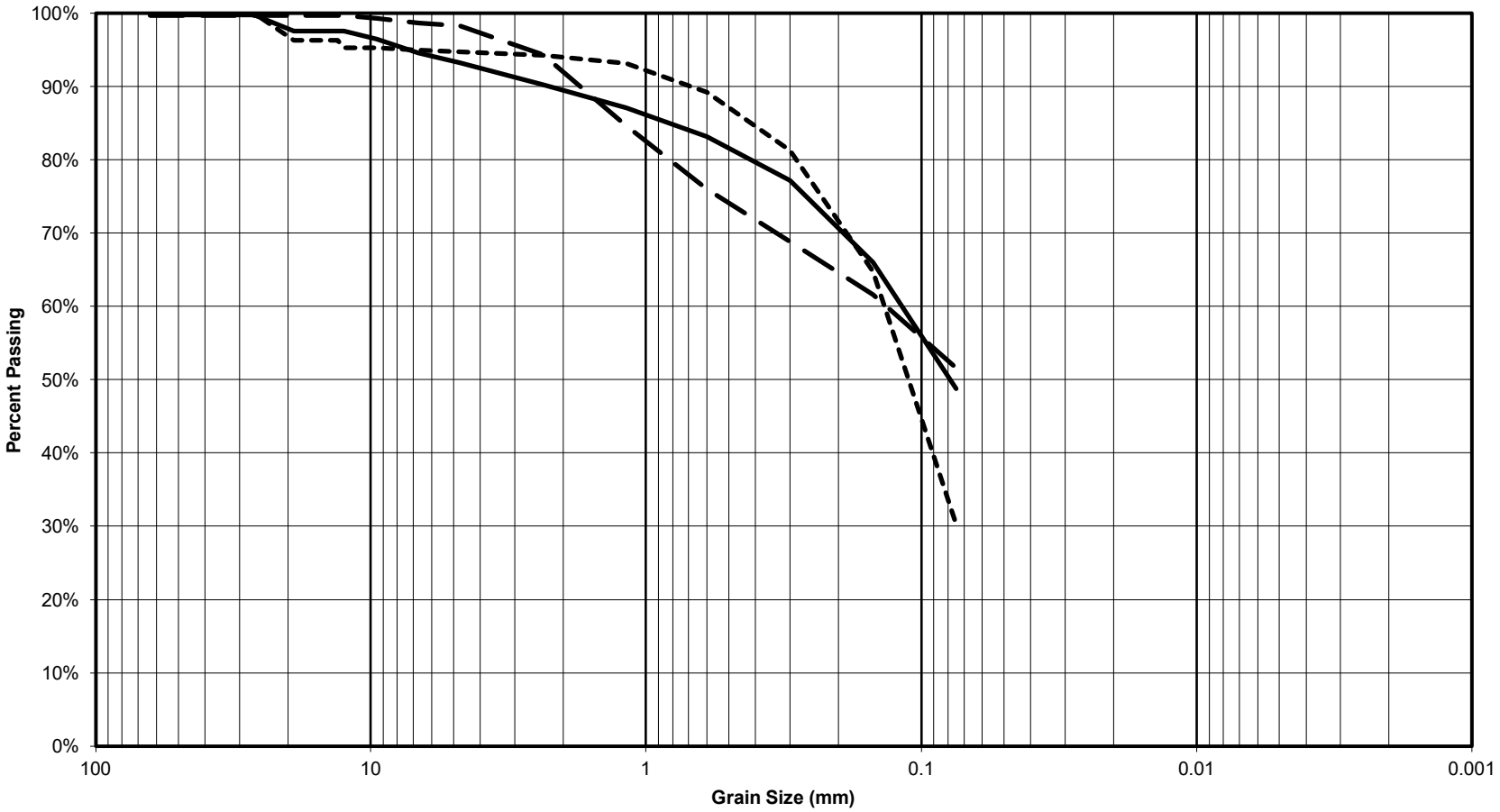
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH13	GB4	6.4 - 6.7	3%	60%	37%	13.9%	Silty SAND
— —	BH13	GB6	10.7 - 11.0	17%	68%	15%	10.9%	Silty SAND with gravel
- - - -	BH14	SS1	0.0 - 0.6	35%	55%	10%	13.1%	Poorly-graded SAND with silt and gravel

