Iqaluit Marine Infrastructure Project

ENVIRONMENTAL MONITORING PLAN

Revision 6

Tower Arctic LTD.

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Table of content

1. Iqaluit Marine Infrastructure Project

1.1. Project Description

The Government of Nunavut (GN), through Economic Development and Transportation (EDT), has initiated the construction of marine infrastructure projects in Iqaluit (Figure 1-1). The facilities are along the western and eastern shores of Koojesse Inlet. The development of a new Deep Sea Port (DSP) and improvements to the existing causeway (a component of the Small Craft Harbour Project (SCH)) will take place along the western shore (Figure 1-2). The SCH Project, which consists of improvements to the municipal breakwater, will be built along the eastern shore (Figure 1-3). The construction of the DSP and SCH will be managed by Community and Government Services (CGS) on behalf of EDT. Responsibility for these facilities will transfer to EDT once operational.

Tower Arctic (TA) was awarded the construction contract for the DSP and SCH Projects, which will collectively be referred to as the Iqaluit Project.

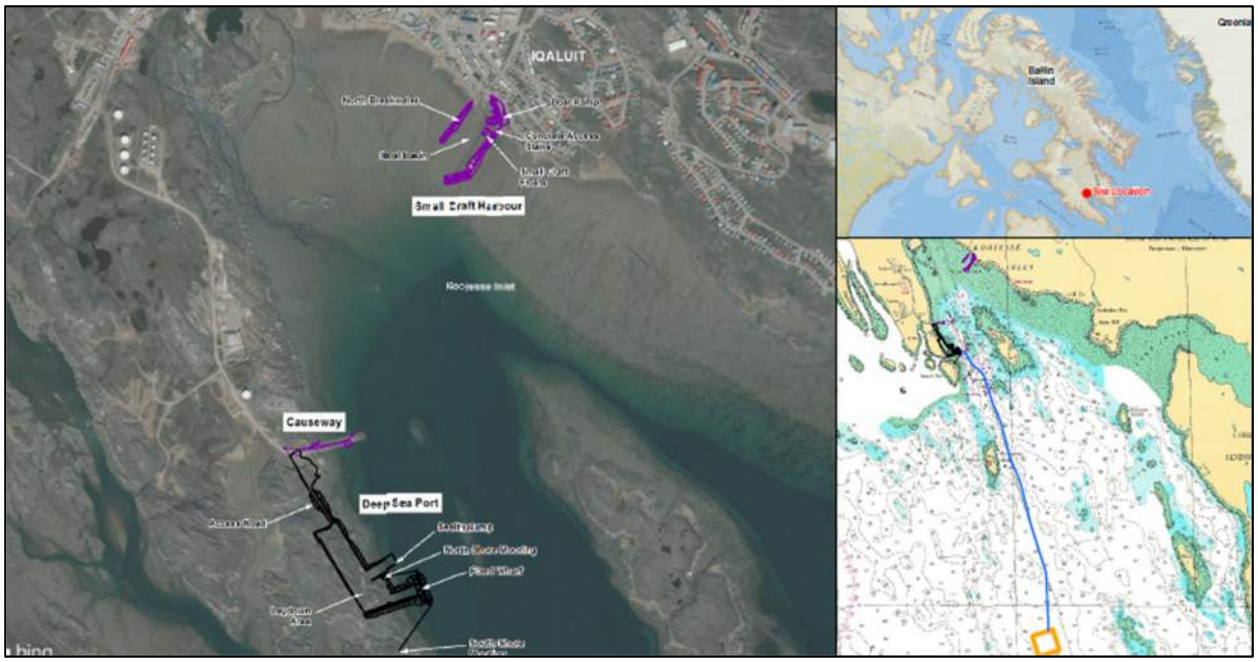


Figure 1-1: Deep Sea Port and Small Craft Harbour Project Locations (Including Disposal at Sea site for dredged material)

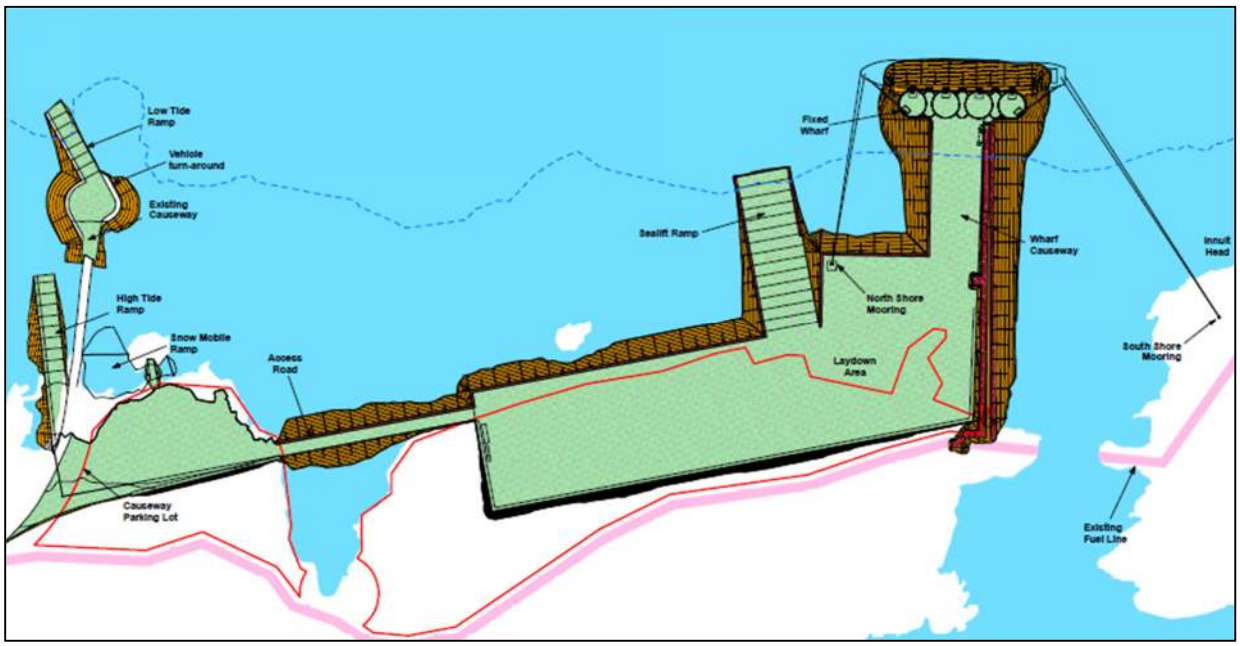


Figure 1-2: Deep Sea Port and Causeway General Arrangement

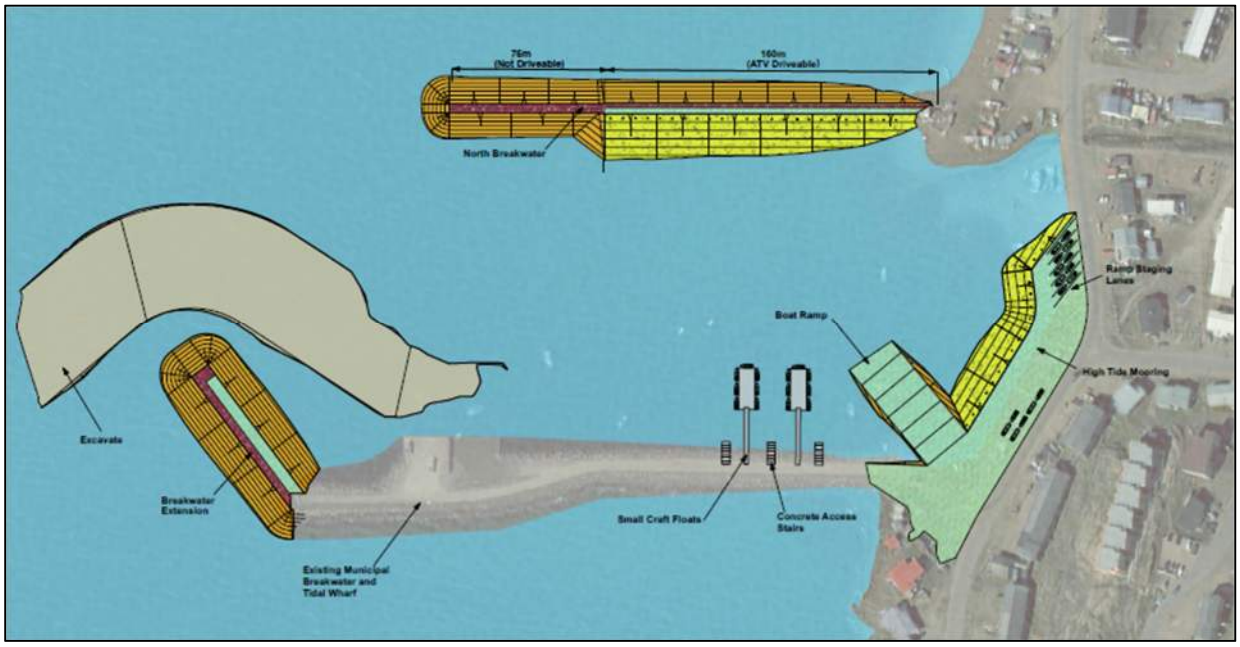


Figure 1-3: Municipal Breakwater General Arrangement

1.2. Construction Activities

Construction activities associated with the Iqaluit Project are outlined in Table 1-1. The table also indicates whether activities are on land, near water, in the intertidal zone or in water.

Table 1-1: Iqaluit Construction Activities

Activity	Iqaluit Facility			
	DSP	Causeway	DAS site	SCH
Drilling for blasting	X	X		
	X	X		
Blasting	X	X		
	X	X		
Transport (rock, sediment)	X	X		X
Crushing and screening to produce aggregates		X		
Stockpiles	X	X		
Infill/earthworks	X	X		X
	X	X		X
	X	X		X
Dredging	X			
Disposal at Sea			X	
Pile driving	X			
Construction vessel traffic	X	X	X	X
Construction vessel refuelling	X			X
Land based equipment refuelling	X	X		X
Drainage (ditches, culverts)	X			X
Boulder removal				X
Installation of small craft floats				X
Installation of concrete access stairs				X

Legend:

In water | Out of water (Intertidal) | Near water | Land based

1.3.Construction Areas

TA has determined Construction Areas for each of the four facilities, which will be used when describing the location of construction activities in weekly and annual reports. These are provided in Figure 1-4 and Figure 1-5.

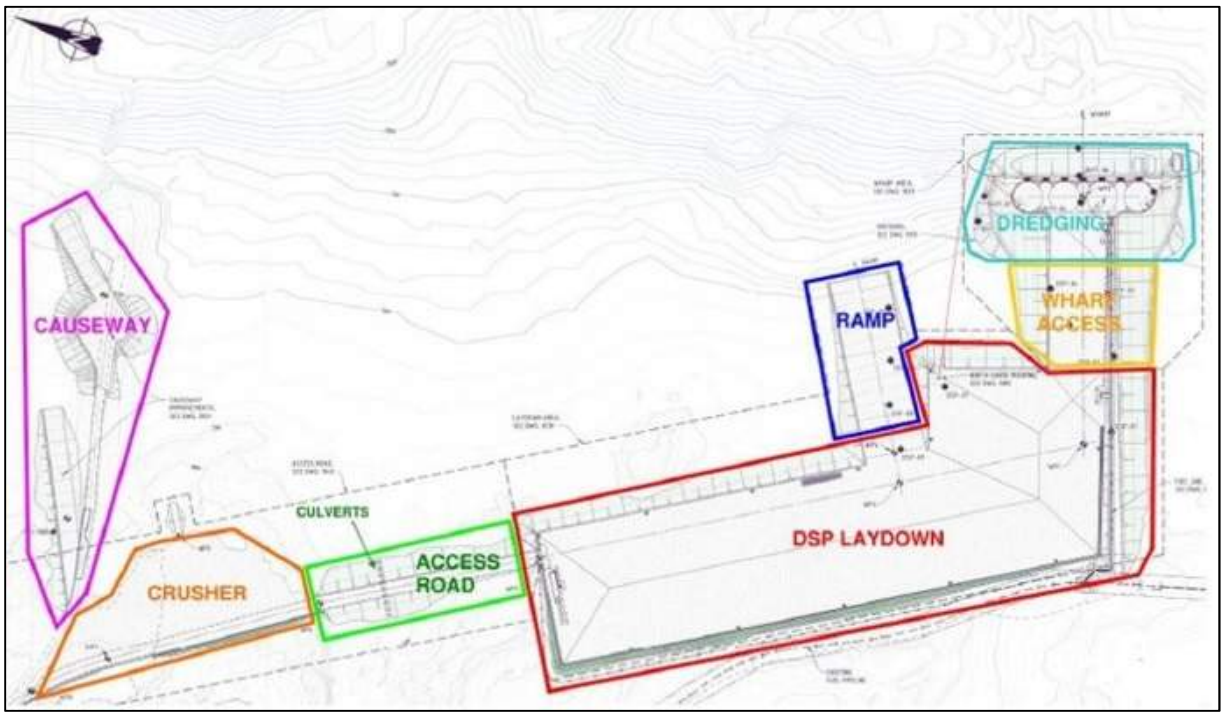


Figure 1-4: Deep Sea Port (DSP) and Causeway Construction Areas

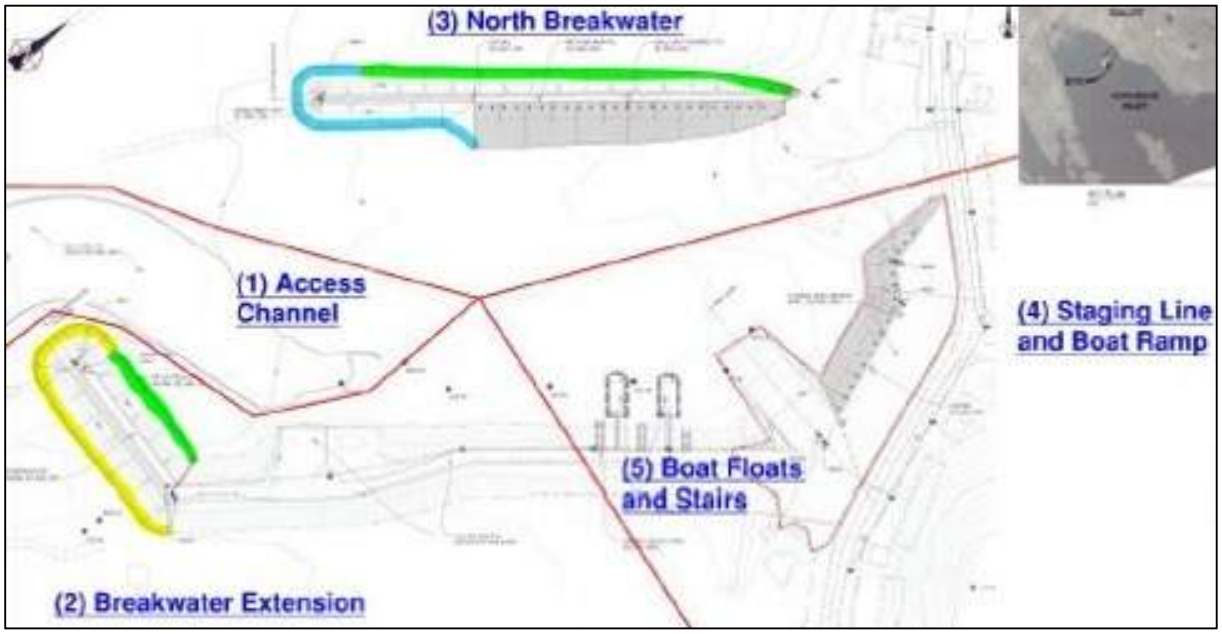


Figure 1-5: Small Craft Harbour Construction Areas (SCH)

2. Receiving Marine Environment

2.1. Bathymetry

Figure 2-1 shows an excerpt of the marine map for Koojesse Inlet. Depth ranges between 0 to 28 m (Chart Datum: CD) in a 500 m radius around the DSP. Between the shoreline at the causeway and the Black Ledge, depth varies from 0 m to 16 m. The entire SCH area is located above the chart datum, in the intertidal zone. In consideration of the tide's amplitude, the maximum water column that could be encountered in the vicinity of the DSP should range from approximately 40 m up to 50 m to the west of the White Top Ledge.

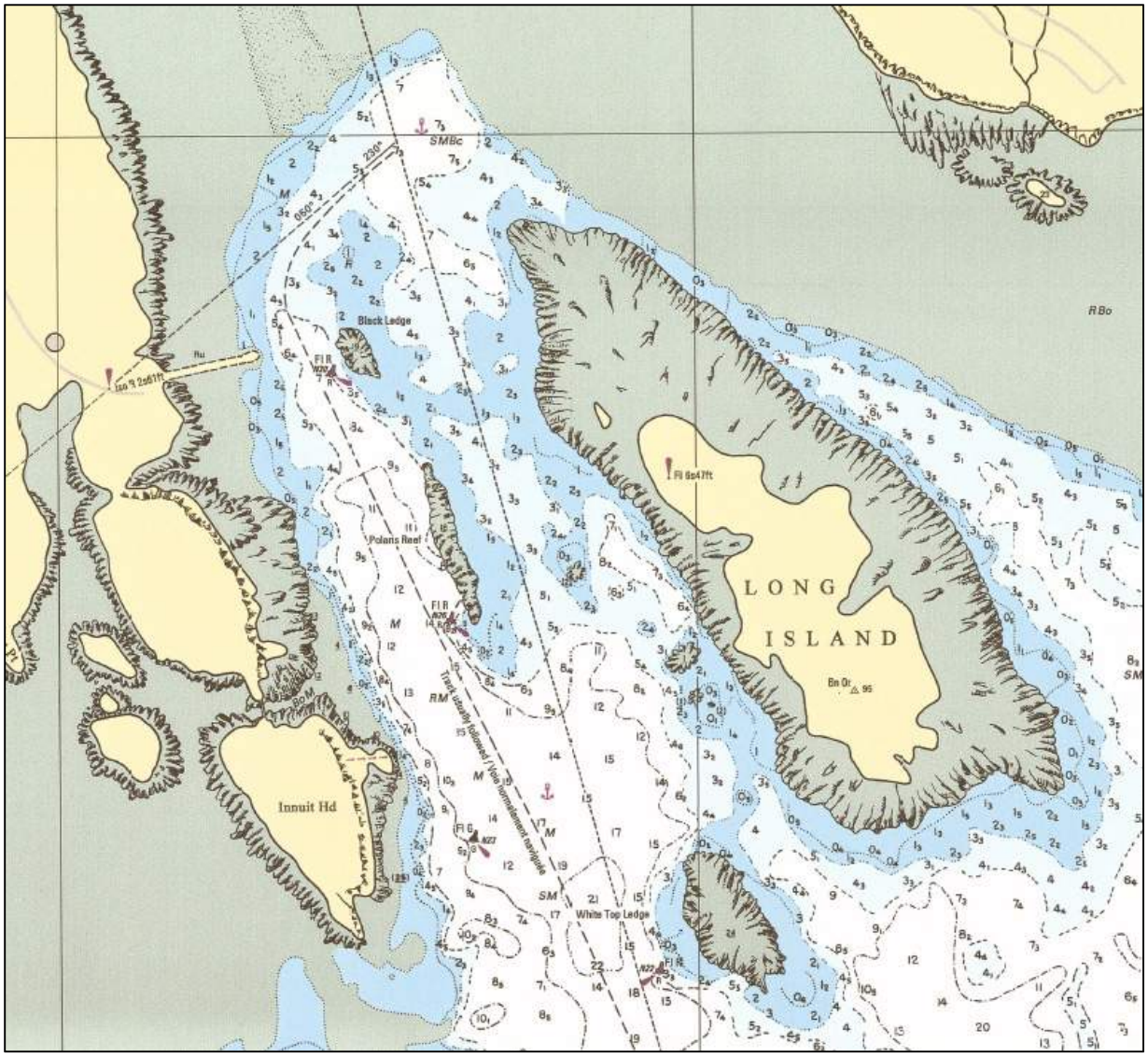


Figure 2-1: Excerpt from map 7127 for Koojesse Inlet (in fathom/feet)

2.2. Tides and Currents

At the site, tides are semidiurnal, with two high and two low tides per lunar day (Hsiao, 1992). The spring and neap tidal ranges are 11.3 m and 7.8 m respectively (CHS, 2016a). Currents measured during the screening process were no greater than 1 m/s (approximately 2 knots) at the surface, decreasing with depth (Advisian, 2017).

When required during monitoring activities, the tidal stage will be recorded according to the tidal prediction (Canadian Hydrographic Services: Iqaluit station #4140: https://www.tides.gc.ca/eng/station?sid=4140).

2.3. Temperature and salinity

Temperature in Koojesse Inlet varies on the first 5 to 10 meters from the surface, with a maximum of 2.08°C at the surface and a maximum change from surface to bottom of 1.75°C. As for salinity, it stabilizes 5 m below the surface to 32.1-32.5 psu (Advisian, 2017).

2.4. Fauna

The main fisheries in the area include Arctic char and Arctic cod.

Marine mammals whose range overlaps with Frobisher Bay and Koojesse Inlet include cetaceans and pinnipeds. However, the most likely marine mammals in Koojesse Inlet are Ringed and Harp seals, which were reported in the area in 2018 by the marine mammal observers charged with monitoring exclusion zones during in-water construction activities.

Table 2-1 shows their status, communication frequencies and dive times.

Table 2-1: Most common marine mammals in Koojesse Inlet

Species	Status*	Presence in Arctic waters	Dive times	Communication frequencies
Ringed seal	COSEWIC: not at risk SARA: no status	Arctic resident	Up to 17 min	0.4 to 16 kHz
Harp seal	COSEWIC: Not assessed SARA: no status	Seasonal visitor (July-december)	Less than 15 min	<16 kHz

Source: Advisian, 2017. Iqaluit Marine Infrastructure – Marine Baseline Report.
*Source : Government of Canada. Species at risk registry. [Online] URL: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html. Consulted in June 2019.

3. Environmental requirements

3.1. Project Permits

All Project permits related to the environment for the Iqaluit Project are in place and are summarized in Table 3-1.

TA will keep copies of the permits at various locations on the site. All permits and license conditions will be kept in a binder at the EM's office. TA will also have a file in its local network at the site with digital copies of the permits. Vessels involved in dredging will have copies of permits from Environment and Climate Change Canada (ECCC). The Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) (Land Use Permit (LUP)) numbers will be placed on the windows of all vehicles and heavy equipment involved in the Iqaluit Project.

Table 3-1: Permits – Iqaluit Marine Infrastructure Project

Regulatory Authority	Permit Type	Permit #	Expiration date	Related Facility	Permit Holder
ECCC	Disposal at Sea	4543-2-02899	July 31, 2019	DSP	GN
		4543-2-02900	April 10, 2020		
Transport Canada	Approval (Notice of Works (NoW))	8200-2016-600096-001 (DSP)	-	DSP, SCH (Municipal breakwater, causeway improvements)	GN
		8200-2016-600095 (SCH-Municipal Breakwater)	-		
		8200-2016-600096-002 (SCH-Causeway)	-		
NIRB	Screening decision	17XN021 (DSP)	-	DSP, SCH (Municipal breakwater, causeway improvements)	GN
		17XN022 (SCH)	-		
DFO	FAA	17-HCAA-00961/17-HCAA-00964	December 1, 2020	One application DSP, SCH (Municipal breakwater, causeway improvements)	GN
		New permit pending for open water season of 2019 (19-HCAA-00476)			
NR Can	Explosives	U300111/E	June 30, 2020	DSP	TA
CIRNAC	Land Use Permit	N2018X0011 (DSP)	January 10, 2023	DSP (DSP Site, causeway) SCH (Municipal breakwater)	GN
		N2018X0009 (SCH)	January 10, 2023		

3.2. Construction environmental management plans

Two construction environmental management plans (CEMP) were devised, one by Advisian and CGS on the screening process and the other by TA based on the CGS's CEMP, to describe how environmental obligations stated in the permits would be met. They outline the measures which have been and will be implemented to avoid, manage or mitigate the impact of construction activities. Regulatory requirements and CEMP measures will collectively be referred to as project commitments.

4. Purpose of the monitoring plan

The permits and CEMP refer to monitoring activities required to demonstrate compliance of construction activities with project commitments. Two measures listed in the CEMP refer directly to the monitoring plan. They are as follows:

- Measure MC01 states that Monitoring Plan(s) will be prepared for the project. The monitoring plan(s) must describe how allowable levels of total suspended solids/turbidity and marine mammal monitoring activities during excavation, dredging, dredge disposal and in-water placement of fill material will be carried out.
- Measure MC05 refers to the development of a monitoring program for overpressure levels during piling activities in order to ensure the protection of fish.

The purpose of this monitoring plan is to describe how TA will implement the monitoring activities listed in these measures for marine construction activities. It also describes the underwater noise monitoring plan as well as monitoring of the marine environment during piling activities. It is complementary to the CEMP and to TA's other construction work plans, namely those listed in Table 4-1 below.

Table 4-1: Construction work plans

Construction work plan	Document number
Construction Health and Safety	Tower Arctic - Site Specific HSE Plan - Iqaluit REV 2
Blasting Management Plan	TA-21808-WP-04-DRILL AND BLAST PLAN - Rev1
Traffic Management Plan	TA-21808-WP-06 - Traffic Management Plan rev2
Spill Prevention and Response Plan	TA-21808-WP-13-SPILL RESPONSE PLAN - rev3
CEMP	TA-21808-WP-12-CEMP-Rev2

5. Environmental team

5.1. Environmental Advisor

5.1.1. Role

The environmental advisor's role will be to assist the environmental monitors with contentious issues, with the assistance of specialists if required, and to liaise with the CGS's representatives and authorities regarding these issues as needed. Such issues could include unforeseen impacts from construction works, new work methods, etc. The advisor's role will also include adjusting monitoring tools as needed to ensure environmental monitoring is efficient and covers project commitments. Stéphane Lorrain has been designated as the environmental advisor.

5.1.2. Experience

With training in geology and a specialization in oceanography, Stéphane Lorrain has over 29 years of practical experience in conducting and supervising studies in oceanography, hydrography, hydrology, and in the characterization of sediment properties and sediment transport studies as well as water quality and GHG monitoring in aquatic systems. These studies were done in the context of major hydroelectric development projects and of port/marine infrastructures and dredging projects.

Mr. Lorrain has developed an expertise in carrying out complex fields surveys related to the physical characterization of aquatic and marine environments. His work was conducted in support of engineering studies (design, construction) and of environmental and social impact assessments. He also serves clients as expert-advisor to design and evaluate environmental monitoring programs in the context of shoreline/riverine erosion and sediment management issues.

Mr. Lorrain has participated in major projects in Nunavik and Northern Manitoba and Quebec, spanning the St. Lawrence River and Gulf of St. Lawrence, the entire northern coast of Quebec from Ungava Bay to Hudson Bay via the Hudson strait and Western Hudson Bay and Northern Manitoba. Abroad, he worked in West Africa over a period of 8 years, the last two years almost on a permanent basis carrying out Metocean surveys and marine biological resources assessments. He supervised water quality studies related to aquatic greenhouse gases emissions in Cameroun, California and Australia among others. In his previous employment, as director of a technical survey and engineering support group, he has participated in major basin-wide hydroelectric projects in Quebec and Manitoba (200 to 1000MW) as well as major port development projects in West Africa and Canada; some were carried out in difficult and challenging logistical, political and organizational contexts.

Mr. Lorrain's resume is included in Appendix 1.

5.2. Environmental Monitor

5.2.1. Role and responsibilities

In compliance with condition 13 of the NIRB screening decision, an environmental monitor will be present full time throughout marine construction activities. The environmental monitor will confirm both land- and marine-based construction activities are compliant with project commitments. The environmental monitor's roles and responsibilities are stated in TA's CEMP. More specifically, the EM's roles and responsibilities with regards to monitoring include:

- Being informed and aware of the construction schedule and activities and advise TA and CGS on modifications required to comply with permits and CEMP as needed
- Attending calls as required to stay informed and to inform CGS and TA of potential issues or mitigation required, and to stay informed of issues resulting from community consultation that may require communication or mitigation
- Ensuring induction of workers and their training with regards to the following are carried out:
    - Project commitments relative to construction activities
    - Specific mitigation measures such as erosion and sediment control, handling of hazardous materials, waste management, fueling, etc.
    - Interactions with wildlife
    - Environmental emergency response procedures
    - Marine mammal observation.
- Inspecting the work site to ensure mitigation measures are in place and project commitments are met
- Carrying out specific monitoring activities and preparing associated databases (wildlife and nesting surveys, turbidity, overpressure and underwater noise)
- Compiling data on marine mammal and wildlife observations
- Suspending non-compliant activities under conditions stated below in the sections regarding the turbidity monitoring, marine mammal observation and acoustic monitoring or if serious harm to the environment is suspected
- Managing and reporting on environmental spills
- Preparing weekly reports.

TA's management team is accountable for the compliance of construction activities with project commitments. As stated in section 6.2, regular meetings between the EM and the site supervisor will be held to discuss work methods and schedules with regards to project commitments and to raise concerns as required to limit the risk of non-compliances.

5.2.2. Experience

Resumes for environmental monitors (EM) proposed to assist with environmental management of construction activities are provided in Appendix 1. The EM will be familiar with the mitigation and monitoring measures provided in the Project CEMPs, TAs CWP, as well as all relevant permit conditions.

