



HARRINGTON HARBOUR ISLAND – LOWER NORTH SHORE

**GEOTECHNICAL STUDY - SEDIMENT CHARACTERIZATION - BIOLOGICAL
CHARACTERIZATION**

SPECIFICATIONS

DESCRIPTION OF REQUIRED SERVICES

1. STUDY CONTEXT

The Department intends to build a new fishing harbour on the Harrington Harbour island. For now, this project is in the preliminary stage. The results of the geotechnical investigation and the characterization study will be reviewed to clarify some of the project's technical issues. A biological characterization is required in order to obtain a description of the marine habitat, fauna and flora found in the study area.

The work would consist in placing pontoons on the shoreline or attaching them to the Transport Canada wharf. The need to have a breakwater on the shoreline will also be studied. Two Harrington Harbour island bays are under review for this mandate: du Village Bay and Len's Cove.

The marine soil in place likely consists of a layer of variable gravel, sand and silt on a high-quality rock. Two previous geotechnical investigations shed some interesting light on the seafloor near the island (see excerpt in Appendix 3).

2. MANDATE

2.1. Drilling and geotechnical investigation

The mandate consists in conducting a geotechnical investigation based on drilling on Harrington Harbour island (see figures 1 and 2 and the photos in Appendix 2). This drilling will require 26 holes to be made near the Transport Canada wharf in du Village Bay (site A) and in the Len's Cove bay (site B) on water or on the foreshore at low tide, all at the discretion of the firm depending on tidal conditions and the work method that the firm intends to use. The work method chosen shall comply with the regulations in force.

The drilling to be carried out is numbered from F-A1 to F-A15 and from F-B1 to F-B11 (see figures 1 and 2). This drilling shall be conducted in accordance with the priority order set by the Department. The numbered order for the drilling corresponds to the priority order on each site (1, 2, 3, etc.). After monitoring the actual geological conditions on the site and talking to the Departmental Representative, the program may have to be adopted as drilling goes along. Deviation from this order shall be by prior agreement with the Departmental Representative.

The mandate requires drilling and geotechnical laboratory testing as well as standard dynamic penetration testing.

Tables 1 and 2 provide a brief description of the drilling to conduct. Most of the drilling shall be done on overburden and on rock.

Table 1. Expected drilling thickness in du Village Bay

Drilling	Current bathymetry	Maximum lower drilling limit	Maximum theoretical thickness to drill	Expected thickness of overburden to be drilled ¹	Expected thickness of rock to be drilled
F-A1	0.00	-3.00	3.00	0.00	3.00
F-A2	-0.90	-3.00	2.10	0.50	1.60
F-A3	-1.50	-3.00	1.50	1.50	0.00
F-A4	-1.90	-6.00	4.10	3.00	1.10
F-A5	-0.70	-3.00	2.30	0.50	1.80
F-A6	-1.50	-3.00	1.50	1.50	0.00
F-A7*	-2.20	-10.00	7.80	3.50	1.50
F-A8%	0.00 ^{&}	-6.00	6.00	1.00	1.50
F-A9%	0.00 ^{&}	-6.00	6.00	1.00	1.50
F-A10*	-0.50 ^{&}	-10.00	9.50	1.50	1.50
F-A11	0.00 ^{&}	-3.00	3.00	0.50	2.50
F-A12	0.00 ^{&}	-3.00	3.00	0.50	2.50
F-A13*	-1.90	-10.00	8.10	3.50	1.50
F-A14*	-4.30	-10.00	5.70	3.50	1.50
F-A15*	-4.50	-10.00	5.50	3.50	1.50

TOTAL:				25.50	23.00
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Table 1 notes

¹ Sediment thickness was approximated based on the geotechnical investigation in Appendix 3 – contractor #1 – 1997.

[&] This bathymetry was approximately estimated from that of 2009 indicated in the plans.

[%] Drilling up to 1.5 m in the rock, or stop at an elevation of -6.0 m if no contact is made with the rock.

^{*} Drilling up to 1.5 m in the rock, or stop at an elevation of -10.0 m if no contact is made with the rock.

Here is a brief description of the drilling to be carried out:

1. In drilling locations F-A1, F-A2, F-A3, F-A5, F-A6, F-A11 and F-A12, drilling shall go up to the -3.0 m elevation below chart datum, regardless of whether it occurs on the overburden or the rock in place.
2. F-A4 drilling shall reach the -6.0 m depth, regardless of whether it occurs on the overburden or the rock in place.
3. For all other drilling on sites A and B, it shall cross all overburden encountered up to the lower elevation indicated for each (-6 m, -10 m or -16 m); however, if contact is made with the rock before the lower elevation required, a depth of only 1.5 m shall be drilled in the rock and the overburden.