Grain Size Analysis

Project: QIK-G2303



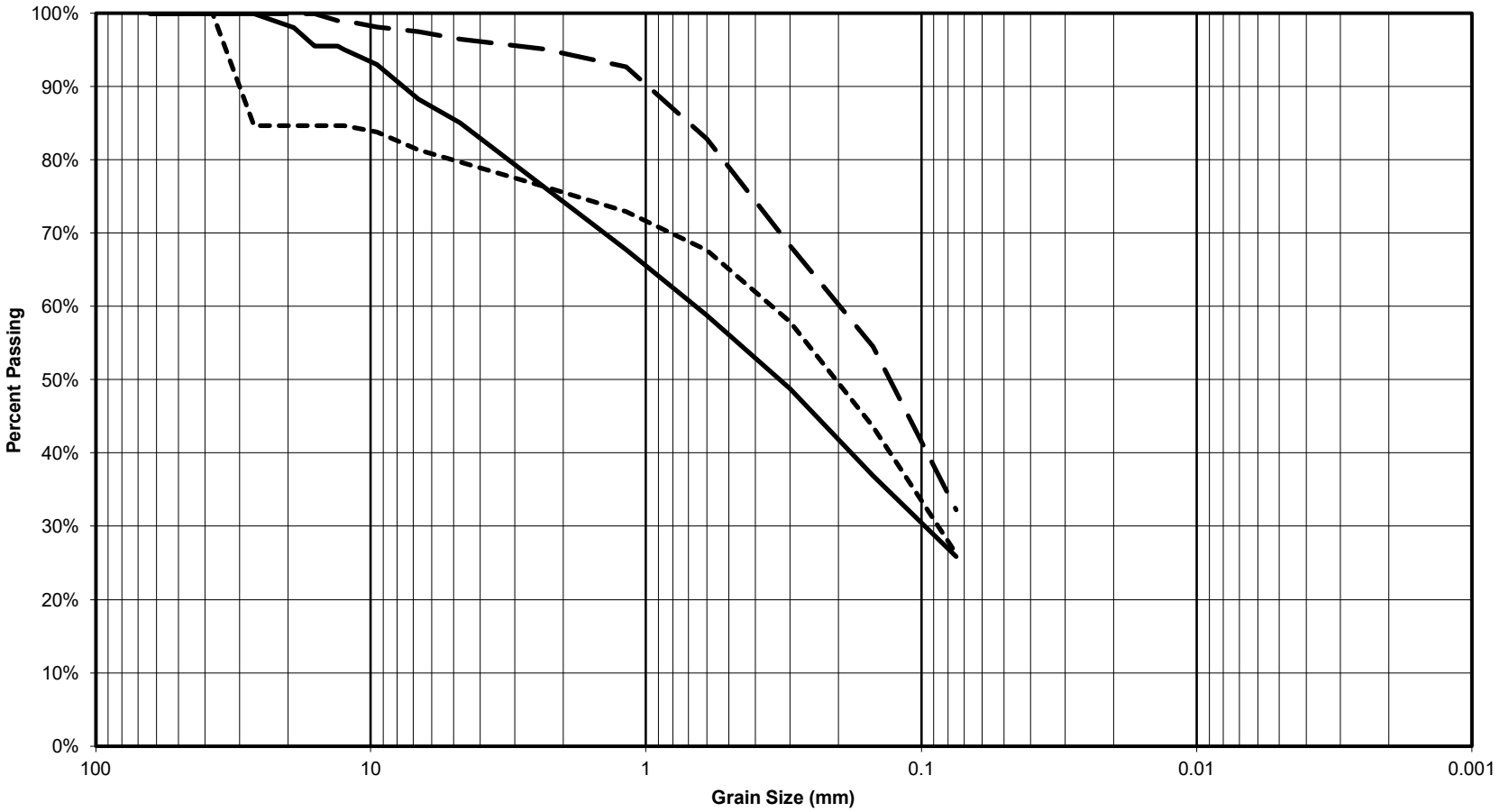
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH14	SS3	1.2 - 1.9	7%	44%	49%	12.1%	Silty SAND
— —	BH14	SS7	6.4 - 7.0	2%	46%	52%	17.4%	Sandy SILT
- - - -	BH15	SS5	3.0 - 3.6	5%	65%	30%	22.6%	Silty SAND