Olivier Bédard-Richard

Olivier Bédard-Richard has more than 7 years of experience in environmental monitoring on different construction projects. Most of the projects in which he has participated have involved environmental monitoring of work in environments with sensitive fish habitats and sedimentation issues. His experience in the field of major construction work allows him to be proactive in dealing with environmental issues according to construction activities.

His experience with aquatic environments includes the following:

Tower Arctic Ltd.

- Environmental monitoring for the Iqaluit and Pond Inlet Marine Infrastructure Projects
- Water quality control and monitoring for in water infill and dredging activities
- Monitoring of overpressure for near water blasts

Services Enviro-Forestiers

- Site supervisor for the construction of infrastructures to ensure unhindered circulation of fish (arch culverts, culverts with weirs, fish spawning sites, etc.)
- Erosion and sedimentation control management for gravel road construction
- Water quality control and monitoring
- Environmental monitoring of wind farms construction activities
- Support to construction teams for the prevention and management of environmental incidents (oil spill, sedimentation of watercourses, projection of stones outside of the authorized area during blasting, etc.).

David Lauzon

David Lauzon is a geographer with over 10 years of experience in the field of environment. His professional career has led him to perfect his knowledge in different disciplines always related to the environment. More specifically, he has worked in various positions allowing him to gain experience in environmental monitoring at the "Nouveau Pont Champlain" site, in the field of marine emergency with “ECRC” and in aquatic technical surveys (water and sediment quality, hydrology, oceanography). Mr. Lauzon has also had the opportunity in his professional career to work in Northern Quebec with various Aboriginal communities and in West Africa.

His experience with aquatic environments includes the following:

Environnement Canada

- Establishing reference water monitoring stations and sampling program
- Erosion monitoring in various location in the St-Lawrence river
- Water Monitoring Program: Water and sediment sampling, lab analysis (including TSS, organic and inorganic trace and ultra-trace), field data collection, calibration of field instruments.

Environnement Illimité Inc

- Simandou Project, West Africa : Turbidity study to evaluate total sediment discharge at a river estuary, including moorings maintenance and instrument calibration, water sampling, tide gauge validation and maintenance
- Hydro-Québec, La Romaine's estuary baseline study : Monitoring of the salinity front, evaluation of the river bed's sediment transport, discharge measurement, deployment of scientific buoys
- Various projects: hydrodynamic study, water level measurements, sediments coring and sampling, moorings preparation and deployment.

ECRC-SIMEC

- Various deployment of environmental protection equipment
- Boat operation
- Marine spill response plan preparation.

SNC-Lavalin

- New Bridge on the St. Lawrence: turbidity monitoring, sampling and analysis in a context of dredging activities.

Pierre-David Beaudry

Pierre-David Beaudry has over 17 years of experience in large project execution. He has worked in many challenging regions of Canada, including Nunavut (in Jayne's Inlet, Iqaluit) and Nunavik as well as abroad (Guinea, Brazil, Malaysia and Australia). The diversity of projects he has worked on and his proactive attitude with regards to problem solving has made him a versatile team leader capable of finding effective solutions in all situations. His vast knowledge of water biology, ichthyology, hydrology, hydro-sedimentology and hydrometry allow him to target environment threatening situations and to interpret further consequences of environmental harm.

All of his experience has been acquired in aquatic environment. The following projects are a sample of what Mr. Beaudry has been working on and can be related to environmental monitor:

SNC-Lavalin (present)

- Public Services and Procurement Canada, Kingston Inner Harbor sediment stability study: Coring, water dynamic and turbidity (TSS/Tu) monitoring, mooring installations, sediment resuspension experiment using Core Mini-Flume
- Montreal Port Authority, Contrecoeur Port terminal expansion project, impact assessment: Turbidity monitoring to document the impact of vessel movement over the water quality (TSS/Tu relationship and satellite photo-interpretation). Habitats characterization (physical and biological) for endangered species (Copper Redhorse). Divers team supervision for benthos, grass and sediment sampling.
- Nature Conservancy Canada, Ile Bouchard erosion study: Installation of tide gauge and turbidity sensor moorings to evaluate the impact of merchant marine's wave of riparian erosion. Wave mitigation and bank restoring method proposals.

Englobe (2003-2018)

- Englobe and René St-Pierre, Katheryn Spirit Project, removal of the cofferdam: Advise and coordinate the purchase and installation of a sediment curtain. Carry out dredge monitoring bathymetry and process data on site to allow the moving of excavators and barges.
- Trois Rivieres Port Authority, post dredging sediments sampling and analysis: Establish sampling protocol, plans field campaign conduct sampling and coordinate samples shipment for external lab analysis, analyze results, write the report
- Montreal Port Authority, Restoration of contaminated sediment at wharf 103, supervised dredging of contaminated sediment, checked by core sampling that contaminated sediment had been completely removed before moving to the next site, made sure contractors complied with turbidity standards, checked integrity of sediment curtains and oil slick boom, halted work if necessary, to apply corrective measures.

5.2.3. Environmental Monitor Rotations

The EM assigned to the Iqaluit Infrastructure Project are as follows:

- Olivier Bédard-Richard will be on 14 days on, 7 days off rotation
- David Lauzon or Pierre-David Beaudry will also be on 7 days on, 14 days off rotation.

In order to ensure a smooth transition between EM, the outgoing environmental monitor will brief the incoming environmental monitor on construction status, monitoring results, main concerns and planned mitigation measures.

A preliminary schedule of the EM's rotations will be submitted to the client at the start of the construction season. The onsite EM will be the primary point of contact for CGS or the Environmental Inspector (EI) during the construction season.

For the first week of construction activities, two EM will be on site simultaneously to ensure a harmonization of monitoring practices.

Environmental Lead

Contentious issues will be discussed among the EM and the most appropriate course of action will be decided as a consensus rather than as an authoritative decision. The EM can engage with the Environmental Advisor to determine the best course of action or to assist in the resolution of certain contentious issues. The Environmental Advisor will consult with qualified personnel as required if a specific expertise is required.

6. Communication

6.1. Environmental Support

Individuals who are tasked to assist the EM, such as marine mammal observers (MMO) will be informed of who the onsite EM is and will be able to contact him by mobile phone or radio. For activities that are being conducted at night, when the EM is off shift, the MMO will be informed to contact the site supervisor directly.

6.2. Site Supervisors

The site supervisors will be in regular communication with the EM throughout the construction season. The site supervisors will be made aware of pertinent activities to remain in compliance with Project commitments. When field decisions are made by the site supervisor, the EM will be engaged to confirm the field decisions do not compromise Project commitment compliance.

A minimum of two meetings will be held per week with the site management team (which includes the site supervisor and the EM). It will allow for the EM to be made aware of upcoming activities and work methods and to discuss relevant project commitments, mitigation measures and concerns.

A worksite committee will also be held every month. Information and concerns with regards to project commitments or environmental issues will be discussed as needed. Minutes of the meeting will be drafted.

6.3. CGS and Environmental Inspector

A kick-off meeting with the Environmental Inspector and CGS's Regulatory Advisor will be held at the start of the construction season.

Two weeks after the start of environmental monitoring activities, a meeting will be organized with the Environmental Inspector and CGS to ensure reports meet project's requirements. After adjustments have been agreed upon, CGS will contact TA's EM as required to make additional comments to meet project commitments. TA's EM will contact TA's Environmental Advisor as required.

7. Marine Construction

7.1. Turbidity monitoring

7.1.1. Training

The EM is responsible for turbidity monitoring during in water works. The EM will make sure that the procedure is implemented in the field. The measurement method is outlined in Appendix 2.

7.1.2. Procedure

Turbidity monitoring for construction activities will be conducted by visual monitoring. During in-water construction activities, in the event there are concerns/considerations for effects to water quality based on visual monitoring, turbidity monitoring will be conducted based on the Canadian Council of Ministers of the Environment (CCME 2007) approved Water Quality Guidelines (WQG). These are as follows:

- CCME: *Turbidity (NTU) Allowance Over Background ("Induced" Turbidity)*: Maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period). Maximum average increase of 2 NTUs from background levels for a longer-term exposure (e.g., 30-d period) in all waters during clear flow. Maximum increase of 8 NTUs from background levels at any one-time when background levels are between 8 and 80 NTUs. Should not increase more than 10% of background levels when background is >80 NTUs for high flow or turbid waters.

Background levels of turbidity established during the screening process indicate clear water conditions are expected in Koojesse Inlet[1].

Background Monitoring

A control site will be used to establish the background turbidity concentration for each monitoring visit. This strategy is well-suited to dynamic environments where tidal variations may influence the spatial distribution of the turbid plume. The location of the control site will be decided on-site by the EM. It will

[1] Advisian, 2017. Iqaluit Marine Infrastructure: Marine baseline report.

be located up current (relative to the direction of the flow) of the point source (dredging site, infill locations), at a minimum distance of 25 m from the plume. At slack tide, the control site will be located outside of the visual plume at a distance of at least 5 times the size of the visual plume.

Compliance Monitoring

A visual observation will be carried out no more than an hour after the beginning of in water works (dredging, infill) to establish the presence of a turbid plume. This will be documented by a time stamp photograph. A visual observation will be done every time field measurements are performed. Visual observations will usually be done from a high point on land or on the boat (breakwaters or sampling boat). Compliance monitoring will be conducted when visual turbidity monitoring has been observed outside of the zone of influence described in Table 7-1.

Table 7-1: Turbidity – zone of influence

	Activity Type			
	In water Infill	**Out of water infill**	**Dredging**	**Disposal at Sea**
Control site	25 m up-current or at a distance 5 times the size of the plume	25 m up-current or at a distance 5 times the size of the plume	25 m up-current or at a distance 5 times the size of the plume	On site before disposal
Compliance Locations	100 m	100 m	100 m	100 m
EM location for visual assessment	Appropriate location to confirm compliance: -DSP: Laydown area -SCH: Breakwater -Sampling boat	Appropriate location to confirm compliance: -DSP: Laydown area -SCH: Breakwater -Sampling boat	Appropriate location to confirm compliance: -DSP: Laydown area -SCH: Breakwater -Sampling boat	From the scow barge

Turbidity monitoring will be carried out at a distance of 100 m from the dredging or infilling activity, in a down current direction (relative to flow) and in the alignment of the expected plume. The plume may be identified visually, or the field team can drift with the flow from the dredging or infilling location until the 100 m distance is reached.

If the turbidity plume is uneven, replicate sampling/measurements (2) will be performed at the same distance (100 m) and the average turbidity will be compared to the turbidity guideline. When the water depth is greater than 3 m, turbidity will be measured 1 m below the surface and 1 m above the seabed. If the water depth is greater than 40 m, a mid-depth sample will also be collected.

Turbidity monitoring will be performed every two hours for short term work (<6 hrs) and every 4 hours for longer term work. If the excavation of infilling rate is increased above the average expected duration, the sampling frequency will be doubled.

The EM will document the following at time of measurement within the turbidity monitoring database:

- Facility for which observation is being documented
- Construction activity for which observation is being documented
- Time of initial visual observation
- Tide height of initial visual observation
- Time of compliance measurement
- GPS coordinates of compliance locations

7.1.3. Turbidity Monitoring Methodology

A boat will be available to the EM should turbidity compliance monitoring be required.

Sampling at different depths in the water column will be carried out using a weighted Van Dorn sampler.

The Hanna 98703 turbidity meter will be used to measure turbidity levels. Calibration will be validated every day when measurements are required. Calibration of the turbidity meter will be carried out on a monthly basis when measurements are required.

7.1.4. Stop Work

If the mean turbidity values exceed the turbidity threshold criterion of 8 NTU from background levels, the following steps must be taken:

- The exceedance will be reported on a daily basis, while also mentioning the steps being taken
- Monitoring will be done on an hourly basis and the distribution of the plume will be documented by visual observations.
- If the exceedance lasts longer than 6 hrs, the work rate will be decreased.

- If the exceedance lasts longer than 24 hrs, work will be stopped.
- The work method may be modified, and the EM will repeat the monitoring to confirm a return to compliant turbidity levels.

Field activities on the water will be conducted during daylight hours only. If an exceedance is observed when the sun sets, then the work rate will be decreased until the following morning when monitoring can resume.

7.1.5. Adaptive Management Procedures

If necessary and after consulting the Environmental Inspector, TA could put in place a compliance monitoring of the turbidity different from what is in the authorization of the regulators. CCME turbidity guidelines are derived from suspended sediment guidelines using a general correlation of 3 to 1. Suspended sediment guidelines are as follows:

- For clear flow, a maximum increase of 25 mg·L-1 from background levels for any short-term exposure (e.g., 24h period) and a maximum average increase of 5 mg·L-1 from background levels for longer term exposures (e.g., inputs lasting between 24h and 30 d). For high flow: Maximum increase of 25 mg·L-1 from background levels at any time when background levels are between 25 and 250 mg·L-1. Should not increase more than 10% of background levels when background is >250 mg·L-1.

Since turbidity guidelines are extrapolated using a general correlation, the CCME recommends that joint analyses of turbidity and suspended solids be carried out in problem areas[2]. Therefore, TA may validate total suspended solid (TSS) concentrations in the event exceedances are measured. In this case, samples will be sent to an accredited laboratory for TSS analysis. Turbidity will be measured on subsamples, prior to the expedition of the samples.

If TSS concentrations are found to be compliant with CCME guidelines, TA may choose to establish a new correlation between turbidity and TSS for the activity causing the exceedance. In order to establish a correlation, samples on which turbidity has been measured on-site will be sent to an accredited laboratory for TSS analysis. Once an acceptable coefficient of determination for linear regressions is established, new turbidity guidelines, which ensure compliance with TSS guidelines, will be established for the site.

If exceedances are observed with regards to turbidity/total suspended solid guidelines, the adjustment of the work method or the implementation of mitigation measures will be used to ensure CCME guidelines are met.

[2] Canadian Council of Ministers of the Environment, 2002, Canadian water quality guidelines for the protection of aquatic life – Total particulate matter. URL: http://ceqg-rcqe.ccme.ca/download/en/217/

If samples are sent to the laboratory for analysis, the following measures will be taken in order to avoid cross contamination, ensure conservation of the samples until they reach the laboratory and proper identification of the samples. The samples will be taken in clean bottles ensuring enough headspace to allow for mixing in the laboratory. The samples will be marked with indelible ink. Appropriate chain of custody documents will accompany the samples. They will be transported to the laboratory using a cooler containing ice to control temperature to 4C. If the samples cannot be transported on the day they are collected, they will be refrigerated until transport. The samples will be analyzed within the appropriate holding time (7 days).

7.2. Marine Mammal and dead fishes Monitoring

Marine mammal observers (MMO) are required for all in water activities. The presence of marine mammals within the exclusion zone will be monitored by the MMO. The exclusion zone size and how an MMO will be facilitated is provided in Table 7-2.

Table 7-2: Marine Mammal Observer, Exclusion Zone and Activity Type

	Activity Type					
	In water Infill	**Out of water infill**	**Dredging**	**Disposal at Sea**	**Near water blasting**	**Pile driving**
Exclusion Zone	20 m	10 m	20 m	As per MMR regulations (100 m at time of report)	500 m	500 m (or as per noise monitoring program)
MMO	Equipment operator	Equipment operator	Dedicated MMO	Ship personnel	Workers enforcing the security perimeter	Dedicated MMO

7.2.1. Training

All MMO will receive a document outlining the characteristics of marine mammals which may potentially be seen near the works. The document also describes the procedure in the event a marine mammal is injured, or a collision has occurred. The EM will review the document with the MMO to ensure its proper application. The training document is provided in Appendix 3.

The training document was adjusted in 2019 to include a decisional flow chart and contact information as well as specificities regarding pile driving activities. EM's will accompany the MMO on the field to ensure procedures are well understood. MMO assigned to the pile driving will be the individuals with the most experience and, if possible, the ones which were most rigorous in 2018.

7.2.2. Procedure

The MMO will perform his duties from selected vantage points depending on the type of on-going work. Sightings will be recorded in a log, which will include:

- Name of the MMO,
- Facility and activities to which the MMO is assigned,
- Observation condition,
- Distance from the works,
- Species observed

In case of injuries possibly caused by on-going work, the MMO will contact the EM who will then inform the DFO for reporting of the incident. In cases of the work being stopped, time of interruption and restart will be noted.

The presence of the MMO will be required for the following activities: Infill, dredging, disposal at sea, blasting and pile driving. Those are described below and will be identified in the weekly report, along with the name of the MMO on duty. The presence of an MMO will be required whenever those activities are occurring, either during daylights hours or at night.

Islands and rocky outcrops in Koojesse Inlet act as visual markers to establish distances from the construction sites. In addition, visual markers (buoys) are moored at know distances from the work site (Figure 7-1) (see Marine mammal observer training document in Appendix 3).

When concurrent activities requiring the presence of an MMO occurs with overlapping exclusion zones, the largest exclusion zone will then be monitored.

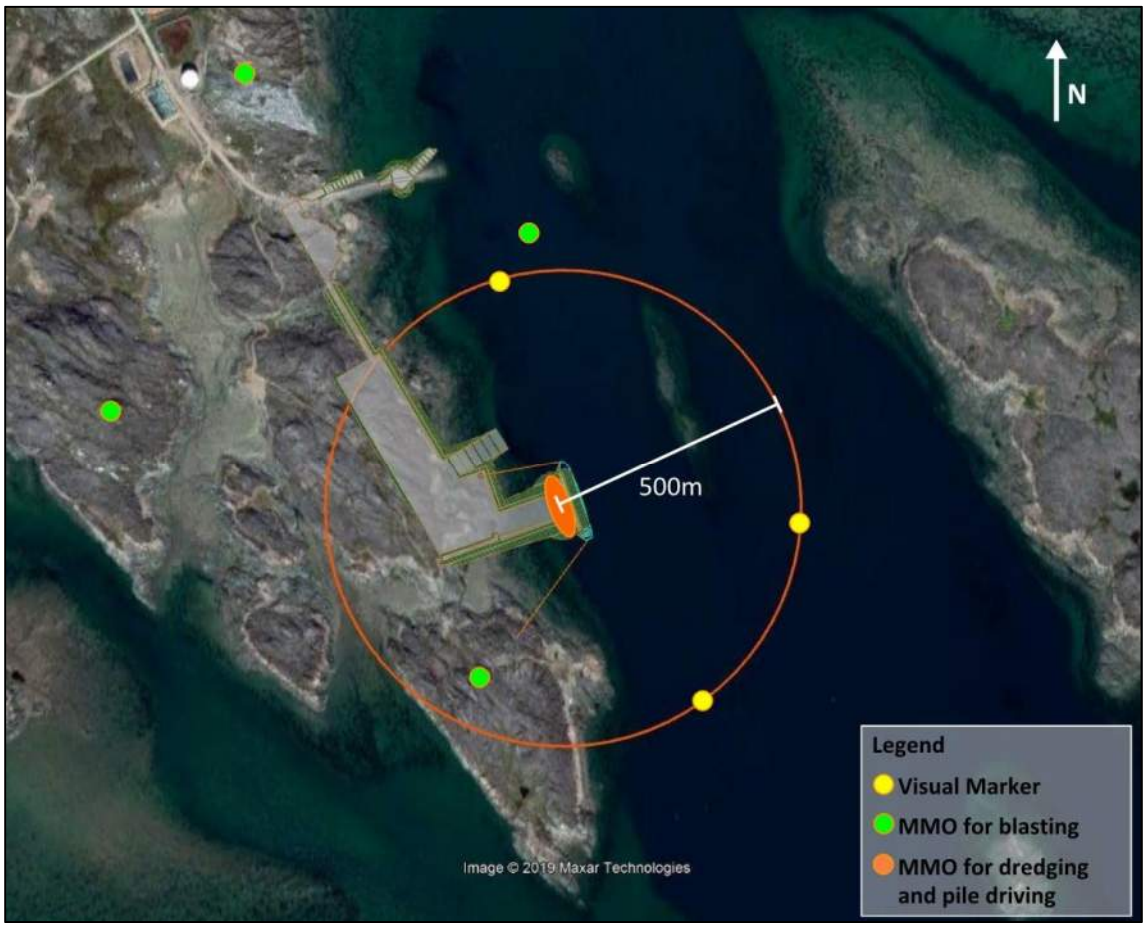


Figure 7-1: Map for Marine Mammal Monitoring

Infill

For all in-water infill or infill in the intertidal zone from the land, the operator of the bulldozer or the excavator used for infilling will act as the MMO since he is able to observe the area as he regularly waits for the fill material. In addition, this worker is posted at the end of the infrastructure under construction which allows for a good vantage point to observe the marine environment. For infill activities using mud scows for the fixed wharf footprint, one of the mud scow's ship mates will act as MMO.

Dredging

For dredging operations, an MMO will be posted on the dredge barge. The MMO will use binoculars to better identify the presence of marine mammals. The MMO will advise the EM if he judges sight lines are not appropriate to monitor the work site's perimeter.

Disposal at Sea

For dredging disposal, which includes the transport and unloading of the dump scow, the ship captain and his seaman will be the MMO. They are experienced in recognizing marine mammals as well as in safety measures to avoid a collision. The area to be monitored for this activity is a 100 m buffer zone around the vessels. The MMO will use binoculars to better identify marine mammals as required. If applicable, they will report their marine mammal sighting to the MMO on the dredge barge.

Blasting

For the blasting activity, workers enforcing the security perimeter during blasting will be the MMO. The exact location of the MMO will be chosen on the day of the blast depending on the location of the blast. MMO must be outside the worker security perimeter during the blasting procedure. One of the MMO will use binoculars to better identify marine mammals.

Pile Driving

For pile driving operations, the MMO will be place on the construction barge NT811. On day light, the MMO will use binoculars to better identify the marine mammals present. Buoys will be placed as markers to help identify the limit of the exclusion zone, once it has been determined. Monitoring of the exclusion zone will begin 30 minutes prior to the start of pile driving activities.

On darkness condition, if the normal construction light can't offer to the MMO enough light to observe the entire exclusion zone the MMO will use a Flir Scout II 640 thermal night vision camera to observe in the complete darkness. If the thermal night vision camera is used, two MMO will observed on rotation to offer rest periods to MMO. The camera model is easy to use and only a short training given by the EM is necessary.

During the initial piling activity, the captain of the boat used for the acoustic monitoring will act as MMO. His observations will be compared to that of the MMO on the construction barge. If their observations concur, only the MMO on the construction barge will continue his observations.

The MMO for the pile driving activities will also monitor the presence of dead fishes. If that happen, the MMO will immediately inform the EM of his observation and additional mitigation measures will put in place as described in section 7.4.3 Change Management.

7.2.3. Stop Work Conditions

Work will stop if a marine mammal is seen within the exclusion zone (refer to Table 7-2) or dead fishes are observed. The MMO will immediately inform the EM by cellphone or using the TA radio. The EM will immediately inform the superintendent using the TA radio that the work must be suspended and will immediately proceed to the site to document the event. During the night shift, when the EM is off duty,

the MMO will contact the superintendent directly using either a cellular telephone or the TA radio. The species of marine mammal, its distance from the marine works, if possible, its health condition, the time and date will be recorded.

For piling activities, work may resume 30 minutes after the mammal has moved outside of the exclusion zone or if it has not been seen within the exclusion zone for at least 30 minutes.

If a marine mammal is injured, the reasons for the injury will also be investigated in order to produce an incident report. *Fisheries and Oceans Canada (DFO)* will be informed within 48 hours if a marine mammal or dead fishes are observed through the DFO'S incident line (867-979-8000) and work may only resume once the DFO representative has given his ascent to the EM.

7.2.4. Adaptive Management Procedures

If dead fishes or marine mammal are observed, work methods, mitigation measures and distances for suspending the work will be reassessed. If the boundary of the exclusion zone changes, the MMO will be notified and the Monitoring plan will be adjusted accordingly.

7.3. Near water blasting

Starting in August 2018, blasting and near water blasting was carried out on the west side of Koojesse Inlet within the DSP laydown and Causeway parking areas (SCH) (refer to Figure 7-2). Roughly half of the blasting required was carried out in 2018. The remainder of the blasting to be carried out is depicted in Figure 7-3.

The DFO permit states that blasting activities shall be conducted according to the DFO's *Guidelines for the use of Explosives, in or near Canadian Fisheries Waters*, which sets an overpressure threshold in the water at 100 kPa.

For information purposes, if the charge per detonation is 80 kg (maximum charge planned for the worksite), the required setback in order to avoid the risk of causing an exceedance of the 100 kPa overpressure threshold is 45 m for rock substrate.[3] Blasts that are at risk of causing an overpressure in the water which exceeds this threshold will be referred to as "near water". Considering set back distances from the water during high and low tide, it is estimated that 10 blasts may be considered "near water" in 2019 depending on the charge per detonation and the timing of the blast with respect to tide height.

[3] Hopky and Wright, 1998. Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters: Calculated from equations in Appendix III.

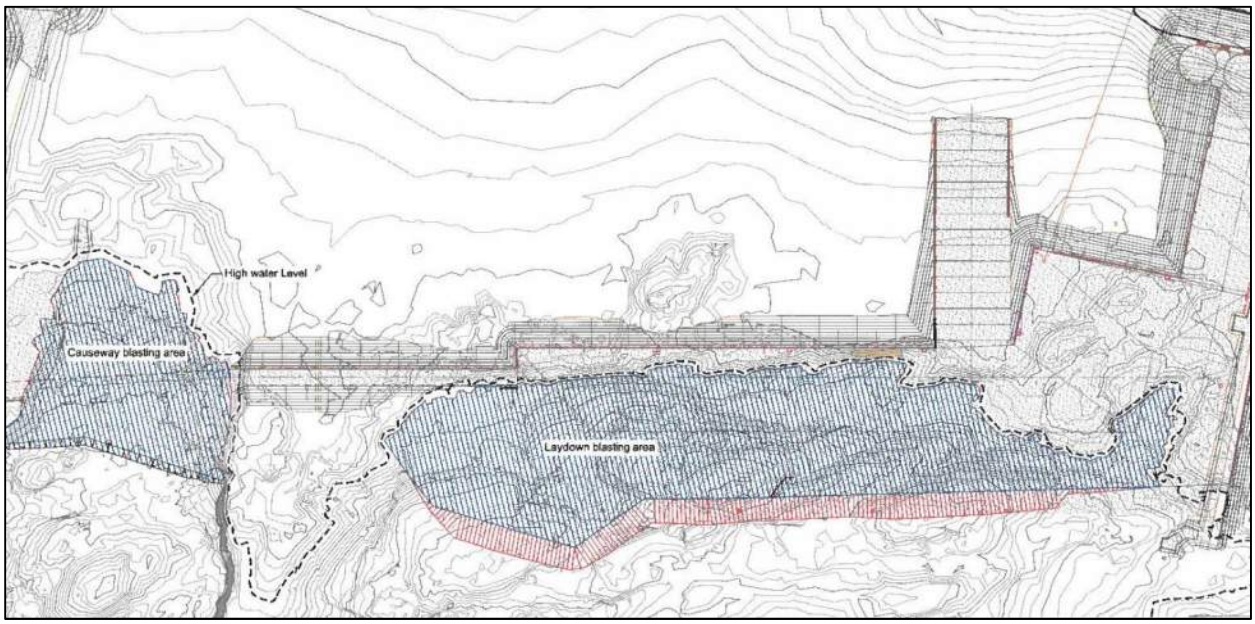


Figure 7-2: Areas where blasting was required in 2018 for the Iqaluit Project

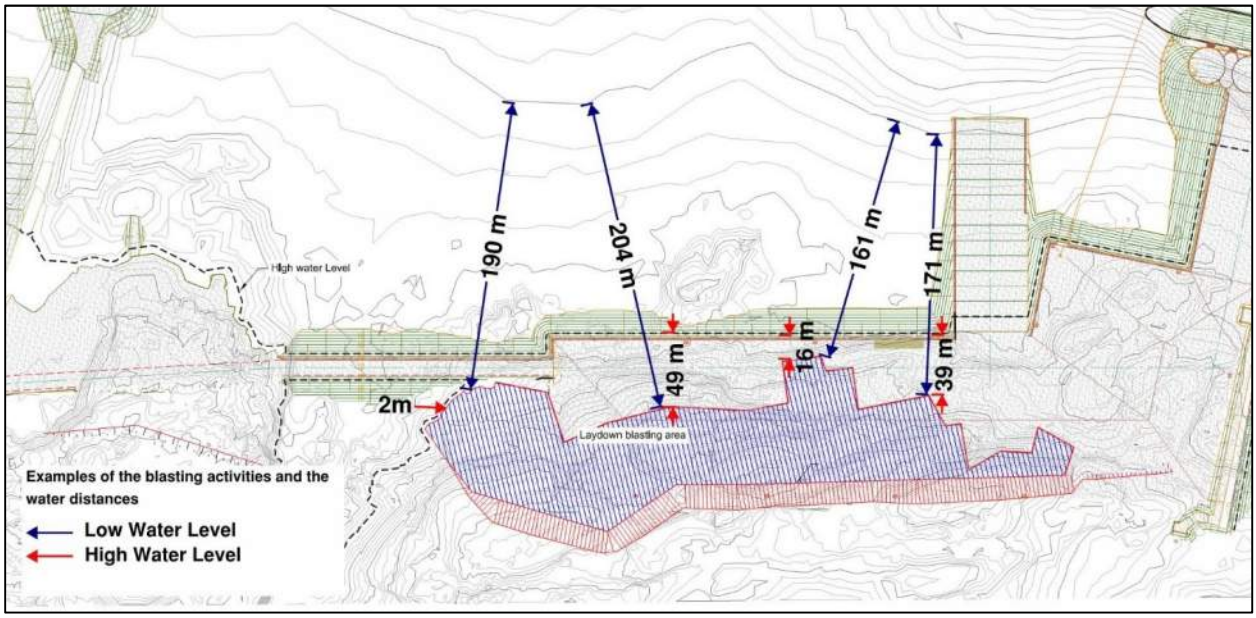


Figure 7-3: Areas where blasting is required in 2019 for the Iqaluit Project

7.3.1. Procedure

Once charges and timing of blasts are known, the EM will determine if the blasts are “near water”. All near water blasts will be monitored for overpressure as described in section 7.3.2. The hydrophone will be set to record overpressure events exceeding a threshold of 15 kPa and will be placed at 1.5m under the water surface.