According to the available information from the geotechnical investigations conducted by two contractors in 1997 and 2015, here are the expected depths for drilling in the overburden and the rock. The geotechnical investigation shall shed light on the geotechnical characteristics of all layers of soil encountered, including the rock. Section 5.2 gives detailed information on the samples to be taken, the tests and analyses to conduct, and the expert opinions to state, especially on excavating and dynamiting the rock.

The various elevations of the overburden and the rock shall be represented in graphs presenting the S-A and S-B segments (see figures 1 and 2, nine (9) segments in all). These graphs will enable better viewing of the dips in the rock and the changes in the depths of the various seafloor layers.

Table 2. Expected drilling thicknesses at Len's Cove

Drilling	Current bathymetry	Maximum lower drilling limit	Maximum theoretical thickness to drill	Expected thickness of overburden to be drilled ²	Expected thickness of rock to be drilled
F-B1%	-0.50	-6.00	5.50	2.00	1.50
F-B2%	-1.00	-6.00	5.00	2.00	1.50
F-B3*	-1.00	-10.00	9.00	4.50	1.50
F-B4*	-5.00	-10.00	5.00	4.50	1.50
F-B5%	-2.00	-6.00	4.00	1.00	1.50
F-B6%	-3.70	-6.00	2.30	1.00	1.50
F-B7*	-5.80	-10.00	4.20	4.20	0.00
F-B8%	-1.50	-6.00	4.50	2.50	1.50
F-B9&	-3.50	-6.00	2.50	2.50	1.50
F-B10\$	-10.00	-16.00	6.00	6.00	0.00
F-B11\$	-10.00	-16.00	6.00	6.00	0.00
TOTAL:				36.20	11.80

Table 2 notes

² Sediment thickness was approximated based on the geotechnical investigation in Appendix 3 – contractor #2 – 2015 conducted in Big Cove.

% Drilling up to 1.5 m in the rock, or stop at an elevation of -6.0 m if no contact is made with the rock.

* Drilling up to 1.5 m in the rock, or stop at an elevation of -10.0 m if no contact is made with the rock.

\$ Drilling up to 1.5 m in the rock, or stop at an elevation of -16.0 m if no contact is made with the rock.

2.2. Sampling and analyses for environmental purposes

The mandate includes sediment sampling to characterize the area to be dredged to conduct better environmental management of the work and to assess the project's environmental impacts. A total of seventeen (17) sediment samples at most shall be taken from among the drilling identified for physico-chemical analysis in the laboratory. The objective is to determine whether the sediment to be dredged is contaminated and if so, the extent to which it is possible to dispose of it on land or at sea.

For the drilling identified in Table 3, a sample representative of the layer of unstable materials up to the -3.0 m elevation shall be taken for analysis. If no contact is made with unstable materials in drilling X, no samples shall be considered. The lower limit of the dredging is estimated at around -3.0 m; the sediment below this limit will not be dredged and as a result, no sampling under this elevation is required.

Drilling shall take into account the specific conditions in this location such as tides, winds, waves, currents, structural condition, environment, and existing normal operations on the site.

Samples for environmental purposes shall be taken from the following drilling in accordance with the following predefined layers:

Table 3. Sampling for environmental purposes*

Sampling station	Sample name	Current bathymetry	Expected thickness of the overburden to be sampled up to -3.0 m
F-A1	SED-A1	0.00	0.00
F-A2	SED-A2	-0.90	0.50
F-A3	SED-A3	-1.50	1.50
F-A4	SED-A4	-1.90	1.10
F-A5	SED-A5	-0.70	0.50
F-A6	SED-A6	-1.50	1.50
F-A7	SED-A7	-2.20	0.80
F-A8	SED-A8	0.00	1.00
F-A9	SED-A9	0.00	1.00
F-A10	SED-A10	-0.50	1.50
F-A11	SED-A11	0.00	0.50
F-A12	SED-A12	0.00	0.50
F-A13	SED-A13	-1.90	1.10
F-B1	SED-B1	-0.50	2.00
F-B2	SED-B2	-1.00	2.00
F-B3	SED-B3	-1.00	2.00
F-B5	SED-B5	-2.00	1.00
Total: 17 samples maximum			

* Excluding duplicates.

2.3. Biological Characterization

The mandate consists in conducting a biological characterization in order to obtain a description of the marine habitat, fauna and flora found in the study area.