Grain Size Analysis

Project: QIK-G2303



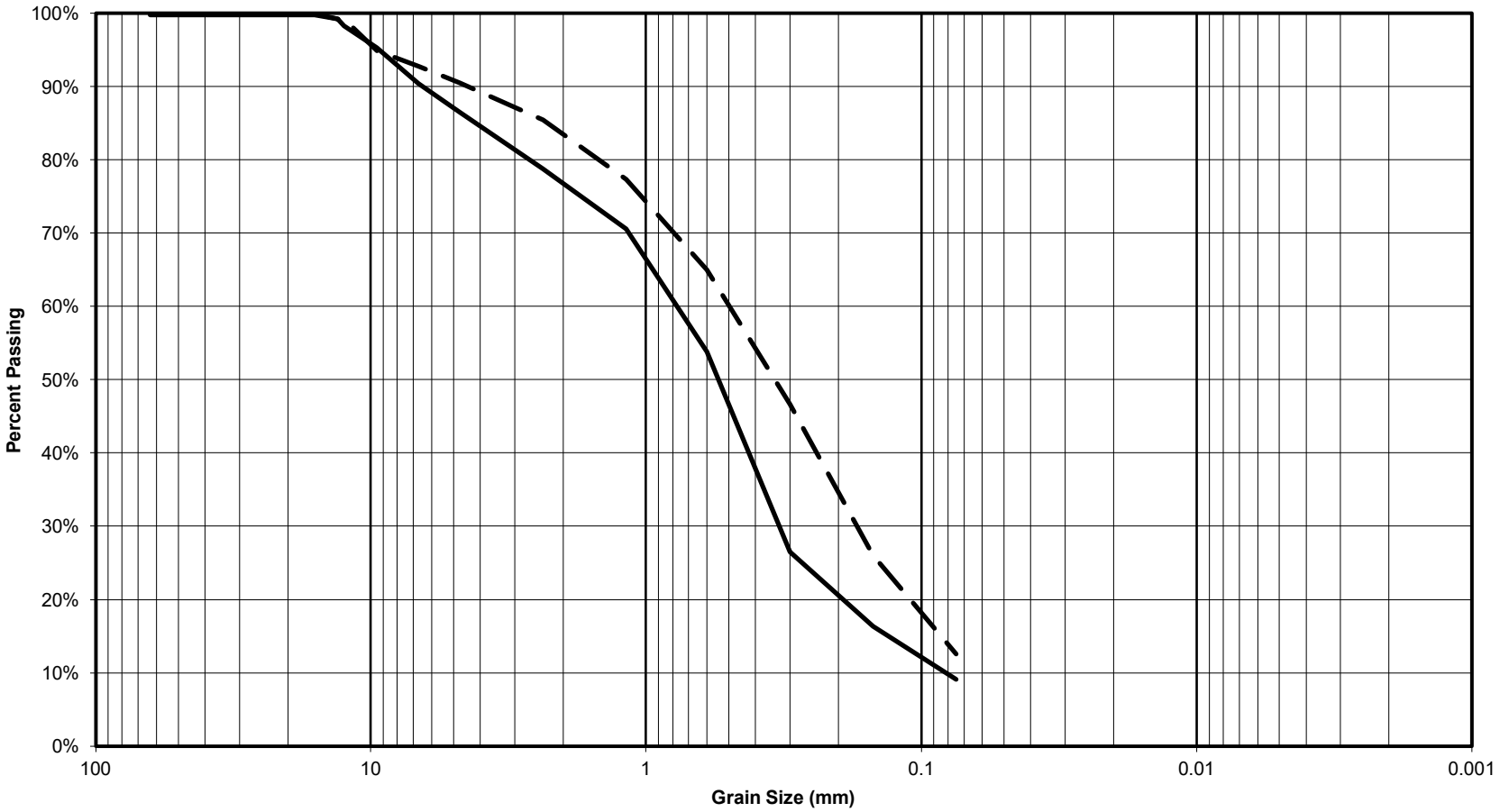
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH16	SS5	5.4 - 6.0	15%	59%	26%	11.7%	Silty SAND
— —	BH16	SS7	7.2 - 7.8	4%	64%	32%	25.3%	Silty SAND
- - - -	BH16	SS8	8.2 - 8.4	20%	54%	26%	14.3%	Silty SAND with gravel