Location

The location of the monitoring station will be seaward from the blast. The exact location will be defined on site.

The hydrophone will be suspended under a buoy. The buoy will be set as close as possible to the blast zone, in an area which has sufficient water depth, and which allows for the receiver of the hydrophone to be placed away from rock projections. Given the amplitude of the tides in Koojesse Inlet, the location of the buoy will be selected to ensure that the hydrophone remains a minimum of 0.5 m above the seabed for the duration of the reading.

Equipment

The hydrophone and receiver unit will be an Instantel Minimate. Its annual calibration was carried out by Instantel during winter 2018-2019. The calibration certificate is available upon request.

A sensor check is automatically performed before the measurements to ensure their accuracy.

Recording

The following information will be recorded in the blast overpressure log:

- Blast number
- Date
- Time
- Water’s distance from the blast
- Maximum charge per detonation
- Tide stage and height at the time of the blast
- Weather (cloud cover, precipitation, etc.)
- Presence of dead fish
- Location of the hydrophone (coordinates, distance from the blast, distance from the water’s edge)
- Trigger level (15 kPa)
- Peak recorded during the blast (kPa).

7.3.2. Adaptive Management Procedures

If the threshold is exceeded, measures will be taken to adjust either the timing of the blast with regards to tide or the maximum charge per detonation in order to reduce the risk of exceeding the overpressure threshold in the water. If dead fish are observed, the EM will confirm if peak overpressure recorded exceeded the 100 kPa threshold and notify the DFO. The blast method will be adjusted as required according to discussions with the DFO.

7.4. Acoustic and Overpressure Monitoring for Pile Driving

Two pile types are required for the DSP. The fixed wharf's template will be framed using 760 mm circular piles, whereas the wharf cells' perimeter will be sheet piled. The piles for the fixed wharf will be driven into a prepared surface made of crushed type 4 aggregates. The depth of the water column at the fixed wharf will vary. It is estimated that the height of the water column where pile installation will take place will range from 15 to 30 m.

The two pile types will be driven with the vibratory pile driver (ex. 44B model) and exceptionally the conventional hammer or the diesel hammer will be used. Systematically, if a hammer is used to pile a 760 mm circular pile, a bubble curtain will be put in place around the pile to reduce the overpressure and the activity will occur only on day light condition.

Table 7-3 below summarizes the main details of the pile installation as well as the estimated schedule for the pile driving activities.

Table 7-3: Summary of pile driving activities

Piles type	Technical details	Estimated start date
Piles for the cells template	9 x 760 mm circular piles	October 2019
	39 x 760 mm circular piles	2020
Cells sheet piles	150 x sheet piles	October 2019
	600 x sheet piles	2020

The DFO's authorization indicates that in-water activities shall be undertaken, such as stated in the application to minimize the potential for stress related behaviors or death of fish and marine mammals, using the following guidelines:

- Setting a marine mammal exclusion zone
- Ensuring underwater pressure and noise levels will not exceed 30 kPa at 10 m and 160 dB re 1 µPa for vibratory pile driving, which also defines the outer limit of the exclusion zone
- If iced-season work occurs, pinnipeds will not be exposed to an in-air level above 100 dB re 20 µPa.

No iced-season work is currently planned for the Iqaluit Project.

A soft start for pile driving will be implemented slowly over a 10 minutes period to ensure mammals and fish have sufficient time to leave the area. Soft start procedures will be implemented every time work has been interrupted for at least 30 minutes.[4]

7.4.1. Acoustic monitoring

7.4.1.1. Training

Tests were carried out on-site on July 20 and 21st with the icListen Smart Hydrophone, which will be used on-site for the underwater monitoring. This allowed for both EM to test the mooring and gain experience in the use of the hydrophone. Data was gathered and results will be discussed with a senior marine biologist in order to ensure data is gathered efficiently and the interpretation of the results by the EM is accurate.

The senior marine biologist or a sound technician will be available to advise the EM if problems arise during monitoring activities or to assist with the treatment and interpretation of data collected.

A sound technician will be available to advise the EM if problems arise during monitoring activities or to assist with the treatment and interpretation of data collected.

7.4.1.2. Procedure

The ambient noise levels will be established both before the start of pile driving at the fixed wharf. It will be established over a two-day period. Measures will be taken at both high and low tides, along three transects radiating away from the fixed wharf location.

The monitoring of the underwater noise will begin right after the soft start period. The purpose is to confirm the size of the exclusion zone initially set at 500 m in compliance with the CEMPs. The minimum radius for the exclusion zone will be 50 m for pile driving activities.

[4] Department of planning, transport and infrastructure, Government of South Australia, 2012. "Underwater piling noise guidelines". [Online]. URL: https://www.dpti.sa.gov.au/__data/assets/pdf_file/0004/88591/DOCS_AND_FILES-7139711-v2-Environment_-_Noise_-_DPTI_Final_word_editing_version_Underwater_Piling_Noise_Guide.pdf. Consulted in May 2019.

The following activities will be monitored:

- Impact driving of 760 mm circular piles
- Vibratory driving of 760 mm circular piles
- Impact driving of sheet piles
- Vibratory driving of sheet piles

Impact driving of sheet piles Measurements will be taken at the beginning of each new activity listed above. Additional measurements will be taken if the work method changes or if conditions such as weather and tide stage change significantly with respect to the initial measurements. A follow up measurement will be taken once a week at the perimeter of the exclusion zone.

The deployment mechanism will be adjusted according to tide stage to minimize noise[5] due to flow around the hydrophone. In order to reduce the effect of strumming, the measurements will be taken while the hydrophone is adrift. If currents and heave allow, the measurements will be taken directly from the boat. If boat heave or strumming is causing too much interference, the hydrophone will be suspended under a drifting surface buoy, using a compliant section (catenary mooring) to decouple the hydrophone from the surface movements as much as possible.

Parasite noise will also be mitigated through the use of ropes rather than metal chains.

The vessel's engine and sonar will be turned off and the crew will be instructed to minimize their movements within the boat in order to limit vessel noise.

Measurements will begin once the signal has stabilized. The measurement period will depend on the stability of the signal. It will be approximately 5 minutes.

7.4.1.3. Location

Measurements will be carried out starting at a 500 m mark offshore from the work site. Depending on the SPL_{RMS} dB (re 1µPa) results, subsequent measurements will be made either further offshore or inshore in order to define the location of the 160 dB (re 1µPa) threshold.

Measurements will be taken north and south of the construction site, in addition to the location directly offshore, to delineate the outer limit of the exclusion zone. The hydrophone will be set to measure the bottom third of the water column (0.7 to 0.8 times the water depth)[6].

[5] National Physical Laboratory, 2014. "Good practice guide no. 133: Underwater noise measurement". [Online]. URL: https://www.researchgate.net/profile/Stephen_Robinson4/publication/263229365_Good_Practice_Guide_No_133_Underwater_Noise_Measurement/links/02e7e53a307c0ad09a000000/Good-Practice-Guide-No-133-Underwater-Noise-Measurement.pdf?origin=publication_detail. Consulted in May 2019.

[6] National Marine Fisheries Service (NMFS) Northwest Region and Northwest Fisheries Science Center, 2012. "Guidance document: data collection methods to characterize Impact and vibratory pile driving source levels relevant to marine mammals". [Online]. URL: https://webcache.googleusercontent.com/search?q=cache:KhAIxoZjiusJ:https://www.researchgate.net/profile/Scott_Veirs/post/Should_i_use

7.4.1.4. Equipment

Underwater noise levels will be measured using Ocean Sonics' icListen Smart Hydrophone (SC2-ETH-X2) specifically designed to monitor pile driving activities, or an equivalent system.

The model selected will minimally cover the frequency range from 10 Hz to 200 kHz, which encompasses the communication frequencies for seals commonly reported in Koojesse Inlet. The frequencies associated with pile driving are generally lower than 2 kHz. A range up to 200 kHz is therefore more than sufficient to cover the range for pile driving activities.[1]

The equipment will have been calibrated prior to mobilization. The calibration certificate will be available upon request. Since the model which will be used is a digital smart hydrophone, it does not require on-site calibration.

For the first week of acoustic monitoring, a second hydrophone will be mobilized on site as a backup in case of a malfunction in the first hydrophone. The delay in delivery of a new hydrophone being a few days, in the event of a malfunction during the weekly follow ups, the follow up will be delayed by a few days while the new equipment is shipped on-site.

7.4.1.5. Recording

The noise parameters recorded will be:

- Noise levels in relation to distance from the piling activity in SPL_{RMS} (dB re 1µPa)
- GPS location (at the beginning and the end of the reading in case of considerable drift).

Additional information will be recorded in order to properly interpret the results, namely:

- EM carrying out the recording
- Nature of work taking place
- Mitigation measures in place during the recording, if used
- Origin of other noises heard during the recording
- Tide conditions and waves
- Weather conditions

The form used to record the results is presented in Appendix 4. SPL_{RMS} dB (re 1µPa) will then be transferred to a log to facilitate follow up.

dBPeak values to determine underwater noise mitigation for marine mammals ie safety zones/attachment/59d6275079197b807798599f/AS%253A325332860194819%25401454576806597/download/pile-driving.pdf+&cd=1&hl=fr&ct=clnk&gl=ca. Consulted in May 2019.

7.4.2. Overpressure monitoring

7.4.2.1. Training

Olivier Bédard-Richard gained experience using the Minimate Pro to monitor overpressure for blasting activities during the 2018 construction season. He will train David Lauzon on the use of the Minimate Pro. He will also be responsible for training personnel on the interpretation of the results as required as well as the resource identified to monitor overpressure results during pile driving and ensure overpressure remains below the threshold.

7.4.2.2. Procedure

Overpressure will be monitored for piling activities stated in section 7.4.1.2.

The receiver of the hydrophone will be placed either on the barge or on the wharf access depending on the configuration of the work site. Table 7-4 describes the overpressure monitoring period for all four pile driving activities stated in section 7.4.1.2.

Table 7-4: Monitoring period

Activity	Overpressure hydrophone recording period
Vibratory driving of 760 mm circular piles	Longest of either first circular pile or first day of circular pile driving and then once weekly.
Impact driving of 760 mm circular piles	Continuous during the use of the hammer
Vibratory driving of sheet piles	Longest of either first sheet pile or first day of sheet pile driving and then once weekly.
Impact driving of sheet piles	Continuous during the use of the hammer

For the first hour of pile driving for each new activity using an impact or vibratory driving, the overpressure results will be observed continuously in order to ensure that overpressure results remain below the threshold (30 kPa). The recorded overpressure results will subsequently be verified every hour during the monitoring period state in Table 7-4.

7.4.2.3. Location

Since overpressure will be recorded 10 m away from the construction site for a longer period (equivalent to either the period required to drive one pile or one day), its location within the water column will account for tide, ensuring that the hydrophone remains a minimum of 0.5 m from the bottom.

7.4.2.4. Equipment

Overpressure will be measured using the Instantel Minimate Pro with its hydrophone.

7.4.2.5. Recording

The hydrophone will be programmed to record events that are above 15 kPa. Peaks of overpressure at 10 m will be recorded directly in the pile driving overpressure log.

7.4.3. Change Management

If readings show that overpressure at 10 m or noise levels at 500 m are exceeded, mitigation measures will be put in place.

For the piling with the hammer and the vibratory pile driver, the first mitigation measure for the noise level will be to broaden the exclusion zone up to where noise level is below threshold. Conversely, if noise levels are lower than expected at 500 m, the exclusion zone will be made smaller. The new boundary will be set in order to ensure noise level are compliant with DFO obligations outside of the exclusion zone. The new boundary will be communicated to the MMO.

Additional mitigation measures for the piling with the hammer may include:

- Diminishing the impact for pile driving (height of hammer or use of a cushion)
- Diminishing the number of impacts per unit of time

Additional mitigation measures for the piling with the vibratory pile driver may include:

- Diminishing the number of impacts per unit of time
- Installation of a bubble curtain

Monitoring of the exclusion zone for both marine mammals and presence of dead fish will be carried out as described section 7.2.

7.5. Barge Anchoring

Condition MC12 of the CEMP states that no anchoring or spudding of barges will be allowed where moderate to abundant seaweed occurs outside of the DSP footprint.

Two sites have been identified for barge spudding, one for the worksite contained mostly within the footprint of the worksite, and one at the Northern tip of Long Island for shelter during bad weather (Figure 7-4).

Figure 7-4: Barge spudding locations

Density of seaweed was verified using satellite imagery shown in Figure 7-4 for the portion of the spudding site outside of the DSP footprint and for the site adjacent to Long Island. The photographs show that seaweed is sparse in the locations identified.

If additional anchoring or spudding sites are required as the worksite evolves, density of the seaweed will be verified using satellite imagery and aerial photographs taken with drone prior to the approval of the sites.

8. Land-based Activities

8.1. Wildlife and Vegetation

TA will carry out a wildlife survey in order to identify sensitive wildlife features. Setbacks and mitigation measures may be as required to avoid disturbance of wildlife. Methodology to be used by the onsite EM is provided in Appendix 5. A report detailing wildlife features observed during the survey and compliance with mitigation measures will be provided to CGS. Mitigation measures will minimize the potential adverse effects on wildlife, migration birds and nests. The survey makes it possible to respect the attenuation measures listed in Table 8-1.

Table 8-1: Wildlife Requirements

WL 10	A pre-construction wildlife sweep shall be conducted by the EM to identify all sensitive wildlife features, e.g. active bird nests, wildlife dens and wildlife foraging or traveling. In the event a sensitive species or feature is identified, buffers or exclusion zones shall be implemented to ensure wildlife are not disturbed. Entry buffers shall be based upon government or biologist recommended setback distances.
WL 11	Work site boundaries shall be flagged to prevent inadvertent loss or alteration of habitat outside of the designated Project footprint.
BR 01	Activities and infrastructure will be sited away from nests and roosts that will be protected by prohibited entry buffers based upon government or biologist recommended setback distances. Any nest that is disturbed will result in immediate notification to ECCC and the GN.
BR 02	Construction activities will not begin until the area has been surveyed for migratory birds and nests (in a non-intrusive manner).

8.2. Sediment and Erosion Control

The EM will monitor land-based activities to confirm if any Sediment and Erosion Control (SEC) measures are required. Primary areas to be monitored are the stockpile and rock crushing areas as identified in Figure 8-1.

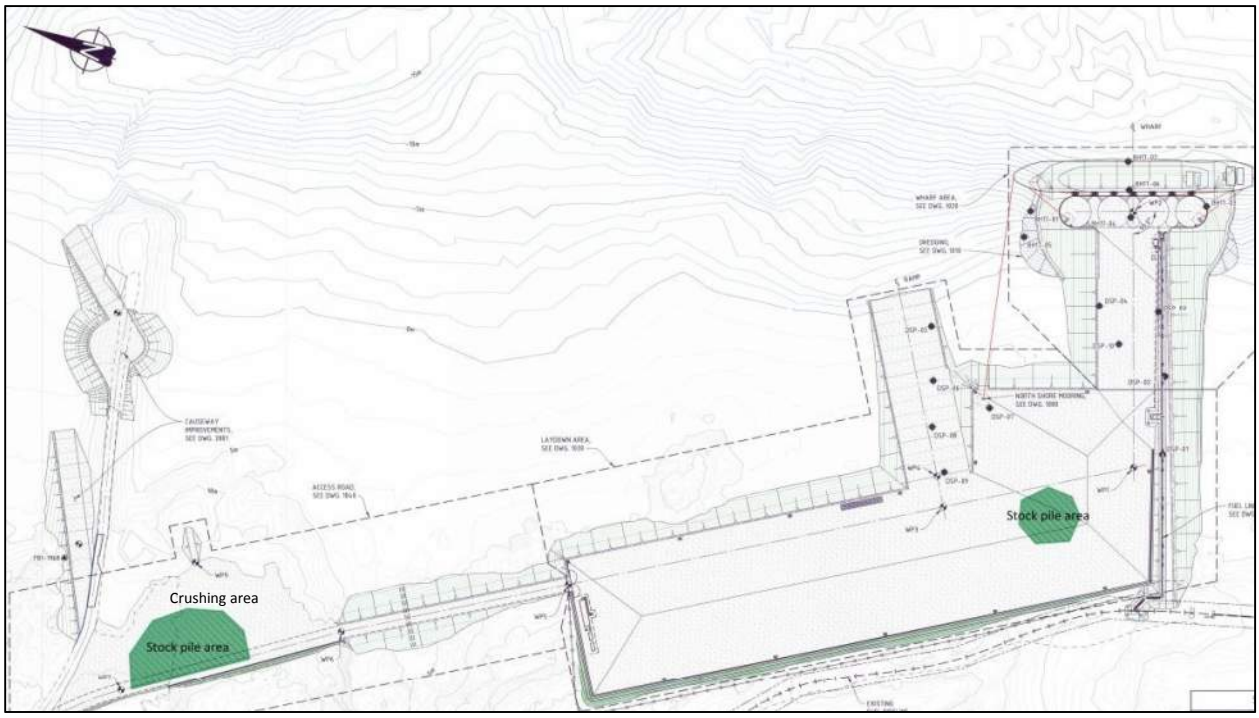


Figure 8-1: Stockpiling areas

8.3. Dust Control

TA will be transporting rock material from the west to the east side of Koojesse Inlet to support construction of the SCH. The route which will be used to do so is provided in Figure 8-2.

The main route used for hauling materials such as stone from the quarry located at the DSP to the SCH will be via:

- Akiliq road
- Alanngua road
- Niuraivi road towards sea lift beach area
- Sea lift beach area
- QIA owned road at pump station
- Sinaa street

The EM will monitor if additional dust control measures are required. If any additional measures are required, this information will be provided in the appropriate weekly report.

Figure 8-2: Haul Road Between DSP and SCH

8.4.Tower Contractor Laydown

A contractor laydown area was established during the 2018 construction season. The purpose of the contractor laydown area is to: a) provide a parking area for construction equipment and vehicles and b) provide a storage area for dangerous goods, and c) provide an area for fuel storage.

Measures for appropriate fuel storage are provided in TAs Spill Response Plan, however, if any spills occur during refuelling this will be reported in the appropriate weekly report.

8.5. Storage of Dangerous Goods

A storage area for dangerous goods (DG) was established within the contractor laydown area (Figure 8-3), where items were stored in designated shipping containers. Explosives for blasting will be stored in an area approximately 5 km north of Koojesse Inlet as permitted by NRCan and the City (Figure 8-4).

Items planned to be stored in both locations are provided in Table 8-2.

Table 8-2: Items for Dangerous Goods and Explosives Storage

Dangerous Goods	Volume	Storage site
Diesel	15,000 L	Laydown area
Gasoline	250 L	Laydown area
Propane	5 m^3	Laydown area
Lubricants and oils	1,000 L	Laydown area
Oxy/Acetylene	5 m^3	Laydown area
Paint	5 L	Laydown area
Explosives	25 kg	Explosives storage area

The arrival of DG and explosives will be documented by the onsite EM, and the storage areas will be inspected weekly to confirm appropriate storage is occurring.

Figure 8-3: Dangerous goods storage area

Figure 8-4: Tower's Explosive Storage Area

9. Reporting

9.1. Check Lists

In order to ensure compliance with the terms and conditions of the various project permits as well as with the CEMP, the environmental monitors will document their surveillance activities within two documents:

- A Commitment Register which summarizes mitigation, monitoring, and permit conditions was developed. It has been transformed into a checklist which will be used once at the onset of the construction season and again towards the end of the work season (Appendix 6)
- An abridged checklist which includes regular environmental conditions to be monitored weekly (Appendix 7).

The EM will always use the previous checklist as a guide in order to ensure a follow up of main environmental concerns.

9.2. Databases

Databases will also be used for monitoring of the following activities:

- Staff training
- Turbidity monitoring
- Underwater noise and overpressure monitoring
- Marine mammal sightings
- Hazardous materials delivered to the site
- Non compliance
- Accidental spills
- Local hires.

Databases will be available to CGS upon request and presented in weekly reports when relevant.

9.3. Pictures

A few relevant dated pictures with descriptive captions will be included in the weekly reports. Other site pictures will be saved per date in a file on the e-builder.

9.4. Weekly Reports

Since EM rotations will begin and end on a Wednesday, weekly reports will be produced by TA with a week that runs from Wednesday to Tuesday. Reports will be submitted to CGS no later than the Tuesday following a construction week. A demonstrative weekly report format is provided in Appendix 8.

9.5. Regulator Reporting

Several regulators have reporting requirements in their permit conditions that are due either annually subsequent to the construction season, once a specific construction activity is complete or subsequent to facility construction. These requirements are outlined in Table 9-1. Weekly reports will be used to prepare reports and substantiate statements made in annual reports.

Annual reports will include a tracking table listing conditions stated in the permits and the section of the report where these conditions are addressed.

Table 9-1: Regulator Reporting Requirements

Authority	Permit	Permit No	Condition No	Detail	Reporting Frequency	Due Date
DFO	FAA -	17-HCAA-00961/64	3.1	Monitoring of avoidance and mitigation measures: The Proponent shall monitor the implementation of avoidance and mitigation measures referred to in section 2 of this authorization and provide an annual report to DFO, by January 31, 2019, 2020, and 2021, and summarizing whether the measures and standards to avoid and mitigate serious harm to fish were conducted according to the conditions of this authorization. This shall be done, by:	Annual	January 31, 2019, 2020, 2021
			3.1.1	Demonstration of effective implementation and functioning: Providing dated photographs and monitoring reports to demonstrate effective implementation and functioning of mitigation measures and standards described above to limit the serious harm to fish to what is covered by this authorization.		
			3.1.2	Contingency measures: Providing details of any contingency measures that were followed to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.		
CIRNAC	Land use permit	N2018X0011 (DSP) N2018X0009 (SCH)	8.	Submit an annual report by March 30th of each year of permitted activities including a technical summary of activities undertaken for the year, a table and map (with exact coordinates in degree/min/sec format in NAD83)	March 30th of each year of permitted activities	March 30th, 2020, 2021

Authority	Permit	Permit No	Condition No	Detail	Reporting Frequency	Due Date
				showing camp locations, air strip and landing location, drilling locations, fuel caches, locations of activities conducted, active and backfilled sumps, a work plan for the following year, any progressive reclamation undertaken.		
NIRB	Screening decision	17XN021 (DSP) 17XN022 (SCH)	36.	Submit a comprehensive report to NIRB at the completion of construction activities and prior to operations (activities, characterization of dredged material and mitigation as required, reasons for installation of silt fences if required, wildlife log with notes on species and behavior, mitigation activities and stop work events and outcome, discussion with regulators about wildlife and updated procedures, spills and responses, how compliance with conditions).	At completion of construction	Tentatively year end 2020
ECCC	Disposal at sea	4543-2-02899/4543-2-02900	11.2	Records of all loading and disposal activities are kept on site for the duration of the permit and are available for inspection by any enforcement officer or analyst, for 2 years following the expiry of the permit.	On going	
			13.2	Submit a written report to the Minister, as represented by the Regional Director of the Environmental Protection Operations Directorate, within 30 days after the expiry of the permit. This report shall contain the following information: a list of all work completed pursuant to the permit, including the location of the loading and disposal sites used, the quantity of matter disposed of at the disposal sites, and the dates on which disposal activities occurred.	30 days after expiration	August 2019 and 2020

Authority	Permit	Permit No	Condition No	Detail	Reporting Frequency	Due Date
			14.1	Submit a written dredged material disposal plan to the Minister, as represented by the Regional Director of the Environmental Protection Operations Directorate, Prairie and Northern Region, identified in 13.2 for approval by the Department of the Environment prior to the commencement of the first dredging operation authorized by this permit. The plan shall address procedures to accurately measure or estimate quantities of dredged material disposed of at the disposal sites, vessel tracking and a schedule for us of the disposal sites. Modifications to the plan shall be made only with the written approval of the Department of the Environment.	Prior to dredging disposal	2018

9.6. Non-Compliance

Any non-compliances will be reported to CGS and the Environmental inspector within 24h. Other concerns will be reported through the weekly reports.

9.7. Reportable Incidents

Measures to be taken in the event of a spill are described in TAs Spill Response Plan. Details on reportable incidents will be provided in the appropriate weekly report.

Appendix 1:
Environmental Advisor and Monitors' resumes

STÉPHANE LORRAIN, B.Sc., M.Sc.

With training in geology and a specialization in oceanography, he has over 29 years of practical experience in conducting and supervising studies in oceanography, hydrography, hydrology, and in the characterization of sediment properties and sediment transport studies as well as water quality and GHG monitoring in aquatic systems. These studies were mainly done in the context of major hydroelectric development projects but also, and not the least, of port/marine infrastructures and dredging projects. Mr. Lorrain has developed an expertise in carrying out complex fields surveys related to the physical characterization of aquatic and marine environments. His work was conducted in support of engineering studies (design, construction) and of environmental and social impact assessments. He also serves clients as expert-advisor to design and evaluate environmental monitoring programs on the context of shoreline/riverine erosion and sediment management issues. Mr. Lorrain has participated in major projects in Nunavik and Northern Manitoba and Quebec, spanning the St. Lawrence River and Gulf of St. Lawrence, the entire northern coast of Quebec from Ungava Bay to Hudson Bay via the Hudson strait and Western Hudson Bay and Northern Manitoba. Abroad, he worked in West Africa over a period of 8 years, the last two years almost on a permanent basis carrying out Metocean surveys and marine biological resources assessments. He supervised water quality studies related to aquatic greenhouse gases emissions in Cameroun, California and Australia among others. In his previous employment, as director of a technical survey and engineering support group, he has participated in major basin-wide hydroelectric projects in Quebec and Manitoba (200 to 1000MW) as well as major port development projects in West Africa and Canada; some were carried out in difficult and challenging logistical, political and organizational contexts.

SECTORS OF EXPERTISE

Environment

- Sedimentology; Physical Oceanography and Marine Geophysics; Coastal Management; Hydrology; Baseline studies; Environmental Impact Study
- METOCEAN studies, coastal erosion studies, numerical modeling (hydrodynamic, wave, hydrology), biophysical characterization of fluvial, estuarine, coastal and marine environments, hydrology and hydrography surveys, environmental monitoring of dredging projects, coastal and estuarine environmental impact assessments, port development, hydroelectric development

Additional expertise

- Management of multidisciplinary studies, management of complex field operations and surveys, business development, integration of local resources and capacity building

EDUCATION

1993 M.Sc., Masters in Oceanography, McGill University, Montreal, Quebec, Canada

1985 B.Sc., Bachelors in Geology, *Université du Québec à Montréal* (UQAM), Montreal, Quebec, Canada

EXPERIENCE

SINCE 2016

SNC-LAVALIN INC., MONTRÉAL, QUEBEC, CANADA

Environment and Geoscience

Senior Oceanographer

Setup and supervise a marine & aquatic study team, comprising survey and data interpretation/numerical modeling capabilities.