A characterization of the epibenthic flora and fauna in the two sites identified in the Harrington Harbour area (Len's Cove and du Village Bay) shall be conducted by taking underwater videos along transects established beforehand by Fisheries and Oceans Canada – Small Craft Harbours (DFO-SCH).

For each site (Len's Cove and du Village Bay), the specific objectives of the mandate are as follows:

- assess the biological quality of the marine environment through video recording;
- identify the species observed and assess their diversity and relative abundance;
- identify habitat type and quality.

The study plan (see Appendix 4) proposes analyzing nine transects to provide an overview of the epibenthic habitat, flora and fauna found in the study area. For the Len's Cove site, five transects shall be created. For the du Village Bay site, four transects shall be created.

For transects T1 to T9:

- Describe the nature of the substrate.
- Identify the plant species present.
- Establish the plant species recovery percentage.
- Identify benthic and fish species.

2.3.1 Substrate

Sediment type is generally considered a key factor for benthic communities because these organisms live in close relationship with the seafloor. Habitat types in the study area shall be determined based on the sediment present.

- Soft substrate habitat: made up mostly of sand.
- Hard substrate habitat: includes the presence of pebbles and blocks.
- Mixed substrate habitat: habitat type between the two others previously described. Characterized by ever-present sand and gravel as well as pebbles.

2.3.2 Flora

For each transect:

- Note the presence of flora (brown, red and green algae; kelp, eelgrass, etc.). Ideally, identify the flora by species or genus.
- Present the recovery percentage.

2.3.3 Fauna

For each transect, the benthic and fish species must be identified. The organisms shall be listed in terms of occurrence (presence or absence) and whenever possible, indicate an abundance. The organisms observed are identified to the lowest identifiable taxon.

2.3.4 Habitat

A qualitative description of the habitat and the fauna (diversity and abundance) must be presented. Beds and other areas of interest shall be demarcated with the aid of a satellite geopositioning system and represented on a map.

The presence of traces of bioturbation, small shellfish or another endofauna, dead shells, crevices (shelters for organisms) and any other signs that enable a qualitative habitat assessment to be conducted shall be noted.

2.3.5 Taking underwater video images

The following methods shall be used for taking underwater video images:

- Take underwater images along the transects.
- Each transect shall be marked with buoys (hand line or other).

- For each transect, the diver has to swim at a constant speed.
- When there are species near the transect, the diver shall stop to take a close-up to add this information to the characterization.
- The video abstracts shall be analyzed by biologists with experience in identifying benthic fauna.
- Data collected in the field shall be complemented by viewing the videos.

2.3.6 Deliverables – Biological Characterization

A full preliminary report (electronic version) shall be submitted to the DFO project manager.

A full final report shall be provided to DFO in electronic format 10 days after comments are received on the preliminary version. The full final report (PDF, including appendices) and all files in their original format (Word, Excel for tables, jpeg for photos and Autocad for drawings) shall be on electronic media. Underwater videos taken shall be on electronic media and in duplicate.

The report shall include, but not be limited to, the following:

- A brief context and the study objectives
- Description of field work and the methodology used
- Description of the receiving environment and its biophysical components that were observed during the dive
- The report shall be prepared in a qualitative description perspective
- Presentation of results separated by site (Len's Cove and du Village Bay)
- Presentation of photographs
- Provide the videos taken along the transects on electronic media
- Location of the transects (latitude and longitude), weather conditions, wind speed and direction, sea conditions, waves, visibility in water, water depth at each transect
- Presentation of the list of wildlife observed (benthic and fish) and identified in each transect. The organisms observed are identified to the lowest identifiable taxon. Identify the species whenever possible. The organisms are presented in terms of occurrence (presence or absence) and whenever possible, in terms of abundance.
- Presentation of the list of flora (brown, red and green algae; kelp, eelgrass, etc.) observed and identified in each transect, as well as the recovery percentage. Identify to the lowest identifiable taxon and, whenever possible, identify by species or genus.
- Presentation of the type of substrate observed along each transect; state the proportion of soft, hard and mixed substrate habitats and provide a qualitative classification of the habitats found
- Presentation of the qualitative description of habitat and wildlife (diversity and abundance for each site (Len's Cove and du Village Bay))
- Also note the presence of traces of bioturbation, small shellfish or other endofauna, dead shells, crevices (shelters for organisms) and any other signs that enable a qualitative habitat assessment to be made
- Maps indicating the location of the site under review and the transects
- Maps with temporal reference points along the transects in order to facilitate viewing the videos
- Maps presenting the habitat type and identifying the substrate type (soft, hard or mixed)
- Maps presenting the flora observed along the transects and the recovery percentage
- Any other complementary observations made underwater (presence of shelly material, garbage, wood, etc.)