Grain Size Analysis

Project: QIK-G2303



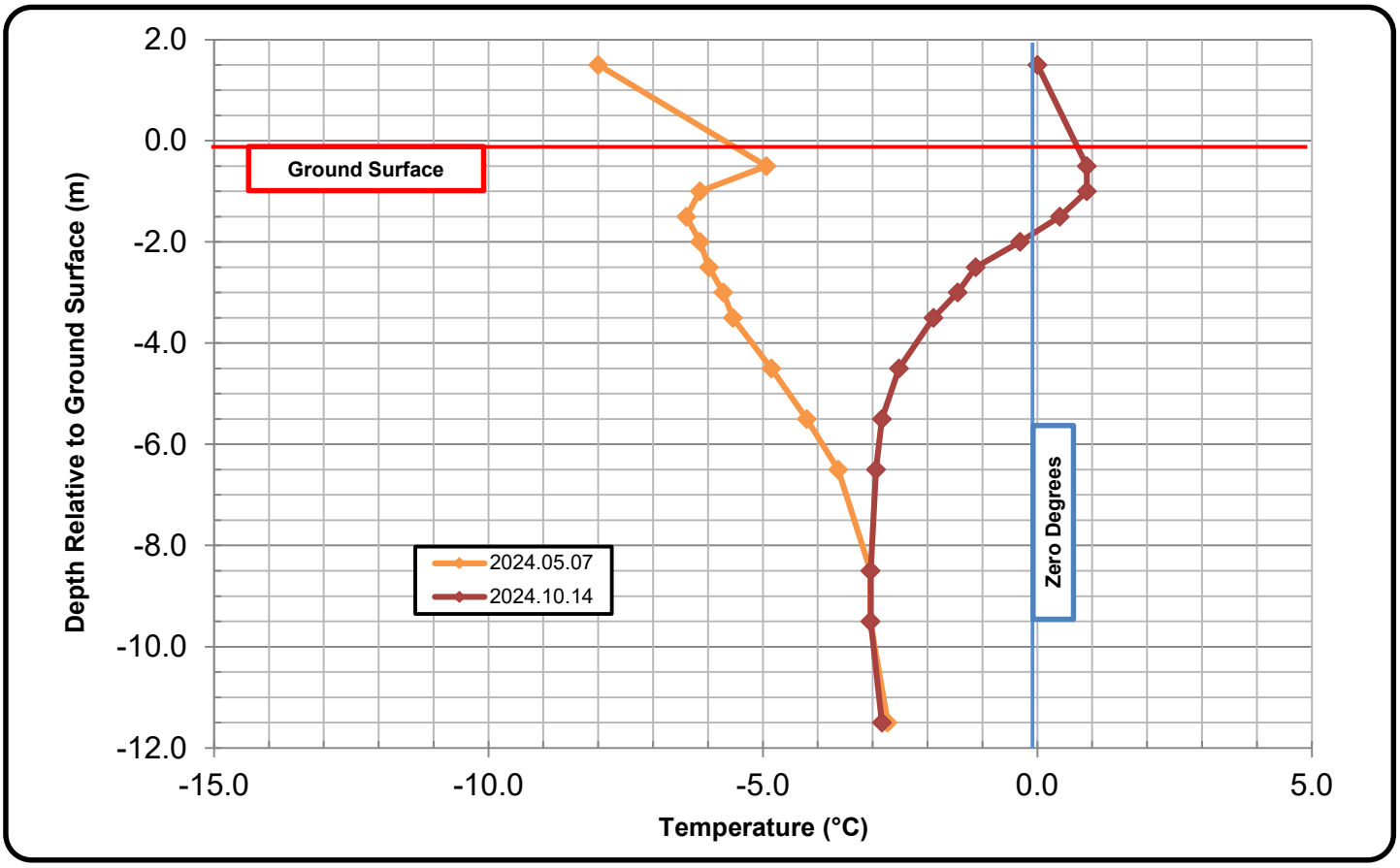
Gravel		Sand			Silt and Clay
Coarse	Fine	Coarse	Medium	Fine	

Unified Soil Classification System ASTM D 2487/2488

Curve	Borehole/Testpit	Sample	Depth (m)	Soil Fractions			Moisture Content	Soil Description
				Gravel	Sand	Silt/Clay		
———	BH17	SS6	4.3 - 4.9	14%	77%	9%	13.4%	Well-graded SAND with silt
— —	BH17	SS9	8.8 - 9.5	10%	77%	13%	15.9%	Silty SAND