Years of Experience

- 30 years

Years with SNC-Lavalin

- 3 years

Key Positions

- Project Director
- Oceanographer
- Geologist

Languages

- French
- English

Site Experience

- Canada
- Guinea
- Morocco
- Sierra Leone
- Tunisia

Computer Applications

- MS Office, various data acquisition software, MatLab

		Project Manager, Conceptual Study - Railway and Port Options Simandou Project, Guinea, West Africa, CA $270 000 (2019)
		Supervise a team of professionals to carry out a high level conceptual analysis focusing on the community and social performance, permits & regulatory framework and environment (biodiversity, status species). The analysis cover 14 options comprising a single mine site, 7 road/rail haul transport and 6 ports distributed in three countries (Côte D'Ivoire, Liberia, Guinea)..
		Project Director, Description of the hydrodynamic conditions at sensitive site located on Île Bouchard, St. Lawrence River, Contrecoeur,Quebec, Nature Conservancy Canada, CA $30 000 (2019)
		Supervise a hydraulic numerical modelling study of flow, water levels and waves to assess the conditions that may affect shoreline erosion. The wave modelling component includes wind wave as well as ship's wake. Provide recommendations to assist in the design of the shoreline protection infrastructure that will be put in place.
		Project Director, Bathymetry surveys in the context of power dam refurbishing (Carillon) and restoration of a river reach (Les Cèdres Powerhouse), Hydro Quebec, Canada, CA $100 000 (2018)
		Supervise a bathymetric survey using a remote controlled boat (ASV: autonomous surface vehicle) to carry out a multibeam survey near (upstream and downstream) of the Carillon Power House as well as a bathymetric survey combining moving boat single beam sounder and remote controlled boat (ASV: equipped with an ADCP). Survey of flow control structures.
		Senior Marine Specialist, Erodibility study for the Kingston Inner Harbour, Public Works and Governmental Services Canada, Ontario, Canada $650 000 (2017 - present)
		In the context of remediation of contaminated sediments in Kingston Inner Harbour, the client is looking for a characterization of the hydrodynamic regime and a determination of the potential of remobilization of the bottom sediments. The survey work includes hydrodynamic seasonal monitoring (wind, water level, wave, flow, TSS), description of sedimentation rates using radio isotopes (210Pb, 137Cs, 7Be), erodibility experiment using a portable Core Mini Flume (design and fabrication, in coll. With National Oceanography Center, Southampton, UK) and conceptual model of sediment transport patterns using STA techniques (sediment trend analysis).
		Senior Marine Specialist, Bathymetric survey and underwater 3D scan of a seawall and wharf, Ville de Montreal, Quebec, Canada, CA $30 000 (2017 - present)
		In the context of the reconstruction of a seawall that collapse into Lake St-Louis, the work included a bathymetric survey and full coverage 3D scan of the seawall. The work was extended to an adjacent wharf for a condition assessment of the wharf's sheet pile.
		Senior Marine Specialist, Design and selection of technical options for the dismantlement of the Corfu Island shipwreck, PWGSC, Magdalen Islands, Quebec, Canada, CA $164 000 (2017 - present)
		In the context of the project, support the project director with regards to marine surveys (diving inspection, bathymetric surveys) and provide a characterization of the metocean (wave, tide, flow) and ice regime for consideration as constraints in the different dismantling approaches that will be proposed. In addition, carry out a coastal geomorphological evaluation to determine potential change in the beach and dune setting after the removal of the shipwreck.
		Senior Marine Specialist, Characterization of the biological and physical environments around the site of the Corfu Island shipwreck, PWGSC, Magdalen Islands, Quebec, Canada, CA $130 000 (2017 - present)
		In the context of the project, supervise a team of marine and terrestrial specialists in characterizing the physical setting of the proposed work site. The work includes the characterization of the coastal and marine habitats; identification of environmental constraints related to the construction activities and contaminated soil management options with regards to the removal of a shipwreck. Land surveys include a topographic survey using an aerial drone, vegetation survey and

		complete beach/dune topographic survey. Marine surveys include a diving survey using underwater cameras and sediment sampling for to determine the marine benthos and physical properties of the bottom.
		Senior Marine Specialist, Hydrographic survey and metocean study for the construction of a new marina, Groupe Selection, Rivière-des-Prairies, Quebec, Canada, CA $50 000 (2017 - present)
		Groupe Selection is building Phase 2 of a large residential complex on the shore of the Rivière des Prairies which will include a new marina. As part of the marina design project, a hydrographic survey was required as well as a description of the hydrology, weather and wave regime in the area.
		Senior Marine Specialist, Expansion Project of the Port Terminal, Montréal Port Authority (MPA), Contrecoeur, Quebec, Canada, CA $166 000 (2016 - 2017)
		› In the context of the Environmental Impact Assessment for the extension of the Port of Montreal at Contrecoeur (addition of a container terminal), responsible for the description of the marine environment and the hydrosedimentological, hydrological and ice regime. The work also includes supervision of the numerical modelling to characterize the fate of dredged sediments and the hydraulic change to the flow pattern from the new wharf configuration.
		Senior Marine Specialist, Expansion Project of the Port Terminal, Montréal Port Authority (MPA), Contrecoeur, Quebec, Canada, CA $1 200 000 (2018-2019)
		› In response to questions following submission of the EIA reports, additional work was required. Supervised additional modeling of mitigation measures to protect sensitive habitats using various dyke designs and change in bottom roughness, as well as modeling of oil spill scenarios.
		Senior Marine Specialist, Environmental Impact Assessment, Dredging of the Beaudet Reservoir, Ville de Victoriaville, Quebec, Canada, CA $140 000 (2016)
		› The Beaudet reservoir is used as the main source of drinking water for the town of Victoriaville. Built over 40 years ago, the reservoir has lost almost 40% of its capacity and dredging is considered to increase the work life of the reservoir. Tasks included the description of the hydrosedimentology regime, the hydrological regime and impact assessment with regards to change in the hydrosedimentological regime using numerical modelling
		Senior Marine Specialist, Dredging Monitoring and Plume Characterization - New Champlain Bridge Corridor Project, Signature on the Saint Lawrence Group, Quebec, Canada, CA $100 000 (2016)
		The construction of the New Bridge requires marine excavation which results in the creation of a sediment plume which exceeds the environmental criteria establish for the project. Called in to describe the situation and provide recommendations to meet the environmental management criteria, the work included among others:
		› Planning, supervising and execution of a monitoring program to characterize the turbid plume generated by marine excavation work › Determination of new TSS-Tu relationship to assist the monitoring program › Description of excavation activities and link with simulations of a complex plume generation model, validation with turbidity variations observed in situ and recommendations to optimize the excavation operating procedures and technology to reduce sediment inputs
		Senior Marine Specialist, Characterization of Fine Sediment Deposits over the Rock Screed on the Louis H. Lafontaine Tunnel, Ministry of Transport, Quebec, Canada, CA $30 000 (2016)
		› In the context of the proposed restoration of the tunnel, the rock screed will be refurbished and identification of fine sediment deposits and characterization is necessary to prevent resuspension of contaminated sediments during construction. The work involved the sampling of fine sediment deposits and physico-chemical and geotechnical

		characterization as well an underwater georeferenced video survey to describe the status of the rock screed

1995 - 2016 | **ENGLOBE, MONTRÉAL, QUEBEC, CANADA**
Oceanographer-Sedimentologist

Senior advisor and director of the Technical Survey and Engineering Support division

Project Director, Simandou Project, Deep-water port, Environmental Assessment, Rio Tinto, Conakry, Conakry, Guinea, CA $6 000 000 (2014 - 2015)

As part of the Bankable Feasibility Study, conduct oceanography, sedimentology and environmental surveys. Complex project managed in the context of EVD (Ebola Virus Disease), requiring specific and stringent Health and Safety protocols, with minimal
logistical support:

- Physical field surveys: Design the different survey plans in collaboration with the client's main consultants (Deltares, HR Wallingford), prepare and apply a rigorous QAQC program, organize and manage the boat and ship support and logistics. On site supervision of the METOCEAN, geophysical, hydrography (multibeam, dual frequency single beam), hydrology and sedimentology (characterization, determination of the fluid mud area and thickness) that serve as inputs to a hydro-sedimentology numerical model to assess the navigation conditions, sediment dynamics and volumes of maintenance dredging
- Environmental surveys: Design the different survey plans in collaboration with the client's main consultants (Deltares, HR Wallingford), prepare and apply a rigorous QAQC program, organize and manage the boat and ship support and logistics. On site supervision of the surveys in the context of the World Bank Performance Standards for biodiversity including: characterization of the benthic and ichthyofauna, primary and secondary productivity, trophic status of the study area, physicochemical characterization of the water column and bottoms sediments and mapping of the mangrove forest

Project Director, METOCEAN program and Multibeam hydrographic survey, Moffat Nichol/CIMA + for Trans Canada Pipeline, Quebec, Canada, CA $700 000 (2013)

Feasibility study for the construction of an oil terminal in the St. Lawrence River estuary:

- Multibeam hydrographic survey of the current port location and proposed port development METOCEAN surveys (current, wave, weather and visibility) during the open water and ice cover seasons
- Characterization of the ice cover and thickness (ice coring, testing of mechanical properties) using time lapse photography and acoustic Doppler surface tracking)

Project Director and Senior Sedimentologist, Partial derivation of the Portneuf River, Hydro-Québec, Quebec, Canada, CA $450 000 (2013)

- Supervise a project to determine if the morphological changes in the estuary of the river, a sand spit and tidal marsh environment of great ecological value for migratory shore birds, were associated with the derivation of the river or by natural coastal processes. The approach combined successive bathymetry surveys and geostatistical data processing, wave and water level hindcasting

Project Director and Senior Oceanographer, Simandou Iron and Mining Project, Environmental Assessment, Environmental Assessment, Golder Australia, Conakry, Guinea, CA $2 000 000 (2011 - 2013)

Oceanographic data program for a deep-water port:

- Oceanographic, tide and weather data collection in a tropical environment to provide MetOcean data to engineers in charge of port design and dredgingSupervised a team of physical oceanographers, geomorphologists, surveyors and field technicians
- Supervised field logistics, boat operations, design of mooring program, and fabrication of moorings and buoys
- Conducted field surveys and ensured equipment maintenance, data processing, validation and reporting Developed state-of-the-art data processing routines (wave
regime, current and weather), and conducted sediment dynamics studies in a mangrove environment

Senior Oceanographer and Sedimentologist, Bel Air Project, AluFer, Boffa, Guinea, CA $200 000 (2012)

Environmental baseline survey for an ore transshipment facility:

- Responsible for the physical description of marine habitats
- Supervised a team of physical oceanographer and geomorphologists Revised documents as part of the port environmental impact assessment

Project Manager and Senior Oceanographer, Climate Change Effects on Safety of Nunavik Narine Infrastructures, Ministère des Transports (MTQ), Quebec, Canada, CA $900 000 (2009 - 2012)

Established procedures and supervised the installation of a network of tide gauges in seven remote subarctic Inuit communities on the coast of Ungava Bay, Hudson Strait and Hudson Bay:

- Conducted a high-precision geodetic survey, using high-precision GPS to determine isostatic rebound for a four-year project
- Installed and maintained instruments over the four-year period, supervised data processing, ensured QA/QC and reported to government authorities

Senior Oceanographer and Sedimentologist, Environmental Baseline Studies of the Rio Tinto Simandou Mining Project - Feasibility and Detailed Engineering Study – Port component, SNC-Lavalin for Rio Tinto - Simfer S.A., Conakry, Guinea, CA $11 000 000 000 (2008 - 2012)

As part of the initial site characterization, supervise environmental baseline studies:

- Supervised various sampling programs and field activities
- Monitored quality control and report production
- Seasonal oceanographic studies (water quality, plume delineation)
- Sediment transport studies to determine the fluvial sediment load
- Flow studies to determine current speed and tidal variation of rivers discharge
- Sediment characterization studies (physicochemical, benthos)
- Identification and characterization of proposed dredging disposal sites
- Characterized mangrove area
- Characterized and identified potential dredging areas

Project Director, Freshwater Plume Delimitation in the Rupert Estuary following the Rupert River Diversion, Hydro-Québec, James Bay, Quebec, Canada, CA $684 000 (2010 - 2011)

- Managed the monitoring program determining and validating the extent of the saltwater wedge after diversion of the Rupert River, a major subarctic river, for hydroelectric development
- Designed moorings (open water and under ice), developed sampling program, conducted seasonal surveys (winter, summer), and ensured data processing and QA/QC

Project Director and Senior Oceanographer, Sainte-Marguerite-3 Hydroelectric Development Project, Hydro-Quebec, , Sainte-Marguerite River Estuary, Gulf of Saint-L, Quebec, Canada, CA $168 000 (2010 - 2011)

- Monitored coastal erosion using bathymetric and topographic surveys as well as time-lapse cameras for 3D measurements of shoreline retreat and bluff erosion in order to estimate erosion rates in the Sainte-Marguerite River estuary, a barrier island environment

Project Director and Senior Sedimentologist, Romaine Hydroelectric Development Project, Hydro-Quebec, Quebec, Canada, CA $1 000 000 (2010 - 2011)

Study of sediment dynamics at salmon spawning sites on the Romain River:

- Design the sampling program to characterize the stratigraphy and study the formation and present day hydrodynamics

of the spawning grounds
- Supervised the sampling surveys using time-lapse photography, sediment tracer study, description of the stratigraphy using freeze coring techniques
- Carried out the study of the hydrodynamics using ADCP current metres, in situ laser particle analyzers
- Ensured sampling and physical characterization of sediment with grab sampler and corer, then freezing of samples
- Described sediment structure and stratigraphy, measured currents, suspended solids / turbidity and hydro-sedimentary conditions at salmon spawning sites
- Conducted follow-up with underwater time-lapse photography, current metre and 3D laser particle analyzer

Project Director, Renard Diamond Project, Roche Itée for Stornoway Diamond Corporation, Otish Mountains, Quebec, Canada, CA $230 000 (2010 - 2011)

Preliminary environmental study (hydrology):
- Supervised hydrological surveys to characterize the drainage basin and flow regime as part of a preliminary environmental study of a proposed mine site

Project Director and Senior Sedimentologist, Wuskwatim Generating Station – Development of a Multi-Station Real-Time Turbidity Monitoring Program, Manitoba Hydro, Burntwood River, Manitoba, Canada, CA $224 000 (2007 - 2011)

- Designed, installed, calibrated and maintained a multi-station real-time turbidity monitoring system adapted to both open water and ice cover seasons
- Collected and processed data in real time during the construction of the hydroelectric generating station to generate automatic turbidity monitoring reports for use by environmental staff in compliance with regulations and reporting

Directeur de projet, Shipping Turbines to Eastmain-1-A Powerhouse A, Panalpina-PanProjects, La Grande, Chisasibi, Quebec, Canada, CA $56 000 (2010)

- Supervised a bathymetric survey along a 16 km stretch of river to verify navigation charts and survey of the unloading ramp in anticipation of transporting and unloading hydroelectric turbines at the Eastmain 1-A power-generating station

Project Director, Environmental Assessment for the Maintenance of Dredging at Lancaster Bar on the St. Lawrence Seaway, St. Lawrence Seaway Management Corporation, Lac Saint-François, Quebec, Canada, CA $85 000 (2010)

- Managed the environmental impact study, sediment sampling and habitat characterization for a St. Lawrence Seaway dredging project under the Canadian Environmental Assessment Act (CEAA)
- Designed the sampling program, managed field work
- Drafted reports and answers to Fisheries and Oceans Canada (DFO) questions Assisted the client in proposing mitigation and compensation measure

Project Director and Senior Oceanographer, Biophysical Characterization of Port-Alfred Harbour, Rio Tinto Alcan, Fjord du Saguenay, Quebec, Canada, CA $50 000 (2010)

- Managed sediment physicochemical characterization, habitat characterization and biological sampling
- Supervised bottom sediment sampling using grab sampler and vibro-coring to obtain 3- to 4 m long cores to depths of up to 20 m, biological sampling (fish, benthos) and habitat characterization
- Produced a description of the physical oceanography to provide inputs to the baseline biophysical study

Project Director and Senior Oceanographer, Sainte-Marguerite-3 Generating Station, Sainte-Marguerite River, Gulf of St. Lawrence, Hydro-Quebec, Quebec, Canada, CA $378 000 (2008 - 2009)

- Supervised sediment study to determine geomorphological changes in the Sainte-Marguerite River by means of comparative bathymetry, physical oceanography (waves, tide, currents and salinity) and analysis of nutrient conditions
- Major erosion at the mouth of the river required continuous monitoring using cameras installed on coastal beaches in

summer 2010 to record the bathymetry

Project Director and Senior Oceanographer, Conawapa Generating Station – Nelson River and Estuary Instrumentation Program, Manitoba Hydro, Manitoba, Canada, CA $2 000 000 (2006 - 2009)

- METOCEAN campaign covering the design, construction and installation of 25 moorings in the west of Hudson Bay and processing of data collected
- Headed a major winter real-time profiling campaign under the ice cover using two helicopters and under-ice moorings
- Characterization of sediment loading to Hudson Bay from the Nelson and Hayes rivers

Specialist – Aquatic Technical Surveys, Dredging of Contaminated Sediment in the Port of Montreal, Dessau, Montréal, Quebec, Canada, CA $9 000 (2008)

- Sampled water and made high-precision near-real-time measurements of turbidity and bathymetry

Specialist – Aquatic Technical Surveys, Dredging of Contaminated Sediment in the St. Louis River, Dessau, Quebec, Canada, CA $2 000 (2007)

- Sampled water and made high-precision near-real-time measurements of turbidity and bathymetry

Project Director and Senior Sedimentologist, Keeyask Generating Station, Stephens Lake and Nelson River, Manitoba Hydro, Manitoba, Canada, CA $25 000 (2007)

- Conducted ADCP flow profiling of the area next to the proposed project site
- Performed water quality multi-parameter profiling
- Supervised the QA/QC and data processing stages

Project Director, Bumbuna Hydroelectric Reservoir, World Bank, Seli River, Sierra Leone, CA $16 000 (2006)

- Devised methodological procedures for characterizing and calculating net GHG emissions from future reservoirs in order to apply carbon credits under a clean development mechanism (CDM) initiative
- Reviewed the literature on water quality parameters, designed a conceptual model and supervised the statistical analysis to determine the sampling effort required and representativeness of data

Project Director and Senior Oceanographer, Romaine Hydroelectric Project, Romaine River estuary, Hydro-Québec, Quebec, Canada (2004 - 2006)

- Physicochemical characterization of water quality, habitat characterization, and study of the snow crab and other crustaceans in the Romaine River estuary and Mingan channel
- Studied the river's sediment regime, determined future loads associated with the construction of four dams on the river
- Prepared the part of the impact study on physical modifications in the estuary and on biological impacts

Project Director and Senior Oceanographer, Nunavik Port Infrastructure Projects, Makivik Corporation in collaboration with Aquapraxis, Nunavik, Quebec, Canada, CA $1 500 000 (2004 - 2006)

- Studied tides and conducted bathymetric and topographic surveys to support the construction of port infrastructure for three Nunavik communities: Tasiujaq, Akulivik and Kangiqsujuaq

Water Quality Specialist, Jéricho Diamon Mine, Tahera Diamond Corporation, Nunavut, Quebec, Canada (2005)

- Supervised quality assurance/quality control (QA/QC) procedures

Project Director, Romaine Hydroelectric Complex, Romaine River, Hydro-Québec, Quebec, Canada, CA $800 000 (2003 - 2004)

Bathymetric surveys at generating station sites:

› On-site supervision of a large-scale bathymetric survey upstream and downstream of the four sites proposed for future hydroelectric generating stations and along 9 300 km reach of the river for the purpose of hydraulic modelling

Project Director, Nunavik Port Infrastructure Project, CIMA+ for the Makivik Corporation in collaboration with Aquapraxis, Nunavik, Quebec, Canada (2003)

› Studied tides and conducted bathymetric and topographic surveys to support the construction of port infrastructure for the Nunavik community of Tasiujaq

Oceanographer and Sedimentologist, Biophysical characterization of the Port of Gaspé, golfe du Saint-Laurent, Public Works and Government Services Canada, Quebec, Canada (2001 - 2003)

› Conducted large-scale sampling of bottom sediments using corers and grab samplers to determine the extent of PAH and Cu contamination in terms of both area and depth
› Characterized habitat using a georeferenced underwater camera system and collected biological samples for risk assessment by a third party

Sedimentologist, ediment Sampling Guide for Dredging and Marine Engineering Projects on the St. Lawrence River. Volume 1, Planning Guidelines, and Volume 2, Field Operations Manual, Environmental Protection Branch,, Environment Canada, Environmental Protection Branch, Quebec, Canada (2001 - 2002)

› Review documentation and prepare the first version

Sedimentologist, Complementary Study on Sediment Resuspension due to Small Crafts in the Lachine Canal, Parks Canada and Public Works Canada, Lachine, Quebec, Canada, CA $75 000 (1997)

› Designed a sampling program and installed measuring instruments to evaluate the resuspension of sediments resulting from the movement of small craft in the Lachine Canal.

Specialist and advisor, Lom Pangar Hydroelectric Power Dam Project, Energy Development Corporation (EDC), Cameroon, CA $2 000 000 (2014)

› Participated in the initial stages of the study in collaboration with Electricité De France (EDF)
› Negotiations with the client, orientation of the study and definition of the objectives with the client for a water quality and GHG (Greenhouse Gases) monitoring project related to the flooding of the Lom Pangar reservoir

1995 | **SEDIMENT STUDY SERVICES, QUEBEC, CANADA**
Sedimentologist

Sediment characterization studies, sediment core sampling and description.

1995 | **BEAK INC., QUEBEC, CANADA**
Sedimentologist

Ecotoxicological data processing.

1989 - 1995 | **ENVIRONMENT CANADA, QUÉBEC, QUEBEC, CANADA**
Ecotoxicology and Ecosystems Department
Project Team Leader, St-Lawrence Center

Physicochemical characterization of bottom sediments, St-Lawrence River, between Cornwall and Quebec City.

1987 - 1988	**CSSA CONSULTANTS, QUEBEC, CANADA** **Oceanographer** Hydrology and oceanography surveys for hydroelectric projects, sampling and water quality.

PROFESSIONAL DEVELOPMENT

2016	MatLab programming, SNC-Lavalin Inc., Montreal, Quebec, Canada
2006	Scuba scientific diving, Institut maritime du Québec, Lévis, Quebec, Canada
2005	Pleasure Craft Operator card, Forensic & Nautical Consultants of Canada Inc. (FNCC), Gatineau, Quebec, Canada
1997	Training on the use of enriched mixtures (nitrox) in scuba diving, TDI, Quebec, Canada
1995	Health and Safety training (contaminated sites), Wastewater Technology Centre, Ottawa, Ontario, Canada
1992	Training on small craft safety, Institut maritime du Québec, Lévis, Quebec, Canada
1985	Field camp, Rouyn-Noranda, Geology, Université du Québec à Montréal, Different locations, Quebec, Canada
1983	Planimetry and cartography internship, Station de l'Université de Montréal, Saint-Hippolyte, Quebec, Canada
1980	Officers' training, Canadian Armed Forces, Chilliwack, British Columbia, Canada

DAVID LAUZON

David Lauzon is a geographer with over 10 years of experience in the environmental field. His professional career has led him to perfect his knowledge in different disciplines always related to the environment. More specifically, he has worked in various positions allowing him to gain experience in environmental monitoring at the "Nouveau Pont Champlain" site, in the field of marine emergency and in aquatic technical surveys (water and sediment quality, hydrology, oceanography). Mr. Lauzon has also had the opportunity in his professional career to work in Northern Quebec with various Aboriginal communities and in West Africa.

SECTORS OF EXPERTISE

Environment	› Emergency plans; Emergency response capacity; Water quality; Sedimentology; Physical oceanography and marine geophysics; Environmental monitoring
Transport	› Dredging
Power	› Hydrology

EDUCATION

2009 | Bachelor's degree in Geography, UQAM, Montreal, Quebec, Canada

EXPERIENCE

Since 2018 | **SNC-LAVALIN, MONTREAL, QUEBEC, CANADA**

Environment & Geoscience

Environmental Supervisor

New Champlain Bridge Corridor project « Nouveau pont Champlain », Signature on the « Saint-Laurent » Construction, Montreal and Brossard, Canada, CDN$4 200 000 000 $ (April 2018 - now)

PCNPC consists of a bridge over the St. Laurent River (3.4 km) including work on the "isle des Sœurs" bridge (500 m), the A-15, the A-10 and 3 viaducts. The PPP project covers 5 years of construction and 30 years of maintenance.

- Carry out environmental monitoring on site;
- Participate in site meetings;
- Provide support to the construction team in the event of an accidental spill;
- Prepare weekly monitoring reports;
- Write environmental non-conformity reports and ensure their follow-up;
- Ensure that the work complies with contractual and environmental permit commitments;
- Participate in the training of workers when starting work packages;
- Maintain the various environmental registers;
- Ensure ongoing communication with the various speakers.

Years of Experience

› 11 years

Years with SNC-Lavalin

› 1 year

Key Positions

› Site supervisor
› Geographer
› Environmental specialist

Languages

› French
› English

Site Experience

› Canada
› Guinée

Computer Applications

› MS Office
› ArcGis

2014 - 2018

ECRC-SIMEC, VERCHÈRES, QUEBEC, CANADA
Operations Support

- Intervene in marine hydrocarbon pollution; deploy environmental intervention equipment, manage field teams, plan operations.
- Participate in the company's certification process by Transport Canada.
- Perform marine operations during training, exercises or spills.
- Carry out mapping and field checks to update intervention plans.
- Provide operational and theoretical training for contractors, consultants and members of the company.

2012 - 2014

ENVIRONNEMENT ILLIMITÉ INC., MONTREAL, QUEBEC, CANADA
Technical Survey Technician

Technical survey technician in multidisciplinary teams on several projects, of various sizes, in different aquatic and marine environments.

- Hydrology: Maintain and calibrate limnimetric stations, measure flow rates/water levels, carry out current meter readings. Sedimentology: Sample sediments with various tools. For example, the Ponar and Shipeck dumpsters, and a vibrating corer.
- Oceanography: prepare, deploy, recover and maintain various equipment/instruments deployed on the surface and subsurface, calibrate measuring instruments. Conduct water sampling campaigns. Other: operate watercraft in various environments; perform ice work, set up weather stations.

2013

ENVIRONNEMENT CANADA, MONTREAL, QUEBEC, CANADA
Laboratory technician

- Perform technical operations in an organic chemistry laboratory to analyze contaminants such as BPCs, HAPs and dioxins and furans in water and sediment.

2011 - 2012

DILLON CONSULTING LTD, BROSSARD, QUEBEC, CANADA
Environmental Specialist

Environmental specialist for site restoration and environmental monitoring projects.

- Sample soils and groundwater.
- Supervise soil decontamination operations.
- Write technical reports.
- Compile and process data from sampling campaigns.

2010 - 2011

ENVIRONNEMENT CANADA, MONTREAL, QUEBEC, CANADA
Field technician / laboratory

- Provide technical assistance for various scientific projects in the field and in the laboratory (sampling and analysis).
- Measure and sample in the aquatic environment.
- Perform technical operations in an organic chemistry laboratory to analyze contaminants such as BPCs, HAPs and dioxins and furans in water and sediment.

AWARDS AND SCHOLARSHIPS

2018 Cold Weather Response Training Advanced, OSRL, Southampton, Royaume-Uni

2016 Assessment technique and de shoreline restoration, Environment and Climate Change Canada, Montreal, Quebec, Canada

2016	Railway Emergency Response Course, Railway Association of Canada, Vancouver, British Columbia, Canada
2015	Incident Command System (ICS 300), Kildoon Emergency Management, Dartmouth, Nova Scotia, Canada
2015	Small Vessel Operator Proficiency Training Course, Quebec Maritime Institute, St-Romuald, Quebec, Canada
2015	Syllabus for the Restricted Operator's Certificate - Maritime Commercial, Quebec Maritime Institute, St-Romuald, Quebec, Canada
2015	Cold Weather Response Training, OSRL, Southampton, United Kingdom
2014	Prevention in a riparian environment, Service Intervention Formation Aquatique, Montreal, Quebec, Canada
2014	Introduction to work codes, Hydro-Québec, Montreal, Quebec, Canada
2014	Incident Command System (ICS 100), eCompliance, Calgary, Alberta, Canada
2014	Incident Command System (ICS 200), eCompliance, Calgary, Quebec, Canada
2014	Marine Spill Response - MSROC, Canadian Coast Guard, Quebec, Quebec, Canada
2012	ASP-Construction, General health and safety on construction sites, Confédération des syndicats nationaux, Montreal, Quebec, Canada
2008	Marine Emergency Function (MED A-3 Training), Survival Marine Equipment Québec Inc., Montreal, Quebec, Canada

OLIVIER BÉDARD-RICHARD

PROFESSIONAL EXPERIENCE

JUNE 2018 – … Tower Arctic Ltd. *Iqaluit*
ENVIRONMENTAL MONITOR

- Environmental monitoring for the Iqaluit and Pond Inlet Marine Infrastructure Projects
- Water quality control and monitoring for in water infill and dredging activities
- Monitoring of overpressure for near water blasts

AUGUST 2013 – JUNE 2018 Services Enviro-Forestiers *Lévis*
ENVIRONMENTAL SUPERVISOR / MONITOR

- Site supervision and management of excavation teams for the construction of Mont-Sainte Marguerite wind farm
    - Infrastructure construction for fish free movement (arch culvert, culvert with weir, fish spawning etc.)
    - Erosion and sedimentation control to protect the fish habitat and water quality.
    - Liaison officer for the project contractor
    - Permits and authorizations management
    - Inspection and quality control of watercourse crossings
    - Support to construction teams for the prevention and management of environmental incidents (oil spill, sedimentation of watercourses, projection of stones out of the authorized area during blasting, etc.)

- Environmental monitor for the construction of the Rivière-du-Moulin wind farm
    - Support to the contractor for making infrastructure for the free movement of fish (arch culvert, culvert with weir, fish spawning etc.)
    - Erosion and sedimentation control to protect the fish habitat and water quality.
    - Observation and monitoring of environmental non-compliance during construction work in and around watercourses
    - Support for environmental impact assessment teams in the project development phase.
    - Management of permits and authorizations and monitoring of inspections of government organizations (Department of Fisheries and Oceans Canada, Environment Canada, etc.)
    - Liaison officer for the project promoter

- Responsible for technical work for the logging of the Romaine 3 project
    - Monitoring and quality control of the works
    - Making habitat for avian wildlife
    - Support to deforestation teams for the prevention and management of environmental incidents

- Environmental monitor for road construction works for the Nicolas Riou Wind Farm
    - Infrastructure construction for the free movement of fish (arch culvert, culvert with weir, fish spawning etc.)

- Erosion and sedimentation control for the protection of the fish habitat and water quality
- Inspection and quality control of watercourse crossings
- Support to construction teams for the prevention and management of environmental incidents (oil spill, sedimentation of watercourses, projection of stones out of the authorized area during blasting, etc.)