2.3.7 Materials and equipment

The consultant shall provide his or her own transportation without assistance from DFO and cover all related costs.

3. AVAILABLE INFORMATION

The 1997 and 2015 geotechnical investigations and a large quantity of photos shall be provided to the successful firm if it so chooses for clarification of the conditions in place. The wharf construction plans shall be provided to the firm at its request.

All information contained in these reports and drawings and provided to the consultants within the scope of this call for tenders or the project itself can be used only for the current project concerned.

4. SPECIFIC CONDITIONS

The work shall not interfere with normal activities taking place in the work area, mainly fishing vessel passage and mooring, mooring of and discharge from the transshipment vessel *Bella Desgagnés*, and fishing vessel refuelling. It is the firm's responsibility to ensure that planning this work does not interfere with fishers' and users' activities and that equipment passage is approved by the owners of the adjacent lands, if necessary.

The nearness of the village, the wharf, the bridge, the plant, and neighbouring houses shall not endanger their stability during activities that include rock drilling.

The drilling shall take into account the presence of several pipes installed on the seafloor near the TC wharf. About three of the pipes are outflows or water intakes. The pipes are installed by the LNS Community Seafood Cooperative plant every May and September. The exact location of the pipes shall be confirmed on site with the plant manager before drilling begins. If necessary, drilling shall be moved to take into account the presence of these pipes and to avoid damaging them.

If during the work it is noticed that an underwater structure not indicated in the drawings or an undetected pipe has been drilled into, drilling must stop immediately, the structures drilled into must be protected if necessary, and the Departmental Representative must be informed before drilling resumes on his or her orders.

Given the nature of the wharf (pile and infill) and the nature of the seafloor, ballast stones and boulders may be hit during drilling near the wharf or in both bays. It will therefore be possible to move the drilling within a limited radius near the initial drilling site. The successful firm is responsible for drilling and for ensuring that its equipment is in good condition despite the possible presence of stones.

5. TESTING

Generally, the testing and information required for each drilled hole are as follows:

5.1. On-site testing

Standard penetration tests and sampling every 1.52 metres and whenever the soil layer changes.

Vane shear testing every 1.52 metres and with every LC in the presence of clay soil.

5.2. Laboratory testing

Geotechnical

For each separate layer, use at least two different samples of the same soil layer to conduct the particle-size analysis (size-distribution curve) and determine the dry and submerged unit weight, shear strength, angle of internal friction, and allowable bearing capacity. The angle of internal friction, insofar as adequate sampling is possible, shall be determined through triaxial shear testing.

If clay is present, determine the cohesion, void ratio, Atterberg limits, water content, compressibility index, and coefficient of consolidation for each soil layer and any other information required for calculating subsidences due to a massive structure or a structure anchored to the rock, especially the (effective) long-term shear strength parameters ϕ and C .

Also provide an expert opinion on the clay's sensitivity to liquefaction if piles or sheet piles are driven into it.

In the basement rock, identify the rock and the angle and direction of the dip and determine its resistance to compression and traction on the representative core samples after discussions with the Departmental Representative. This testing shall be done in accordance with the most recent CAN/CSA standards. Determine the recovery and RQD for each rock core sampled. Identify the rock discontinuity (layering, fractures, joints, faults, alteration zone, etc.).

Indicate whether seafloor excavation with a steam shovel (or a Tramac with a shovel attached) is feasible. Also provide an opinion on the feasibility of dynamiting the rock, the necessary precautions taking into account not only the nearness of buildings, but also other environmental issues; the approximate loads required for excavation to the -3.5-m level, the duration of the excavation or dynamiting required, etc.

Provide a copy of the laboratory testing sheets for each test conducted. In the procedure for determining the various parameters required in this mandate, indicate whether it is a mean value or a representative value and what the standard deviation of the values calculated is.