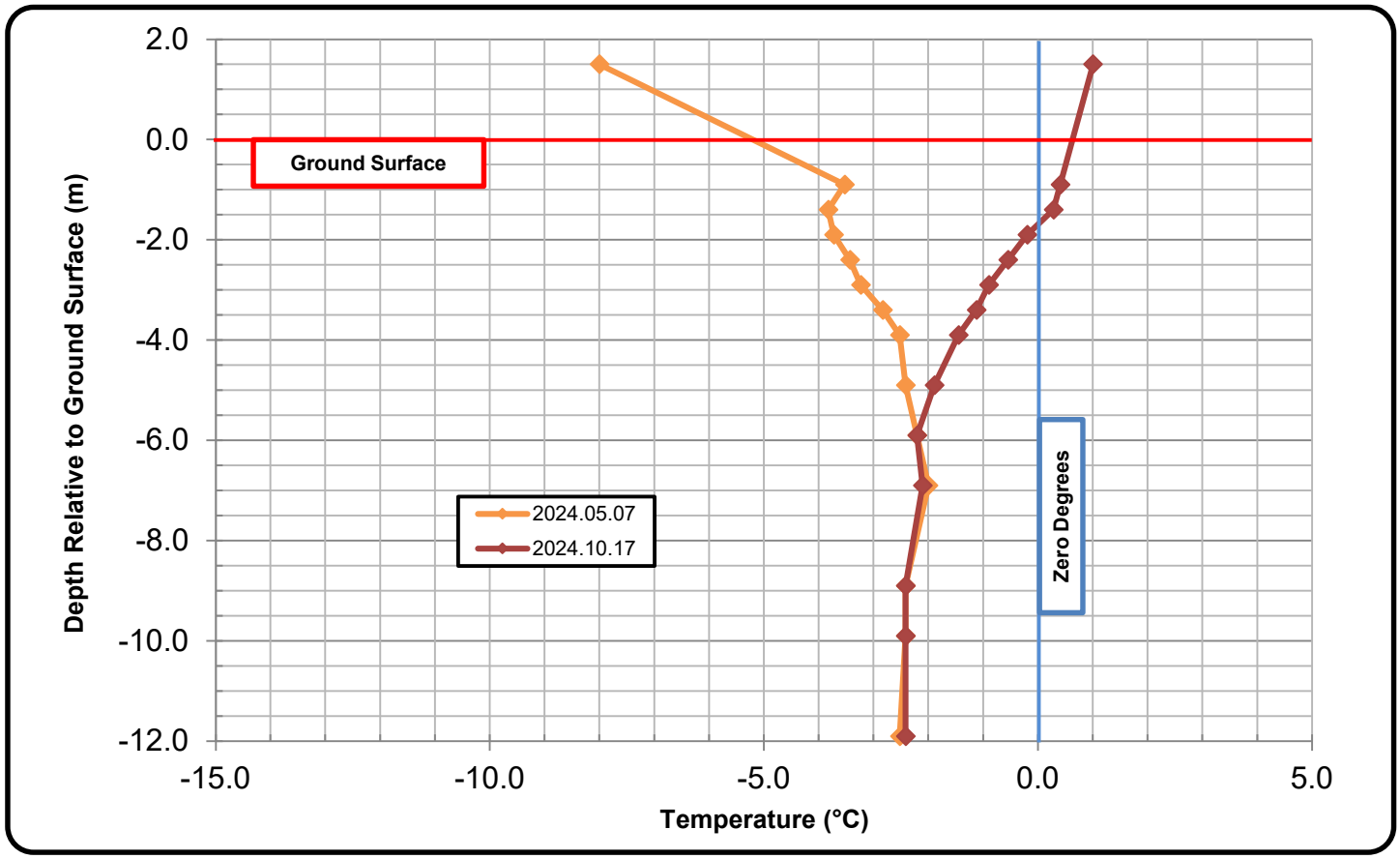
Thermistor Report - T1

PROJECT No.:		QIK-G2303			THERMISTOR No.:		T1	
PROJECT NAME:		Deep-Water Port Facility			DATE INSTALLED:		2024.05.06	
PROJECT LOCATION:		Qikiqtarjuaq, NU			LOCATION:		BH01	
Date of Reading :		2024.05.07	2024.10.14					
Thermistor Bulb	Depth (m)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)
AIR	1.5	-8.0	0.0					
1	-0.5	-4.9	0.9					
2	-1.0	-6.1	0.9					
3	-1.5	-6.4	0.4					
4	-2.0	-6.1	-0.3					
5	-2.5	-6.0	-1.1					
6	-3.0	-5.7	-1.5					
7	-3.5	-5.5	-1.9					
8	-4.5	-4.8	-2.5					
9	-5.5	-4.2	-2.8					
10	-6.5	-3.6	-2.9					
11	-8.5	-3.0	-3.0					
12	-9.5	-3.0	-3.0					
13	-11.5	-2.7	-2.8					