OCT. 2011 - AUGUST 2013 Proforêt Consultants inc. *Lac Mégantic*
ENVIRONNEMENTAL MONITOR

- Environmental monitoring for the construction of the Rivière-du-Moulin wind farm
  - Support to the contractor for making infrastructure for the free movement of fish (arch culvert, culvert with weir, fish spawning etc.)
  - Erosion and sedimentation control to protect the fish habitat and water quality.
  - Observation and monitoring of environmental non-compliance during construction work in and around watercourses
  - Support for environmental impact assessment teams in the project development phase
  - Management of permits and authorizations and monitoring of inspections of government organizations (Department of Fisheries and Oceans Canada, Environment Canada, etc.)
  - Liaison officer for the project promoter

- Environmental monitoring for the construction of Massif du Sud wind farm
  - Support to the contractor for making infrastructure for the free movement of fish (arch culvert, culvert with weir, fish spawning etc.)
  - Erosion and sedimentation control to protect the fish habitat and water quality.
  - Observation and monitoring of environmental non-compliance during construction work in and around watercourses
  - Support for environmental impact assessment teams in the project development phase
  - Management of permits and authorizations and monitoring of inspections of government organizations (Department of Fisheries and Oceans Canada, Environment Canada, etc.)
  - Liaison officer for the project promoter

MAY 2008 – OCTOBER 2011 Produits Forestiers Anticosti *Anticosti*
FORESTRY TECHNOLOGIST / FOREMAN

- Supervision of forestry operations
- Prescription of inventories and post-treatment follow-up

SCHOOL CURRICULUM

2016 - 2017 Laval University *Québec*
FACULTY OF BUSINESS ADMINISTRATION
Certificate in Entrepreneurship and business Management

2007 - 2011 Cégep de Sainte-Foy *Québec*
DEPARTMENT OF WOOD AND FOREST TECHNOLOGIES

College Diploma in Forest Technology

MEMBER OF THE ORDRE DES TECHNOLOGUES PROFESSIONNELS DU QUÉBEC.

PIERRE-DAVID BEAUDRY, Technician

Over his 19 years of employment as an environmental field technician, Pierre-David Beaudry has successfully participated in an impressive range of projects related to biological and physical aquatic environments for various clients including Public Utilities, industrial and mining companies, federal services and municipalities among others. He has worked in all many challenging regions of Canada, including Nunavut (in Jaynes Inlet, Iqaluit) and Nunavik as well as abroad (Guinea, Brazil, Malaysia and Australia). He has acquired expertise in field logistics and large project execution. The diversity of projects he has worked on and his proactive attitude with regards to problem solving has made him a versatile team member capable of finding effective solutions in all situations. As a senior technician, Mr. Beaudry has developed a special interest in hydrology, water quality, and oceanography, areas in which he has helped improve sampling techniques and developed standard operating procedures.

AREAS OF EXPERTISE

Environment

› Transport, mining and hydropower project; water quality, aquatic habitat characterisation; fisheries studies; sediments; oceanography, habitat restoration, greenhouse gas measurements

STUDIES

2002

DEC (Diploma of Collegial Studies) in Hunting and Fishing Management Techniques, CÉGEP de Baie-Comeau, Baie-Comeau, Québec, Canada

PROFESSIONAL EXPERIENCE

SINCE 2018

SNC-LAVALIN INC., MONTRÉAL, QUÉBEC, CANADA

Environment and geosciences - East

Aquatic Surveys Senior Technician

Hydrological Survey, Various Clients, Canada

Campagne de surveillance hydrométrique hivernale et estivale à la Mine Renard, Diamants Stornoway, Québec, Canada, 100 000 $ CA (2017 - présent)

› Project Field Manager for the Mine Site Environmental Monitoring Program, Diamonds Stornoway Canada. Multi season hydrological surveys were required to determine the conditions for the mine effluent mixing, requiring measurements of very low flows at Lake Lagopede and measurement of water temperature profiles to characterize the water bodies involved and mixing conditions. In addition, the installation and maintenance of 4 hydrometric stations was carried out, as well as providing two new stations and optimizing the telemetry network of all stations.

Années d'expérience totale

› 17 années

Années d'expérience SNC-Lavalin

› 1 années

Fonctions principales

› Quality Insurance / Quality Control
› Coordination Site Manager
› Environment Specialist

Langues

› French
› English

2003 - 2018

ENGLOBE, QUEBEC, QUEBEC, CANADA

Aquatic Surveys Senior Technician

Ecotoxicology and site restoration, Various clients, Canada

Englobe and René St-Pierre - Katheryn Spirit Project - Removing the cofferdam, Beauharnois (2018)

› Specialist and field coordinator. In the context of the dismantlement of the shipwreck, conduct a bathymetry to calculate the volumes to be removed to reach the pre-embankment elevation. Advise for the purchase and installation of a sediment curtain. Coordinate and install the sediment curtain. Establish a method of inspecting and monitoring curtain condition. Carry out dredge monitoring bathymetry and process the data in situ, to allow moving the excavators and barges.

Trois-Rivières Port Authority – Post dredging Sediment Sampling and Analysis - Wharf 19 and 20, Trois-Rivières (2015 et 2017)

› Project manager. Establish sampling protocol, plan field campaign, conduct sampling, coordinate sample shipment for external laboratory analysis, analyze results, write the report and monitor budget.

Public Works and Government Services Canada (PWGSC) - Characterization and Classification of Sediments from Three Marinas - Risk Analysis, Kingston and Thunder Bay, Canada (2016)

› Team leader, Coordinate and carry out sampling work with grab sampler. Coordinate the sending of samples according to the analysis times.

LVM – Port of Pointe-Noire sediment contamination monitoring, Sept-Îles, Québec (2012)

› Senior Technician. Positioned stations in the field, directed crane operator to take core samples with a vibrocorer, and labeled and shipped samples.

Dessau – Restoration of contaminated sediment at Wharf 103, Montréal, Québec (2007)

› Site Supervisor. Supervised dredging of contaminated sediment, checked by core sampling that contaminated sediment had been completely removed before moving to next site, made sure contractor complied with turbidity standards, checked integrity of sediment curtain and oil slick boom, halted work if necessary to apply corrective measures.

Hydrological Survey, Various Clients, Canada

Canadian hydrographic service – Bathymetric data update – Area between Québec and L'Isle-Verte (2018)

› Team leader and instructor. Perform single beam bathymetry equipped with an inertial platform. Training of new employees. Install a multibeam system on two different boats. Technical support. Performed health and safety duties and data quality control.

Expérience de site

› Australia
› Brazil
› Canada
› United States
› Guinea (Conakry)
› Malaisia

Connaissances informatiques

› MS Office
› Hypack
› Winriver II
› Ruskin
› Winsitu
› Trimble Office

Canadian hydrographic service – Bathymetric data update – Area between Québec and L'Isle-Verte (2018)

› Team leader and instructor. Perform a single beam bathymetry equipped with an inertial platform. Train employees. Install a multibeam system on two differents boat. Technical support. Work safety and data quality control.

Hydro-Québec – Romaine project – Post landslide bathymetry downstream of the power plant, RO-2, Havre-Saint-Pierre (2017)

› Team leader and instructor. Conduct a bathymetry downstream of dam RO-2 to determine the extent of morphological change in the basin following a major landslide. Train employees. Data quality control.

Hydro-Québec – Des Cèdres generating station– Bathymetry of des Cèdres basin, Salaberry-de-Valleyfield (2017)

› Team leader and coordinator. Coordinate single and multi-beam bathymetric surveys (3 boats).
› Adapt the surveys according to the weather and physical conditions of the environment. Ensuring the quality of single beam data

Hydro-Québec – Romaine project – Physical Characterization of the Romaine Estuary and Control Zones, Havre-Saint-Pierre (2017)

› Team leader and coordinator. Coordinate and carry out bathymetry work, characterization of caplan breeding areas and channel characterization.

Rio Tinto Iron and Titan – Tio mine – Installation of Parshall flumes and hydrology probes for the continuous measurement of flow rates and physicochemical parameters of mine effluents, Havre-Saint-Pierre (2016-2017)

› Foreman and team leader. Establish the schedule of work. Order materials and equipment for the installation of five Palmer Bowlus and H-flume flow measurement channels. Coordinate the need for heavy machinery, specialized labor and materials based on union constraints and limited hours of work cause by train access to the mine site. Supervise the work to ensure compliance with plans and specifications. Make modifications to the plans and specifications to adapt to the on site conditions. Make the plans as built and write the report.

Rio Tinto Fer et Titan – Mine Tio – Verification and inspection of the flow measurement channels according to the criteria of the MDDELCC, Havre-Saint-Pierre (2016-2017)

› Team leader. Conduct inspection and verification of the calibration of the flow measurement channels installed at the five effluents of the Tio mine. Propose corrective measures or replacement of non-compliant channels. Write verification reports

Hydro-Québec – Rebuilding of the Bryson Power house – Bathymetric surveys – Bryson, 156 k$ (2016)

› Chef d'équipe et responsable sécurité. Coordonner et réaliser une bathymétrie à l'amont et à l'aval de la centrale de Paugan. Coordonner les travaux à l'intérieur d'une fenêtre de temps très limitée en raison du fait que les travaux de réfection en cours ne permettaient pas la fermeture des groupes turbines-alternateurs sur une longue période. S'assurer de la sécurité des travaux. Valider la qualité des données. Rédiger le rapport.

Hydroméga Services Inc. – Kapuskasing River Power Project - Limnological and Bathymetry Monitoring, Kapuskasing, Ontario (2015-2017)

› Team leader and coordinator. Plan and organize field campaigns. Install a water level gauging station equipped with satellite telemetry. Perform flow measurements using a Doppler current meter. Perform survey grade bathymetric surveys. Perform quality control duties. Data processing and field report preparation.

Stornoway Diamond – Renard diamond project – Hydrological summary of the Lagopede Lake and effluent dispersion model validation, James-Baie, Quebec, Canada (2015- 2016)

› Team leader and coordinator. Establish, with the client, a work plan in accordance to the ministry requirements. In lake water speed measurement with a bottom mount ADCP, stream gaging and water level station maintenance, data quality validation, reporting.

MTQ – Richelieu River bathymetric survey, St-Hilaire, Quebec, Canada (2015)

› Team leader. Carry out a high precision bathymetric survey over 320 km of line, develop a method that allow surveying at twice the normal speed, measure water flow with ADCP, validate data quality, prepare the final product.

Hydro-Québec – Romaine River hydroelectric project (1550 MW) – Bathymetry from helicopter, water gaging and bottom mount current meter installation, Havre-Saint-Pierre, Québec, Canada (2014)

› Team leader. Meet with the client to discuss about his needs, establish the more appropriate survey plan to meet the goal, conduct and coordinate the bathymetric survey, validate data quality and prepare the final report and maps.

Hydro-Québec – New bridge for the St. Lawrence corridor project – Île de la Couvée access – Bathymetric survey, summer (2014)

› Team leader and coordinator. Establish the technical approach and the project feasibility with the client, wright the work safety plan, plan the schedule, coordinate the various equipment order and staff needs, conduct the first bathymetry survey from an helicopter ever attempts at this moment, install two bottom mount current meter (ADCP) in the Romaine River estuary, validate data quality and prepare et revise the final report.

Roche ltée for Némaska Lithium – Whabouchi Mining Project – Reference state and data acquisition for mining effluent modelling, James-Bay, Quebec, Canada (Spring, Summer and Fall 2014)

› Team leader and coordinator. Elaborate the work plan, instruments calibration and preparation, conduct and coordinate field activities to gather all the data needed for the effluent dispersion model such as; installation of water level stations (3), installation of a weather station, bathymetric surveys and water flow measurement (various method), water quality profiling and sampling (comparison of two methods for metal trace analyses), sediments sampling, monitor the schedule and budget, QAQC procedures and analyses, write the final report.

Roche Ltd. for Dahrouge Geological Consulting Ltd. – Eldor Mining Project, Nunavik, Québec (2013)

› Team Leader. Wrote work and safety plans, devised and organized work for a multidisciplinary program: measured water quality in situ, sampled water for third-party laboratory analysis, measured flows, downloaded data from water level stations, calibrated instruments, conducted research fishing, characterized habitats, processed data and helped produce the report.

Hydro-Québec – La Romaine Hydroelectric Project (1,550 MW) – hydrosedimentology monitoring of the Romaine River estuary, Havre-Saint-Pierre, Québec, Canada (spring, summer and fall 2013)

› Senior Technician. Coordinate the various orders and purchases of equipment, calibrate and perform performance testing of various instruments, install two mooring instruments perform multi-sampling field, to ensure data quality.

Hydro-Québec – EM-1 and EM-1A generating stations and Rupert diversion project – Location and characterization of the water intake of Waskaganish pumping station, James-Bay, Quebec, Canada (fall 2013)

› Team leader. Establish the work plan and method, conduct and coordinate field activities, analyze data and write the final report.

Ministère des Transports du Québec (MTQ) – Water level gauging and tidal effect at the mouth of the York River, Gaspé, Québec (2012)

› Team Leader. Install four tide gauges in the York River and its estuary, conduct stream gauging (Doppler current meter), took water level readings (RTK GPS), processed and analyzed data collected, and helped draft the final report.

Roche Ltd. for Stornoway Diamond Corporation – Renard Diamond Project – Environmental baseline study (hydrology), James Bay region, Québec (2010, 2013)

› Team Leader. Organized and carried out hydrological monitoring, installed a meteorological station, measured stream flows, install water level stations and wrote the field work report.

Roche Ltd. for Century Iron Mining Corporation – Duncan Mining Project, Water level gauging, James Bay region, Québec (2011–2012)

› Team Leader. Drafted work plan, participated in developing the general approach, conducted gauging in four streams, installed two water level stations, process and analyze the data.

Hydro-Québec – La Romaine Hydroelectric Project (1,550 MW) – Sediment monitoring at salmon spawning grounds, Havre-Saint-Pierre, Québec (2011)

› Team Leader. Wrote work and safety plans, designed two structures (max. 1 x 1 m) for mounting, without mutual interference, measuring instruments and an underwater camera, coordinated purchasing and equipment orders, calibrated instruments and tested their performance, carried out field work, checked data quality and wrote mission report.

Hydro-Québec – Sainte-Marguerite estuary bank erosion monitoring, Sept-Îles, Québec (2009)

› Senior Technician. Conducted physical and chemical surveys in the estuary of the Rivière Sainte-Marguerite, and recovered a wave buoy, Doppler current meters and tide gauges.

Hydro-Québec - Hydroelectric Project EM1-A and Rupert Diversion - Monitoring the sedimentary cone of the floodway, James Bay (2008-2009)

› Senior technician. Participate in planning and organizing campaigns and develop a method and support for using ice corer from ice cover. Coordinate field activities.

Manitoba Hydro – Conawapa Hydropower Project, Nelson River, Manitoba, Canada (2007)

› Technician. Measured turbidity and recovered tide gauges in the Nelson River estuary.

Hydro-Québec – Fall flood monitoring on major rivers in the Grande Rivière watershed, James Bay region, Québec (2005)

› Technician. Helped coordinate and carried out stream gauging (Doppler and rotating current meters) on major rivers in the Grande Rivière watershed.

Oceanography, Various clients, Canada

Hydro-Québec – La Romaine Hydroelectric Project (1,550 MW) – Primary production follow-up – Havre-Saint-Pierre (2013, 2015 et 2017)

› Team leader and coordinator. Survey of algal primary production by water sampling and in-situ measurements, coordinate and implement the mooring buoys of two multi-tools from a fishing vessel, monitor the saline front and ensure the safety of operations. Prepare and analyze data for the final report.

City of Petit-Saguenay - Wharf Expansion Project - Characterization of the Physical, Chemical and Biological Environment - Petit-Saguenay (2015)

› Coordinator and team leader. Perform a single beam bathymetry. Collect sediment samples using a grab sampler and a percussion corer. Characterize benthic habitat using georeferenced underwater video transects to characterize shallow areas. Do the data analysis. Write the report.

CIMA+ for TransCanada – Energy East Pipeline Project, Metocean data acquisition, Cacouna, Québec, Canada, (2013-2014)

› Team Leader. Prepared safety plans. On site coordinator, safety manager; installed moorings, sensors and automated cameras to follow-up ice movements.

SNC-Lavalin for Rio Tinto – Simandou Project Port Component – Aquatic environment baseline study, Forécariah, Guinea (2011-2012)

› Team Leader. Supervised and carried out field activities in marine and estuarine environments to study water quality, sediment dynamics, benthos and bathymetry. Prepared safety plans, maintained client relations in the field, wrote daily and weekly reports intended for client and helped develop sampling plans.

Genium for Makivik Corporation – Nunavik port infrastructure program, Kangiqsualujjuaq, Québec (2006)

› Technician. Installed and raised moorings and monitored tide (RTK GPS).

Greenhouse gases and water quality, Various clients, Canada

Hydro-Québec - Romaine Hydroelectric Project (1550 MW) - Monitoring GHG Emissions from Reservoirs, Havre-Saint-Pierre (2008-2018)

› Team leader. Plan sampling campaigns, install automated GHG sampling systems on surface buoys or into power plants, perform performance tests and calibrate instruments, direct and organize fieldwork and / or guide the team responsible perform fieldwork, ensure the quality of data collected, process data and analyze results.

Rio Tinto Iron and Titan - Tio Mine - Monitoring the water quality of Petit Pas, Jean and Allard lakes; Havre-Saint-Pierre (2016-2017)

› Team Leader, Write the offer of services. Plan and coordinate activitiesfield and the needs of helicopter transport, equipment and external consultant. Sample water by following the trace metal sampling.

Manitoba Hydro – Manitoba reservoir GHG emission monitoring, Canada (2007-2014)

› Team Leader. Participated in planning, collected data in the field and/or directed team responsible for field work, checked the quality of data collected and processed data.

Hydro-Québec – Monitoring GHG emissions from various reservoirs James-Baie, Québec (2007-2012)

› Team Leader. Participated in planning, collected data in the field and/or directed team responsible for field work, checked the quality of data collected, processed data and analyzed results.

City of Vancouver – Monitoring sewage treatment plant GHG emissions, Vancouver, B.C., Canada (2011-2012)

› Team Leader. Managed field work, adjusted work to constraints in a new environment (first in situ study in this area), maintained client relations in the field and client satisfaction, analyzed results and collaborated in writing annual report.

Department of Water Resources – Oroville reservoir GHG emission monitoring, Oroville, California, USA (2012)

› Team Leader. Headed data collection, organized field activities, maintained client relations, checked quality of data collected and analyzed results.

Sarawak Energy – Bakun reservoir GHG emission monitoring, Malaysia (2011)

› Team Leader. Participated in planning, organized shipment of gear, made field measurements, maintained client satisfaction in the field, processed data and analyzed results. Instructed university, ministerial and business representatives on methods and principles of GHG sampling in aquatic environments.

International Energy Association (IEA) / Hydro-Québec – Ribeirão das Lajes reservoir GHG emission monitoring, Brazil (2011)

› Team Leader. Planned and organized a reservoir GHG sampling campaign in Brazil as part of a worldwide comparative study, made field measurements, processed data and analyzed results

Stanwell Energy – GHG emission monitoring, Barron Gorge, Queensland, Australia (2010)

› Senior Technician. Designed and built a portable GHG bubble collector that was easy to disassemble. Supported and advised the project leader regarding methods and approaches to use, made field measurements, maintained client relations and checked the quality of data collected.

Hydro-Québec – Péribonka Project, Québec (2010)

› Team Leader. Headed water quality sampling in Péribonka reservoir for the hydroelectric development project on the river of the same name.

Glaciology, Hydro-Québec, Canada

Hydro-Québec - Assessment of ice-bearing capacity and thickening of ice - Multi-project Estrie, Outaouais and Laurentide (winter 2017)

› Coordinator and team leader. Coordinate equipment and personnel needs. Evaluate the bearing capacity of the ice. Perform ice thickening work for ice bridge construction to allow the passage of machinery for power pole replacement. Write the reports.

Hydro-Québec – Rupert Diversion Project – Ice thickness characterization, James Bay region, Québec (2003)

› Technician. Participated in work to characterize the thickness of ice in Rupert Bay, and on rivers and lakes affected by the Rupert Diversion Project.

Biologie aquatique, Divers clients, Canada

Cascades Paper Mill - Environmental Effects Monitoring Study (EEM), Cascades Paper Mill, KingseyFall (2018)

› Team leader. Capture and determine which fish species will be used for the study using various fishing gear. Collect gonads and liver for gonadosomatic and hepatosomatic indices. Collect bone structures, prepare them and read them. Install and remove benthos traps.

Québec Port Authority - Port of Quebec (Beauport sector) - Baseline for the Port Expansion Project, Beauport and Montmagny (2016-2018)

› Team leader. Reference status (characterization), study of spawning of American shad and striped bass, sampling of environmental DNA. Investigate with commercial fishermen to obtain information on striped bass spawning habits. Hydrodynamic and tidal characterization of spawning site using a Doppler current meter.

S.E.N.C. - New Highway 30 - Follow-up of fish compensatory habitat use at Iles de la Paix, Montreal, (2017)

› Team leader. Sampling and inventorying the fish community and its habitat. Characterize the banks and identify erosion zones.

Hydro-Québec - Rehabilitation of the Bryson Generating Station - Ichthyological Inventory – Bryson (2016)

› Senior technician. Evaluate fish communities and fish habitats and identify their habitat in the area impacted by the remediation works at the Bryson Generating Station. Conduct sampling of the fish community and its habitat. Identify potential spawning areas for fall and spring species.

Hydro-Québec – Walleye and lake whitefish follow-up program, Mercier GS, Grand-Remous, Québec (2004-2012)

› Team Leader. Conducted and coordinated follow-up on walleye and lake whitefish spawning downstream of Mercier dam before and after developing a multispecies (walleye/lake whitefish) spawning bed, characterized substrate, water velocity, flow patterns and sediment regime, and monitored spawning timing.

Hydro-Québec – Draining of Pointe-des-Cascades basins, Québec (2008-2017)

› Senior Technician. Saved fish of various species, trapped during fall draining of Pointe-des-Cascades basins, by means of electrofishing and seine nets.

Hydro-Québec – EM 1/1 A powerhouses, Rupert diversion, Rupert forebay and increased-flow section – Multiple fish-related projects, James Bay region, Québec (2003-2011).

› Chef Team Leader and Substitute Coordinator. Carried out and/or coordinated field activities (up to 20 workers and 4 helicopters), including the following:
  – Captured lake sturgeon for a hatchery and prepared specimens for helicopter lifting.
  – Located spawning grounds, recorded (walleye and lake sturgeon) spawning times and characterized habitat (substrate, water velocity and flow patterns).
  – Conducted follow-up at compensation developments by monitoring use, reproduction success, eggs and larval drift.
  – Monitored fishway use by means of passive inductive transponder (PIT) tags (caught and tagged fish and downloaded data from detection station).
  – Installed telemetry transmitters on lake sturgeon for tracking from helicopter.
  – Ensured final identification in the lab of larvae and eggs collected in drift nets.
  – Wrote a guide on identifying larvae and eggs of Rupert and Eastmain watershed fish species.
  – Participated in the various stages of hatchery breeding and rearing of lake sturgeon.
  – Conducted bathymetric survey and stream gauging (Doppler current meter) from a motorboat in an area of very high flow (KP 333 of the Rupert) and a topographic survey of shores (RTK GPS).

Hydro-Québec – Telemetry monitoring of lake trout and lake sturgeon during Rupert forebay impoundment, James Bay region, Québec (2010)

› Team Leader. Participated in developing the strategic approach (work and safety plans), captured lake trout, installed transmitters on them and telemetry receivers on the ice cover.

RSW Inc. for Qulliq Energy Corporation – Jaynes Inlet Hydropower Project – Environmental baseline, Nunavut (2009)

› Senior Technician. Carried out field work for several components of the environmental impact study (fish, benthic invertebrates, and water and sediment quality), checked data quality and participated in coordinating work.

New York Power Authority (NYPA) – Lake Sturgeon Habitat Improvement Project, Cornwall, Ontario (2004- 2009)

› Wildlife Technician. Participated in field characterization (substrate, flow velocity, etc.) and sampling (spawners and eggs), and monitored over a three-year period two lake sturgeon spawning beds developed by Environnement Illimité. NYPA won an environmental award from the National Hydropower Association for this project.

Brookfield Renewable Power – Compensation development program for Rapides-des-Cèdres GS (9.8 MW), Notre-Dame-du-Laus, Québec (2003-2005)

› Wildlife Technician. Conducted field activities for monitoring walleye spawning habitats downstream of Rapides-des-Cèdres dam: characterized substrate, water velocity, flow patterns and sediment regime, and monitored spawning timing

Hydro-Québec – Rupert Diversion Project – Follow-up on native fishing, James Bay region, Québec (2005)

› Wildlife Technician. Participated in public relations with Crees for follow-up on Native fishing in the Rupert River.

Groupe Conseil UDA inc. – Lévis-Montréal gas pipeline, Québec (2005-2006)

› Team Leader. Directed and worked on fish inventories and characterized habitats to be crossed by a planned pipeline from Lévis refineries to Montréal. Approached and established relations with owners affected by the project

Cascades Paper – Environmental effects monitoring, Québec (2003)

› Wildlife Technician. Conducted research fishing, collected gonads and livers of fish caught, and installed benthic traps.

Other projects, Canada

Station touristique Val Saint-Côme – Snow park study, Saint-Côme, Québec (2006)

› Project Leader. Designed and implemented a snow park construction method aimed at reducing accidents among users. The method was developed after the Ministère de l'Éducation, du Loisir et du Sport published a guide that most stakeholders considered too restrictive. After introducing the new method proposed by Environnement Illimité, injuries reported in the snow park dropped to 53% of number in the preceding year.

2002 - 2003

SOCIÉTÉ DE LA FAUNE ET DES PARCS (FAPAQ), SHAWINIGAN, QUÉBEC, CANADA

Wildlife Technician

› Monitored and assessed rotenone-treated lakes based on fishing statistics.

› Participated in work by the fur bearer management unit (managed permits, mapped territories on ArcView, compiled data, etc.).

› Compiled statistics collected and drew up annual hunting and fishing balances for ZECs in the Mauricie region.

› Set quotas for lakes in the Saint-Maurice and Mastigouche wildlife reserves.

› Determined the age of moose by analyzing teeth.

› Collected data to document environmental damage to fish habitat.

› Visited potential sites for fishways to cross obstacles to upstream migration

› Participated in an enquiry in the adjacent FAPAQ region related to sport fishing in Lac Saint-Pierre.

2002

ASSOCIATION OF LANAUDIÈRE ZECS (CONTROLLED HARVESTING ZONES), SAINT-ZÉNON, QUÉBEC

Wildlife Technician

› Studied possible introduction of a special strain of brook trout from the Rupert River into a lake in ZEC des Nymphes.

› Conducted forest inventories in areas with different types of precommercial thinning, mapped over a small game inventory.

› Conducted a forest inventory to propose forestry measures promoting grouse.

› Supervised student interns and laborers.

› Assessed potential beaver habitat based on forest inventories.

› Controlled and relocated harmful beaver.

› Characterized and assessed the habitat potential of a chain of walleye lakes.

› Located brook trout spawning grounds.

PERFECTIONNEMENT PROFESSIONNEL

2018	First aid, Sentinel Inc., Montréal, Québec, Canada
2016	Ice rescue, SIFA, Montréal, Québec, Canada
2016	Boat Rescue and Responder in waterfront areas, SIFA, Montréal, Québec, Canada
2014	Small vessel operator (SVOP), Institut Maritime du Québec, Montréal, Québec, Canada
2013	Electrofishing crew supervisor, Vancouver Island University, Montréal, Québec, Canada
2011	Hydro-Québec Work Safety Code, Hydro-Québec, Québec, Canada
2006	Construction Site Safety (ASP), ASP Construction, Joliette, Québec, Canada
2006	SIMDUT, ASP Construction, Joliette, Québec, Canada
2005	Scuba Diving, Action Scuba, Pointe_Claire, Québec, Canada
2003	Recreational Boating, ESNQ/CSBS, Joliette, Québec, Canada
2002	Aerial security, Centre québécois de formation en aéronautique, Shawinigan, Québec, Canada
2002	Wilderness Survival, Cégep de Baie-Comeau, Baie-Comeau, Québec, Canada

PRESENTATION

Beaudry, Pierre-David, (speaker) Methods and principles for fresh water GHG measurements, Kuching, Malaysia, 2011.

Appendix 2: Turbidity sampling procedure

Procedure for turbidity monitoring

Turbidity monitoring for construction activities will be conducted by visual monitoring. Compliance monitoring will be conducted when visual turbidity monitoring has been observed outside of the zone of influence described in table 6-1 of the monitoring program.