5.3. Sampling

a) Clay

In the event that a drill makes contact with the material layers that contain at least a small amount of clay, sampling shall be done with a Shelby sampler 75 mm in diameter and a piston sampler. The goal is to take samples that are the most intact possible; the opinion of the person responsible for drilling shall prevail if the sampling quality has to be improved. In the drilling cost, the firm shall take into account the risk of certain Shelby samplers breaking down when sampling is conducted in mixed soils. In each soil layer with at least a small amount of clay, two to three samples taken with a Shelby sampler are required. Indicate the percentage and location of all material sampled.

b) *In all other cases (including in rock)*

Drilling shall be done at least with N calibre, especially with rock, where it is important to have accurate information available. The rock coring method shall be adapted to the conditions met with a view to maximizing the quality and representativeness of the cores collected. The Contractor shall take all the necessary steps to comply with this requirement. Indicate the percentage and location of all material sampled. Provide clarifications regarding the foliation dip in the rock and the discontinuities.

6. SEDIMENT SAMPLING AND CHARACTERIZATION

The consultant shall take soil and sediment samples. In all, 17 samples shall be taken (see Table 3).

6.1. Sediment sampling

The consultant shall take sediment samples up to a thickness of about 2.0 m.

The soil samples to be analyzed shall be taken in the previously identified drilled holes (see characterization plan).

The consultant shall also plan to take duplicate samples.

All samples shall be taken and saved in compliance with the Environment Canada *Sediment Sampling Guide for Dredging and Marine Engineering Projects* (volumes 1 and 2) and in accordance with the requirements in the *Criteria for the Assessment of Sediment Quality in Quebec and Application Frameworks: Prevention, Dredging and Remediation* (Environment Canada and MDDEP, 2007).

The consultant shall fully comply with the instrument cleaning method in order to avoid cross-contamination.

The actual sampling stations shall be positioned accurately (about 1 metre) with the aid of a GPS. To have control points for GPS coordinates, the coordinates of an exact position (fixed point) shall be taken and integrated into the report.

The consultant shall provide a description of each sample (particle size, odour, colour, presence of debris, organic matter or marine organisms, etc.). The consultant shall present photographs of harbour facilities at the time of the sampling, equipment used, and each sample in order to illustrate the sediments in place.

If changes to the sampling plan are required, the DFO project representative shall approve them before they are implemented.

6.2. Analyses

The physico-chemical analyses of the sediments sampled shall be conducted in accordance with the *Methods Manual for Sediment Characterization (1992)* by a laboratory accredited by the Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques (MDDELCC).

The laboratory shall conduct analyses for the following substances:

- PAHs, PCBs and TOC (appropriate tests for sediments);
- Petroleum hydrocarbons C₁₀–C₅₀;
- Metals: arsenic, cadmium, chromium, copper, mercury, nickel, lead, and zinc.

6.3. Sampling report

The sampling results shall be presented in a separate report, which must include, but not be limited to, the following:

- Field work description, methodology, sampling program, analytical program, positioning of samples taken (latitude and longitude), etc.;
- A brief description of the methods used for the analyses with references; identification of instruments/devices used with detection limits and main products used;
- Presentation of the list of samples in the form of a table (sampling station coordinates, water depth, sampling method, parameters analyzed, visual and olfactory description, marine organisms, observations, particle size, sampling volume, etc.);
- The samples taken shall be identified in the report in accordance with the nomenclature identified in Table 3.
- Photos of the samples and of the site when the sampling took place;
- Description of the samples when they were received at the laboratory (temperature, etc.);
- Presentation of the analysis results in the form of tables in comparison with (for sediments) the federal-provincial criteria, the federal criteria for disposal at sea, and the generic criteria (based on the *Criteria for the Assessment of Sediment Quality in Quebec and Application Frameworks: Prevention, Dredging and Remediation* document published by Environment Canada and MDDELCC in 2007 and the *Methods Manual for Sediment Characterization* published by Environment Canada's St. Lawrence Centre in 1992). The analysis results shall also be compared with the *Grille de gestion des sols contaminés excavés intérimaire [interim management grid for excavated contaminated soils]* in the MDDELCC's *Politique de protection des sols et de réhabilitation des terrains contaminés du MDDELCC [soil protection and contaminated grounds recovery policy]* (2002) in order to assess the possibility of managing sediments on land;
- Chemical analysis certificates and quality control in accordance with Environment Canada standards;
- The field identification (sample number) shall be indicated in all tables and on all analysis certificates, along with the laboratory number and, if applicable, the subcontractor's laboratory number;
- For reference material, the laboratory shall use matrices of the same nature as the material analyzed (soil and sediment);
- The laboratory may be required to provide information on the analyses and to answer questions from regulatory agencies. The name of and contact information for the chemist in charge of the project shall be stated in the report.

6.4. **Materials and equipment**

The laboratory shall provide all materials and equipment necessary for performing the work and shall ensure that they work properly.