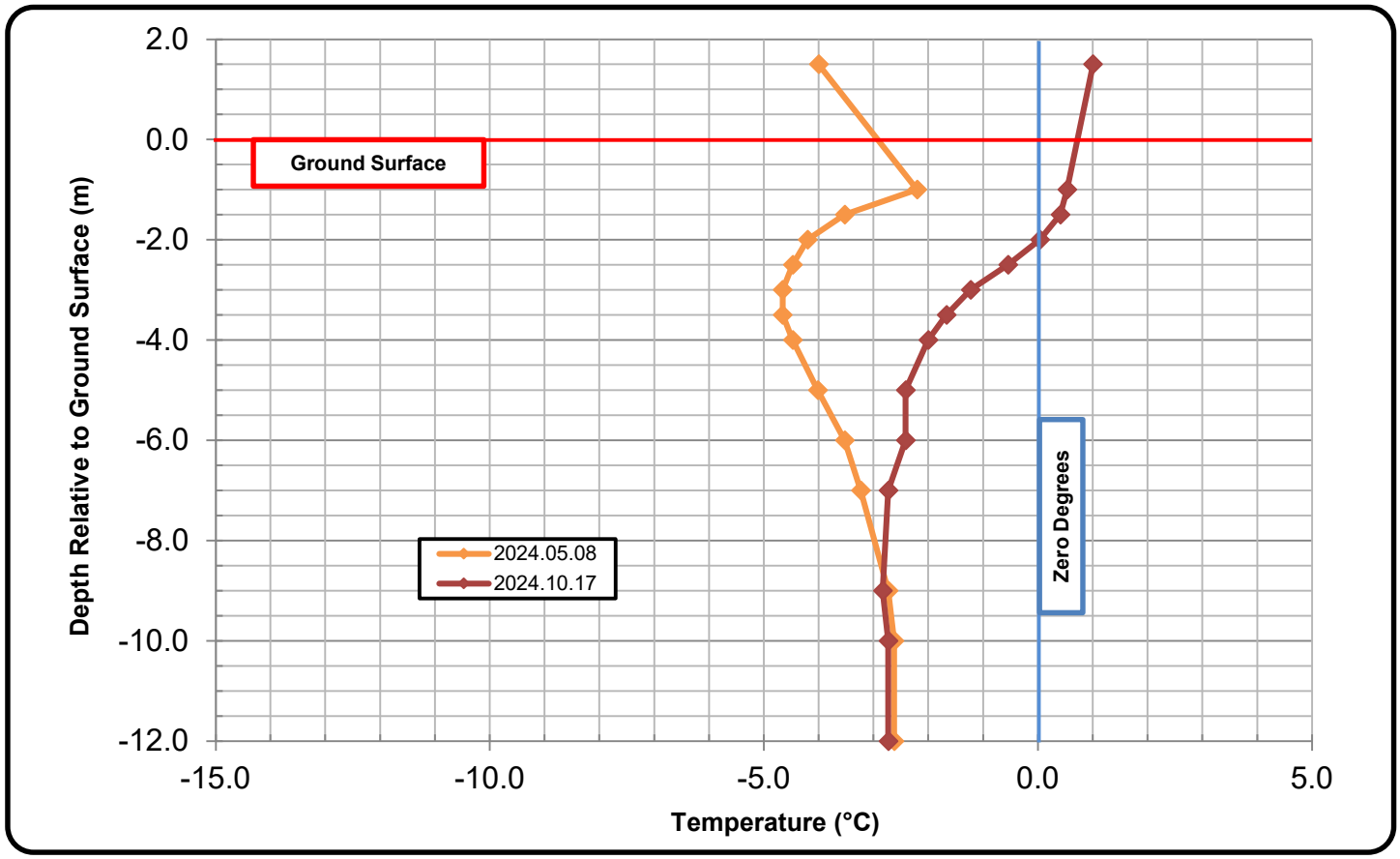
Thermistor Report - T2

PROJECT No.:		QIK-G2303			THERMISTOR No.:		T2	
PROJECT NAME:		Deep-Water Port Facility			DATE INSTALLED:		2024.05.06	
PROJECT LOCATION:		Qikiqtarjuaq, NU			LOCATION:		BH10	
Date of Reading :		2024.05.07	2024.10.17					
Thermistor Bulb	Depth (m)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)
AIR	1.5	-8.0	1.0					
1	-0.9	-3.5	0.4					
2	-1.4	-3.8	0.3					
3	-1.9	-3.7	-0.2					
4	-2.4	-3.4	-0.5					
5	-2.9	-3.2	-0.9					
6	-3.4	-2.8	-1.1					
7	-3.9	-2.5	-1.5					
8	-4.9	-2.4	-1.9					
9	-5.9	-2.2	-2.2					
10	-6.9	-2.0	-2.1					
11	-8.9	-2.4	-2.4					
12	-9.9	-2.4	-2.4					
13	-11.9	-2.5	-2.4					