Equipment list:

1- Boat
2- Boat safety equipment
3- Life jacket and/or isothermal suit
4- GPS with depth sampler
5- Sampling pole
6- Weighted Van Dorn sampler
7- Clean sampling bottles
8- Turbidity meter
9- Log/field notebook with pen/pencil
10- If samples to be sent to the laboratory:
    a. Cooler and ice pack
    b. Indelible ink pen/marker
    c. Clean bottles
    d. Chain of custody document

Basic sampling steps are as follows:

1. On land prior to departure – calibration as per instruction manual:
    a. Calibrate the turbidity meter if it hasn't been done a month, or;
    b. Validate calibration
2. Ensure safety equipment is placed in the boat, personal protection gear and perform a safety check as required in TA's safety plan
3. Sampling locations:
    a. Sample control site first (either 25 m up-current from plume or at slack tide at a distance equivalent to 5X the size of the plume)
    b. Compliance locations to be sampled will be in the plume 100 m down-current from the turbidity generating activity
    c. If the plume is discontinuous, use 3 locations within the plus at 100 m down-current instead of just one
    d. Validation location to be sampled will be in the plume 300 m down-current from the turbidity generating activity
4. Find sampling locations using GPS coordinates.
5. Use a boat to reach sampling locations.
6. Measure the height of the water column using the GPS system:
    a. If water column is <3 m, ony take a surface sample using the pole
    b. If the water column is >3m and <40 m, take a surface sample using the pole or the Van

Dorn sampler (at least 30 cm below the surface but aim for 1 m below the surface) and a sample 1 m above the seabed using the Van Dorn sampler

c. If the water column is >40 m, take a surface sample using the pole or the Van Dorn sampler (at least 30 cm below the surface but aim for 1 m below the surface), a sample at mid-height of the water column and a sample 1 m above the seabed using the Van Dorn sampler

7. Prior to sampling, stop the boat at the sampling location and wait until the boat is completely immobile. If tide is flowing, it may be required to keep the engine running. In this case, ensure that the samples are taken from the front of the boat, away from the motor.
8. Rinse the bottle or sampler twice at the site before beginning the sampling.
9. For a surface water sample, with the help of the pole submerge the 500ml bottle previously attached to the end of the 2m pole quickly and vertically. The bottle must be lowered quickly into the water so that the air stays in the bottle and the water starts to enter the bottle at least 30 cm deep. Wait until the bottle is completely filled before surfacing.
10. For a sample lower in the water column, use the Van Dorn sampler:
    a. In the presence of current, ensure the sampler is properly weighted.
    b. Ensure that faucets on either end of the sampler are closed.
    c. Every meter along the length of the rope will have been previously marked so estimate the depth required.
    d. Lower the sample to the desired depth and activate the trigger.
11. Shake the bottle and immediately fill a sample vial with the collected water.
12. If a 500 ml bottle is required for the laboratory analysis:
    a. Ensure the bottle is properly identified with indelible ink prior to filling it
    b. Take a subsample in the vial to measure turbidity with the turbidity meter
    c. Stir the sampler again after filling half of the bottle to ensure particulate matter has not settled out of the water
    d. Leave enough head space for mixing at the laboratory (fill until the bottle's "elbow")
    e. Place the bottle inside of the cooler
    f. Ensure cooler contains the chain of custody documents in a Ziploc bag
13. Read the turbidity level (refer to the turbidimeter instruction manual).
14. Note on the notebook the:
    a. Date and time
    b. Facility and activity
    c. Current phase
    d. Current height
    e. Turbidity level in NTU measured by the turbidimeter
    f. Specific observations (mitigation measures in place, duration of the plume, weather).
15. Repeat steps 6 to 14 at each location.

Appendix 3: MMO training program

Tower Arctic Ltd. – Marine Mammal Observer Training Program

1. Training program schedule
2. Project location and construction sites
3. MMO roles and responsibilities
4. Marine mammal (species and description)
5. Marine mammal signs of distress
6. What to do in case of sighting a marine mammal

1. Training program schedule

A. Class training (2 hour)
   I. Project Security Induction
   II. Review of the training program with the Environmental Monitor

B. Field training (2 hours)
   I. Visit of the construction site
   II. Presentation of the construction team involved in the activities to monitor
   III. Job safety analysis
   IV. Access to the observation sites

2. Project location and construction sites

Figure 2-1: Map of the construction site

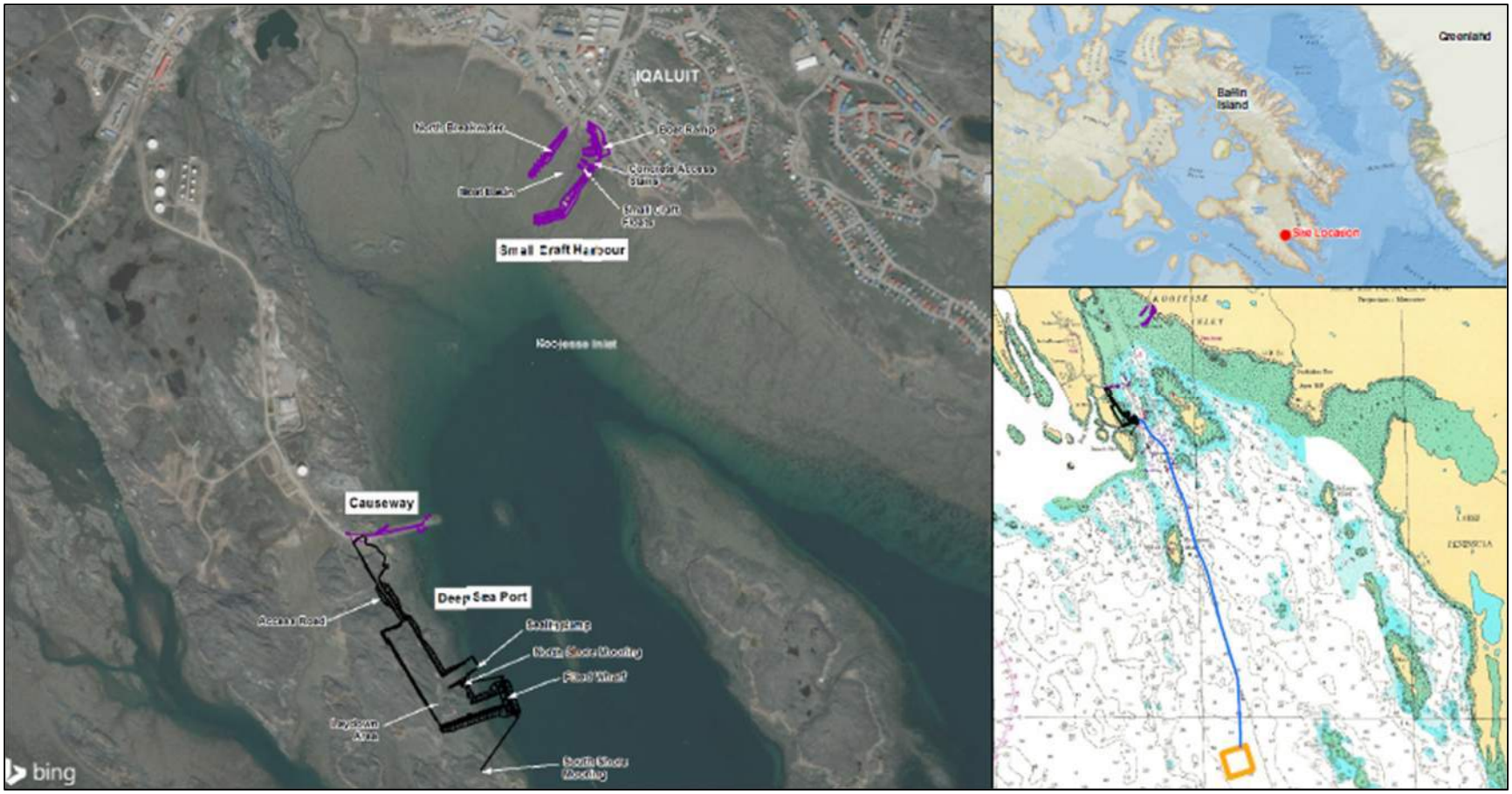


Figure 2-2: DSP site areas

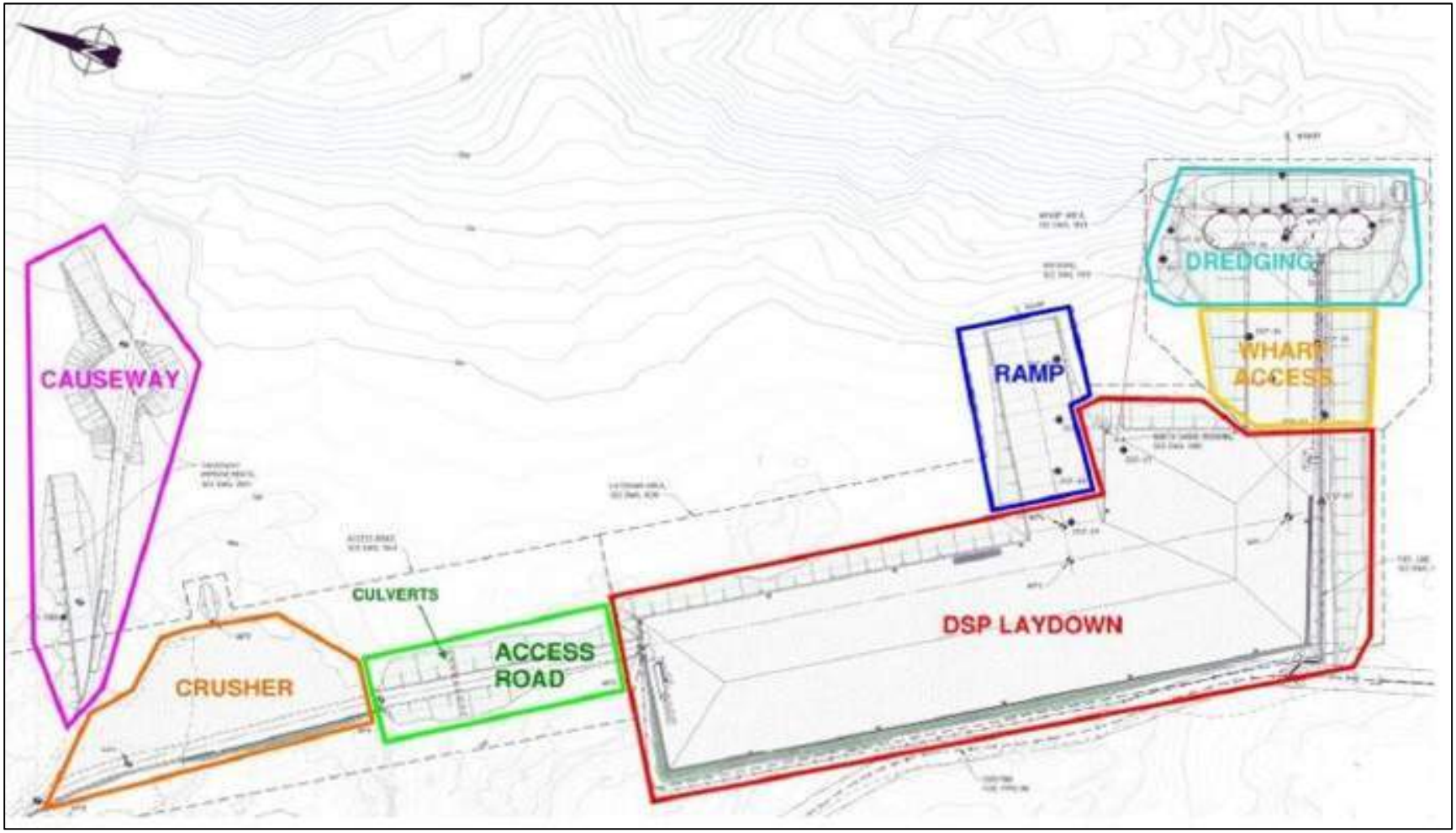
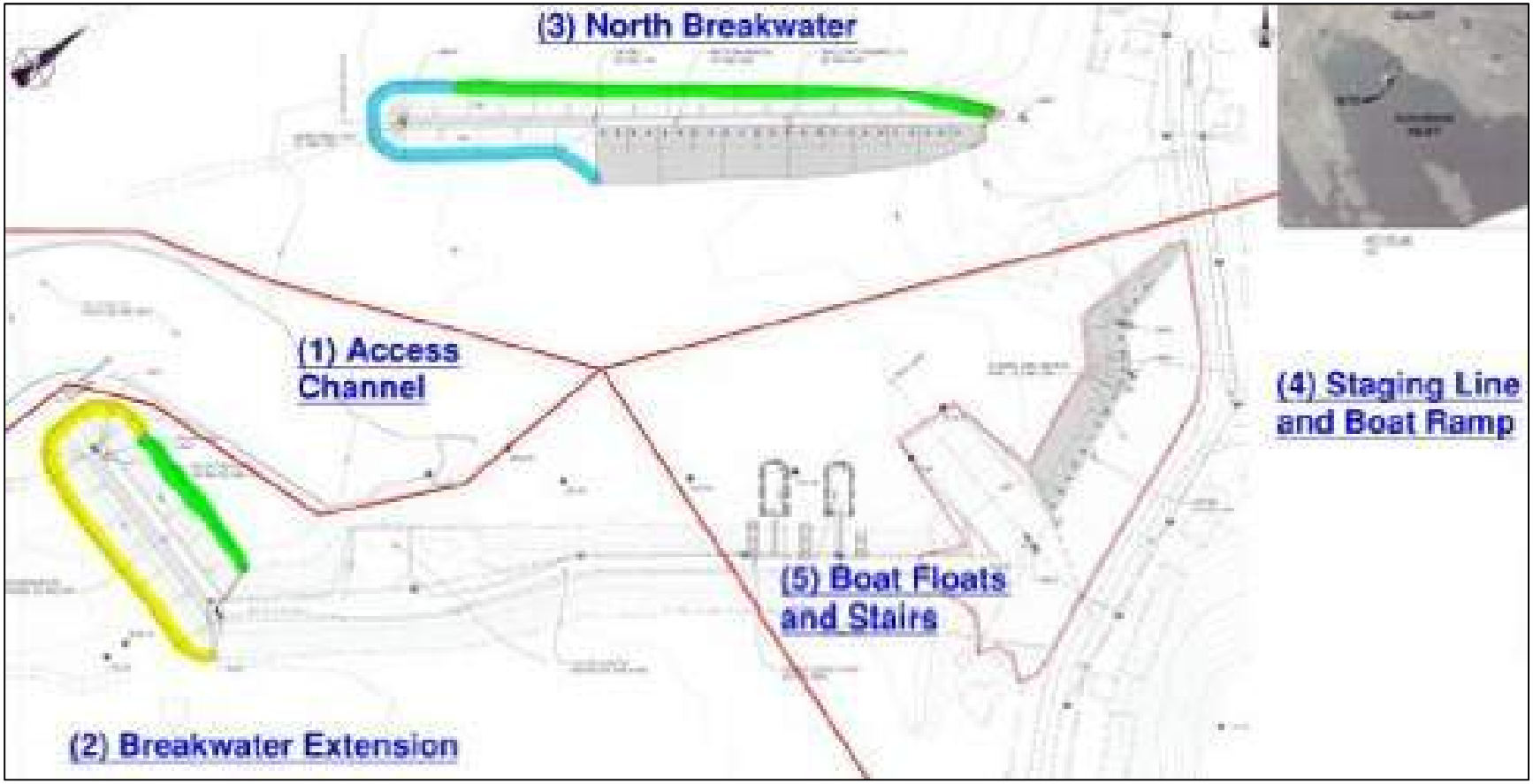


Figure 2-3: SCH site areas



3. MMO roles and responsibilities

What is a marine mammal observer or MMO?

An MMO carries out visual detection of marine mammals during surveys associated with marine projects. The latter is primarily associated with mitigating the potential impacts of anthropogenic sound on marine mammals by implementing a suite of real-time mitigation measures.

In this case, MMOs are required to monitor the presence and behavior of marine wildlife during pile-driving and during the use of explosives (e.g. blasting for excavation)

The use of an MMO is mandatory during all in water or near water activities that may generate underwater sounds.

The role of an MMO includes visually monitoring marine mammals (and other marine fauna) at sea using binoculars, completing the necessary effort, sighting and operational data forms, implementing the required mitigation measures (described below), reporting to the Environmental Monitor (EM) and/or site superintendent, and providing general advice and guidance on minimizing impacts on marine mammals.

The MMO has a serious responsibility and has the power to stop work whenever set conditions are not met.

Why do we need a marine mammal observer?

Apply the law associated to the observation of the whale, beluga, and other protected species and the impact of construction works in the area on those species.

Be compliant to meet the requirements of our permits.

What are the activities that needs to be monitored by an MMO?

The activities that need to be monitored by an MMO will be mostly those of the DSP construction and include; in water infill, dredging, disposal at sea, pile driving and blasting.

What does it take?

Have received training;

Understand the impacts (under water noise pollution, turbidity, risk of equipment working in water) of construction work on the ecosystem;

Be meticulous and patient;

Take thorough and clear field notes;

Be prepared for the right weather;

Good at evaluating distances;

Understand the chain of communication

Immediately communicate to the EM or field superintendent any sighting that is located within the exclusion zone and confirm that the work has stopped;

Document all sightings;

How to be respectful on the local fauna?

Keep a mindful distance from wildlife while operating vessels;

Keep the noise to a low level or establish an exclusion zone and monitor it;

Do not harass, feed, or get close to wildlife;

Communicate clearly and politely with people when you see improper behavior.

What is the exclusion zone?

The exclusion zone is an area where no marine mammals shall be present when a specific work is being performed. The distance between the work and the boundary of the exclusion zone will be different based on the nature of the work.

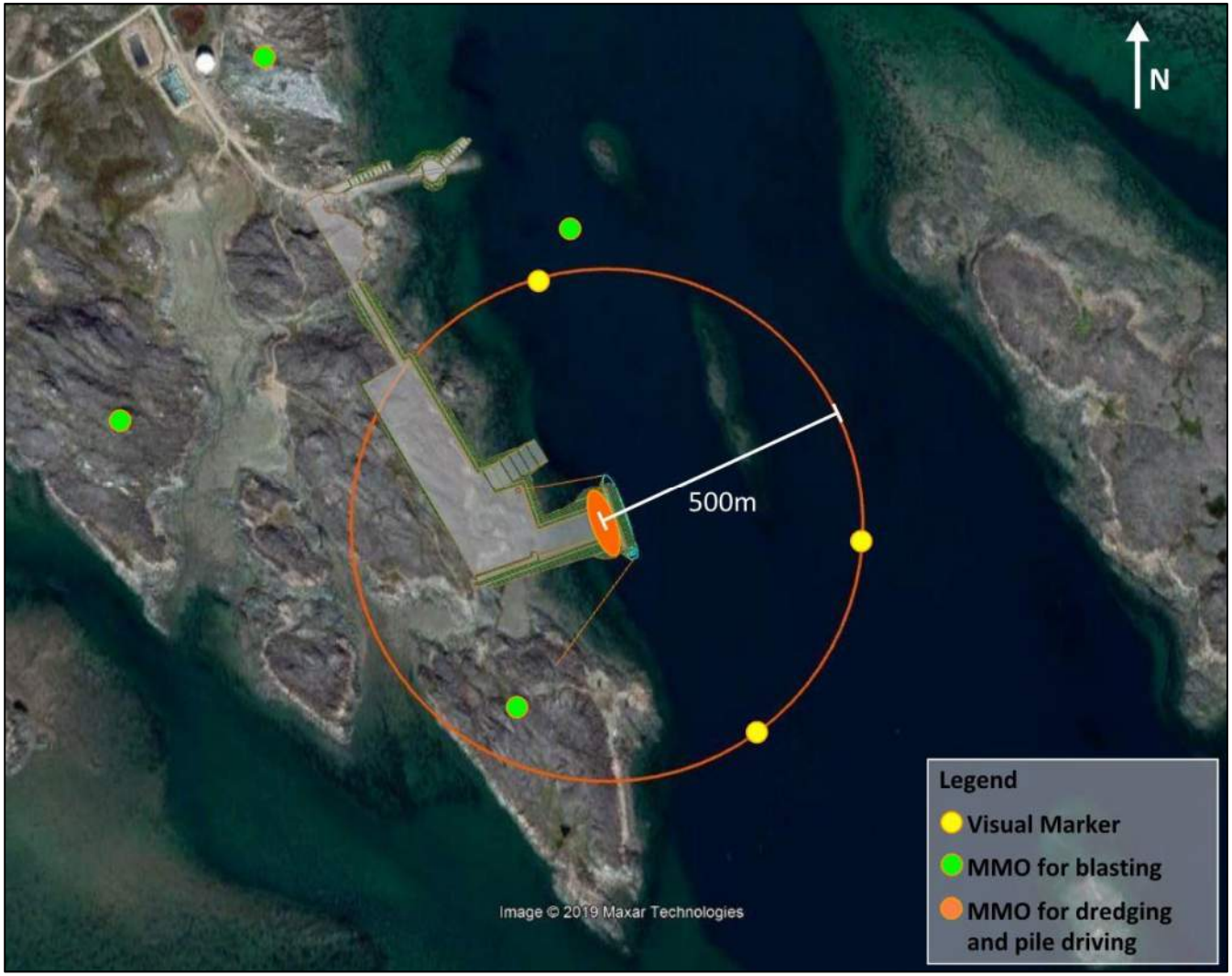
Exclusion zone visual markers; some buoys might be installed in the water with a known distance from work.

Table 3-1: Construction activities and exclusion zone

	Construction activities					
	In water Infill	Out of water infill	Dredging	Disposal at Sea	Pile driving	Blasting
Exclusion Zone	20 m	10 m	20 m	100 m	500 m	500 m

Where the MMO can observe the exclusion zone?

Figure 3-1: MMO observation sites



Without visual marker, how an MMO can evaluate a distance?

Figure 3-2: DFO distance evaluation

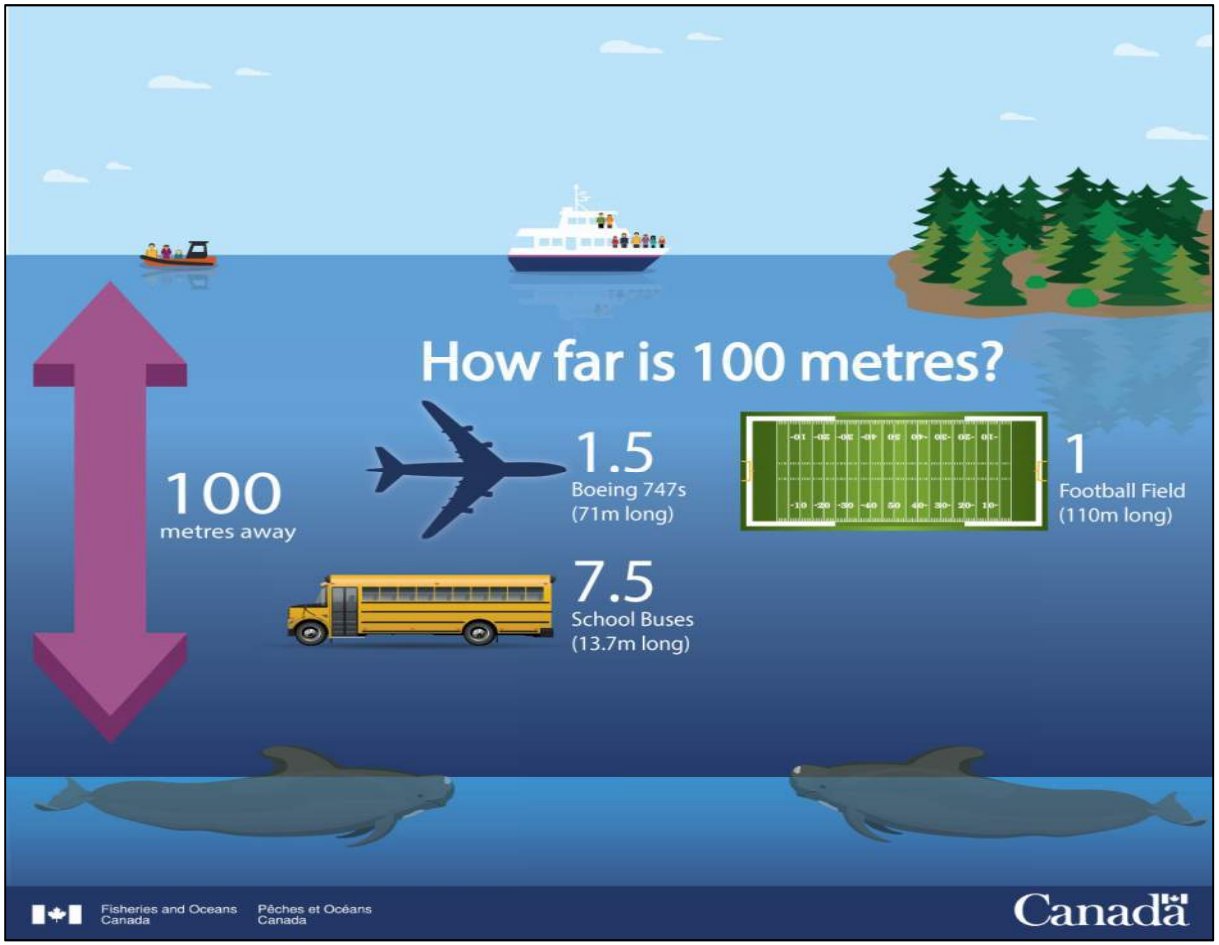
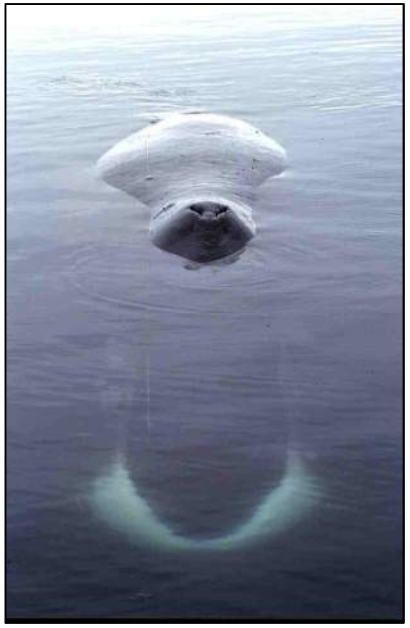


Figure 3-3: natural reference point in Koojesse Inlet

4. Marine mammals (species and description)

Bowhead whale

A stocky dark-colored whale without a dorsal fin, it can grow 14 to 18 m (46 to 59 ft) in length. This thick-bodied species can weigh from 75 to 100 tones.



Fin whale

The fin whale is usually distinguished by its tall spout, long back, prominent dorsal fin, and asymmetrical coloration. The average size of adult males and females is about 18.5 and 20 meters (61 and 66 ft), respectively, averaging 38.5 and 50.5 tones.



Sei whale

The whale's body is typically a dark steel grey with irregular light grey to white markings on the ventral surface, or towards the front of the lower body. Adult males average 14 m (46 ft) and adult females 14.5 m (48 ft), weighing 15.5 and 17 tones.



Blue whale

The blue whale has a long tapering body that appears stretched in comparison with the stockier build of other whales. At up to 29.9 meters (98 ft) in length and with a maximum recorded weight of 173 tones, it is the largest animal known to have ever existed. Long and slender, the blue whale's body can be various shades of bluish-grey dorsally and somewhat lighter underneath.

Harp Seal

Male and female harp seals are similar in size with adults averaging 1.6 m in length and weighing 130-150 kg.

Ringed Seal

The smallest species in the seal family, Ringed seals average about 1.5m in length and weigh between 50–70 kg.

Walrus

Walruses have huge bodies and relatively small heads with no external ears. They have broad, bristled muzzles; and enormously elongated upper canine teeth forming heavy tusks. Walruses can turn their rear flippers forward and use all four limbs when moving onto shore.

Beluga

Belugas have the following characteristics and distinguishing features: Adults range in total length from 2.6 to 4.5 m and weigh up to 1,900 kg; Adult females are about 80% the length of males. Adults are pure white in color; newborns are born a dark grey, sometimes with mottling, and lighten as they mature.

Killer whale

The Killer Whale is a member of the dolphin family. Killer Whales are found in all of the world's oceans. It is easily recognized by its distinct black and white patterns. The Killer Whale is known as ''Aarluk'' in Inuktitut and has the following characteristics: Tall, uniquely-shaped dorsal fin on individual whales; usual length for male 6.70m to 8.50m and female 5.50m to 7.30m

Narwhal

Narwhals, also known as sea unicorns, are toothed whales Narwhals have the following characteristics: Medium-sized whale with no dorsal fin. Adult males can reach 5.4 m in length and about 1,935 kg in weight; females 4.9 m and about 1,552 kg. Females with a tusk, males with no tusk, and two tusks are rare occurrences.

5. Marine mammals signs of distress

When the marine mammal that being watched, the animal is in distress if he:

- leaves the area or;
- dives frequently

Stops its activities, including:

- resting
- feeding
- nursing
- socializing
- communicating with each other (vocalizing)

Begins or stop behaviors like:

- breaching, where a whale leaps headfirst from the water
- lob tailing, where a whale repeatedly slaps the surface of the water with its tail
- flipping, where a whale slaps the surface with one or both fins directly behind its head
- continually changes its swimming speed or direction.