6.5. **Quality assurance program**

All characterization projects shall include a sampling and laboratory analysis quality assurance and control program. When it presents the detailed sampling protocol, the successful firm shall also present a quality control program for the field work. This program shall include:

- field duplicate samples (about 10% of the number of samples taken).

In addition, the laboratory analysis program should include a set of intra-laboratory verifications applied to day-to-day operations. Various analyses may be conducted by the laboratory. These include:

- method blank;
- in-house reference material;
- certified reference material;
- laboratory duplication;
- fortified sample.

7. **ADDITIONAL DRILLING**

The Department reserves the right to require additional drilling and sampling in order to determine the rock profile (if applicable) or the overburden characteristics more accurately. This additional drilling shall be done within the limits of the planned new developments. However, it is agreed that the Department cannot guarantee that additional drilling and testing will be required for purposes of this request for proposals.

8. **KEY PLAN**

All elevations provided in the drilling logs and in the technical reports shall be measured relative to chart datum (CD).

Several vertical and horizontal reference datums are near the facilities and can be used to georeference the drilling. To this effect, refer to the .dwg files provided or visit the following website: <http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/twl-mne/benchmarks-reperes/search-recherche-eng.asp?AREA=LAU> (more specifically, the following address): <http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/twl-mne/benchmarks-reperes/station-eng.asp?T1=2550®ion=LAU>.

Drilling conducted in the field shall be as close as possible to their location stated in the drawing. The exact drilling location shall appear in the plans provided by the consultant in the report.

9. TECHNICAL REPORTS

A daily report shall be submitted to the Departmental Representative throughout the project, providing an update on the progress of the work and presenting the preliminary results. This daily report can be communicated verbally or submitted through an email sent to the Departmental Representative. The work must be closely monitored in case additional drilling is required, the requested drilling is no longer required, or new information is made available to better guide the Department.

One (1) copy of the preliminary technical report (which shall have the same style as the final) shall be provided in electronic format for comments no later than two (2) weeks after the end of the on-site drilling.

Three (3) paper copies of the final report in French, with comments from the Departmental Representative, shall be provided one (1) week after the firm receives those comments. A copy of all final documents shall be provided on a CD with the final report (in .pdf for the text and figures and in .dwg for the drawing and the sections).

The technical report shall include, but not be limited to:

1. A specific, accurate location plan for the drilling conducted and stratigraphic sections of the land. These sections shall show the various layers, including the profile of the various overburden layers and, if applicable, the basement rock, along with their characteristics.
2. All laboratory test results and physico-chemical analyses along with those obtained on site shall be presented. The results shall be grouped together in tables highlighting the representative values of the parameters determined with the aid of testing for each sediment or rock layer encountered.
3. Photos of the equipment used and of the on-site facilities, as well as a description of the equipment and methods used on site and in the laboratory. Photos to illustrate the quality of the rock cores, if applicable.
4. Description of the key plan used, whether it is the same as that used in the drawings provided or not, and confirmation that all levels in the technical report and in the plans are relative to chart datum.
5. A boring log for each drilling performed and containing all of the relevant information.
6. All soil and rock characteristics necessary for calculating the H-piles for a retaining wall or sheet piles, including their anchorage to the rock, if applicable, and the safety factors to be applied when a new structure of this type is designed.
7. All soil characteristics necessary for calculating and verifying the stability of a weight structure such as riprap or a backfilled wharf.
8. Any other relevant information for giving an exact description of the soils and the rock run into, including an assessment of the short- and long-term shear strength for each soil layer and the bearing capacity of the various soil layers encountered and the rock based on the types of structures planned. All safety factors used shall explicitly appear in the report.

9. The required information for assessing the feasibility of excavating the rock in place up to the -3.0 m elevation in the basin, including the type and power of the machinery to use (Tramac), time required for excavation, and anticipated unit costs.

10. The information required for assessing the feasibility of dynamiting the rock up to the -3.0 m elevation in the basin, including an opinion on the stability of nearby elements and on the probable impacts on the population. The types of loads, duration, quantity of the loads, etc., and the anticipated unit costs should also be included in the report.

10. TIMEFRAME

Preparation of the campaign and the characterization shall begin when the contract is awarded. Note that all field work shall be completed no later than August 15, 2016. The preliminary drilling logs shall be submitted to SCH the following week (i.e. before August 25, 2016).

Compliance with deadlines is essential to fulfilling the plans and specifications. The firm shall provide in its proposal its detailed schedule, which shall take into account the nature of the drilling operations, the work site, weather conditions, conditions specific to the site, and normal activities nearby.