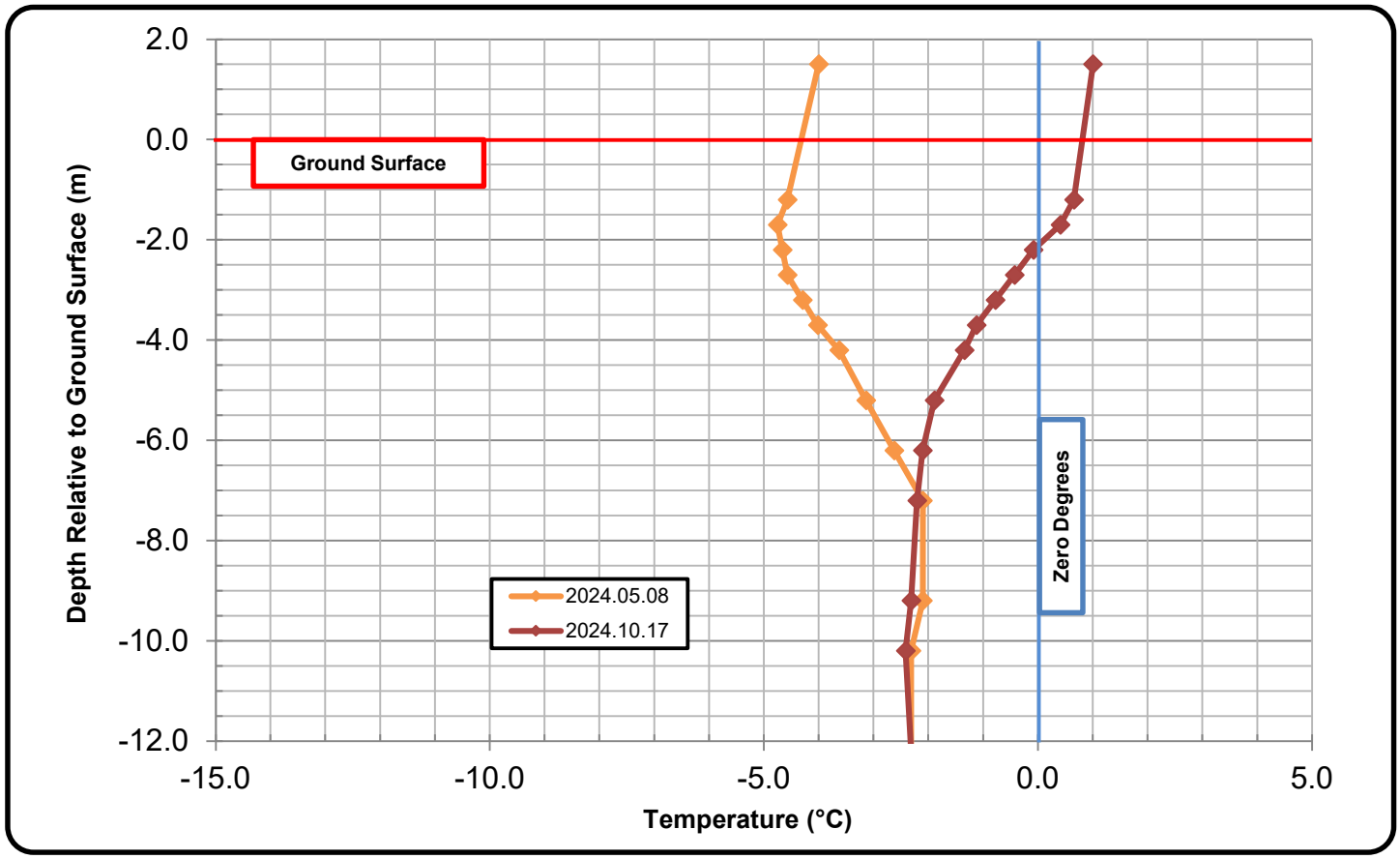
Thermistor Report - T3

PROJECT No.:		QIK-G2303			THERMISTOR No.:		T3	
PROJECT NAME:		Deep-Water Port Facility			DATE INSTALLED:		2024.05.07	
PROJECT LOCATION:		Qikiqtarjuaq, NU			LOCATION:		BH11	
Date of Reading :		2024.05.08	2024.10.17					
Thermistor Bulb	Depth (mbg)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)
AIR	1.5	-4.0	1.0					
1	-1.0	-2.2	0.5					
2	-1.5	-3.5	0.4					
3	-2.0	-4.2	0.0					
4	-2.5	-4.5	-0.5					
5	-3.0	-4.7	-1.2					
6	-3.5	-4.7	-1.7					
7	-4.0	-4.5	-2.0					
8	-5.0	-4.0	-2.4					
9	-6.0	-3.5	-2.4					
10	-7.0	-3.2	-2.7					
11	-9.0	-2.7	-2.8					
12	-10.0	-2.6	-2.7					
13	-12.0	-2.6	-2.7					



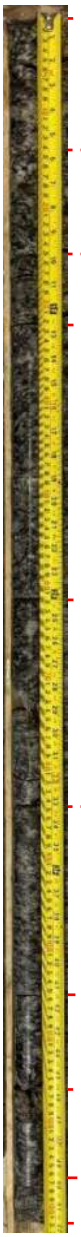
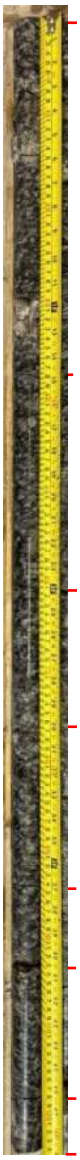
Thermistor Report - T4

PROJECT No.:		QIK-G2303			THERMISTOR No.:		T4	
PROJECT NAME:		Deep-Water Port			DATE INSTALLED:		2024.05.07	
PROJECT LOCATION:		Qikiqtarjuaq, NU			LOCATION:		BH13	
Date of Reading :		2024.05.08	2024.10.17					
Thermistor Bulb	Depth (m)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)	Temp (°C)
AIR	1.5	-4.0	1.0					
1	-1.2	-4.6	0.7					
2	-1.7	-4.8	0.4					
3	-2.2	-4.7	-0.1					
4	-2.7	-4.6	-0.4					
5	-3.2	-4.3	-0.8					
6	-3.7	-4.0	-1.1					
7	-4.2	-3.6	-1.3					
8	-5.2	-3.1	-1.9					
9	-6.2	-2.6	-2.1					
10	-7.2	-2.1	-2.2					
11	-9.2	-2.1	-2.3					
12	-10.2	-2.3	-2.4					
13	-12.2	-2.3	-2.3					



RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	1 of 1
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	August 25-29, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	CH01
CORE DIAMETER:	36 mm	**TOTAL CORE LENGTH:**	465 cm

ROW 1	ROW 2	ROW 3
 L = 0 cm L = 18 cm L = 0 cm L = 12.5 cm L = 17 cm L = 49 cm L = 15 cm L = 0 cm	 L = 0 cm L = 10.5 cm L = 0 cm L = 29.5 cm L = 0 cm L = 21 cm L = 10.5 cm L = 10.5 cm L = 0 cm	 L = 0 cm L = 23.5 cm L = 15.5 cm L = 17.5 cm L = 0 cm L = 16 cm L = 0 cm **RQD = 266/465 = 57%**

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	1 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	Aug 30 - Sept 2, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	CH02
CORE DIAMETER:	0-236cm: 36 mm / 236-713cm: 25mm	**TOTAL CORE LENGTH:**	713 cm