6. What to do in case of sighting a marine mammal

Figure 6-1: MMO's decision diagram

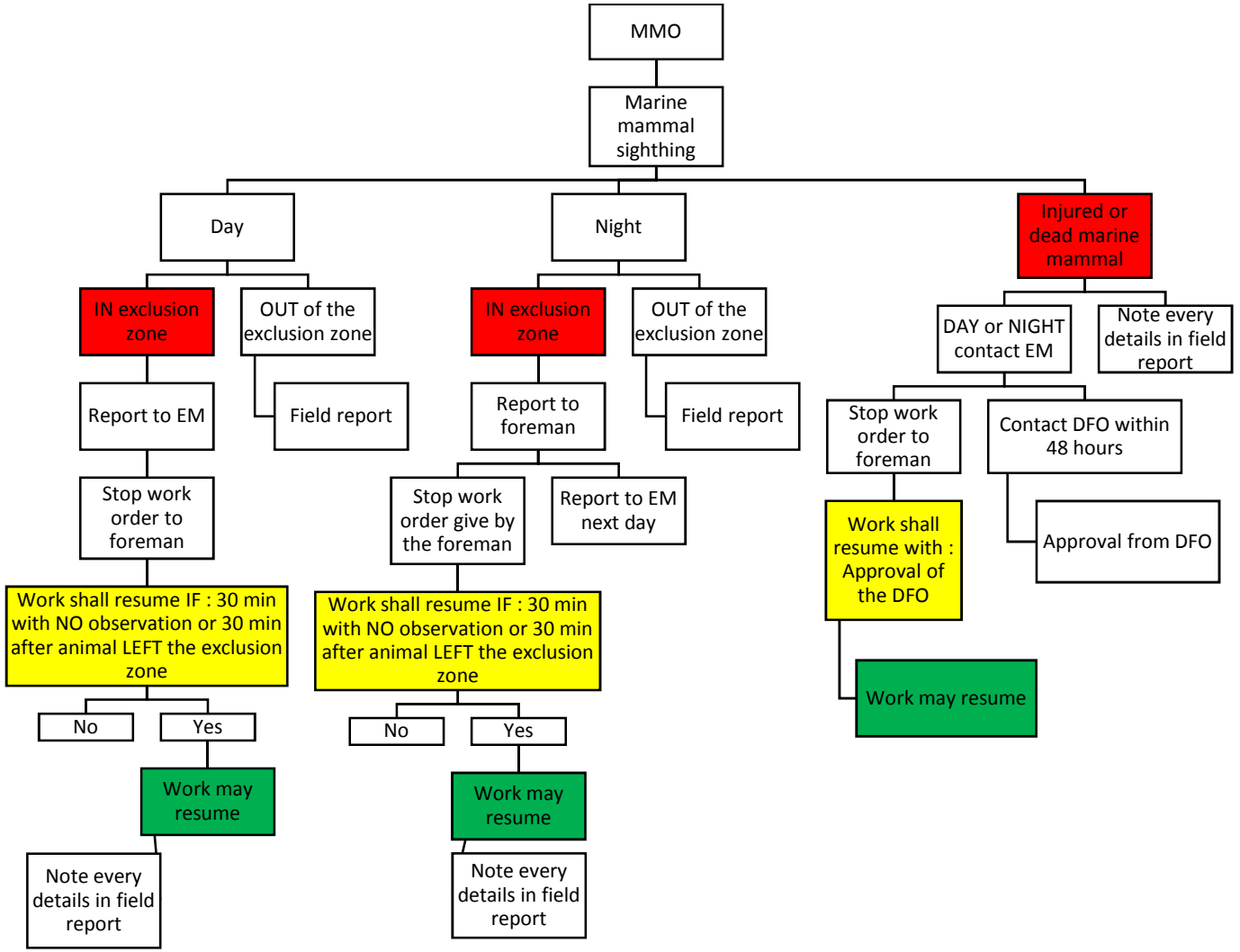


Figure 6-2: MMO's field report

TOWER ARCTIC LTD

Project : _____

Date (day/month/year) : _____

Marine mammals observer (name) : _____

Environmental monitor on duty (name) : _____

Foreman on duty (name) : _____

Activity and location that is observed : _____

Exclusion zone (metres) : _____

Time of observation (xx:xx pm/am)	Duration of the observation (minutes)	Observed species	Distance from the work area (m)	Number of specimens observed	Comment on animal(s) behaviour	Stop work (yes/no)	Stop work = yes Person contacted

Signature of the observer: _____

page ____ of _____

Table 6-1 : Contact informations

	Cellphone number	Radio frequency
Environnemental Monitor		
Olivier Bédard-R.	1 (418) 953-3781	Simplex 1
David Lauzon	1 (514) 207-0990	Simplex 1
Pierre-David Beaudry	1 (514) 219-2927	Simplex 1
Day shift Superintendent for Civil Works		
Norbert Morency	1 (418) 554-4316	Simplex 1
Day shift Superintendent for Marine Works		
Peter-Mark Noel	1 (418) 254-6102	VHF 72
Christian Lamontagne	1 (418) 569-5788	Simplex 2
Night shift Foremen for Civil Works		
To be determined		Simplex 1
Night shift Foremen for Marine Works		
To be determined		Simplex 2

In the case of abuse, harassment or poaching, contact the following toll-free numbers as soon as you can:

- Crime Stoppers: 1-800-222-TIPS (8477)
- Canadian Coast Guard: 1-800-565-1633

Appendix 4: Underwater Acoustic Measurement

UNDERWATER ACOUSTIC MEASUREMENT

Environmental monitor's name	Name of others present	Date and time (yyyy-mm-dd) to

Description of work	Description of mitigation measures

Results

Underwater noise

Duration	Initial position	Initial distance	Final position	Final distance	SPL_{peak} max (dB re 1µPa)	SPL_{inst} max (dB re 1µPa)	SPL_{RMS} (dB re 1µPa)	SEL_{cum} (dB re 1µPa^2s)

Notes

Weather conditions

	Temperature (T°C)	Wind (km/h)	Precipitation	

Marine conditions

	Average depth (m)	Current	Beaufort	

Instrumentation

Soundmeter:	Calibration				
Hydrophone:					
Calibrator:	Initial calibration	Time:		Calibration level:	
Depthmeter:	Final calibration	Time:		Deviation:	

Completed by : _____ **Date :** _____

Appendix 5: Wildlife survey methodology

METHODOLOGY TO MONITOR WILDLIFE, BIRD AND NEST

Equipment list:

- GPS
- Field notebook and pencil
- Binoculars
- Flagging tape
- Map of the project footprint
- Camera

Code of conduct:

- Inventory in a non-intrusive way
- Respect the presence of birds and nests
- Be alert to potential predators
- Minimize inventory time
- Observe from a distance first
- Do not take nests or eggs
- Monitor safely

Methodology to do the survey:

- To do the survey, the monitor will walk quietly in the footprint of the project and nearby. The monitor must move while respecting the variations of the ground since it is very steep.
- In places where the monitor can have a good view of part of the project's footprint, the monitor takes around 15 minutes to scan the area with and without the help of binoculars to see possible wildlife. He takes the opportunity to listen if it's possible to hear birds or wildlife.
- If a bird is observed, the monitor observes its behavior to determine if it's possible that a nest is present. The kind of behavior can be warning shouts, the regular comings and goings, transport food to the nestlings, etc. The characteristics of the observed bird should be noted and if possible, a picture will be taken. Based on the signs of presence or absence of a nest, the monitor could approach quietly to confirm the presence of a nest without disturbing the nestling. If a nest is present, a flag tape will be placed near the nesting site without disturbing the nestling to allow a buffer around the nest.
- If wildlife other than birds is observed, the monitor will note the characteristics and the number of animal (s). If possible, a picture will be taken. If a large wildlife congregation or a sensitive species is monitored, the information is noted.

Appendix 6: Detailed checklist based on commitment register

BI-YEARLY CHECKLIST

Tower Arctic Ltd
Project #: 21808

Name:	
Inspection period:	
Location:	
Nature of work:	

	Element to verify	Respect of requirement				Comment
		C	NC	OI	NA	
Administrative						
DFO - General ECCC 13.3 NIRB 2 INAC 48 INAC 49 INAC 50	Maintain a copy of the permit and its application on site and provided to federal or provincial officials. The permit must be kept on hand at all times. Work crews should be familiar with and adhere to the conditions: - A copy of the ECCC permit will be kept on all ships used for the operation. - Display a copy of INAC permit in a conspicuous plan in each campsite established for this land use operation. - Display the permit number on all vehicles and equipment.					
NIRB 34	Transmit CEMP and Spill contingency and Emergency Management Plan to NIRB.					
NIRB 2c	Obtain a permit NRCan Explosive transport, storage and use					
NIRB 2g	Obtain INAC land use permit					
NIRB 2f	Obtain a Nunavut water board permit					
INAC 3	Field Supervisor shall contact or meet with a Land Use Inspector at the Department of Indigenous and Northern Affairs Canada, phone number (867) 975-4295; email address aandc.fieldoperationslands-opsregionaleterre.aadnc@canada.ca, at least 48 hours prior to the commencement of this land use operation.					
INAC 4	Provide notification of commencement of the land use operation within 10 days to the Engineer at Iqualuit office (landsmining@aandc.gc.ca or 867-975-4283)					
INAC 5	Provide locations of the following activities, if applicable, related to the project within 10 days of establishment (campsite, fuel caches, airstrip, drill laydown area and quarry locations).					
INAC 6	Provide in writing to the Engineer, at least forty-eight (48) hours prior to commencement of this land use operation, the following information: a) person(s) in charge of the field operation to whom notices, orders and reports may be served; b) alternates; c) indirect methods of contacting above person(s)					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
INAC 7	Notify a Land Use Inspector at least 10 days prior to the completion of the land use operation of: a) a plan for removal or storage of equipment and materials; b) when final clean-up and restoration of the lands used will be completed.					
INAC 8	Submit an annual report by March 30th of each year of permitted activities including a technical summary of activities undertaken for the year, a table and maps showing camp locations, air strip and landing locations, drilling locations, fuel caches, locations of activities conducted, backfilled sumps, work plan for the following year, progressive reclamation undertaken.					
INAC 9	Submit to the Engineer a a Spill Contingency Plan for use during the construction and operation of the winter road, 10 days prior to the commencement of activity.					
NIRB 36	Submit a comprehensive report to NIRB at the completion of construction activities and prior to operations (activties, caracterization of dredged material and mitigation as required, reasons for installation of silt fences if requied, wildlife log with notes on species and behavior, mitigation activities and stop work events and outcome, discussion with regulators about wildlife and updated procedures, spills and responses, how compliance with conditions).					For information purposes only.
DFO 3.1	Monitor the implementation of avoidance and mitigation measures referred to in section 2 and provide an annual report to DFO by January, 2019, 2020 and 2021 , and summarizing whether the measures and standards to avoid and mitigate serious harm to fish were conducted according to the conditions of this authorization.					
DFO 3.1.1	Providing dated photographs and monitoring reports to demonstrate effective implementation and functioning of mitigation measures and standards described above to limit the serious harm to fish that is covered by this authorization.					
DFO 3.1.2	Contingency measures: providing details of any contingency measures that were followed to prevent impacts greater than those covered by this authorization in the event that mitigation measures did not function as described.					
TC (DSP) 2 TC (Causeway) 1 TC (SCH) 1	Prior to construction, construction details must be submitted to the Navigation Protection Programs for review and approval					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
TC (DSP) 12 TC (Causeway) 13 TC (SCH) 15	Any proposed changes shall be reviewed and accepted by the Navigation Protection Program prior to implementation					
TC (Causeway & SCH) 10 & 12	The owner shall notify the Canadian Coast Guard Marine Communications and Traffic Services Center and the Navigation Protection Program when construction activities are complete.					
TC (Causeway) 11 TC (SCH) 13	As built drawings, including bathymetric survey data and cautionary buoy location and characteristics, must be submitted to Transport Canada's Navigation Protection Program and the DFO's Canadian Hydrographic Service within 1 year of project completion.					
TC (SCH) 2	Notice to Shipping shall be submitted to Canadian Coastguard Marine Communications and Traffic Services prior to construction. The Canadian Coastguard Marine Communications and Traffic Services prior to construction shall be notified of start date at least 48 h prior to the start of construction.					
ECCC 11.2	Inspections: all records of all loading and disposal activities are kept on site for the duration of the permit and are available for inspection by any enforcement officer or analyst, for 2 years following the expiry of the permit					
ECCC 12.1	The loading or disposal at sea referred to under this permit shall not be carried out by any person without written authorization from CGS					
ECCC 12.2	Records of loading and unloading activities are kept on site for the duration of the permit (including new permit which expires on July 9th 2020). These records will be transfered to the CGN as they must be available for consultation for two years after the expiration of the expiration of the permit.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
ECCC 13.1	Provide the following information at least 48 hours before loading and disposal activities commence: name or number of ship, platform or structure used to carry out the activity, name of the contractor including corporate and on-site contact information and expected period of activity, To be provided to: the Environmental Enforcement Division of the Department of the Environmental, Prairie and Northern Region, 867-873-8185 (fax) or ec.immersionenmerrpn-disposalatseapnr.ec@canada.cam(email)					
ECCC 13.2	Submit a written report to the Minister, as represented by the Regional Director of the Environmental Protection Operations Directorate, within 30 days after the expiry of the permit. This report shall contain the following information: a list of all work completed pursuant to the permit, including the location of the loading and disposal sites used, the quantity of matter disposed of at the disposal sites, and the dates on which disposal activities occurred					
ECCC 14.1	Submit a written dredged material disposal plan to the Minister, as represented by the Regional Director of the Environmental Protection Operations Directorate, Prairie and Northern Region, identified in 13.2 for approval by the Department of the Environment prior to the commencement of the first dredging operation authorized by this permit. The plan shall address procedures to accurately measure or estimate quantities of dredged material disposed of a t the disposal sites, vessel tracking and a schedule for us of the disposal sites. Modifications to the plan shall be made only with the written approval of the Department of the Environment					
ECCC 14.2	Modification to disposal at sea mitigation measures in the CEMP shall be made only with the written approval of the department of the Environment.					
INAC 47	It is required to immediately notify the Engineer of the transfer/sale fo property/assets authorized under this permit upon completion of transaction.					
Hazardous Materials Measures						
INAC 26	No chemicals used in connection with the land use operation without prior approval of the Engineer.					
HM01. NIRB 12	Ensure staff is trained and qualified to safely handle the hazardous waste and materials.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
INAC 41 HM02.	Hazardous waste and materials shall be stored a minimum 31 m distance from a waterbody or identified sensitive environmental area (as identified through permitting, during pre-construction surveys [if required] or by the EI or EM).					
INAC 42	Locate mobile fuel facilities on land when stationary for any period of time exceeding 12 h.					
HM03.	A suitable container, based on the properties of the waste or materials to be stored, shall be selected: hazardous materials shall be stored in their original containers, where possible, or in containers specially manufactured for the purpose of storing a specific hazardous waste or materials.					
HM04.	Containers used for hazardous waste and materials shall not be used for non-hazardous waste types.					
NIRB 9	Use adequate secondary containment or a surface liner (e.g., self-supporting insta-berms and fold-a-tanks) when storing barreled fuel and chemicals at all locations.					
HM05.	All hazardous waste and materials shall be stored on a firm working surface that is impervious to leaks.					
INAC SCH 35 INAC 32 (access wildlife) HM06.	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, and is inaccessible to wildlife					
NIRB 22 INAC 33 HM07.	Drainage into and from the storage area shall be controlled, and/or suitable secondary containment implemented, to prevent spills or leaks from leaving the site and to prevent run-off from entering the site.					
HM08.	Containers shall be sound, sealable and not damaged or leaking.					
HM09.	Containers shall be closed and sealed at all times, except while materials are being added or removed.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
HM10.	All hazardous waste and materials shall be classified and labelled – containers must be clearly labelled to identify their contents according to requirements of the Workplace Hazardous Materials Information System (WHMIS) and the relevant Transport Authority.					
HM11.	All hazardous waste and material containers shall be accompanied by the Material Safety Data Sheet (MSDS) or have the MSDS on file available.					
HM12.	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).					
INAC 33 INAC 43 HM13.	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.					
HM14.	Inspections of the hazardous waste and materials management shall be performed and recorded at least weekly.					
NIRB 44 INAC 29 INAC 30 HM15.	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.					
NIRB 45 HM16.	Shipping of all dangerous goods shall be registered with Government of Nunavut as detailed in Table 4-1 and appropriate shipping documents shall accompany all movements of dangerous goods.					
HM17.	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.					
HM18.	Any open source of ignition, open flame, hot works and smoking is prohibited in the hazardous waste and materials storage area. All designated smoking areas shall have appropriate fire proof containers for waste.					
HM19.	Engines will be shut off and smoking shall be prohibited during fueling.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
INAC 44	Ensure that refuelling of equipment occus a minimum of 31 m away from the HWL of any water body, at a designated area. All refueling and bulk fuel transfers must be conducted over a drip tray or secondary containment.					
NIRB 22 INAC 33 INAC 43 HM20.	During transfer of petroleum products, a qualified 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).					
INAC 45	Ensure that all fuel caches are flagged and are contained in covered secondary containment during the winter months or when daily monitoring is not possible.					
NIRB 11 INAC 46 HM21.	Hydrocarbon contaminated soils shall be removed and treated on site or transported to an approved disposal site for treatment.					
Non-Hazardous Waste and Wastewater Measures						
WW01.	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.					
WW02.	Where possible, materials shall be re-used, reduced and/or recycled to minimize waste generated.					
WW03.	Install barriers to prevent vehicle interaction at waste storage areas.					
INAC 2 INAC 27 (non-combustible) INAC 28	Remove from Territorial lands all garbarge, debris, scrap metal, discarded machinery and parts, barrels and kegs, buildings and building materials, to an approved landfill or disposal facility (approved by a Land Use Inspector).					
NIRB 7 INAC 13	Keep all garbage and debris in bags placed in a covered metal container or equivalent until disposed of at an approved facility. All such wastes shall be kept inaccessible to wildlife at all times.					
WW08.	All waste shall be stored in plastic bags while conducting marine work to prevent waste being released into the water.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
NIRB 22 WW011.	Waste shall not be deposited in, or placed on land or ice, under any conditions where the waste may enter Arctic waters.					
WW04.	Waste shall be segregated in clearly marked waste containers applicable to the end use (e.g. landfill waste categories used by the City; i.e. wood waste).					
WW05.	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.					
WW06.	Containers and tanks are to be in good condition (no rusting or apparent structural defects).					
WW07.	Tanks or vessels must be able to withstand the pressure expected by the stored waste, taking into account factors such as temperature fluctuations.					
INAC 17 WW09.	Daily site cleaning (housekeeping practices) and routine inspections shall be completed to ensure materials are correctly sorted and placed in the proper bins.					
WW010.	Vehicle washing areas for haul trucks, if required, shall be contained separately and shall be provided with an oil water separator sized to expected flows and conditions.					
NIRB 27 WW012.	All garbage, fuel and equipment shall be removed upon abandonment and completion of the construction activities.					
NIRB 28 WW013.	All clean-up and restoration of the lands used shall be completed prior to the end of each field season and/or completion of site construction.					
INAC 10	complete all clean-up and restoration of the lands used prior to the expiry date of the INAC permit.					
Traffic Measures						
TF01.	Consult and coordinate with existing road service providers in the City. Road use shall not disrupt the delivery of community services (including emergency services) and will be done in consultation with the City of Iqaluit administration.					
TF02.	Traffic awareness concerning road safety, particularly for children and teens shall be implemented in the community.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
TF03.	Project specific speed limits shall be set, not greater than limits specified in the City (to be agreed). Speed limits will be set such that community safety is maintained and for the control of dust mobilization.					
TF04.	Road use timing restrictions shall be adhered to *(to be agreed with City administration)* .					
TF05.	Traffic control measures (e.g. fencing, lights, etc.) at the existing causeway and/or busy intersections along Akilliq Road and to the SCH, as required. This may include the use of a traffic monitor.					
NIRB 21 (without runoff) TF06.	Suitable dust suppressants (non-toxic and biodegradable) to reduce dust generation to acceptable levels shall be used. Dust suppressants will be in accordance with the Government of Nunavut, Department of Sustainable Development, Environmental Protection Service, and Environmental Guideline for Dust Suppression.					
TF07.	Regular inspection and maintenance of water control features shall be undertaken during construction.					
TF08.	Vehicle loads shall be covered when required to reduce dust generation.					
TF09.	Consultation with the City and community shall be undertaken to minimize obstruction of access to the municipal dump, to businesses along Akilliq Road and municipal breakwater.					
TF10.	A parking area and access from Akilliq Road to the existing causeway shall be maintained during construction, other than during blasting in the vicinity of the causeway or for other reasons related to safety.					
Vehicle and Equipment Use Measures						
INAC SCH 2	a) The permittee shall offset vehicle travel in areas without snow covered surface. b) The permittee shall confine the line to a maximum of 10 m unless otherwise authorized in writing by the land use inspector.					
INAC 12	Only the type, size and number of equipment that is listed in the accepted application may be used, unless otherwise authorized in writing by the Land Use Inspector.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
VE01.	Drivers will be properly trained and licensed. Personnel shall be encouraged to drive defensively and courteously.					
ECCC 11.3	Ship operating under the authority of this permit shall carry and display a radar-reflecting device at all times mounted on the highest practical location					
VE02.	All vehicles shall have adequate lighting so they can be easily seen.					
VE03.	Construction equipment shall be sized correctly for the task and suitable to drive on City roads, where required.					
VE04.	A regular maintenance and inspection program for Project vehicles and equipment shall be implemented to ensure construction equipment is in good working order.					
VE05.	When existing local facilities are not available for refuelling, onshore equipment and vehicles must be serviced and refuelled at least 15 m away from sensitive habitats unless secondary containment is used; preferably over an impermeable surface (e.g. drip trays). 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.					
VE06.	Revving of engines on mobile or stationary machines shall be limited and equipment not in use shall be shut down (restrict idling).					
VE07. NIRB 20	Gas or diesel engine exhausts shall be fitted with noise mufflers, where available.					
VE08.	The use of horns, bells, hooters, or other audible signals on mobile equipment shall be limited, while maintaining safe operation.					
VE09.	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.					
VE10.	Equipment (including material stockpiles and vehicle parking areas) shall be located as far as practical from residences or sensitive wildlife features (or habitats). If the noise source is directional, equipment will be orientated to minimize propagation in critical directions.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
VE11.	When offshore equipment and marine vessels are refueled through a floating hose, Contractor will 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.					
NIRB 18 VE12. INAC 20 INAC 21 INAC 22	Equipment or vehicles shall not be moved unless the ground surface is in a state capable of fully supporting the equipment or vehicles without rutting or gouging. Overland travel of equipment or vehicles must be suspended if rutting occurs.					
Marine Traffic Control Measures						
MT01.	Construction vessels will keep to pre-defined work areas and routes that will not interfere with sealift deliveries and to minimize the impact on existing traffic and navigation.					
MT02.	Clear communication protocols or procedures for vessels working in the area will be established.					
MT03.	Communication protocols will be established to notify the community of marine activities, including ongoing consultation with the community and HTA and Notice to Shipping.					
MT04.	All delivery of construction equipment will occur through existing sealift shipments.					
MT05.	A permit or approval will be issued by Transport Canada under the Navigation Protection Act, which will include notification and communication protocols for marine users to be aware of potential navigation interferences. Contractor will be updated with any additional requirements.					
TC (DSP) 3	Prior to construction, a traffic management plan that considers navigation access and safety in Koojesse Inlet during construction of the Deep Sea Port, Small Craft Harbour and Causeway improvement projects must also be developed and submitted to the Canadian Coast Guard and the Navigation Protection Program					
MT06.	Vessels will be appropriately marked in accordance with regulations administered by Transport Canada.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
TC (DSP) 4	Navigation lights mounted to the Warf shall be blue, as depicted in drawings W8 and W9 submitted to TC. Navigation lights shall be Fixed Beam with a Nominal Range of 2 nautical miles					
TC (DSP) 5	Wharf and laydown area shall be lit at all times of reduced visibility during the navigation season					
TC (DSP) 8	All mooring vessels shall be aware of the mooring line conditions and associated drawings M1 and M2					
TC (DSP) 9	All mooring vessels shall have copies of the mooring line conditions and drawings M1 and M2 on hand					
TC (Causeway) 2	Prior to construction, notices shall be posted at all local boat launch sites. Notices shall contain a map with project location, dates when access will be restricted and any pertinent navigation safety information. For SCH, the notices will also contain, tidal ranges when access is restricted and zones that can be accessed safely. Proof of posting, including location details, shall be submitted to the Navigation Protection Program.					
TC (Causeway) 4 TC (SCH) 5	During construction, signs stating "Construction ahead" must be: legible from a min distance of 200 m, visible from all point of marine approach, yellow or orange with black lettering, marked with retro-reflective material.					
TC (Causeway) 5	The owner of the work shall ensure vessels can navigate safely through or around the work.					
TC (Causeway & SCH) 6	All temporary works including silt curtains and anchored vessels acting as work plateforms shall be marked, from dusk to dawn and during periods of restricted visibility, with yellow flashing lights that are located att each end of the works and at any other location or adjacent to the works so that lights are spaced no more than 10 m apart.					
TC (Causeway) 7	A cautionary buoy shall be installed and maintained at the end of the Causeway improvement throughout the navigation season. The buoy shall be yellow in colour with yellow retro-reflective material and extend a min of 1 m above the waterline.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
TC (Causeway& SCH) 8	All temporary works must be completely removed on project completion.					
TC (Causeway& SCH) 9	All dredged material must be deposited above the high water mark.					
TC (SCH) 10	Navigation on the north breakwater shall, as depicted in plan L1, be green in colour, have 3 sec flash with a nominal range of 2 nautical miles, have a 360 degree arc of visibility, have a focal height of 4 m above HHWL and be fonctional at all times.					
TC (SCH) 11	Navigation on the south breakwater shall, as depicted in plan L1, be red in colour, have 3 sec flash with a nominal range of 2 nautical miles, have a 360 degree arc of visibility, have a focal height of 4 m above HHWL and be fonctional at all times.					
Blasting Measures						
BL01.	Construction should be initiated prior to the arrival of migratory birds (breeding season mid-May to mid- August) such that the surrounding area becomes unattractive for nesting. A pre-construction survey shall be conducted by the EM to identify all sensitive wildlife features, e.g. active bird nests, wildlife dens and wildlife foraging or traveling nests, if blasting commences within this window.					
BL02.	Blasting shall be restricted to hours in accordance to the City's noise by-law (#599) or as agreed with the City.					
BL03.	A notification protocol with input from the local community and other stakeholders for advance notification of planned substantial noise-causing activities (such as blasting) shall be implemented.					
BL04.	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. Entry buffers shall be based upon government or biologist recommended setback distances. Any nest that is disturbed will result in immediate notification to Environment and Climate Change Canada (ECCC) and the GN.					
BL05.	Prior to blasting occurring, warning must be issued in affected area using loud signaling devices.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
BL06.	Blast mats shall be used to prevent physical damage from fly rock and suppress dust where appropriate and as per DFO Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters.					
BL07.	Dust suppressants and/or watering shall be used to reduce dust generation from blasting to acceptable levels.					
BL08.	No blasting shall occur in-water.					
BL09 DFO 2.2.2	All blasting activities shall be conducted following DFO's *Guidelines for the use of Explosives in or near Canadian fisheries waters*. Refer to the drilling and blasting work plan for the specific procedure.					
Sediment and Erosion Control Measures						
INAC 18	Install erosion and sediment mintigation measures on disturbed areas before, during and after construction and as the land use operation progresses					
INAC 19	Insulate the ground surface beneath all structures and facilities associated with this land use operation to: a) prevent the ground from settling and/or eroding; b) prevent the melting of permafrost					
INAC 23	Ensure that bank disturbances are avoided and no mechanized clearing is carried out immediately adjacent to watercourses.					
INAC 24	Avoid discturbance on slopes prone to natural erosion and alternative locations and utilize alternative locations.					
DFO 2.1 NIRB 19	Sediment and erosion control measures must be in place and shall upgraded and maintained such that release of sediment is avoided at the location of the authorized work, undertaking or activities, with the exception of sea disposal of the dredged material					
INAC 14	Use portable ramps during loading or unloading ships or barges in a manner as to prevent shoreline erosion and sediment deposition in the water					
INAC 16	Slope sides of excavations and embankments except in solid rock to a horizontal/vertical ratio of 2:1 unless otherwise authorized by the land use inspector.					
SE01.	Perimeter controls shall be applied to act as a barrier, preventing sediment from reaching surrounding water courses (i.e. sediment/silt fence).					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
SE02.	Temporary sediment control measures shall be applied at the base of any soil or rock stockpiles.					
SE03.	Water quality in the marine environment shall be monitored for sediment run-off. If visual monitoring identifies sediment run-off, turbidity will be measured and compared to the Canadian Council of Ministers of the Environment (CCME) guidelines for the protection of aquatic life (the water quality guidelines).					
SE04.	Material shall be stockpiled in such a way that debris/sediments will not enter the marine environment. Material will not be stockpiled on the ice.					
SE05.	Permanent drainage features will be incorporated into the DSP laydown area as required to mitigate ponding during construction and operation.					
Marine Construction Management Measures						
NIRB 24	implement measures designed to minimize disturbance to seabed sediments and benthic communities and marine wildlife when carrying out project activities within the marine environment.					
ECCC_2018 9 ECCC_2019 10	Total quantity of dredged material to be disposed of by bottom dumping: 64,000 m^3. Maximum from July 10th 2019 to July 9th 2020 is 30,000 m^3.					
ECCC_2018 6 ECCC_2019 7	Loading method: barge-mounted mechanical dredge, a clamshell dredge or a crane equipped with a clamshell dredge.					
ECCC_2018 7 ECCC_2019 8	Towed bottom dumping scows take the most direct navigatinoal route between the loading and unloading sites.					
ECCC_2018 8 ECCC_2019 9	Unloading method: bottom dumping					
DFO 5.1.1.2	In addition to the outlined criteria in the Iqaluit Application. A digital photographic records of pre-construction, during construction and post construction conditions using the same vantage points and direction to show that the approved works have been completed in accordance with the Iqaluit Application					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
DFO 2.2.3	In-water construction activities shall be undertaken as outline in the Iqaluit application to minimize the potential for stress or death of fish					
MC01.	The Contractor will prepare Monitoring Plan(s) for the Project that include requirements during excavation, dredging, dredge disposal and in-water placement of fill material. This will include allowable levels of Turbidity/Total Suspended Solids (TSS) and marine mammal monitoring requirements.					
NIRB 25	Implement suitable erosion and sediment suppression measures on all areas before, during and after conducting activities in order to minimize turbidity plumes from the work site into the waterbody including the installation of silt screens.					
MC02.	Measures to reduce sediment mobilization during in-water activities shall be used by the Contractor when TSS/turbidity exceeds CCME water quality guidelines.					
MC03.	Contractor will request from Amaruq Hunters and Trappers Association (HTA) information on recent marine mammal sightings before the onset of construction activities that could result in disturbance or injury.					
MC04.	Soft-start procedure shall be implemented for pile-driving that could generate underwater noise above auditory threshold for marine mammals.					
DFO 2.2.3.2 MC05.	Vibratory piling equipment shall be used to reduce noise effects to community and marine fauna, where possible. A monitoring program shall be developed to verify that underwater pressure levels are less than 30 kPa @ 10 m from the piling activity to prevent injury to fish.					
DFO 2.3.3 MC06.	Additional mitigation measures, e.g. bubble curtains, shall be required for pile driving, if the underwater noise auditory thresholds for fish are exceeded.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
DFO 2.3.1 DFO 2.2.3.1 DFO 2.2.3.2 MC07.	Marine Mammal Observers (MMOs) will be employed to monitor the presence of marine mammals in defined marine mammal exclusion zones around construction activities that have the potential to exceed the underwater noise auditory threshold for marine mammals of 160 dB re 1µPa. The exclusion zone will be initially set at 500 m, with in-situ underwater noise monitoring to be conducted at the onset of the construction activity to verify the exclusion zone based on the underwater noise auditory threshold. The construction activity will be suspended if a marine mammal enters the exclusion zone and will not restart until 30 minutes after it is was last observed or it is seen leaving the exclusion zone.					
MC08.	An MMO will be present during dredging, dredge disposal and in-water placement of fill material to monitor for presence of marine mammals. The MMO will monitor for stress related behaviours to marine mammals. If observed, adaptive management will be implemented or, if necessary, stop work will be implemented until effective mitigation measures are in place.					
DFO 2.3.4 MC09.	If construction is to occur during the iced-season, in-air sound levels will be measured when pinnipeds are observed on the ice during construction activities that have the potential to exceed the in-air acoustic threshold. In the absence of Canadian guidelines, the United States in-air acoustic threshold for non-harbour seal pinnipeds of 100 dB re20µPa rms will be adopted. The construction activity will be suspended if the seals are exposed to noise levels above the threshold.					
MC10.	Pile driving shall be conducted within the hours agreed with the City and in adherence to the City's noise by-law (#599).					
MC11.	Mechanical dredging will be the preferred method, which results in lower levels of turbidity and underwater noise compared to hydraulic methods.					
MC12.	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 by the MMO. Work must not re-start until the marine mammal has moved out of the exclusion zone.					
DFO 2.2.4	Project-related vessels shall be operated as outlined in the Iqaluit application					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
MC13.	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 CA/EI and DFO.					
MC14.	Rapid acceleration of vessels shall be avoided.					
MC15.	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.					
MC16.	The area of sea that is artificially illuminated shall be minimized.					
MC17.	Water-based equipment or machinery shall be located and secured in such a way as to prevent grounding in identified sensitive habitats.					
DFO 2.1.1	Rock or fill material used for in-water construction shall be free of fines					
MC18.	Rock material used for in-water construction, will be free of material that would result in exceedances of the water quality guidelines outside the work area.					
MC19.	No anchoring or spudding of barges will be allowed where moderate to abundant seaweed occurs outside of the DSP footprint.					
DFO 2.3.2 NIRB 23	If dead fish or marine mammals are observed, work shall be suspended as outline in the Iqaluit Application and DFO shall be notified within 48 hours. No work shall recommence until approved by DFO					
NIRB 23	An EM will be present during all in-water construction activities to monitor for stress related behaviours or for fish kills. If observed, adaptive management will be implemented or, if necessary, stop work will be implemented until effective mitigation measures are in place.					
MC21.	All lubricants and hydraulic fluids used on equipment that will be working below the high water level will be biodegradable and non-toxic.					
MC22.	All Project marine construction vessels and equipment shall be clean and free of marine fouling to avoid the introduction of invasive species.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
MC23.	Vessel operators will be appropriately trained and qualified and familiar with the operational area.					
MC24.	The equipment used will be in proper working order and will be maintained in such a way so as to adequately prevent leaks and spills					
MC25.	Dredging operators will be properly trained and will operate equipment based on best industry practise, which will include utilising techniques that will minimise the re-suspension of sediment in the water column.					
MC26.	If mechanical dredge methods are used, operators will ensure that the bucket is fully emptied into the barge before swinging the bucket back over the water.					
MC27.	Dredging and loading time will be minimized to the extent possible, and appropriate techniques will be utilized to keep sediment within the immediate work area.					
MC28.	Every reasonable effort will be made to minimise any overflow or spillage from the barges.					
MC29.	Direct or indirect releases of water containing elevated suspended solids or elevated turbidity will be minimized or managed.					
MC30.	Barges destined for the disposal site will only transit under suitable conditions to minimise risk of spillage enroute.					
MC31.	The most direct navigation route from the load site to the disposal site will be taken.					
MC32.	All disposal activity must occur within the specified disposal site boundaries.					
MC33.	Disposal time will be minimized to the extent possible.					
MC34.	If required, access along the beach between the Sealift Beach and municipal breakwater at the SCH will be marked so that the area used by heavy equipment is restricted to that required for safe operations. A maximum width of 7 m in the high intertidal will be used.					
DFO 2.2.1 MC35 for SCH	Heavy equipment shall access the intertidal areas during construction only when intertidal area is dry					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
MC36.	All excavation of material at the SCH will be conducted by land based equipment at low tide (out of water).					
Wildlife Measures						
NIRB 14 INAC 36 INAC 39 WL01.	A zero-tolerance policy regarding the harassment, disturbance, enticing and feeding of wildlife, whilst working on the Project, shall be implemented and communicated through the induction process.					
NIRB 15	All project personnel are made aware of the measures to protect wildlife and are provided with training and/or advice on how to implement these measures.					
WL02.	The EM shall be on site as required to assess the presence of wildlife (including Species at Risk) and determine potential impacts to construction activities.					
WL03.	All workers shall be trained in relation to the wildlife and birds (particularly species at risk) expected to occur in the area, including traditional knowledge, through site induction and tool box sessions. http://www.sararegistry.gc.ca/virtual_sara/files/policies/EA%20Best%20Practices%202004.p					
WL04.	Polar bear sightings shall be reported immediately to the EM and CA/EI so that appropriate actions are taken. (report to Conservation officer of Iqualuit 867-924-6235)					
WL05.	Sightings of wildlife species, with particular attention to species at risk, shall be recorded on a wildlife sighting form (including recording the time, date, location, activity, and proximity to workers).					
WL06.	Wildlife sightings shall be tracked in order to respond appropriately to emerging trends.					
WL07.	Food, food waste, and other attractants shall be handled, stored and disposed of safely to avoid attracting and habituating wildlife and birds.					
WL08.	Speed limits will 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.					
WL09.	Appropriate mitigation measures will be implemented in the event large congregations of wildlife and birds occur during construction.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
WL10.	A pre-construction wildlife sweep shall be conducted by the EM to identify all sensitive wildlife features, e.g. active bird nests, wildlife dens and wildlife foraging or traveling. In the event a sensitive species or feature is identified, buffers or exclusion zones shall be implemented to ensure wildlife are not disturbed. Entry buffers shall be based upon government or biologist recommended setback distances.					
INAC "52"	No activity conducted between may 15 and july 15 within the Caribou protection areas annexed to this Land Use Permit, except with the approval of the Land use Inspector based on the arrival and departure of caribou cows.				X	
INAC "53a"	In the event caribou cows calve outside of the Caribou Protection Areas, suspend operations within the area occupied by the cows and calves between May 15 and July 15.					
INAC "53b"	In the event caribou cows and calves are present, suspend blasting, overflights less than 300 m in altitude, use of snowmobiles and ATVs outside the immediate vicinity of the camp					
INAC "54"	During caribou migration, no operation shall be located or cause substantial diversion to migration and cease activities that may interfere with migration such as airborne geophysics surveys or movement of equipment, until the caribou have passed.					
INAC 34	No unnecessary damage to wildlife habitat in conducting this land use operation.					
WL11.	Work site boundaries shall be flagged to prevent inadvertent loss or alteration of habitat outside of the designated Project footprint.					
WL12.	Lighting shall be limited to the extent required to provide a safe work site and shielded and directed to reduce diffusion outside of the work area.					
NIRB 13	The proponent should ensure that there is no damage to wildlife habitat in conducting this operation					
NIRB 5 WL13. INAC 40	Water shall not be extracted from any fish-bearing waterbody unless the water intake hose is equipped with a screen of appropriate mesh size to ensure that there is no entrapment of fish.					
INAC 35	No obstruction of the movement of fish while conduction the land use operation.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
Bird Measures						
NIRB 16 INAC 37 BR01.	Activities and infrastructure will be sited away from nests and roosts that will be protected by prohibited entry buffers based upon government or biologist recommended setback distances. Any nest that is disturbed will result in immediate notification to ECCC and the GN.					
BR02.	Construction activities will not begin until the area has been surveyed for migratory birds and nests (in a non-intrusive manner).					
BR03.	Nest monitoring may be periodically required to determine efficacy of setbacks and buffers.					
NIRB 17	Minimize activities during periods when birds are particularly sensitive to disturbance such as migration, nesting and moulting.					
Vegetation Measures						
VG01.	Vehicle and equipment mobilized to site shall be inspected to ensure they are clean and free of soil, invasive plants and/or their seeds.					
VG02.	All personnel shall be trained through the induction and subsequent toolbox talk session on the risk of damaging or disturbing vegetation and sensitive communities.					
VG03. NIRB 6 WL14.	Monitoring of disturbed areas for potential weed infestations shall occur on a regular basis.					
Cultural, Heritage and Archaeological Measures						
CH01.	If historical or palaeontological features (e.g. stone features, stone tools, modified bone, fossils) not previously recorded are identified within the construction footprint during construction, the measures outlined in the Archaeological Resource Discovery Protocol shall be implemented.					
CH02.	All workers shall be briefed regarding the potential negative effects of construction activities to archaeological and palaeontological resources and shall be familiar with the Archaeological Resource Discovery Protocol.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
CH03.	If potential human remains are found within the footprint during construction, the measures outlined in the Archaeological Resource Discovery Protocol shall be implemented.					
CH04.	Project personnel shall be prohibited from collecting any archaeological or palaeontological materials.					
CH05.	All stone features identified will be photographed and mapped in detail and then excavated through staged dismantling. If vegetation cover or soil is present, 1 by 1 m test units will be placed inside the features and shovel testing will be undertaken outside of the features. Depending on the results of the subsurface excavations additional excavations units will be undertaken.					
CH06.	Artifact scatters will be mapped, all of the artifacts will be collected and a sample of the site will be subject to controlled excavation. A surface inspection for artifacts will occur at all sites and all artifacts that are threatened by the Project will be collected, cleaned and catalogued. Any collected artifacts that are assessed as being unstable will be discussed with our conservator prior to be being transported for conservation.					
CI01.	A dedicated emergency responder shall be provided for the Project and an emergency medi-vac plan will be in place for the construction workforce.					
CI02.	Contractor employees shall be required to sign a Code of Conduct governing behaviour on the work site and during recreational hours to reduce the likelihood of negative social effects on the community.					
CI03.	Contractor shall implement a cultural awareness program for all staff to promote understanding and respect for local residents.					
CI04.	A zero tolerance policy for illicit drug possession or use shall be imposed.					
CI05.	A fire response plan to reduce impacts to local fire services will be prepared. Project staff shall be trained in the use of fire suppression aids.					
CI06.	A dedicated fuel truck shall be used to meet Project fuel requirements, if fuel supplies in the City are insufficient.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
CI07.	Ongoing communication and consultation will inform hunters, fishers, cruise ship operators and outfitters during construction to minimize access restrictions and maintain safety.					
CI08.	If scheduled flights have insufficient capacity to transport work crews and equipment private charter flights, shall be used as necessary, to ensure seats are not taken that the community depends on.					
Spill Prevention and Response Measures						
SP01. NIRB 12	All workers shall be trained in the spill prevention and response requirements during site induction and subsequent toolbox talk sessions.					
SP02.	Spill kits shall be readily available, and will be appropriate to the type and amount of hazardous and waste materials anticipated for the Project. Standard spill kits typically contain absorbent booms, socks, pads, waste bags and ties, and PPE such as gloves and goggles. Further details on the contents of the spill kits will be provided by the successful Contractor.					
NIRB 10 INAC 15 (+drill sites)	Ensure that appropriate spill response equipment and clean-up materials (e.g., shovels, pumps, barrels, drip pans, and absorbents) are readily available during any transfer of fuel or hazardous substances, at all drill sites, fuel storage sites, and at all refuelling stations.					
NIRB 12 SP03. INAC 31 (NT-NU spill report form)	Spills shall be reported according to the Spill Contingency Planning and Reporting Regulations (R-068-93) and magnitudes of the events. (24-Hour Spill Report Line by calling 1-867-920-8130). Reporting requirements for spill magnitudes of individual contaminants are provided in Schedule B of the Regulations (R-068-93). Report all spills in accordance with instructions contained in the NT-NU spill report.					
SP04.	Hydraulic, fuel, and lubrication systems of equipment near watercourses and sensitive habitats shall be inspected periodically to ensure that the systems are in good condition and free of leaks.					
SP05.	Appropriately sized drip trays for stationary equipment shall be used. Use secondary containments and drip trays in a manner which does not lead to the collection of rainwater and/or snow.					