The final report on all work and analyses shall be submitted to SCH no later than September 30, 2016.

11. METHOD OF PAYMENT

Payments shall be made in accordance with the terms stated herein.

• Phase 1: Mobilization and demobilization

This phase shall be paid in one installment and include costs for mobilizing and demobilizing all equipment required for the geotechnical investigation, the drilling and the characterization that are part of this project; staff travel costs, accommodation expenses, cover charges, and salaries during the mobilization and demobilization period.

• Phase 2: Drilling

a) Drilling in the sediment overburden

This phase shall be paid per linear metre drilled in the sediment overburden on the seafloor. It shall include:

- The cost of the drilling machine, the driller, the driller assistant and any equipment required (including the drilling machine and the barge), the salary of at least an intermediate engineer who shall oversee the work, and the salary of a resident engineer (or senior technician) who shall supervise the work on site. These two positions may be held by the same engineer (of at least intermediate level).
- Replacement costs for pieces of equipment broken during drilling.
- Time lost owing to defective machinery or lack of people on the site, breakdowns, etc.
- The costs of all testing conducted on site (see paragraph 5.1).

b) Rock drilling

This phase shall be paid per linear metre drilled in the rock on the seafloor and shall include all costs stated in the previous paragraph (11.2 a)).

Any material making use of a core drill indispensable on at least 0.6 m in length without interruption shall be considered rock.

• **Phase 3: Laboratory testing**

a) Geotechnical

This phase shall be paid per unit per test and shall include all costs incurred to conduct the testing described in paragraph 5.0 for each soil and rock layer hit during drilling. The item shall be paid as follows:

- 1) Granular material
- 2) Clay
- 3) Rock

b) Sampling and analyses for environmental purposes

For all work stated in paragraph 6.0, the consultant shall present a fixed unit price for each sampling and analysis method. Only actual expenses incurred by the consultant shall be invoiced. The item shall be paid as follows:

- 1) Metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn)
- 2) PAHs
- 3) PCBs (Aroclor)
- 4) TOC
- 5) C₁₀-C₅₀

Notes:

1. The unit price submitted for sampling includes assessing the field parameters, sampling, material and equipment required for sampling, production of daily reports, work preparation; transportation of sampling containers, freezers and refrigerators; transportation of samples to the laboratory, and any other item inherent in the activities.
2. The unit price submitted for chemical analyses shall include, but not be limited to, the costs related to the following items: analyses, internal laboratory quality control measures, analysis certificates, and any other service inherent in sample analysis.

• **Phase 4: Technical reports**

a) Geotechnical

This phase shall be paid as one general unit and shall include preparing the report containing all geotechnical information requested, including the preparation of the electronic version of a preliminary report and the preparation of an electronic version and three (3) paper copies of a final report (after comments are received from SCH).

b) Sampling and environmental analyses

This phase shall be paid as one general unit and shall include preparing the report containing all information on the sampling and the environmental analyses requested, including the preparation of the electronic version of a preliminary report and the preparation of an electronic version and three (3) paper copies of a final report (after comments are received from SCH).

- **Phase 5: Biological characterization and report**

This phase shall be paid as one general unit and shall include all other costs not set out in the other phases and related to only the biological characterization.

- **Phase 6: Miscellaneous costs**

This phase shall be paid as one general unit and shall include all other costs not set out in the other phases.

- **Phase 7: Standby**

This phase shall be paid by the hour (for a maximum of eight (8) hours per day, including hours worked), and shall include:

- a) Staff salaries
- b) Team accommodation costs and cover charges
- c) Machinery and equipment costs

Only inclement weather shall be considered a valid reason for standby fees. The machinery must be in good working order because breakdowns that result in loss of periods favourable for drilling shall not be taken into account in the calculation of standby time payable. (Direct and indirect time losses). The person in charge of the work shall contact the Departmental Representative to inform him or her of any standby periods caused by inclement weather.

12. HEALTH AND SAFETY

The firm shall ensure that all work is done in such a way that the health and safety of the public and of the staff working on site, as well as the environment, take precedence over issues related to costs and work schedule.