ROW 1	ROW 2	ROW 3
 L = 0 cm L = 21 cm L = 0 cm L = 10.5 cm L = 0 cm L = 13.5 cm L = 0 cm L = 11.5 cm L = 11.5 cm L = 0 cm	 L = 0 cm L = 18.5 cm L = 12.5 cm L = 17 cm	 L = 0 cm L = 17 cm L = 12.5 cm L = 15.5 cm L = 0 cm L = 23 cm

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	2 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	Aug 30 - Sept 2, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	CH02
CORE DIAMETER:	0-236cm: 36 mm / 236-713cm: 25mm	**TOTAL CORE LENGTH:**	713 cm

ROW 4	ROW 5	ROW 6
		
L = 21.5 cm	L = 21 cm	L = 18 cm
L = 0 cm	L = 37 cm	L = 19 cm
L = 33.5 cm	L = 12 cm	L = 26 cm
L = 10.5 cm	L = 19.5 cm	L = 16.5 cm
L = 14 cm	L = 0 cm	L = 11.5 cm
L =26cm	L = 13.5 cm	L = 0 cm
L = 0 cm	L = 0 cm	**RQD = 518/713 = 73%**
L = 23 cm	L = 11.5 cm	
	L = 0 cm	

RQD Data Sheet

PROJECT No.:	CHE-G2401	**PAGE:**	1 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	Sep 3-4, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	CH03
CORE DIAMETER:	25 mm	**TOTAL CORE LENGTH:**	515 cm

ROW 1	ROW 2	ROW 3
 L = 0 cm L = 13 cm L = 0 cm L = 11.5 cm L = 0 cm	 L = 0 cm L = 12.5 cm L = 16.5 cm L = 14.5 cm L = 0 cm	 L = 14.5 cm L = 16 cm L = 0 cm L = 15 cm L = 0 cm L = 10.5 cm L = 0 cm L = 11.5 cm L = 0 cm

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	2 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	Sep 3-4, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	CH03
CORE DIAMETER:	25 mm	**TOTAL CORE LENGTH:**	515 cm

ROW 4		
 L = 0 cm		**RQD = 135.5/515 = 26%**

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	1 of 1
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	Sept 6-7, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	CH04
CORE DIAMETER:	25 mm	**TOTAL CORE LENGTH:**	288 cm

ROW 1	ROW 2	
 L = 0 cm L = 11.5 cm L = 0 cm L = 21.5 cm L = 0 cm	 L = 0 cm L = 10.5 cm L = 0 cm L = 11.5 cm L = 29 cm L = 17.5 cm L = 0 cm	**RQD = 101.5/288 = 35%**

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	1 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	Sept 7-16, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	CH05
CORE DIAMETER:	25 mm	**TOTAL CORE LENGTH:**	492 cm

ROW 1	ROW 2	ROW 3
		
L = 0 cm	L = 12 cm	L = 11.5 cm
	L = 11.5 cm	L = 13 cm
	L = 11 cm	L = 0 cm
	L = 0 cm	L = 14 cm
	L = 10.5 cm	
	L = 11.5 cm	
	L = 0 cm	L = 0 cm
	L = 11 cm	
L = 17 cm		
	L = 0 cm	
	L = 15.5 cm	
L = 0 cm		L = 11 cm
	L = 13.5 cm	
L = 15 cm		
	L = 0 cm	

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	2 of 2
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	Sept 7-16, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	CH05
CORE DIAMETER:	25 mm	**TOTAL CORE LENGTH:**	492 cm

ROW 4		
 L = 0 cm		**RQD = 178/492 = 36**

RQD Data Sheet

PROJECT No.:	QIK-G2303	**PAGE:**	1 of 1
PROJECT NAME:	New Deep-Water Port Facility	**DATE DRILLED:**	Sept 17-18, 2024
PROJECT LOCATION:	Qikiqtarjuaq, NU	**LOCATION:**	CH06
CORE DIAMETER:	25 mm	**TOTAL CORE LENGTH:**	347 cm

ROW 1	ROW 2	ROW 3
		
Boulder at Surface to 174 cm	**Boulder from 195 to 220 cm**	**Boulder from 318 to 345 cm**
RQD = 12/174 = 7%	**RQD = 25/25 = 100%**	**RQD = 27/27 = 100%**

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Basis of the Report: The information, opinions, and/or recommendations made in this report are in accordance with ABG Ltd.'s present understanding of the site-specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site-specific project differs or is modified from what is described in this report, or if the site conditions are altered, this report is no longer valid unless ABG Ltd. is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

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Varying or Unexpected Conditions: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, ABG Ltd. must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. ABG Ltd. will not be responsible to any party for damages incurred as a result of failing to notify us that differing site or sub-surface conditions are present upon becoming aware of such conditions.

Planning, Design or Construction: Development or design plans and specifications should be reviewed by ABG Ltd. sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc.) to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-surface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; ABG Ltd. cannot be responsible for site work carried out without being present.

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