Element to verify		Respect of requirement				Comment
		C	NC	OI	NA	
SP06.	Routine inspections of equipment for leaks, cracked hoses and other conditions that may result in spills shall be undertaken. The Contractor shall ensure external equipment surfaces are free of oil, diesel and other potential contaminants prior to use.					
SP07.	Hoses and nozzles used for dispensing fuel shall be maintained in good repair, free of leaks, and equipped with automatic shut-offs.					
SP08.	Any delivery hose that has the potential to cause a spill, if it were pulled away from the delivery pump, shall be fitted with a breakaway valve.					
SP09.	Operators shall always stay with the nozzle while refuelling.					
SP10.	Maintenance and operating procedures shall be established and posted to prevent spills.					
SP11.	The Contractor shall drain the existing fuel line (leading to Innuit Head) prior to undertaking blasting works for the laydown area due to the proximity of the fuel line.					
SP12.	Construction vessels must comply with the requirements for shipboard oil pollution emergency plan and arrangements with a certified response organization defined under the Canada Shipping Act, 2001. The requirements are dependent on the size of the vessel.					
Community issues						
NIRB 29	Engage with local residents regarding planned activities in the area and should solicit available Inuit Qaujimaningit and information regarding current recreational and traditional usage of the project area which may inform project activities. Posting of translated public notices and direct engagement with potentially interested groups and individuals prior to undertaking project activities is strongly encouraged					
NIRB 30	Ensure that project activities do not interfere with Inuit wildlife harvesting or traditional land use activities.					
NIRB 31	To the extent possible, hire local people and access local services where possible.					
NIRB 32	Ensure that access to work areas is controlled and restricted to construction personnel. This should include the posting of signs noting hazards during construction activities.					

Appendix 7: Weekly checklist

WEEKLY ENVIRONMENTAL SURVEILLANCE CHECKLIST

Environmental monitor's name	Name of others present	Inspection period (yyyy-mm-dd) to

Location	Nature of work

ENVIRONMENTAL SURVEILLANCE OF WORKSITE

Element to verify	Respect of				Non compliance and opportunity for improvement	
	C	NC	OI	NA	Description	Reference #
1. Cleanliness						
a) Work site and facilities are clean						
2. Environmental management and follow up						
a) Workers have received induction and MMO's have received specific training						
b) Permits & Authorizations (works, discharges, approved method)						
c) Site rehabilitation (compliant, completed and approved)						
d) Issues raised by stakeholders (community, authorities)						
3. Air quality						
a) Dust (control and mitigation measures)						
4. Acoustics						
a) Works carried out in compliance with noise by-laws						
b) Machinery noise (mufflers)						
c) Underwater sound readings carried out for both piling and vibrating						
d) Overpressure readings for blasting and piling						
5. Water management						
a) Domestic wastewater (toilets, level, transport, elimination)						
b) Surface water (turbidity, monitoring, control measures, discharge, snow, culverts)						
c) Industrial wastewater (concrete washout, cleaning stations, curing water)						
d) Drainage and erosion (stabilization, berms, barriers, curtains, basins, drains)						
6. Waste management						
a) Seperation (wood, cardboard/paper, metal, domestic waste)						
b) Handling and storage (identification, location, container, protection)						
c) Disposal (approved facility)						

WEEKLY ENVIRONMENTAL SURVEILLANCE CHECKLIST

7. Hazardous materials and hazardous waste						
a) Storage (location, protection against weather, identification)						
b) Classification and segregation (flammable, gas, compatibility)						
c) Containment (capacity, basin, double wall, condition, watertight)						
d) Storage conditions (identification, container, grounding, cleanliness)						
e) Disposal (approved facility, proof of disposal)						
8. Vehicles and machinery						
a) Fuelling (method, tank, location, mitigation)						
b) Stationary equipment (secondary containment, general condition, leaks)						
c) Mobile equipment (general condition, maintenance, leaks)						
d) Maintenance (method, approved location, watertight surface)						
e) Cleaning and washing (method, approved location, residual water)						
f) Biodegradable and non toxic hydraulic oil (below HWL)						
g) Circulation of heavy machinery under the HWL only in "dry" conditions						
9. Protection of wildlife						
a) Wildlife protection on land (declaration, respect, buffer zones)						
b) Fish (no dead or injured fish observed during construction)						
c) Marine mammals (presence of trained MMO, presence of visual markers, recordings, stop work, DFO informed if incident)						
10. Excavation and management of contaminated material						
a) Contminated soil/sediment (authorization, testing, storage, elimination)						
b) Clean soils and sediments (disposal as per authorization)						
11. Management of accidental spills						
a) Spill kits (availability, contents, critical sites)						
b) Contamination (declaration, intervention, elimination, prevention)						
c) Emergency Preparedness Plan (emergency numbers, awareness)						
12. Traffic management						
a) Marine signage (buoys, lights, location)						
b) Signage on land (site perimeter, traffic)						
c) Traffic management (communication plan authorized and applied)						

C : Compliant *NC : Non compliant* *OI : Opportunity for improvement* *NA : Not applicable*

WEEKLY ENVIRONMENTAL SURVEILLANCE CHECKLIST

COMMENTS

OBSERVATIONS AND PICTURES	
1.	**2.**
3.	**4.**

Form drafted by: Isabelle Bertrand
Verified by: David Lauzon
Approved by: Olivier Bédard-Richard

5.	**6.**
7.	**8.**
9.	**10.**

WEEKLY ENVIRONMENTAL SURVEILLANCE CHECKLIST

Checklist completed by : _____ **Date :** _____

Appendix 8: Weekly report template

Iqaluit Marine
Infrastructure Project

ENVIRONMENTAL WEEKLY REPORT

Week XX : Month day to Month day, 2019

Tower Arctic LTD.

Contract Number: 15235-00290-07

Project Number: 15235-00290

Tower Arctic Number: 15235-00290-TA-Environmental Report 10-11-18

Submitted From: Tower Arctic LTD

Submitted To: Government of Nunavut
Advisian

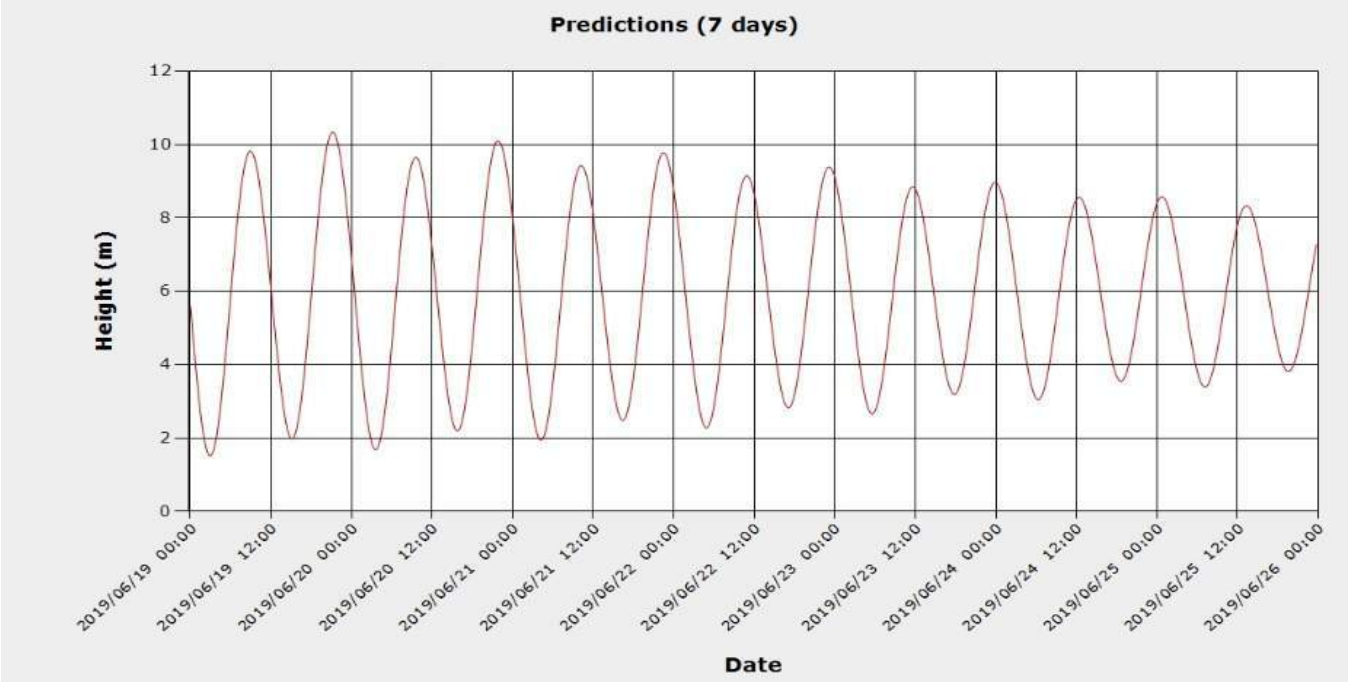
Date Submitted: Month day, 2019

Prepared by : EM on duty in the week

1. Environmental Conditions

1.1 Tides

Tide height at Iqaluit Station for week XX ranged from XX m to XX m, with low tides occurring around XX am/pm on MM/DD and XX am/pm on MM/DD.



1.2 Weather

Average temperature ranged from XX°C to XX°C for the week. As for precipitations, XX mm of rain/snow fell on MM/DD. Wind gusts exceeding XX km/h occurred on MM/DD and on MM/DD.

2. Summary of construction activities

Table 2 -1: Summary of construction activities during week XX

Activity	Location	Schedule	Description/ technique	Equipment	Outcome	Photo reference	Comment
Rock drilling							
Rock blasting							
Stockpiling							
Rock crushing							
In water infill							
Out of water infill							
Dredging							
Disposal at sea							
Pile driving							
Other (ex. temp barge)							

3. Environmental Monitoring

3.1 General

- Context
- Main issues or events that do not belong in other sections in point form

3.2 Environmental inspections

- Person responsible for inspections
- Areas inspected with date or frequency during the week
- If specific topics monitored, date and brief description
- Refer to checklist used and join in appendix

3.3 Shipment of dangerous goods

Table 3 -1: Dangerous goods received at site

Item	Quantity

3.4 Equipment

Table 3 -2: List of machinery inspected during week XX (If inspections took place)

Equipment/Vehicule	ID	Inspected by

3.5 Turbidity monitoring

3.5.1 Visual monitoring

Visual turbidity monitoring is being conducted for the following construction activities:

- Dredging
- Disposal at Sea
- Infill (in and out of water)

The compliance location for each of these activities is provided in Table 6-1 of the MMP.

A record of visual monitoring for week XX is provided in Appendix x .

Table 3 -3: Summary of turbidity observed for each activity

Activity	General observations
Dredging	A summary of whether turbidity was observed for dredging (period, average and max range, average duration)
Disposal at sea	A summary of whether turbidity was observed for disposal at sea. (period, average and max range, average duration)
In-water infill	A summary of whether turbidity was observed for infill. (period, average and max range, average duration)
Out of water infill	A summary of whether turbidity was observed for infill. In this case it would only be a brief statement of whether there is additional turbidity at the tidal exchange

List main observations not associated with activities listed in table 3-3.

3.5.2 Water sampling

Sampling occurred on DD/MM for XX activity associated with XX facility based on visual monitoring. Samples were taken by NAME.

A record of water sampling for week XX is provided in Appendix x.

Additional comments such as bad conditions preventing sampling or other

3.6 Blasting monitoring

3.6.1 Visual monitoring

Rock projections for the blasts remained within the boundaries of the worksite. No dead or injured fish were observed.

3.6.1 Measured

Table 3 -6: Summary of blast during week XX

Date	Max Charge (kg)/Delay	Blast Time	Water distance (m)	Near water (Y/N)

XX overpressure measurements were taken. The hydrophone was placed XX m from the blast site (XX m from the shoreline). Overpressure results were XX or ranged between XX and XX. Details for overpressure monitoring results are described in the blast overpressure log available in appendix XX.

3.7 Marine Mammal Observer

Marine mammal monitoring is being conducted for the following construction activities:

- Dredging
- Disposal at Sea
- Infill (in and out of water)
- Blasting
- Piling

The exclusion zones for each of these activities are provided in Table 6-2 of the MMP. General observations are summarized in table 3-7.

Description of:

Incursions in the exclusion zone and interruption of work
Incidents/injuries
Reports to DFO

Table 3 -6: MMOs on-duty for week XX

Dredging	DAS	Infill	Blasting	Pile Driving
Name				

Table 3-7: Summary of tmarine mammals observed for each activity

Activity	General observation	Incidents/Stop work
Dredging	A summary of whether mammals were observed (species, distance, number)	Date, description
DAS		
Infill		
Blasting		
Piling		

Observations were recorded in daily reports and compiled in the associated database. The database is available in appendix XX .

3.8 Acoustic Monitoring

To be adjusted once the relevant MMP has been commented and is complete

Should include:

- Monitoring activities carried out (ambient and during piling) with dates
- Main results for SPL_{RMS}
- Set exclusion zone
- Monitoring for overpressure due to piling carried out with dates
- Main results in kPa
- Subsequent weekly verification
- Reference to acoustic monitoring log
- Reference to overpressure log

3.9 Environmental Incidents

No in-water spills reported during week XX. Spills are summarized in table 3-8 below. The product spilled was recovered and XX m^3 of contaminated soils were excavated. Soils and hazardous waste were temporarily stored in closed containers on the laydown area.

Table 3 -8: Incidents during week XX

Date	Location	Quantity/ Product	Environment affected	Incident report

On DD/MM, XX m^3 of contaminated soils and XX m^3 of hazardous waste was disposed of by XX, which specializes in the disposal of hazardous waste. (only when soils and hazardous waste disposed of)

4. Communication

4.1 Training

XX new employees, including XX MMOs, mechanics and operators started working for TA during week XX.

Table 4 -1: Training during week XX

Type of training	Number	Given by

4.2 Internal communication

Brief summary of:

- Kick off meetings (either with GN or internally with subcontractors if carried out)
- Committee meetings (minutes available on request)
- Official meetings with GN
- Meeting with management that needs to be discussed

4.2 Community meeting

- Meetings with the community with date and who presented/rough number of people who participated and representatives from GN or other organizations if information available

- Meetings with the hunting groups with date and who presented/roughly number of people who participated

Minutes of the meeting or a summary of topics discussed and issues raised are presented in appendix XX.

4.3 Advertissements

Blasting	Blasting notices are posted on the Iqaluit Public Services Announcement community Facebook page the day before blasting is scheduled to occur. Notices are also posted in the following locations: •Xx
General construction	General construction signs are posted on the road access to the causeway to continually alert community residents to the ongoing construction occurring for the causeway and DSP.
Marine construction	Only include this when it first occurs or if something changes. Navigational Warnings (NAVWARNs) have been posted since xx, specific for the marine based construction activity (dredging, disposal at sea).
Community access	Summary on whether or not there will be any community access issues for the construction week. If yes, there would also be a note in the Communication section for how this was communicated
Resident feedback and concerns	A few sentences to track issues by residents, should there be a conversation between TA staff and residents that CGS needs to be aware of and may have to handle or deal with, or may affect scope of work.

5. Construction activities for next week

Table 5 -1: Planned construction activities for next week

Activities	Associated monitoring

EM on site for next week : EM name