By accepting this contract, the firm agrees to take ownership of all responsibilities normally attributed to the principal contractor under the *Act respecting occupational health and safety* and to act as site supervisor regardless of the number of workers assigned to it. Provide the Departmental Representative with a mechanical inspection certificate for each piece of machinery used on the site and a safe work plan (mini-prevention program) including the following:

- Corporate OHS policy
- Work description, schedule and costs
- Health and safety responsibilities description and flow chart
- Physical and material organization of the site

- First aid
- Training required for workers
- Procedure in the event of serious accidents or of deaths
- Emergency plan

The people performing the work shall wear a lifejacket (MEC) that keeps the head above water when they are on floating equipment or near the edges of the wharves. Ensure that the required lifejacket complies with Canadian General Standards Board standard CAN/CGSB-65.7, *Lifejackets, Inherently Buoyant Type*.

Obtain a compliance letter issued by Transport Canada and send it to the Departmental Representative for approval of the rescue boat before the work begins.

Ensure that the rescue boat is available to the workers at all times in the event of an emergency.

Drilling shall be done in compliance with applicable codes, standards and regulations. More specifically, the work shall be done in compliance with:

- The *Canada Labour Code*, Part II, *Canada Occupational Health and Safety Regulations*;
- The Canadian Standards Association (CSA);
- *An Act respecting occupational health and safety*, CQLR, chapter S-2.1 (1997);
- *Safety Code for the construction industry*, chapter S-2.1, r. 6 (1997) (affecting marine projects).

The firm shall identify the risks and hazards related to each task performed during drilling operations.

The firm shall ensure that the workers have received the required training and information to perform their duties safely and that all tools and protective equipment required are available and are compliant with standards, acts and regulations.

The firm shall inform its employees of their right to refuse to perform any work that is hazardous to their health or safety.

Before starting the project, the firm shall plan and organize the work to eliminate hazards or risks at the source or to foster collective protection so that reliance on personal protective equipment can be kept to a minimum. When personal protective equipment is required, the workers shall ensure that it is compliant with the standards, acts and regulations in force.

In the event of an unexpected incident, take all necessary measures, including shutting down operations, to protect the health and safety of the workers and the public, and immediately notify the Engineer.

The consultant agrees to:

- comply with the provisions of the *Act respecting occupational health and safety* and the *Safety Code for the construction industry* at all times;
- comply with the clauses associated with work near watercourses and underwater work (sections 14.1 and 14.2);

- inform its employees of their right to refuse to perform any work that is hazardous to their health or safety;
- demarcate the work area and control access to it if the firm uses the wharf.

In the event of an unexpected incident, take all necessary measures, including shutting down operations, to protect the health and safety of the workers and the public, and immediately notify DFO.

12.1. Specific conditions for work involving risks of drowning

For all work involving risks of drowning, the following requirements shall be met:

- Comply with section 2.10.13 of the *Safety Code for the construction industry*;
- Wear a lifejacket or a personal flotation device that complies with:
 - Canadian General Standards Board standard CAN/CGSB-65.7-M88 (Lifejackets, Inherently Buoyant Type) published in 1988, and is approved by Transport Canada for a few exceptions;
 - Be protected by a safety net or an anti-fall device;
- Obtain a compliance letter issued by Transport Canada and send it to the project manager for approval of all vessels (transport, rescue, inspection or other) used during dives;
- Ensure that a rescue boat moored in the water is available for every station. However, when the vessel is accessible by land, it can serve many stations on the condition that the distance between each one and the vessel is less than 100 m;
- Ensure that the vessel is equipped with an engine powerful enough to overcome the current;
- Ensure that the vessel has the required characteristics to board people likely to take part in a rescue operation;
- Ensure that the rescue boat is available to the workers at all times in the event of an emergency;
- Ensure that a qualified person is available to start the emergency equipment. This person shall have a pleasure boat operator competency card for the length of the vessel used;
- Establish written emergency procedures in which the information stated below can be found. Ensure that all workers affected by these procedures have received the required training and information to apply them.
- When the work site is a pier, basin, jetty, wharf or other similar structure, a ladder with at least two (2) rungs above the water surface shall be installed on the front of the structure at 60-m intervals. This measure applies even for construction projects. In this situation, a temporary ladder (or portable ladder) shall be used and removed upon completion of the work if the owner does not have basic facilities. However, the owner must be informed in writing if the site is not compliant with the *Canada Labour Code*, Part II.

12.2. Specific conditions for underwater work

By accepting this contract, the Consultant commits to complying with the following requirements:

- The CSA Z275.2 and Z275.4 diving standards, as required by the CSST.
- Ensuring that the on-site team consists of at least three (3) people, including:
 - an active diver who will be connected to the surface;
 - a stand-by diver ready to intervene;
 - a tender.
- The Contractor shall attach a copy of the dive record to its invoice to the Department.